

BENGALLA Mining Company



Continuation of Bengalla Mine

Environmental Impact Statement

September 2013

Volume 1 Main Report



Hansen Bailey
ENVIRONMENTAL CONSULTANTS





Continuation of Bengalla Mine

Environmental Impact Statement

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EIS Statement

EIS Statement

Submission of Environmental Impact Statement (EIS) Under Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*

EIS Prepared by

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In Respect of

Continuation of Bengalla Mine Project

Proponent Name

Bengalla Mining Company Pty Limited

Proponent Address

LMB 5
MUSWELLBROOK NSW 2333

Land to be Developed

See **Appendix B** of this EIS.

Proposed Development

Development and operation of the Continuation of Bengalla Mine Project and associated activities as outlined in **Section 4** of this EIS.

Environmental Impact Statement

An Environmental Impact Statement for the Project is attached.

Certification

I certify that I have read and am aware of the terms of the Expert Witness Code of the Land and Environment Court of NSW.

I further certify that I have prepared the contents of this EIS and to the best of my knowledge:

- It is in accordance with Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*;
- Meets the form and content requirements of Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*;
- It contains all available information that is relevant to this EIS for the activity to which the Statement relates; and
- The information contained in the statement is neither false nor misleading.

Signature



Name

James Bailey,
Director

Date

September 2013



Executive Summary

Executive Summary

Introduction

Bengalla Mining Company operates the existing Bengalla Mine. Bengalla Mine is generally bounded by Wybong Road to the north, Roxburgh Road to the west, Overton Road to the east, and the Muswellbrook-Ulan Rail Line to the south.

Bengalla Mining Company was granted Development Consent (DA 211/93) in 1995 by the then Minister for Urban Affairs and Planning. This consent authorised the construction and operation of a surface coal mine, coal preparation plant, rail loop, loading facilities and other associated infrastructure. The application for DA 211/93 was supported by the *Environmental Impact Statement for Bengalla Coal Mine (1997)* under which mining operations commenced in 1998.

The original consent allowed Bengalla Mining Company to extract up to 8.7 million tonnes per annum of Run of Mine coal for a period of 21 years. The *Environmental Impact Statement for Bengalla Coal Mine* recognised that significant coal reserves continued west beyond the 21 year mining extent:

“The coal reserves continue to the west of the limit of excavation, and beyond the edge of the Authorisation area. It is anticipated that these reserves will be mined by open cut methods in the future, subject to appropriate approvals”.

As part of its ongoing commitment to future operations at Bengalla Mine and long term investment in the Upper Hunter region, Bengalla Mining Company has completed detailed scoping and feasibility studies to facilitate the continuation of mining to the west of the existing operations.

Additional resources are known to occur to the west of the area assessed in this Environmental Impact Statement and it is Bengalla Mining Company's intention to seek further approvals in this regard in the future subject to additional approvals and favourable market conditions.

Bengalla Mining Company is seeking a new Development Consent under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* to enable mining to continue for an additional 24 years at a maximum production rate up to 15 Million tonnes per annum of Run of Mine coal to a total of 316 Million tonnes Run of Mine coal (the Project). Under the Project, mining would continue in a westerly direction, but will remain on lands within mining authorisations (currently held by Bengalla Mining Company or another mining company to be transferred).

This Project will ensure the ongoing employment of the existing workforce for up to a further 24 years while maximising the recovery of a high quality, and well known, coal resource. The Project will provide a significant financial contribution to the Commonwealth and New South Wales State Government in the form of company taxes and royalties.

Existing Environment

Regional Setting

The Project is located within the Muswellbrook Local Government Area in the Upper Hunter region of New South Wales. The dominant land uses in the region are coal mining, power generation and agriculture. The Hunter River is the major watercourse in the area and performs an important role in supporting the region's populations and industries.

Located 4 kilometres to the east of the Project is the township of Muswellbrook. To the north of the Project are the approved Mount Pleasant Project and the Dartbrook Mine. Neither of these developments are currently operational.

To the south-east are the operational Mt Arthur Coal Mine, Drayton Mine and Bayswater Power Station. The township of Denman is located approximately 15 kilometres to the south-west. To the west of the Project is the Xstrata Mangoola Coal Mine along with rural residential and rural properties.



Topography

The land within the Project Boundary is generally undulating and slopes downwards towards the Hunter River to the south. The Hunter River alluvial floodplain is situated within the eastern and southern extents of the Project Boundary largely adjacent to the existing rail loop.

In the eastern part of the Project Boundary, the Overton Ridge naturally reaches an elevation of 188 metres Australian Height Datum. To the south of Overton Ridge are the lower hillslopes, which range in elevation from 250 metres Australian Height Datum to 134 metres Australian Height Datum near the Hunter River. The area within the Project Boundary predominantly contains slopes of gentle gradients.

Catchments

The Project is located within the Hunter River catchment, which has a total area of approximately 4,300 square kilometres to Muswellbrook. The main channel of the Hunter River varies in width from 50 metres to 100 metres, whereas the alluvial floodplain is approximately 2 kilometres wide and passes directly to the south of the existing Bengalla Mine. Consequently, the catchment within the Project Boundary drains in a south and south-easterly direction. The local drainage network generally consists of relatively steep gullies draining from the surrounding hills into flat, meandering tributaries across the Hunter River floodplain.

Located within the Project Boundary is the 3rd order ephemeral stream, Dry Creek. Dry Creek flows generally southwards through the central portion of the Project Boundary before joining into the Hunter River to the south-west of Bengalla Mine. Due to its relatively small catchment area of approximately 18 square kilometres, Dry Creek often maintains zero flow which is interrupted sporadically by short periods of discharge during prolonged or heavy rainfall.

Land Use

The Upper Hunter region has a long history of rural land use for a variety of agricultural and industrial activities, predominantly grazing and coal mining. The dominant land uses within and immediately adjacent to the Project Boundary include open cut coal mining and industrial activities, agriculture, rural residential and rural areas. The Hunter River is south of the Project Boundary and plays an important role in the region's mining, power generation and agricultural enterprises. Bengalla Mining Company owns 3,200 hectares of land within and surrounding the Project Boundary of which the Approved Bengalla Mine accounts for 974 hectares. The remainder of Bengalla Mining Company's land is licensed to operators for a variety of agricultural enterprises. The agricultural land within the Project Boundary currently is used primarily for cattle grazing. Bengalla Mining Company's landholdings outside of the Project Boundary are used for dairying, thoroughbred breeding, cattle grazing and lucerne hay production.

The Mount Pleasant Project is wholly owned by Coal & Allied and located to the immediate north of the Project Boundary. The Mount Pleasant Project has approval for the construction and operation of an open cut coal mine, coal preparation plant, transport and rail loading facilities and associated facilities at a production rate of up to 10.5 Million tonnes per annum of Run of Mine coal to 2020. No coal mining has occurred at the site to date.

Approximately 2 kilometres to the south, BHP Billiton's Mt Arthur Coal Mine operates an approved open cut and underground coal mine at up to 36 Million tonnes per annum Run of Mine from the Mt Arthur Complex. Open cut and underground operations are approved to continue until 2022 and 2030 respectively. The Xstrata Mangoola Coal Mine is located 6 kilometres west of the Project. Xstrata Mangoola Coal Mine was granted approval in June 2007 for the construction of an open cut coal mine and associated infrastructure to 2029.

Various potential interactions may occur between the Project and other coal mining operations including operational controls and water management infrastructure. In order to address potential cumulative issues associated with the Project and adjacent operations, it has been assumed that further approvals will be granted to enable operations to continue beyond current approval limits. This assumption is intended to represent a potential 'worst case' scenario with consideration of potential cumulative environmental impacts in relation to (at least) air quality, noise and traffic impacts.

Bengalla Mining Company has consulted with neighbouring operations with a potential for cumulative impacts with the Project and incorporated findings in this Environmental Impact Statement.

The Project is located within lands that have been largely disturbed by previous agricultural activities, particularly cultivation and grazing. Agriculture has been conducted in the vicinity of the Project since European settlement of the Muswellbrook area in 1824. As a result of extensive agriculture, the landscape in the area typically consists of grassland interspersed with small woodland remnants.

Bengalla Mining Company has operated adjacent to neighbouring agricultural enterprises since its approval in 1995. Approximately 2,200 hectares of the land not required for mining is currently being used for agricultural purposes including dairying, cattle production and horse stud industries. Bengalla Mining Company has made a commitment to maintain the agricultural productivity of its land holdings which it has done since 1995. Bengalla Mining Company has established lease agreements with third parties for the management of three dairy farms and the Bengalla Stud. There are also a variety of agricultural enterprises adjacent to the Project Boundary including grazing, dairying, equine industries, viticulture and olive groves.

There are no State Forests within 50 kilometres of the Project. There are no National Parks in close proximity to Bengalla Mine, with the closest being 22 kilometres east of the Project.

Land Ownership

The land surrounding the Project is largely dominated by mine owned land for various current or proposed mining operations. All of the land within the Project Boundary is owned by Bengalla Mining Company, with the exception of three lots owned by Coal & Allied (for the Mount Pleasant Project). Coal & Allied also owns a large area of land to the north of Bengalla Mine. The land to the south of the Hunter River is held by BHP Billiton for the Mt Arthur Coal Complex.

Xstrata Mangoola Coal Mine occupies a significant area of land to the west of the Project. Located between the Project Boundary and the Xstrata Mangoola Coal Mine is Idemitsu Australia Resources Pty Ltd Assessment Lease 19 associated with the West Muswellbrook Project. Several lots within the Assessment Lease 19 are owned by Idemitsu Australia Resources Pty Ltd.

The land between Bengalla Mine and Xstrata Mangoola Coal Mine is comprised of privately owned rural residential properties. Private landholders in the vicinity of the Project are generally concentrated along Roxburgh Road and Wybong Road. Additional private residences are located on Denman Road to the south-west and east of the Project Boundary area, near the Muswellbrook Racecourse area.

Climate

The Upper Hunter region experiences a warm temperate climate, characterised by seasonal variations of hot, wet summers and mild, dry winters. In the winter months, high pressure systems alternate with cold fronts, combining to produce cool, dry conditions. Frosts and fog are prevalent in the cooler, drier months from mid-autumn to late spring. The warm and dry conditions during the summer months are produced by synoptic high pressure systems over the Great Australian Bight. Synoptic low pressure systems occur intermittently during summer, resulting in periods of heavy rain and thunderstorms.

The temperatures recorded at Jerrys Plains establish that the Upper Hunter region experiences warm temperatures during the summer and very cool temperatures during the winter. January is the warmest month, averaging a daily maximum temperature of 31.7 degrees Celsius. July is the coolest month of the year, with a mean daily maximum temperature of 17.4 degrees Celsius and a mean daily minimum temperature of 3.8 degrees Celsius.

In the Upper Hunter region, rainfall is substantially higher in the summer than in the winter. The monthly rainfall measured at Jerrys Plains varies from 36.5 mm in August to 76.8 mm in January.

A direct correlation exists between higher temperatures, afternoon winds and evaporation. Accordingly, evaporation rates are highest in the summer. In the Upper Hunter region, the evaporation rate substantially exceeds the rainfall.

The wind directions have remained consistent in recent years, with winds prevailing from the south-east during summer and from the north-west during winter. Maximum wind speeds are generally greater in the summer than in the winter. In 2011, February and September recorded the strongest winds, with a mean maximum wind speed of 11 metres per second.

Geology

Bengalla Mine is situated in the north-west of the Hunter Coalfield, a division of the Sydney Basin on the western limb of the north-south trending Muswellbrook Anticline. As a result, coal seams subcrop near the eastern extent of the Project Boundary and dip to the west at approximately 8 degrees near subcrop, decreasing to 2-3 degrees at greater depths.

The stratigraphic sequence across the site is comprised of the late Permian Whittingham Coal Measures. The Whittingham Coal Measures are up to 800 metres thick and consist of sandstone, siltstone, claystone, conglomerate and tuff, within which intermittent coal seams exist. The target coal seams for the Project are located within the Jerrys Plains and Vane Subgroups of the Whittingham Coal Measures. The Permian coal measures are overlain by thin Quaternary alluvial deposits. Quaternary alluvial deposits consist of sand and gravel along creek valleys and in the alluvial floodplain of the Hunter River.



Exploration

Since the grant of Authorisation 438 in February 1991, Bengalla Mining Company has undertaken numerous exploration programs to define the coal deposit at Bengalla Mine. Detailed exploration drilling was conducted from May 1991 to October 1992 to obtain structural, lithological and coal quality data. Partially cored holes were drilled to obtain a sample for pilot-scale washing and combustion testing with extensive drilling of shallow open holes in 1996-1997 and 2002 to define the limits of oxidation for the coal seams and further define the Warkworth and Piercefield seams. Cored holes were drilled to obtain samples for spontaneous combustion testing in 2007. Samples of fresh and oxidised coal were collected for the testing.

Recent exploration drilling during 2011 and 2012 has been conducted for the purpose of defining seam geology, structure and quality within Assessment Lease 13 immediately to the west of the Approved Bengalla Mine. The Assessment Lease 13 exploration drilling program comprised of 25 boreholes totalling 5,683 metres with an additional five fully cored diamond drilled boreholes totalling 1,206 metres. All boreholes targeted the Edderton seam, which occurs at a depth of approximately 220-250 metres and is the basal seam (in sections) for the Project.

Faulting and igneous intrusions have not had a significant influence on Bengalla Mine's design, although they do have localised impacts on scheduling, wall stability, groundwater and coal quality. Most faults are high angle normal faults trending in a westerly to north-westerly direction. Narrow, north north-westerly trending dykes have previously been encountered within the Project Boundary.

Deposit Utilisation

Exploration drilling and preliminary studies have identified a significant quantity of in situ coal that is amenable to open cut mining. From this inventory, mine planning has indicated the potential for extraction of 316 Million tonnes of ROM coal associated with the Project mine plans. The primary seams that may be mined are the Warkworth, Mt Arthur, Piercefield, Vaux, Broonie, Bayswater, Wynn and Edderton seams. An additional 63 Million tonnes of Run of Mine coal is present within the Edinglassie seam, which underlies the Edderton seam. The Edinglassie seam is currently not economic to mine by open cut methods and has therefore been excluded from the open cut mine plan for the Project.

Approved Operations

Bengalla Mining Company operates the Bengalla Mine in accordance with DA 211/93 (as modified) which extracts up to 10.7 Million tonnes per year of Run of Mine coal generally progressing from east to west with approval to operate to 2017.

The dragline and excavator mining method is supported by a truck fleet and full time equivalent workforce of 400. Progressive rehabilitation occurs generally from east to west to an approved overburden emplacement height of Reduced Level 270 metres.

Coal is processed via the existing Coal Handling and Preparation Plant which utilises two-stage washing with rejects co-disposed in overburden emplacement areas. Product is transported predominantly to the export market via the dedicated rail loop and loading facilities. Bathhouse and administration buildings and other coal mining related facilities also exist at the site. Bengalla Mining Company also constructed the Bengalla Link Road.

Bengalla Mining Company holds various licences and leases additional to DA 211/93 under which Bengalla Mine is operated. An industry leading and comprehensive Real Time Environmental Monitoring System and static monitoring system has been in place at Bengalla Mine since 1999 which includes surface water, groundwater, blast, air quality and noise.

Operations at Bengalla Mine are conducted in accordance with the Bengalla Environmental Management System, which is certified to International Standards Organisation 14001 standards. The Bengalla Environmental Management System was certified in 1997, making Bengalla Mine the first coal mining operation in the world to achieve this level of accreditation.

Bengalla Mining Company also operates in accordance with the Rio Tinto Coal Australia Health, Safety, Environment and Quality Management System which provides a framework for health, safety and environment standards and quality reporting requirements. This system ensures all operations work uniformly within internationally recognised frameworks, such as International Standards Organisation 14001, Australian Standard 4801 and meet various certifications, as well as internal and external reporting requirements.



The Project

Bengalla Mining Company is seeking Development Consent to facilitate the continuation of open cut coal mining for 24 years largely within current mining authorities and within the Project Boundary to facilitate:

- Open cut mining towards the west at a rate of up to 15 Million tonnes per annum to a total of 316 Million tonnes Run of Mine coal;
- Continued use of the existing dragline, truck fleet and excavator fleet (with progressive replacement or substitution with equivalent equipment);
- An out of mining area Overburden Emplacement Area to the west of Dry Creek which may be utilised for excess spoil material until it is intercepted by mining;
- Continued use, extension or relocation to existing infrastructure, including administration and parking facilities, in-mining area facilities (including dragline shut down and erection pad), helipad, tyre laydown area, explosives and reload storage facility, core shed workshop, roads, reject bin, Run of Mine Hopper, stockpiles, conveyors, water management infrastructure, supporting power infrastructure rail and rail loading infrastructure and ancillary infrastructure;
- Construction and use of various items of new infrastructure (including radio tower, extensions to the Main Infrastructure Area and associated water reticulation infrastructure, additional Raw coal stockpile and upgrade to the Run of Mine coal stockpile (along with associated conveyor network) generally as shown on the infrastructure plans and construction of the Mount Pleasant Staged Discharge Dam;
- Processing, handling and transportation of coal via the (upgraded) Coal Handling and Preparation Plant and rail loop for export and domestic sale;
- Continued rejects and tailings co-disposal in the Main Overburden Emplacement Area and temporary in mining area reject emplacement;
- Relocation of a 6 kilometre section of Bengalla Link Road at approximately Year 15 near the existing mine access road to facilitate coal extraction;
- The diversion of Dry Creek via dams and pipe work with a later permanent alignment of Dry Creek through rehabilitation areas when emplacement areas are suitably advanced;
- Relocation of water storage infrastructure as mining progresses through existing dams (including the Staged Discharge Dam and raw water dam); and
- A workforce of approximately 900 full time equivalent personnel (plus contractors) at peak production.

Regulatory Framework

The Project is defined as development “for the purpose of mining that is ‘coal mining’”, as listed under Clause 5 of Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011*. Development for the purposes of mining is not permissible without Development Consent on the land within the Project Boundary. As such, the Project is declared a State Significant Development and will be subject to the provisions of Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979*.

The Project is located entirely within the Muswellbrook Local Government Area. The majority (66 percent) of the land within the Project Boundary is zoned as “RU1 Primary Production” under the *Muswellbrook Local Environment Plan 2009*. The majority of the remaining land is zoned as “E3 Environmental Management” with lesser amount of land zoned “SP2 Rail Infrastructure Facilities”. Clause 5 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* states that where there is an inconsistency with another environmental planning instrument, the provisions of the State Environmental Planning Policy will prevail. As such, the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* overrides the *Muswellbrook Local Environment Plan 2009*, which results in mining and associated activities being permissible in Zone E3 (Environmental Management) and therefore on all land within the Project Boundary.

In accordance with Clause 3 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*, Bengalla Mining Company made a request for Director-General’s Requirements on 17 February 2012. Following consultation with the relevant government agencies, the Director-General of the Department of Planning and Infrastructure issued Director-General’s Requirements for the Project on 13 March 2012.

The Project will seek as required, relevant approvals under New South Wales legislation not exempt by Section 89J under Division 4.1 of Part 4 of the *Environmental Planning & Assessment Act 1979*.

The Project was referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities on 31 March 2012. The Minister for Sustainability, Environment, Water, Population and Communities declared the Project to be a ‘controlled action’ on 7 June 2012 due to its potential impact on threatened species and communities listed under the *Environment Protection and Biodiversity Conservation Act 1999*. As such, the Project will subsequently require assessment under the *Environment Protection and Biodiversity Conservation Act 1999*.

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The Department of Sustainability, Environment, Water, Population and Communities accredited the assessment process under the *Environmental Planning and Assessment Act 1979*. The Department of Sustainability, Environment, Water, Population and Communities's assessment requirements were provided to the Director-General of the Department of Planning and Infrastructure who included them in the supplementary Director-General's Requirements for the Project which were subsequently received on 12 July 2012.

Stakeholder Engagement

Bengalla Mining Company has conducted effective stakeholder engagement programs for Bengalla Mine since its initial exploration licence was granted in 1991. Since the approval of Bengalla Mine, Bengalla Mining Company has continued to enhance its stakeholder engagement program. The Bengalla Mining Company Community Consultative Committee meets at least quarterly to provide a forum for open discussion between the community, Muswellbrook Shire Council, relevant government agencies and Bengalla Mining Company representatives.

Bengalla Mining Company recognises the importance of the Upper Hunter community to its mining operation and values the relationship it has developed. This relationship has been strengthened throughout the years due to Bengalla Mining Company's efforts to be more than just a major source of local employment and economic growth.

Bengalla Mining Company has worked in partnership with the local community contributing to provide positive long term outcomes for the Hunter Valley region. Since operations commenced in 1998, Bengalla Mining Company has directly contributed over \$700,000 to community based sponsorship programs.

Bengalla Mining Company has provided significant annual funding and employment commitments as part of the existing Voluntary Planning Agreement with Muswellbrook Shire Council which provides annual funding of \$400,000 for the Bengalla Coal Community Fund, \$125,000 for Council Roads Maintenance Fund, \$15,000 for Council Environmental Officer and the engagement of four apprentices.

Bengalla Mining Company will also contribute \$50,000 to Muswellbrook Shire Council's revised 'Mine Affected Roads Strategy' which shall review the effectiveness of the road network in consideration of other industry in the vicinity of Bengalla Mine.

Bengalla Mining Company also participates in the Coal & Allied Community Development Fund to support communities in the Hunter Valley to build community capacity, address development challenges and take advantage of emerging opportunities.

In partnership with the Upper Hunter Valley Aboriginal Community, as part of Coal & Allied, Bengalla Mining Company contributes to the Coal & Allied Aboriginal Community Development Fund investing more than \$3.05 Million in education, training, community and business development projects benefiting the Hunter Valley Aboriginal community since its inception.

A range of stakeholders were identified to be consulted in relation to the Project based on Bengalla Mining Company's existing stakeholder relationships and a review of existing databases developed during the preparation of previous modifications. Consultation occurred with various Local, State and Commonwealth government agencies to provide an understanding of the Project and some key findings of the technical studies.

Environmental Impact Statement Project briefings were offered to neighbouring land owners and the wider local community via telephone, personal letters (for neighbouring land owners) and community newsletters. Near neighbours were provided a personal letter outlining the details of the Project and extending an invitation to attend one of the upcoming Project community information sessions. Advertised, specific community information sessions were in Muswellbrook each Thursday in March 2012. The information sessions were designed to provide a Project Team member to which members of the community would find more readily accessible to meet and discuss the Project. In total, nine people attended the information sessions where they had the opportunity to meet and discuss potential concerns with Project personnel.

Six newsletters were distributed in relation to the Project from November 2011 to May 2013 to near neighbours, regulators and other interest parties, with two distributed to over 8,500 residents in the Muswellbrook area. On 27 October 2012, Bengalla Mining Company conducted the biannual Bengalla Community Open Day. Members from the Project Team were present on the day and established an information stall to present the key components of the Project to interested community members including the Project description, Environmental Impact Statement preparation and timing along with potential environmental, social and economic impacts of the Project.

Aboriginal community consultation for the Project was conducted in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* with 30 Aboriginal organisations registering an interest and participating throughout the process.

Impacts, Management and Mitigation

A risk assessment was undertaken to identify potential environmental and socio-economic issues associated with the Project. The purpose of the risk assessment process was to prioritise and focus the required assessments for the Project in consideration of the Director-General's Requirements and the findings from the stakeholder engagement program. Key findings from the environmental and socio-economic impact assessments are discussed below.

Air Quality

An Air Quality Impact Assessment was undertaken by Todoroski Air Sciences to predict the air quality impacts on receptors in the vicinity of the Project and to recommend measures to account for these impacts. In total, the Project is predicted to impact four private receptors (Receptors 106, 110S, 110N and 156S) and five private properties (109 and 245/246/249/250) above relevant air quality criteria excluding those that are currently entitled to acquisition by other mining companies.

The cumulative annual average Particulate Matter up to 10 micrometers in size criterion (30 micrometers per metre cubed) is predicted to be exceeded at three privately owned receptors 106, 110N and 110S (in addition to 13 currently entitled to acquisition by other mining companies). In addition, there are six properties owned by three landholders which do not have a residence (111, 109 and 245/246/249/250) where more than 25 percent of the property area is predicted to experience exceedances of relevant criterion.

The maximum 24-hour average Particulate Matter up to 10 micrometers in size criterion (50 micrometers per metre cubed) is predicted to exceed relevant criteria at least one day per year under worst case weather conditions at six private receptors (29, 156S, 161, 222, 230 and 286) in addition to those which are currently entitled to acquisition by other mining companies. Of these six receivers, only receptor 156S is expected to experience Project alone exceedances on more than five days in any year.

There are not predicted to be any exceedances of the annual average total suspended particulates and dust deposition criteria at private receiver, excluding receptors which currently have a right to acquisition upon request. Similarly, there are not predicted to be any exceedances of the advisory reporting standards for Particulate Matter less than 2.5 micrometres in size.

The assessment determined that air quality impacts caused by construction activities would be short and sporadic, and that the total dust generated by construction is minor compared to operational dust emissions. As a result, construction activities are not expected to cause any discernible impacts above the predicted operational impacts.

Impacts arising from the transportation of coal by rail were assessed by predicting Total Suspended Particulates and Particulate Matter up to 10 micrometers in size concentrations at a distance of 50 metres from the rail line. In rural areas and urban areas, the 24-hour average Total Suspended Particulates and Particulate Matter up to 10 micrometers in size concentrations are predicted to be well below levels known to cause adverse impacts on human health and amenity.

A cumulative sensitivity analysis was completed to consider the Mt Arthur Coal and Xstrata Mangoola Coal Mine's recently submitted modifications to their respective approvals. This analysis confirmed that there are no additional private receptors predicted to be impacted as a result of the Project and currently proposed modifications beyond New South Wales Government amenity guidelines (that are not already located within an existing zone of affectation).

The New South Wales Office of Environment and Heritage's contemporaneous assessment method was applied to examine the potential maximum total (cumulative) 24-hour average Particulate Matter up to 10 micrometers in size impacts for the Project. The results indicate that systemic exceedances (greater than five days of exceedance per year) of the maximum 24-hour average Particulate Matter up to 10 micrometers in size criterion are predicted to occur at one private additional receptor in Year 24 of the Project.

There are currently no criteria applicable for Particulate Matter less than 2.5 micrometres in size particulate impact assessment in New South Wales, however there are National Environmental Protection Measure advisory reporting standards that apply to the exposure of the population as a whole, as assessed by monitoring at suitable 'National Environmental Protection Measure' performance monitoring sites. An assessment of approximate levels of Particulate Matter less than 2.5 micrometres in size that are predicted to occur as a result of the Project has been determined. An examination of the predicted Particulate Matter less than 2.5 micrometres in size levels for the Project shows the total predicted contributions from the Project are predicted to be within the National Environmental Protection Measure reporting standards.

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Bengalla Mining Company will update the existing Air Quality and Greenhouse Gas Management Plan in consultation with the relevant regulators and shall include all reasonable and feasible mitigation measures to minimise air quality impacts. Bengalla Mining Company will continue to operate its air quality monitoring network, including real time dust monitors and a meteorology station. The existing dust and blast management systems will be upgraded with a real time air quality management system combined with predictive meteorological forecasting

Greenhouse Gas

Todoroski Air Sciences conducted a Greenhouse Gas Impact Assessment, which identified the main sources of greenhouse gas emissions. The main sources include diesel usage, explosives usage, electricity consumption, fugitive emissions of carbon dioxide and methane, and the transportation and end use of product coal.

The Project is predicted to generate an average of 0.77 Million tonnes Carbon Dioxide equivalent of Scope 1 and Scope 2 emissions per year. In 2010, the greenhouse gas emissions for Australia totalled an estimated 543 Million tonnes Carbon Dioxide equivalent. The Scope 1 and Scope 2 emissions for the Project represent approximately 0.14 percent of Australia's total greenhouse gas emissions as at 2010.

The Australian Government has proposed the implementation of carbon pricing mechanisms, which will impose a fixed price on greenhouse gas emissions. The mechanism will not impose a cap on greenhouse gas emissions from individual facilities or from Australia as a whole. It is expected that the Project will exceed the threshold of 25,000 tonnes CO_{2-e} per year. As a result, the predicted annual average Scope 1 greenhouse gas emissions from the Project of 693,715 tonnes Carbon Dioxide equivalent will be subject to the carbon pricing mechanism.

Bengalla Mining Company will implement all reasonable and feasible measures to reduce fuel and electricity usage. These measures will be included in the updated Air Quality and Greenhouse Gas Management Plan.

Noise

An Acoustic Impact Assessment was undertaken by Bridges Acoustics. It included an assessment of the noise impacts resulting from the Project. The noise levels generated by the Project during the operational phase were assessed using the intrusiveness criteria.

Significant noise impacts (greater than 5 decibels above the intrusive criteria) are predicted to occur at six private receptors (110N, 152, 153, 154, 156E and 156S) owned by five landowners that are not currently subject to acquisition by other mining companies, upon the request of the landowner.

An additional 11 private receptors (105, 106, 108, 110S, 126N, 146, 156W, 161, 186N, 180 and 184) owned by nine landowners would be moderately affected (between 2 and 5 decibels above the intrusive criteria) by the Project under a worst-case noise modeling scenario. In total, 12 private receptors have been predicted to experience mild noise impacts (between 1 and 2 decibels above the intrusive criteria) from the Project.

Cumulative noise levels generated by the Project and other sources were assessed to the amenity criteria. Although the Project will contribute to cumulative noise impacts at some receivers, there are not predicted to be any cumulative exceedances of the amenity criteria at any private receiver.

There are two additional properties (111 and 211) predicted to experience a significant noise impact from the Project in one or more modelled years over more than 25 percent of vacant land in contiguous landownership that are not currently subject to acquisition by another mining company on request.

An additional four properties (receptor 109, 121/125 and 167) owned by three landholders would also be moderately affected by noise over more than 25 percent in contiguous landownership. A further three properties (99/100 and 101) owned by two landholders are predicted to be mildly affected by noise over more than 25 percent of contiguous landownership. All other private receptors and properties are predicted to receive noise levels within intrusive criteria.

The modeled noise contours for construction activities indicate there are no additional receptors significantly or moderately affected by construction noise levels more than 10 dBA above the noise criteria under prevailing weather conditions.

The existing background road traffic noise levels along Denman Road (including within the township of Muswellbrook) are presently above relevant criteria at some residences and will not increase materially as a result of the Project. The maximum predicted increase in road traffic noise is 1.8 decibel (A-weighted) during the construction phase and 1.5 decibel (A-weighted) during the operational phase of the Project.

The rail traffic noise criteria are predicted to continue to exceed relevant criteria at various locations near Muswellbrook, along both the Main Northern Railway Line and the Ulan Railway Line. Additional train movements associated with the Project are predicted to increase noise levels by approximately 0.7 decibel (A-weighted) near the Ulan Railway Line between the Project and Muswellbrook and by approximately 0.5 decibel (A-weighted) at residences near the Main Northern Railway Line south-east of the Ulan Line junction.

Bengalla Mining Company will continue to implement engineering controls to minimise the noise levels generated by heavy mobile equipment and coal processing facilities. These controls will be incorporated into the Noise Management Plan which will be updated in consultation with the relevant regulators to include feasible and reasonable noise management measures to minimise construction and operational noise levels associated with the Project. Bengalla Mining Company will upgrade the existing real time noise monitoring program to include a predictive system to reduce impacts at private receivers.

Blasting

An Acoustic Impact Assessment was undertaken by Bridges Acoustics and included an assessment of the blasting impacts resulting from the Project.

All residences within 1,500 metres of active mining areas are owned by mining companies or entitled to acquisition by mining companies. Exceedances of the overpressure and ground vibration criteria are not predicted to occur at distances of more than 1,500 metres from mining areas. Therefore, the blasting associated with the Project will not impact any privately owned receptors that are not currently entitled to acquisition by mining companies.

Blasting impacts on heritage structures and communications masts are predicted to be within acceptable levels. Blasting will continue to be undertaken within 500 metres of the Muswellbrook-Ulan Railway Line in the early years of the Project and Bengalla Mining Company will continue to consult with the Australian Rail Track Corporation to ensure that there are no impacts on passing trains. Impacts can be avoided by either delaying the blast or temporarily closing the rail line consistent with current procedures.

Bengalla Mining Company will update the Blast Management Plan in consultation with the relevant regulators. In addition a real time blast fume management system combined with predictive meteorological forecasting capabilities will be implemented for the Project and will outline measures to ensure that the blasting criteria are not exceeded at sensitive private receivers, heritage structures or public infrastructure.

Visual

A Visual Impact Assessment was undertaken by JVP Planning and Design to identify the potential visual and lighting impacts caused by the Project.

Most locations in Muswellbrook will be shielded from the Project by the rehabilitated eastern areas at the existing Bengalla Mine. However, some locations in South Muswellbrook will experience limited views of the mining area. Although these locations are sensitive, the visual impact will be low as the visible component of the mining area represents only a small percentage of the view.

The Project is not visible from Aberdeen due to the screening provided by the rehabilitated areas. The township of Denman will also be shielded from the Project. The visual sensitivity of these locations is low due to the significant distance from Denman to the Project. As a result, the visual impact on Denman will be low.

The Project is screened from sensitive locations on the Mt Arthur Coal owned Pukara Estate by olive trees, resulting in low visual impact. However, there will be high visual impacts at the working areas at Pukara Estate. These working areas are generally not accessed by the public.

The nearest privately owned vineyard is located approximately 12 kilometres south-west of the Project Boundary. Due to the significant distance from the Project the visual impact is predicted to be low.

There are not expected to be any significant impacts on rural residences to the north and east of the Project. Views from these locations will be screened by the rehabilitated areas at the existing Bengalla Mine.

Rural residences to the south and south-west are subject to views of the existing Bengalla Mine. These locations will continue to experience views of the Overburden Emplacement Area and active face. To the west of the Project, the rural residences that are currently impacted will continue to experience moderate to high visual impacts from the active face.

The lighting effects produced by the Project will be similar to the effects generated by the existing Bengalla Mine. Since mining will progress to the west, lighting impacts are expected to decrease for receptors to the east and increase for receptors to the west.

In order to reduce visual impacts, progressive rehabilitation of the Overburden Emplacement Areas will continue to be undertaken. This will reduce the contrast between the components of the Project and the surrounding landscape. Landscape plans will ensure that rehabilitated areas emulate the surrounding pasture land and open woodland.

Bengalla Mining Company will continue to establish tree screens and plantings at some offsite locations. The existing Rehabilitation Management Plan and Landscape Management Plan will be updated in consultation with the relevant regulators to incorporate the commitments in this Environmental Impact Statement.

Surface Water

A Surface Water Impact Assessment was undertaken by WRM Water and Environment. The assessment identified the potential impacts to surface water resources and recommended measures to account for these impacts. A geomorphic assessment of Dry Creek within the Project Boundary was also completed to confirm its existing physical characteristics.

During the Project life, the catchment area draining to Dry Creek will be reduced by 983 hectares. The final landform will reduce the Dry Creek catchment by 22 percent compared to the pre-mining catchment. The reduction in the Hunter River catchment both during and after mining will be negligible at around 0.1 percent.

The reduction in catchment areas will result in reduced flow volumes in the Hunter River and Dry Creek. Flow volumes in the Hunter River will be reduced by between 458 megalitres/year to 923 megalitres/year during mining and by 423 megalitres/year after mining which represents approximately a 0.2 percent reduction in the Hunter River's flow volume (as at Denman). Bengalla Mining Company will hold all relevant licences, share component and allocation required to comply with the *Water Management Act 2000* and *Water Act 1912* requirements.

A water balance was undertaken to determine the volumes of water that will need to be extracted from and/or discharged into the Hunter River. Raw water will need to continue to be extracted from the Hunter River to meet operational water demands. The median external water requirement is predicted to be 1,500 megalitres/year. The 99th percentile water requirement which occurs under very dry conditions is predicted to be 2,200 megalitres/year. Bengalla Mining Company holds share components totalling 6,011 units for the Hunter Regulated River Water Source comprising 1,449 High Security Units and 4,562 General Security Units to account for any potential impacts.

Excess water accumulated on site will continue to be discharged into the Hunter River in accordance with the rules of the Hunter River Salinity Trading Scheme. Under average rainfall conditions, the Project will not need to discharge any water. The Project will need to discharge approximately 350 megalitres/year under 99th percentile wet conditions. The rules of the Hunter River Salinity Trading Scheme ensure that the salinity of the Hunter River is not materially impacted.

All components of the Project are located outside of the 1 in 100 year flood extent of the Hunter River as the Project mines further away to the north-west from the Hunter River than the existing Bengalla Mine. Therefore, the Project is not expected to impact the flood behaviour of the Hunter River.

The Bengalla Water Management System has been designed to minimise impacts on flow volumes in the Hunter River, avoid uncontrolled releases of contaminated water and minimise raw water usage. The existing Water Management Plan will be updated to address the predicted impacts of the Project. Bengalla Mining Company will continue to conduct monitoring of water quality and quantity in onsite storages, Dry Creek and the Hunter River.

Groundwater

A Groundwater Impact Assessment was undertaken by Australasian Groundwater and Environmental Consultants. This assessment characterised the local groundwater regime and determined the potential impacts to groundwater systems.

The only significant aquifer in the vicinity of the Project is the Hunter River alluvial aquifer. Mining occurs closest to the Hunter River alluvium at the beginning of the Project, and further away than the currently Approved Bengalla Mine. In Year 1, the Hunter River alluvial aquifer in the immediate vicinity of the Project will continue to experience a drawdown of less than 2 metres. The drawdown of the alluvial aquifer will reduce as mining progresses towards the north-west. This water take will be accounted for by allocation attached to relevant licences which are already held.

Under pre-mining conditions groundwater flows from the Permian to the alluvium. The Project will cause Permian groundwater to flow to the open cut mining areas thereby reducing flow to the alluvium. The maximum reduction in flow to the alluvium is approximately 0.63 megalitres/day at the beginning of Year 1. The maximum annual reduction in flow to the alluvium is approximately 220 megalitres/year in Year 1. As mining moves away from the alluvium, the reduction in flow decreases to approximately 0.25 megalitres/day in the later years of the Project life.

Bengalla Mining Company holds 442 units for the Hunter Regulated River Alluvial Water Source to account for these potential impacts.

The volume of groundwater inflows into the mining area is predicted to average 110 megalitres/year. Maximum groundwater inflow rate is predicted to be 365 megalitres/year.

There are a number of registered mine-owned bores within the zone of depressurisation. However, only one impacted registered bore is located on privately owned land and the drawdown at this bore is predicted to be less than 2 metres. This is the same as the minimal impact requirement under the Aquifer Interference Policy.

Water will accumulate in the final void following mine closure. The water level of the final void is predicted to reach up to Reduced Level 37 metres. This water level is significantly below the crest of the final void, making it very unlikely that the final void will overflow.

The final void will behave as a groundwater “sink”, which prevents saline water in the void from migrating into the surrounding groundwater systems.

The Surface Water Impact Assessment also assessed the rate of water level recovery in the final void using the OPSIM modelling software. The water balance methodology used by this method estimated that the long term water level would vary between RL 64 metres and 71 metres. Differences in final void levels between the two methods can be attributed to slight differences in input data sets and the method in which the void is simulated.

Both the groundwater model and the OPSIM model indicate that the water level in the final void will stabilise well below the crest of the final void. Therefore spillage of water into the environment will not occur. The final void will act as a sink for groundwater which will prevent any poor quality water that develops within the mining area from migrating into the surrounding groundwater system.

Bengalla Mining Company will update the Water Management Plan to address the impacts of the Project on groundwater systems and will continue to monitor groundwater inflows and water quality and quantity in regional and local groundwater systems.

A peer review of the Groundwater Impact Assessment was undertaken by Kalf and Associates. The peer review concluded that the groundwater model was fit for purpose and that the impacts predicted by the model were reasonable.

Geochemistry

A Geochemical Impact Assessment was undertaken by RGS Environmental. The purpose of the assessment was to determine the geochemistry of the overburden and coal reject materials associated with mining operations.

All overburden material (except Archerfield Sandstone) is likely to be Non-acid Forming and have a negligible (≤ 1 percent) total sulphur or sulphide sulphur content. Most overburden materials are likely to have excess acid buffering capacity and should compensate for any acid that could theoretically be generated from these materials.

The Archerfield Sandstone interburden material is likely to be Potentially Acid Forming. This material has a lower pH, higher salinity and higher sulphur content compared to the other overburden materials. If Archerfield Sandstone interburden materials were exposed to atmospheric conditions for a significant period of time, it is likely that the sulphate concentration of surface runoff/seepage would increase over time.

The total metal concentrations of the overburden samples were well below the National Environment Protection Council's criteria for soils (parks, recreation open spaces and playing fields).

Hence, the overburden materials are unlikely to pose a significant risk to the environment due to total metal concentrations in solids or revegetation and rehabilitation.

Overburden materials are likely to be sodic and therefore prone to dispersion and erosion. Overburden materials that report to the emplacement area may have structural stability problems. Some lithologies are less sodic than others and may be more suitable for revegetation and rehabilitation activities.

The coal reject samples from the Wynn seam were determined to be Potentially Acid Forming. Coal rejects from the Vaux and Bayswater seams presented a lower risk of acid generation. The average acid neutralising capacity of the reject materials is estimated to be 1.5 times greater than the maximum potential acidity. The overburden and coal reject materials as a whole are expected to be Non-acid Forming.

Runoff and seepage from Wynn seam coal rejects would be acidic, saline and containing elevated sulphate levels. This can impact upon vegetation growth and water quality. It is also expected that reject materials from the Wynn seam would generate elevated concentrations of several trace metals if exposed to oxidising conditions.

The internal Acid Mine Drainage Management Plan will be revised for the Project.. Bengalla Mining Company will continue to implement measures to prevent impacts arising from Potentially Acid Forming materials. Archerfield Sandstone will be covered by at least 5 metres of acid neutralising and inert overburden. Similarly, Wynn seam coal rejects will be covered using Non-acid Forming overburden.

Aboriginal Archaeology and Cultural Heritage

An Aboriginal Archaeology and Cultural Heritage Impact Assessment was undertaken by AECOM Australia. The purpose of the assessment was to identify the archaeological resource within the Project Boundary. This was achieved through a search of the Aboriginal Heritage Information Management System database and an archaeological field survey.

An archaeological field survey was conducted over 15 days by AECOM archaeologists and 28 registered Aboriginal parties. The survey covered all of the land within the Study Area (i.e. the Project Boundary excluding the existing Approved Bengalla Mine).

A total of 289 Aboriginal sites were identified within the Study Area. The Project will impact 263 of these sites, comprised of 259 artefact scatters or isolated artefacts, one stone quarry and three potential scarred trees. The stone quarry is considered to be of high archaeological significance. The three scarred trees and two of the artefact scatters are considered to be of moderate archaeological significance. The remaining artefact scatters and isolated artefacts are of low archaeological significance.

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The archaeological survey for the Project identified a rich landscape of past Aboriginal activity as evidenced from the numbers of stone artefacts recorded over the Study Area. Surface artefacts, which form Aboriginal archaeological and cultural sites, were recorded over the entire landscape but most intensely associated with creek lines and drainage lines, including Dry Creek.

While having varying degrees of scientific significance, these stone artefacts are of cultural importance to Aboriginal people as they attest to the occupation and use of the Study Area by Aboriginal people in the past and provide an important tangible link to their heritage.

The identification of stone artefacts and archaeological sites notwithstanding, Aboriginal stakeholders involved in the assessment process have not disclosed any specific knowledge related these artefacts or sites. However, during the archaeological survey, Aboriginal stakeholders noted the importance of B10 quarry site for its rarity in the Hunter Region, being one of only a handful of these site types found locally. In addition, Aboriginal stakeholders highlighted several key landscape features as important on the basis of their associated archaeological record. Dry Creek was highlighted by Aboriginal stakeholders as a focal point for past Aboriginal activity due to higher artefact numbers identified in association with it. Aboriginal stakeholders expressed interest at finding artefact scatter BM-AS26-12 on the crest of a hill on the western boundary of the Study Area. This highlighted the importance of vantage points in Aboriginal site selection.

Wanaruah Local Aboriginal Land Council stated that the Study Area was important to Aboriginal people due to its proximity to an Aboriginal song line, with Mt Arthur being one of the guiding landmarks. In addition, Wanaruah Local Aboriginal Land Council noted the Study Area is important as it is within walking distance to a number of known ceremonial areas (not identified).

There are 26 sites that are located within the Project Boundary but outside of the Disturbance Boundary. These sites will not be impacted by the Project.

In order to account for the impacts to Aboriginal cultural heritage, the existing Aboriginal Cultural Heritage Management Plan will be revised in consultation with registered Aboriginal parties and the relevant regulators. The Aboriginal Cultural Heritage Management Plan will outline mitigation measures, including surface collection of artefacts, scarred tree investigation and removal and fencing of sites that are not impacted by the Project. The management plan will also include procedures for the care and control of salvaged artefacts.

Historic Heritage

A Historic Heritage Impact Assessment was undertaken by AECOM Australia. The purpose of the assessment was to identify historic heritage sites in the vicinity of the Project and to assess the impacts to these sites.

The assessment identified five historic sites within the Project Boundary. The Project will directly impact three historic sites: House Site 1, House Site 2 and the Stockyard with only the Stockyard determined to be of local significance. House Site 3 is located within the Project Boundary but will not be impacted by the Project.

The Bengalla Homestead is listed as a heritage item under the *Muswellbrook Local Environmental Plan 2009* and is located within the Project Boundary. There are also six listed heritage items in close proximity to the Project: Dalama Stud, Overdene, Blunt's Butter Factory, Keys Family Private Cemetery, Edinglassie Homestead and Rous Lench Homestead. The Project will not directly impact any of these listed heritage items.

Due to the air quality and noise impacts of the Project, the Bengalla and Overdene homesteads will continue to remain vacant. The visual impacts of the Project on the Bengalla, Overdene, Edinglassie and Rous Lench homesteads will be similar to the impacts currently experienced. Therefore, the Project will continue to indirectly impact these homesteads. There are not expected to be any indirect impacts on House Site 3, Dalama Stud, Blunt's Butter Factory or the Keys Family Private Cemetery.

Impacts on historic heritage items will be managed in accordance with the European Heritage Management Plan, which will be revised in consultation with the relevant regulators. The European Heritage Management Plan includes Conservation Management Plans for the Bengalla and Overdene homesteads, which outline the maintenance works for these homesteads. An archival recording for the Stockyard will be prepared prior to the disturbance of the site.

Ecology

An Ecological Impact Assessment was undertaken by Cumberland Ecology to determine the impacts of the Project on current biodiversity values, including threatened species, populations and ecological communities. This assessment involved a review of previous ecological studies and detailed flora and fauna surveys.

The Project will result in the disturbance of approximately 881 hectares of native vegetation, including forest and woodland communities and large areas of open grassland and scattered trees. An additional 69 hectares of non-native vegetation will be removed, including tree and shrub plantations, exotic grasslands and Low Diversity Derived Native Grassland / Exotic Pasture.

The Project will remove approximately 554 hectares of Threatened Ecological Communities including 535 hectares of critically endangered Box Gum Woodland. The area of Box Gum Woodland to be impacted represents 9 percent of the community in the Hunter Region and 0.2 percent in the community in New South Wales.

Two threatened flora species were identified within the Project Boundary: Lobed Blue Grass and Tiger Orchid. The Lobed Blue Grass is listed as 'Vulnerable' under the *Environment Protection and Biodiversity Conservation Act 1999*, but is no longer listed under the *Threatened Species Conservation Act 1995*. The Tiger Orchid is listed as an endangered population under the *Threatened Species Conservation Act 1995*.

Nine species of threatened fauna were identified within the Project Boundary, consisting of four woodland bird species, four microbat species and the Squirrel Glider. An additional 12 species have the potential to occur in this area. The Project will impact threatened flora and fauna by removing potential habitat for these species. The Project will disturb approximately 259 hectares of potential habitat for the Tiger Orchid and 881 hectares of potential habitat for Lobed Blue Grass. All of the native vegetation within the Project Boundary is considered suitable habitat for the threatened fauna species that have the potential to occur in this area. Therefore, the Project will remove approximately 881 hectares of potential habitat for threatened fauna species.

The Study Area is essentially dry and lacks aquatic habitats other than a sparse series of ephemeral pools along what is appropriately called Dry Creek. This small ephemeral stream is dry for most of its length and lacks flowing water. After heavy rains it carries some shallow pools but the stream bed has been extensively eroded and channelised as a result of historic clearing of the catchment. Consequently, Dry Creek supports very little in the way of aquatic habitat and does not support major occurrences of macrophytes, or fish habitat.

Some farm dams have been created by enlarging and damming some points along Dry Creek and its tributaries. These support water birds on occasion and are expected to support common freshwater invertebrates. However, fish habitats are generally lacking from the Study Area. At most, the pools in the creek may support eels, tortoises and possibly Mosquito Fish. No threatened aquatic species are considered likely to occur within the Study Area.

The occurrence of groundwater dependent ecosystems in the Study Area is represented by terrestrial vegetation and by cave and aquifer ecosystems. The Terrestrial Vegetation groundwater dependent ecosystem comprises areas of Hunter Floodplain Red Gum Woodland that occur along Dry Creek and its tributaries. Hunter Floodplain Red Gum Woodland is likely to have a partial reliance, but not a total dependence on groundwater. Aquifer ecosystems have the potential to act as habitat for stygofauna.

The Project will result in the clearance of approximately 9.4 hectares of Hunter Floodplain Red Gum Woodland. The drawdown of the Hunter River alluvial aquifer has the potential to impact terrestrial groundwater dependent ecosystems in the floodplain. However, the Project is not considered likely to pose a direct threat to any stygofauna community that may be present in the groundwater.

A Biodiversity Management Plan will be prepared for the Project in consultation with the relevant regulators. The Biodiversity Management Plan will include procedures for managing ground disturbance, relocating fauna and key habitat features, and rehabilitation of disturbed areas. The aim of rehabilitation will be to re-establish agricultural land with at least 10 percent open woodland corridors across all disturbed areas with the exception of the eastern face of the overburden emplacement area. The eastern face of the overburden emplacement area will be rehabilitated to contain a higher density woodland community, to assist in further mitigating the visual impacts of the Project. There will be an emphasis on restoring Box Gum Woodland and Derived Native Grassland.

Bengalla Mining Company will also enhance the areas of Dry Creek to be retained to the south of the Project and north of the Bengalla Link Road and also adjacent to the Hunter River and will include the planting of the regionally endangered population *Eucalyptus camaldulensis* (River Red Gum).

In addition, Bengalla Mining Company will undertake biodiversity offsetting in accordance with the proposed 'Upper Hunter Strategic Assessment' process. Bengalla Mining Company will provide a financial contribution to the 'Upper Hunter Offset Fund' to compensate for the removal of 950 hectares of vegetation, including 881 hectares of native vegetation.

The offset funding will satisfy State and Commonwealth ecological objectives by conserving offset land in perpetuity, managing strategically located land to high ecological standards and restoring the condition and extent of habitats to ensure that the Project maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term.

Preliminary total credits (ecosystem credits and species credits) required to offset the Project's vegetation within the Disturbance Boundary have been calculated. The current version of the Biodiversity Certification Assessment Methodology is undergoing further revision at the time of drafting this document, which when recalculated, will alter the final credit requirements. The process of credit and offset calculation will be completed in 2014 when the Upper Hunter Biodiversity Plan is finalised.

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Upon finalisation of an acceptable 'Upper Hunter Strategic Assessment' process, Bengalla Mining Company will recalculate the credit requirements for the Project in consultation with relevant regulators and contribute the commensurate financial contribution to the 'Upper Hunter Offset Fund'. In the unlikely event that the 'Upper Hunter Strategic Assessment' process is not implemented or is not acceptable to Bengalla Mining Company, its representatives will consult with the relevant regulators to determine an alternative offset strategy for the Project within two years of the granting of Development Consent.

Stygofauna

A Stygofauna Impact Assessment was undertaken by Eco Logical Australia. The existence of stygofauna was confirmed through a review of previous stygofauna studies and a two-stage sampling program. Samples were collected from 13 bores in the vicinity of the Project. Stygofauna was present at 10 of these sites, of which nine were located within the Hunter River alluvium. The drawdown of the Hunter River alluvial aquifer has the potential to impact stygofauna communities. The high numbers of stygofauna and the presence of six taxa indicate that the drawdown induced by mining at Bengalla Mine has had a minimal impact on the stygofauna community. The drawdown induced by the Project is not predicted to exceed the drawdown induced by existing mining operations. Drawdown will decrease as mining progresses to the west, allowing stygofauna to recolonise the currently dewatered sediments. As such, no mitigation is required for stygofauna.

Traffic and Transport

A Traffic and Transport Impact Assessment was undertaken by DC Traffic Engineering. The purpose of the assessment was to quantify the additional vehicle and train movements generated by the Project and to assess the resulting impacts on the road and rail network.

All access to the Project will be via the Bengalla Link Road and Bengalla Mine Access Road. The Bengalla Link Road will be realigned in approximately Year 15 to allow mining to progress to the west.

Modelling was undertaken to assess the performance of three key intersections during the peak construction and operational periods: Denman Road / Bengalla Link Road, Denman Road / Thomas Mitchell Drive and New England Highway / Thomas Mitchell Drive. The performance of each intersection was assessed based on the level of service, degree of saturation, average delay and maximum queue length.

The Denman Road / Bengalla Link Road and Denman Road / Thomas Mitchell Drive intersections were found to be performing satisfactorily under existing traffic conditions. However, the New England Highway / Thomas Mitchell Drive intersection is currently performing poorly during the AM peak (6:00 am – 7:00 am). Mt Arthur Coal Mine is currently upgrading this intersection to a seagull configuration. Mt Arthur Coal Mine is also obligated to upgrade the Denman Road / Thomas Mitchell Drive intersection to a seagull configuration by 2019.

The upgrade of the New England Highway / Thomas Mitchell Drive intersection will have been completed before the construction phase for the Project. The traffic modelling for the peak construction period has accounted for the upgrade to this intersection. All of the key intersections are expected to perform at a good or acceptable level of service during the construction phase.

The Denman Road / Thomas Mitchell Drive intersection will have been upgraded before the peak operational period (approximately Year 4). The traffic modelling for the peak operational period has accounted for both intersection upgrades. The modelling predicts that all of the key intersections will perform at a satisfactory level of service (or better).

The model results establish that the Mt Arthur Coal's required intersection upgrades will adequately address the traffic impacts caused by mining operations in the locality. Therefore, no additional mitigation measures are required from Bengalla Mining Company.

The realignment of the Bengalla Link Road will increase the length of this travel route by approximately 900 metres. Assuming a travel speed of 90 kilometres/h this means that travel times will increase by 36 seconds.

The Project is predicted to increase the product coal output of the Bengalla Mine to approximately 12.3 Million tonnes per annum. As a result, the number of loaded train movements per year will increase to 1,435, however this remains within existing approved levels. The number of daily train movements associated with Bengalla Mine will increase to 10 (including unloaded inbound trains). The commencement of mining operations at the Mount Pleasant Project will generate an additional six train movements per day.

An assessment of the Project impacts to the existing rail network was also undertaken. Generally, a development is considered to have a potentially significant impact over those parts of the rail network where traffic associated with that development makes up 10 percent or more of the overall traffic volume. When assessed against rail traffic forecast for the Muswellbrook Junction in 2016, rail traffic associated with the haulage of product coal from the Project will make up 9.8 percent of the total volume of coal trains only. The area of significant influence of the Project on the wider rail network is therefore not significant, being considered to extend from Bengalla Mine rail loop to the Muswellbrook Junction.

Bengalla Mining Company will update its existing Road Closure Management Plan (as a component of the Blast Management Plan) in consultation with the relevant regulators. The new section of Bengalla Link Road will be constructed to the relevant required standard and dedicated by Bengalla Mining Company as a public road in around Year 15. The design will include a 'like for like' replacement of the current Bengalla Mine Access Road intersection approximately 900 metres south. The intersection will consist of a channelised right turn with a minimum 160 metres right turn lane with a slight uphill grade.

Bengalla Mining Company will also construct an intersection from the existing Roxburgh Road onto the realigned section of the Bengalla Link Road. This intersection will require Roxburgh Road to be altered to allow a 90 degree angle of intersection.

Bengalla Mining Company will remain responsible for the life of the Project for the costs of the maintenance of the Bengalla Link Road to the intersection with the Bengalla Mine Access Road as agreed with Muswellbrook western limit of the 1 in 100 year flood level as agreed with Muswellbrook Shire Council. Muswellbrook Shire Council is undertaking a Mine Affected Road Study with the view to revisiting the Western Roads Strategy originally prepared in 1997.

Whilst this document has not yet been released Bengalla Mining Company remain committed to liaising with Muswellbrook Shire Council and the Roads and Maritime Service regarding any future realignment of the Bengalla Link Road and ongoing management of the surrounding road network. The realigned section of the Bengalla Link Road and intersection design will be constructed in accordance with the relevant guidelines and will be developed in consultation with Muswellbrook Shire Council.

Social

A Social Impact Assessment was undertaken by Martin & Associates. The purpose of the assessment was to develop a profile of the local area, which primarily encompasses the Primary Study Area (Muswellbrook Local Government Area) and the Secondary Study Areas (Muswellbrook, Singleton and Upper Hunter Local Government Areas) and identify any future social impacts which may result from both the construction and operation of the Project.

Two workforce scenarios were used in order to identify and appropriately assess potential social impacts associated with the Project. Scenario 1 ('Expected Case') and Scenario 2 ('Alternative Case') were designed to test the sensitivity of the assumptions utilised for Scenario 1. Both Scenarios assume that there will be some non-local portion of the workforce which will relocate to the Primary Study Area. The key differing factor between scenarios is the extent of the share of commuters and non-locals expected to relocate into the Primary Study Area.

The 2011 Census showed that the most significant industries in terms of employment in the Muswellbrook Local Government Area were mining (employing 21.3 percent of employed people over 15 years of age), retail trade (9.2 percent), agriculture, forestry and fishing (7.1 percent), health care and social assistance (6.9 percent), accommodation and food services (6.9 percent) and construction (6.7 percent). A similar employment structure was apparent in the Secondary Study Area.

A significant shift in the unemployment rate in the Muswellbrook Local Government Area has occurred over the 12 months to June 2013, associated with the recent downturn in the coal mining industry. In June 2012, the unemployment rate for the Muswellbrook Local Government Area was 2.8 percent (233 people) which was slightly higher compared to the Singleton and Upper Hunter Local Government Areas, which were 1.2 percent and 1.3 percent respectively although significantly lower than New South Wales (5.2 percent).



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In contrast, the unemployment rate in December 2012 in the Muswellbrook Local Government Area was 4.7 percent (412 people). These figures have been trending upward consistent with the Secondary Study Area where unemployment levels have returned to similar levels as in 2008 with almost 1,000 persons being unemployed. This is in marked contrast to the situation in June 2012 when it was considered that the local economy was enjoying very close to full employment with any remaining unemployment considered to represent long term unemployed or structural unemployment. The current unemployment numbers suggest that there are unemployed people available with appropriate skills to support the Project (as at 2013).

The assessment identified that approximately 90 semi-permanent and / or short term households / units will be required as a result of the direct construction workforce. The total population increase to the Muswellbrook Local Government Areas during peak construction was estimated at 349. As a significant portion of the Project construction workforce will be commuting on a daily basis and on a work week basis, limited impacts are anticipated on the various elements of community infrastructure. There may be slight impacts on the outpatient health services facilities at Muswellbrook hospital and at the two General Practitioner community health centres due to servicing of the normal needs of the construction workforce on a daily basis but these impacts are considered to be manageable within the normal facility planning assumptions. Demand for schooling and childcare facilities of these employees would not exceed 10 school students and childcare places at the peak of construction which is considered to be well within current planning assumptions.

Impacts of the operational phase of the Project were assessed under workforce Scenarios 1 and 2. Results indicated that the initial determined that the initial and flow on employment expected to be generated by the operations phase of the Project under the two workforce scenarios and the predicted increase in population and consequent housing requirements associated with the non-local hires that will either relocate to the area or be weekly commuters in the operations phase.

The operations phase is expected to generate a total of approximately 1,164 jobs, 491 being direct and an additional 673 being flow-on jobs. Both scenarios will result in 118 jobs being generated for local workers and an additional 862 being generated for non-local workers (residing outside the Secondary Study Area).

Results from the 'Expected Case' indicate a total population increase of 952 and the need for 403 residential units of which 243 would be for families and/or couples and the remaining 163 to accommodate the needs of singles and work week commuters.

Scenario 2 would result in a total population increase of 1,404 and the need for 583 residential units of which 398 would be suitable for families and couples and the remaining 185 suitable for singles and work week commuters.

The assessment of the operational phase concluded under Scenario 1- the 'Expected Case' is sustainable within the current mine plan with a new workforce scheduled to build-up over a period of 4-5 years, provided that there are no cumulative pressures from other new proposals which require significant numbers of new housing. Scenario 2 would be difficult to achieve without extending the current scheduled build-up of the workforce.

A cumulative assessment also determined that with consideration of existing operating mines and approved projects operating at their maximum approved impacts there would be a cumulative social impact. However, a recent downturn in the 'mining boom' indicates that the assessment represents a significant worst-case base, in the current economic climate. The potential cumulative impacts were identified included a potential shortage in local construction workforce, additional stress on temporary accommodation and dwellings along with exacerbated impacts on community infrastructure.

A review of the employment trends in both the agricultural and mining industries over the past 15 years, suggest that employment recruited from the agriculture sector to the Project will be limited. Bengalla Mining Company will also provide relevant information on its workforce to Muswellbrook Shire Council to ensure it has adequate information to assist in its future infrastructure and development planning.

Bengalla Mining Company will also continue to utilise its already long running procedures (revised as necessary) in relation to social components of the operation. These procedures will ensure that Bengalla Mining Company continues to assist in managing issues associated with employee relocations to the Muswellbrook Local Government Area (including housing and general assistance), ensuring ongoing Aboriginal employment positions are available for the Project and providing a robust framework for managing fatigue issues (primarily associated with shift work).

In addition, Bengalla Mining Company has commenced initial proceedings to revise its existing Voluntary Planning Agreement with Muswellbrook Shire Council to provide in kind and monetary contributions to ensure any potential social effects of the Project are accounted for.

Economics

An Economic Impact Assessment was undertaken by Gillespie Economics, which aimed to determine both the economic efficiency and economic impacts of the Project.

A Benefit Cost Analysis confirms that when production costs (acquisition costs for affected land, opportunity cost of land, operating costs, decommissioning costs, etc.) and production benefits (revenues from production, residual values of land, etc.) are considered, the Project will have net production benefits to Australia of \$1,790 Million.

This net production benefit is distributed amongst a range of stakeholders including the regional community, Bengalla Mining Company, its shareholders and government.

In summary, the Project will result in the following economic benefits to the New South Wales economy:

- \$2,408 Million in annual direct and indirect regional output or business turnover;
- \$1,223 Million in annual direct and indirect regional value added;
- \$441 Million in annual indirect household income; and
- 4,868 indirect jobs. The Project will result in the following economic benefits to the regional economy (Muswellbrook, Singleton and Upper Hunter Local Government Areas):
- \$1,486 Million in annual direct and indirect regional output or business turnover;
- \$789 Million in annual direct and indirect regional value added;
- \$155 Million in annual direct and indirect household income; and
- 1,745 direct and indirect jobs.

Based on the above, the Project is considered desirable and justified from an economic efficiency perspective.

The cessation of Bengalla Mine under the existing approval would lead to a reduction in economic activity in the region. Given the current uncertainty in the coal mining sector, it is important for government to continue to effectively utilise the economic benefits, skills and expertise generated by Bengalla Mine to further strengthen and broaden the region's economic base.

Hazard Analysis

Hansen Bailey conducted a Preliminary Hazards Analysis for the Project, as required by *State Environmental Planning Policy 33 – Hazardous and Offensive Development*. The purpose of the analysis was to identify potential hazards, assess the significance of these hazards and develop potential management and control procedures.

The key hazardous materials required for the Project include explosives, hydrocarbons and other hazardous chemicals. The key hazardous chemicals include diesel and petrol fuels, oils, degreasers, kerosene, greases and explosives. Hazardous materials and chemicals are stored and handled in accordance with the relevant licenses, guidelines and Australian Standards.

A qualitative risk assessment presented was completed for the Preliminary Hazard Analysis to identify potential hazards associated with the Project and ensures that adequate risk mitigation and response measures will be implemented. This risk assessment has confirmed that the Project will not impose an unacceptable level of risk, with appropriate management.

All bulk materials will continue to be transported to site by a licensed contractor in accordance with the relevant transport codes and standards. Bengalla Mining Company has developed emergency response procedures for addressing spills or leakages or hazardous materials.

The Hazard Analysis has confirmed that the Project will not impose any unacceptable level of risk and is therefore not considered hazardous or offensive. Bengalla Mining Company will revise its internal procedure, Major Hazard Management Plan and Explosives Management Plan which will outline the procedures for transport and storage of substances, storage locations, material quantities and emergency response procedures.

Waste

Bengalla Mining Company implements a comprehensive waste management system to manage the disposal, tracking and reporting of waste at Bengalla. In addition, waste is managed in accordance with a number of Coal & Allied and Rio Tinto Environmental Performance Standards.

The volume of general waste generated by the operation is expected to increase as a result of the Project due to the increase in production and workforce. General waste volumes will be minimised by implementing strategies for the reuse or recycling of waste.

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Coal reject materials will continue to be managed by way of co-disposal. Sewage will continue to be treated at the onsite waste water treatment plant, which will be managed in accordance with the relevant Australian Standards. Contaminated materials such as grease and oil will be retained in storage tanks in a bunded area, prior to removal by a licensed contractor.

Contamination

A Preliminary Contamination Analysis was undertaken by Hansen Bailey to identify potential contamination sources within the Project Boundary. This analysis was undertaken in accordance with *State Environmental Planning Policy 55 – Remediation of Land*.

The sources of potential contamination identified within the Project Boundary were the historic heritage sites as these structures are associated with past agricultural land uses. The results of the preliminary contamination assessment identified the need for an additional investigation to assess the extent of contamination within the Disturbance Boundary prior to disturbance.

A detailed contamination investigation will be undertaken by a licensed contractor to assess the extent of contamination associated with current and former rural residence sites. Following this investigation, a remediation action plan will be prepared and implemented for the Project if required.

Soils and Land Capability

A Soils and Land Capability Impact Assessment was undertaken by GSS Environmental. The purpose of the assessment was to identify the soil types and land capability classes within the Project Boundary.

Seven different soil types were identified within the Project Boundary, with the dominant soil types being Brown Chromosol, Red Chromosol, Brown Vertosol and Rudosol. The predominant soil type in Dry Creek is a deep Brown Chromosol. All of the soil types are suitable for use as topdressing material, with the exception of Rudosol. Approximately 1.5 Million meters cubed of topdressing material will be available for use in rehabilitation. All of the soil types within the Project Boundary are classified as being of low to moderate fertility (under the '*Draft Inherent Soil Fertility of New South Wales*'). Acid sulphate soils are unlikely to be present within the Project Boundary.

The majority of the land within the Project Boundary (60 percent) falls within Land Capability Class V. There are smaller areas of Class II (4 percent), Class IV (12 percent), Class VI (12 percent) and Class VII (16 percent) land. The Land Capability Class determines the agricultural suitability of the land. The majority of the land constitutes Agricultural Suitability Class 3 land (68 percent). The remaining land falls under Class 2 (4 percent) and Class 4 (28 percent).

This assessment considered the potential impacts of the Project on Strategic Agricultural Land. There are approximately 28 hectares of mapped Biophysical Strategic Agricultural Land within the Project Boundary. However, only 1 hectare occurs within the Disturbance Boundary associated with the relocation of the Bengalla Link Road not as a result of mining related activities.

Bengalla Mining Company will undertake rehabilitation in accordance with its Rehabilitation Management Plan, which will be updated in consultation with the relevant regulators. The Rehabilitation Management Plan will outline the procedures for topsoil stripping, stockpiling and re-spreading.

Agriculture

Scott Barnett & Associates prepared an Agricultural Impact Statement which assessed the impacts of the Project on agriculture through disturbance of agricultural land and reduced access to water resources. All land within the Study Area is owned by Bengalla Mining Company or another mine.

The land within the Study Area is predominantly used for beef cattle breeding for the weaner and domestic market. The current beef cattle production amounts to a gross value of \$0.2 Million per year and a net value of \$0.1 Million per year. With improvements to the land, this could increase to a gross value of \$0.3 Million per year and a net value of \$0.2 Million per year.



The agricultural production from the land within the Disturbance Boundary will be foregone as a result of the Project. It has been conservatively assumed that all agricultural production within the Project Boundary will be foregone. The represents approximately 0.06 percent of the total regional agricultural production, 0.002 percent of the total state production and 0.0005 percent of the total national production.

The Project will also reduce the availability of water for agricultural purposes. Surface water taken by the Project could otherwise be used for lucerne hay and maize production. The maximum water requirement for the Project 2,200 megalitres is sufficient for irrigating 283 hectares of land. The crop production from this land amounts to a gross value of \$1.2 Million per year and a net value of \$0.3 Million per year.

The groundwater taken from the Hunter River alluvial aquifer could also have been used for lucerne hay and maize production. The 220 megalitres/year estimated to be taken by the Project is sufficient for irrigating 28 hectares of land, which can generate production with a gross value of \$0.1 Million and net value of \$0.02 Million.

The Project will disturb approximately 1 hectare of Biophysical Strategic Agricultural Land on land owned by Bengalla Mining Company.

The Project Boundary also contains 35 hectares of land mapped as being within the Equine Critical Industry Cluster. No existing studs occur in this area. Additionally, the Project will not disturb any of this land.

The Project Boundary also contains land mapped as being within the Viticulture Critical Industry Cluster. Approximately 494 hectares of this land was verified as being Viticulture Critical Industry Cluster land, of which 369 hectares will be disturbed by the Project. No viticulture industry occurs within the Project Boundary and the nearest winery being 6 kilometres south-west at the Mt Arthur Coal owned Rosemount Vineyard. The closest privately owned vineyard is 12 kilometres to the south-west of the Project Boundary.

The land within the Disturbance Boundary will be maintained as agricultural land for as long as practicable. Following mining, disturbed areas will be rehabilitated to Agricultural Suitability Class 3 and Class 4 land generally consistent with land in the Disturbance Boundary. Agriculture will be re-introduced into safe and stable rehabilitated areas as soon as practicable.

Bengalla Mining Company will update the Rehabilitation Management Plan and Landscape Management Plan in consultation with the relevant regulators which shall include a plan for weed and pest management.

Rehabilitation and Mine Closure

Rehabilitation at Bengalla Mine is undertaken in accordance with the Rehabilitation Management Plan, the objectives of which are to:

- Achieve an acceptable post-mining land use suitability;
- Develop a landform that is free draining and stable, with pasture cover;
- to Provide for the growth of vegetation, establishment of pasture or habitat;
- Preserve the quality of downstream waters;
- Control all hazards associated with the final highwall and low wall; and
- Ensure that the final low wall is shaped, stable and maintains pasture cover.

As mining operations progresses to the west, overburden emplacement areas will be established to the east of active mining areas. Once established, the overburden emplacement areas will be shaped for progressive rehabilitation as soon as practicable. Rehabilitation development will include a range of measures, including topsoil management and relocation, establishment of erosion and sediment controls, habitat reinstatement and revegetation works.

Topsoil resources will be stripped to the recommended depth and stockpiled for later use. Topsoil material is used in available rehabilitation areas as soon as practicable after stripping to preserve native seed banks and soil microflora. If topsoil needs to be stored for more than three months, stockpiles will be revegetated prior to respreading.

Bengalla Mining Company will continue to revegetate rehabilitated areas using specific seed mixes for pastoral and native vegetation areas, which contain native species and have proven successful in previous use. To promote effective links between site rehabilitation and remnant vegetation, a series of native vegetation corridors will be established across the site.

Rehabilitated areas will continue to be monitored on a regular basis to ensure that rehabilitation objectives are being met and that revegetation and long term landform sustainability is achieved. Maintenance and management works in rehabilitation areas will be undertaken to address any issues or recommendations identified during monitoring.

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Should further approvals not be sought and granted at Bengalla Mine, a preliminary final landform has been designed to result in a generally undulating landscape with slopes generally to 10 degrees and up to a maximum of 21 degrees on the low wall. Progressive rehabilitation of disturbed areas will incorporate the construction of erosion and sediment control and water management structures. It is anticipated that the landform will be predominately rehabilitated to grazing pasture, comparable to pre-mining land use with plantings of native woodland vegetation to achieve a minimum of 10 percent tree cover. Higher density tree coverage will occur of the eastern face of the overburden emplacement area.

A number of final void options were considered in the design of the most relevant final landform. The Blast and Doze method was determined to be the most suitable option which will result in a final void with a battered low wall.

Following consultation with community stakeholders and in consideration of pre-mining land use, consistent with rehabilitation conducted since 1998, a mixture of native bushland and cattle grazing was determined to be the most suitable post-mining land use. This combination of agricultural (cattle grazing) and conservation land use remains the preferred option for mine closure for the Project. In the event that further approvals are not sought or granted, Bengalla Mining Company will prepare a Mine Closure Plan within five years of the end of the Project.

Management and Monitoring

Bengalla Mining Company has identified and commits to the operational controls outlined in the Management and Monitoring Summary of this Environmental Impact Statement for all activities associated with the Project.

The aim of the Management and Monitoring Summary is to ensure that any potential environmental and socio-economic impacts resulting from the Project as identified in this Environmental Impact Statement are managed and monitored appropriately.

Project Justification

Bengalla Mine is arguably one of the most technically advanced and productive coal mining operations in New South Wales. Bengalla Mine has utilised real time noise and air monitoring systems since 1999 and was the first coal mine in Australia to gain accreditation to ISO14001 Standards for its Environmental Management System.

During its operation, Bengalla Mining Company has been a major employer of the local community, employing 358 full time equivalent workers as at September 2011 of which approximately 46 percent are currently residing in the Muswellbrook LGA; and 89 percent within the combined Muswellbrook, Upper Hunter and Singleton Local Government Areas. A large proportion of the existing Bengalla Mine workforce were employed as 'clean-skins' (workers without coal mining experience which Bengalla Mining Company has trained).

Bengalla Mining Company has maintained a commitment to coexist within neighbouring agricultural enterprises since its approval in 1995. Approximately 2,200 hectares of the land not required for mining is used for agricultural purposes including dairying, cattle production and horse stud industries. Bengalla Mining Company has made a commitment to maintain the agricultural productivity of its land holdings which it has done since 1995. There are also a variety of agricultural enterprises present adjacent to the Project Boundary including grazing, dairying, equine industries, viticulture and an olive grove.

Approval of the Project will allow up to 316 Million tonnes of Run of Mine coal to continue to be mined at Bengalla Mine, ensuring security of employment for the existing workforce and continuity of the socio-economic benefits currently experienced in the Hunter region, New South Wales and Australia. The Project will facilitate the recovery of a valuable coal resource in an area that has long been set aside for mining by the New South Wales Government on land acquired by Bengalla Mining Company for the specific purpose of the continuation of coal mining.



The Project will facilitate the recovery of a valuable, export quality thermal coal. Thermal coal remains a highly sought after energy source in Asian countries, including Japan, Korea, Taiwan, China and India. These countries continue to be the world's largest coal importers, and will largely account for an approximately 70 percent growth in total coal imports from 2009 to 2035. This increasing demand supports the need for the Project and justifies further investment in the thermal coal mining industry.

To this end the Project will enable Bengalla Mine to continue to:

- Assist Australia to continue to meet the international demand for thermal coal for at least the next 24 years, during which time it is expected that there will continue to be a strong world demand for coal for the purposes of generating electricity;
- Support Australia in maintaining its reputation as a consistent and reliable supplier of thermal coal to its existing and expanding markets; and
- Contribute materially to sustaining the Australian economy and maintaining the economic stability of New South Wales and the Hunter region.

The Project has been rigorously environmentally assessed in accordance with the *Environmental Planning and Assessment Act 1979*, its 'objects', including the principles of Ecologically Sustainable Development and by processes and in the manner required by the Director General's Requirements. This assessment has concluded that the Project should be approved under the *Environmental Planning and Assessment Act 1979*.

There are environmental costs which have been identified and which are capable of being acceptably managed by operational controls, land acquisition and management plans that would be established and adopted as approved by the Director-General of Planning and Infrastructure and other appropriate Government agencies and authorities. Ecological and long term costs have been minimised and will be accounted for by management strategies to maintain and improve vegetation and ecological values in the long term.

The Project will maximise the economic and social value from the remaining coal resource by a mine plan that will appropriately address the environmental and socio-economic constraints and the objects of the *Environmental Planning and Assessment Act 1979*, including the principles of Ecologically Sustainable Development.

The Project will provide net production benefits of \$1,790 Million over the 24 year Project life and will:

- Maximise the recovery of a high quality, thermal coal resource for which there is an increasing global demand;
- Create approximately 1,822 direct and indirect jobs in the local economy;
- Create approximately 4,868 direct and indirect jobs in New South Wales;
- Continue and extend financial support to the region, New South Wales and Australia with taxation and royalty benefits of \$1,278 Million over the Project life; and
- Achieve the most efficient economic use of the land.

It has been demonstrated that the Project represents a low strip ratio, low ash content product which will continue to provide thermal coal for current and future generations and will generate significant economic benefits in the process. The Project's social and environmental impacts have been minimised as far as practicable by implementing all reasonable and feasible management and mitigation measures.

As a consequence, the socio-economic benefits of the Project will outweigh its social and environmental costs. Therefore, the Project is in the public interest.





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- B Schedule of Land to which this EIS Applies
- C Detailed Design Drawings
- D Regulatory Correspondence
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- F Revised Environmental Risk Assessment
- G Air Quality Impact and Greenhouse Gas Assessment

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- H Acoustic Impact Assessment
- I Visual Impact Assessment Study
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- N Historic Heritage Report

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- P Stygofauna Assessment
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- R Social Impact Assessment
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- V Soil and Land Capability Impact Assessment
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- X Dry Creek Interim Management System and Conceptual Re-establishment Study



1

Introduction

This section provides an introduction to the Environmental Impact Statement (EIS) for the Bengalla Continuation of Mining Project. It describes the background and context of the Bengalla Continuation of Mining Project, introduces the proponent and outlines the purpose and structure of the EIS.

1.1 Background

Bengalla Mining Company Pty Limited (BMC) operates the Bengalla Mine (Bengalla) in the Upper Hunter Valley of NSW. Bengalla is situated approximately 130 kilometres (km) north-west of Newcastle and 4 km west of the township of Muswellbrook (see **Figure 1**). It is generally bounded by Wybong Road to the north, Roxburgh Road to the west, Overton Road to the east and the Bengalla Link Road and Muswellbrook-Ulan Rail Line to the south.

On 7 August 1995, BMC was granted Development Consent (Development Application (DA) 211/93) (**Appendix A**) by the then Minister for Urban Affairs and Planning. This consent authorised the construction and operation of a surface coal mine, coal preparation plant, rail loop, loading facilities and other associated infrastructure. The application for development consent was supported by the *Environmental Impact Statement for Bengalla Coal Mine* (Bengalla 1993 EIS) (Envirosciences, 1993).

The original consent allowed the extraction of up to 8.7 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal for a period of 21 years from Bengalla. The Bengalla 1993 EIS recognised that significant coal reserves continued west beyond the 21 year mining extent:

"The coal reserves continue to the west of the limit of excavation and beyond the edge of the Authorisation area. It is anticipated that these reserves will be mined by open cut methods in the future, subject to appropriate approvals" (Bengalla 1993 EIS).

There have since been four approved modifications to DA 211/93. Bengalla is now approved to produce up to 10.7 Mtpa of ROM coal. A detailed account of Bengalla's approvals history is provided in **Section 3**. Approximately 7 Million tonnes (Mt) and 8.5 Mt of ROM was extracted in 2011 and 2012 which yielded approximately 5.4 Mt and 7 Mt of saleable coal respectively (BMC, 2012a).

BMC was granted Mining Lease 1397 in 1996 and mining operations subsequently commenced in 1998. As part of its ongoing commitment to future operations at Bengalla and long term investment in the Upper Hunter region, BMC has completed detailed scoping and feasibility studies to facilitate the continuation of mining to the west of the existing operations.

BMC is seeking a new Development Consent under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to enable mining to continue for an additional 24 years at a maximum production rate of 15 Mtpa of ROM coal (the Project). Under the Project, mining would continue in a westerly direction, but will remain predominantly on lands within the mining authorisations currently held by BMC.

The Project will largely rely upon the currently approved and constructed mine site infrastructure, including the Coal Handling and Preparation Plant (CHPP), rail loop and loading facility, workshop and administrative buildings. Some of this infrastructure will need to be upgraded or relocated to accommodate the proposed increase in production from 10.7 Mtpa to 15.0 Mtpa and extension of mining.





BENGALLA MINE

Locality Plan

FIGURE 1

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1.2 Project Overview

BMC is seeking Development Consent under Part 4 of Division 4.1 of the EP&A Act to facilitate the continuation of open cut coal mining largely within current Mining Leases and within the Project Boundary as shown on Figure 2 on the land listed in Appendix B.

An indicative layout of the Project is provided in Figure 3 and is generally comprised of the following:

- Open cut coal mining at up to 15 Mtpa ROM coal of a total resource of 316 Mt for up to 24 years continuing to utilise a dragline and truck / excavator fleet;
- Continue mining to the west of current operations;
- An additional Overburden Emplacement Area (OEA) to the west of Dry Creek which may be utilised for excess overburden material until it is intercepted by mining;
- Processing, handling and transportation of coal via the existing CHPP (to be upgraded) and rail loop for export and domestic sale;
- An additional CHPP stockpile and ROM coal stockpile;
- Continued use, expansion and upgrades to existing and new infrastructure;
- Construction of a radio tower;
- Relocation of the Explosives Magazine and Reload Facility;
- Relocation of a section of Bengalla Link Road near the existing mine access road to enable coal extraction;
- The diversion of Dry Creek via dams and pipe work with a later permanent re-alignment of Dry Creek through rehabilitation areas once stability is established;
- Relocation of water storage infrastructure as mining progresses through existing dams (including the staged discharge dam);
- Construction of raw water dams and a clean water dam;
- A gradual increase in the approved workforce from 400 up to approximately 900 full time equivalent personnel (plus contractors) at peak production; and
- Supporting power reticulation infrastructure.

The 900 full time equivalent personnel includes contractors that work at Bengalla on a regular basis for various activities including but not limited to electrical works, plant and equipment maintenance, engineering and other ongoing purposes. An additional contractor base workforce of up to approximately 315 personnel will be required during the peak construction phase. Further discussion in relation to the construction workforce and schedule is presented in Section 4.11.

The Project will generally be undertaken within the Disturbance Boundary as illustrated on Figure 3. Minor additional disturbance associated with ancillary works including the Dry Creek pipeline and associated power supply, fencing, firebreaks, water diversion structures, minor contour banks, tracks along pipelines, powerlines, topsoil storage areas, temporary construction areas and sediment control structures will also be required. Any additional disturbance located outside the Disturbance Boundary (but within the Project Boundary) will be subject to the relevant BMC approvals including the completion of a Ground Disturbance Permit (GDP) as discussed in Section 3.13.

Upon the granting of the new Development Consent, DA 211/93 (as modified) and DA 273/2006 will be surrendered at a mutually agreeable time between BMC and the Department of Planning and Infrastructure (DP&I).

1.3 Proponent

The proponent for the Project is BMC which is owned by the Bengalla Joint Venture. The Bengalla Joint Venture is constituted by:

- CNA Bengalla Investments Pty Limited (a subsidiary of Coal & Allied Industries Limited, a Rio Tinto Group company) 40%;
- Wesfarmers Bengalla Limited (a wholly owned subsidiary of Wesfarmers Limited) 40%;
- Taipower Bengalla Pty Limited (a wholly owned subsidiary of Taiwan Power Company) 10%; and
- Mitsui Bengalla Investment Pty Limited (a wholly owned subsidiary of Mitsui Coal Holdings Pty Limited) 10%.

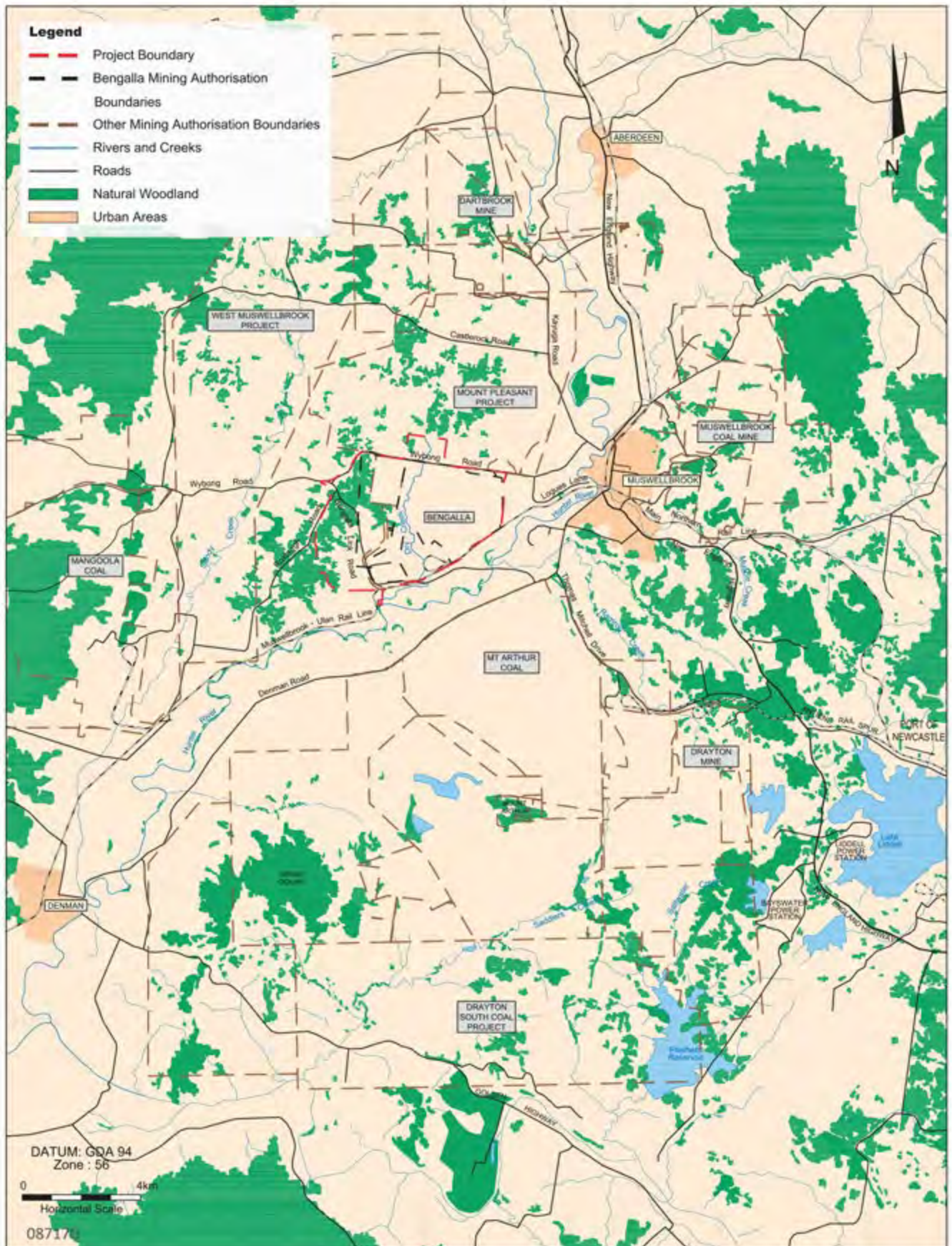
The contact details for BMC are:

Bengalla Mining Company Pty Limited
LMB 5
MUSWELLBROOK NSW 2333

Phone: 02 6542 9500

Fax: 02 6542 9599

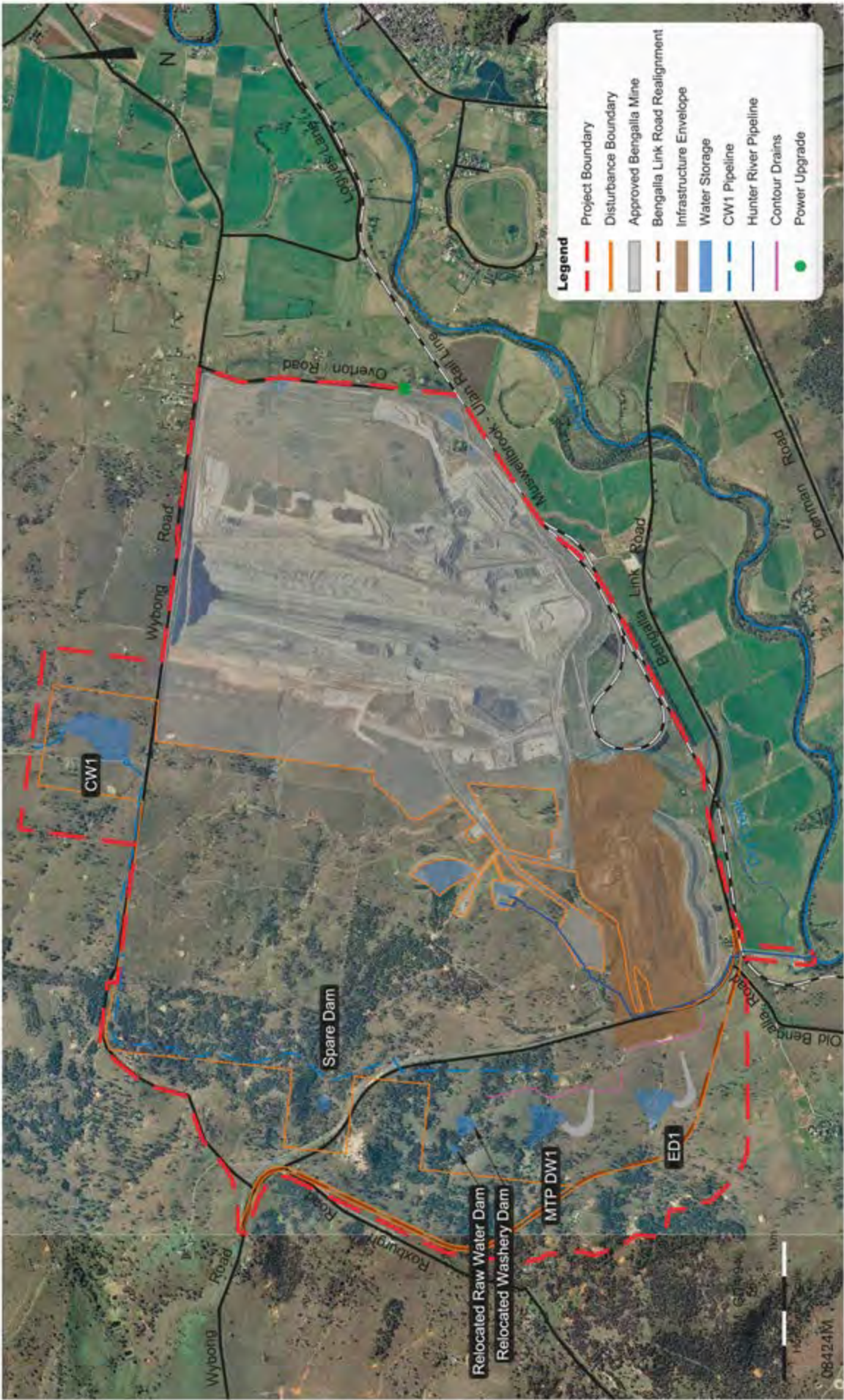
Website: <http://www.riotintocoalaustralia.com.au/>



BENGALLA MINE

Regional Locality

FIGURE 2



BENGALLA MINE
Conceptual Project Layout
FIGURE 3

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1.4 Document Purpose

BMC seeks a Development Consent under Part 4 of Division 4.1 of the EP&A Act to enable coal mining and associated activities to continue at Bengalla. The Project will facilitate the extraction of up to a maximum of 316 Mt of ROM coal at a rate of up to 15 Mtpa for up to 24 years.

A request for Director-General's Environmental Assessment Requirements (DGRs), supported by a Background Document was made to DP&I on 17 February 2012, in accordance with clause 3 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). DGRs were subsequently issued by DP&I on 13 March 2012.

A table listing all DGRs and where they have been addressed in this EIS is included in **Section 6**. This section also addresses all other regulators submissions to the DGRs. Supplementary DGRs were issued on 12 July 2012 to specify additional matters for assessment.

This EIS has been prepared by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of BMC to support the application for Development Consent. Under Section 78A(8A) of the EP&A Act, a development application for State Significant Development (SSD) must be accompanied by an EIS. This EIS has been prepared in accordance with the form and content requirements prescribed by clauses 6 and 7 of Schedule 2 of the EP&A Regulation. The Project Boundary to which this EIS applies is illustrated in **Figure 3**. The schedule of land to which this EIS applies (all land located either wholly or partly within the Project Boundary) is provided in **Appendix B**.

This EIS also supports an application to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (SEWPaC) for approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This EIS includes a consideration of all issues raised during the extensive stakeholder engagement process undertaken for the Project. It also addresses the DGRs by assessing the social, economic and environmental impacts of the Project to enable the Minister for Planning and Infrastructure to determine the development application. A summary of stakeholder issues raised in relation to the Project and a checklist of the DGRs and where these have been addressed is presented in **Section 6.4.1**.

1.5 Document Structure

This EIS consists of six volumes. This volume (Volume 1) includes the main EIS report prepared by Hansen Bailey and presents a Project description, summary of associated environmental, social and economic impacts and the mitigation and management measures proposed. Volume 1 is structured as follows:

- **Section 2** provides relevant information on the existing environmental setting including land use;
- **Section 3** describes the existing approved mining operations at Bengalla, environmental management system and existing environmental commitments;
- **Section 4** provides a detailed description of the Project;
- **Section 5** outlines the regulatory framework applicable to the Project;
- **Section 6** details the stakeholder engagement undertaken for the Project and discusses the issues raised. Specifically, this section lists the DGRs and identifies where these matters are addressed in this EIS;
- **Section 7** provides a summary of the risk assessment process adopted to rank all identified environmental and social issues to assist in directing the focus of this EIS;
- **Section 8** assesses the potential environmental and social impacts of the Project and outlines the proposed management and mitigation measures;
- **Section 9** provides a summary of the management and mitigation measures committed to;
- **Section 10** provides a detailed Project justification and conclusion;
- **Section 11** defines the abbreviations used throughout this EIS;
- **Section 12** provides a list of all materials referenced in this EIS; and
- **Section 13** presents the study team involved in the compilation of this EIS.

Volumes 2 to 6 contains the schedule of land to which this EIS applies, existing planning approvals, regulatory correspondence, stakeholder engagement materials and the revised environmental risk assessment undertaken for the Project. In addition, the specialists technical assessments in full and support the main volume of this EIS.



2

Existing Environment

This section provides an overview of the regional setting, topography, catchments, climate, geology and land use for the areas within and surrounding the Project Boundary. The ownership of land relevant to the Project is also discussed.

2.1 Regional Setting

The Project is located within the Muswellbrook Local Government Area (LGA) in the Upper Hunter region of NSW. The dominant land uses in the region are coal mining, power generation and agriculture. The Hunter River is the major watercourse in the region and performs an important role in supporting the region's populations and industries.

Located 4 km to the east of the Project is the township of Muswellbrook. The New England Highway and the Main Northern Railway Line both pass through Muswellbrook. To the north of the Project are the Mount Pleasant Project and the Dartbrook Mine. Neither of these developments is currently operational. The Hunter River and the Muswellbrook-Ulan Rail Line pass immediately to the south of the Project. To the south-east are the Mt Arthur Coal Mine, Drayton Mine and Macquarie Generation Power Stations (see Figure 4). The township of Denman is located approximately 15 km to the south-west. To the west of the Project is the Mangoola Coal Mine and rural residential and rural properties.

2.2 Topography

The land within the Project Boundary is generally undulating and slopes downwards towards the Hunter River to the south. The Hunter River alluvial flats are situated within the eastern and southern extents of the Project Boundary.

In the eastern part of the Project Boundary, the Overton Ridge naturally reaches an elevation of 188 metres (m) Australian Height Datum (AHD). To the south of Overton Ridge are the lower hillslopes of the Hunter Valley, which range in elevation from 250 m AHD to 134 m AHD near the Hunter River (Envirosciences, 2003).

The area within the Project Boundary predominantly contains slopes of gentle gradients (less than 5 degrees). The gullies in the lower reaches of ephemeral streams draining into the Hunter River generally have slopes of less than 2.5 degrees. Ridgetops also generally have a gradient of less than 2.5 degrees. The Hunter River alluvial floodplain generally has a gradient of less than 1 degree.

Landscape features present within the Project Boundary include:

- Active mining areas within the Approved Bengalla Mine;
- Completed mining areas that are awaiting or in the process of being rehabilitated;
- Rehabilitated areas;
- Bengalla Mine infrastructure; and
- Open paddock grazing land with stands of remnant forest and regrowth woodland.

Prior to mining at Bengalla, the land within the Project Boundary was used for agricultural purposes. As a result, the land to the west of the Approved Bengalla Mine has been substantially cleared and contains only remnant woodland.

Wollemi National Park is located approximately 22 km to the south of the Project. This encompasses an area of 501,000 ha and consists of open eucalyptus forest, closed forest, woodland and rainforest (NPWS, 2005).

2.3 Catchments

The Project is located within the Hunter River catchment, which has a total area of approximately 4,300 km² to Muswellbrook. The main channel of the Hunter River varies in width from 50 m to 100 m, whereas the alluvial floodplain is up to approximately 2 km wide.

The Hunter River passes directly to the south of Bengalla. Consequently, the catchment within the Project Boundary drains in a south and south-easterly direction. The local drainage network generally consists of relatively steep gullies draining from the surrounding hills into flat, meandering tributaries across the Hunter River floodplain. Bengalla Mine is located adjacent to the Hunter River floodplain with the eastern and southern limits of the Project Boundary located within the Hunter River alluvium.

Dry Creek drains the western portion of the land within the Project Boundary. The creek flows southwards through the site and discharges into the Hunter River to the south-west of Bengalla. Dry Creek is ephemeral and has a total catchment area of approximately 18 km². The other watercourses in the vicinity of the Project are also ephemeral. Long periods of zero flow are interrupted by short periods of discharge during periods of prolonged and/or heavy rainfall.



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BENGALLA MINE
Existing Environment

FIGURE 4

In accordance with the Strahler stream classification, Dry Creek is a third order stream.

A baseline photographic record and visual fly through of the Dry Creek alignment within the Project Boundary was completed for the Project. **Plate 1** provides a representative example of Dry Creek from within the Project Boundary. Additional detail regarding baseline conditions of Dry Creek is discussed in **Section 8.6**.

The Hunter River is regulated upstream of Bengalla by Glenbawn Dam, with a catchment area of 1,300 km². Under current catchment conditions the Hunter River is perennial, with a minimum flow rate of approximately 10 Megalitres/day (ML/d). The median (50th percentile) flow rate is about 380 ML/day and the fifth percentile flow rate is greater than 100 ML/day. It is likely that regulation has increased the frequency of low flows and moderately reduced the frequency of high flows (See **Section 8.6**).

2.4 Land Use

The Upper Hunter region has a long history of rural land use for a variety of agricultural and industrial activities, predominantly grazing and coal mining. The dominant land uses within and adjacent to the Project Boundary include open cut coal mining and industrial activities, agriculture, rural residential and rural areas. The Hunter River is south of the Project Boundary and plays an important role in the region's mining, power generation and agricultural enterprises. **Figure 5** provides an indication of the proximity of industries in relation to Bengalla.

BMC currently owns 3,203 hectares (ha) of land within and surrounding the Project Boundary. The Approved Bengalla Mine accounts for 974 ha of this area. The remainder of BMC's land is licensed to agricultural operators for a variety of agricultural enterprises, primarily for cattle grazing (see **Plate 2**). BMC's landholdings outside of the Project Boundary are used for dairying, thoroughbred breeding, cattle grazing, lucerne hay production and hemp production.

Plate 1 Typical Dry Creek Section



Each of the key surrounding land uses in relation to agriculture, power generation and industry, coal mining, rural and residential developments and National Parks and State Forests are discussed further below.

The Bengalla Link Road is a dedicated public road constructed under Development Consent (DA 211/93).

2.4.1 Coal Mining

The Upper Hunter region has a long history of coal mining development. Coal mining in the region commenced in 1906 with the establishment of the Muswellbrook Colliery (see **Figure 4**). Mining in the region has since expanded significantly, particularly in the vicinity of the Project. Coal mining contributes significantly to the economy of the Upper Hunter region. According to the *Upper Hunter Economic Diversification Project* (Buchan Consulting, 2011), the mining industry in the region generated an estimated \$6.2 Billion in revenue in 2010. In addition, mining employs 19.3% of persons in the Muswellbrook LGA, which is substantially more than any other sector (Buchan Consulting, 2011).

Table 1 and **Figure 4** identify the existing and approved mining operations within 10 km of the Project. These Projects have been considered in the assessment of cumulative environmental impacts, where applicable. The key interactions between the Project and other approved mining developments in close proximity are described in further detail below.

Mount Pleasant Project

The Mount Pleasant Project is wholly owned by Coal & Allied, subsidiary of Rio Tinto Coal Australia (RTCA). It is located to the immediate north of the Project Boundary. The Mount Pleasant Project was granted development consent (DA 92/97) in 1999, which was supported by the *Mount Pleasant Mine Environmental Impact Statement* (Mount Pleasant EIS) (ERM Mitchell McCotter, 1997). The Mount Pleasant Project has approval for the construction and operation of an open cut coal mine, coal preparation plant, transport and rail loading facilities and associated facilities at a production rate of up to 10.5 Mtpa ROM coal.

Plate 2 Existing Land Use



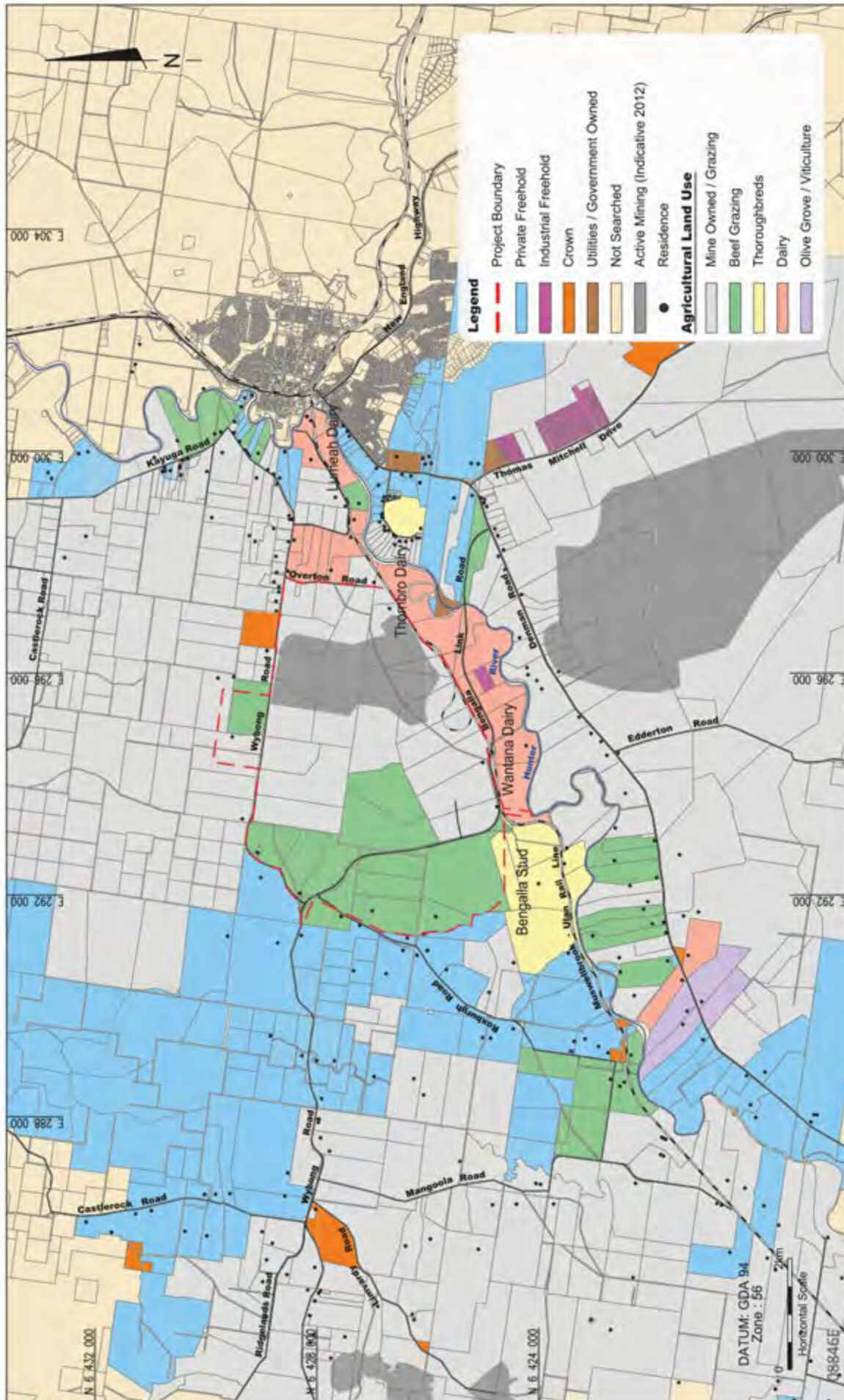


FIGURE 5
Indicative Land Use

Table 1 Coal Mining Operations in Proximity to Project

Mine	Distance from the Project	Description	Status
Mount Pleasant Project	<1km north	Open cut coal mine approved to extract up to 10.5 Mtpa of ROM coal for a period of 21 years. Development commenced in 2004 with the construction of Environmental Dam 1. This project has not yet commenced coal extraction operations at this time.	Approved until 22/12/2020
Mt Arthur Coal Mine	2 km south	Currently operating open cut and underground coal mine to extract from Mt Arthur Coal Complex up to 36 Mtpa ROM coal. The operator has also recently submitted a Modification to Project Approval 06_0091, to facilitate a four year continuation of the open cut mine life from 2022 to 2026 at the currently approved maximum rate of 32 Mtpa with an additional footprint of 400 ha along with other infrastructure changes.	Open cut until 2022 (2026 if modification granted). Underground until 2030
Mangoola Coal Mine	8 km west	Currently operating open cut coal mine extracting and processing up to 10.5 Mtpa of ROM coal for a period of 21 years. Project Approval 06_0014 has been modified five times. The operator has also recently submitted a Modification to its Project Approval, to facilitate an increase in production rates 13.5 Mtpa along with other associated infrastructure changes. No amendment to the approved project disturbance boundary is being sought.	Approved until 20/11/2029
Muswellbrook Coal Mine	6 km east	Currently operating open cut coal mine extracting and processing up to 2 Mtpa of ROM coal.	Approved until 01/09/2015
Drayton Mine	8 km south-east	Open cut coal mine extracting up to 8 Mtpa of ROM coal.	Approved until 31/12/2017
Drayton South Coal Project	16 km south	Proposed open cut and highwall mining processing up to 7 Mtpa for ROM coal for a period of 27 years within the Drayton South area while continuing to utilise Drayton Mine's existing infrastructure and equipment.	DP&I Assessment Process
Dartbrook Mine	9 km north-east	Underground mine extracting up to 6 Mtpa of ROM coal for a period of 21 years. Mining was suspended due to operational and geological issues. Dartbrook has been under care and maintenance since 2007.	Approved until 05/12/2022
West Muswellbrook Project	4 km west	Explorations activities currently ongoing within Assessment Lease 19 granted to 9 September 2014.	Exploration
Spur Hill Project	8 km south-west	Exploration activities within Exploration Licence 7429.	Exploration

The Mount Pleasant Project physically commenced in 2004 with the construction of Environmental Dam 1 (ED1). No other construction or coal mining has occurred to date.

In 2011, a modification to DA 92/97 was approved, supported by the 'Mount Pleasant Project Modification Environmental Assessment Report' (Mount Pleasant 2010 EA) (EMGA Mitchell McLennan, 2010). This modification allowed the mine infrastructure to be sited within an infrastructure envelope, as opposed to the specific locations specified in the Mount Pleasant EIS. The modification also provided the option of a conveyor / service corridor as an alternative to the approved rail facilities. The conveyor / service corridor passes through the Project Boundary.

In order to address potential cumulative issues associated with the Project and the Mount Pleasant Project, it has been assumed that further approvals will be granted to enable operations to continue beyond 2020. This assumption is intended to represent a potential 'worst case' scenario with consideration of potential cumulative environmental impacts. An assessment of the cumulative air quality, noise and traffic impacts associated with this potential worst case scenario has been applied to this EIS and is discussed in **Section 8**. Key Project interactions with the Mount Pleasant Project are discussed in detail in **Section 4.12**.

Coal & Allied and BMC have a protocol in place that will facilitate open cut coal mining by BMC to the south of Wybong Road within Mount Pleasant Project Mining Lease 1645. Consultation with Coal & Allied in relation to the Mount Pleasant Project is discussed in **Section 6**.

Mt Arthur Coal Mine

Hunter Valley Energy Coal's (HVEC) Mt Arthur Coal Mine is located approximately 2 km south of the Project. Mt Arthur Coal Mine operates an approved open cut and underground coal mine (in accordance with Project Approval 06_0091) to extract up to 36 Mtpa ROM coal. Open cut and underground operations are approved to continue until 2022 and 2030 respectively.

HVEC is seeking a Modification to Project Approval 06_0091 to facilitate:

- A four year continuation of the open cut mine life from 2022 to 2026 at the currently approved open cut mining maximum rate of 32 Mtpa;
- Increase in open cut disturbance areas of approximately 400 ha;
- Use of the existing conveyor corridor for overburden emplacement;
- Various infrastructure changes; and
- Increasing the maximum number of train movements per day to 19.

In order to address potential cumulative issues associated with the Project and Mt Arthur Coal Mine, it has been assumed that approval for the above modification is granted and in addition further approvals will be sought and granted to enable the continuation of mining westwards beyond 2026. This assumption is intended to represent a potential 'worst case' scenario with consideration of potential cumulative environmental impacts. An assessment of the cumulative air quality, noise and traffic impacts associated with this potential worst case scenario has been applied to this EIS and is discussed in **Section 8**.

Mangoola Coal Mine

Xstrata Mangoola Pty Ltd (Xstrata Mangoola) operates the Mangoola Coal Mine (Mangoola) located 6 km west of the Project. Xstrata Mangoola was granted Project Approval 06_0014 in June 2007 for the construction of an open cut coal mine and associated infrastructure to 20 November 2029. Since this time, five modifications to the original Project Approval 06_0014 have been granted for the following:

- Modification 1 – 'Early Works' granted on 22 July 2008;
- Modification 2 – 'Pipeline Modification' granted on 23 June 2009;
- Modification 3 – 'Mining Infrastructure Area and CHPP' granted on 4 November 2009;
- Modification 4 – 'Modifications to Mine Plans' granted on 22 June 2012; and
- Modification 5 – 'Night Time Works' granted on 23 February 2010.

Access to Mangoola is primarily via the Bengalla Link Road and Wybong Road. Any changes to the Bengalla Link Road alignment associated with the Project have considered currently approved traffic levels at Mangoola (see **Section 8.13**). BMC will continue to consult with Xstrata Mangoola in relation to the construction of the realignment of the Bengalla Link Road in approximately Year 15.

Xstrata Mangoola is currently seeking a modification to Project Approval 06_0014 to facilitate:

- Increase in the maximum rate of extraction from 10.5 Mtpa ROM coal to 13.5 Mtpa ROM coal;
- Increase in equipment numbers to support increased mining intensity;
- Increase in employee numbers to support additional equipment and operational needs and requirements;
- Increase frequency of blasting from five blasts per week to six blasts per week;
- Relocation of one temporary ROM stockpile to a permanent ROM stockpile location;
- Utilisation of up to 50,000 tonnes per annum (tpa) of suitable mined waste rock for onsite gravel production; and
- Discharge of saline water to the Hunter River under the rules and regulations of the Hunter River Salinity Trading Scheme (HRSTS).

No increase or extension to the approved project disturbance boundary is sought.

2.4.2 Agriculture

The Project is located within lands that have been largely disturbed by previous agricultural activities, particularly cultivation and grazing. Agriculture has been conducted in the vicinity of the Project since European settlement of the Muswellbrook area in 1824. As a result of extensive agriculture, the landscape in the area typically consists of grassland interspersed with small woodland remnants.

The Hunter River meanders south from Glenbawn Dam (east of Scone) and passes to the south of the Project before flowing east towards Newcastle. The Hunter River and its alluvial floodplain support agricultural activities including viticulture, grazing, dairying, lucerne hay production, horse studs and olive groves. In 2009, agricultural production in the region amounted to \$248 Million (M). The viticulture and thoroughbred breeding industries generated revenues of \$45 to 55 M and \$100 M respectively (Buchan Consulting, 2011).

BMC has operated adjacent to neighbouring agricultural enterprises since its approval in 1995. Approximately 2,200 ha of the land not required for mining is used for agricultural purposes including dairying, cattle production and equine industries.

BMC has made a commitment to maintain the agricultural productivity of its land holdings, which it has done since 1995. BMC has established lease agreements with third parties for the management of three dairy farms and the Bengalla Stud.

There are also a variety of agricultural enterprises adjacent to the Project Boundary including grazing, dairying, equine industries, viticulture and an olive grove. A full discussion of agricultural impacts associated with the Project is provided in **Section 8.20**. **Figure 5** presents the Project in context of the surrounding land uses. A description of each is provided below.

Grazing

Other than mining, small-medium scale, semi-rural grazing properties are a frequent land use surrounding the Project primarily to the east and west.

Dairying

From 1995 to 2004, the Bengalla Agricultural Company managed three dairy farms in the vicinity of Bengalla: Thornbro, Wantana and Lumeah. The management of these dairy farms was transferred to private operators in 2004. These farms remain under the management of licensees and currently produce approximately 4.7 M litres of milk annually.

The closest privately owned dairy farm is located approximately 3 km south-west of the Project Boundary.

Viticulture

The Upper Hunter region contains several wineries and vineyards with Cruickshank's Callatoota Vineyard being closest, located approximately 12 km to the south-west of the Project Boundary on Denman Road. Roxburgh Vineyard is owned by HVEC in conjunction with the operation of Mt Arthur Coal Mine.

Equine

In addition to Bengalla Stud, there are several horse enterprises in the Hunter Valley, however the nearest privately owned horse stud is located 3.5 km south-west of the Project Boundary. There are existing thoroughbred racing and training facilities located on Racecourse Road, to the south-east of Bengalla.

Woodlands and Coolmore Studs are located approximately 16 km and 18 km south, respectively, from the Project Boundary with various other mining operations and projects located in between, including Mt Arthur Coal Mine, Drayton Mine and the proposed Drayton South Coal Project.

Olive Groves

Pukara Olives is an 80 ha olive grove located on Denman Road approximately 4.5 km south-west of the Project Boundary. Pukara Olives was established in 1999 and has coexisted within proximity to Bengalla since this time. Pukara Olives is owned by HVEC in conjunction with the operation of Mt Arthur Coal Mine.

2.4.3 Power Generation and Other Industry

The Bayswater and Liddell Power Stations, both owned by Macquarie Generation, are located approximately 16 km to the south-east of Bengalla. Bayswater Power Station utilises four 660 megawatt (MW) generating units to produce approximately 16,000 Gigawatt hours (GWh) of electricity per year. Liddell Power Station is comprised of four 500 MW generating units, which produce approximately 10,000 GWh of electricity annually. The Liddell and Bayswater Power Stations were commissioned in 1971 and 1985, respectively.

Macquarie Generation's operations in the Hunter Valley supply approximately 13% of the electricity consumed by eastern Australia (Queensland to South Australia) and 40% of the electricity consumption in NSW. Macquarie Generation is one of Australia's largest electricity providers. On 12 January 2010, the then Department of Planning granted approval for a concept plan for the Bayswater B Power Station. This is a proposed gas or coal fired power station to be constructed near the existing Bayswater Power Station.

The Muswellbrook Industrial Estate is located on Thomas Mitchell Drive to the south-east of Bengalla (see **Figure 5**). Muswellbrook Industrial Estate is comprised of a variety of businesses that largely provide support services to the mining industry.

2.4.4 Rural and Residential Developments

The township of Muswellbrook is located approximately 4 km east of Bengalla. Muswellbrook is situated on the New England Highway, approximately 25 km south of Scone and 50 km north-west of Singleton. The town has a population of approximately 10,500 (MSC, 2011a).

The rural township of Denman is located approximately 15 km south-west of Bengalla. Denman has a population of approximately 1,500 (MSC, 2011a). The townships of Muswellbrook and Denman are both situated in the Muswellbrook LGA, which is estimated to have a population of 16,098 (ABS, 2012a). There are several privately owned rural properties located to the west and south-west of the Project Boundary.

2.4.5 National Parks and State Forests

There are no State Forests within 50 km of the Project. There are no substantial National Parks in close proximity to Bengalla Mine. The closest National Parks are Wollemi National Park situated approximately 22 km to the south and Goulburn River National Park situated approximately 30 km west of Bengalla.

2.5 Land Ownership

The ownership of land within and surrounding the Project Boundary is shown in **Figure 6**. All of the land within the Project Boundary is owned by BMC, with the exception of three lots owned by Coal & Allied (for the Mount Pleasant Project). Coal & Allied also owns a large area of land to the north of Bengalla. The land to the south of the Project Boundary is held by HVEC for the Mt Arthur Coal Mine.

Xstrata Mangoola occupies a significant area of land to the west of the Project. The land between Bengalla and Mangoola is comprised of privately owned rural residential properties. Much of this land is situated within the West Muswellbrook Project's Assessment Lease (AL) 19 (see **Figure 6**).

Other private landholdings occur to the east of Bengalla, near the Muswellbrook Racecourse. Potential impacts to mine owned properties and receptors are discussed in **Section 8.1** and **Section 8.3**.

Table 2 lists the properties in the vicinity of the Project that remain under private ownership. This table allocates a unique identifier to each individual lot of land in the area and should be read in conjunction with **Figure 6**.

For the purpose of this EIS individual households will be referred to as receptors. Where properties are currently entitled to acquisition upon written request by a coal mine, being within a Zone of Affection (ZOA) it is indicated with explanatory notes at the bottom of the table.

Table 2 Non-Mine Land Ownership

ID	Name	ID	Name	ID	Name
1	Cowtime Investments Pty Ltd	28	C Horne*	56	NJ Keevers
2	Cowtime Investments Pty Ltd	29	Jabetin Pty Limited	57	AC Good
3	Cowtime Investments Pty Ltd	30	Telstra Corporation Limited	58	RS & JT Cridland
4	Cowtime Investments Pty Ltd	31	The Council of the Municipality of Muswellbrook	59	Englebrecht Racing Stables
5	Cowtime Investments Pty Ltd	32	YS Boyle	60	RH Englebrecht
6	LG & CM Kelman	33	NSW Greyhound Breeders Owners & Trainers	61	JR Gleeson & MR Cranfield
7	LG & CM Kelman	34	NSW Land And Housing Corporation	62	DR & CJ Tubb
8	CK Birch	35	WJ Hardes	63	JP Drake
9	CK Birch	36	WJ Hardes	64	MJ Drake^
10	WJ Adnum	37	NSW Land and Housing Corporation	66	JR Scriven^
11	WJ & DW Adnum	38	NSW Land and Housing Corporation	67	PM & FP Farrell & HG & MG Cope
12	WJ Pitman	39	WJ Hardes	68	JT & SE Bancroft
13	WJ Adnum	40	SW & KL Barkley	69	G Gillfeather
14	DL & FR Wicks	41	FK & WDG Almond & PW Hume	70	GJ Meyer
15	DL & FR Wicks	42	DP Englebrecht^	71	AR Masters
16	DL & FR Wicks	43	KB & JA Barnett^	72	RJD & DA Osborn
17	LJ Purser	44	MJ McGoldrick	73	RJD & DA Osborn
18	DM Purser	46	Muswellbrook Race Club Limited	74	JR Hall
19	RK & NV Googe	47	DL Robinson	75	Talbot & Jazipa Pty Ltd
20	RK & NV Googe	48	MC & LI Dobie	76	JA & DJ Forder
21	RK & NV Googe*	49	ML & EA Sweeney	77	MSC
22	N & M Sormaz	50	TD Barron	78	Christian Outreach Centre
23	RB Parkinson	51	RA Byrnes & MA Moller	79	Christian Outreach Centre
24	JM Simpson	52	GL & IL Andrews	80	MSC
25	RK & NV Googe	53	SY Johnson	81	JR & JA Buckley
26	RK & NV Googe	54	JR Gleeson & MR Cranfield	82	JR & JA Buckley
27	C Horne*	55	SM Bredden	83	JR & JA Buckley

ID	Name	ID	Name	ID	Name
84	SRP & RF Ray	120	TW Roots^	155	PG & CM Lane^
85	Hallett & Campbell & Anderson	121	MR & M Peel	156	NJ & RY Ellis
86	Hallett & Campbell & Anderson	122	TW Roots	157	NJ & RY Ellis
87	F & IR Webber	123	Commissioner for Railways	158	HVEC (formerly RR & JM Hamilton)
88	PR & M Burgmann	124	Commissioner for Railways	159	RB & SA Parkinson
89	GW & HM Blake	125	MR & M Peel	160	RB & SA Parkinson
90	RW Jones	126	JDM Markham**	161	RB & SA Parkinson
91	TR & KM Paulsen	127	AA & BT Meyer	162	RB & SA Parkinson
92	TR & KM Paulsen	128	State Rail Authority of NSW	163	RB & SA Parkinson
93	DJ Phillips	129	State Rail Authority of NSW	164	RB & SA Parkinson
94	Public Works NSW	130	AA & BT Meyer**	165	RB & SA Parkinson
95	Minister for Public Works NSW	132	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	166	BA & TE Strachan*
96	RJ & AM Hordern	133	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	167	RJ & SA Lane
97	GR Cole	134	Minister for Public Works**	168	JB Moore*^
98	RL Wilks	135	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	169	JB Moore*/**
99	HR & BC Grugeon	136	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	170	JB Moore*/**
100	HR & BC Grugeon	137	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	171	BL & ML Bates*/**
101	FYP Zhu & HM Weng	138	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	172	BL & ML Bates*/**
102	LA & CA Macpherson	139	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	173	BL & ML Bates*/**
103	HVEC (formerly Eglington & Fuller & Goodchild)	140	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	174	JB Moore*
104	RW Turner	141	FN Google**	175	JB Moore*/**
105	RW Turner	142	FN Google**	176	JE & JL Lonergan**
106	MJ & MJ Duncan	143	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	177	JE & JL Lonergan**
107	HVEC (formerly BD Eglington & SR & L Fuller & SM & RD Goodchild)	144	S.R. & J. W. Lawson (Lindisfarne) Pty Limited**	178	JE & JL Lonergan**
108	MJ & MJ Duncan	145	PJ Brown	179	JE & JL Lonergan**
109	EJ & CA Denton	146	JJ & PJ Brown	180	JE & JL Lonergan
110	GR & MK Walsh	147	TW Roots	181	JE & JL Lonergan**
111	GR & MK Walsh	148	TW Roots	182	JE & JL Lonergan**
112	MG & LI Latham^	149	RM & KF Merrick**	183	JL Smith & KL Balmer**
113	MG & LI Latham^	150	RM & KF Merrick**	184	JL Smith & KL Balmer**
114	JM Wild^	151	DT Gilder	185	JE & JL Lonergan**
117	E Rankin^	152	MR Peel	186	RB & SA Parkinson**
118	E & WJ Rankin^	153	PR Ellis	187	RB & SA Parkinson**
119	E & WJ Rankin^	154	PSJ Murray	188	JL Smith & KL Balmer**

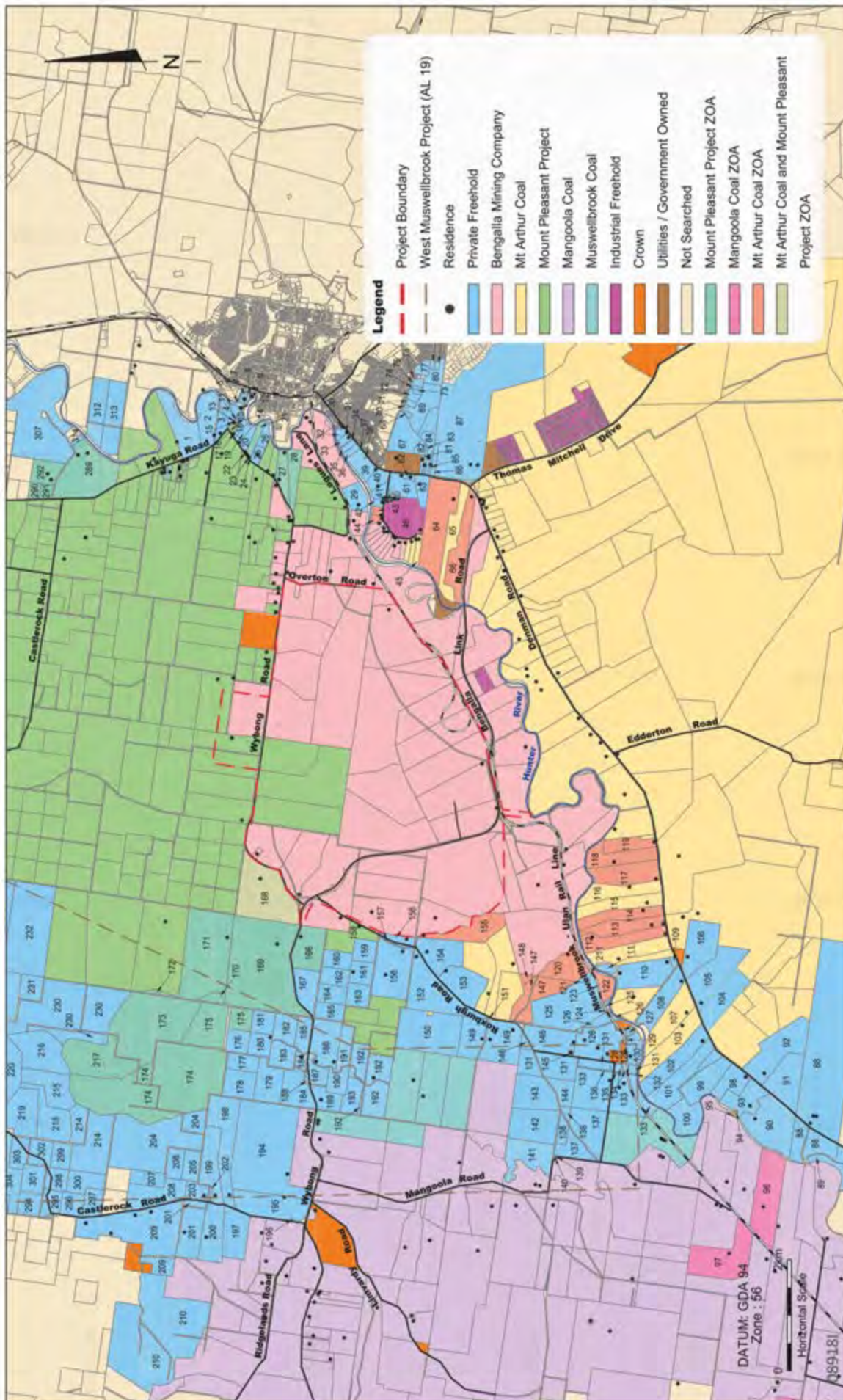
2 Existing Environment

ID	Name	ID	Name	ID	Name
189	FN & WL Googe**	219	HJ & RA Wright**	272	JS & NM Lonergan
190	RB & SA Parkinson**	220	AJ & LL Martin**	273	DR Bluford
191	RB & SA Parkinson**	221	CW Hutchinson	275	WE White & J Hutchinson
192	GT McNeill**	222	JD Vandenberg	279	Coal & Allied Operations (formerly D Small)
193	FN & WL Googe**	224	DB & RJ Wright	286	IJ & CM Richards
194	DMA Carey**	225	GC Sparre	288	DS MacDonald & DE Kilgannon
195	AH & JA Thiecke**	226	GC Sparre	289	KJ & GM Yore*
196	Church Property for the Diocese of Newcastle	227	GC Sparre	290	DHH Macintyre*
197	G & JM Jackson	228	GC Sparre	291	DHH Macintyre*
198	IV & CA Ingold**	229	GC Sparre	292	DHH Macintyre*
199	SH Jennar**	230	GC Sparre**	294	AM Pratt**
200	MA Perkins	231	GC Sparre**	295	AM Pratt**
201	DG Peace	232	GC Sparre**	296	AM Pratt**
202	SH Jennar**	233	GC Sparre	297	AM Pratt**
203	RG Gowing**	245	JS & NM Lonergan	298	AM Pratt**
204	RG Gowing**	246	JS & NM Lonergan	299	AM Pratt**
205	RG Gowing**	247	GM Casey	300	AM Pratt**
206	RG Gowing**	248	GM Casey	301	AM Pratt**
207	RG Gowing**	249	JS & NM Lonergan	302	AM Pratt**
208	RG Gowing**	250	JS & NM Lonergan	303	AM Pratt**
209	RG Gowing	251	GM Casey	304	GT Keast**
210	MJ & CA Le Breton	252	GM Casey	305	JE Lonergan
211	TM Peel	253	GM Casey	307	Dapkos Pty Limited
214	RG Gowing**	256	GM Casey	308	AP & PE McManus
215	JH & CM Almond**	259	GM Casey	309	GT Keast
216	JH & CM Almond**	260	GM Casey	312	Dapkos Pty Limited
217	BL & ML Bates*/**	263	GM Casey	313	Dapkos Pty Limited
218	TP & DP Reading**	264	GM Casey	314	S Yore

*Entitled to acquisition as a result of the Mount Pleasant Project ^Entitled to acquisition by Mt Arthur Coal Mine

**Located within West Muswellbrook Project's AL19





BENGALLA MINE

Land Ownership

FIGURE 6

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

2.6 Climate

The Upper Hunter region experiences a warm temperate climate, characterised by seasonal variations of hot, wet summers and mild, dry winters. In the winter months, high pressure systems alternate with cold fronts, combining to produce cool, dry conditions. Frosts and fog are prevalent in the cooler, drier months from mid-autumn to late spring. The warm and dry conditions during the summer months are produced by synoptic high pressure systems over the Great Australian Bight. Synoptic low pressure systems occur intermittently during summer, resulting in periods of heavy rain and thunderstorms.

The meteorological data used in the preparation of this EIS has been sourced from the Bengalla meteorological station at Logues Lane and the Bureau of Meteorology (BoM) monitoring stations at Jerrys Plains and Scone. The recording periods for these stations and their locations relative to Bengalla are provided in Table 3. Long term meteorological data is summarised in Table 4 and discussed below.

2.6.1 Temperature and Humidity

The temperatures recorded at Jerrys Plains establish that the Upper Hunter region experiences warm temperatures during the summer and very cool temperatures during the winter. January is the warmest month, averaging a daily maximum temperature of 31.7°C. July is the coolest month of the year, with a mean daily maximum temperature of 17.4°C and a mean daily minimum temperature of 3.8°C.

Table 3 Regional Meteorological Stations

Name	Operator	Station No.	Location	Period Record
Jerrys Plains Post Office	BoM	061086	25 km south-east of Project Boundary	1884 – current
Scone SCS	BoM	061089	24 km north-east of Project Boundary	1950 – current
Bengalla Meteorological Station	BMC	N/A	Near Logues Lane to the east of Project Boundary	1991 – current

Table 4 Long Term Meteorological Data Summary

Month	Mean Daily Temperature (°C)				Mean Monthly Rainfall (mm)		Mean Monthly Rain Days		Mean Monthly Humidity (%)		Mean Monthly Evaporation (mm)
	Jerrys Plains		Scone		Jerrys Plains	Scone	Jerrys Plains	Scone	Scone		
	Min	Max	Min	Max					9:00 am	3:00 pm	
Jan	17.2	31.7	16.9	31.1	76.8	81.3	6.5	6.5	67	43	220.1
Feb	17.1	30.9	16.9	29.9	72.8	77.3	6.0	5.9	73	47	175.2
Mar	15.0	28.9	14.6	27.9	58.8	51.7	5.8	5.1	73	47	155.0
Apr	11.0	25.3	11.3	24.5	44.3	39.4	4.9	4.4	71	47	105.0
May	7.4	21.3	8.1	20.1	40.8	46.9	4.9	5.3	76	56	68.2
Jun	5.3	18.0	6.0	16.9	48.0	45.2	5.5	6.0	78	58	48.0
Jul	3.8	17.4	4.7	16.3	43.6	36.6	5.2	5.1	75	54	55.8
Aug	4.4	19.4	5.6	18.3	36.5	39.2	5.3	5.3	67	46	83.7
Sep	7.0	22.9	7.9	21.4	42.0	39.2	5.2	5.3	62	43	117.0
Oct	10.3	26.2	10.9	24.8	52.2	59.4	5.9	6.3	59	42	155.0
Nov	13.2	29.1	13.3	27.6	61.1	61.7	6.2	6.5	62	41	183.0
Dec	15.7	31.3	15.7	30.2	67.9	68.4	6.4	6.7	61	39	220.1
Mean	10.6	25.2	11.0	24.1	53.7	53.9	5.6	5.7	68.7	46.9	132.2
Total	-	-	-	-	644.8	646.3	67.8	68.4	-	-	1,586.1

Humidity data was sourced from the BoM meteorology station at Scone. Humidity levels exhibit variability and seasonal flux throughout the year. Mean morning humidity levels (at 9:00 am) range from 59% to 78%. Mean afternoon humidity levels (at 3:00 pm) range from 39% to 58%. The spring months generally experience lower humidity than rest of the year.

2.6.2 Rainfall

In the Upper Hunter region, rainfall is substantially higher in the summer than in the winter. The monthly rainfall measured at Jerrys Plains varies from 36.5 millimetres (mm) in August to 76.8 mm in January. In 2011, Bengalla received 777 mm of rain, falling over 138 rain days. This was similar to the previous year, where the annual rainfall was 722 mm, distributed over 132 rain days (BMC, 2012b).

In summer, rainfall is generally due to low pressure troughs and an increased maritime influence, with onshore winds penetrating as far inland as Muswellbrook. This generates intense thunderstorms, accounting for the higher and more intense rainfall experienced in the summer months. The rainfall patterns in the Upper Hunter region have been considered for the purposes of the Surface Water Impact Assessment and Groundwater Impact Assessment (see **Section 8.6** and **Section 8.7** respectively).

2.6.3 Evaporation

Evaporation data for the region was sourced from the BoM meteorological station at Scone. A direct correlation exists between higher temperatures, afternoon winds and evaporation. Accordingly, evaporation rates are highest in the summer. The mean monthly pan evaporation rate ranges from 48 mm in June to 220 mm in January. In the Upper Hunter region, the evaporation rate substantially exceeds the rainfall. These evaporation rates have been adopted for the Surface Water Impact Assessment and Groundwater Impact Assessment (see **Section 8.6** and **Section 8.7** respectively).

2.6.4 Wind Speed and Direction

The windroses in **Figure 7** depict the wind speeds and directions experienced at Bengalla. The wind directions have remained consistent in recent years, with winds prevailing from the south-east during summer and from the north-west during winter (BMC, 2012b).

Maximum wind speeds are generally greater in the summer than in the winter. In 2011, the February and September recorded the strongest winds, with a mean maximum wind speed of 11.0 meters per second (m/s). The lowest monthly mean maximum wind speed of 7.9 m/s was recorded in May (BMC, 2012b). Wind speeds and directions have been considered in the Air Quality Impact Assessment and Acoustic Impact Assessment (see **Section 8.1** and **Section 8.3** respectively).

2.7 Geology

2.7.1 Stratigraphy

Bengalla is situated in the north-west of the Hunter Coalfield, a division of the Sydney Basin. Bengalla is located on the western limb of the north-south trending Muswellbrook Anticline. As a result, coal seams subcrop near the eastern extent of the Project Boundary and dip to the west. The dip is approximately 8 degrees near subcrop, decreasing to 2 to 3 degrees at greater depths.

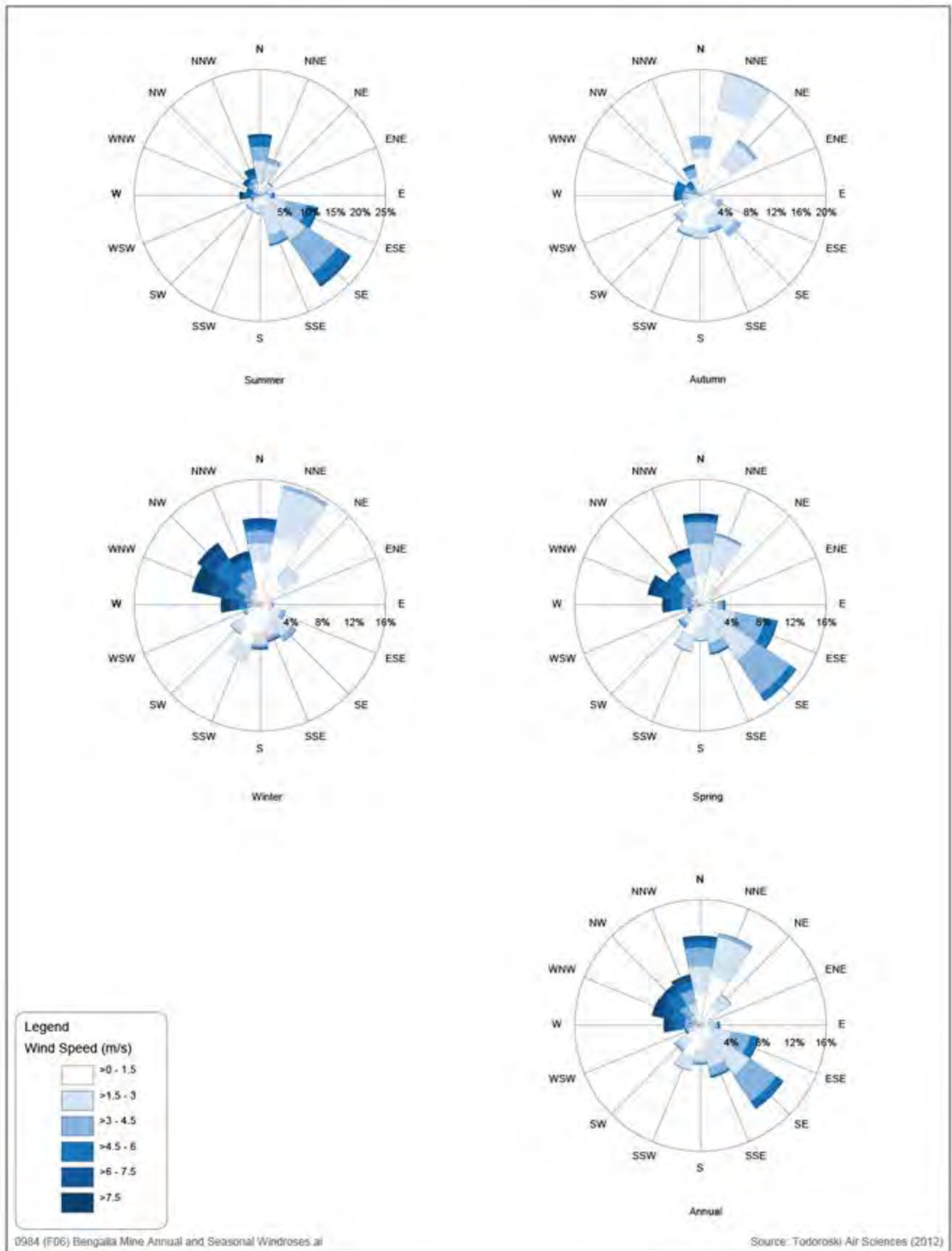
The stratigraphic sequence across the site is comprised of the late Permian Whittingham Coal Measures. The Whittingham Coal Measures are up to 800 m thick and consist of sandstone, siltstone, claystone, conglomerate and tuff, within which intermittent coal seams exist. The target coal seams for the Project are located within the Jerrys Plains and Vane Subgroups of the Whittingham Coal Measures and extend from the Warkworth to the Edderton seam. An indicative stratigraphic column showing the target seams for the Project is provided in **Figure 8**.

The Permian coal measures are overlain by thin Quaternary alluvial deposits. Quaternary alluvial deposits consist of sand and gravel along creek valleys and in the alluvial floodplain of the Hunter River.

2.7.2 Exploration

Since the grant of A 438 in February 1991, BMC has undertaken numerous exploration programs to define the coal deposit at Bengalla. Detailed exploration drilling was conducted from May 1991 to October 1992 to obtain structural, lithological and coal quality data. From September to November 1993, partially cored holes were drilled to obtain a sample for pilot-scale washing and combustion testing.

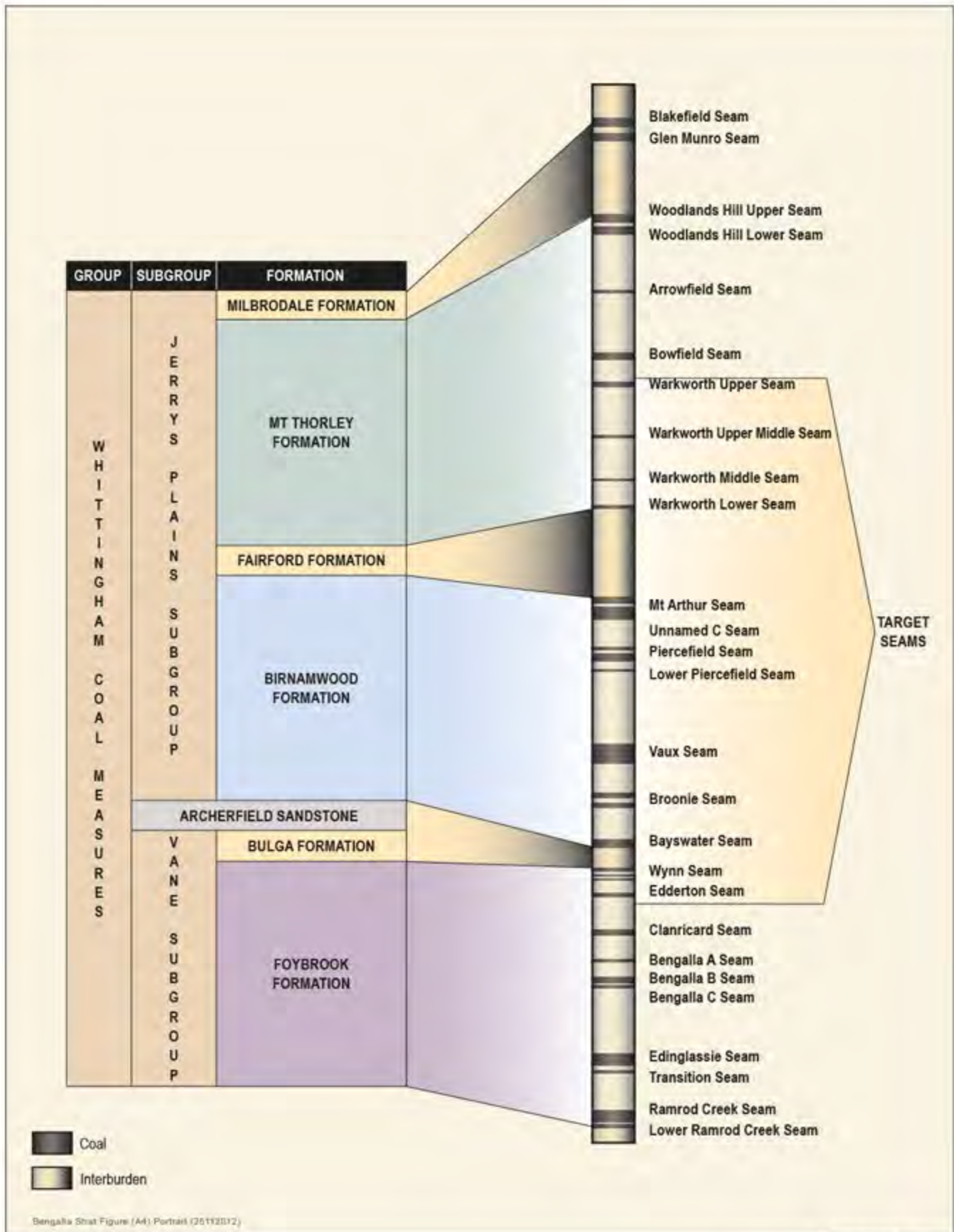
Extensive drilling of shallow open holes was conducted between December 1996 and May 1997 to define the limits of oxidation (LOX) for the coal seams within the authorisation boundary. Further LOX drilling was undertaken from February to April 2002 consisting of over 170 boreholes aimed to further define the Warkworth and Piercefield seams. In May and October 2007, cored holes were drilled to obtain samples for spontaneous combustion testing. Samples of fresh and oxidised coal were collected for testing.



BENGALLA MINE

Annual and Seasonal Windroses

FIGURE 7



BENGALLA MINE

Indicative Stratigraphic Column

FIGURE 8



Hansen Bailey
 Environmental Impact Statement

2 Existing Environment

Recent exploration drilling during 2011 and 2012 has been conducted for the purpose of defining seam geology, structure and quality within AL13 immediately to the west of the Approved Bengalla Mine. The AL13 exploration drilling program was completed and comprised 25 boreholes totalling 5,683 m with an additional five fully cored diamond drilled boreholes totalling 1,206 m. All boreholes targeted the Edderton Seam which occurs at a depth of approximately 220 m to 250 m. Faulting and igneous intrusions have not had a significant influence on Bengalla's design, although they do have localised impacts on scheduling, wall stability, groundwater and coal quality. Most faults are high angle normal faults trending in a westerly to north-westerly direction. Narrow, north north-westerly trending dykes have previously been encountered within the Project Boundary.

2.7.3 Deposit Utilisation

Exploration drilling and preliminary studies have identified a significant quantity of in situ coal that is amenable to open cut mining. From this inventory, mine planning has indicated the potential for extraction of 316 Mt of ROM coal associated with the Project mine plans (see **Section 4**). The primary seams that may be mined are the Warkworth, Mt Arthur, Piercefield, Vaux, Broonie, Bayswater, Wynn and Edderton seams. An additional 63 Mt of ROM coal is present within the Edinglassie seam, which underlies the Edderton seam. The Edinglassie seam is currently not economic to mine by open cut methods and has therefore been excluded from the open cut mine plan for the Project.

Quantities of in situ coal and potential ROM coal quoted here are not as yet compliant with the requirements of the JORC Code 2004 and do not constitute the official statement of coal reserves and coal resources for Bengalla. It is expected that further evaluation work will allow the quantities of coal quoted here to be converted to JORC compliant reserves and resources in the near future.





3

Approved Operations

This section provides a detailed description of the approved operations at Bengalla including the existing approvals and licensing regime. All aspects of the operations are discussed, including mining, infrastructure, coal processing, handling and other associated activities. This section also provides a description of the existing environmental management system used to manage environmental issues at Bengalla.

3.1 Planning Approvals

3.1.1 Original Approval

In 1990, the State government invited expressions of interests from mining companies for the development of the in situ coal reserves at Bengalla. On 7 August 1995, BMC was granted development consent DA 211/93, which allowed for the "Construction and operation of a surface coal mine, coal preparation plant, rail loop, loading facilities and associated facilities". DA 211/93 authorised the following:

- Extraction of coal within the 21 year coal extraction limit until 2017;
- Maximum ROM coal production of 8.7 Mtpa;
- Maximum reserve of 147 Mt of ROM coal;
- Coal mining using dragline, excavator / shovel mining methods and a truck fleet;
- Open cut strip mining progressing from east to west;
- OEA to a maximum height of Reduced Level (RL) 240 m AHD;
- Construction workforce of approximately 510 employees;
- Permanent workforce of approximately 300 employees; and
- Construction and operation of the CHPP and associated facilities, rail loop and loading facilities, bathhouse and administration buildings and other coal mining related facilities.

The original DA 211/93 was supported by the Bengalla 1993 EIS.

3.1.2 Modification 1

On 9 November 2006, DA 211/93 (Modification 1) was granted, providing approval for the following modifications to Bengalla:

- Increase in the maximum height of the final landform height from RL 240 m to RL 270 m;
- Relocation of the overland conveyor, ROM hopper and associated emergency coal stockpile;

- Modifications to the CHPP to facilitate two-stage washing and an extension of the ROM and product coal stockpile;
- Construction of two permanent tailings drying areas to be used for the placement of tailings on a temporary basis; and
- Increase in the maximum allowable annual production 10.7 Mtpa of ROM coal.

The document supporting DA 211/93 (Modification 1) was the *Statement of Environmental Effects Modification to Mining Operations* (Bengalla 2006 SEE) (Hansen Consulting, 2006a).

3.1.3 Modification 2

On 6 December 2007, DA 211/93 (Modification 2) was granted, providing approval for the following modifications to Bengalla:

- Wantana Extension:
 - Extending open cut coal mining operations to the south of Bengalla to include an additional coal extraction area of 32 ha (within the existing Mining Lease and DA boundaries); and
 - Construction of associated water management infrastructure.
- Infrastructure Modifications:
 - Minor extensions to the administration, bathhouse and workshop buildings;
 - Extensions to car parking facilities; and
 - Relocation of existing facilities within the workshop hardstand area.
- In-mining area facilities:
 - Relocation and upgrade of an in-mining area refuelling facility;
 - Construction of a laydown area and associated infrastructure; and
 - Relocation of existing in-mining area infrastructure that will be consumed by mining operations in the future.

The document supporting DA 211/93 (Modification 2) was the *Wantana Extension Statement of Environmental Effects* (Hansen Bailey 2007a).

3.1.4 Modification 3

On 22 July 2008, DA 211/93 (Modification 3) was granted, providing approval for the following modifications to Bengalla:

- Construction of the Bengalla Link Road Stage 2 on an alternative alignment to that originally approved; and
- Deferral of the relocation of the ROM hopper and associated facilities from their existing location to a site adjacent to the CHPP.

The document supporting DA 211/93 (Modification 3) was the *Bengalla Mine Development Consent Modification Environmental Assessment* (Bengalla 2008 EA) (Hansen Bailey, 2008).

3.1.5 Modification 4

On 7 October 2011, DA 211/93 (Modification 4) was granted, providing approval for the following modifications to Bengalla:

- Acceleration of mining operations in the Wantana Extensions to align these with existing operations in the remainder of Bengalla; and
- Implementation of an overburden emplacement strategy to resolve the overburden emplacement capacity issues experienced at Bengalla.

The document supporting DA 211/93 (Modification 4) was the *Bengalla Mine Development Consent Modification Environmental Assessment* (Bengalla 2010 EA) (Hansen Bailey, 2010).

3.2 Other Licences and Leases

In addition to its planning approvals, Bengalla operates under a number of mining authorities and various other licences. **Table 5** lists all approvals, licences, leases and other authorities held by BMC.

3.3 Environmental Record

BMC has a proven history of best practice environmental management, which will continue to be implemented for the Project. Bengalla is operated in accordance with the Coal & Allied EMS, accredited to the International Standards Organisation (ISO) 14001.

The EMS relies upon an environmental policy, a series of regulatory required management plans, a monitoring program and environmental standards and procedures. The Environmental Policy directs planning which in turn affects implementation and operation, management measures and a continuous review and improvement process. The EMS is designed so that BMC can effectively manage its environmental issues, ensure compliance with regulatory requirements, continually improve its environmental performance and satisfy the expectations of stakeholders.

An Annual Review is produced each calendar year in accordance with the existing consent conditions. Bengalla's environmental performance with respect to the relevant monitoring requirements is documented in the Annual Review, and made available to the community on their website.

BMC has maintained a good record of environmental performance. BMC has not been subject to any proceedings under a Commonwealth or State law for the protection of the environment or the conservation and sustainable use of natural resources. All exploration activities have been undertaken in accordance with the conditions of BMC's mining authorities and Development Consent.

3.4 Mine Plan and Mining Method

Bengalla is an open cut coal mining operation where mining advances in a westerly direction based on dragline strips approximately 60 m in width. Overburden is removed by two methods; a truck and excavator operation and through the use of a dragline. Coaling is undertaken by a truck and excavator operation.

Mining operations at Bengalla commenced in October 1998 with the first coal exported in April 1999. A total of 31 strips will be mined within the DA Boundary as described in the Bengalla 2006 SEE as illustrated in **Figure 9**. By August 2012, strip 21 had been completed with work commencing on strip 22. Mining operations within the Wantana Extension area commenced during early 2010 (BMC, 2012b).

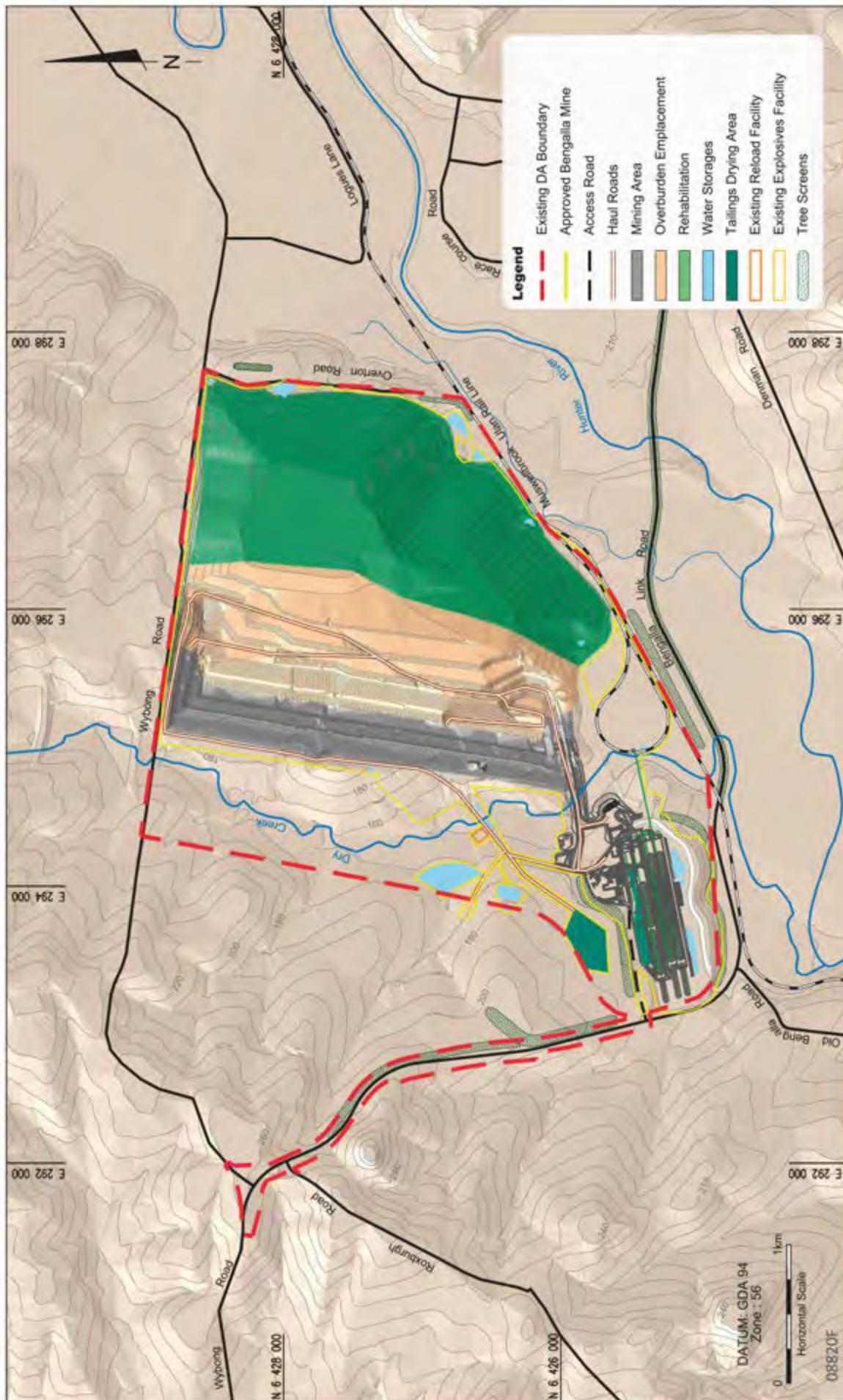
The approved mining area contains a multi-seam coal deposit consisting of eight economically viable open cut mineable coal seams. BMC extracts coal from the Warkworth seam to the Edderton seam, which form part of the Whittingham Coal Measures (Hansen Bailey, 2010). Bengalla is situated on the western limb of the Muswellbrook Anticline with the coal seams generally dipping to the west at approximately 5 degrees. The average strip ratio at Bengalla is approximately 3.5 bank cubic metres (bcm) of overburden to each ROM tonne (t) of coal recovered.

Mining operations are conducted by up to 400 full time permanent employees 24 hours a day, 7 days a week utilising an equipment fleet consisting of a dragline, loading units, a fleet of trucks and other ancillary open cut mining equipment. Topsoil is initially stripped using dozers, loaders and trucks and either stockpiled in a designated area; or where possible, spread onto shaped overburden prior to rehabilitation. Pre-stripped overburden is removed by loader and / or excavator and trucks in advance of the dragline operation and subsequent coaling.

Table 5 Approvals, Leases and Licences

Approval	Description	Duration	Authority
DA 211/93	Development Consent	07/08/95–07/08/17	DP&I
DA 211/93 (Modification 1)	Development Consent – Modification 1	09/11/06–07/08/17	DP&I
DA 211/93 (Modification 2)	Development Consent – Modification 2	06/12/07–07/08/17	DP&I
DA 211/93 (Modification 3)	Development Consent – Modification 3	22/07/08–07/08/17	DP&I
DA 211/93 (Modification 4)	Development Consent – Modification 4	07/11/11–07/08/17	DP&I
DA 273/2006	Development Consent Explosives facility	06/09/06–Perpetuity	MSC
Mining Lease 1397	Mining Lease	27/06/96–27/06/17	DTIRIS – DRE
Mining Lease 1450	Mining Lease	11/06/99–11/06/20	DTIRIS – DRE
Mining Lease 1469	Mining Lease	05/06/00–05/06/21	DTIRIS – DRE
Mining Lease 1592	Mining Lease	19/04/07–19/04/28	DTIRIS – DRE
AL 13	Assessment Lease	20/12/06–19/12/11*	DTIRIS – DRE
A 438	Exploration Licence	18/08/09–07/05/14	DTIRIS – DRE
EPL 6538	Environmental Protection Licence	11 September (anniversary)	NSW Office of Environment and Heritage (OEH)
C 98/2152	Bengalla Mine Operations Plan	01/01/13– 26/06/15	DTIRIS – DRE
20BL169798	Groundwater Extraction Licence	Expiry date: 31/10/15	NSW Office of Water (NOW)
20BL172091 20BL172092 20BL172093	Bore Licences for Wantana	04/02/09 – Perpetuity	NOW
20BL172488	Monitoring bore	17/05/10 – Perpetuity	NOW
Various Water Access Licences	Hunter River Water Access Licence 1,449 High Security Units and an additional 4,562 units of General Security Units	Perpetuity	NOW
Various Water Access Licences	Alluvial Groundwater Licences	Perpetuity	NOW
20PE001354	Hunter River Pump	01/05/97 (Annual Review)	NOW
07-100151-001	Licence to Store	Expiry date: 10/01/18	OEH
27484	Licence to Sell / Possess	Expiry date: 18/12/13	OEH
23150	Radiation Licence	Expiry date: 26/04/14	OEH
1320	Radiation Licence	Expiry date: 09/04/13^	OEH
1321	Radiation Licence	Expiry date: 09/04/13^	OEH
1322	Radiation Licence	Expiry date: 09/04/13^	OEH
7285	Radiation Licence	Expiry date: 21/01/14	OEH
7286	Radiation Licence	Expiry date: 21/04/14	OEH

* Application lodged and renewal pending. ^Renewal lodged.



BENGALLA MINE

Existing Approved Operations

FIGURE 9

Hansen Bailey
ENVIRONMENTAL CONSULTANTS



Overburden is emplaced within the Main OEA located to the east of active mining operations. The Main OEA is approved up to a height of RL 270 m within the Approved Bengalla Mine (see **Figure 9**). The northern face of the existing OEA has been developed at the angle of repose in order to maximise coal extraction within the northern part of the DA Boundary and will be sloped to 10 degrees prior to final rehabilitation.

Bengalla is approved to mine at a rate of up to 10.7 Mtpa ROM coal. The maximum production levels have not yet been reached. During the 2011 and 2012 calendar years, Bengalla produced approximately 7 Mt and 8.4 Mt of ROM coal respectively.

3.5 Blasting

Blast criteria at Bengalla are generally consistent with the Australian and New Zealand Environment and Conservation Council's (ANZECC) *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) (ANZECC Guidelines) with the exception that BMC blasts from 7:00 am to 5:00 pm under strict procedural controls (see **Section 3.14**). Blasting is conducted at Bengalla to loosen overburden at the rate of up to two blast events per day and four blast events per week on average over a 12 month period.

BMC monitors ground vibration and overpressure levels of each blast event at a number of representative locations surrounding Bengalla (see **Figure 11** and **Section 3.14.4**). A review of previous blast monitoring data has confirmed that blasting activities at Bengalla have generally remained within the recommended criteria.

3.6 Coal Handling and Processing

3.6.1 Transport and Storage

Coal is transported via haul trucks to the ROM hopper, where it is fed into the CHPP for processing. The ROM hopper and associated facilities were relocated adjacent to the CHPP in June 2009. The relocation of the ROM hopper and associated facilities, subsequently allowed mining operations to enter into the Wantana Extension area.

The first stage of coal processing involves crushing ROM coal to less than 250 mm in size. The crushed coal is then transported along a 300 m conveyor to a secondary crushing station where it is reduced in size to less than 50 mm. All conveyors are enclosed, where practicable, to reduce both noise and dust emissions. After it is crushed, coal can be bypassed to product, direct fed into the CHPP, or transported and stockpiled on the raw coal stockpile. All stockpiles employ dust suppression and process strategies to minimise dust emissions.

3.6.2 Coal Handling and Preparation Plant

The Bengalla CHPP utilises dense medium cyclones and single stage belt press filters to process coal to meet customers' product specifications. The dense medium cyclones treat the coarse material (-50 mm +1.4 mm) and passes the reject material through the reject screen. The spirals treat the fine material (-1.4 mm +0.125 mm), producing fine coal and reject material. The extra fine material (-0.125 mm) is not beneficiated and is treated as reject material.

The CHPP was designed to maximise resource recovery from the ROM coal. In 2010, the Bengalla CHPP yielded 76% product coal from the ROM coal processed. This was an improvement on 76% in 2009 and 74% in 2008 (BMC, 2010). The CHPP contains two washery modules, each with a capacity of 850 tonnes per hour (tph). Each module uses a dense medium cyclone and spirals to separate mineral contaminants. After processing, the product coal is centrifuged to reduce moisture before being conveyed to a coal stockpile for storage.

Bengalla's CHPP utilises a ROM coal stockpile and two product coal stockpiles as part of its handling and preparation process (see **Figure 9**) with a total approved capacity of 1,035,000 t. The CHPP and stockpiles are surrounded by earth bunds to account for the visual and noise impacts on surrounding areas. Dust from stockpile areas is managed by an industry first automated sequential spray system, which is triggered when wind speeds exceed 5.6 m/s.

3.7 Product Transport

After processing is completed, product coal is reclaimed using twin boom portal type reclaimers and conveyed to the rail load out facility. This facility is fully automated and loads an average of 3,500 tph. The rail load out facility is located immediately to the south of Bengalla and is operated out of the CHPP control room in the main administration complex.

Bengalla produces a thermal coal for both the export market (low ash export grade between 12% to 13% ash content) and domestic market (higher ash domestic coal product usually below 27% ash). Most of the product coal is transported to the Port Waratah Coal Loader at Newcastle for export. BMC's key export markets currently include Japan, Korea, Taiwan and China. Lesser amounts are infrequently railed directly to the Macquarie Generation power stations for domestic power generation.

3.8 Waste Management

3.8.1 Tailings and Coarse Reject

Bengalla does not have any tailings dams to store reject material. Two waste streams from the CHPP process, tailings and coarse reject are combined and stored in a reject bin before being hauled back to be co-disposed in the Main OEA where it is dried in cells, buried within the Main OEA and capped with a minimum of 5 m of inert overburden material.

3.8.2 Overburden

Overburden is emplaced within the existing Main OEA located to the east of active mining operations. The Main OEA is approved up to a height of RL 270 m within the Approved Bengalla Mine. The northern face of the Main OEA has been developed at the angle of repose in order to maximise coal extraction within the northern part of the DA Boundary.

The Southern OEA Extension involves the development of the existing Main OEA further towards the south-east and will generate approximately 10 Million loose cubic metres (Mlcm) of additional overburden emplacement capacity at Bengalla. This landform will extend from the old conveyor belt road at around 10 degrees towards the north-west to the maximum approved OEA height of RL 270 m. The Southern OEA Extension has been designed to blend in with the currently approved mine plan, with some minor adjustments to create a free draining final landform. Construction of the Southern OEA Extension is scheduled to be completed in 2013.

The temporary Western OEA as described in the Bengalla 2010 EA has not yet been constructed in its currently approved location. The Western OEA is approved to be constructed to a maximum height of RL 210 m, which will complement the natural topography. The Western OEA will provide for an additional 6.6 Mlcm of overburden emplacement capacity and cover a total area of approximately 25 ha.

BMC will utilise the Western OEA for emplacing overburden material in order to reduce the amount of land disturbance and the impacts associated with the rehandling of this material at a later date in an overburden constrained situation only. Should the Western OEA be required, it is planned to be constructed in stages. The temporary rehabilitation of the Western OEA will be undertaken as each stage is developed to ensure the area of open overburden is minimised. The northern face of the existing OEA has been temporarily steepened to accommodate additional overburden capacity. It is planned to be reshaped to a 10 degree slope in preparation for final rehabilitation by 2016.

3.8.3 Hydrocarbons

Bengalla operates a bioremediation facility where any soil that is found to be contaminated with hydrocarbons is placed for remediation. The bioremediation facility consists of active cells where the bioremediation process occurs. The cells are (optionally) fitted with an automated irrigation system and soil moisture probes to ensure soil conditions are suitable for beneficial bacteria and microbes to aid the remediation process.

To reduce the duration of the bioremediation process, BMC adds a microbial powder to the soil to increase the hydrocarbon breakdown process and reduce the time required to treat the soil, as required. Samples are regularly taken to confirm hydrocarbons levels, and when the soil meets specific land use criteria, it is appropriately placed in the Main OEA.

3.9 Infrastructure

The main administration building is the primary planning, maintenance and administration centre for Bengalla. In-house training and inductions are provided in the two training rooms within the office area. The administration building is on the northern side of the Bengalla Mine Access Road and is the entrance for visitors to the mine. The main car parking areas are adjacent to the administration building and on the other side of the mine access road. An additional parking area is located immediately to the north of the administration building.

The workshop area is situated immediately west of the administration building. The workshop consists of heavy vehicle bays, light vehicle bays, tyre change facilities and a work shed. The workshop area is where maintenance and major repairs are performed on the mobile plant and equipment used on site. Materials and parts are housed in the supply area of the workshop. The vehicle wash bays are located to the north of the workshop area. A bulk oil and diesel storage facility is located in the western portion of the Mine Infrastructure Area (MIA). The administration and workshop areas are illustrated in **Figure 9**. Access to the Bengalla administration area is via the Bengalla Link Road and Bengalla Access Road.

3.10 Workforce and Hours of Operation

BMC has approval to employ up to 400 full time equivalent personnel. Maintenance activities, deliveries, coal processing, coal transport and mining operations occur 24 hours a day, seven days a week.

3.11 Rehabilitation

Rehabilitation at Bengalla is currently undertaken in accordance with DA 211/93 and the approved Mining Operations Plan (MOP) (BMC, 2012c) and the approved Rehabilitation Management Plan required under DA 211/93 and relevant standards provided by the Bengalla EMS. The main objective of rehabilitation at Bengalla is to develop an undulating, free-draining landform with an optimum land capability which supports the original agricultural land use for predominately cattle grazing. Rehabilitation is undertaken progressively at Bengalla as an integral component of operations. An example of BMC's successful rehabilitation (with the Muswellbrook township visible in the background) is provided on Plate 3.

3.12 Water Management

BMC's water management system was designed so that the use of fresh water from the Hunter River was minimised. This is achieved by maximising the recycling of CHPP process water. Secondary quality water resulting from the dewatering of rejects is reused on site. In addition, saline mine water and treated sewage water are used for coal processing and dust suppression wherever possible.

Dams, pipelines and associated drainage structures have been designed so that water from catchments in undisturbed areas is diverted, where possible, away from disturbed areas and sediment laden mine water. Controls have been implemented to ensure that stormwater and groundwater from mining areas is diverted to either mine water dams or the mining area void, with discharge offsite a final option.

Under the HRSTS, excess water from Bengalla can be discharged into the Hunter River during periods of 'high' or 'flood' flows. Discharges are conducted strictly in accordance with the HRSTS and Bengalla's Environmental Protection Licence (EPL) 6538. All discharges are released from the main Bengalla water storage (Staged Discharge Dam) and additional surface water monitoring undertaken during discharge events. Bengalla generally operates with a net water deficit and rarely discharges mine water under the HRSTS.

Historical discharges from Bengalla have included:

- 109 ML in 2001;
- 205 ML in 2007;
- 64 ML in 2008;
- 49 ML in 2010;
- 109 ML 2011; and
- Nil in 2012.

The HRSTS was introduced by the NSW government to reduce salinity levels in the Hunter River and permits control of mine water discharges into the Hunter River. The HRSTS is governed by the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.

BMC optimises its water balance using its Real Time Environmental Monitoring Systems (RTEMS). The RTEMS is the framework used to monitor Bengalla's fully automated water management system. It provides Bengalla personnel with information on water movement and usage across the site. The RTEMS also contains a range of alarms and safeguards to detect any potential discharges, leaks or water related incidents.

Plate 3 Main OEA Rehabilitation Overlooking Muswellbrook Township



As an added precaution, inspections of water and sedimentation dams are conducted on a regular basis. Further detail on monitoring is provided in **Section 3.14**. The existing water management system implemented at Bengalla is illustrated in **Figure 10**.

The demand for drinking water throughout the office and workshop complex is currently met by water transported by truck from Muswellbrook; however an existing water treatment plant is located onsite and is used intermittently.

3.13 Environmental Management System

Operations at Bengalla are conducted in accordance with the Bengalla EMS, which is certified to ISO 14001 standards. The Bengalla EMS was certified in 1997, making Bengalla the first coal mining operation in the world to achieve this level of accreditation.

The EMS relies upon an Environmental Policy, a series of regulatory required management plans as described in **Table 6**, a comprehensive monitoring program (described in **Section 3.14**) and environmental standards and procedures as shown in **Table 7**. The Environmental Policy (see <http://www.riotintocoalaustralia.com.au>) directs planning which in turn affects implementation and operation, management measures and a continuous review and improvement process.

The EMS is designed so that BMC can effectively manage its environmental issues, ensure compliance with regulatory requirements, continually improve its environmental performance and satisfy the expectations of stakeholders.

As part of the EMS, BMC also has in place an Aspects and Impacts Register, which systematically identifies all activities related to the mine that could cause environmental harm and applies a risk ranking of these aspects. Those aspects which

are subsequently identified with a critical or high level of risk are prioritised within Departmental Environmental Action Plans so that they are appropriately managed.

To drive the operation's performance, each department has in place a documented Health, Safety and Environmental Action Plan, which outlines projects that will aid in achieving the mine's environmental objectives and targets.

In addition, the EMS describes objectives and performance outcomes for rehabilitation, flora and fauna, spontaneous combustion, acid rock drainage and contaminated sites. The EMS also describes measures involved in auditing, reviews, reporting, calibration, maintenance and accountabilities.

3.14 Environmental Monitoring Program

A key component of the EMS is the Bengalla EMP. The EMP includes a comprehensive monitoring program, which is outlined in **Table 8** and details procedures for BMC to effectively monitor the environmental performance of its operations. The EMP has been developed in accordance with Bengalla's EPL 6538 and conditions associated with existing DA 211/93. The monitoring network has been expanded over time and is presented on **Figure 11** and **Figure 12**. Existing practices in relation to environmental monitoring are discussed further below.

3.14.1 Air Quality

A range of dust monitoring technologies are utilised at Bengalla to ensure the accurate and reliable monitoring of air quality impacts on the surrounding environment. The combination of collected data and real time dust monitoring provides the information needed for Bengalla to proactively and effectively implement operational controls to reduce or minimise dust emissions. The air quality monitoring network is operated in accordance with the requirements of the *Approved Methods for Sampling of Air Pollutants in New South Wales* (DEC, 2005). This network includes:

- Four real time monitors, which operate as part of the Bengalla RTEMS;
- Nine High Volume Air Samplers (HVAS) which monitor Total Suspended Particles (TSP) and particulate matter less than 10 microns in diameter (PM₁₀); and
- 29 Depositional Dust Gauges.

The BMC air quality monitoring network implements best practice monitoring methods beyond current regulatory requirements. BMC contracts an independent qualified consultant to undertake the air quality monitoring. The four real time monitoring sites utilise E-Bam monitors, which have been installed to allow continuous PM₁₀ measurements. This is a proactive approach to managing environmental impacts of the operations.

Table 6 BMC Existing Environmental Management Plans

Management Plan	DA 211/93 Consent Condition
Noise Management Plan	Schedule 3, Condition 8
Blast Management Plan	Schedule 3, Condition 16
Air Quality and Greenhouse Gas Management Plan	Schedule 3, Condition 23
Water Management Plan	Schedule 3, Condition 28
Cultural Heritage Management Plan (Aboriginal and European)	Schedule 3, Condition 29
Landscape Management Plan	Schedule 3, Condition 35
Rehabilitation Management Plan	Schedule 3, Condition 41
Environmental Management Strategy	Schedule 5, Condition 1

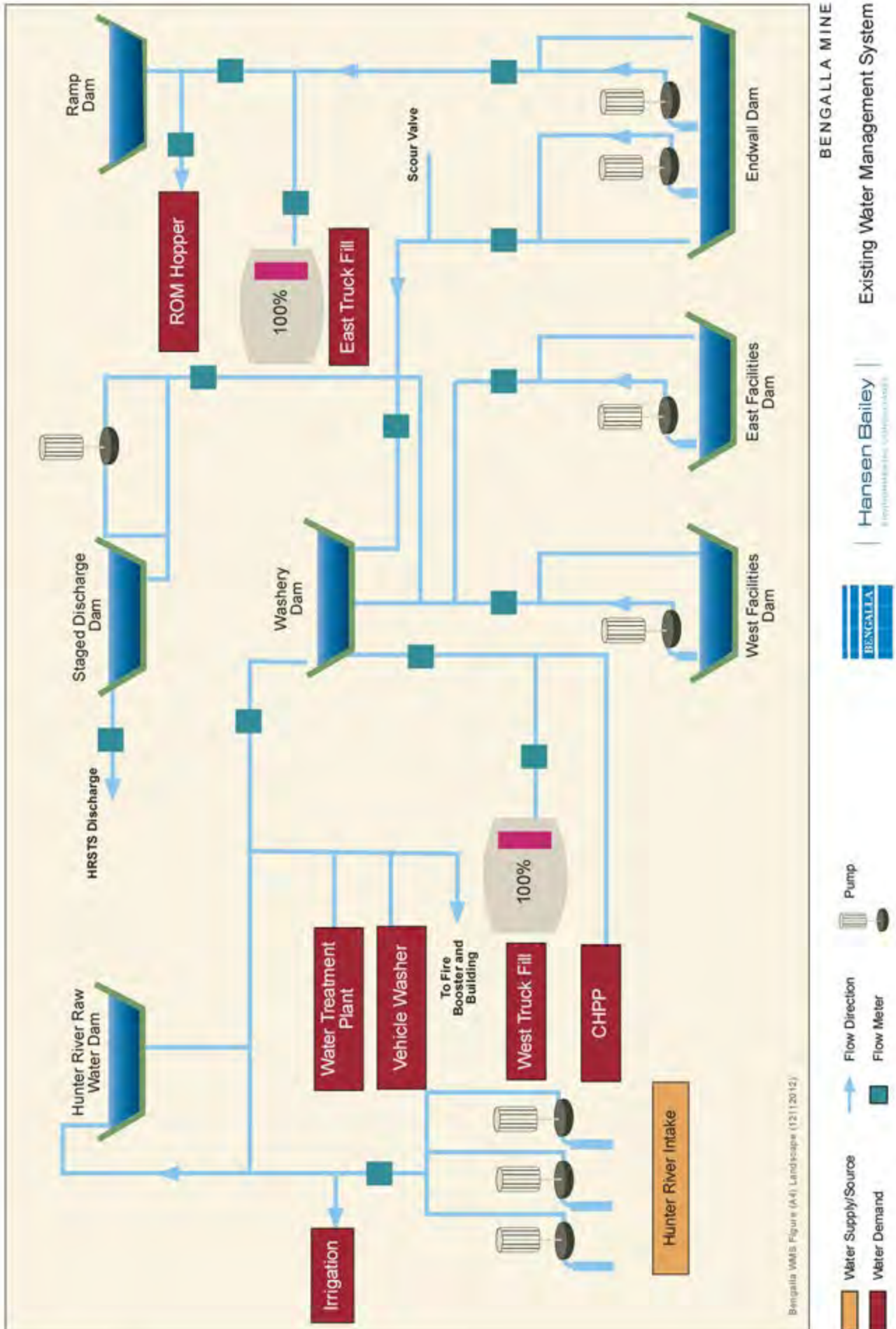
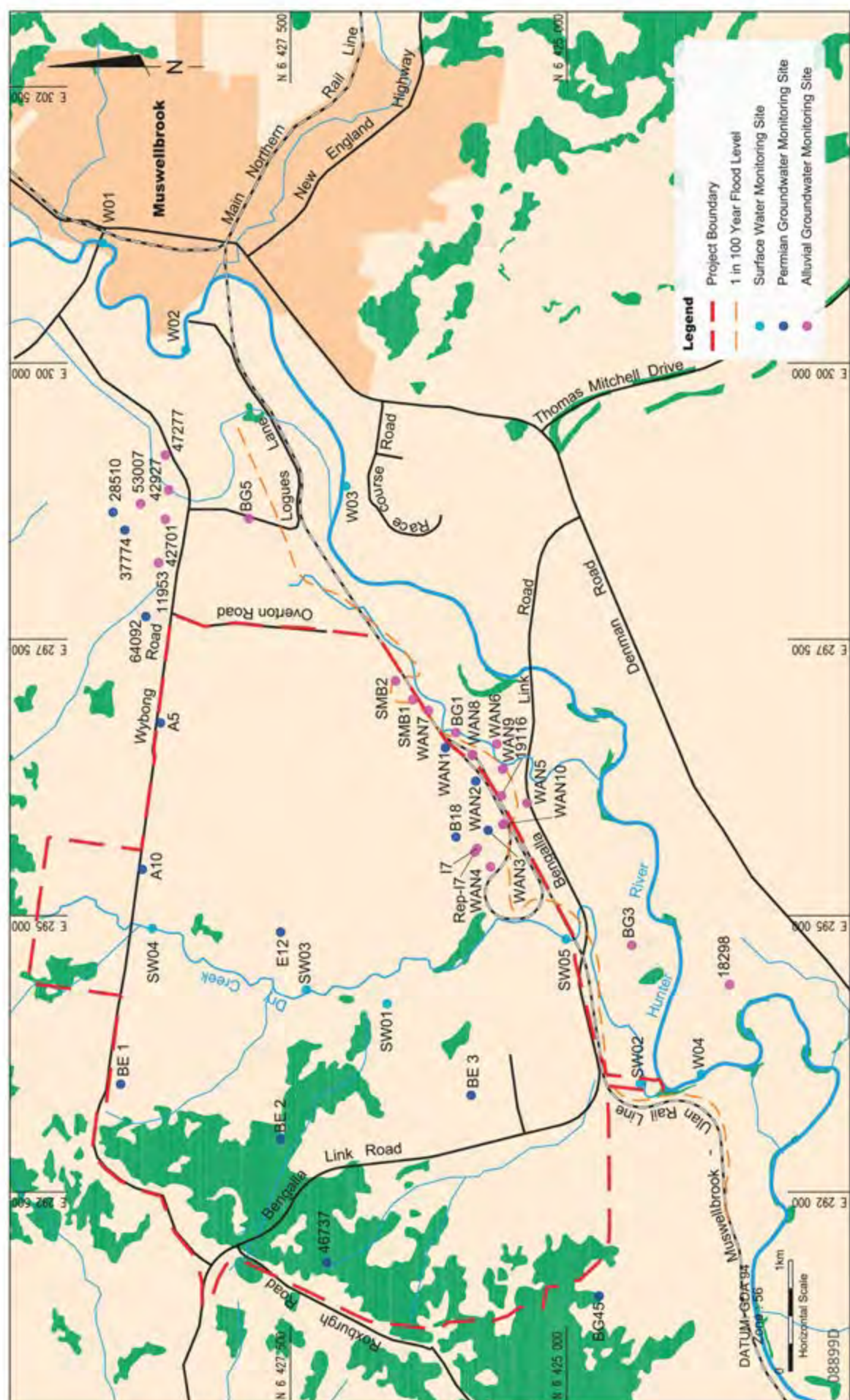


FIGURE 10



FIGURE 11



Existing Surface Water and Groundwater Monitoring Network

FIGURE 12

Table 7 Environmental Management Systems, Standards and Procedures

RTCA HSEQ System – Management Standards	EMS Procedures
1 Policy	1.1 Aspects and Impacts
2 Legal and Other	1.2 Objectives and Targets
3 Hazard Identification and Risk	1.3 Risk Assessment
4 HSEQ Management Improvement Planning	1.4 Environmental Audits, Inspections and Non-conformance Management
5 Organisation, Accountability and Responsibility	1.5 Environmental Legislative Compliance
6 Training, Competency and Awareness	1.6 Environmental Training
7 Contractor Management	1.7 Environmental Reporting
8 Document Control	1.8 Incident Reporting
9 Communication and Consultation	1.9 Communications (includes community and complaints management)
10 Operational Control	1.10 Monitoring and Management
11 Management of Change	1.11 Annual Management Reviews of the EMS
12 Disaster Management and Recovery	1.12 Document Control
13 Measuring and Monitoring	3.1 Property Transactions Guidelines (Rio Tinto)
14 Non-conformance Incident and Action Management	4.1 Closure Planning Guidelines
15 Data and Records Management	5.1 Rehabilitation
16 Performance Assessment and Auditing	6.1 Waste Management
17 Management Review	6.2 Coarse Rejects and Tailings Disposal
Rio Tinto Environmental Performance Standards	7.1 Water Management
E1 Environmental Management System	7.2 Water Discharge
E2 Air Quality Control	8.1 Dust Management CPP
E3 Acid Rock Drainage Prediction and Control	8.2 Air Quality – Mobile Equipment
E4 Greenhouse Gas Emission	8.3 Air Quality – Spontaneous Combustion
E5 Hazardous Materials and Contamination Control	9.1 Noise
E6 Noise and Vibration Control	9.2 Blasting (includes air quality and vibration)
E7 Non Mineral Waste Management	10.1 Visual Management (includes infrastructure design and lighting management)
E8 Mineral Waste Management	10.2 Flora and Fauna
E10 Water Use and Quality Control	10.3 Ground Disturbance Permit
	12.1 Acid Mine Drainage Prevention and Control
	13.1 Site Contamination Prevention and Control

Table 8 Existing Environmental Monitoring Program

Category	Parameter	Program
Air Quality	TSP	5 HVAS
	PM ₁₀	4 HVAS
	Dust Deposition	29 Depositional Dust Gauges
	Real Time Air Quality Monitors	4 Locations
Meteorological Monitoring	Meteorological Station	1 Location
	Temperature Inversion Tower	1 Location
Noise Monitoring	Attended Noise Monitoring	4 Locations
Blast Monitoring	Fixed Blast Monitor	11 Locations
Water Quality	Surface Water	9 Locations
	Groundwater	35 Locations

BMC also calculates greenhouse gas emissions generated by Bengalla. A monthly greenhouse gas emission inventory is calculated by converting emissions to a carbon dioxide equivalent (CO_{2-e}) tonnage based on National Pollutant Inventory and Australian Greenhouse Office calculation standards. Specific inputs include electricity usage, diesel usage and methane production (determined from the monthly coal tonnage extracted).

3.14.2 Meteorology

BMC operates a meteorological site in accordance with the requirements of the 'Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales' (DEC, 2007) and the Australian Standard (AS) '2922-1987 Ambient Air – Guide to the Siting of Sampling Units'. The existing meteorological station monitors a range of parameters including:

- Wind speed (m/sec) monitored continuously;
- Wind direction (degrees) monitored continuous;
- Air temperature ($^{\circ}\text{C}$) monitored continuously;
- Rainfall (mm) monitored daily;
- Relative humidity (%) monitored daily; and
- Solar Radiation watts per meter square (W/m^2) monitored daily.

An inversion tower is also used to monitor temperature, wind speed and direction, incorporated as part of the RTEMS, to ensure best practice environmental management is achieved. Monitoring undertaken at the meteorological station and inversion tower is used to assist in the planning of activities and interpretation of blast, noise, air quality and water monitoring data.

3.14.3 Noise

Noise monitoring at Bengalla is conducted in accordance with the *NSW Industrial Noise Policy* (INP) (DEC, 2000) to ensure comprehensive and effective monitoring of any impacts to the surrounding environment. Noise is measured on a quarterly basis, during optimal meteorological conditions, by an independent qualified consultant employing best practice monitoring techniques. Monitoring is conducted at the most affected receptor to determine compliance with the $L_{\text{Aeq}(15 \text{ minute})}$ noise limits. Noise is also measured 1 m from any required dwelling to determine compliance with the $L_{\text{A1}(1 \text{ minute})}$ noise limits, where practical.

Bengalla's noise monitoring system includes:

- Two real time noise monitors which operate as part of the RTEMS; and
- Four attended noise monitoring locations.

The two real time noise monitors, which are linked to the RTEMS, provide continuous measurement and relay of noise levels surrounding Bengalla. This allows the planning of activities to occur during optimal conditions and effective onsite proactive management of noise impacts.

3.14.4 Blast

BMC monitors blasting activities at Bengalla in accordance with the AS 2187.2-2006 – *Explosives – Transport Storage and Use – Part 2: Use of Explosives*. Monitoring utilises 10 real time blast monitors ensuring any blast event which triggers threshold criteria. For each blast event the parameters recorded include:

- Location of blast monitoring site;
- Time and date of monitoring;
- Blast location and name;
- Peak vector sum (PVS) – (mm/s); and
- Air overpressure peak (dBL_{in} Peak).

3.14.5 Water

Surface Water

All surface water quality monitoring at Bengalla is conducted in accordance with the requirements provided in *Approved Methods for Sampling and Analysis of Water Pollutants in New South Wales* (DEC, 2004) and AS 5667:1-1998. Four onsite water management structures are included in the quarterly surface water monitoring program and two points on ephemeral Dry Creek monitored following a high rainfall event.

BMC's surface water monitoring program includes:

- Six monitoring locations to monitor surface water flows and quality upstream and downstream of the mine; and
- Three monitoring locations are utilised to monitor the volume and quality of water discharged from the site under the HRSTS.

During discharge of saline water from site, all monitoring is conducted in accordance with the methods specified in EPL 6538. Representative samples are collected to measure Total Suspended Solids (TSS) and pH. Monitoring also incorporates an Electrical Conductivity (EC) probe designed to measure from 0 to 10,000 microsiemens ($\mu\text{S}/\text{cm}$). In addition, to assist with the internal management of water quality on site, all dams which are part of the closed water management system, are sampled annually for pH, EC and TSS.

Groundwater

BMC operates an extensive groundwater monitoring program in the vicinity of Bengalla to adequately assess groundwater quality and quantity, conducted in accordance with AS 5667.1- 1998, *Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples* and AS 5667.11-1998, *Guidance on Sampling of Groundwaters*. The monitoring program currently consists of 35 groundwater monitoring points (see Section 8.7). The alluvium, shallow hardrock and deep hardrock bores are all sampled for Standing Water Level, pH, EC, Total Dissolved Solids (TDS) at various frequencies with full chemical analysis undertaken annually.

Monitoring is undertaken in the vicinity of the alluvial fringe of the Hunter River floodplain, positioned within both the alluvial aquifer and underlying coal seam aquifers surrounding the alluvium. This allows BMC to assess any relationship between the depressurisation of the coal seam aquifers with any variations to groundwater levels. Groundwater inflow is calculated by determining and quantifying contributing components including mining area water, data on rainfall and mining area catchment area.

3.15 Auditing and Reporting

The results of Bengalla's EMP are published in the Annual Review (formerly the Annual Environmental Management Report). This is distributed to employees, relevant government agencies and the Bengalla Coal Mine Community Consultative Committee (CCC). The Annual Review is made publicly available on the Coal & Allied website and at the Muswellbrook local library and MSC. In addition any non-compliance with the Bengalla assessment criteria is reported to the relevant agency within seven days of the incident occurring, which includes a description of the exceedance or incident, the likely cause and any actions undertaken or proposed to be undertaken by BMC to address the incident.

Regular independent audits are commissioned by BMC to ensure operations are environmentally compliant with the relevant statutory requirements, development approvals, licences, management plans, procedures and standards. BMC commissions an independent environmental audit every three years, which is then supplied to any relevant regulatory authorities and made publically available on the Coal & Allied website.

3.16 Existing Restoration and Research Projects

3.16.1 Upper Hunter Rehabilitation Initiative Project

BMC supported the Upper Hunter River Rehabilitation Initiative (UHRRI) Project together with BHP Billiton between 2003 and 2008. This support was voluntary and not a requirement of any development consent condition. The UHRRI Project aimed to create habitat for native plants and animals, improve the ecological health of the river and contributed to academic knowledge of environmental degradation to ultimately improve the effectiveness of rehabilitation (Upper Hunter Rehabilitation Initiative, 2013).

The Project was managed by Macquarie University and the Upper Hunter Catchment Management Authority (UHCMA) and was undertaken on a 10 km reach of the Hunter River, south of Muswellbrook. The primary aims of the five-year project were to research the effects on the river of installing 32 engineered log structures along the edges of the Hunter River and planting over 60,000 individual plants. A range of native plant species were planted along the riverbanks to help restore native biodiversity and enhance the riparian zone to areas that had become overgrown by exotic weed species.

The joint environmental initiative supported various academic works and in 2003 BMC and BHP Billiton together won the Hunter Coal Industry Environmental Management Award. The UHCMA presented the Hunter Coal Industry Environmental Management Awards to promote excellence in the industry and encourage mining companies to go beyond legislated requirements.

Various research programs were undertaken by scientists and postgraduate students from Macquarie University, Griffith University, the University of New England and NSW Fisheries. The successful academic outcomes from the project supported research studies including over 24 referred papers, two books, 13 book chapters, 13 conference papers and seven other works (Upper Hunter Rehabilitation Initiative, 2013).

3.16.2 Soil Carbon Sequestration Project

BMC is currently undertaking a Soil Carbon Sequestration Project investigating the potential to increase productivity and profitability for Hunter Valley farmers through improved soil fertility and the storing of carbon. The project will run over four years and aims to increase soil carbon sequestration, the removal of carbon from the atmosphere by storing it in soil.

In addition to improving agricultural yields and reducing greenhouse gas emissions, the project also has the potential to provide landowners with additional income, by trading sequestered carbon under the federal government's Carbon Farming Initiative. A significant component of the Soil Carbon Sequestration Project is research into the effects of biochar application on soil properties of the region. The project is being undertaken in partnership the University of Newcastle, UHCMA and up to 20 regional landowners.

3.17 Mine Health & Safety

BMC operates in accordance with the RTCA Health, Safety, Environment and Quality (HSEQ) management system which provides a framework for health, safety and environment standards and quality reporting requirements. This group-wide system ensures all Rio Tinto operations work uniformly within internationally recognised health, safety and environment frameworks, such as ISO 14001, AS 4801 and meet various certifications, as well as internal and external reporting requirements.

The HSEQ management system outlines an approach for sound hazard and risk identification, evaluation and management, ongoing verification and review of performance. Mandatory safety standards cover our principal safety hazards:

- Isolation;
- Electrical safety;
- Vehicles and driving;
- Working at heights;
- Confined spaces;
- Management of mining area slopes, stockpiles, spoils and waste dumps;
- Cranes and lifting equipment;
- Aviation; and
- Underground.

Ensuring all employees and contractors work in a healthy and safe environment is achieved through the implementation of systems and standards by dedicated health and safety professionals at BMC. BMC's mandatory occupational health standards apply to all employees and contractors and are regularly audited, providing the opportunity for continual improvement in performance. BMC's leadership team is accountable for performance against the health and safety standards. They are supported by competent and trained personnel whose responsibilities include implementing health systems and monitoring workplace conditions to control exposure to health hazards.

Health and safety team members manage risk registers, conduct personal monitoring for dust, noise, thermal stress and audiometric testing, as well as educate and inform operational teams of health findings and initiatives. The implementation and business performance against health and safety standards is checked through an independent audit process. BMC uses a range of tools and programs to ensure that health and safety remains foremost in the minds of employees and leaders.

3.17.1 Health Performance

During 2011, BMC participated in a voluntary Health and Wellbeing Program to continually improve performance against the RTCA health standards and embed the health and wellness program 'Achieve Health' launched in 2008. Achieve Health is designed to raise awareness and improve the health and wellbeing of employees by offering health related initiatives and encourage participation in a range of activities.

This voluntary program is supported by an external health service provider and is closely linked to Rio Tinto's health target of achieving 70% participation in Health Risk Assessments by the end of 2013. Achieve Health delivers programs such as skin cancer checks, health assessments, personal fitness and wellbeing plans for employees. In addition, BMC implement the RTCA Fatigue Management Framework implemented to reduce the risk of fatigue-related incidents occurring.

3.17.2 Safety Performance

BMC has developed a range of programs to drive continual improvement with regards to safety including:

- Continuing to embed the Safety Semi Quantitative Risk Assessment process which began in September 2011. Quantitative risk analysis is the highest level of analysis within the Rio Tinto HSEQ risk management framework and applies the most rigorous and deductive methodologies. Typically, this involves numerical estimates of risk, by combining a detailed analysis of potential consequences and the frequency of occurrence; and
- Continuing the implementation of the Site Safety Acceleration Program. This is a behavioural based safety program which allows us to review and assess current safety performance and design and execute improvements and sustain improved behaviours.

To achieve reductions in vehicle incidents, in-vehicle driving monitoring systems have been installed on a variety of equipment to ensure an ongoing high level of safety is achieved.



4

The Project

This section provides a detailed description of the Project including the conceptual 24 year mine plan staging, indicative equipment, infrastructure and manning requirements, waste and water management, proposed conceptual construction program and key interactions with neighbouring industry. It also includes a discussion on the need for the Project and the alternatives considered.

4.1 Project Overview

BMC is seeking Development Consent under Division 4.1 of Part 4 of the EP&A Act to facilitate the continuation of open cut coal mining largely within current mining authorities within the Project Boundary as shown on **Figure 13** and listed in **Appendix B**.

An indicative layout of the Project is provided in **Figure 13** and is generally comprised of:

- Open cut mining towards the west at a rate of up to 15 Mtpa ROM coal for 24 years to a total of 316 Mt;
- Continued use of the existing dragline, truck fleet and excavator fleet (with progressive replacement or substitution with equivalent);



- An out of mining area OEA to the west of Dry Creek, which may be utilised for excess overburden material until it is intercepted by mining;
- Continued use, extension or relocation to existing and new infrastructure, including administration and parking facilities, in-mining area facilities (including dragline shut down and erection pad), helipad, tyre laydown area, explosives and reload storage facility, core shed workshop, roads, reject bin, ROM hopper, stockpiles, conveyors, water management infrastructure, bioremediation area, supporting power infrastructure, rail and rail loading infrastructure and ancillary infrastructure;
- Construction and use of various items of new infrastructure (including radio tower, extensions to the MIA, additional raw coal stockpile and upgrade to the ROM coal stockpile (along with associated conveyor network) generally as shown on the infrastructure plans and construction of the Mount Pleasant Staged Discharge Dam and associated water reticulation infrastructure;
- Processing, handling and transportation of coal via the (upgraded) CHPP and rail loop for export and domestic sale;
- Continued rejects and tailings co-disposal in the Main OEA and in the temporary in-mining area reject emplacement;
- Relocation of a 6 km section of Bengalla Link Road at approximately Year 15 near the existing mine access road to facilitate coal extraction;
- The diversion of Dry Creek via dams and pipe work with a later permanent alignment of Dry Creek through rehabilitation areas when emplacement areas are suitably advanced;
- Relocation of water storage infrastructure as mining progresses through existing dams (including the Staged Discharge Dam and raw water dam); and
- A workforce of up to 900 full time equivalent personnel (plus contractors) at peak production.

The Project will generally be undertaken within the Disturbance Boundary as illustrated on **Figure 13**. The fixed (permanent) infrastructure will be located within the Infrastructure Envelope shown on **Figure 13**. This may be aligned or located differently to what is depicted on the detailed infrastructure plans but will be within the Infrastructure Envelope.



4.2 Comparison of the Approved Operations to the Project

Table 9 provides a summary of key Project components and comparison with the Approved Bengalla Mine.

Table 9 Key Project Components and Comparison with the Approved Bengalla Mine

Component	Approved Bengalla Mine	Project
Planning Approval and Supporting Documents	• DA 211/93 (as modified) – Bengalla 1993 EIS – Bengalla 2006 SEE – Wantana 2007 SEE – Bengalla 2008 EA – Bengalla 2010 EA • DA 273/2006 for the Explosives Storage Facility – Bengalla Explosives Storage Facility SEE (Hansen Consulting, 2006b)	• New Development Consent – This EIS
Life of Mine	27 June 2017	24 years from the grant of Development Consent
Deposit	178.5 Mt ROM coal within the currently approved coal extraction limit	Additional 316 Mt ROM coal within the mining areas shown on Figure 14 to Figure 18
Mining Method	Open cut - dragline, truck and excavator	No change to general mining method – dragline, truck and excavator (machinery will be progressively upgraded)
Production	Up to 10.7 Mtpa ROM coal	Up to 15.0 Mtpa ROM coal
Operational Hours	Mining operations and coal processing 24 hours per day, seven days per week	No change to operational hours
Workforce	Approximately 400 full time personnel	• Up to 900 full time equivalent personnel (plus contractors) • Up to 315 additional contractors required during the construction period between Year 1 to Year 4
Blasting	• Maximum of two blast events per day and four blast events per week averaged over a calendar year • Blasting between 7:00 am and 5:00 pm Monday to Saturday, inclusive	• Maximum of four blast events per day and 12 blast events per week averaged over a calendar year • Blasting generally between 7:00 am and 5:00 pm Monday to Saturday. • Blasting on Sundays between 10:00 am and 3:00 pm will be undertaken at up to one blast event per day when within 500 m of the infrastructure areas in accordance with Blast Management Plan (see Section 4.3.3)
Infrastructure	Infrastructure: • Administration and parking facilities • Relocatable facilities including dragline maintenance pad, helipad, crib and amenity facilities, fuel farm, truck park-up and maintenance construction pad), bioremediation farm, substation pads and topsoil stockpiles • Explosives and reload storage facility • Core shed • Roads • Wash Bay • Water management infrastructure • Roads • Wash Bay • Radio tower • Power infrastructure • Fuel and lubricant facility • Ancillary infrastructure	Continued use of existing (relocated) or upgraded infrastructure: • Administration and parking facilities • Relocatable facilities including dragline maintenance pad, helipad, crib and amenity facilities, fuel farm, truck park-up and maintenance construction pad, bioremediation farm, substation pads and topsoil stockpiles • Explosives and reload storage facility • Core shed Workshop and administration buildings • Water management infrastructure • Roads • Wash Bay • Radio tower • Power infrastructure • Fuel and lubricant facility • Ancillary infrastructure

Component	Approved Bengalla Mine	Project
Coal Processing Infrastructure	• ROM hopper processing rates of up to 2,100 tph • CHPP processing rates up to 1,700 tph • Surge bin capacity of 600 t • Total CHPP coal stockpile capacity of 1,035,000 t • Emergency ROM coal stockpile • Stacking and reclaiming system • Rejects thickener	• ROM hopper upgrade to approximately 2,600 tph • CHPP processing rates up to 2,600 tph • Additional approximately 450 t surge bin • An increase in the size of coal CHPP stockpiles to approximately 1,215,000 t • Additional processing module • Emergency ROM coal stockpile upgrade (and relocation with the ROM hopper) • Relocated ROM hopper established on or after Year 4 • Upgrades to the stacking and reclaiming system • Additional rejects thickener
Rejects Management	• Reject material is stored in a 700 t reject bin before being dried in cells and in temporary emplacements in the mining area and buried within the overburden area and capped with a minimum of 5 m of inert overburden material	• No change to method of reject disposal • Reject bin relocated and constructed after Year 2
Coal Transport	• 3,500 tph rail load out facility • All product coal by rail (no road transport) • Product coal to Port of Newcastle • Up to 16 laden train movements per day • Small amounts of product coal to NSW power stations	• 5,000 tph rail load out facility • No other changes to transport methods, number of train movements or destination
Public Roads	• Construction of Bengalla Link Road	• Relocation of an approximately 6 km section of Bengalla Link Road around Year 15 near the mine access road
Landform	• Maximum 270 RL development of OEA	• No increase to maximum RL of landform
Water Management	Water Management System comprised generally of: • Mine water dams and clean water dams • Discharge dam and point • Hunter River intake	• Additional dam (CW1) north of Wybong Road and associated Infrastructure • Relocation of existing water management system (including the Staged Discharge Dam) as mining advances • Diversion of Dry Creek (temporary via pipeline, longer term reinstated through the Main OEA) • Continued use of Hunter River Intake • Construction of the Mount Pleasant Discharge Dam and associated pipeline linking the Mount Pleasant Project with the Mount Pleasant Discharge Dam • Additional dams to the west of mining area as shown in Figure 3

4.3 Conceptual Mine Plan

4.3.1 Mine Plan Layout

The Project will extract the open cut coal reserves from the Warkworth to the Edderton coal seams (under current market conditions) within the Whittingham Coal Measures, focusing on parts of the Jerrys Plains and Vane subgroups. Approximately 1,200 Million bank cubic meters (Mbcm) of overburden material will be moved and approximately 70 Mt of coal reject will be produced from the processing of the ROM coal over the Project life.

Figure 14 to Figure 18 illustrates the conceptual mine plan layouts for Years 1, 4, 8, 15 and 24 respectively. The staged mine plans have been selected for modelling as they represent a combination of mining at the extremities of the Project life at the greatest intensities of mining. Mining operations will continue Bengalla's progress in a general westerly direction. Additional coal resource is known to occur beyond the Disturbance Boundary however, is not proposed to be extracted as part of the Project. It is anticipated that subject to market factors and resource confirmation, BMC will seek the relevant approval for the extraction of these resources in the future.

The mine plans allow for the establishment of a satellite extraction area (i.e. individual mining area in advance of the main extraction area) from Year 2 of the Project to assist with coal quality management and to maximise resource extraction efficiency. This satellite extraction area will be contained within the maximum footprint of the mining operations area and will be mined through with the westerly progression of the mine plan. No additional equipment fleet is required for the development of the satellite extraction area with equipment transferred from the main extraction area as required. The dragline will not be utilised within the satellite extraction area.

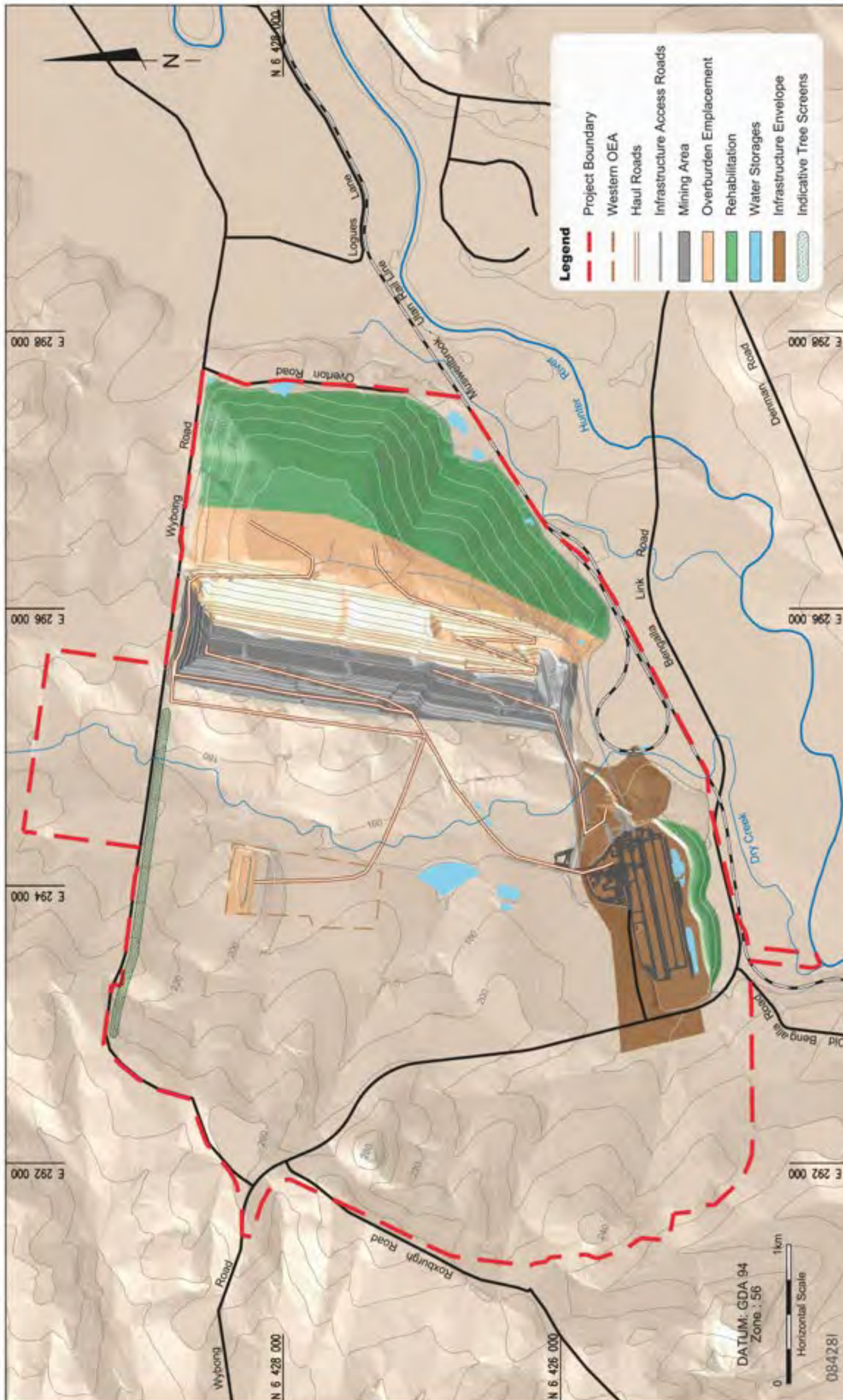


The mine plan incorporates a Western OEA to provide flexibility for overburden to be emplaced from the main mining area or may be required during the construction of CW1. Given the generally westerly sloping topography within the Project Boundary, this location will enable the operations to progress far enough west to naturally alleviate the overburden capacity issues currently experienced by the time the Western OEA is intercepted around Year 7. The Western OEA will provide BMC with the flexibility for an additional approximately 12 Mbcm of overburden emplacement capacity. The limit of the temporary Western OEA will be defined by its construction to a maximum height of RL 220 m.

The Project will not result in any increase to the approved maximum height of the OEA of RL 270 m. As Bengalla progresses in a westerly direction, the natural topography also dips to the west and as a result, from approximately Year 8 to Year 24 the landform will gradually slope down from RL 270 m (see Figure 16 to Figure 18). This reduction in the height of the OEA will result in mining activities being further shielded from sensitive receptors located in the east. The northern portion of the Main OEA will remain steepened until approximately Year 4 to accommodate additional overburden capacity and to maximise coal recovery.

Once mining activities have progressed sufficiently, overburden will be shaped generally consistently with the conceptual landform designs presented on Figure 14 to Figure 18. Topsoil will then be respread on the shaped areas to a minimum depth of 100 mm. Contour banks will be constructed at regular intervals down the slope of the rehabilitation area. The area is then raked to generally remove rocks greater than 200 mm in diameter. Areas are then scarified along the contour to assist in seed germination and water infiltration.

Revegetation will be undertaken progressively after the completion of surface preparation with inert capping material and topsoil spread over areas to be rehabilitated. This will occur as soon as possible to maintain topsoil quality and take advantage of native seed banks if present. Seeding of a rehabilitation area will commence as soon as practical. A conceptual final landform for the Project has been developed in the event that a future approval for the continuation of mining beyond the mine plan is not sought or granted and is described in detail in Section 8.21.



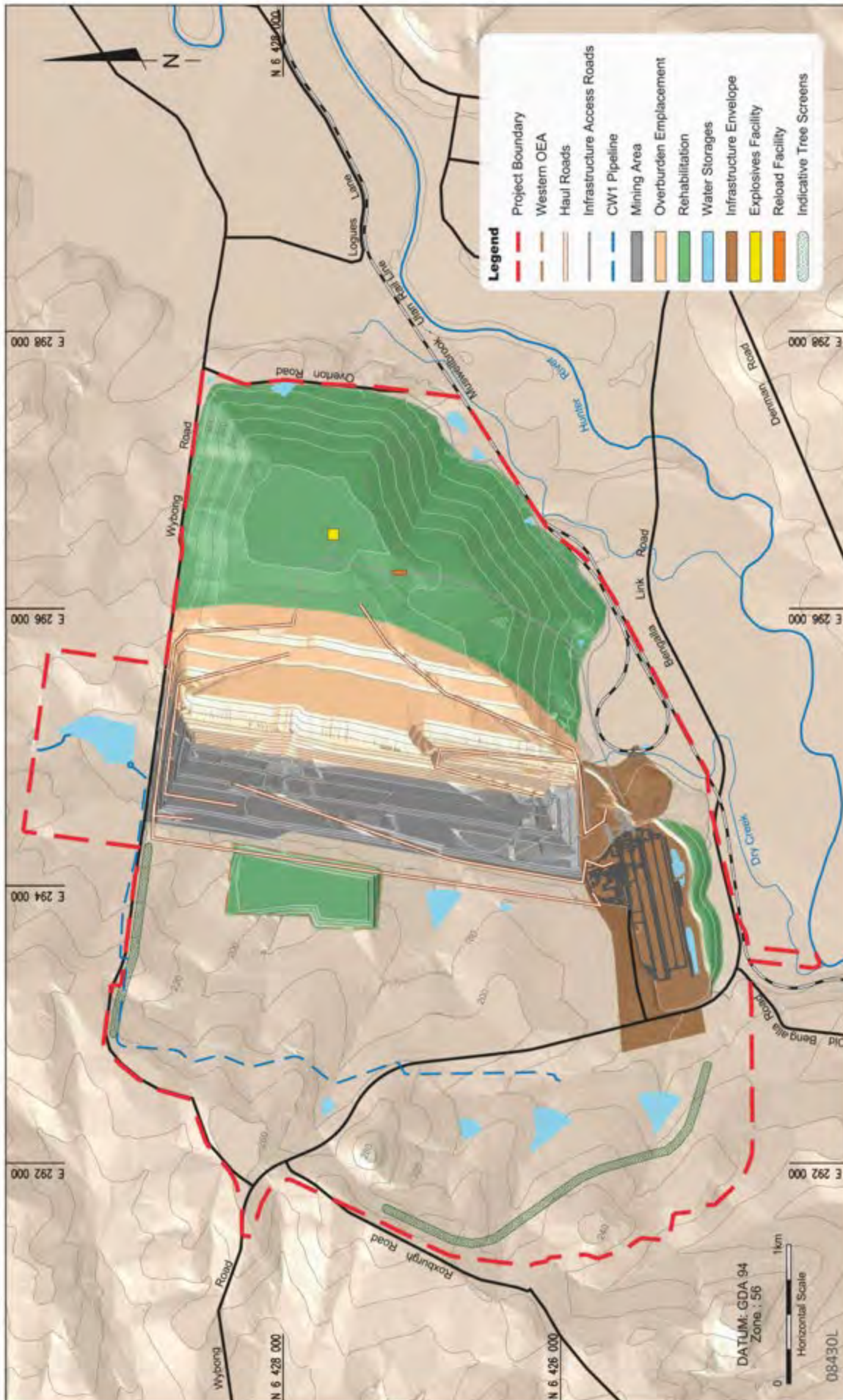
BENGALLA MINE

Conceptual Year 1 Mine Plan

FIGURE 14

Hansen Bailey
ENVIRONMENTAL CONSULTANTS





BENGALLA MINE

Conceptual Year 8 Mine Plan

FIGURE 16

Hansen Bailey
ENVIRONMENTAL CONSULTANTS



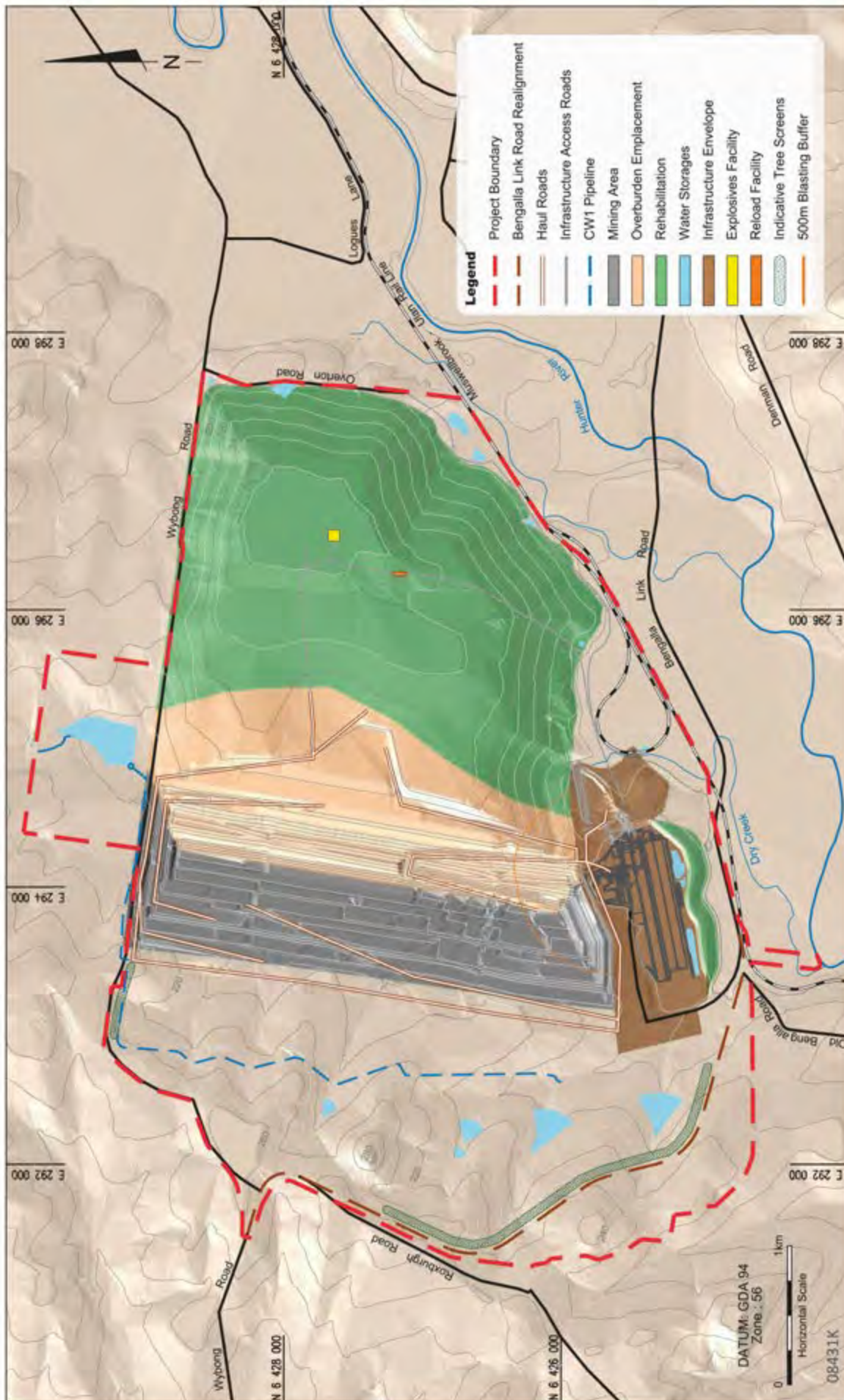
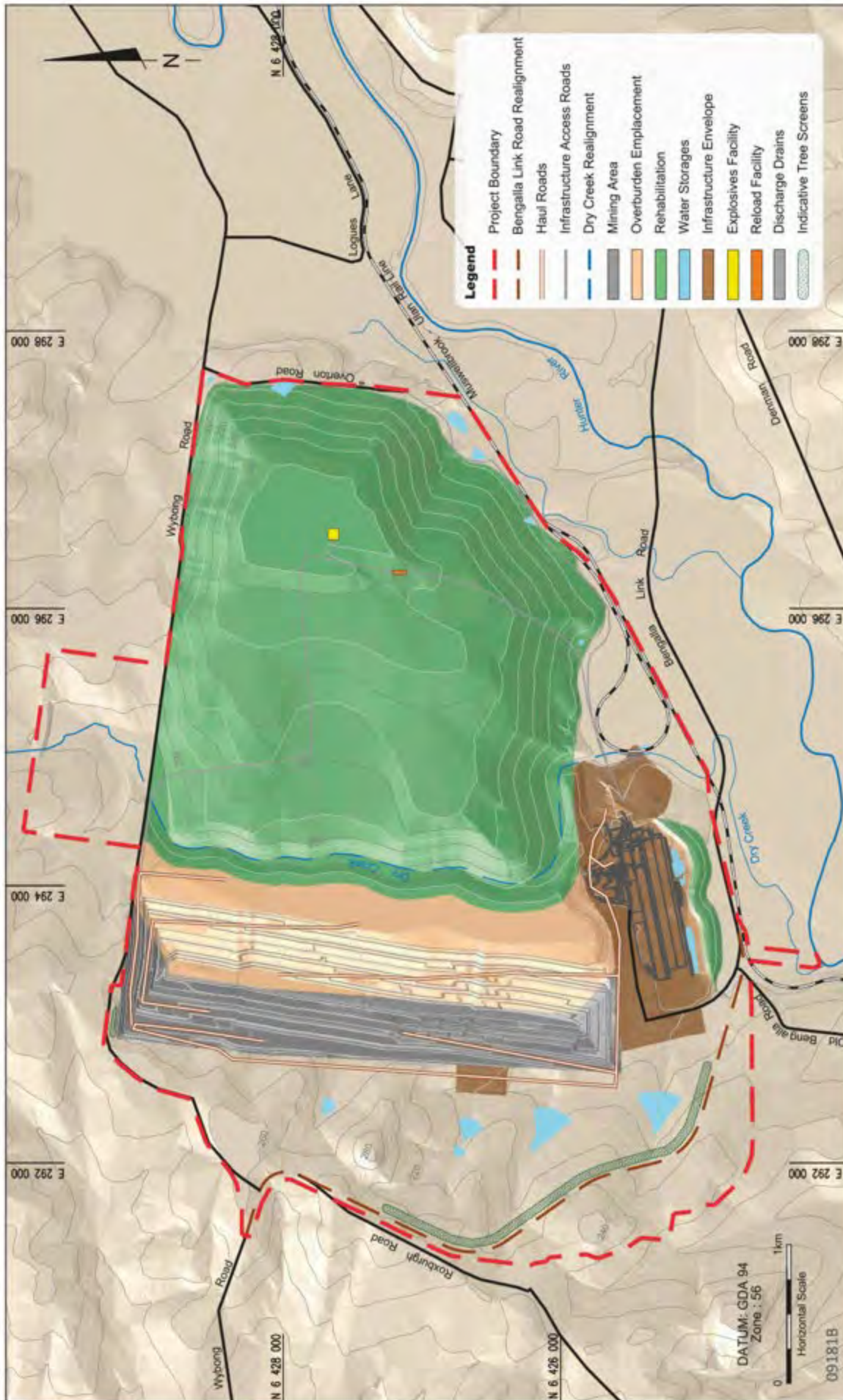


FIGURE 17
Conceptual Year 15 Mine Plan

Hansen Bailey
ENVIRONMENTAL CONSULTANTS





BENGALLA MINE

Conceptual Year 24 Mine Plan

FIGURE 18

Hansen Bailey
ENVIRONMENTAL CONSULTANTS



4.3.2 Mining Schedule and Methods

Year 1 of the Project is scheduled to produce up to 10.7 Mt ROM coal (consistent with existing approvals) with production gradually increasing to 15 Mt ROM coal by Year 4. An indicative production schedule for the conceptual staged years which has been conservatively utilised in relevant assessments is provided in Table 10.

The Project will continue to utilise its dragline and excavators operation supported by a fleet of haul trucks to transport coal to the ROM hopper for processing or overburden to emplacement areas. Open cut strip coal mining will advance to the west based on dragline strips of approximately 60 m in width subject to operational and mining conditions. The Project will require approximately 43 dragline strips subject to operational and mining conditions. Figure 19 provides an illustration of the open cut coal mining process at Bengalla as further described below.

Typical of a dragline operation supported by a trucks and excavators, topsoil is initially stripped from the mining area and either utilised on available rehabilitation areas and / or stockpiled for later use. Prestrip mining of both overburden and ROM coal then occurs down to the Piercefield seam with access to the prestrip areas via highwall ramps. During this stage, overburden is blasted prior to being removed by loader or excavator and trucks to uncover the coal. The Project fleet then progresses through the formation to uncover each coal seam to be extracted in the mining sequence prior to the implementation of the dragline.

BMC's P&H 9020 dragline is the primary piece of equipment for interburden removal between the Vaux to the Edderton seams, although historically it has been used outside this horizon which may occur again in the future. The nominal strip width is 60 m to optimise the dragline operation and provide sufficient width for coal recovery.

The dragline has an operating radius of 105 m and a nominal digging depth and a dumping height subject to operational and mining conditions.

The dragline currently works in four passes. The first pass removes the interburden down to the Vaux seam and the interburden to the Broonie / Bayswater seams is removed in the second pass. This may change as higher production levels are achieved. The Broonie / Bayswater interburden is blasted in generally 60 m wide strips and excavated with a dragline to an overall slope to meet geotechnical requirements. The Broonie / Bayswater coal section is blasted and cut to an overall slope meeting geotechnical requirements.

The dragline then removes the interburden to the Wynn seam and in the fourth pass, the interburden to the Edderton seam. Interburden is dragline dumped at an angle of repose in the order of 37 degrees with the lowermost pad undercut to approximately 45 degrees. Mining methods will generally follow the above description. However, there may be variations to dimensions, timings, orders of events and other elements of the mining method where conditions dictate.

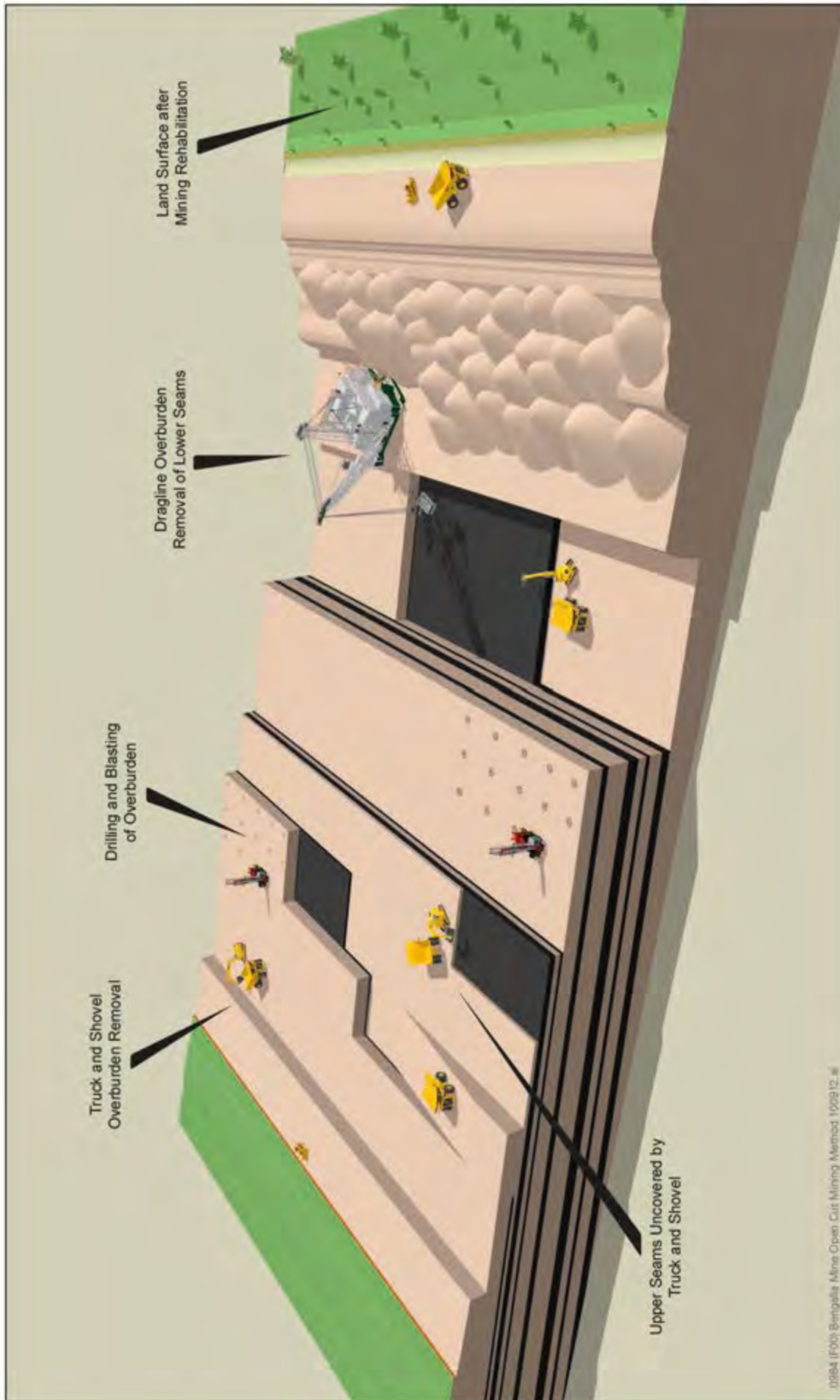
4.3.3 Blasting

The hard rock overburden materials in the mining sequence typically require blasting to achieve suitable fracturing and fragmentation to enable efficient removal of these materials. Exploration drilling has indicated that the Project overburden materials are generally consistent with material currently encountered by existing operations (east of the Project). A review of the material to be mined has confirmed that the desired powder factor for blasting is likely to be approximately 0.6 kilogram (kg) of explosive per bcm of material. The ultimate powder factor utilised for the Project will be refined throughout the mine life to maximise efficiency.

Table 10 Modelled Production Schedule

Year	Total Overburden (Mbcm)	ROM Coal (Mtpa)	Product Coal (Mtpa)	Forecast Number of Train Movements (per annum)	Reject Material (Mtpa)
1	43.2	10.7	8.7	1,012	2.0
4	55.0	15.0	12.3	1,435	2.7
8	55.0	15.0	12.3	1,435	2.7
15	65.0	15.0	12.3	1,435	2.7
24	75.0	15.0	12.3	1,435	2.7





BENGALLA MINE

Open Cut Mining Method

FIGURE 19

Mine planning has predicted approximately 575 blast events per year (or up to an average of 12 blast events per week) will be required. This flexibility is required to enable BMC to facilitate appropriate management of blasting and environmental impacts as determined by site technical and environmental requirements.

Blasting will largely continue to be undertaken during the hours 7:00 am to 5:00 pm Monday to Saturday. As a result of the Project and in order to maintain safety of all onsite personnel, it will be necessary to temporarily evacuate relevant personnel when a scheduled blast is within 500 m of the infrastructure area (or approved but not yet constructed Mount Pleasant Project infrastructure area) to a suitable location situated a safe distance away from the scheduled blast. To facilitate this, limited blasting may also be conducted on Sundays between the hours of 10:00 am and 3:00 pm when the scheduled blast is located within 500 m of the infrastructure area. Specific details and procedures associated with blasting within 500 m of the infrastructure area including notification processes are included in **Section 8.4**.

The Project will require the storage of explosives and other related materials within the existing explosives storage facility. The explosives storage facility will be required to be relocated to the general location presented on **Figure 14** and will be designed in accordance with the relevant standards and guidelines (AS2187.2-2006 – Explosives – Storage, Transport and Use. Part 2: Use of Explosives).

4.3.4 Equipment Fleet

An indicative equipment fleet to accommodate maximum production levels for the Project is listed in **Table 11**. These are operational numbers at any given time and do not include units out of service such as in the workshop (under repair or service). Actual makes and models of equipment for the Project may vary, however operations will be undertaken to ensure that noise levels meet the noise predictions within this EIS.

All equipment required for the Project will be mobilised on site on a progressive basis consistently with the scheduled mining production levels. Various ancillary and other items of equipment will be required, including but not limited to water pumps, light plants, generators, service trucks, mobile cranes, delivery trucks, light vehicles and fuel oil trucks. It is anticipated that with technological development, new pieces of equipment may be employed within the mining industry. BMC will take advantage of this new technology provided environmental impacts from the use of this equipment satisfy the noise and dust emissions limits set by the Development Consent.

Table 11 Indicative Mobile Equipment Fleet

Equipment Type		Project Fleet
Dragline	P&H 9020	1
Excavators / Loaders	Hitachi EX5500 (or equivalent)	7
	Hitachi EX3600 (or equivalent)	2
	LeTourneau 1800 Loader (or equivalent)	2
Haul Trucks	Komatsu 830 E AC (240 t) (or equivalent)	53
	Hitachi EH4500 (253 t) (or equivalent)	
	Caterpillar 789 (190 t) (or equivalent)	
Dozers	Caterpillar D11 (or equivalent)	14
	Caterpillar D10 (or equivalent)	2
	Caterpillar 854G (Rubber Tyred Dozer) (or equivalent)	3
Drill	SK50 (or equivalent)	7
Graders	Caterpillar 16 M (or equivalent)	6
	Caterpillar 24 M (or equivalent)	2
Water carts	Euclid R 90 (80 KL) (or equivalent)	7
Other ancillary equipment (e.g. water pumps, lighting plants, mobile cranes, etc)	Various	Various

4.4 Coal Handling and Preparation Facilities

4.4.1 ROM Coal Handling

ROM coal will be unloaded from rear dump trucks into the existing ROM hopper where the primary coal sizing plant will reduce the size of the coal to a diameter of less than 250 mm. Where scheduling or operational reasons dictate, ROM coal may be temporarily located in mining area before being transported to the primary coal sizing plant. **Figure 20** provides an illustration of the coal handling process at Bengalla as further described below.

To accommodate the increased production levels, the existing ROM hopper and primary sizer will be upgraded to achieve a ROM coal feed rate of approximately 2,600 tph. This upgrade to the existing ROM hopper will be conducted around Year 3 of the Project.

In order to minimise haul road lengths and improve coal handling efficiency, a relocated ROM coal hopper will also be required to be established west of the infrastructure area. Following its construction, a 40,000 t ROM coal stockpile will also be relocated within the Infrastructure Envelope adjacent to the relocated ROM coal hopper.

The crushed coal will then be transported along a conveyor to a secondary crushing station (including secondary sizer, roller screen and tertiary sizer) where it will be reduced to a nominal diameter of less than 50 mm. The secondary crushing station will also require an upgrade to accommodate the additional throughput of up to 2,600 tph. After crushing, coal will be bypassed to product, direct fed into the CHPP or stockpiled on the raw coal stockpile.

The existing 200,000 t raw coal stockpile will continue to operate. An additional raw coal stockpile of approximately 180,000 t will be constructed. An additional stacker and reclaimer capable of processing 2,600 tph will also be used to service the additional raw coal stockpile. In order to meet the Project CHPP processing needs, the existing and additional raw coal reclaiming system will operate simultaneously. The existing raw coal stockpile process capacity may also be upgraded to match the new stockpile.

The existing raw coal bypass system will be upgraded to permit all raw coal to be directed to either of the raw coal stockpiles. Materials testing will be done to accurately determine coal quality prior to the determination of coal processing requirements. Raw coal can then either be bypassed directly to the product coal stockpile or reclaimed for processing in the CHPP.

An extension to the existing emergency ROM coal stockpile will be required to be used in the event that there is a failure, delay in the offsite coal chain to the Port of Newcastle or other operational reasons. ROM coal may also be temporarily stockpiled within the confines of the mining area from time to time where operational efficiencies so require. The maximum ROM coal stockpile capacity on site will be up to 350,000 t.

The Project coal handling system is shown in **Figure 20**.

4.4.2 Coal Handling and Preparation Plant

The Project involves an upgrade to the existing Bengalla CHPP to enable the handling and processing of up to 15 Mtpa ROM coal. Reclaimed ROM coal will be fed into a surge bin of approximately 800 t capacity from where it will be withdrawn at a controlled rate for processing in the CHPP. A new additional approximately 450 t raw coal surge bin will be constructed north of the existing surge bin to feed the third CHPP module which shall accommodate a ROM coal feed rate in the order of 2,600 tph.

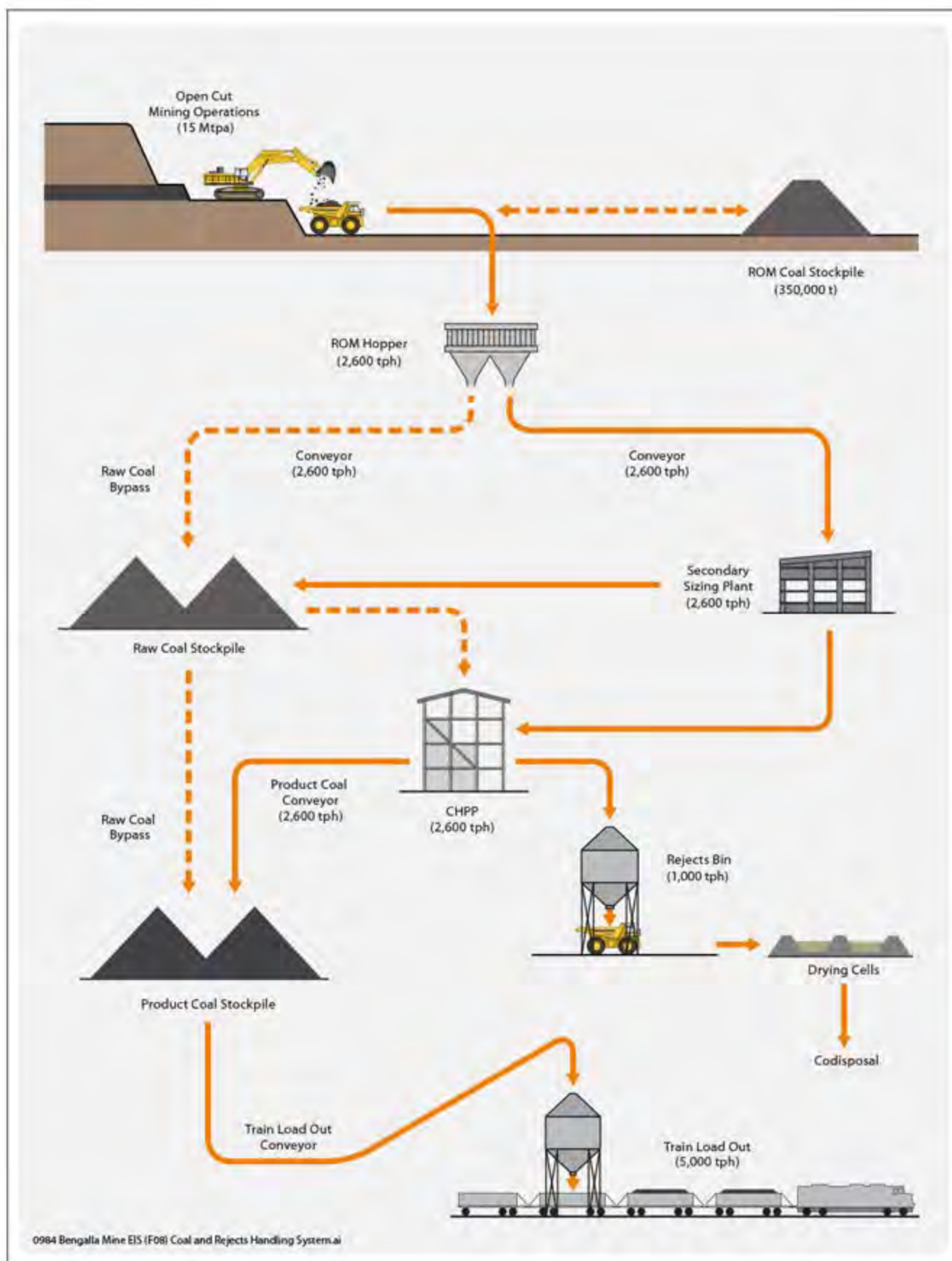
The Project will include an additional coarse module similar to those currently in operation and an upgrade to the common fines circuit and other circuits. All fine coal will be processed through a common fines module. Each module utilises dense medium cyclones and spirals to process the various size coal fines.

The indicative layout of the CHPP and other associated facilities is illustrated on **Figure 21**. Additional detailed conceptual plans of key infrastructure upgrades to meet Schedule 1 of EP&A Regulation) are provided in **Appendix C**. This design will be revised and finalised upon the determination of Development Consent in accordance with any required conditions of approval.

4.4.3 Product Coal Handling

All product coal is dewatered by centrifuges before the product is placed on the plant product conveyors (along with any raw coal from the bypass system) and fed onto the product coal stockpiles or directed to the train load out facility.

The Project will not require an increase to the approved configuration of the product coal stockpiles. The quality of the coal from the Project is sampled and analysed before being placed on the stockpiles. Different coal products are stored in designated sections of the product stockpile to meet market needs.



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BENGALLA MINE
Coal Handling Process

FIGURE 20



BENGALLA MINE

Infrastructure and Upgrade Layout - CHPP Area

FIGURE 21

4.4.4 Product Transport

The Project will involve the transport of product coal by rail nominally to the Port of Newcastle for sale to the export market with lesser amounts railed directly to NSW power stations. Product coal will be conveyed from the product stockpiles to the Bengalla Rail Loop and associated automated train load out facility (see **Figure 13**).

The existing Bengalla Rail Loop has sufficient capacity for the Project's planned increase in coal production up to 15 Mtpa. Forecast train movements to accommodate the Project will require up to 1,435 train movements per year and will not require any increase from approved levels (see **Table 9**). The Project will continue to facilitate coal from the Mount Pleasant Project via a conveyor upon its construction (or another approved method) to Bengalla Mine.

4.5 Reject Material and Overburden Waste

Bengalla does not require the use of an out of mining area tailings dam. Tailings are and will be managed through drying and co-disposal in the Main OEA. Ultrafine material (smaller than 0.125 mm) is thickened, dewatered on belt press filters and then combined with other reject streams for final disposal back into the overburden. A second rejects thickener may be installed for the Project.

Reject material is stored in the 700 t reject bin before being transported back to the extraction area where it is dried in cells located within the areas for overburden re-emplacement, buried within the Main OEA and finally capped with a minimum of 5 m of inert material.

To accommodate the additional production levels, the reject bin may be relocated generally adjacent to the exit route from the existing ROM bin to make use of mine trucks exiting the ROM pad for the collection and transport of reject material. In addition, the reject bin may also be upgraded to approximately 1,000 t capacity. The location of the relocated reject bin is presented on **Figure 21**.

Following the construction of the relocated ROM coal hopper, the rejects bin may also be required to be relocated within the Infrastructure Envelope adjacent to the relocated ROM coal hopper.

Bengalla will continue to operate a bioremediation facility where any soil contaminated with hydrocarbons is placed for remediation and progressively relocated within the Disturbance Boundary as required. When the soil meets specific land use criteria, it will continue to be appropriately placed in the Main OEA.

4.6 Mine Infrastructure

The Project will utilise the existing Bengalla infrastructure described in **Section 3**. Key items that may need to be upgraded or relocated to facilitate mining as part of the Project (but not limited to) include:

- Workshop and administration buildings;
- Explosives storage and reload facility;
- Water management infrastructure;
- Helipad;
- Dragline maintenance pad;
- Generator compound;
- Mine Access Road; and
- Ancillary infrastructure.

A general indicative arrangement of the MIA is shown on **Figure 21** and each of these described below. The elements of the MIA will be located within the Infrastructure Envelope shown on **Figure 22**. Their exact layout may be different from the detailed plans of the infrastructure but all elements will be within the Infrastructure Envelope.

4.6.1 Workshops and Administration

The Project will require the construction of additional workshops and administration area infrastructure to accommodate the Project workforce. It will generally be contained within the Infrastructure Envelope within the Project Boundary. Upgrades to the existing workshop and administration are anticipated to contain (but may not be limited to) the following items:

- Additional parking for heavy and light vehicles;
- Additional heavy and light vehicle maintenance workshop and laydown areas with supporting services;
- Fuel and lubricant facilities;
- Light and heavy vehicle wash station incorporating a catch dam, sediment control dam and oil separator; and
- Crib hut and bathhouse buildings.

Further detail in relation to each of the above items is discussed below.



Infrastructure and Upgrade Layout - Administration and Workshop Area

FIGURE 22

Parking

The Project will require the construction of an additional, sealed parking area consisting of approximately 50 spaces located within the Infrastructure Envelope. Additional areas of car parking will be constructed within the Infrastructure Envelope to accommodate approximately 250 additional car parking spaces.

The existing two lane heavy vehicle marshalling area and parking facility will also be relocated and upgraded to facilitate the Project. Additional temporary parking will also be required during construction periods within the Disturbance Boundary. Temporary parking will be located at appropriate locations within the Disturbance Boundary from time to time.

Office Facilities

The Project will include the construction of additional office capacity to accommodate the additional workforce and provide for further training and conference facilities. Two new office blocks will be constructed as production levels increase for the Project. A new 1,000 m² single story office block with a further double storey 1,400 m² office block will be constructed within the Infrastructure Envelope. The layout may vary from the detailed plans but the office facilities will be within the Infrastructure Envelope.

Vehicle Maintenance Workshop and Support Services

The Project will require the construction of an additional four bay extension to the existing heavy vehicle workshop including a separation bay. A new three bay light vehicle workshop will also be constructed adjacent to the existing heavy vehicle workshop.

A two bay heavy vehicle tyre changing facility will be constructed west of the current workshop area. Expired tyres will then be stored in the new tyre storage area until disposal.

Four new laydown areas of various sizes will be constructed throughout the MIA. In addition, two new covered storage sheds constructed within the new laydown areas will also provide for additional storage capacity.

Fuel and Lubricant Facilities

The fuel and lubricant storage facilities will require a total maximum storage volume of 1,320,000 Litre (L). All diesel storages will be above ground, self bunded storage tanks, constructed in accordance with relevant Australian Standards, including but not limited to 'AS 1940 The Storage and Handling of Flammable and Combustible Liquids'.

Additional upgrades to storage tanks associated with petroleum products, concentrated engine coolant and diesel will also be required for the Project. The facility will also provide for the reclaiming and storage of waste oil and waste coolant resulting from vehicle and servicing repair.

The mining vehicle fleet will generally be refuelled by the service vehicles at temporary, designated locations around the mine site relocated appropriately from time to time. Fuel and bulk lubricant will be delivered by trucks to the unloading area, which will be designed for the containment of spillage. Diesel will be delivered on a daily basis with up to six B-Double (50,000 L) trucks per day. All storm water from the facility will be collected at a common collection point and pumped into a designated contained storage area for oil separation and treatment, located at the heavy vehicle wash.

The fuel and lubricant facilities will be relocated from time to time within the Disturbance Boundary as described in Section 4.6.3.

Wash Station

A new two bay heavy vehicle washdown bay will be constructed within the Infrastructure Envelope to accommodate additional Project fleet (precise layout and location may vary from detailed plans but within the Infrastructure Envelope). The heavy vehicle washdown bay will accommodate haul trucks (both overburden and coal haulage), dozers, graders and loaders and will prepare heavy vehicles for entry to the workshop.

A new light vehicle washdown bay will be constructed on the entrance road to the light vehicle car park.

A new solid removal system and hydrocarbon treatment area will also be constructed for the new heavy and light vehicle washdown bays. Muds and greases / oils removed from both the heavy and light vehicles will be collected in the drive in sump capable of being cleaned out by a front end loader. Waste water will be pumped into an oil separator prior to reticulation into the existing water management system.

Crib Hut and Bathhouse

The existing crib hut and bathhouse will be required to be upgraded by Year 4 to accommodate the additional Project personnel requirements. A modification to the existing male bathhouse will provide for up to 650 personnel. A new female bathhouse will be constructed to provide for up to 140 personnel.

4.6.2 Explosives and Reload Facility

The relocation of the explosive storage and reload facility will be required prior to Year 4 and will be constructed in accordance with AS 2187:1998 *Explosives - Storage, Transport and Use - Storage (1998)* and relevant NSW Occupational Health and Safety (OH&S) regulations.

The relocated facility will be sited in a fully bunded position on the existing OEA as identified on **Figure 13** which is located a sufficient distance from onsite facilities, such as offices, within the Project Boundary to ensure safety. The relocated position will require the construction of an all-weather access road to enable access for heavy vehicles. The access road will permit access from both the northern and southern portion of the Project as presented on **Figure 13**.

4.6.3 Relocatable Facilities

The dragline maintenance pad necessary for the maintenance of the dragline pad including parking services, crib rooms and associated facilities (relocatable facilities) will be relocated throughout the duration of the Project to facilitate the natural progression of mining. A dragline maintenance pad(s) will initially be constructed generally to the north of the infrastructure area.

In order to facilitate access in the event of an emergency, BMC will continue to maintain the existing helipad to the west of the highwall.

Key additional infrastructure items that may be required to be relocated to facilitate the progression of mining include in-pit facilities (crib and amenity facilities, fuel farm, truck park-up, and maintenance construction pad), bioremediation farm, substation pads, and stemming gravel and topsoil stockpiles. All relocated infrastructure items will be located (and relocated as required) at suitable locations within the Disturbance Boundary.

4.6.4 Power Supply Infrastructure

It is intended that the Project will require the upgrade of the existing power supply. The upgrades are primarily required to support water management infrastructure along with onsite operational needs if necessary. It is anticipated that BMC will either establish mains power to CW1 via connections to existing infrastructure with two generators located in the infrastructure area or at CW1 adjacent to Wybong Road to supplement this source in the event of power loss.

As an alternative to the above, three generators would be commissioned in order to provide sufficient power without the requirement for an external power supply source. The generator storage compound will be constructed for the Project and will be required to contain up to three 1,250 Kilovolt-ampere (kVA) powered diesel generators (of which two will operate at any time) and associated 55,000 L diesel storage capacity.

All necessary power supply works will be undertaken in consultation with the relevant power authority as required and will be located within the Project Boundary; with the exception of the power upgrade of existing power lines or duplication of the switch yard which will be located generally as shown on **Figure 3** within the Project Boundary.

4.6.5 Ancillary Infrastructure

Minor additional disturbance associated with ancillary works including Dry Creek pipeline, Mount Pleasant Discharge Dam pipeline and associated power supplies, fencing, firebreaks, water diversion structures, minor contour banks, tracks along pipelines, powerlines, temporary service areas, core shed and portable buildings, temporary construction, heavy vehicle park up areas and sediment control structures may be required. These will generally be located within the Disturbance Boundary.

Any elements of the Project or disturbance located outside the Disturbance Boundary but within the Project Boundary will be subject to internal BMC approvals including the completion of a comprehensive GDP and as described in **Section 3.13**. The Project will require alignment modifications to the internal power reticulation network to facilitate the staged progression of mining operations within the Project Boundary.

4.7 Mine Access

All access to the Project will remain via the existing Bengalla Mine Access Road off the Bengalla Link Road. An alternative site access road may be required to accommodate relocated infrastructure and would be located within the Infrastructure Area shown on **Figure 22**. Additional road networks or extensions to existing internal roads will also be constructed in order to provide access to the various new and upgraded infrastructure elements. The existing Bengalla Mine Access Road will also be utilised as the primary emergency entry and exit route.

Mining activities will intersect a 2 km section of the Bengalla Link Road. However, to provide the best alignment for traffic, BMC is proposing to realign a section of the Bengalla Link Road (approximately 6 km in length) to the west of its current alignment. The new road section will replicate the existing two lane, two way rural road with a nominal speed limit of 100 km/hour that was constructed by BMC in 2009 (see **Figure 23**). The existing section of Bengalla Link Road will be closed (and purchased by BMC if possible) and the new section of Bengalla Link Road will be constructed to the relevant required standard and dedicated by BMC as a public road. BMC is the landowner of all the land proposed for the new section of the realigned Bengalla Link Road.

The design will include a 'like for like' replacement of the current Bengalla Mine Access Road intersection approximately 900 m south. The intersection will consist of a channelised right turn with a minimum 160 m right turn lane with a slight uphill grade (see **Figure 24**).

BMC will also construct an intersection from the existing Roxburgh Road onto the realigned section of the Bengalla Link Road. This intersection will require Roxburgh Road to be altered to allow a 90 degree angle of intersection (see **Figure 24**). Impacts associated with the relocation of the Bengalla Link Road are discussed in **Section 8.13**.

The realigned section of the Bengalla Link Road and intersection design will be constructed in accordance with the 'Guide to Road Design Part 4A – Signalised and Unsignalised Intersections' (Austroads, 2009) and will be developed in consultation with MSC.

BMC will remain responsible for the life of the Project for the costs of the maintenance of the Bengalla Link Road to the Bengalla Mine Access Road (subject to MSC's responsibilities as the roads authority under the Roads Act 1993 (Roads Act)).



4.8 Water Management

4.8.1 Mine Water Management System

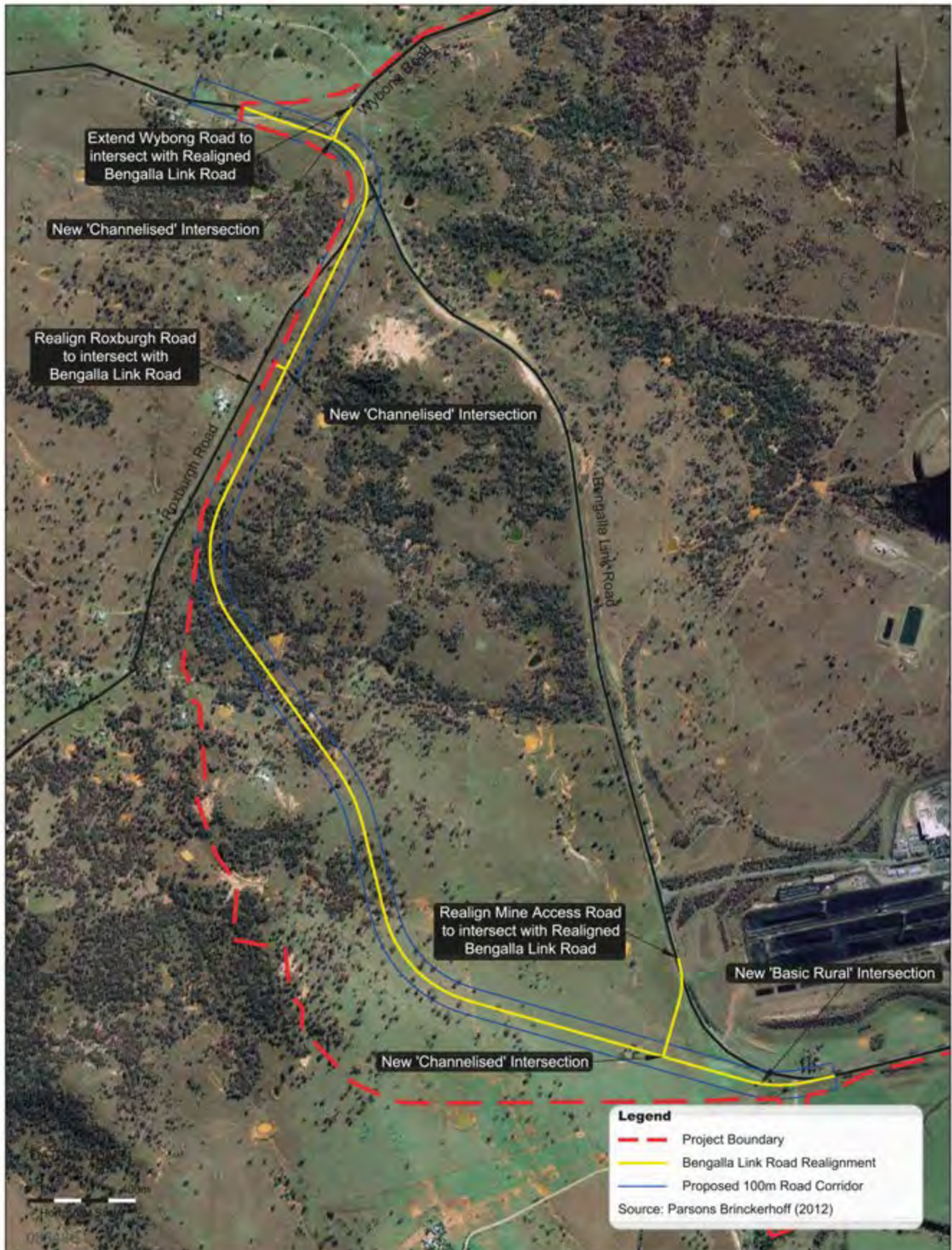
The water management system required for the Project will be integrated with the existing water management system to enable optimal collection, use, recovery and recycling of water within the Project Boundary.

Figure 14 to **Figure 18** illustrate the indicative water management system for the Project as mining activities progress, opening and creating new catchments.

The initial catchment areas above the mining area will require a system of catch dams, bunds, piped transfers and diversion drains to ensure that the water upstream does not inundate the mining area during large rainfall events. Clean water runoff will be collected in surface drainage channels and diverted away from the mine area into their natural flow or will enter into the water management system. Surface water from disturbed areas will enter into one of the various existing sedimentation dams or those proposed for the Project for treatment in the water management system. All sediment dams for the Project will be designed consistently with best management practice or required by a public authority (other than Landcom or the Superannuation Administration Corporation or any of their subsidiaries) to prevent the contamination of a water source.

BMC currently holds Water Access Licence (WAL) 001106 which has high security share component from the Hunter River of up to 1,449 units attached. Additionally, BMC hold WALs for the Hunter River with a further 4,562 general security units. Allocation from these licences will supply necessary supplements to the existing site water largely for use in the CHPP and for dust suppression. The existing pump and associated water pipeline (see **Figure 14**) will continue to be used to transfer water from the Hunter River for use in the water management system. BMC holds various other water licences which are detailed in **Section 5**.

Water recovered from mining operations will be pumped into the Main Water Dam where it can then be transferred to other areas within the mine as required largely for use in the CHPP or for dust suppression. During periods of high rainfall, excess water from the Project can also be discharged into the Hunter River under the HRSTS during periods of 'high' or 'flood' flows. Discharges will be conducted in accordance with BMC's EPL 6538 and the *Hunter River Salinity Trading Scheme Regulation 2002*. All discharges will be released from the Staged Discharge Dam with additional surface water monitoring undertaken during any such discharge event. Discharge requirements for the Project are further described in **Section 8.6**.



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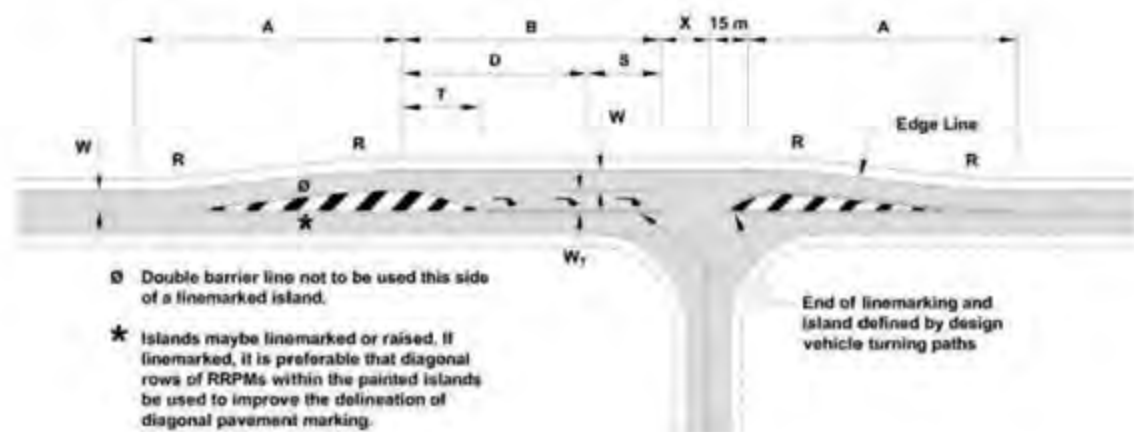


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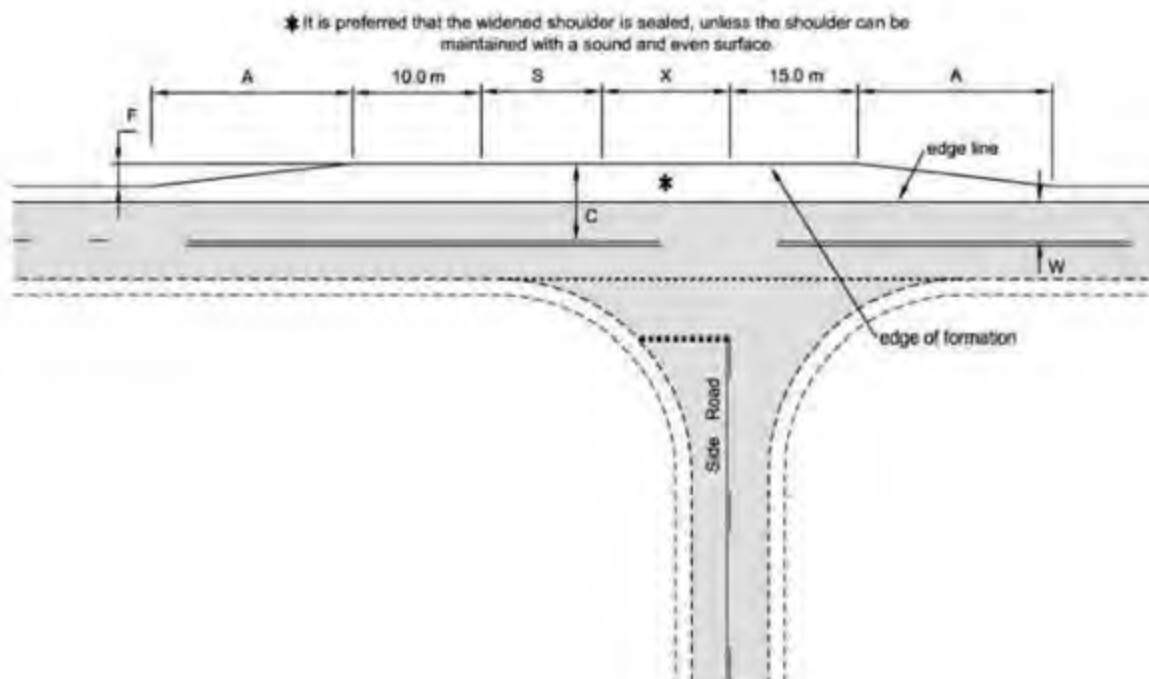
Conceptual Bengalla Link Road Realignment

FIGURE 23

Channelised Intersection



Basic Rural Intersection



08947D

Source: Austroads Guide to Road Design



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BENGALLA MINE

Indicative Intersection Design

FIGURE 24

4.9 Dry Creek

4.9.1 Interim Diversion

Dry Creek is an ephemeral gully line that often maintains zero flow which is interrupted sporadically by short periods of flow during prolonged and / or heavy rainfall (see **Section 8.6**). Dry Creek commences north of Wybong Road within the Mount Pleasant Project Mining Lease 1645 and drains from north to south to the Hunter River, which is located approximately 1 km south of the Project Boundary (see **Figure 14**).

BMC engaged Parsons Brinckerhoff to undertake an interim management system and conceptual Dry Creek re-establishment study that will allow mining operations to continue west for the Project. The overall Dry Creek relocation design has been prefaced by and informed by studies completed from conceptual and prefeasibility through to feasibility phases from 2007 to 2012, to determine the preferred option for the Project. A discussion in relation to the alternatives considered is provided in **Section 4.13.9**.

The Dry Creek catchment north of CW1 maintains a 665 ha total catchment area. The dam would capture the runoff generated from a 1 in 200 year Average Recurrence Interval (ARI), 72 hour storm prior to passing under Wybong Road and onto BMC land. Noting that this dam is essentially all surcharge capacity, CW1 has a surcharge capacity of 900 ML to reduce the potential for runoff entering BMC's void.

To minimise footprint of CW1 the removal of approximately 300,000 bcm of material from within the current footprint as depicted on **Figure 14** is required. The material will be transported across Wybong Road for emplacement within the Main OEA in or in the Western OEA in consultation with relevant regulators and in accordance with the protocol described in **Section 4.9.4**. Should this material be required for use as part of the Mount Pleasant Project (in accordance with relevant approvals), this material would be used as described in that approval.

As mining progresses to the west, it is anticipated that Dry Creek will be impacted from mid-way through Year 2 of mining operations. As such, the construction of CW1 north of Wybong Road will be required to commence in Year 1. CW1 will provide for the catchment of all water upstream of its location and will be constructed in accordance with Landcom (2004) and has been designed to be capable of containing a 1 in 200 year rainfall event.

4.9.2 Temporary Diversion and Hardware

To maintain safe operating levels, clean water from CW1 will have a design flow of 1,085 L/s into a pipe to divert clean water around mining operations until Dry Creek is reinstated after Year 15. The pipeline will be approximately 5.4 km long and will facilitate water to be transported to a discharge point west of the current Mine Access Road. An energy dissipating structure would be constructed at the end of the pipeline to minimise erosion potential from the water re-entering the existing drainage line. An indicative pipeline alignment is presented on **Figure 18**.

It will be necessary for the pipes to be placed under the surface of both Wybong Road and the Bengalla Link Road. BMC will consult with MSC in relation to any potential short term traffic implications.

In order to provide for sufficient pumping capacity of CW1, three pumps are required to be commissioned and installed adjacent to CW1.

To facilitate the pumps required for the diversion, additional power supply requirements will be necessary as discussed in **Section 4.6.4**. Both the mains power and generators options will be capable of producing for sufficient electricity capacity to power both pumps for 100% of the time if required.

The generators will be located within the Mine Infrastructure Area and as a result will require power to be directed along internal power reticulation network to the pumps located adjacent to CW1. It is anticipated that the existing transmission lines will be progressively relocated to facilitate mining however will be contained within the Project Boundary.

The generators will also have the ability to synchronise to the site network power. This is required to reduce the risk associated with possible delays with a future Ausgrid application to upgrade supply to the mine site should it be deemed necessary which may result in the duplication of the existing switch yard and upgrading external reticulation power supply.

4.9.3 Dry Creek Reinstatement

After Year 15 and prior to Year 24, a permanent realignment of Dry Creek will be constructed using best practice initiatives to ensure its successful stabilisation. Further detailed discussion in relation to the final location and conceptual rehabilitation design for Dry Creek is provided in **Section 8.21**.

A discussion of the alternatives considered for the reinstatement of Dry Creek is included in **Section 8.21**.

4.9.4 Mount Pleasant Project Discharge

Section 6.4.3 (v) of the Mount Pleasant 1997 EIS permits the following in relation to water discharge:

“Surplus water will be discharged from the main storage dam (RW1) to the natural watercourse and into the Hunter River via the major drainage line west of the Bengalla Mine. Water will mainly be released during high rainfall periods in compliance with the Hunter Salinity Trading Scheme. Some lower flow releases may also be required during the later years of mining.”

Inferred from the above statement is that the Mount Pleasant Project is permitted to discharge mine water from RW1 into the existing Dry Creek in accordance with an appropriate EPL and the HRSTS. In order to mitigate the Project interrupting the Mount Pleasant Project's currently approved discharge route (via RW1 into Dry Creek) it is proposed that BMC, as part of the Project, will construct a 300 ML Mount Pleasant Discharge Dam 1 (Mount Pleasant DW1) and associated pipeline (located generally adjacent to CW1 (see **Appendix X**)) in accordance with relevant guidelines and standards. Following the receipt of Development Consent, if granted, BMC will construct Mount Pleasant DW1 within a mutually agreeable timeframe, but prior to the commencement of mining operations associated with the Mount Pleasant Project. Mount Pleasant DW1 will not be utilised in the Project water management system but rather, will be available to the Mount Pleasant Project, subject to appropriate approvals.

Mount Pleasant DW1 will be constructed by BMC for the Project however; Coal & Allied would seek any additional required approvals under the EP&A Act or other relevant legislation to facilitate its use.

Further discussion in relation to interactions with the Mount Pleasant Project is provided in **Section 4.12**.

4.10 Hours of Operation and Employment

The Project will require up to approximately 900 full time equivalent personnel.

Maintenance activities, deliveries, coal processing, coal transport and mining operations will be conducted 24 hours a day, seven days per week.

Construction activities to be undertaken for the Project will require up to an additional 315 employees. Construction activities as described in **Section 4.11** will be required to be undertaken 24 hours per day, seven days per week.

4.11 Construction

To facilitate the practicalities associated with increasing production levels to 15 Mtpa a two staged approach to infrastructure is required. Temporary construction project offices and car park area will be required to be utilised for the duration of the proposed construction program to develop the appropriate infrastructure to achieve the Project production levels. The temporary construction project offices and other relevant infrastructure will be located north of the existing Bengalla Mine Access Road within the Disturbance Boundary.

An overview of the indicative construction schedule is provided below.

4.11.1 Stage 1 – Upgrade to 13 Mtpa

Stage 1 additional infrastructure or upgrades to facilitate 13 Mtpa ROM coal production are anticipated to be completed by mid-Year 2. The indicative construction schedule to accommodate Stage 1 construction is presented in **Table 12**. The commencement of stages may be delayed due to market forces or other matters beyond the reasonable control of BMC.

4.11.2 Stage 2 – Upgrade to 15 Mtpa

Stage 2 additional infrastructure or upgrades to facilitate 15 Mtpa ROM coal production are anticipated to be completed by the end of Year 3. The indicative construction schedule to accommodate Stage 2 construction is presented in **Table 12**.

4.11.3 Other Construction Works

Additional infrastructure components not directly associated with the CHPP or MIA however necessary for facilitating increased production will also be required to be constructed by the end of Year 3. These items include various activities associated with the interim diversion of Dry Creek, additional fuelling, storage and maintenance locations. The indicative construction schedule to accommodate the construction of these activities is presented in **Table 13**.

Additional infrastructure requirements will also be constructed throughout the duration of the Project to accommodate the progression of mining in appropriate locations within the Disturbance Boundary and will include, but not be limited to the following: Dry Creek diversion and associated works including CW1 construction, pipeline establishment, pump commissioning, power reticulation and associated earthworks; Dry Creek reinstatement; Bengalla Link Road realignment; water management infrastructure and other ancillary works.

Table 12 Indicative Mine Infrastructure Construction Schedule

Infrastructure Construction Component	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Stage 1 - Upgrade to Mine Infrastructure (13 Mtpa)												
Temporary construction administration area												
Existing car park extension												
Covered stores building												
Modification to existing bathhouse												
Construction of new light vehicle workshop												
Earthworks, drainage and water management												
Office Extension (Block F)												
Stage 1 & 2 Upgrade to CHPP (13 Mtpa and 15 Mtpa)												
Relocation of reject bin and associated conveyors												
Conveyor and transfer station civil works												
Installation of stockpile stacker and reclaimers												
Construction of CHPP module 3												
Construction of additional filter house												
Upgrade of existing and construction of new conveyor and transfer stations												
CHPP commissioning and verification												
Earthworks, drainage and water management												
Excavation and civil works for new conveyor slot												
New bridge and road realignment												
Establishment of the ROM bin, primary crusher station and associated earthworks												
Installation of new ROM conveyors and transfer stations												
Installation of new sizing and screening station												
Stage 2 - Upgrade to Mine Infrastructure (15 Mtpa)												
Hydrocarbon storage area upgrade												
Eastern public car park and light vehicle car park extension												
New tyre change facility												
Modification to existing and construction of new bathhouse												
Office Block (Block G)												
Construction of generator compound												
Workshop extension												
Earthworks, drainage and water management												
Other Works												
Refuelling upgrade to 550,000 L												
New tyre storage facility												
Dragline maintenance pad												
Refuelling upgrade to 880,000 L												

Infrastructure Construction Component	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Dry Creek Diversion (including CW1 construction, pipeline establishment, pump commissioning, power reticulation and associated earthworks)												
Relocation of the explosives and reload facility												
Indicative Construction Manning Required	-	-	85	195	315	245	160	150	45	85	125	150

Table 13 Indicative Project Construction Schedule

Infrastructure Construction Component	Project Timing	Indicative Construction Manning Required
Bengalla Link Road Realignment	Approximately Year 13	Up to 50 contract personnel for 1 year
Dry Creek Reinstatement	After Year 15	Up to 30 contract personnel for 1 year
Erosion and sediment control structures and water management earthworks	Ongoing to facilitate Project progression	Limited contract personnel

4.12 Interaction with the Mount Pleasant Project

The Mount Pleasant Project is wholly owned by RTCA. It is located to the immediate north of the Project Boundary. The Mount Pleasant Project holds DA 92/97, which is supported by the Mount Pleasant 1997 EIS. The Mount Pleasant Project is approved for the construction and operation of an open cut coal mine, coal preparation plant, transport and rail loading facilities and associated facilities at a production rate of up to 10.5 Mtpa ROM coal. Though mining has not yet commenced the development has been activated with the construction of a dam.

A modification was granted to DA 92/97, supported by the Mount Pleasant 2010 EA which permitted an infrastructure envelope for siting mine infrastructure (in place of the specific locations presented in the EIS) and the provision of an optional conveyor / service corridor between the Mount Pleasant Project area and Bengalla as an alternative to the approved rail facilities.

Table 14 presents a list of interactions between Mount Pleasant Project and the Project. These interactions are also presented conceptually on **Figure 25**. Consultation with Coal & Allied in relation to the Mount Pleasant Project is discussed in **Section 6**. BMC will continue to explore synergies with the adjacent Mount Pleasant Project which will include any future opportunities to share infrastructure.

Additional detail regarding the construction of Project water management infrastructure associated with the Mount Pleasant Project is provided in **Section 4.9.4**.

4.13 Project Alternatives

A number of project alternatives have been investigated. A primary objective of these investigations was to develop a mine plan that considered the principles of Ecologically Sustainable Development (ESD) whilst providing the best practical environmental, social, physical and economic outcomes for the Project.

Each of the alternatives investigated were refined according to the environmental impacts, the approvals required, operational practicality, timing and economic limitations. The various Project alternatives that were considered during this process are described below.

4.13.1 Option 1 – Do Nothing Approach

Under Option 1, Bengalla would cease operations in 2017. This would result locally in the loss of approximately 400 jobs and 900 potential future employment opportunities.

It would also lead to the loss of local socio-economic benefits created by Bengalla in addition to the loss of ongoing benefits and royalties and other payments to both the NSW State and Federal governments and significant economic benefits flowing from the gross annual revenues from the Project.

It would leave approximately 964 ha of land available for the best agricultural use which would be grazing of livestock. The land would generate a maximum of \$1.1 M per annum and employ only one person (see **Section 8.20**).

Table 14 Mount Pleasant Project Potential Interactions

Mount Pleasant Project	Interaction with the Project
Mining of the Mount Pleasant Project - Open cut coal mine to extract approximately 197 Mt of ROM coal over a period of 21 years - Maximum rate of up to 10.5 Mtpa - Approval valid until 22 December 2020	- The Mount Pleasant Project has been assessed in this EIS for cumulative purposes on the assumption that construction of the Mount Pleasant Project commences in Year 4 of the Project - Mount Pleasant Project is consistent with that described in the Mount Pleasant EIS and Mount Pleasant EA and associated approval DA 92/97 (as modified) - The Mount Pleasant Project obtains the relevant approval to continue mining in accordance with the above beyond 2020 at the same rate as currently approved
Water Discharge Discharge mine water from RW1 into the existing Dry Creek in accordance with the HRSTS	- BMC will construct a 300 ML Mount Pleasant Discharge Dam 1 (Mount Pleasant DW1) and associated pipeline (see Figure 13) in accordance with relevant guidelines and standards - BMC will construct Mount Pleasant DW1 within a mutually agreeable timeframe prior to the commencement of mining operations associated with the Mount Pleasant Project. - Mount Pleasant DW1 will not be utilised in the Project water management system - Coal & Allied would seek any other required approvals separately for the use of the facility, as required
Mining Authorisations	- Mining Lease 1645 (North of Wybong Road) application for Part transfer (surface down 40 m below) to facilitate CW1 dam construction - Mining Lease 1645 (South of Wybong Road) application for part transfer to facilitate surface mining
Rail and Service Corridor - Rail alignment as presented in the MTP 1997 EIS and MTP 2010 EA - Service corridor as presented in the MTP 2010 EA - Transport of coal from site by either (but not both) conveyor to Bengalla or rail via an onsite rail loop	- Mount Pleasant Project will enter into an agreement with the Minister for Mineral Resources, in consultation with BMC to facilitate the relocation of the Mount Pleasant rail loop or the conveyor / service corridor - If the Mount Pleasant Project requires the use of the Bengalla rail loop then BMC will negotiate in relation to its future use
Infrastructure Area As presented in the MTP 2010 EA	- The Project will require the construction of CW1 north of Wybong Road to facilitate the diversion of Dry Creek (see Figure 13). CW1 is partially located within the Mount Pleasant Project Infrastructure Envelope - A protocol between Coal & Allied and BMC is currently under negotiation facilitating the siting of CW1 within the Disturbance Boundary
Land Access	A protocol between Coal & Allied and BMC is currently under negotiation to enable the Project to progress through Coal & Allied owned land within the Disturbance Boundary

The do nothing approach would result in the Project coal resource to remain within the ground and would fail to respond to the need for the Project as described in **Section 10**. This failure to respond to the Project need would be in the context that the Project as proposed is capable of being conducted in accordance with the objects of the EP&A Act and is also well justified in socio-economic, environmental and planning terms.

The surrounding area has previously been designated as an area for coal mining by the State government with the issuance of numerous existing mining authorities as can be seen on **Figure 2**. This is further demonstrated by the number of successfully operating mines and other approved Projects within proximity to Bengalla including Mt Arthur Coal Mine and Xstrata Mangoola, along with future projects including the Mount Pleasant Project, West Muswellbrook and Dartbrook Mine (see **Table 1**).

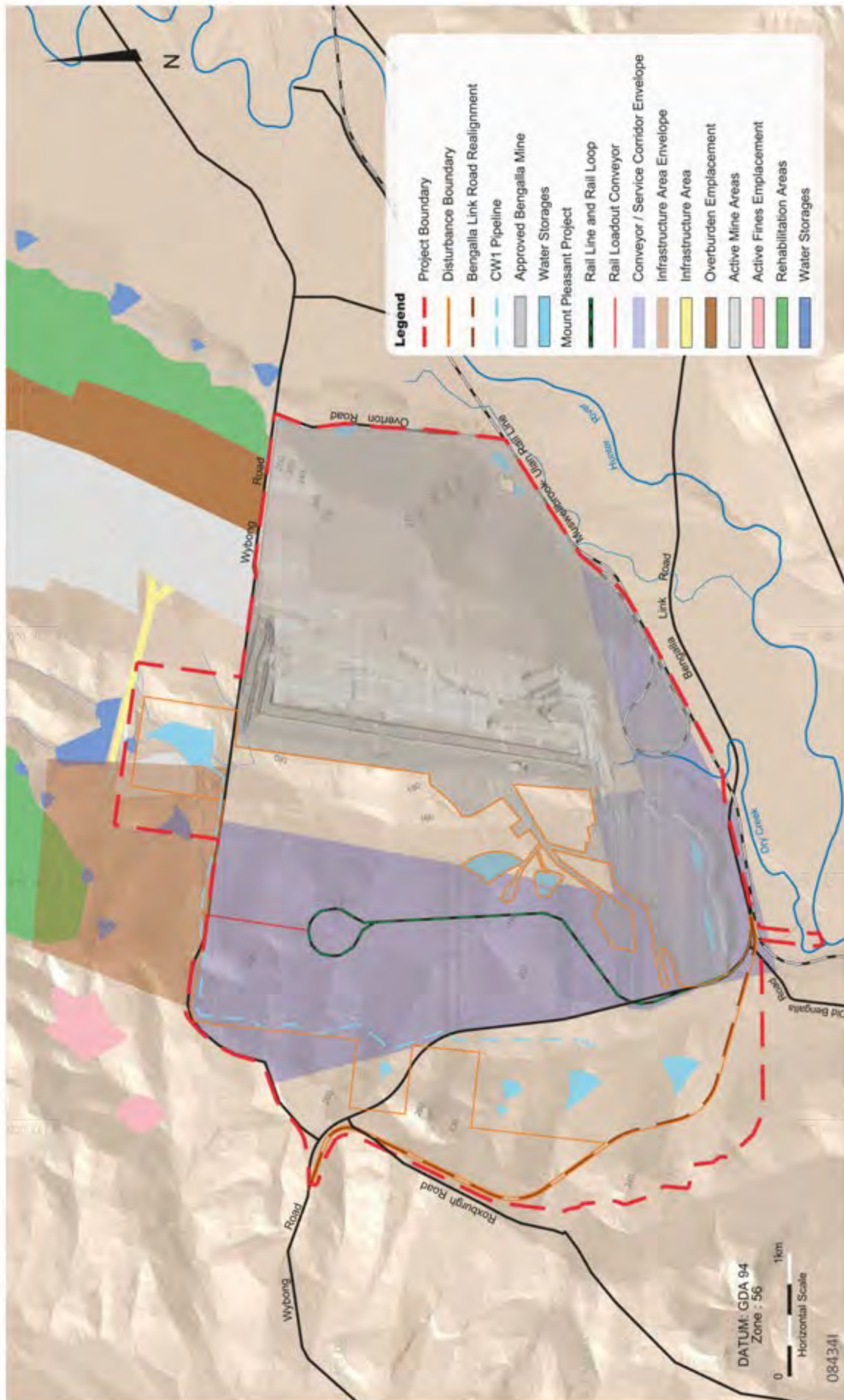
Failure to recover the coal resource when it can be recovered in accordance with applicable environmental planning objectives and social and environmental requirements would be contrary to the planning objectives for the region and the State of NSW.

This option was rejected on the basis of the success of the existing operation along with current market conditions and the significance of this internationally sought after coal resource.

4.13.2 Option 2 – 24 Years at 10.7 Mtpa

Option 2 includes continuation of mining for a further 24 years at a maximum already approved ROM coal production rate of up to 10.7 Mtpa.

An assessment of both the air quality and noise impacts associated with this option were considered. It was determined that an increase in production would not significantly increase impacts to private receptors from dust and noise (see **Appendix G** and **Appendix H**) and indicated that the socio-economic benefits of the higher production rates far outweigh the costs in relation to land affectation, other external costs and environmental considerations.



BENGALLA MINE

Interactions with Mount Pleasant Project

FIGURE 25

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This option would result in no additional increase in employment numbers and hence reduced economic and social flow on effects when compared to 15 Mtpa (Option 3). In addition, this option would result in the loss of revenues associated with not extracting the additional 59 Mt of ROM coal available throughout the duration of the Project.

This option was rejected on the basis of the speed at which mining operations would progress west away from Muswellbrook would be reduced when compared to Option 3 slowing rehabilitation of the visible areas. In addition, the rate of extraction (when compared to Option 3) would decrease the recovery of the state's mineral resource in terms of Clause 15 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2011 (Mining SEPP) (see Section 5.3.1).

4.13.3 Option 3 – 24 Years at 15 Mtpa down to the Basal Seam

Option 3 includes continuation of mining for a further 24 years at a maximum ROM coal production rate of up to 15 Mtpa with mining of the entire coal resource down to the Ramrod Creek seam. This option would involve mining to a greater depth and would require the subsequent increase in height of the existing OEA above the current RL 270 m. Detailed mine planning has indicated that there are currently no economically viable coal seams available for extraction via open cut methods as proposed by the Project beyond the Edderton seam.

This option was rejected due to the following:

- Economically unviable due to unacceptable overburden to ROM coal stripping ratios;
- Depth of mining and potential final void limitations;
- Additional equipment fleet requirement;
- Coal quality limitations;
- Geological constraints associated with mining through difficult underlying interburden layers; and
- Unacceptable environmental impacts.

4.13.4 Option 4 – Continuation of Mining Retaining the Existing Bengalla Link Road

Development of a viable mine plan that does not impact on the Bengalla Link Road would result in the sterilisation of approximately 8 Mt of coal reserves and would impede the efficiency of the dragline strip operation with consequential negative impacts on the efficiency of the recovery of the state's mineral resource. The traffic impacts to adopt this option are described in Section 8.13 and in summary indicated for an adopted average travel speed of 90 km/h an additional 36 seconds of travel time would be a result of the realigned road. As such, this option was rejected.

4.13.5 Option 5 – Underground Operation

Rio Tinto Coal Australia (on behalf of BMC) has undertaken an Order of Magnitude study into the potential development of an underground operation at Bengalla.

The potential methods of mining the coal resources in the Project Boundary include open cut and underground extraction. Bengalla is located in the Hunter Coalfield in the northern part of the Sydney Basin and the seams within the Project Boundary belong to the Whittingham Coal Measures.

Underground mining, either bord and pillar or longwall is applied widely throughout coal seams internationally. Longwall mining methods are being utilised by the industry because this type of mineral extraction provides greater safety and higher resource recovery and productivity compared with other underground methods. However, longwall coal extraction needs to be determined on a site specific basis.

Due to the nature and close proximity of numerous coal seams in the Whittingham Coal Measures, open cut mines operating in an environmentally acceptable manner have dominated Hunter Valley coal production in the past decades to ensure coal seams are not sterilised and maximum value is obtained from each resource mined. On the basis of proven technology together with a management commitment to minimise environmental risk, open cut mining utilising a large walking dragline supported by a pre-strip fleet of excavators and shovels is the preferred option for the Project.

For optimum economic working by longwall panel underground methods the coal seams should be as follows (BMC, 2012):

- Of a working section thickness to support long wall operations (i.e. between 2.0 m and 4.5 m as face cutting heights generally range from 2.8 m to 3.0 m);
- Not contain significant splitting of coal plys;
- Not contain partings or stone bands within a seam greater than 1 m;
- Depth of cover below original topography surface should be more than 60 m; and
- Vertical seam separation of greater than 20 m is required.

Exploration drilling, resource and reserve modelling have established that the Project deposit consists of a number of thin seams with stone parting bands that split as the deposit moves to the west through the lease areas. Mining any seams by underground methods from the surface to the Edderton seam will sterilise existing coal reserves and reduce the viability of the deposit.

The Warkworth and Mount Arthur Seams occur within 60 m of the original topography, are less than 2 m thick and are therefore not viewed as mineable under longwall conditions.

The remaining seams from the Piercefield to the Edderton have adequate depth below natural surface to be mineable but the variance in the coal thickness, splitting seam plies and stone parting bands greater than 1 m as the deposit moves west also discounts these seams as suitable for underground mining. Mining any seams by underground methods from the Warkworth to the Edderton seams would sterilise the adjacent seam coal reserves and reduce the viability of the deposit.

Open cut mining will allow recovery of the resource to the Edderton seam, whereas underground mining would only allow recovery of the thicker deeper seams, such as the Edinglassie seam. The faulting detected in the deposit would also reduce the viability of longwall mining. These constraints considerably reduce the quantity of coal that can be economically worked from this resource by underground methods.

Open cut mining will not exclude mining of the deeper seams by underground methods at some time in the future. The Edderton Seam has been chosen as the floor of the mining area for economic and environmental reasons. The Order of Magnitude study has confirmed that the Edinglassie seam is the only seam currently capable of supporting a large scale longwall operation (due to being of adequate thickness to support a longwall miner). The Edinglassie seam is not currently mined by the existing open cut operation nor proposed to be mined for the Project and lies underneath the open cut mine shell. The resource is contained within the existing authorities including ML 1397, ML 1450 and ML 1469.

Recovery of the Edinglassie seam by underground methods would not only be uneconomical, with a mineable resources of only 33 Mt (within the same footprint as the Project), but would also sterilise the 316 Mt of coal proposed to be extracted for the Project. The result of the study concluded that the Edinglassie seam could not support a standalone underground operation at Bengalla and would result in the loss of 283 Mt of coal thus reducing the efficiency of the recovery of the State's coal reserves.

4.13.6 Option 6 – Production Levels Greater than 15 Mtpa

Option 6 considered the development of a production levels greater than 15 Mtpa from Bengalla. High level studies revealed that the mining area is too confined to enable efficient operations and resource extraction to occur and as a result was not considered further.

4.13.7 Option 7 – The Project

Option 7 represents the mine plan for which Development Consent is sought as presented and assessed within this EIS (see **Figure 14** to **Figure 18**). It has been developed through a series of mine planning options analysis workshops, environmental constraints analyses and scenarios completed since 2008 and as briefly described above. The primary aim of these workshops was to develop a mine plan that minimises environmental and social impacts while maximising resource recovery, operational efficiency and compliance with the objects of the EP&A Act and relevant environmental planning instruments (see **Section 5.2**).

The Project mine plan layout has been developed to minimise the disturbance footprint at any one time to reduce environmental impacts. The final siting of the infrastructure area has been designed to be concentrated and adjoins or builds onto existing infrastructure.

The Project as described in **Section 4.1** represents the most logical and efficient method of resource extraction for a period of 24 years at a maximum ROM coal production rate of up to 15 Mtpa achieved from Year 4 onwards. The consistent nature of the coal resource, the continued use of current mining methods and the extensive mining experience gained by BMC under the current consent, facilitates the higher extraction rates as proposed without resulting in any substantial increase in noise and air quality emissions from the Project.

Detailed mine planning for the Project has involved the development of scenarios that address the following:

- Maximising coal recovery;
- Providing for an optimal mine plan footprint and sequencing based on the structure of the coal resource that continues and ties in with the existing operations;
- Coal recovery depths, including investigations in relation to increasing the mining to varying coal mining horizons;
- Consideration of the construction and infrastructure facilities that largely adjoin or build onto existing infrastructure in an effort to minimise disturbance;
- Consideration of the approved Mount Pleasant Project and potential interactions (see **Section 4.12**); and
- Maximising the efficiency of the dragline strip operation by mining the additional 8 Mt of ROM coal west of the Bengalla Link Road.

The environmental impact assessments undertaken within this EIS have confirmed that the proposed mine plan and associated production rates can be undertaken in the absence of any unacceptable environmental consequences that cannot be accounted for or offset and will enable BMC to continue to be a competitive player within the export coal market.

4.13.8 Project Amendments Resulting from Stakeholder Consultation

Significant effort has been placed on conducting effective consultation with both regulatory and community stakeholders throughout the preparation of the EIS (see **Section 6**). As a result of the consultation program several key considerations have been built into the Project. These include:

- Amendments have been made to the Project mine plan to ensure coal extraction is conducted entirely within BMC's existing mining authorisations (see **Section 5.4.1**);
- Commitment to BMC rehabilitating the eastern face of the OEA with woody native vegetation to achieve higher density tree plantings (see **Section 8.21**);
- Commitment to work with MSC throughout the preparation of the Mine Affected Road Strategy to assist in guiding the location for the final alignment of the Bengalla Link Road (see **Section 8.13**);
- Significant work was undertaken in relation to developing additional information in the Ecological Impact Assessment to address the Upper Hunter Strategic Assessment (see **Section 8.11**); and
- Commitment to continue to consult with MSC and DRE regarding the final surface relief across the Main OEA (see **Section 8.21**).

4.13.9 Dry Creek Alternatives

Seven detailed options and alternatives have been investigated for the final alignment of Dry Creek in order to obtain the best possible environmental outcome with considerations of mining practicalities. Alternatives considered included:

- Establishment of a storage dam located in the northern portion of the existing Project Boundary south of Wybong Road along with a creek alignment that would marry into a diversion created halfway along the final landform. This option would result in the sterilisation of an estimated 30 Mt of ROM coal necessary to create stable batters and suitable buffers from the storage dam and would shorten dragline strips and affect access into the lower sections of the mine. In addition, approximately 115 Mbcm of overburden capacity would be lost;
- Reinstatement of Dry Creek along its natural alignment complete with 10 degree slopes through the OEAs once mining has progressed sufficiently. This option would not require an increase to the approved maximum height of the OEA however, would result in an unnatural stream configuration;
- Reinstatement of Dry Creek to flow into the final void which would allow equilibrium to be achieved in a shorter timeframe. This option would prevent runoff to infiltrate into the Hunter River during rainfall events that may potentially degrade the quality of the water;

- Reinstatement of Dry Creek to flow to the east around the OEA to connect with the Hunter River (e.g. at a point where the Hunter River moves in close proximity to the Muswellbrook to Ulan Rail Line east of the OEA). This option was not considered appropriate as it would increase Dry Creek's natural length by several hundred metres and require a large amount of material movement;
- Reinstatement of Dry Creek by installing a tunnel which would transport runoff underneath the OEA. This would restrict any riparian vegetation from being established along the Dry Creek Diversion;
- Reinstatement of Dry Creek to flow along its original alignment with banks at steep angles. This would create an unnatural bank structure and associated riparian corridor. This option would also encourage erosion and sedimentation issues; and
- Retain Dry Creek in present location. This option was considered not a feasible alternative. This would also create major mine planning obstacles of instability to overcome if mining continued around Dry Creek.

The preferred option is presented on **Figure 18**. It includes the establishment of CW1 north of Wybong Road (in consultation with Coal & Allied) along with a creek alignment that would meander south (between the final void and the Main OEA) before heading east around the northern part of the CHPP and south along its original alignment towards the Hunter River. This option was sought for the Project due to:

- Provision of the most natural alignment of the creek that fits in with the Project mine plans and create the most natural meandering flow, consistent with existing conditions necessary to ensure the design grade parameters between 0.5% and 1.5%. Other options considered require the construction of steeper slopes that were less compatible with the final shaped overburden surface;
- The requirement for the least amount of overburden removal as it can be constructed as part of the normal sequence of overburden removal;
- No requirement to sterilise any of the Project coal resource;
- Not incurring additional rehabilitation costs; and
- Having the lowest associated development cost.





5

Regulatory Framework

This section describes the environmental and planning regulatory framework applicable to the Project and considers both NSW and Commonwealth legislation. A flowchart illustrating the planning assessment and consultation process relevant to the Project is presented in **Figure 26**.

5.1 Introduction

The principal approval required for the Project is Development Consent under the EP&A Act. The approval's regime under Division 4.1 of Part 4 of the EP&A Act is described in **Section 5.2**.

Section 89J of the EP&A Act lists the approvals that are not required for approved developments under Division 4.1 of Part 4 (see **Section 5.5**). In addition, section 89K of the EP&A Act lists a number of approvals that cannot be refused if they are necessary for the carrying out of an approved development under Division 4.1 of Part 4 (see **Section 5.4**). There are other licences and approvals under NSW legislation which will be required for the Project, as described in **Section 5.9**, which are not listed in either section 89J or 89K. These are all described below. The Project will also require approval under the Commonwealth EPBC Act.

5.2 Environmental Planning and Assessment Act 1979

5.2.1 Objects of the Act

As stated in section 5 of the EP&A Act, the objects are:

- “(a) to encourage:
 - (i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,
 - (ii) the promotion and co-ordination of the orderly and economic use and development of land,
 - (iii) the protection, provision and co-ordination of communication and utility services,
 - (iv) the provision of land for public purposes,

- (v) the provision and co-ordination of community services and facilities and
 - (vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities and their habitats and
 - (vii) ecologically sustainable development and
 - (viii) the provision and maintenance of affordable housing and
- (b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State and
 - (c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.”

Section 10 assesses the Project in the context of the objects of the EP&A Act.

5.2.2 Applicability of Division 4.1 of Part 4

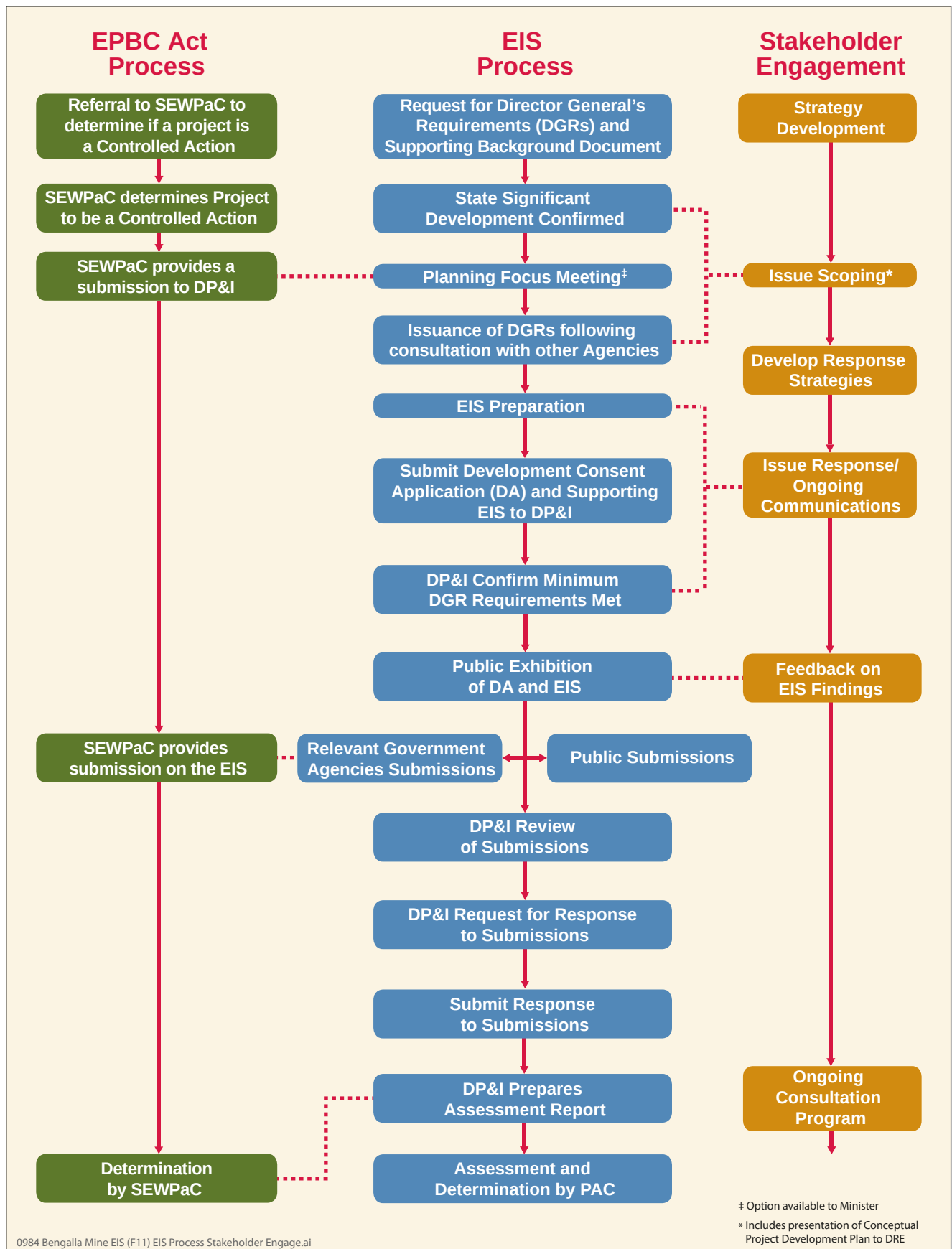
On 1 October 2011, Division 4.1 of Part 4 replaced Part 3A of the EP&A Act as the planning and determination regime for SSD.

Under section 89C of the EP&A Act, a development is SSD if it is declared by any State Environmental Planning Policy (SEPP) to be SSD. *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) at clause 8(1) provides:

“8 Declaration of State significant development: section 89C

- (1) Development is declared to be State significant development for the purposes of the Act if:
 - (a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act and
 - (b) the development is specified in Schedule 1 or 2.”

“Development for the purpose of mining that is coal mining” is listed in clause 5 of Schedule 1 of SRD SEPP.



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Planning Approvals and Consultation

FIGURE 26

5.2.3 Permissibility and Development Consent and Zoning

Section 89E(2) of the EP&A Act provides that “*Development consent may not be granted if the development is wholly prohibited by an environmental planning instrument*”.

Section 89E(3) EP&A Act provides that “*Development consent may be granted despite the development being partly prohibited by an environmental planning instrument*”.

The Project is located entirely within the Muswellbrook LGA. The majority (66%) of the land within the Project Boundary is zoned as “RU1 Primary Production” under the Muswellbrook Local Environment Plan 2009 (Muswellbrook LEP). The majority of the remaining land is zoned as “E3 Environmental Management” with lesser amount of land zoned “SP2 Rail Infrastructure Facilities”. The zonings for the land within and surrounding the Project Boundary are shown in **Figure 27**.

The land use table in the Muswellbrook LEP states that mining is prohibited within Zone E3. However, the permissibility of mining developments is also governed by Mining SEPP. Clause 7(1) of the Mining SEPP provides:

“7 Development permissible with consent

(1) Mining

Development for any of the following purposes may be carried out only with development consent: ...

(b) mining carried out:

- (i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or*
- (ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999.”*

The Muswellbrook LEP provides that development for the purposes of “extensive agriculture” is permissible within Zone E3. By virtue of clause 7(1)(b)(i) of the Mining SEPP, mining is also permissible within zone E3. This is inconsistent with the land use table in the Muswellbrook LEP. Clause 5 of the Mining SEPP states that where there is an inconsistency between the SEPP and another Environmental Planning Instrument (EPI), the SEPP will prevail to the extent of the inconsistency. Therefore, the Mining SEPP will override the Muswellbrook LEP, resulting in mining being permissible in Zone E3 with Development Consent.

The land use table in the Muswellbrook LEP provides that open cut mining is permissible with Development Consent in zone RU1. Therefore, mining is permissible with Development Consent on all land within the Project Boundary on which mining or mining operations would occur. The land within the Project Boundary which is zoned SP2 would contain only the rail infrastructure which is part of the Approved Bengalla Mine or “*development ordinarily incidental or ancillary to...*” rail infrastructure facilities which, under the Muswellbrook LEP is permissible in that zoning. Therefore, the provisions of section 89E do not prohibit the development.

5.2.4 Consent Authority

Pursuant to section 89D of the EP&A Act, the Minister for Planning and Infrastructure is the consent authority for SSD. However, section 23 of the EP&A Act enables the Minister to delegate his or her functions to a number of other persons or authorities, including the Planning Assessment Commission (PAC). As at the date of this EIS there are current delegations to the PAC, including determination functions under sections 89D and 89E for SSD.

5.2.5 Need for an Environmental Impact Statement

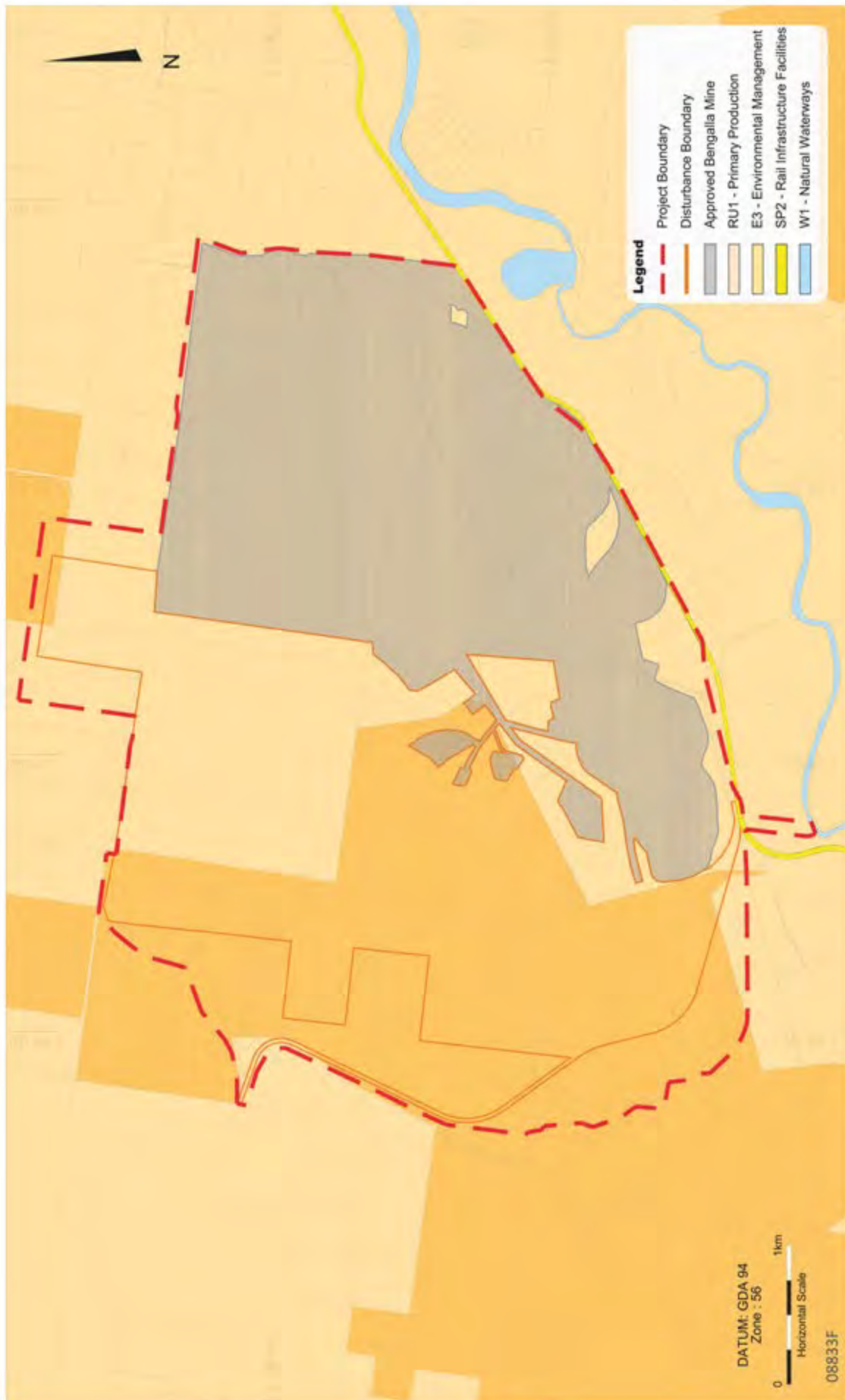
Section 78A(8A) of the EP&A Act states that a development application for SSD must be accompanied by an EIS prepared in accordance with the EP&A Regulation. The form and content requirements for an EIS are provided in Schedule 2 of the EP&A Regulation.

5.2.6 Environmental Assessment Requirements

Clause 3 of Schedule 2 of the EP&A Regulation states that prior to the preparation of an EIS, the applicant must make a written application to the Director-General for DGRs. A request for DGRs, supported by the Continuation of Bengalla Mine Background Document, was made by BMC on 17 February 2012. In response, DGRs for the Project were issued by the Director-General on 13 March 2012 with supplementary DGRs issued on 12 July 2012. **Section 6.4.1** describes the DGRs and specifies where each has been addressed in this EIS.

5.2.7 Public Participation

Pursuant to Section 89F of the EP&A Act and clause 83 of the EP&A Regulation, the development application and supporting EIS must be placed on public exhibition for a period of at least 30 days. During this exhibition period, any person may make written submissions to the Minister regarding the proposed development.



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Land Zoning

FIGURE 27

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5.2.8 Evaluation

Section 89H of the EP&A Act stipulates that section 79C applies to a SSD development application.

Section 79C of the EP&A Act specifies the matters that the consent authority is to consider when determining a development application. The consent authority is to consider the following matters that are relevant to the development application:

“(1) Matters for consideration—general

In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:

- (a) *the provisions of:*
 - (i) *any environmental planning instrument and*
 - (ii) *any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Director-General has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved) and*
 - (iii) *any development control plan and*
 - (iv) *any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F and*
 - (v) *the regulations (to the extent that they prescribe matters for the purposes of this paragraph) and*
 - (vi) *any coastal zone management plan (within the meaning of the Coastal Protection Act 1979), that apply to the land to which the development application relates,*
- (b) *the likely impacts of that development, including environmental impacts on both the natural and built environments and social and economic impacts in the locality,*
- (c) *the suitability of the site for the development,*
- (d) *any submissions made in accordance with this Act or the regulations,*
- (e) *the public interest.”*

Section 10 describes how each of these matters has been addressed in this EIS.

5.2.9 Planning Assessment Commission

The Minister can refer a development application to the PAC for its review and report to the Minister. The functions of the PAC relevant to the development application are set out in section 23D of the EP&A Act including:

“... to review any (or any aspect or part of any) development, activity, infrastructure or project to which this Act applies and to hold a public hearing into any matter the subject of any such advice or review ...”

5.2.10 Determination and Appeals

Pursuant to section 80 of the EP&A Act, the consent authority can determine a development application by either granting consent or refusing consent. If the consent authority decides to grant consent, the consent can be unconditional or subject to conditions.

Under section 82(1) of the EP&A Act, a development application is deemed to have been refused consent if a determination has not been made within the relevant period. The relevant period for SSD applications is 90 days, as provided by clause 113 of the EP&A Regulation. Section 82(2) of the EP&A Act provides that the expiration of the relevant period does not preclude the consent authority from making a determination. However, the deemed refusal of the development application does give rise to rights of appeal.

Section 97 of the EP&A Act states that an applicant who is dissatisfied with the consent authority's determination can lodge an appeal in the Land and Environment Court within 6 months after the determination. If the appeal is against a deemed refusal under section 82(1) of the EP&A Act, the appeal must be commenced within 6 months after the expiration of the relevant period.

Section 98 of the EP&A Act allows an objector to appeal against a consent authority's decision to grant consent within 28 days after the date on which notice of the determination was given. Section 23F of the EP&A Act states that a decision made by the PAC cannot be challenged if it was made after a public hearing.

5.2.11 Development Contributions

Section 94 of the EP&A Act enables the consent authority to impose a condition requiring the applicant to provide a development contribution if the consent authority *“... is satisfied that development for which development consent is sought will or is likely to require the provision of or increase the demand for public amenities and public services within the area ...”*

Section 93F of the EP&A Act enables the applicant to enter into a Voluntary Planning Agreement (VPA) with planning authorities effectively in lieu of a section 94 contribution.

Discussions with MSC for the Project are well progressed in relation to the revision of the existing VPA and establishment of a new VPA for the Project (see **Section 6.1.1**).

5.2.12 Disclosure of Reportable Political Donations and Gifts

Pursuant to section 147 of the EP&A Act, an applicant is required to provide full disclosure of any political donations and gifts at the time of making a development application. A person making a submission regarding a development application is also required to provide full disclosure of any political donations and gifts.

BMC has not made any political donations or gifts to political parties.

5.3 NSW Environmental Planning Instruments

The following sections provide a review of the EPIs that are applicable to the Project. EPIs include Local Environmental Plans (LEPs), Regional Environmental Plans and SEPPs.

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

The Mining SEPP determines the permissibility of mining related developments and the matters that must be considered by consent authorities when evaluating development applications for mining developments. The permissibility of mining and the associated activities within the Project Boundary is discussed in **Section 5.2.3**.

The consent authority is required to consider the compatibility of the proposed development with surrounding land uses. Clauses 12 and 13 of the Mining SEPP require that:

“Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

(a) consider:

- (i) the existing uses and approved uses of land in the vicinity of the development and*
- (ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development and whether the development is likely to have a significant impact on current or future recovery of minerals*

(iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses and

(b) evaluate and compare the respective public benefits of the development and the surrounding land uses and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility.”

The land uses in the vicinity of the Project are described in **Section 2**. The dominant land use in the immediate vicinity of the Project is coal mining. The Project will be compatible with the use of the surrounding land for coal mining. The other main land uses in the vicinity of the Project are agriculture and rural residential developments. The impacts of the Project on these land uses have been extensively assessed in this EIS and mitigation and management measures have been proposed to avoid or alleviate potential land use incompatibilities.

Pursuant to clause 14, the consent authority is required to consider whether or not to impose conditions to ensure that impacts on significant water resources, threatened species and biodiversity are avoided or minimised and greenhouse gas emissions are minimised.

Clause 15 requires the consent authority to consider the development's efficiency of resource recovery. The consent authority must also consider whether or not to impose conditions in order to optimise the resource recovery. The Project has adopted a mine plan that seeks to optimise resource recovery without causing unacceptable environmental impacts. BMC considered a number of alternatives for the recovery of the resource as discussed in **Section 4.13**. The Project was determined to be the most appropriate alternative for recovering the resource within the Project Boundary whilst at the same time minimising any consequential impacts on resource recovery within adjoining mining areas.

Pursuant to clause 16, the consent authority must consider whether or not to impose conditions concerning the transportation of coal by public roads. The Project will not involve the transportation of coal by road.

Under clause 17, the consent authority must consider whether or not to impose conditions to ensure the rehabilitation of the land. The Project will involve the rehabilitation of all land that is disturbed in the course of mining operations, as described in **Section 8.21**.

5.3.2 State Environmental Planning Policy 33 – Hazardous and Offensive Development

State Environmental Planning Policy 33 – Hazardous & Offensive Development (SEPP 33) governs the assessment of developments for the purposes of a “potentially hazardous industry” or “potentially offensive industry”.

Clause 12 of SEPP 33 requires a preliminary hazard analysis to be prepared in accordance with current circulars or guidelines (including the Hazardous and Offensive Development Application Guidelines) and the ‘Hazardous Industry Planning Advisory Paper No. 6’ referred to in the DGRs). The preliminary hazard analysis is discussed in **Section 8.16**.

Clause 13 of SEPP 33 requires the consent authority to consider the following:

- “(a) current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development and*
- (b) whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply and*
- (c) in the case of development for the purpose of a potentially hazardous industry – a preliminary hazard analysis prepared by or on behalf of the applicant and*
- (d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application) and*
- (e) any likely future use of the land surrounding the development.”*

5.3.3 State Environmental Planning Policy 44 – Koala Habitat Protection

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) encourages the conservation and management of natural vegetation areas to ensure that there is ongoing protection of koalas and their habitat. Muswellbrook LGA is listed under Schedule 1 as an area to which SEPP 44 applies.

Clause 9 of SEPP 44 requires the preparation of a plan of management where a development is proposed to be carried out on lands that constitute “core koala habitat”. To determine whether the land constitutes “core koala habitat”, it is first necessary to determine whether the land is “potential koala habitat”. “Potential koala habitat” is defined under clause 4 as “*areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*”.

The Ecological Impact Assessment undertaken for the Project has determined that the Project Boundary is “potential koala habitat” due to the presence of feed tree species including *Eucalyptus albens* x *Eucalyptus moluccana* (White Box x Grey Box intergrade) and *Eucalyptus tereticornis* (Forest Red Gum). Both *Eucalyptus albens* (White Box) and *Eucalyptus moluccana* (Grey Box) are known koala secondary food trees and thus it is probable that koalas would browse on intergrades of these two tree species.

The next step is to determine whether the land is “core koala habitat”. Clause 4 of SEPP 44 defines “core koala habitat” as:

“an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.”

Recent ecological surveys of the area, including the Ecological Impact Assessment for this Project, have not recorded any occurrences of the koala within the Project Boundary. Therefore, it has been concluded that the land within the Project Boundary is not “core koala habitat”. As a consequence, there is no need to prepare a plan of management. Further detail in relation to the Ecological Impact Assessment is discussed in **Section 8.11**.



5.3.4 State Environmental Planning Policy 55 – Remediation of Land

State Environmental Planning Policy 55 – Remediation of Land (SEPP 55) aims to promote the remediation of contaminated land. Clause 7 imposes the following obligations on a consent authority:

- “(1) A consent authority must not consent to the carrying out of any development on land unless:*
- (a) it has considered whether the land is contaminated and*
 - (b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out and*
 - (c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.”*

Pursuant to clauses 7(2) and 7(4), a preliminary investigation must be undertaken for land that has been used for agriculture and mining. If the proposed development represents a change in use of this land, the consent authority cannot grant consent to the development application unless it has considered the preliminary investigation of the land. The Project will involve a change in the use of the land to the west of the Approved Bengalla Mine. Accordingly, the applicant has undertaken the required preliminary investigation, which is provided in **Section 8.20**. The investigation determined that there is no contaminated land within the area of the Project Boundary where a change of use is proposed.

5.3.5 Hunter Regional Environmental Plan 1989 (Heritage)

The Hunter Regional Environmental Plan 1989 (Heritage) (Hunter REP) aims to conserve the environmental heritage of the Hunter Region. Items of state, regional and local heritage significance are listed under schedules 1, 2 and 3 of the Hunter REP. None of these heritage items are located within the Project Boundary. There are two items located in the vicinity of the Project Boundary:

- Keys Family Private Cemetery, a regional environmental heritage item (Schedule 2) (Hunter REP); and
- Overdene Homestead, a local environmental heritage item (Schedule 3) (Hunter REP).

Additionally, the Bengalla Homestead (Schedule 4) (Hunter REP) is within the Project Boundary.

Clause 13 of the Hunter REP states that ‘Council’ can only grant consent to a development in the vicinity of a heritage item after it has assessed the effect of the development on the heritage significance of the item. The impacts of the Project on the Keys Family Private Cemetery and Overdene Homestead and the Bengalla Homestead are discussed in **Section 8.10.3**.

5.3.6 Muswellbrook Local Environment Plan 2009

The Project is within RU1, E3 and SP2 zones under the Muswellbrook LEP as discussed in **Section 5.2.3**.

5.4 Requirements Under Other NSW Legislation

In order to carry out the Project, BMC will require a number of approvals in addition to Development Consent. Section 89K states that the following authorisations cannot be refused if necessary for carrying out any approved:

- (a) “an aquaculture permit under section 144 of the Fisheries Management Act 1994,*
- (b) an approval under section 15 of the Mine Subsidence Compensation Act 1961,*
- (c) a mining lease under the Mining Act 1992,*
- (d) a production lease under the Petroleum (Onshore) Act 1991,*
- (e) an environment protection licence under Chapter 3 of the Protection of the Environment Operations Act 1997 (for any of the purposes referred to in section 43 of that Act),*
- (f) a consent under section 138 of the Roads Act 1993,*
- (g) a licence under the Pipelines Act 1967.”*

Each is described further below.

5.4.1 Mining Act 1992

Summary

Under section 5 of the Mining Act, it is an offence to mine for minerals except in accordance with a valid authorisation. Section 6 of the Mining Act provides that a valid authorisation is also needed for certain activities that are incidental to mining, including water storages, tailings dams and stockpiles.

BMC will seek the following authorisations under the Mining Act:

- Renewal of existing Mining Leases (1397, 1450, 1469 and 1592);
- Convert BMC AL13 and EL A438 to new Mining Lease for coal mining;

- A new mining lease for surface purposes to a depth of 40 m for surface mining purposes only (being the surface activities described in this EIS) over the area west of AL13 within A102 required for necessary Project infrastructure; and
- Part transfers of Coal & Allied Mining Lease 1645 (which overlays part of AL13 south of Wybong Road and a section of the surface only for the necessary area north of Wybong Road).

The required authorisations required for the Project are shown on **Figure 28** and are discussed below.

Part Transfer Coal & Allied Authorisations

It is proposed that the areas of Mining Lease 1645 (held by Coal & Allied Operations Pty Limited) necessary for supporting the relevant elements of the Project (indicatively those which are shown on **Figure 28**) will be part transferred at the appropriate time having regard for progress of the Project by the holder of Mining Lease 1645 (Coal & Allied Operations Pty Ltd) to BMC, which includes areas to the:

- South of Wybong Road; and
- North of Wybong Road in the area of the Dry Creek clean water diversion dam (CW1).

5.4.2 Protection of the Environment Operations Act 1997

Section 48 of the *Protection of the Environment Operations Act 1997* (POEO Act) provides that an EPL is needed for the carrying out of scheduled activities under the Act. Under clause 28 of Schedule 1 of the POEO Act, “mining for coal” is declared to be a scheduled activity if the daily production exceeds 500 t, or if the disturbance area exceeds 4 ha. Therefore, the Project is a scheduled activity and will require an EPL.

BMC currently holds EPL 6538 for the Approved Bengalla Mine. BMC will seek the necessary variations to this licence to accommodate the Project. Those variations will include the right to discharge water from a different licensed discharge point location to that currently approved.

5.4.3 Roads Act 1993

Under section 138 of the *Roads Act 1993* (Roads Act), work cannot be carried out in, on or over a public road unless the appropriate roads authority has given consent. Consent under section 138 will be required for the realignment of Bengalla Link Road. The relevant roads authority is MSC.

The realignment of Bengalla Link Road will intersect Wyndham Arms right of way which is a Crown road. At the intersection there will be work on a Crown road and will therefore require consent under section 138 of the Roads Act from the Minister administering the Roads Act.

The Project will also necessitate the crossing of Wybong Road to enable earthen materials from the earthworks associated with the construction of CW1 to be deposited on the southern side of Wybong Road as part of the OEA(s). Some minor remediation works to Wybong Road may also be required upon completion of the temporary crossing works. Since Wybong Road is a council road, this work will require the consent of MSC.

The Project will also involve the construction of a pipeline that passes beneath the surface of Wybong Road for which consent under section 138 of the Roads Act from MSC will also be required.

Pursuant to section 89K(1)(f) of the EP&A Act, the necessary consents under section 138 of the Roads Act cannot be refused if they are required for the carrying out of a project that has been granted Development Consent under the EP&A Act.

5.4.4 Water Management Act 2000

The licensing and approvals provisions of the *Water Management Act 2000* (WM Act) apply (in general terms) to water sources that are subject to a Water Sharing Plan (WSP). Parts 2 and 5 of the Water Act 1912 continue to apply to water sources that are not subject to a WSP.

There are two water sharing plans that are relevant to the Project:

- ‘WSP for the Hunter Regulated River Water Source 2003’ (Hunter River WSP); and
- ‘WSP for the Hunter Unregulated and Alluvial Water Sources 2009’ (Hunter Unregulated WSP).

The water sources affected by of the Project that are within these WSPs will be subject to the approvals and licensing provisions of the WM Act. The water sources affected by the Project that are outside of a WSP will be governed by the Water Act.

The Hunter River WSP applies to all water between the banks of the Hunter River downstream of Glenbawn Dam. A WAL will therefore be required for water extracted from the Hunter River. The WSP also applies to water in the alluvial sediments underlying waterfront land (within 40 m of the river bank). The long term average annual extraction limit for this water source is 217,000 ML/year, which represents approximately 20% of the natural flow. Since the commencement of the WSP, water extraction has been substantially below the extraction limit (DWE, 2009).

The Hunter Unregulated WSP applies to 39 water sources in the Hunter Region. The Project is situated entirely within the Muswellbrook Water Source, which has a total share component of 1,816 units, including 636 unit shares for unregulated river access licences.

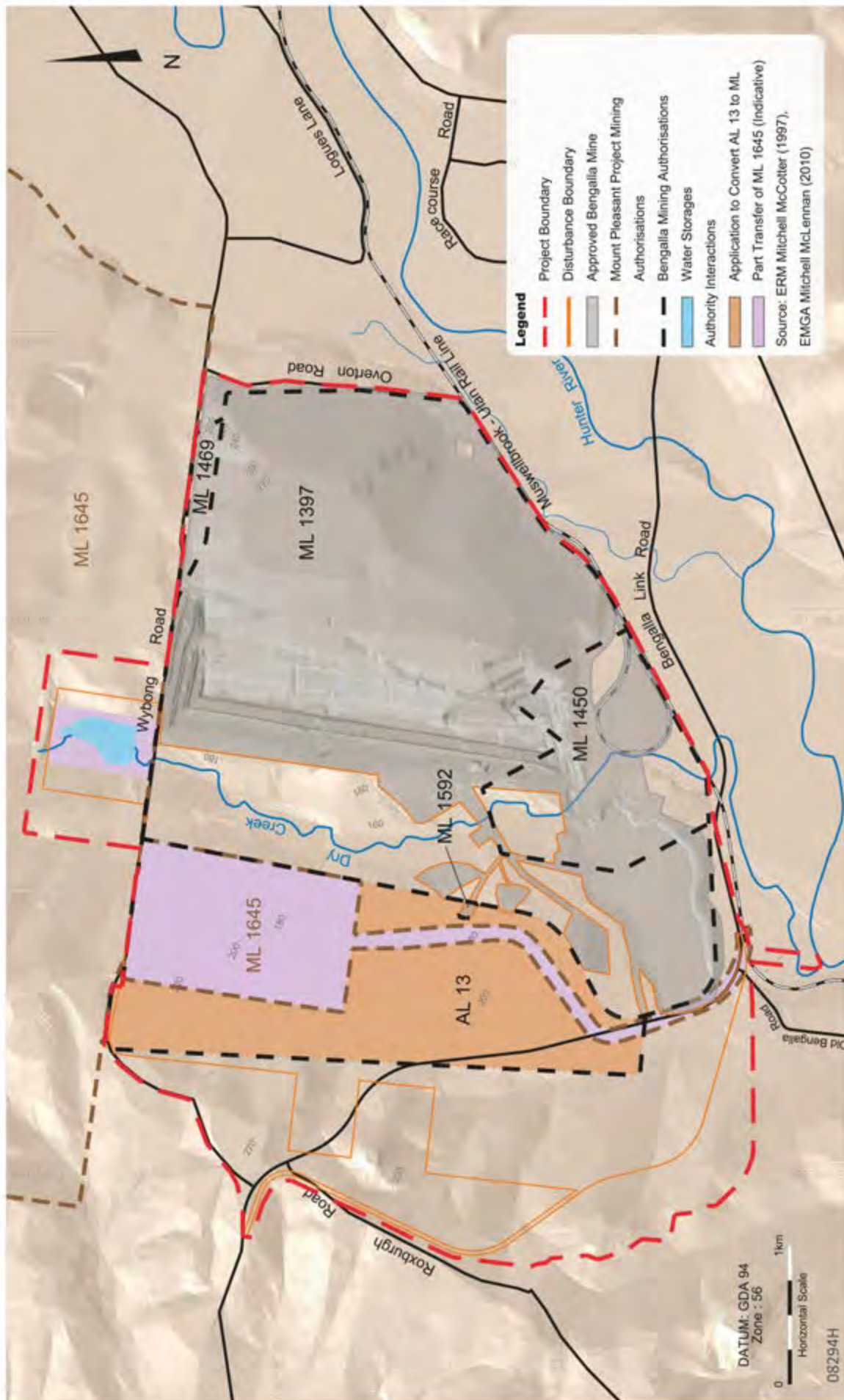


FIGURE 28

The WSP applies to all surface water and alluvial aquifers within the water source. Therefore, the WSP applies to surface flows in Dry Creek. A WAL will be required for water taken from the Dry Creek catchment.

The Hunter Unregulated WSP also applies to the Hunter Regulated River Alluvial Water Source. This water source includes water contained in the Hunter River alluvium (excluding the sediments within 40 m of the river bank). The alluvial sediments within 40 m of the bank are regulated by the Hunter River WSP. A WAL will be required if the Project reduces the groundwater flow to the alluvium. The areas to which the WSPs apply are shown on Figure 29.

CW1 Diversion Dam

CW1 (the clean water diversion dam north of Wybong Road) will capture surface run off and then divert that water around the Project and put it back into the catchment which ultimately flows into the Hunter River. Section 60I of the *Water Management Amendment Act 2010* renders the diversion of water from a water source in connection with a mining activity as taking water for the purposes of the WM Act "... whether or not water is returned to that water source ...".

Section 60I has not yet commenced. If it does commence, then any water diverted by CW1 may have to be accounted for under a WAL for the Hunter Regulated River. BMC holds WAL 001106 with a share component of 1,449 units (High Security) on the Hunter Regulated River. BMC also holds other water access licences with a general security share components totalling 4,562 units for the Hunter Regulated River Water Source and 442 units for the Hunter Regulated River Alluvial Water Source.

Water Act 1912

The Hunter water sharing plans exclude water in the basement rocks (which includes the porous rock aquifers). Accordingly, under section 112 of the Water Act, a bore licence is required for the Project.

The embargoes against grants of Water Act licences under section 113A of the Water Act do not apply to the porous rock aquifers in the Hunter. Accordingly, it is open for there to be a grant of the necessary water licence for the Project.

BMC holds a bore licence under Part 5 of the Water Act for the basement rocks authorising a maximum annual extraction of 125 ML pa. This would be subject to an application to vary licence.

Water Management System

Clause 18(1) of the *Water Management (General) Regulation 2011* (WM Regulation) states that a WAL is not required for any of the purposes listed under Part 1 of Schedule 5 of the WM Regulation. 'Excluded works' are listed under Part 1 of Schedule 5 as a purpose that does not require a WAL. 'Excluded works' are defined in Schedule 1 of the WM Regulation and include:

"Dams solely for the capture, containment and recirculation of drainage and / or effluent, consistent with best management practice or required by a public authority (...) to prevent the contamination of a water source, provided such dams are located on a minor stream."

Therefore, a WAL does not need to be obtained for water captured in sediment dams.

Pursuant to section 89J(1)(g) of the EP&A Act, the Project will not require approval under sections 89, 90 and 91 of the WM Act. The applicability of these sections is discussed in Section 5.5.4.

Water Licensing Summary

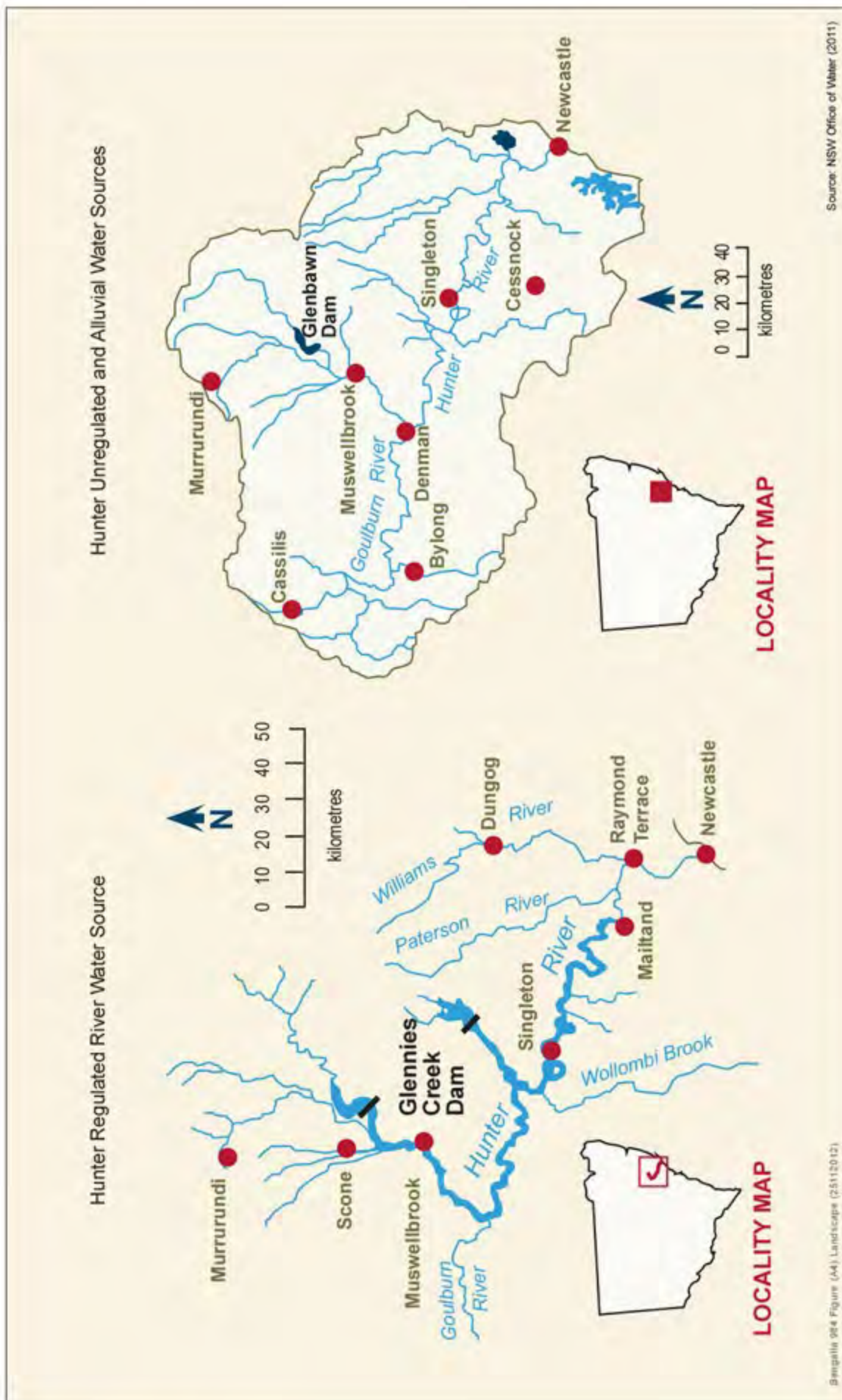
It is an offence to take water from a water source except in accordance with a WAL unless an exemption applies. WALs with sufficient water allocation (derived from share component) must be held under the WM Act to account for all water taken by the Project from a water source in any one "water year" (1 July to 30 June). Similarly, a groundwater licence under Part 5 of the Water Act with sufficient annual entitlement must be held to account for the maximum amount of water taken by the Project from outside a WSP area (i.e. the Permian coal measures).

BMC will hold all relevant licences, share component and allocation required to comply with the WM Act and Water Act at all times water is taken, whether during or after the life of the Project. Table 15 lists water licences which will need to be progressively sought for the Project.

BMC hold WALs with sufficient share component totalling 6,017 units (comprising 1,455 high security units and 4,562 general security units) to account for the maximum predicted take for the life of the Project from the Hunter Regulated River Water Source (Management Zone 1A). BMC maintains exclusive rights for the dedicated use of at least 2,534 units (comprising 1,449 high security units and 1,085 general security units) under these WALs for the Project. The remaining units of the WALs (comprising 2,702 units) are currently subject to use by licensees of BMC owned land for agricultural purposes.

BMC also holds WALs with sufficient share component totalling 490 units for the Hunter Unregulated and Alluvial Water Source (year) (Hunter Regulated River Alluvial Water Source). BMC maintains exclusive rights for the dedicated use of at least 377 units under these WALs for the Project.

Given that BMC does not currently hold a WAL for the Hunter Unregulated and Alluvial Water Source (Muswellbrook Water Source), water will not be taken from this source until BMC has secured a WAL(s) with sufficient share component to authorise the take for the Project. There are 24 unregulated river WALs in existence for the Muswellbrook Water Source held by 21 separate holders with a total of 636 units of share component.



BENGALLA MINE
Water Sharing Plans

FIGURE 29

In accordance with Part 5 of the Water Act, BMC holds a licence to authorise the take of 125 ML of groundwater. To account for the maximum amount of groundwater taken by the Project at any one point during its life, BMC will make the required application to NOW to amend its licence conditions so as to increase the volumetric extraction authorised by the licence.

In respect of the water, which will be taken after mining, BMC will investigate in consultation with NOW appropriate surrender of entitlements in lieu of holding licences indefinitely (or other agreed mechanism).

By virtue of clauses 18 and 36 and Schedule 1 of the *Water Management (General) Regulation 2011*, mine water dams on site and the use of the water from them are exempt from the requirement for licences or approvals.

Further detail in relation to impacts to water sources is provided in **Section 8.6** and **Section 8.7** and the Aquifer Interference Policy (AIP) Compliance Criteria in **Section 5.7**. BMC will also obtain the necessary bore licences prior to the installation of new monitoring bores.

Harvestable Rights

A WAL is not required to take and use water by means of harvestable rights dams in accordance with the applicable harvestable rights order under the WM Act. Harvestable rights may be available to account (wholly or partially) for the take of water from a water source. In the case of the Project, the maximum take from the Muswellbrook Water Source is estimated at 39 ML/year.

BMC's calculated harvestable rights (based on its total landholding of 3,203 ha less the Disturbance Boundary and the Approved Bengalla Mine resulting in a net area of 1,551 ha) has been determined to be 109 ML per water year.

BMC has nominated Spare Dam and Relocated Staged Discharge Dam as shown on **Figure 3** as its harvestable rights dams from which water can be taken and used without a WAL. These dams have an annual average capture volume of 60.9 ML (less than the capacity allowed under the Harvestable rights Order).

Available Water Determinations

BMC currently has exclusive use of a large proportion of the units under its WALs (see **Table 15**). The remaining units are or may be subject to term transfers and/or use by licensees of BMC owned land for agricultural purposes. However, BMC enters into licence agreements on terms that allow it to resume from time to time (either temporarily or permanently) use of the land and/or water licences when required for mining operations effectively giving BMC priority over the use of that water entitlement.

Available Water Determinations (AWDs) for both general security and high security WALs in the Hunter Regulated River water source have been 1 ML per unit of share component for the past six water years. Similarly, WALs in the Hunter Regulated River Alluvial Water Source have been 1 ML per unit of share component for the past five water years. It is acknowledged that high security licences have priority over general security licences when determining AWDs in dry conditions.

Table 15 Project Water Licensing Requirements

Water Type	Water Source	Predicted Annual Take (ML/year)		BMC Current Entitlements Held	Licence Allocation Required (ML/year or Units)	Water Available in Water Source
		Avg	Max			
Water Management Act 2000						
Groundwater	Hunter Unregulated and Alluvial Water Source – Hunter Regulated River Alluvial Water Source	112	220	442 ML	0	23,722 units
Surface Water	Hunter Regulated River Water Source (Management Zone 1A)	1,500	2,257	3 high security WALs totalling 1,455 units 25 general security WALs totalling 4,562 units	0	10,378 high security units 75,035 general security units
	Hunter Unregulated and Alluvial Water Source - Muswellbrook Water Source	20	39	109 ML	0	636 units
Water Act 1912						
Groundwater	Coal seam and Bedrock Aquifer	110	365	125 ML	240	N/A

In consideration of the relatively stable recent AWDs and the large volume of licences held by BMC, it is considered that BMC holds sufficient entitlement to account for the peak annual take of water from the Hunter Regulated River Water Source (2,257 ML) and the Hunter Unregulated and Alluvial Water Source (Hunter Regulated River Alluvial Water Source) (220 ML) having regard for AWDs, which may reduce the value of one unit below 1 ML.

In the unlikely event that the water supply needs of the Project cannot be met by existing licences due to AWDs, the necessary water entitlements would be purchased. The Hunter Regulated River Water Source is an active trading market, with over 85,000 units of share component (general and high security units) estimated to exist at the commencement of the water sharing plan in Management Zone 1.

To the extent that any available water determinations reduce the value of one unit to a level such that the water needs of the Project cannot be met and additional licences cannot be secured on the market, this is acknowledged as a commercial risk for the Project production.

5.4.5 Dams Safety Act 1978

The *Dams Safety Act 1978* (Dams Safety Act) requires the NSW Dams Safety Committee (DSC) to “*formulate measures to ensure the safety of dams*” and to “*maintain a surveillance of prescribed dams*”. A “*prescribed dam*” is any dam listed under Schedule 1 of the Dams Safety Act.

The Project will involve the construction of dams that are likely to be prescribed dams. These include the relocated Staged Discharge Dam (currently a prescribed dam), Mount Pleasant Discharge Dam and CW1.

The proposed dams for the Project have been referred to the DSC in the course of the stakeholder consultation undertaken for this EIS (see Section 1). If one or more of the proposed dams are deemed to be prescribed dams, then activities in the vicinity of these dams will be regulated by the Dams Safety Act and the DSC.

5.4.6 Coal Mine Health and Safety Act 2002

Under section 100 of the *Coal Mine Health and Safety Act 2002*, emplacement areas can only be established with the approval of the Minister. An “*emplacement area*” is defined to mean “*any pile, heap, hole, excavation or place in which or on which reject (whether in a solid state or in a solution or suspension) is piled, heaped, dumped, accumulated or deposited or placed ...*”. An application for approval of emplacement areas will be made with the Minister or his delegate when required.

5.4.7 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) lists and defines threatened species, populations and ecological communities and critical habitat within NSW. The TSC Act also provides a framework for the assessment of a development’s impacts on threatened species. A detailed assessment of the Project’s impacts on threatened species and ecological communities is provided at Section 8.11.

5.5 Exemptions from other Approval Requirements

Under section 89J, the following authorisations are not required for any SSD that has been granted Development Consent:

- A permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*;
- An approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977* (Heritage Act);
- An Aboriginal Heritage Impact Permit (AHIP) under section 90 of the *National Parks and Wildlife Act 1974* (NPW Act);
- An authorisation referred to in section 12 of the *Native Vegetation Act 2003* (NV Act) (or under any Act repealed by that Act) to clear native vegetation or State protected land;
- A bushfire safety authority under section 100B of the *Rural Fires Act 1997*; and
- A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the WM Act.

The approvals which have potential relevance to the Project are discussed in the following sections.

5.5.1 Heritage Act 1977

The Heritage Act governs the management of items of European heritage significance (referred to as “*relics*”). Section 139(1) of the Heritage Act states that “*A person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit*”.

There are no heritage items listed under the Heritage Act to be affected by the Project. Historic heritage is further described in Section 8.10.

5.5.2 National Parks and Wildlife Act 1974

Under the section 86 of the NPW Act, it is an offence to harm or desecrate an Aboriginal place or object except in accordance with an AHIP issued under Section 90 of the NPW Act.

Pursuant to section 89J(1)(d) of the EP&A Act, the granting of Development Consent will remove the requirement to obtain an AHIP prior to the salvage or destruction of Aboriginal objects. However, Aboriginal cultural heritage impacts assessments and management plans are required and must be consistent with OEH guidelines.

Part 8A of the NPW Act establishes offences pertaining to the harming of threatened species, populations, ecological communities and critical habitats. However, sections 118A(3)(b)(i), 118C(5)(b)(i) and 118D(2)(b)(i) state that a valid defence exists where the act causing the harm is essential to the carrying out of a development for which Development Consent has been granted.

5.5.3 Native Vegetation Act 2003

Section 12 of the NV Act prohibits the clearing of native vegetation except in accordance with a Development Consent granted under the EP&A Act or a property vegetation plan.

5.5.4 Water Management Act 2000

The Project will include and constitute controlled activities and management works and will use water which, except where exemptions apply (see above), ordinarily require approvals under sections 89 (water use), 90 (management works) and 91 (controlled activities). These approvals will not be required where Development Consent under Division 4.1 is granted.

An aquifer interference activity approved under Section 91 would be required but for the fact that these provisions have not commenced in the area of the Project. However, the AIP (NOW, 2012) requires assessment in the context of the Project.



5.6 Plans and Policies

5.6.1 MSC Land Use Development Strategy (Coal Mining Component)

In November 2011, MSC introduced the 'Draft Land Use Development Strategy (Coal Mining Land Use Component)' (LUDS) (MSC, 2012). The coal mining component of the LUDS prescribes a number of planning principles to ensure that current and future land uses are not prejudiced by coal mining developments. The LUDS sets out MSC's expectations for mining projects and the issues that it will consider when evaluating a proposed project for the purposes of making a submission on the Project. The underlying principles of the LUDS are:

- Intensification of existing and approved mining activities are favoured over an increase in the footprint of mining activities;
- Land use conflict needs to be managed between mining activities and adjoining uses, particularly in regard to the development and growth of Muswellbrook township;
- Impacts of mining activities on the health and well-being of residents in settlements and townships require investigation and monitoring throughout the lifetime of the mine;
- Recognition needs to be given to the central location of Muswellbrook in regard to the movement of coal resource through the Upper and Mid Hunter Valley;
- There is a need for a whole of life consideration for mining activities, including quality rehabilitation and restoration of mined land;
- Mining activities as far as possible should complement rather than dominate landscapes, particularly as seen from the road;
- Provision needs to be made for the diversification of land uses within the Shire, particularly ensuring that once mining has ceased compatible land use activities can re-establish and add to the Shire's diversity and economic base;
- Rehabilitation of land post mining should set the platform for future land use, recreation opportunities and provide for opportunities to strengthen the districts biodiversity resource;
- Best practice activities employed in the mining industry should be employed in mining activities throughout the Shire; and
- Recognition that mining activity is a positive contributor to the Shire's economy and that the mining industry continues to work in partnership with Council.

This EIS proposes mitigation and management measures to ameliorate the predicted impacts of the Project as described in **Section 8**. These measures assist in achieving these principles to the maximum extent practicable.

5.6.2 Agricultural Impact Statement

The DGRs require that the "... the EIS to contain a rigorous assessment of the agricultural impacts of the project. Your assessment must be in accordance with the new Agricultural Impact Statement (AIS) guideline, which is available on the Department's website".

The AIS for the Project is summarised in **Section 8.20**.

5.6.3 Upper Hunter Strategic Regional Land Use Plan

In March 2012, the NSW government placed the *Draft Upper Hunter Strategic Regional Land Use Plan* (draft SRLUP) (DP&I, 2012a) on public exhibition. The document established a preliminary 'Gateway process' for a scientific assessment of the impacts of a SSD (of the same nature as the Project) on Strategic Agricultural Land (SAL):

"The Department also advises that there are a number of recent key policy and planning documents that are relevant to the project. These include the draft Upper Hunter Strategic Regional Land Use Plan and the draft Aquifer Interference Policy ... These DGRs may be amended to reference these additional documents once they are finalised to ensure that they are appropriately considered during the preparation of the EIS. ... The Department strongly recommends that you consider the draft Plan and in particular the draft Gateway criteria in Chapter 11 of the Plan during preparation of your mine plan and EIS."

In September 2012, the *Upper Hunter Strategic Regional Land Use Plan* (SRLUP) (DP&I, 2012b) was finalised and released. The document provides a Gateway process for all State significant developments, which involves the verification of SAL, and if it exists, the assessment by an independent panel of experts (referred to as the 'Gateway Panel') against the criteria of the SRLUP.

Implementation of the SRLUP through environmental planning instrument (and/or legislation) has not yet occurred as at the date of this EIS. It will be brought into operation by amendments to the Mining SEPP and other necessary legislative changes. Consequently, the Gateway process foreshadowed in the SRLUP does not apply to the Project.

In this regard, the Project will not be required to hold a Gateway certificate for the development application to be lodged. However, the assessment criteria of the SRLUP relevant to the Project have been considered in this EIS. There are two categories of SAL:

- Biophysical Strategic Agricultural Land (BSAL); and
- Critical Industry Cluster land (CIC), which is represented by the Equine and Viticulture CIC.

The indicative extent of SAL for the Upper Hunter region is provided in Map 6 of the SRLUP. **Figure 30** illustrates the proximity of the Project Boundary and Project Disturbance Boundary to the areas of SAL mapped in the SRLUP.

Biophysical Strategic Agricultural Land

The indicative extent of BSAL illustrated in Map 6 of the SRLUP is based on the criteria provided in Table 1 of the SRLUP.

The Approved Bengalla Mine occurs within the spatial limits of mapped BSAL (including the CHPP and administration facilities to be utilised by the Project). However, in relation to the Disturbance Boundary, only 1 ha associated with the southern section of the realignment of the Bengalla Link Road realignment is within the spatial limits of mapped BSAL. The existing southern portion of the Bengalla Link Road (part of the Approved Bengalla Mine) is located wholly within BSAL.

Further discussion in relation to the extent of verified BSAL within the Project Disturbance Boundary is presented below and in **Section 8.20**.

Equine Critical Industry Cluster

The indicative extent of the Equine CIC as illustrated in Map 6 of the SRLUP and based on the mapping criteria provided in the Appendix of the SRLUP. In the Muswellbrook LGA, the Equine CIC includes land "within 2 km of the Muswellbrook Denman Road or the New England Highway north of Muswellbrook".

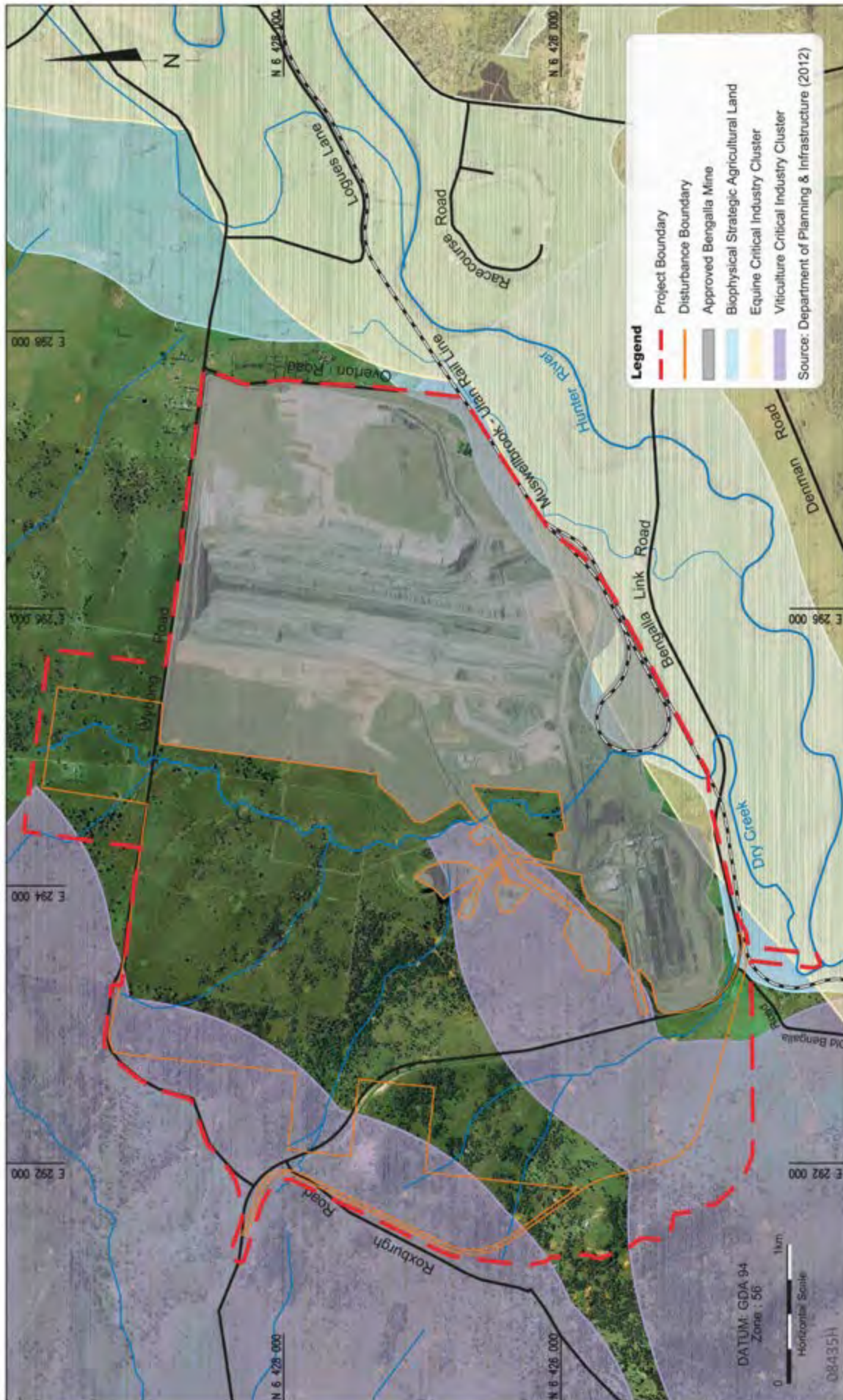
The Approved Bengalla Mine occurs within the spatial limits of mapped Equine CIC (including the existing CHPP and Administration facilities to be utilised by the Project). However, the Disturbance Boundary does not occur within the spatial limits of the mapped Equine CIC. Further discussion in relation to the extent of verified Equine CIC within the Disturbance Boundary is presented in **Section 8.20**.

Viticulture Critical Industry Cluster

The indicative extent of the Viticulture CIC is illustrated in Map 6 of the SRLUP. The criteria provided in the Appendix of the SRLUP to determine if land is Viticulture CIC is as follows:

- "...Land (excluding National Park and State Forests) within 20 km of Denman; and
- Falls under soil fertility classes 'high', moderately high, moderate or moderately low under the Draft Inherent General Fertility of NSW (OEH); and
- Land capability classes I, II, III, IV or V under the Land and Soil Capability Mapping of NSW (OEH); and
- Is within 2 km of a mapped alluvial water source."

The Approved Bengalla Mine occurs within the spatial limits of mapped Viticulture CIC (including the existing CHPP and administration facilities to be utilised by the Project). Additionally, approximately 494 ha of the Project Boundary occurs within the spatial limits of mapped Viticulture CIC.

**FIGURE 30**

Hansen Bailey
ENVIRONMENTAL CONSULTANTS



The Soils and Land Capability Impact Assessment (Section 8.19) to determine soil fertility and land capability and the Groundwater Impact Assessment (Section 8.7) to determine the extent of any alluvial aquifer were investigated to determine if land within the Project Boundary conformed to the requirements presented in the SRLUP Appendix.

Following the verification process it was determined that the Project Boundary contains 494 ha of Viticulture CIC that meets all the criteria presented in the SRLUP Appendix. Of this a total of 369 ha of verified Viticulture CIC is located within the Disturbance Boundary although the nearest vineyard not owned by the operator of a coal mine is located 12 km to the south-west away from the Project Boundary at the closest point.

Further discussion in relation to the extent of verified Viticulture CIC within the Disturbance Boundary is presented in Section 8.20.

Site Verification

As part of the Gateway process, site verification must be undertaken for the land within the Project Disturbance Boundary, if it is mapped as SAL in accordance with Map 6 of the SRLUP. In order for the land to be considered SAL, the land must satisfy the criteria for BSAL or CIC (see Section 8.20).

In Chapter 11 of the SRLUP it is noted that "Due to the regional scale of the strategic agricultural land maps in the plan it is important that appropriate processes are in place to provide for site-specific verification that the particular sites do in fact meet the strategic agricultural land criteria." As such this EIS considers whether the mapped land does or does not meet the criteria, relevant to the Project, for Equine CIC and/or a Viticulture CIC.

Discussion

The SRLUP proposes 'gateway criteria' which must be considered by the 'gateway panel' in its assessment of the proposal. As part of the assessment process, a site verification process must be undertaken for the land mapped as SAL. In order for the land to be considered SAL, the land must satisfy the criteria for BSAL or CIC. These criteria are defined in Chapter 3 of the SRLUP and are reproduced in Table 16.

The SRLUP provides that the 'gateway panel' must consider the criteria defined in Chapter 11 of the SRLUP. The criteria for BSAL and CIC are provided and consideration given in Table 17.

The *Interim Strategic Agricultural Land Policy for State Significant and Transitional Part 3A Mining and Coal Seam Gas Proposals in the Upper Hunter and New England North West Regions* (Interim Policy) requires the AIS for the Project to include specific focused assessment of the impacts of the proposal on strategic agricultural land, having regard to the draft gateway criteria in the draft SRLUPs.

As the SRLUP has now been released in final form, the AIS and this EIS will incorporate an assessment as required by the Interim Policy having regard for the gateway criteria in the SRLUP.

Gateway Criteria Assessment

Under the SRLUP if a State significant development is located on land that has been confirmed as SAL, the proposal will be assessed by the Gateway Panel against the criteria listed in Table 2 of the SRLUP. The assessment criteria are reproduced Table 17.

Although not applicable by means of legislation, the Gateway process and criteria of the SRLUP is relevant to the assessment of the Project, due to the DGRs which requires the EIS to "consider the draft Plan and in particular the draft Gateway criteria in Chapter 11 of the Plan". In this instance, the Gateway criteria of the SRLUP has been adopted, which supersedes the draft SRLUP.

This EIS and the AIS prepared for the Project (see Appendix W), which is required by means of the *Strategic Regional Land Use Policy* (DP&I, 2012c), includes a specific focussed assessment of the impacts of the Project on SAL having regard to the Gateway criteria in the SRLUP. In order to fulfil the request with the DGRs, the AIS draws upon conclusions provided in expert impact assessments prepared for the Project, which encompass a number of environmental and socio-economic disciplines. As indicated in Table 2 of the SRLUP (reproduced as Table 17) it will be necessary to take into account "Any advice on water impacts received from the Commonwealth Independent Expert Scientific Committee on Coal seam Gas and Large Coal Mining Development" in the assessment of the Project against the criteria of the SRLUP.



Table 16 Verification of Strategic Agricultural Land Values

Value	Criteria	Project Trigger	Section
Biophysical Strategic Agricultural Land	Land that falls under soil fertility classes 'high' or 'moderately high' under the Draft Inherent General Fertility of NSW (OEH) and		8.19 and 8.20
	Land capability classes I, II or III under the Land and Soil Capability Mapping of NSW (OEH) and	✓	8.19 and 8.20
	- Reliable water of suitable quality, characterised by land having rainfall of greater than 350mm per annum (9 out of 10 years); or - Properties within 150 m of - A regulated river, or - Unregulated rivers where there are flows for at least 95% of the time (i.e. the 95th percentile flow of each month of the year is greater than zero) or 5th order and higher rivers, or - Groundwater aquifers (excluding miscellaneous alluvial aquifers, also known as small storage aquifers) which have a yield rate greater than 5L/s and total dissolved solids of less than 1,500 mg/L.	✓	8.7 and 8.20
	or		
	Land that falls under the soil fertility class 'moderate' under the Draft Inherent General Fertility of NSW (OEH) and	✓	8.19 and 8.20
	Land capability classes I or II under the Soil Capability Mapping of NSW (OEH), and	✓	8.19 and 8.20
Critical Industry Cluster	- Reliable water of suitable quality, characterised by land having rainfall of greater than 350mm per annum (9 out of 10 years); or - Properties within 150 m of - A regulated river, or - Unregulated rivers where there are flows for at least 95% of the time (i.e. the 95th percentile flow of each month of the year is greater than zero) or 5th order and higher rivers, or - Groundwater aquifers (excluding miscellaneous alluvial aquifers, also known as small storage aquifers) which have a yield rate greater than 5L/s and total dissolved solids of less than 1,500 mg/L.	✓	8.6 and 8.20
	Industry clusters that meet the following criteria: - There is a concentration of enterprises that provides clear development and marketing advantages and is based on an agricultural product; - The productive industries are interrelated; - It consists of a unique combination of factors such as location, infrastructure, heritage and natural resources; - It is of national and/or international importance; - It is an iconic industry that contributes to the region's identity; and - It is potentially substantially impacted by coal seam gas or mining proposals.	✓	8.20

Table 17 Indicative Gateway Assessment Criteria for Strategic Agricultural Land

Value	Criteria	Section
Biophysical Strategic Agricultural Land	Whether the proposal would significantly reduce the agricultural productivity of the land based on a consideration of:	-
	• Impacts on the land through surface area disturbance and subsidence	8.20
	• Impacts on: - Soil fertility - Rooting depth, or - Soil profile materials and thickness	8.19
	• Increases in land surface microrelief or soil salinity, or significant changes to soil pH; and	8.19
	• Impacts on Highly Productive Groundwater, including the provisions of the Aquifer Interference Policy and the advice on the Minister for Primary Industries (note that the Minister for Primary Industries will be required to take into account the advice of the Commonwealth Independent Expert Scientific Committee in providing advice in this stage).	8.7

Value	Criteria	Section
Critical Industry Clusters	Whether the proposal would lead to significant impacts on the critical industry cluster through:	-
	• Surface area disturbance	8.20
	• Subsidence	N/A
	• Reduced access to agricultural resources	8.20
	• Reduced access to support services and infrastructure	8.20
	• Reduced access to transport routes	8.20
	• Loss of scenic and landscape values	8.20
Consultation	Any advice received from the Commonwealth Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development.	N/A

5.7 Aquifer Interference Policy

The following section identifies the relevant assessment criteria from the AIP and assesses each of them against the Project.

5.7.1 Water Sources

Requirement

Which water source(s) will the activity take water from. [clause 2.1, AIP – page 7]

Assessment

The proposed activity (the Project) will take water from the:

- Permian groundwater system – regulated (for licensing) under the Water Act 1912;
- Hunter Regulated River Alluvial Water Source – regulated under the WM Act;
- Hunter Regulated River Water Source – regulated under the WM Act; and
- Muswellbrook Water Source – regulated under the WM Act.

5.7.2 Quantities

Requirement

A prediction of the total amount of water that will be taken from each connected groundwater or surface water source on an annual basis as a result of the activity and after closure of the activity.... [clause 2.1, AIP – page 7]

How and in what proportions this take will be assigned to the affected aquifers and connected surface water sources, even if take predictions are not based on groundwater modelling. [clause 2.1, AIP – page 7]

Assessment

Modelling has been undertaken to determine the quantities of water that will be taken from groundwater sources. The peak annual take is predicted to be:

- 365 ML from the Permian groundwater system;
- 220 ML from the Hunter Regulated River Alluvial Water Source;
- 2,257 ML from the Hunter Regulated River Water Source; and
- 39 ML from the Muswellbrook Water Source.

5.7.3 Applicable Licence Exemptions

Requirement

How any relevant licence exemptions might relate to the water to be taken by the activity. [clause 2.1, AIP – page 7].

Assessment

There are no licence exemptions relevant to inflows to mining areas.

Runoff from disturbed areas will be captured in dams, which are considered to be excluded works under the WM Act and WM Regulation and reused for mining related activities (such as dust suppression and coal washing). There is a licence exemption for water taken using an excluded work.

5.7.4 Characteristics of Water Requirements

Requirement

The characteristics of the water requirements such as whether it is taken at a fixed rate or varying in time, i.e. is it ongoing, constant, unavoidable - which, in the case of regulated rivers, means that high security water may be required to account for the water requirements - or is it climatically/time varying or controllable in some way - which, in the case of regulated rivers, implies general security water is likely to be adequate to account for the water taken. [clause 2.1, AIP – page 7]

Assessment

The water taken from groundwater sources will vary over the Project life. The groundwater inflows to mining areas will peak in Year 1 and then gradually decrease as mining moves away from the Hunter River alluvium. The variation in inflow volumes over the Project life is discussed in **Section 8.7**. The reduction in flow to the Hunter River alluvium will also peak in Year 1 and decrease as mining progresses away from the alluvium. The reduction in flows to the alluvium over the Project life is discussed in **Section 8.7**.

5.7.5 Availability of Water Entitlements

Requirement

Whether there are sufficient water entitlements and water allocations that are able to be obtained to cover the characteristics of the water requirements. Consideration must also be given to the water sharing plan rules by which water is credited to water accounts on an annual basis and by which those accounts may be managed (e.g., carryover rules for unused water allocations) to provide the flexibility required to ensure there is sufficient water in accounts to cover the take of water. [clause 2.1, AIP – page 7]

Assessment

A request to vary the conditions of the existing Water Act licence will be made. There is no embargo against such action.

The necessary share component for the WAL is already held by the BMC and can be transferred to the relevant WAL at the appropriate time.

5.7.6 How Water Entitlements will be Obtained

Requirement

How this water will be obtained by what mechanism and what licence category, consistent with any trading rules specified in either the Minister's access licence dealing principles and/or relevant water sharing plans. Consideration will also need to be given to the possibility and effect of low water allocations in regulated river systems. For example, if high security entitlements have been purchased to cover the ongoing take of water from a regulated river water source, then there may be years of low water allocations due to low water availability. This may result in insufficient water allocation being credited to the high security licence account.

One way to cover this shortfall would be to enter the temporary water trading market and purchase water allocations credited to other licences. The costs and ability to undertake this sort of trade (i.e., the market depth) during these low allocation times will need to be understood. [clause 2.1 AIP – page 8]

Assessment

Clause 54(2) of the Hunter Unregulated and Alluvial Water Sources WSP provides that "An available water determination shall be made at the commencement of each water year for all aquifer access licences in the Hunter Regulated River Alluvial Water Source and should be equivalent to the available water determination made for regulated river (high security) access licences under the Water Sharing Plan for the Hunter Regulated River Water Source 2003".

The plan makes provisions for adjustments to the available water determination provisions after six years after the commencement of the plan.

The Bengalla Joint Venture holds a total of 442 units of share component for the Hunter Regulated River Alluvial Water Source and therefore the available water determination would need to go below 50% for Hunter Regulated River High Security share components before BMC would need to obtain additional allocations.



5.7.7 'Activation' of Existing Entitlements

Requirement

The effect that activation of existing entitlement may have on future available water determinations for the proposed licence category and entitlement volume. [clause 2.1, AIP – page 8]

Assessment

It is not believed that there will be any impact on future Available Water Determinations by the 'activation' of these entitlement volumes due to the small quantity compared to the total share component (24,132 unit shares in the Hunter Regulated River Alluvial Water Source – see clause 32(jj) of the Hunter Unregulated and Alluvial Water Sources, 2009).

5.7.8 Inflow Minimisation Measures

Requirement

Actions required both during operation and post-closure to minimise the risk of inflows to a mine void as a result of flooding, since these are very difficult to account for volumetrically. Therefore, set-back distances from rivers should be no less than that required to ensure structural integrity of the river bank during flooding events. Levee banks or landforms should also be constructed at the appropriate time to prevent at least a 1 in 100 year flood from entering the site either during or after operation. In some instances, where the implications of such inflows are significant, levee bank levels may be required to be higher. [clause 2.1, AIP – page 8]

Assessment

The Surface Water Impact Assessment included a flood impact assessment (see Section 8.6). This assessment found that all components of the Project (including the final void) are located outside of the 1 in 100 year flood extent of the Hunter River.

5.7.9 Water Take Beyond Project Life

Requirement

A strategy for accounting for any water taken beyond the life of the operation of the project, such as continuing to hold the appropriate amount of licence entitlement to cover the ongoing volumetric impact or surrendering a component of licence entitlement at the end of the project. [clause 2.1, AIP – page 8]

Assessment

The Groundwater Impact Assessment predicted that water will continue to be taken from the Hunter Regulated River Alluvial Water Source after mine closure. The long term annual reduction in flow to the alluvium is predicted to be 220 ML/year (0.6 ML/day). The water allocations required for the Project will be sufficient for the post-mining water take. BMC will maintain these water licences following closure of the mine.

5.7.10 Hydraulic Connection between Aquifers

Requirement

Any potential for causing or enhancing hydraulic connection between aquifers or between groundwater and surface water sources and quantification of this risk in the volumetric inflow estimates. [clause 2.1, AIP – page 8]

Assessment

The groundwater model predicts that mining associated with the Project will induce flow from the alluvium to the Permian. This is a reversal of the flow direction under pre-mining conditions. However, the flux generated by the Project will be less than the flux generated by the existing operations at Bengalla.

5.7.11 Other Uncertainties

Requirement

Quantification of any other uncertainties in the groundwater or surface water impact modelling conducted for the activity. [clause 2.1 AIP – page 8]

Assessment

The Groundwater Impact Assessment included a sensitivity analysis to determine the effect of uncertainty on the predicted inflows to mining areas and reductions in flow to the alluvium. The sensitivity analysis is discussed in Section 8.7.3.

5.7.12 Monitoring Actual Take

Requirement

Strategies in place for monitoring actual and reassessing any predicted take of water and how any changes in these requirements will be accounted for, including analysis of water market depth and/or in-situ mitigation and remediation options. [clause 2.1 AIP – page 8]

Assessment

BMC operates a network of groundwater monitoring bores and will undertake monitoring of inflows to mining areas and impacts on alluvial aquifers.

5.7.13 Ability to Obtain Necessary Water Licences

Requirement

- (a) *Ability to demonstrate that they have the ability to obtain the necessary licences in order to account for the take of water from any relevant water source; or*
- (b) *Ability to demonstrate that the proposal has been designed in such a way as to prevent the take of water where applicants are unable to meet the requirements specified in point (a) above. [clause 3.2 AIP – page 11].*

Assessment

The BMC own water licences and water access licences with the necessary water entitlements, as identified in **Table 15**.

5.7.14 'Minimal Impact' Considerations Requirement

Ability to demonstrate that adequate arrangements will be in place to ensure that the minimal impact considerations specified in Table 1 and section 3.2.2 can be met. [clause 3.2, AIP – page 11]

Assessment

There are different minimal impact considerations that apply to “highly productive” and “less productive groundwater”. The criteria for “highly productive groundwater” are:

- (a) *Total dissolved solids of less than 1,500 mg/L; and*
- (b) *Contains water supply works that can yield water at a rate greater than 5 L/s.*

The Hunter River alluvial aquifer satisfies these criteria and therefore constitutes highly productive groundwater. The Permian coal measures are a less productive groundwater source.

For both highly productive and less productive groundwater, the maximum allowable water table variation is 10% at a distance of 40 m from any high priority Groundwater Dependent Ecosystems (GDEs) or culturally significant sites listed under a WSP. There are no high priority GDEs or culturally significant sites within the zone of depressurisation associated with the Project.

The maximum allowable decline in the water table at any water supply work is 2 m. Only one registered bore (GW073576) is expected to experience a decline in water levels. The drawdown at this location is predicted to be 2 m. Therefore, the Project complies with this minimal impact consideration.

For highly productive groundwater, the maximum allowable decline in pressure head at a water supply work is 2 m or 40% (whichever is lower). For less productive groundwater, the maximum allowable decline is 2 m. The maximum drawdown predicted by the groundwater model is 2 m, which occurs at bore GW073576.

With respect to water quality, the minimum impact considerations for highly productive groundwater are:

- Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity;
- No increase of more than 1% per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity. Redesign of a highly connected surface water source that is defined as a “reliable water supply” is not an appropriate mitigation measure to meet considerations 1.(a) and 1.(b);

- No mining activity to be below the natural ground surface within 200 m laterally from the top of high bank or 100 m vertically beneath (or the three dimensional extent of the alluvial water source - whichever is the lesser distance) of a highly connected surface water source that is defined as a “reliable water supply”; and
- Not more than 10% cumulatively of the three dimensional extent of the alluvial material in this water source to be excavated by mining activities beyond 200 m laterally from the top of high bank and 100 m vertically beneath a highly connected surface water source that is defined as a “reliable water supply”.

For less productive groundwater, only the first consideration applies. Since mining will move away from the alluvium, the impacts of the Project on salinity are expected to be lower than the impacts caused by existing mining operations. Historical monitoring data has shown that mining at Bengalla has indicated a stable to falling salinity in the Hunter River alluvial aquifer. Therefore, the Project is not expected to lower the beneficial use category of the groundwater source. Similarly, the Project is not expected to increase the salinity of the Hunter River by more than 1%.

Mining will not be undertaken within 200 m of the high bank of the Hunter River or beneath the river. The Project will not involve the extraction of alluvial material. Therefore, the Project complies with the minimal impact considerations for water quality.

5.7.15 Contingent Remedial Actions Requirement

Proposed remedial actions for impacts greater than those that were predicted as part of the relevant approval [including]:

- (a) *consideration of the potential types and risks of unforeseen impacts that may occur during the operational phase or post-closure of the aquifer interference activity; and*
- (b) *whether the proposed mitigation, prevention or avoidance strategies will minimise these risks; and*
- (c) *whether the proposed remedial actions are adequate, should the proposed risk minimisation strategies in (b) fail; and*
- (d) *advice on what further mitigation, prevention, avoidance or remedial actions may be required; and*
- (e) *appropriate conditions that maintain any mitigation, prevention, avoidance or remediation actions until they are no longer required to keep the impacts at or below the predicted levels. [clause 3.2, AIP – page 11]*

Assessment

BMC will undertake monitoring of groundwater quantity and quality in accordance with a Groundwater Management Plan. This management plan will be updated to account for the impacts of the Project.

5.7.16 Minimal Impact Considerations

Requirement

If the predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable.

Where an activity's predicted impacts are greater than the Level 1 minimal impact considerations specified in Table 1, but these predicted impacts exceed the Level 1 thresholds by no more than the accuracy of an otherwise robust model, then the project will be considered as having impacts that are within the range of acceptability, with extra monitoring and potential mitigation or remediation required during operation, should the project be approved. In such instances, the Minister's advice will include a request that appropriate conditions be imposed to ensure the impacts of the activity are acceptable. This may include for example, adaptive management conditions requiring the proponent to monitor the actual impacts of the proposal and take action to mitigate or remediate the impacts that exceed the Level 1 thresholds.

Where the predicted impacts are greater than the Level 1 minimal impact considerations by more than the accuracy of an otherwise robust model, then the assessment will involve additional studies to fully assess these predicted impacts. If this assessment shows that the predicted impacts do not prevent the long-term viability of the relevant water-dependent asset, as defined in Table 1, then the impacts will be considered to be acceptable. [clause 3.2.1, AIP – page 13]

Assessment

The Groundwater Impact Assessment undertaken by Australasian Groundwater and Environmental Consultants (AGE) (Appendix K) has predicted that the impacts caused by the Project will be less than the Level 1 minimal impact considerations.

5.7.17 Additional Considerations

Requirement

Acidity issues to arise, for example exposure of acid sulphate soils;

Water logging or water table rise to occur, which could potentially affect land use, groundwater dependent ecosystems and other aquifer interference activities. Specific limits will be determined on a case-by-case basis, depending on the sensitivity of the surrounding land and groundwater dependent ecosystems to water logging and other aquifer interference activities to water intrusion. [clause 3.2.2 AIP – page 25].

Assessment

The Soils and Land Capability Impact Assessment found that acid sulphate soils are unlikely to be present within the Project Boundary (see Section 8.19).

The Project will cause a decline in the water table. Therefore, the Project is not expected to increase the risk of water logging.

5.7.18 Requirements of Proponents

Requirement

The proponent of an activity that may result in aquifer interference will need to provide the following to enable assessment of the activity against minimal impact considerations:

- I. establishment of baseline groundwater conditions including groundwater depth, quality and flow based on sampling of all existing bores in the area potentially affected by the activity, any existing monitoring bores and any new monitoring bores that may be required; and*
- II. a strategy for complying with any water access rules applying to relevant categories of water access licences, as specified in relevant water sharing plans;*
- III. details of potential water level, quality or pressure drawdown impacts on nearby water users who are exercising their right to take water under a basic landholder right;*
- IV. details of potential water level, quality or pressure drawdown impacts on nearby licensed water users in connected groundwater and surface water sources;*
- V. details of potential water level, quality or pressure drawdown impacts on groundwater dependent ecosystems;*
- VI. details of potential for increased saline or contaminated water inflows to aquifers and highly connected river systems;*
- VII. details of the potential to cause or enhance hydraulic connection between aquifers;*
- VIII. details of the potential for river bank instability, or highwall instability or failure to occur;*
- IX. details of the method for disposing of extracted water (in the case of coal seam gas activities). [clause 3.2.3 AIP – page 26]*

Assessment

These issues have been addressed in the Groundwater Impact Assessment (see Appendix K).

5.8 Commonwealth Legislation

5.8.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas of national significance. The EPBC Act is administered by SEWPaC and provides protection for listed Matters of National Environmental Significance (MNES). There are eight MNES in total:

- Listed threatened species and ecological communities;
- World heritage properties;
- National heritage places;
- Wetlands of international importance;
- Migratory species;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park; and
- Nuclear actions.

If a proposed action is likely to have a significant effect on one or more MNES, an approval from the Minister for Sustainability, Environment, Water, Population and Communities must be obtained before the action can be carried out.

Under section 68 of the EPBC Act, a proposed action must be referred to the Minister if the proponent thinks that the action is or may be a "controlled action". If the Minister declares that the proposed action is a controlled action, the action must be the subject of an impact assessment under Part 8 of the EPBC Act. A controlled action cannot be carried out unless the Minister has granted approval under Section 133 of the EPBC Act.

The Project was referred to SEWPaC on 31 March 2012. On 7 June 2012, SEWPaC declared that the Project is a controlled action and will subsequently require assessment under the EPBC Act. The Project was considered a controlled action due to its potential impacts on threatened species and communities, which is a protected matter under sections 18 and 18A of the EPBC Act.

The Project will result in the clearing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, which is a critically endangered ecological community under the EPBC Act.

The assessment approach prescribed by SEWPaC was accreditation of the assessment process under the EPBC Act. DP&I issued supplementary DGRs in this regard on 12 July 2012 (see **Appendix D**). Therefore, this EIS will be considered by the Minister when deciding whether or not to approve the Project under Section 133 of the EPBC Act.

5.8.2 Native Title Act 1993

The *Native Title Act 1993* (NT Act) facilitates the recognition and protection of native title. Under section 13 of the NT Act, a person can apply to the Federal Court for a determination of native title. There is currently a native title determination application over a large area of land in north-western NSW, including the land within the Project Boundary. This application known as 'Gomeroi People' (NSD2308/11) has not yet been determined by the Federal Court.

Section 23A of the NT Act states that native title is extinguished by "previous exclusive possession acts". Under section 23B of the NT Act, native title over land is extinguished by the grant of a freehold estate over that land, provided that the grant occurred on or before 23 December 1996.

Freehold estates were granted or roads dedicated in respect of all of the land within the Project Boundary prior to 23 December 1996. Therefore, no native title rights exist within the Project Boundary.



5.9 Summary of Required Licences and Approvals

Table 18 provides a summary of the licences, leases and approvals needed to enable the construction and operation of the Project.

Table 18 Licences and Approvals Required for the Project

Approval	Legislation	Authority	Comments
Development Consent for the construction and operation of the Project	Section 89E of Part 4 of the EP&A Act empowers the Minister for Planning & Infrastructure to grant a Development Consent	Minister for Planning & Infrastructure	Under section 23 of the EP&A Act, the Minister may delegate his / her functions as the consent authority to the PAC.
Mining Leases	Section 63 of the Mining Act enables the Minister for Resources and Energy to grant a mining lease	Minister for Resources & Energy	Under section 89K of the EP&A Act, a Mining Lease must be granted to a development that has been granted development consent. The Mining Lease must be substantially consistent with the Development Consent. A renewal of the existing mining leases held for the Project will be sought in advance of their expiry. A mining lease application will be made in respect of the area of AL 13. An application for part transfer of Mining Lease 1645 within the Project Boundary will be lodged.
Preparation of a Mining Operations Plan (or equivalent) to the satisfaction of DRE	Typically required as a condition of a Mining Lease issued under the Mining Act	DRE	Will be sought following the issuing of a Mining Lease
Approval for the carrying out of a "Controlled Action"	Section 133 of the EPBC Act enables the Minister for SEWPaC to approve the taking of a controlled action	SEWPaC	SEWPaC has accredited the assessment process under Division 4.1 of Part 4 of the EP&A Act.
EPL	Chapter 3 of the POEO Act	OEH	Section 89K of the EP&A Act provides that an EPL must be granted to a development that has been granted development consent.
AHIP	Section 90 of the NPW Act	NPWS	Section 89J of the EP&A Act provides that a permit of this type is not required for a development that has been granted development consent.
Authorisation to clear Native Vegetation	Section 12 of the NV Act	OEH	Section 89J of the EP&A Act provides that an authorisation of this type is not required for a development that has been granted development consent.
Water Use Approval	Section 89 of the WM Act	NOW	Section 89J of the EP&A Act provides that a water use approval is not required for a development that has been granted development consent.
Water Management Work Approval	Section 90 of the WM Act	NOW	Section 89J of the EP&A Act provides that a water management work approval is not required for a development that has been granted development consent.
Controlled Activity Approval	Section 91 of the WM Act	NOW	Section 89J of the EP&A Act provides that a controlled activity approval is not required for a development that has been granted development consent.
Water Access Licence(s)	Parts 2 and 3 of Chapter 3 of the WM Act	NOW	Will be obtained as required. Requirements are set out in Table 15
Bore Licence	Part 5 of the Water Act	NOW	Will be obtained (or existing varied) as required. Existing bore licences held in respect of the project may require variation to account for the modelled volumetric take from the porous rock aquifers.
Consent to carry out a work in on or over a public road	Section 138 of the Roads Act	MSC and Minister for Road & Ports	Section 89K of the EP&A Act provides the granting of this approval must be approved substantially consistent with the Part 3A approval

Approval	Legislation	Authority	Comments
Closure of Bengalla Road	Section 37 of the Roads Act	MSC	An application will be made at the appropriate time.
Construction Certificate	Division 1 of Part 4A of the EP&A Act	MSC	Will be obtained as required.
Building Certificate	Section 149A of the EP&A Act	MSC	Will be obtained as required.
Approval for works over Crown land	Crown Lands Act	DoL	Separate Approval
Notification of Dangerous Goods	Work Health and Safety Regulation	WorkCover	Will be provided when required.
Environment Management Plans	Conditions of Development Consent	DP&I	Will be updated following the determination of Development Consent.





6

Stakeholder Engagement

This section provides a summary of the stakeholder engagement program undertaken for the Project, which included consultation with near neighbours and the surrounding community, local and State government, industry regulators and the local Aboriginal community. It also provides an overview of the engagement process applied for the Project, its objectives, a description of the various engagement phases, the engagement activities undertaken and findings that have been incorporated into the impact assessments undertaken for this EIS.

A Social Impact Assessment was also undertaken as a component of this EIS and is discussed further in Section 8.14.

6.1 Existing Stakeholder Engagement

BMC has conducted effective stakeholder engagement programs for Bengalla since its initial exploration licence was granted on the 14 February 1991. To demonstrate their commitment to commencing operations associated with Bengalla, in 1993 BMC established an office in the centre of the Muswellbrook business area. The office provided an open outlet for consultation and community members were advised that information regarding the EIS was freely available at this office.

This office is currently situated at 19 Bridge Street Muswellbrook and is still in operation and houses Coal & Allied's Muswellbrook based employees and stakeholder relations team. During the release of Project and Coal & Allied quarterly newsletters the community were regularly referred to this shopfront as a means of contacting key Project Team members to discuss any aspect of the Project and EIS process.

Since the original Bengalla 1997 EIS, BMC has continued to enhance its stakeholder engagement program through the operation of Coal & Allied's communications procedures and particularly through the Muswellbrook Community Relations Program. Regular meetings with local organisations including MSC are conducted and aimed at providing updates in relation to the status of Coal & Allied's projects around Muswellbrook.

The BMC CCC meets regularly to provide a forum for open discussion between the community, MSC, relevant government agencies and BMC representatives. The BMC CCC discusses issues directly relating to the mining operation and environmental performance.

A summary of demonstrated BMC stakeholder engagement is provided in Table 19.

6.1.1 Existing Community Contributions

BMC recognises the importance of the Upper Hunter community to its mining operation and values the relationship it has developed. This relationship has been strengthened throughout the years due to BMC's efforts for being more than just a major source of local employment and economic growth. BMC has worked in partnership with the local community contributing to provide positive long term outcomes for the Hunter Valley region.

Since operations commenced in 1998, BMC have directly contributed over \$700,000 to community based sponsorship programs including (but not limited to):

- Muswellbrook Show;
- Upper Hunter Show and Mining Expo;
- Upper Hunter River Rehabilitation Initiative;
- Muswellbrook Regional Centre Art Prize;
- NSW Ambulance;
- Westpac Rescue Helicopter;
- Local Junior and Senior Sporting Teams and events;
- Local Education, Community Events / Organisations;
- Muswellbrook Race Club and Race Day; and
- Arts and Cultural Events.

Voluntary Planning Agreement

In addition to the above community contributions, BMC have provided significant annual funding and employment commitments as part of its existing VPA with MSC (see Section 5.2.11). The existing VPA is required by Division 6 of Part 4 of the EP&A Act and is stipulated in DA 211/93 (as modified). The existing VPA between MSC and BMC allows annual funding of \$400,000 for the Bengalla Coal Community Fund, \$125,000 for Council Roads Maintenance Fund, \$15,000 for Council Environmental Officer and the engagement of four apprentices.

Discussions with MSC over a revised VPA for the Project are well progressed. Details in relation to the proposed content of the revised VPA are included in Section 8.14.4.

Table 19 Demonstrated Stakeholder Engagement

Activity	Details
Coal & Allied's Muswellbrook Shop Front	Currently situated at 19 Bridge Street Muswellbrook, this shop front houses Coal & Allied's Stakeholder Relations and Mount Pleasant Project Team
Community Newsletters	Coal & Allied Community Newsletters – distributed quarterly in Muswellbrook and Singleton editions
Community Information phone lines	- Coal & Allied information line - BMC blasting hotline - Environment contact line available 24/7
BMC website	Available 24/7
Adjacent residents	Personal visits, newsletters and website
Muswellbrook community consultation	- Biannual Community Open Day and general community sponsored events - Reports and meeting information accessible in the Muswellbrook and Denman libraries - Newsletters - Website - Upper Hunter Show and Bursting With Energy Expo - Site tours and presentations - Local media - Presentations at local schools
Aboriginal Groups consultation	Meetings and site inspections, newsletters and website
BMC CCC	Meets approximately every three months with representatives from the community, government agencies, MSC and BMC
Coal & Allied Community Development Fund	Contributes to projects aimed at providing benefits for the local community
Coal & Allied Community Partnerships	A continuing active partnership program with key organisations that provide a service valued by the community and have an approach to their business that is aligned with Coal & Allied principles
Coal & Allied Aboriginal Community Development Fund	Contributes to projects aimed at providing benefits for the Upper Hunter Aboriginal community
MSC consultation	Coal Mine General Manager forum, personal discussions, presentations and site tours, newsletters and website
Government agency consultation	Offers of presentations and site tours, scheduled external reporting of monitoring results and performance, newsletters and website
BMC Employees & Contractors	- Regular 'BMC Toolbox Talks' - Induction presentations - Information boards, newsletters and website - Open Day and Family Day
BMC Corporate	- Internal reports - Coal & Allied / Rio Tinto Coal Australia website
Environmental Non-Government Organisations	- Newsletters - Presentations
Neighbouring industry	- Newsletters - Presentations and site tours - Attendance at meetings - Coal & Allied / Rio Tinto Coal Australia website
Media	- Newsletters - Radio - Newspapers - BMC CCC minutes - Coal & Allied / Rio Tinto Coal Australia website

(Source: BMC, 2012b)

Coal & Allied Community Development Fund

The Coal & Allied Community Development Fund (previously called the Coal & Allied Community Trust) was established in 1999 to support communities in the Hunter Valley to build community capacity, address development challenges and take advantage of emerging opportunities. Since its inception, the Coal & Allied Community Development Fund has contributed more than \$11 M to projects aimed at providing benefits for the local community.

Coal & Allied Aboriginal Community Development Fund

In partnership with the Upper Hunter Valley Aboriginal Community, Coal & Allied launched the Aboriginal Development Consultative Community (now known as the Coal & Allied Aboriginal Community Development Fund (ACDF)) in 2006, investing more than \$3.05 Million in education, training, community and business development projects benefiting the Hunter Valley Aboriginal community since its inception. The ACDF is a funding program accessible by any Aboriginal person or group in the Upper Hunter Valley region undertaking a project to benefit the wider Aboriginal community. The ACDF operates under a set of guidelines established and agreed to by the Upper Hunter Valley Aboriginal community and Coal & Allied.

The projects funded are those most likely to deliver long term, sustainable outcomes for the Upper Hunter Valley Aboriginal community and applications may be made by members of the Upper Hunter Valley Aboriginal community, including the areas of Muswellbrook and Upper Hunter (BMC, 2012b).

Based on the established objectives, the ACDF looks to fund proposals of the following nature:

- Aboriginal business development;
- Educational programs;
- Heritage and culture;
- Training and employment;
- Community development;
- Community health and wellbeing; and
- Projects that have compelling and significant benefit for the whole Upper Hunter Aboriginal community.

More detail in relation to recent projects supported by the ACDF program is available on the Coal & Allied website www.riotintocoalaustralia.com.au.

6.2 Stakeholder Identification

A range of stakeholders were identified for the Project based on BMC's existing stakeholder relationships and a review of existing databases developed during the preparation of previous modifications.

Consultation records for these projects were supplemented with an analysis of recent cadastral information, BMC's records and background research into the local area. This enabled a comprehensive list of key stakeholders to be developed for the Project.

The key stakeholders identified for the Project and the methods and types of consultation undertaken for each are identified in Table 20.

Other Infrastructure and Service Providers

Australian Rail Track Corporation (ARTC) has not been consulted regarding the Project as provisions in ARTC's Hunter Valley Access Undertaking (approved by the Australian Competition and Consumer Commission (ACCC) in June 2011) provide a mechanism for contracting for additional track capacity from mines to the Port of Newcastle, based on 10-year contract commitments. ARTC has current plans for expansion of rail track capacity to meet industry requirements for 208 Mtpa of capacity to existing terminals, and is developing plans for rail track capacity to match Port Waratah Coal Services (PWCS) proposed "Terminal 4" development. Bengalla and/or Coal & Allied would utilise the ARTC process to contract for any additional track capacity requirement to support the proposed expansion.

Consultation with PWCS regarding the Project will be conducted under the Long Term Capacity Framework agreement with the NSW Government (via Newcastle Port Corporation) to conduct an annual process for nominations for new port capacity, and is obliged to make capacity available (including construction of new capacity as required – particularly via a new terminal "Terminal 4") to any producer willing to commit to a long-term contract. BMC and/or Coal & Allied would utilise this process for obtaining any additional port capacity required to support the Project.

Consultation with Newcastle Port Corporation (NPC) is not considered necessary as port capacity is managed via the terminal operators (in this case PWCS) under NPC auspices.

Consultation with the Hunter Valley Coal Chain Coordinator (HVCCC) is not considered necessary for the preparation of an EIS. The ARTC contracting process has provision for consultation with HVCCC to ensure sufficient aligned coal chain capacity for rail track contracts.

Table 20 Project Stakeholders and Methods of Engagement

Stakeholder	Method of Engagement
Community Stakeholders	
Near Neighbours / Community	• Community Newsletter 'Continuation of Bengalla Mine' (1 November 2011) • Bengalla Community Open Day (27 October 2012) • Personalised Project notification letter and accompanying Project Fact Sheet, including offer of briefing to 31 near neighbours (24 February 2012) • Personalised letter to 93 near neighbours (13 March 2012) notifying each about the consultation program and Coal & Allied Shopfront • Coal & Allied Shopfront – Community open day sessions specific to the Project open in Muswellbrook every Thursday from 1 March 2012 to 31 March 2012 between 9:00 am and 12:00 pm. • Coal & Allied community newsletter Muswellbrook edition (released to 8,500 residents): – Issue 9 February 2012 – Issue 10 July 2012 – Issue 11 September 2012 – Issue 12 December 2012 – Issue 1 March 2013 • Bengalla Community Open Day (27 October 2012) • Continuation of Bengalla Mine Project Update Newsletter (October 2012)
Muswellbrook LGA	• Coal & Allied community newsletter Muswellbrook edition (released to 8,500 residents): • Coal & Allied Shopfront – Community open day sessions specific to the Project open in Muswellbrook every Thursday from 1 March 2012 to 31 March 2012 between 9:00 am and 12:00 pm. • Bengalla Community Open Day (27 October 2012) • Continuation of Bengalla Mine Project Update Newsletter (October 2012)
Aboriginal Community	• Public notice in Muswellbrook Chronicle (17 February 2012) and the Hunter Valley News (22 February 2012) • Letter inviting expressions of interest (19 March 2012) to all Aboriginal stakeholders identified by regulatory agencies and from responses to the newspaper notifications. • Onsite survey methodology discussion and planning meeting (4 April 2012) • Field archaeological survey (14 May to 6 June 2012) • Aborist potential scar tree assessment (15 August 2012) • Draft Aboriginal and Cultural Heritage Impact Assessment review (9 October – 6 November 2012)
BMC CCC	• Project Presentation (22 February 2012) • Project Presentation (22 May 2012) • Project Update Presentation (21 November 2012) • Project Update 22 May 2013
Bengalla Employees & Contractors	• Tool Box Talk, Website and Factsheet (February 2012)
Federal Government Agencies	
Department of Sustainability, Environment, Water, Population and Communities (SEWPaC)	• Preliminary briefing (8 February 2012) • Project Update (17 December 2012) • Project Update (11 July 2013)
State Government Agencies	
Department of Planning and Infrastructure (DP&I)	• Initial Briefing (17 November 2011) • Submit Background Document (21 February 2012) • Offset Strategy Consultation Strategy with OEH (3 May 2012) • Project DGRs Letter (11 May 2012) • Project Update via telephone (6 June 2012) • Offer of Project Briefing (8 November 2012) • Site Visit (27 February 2013) • Project Update (4 July 2013)

Stakeholder	Method of Engagement
Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) Division of Resources Energy	• Project briefing (21 February 2012) • Combined briefing by BMC and Coal & Allied to discuss interactions with the Mount Pleasant Project and mining authorisations (25 July 2012) • Conceptual Project Development Plan (CPDP) Meeting (29 August 2012) • Correspondence with DTIRIS culminating in a letter from DTIRIS to DP&I supporting the Project (15 May 2013)
DTIRIS – Primary Industries (Agriculture)	• Project briefing (9 August 2012)
DTIRIS – Primary Industries (Fisheries)	• Offer of Project briefing via telephone (3 December 2012)
DTIRIS - NSW Office of Water (NOW)	• Briefing meeting (9 February 2012) • Project Update Meeting – Draft Groundwater and Surface Water Impact Assessment Report Discussion (7 November 2012)
Office of Environment and Heritage (OEH) (including Environment Protection Authority (EPA) and Heritage Branch)	• Project Briefing at Newcastle offices (2 February) • Offset Strategy Consultation Strategy with DP&I (3 May 2012) • Project Briefing (14 December 2012) • Project Update (19 February 2013) • Project Update (18 July 2013)
UHCMA	• Factsheets • Project Briefing in Muswellbrook (16 October 2012)
NSW Health - Hunter New England Health	• Offer of Project briefing (17 October 2012)
NSW Dam Safety Committee	• Project Briefing in Sydney (22 August 2012)
Catchment and Lands (Crown Lands Division)	• Project Briefing via telephone (5 December 2012)
Forestry NSW	• Project Briefing via telephone (10 August 2012)
Local Government Agencies	
MSC	• Initial briefing (January 2012) (Mayor and General Manager) • RTCA Newsletter with accompanying letter of offer for briefing (February 2012) (Councillors and officers) • Preliminary Consultation Meeting - discussion of DGRs (18 April 2012) • VPA discussion (4 December 2012) • Bengalla Link Road interactions (11 December 2012) • VPA discussions (May – July 2013)
Infrastructure and Service Providers and Other Mines	
Transport for NSW (including Centre for Transport Planning, Roads & Maritime Services (RMS))	• Offer of briefing (April 2012)
Mount Pleasant Project	• Regular Project discussions and interaction meetings 2009-2013
Relevant neighbouring mines and industry	• Coal & Allied community newsletter Muswellbrook edition



6.3 Issue Scoping

Stakeholder consultation was undertaken in accordance with existing engagement practices at Bengalla and the stakeholder engagement strategy developed for the Project, which had the following key objectives:

- Identification of potential stakeholders to engage with and the scoping of key issues to guide the Social Impact Assessment;
- Identification of major areas of concern and an appropriate level of engagement required for each stakeholder and assessment in the EIS;
- Integration of the stakeholder engagement for the Project with the management of ongoing community engagement as undertaken by BMC;
- Further development of landowner and community engagement;
- Ensure consistency of key messages with the adjacent Mount Pleasant Project; and
- The development of clear and consistent key messages for the Project that allow for effective engagement with all relevant stakeholders.

As indicated in **Table 20**, various consultation methods were adopted to identify stakeholder issues. These consultation methods are described in further detail below.

The outcomes of the stakeholder consultation were incorporated into the risk assessment conducted for the Project as presented in **Section 7**.

6.3.1 Community Engagement

EIS Project Briefings and Shopfront Information Days

EIS Project briefings were offered to neighbouring land owners and the wider local community via telephone, personal letters (for neighbouring land owners) and community newsletters. Near neighbours were provided a personal letter outlining the details of the Project and extending an invitation to attend one of the upcoming Project community information sessions.

Specific community information sessions were held at Coal & Allied's shopfront at 19 Bridge Street, Muswellbrook, from 9 am – 12 pm each Thursday in March 2012. The information sessions were designed to provide a Project Team member to which members of the community would find more readily accessible to meet and discuss the Project.

In total nine people attended the information sessions where they had the opportunity to meet and discuss potential concerns with key Project personnel.

Community Newsletters

Project community newsletters were distributed in relation to the Project from November 2011 to November 2012 and are reproduced in **Appendix E**.

A Project newsletter was distributed in November 2011 to familiarise stakeholders and the wider community with the Project and to provide information regarding time frames and the stakeholder consultation process. This newsletter was distributed to local, State and Commonwealth government agencies, neighbouring land owners and industries, the local Aboriginal community and 8,500 residents in the Muswellbrook LGA.

In October 2012 a 'Continuation of Bengalla Mine Project Update Newsletter' was developed for the Bengalla Community Open Day and distributed during this event.

Coal & Allied's regular community newsletter Muswellbrook edition also contained information about the status of the Project and was released to over 8,500 local receptors along with key regulators and community members. The Coal & Allied newsletter was released on the following dates:

- Issue 9 February 2012;
- Issue 10 July 2012;
- Issue 11 September 2012;
- Issue 12 December 2012; and
- Issue 1 March 2013.

In addition to the above, a BMC CCC newsletter was distributed to the local community surrounding Bengalla including:

- Racecourse Road and Sheppard Avenue;
- Neighbours from the intersection of Wybong Road / Kayuga Road along Wybong Road to 2 km past the intersection of Roxburgh Road / Wybong Road;
- Roxburgh Road; and
- Denman Road from the intersection of Racecourse Road to 5 km past the intersection of Denman / Edderton Road.

The BMC CCC newsletter contained information regarding the Project and was distributed to the above neighbours on the following dates:

- November 2011;
- February 2012;
- May 2012;
- August 2012; and
- November 2012.

Bengalla Community Open Day

On 27 October 2012, BMC conducted the biannual Bengalla Community Open Day. Members from the Project Team were present on the day and established an information stall to present the key components of the Project to interested community members including the Project description, EIS preparation and timing along with potential environmental, social and economic impacts (see **Plate 4**).

As discussed above a specific 'Bengalla Community Open Day Newsletter' (October 2012) was developed for distribution to community members on the day of the event. A copy of the 'Bengalla Community Open Day Newsletter' is included in **Appendix E**.

Other Miners and Industry

During key stages of the preparation of the EIS, members of the Project Team contacted adjacent mining operations, including Mt Arthur Coal Mine and Xstrata Mangoola, to inform them of the Project and to discuss any potential concerns or interactions. No issues were raised during the consultation program.

6.3.2 Regulator Engagement

As indicated in **Table 20**, a number of briefings and presentations were provided to Local, State and Commonwealth government agencies throughout the planning and preparation of this EIS. These consultations provided regulators with an understanding of the Project, some of the key findings from the technical studies and an overview of community stakeholder issues raised.

Plate 4 Bengalla Community Open Day



6.4 Issue Response

Following completion of the issue scoping phase, responses were provided for all issues raised by stakeholders in relation to the Project. A summary of the responses to these issues is provided in this section. These issues have all been incorporated in detail in the impact assessments undertaken for this EIS. Strategies for the management and mitigation of these issues are also detailed in this EIS. Where possible, specific issues raised by stakeholders in relation to the Project were addressed directly with the relevant stakeholders.

6.4.1 Director-General's Environmental Assessment Requirements

Department of Planning & Infrastructure

In response to the regulatory consultation undertaken for the Project, the Director-General of the DP&I issued DGRs for the Project (SSD-5170) on 13 March 2012. Supplementary DGRs were issued on 12 July 2012 to address issues from SEWPaC. The DGRs are provided in full at **Appendix D**.

Table 21 outlines the DGRs and the section of the EIS which corresponds to each requirement.

Table 21 Director-General's Environmental Assessment Requirements

Issue	Description	EIS Section
General Requirements	The Environmental Impact Statement (EIS) for the development must meet the form and content requirements in Clauses 6 and 7 of Schedule 2 of the <i>Environmental Planning and Assessment Regulation 2000</i> .	-
	In addition, the EIS must include a: - Detailed description of the development, including: - Need for the proposed development; - Justification for the proposed mine plan, including efficiency of coal resource recovery, mine safety and environmental protection; - Likely staging of the development - including construction, operational stage/s and rehabilitation; - Likely interactions between the development and existing, approved and proposed mining operations in the vicinity of the site, particularly the approved but not yet operational Mt Pleasant mine and the Mt Arthur mine; - Plans of any proposed building works; - Forecast coal volumes and train movements.	4 and 10
	Consideration of all the relevant environmental planning instruments, including identification and justification of any inconsistencies with these instruments.	5
	Risk assessment of the potential environmental impacts of the development; including key issues for further assessment.	7
	- Detailed assessment of the key issues (see below) and any other significant issues identified within the risk assessment, which includes: - A description for the environment using sufficient baseline data; - An assessment of the potential impacts of all stages of the project including any cumulative impacts taking into consideration relevant guidelines, policies plans and statutes; and - A description of the measures that would be implemented to avoid, minimise and if necessary offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage any significant risk to the environment.	8
	A consolidated summary of all the proposed environmental management and monitoring measure, highlighting commitments included in the EIS.	9
Key Issues	Land Resources – including an Agricultural Impact Statement and a detailed assessment in of the potential impacts on: - Soils and land capability (including salination and contamination); - Landforms and topography, including steep slopes; and - Land use, including agricultural, forestry, conservation and recreational use, with particular attention on viticulture and equine industries.	8.19 and 8.20
	Water Resources – including: - Detailed assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including: - Detailed modelling of potential groundwater impacts, including any potential impacts on the alluvial aquifers of the Hunter River and confirmation of the physical extent of the river's alluvium; - impacts on affected licensed water users and basic landholder rights; - impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows; - details and staging for the proposed Dry Creek re-diversion; and - a flood assessment including identification of any necessary flood impact mitigation measures; - A detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume, salinity and frequency of any water discharges), water supply infrastructure and water storage structures; - An assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; - Assessment of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources; - Identification of any licensing requirements or other approvals under the <i>Water Act 1912</i> and/or <i>Water Management Act 2000</i>; - Demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP); - A description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo; - A detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts; and - Compliance with the Hunter River Salinity Trading Scheme.	8.6 and 8.7

Issue	Description	EIS Section
Key Issues	• Biodiversity – including: – Measures taken to avoid, reduce or mitigate impacts on biodiversity; – Accurate estimates of proposed vegetation clearing; – A detailed assessment of potential impacts of the development on any: • Terrestrial or aquatic threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems; and • Regionally significant remnant vegetation, or vegetation corridors; and – a comprehensive offset strategy to ensure the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term;	8.11
	• Heritage – including: – An Aboriginal cultural heritage assessment (including both cultural and archaeological significance) which must: • Demonstrate effective consultation with Aboriginal communities in determining and assessing impacts and developing and selecting mitigation options and measures; and • Outline any proposed impact mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures).	8.9
	– A historic heritage assessment (including archaeology) which must: • Include a statement of heritage impact (including significance assessment) for any State significant or locally significant heritage items; and • Outline any proposed mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures).	8.10
	• Air Quality – including a quantitative assessment of potential: – Construction and operational impacts, with a particular focus on dust emissions (including PM_{2.5} and PM₁₀ emissions and dust generation from coal transport), as well as diesel and blast fume emissions; – Reasonable and feasible mitigation measures to minimise dust, diesel and blast fume emissions, including evidence that there are no such measures available other than those proposed; and – Monitoring and management measures, in particular real-time air quality monitoring.	8.1
	• Greenhouse Gases – including: – A quantitative assessment of potential Scope 1, 2 and 3 greenhouse gas emissions; – A qualitative assessment of the potential impacts of these emissions on the environment; and – An assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency.	8.2
	• Noise, Vibration & Blasting – including a quantitative assessment of potential: – Construction, operational and off site transport noise impacts; – Blasting impacts on people, livestock and property; – Reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed; and – Monitoring and management measures, in particular real-time, attended noise monitoring and predictive meteorological forecasting;	8.3 and 8.4
	• Traffic & Transport – including: – Accurate predictions of the road and rail traffic generated by the project; – A detailed assessment of the potential impacts of the development on the capacity, efficiency and safety of the: • Local and regional rail network, having regard to the strategic objectives and cumulative impacts for the passenger and freight rail network; and • Local and regional road network, with particular regard to a cumulative traffic impact assessment; condition assessment of the existing network; proposed new road infrastructure; and impacts of coal trains on level crossing operations. – Details of mine to port or other domestic customer transport movements, train path availability and any required rail infrastructure works; and – A detailed description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road and rail networks in the surrounding area over the life of the project; – Details of the existing interactions with and potential opportunities to join inter-mine arrangements for maintenance and/or upgrade of public roads, particularly Thomas Mitchell Drive; and – Details of interactions with the approved rail corridor for Mt Pleasant mine.	8.13
	• Visual – including: – A detailed assessment of the: • changing landforms on the site during the various stages of the project; and • potential visual impacts of the project on private landowners in the surrounding area as well as key vantage points in the public domain, including lighting impacts; and – A detailed description of the measures that would be implemented to minimise the visual impacts of the project.	8.5

Issue	Description	EIS Section
Key Issues cont'	• Waste – including: – Accurate estimates of the quantity and nature of the potential waste streams of the development, including tailings and coarse reject; – A tailings and coarse reject disposal strategy; and – A description of measures that would be implemented to minimise production of other waste and ensure that that waste is appropriately managed.	8.17
	• Hazards – including bushfires.	8.16
	• Social & Economic – including an assessment of the: – Potential direct and indirect economic benefits of the project for local and regional communities and the State; – Potential impacts on local and regional communities, including: • increased demand for local and regional infrastructure and services (such as housing, childcare, health, education and emergency services); and • impacts on social amenity; – A detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the project, including any infrastructure improvements or contributions and/or voluntary planning agreement or similar mechanisms; and – A detailed assessment of the costs and benefits of the development as a whole and whether it would result in a net benefit for the NSW community; and	8.14 and 8.15
	• Rehabilitation – including the proposed rehabilitation strategy for the site, having regard to the key principles in the Strategic Framework for Mine Closure, including: – Rehabilitation objectives, methodology, monitoring programs, performance standards and proposed completion criteria; – Nominated final land uses and land forms, having regard to any relevant strategic land use planning or resource management plans or policies; and – The potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.	8.21
Plans and Documents	The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Schedule 1 of the <i>Environmental Planning and Assessment Regulation 2000</i> . These documents should be included as part of the EIS rather than as separate documents.	Appendix C
References	The assessment of the key issues listed above must take into account relevant guidelines, policies and plans as identified. While not exhaustive, Attachment 1 contains a list of some of the guidelines, policies and plans that may be relevant to the environmental assessment of this development.	12
Consultation	During the preparation of the EIS, you must consult with relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with the: • Commonwealth Department of Sustainability, Environment, Water, Population and Communities; • Office of Environment and Heritage (including the Environment Protection Authority and the Heritage Branch); • Division of Resources and Energy within the Department of Trade and Investment, Regional Infrastructure and Services; • Department of Primary Industries (including the NSW Office of Water; NSW Forestry, Agriculture and Fisheries sections; Catchments and Lands (Crown Lands Division)); • Transport for NSW (including the Centre for Transport Planning, Roads and Maritime Services); • NSW Health; • ARTC and coal chain operators including Railcorp, Newcastle Ports Corporation and the Hunter Valley Coal Chain Co-ordinator; • Dams Safety Committee; • Hunter-Central Rivers Catchment Management Authority; and • Muswellbrook Shire Council. The EIS must describe the consultation process and the issues raised and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	6
Further consultation after 2 years	If you do not lodge a DA and an EIS for the development within 2 years of the issue date of these DGRs, you must consult further with the Director-General in relation to the requirements for lodgement.	N/A

Regulatory Submissions to DGRs

Submissions to the DP&I were received from the following regulatory agencies:

- Transport for NSW – Roads and Maritime Services (RMS);
- NSW Department of Primary Industries – Fisheries;
- NSW Department of Primary Industries – Office of Agricultural Sustainability and Food Security;
- NSW Department of Primary Industries – Crown Lands;
- NOW;
- NSW Environment Protection Authority (EPA);
- DTIRIS - DRE;
- MSC; and
- SEWPaC.

The issues raised by each of the above mentioned regulatory agencies and where they have been addressed in this EIS are included in **Appendix D** and in individual technical appendices.

6.4.2 Regulatory Consultation Responses

Arising throughout the duration of the stakeholder engagement program, including at project briefings or other meetings, a number of issues were raised by regulatory agencies that were not specifically raised in their submissions to the DGRs. All issues raised were addressed by BMC or the relevant technical specialist and incorporated into the impact assessments undertaken as part of this EIS.

Table 22 Regulatory Stakeholder Issues

Regulator	Issue Raised	EIS Section
DP&I	Dry Creek interim diversion and realignment	4.9, 8.6 and 8.21.7
	Cumulative noise and dust generation	8.1 and 8.3
	Ecological offsetting	8.11.4
	Rehabilitation and mine closure	8.21
	VPA with MSC	5.2.11, 6.11 and 8.14
	Legislative requirements and EIS process	5 and Figure 26
DTIRIS – Primary Industries (Agriculture)	Agricultural impacts and final land use	8.20
	Soil testing, results and management	8.19
	Rehabilitation objectives and topsoil management	8.21
	Leasing arrangements regarding agricultural land	8.20
DTIRIS – DRE	Land ownership	2.5
	Regional geology including Project reserves and exploration	2.7
	Project infrastructure requirements	4
	Project mine plan progression and timing	4.3
	Rehabilitation and final landform	8.21
	Dry Creek interim diversion and realignment	4.9, 8.6 and 8.21.7

Table 22 outlines the regulatory stakeholder issues raised and the section of the EIS where each is addressed.

6.4.3 Community Responses

A range of environmental and social issues were raised by neighbouring land owners and the wider local community during the stakeholder engagement program. The issues that were most commonly raised broadly related to:

- EIS process;
- Zone of impact;
- Interactions with the Mount Pleasant Project;
- Diversion and reinstatement of Dry Creek;
- Noise and blasting impacts;
- Air quality impacts;
- Traffic and transport;
- Cumulative environmental impacts; and
- Economic / social impacts.

As described above in **Section 6.1**, consultation with both regulatory and community stakeholders has been completed throughout the preparation of this EIS. A number of key changes to the Project we have made in response to this consultation.

A discussion in relation to the Project changes as a result of consultation is included as part of the alternative considered for the Project (see **Section 4.13**).

Table 23 outlines the community stakeholder issues raised and the section of the EIS where each is addressed.

Regulator	Issue Raised	EIS Section
DTIRIS – DRE - con't	Dry Creek realignment alternatives considered	4.13.9
	Renewal of the existing MOP	3.2
	Mining authorisations required for the Project	5
	Interactions with the Mount Pleasant Project and associated mining authorisations	4.12
	Ecological offsetting using the Upper Hunter Strategic Assessment process	8.11.4
	Western OEA	4.5
Dams Safety Committee	Existing and proposed water management system	4.8 and 8.6
	Dam design parameters and flooding particularly associated with CW1	4.8 and 8.6
MSC	Rehabilitation, final void and final landform design	8.21
	Interactions with the Mount Pleasant Project	4.12
	Visual impacts and screening	8.5
	Local council plans and policies	5.6
	Ecological impacts and associated offset strategy	8.11
	Cumulative road impacts and regional road upgrades	8.13
	VPA with MSC in relation to social impacts	5.2.11, 6.11 and 8.14
	Dry Creek interim diversion and realignment	4.9, 8.6 and 8.21.7
	Bengalla Link Road realignment	4.7 and 8.13
NOW	Dam design and flooding	4.8 and 8.6
	Water extraction and licensing	5.44, 8.6 and 8.7
	Dry Creek interim diversion and realignment	4.9, 8.6 and 8.21.7
	Impacts to GDEs	8.11 and 8.12
	OEA seepage water quality	8.8
	Post-mining groundwater quality	8.7
EPA	Dry Creek interim diversion and realignment	4.9, 8.6 and 8.21.7
	Final void and final landform design	8.21
	Dam design and flooding	4.8 and 8.6
	Ecological offsetting using the Upper Hunter Strategic Assessment process	8.11.4
	Air quality and noise assessment and management measures	8.1 and 8.3
	Site water balance	8.6
SEWPac	"Controlled action" referral	5.8.1
	Impacts to federal listed species (separate from state listed species)	8.11.3
	Principles of ecological offsetting	8.11.4
Forests NSW	Proximity to National Parks and State Forests	8.11
UHCMA	Consideration of UHCMA policies	8.11
	Remediation of local waterways	
	Ongoing liaison with UHCMA in relation to remediation works	

Table 23 Community Stakeholder Issues

Ref	Issue Raised	EIS Section
1	EIS process	
a	Consultation process	This Section
b	EIS approvals process and lodgement	Figure 26
2	Zone of impact	
a	Extent of the zone of affectation and management areas	8.1 and 8.3
3	Interactions with the Mount Pleasant Project	
a	Project overlapping with the Mount Pleasant Project	4.12
b	Interacting mining authorities	5.4.1
4	Diversion and reinstatement of Dry Creek	
a	Interim diversion of Dry Creek	4.9, 8.6 and 8.21.7
b	Use of CW1 for the Mount Pleasant Project	4.12
c	Options considered for the realignment of Dry Creek	4.13.9
d	Loss of catchment area	8.6
5	Noise and blasting impacts	
a	Predicted noise and blasting impacts	8.3 and 8.4
b	Night time blasting	8.4
6	Air quality Impacts	
a	Air quality monitoring	8.1
b	Cumulative air quality impacts	
7	Traffic and transport	
a	Assessment of forecast traffic movements	8.13
8	Cumulative environmental impacts	
a	Air quality	8.1.3
b	Traffic - intersection performance	8.13.3
9	Economic / social impacts	
a	Property devaluation in the local area	8.14
b	Mining impacts on lifestyle	

6.5 Aboriginal Community Consultation

Aboriginal community consultation for the Project was conducted by Hansen Bailey and AECOM Australia Pty Ltd (AECOM) in accordance with the 'Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010' (DECCW, 2010a) (Aboriginal Consultation Requirements).

The Aboriginal community consultation program consists of the following components:

- Stage 1 - Notification and registration;
- Stage 2 - Project information;
- Stage 3 - Survey methodology and fieldwork; and
- Stage 4 - Draft Aboriginal Archaeological and Cultural Heritage Assessment review.

A summary of the Aboriginal community consultation for the Project is described below.

6.5.1 Stage 1 - Notification and Registration

Consultation with Regulatory Agencies

Section 4.1.2 of the Aboriginal Consultation Requirements requires the proponent to consult with the following agencies for the purpose of identifying Aboriginal people who may hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects or places within the Study Area:

- OEH;
- NSW Department of Aboriginal Affairs – Office of the Registrar;
- Hunter-Central Rivers Catchment Management Authority;
- MSC;
- Native Title Services;
- National Native Title Tribunal; and
- Wanaruah Local Aboriginal Land Council (WLALC).

On 27 February 2012, these agencies were consulted via a letter seeking assistance in identifying potentially interested Aboriginal stakeholders.

On 28 February 2012, the Department of Aboriginal Affairs – Office of the Registrar indicated that there are no Registered Aboriginal Owners (under Division 3 of the *Aboriginal Land Rights Act 1983*) of the land within the Project Boundary. OEH responded on 29 February 2012 by providing a list of 47 stakeholder groups. On 29 February 2012, National Native Title Tribunal responded by providing the results of a native title search, however no additional Aboriginal stakeholders were identified. On 6 March 2012, WLALC provided a list of 32 stakeholder groups. WLALC also expressed an interest in being consulted as part of this assessment.

On 29 March 2012, MSC responded by providing a list of 35 stakeholders. Hunter-Central Rivers Catchment Management Authority advised in a letter dated 30 March 2012 that it would not be providing the details of any Aboriginal stakeholders. Native Title Services responded by email on 10 April 2012, indicating that it could not release the details of any stakeholder groups due to privacy reasons.

Public Notification

Section 4.1.3 of the Aboriginal Consultation Requirements requires that a project must be advertised in the local newspaper. In accordance with this requirement, the Project was advertised in the Muswellbrook Chronicle on 17 February 2012 and the Hunter Valley News on 22 February 2012.

The notice invited Aboriginal stakeholders to express an interest in being consulted as part of the Aboriginal Cultural Heritage Impact Assessment. In accordance with Section 4.1.4 of the Aboriginal Consultation Requirements the registration period extended for 14 days to the 7 March 2012.

Five Aboriginal stakeholder groups responded to the public notice and were duly accepted as participants in the consultation program for the Aboriginal Cultural Heritage Impact Assessment.

Following the correspondence from the agencies and the newspaper notifications a total of 53 Aboriginal stakeholder groups were identified to be consulted for the Project.

Invitations for Expressions of Interest

In accordance with Section 4.1.3 of Aboriginal Consultation Requirements on 19 March 2012, a letter inviting expressions of interest was sent to all Aboriginal stakeholders identified by the regulatory agencies. A total of 53 Aboriginal stakeholders were invited to register an interest in being consulted as part of the Aboriginal cultural heritage impact assessment. The closing date for expressions of interest was 2 April 2012, which provides the necessary 14 day period for expressions of interest.

The draft methodology for the archaeological survey component of this Aboriginal Cultural Heritage Impact Assessment was also attached to this letter and stakeholders were invited to comment on the methodology. Comment on the draft survey methodology was sought by the 16 April 2012. Additional comments in relation to the consultation conducted for the survey methodology is provided in Section 6.5.3.

This letter also advised all stakeholders that there would be a planning meeting held at Bengalla on 4 April 2012 to discuss the Project, consultation process and the proposed archaeological survey methodology.

By the closing date for expressions of interest (2 April 2012), 12 stakeholder groups had expressed an interest in the Project. To enable sufficient time to respond to the personalised registration letter the period for expressions of interest was extended until after the onsite planning meeting held on 4 April 2012. This enabled an additional four groups registered an interest on 3 April 2012 and a further four groups registered an interest in person at the planning meeting.

A total of 28 groups registered as part of the Aboriginal Cultural Heritage Impact Assessment following responses to the public notice, personalised expression of interest letter and onsite planning meeting (see Table 24).

Table 24 Registered Aboriginal Parties

Ref	Group Name
1	Aliera French Trading
2	Bawurra Consultants
3	Breeza Plains Culture and Heritage Consultants
4	Bunda Consultants
5	Cacatua Cultural Consultants
6	DFTV Enterprises
7	Deslee Talbott Consultants
8	Gidawaa Walang Cultural Heritage Consultancy
9	Hunter Valley Aboriginal Corporation
10	Hunter Valley Cultural Surveying
11	Indigenous Outcomes
12	Kauwul (trading as Wonn1 Contracting)
13	Kawul Cultural Services
14	Myland Cultural & Heritage Group
15	Ngarramang-Kuri Aboriginal Culture & Heritage Group
16	Roger Noel Matthews Consultancy
17	Ungooroo Aboriginal Corporation
18	Upper Hunter Heritage Consultants
19	Upper Hunter Wonnarua Council
20	Waabi Gabinya Cultural Consultancy
21	Wallangan Cultural Services
22	Wanaruah Local Aboriginal Land Council
23	Warragil Cultural Services
24	Warul Consultants
25	Wattaka Wonnarua Culture Consultants
26	Widescope Indigenous Group Pty Ltd
27	Wonnarua Culture Heritage
28	Yinarr Cultural Services

Two further stakeholders expressed an interest in this assessment after the registration closure date on 11 April 2012 including Greg Griffiths and T&G Culture Consultants. Both Greg Griffiths and T&G Culture Consultants were incorporated into the consultation program for the Project.

Notification of Registered Aboriginal Stakeholders

In accordance with Section 4.1.5 of the Aboriginal Consultation Requirements the expression of interest letter dated 19 March 2012, advised that contact details would be forwarded to OEH and WLALC unless they stipulated that they did not want their details distributed.

In accordance with Section 4.1.6 of the Aboriginal Consultation Requirements, the details of registered Aboriginal parties (RAPs) stakeholders were provided to OEH and WLALC on 30 April 2012.

- A copy of the public notice placed in the Muswellbrook Chronicle and Hunter Valley News;
- A copy of the letter inviting expressions of interest, sent to all Aboriginal stakeholders on 19 March 2012; and
- A record of RAPs whom have registered for consultation as part of the Aboriginal cultural heritage impact assessment.

6.5.2 Stage 2 - Project Information

Planning Meeting

In order to satisfy Sections 4.2.1 and 4.2.2 of the Aboriginal Consultation Requirements, a planning meeting was held on site at Bengalla on 4 April 2012. The purpose of the planning meeting was to:

- Present a detailed briefing about the Project;
- Discuss the draft survey methodology and the nature and scope of the assessment;
- Outline the EIS process;
- Specify critical timelines and milestones for the completion of assessment activities and delivery of reports;
- Clearly define agreed roles, functions and responsibilities in relation to Aboriginal consultation;
- Identify, raise and discuss the RAPs cultural concerns, perspectives and assessment requirements (if any) and provide contact details should any individual discussions be required; and
- Provide a forum in which cultural knowledge of the land within the Project Boundary can be discussed.

A total of 24 Aboriginal stakeholders attended the planning meeting.

6.5.3 Stage 3 - Survey Methodology and Fieldwork

Methodology

In accordance with Section 4.3.1 of the Aboriginal Consultation Requirements, the proposed methodology for the archaeological survey was provided to registered stakeholders accompanying the letter dated 19 March 2012.

The methodology letter provided a description of the Project, previous Aboriginal impact assessments and context, results from a desktop assessment along with the proposed archaeological survey methodology for the Project.

All Aboriginal stakeholders were encouraged to provide comments and raise any concerns in relation to the draft methodology or cultural heritage issues either in writing, during the planning meeting or during any stage of the consultation process.

Five stakeholder groups provided a response to the draft archaeological survey methodology including:

- Breeza Plains Culture and Heritage Consultants;
- DFTV Enterprises;
- Gidawaa Walang Cultural Heritage Consultants;
- Ungooroo Aboriginal Corporation; and
- Cacatua Culture Consultants.

All of these groups agreed with the content in the draft methodology (see **Section 8.9**).

Archaeological Survey

All Aboriginal stakeholders that had registered an interest prior to the planning meeting were offered the opportunity to participate in an archaeological survey of the land within the Project Boundary. All 28 registered stakeholder groups accepted the offer of participating in the archaeological survey.

As explained in the methodology, it was estimated that three weeks would be needed to survey the entire area within the Project Boundary outside the Approved Bengalla Mine. Due to the large number of groups involved in the assessment, the 28 groups involved in the archaeological survey were divided equally into three working groups. Each working group was allocated to one week of the archaeological survey. All stakeholder groups were asked to nominate an archaeological survey representative and to indicate the weeks that their representative would be available to undertake archaeological survey.

Each of the 28 stakeholder groups was provided the opportunity to select a one of the three working groups according to the availability of their archaeological survey representative. The final allocations for the 28 groups are shown in **Table 25**.

Each Aboriginal group was personally contacted by phone and / or email to confirm dates representatives were required in the field, request insurances and to provide other logistics. The archaeological survey was then scheduled for the three weeks from 14 May 2012 to 1 June 2012 and consisted of the following:

- Working Group 1 (14 May 2012 – 18 May 2012);
- Working Group 2 (21 May 2012 – 25 May 2012); and
- Working Group 3 (28 May 2012 – 1 June 2012).

The third week of archaeological survey was scheduled for the working week from 28 May 2012 to 1 June 2012. Due to inclement weather, the final three days of archaeological survey were postponed until the following week. That is, the archaeological survey originally scheduled for the three days from 30 May to 1 June 2012 was undertaken on 4 – 6 June 2012.

An additional one day of fieldwork was conducted on the 15 August 2012 by representatives present from AECOM, Global Soils Systems and BMC in conjunction with Aboriginal stakeholders representing Gidawaa Walang Cultural Heritage Consultancy and Wallangan Cultural Services. The purpose of the additional survey fieldwork was to determine the nature and origin of four potential scar trees identified within the Project Boundary. Results from the assessment are discussed further in **Section 8.9**.

6.5.4 Stage 4 - Draft Aboriginal Archaeological and Cultural Heritage Assessment Review

The draft Aboriginal Cultural Heritage Impact Assessment was issued to all 30 RAPs on 9 October 2012. Responses to the assessment were provided by 14 Aboriginal groups. A summary of the responses is provided below. The reviews of the assessment can be seen in full in **Appendix M**.

Stakeholder Responses

Of the 14 responses received on the draft report, seven Aboriginal stakeholder groups agreed with the content of the report and did not wish to make further comment. A further three groups, when contacted, stated they did not wish to make comment. A written response was provided from four Aboriginal stakeholder groups with the responses summarised below.

- WLALC highlighted the importance of land within the Project Boundary to Aboriginal people. In addition, the WLALC made several recommendations which are summarised below:
 - That the 'Management Recommendations' in the draft assessment be correctly titled "Consultant's Management Recommendations";
 - That the recommendations be included in the assessment under Aboriginal community Recommendations;
 - An Aboriginal cultural surface and subsurface investigation be conducted by and in consultation with the Aboriginal community;
 - That the Aboriginal community be given employment opportunities in all areas of the Project mining process through Aboriginal specific traineeships and employment programs or alike;
 - That the proponent funds the building of a Keeping Place, learning centre and 50 ha cultural heritage offset area be established for the Aboriginal Community; and
 - That BMC provides an annual financial contribution for the life of the mine to a trust for Aboriginal employment, education programs and health services in the Upper Hunter.
- Kauwul requested a particular individual be consulted and to participate in the site salvage and the inspection and decision-making process with regard to the scarred trees;

Table 25 Archaeological Survey Fieldwork and Participants

Working Group	Survey Period	Stakeholder Group
1	14 May 2012 – 18 May 2012	Roger Noel Matthews
		Indigenous Outcomes
		Myland Cultural and Heritage Group
		Upper Hunter Heritage Consultants
		Wonnarua Culture Heritage
		Bawurra Consultants
		Bunda Consultants
		Yinarr Cultural Services
		Ngarramang-Kuri Aboriginal Culture and Heritage Group
2	21 May 2012 – 25 May 2012	Kawul Cultural Services
		Warragil Cultural Services
		Breeza Plains Culture and Heritage Consultants
		Gidawaa Walang Cultural Heritage Consultancy
		Cacatua Culture Consultants
		Wallangan Cultural Services
		Upper Hunter Wonnarua Council
		DFTV Enterprises
		Deslee Talbott Consultants
		Hunter Valley Cultural Surveying
3	28 May 2012 – 1 June 2012 & 4 – 6 June 2012	Hunter Valley Aboriginal Corporation
		Widescope Indigenous Group
		Kauwul
		Wanaruah Local Aboriginal Land Council
		Aliera French Trading
		Waabi Gabinya Culture Consultants
		Cacatua Culture Consultants
		Upper Hunter Wonnarua Council
		Wallangan Cultural Services
		Gidawaa Walang Cultural Heritage Consultancy

- HVAC stated that they did not wish to make specific comment however supported the views of the WLALC; and
- DFTU Enterprises commented that land surveyed during the second week of the survey was densely covered with pasture grass which lowered surface visibility and limited the potential to identify evidence of surface archaeological materials.

As discussed in **Section 6.1.1**, BMC (through Coal & Allied contribute to the Coal & Allied ACDF where more than \$3.05 M has been provided to education, training, community and business development projects benefiting the Hunter Valley Aboriginal community since its inception in 2006.

BMC will continue to support the Coal & Allied ACDF to help deliver long term sustainability to Aboriginal business and programs in the Hunter Valley.

Details of proposed mitigation and management strategies of all sites will be included as part of the revised Aboriginal Cultural Heritage Management Plan (ACHMP) to be prepared following approval of the Project. The ACHMP will be developed in consultation with all RAPs. All RAPs will be provided the opportunity to be involved in the proposed surface collection (see **Section 8.9.4**). All other comments have been considered in the final Aboriginal Cultural Heritage Impact Assessment in **Appendix M**.

6.6 Ongoing Stakeholder Engagement

BMC is committed to continuing its stakeholder engagement program throughout the life of the Project. Ongoing stakeholder engagement will include regular contact with neighbouring land owners, representatives of key local and State regulatory authorities and industry bodies and the release of information on the status of the Project, key Project issues and environmental performance.

Project information sheets will be distributed upon the submission of this EIS to provide an update on this EIS process and where this EIS may be viewed by the public.

Mechanisms that will be employed by BMC to ensure effective ongoing engagement and communication with Project stakeholders will include:

- Regular engagement with individual near neighbours including the distribution of frequent newsletters and Project updates;
- Continuation of the established BMC CCC;
- Company representation on appropriate environmental and community groups;
- Ongoing distribution of the Coal & Allied Community Newsletter – Muswellbrook Edition;
- Continued regular consultation and working group meetings with Mount Pleasant Project personnel;
- Regular updates and documentation available on the Coal & Allied website; and
- Ongoing support and participation at relevant key community events.

Training of employees and contractors will be undertaken commensurate with each job description in relation to the commitments in this EIS and as part of the commitment to ongoing stakeholder consultation.

In addition, an Annual Review that summarises company activities and performance in the areas of environment and community will be prepared and made available to the public on the Coal & Allied website.





7

Risk Assessment

7.1 Revised Risk Assessment

The Background Document which supported the request for DGRs to DP&I included a preliminary risk assessment which identified potential environmental and socio-economic issues associated with the Project. The primary purpose of the risk assessment process was to prioritise and focus the required environmental and socio-economic impact assessments for the EIS.

Each of the environmental issues has been assessed and addressed to a relevant extent and where appropriate, management and mitigation options developed. Following stakeholder engagement and the receipt of the DGRs, a revision of this preliminary risk assessment was undertaken to incorporate additional requirements. The revised risk assessment is presented in full in **Appendix F**.

Each of the potential environmental issues was ranked in accordance with the RTCA HSEQ Risk Classification Matrix (see **Appendix F**) as being of low, moderate, high or critical risk. The risk rating allocated to an impact is dependent upon the probability of the impact occurring and the potential consequences should the impact materialise.

Table 26 summarises findings from the revised risk assessment which indicated that in the absence of controls several aspects associated with the Project potentially pose a high environmental risk. Many of the aspects were rated as high to moderate risk. No critical risks were identified.

Aspects identified as having a higher environmental impact risk ranking formed the primary focus of this EIS and were more intensively assessed. Aspects which have been identified as having a moderate to low risk were also assessed however a lesser scope of works was conducted for these secondary issues, based on their lower risk rating.

Table 26 Environmental and Socio-Economic Risk Rating

Critical	High	Moderate	Low
None	Air Quality	Greenhouse Gas	Hazardous (including bushfire)
	Noise	Surface Water	Waste
	Blasting	Geochemical	Flooding
	Visual and Lighting	Historical Heritage	Spontaneous Combustion
	Groundwater	Traffic and Transportation	
	Aboriginal Heritage	Agriculture	
	Ecology (Biodiversity)	Rehabilitation and Final Landform	
	Social	Soils and Land Capability	
	Economics		



8

Impacts, Management and Mitigation

This section provides a summary of potential environmental and social impacts from the Project and discusses the management and mitigation measures to be implemented. The issues have been prioritised in accordance with the DGRs and the risk assessment (in consideration of stakeholder engagement) described in Section 7.

8.1 Air Quality

8.1.1 Background

An Air Quality and Greenhouse Gas Impact Assessment was undertaken by Todoroski Air Sciences and is presented in **Appendix G**. The purpose of the assessment was to quantitatively predict and assess the air quality impacts at receptors in the vicinity of the Project and to recommend measures to account for and manage any impacts above the applicable criteria. The assessment comprised of a quantitative evaluation of potential air quality impacts of the Project and included:

- Meteorological and climatic conditions and the existing air quality conditions within the region;
- The air quality criteria applicable to the Project;
- Methods used to estimate dust emissions from the Project for selected future years representing key stages over the life of the Project;
- Predicted dust dispersion patterns due to emissions from the Project and cumulative impacts from other sources;
- An assessment of the predicted dust concentration and deposition levels with applicable criteria;
- Predicted blast fume emission patterns due to emissions from the Project;
- Predicted dust dispersion patterns from rail transport from the Project;
- Predicted diesel emissions resulting from the Project; and
- Management and mitigation measures, as required.

The greenhouse gas impact assessment component is summarised in **Section 8.2**.

Air quality modelling for the assessment was carried out in accordance with the *Approved Methods for the Modeling and Assessment of Air Pollutants in NSW* (Approved Methods) (DEC, 2005). These are the most contemporary guidelines in NSW for the modelling and assessment of air pollution sources using dispersion models.

Air Pollutants

Particulate matter is the air pollutant that is generated in the greatest quantity by mining operations. Particulate matter from mining predominantly consists of dust particles of varying sizes and compositions. TSP is the total mass of all particles suspended in the atmosphere. The upper limit of the size range for TSP is generally taken to be 30 micrometres (μm), since particles larger than 30 to 50 μm will settle out of the atmosphere too quickly to be regarded as air pollutants. TSP is commonly divided into two sub-components, namely PM_{10} and $\text{PM}_{2.5}$. The PM_{10} sub-component includes all particles with aerodynamic diameters of 10 μm or less. Similarly, the $\text{PM}_{2.5}$ sub-component includes all particulate matter with an aerodynamic diameter of 2.5 μm or less. Deposited dust is comprised of all particulate matter that settles out of the atmosphere onto the dust deposition gauge.

Assessment Criteria

Air quality criteria are benchmarks set to protect the health and amenity of the community. The air quality assessment criteria for particulate matter are presented in **Table 27**. These criteria are prescribed by the Approved Methods (DEC, 2005) and are thresholds for the cumulative dust generated by all sources, as opposed to dust generated by the Project alone. As a result, background levels need to be considered when using these criteria to assess potential impacts.

Table 27 Air Quality Particulate Matter Assessment Criteria

Pollutant	Criterion ($\mu\text{g}/\text{m}^3$)	Averaging Period	Agency
TSP	90	Annual average	National Health and Medical Research Council
PM_{10}	50	Maximum 24-hour average	EPA
	30	Annual average	EPA

Source: DEC, 2005

The criteria adopted by DP&I are identical to the Approved Methods criteria except for the PM₁₀ 24 hour (hr) criterion. DP&I has adopted a PM₁₀ 24-hr criterion of 50 micrograms per cubic metre (µg)/m³ for the Project alone.

In addition to possible health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. The criteria for dust deposition levels are imposed to protect against nuisance dust deposition impacts on a cumulative basis from all dust sources (DEC, 2005). The dust deposition criteria prescribed by Approved Methods are presented in **Table 28**.

The maximum acceptable increase in dust deposition over background dust levels is 2 g/m²/month. This is the maximum allowable dust deposition that can be generated by the Project alone (incremental). The maximum allowable dust deposition from all sources (cumulative) is 4 g/m²/month.

The OEH criteria are generally consistent with the National Environment Protection Measures (NEPM) for ambient air quality. In 2003, the National Environment Protection Council (NEPC) amended the NEPM to include advisory reporting standards for PM_{2.5}. The advisory reporting standards for PM_{2.5} are 25 µg/m³ for the maximum 24-hr average and 8 µg/m³ for the annual average. These advisory reporting standards under the NEPM have not been adopted by the NSW government as impact assessment criteria. The Upper Hunter Air Quality Monitoring Network station at Muswellbrook provided PM_{2.5} for the assessment. No PM1 was available and there are currently no impact assessment criteria or advisory standards for PM1.

The Project may also generate emissions of other air pollutants, including carbon monoxide (CO), nitrogen dioxide (NO₂) and sulphur dioxide (SO₂). The sources of these emissions are most likely to be diesel powered equipment used on site and blasting activities.

The Approved Methods impact assessment criteria for CO and NO₂ are presented in **Table 29**.

Background Air Quality

The main sources of particulate matter in the wider area of the Project include active mining, agricultural activities and emissions from local anthropogenic activities. A detailed review of existing monitoring data was undertaken to determine the existing background particulate matter concentrations and dust deposition levels in the surrounding area. The air quality monitoring network in the vicinity of the Project is illustrated in **Figure 11** and consists of:

- Seven Tapered Element Oscillating Microbalances (TEOMs), owned by HVEC and OEH, which monitor ambient PM₁₀;
- 10 HVAS, owned by BMC, which measure either TSP or PM₁₀;
- 29 dust deposition gauges owned by BMC; and
- Two OEH ambient air quality monitors (Muswellbrook and Beresfield), which are part of the Upper Hunter Valley Monitoring Network.

The review of the available monitoring data is provided in **Appendix G**.

The annual average PM₁₀ concentrations are generally below the Approved Methods criterion of 30 µg/m³. Minor exceedances of this criterion were measured at two of the BMC owned monitoring locations in 2009. Monitor PM1 is located near the Muswellbrook Racecourse and monitor PM2 is immediately to the south of Muswellbrook. There were a number of notable regional dust storms in 2009, which would have significantly contributed to the annual average concentrations.

Table 28 Air Quality Dust Deposition Assessment Criteria

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Levels (g/m ² /month)	Maximum Total Deposited Dust Levels (g/m ² /month)
Deposited Dust	Annual average	2	4

Source: DEC, 2005

Table 29 Air Pollutants Assessment Criteria

Pollutant	Averaging Period	Criterion
Carbon monoxide (CO)	15 minute	100 mg/m ³
	1 hr	30 mg/m ³
	8 hr	10 mg/m ³
Nitrogen dioxide (NO ₂)	1 hr	246 µg/m ³
	Annual	62 µg/m ³

Source: DEC, 2005

The recorded 24-hr average PM_{10} concentrations were generally below the Approved Methods criterion of $50 \mu\text{g}/\text{m}^3$. However, this criterion is occasionally exceeded at locations to the east and south of Muswellbrook.

The annual average TSP concentrations at all monitoring locations were below the Approved Methods criterion of $90 \mu\text{g}/\text{m}^3$. TSP concentrations are generally higher in spring and summer. During the warmer months, drier ground conditions give rise to increased potential for windblown dust and there are higher pollen levels and a greater risk of bushfires.

Cumulative annual average dust deposition levels at locations near Muswellbrook are generally below the Approved Methods criterion of $4 \text{ g}/\text{m}^2/\text{month}$. This criterion was exceeded at location D23A immediately west of Muswellbrook in 2007 and 2009. Dust deposition levels in nearby monitors were considerably lower than the criterion. This suggests that the elevated dust levels at D23A are due to a source near the monitor rather than operations at Bengalla.

NO_2 monitoring data collected from Beresfield and Muswellbrook monitors indicate that there were no exceedances of the Approved Methods 1-hour average and annual average goals, with readings of $246 \mu\text{g}/\text{m}^3$ and $62 \mu\text{g}/\text{m}^3$, respectively. The maximum 1-hour average concentrations are approximately $80 \mu\text{g}/\text{m}^3$ and annual average concentrations are approximately $16 \mu\text{g}/\text{m}^3$.

8.1.2 Methodology

Meteorological Modelling

Meteorological data were sourced from ten monitoring stations in the region:

- Bengalla weather station;
- Bengalla inversion tower;
- Mt Arthur Coal weather station (Macleans Hill);
- BoM Paterson (Tocal) weather station;
- BoM Scone Airport weather station;
- BoM Cessnock Airport weather station;
- BoM Williamtown RAAF weather station;
- BoM Nullo Mountain weather station;
- BoM Merriwa (Roscommon) weather station; and
- BoM Murrurundi Gap weather station.

Meteorological data from these sources were processed using the TAPM and CALMET modelling programs. The TAPM simulation involved 30 km, 10 km, 3 km and 1 km nesting grids with 35 vertical grid levels to create an upper air data file for use in CALMET. The CALMET modelling also used a nested approach where the three dimensional (3D) wind field from the coarser 3 km grid outer domain ($150 \times 150 \text{ km}$) is used as the starting field for the finer 0.3 km

grid inner domain ($30 \times 30 \text{ km}$) for each modelled year. Local land use and detailed topographical information, including proposed mine topography were also included in the model. This was done to consider any future local changes in the wind field that may arise due to the effects of the mining area.

The weather station data, land use and terrain data were used as inputs to the meteorological modelling to produce a three dimensional, hourly varying wind field of the entire area for a full year. This wind field was used in the subsequent air dispersion modelling. Further detail on the methodology used is provided in **Appendix G**.

Air Quality Modelling

The air quality dispersion modelling and assessment of air pollution sources has been undertaken in accordance with the Approved Methods. Dispersion models are used to predict concentrations of key pollutants at ground level receivers. This assessment employed the CALPUFF modelling package, which is approved by EPA.

Five modelling scenarios were considered in this assessment. The mine plans for Years 1, 4, 8, 15 and 24 were selected to represent the progression of the Project. These are the years in which the worst-case impacts are likely to occur due to the location of operations and the potential to generate dust. These five scenarios represent the range of potential impacts over the Project life and are indicative of worst-case scenarios.

For each of the modelling scenarios, dust emission estimates were calculated by analysing the types of dust generating activities taking place and applying suitable emissions factors. The emission factors were sourced from both local and United States Environmental Protection Agency (US EPA) documentation. These factors are considered the most applicable and representative factors for determining dust generation rates for the proposed activities (including drilling, blasting, hauling, handling, emplacing and grading of overburden, topsoil, rejects and/or product).

The effect of dust management measures have been considered in the calculation of dust emissions. The *Coal Mine Particulate Matter Control Best Practice Management Determination* (BMC 2012a) estimated that Bengalla was currently achieving a 75% reduction in dust emissions from haul roads. This study also stated that an 85% reduction in haul road dust could be achieved by implementing further dust controls.

The level of dust control on haul roads would vary depending on the number of water cart passes per hour. It was determined that at least 2.2 water carts will be required on a continuous basis. The Project will utilise up to seven water carts, which allows ample time for re-filling and maintenance. Therefore, the Project is capable of achieving the required level of control for haul road dust emissions. Detailed emissions estimation calculations are provided in **Appendix G**.

Cumulative Air Quality Assessment

In order to assess cumulative air quality impacts, the modelling considered emissions from approved mining operations in the vicinity of the Project (Mt Arthur Coal Mine, Mount Pleasant Project, Mangoola Coal Mine, Drayton Mine and Muswellbrook Coal Mine). Emissions estimates for these operations were obtained from publicly available air quality impact assessments. The proposed Drayton South Coal Project was also considered in the cumulative impact assessment, based on impact assessments which were publicly available at the time of the assessment. The Drayton South Coal Project is unlikely to contribute to cumulative dust levels with the Project due to the significant distance (approximately 16 km south) and the predominant wind direction in the area.

For the neighbouring Mount Pleasant Project, it has been conservatively assumed that construction activities will commence in Year 4, with coal extraction commencing in Year 8 of the Project and generally as described in the Mount Pleasant 1997 EIS. Despite the current Mount Pleasant DA 92/97 expiring in 2020, it has been assumed for the purposes of modelling that Coal & Allied would seek the relevant approval to enable future mining and as a result has been conservatively considered to be operational for the duration of the Project.

In order to assess worst case cumulative air quality impacts of Mt Arthur Coal Mine and Xstrata Mangoola operations, it has been conservatively assumed that these operations will continue until the end of the Project life at existing approved rates (which are greater than production levels currently occurring).

Table 30 summarises the anticipated TSP emissions for each of the nearby mining operations and how each operation has been incorporated into the Project cumulative air quality assessment. Other mining operations in the Hunter Valley will make a small contribution to cumulative dust levels. An allowance was made for these mining operations and other non-modelled dust sources in the Hunter Valley. The cumulative dust levels generated by the modelled sources were subtracted from actual monitored dust levels to determine the contribution from non-modelled sources.

The following contributions from non-modelled sources were determined:

- 5.0 µg/m³ for PM₁₀;
- 28.0 µg/m³ for TSP; and
- 1.7 g/m²/month for Dust Deposition.

Cumulative Sensitivity Analysis

As discussed in Section 2.4.1 following the completion of the Air Quality Impact Assessment, Mt Arthur Coal Mine and Mangoola submitted modifications to their respective approvals. As such, a cumulative sensitivity analysis was undertaken for the Project to determine the potential impacts arising from the proposed (but not yet approved) modifications to existing operations and approval periods. The cumulative assessment originally assumed Mt Arthur Coal Mine operating for the duration of the Project and emissions from Mangoola consistent with its existing approval.

Due to the distant location of the Drayton south Coal Project in relation to the Project (approximately 16 km south-west) along with consideration of the predominant wind patterns, the proposed development is unlikely to add any significant contribution to cumulative air quality impacts with the Project and as a result was not considered further in the sensitivity analysis. As a result of the sensitivity analysis, there were no additional private receptors predicted to be impacted as a result of the Project and currently proposed modifications that are not already located within an existing ZOA.

Results from the sensitivity analysis indicate that three receptors (110N, 110S and 106) and two vacant properties (109 and 111) would not be significantly impacted above the cumulative annual average PM₁₀ criterion if the Project were to consider Mt Arthur Coal Mine ceasing operations in 2026 as per the current modification (see Table 31).

Additional discussion in relation to the results of the cumulative air quality sensitivity analysis is presented in Appendix G.

Table 30 Estimated Emissions for Nearby Mining Operations

Mining Operation	Year 1	Year 4	Year 8	Year 15	Year 24
Mount Arthur Coal Mine	22,996,561	25,708,373	24,809,310	24,809,310	24,809,310
Mount Pleasant Project	-	2,362,500	4,250,000	5,250,000	6,300,000
Xstrata Mangoola	3,733,301	3,618,969	3,013,405	3,013,405	3,013,405
Drayton Coal Mine	5,168,196	3,225,173	-	-	-
Muswellbrook Coal Mine	972,967	-	-	-	-

Assessment of Diesel Emissions

An assessment was undertaken to predict NO₂ emissions caused by diesel combustion. The emissions from diesel powered equipment were estimated using manufacturer's data. The manufacturer's specifications expressed the total non-methane hydrocarbon and nitrogen oxides (NOx) emissions. In the absence of NO₂ emissions specifications, it has been conservatively assumed that NO₂ accounts for all non-methane hydrocarbon and NOx emissions. Dispersion modelling was performed using the CALPUFF model. The predicted impacts of the Project were added to measured background levels to determine the total impact. This modelling is considered to be conservative as the predicted emission rates are likely to be greater than actual.

Assessment of Blast Fume Emissions

Fume emission factors for blasting were determined using the available data from a Commonwealth Scientific and Industrial Research Organisation (CSIRO) study into blasting in the Hunter Valley (Attalla et al, 2008). Dispersion modelling was undertaken using the CALPUFF modelling package. Blasting was simulated for a full year for each hour of the day where blasting is permissible. This assessment assumed that blasting would not be undertaken under conditions that BMC's blasting protocols designate as being unsuitable for blasting.

Assessment of Emissions due to Coal Haulage

A study conducted by Katestone Environmental on behalf of Connell Hatch determined that the emissions factor for an uncovered train wagon was 9.6 g of TSP per km (Connell Hatch, 2008). This emissions factor was adopted for this assessment. The CAL3QHCR dispersion model, developed by the US EPA, was used to assess potential impacts during coal haulage. The assessment considered a range on wind speed and direction combinations relative to the rail line alignment.

8.1.3 Impact Assessment

Predicted Air Quality Impacts

Figure 31 illustrates the predicted worst case air quality contours for cumulative annual average TSP, PM₁₀ concentrations and maximum 24-hr average PM₁₀ concentrations (Project alone) and dust deposition relative to neighbouring properties. These contours represent the worst case air quality impacts over the Project life and were produced by consolidating the air quality contours for all the modelled years. Figure 31 shows the extent of air quality impacts relative to neighbouring private receptors. The results of the dispersion modelling indicate that the Project is predicted to contribute to exceedances of the air quality criteria at the privately owned receptors listed in Table 31. The impacts listed in Table 31 present the worst case year in the Project life.

Additionally, predicted impacts to mine owned receptors in each modelled year are presented in Appendix G.

The maximum 24-hr average PM₁₀ contour represents the PM₁₀ concentrations that are predicted to be experienced at any point, on the worst day of impact over the Project life. The proactive management of the operations utilising real-time monitoring equipment will reduce the likelihood that these maximum predicted levels occur due to the Project.

Operational Discussion

No exceedances of TSP or dust deposition criterion are predicted at any private receptor (which does not currently have a right to acquisition upon request by a mining company).

A total of 16 private receptors are predicted to experience exceedances of the maximum 24-hr average PM₁₀ criterion during the Project life. Systematic exceedances (more than 5 days in any year) are predicted to occur at seven of these receptors (i.e. 118, 155, 156S, 166, 168, 169 and 171). Of the receptors that are expected to experience systematic exceedances, only one receptor (156S) is not currently entitled to acquisition by other neighbouring mining developments. Receptors 29, 156W, 161, 222, 230 and 286 are expected to experience exceedances of this criterion, but not for more than 5 days in any year.

The cumulative annual average PM₁₀ criterion is expected to be exceeded at 17 receivers, 14 of which are currently entitled to acquisition by the Mount Pleasant Project, Mt Arthur Coal Mine or Xstrata Mangoola (see Table 31). Only receptors 106, 110N and 110S are not currently entitled to acquisition under existing development consents. At these receivers, the annual average PM₁₀ concentrations resulting from the Project alone are below the criterion.

In summary, the Project will impact four privately owned receptors that are not entitled to acquisition upon request by a mining company. Receptors 106, 110N, 110S and 156S are predicted to experience exceedances of the relevant assessment criterion.

Six additional properties owned by three landholders (109, 111 and 245/246/249/250) that are not currently subject to acquisition by another mining company are predicted to experience exceedances of the PM₁₀ annual average criterion over more than 25% of any contiguous land, under a single ownership.

As there are currently no impact assessment criteria for PM_{2.5}, the predicted PM_{2.5} concentrations were assessed using the NEPM advisory reporting standard. No privately owned receptors are predicted to experience annual average PM_{2.5} concentrations above the advisory reporting standard of 8 µg/m³.



FIGURE 31

Table 31 Summary of Predicted Air Quality Exceedances

Receiver ID	Receptor Name	PM ₁₀		TSP	Dust Deposition	
		24-hour	Annual	Annual	Annual	
		Project Alone (50 µg/m³) (Days per year above criteria)	Project and other sources (30 µg/m³)	Project and other sources (90 µg/m³)	Project Alone (2 g/m²/ month)	Project and other sources (4 g/m²/ month)
RECEIVERS						
29	Jabetin Pty Limited	57 µg/m³ - 1 day (Year 8)	-	-	-	-
106#	MJ & MJ Duncan	-	31 µg/m³ (Year 24)	-	-	-
110S#	GR & MK Walsh	-	32 µg/m³ (Year 24)	-	-	-
110N#	GR & MK Walsh	-	31 µg/m³ (Year 24)	-	-	-
112N*	MG & LJ Latham	-	31 µg/m³ (Year 24)	-	-	-
112S*	MG & LJ Latham	-	39 µg/m³ (Year 24)	-	-	-
113*	MG & LJ Latham	-	40 µg/m³ (Year 24)	-	-	-
114*^	JM Wild	58 µg/m³ - 1 day (Year 24)	41 µg/m³ (Year 24)	-	-	-
117*^	E Rankin	-	44 µg/m³ (Year 24)	94 µg/m³ (Year 24)	-	-
118*^	E & WJ Rankin	67 µg/m³ - 8 days (Year 24)	44 µg/m³ (Year 24)	93 µg/m³ (Year 24)	-	-
119*^	E & WJ Rankin	51 µg/m³ - 3 days (Year 24)	43 µg/m³ (Year 24)	92 µg/m³ (Year 24)	-	-
155*^	PG & CM Lane	59 µg/m³ - 6 days (Year 24)	-	-	-	-
156S^	NJ & RY Ellis	60 µg/m³ - 9 days (Year 24)	-	-	-	-
156E^	NJ & RY Ellis	52 µg/m³ - 2 days (Year 24)	-	-	-	-
161	RB & SA Parkinson	63 µg/m³ - 2 days (Year 24)	-	-	-	-
166*	BA & TE Strachan	92 µg/m³ - 44 days (Year 24)	32 µg/m³ (Year 24)	-	-	-
168*^	JB Moore	211 µg/m³ - 166 days (Year 24)	68 µg/m³ (Year 24)	147 µg/m³ (Year 24)	3.68 g/m²/ mth (Year 24)	5.5 g/m²/ mth (Year 24)
169*	JB Moore	88 µg/m³ - 57 days (Year 24)	32 µg/m³ (Year 24)	-	-	-
171*	BL & ML Bates	109 µg/m³ - 83 days (Year 24)	34 µg/m³ (Year 24)	-	-	-
222	JD Vandenberg	55 µg/m³ - 1 day (Year 24)	-	-	-	-
230	GC Sparre	80 µg/m³ - 3 days (Year 24)	-	-	-	-

Receiver ID	Receptor Name	PM ₁₀		TSP	Dust Deposition	
		24-hour	Annual	Annual	Annual	
		Project Alone (50 µg/m ³) (Days per year above criteria)	Project and other sources (30 µg/m ³)	Project and other sources (90 µg/m ³)	Project Alone (2 g/m ² /month)	Project and other sources (4 g/m ² /month)
252*	GM Casey	-	36 µg/m ³ (Year 24)	-	-	-
286	IJ & CM Richards	55 µg/m ³ - 1 day (Year 24)	-	-	-	-
292W*	DHH Macintyre	-	32 µg/m ³ (Year 8)	-	-	-
25% CONTIGUOUS PROPERTIES						
109#	EJ & CA Denton	N/A	Year 24	N/A	N/A	N/A
111#	GR & MK Walsh	N/A	Year 24	N/A	N/A	N/A
245, 246, 249 & 250	JS & NM Lonergan	N/A	Year 15 & Year 24	N/A	N/A	N/A
289*	KJ & GM Yore	N/A	Year 8	N/A	N/A	N/A

Note: N/A denotes no applicable criteria

*Denotes property is currently subject to acquisition by another mining company upon written request by the landowner.

Denotes property affected by cumulative impacts only if Mt Arthur Coal Mine seeks further approvals after 2026.

^ Affected by significant noise levels above relevant criteria by the Project (see Table 40 and Table 41).

No exceedances of the advisory reporting standard for the maximum 24-hour average PM_{2.5} concentration are predicted to occur at privately owned properties which do not already have a right to acquisition upon request have been predicted. Exceedances of the NEPM advisory reporting standards are listed in Table 34.

No exceedances of air quality criteria have been predicted for any other private receivers. Maximum predicted annual average and 24-hour average PM_{2.5} concentrations for all modelled receptors are presented in Appendix G.

Assessment of Total Cumulative 24-hr PM₁₀ Concentrations

The Approved Methods contemporaneous assessment method was applied to examine the potential maximum total (cumulative) 24-hr average PM₁₀ impacts for the Project. A two stage approach was adopted for the cumulative) 24-hr average PM₁₀ assessment.

The first stage of the analysis focused on six locations that were chosen to represent the sensitive receptors surrounding the Project. The chosen locations are located at each of the monitoring stations where accurate ambient monitoring data is available (see Appendix G). Where there was potential for higher impacts to occur than those presented in the first stage of the assessment, each individual receptor was examined further in detail and was individually assessed using the contemporaneous method.

The results indicated that there was a potential for exceedances of the PM₁₀ 24 hour criterion during Year 15 and 24 in the vicinity of monitoring location DC01 and possibly DC05 or PM₁₀-3 (where there was no available monitoring data).

As a result, a second stage detailed assessment of the potential cumulative 24-hr average impacts was conducted at each receptor in the vicinity of monitoring location DC01, DC05 and PM₁₀-3 (see Figure 31). The assessment in the vicinity of monitoring station DC01 used the measured background level at the nearest monitoring station (DC01) added with the predicted mine only incremental dust level at each receptor to determine the cumulative impact.

The results presented in Table 32 indicated that systemic exceedances (greater than five days of exceedance per year) of the maximum 24-hr average PM₁₀ criterion are predicted to occur at one private receptor in Year 24 of the Project.

Statistical Assessment of Cumulative 24-hr PM₁₀ Concentrations

A further assessment of the potential for cumulative 24-hr PM₁₀ impacts was conducted using a statistical approach. The cumulative air dispersion modelling assessment is conducted specifically to address the spatial and time varying effects of the background dust levels and also the addition of new emissions from proposed projects. This provides a realistic assessment of the potential cumulative impacts that may arise.

Ambient dust concentration data from five TEOM and one HVAS station operating in the area were used as reference locations for assessing the cumulative impact.

The probability of an observed background concentration occurring on a given day was calculated and weighted by the number of values in the dataset.

The result is a distribution of all possible combinations of background and predicted levels and the probability of these combinations occurring. On the basis of this data, the number of days per annum above the 24-hour average PM_{10} criterion of $50\mu g/m^3$ at the representative receptor locations, corresponding with background data from each of the existing monitoring sites was calculated. The results for each of the modelled years at each of the reference locations are presented in Table 33.

The results show that the probability of exceedance days at the reference locations largely depends on the location of the monitor relative to the mining activities. Overall, the assessment indicates conservatively, zero to six days of additional exceedance at the assessed locations with the exception of DC01 where up to 22 days of additional exceedance may arise. The statistically predicted impacts at the DC01 monitor arise largely as a result of the short-term modelling predictions as the mine progresses to the west in the later years.

Table 32 Contemporaneous Assessment of Cumulative PM_{10} 24-Hour Average Criterion

Representative Monitoring Location	Receptor ID	Receptor Name	Year 15	Year 24
DC01	106	MJ & MJ Duncan	0	0
	110S	GR & MK Walsh	0	0
	110N	GR & MK Walsh	0	0
DC05 or PM_{10-3}	152	MR Peel	0	5
	153	PR Ellis	0	3
	154	PSJ Murray	0	5
	156E	NJ & RY Ellis	0	4
	156W	NJ & RY Ellis	0	3
	161	RB & SA Parkinson	2	6
	180	JE & JL Lonergan	0	5
	184	JL Smith & KL Balmer	0	3
	186N	RB & SA Parkinson	0	2
	186S	RB & SA Parkinson	0	0

Note: Monitor DC05 has only limited data for the year, and similarly PM_{10-3} uses a HVAS with data available only every 6th day.

Table 33 Probability of PM_{10} 24-Hour Average Criterion

Monitoring Location	Year 1	Year 4	Year 8	Year 15	Year 24
DC01	0.1	0.1	0.2	4.3	22.3
DC02	0.3	0.3	0.3	0.3	0.3
DC03	0.1	0.1	0.1	0.1	0.1
DC04	0.0	0.0	0.0	0.0	0.0
DC05	0.0	0.0	0.0	0.0	0.0
PM_{10-3}	5.0	5.0	5.0	5.2	6.0

Note: Monitor DC05 has only limited data for the year and similarly PM_{10-3} uses a HVAS with data available only every 6th day.

Construction Activities

Construction activities associated with the Project were considered in the Air Quality Impact Assessment. The main dust emissions during the construction phase are caused by vehicles travelling on temporary access roads, handling of materials and wind erosion of exposed areas. Construction activities have been assumed to be completed by Year 4 of the Project to provide a worst case assessment. The Bengalla Link Road realignment and the Dry Creek reinstatement were considered during Year 13 and after Year 15 respectively. The assessment determined that any impacts caused by construction activities would be short and sporadic and that the total dust generated by construction is minor compared to operational dust emissions. As a result, construction activities are not expected to cause any discernible impacts above the predicted operational impacts.

Diesel Emissions

The model predictions indicate that annual average NO_2 concentrations will be below the criterion at all private receivers. The predicted 1-hr average NO_2 concentrations are also below the criteria at all private receptors in Years 1, 4, 8 and 15. The only predicted exceedance of the 1-hour average NO_2 criterion occurs at Receptor 168 in Year 24, where the concentration is predicted to be $272 \mu\text{g}/\text{m}^3$. Due to the conservative assumption that all non-methane hydrocarbon and NO_x emissions would be in the form of NO_2 and double counting of existing emissions in the background level, it is possible that the actual concentrations will be lower than the criterion of $246 \mu\text{g}/\text{m}^3$. Receptor 168 is currently subject to acquisition by Mt Arthur Coal Mine and the Mount Pleasant Project and is identified in Table 34 as being impacted as a result of the Project.

Table 34 Predicted Exceedances of $\text{PM}_{2.5}$ Advisory Reporting Standards

ID	Receiver	Maximum 24-hr Average ($25 \mu\text{g}/\text{m}^3$)	Annual Average ($8 \mu\text{g}/\text{m}^3$)
168*^	JB Moore	26	-

*Denotes property is currently subject to acquisition by another mining company upon request by the landowner.

^Property exceeds air quality criteria as presented in Table 31.

Diesel combustion also has the potential to cause emissions of CO. The background NO_2 levels are considerably lower than the assessment criteria for NO_2 . Based on the typical relationship between NO_2 and CO, it was determined that total CO levels would be below the relevant criteria.

$\text{PM}_{2.5}$ Emissions

There are currently no criteria applicable for $\text{PM}_{2.5}$ in NSW, however there are NEPM advisory reporting standards that apply to the exposure of the population as a whole, as assessed by monitoring at suitable NEPM 'performance monitoring sites'.

Therefore the NEPM criteria would not generally apply in the near proximity to coal mines, or near to other potentially large sources of particulate emissions. Despite the absence of suitable criteria, this assessment quantifies the approximate levels of $\text{PM}_{2.5}$ that may arise as a result of the Project.

An examination of the predicted $\text{PM}_{2.5}$ levels for the Project shows the total predicted contributions from the Project are small and generally only a few micrograms per cubic metre of air. The Project might therefore comprise approximately 40% of the levels shown. This would be the Project's addition to the existing environment and would be too small to discern in any practical sense.

Ambient $\text{PM}_{2.5}$ levels are likely to be governed by many minor non-mining background sources such as wood heaters and motor vehicles which cannot be reasonably modelled in small populations and rural areas furthermore there is little $\text{PM}_{2.5}$ monitoring data available for inclusion within a detailed assessment. The available $\text{PM}_{2.5}$ data collected at the Upper Hunter Air Quality Monitoring Network station at Muswellbrook was examined in the absence of Project specific data. The data show a trend of increasing $\text{PM}_{2.5}$ levels in the winter and reduced levels in the summer, whereas the PM_{10} levels do not show such a distinct seasonal trend.

Blast Fume Emissions

Blasting also has the potential to cause NO_2 emissions. This Air Quality Impact Assessment determined that blasting at 7:00 am, 4:00 pm and 5:00 pm could result in blast fume impacts to private receivers. These results indicate that meteorological conditions during these periods may be unfavourable and should be considered carefully prior to blasting. Blast fume impacts were also found to generally occur when wind speeds are less than 2 m/s.

As noted above, the modelling predictions for Year 24 indicate that Receptor 168 (subject to acquisition by another mining company upon request) may experience NO_2 levels of up to $272 \mu\text{g}/\text{m}^3$ in Year 24, which is slightly above the 1-hour average period criterion of $246 \mu\text{g}/\text{m}^3$. Total annual average impacts at this residence are below the relevant criterion. It may be the case that no actual impact occurs at Receptor 168 in practice, given the total cumulative impact predicted is relatively close to the criterion and the modelling predictions are considered to be conservative. Modelling results of NO_2 impacts for private receptors (both 1-hour average and annual average concentrations) and isopleth diagrams of these predictions during each potential blast hour of each year are presented in Appendix G.

The SO₂ emissions potentially generated by the Project were assessed as being too low to result in any significant offsite pollutant concentrations. The blasting protocols at Bengalla warn of potential impacts under these low wind speed conditions from which operations personnel have the ability to reschedule blasts. The current operator judgement based system has not resulted in issues, however will be replaced with a predictive management system, to be implemented by BMC, to minimise the risk of future blast fume impacts. No blast fume impacts are expected to occur in any other hours of the day.

Rail Transport

The dust concentrations at a distance from the rail line are dependent on the nature of the surrounding environment. In rural areas, the maximum cumulative 24-hour average TSP and PM₁₀ concentrations at a distance of 50 m from the rail line were predicted to be 3 µg/m³ and 1.2 µg/m³, respectively. In urban areas, the maximum cumulative 24-hour average TSP and PM₁₀ concentrations at a distance of 50 m from the rail line were predicted to be 1.5 µg/m³ and 0.6 µg/m³, respectively. These concentrations are well below levels known to cause adverse impacts on human health and amenity.

8.1.4 Mitigation and Management

Dust Management

The Project has been designed so that material hauling distances and handling are minimised, resulting in reduced dust emissions. The effects of the mine design on dust emissions have been internalised in the modelling. To further reduce dust emissions, BMC has committed to additional reasonable and feasible best practice dust management measures.

BMC was recently required to undertake a Pollution Reduction Program in accordance with EPL 6538, which included a best management practice determination of all dust generating activities. The major dust generating activities identified in the Pollution Reduction Program were wheel generated dust on unpaved surfaces, loading and unloading of overburden, bulldozing activities and wind erosion (BMC, 2012a). All reasonable and feasible measures for reducing dust emissions from loading and unloading of overburden and bulldozing activities are currently being implemented at Bengalla Mine and will continue to be implemented for the Project. The Pollution Reduction Program recommended the use of a chemical suppressant on haul roads and interim stabilisation of exposed areas using vegetation and/or chemical suppression.

Construction activities will incorporate leading practice dust minimisation measures and will include:

- Maintaining sufficient levels of moisture on the trafficked surfaces;
- Limiting vehicle speeds in construction areas; and
- Rehabilitation of completed sections of the site as soon as practicable.

In order to address government and community concerns regarding the impacts of mining on regional air quality in the Hunter Valley, BMC will continue to implement best practice dust management practices, including:

- Best practice dust management techniques (e.g. water sprays, sheltered emplacement during high wind, minimising fall heights of materials and expedited rehabilitation);
- Guidance to employees on dust management measures and visual identification of dust for specific sources and activities;
- Commitment to achieving 85% control on primary haul roads through watering or the use of chemical dust suppression agents;
- The use of automated monitoring systems (visual monitors and dust and wind speed alarms) situated in and around active mining areas that detect adverse dust and meteorological conditions; and
- Temporary cessation of particular operations during periods of high dust to reduce the potential for further dust impacts.

The measures proposed for the Project are consistent with the recommendations of the *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone Environmental, 2010).



Air Quality Monitoring

BMC currently conducts air quality monitoring at the locations shown in **Figure 11**, which are representative of sensitive receivers. Proposed improvements to the current network will enhance BMC's ability to manage dust impacts and verify the environmental performance of the Project and include:

- Installation of TEOM monitors to largely replace or augment the HVAS monitoring network;
- Best endeavours to establish an ambient air quality monitoring data sharing arrangement with neighbouring coal mines;
- Commissioning of additional dust monitors to the west, north-west and south-west of the Project as mining continues to the west; and
- Update of the existing dust and blast management systems with a real time air quality management system combined with predictive meteorological forecasting.

Bengalla utilises four E-bam monitors to continuously monitor dust levels. Real time monitoring allows dust controls to be controlled when dust concentrations approach or exceed the regulatory air quality assessment criteria. Meteorological monitoring is undertaken to predict adverse weather conditions. Using this information, operations can be modified to prevent dust exceedances from occurring during adverse meteorological conditions.

Blast Management System

Whilst the current blast management system has proven to be adequate for mitigating the risk of blast impacts, BMC will investigate and implement an advanced blast forecasting system as part of an improved blast management system. Actual and predicted meteorological conditions for each blast will be utilised to minimise the risk of blast fume impacts. Blast procedures will be revised regularly as the Project progresses from east to west to minimise potential impacts on sensitive receptors.

Air Quality and Greenhouse Gas Management Plan

The current BMC Air Quality and Greenhouse Gas Management Plan will be updated for the Project in consultation with the relevant regulators for construction and operational activities associated with the Project and shall include commitments in this EIS. The updated Air Quality and Greenhouse Gas Management Plan will include the following for each pollutant and emissions source:

- Key performance indicator;
- Monitoring method;
- Location, frequency and duration of monitoring; and
- Monitoring, response and reporting procedures.

8.2 Greenhouse Gas

8.2.1 Background

Todoroski Air Sciences conducted an air quality assessment for the Project which is presented in full in **Appendix G**. This study included the assessment of greenhouse gas impacts which is summarised below.

8.2.2 Methodology

The *Australian Department of Climate Change and Energy Efficiency (DCCEE) National Greenhouse Accounts (NGA) Factors 2010* defines three scopes (Scopes 1, 2 and 3) for different greenhouse gas emission categories for developments, based on whether the emissions generated are from "direct" or "indirect" sources.

Scope 1 and Scope 2 emissions encompass the direct sources of emissions from the Project. These include emissions:

"...from sources within the boundary of an organisation as a result of that organisation's activities" (DCCEE, 2011).

For the Project, Scope 1 and Scope 2 greenhouse gas emissions include the onsite combustion of diesel fuel, emissions of methane from the exposed coal seams, emissions from the use of explosives and onsite consumption of electricity.

Scope 3 emissions occur due to the indirect sources from the Project as:

"...emissions generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation" (DCCEE, 2011).

Scope 3 emissions for the Project were identified as resulting from the purchase of diesel and electricity for use on site, the transport of product coal to its final destination and the final use of the product coal. These emissions are considered as Scope 1 and 2 emissions associated with other projects.

Greenhouse gas emission factors are generally standardised and expressed as CO₂-e which is calculated by multiplying the individual gas emission factor by its respective Global Warming Potential. To quantify the amount of CO₂-e generated by the Project, specific emission factors were adopted from DCCEE and other sources for each of the major greenhouse gas generating activities (see **Appendix G**). These estimated greenhouse gas emissions generated in all three scopes defined are based on approximated qualities of materials and where applicable generic emission factors. Therefore the estimated emissions for the Project are considered conservative.

The emission factor based on the release of methane from the coal seams at the Project was taken to be 0.0324 t of CO₂-e per t of ROM coal.

This emission factor has been calculated based on actual testing of the methane gas from the coal seam sourced from data obtained during exploration drilling (Coal Bed Energy Consultants, 2012). This emission factor is lower than the default factor provided in the National Greenhouse Accounts Factors document and was utilised in the assessment to provide a more accurate estimate of emissions generated for the Project.

8.2.3 Impact Assessment

The main sources of greenhouse gas emissions from the extraction and processing of coal for the Project were identified as resulting from diesel usage, explosives usage, electricity consumption, fugitive emissions of carbon dioxide and methane and the transportation and end use of product coal. The annual greenhouse gas emissions predicted for the Project from these sources are summarised in **Table 35**.

In 2010, the estimated greenhouse emissions for Australia were 543 Mt CO₂-e (DCCEE, 2011). In comparison, the estimated annual average greenhouse emissions over the life of the Project were assessed as 0.77Mt CO₂-e (Scopes 1 and 2). Therefore, the annual greenhouse gas emissions from the Project (including Scope 1, 2 and 3 emissions) were considered to constitute approximately 0.14% of the total Australian greenhouse gas emissions in 2010. Emissions from the shipping of product coal are not included in this assessment due to the uncertainties in emission estimates, including uncertainty in future export destinations and limited data on emission factors and/or fuel consumption for ocean going vessels.

The commitment from the Australian government to reduce greenhouse gas emissions is proposed to be achieved through the introduction of the carbon pricing mechanisms. This will involve a fixed price on greenhouse gas emissions, with no cap on Australia's greenhouse gas emissions, or emissions from individual facilities.

It is expected that the Project will exceed the facility threshold of 25,000 t CO₂-e pa for participation in the carbon pricing mechanisms. As such, Scope 1 greenhouse gas emissions from the Project will be subject to the carbon pricing mechanism (Commonwealth of Australia, 2011).

8.2.4 Mitigation and Management

Mitigation and management measures that will be implemented to minimise greenhouse gas emissions generated as a result of the Project and ensure ongoing energy efficiency include:

- Monitoring fuel efficiency of diesel equipment;
- Optimising conditions for fleet operations;
- Use of high efficiency electric motors; and
- Energy efficient lighting systems.

These mitigation measures will be included in the updated Air Quality and Greenhouse Gas Management Plan and in the relevant management standards and procedures of the Bengalla EMS.



Table 35 Predicted Annual Greenhouse Gas Emissions

Activity	Emissions (t CO ₂ -e)
Fuel consumption (including diesel generators and mobile equipment) during construction and operation – Scope 1	218,949
Explosives consumption – Scope 1	4,590
Fugitive emissions – Scope 1	470,176
Scope 1 Emissions Sub Total	693,715
Electricity consumption – Scope 2	105,811
Scope 2 Emissions Sub Total	105,811
Transport of product coal – Scope 3	1,437,020
End use of product coal – Scope 3	27,303,387
Scope 3 Emissions Sub Total	28,740,407
Total Annual	29,539,933

* Scope 1 emissions only are covered by the Commonwealth Government's Carbon Pricing Mechanism (Commonwealth of Australia, 2011).

8.3 Noise

8.3.1 Background

An Acoustic Impact Assessment for the Project was completed by Bridges Acoustics and is presented in full in **Appendix H**. The Acoustic Impact Assessment included quantitative consideration of operational mining noise, construction noise, offsite road and rail noise, sleep disturbance and low frequency noise. It also assessed blasting impacts on people, livestock and property. Blasting is specifically addressed in **Section 8.4**.

The Acoustic Impact Assessment is summarised below and has been undertaken in accordance with the following policies and guidelines:

- The INP prepared by the EPA (EPA, 2000) to determine background levels, recommended noise criteria, predicted noise levels and recommended negotiation options;
- The *NSW Road Noise Policy* (RNP) (DECCW, 2011) for road traffic noise and sleep disturbance criteria outside the Project Boundary;
- The *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) provides criteria, recommended hours and methods for assessing noise from construction activities;
- The *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (DECC, 2007a) for noise from train movements on publicly owned rail lines; and
- The *Draft Rail Infrastructure Noise Guideline* (Draft RING) (OEH, 2012a) provides criteria and methods to assess noise from train movements on publicly owned rail lines.

8.3.2 Methodology

Introduction

Predicted noise levels at receptors for the Project have been assessed using a comprehensive site model based on RTA Technology's Environmental Noise Model software, which is considered the most appropriate choice for situations involving complex terrain, a large number of noise sources and where a detailed assessment of the effect of weather conditions on noise propagation is required. It has previously been endorsed by EPA for assessing noise from mining developments. The environmental noise model assessed representative Project operating scenarios including normal mining activities, coal handling and processing activities and operation of the rail loading facility.

Noise levels for the Project have been modelled for representative operating scenarios, time periods and weather conditions for Year 1, 4, 8, 15 and 24 under neutral and prevailing weather conditions.

The predicted noise levels for both construction and operational activities have assumed the implementation of all feasible and reasonable noise management and mitigation measures. These measures include fitting mobile equipment and CHPP plant with noise controls, as well as the construction of noise bunds.

The modelling has predicted the worst case noise levels by assuming that all equipment is operating under noise enhancing weather conditions. Although this situation may occur occasionally, noise levels will generally be lower than the predicted levels.

Background Noise Levels

Results from quarterly noise monitoring results conducted between 2000 and 2011, including measured noise levels and indication of audible sounds noted by monitoring personnel, were utilised to determine the existing ambient noise levels and appropriate background noise levels for the Project.

Monitoring was conducted at four representative receptor locations in the vicinity of the Project Boundary as shown on **Figure 11**, which included:

- N08 - A monitoring location near the Moore residence (Property 166), representing receptors to the north-west of the Project.
- N09 - A monitoring site, representing receptors along Wyndham Arms Right of Way, west of the Project Boundary;
- N010 - A monitoring location on Denman Road, representing receptors to the south-west of the Project Boundary; and
- N011 - A monitoring location on Rasecourse Road, representing receptors east of the Project Boundary.

The assessment also included a detailed review of the previous monitoring of background noise levels at four representative monitoring locations, based on a combination of long term unattended monitoring. Given the extensive database of noise monitoring results available for receptor locations near the Project, no additional noise surveys have been carried out for this assessment. Background noise data levels were developed based on an extensive review of noise data for the years 2000 to 2011 and are shown in **Table 36**.

Table 36 Adopted Background Noise Levels

Receptor Area	Background Level, L _{A90,15min}		
	Day	Evening	Night
East (Racecourse Road)	33	32	31
West (Hamilton)	30	30	30

Receptors

Bengalla adjoins rural and residential receptors in all directions, with other operating and approved coal mines located south-east and north of Bengalla. Some of the closest rural properties have previously been purchased by BMC to provide land for the mine or a noise and/or air quality buffer around the mine (see Figure 6).

A number of properties not owned by BMC have been purchased by owners of the approved but currently undeveloped Mount Pleasant Project located to the north and the operational Mt Arthur Coal Mine located to the south-east.

Noise Criteria

Project Operational Noise

The INP recommends two separate noise criteria for operational noise, being an intrusive criteria designed to limit the relative audibility of the Project, while the amenity criteria are designed to limit the total or cumulative level of industrial noise from all industrial sources in the area. Intrusive criteria are set at 5 dBA above the background noise level. The assessment considered modifying factors such as tonality or impulsiveness to adjust noise levels where required. The existing noise criteria specified in Schedule 3, Condition 1 of DA 211/93 are shown in Table 37. All properties are subject to sleep disturbance criteria set 10 dBA above the night intrusive criteria (or 15 dBA above the night background noise level).

Cumulative Operational Noise

The INP recommends amenity criteria designed to limit the total or cumulative noise impacts. Other industrial developments with the potential to produce significant environmental noise include the Mount Pleasant Project to the north, Mangoola Coal Mine to the south-west, Mt Arthur Coal Mine to the south, Muswellbrook Coal Mine to the distant east and Dartbrook Coal Mine (currently under care and maintenance) to the north-east. The INP amenity noise criteria for rural categories of 50 L_{Aeq} during day periods, 45 L_{Aeq} during evening periods and 40 L_{Aeq} during night periods has been adopted to assess cumulative noise levels.

Construction Noise

Construction noise levels have been assessed under the ICNG. Section 1.2 of the ICNG states it does not apply to industrial sources, including construction associated with quarrying and mining which suggests this activity be assessed under the INP. As such, the assessment for construction noise for the Project has been compared to the operational criteria provided in Table 37.

Sleep Disturbance

Sleep disturbance can occur when a short, sharp noise is clearly audible over the background noise level within a bedroom. The RNP is the currently the only policy that addresses sleep disturbance.

The RNP acknowledges that the effects of noise on sleep disturbance have not yet been conclusively determined. However it suggests a range of 50-55 dBA inside a bedroom, which is approximately equivalent to an external noise level of 60-65 dBA. An assessment of noise levels within the historical criteria are considered unlikely to cause sleep disturbance.

Road Traffic Noise

The Project would generate traffic on Denman Road, Bengalla Link Road and other local roads during the construction and operational phases. Traffic noise criteria primarily apply to operational traffic, as construction related traffic only occur for a relatively brief period compared to the life of the Project. Recommended noise criteria apply to all traffic including vehicles associated with the Project and other vehicles on the road. Relevant road traffic noise criteria of the RNP are listed in Table 38.

Rail Traffic Noise

Rail noise criteria are sourced from the Interim Rail Noise Guideline, which recommends trigger levels of 65 $L_{Aeq,15hr}$ during the day, 60 $L_{Aeq,9hr}$ during the night and 85 L_{Amax} from existing rail lines. Similarly, condition L6.1 of EPL 3142 issued to ARTC, covering train movements on all railways controlled by ARTC, specifies noise level objectives of 65 $L_{Aeq,15hr}$ day, 60 $L_{Aeq,9hr}$ night and 85 L_{Amax} at 1 m from the facade of affected residential premises.

Low Frequency Noise

Section 4 of the INP recommends low frequency noise levels considered in the normal operational noise criteria by the addition of a 'modifying factor' to either a source sound power level or a received noise level. Any modifying factors that are relevant to the assessment, including low frequency penalties, have been applied to the adopted sound power levels for mining and transportation equipment. No additional assessment of low frequency noise levels is required.



Table 37 Operational Noise Criteria

ID	Receptor	Noise Criteria Intrusive/Consent					
		Day (7 am to 6 pm) ¹ and Evening (6 pm to 10 pm)		Night (10 pm to 7 am) ¹			
		Intrusive L _{Aeq(15Min)}	Consent L _{Aeq(15Min)}	Intrusive L _{Aeq(15Min)}	Consent L _{Aeq(15Min)}		
65	HVEC (formerly F & IR Webber)	38 (Day) 37 (Evening)	38	36	40		
45	HVEC (formerly BD & JN Englebrecht)				39		
43	KB & JA Barnett		37		36	38	
44	MJ McGoldrick						
29	Jabetin Pty Limited		36			37	
41	FK & WDG Almond & PW Hume						
42	DP Englebrecht						
49	ML & EA Sweeney						
48	MC & LJ Dobie						
47	DL Robinson						
50	TD Barron						
51	RA Byrnes & MA Moller						
64	MJ Drake						
66	JR Scriven						
60	RH Englebrecht						
59	Englebrecht Racing Stables Pty Ltd						
58	RS & JT Cridland						
57	AC Good						
55	SM Bredden						
54	JR Gleeson & MR Cranfield						
52	GL & IL Andrews						
53	SY Johnson						
63	JP Drake						
155	PG & CM Lane	35	38	35			38
158	MTP (formerly RR & JM Hamilton)		38				37
156	NY & RY Ellis		36		35		36
152	MR Peel						
154	PSJ Murray		35			40	
118	E & WJ Rankin					38	
116	HVEC (formerly J & E Zahra)						
119	E & WJ Rankin						

ID	Receptor	Noise Criteria Intrusive/Consent			
		Day (7 am to 6 pm) ¹ and Evening (6 pm to 10 pm)		Night (10 pm to 7 am) ¹	
		Intrusive L _{Aeq(15Min)}	Consent L _{Aeq(15Min)}	Intrusive L _{Aeq(15Min)}	Consent L _{Aeq(15Min)}
120	TW Roots	35 - con't	35 - con't	35 - con't	37
69	Latham				
117	E Rankin				
168	JB Moore				36
114	JM Wild				
115	HVEC (formerly J & E Zahra)				
113	MG & LJ Latham				
46	Muswellbrook Race Club Limited	40	40	40	40
	Other private land	-	35	-	35

¹ On Sundays and public holidays, the night period ends and the day period begins at 8 am.

Table 38 Road Traffic Noise Criteria

Roads	Noise Criteria L _{Aeq}	
	Day and Evening	Night
Arterial Roads (Denman Road, Bengalla Link Road)	60 L _{Aeq,15hr}	55 L _{Aeq,9hr}
Local Roads (all other roads)	55 L _{Aeq,1hr}	50 L _{Aeq,1hr}

Meteorology

A representative meteorological data set was produced based on detailed weather records from the existing Bengalla weather station and inversion tower. A review of recent weather data has also been completed to confirm the previously adopted prevailing weather conditions remain valid for the Project.

Meteorological data was examined, for use in the meteorological modelling software equivalent to the *Noise Enhancement Wind Analysis* program. Data for the 12 month period (2009) at 30 minute intervals was analysed to provide a full year of representative data for the Project for the purposes of modelling. The prevailing meteorological conditions, which were subsequently included in the noise model, are shown in **Table 39**.

Temperature inversion strength and associated wind condition data from the existing Bengalla inversion tower was analysed for a full year (2010) to determine the representative range of temperature inversions in the area. Dominant winds associated with inversions from the east-north-east, has been included as the prevailing conditions. Inversion strength ranges from 1 °C/100 m to above 7 °C/100 m showing a median wind speed from 0.85 to 1.0 m/s.

Night scenarios included an equivalent inversion of 8°/100 m, consistent with previous weather parameters; which is significantly stronger and causes greater noise enhancement than the INP default 3 /100 m inversion strength.

8.3.3 Impact Assessment Project Operational Noise

Project operational noise levels have been modelled for representative operating scenarios, time periods and weather conditions. **Figure 32** presents the combined worst case predicted noise levels for the Project during day/evening while **Figure 33** presents worst case predicted noise levels during the night period. Results from day time Project noise modelling indicate that the day/evening and night time period are the worst case weather conditions for the Project with predicted day time results occurring within these results. A full assessment of Project operational noise levels including key assumptions utilised for the purposes of modelling and detailed predicted noise levels for all receptors are presented in **Appendix H**.

A summary of the predicted worst case modelled noise levels during all conditions for the Project at private receptors is presented in **Table 40** and **Table 41**. **Table 40** indicates receptors or properties that would be potentially affected by noise from the Project. **Table 41** identifies properties that are predicted to receive noise impacts over 25% of a contiguous property area in a single landownership. Properties presented in **Table 41** are additional to those shown in **Table 40** (i.e. where a higher noise level is predicted at the residence, the property has not been duplicated in **Table 41**).

Table 39 Adopted Noise Assessment Meteorological Conditions

Atmospheric Parameter	Day and Evening			Night	
	Neutral	SE Wind	SSW Wind	Inversion	ENE Wind
Temperature (°C)	20	20	20	10	10
Relative Humidity (%)	70	70	70	90	90
Wind Speed (m/s)	0	3	3	0	2
Wind Direction	-	South-east	South-south-west	-	East-north-east
Temp Gradient (°C/100 m)	-1	-1	-1	3	3
Equivalent Inversion	-1	6.5	6.5	3	8

Some receptors and / or properties are predicted to receive noise levels of 5 dBA or more over the intrusive noise criteria and are shown in bold to highlight potentially significant noise impacts from the Project. Receptors predicted to receive 3 to 5 dBA over the intrusive noise criteria are expected to receive moderate noise impacts from the Project, while receptors predicted to receive up to 2 dBA over the intrusive criteria are expected to receive mild noise impacts from the Project. A dash represents a prediction less than the intrusive criteria.

Operational Noise Discussion

Receptors

Table 40 indicates impacts at private receptors. No private receptors to the east of Bengalla are predicted to experience exceedances of the intrusive criteria. It shows that a significant noise impact of more than 5 dBA above the intrusive criteria is predicted at six private receptors (110N, 152, 153, 154, 156E and 156C) owned by five landowners that are not currently subject to acquisition by other mining companies upon request of the landowner. An additional 11 private receptors (105, 106, 108, 110S, 126N, 146, 156W, 161, 186N, 180 and 184) owned by nine landowners would be moderately affected by the Project under a worst-case noise modelling scenario. A further 12 private receptors have been predicted to experience mild noise impacts from the Project.

Contiguous Land

Table 41 lists noise level exceedances of the intrusive criterion at properties over 25% of land in a contiguous single private landownership. There is only two additional properties (111 and 211) predicted to experience a significant noise impact from the Project in one or more modelled years over more than 25% of vacant land in contiguous landownership that is not currently subject to acquisition by another mining company on request.

An additional three properties (receptor 109, 121/125 and 167) would also be moderately affected by noise over more than 25% in contiguous landownership. A further three properties (99, 100 and 101) are predicted to be mildly affected by noise over more than 25% of contiguous landownership.

All other private receptors and properties are predicted to receive impacts less than the intrusive criterion.

Noise levels from the Project would be audible over areas of grazing land owned by BMC and private landowners. Predicted noise levels experienced by livestock would vary from time to time depending on the location of the livestock within each grazing property. BMC has operated dairy farms and grazed other livestock on land adjacent to the Approved Bengalla Mine since 1995. Further discussion in relation to the potential impacts on agricultural activities is discussed in Section 8.20.

Cumulative Operational Noise

Noise levels from existing industrial sources, including coal mines operating in conjunction with the Project, have been assessed for potentially affected receptor properties and compared to the noise amenity criteria. Other industrial developments with the potential to produce significant environmental noise include:

- Mount Pleasant Project (though not yet operational) to the north;
- Xstrata Mangoola to the south-west;
- Mt Arthur Coal Mine to the south;
- Muswellbrook Coal Mine to the east; and
- Dartbrook Coal Mine (currently under care and maintenance) to the north-east.

Cumulative industrial noise levels during night prevailing weather conditions, from the Project and other industrial developments, have been calculated for privately owned receptors that are predicted to be affected by noise from the Project and are not currently subject to acquisition by a mining company.





Worst Case Project Noise Contours - Night

FIGURE 33

Table 40 Predicted Noise Level Exceedance of Intrusive Criteria at Private Receivers

Receptor ID	Description	Predicted Maximum Noise Level (dBA L _{Aeq,15min})				
		Year 1	Year 4	Year 8	Year 15	Year 24
Eastern receptors subject to 38 day / 37 evening / 36 night L _{Aeq,15min} noise criteria						
Mild						
25	RK & NV Googe	37.6	-	-	-	-
22	N & M Sormaz	37.5	-	-	-	-
23	RB Parkinson	37.8	-	-	-	
24	JM Simpson	37.9	-	-	-	-
27W*	C Horne	38.7	37.3	-	-	-
29^^	Jabetin Pty Limited	37.6	-	-	-	-
43*	KB & JA Barnett	37.6	-	-	-	-
44*	MJ McGoldrick	37.9	-	-	-	-
Other receptors subject to 35 day / 35 evening / 35 night L _{Aeq,15min} noise criteria						
Significant						
110N^	GR & MK Walsh	37.0	36.1	36.8	37.4	40.2
112N*^	MG & LJ Latham	38.8	37.9	38.8	39.3	41.7
112S*^	MG & LJ Latham	37.6	37.4	37.9	38.4	40.4
113*^	MG & LJ Latham	38.3	37.9	38.7	39.1	41.0
114*^	JM Wild	39.0	38.6	39.5	39.9	41.7
117*^	E Rankin	39.8	39.5	40.2	40.6	42.1
118*^	E & WJ Rankin	41.7	41.2	41.9	42.7	44.4
119*^	E & WJ Rankin	41.1	41.5	41.5	41.4	42.7
120*	TW Roots	38.6	37.4	38.3	38.5	41.2
152	MR Peel	37.4	36.3	38.3	38.9	44.6
153	PR Ellis	35.6	34.6	37.0	37.1	42.1
154	PSJ Murray	37.1	35.8	38.0	36.9	42.6
155*	PG & CM Lane	38.3	37.0	39.7	39.1	45.4
156E	NJ & RY Ellis	39.4	38.4	40.3	42.0	46.7
156S	NJ & RY Ellis	37.6	36.5	38.2	39.5	45.0
166*	BA & TE Strachan	38.0	37.5	38.0	38.1	41.3
168*^	JB Moore	42.3	41.2	40.8	45.2	48.1
171*^	BL & ML Bates	38.0	37.5	36.9	41.2	42.9
Moderate						
105	RW Turner	-	-	35.4	36.5	37.9
106^	MJ & MJ Duncan	36.2	36.2	36.8	37.5	39.4
108	MJ & MJ Duncan	35.7	35.4	36.3	37.1	39.0
110S^	GR & MK Walsh	36.7	36.4	36.9	37.7	39.9
126N	JDM Markham	-	-	-	-	37.6
146	JJ & PJ Brown	-	-	-	-	37.4
156W	NJ & RY Ellis	35.4	35.4	-	38.9	39.7
161	RB & SA Parkinson	35.5	35.4	34.4	38.4	39.6
186N	RB & SA Parkinson	-	-	-	-	37.2

Receptor ID	Description	Predicted Maximum Noise Level (dBA L _{Aeq,15min})				
		Year 1	Year 4	Year 8	Year 15	Year 24
169*	JB Moore	37.7	36.7	36.8	37.4	39.5
180	JE & JL Lonergan	-	-	-	35.9	37.3
184	JL Smith & KL Balmer	-	-	-	35.3	37.8
Mild						
102	LA & CA Macpherson	-	-	-	-	36.4
126C	JDM Markham	-	-	-	-	36.6
126S	JDM Markham	-	-	-	-	35.9
130	AA & BT Meyer	-	-	-	-	35.7
145	PJ Brown	-	-	-	-	36.3
186S	RB & SA Parkinson	-	-	-	-	35.5
189	FN & WL Googe	--	-	-	-	35.8

Bold text denotes noise levels exceeding criteria by 5 dBA or more.

** Denotes property is currently subject to acquisition by another mining company upon request by the landowner.*

^ Also affected by significant dust levels above relevant criteria by the Project (see Table 31)

^^Property in BMC's existing Management Zone

- Result is less relevant criteria for the associated Project Year

Table 41 Predicted Noise Level Exceedance of Intrusive Criteria Over 25% Contiguous Private Property

Receptor ID	Name	Predicted Maximum Noise Level (dBA L _{Aeq,15min})				
		Year 1	Year 4	Year 8	Year 15	Year 24
Eastern receptors subject to 38 day / 37 evening / 36 night LA _{Aeq,15min} noise criteria						
Moderate						
66*	JR Scriven	38.0	36.0	37.9	37.3	38.3
Mild						
64*	MJ Drake	-	-	-	-	37.1
Other receptors subject to 35 day / 35 evening / 35 night L _{Aeq,15min} noise criteria						
Significant						
111	GR & MK Walsh	37.0	36.3	37.0	37.6	40.3
211	TM Peel	37.4	36.1	36.8	37.1	40.2
Moderate						
109	EJ & CA Denton	36.6	36.3	36.9	37.6	39.8
121, 125	MR & M Peel	-	-	-	-	38.3
167	RJ & SA Lane	36.1	35.7	35.6	37.7	38.7
Mild						
99, 100	HR & BC Grugeon	-	-	-	-	35.2
101	FYP Zhu & HM Weng	-	-	-	-	35.7

Bold text denotes noise levels exceeding criteria by 5 dBA or more.

** Denotes property is currently subject to acquisition by another mining company upon request by the landowner.*

- Result is less relevant criteria for the associated Project Year

The calculated cumulative noise levels have been compared with the 40 $L_{Aeq,9hr}$ night amenity criterion, as predicted noise levels are generally higher and the amenity criterion is lower during the night period. For the purposes of this assessment, estimated noise levels over an entire night period ($L_{Aeq,9hr}$) from the Project are estimated using a conservative correction factor of -3 dBA lower than the predicted $L_{Aeq,15min}$ level listed in **Table 40** due to typical variation in open cut mine operations and weather conditions during a typical night.

Predicted combined noise levels from the Project and other industrial developments are predicted noise levels for the worst case year at each receiver. It is predicted that the Project would be a major contributor to cumulative noise levels at nine private receptors, however all receptors are expected to receive cumulative noise levels below the 40 $L_{Aeq,9hr}$ night criterion. The Project would contribute typically 25% to 30%, but up to 68%, of total predicted noise levels at potentially affected receivers.

Construction Noise

Noise levels for the worst case construction scenario have been calculated using the Project noise model for Year 1, 4 and 15. Construction activities were assessed according to the indicative construction schedule presented in **Section 4.11** and included the following activities:

- An additional ROM coal stockpile located generally east of the existing ROM hopper;
- An additional raw coal stockpile located generally north of the existing raw coal stockpile;
- Various additions to the stores, administration, bathhouse and workshop buildings and car park;
- Relocation of the reject bin and associated conveyors and transfer stations;
- A series of clean water dams to the north and west of the mining area as and when required, including a temporary pumping station and pipeline to carry diverted water from Dry Creek;
- Extensions to the CHPP;
- Modifications to the rail load out conveyors;
- Relocation of the existing ROM hopper and construction of associated conveyors, sizing station and transfer station;
- Realignment of a section of the Bengalla Link Road in approximately Year 15; and
- Reinstatement of Dry Creek.

As multiple mining related construction activities are not expected to occur concurrently, maximum construction noise levels from the loudest activity have been adopted for Years 1 and 4.

The modelled construction noise levels for each nominated year were then added to existing day neutral and day prevailing noise levels, as normal mining activity is expected to continue during all construction periods. Receptors that were predicted to be significantly affected by operational noise from the Project have been excluded from the assessment. Results from the construction noise assessment are presented in **Table 42**.

Construction activities occurring in Years 1 through to 3 are directly related to mining. The ICNG states that construction activities associated with mining are to be assessed against the operational noise criteria in the INP. In contrast, the Bengalla Link Road realignment in Year 15 is an activity that is not directly associated with mining. It has been assessed against the construction noise criterion in the ICNG, which is 10 dBA above the background level.

The modelled noise contours for construction activities indicate there are no additional receptors significantly or moderately affected by construction noise levels more than 10 dBA above the noise criteria under prevailing weather conditions. An additional 23 receptors would be mildly affected by construction noise levels up to 5 dBA above the operational intrusive noise criterion.

The Bengalla Link Road Realignment work proposed to be undertaken in approximately Year 15 indicate all listed receptors would receive construction noise levels above the 'noise affected' criterion recommended by the ICNG under prevailing weather conditions. Given the relatively short term nature of construction work, the ICNG recommends all feasible and reasonable noise mitigation and management measures be implemented to minimise construction noise levels at affected receivers.

Sleep Disturbance

Sleep disturbance noise associated with mining operations includes a number of diesel powered machines, draglines, tracked dozers, excavators, loaders, ROM hopper, CHPP and rail loop. Maximum sound power levels have been adopted and a number of existing management measures implemented to avoid sleep disturbance as a result of these sources. A theoretical worst case sleep disturbance assessment has been completed for the Project.

Sleep disturbance noise contours produced by the adopted assessment strategy predicts a maximum noise level of 45 $L_{A1,1min}$ or slightly higher at Receptors 156 with slightly lower noise levels predicted at Receptor 118 and 155. Each of these receptors are predicted to receive significant operational noise impacts. All other privately owned receptors are expected to receive noise levels within the sleep disturbance criteria.

Compared to the 60 L_{Amax} sleep disturbance criterion and with proposed management measures in place, which would reduce the likelihood of the predicted levels occurring, maximum noise levels from the Project are considered acceptable.

Table 42 Predicted Worst Case Project Construction Noise Levels

Receptor ID	Name	Predicted Maximum Noise Level		
		Year 1 and 2	Year 3	Year 15
		Operational Criterion, 35 L _{Aeq,15min}		Construction Criterion, 40 L _{Aeq,15min}
Significant				
152^	MR Peel	46.4	42.2	51.5
154^	PSJ Murray	46.7	41.7	47.5
155*	PG & CM Lane	48.4	42.1	51.0
156E^	NJ & RY Ellis	49.7	44.9	57.4
156S^	NJ & RY Ellis	46.6	42.4	53.4
Moderate				
153^	PR Ellis	43.6	42.7	45.5
156W^	NJ & RY Ellis	43.7	36.8	43.9
161^	RB & SA Parkinson	41.6	36.3	44.8
166*^	BA & TE Strachan	41.4	37.8	54.9
168*^	JB Moore	43.8	41.5	50.5
169*	JB Moore	40.7	36.8	53.2
171*	BL & ML Bates	41.4	38.7	46.2
Mild				
2	Cowtime Investments Pty	37.6	36.2	33.1
3	Cowtime Investments Pty	37.3	36.2	33.1
17	LJ Purser	37.1	36.3	33.3
19	RK & NV Googe	37.5	36.7	33.4
25^	RK & NV Googe	38.1	37.1	33.5
22^	N & M Sormaz	38.0	37.1	33.5
23^	RB Parkinson	38.3	37.2	33.6
24^	JM Simpson	38.3	37.2	33.6
27E*	C Horne	37.5	36.7	32.6
27W*	C Horne	39.2	38.1	33.3
29^	Jabetin Pty Limited	39.7	37.6	32.4
39	WJ Hardes	37.4	35.5	31.3
40	SW & KL Barkley	38.3	36.3	31.9
41	FK & WDG Almond & PW Hume	38.9	36.8	32.3
42	DP Englebrecht*	39.2	37.1	32.4
43*	KB & JA Barnett	40.1	37.9	32.9
44*	MJ McGoldrick	40.3	38.1	33.0
47	DL Robinson	39.1	36.9	32.4
49	ML & EA Sweeney	38.9	36.7	32.3
50	TD Barron	39.0	36.8	32.4
51	RA Byrnes & MA Moller	39.0	36.7	32.3
52	GL & IL Andrews	38.9	36.5	32.3
53	SY Johnson	38.8	36.5	32.3

Receptor ID	Name	Predicted Maximum Noise Level		
		Year 1 and 2	Year 3	Year 15
		Operational Criterion, 35 L _{Aeq,15min}		Construction Criterion, 40 L _{Aeq,15min}
54	JR Gleeson & MR Cranfield	38.7	36.5	32.2
55	SM Bredden	38.7	36.5	32.2
57	AC Good	38.7	36.4	32.2
58	RS & JT Cridland	38.6	36.3	32.1
59	Englebrecht Racing Stables	38.4	36.3	32.2
60	RH Englebrecht	38.2	36.2	32.2
48	MC & LI Dobie	39.0	36.8	32.3
149N	RM & KF Merrick	35.5	31.1	31.4
186N^	RB & SA Parkinson	38.9	33.4	31.5
186S^	RB & SA Parkinson	36.7	32.4	41.3
180^	JE & JL Lonergan	38.6	34.9	42.9
184^	JL Smith & KL Balmer	37.9	35.4	42.2
189^	FN & WL Googe	35.7	32.8	39.8
192	GT McNeill	35.9	30.7	36.0

*Denotes property is currently subject to acquisition by another mining company upon request by the landowner

^Denotes property is already affected as listed in Table 40

Road Traffic Noise

An assessment of road traffic noise during proposed construction and operational phases of the Project has been undertaken based on peak traffic levels predicted to occur during construction. A worst case scenario has been assessed based on 100 car movements to the Project during the 6:00 am to 7:00 am and 100 car movements from the Project during the period 4:00 pm to 6:00 pm. An average of 20 construction related truck movements per day are also assumed to occur, with six of the 20 movements assumed to occur in the morning peak.

Calculated construction traffic noise levels indicate a maximum increase of 1.8 dBA should be expected at all receptors as a result of construction related traffic. Given the relatively short term nature of construction traffic, the predicted noise level increases are not expected to be significant.

Calculated traffic noise levels associated with the operational phases of the Project is predicted to contribute 1.5 dBA or less to total traffic noise levels at all receivers. Closest Muswellbrook receptors to Denman Road would continue to receive traffic noise levels over the criteria during the day and night, while closest rural receptors to Denman Road would receive traffic noise levels close to or marginally over the day noise criterion and up to 5.5 dBA over the night noise criterion. Traffic noise levels from Bengalla Link Road would be within relevant noise criteria, while Wybong Road traffic noise levels would exceed the day and night noise criteria at closest receptors to the road.

Rail Traffic Noise

Project related train movements and calculated noise levels produced by existing train movements on the NSW government owned rail network were assessed against the 65 L_{Aeq,15hr} day, 60 L_{Aeq,9hr} night and 85 L_{Amax} noise criteria. It is predicted that maximum noise levels would not change as a result of the Project, as coal trains associated with the Project are assumed to produce the same maximum noise level as existing coal trains.

Additional train movements associated with the Project will result in a train noise increase of approximately 0.7 L_{Aeq,24hr} at receptors near the Ulan Railway Line between the Project and Muswellbrook and an increase of just under 0.5 L_{Aeq,24hr} at receptors near the Main Northern Railway Line south-east of the Ulan Rail Line junction.

Future rail traffic, including additional train movements associated with other mining projects transporting coal via the Ulan Railway Line and Main Northern Railway Line north of Muswellbrook, would result in exceedances of the current night noise criterion at the closest Logues Lane and Bridge Street receptors and at approximately 15 of the closest Victoria Street receivers. Future noise levels on or above the criterion would occur with or without additional rail traffic associated with the Project.

Low Frequency Noise

Low frequency noise levels from the Project are implicitly controlled by the intrusive noise criteria, as intended by the INP, so that unreasonable low frequency noise impacts are unlikely to occur at any privately owned receivers.

8.3.4 Mitigation and Management Existing Noise Control Strategies

An active noise management strategy has been implemented, including the following management measures:

- Mobile equipment, including trucks, dozers, graders and water carts generally operate on elevated and exposed sections of the OEA during the day and early evening and on lower and more shielded sections of the OEA during the sensitive night period;
- Mining machinery generally work below the surface during the sensitive night period, undertaking surface work (including clearing, topsoil stripping, stockpiling and rehabilitation) is completed during the day;
- Drilling and drill pad preparation generally occurs at least 6 m below the natural surface during the evening and night; and
- Operation of an upgraded real time noise monitoring system to provide feedback regarding Bengalla's acoustic performance allowing equipment to be carefully positioned to avoid excessive noise at receptors.

Reasonable and Feasible Noise Controls

Since operations commenced at Bengalla in 1998, BMC has placed significant resources into achieving all reasonable and feasible noise mitigation measures in an effort to minimise operational noise levels. BMC has a long history of working closely with equipment manufacturers in achieving the lowest possible SPLs available, particularly with regard to the haul truck fleet. **Table 43** indicates current feasible and reasonable best practice equipment modifications, a combination of which will continue to be employed for the Project.

Over the past four years in particular, BMC has worked with its suppliers to develop a three phase approach to continuous improvement of the sound power performance to achieve best practice noise attenuation on its haul trucks. In order to achieve lower SPLs, BMC and its supplier developed a retrofit of the haul truck's countermeasure kit.

Further work at BMC's supplier's proving ground has also been undertaken including mobilising Australian sound testing service providers to establish "like for like" testing during further development of the countermeasure. Additionally, BMC has expended over \$8 M in the past four years alone in sound attenuation of its new and existing equipment.

BMC remains committed to a best practice achievable noise attenuated fleet through ongoing and continual improvement. The SPLs adopted for the Project noise modelling are practically

achievable and represent all reasonable and feasible noise mitigation available at the present time to minimise mining noise. Additional details in regard to SPLs adopted for the Project are provided in **Appendix H**.

BMC has also committed to continuing to implement the existing proactive noise management strategy for the Project, which includes the following management measures:

- Mobile machines including trucks, dozers, graders and water carts generally operate on elevated and exposed sections of the OEA during the day and early evening and on lower and more shielded sections of the OEA during the sensitive night period;
- Mining machines generally work below the surface during the sensitive night period. Surface work including clearing, topsoil stripping, stockpiling and rehabilitation is completed during the day;
- Drilling and drill pad preparation generally occurs at least 6 m below the natural surface during the evening and night;
- Use of wheeled dozers instead of tracked dozers on exposed areas;
- A continuous data link from the weather monitoring station was established to allow informed decisions to be made regarding appropriate equipment operating locations; and
- A real time noise monitoring system was established to provide feedback regarding Bengalla's acoustic performance and to allow equipment operating locations to be fine-tuned to avoid excessive noise at receivers.

All feasible and reasonable noise mitigation measures have also been incorporated into the existing CHPP and will continue to be implemented for all of the proposed infrastructure modifications and the additional mobile equipment associated with the Project. This may vary to encompass engineering developments over time.

A large bund approximately 24 m high has been constructed along the southern boundary of the CHPP area and will be maintained for the Project. The north-south alignment of the mining area also results in some acoustic shielding for receptors located east and west of the Project, with receptors to the east shielded by the OEA and receptors to the west shielded from some equipment operating in deeper mining areas.

The north-south alignment of the mining area provides shielding for receptors to the east and west. Receptors to the east are shielded by the OEA whereas receptors to the west are shielded from equipment operating in deeper mining areas.

Therefore the noise controls as committed to in this EIS are considered to be feasible and reasonable while any additional noise controls are considered economically and practically unreasonable.

Table 43 Indicative Engineering and Operational Noise Controls Summary

Aspect of Operations	Noise Controls
Mobile Equipment	Excavators • Sound attenuated exhaust system (including covers) • Hornless horn (notification of load completed to truck operator without using the machine horn) • Cooler Splitters • Rear Sound attenuation • Module Linings (including Sound attenuated engine bay doors) Haul Trucks • Engine side panels • Engine Belly Pan cover • Radiator Silencer • Exhaust system silencers • Rear engine compartment enclosure • Centre deck Lining • Front Panel Assembly below radiator attenuator • Grill and Hood seals • Alternator air intake silencer • Retarding grid attenuation package • Upper Horse collar panels • Blower duct cover and hoses • Covers over openings that are not fitted with louvers Dozers, Water carts and Graders • Fitted with factory supplied sound attenuated options • Modifications to dozer tracks Drills • Acoustic panels fitted • Hornless horn • Engine bay panelling • Sound attenuated exhaust system
CHPP Equipment	• ROM hopper is located within a box cut to maximise shielding • ROM hopper consists of double-steel skin walls, with the steel layers separated by sand to reduce vibration • CHPP has been designed to minimise roof, wall and floor vibration • Number of vibration screens and centrifuges has been minimised • CHPP clad with steel sheeting • Elevated conveyors have been enclosed wherever possible • Conveyor frames and idlers have been designed to minimise vibration • Transfer chutes optimise material flow paths to reduce impact noise • Reclaimers utilise optimum chain sprocket profiles and bucket guides to minimise impact noise
Rail Load out Facility	• Rail loop is at an optimal gradient to control locomotive noise and wagon coupling noise • Rail loop uses large radius bends to minimise wheel and flange noise • Train loading system is entirely enclosed • Rails have been continuously welded instead of jointed • Points and cross-overs have been designed to minimise wheel impact noise



Additional Noise Control Strategies

Construction

Predicted construction noise levels have been calculated in the absence of noise mitigation measures to identify potentially affected receptors and dominant construction activities. The assessment indicates the majority of receptors that are potentially affected by construction noise are also either potentially affected by operational noise or are already subject to acquisition by another mining company.

BMC will revise the existing Noise Management Plan to consider all feasible and reasonable noise management measures to minimise construction noise levels, particularly during prevailing weather conditions including:

- The construction activities associated with the Project, including timing, equipment and activities that could produce audible noise at any privately owned residence and, where possible, to avoid or reduce noise levels at identified receptors;
- Identification of any required evening and night construction work with time restrictions imposed for particularly noisy activities such as rock hammering or concrete cutting; and
- Communication and response protocols will be developed to minimise the potential for nuisance noise.

Operation

Additional noise control options with the potential to offer lower noise levels at receptor properties have been considered in this assessment. Feasible and reasonable noise mitigation measures have been incorporated into the existing CHPP and will be continued in all proposed infrastructure modifications associated with the Project, including:

- The proposed relocated ROM hopper will include an equivalent level of noise control as the existing hopper, which was designed and constructed following best practice procedures;
- Best practice modifications will continue to be implemented at the CHPP building, which currently produces a sound power level of 115 dBA;
- Conveyors will continue to be limited to a sound power level of no more than 76 dBA per metre for sections of conveyor that cannot be enclosed; and
- The rail load out facility, stackers and reclaimers will continue to be managed and modified following best practice control measures.

Noise Management Plan

BMC will update the existing Noise Management Plan which incorporates a combination of engineering controls and mitigation measures employed to manage and control noise impacts associated with the existing Bengalla operations. Existing noise control and management measures will continue to be implemented as part of the Project to ensure best practice controls are maintained.

Real time noise monitoring will be undertaken at representative receptors to facilitate ongoing noise management. Data from these monitors will be transmitted to an onsite office or control room, where operators will be able to respond to and avoid noise exceedances.



8.4 Blasting

8.4.1 Background

An Acoustic Impact Assessment for the Project was completed by Bridges Acoustics and is presented in full in **Appendix H**. The blasting assessment component is summarised below and has been undertaken in accordance with the following policies and guidelines:

- The *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC, 1990) recommends residential ground vibration and overpressure limits and time restrictions for blasting;
- *Assessing Vibration – a Technical Guide* (DEC, 2006) provides recommended criteria and methods for assessing vibration, primarily from construction activities such as pile driving but excluding vibration associated with blasting; and
- *DIN 4150 Part 3 – Structural Vibration: effects of vibration on structures* (ISO, 1999).

The blast impact assessment methodology and impact predictions are summarised below.

8.4.2 Methodology

Introduction

The blast assessment calculated the likely ground vibration and overpressure levels generated by blasting required for the Project for each of the nearby receptors and sensitive features, for comparison with the relevant criteria.

A database of previous blast events was supplied by BMC for analysis as part of the blast assessment. The database included the location, Maximum Instantaneous Charge (MIC) and measured vibration and overpressure levels at eleven representative locations (see **Figure 11**) for all blast events that have occurred at Bengalla during the period 2007 to 2011.

Analysis of the BMC blast monitoring data has confirmed that the AS 2187.2 vibration and overpressure equations are appropriate for the Project, based on commonly adopted values of $K=1140$ and $b=1.6$ for the ground vibration coefficients. Air blast overpressure and ground vibration levels for blast events closest to the receptor locations were calculated utilising the methods set out in AS 2187.2-2006 for comparison with the relevant criteria. As described in **Section 4.3.3**, blasting for the Project is proposed to occur at the rate of up to 12 blast events per week, during the hours of 7:00 am to 5:00 pm, Monday to Saturday.

To minimise the disruption to workshop and office activities limited blasting on Sundays is proposed during the hours of 10:00 am to 3:00 pm when a scheduled blast is located within 500 m of the MIA. A maximum of one blast per day will be undertaken on Sundays and any such blast will be subject to reduced vibration impact criteria (see **Table 44**).

MSC along with all privately owned residents located within the Project noise management zone (see **Table 40** and **Table 41**) will be offered to be notified of a Sunday blast.

Blasting Criteria

Residential noise and vibration criteria associated with blasting are recommended in the *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC, 1990). Noise and vibration limits recommended in the policy for occupied receptors are consistent with current levels to which blasting is managed at Bengalla and are presented in **Table 44**.

It is recognised in the policy that blast effects cannot always be controlled accurately and higher limits of 115 dBL and 5mm/s peak particle velocity are generally allowed for up to 5% of the total number of blasts in a 12 month period. For the Project, criteria of 10 mm/s and 120 dBL have been adopted for heritage buildings to protect them from structural and cosmetic damage. A ground vibration criterion of 50 mm/s has been adopted for more robust heritage structures such as building foundations (house sites) and cemeteries. An overpressure criterion has not been assigned to these structures as they are not sensitive to overpressure impacts.

Table 44 Blasting Amenity Criteria

Criteria	Overpressure (dBL)	Ground Vibration (mm/s)
Less than 5% of total blasts to exceed	115	5
No blasts to exceed	120	10

8.4.3 Impact Assessment

The review of BMC blast monitoring results for the period 2007 – 2011 indicates that a setback distance from non-mine owned receptors and heritage buildings of 1,470 m from Project blasting would be appropriate to ensure impacts remain below the relevant criteria. All private receptors located within 1,500 m of Project mining areas are either owned by BMC (or other mining company) or are subject to acquisition by a mining company.

The closest remaining sensitive residence to active mining areas proposed for the Project would be Receptor 156, located approximately 1,500 m from the active mining area (see **Figure 6**). Exceedances of the blast criteria are unlikely to occur at Residence 156 and at other privately owned Receptors located at a greater distance from the active mining area with the existing or an equivalent blast management system in place. All other private receptors not subject to acquisition by a mining company are located at least 1,500 m from active blast areas.

In addition to blast vibration and overpressure levels, potential blast fume impacts generated the Project were assessed by Todoroski Air Sciences (see **Appendix G**). These results of this assessment and proposed mitigation measures are discussed in **Section 8.1**.

A number of structures and features were also assessed in addition to residential receptors to determine potential blast impacts resulting from the Project. Each is discussed in detail below and included heritage structures, communications masts, Muswellbrook – Ulan Rail Line, public roads; and Bengalla MIA.

Heritage Structures

As discussed in **Section 8.10**, AECOM identified a number of heritage buildings and structures in the vicinity of the Project. Predicted blast impacts for each site are provided in **Table 45**. No exceedances of relevant criteria are predicted.

Communication Masts

A property utilised for industrial purposes containing two communication masts is located approximately 1,200 m south of the Project Boundary (see **Figure 6**). While no blast monitoring results are currently available at this property, interpolation from the Edinglassie monitoring results indicates that the masts have previously received ground vibration levels typically below 5 mm/s but occasionally up to 10 mm/s, with overpressure levels previously reaching 128 dBL but typically less than 118 dBL.

No damage to the masts has been reported as a result of blasting and as the masts have been designed to withstand windy conditions and do not have a significant surface area, they are not expected to be sensitive to overpressure.

Further, the active mining areas at Bengalla will progress away from the communication masts over the life of the Project, with an associated reduction in blast impacts.

Muswellbrook – Ulan Rail Line

Blasting near the Muswellbrook-Ulan Rail Line may result in a number of potential impacts, including:

- Ground vibration affecting the tracks;
- Overpressure affecting the trains; and
- Flyrock affecting both trains and tracks.

Previous blasts have regularly occurred approximately 250 m from the Muswellbrook-Ulan Rail Line. BMC's existing management procedures include consultation with ARTC and either the temporary closure of the railway line or the delay of blast times to ensure that no trains pass potentially impacted areas when a blast is detonated within 500 m of the track. This practice will continue to minimise risks due to blasting, although blasts within 500 m of the railway line are only expected during the early years of the Project.

Public Roads

Proposed blasts will remain more than 500 m from the Bengalla Link Road as the realignment works will be completed before the active mining area approaches to within 500 m of the road.

Intermittent closure of Wybong Road east of the Bengalla Link Road will continue to be required as blasts are detonated in the northern part of the active mining area within 500 m of the road. No other public roads are expected to be affected by blasting. The revised Blast Management Plan will include management measures to protect users of Wybong Road from flyrock and other blast impacts.

Table 45 Predicted Blasting Impacts to Heritage Structures

Building/Structure	Distance to Project Blast (m)	Adopted Impact Criteria	Ground Vibration (mm/s)			Overpressure (dBL)		
			MIC (kg)			MIC (kg)		
		Ground Vibration (mm/s) / Overpressures (dBL)	500	1,000	1,500	500	1,000	1,500
Overdene Homestead*	2,150	10/120	0.8	1.3	1.8	99	102	104
Bengalla Homestead*	1,600	10/120	1.2	2.1	3.0	103	106	108
Rous Lench	2,100	10/120	0.8	1.4	1.9	105	108	109
Edinglassie Homestead	1,900	10/120	0.9	1.6	2.3	106	109	110
Old Bengalla Site	1,100	50/-	2.2	3.9	5.4	-	-	-
Keys Family Cemetery^	1,100	50/-	2.2	3.9	5.4	-	-	-
House Site 3^	360	50/-	13.4	23.3	32.2	-	-	-

* Overpressure levels at these sites have been reduced by 5 dBL to account for shielding provided by the OEA.

^ Heritage item not sensitive to overpressure impacts.

Bengalla Mine Infrastructure Area

Blasts proposed for the Project will occur within 500 m of the MIA including the rail loop, CHPP, stockpiles and administration and other buildings. While blasting near the infrastructure area is primarily an issue affecting BMC rather than causing an environmental impact to external receivers, the revised Blast Management Plan will include management measures to minimise the risk of personal injury and equipment damage.

8.4.4 Mitigation and Management

BMC's existing Blast Management Plan will be revised in consultation with the relevant regulators to include at least the following:

- Maximum of 12 blast events per week during the hours of 7:00 am to 5:00 pm, Monday to Saturday;
- Commitment for a maximum of one blast event per day during the hours of 11:00 am to 3:00 pm on Sundays only for blasts scheduled within 500 m of the MIA as defined on **Figure 17** (or the approved but not yet constructed Mount Pleasant Project infrastructure area);
- MSC along with all privately owned residents located within the Project noise management receptor zone (see **Table 40** and **Table 41**) will be offered to be notified of a Sunday blast.
- Blast design procedures to be undertaken by appropriately qualified personnel to minimise the potential for overpressure, ground vibration and blast fume impacts to residential receptors, surrounding infrastructure and BMC employees;
- Ongoing review of real-time meteorological monitoring information (wind speed, direction, inversion) before the firing of any blast;
- The existing blast monitoring system will be regularly reviewed and implemented to ensure it is representative of the nearest sensitive receptors in consultation with relevant regulators;
- Procedures for the notification of neighbours of upcoming blast events (timing and location) and maintenance of the BMC Blasting Hotline;
- Management measures to close public roads, rail infrastructure and evacuate MIAs within 500 m of a blast site during the blast event and until potentially impacted areas are clear of dust and fumes; and
- A summary of blast monitoring sites and procedures.

8.5 Visual and Lighting

A Visual Impact Assessment has been undertaken for the Project by JVP Visual Planning & Design and is provided in **Appendix I**. The purpose of the assessment was to identify the character of the existing surrounding visual landscape and identify any potential impacts for each stage of the Project with regard to visual effect, sensitivity and night light effects. Relevant management and mitigation measures to ameliorate adverse visual impacts associated with the Project have also been ascertained.

8.5.1 Background

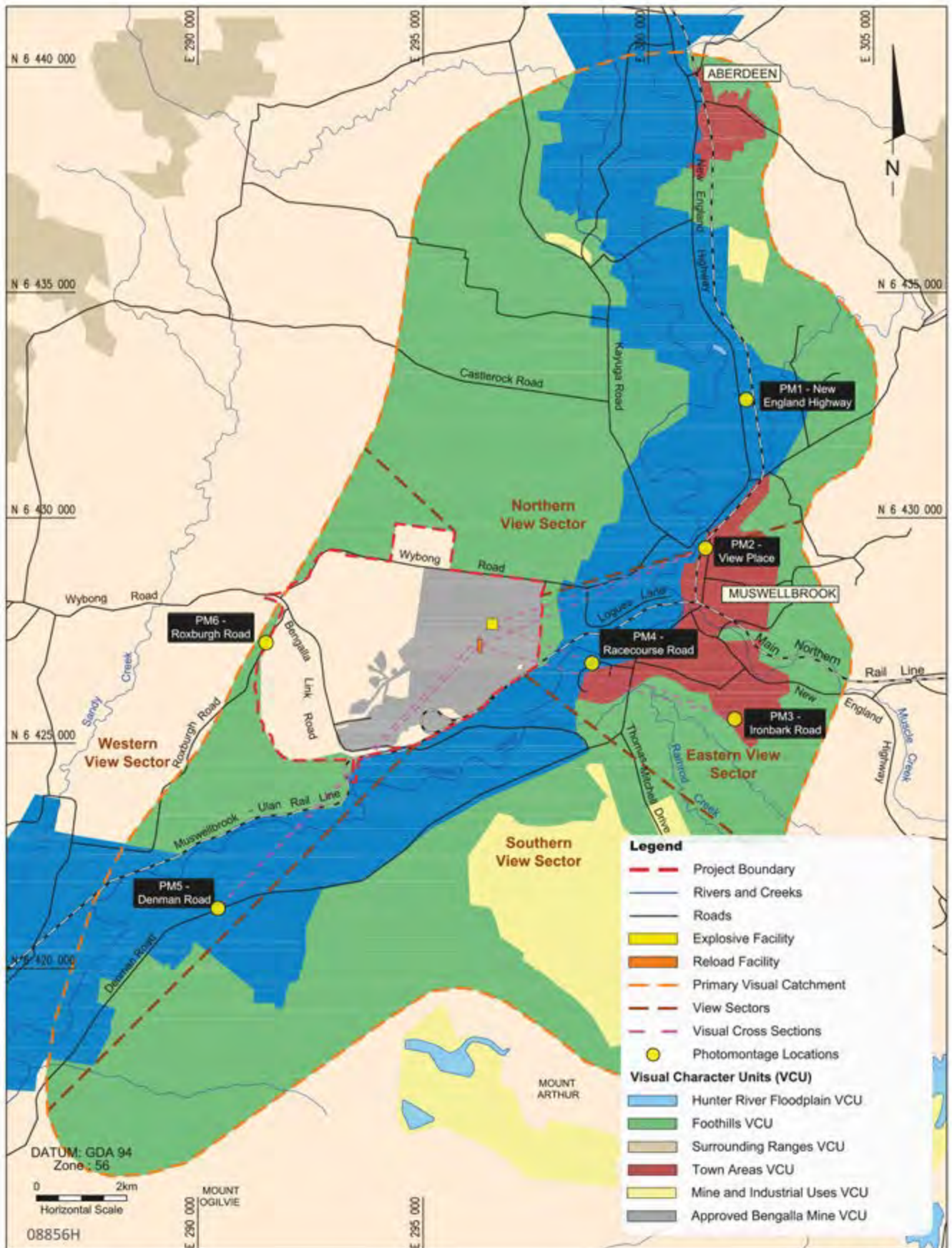
The Primary Visual Catchment (PVC) represents the area where the majority of critical views of the Project may be experienced and is shown on **Figure 34**. The visual settings surrounding the Project are created by a range of different landscapes which vary as a result of topography, vegetation cover and land use types. This can create screening or visual buffers, or alternatively provide a viewing corridor to specific areas within the Project Boundary.

The Project PVC is encapsulated by the ranges to the west and north of the Project Boundary, Aberdeen 10 km to the north-east, Muswellbrook 4 km to the east and the hills behind the town and by the existing Mt Arthur Coal Mine to the south. The small ridge located in the centre of Mt Arthur Coal Mine marks the south-eastern corner of the PVC.

In the broader sense, the PVC is strongly defined by the Hunter River Floodplain, which extends in a general north – south alignment (see **Figure 34**). A further critical element of the PVC is the existing mining operations in the area, being the existing operations associated with the Approved Bengalla Mine, Mt Arthur Coal Mine located south of Bengalla and Xstrata Mangoola to the west. It also includes the undeveloped but approved Mount Pleasant Project to the north of the Project Boundary.

The existing Main OEA is the major mine component visible from surrounding viewing locations. The Main OEA has two faces, the active face to the west and the outer edge to the east. The active face is unshaped, steep, angular and contains raw overburden material creating a high visual contrast and low integration with the environment, due to colour, form and scale. The outer edge has both rehabilitated and ongoing rehabilitation faces as shown on **Plate 3**. Rehabilitated faces are graded to a slope of approximately 10 degrees, revegetated and have less visual impact on the existing landscape environment.

Some pre-rehabilitated faces have been graded to their future shape, however are still in the process of gaining the vegetation cover that will be their future colour and texture. The Main OEA will continue to progress in a westerly direction as operational areas continue for the Project.



BENGALLA MINE

Visual Assessment Locations

FIGURE 34

The height of the Project's final emplacement landform will not increase above the currently approved maximum elevation of RL 270 m as shown in **Figure 14**. If required to be constructed, the Western OEA will become a part of this overall emplacement as mining activities move west, until it is mined through.

8.5.2 Methodology

The visual character and sensitivity of the landscape was determined by considering the existing landscape settings and how they are seen from various viewing locations. The visual effect was assessed by considering the visual characteristics of the Project in the context of the landscape within which it is seen. The overall visual impact of the Project was then determined by assessing the interaction between visual sensitivity and visual effects (see **Table 46**).

The assessment also considered the SRLUP and the MSC LUDS which was exhibited in early 2012. The SRLUP determines that the Project Boundary contains both SAL and CIC. The Project addressed the 'Gateway Criteria' listed within the SRLUP, with relevance to visual amenity being the potential loss of scenic and landscape values.

Existing Visual Environment

The evaluation of the existing visual environment consists of an assessment of both the landscape and specific viewing locations within it that may be impacted by the Project. Visual Character Units (VCU) group areas with similar visual features in a landscape and are defined in terms of topography, vegetation, hydrology and land use features. The VCUs identified within the PVC are shown on **Figure 34** and include:

- **Hunter River Floodplain VCU** which is visually dominated by river flats;
- **Foothills VCU** which consists of varying elevations and clearings that generally support grasslands, scattered trees, woodlands or open forest;
- **Mine and Industrial Uses VCU** which include the Approved Bengalla Mine operations, Mt Arthur Coal, Xstrata Mangoola, Thomas Mitchell Drive Industrial Estate and future Mount Pleasant Project;
- **Town Areas** (Muswellbrook and Aberdeen) VCU which support a variety of functions and contain residential developments, most notably the Racecourse Road Precinct in Muswellbrook due to its close proximity, and other areas with views of the Project; and

- **Surrounding Ranges VCU** with significant elevations that are at a great distance from the Project. These ranges define the eastern and western edges of the Hunter Valley and provide a generally densely-forested backdrop to valley views.

The various VCUs surrounding the Project Boundary create a range of visual settings. The Hunter River Floodplain VCU creates strong contrast and visual interest to surrounding landscapes, while enabling long views from far locations such as Aberdeen and distant highway locations. The existing Approved Bengalla Mine, as part of the Mine and Industrial Uses VCU is also a visible part of the landscapes in this locality. All of the five VCUs interact to create various landscape settings, which may vary as they are seen from different viewpoints in the area.

Representative Viewing Locations

The PVC was divided into four distinct viewing sectors as shown on **Figure 34** which included:

- Northern View Sector;
- Eastern View Sector;
- Southern View Sector; and
- Western View Sector.

There are numerous locations where people are likely to obtain a view of the Project. Computer-generated, photomontage models were used to assist in the determination of visual effect of the existing view and then the stages of mine life (Years 1, 4, 8, 15 and 24). The models enabled accurate views of the Project to be generated from representative viewing locations, taking into account screening of views by natural topography.

To illustrate worst case views of the Project from external locations, six representative viewing locations were selected where photomontages were developed including:

- New England Highway north of Muswellbrook (PM1);
- View Place in north Muswellbrook (PM2);
- Ironbark Road views from the Ironbark Estate (PM3);
- Racecourse Road (PM4);
- Denman Road (PM5); and
- Roxburgh Road to the west of Bengalla (PM6).

Photomontage locations are presented on **Figure 34**.

Table 46 Visual Impact Assessment Matrix

Visual Sensitivity	Visual Effect			
	High	Moderate	Low	Very Low
High	High Impact	High/Moderate Impact	Moderate/Low Impact	Low Impact
Moderate	High/Moderate Impact	Moderate Impact	Moderate/Low Impact	Very Low Impact
Low	Moderate/Low Impact	Moderate/Low Impact	Low Impact	Very Low Impact

In addition to the preparation of photomontages cross sections of were developed from View Place (PM2), Ironbark Road (PM3) and Denman Road (PM5) to illustrate potential views of the explosive and reload facility to be relocated within the Main OEA (see **Figure 34**). These are discussed further in **Section 8.5.3**.

Visual Sensitivity

Visual sensitivity is a measure of how critically a change to the landscape is perceived by persons occupying the surrounding land. Viewing locations situated in residential, tourist and recreation areas generally have a higher visual sensitivity than locations in industrial, agricultural or transport areas. This is due to land being used as part of a leisure experience, making use of the scenic amenity values of the surrounding landscape and often over extended viewing periods.

Visual sensitivity may range from high to low and is affected by factors such as screening, distance and orientation of the receptor in relation to the Project. However, if views are completely shielded from a particular location, a visual sensitivity score will not be assigned.

Visual sensitivity was determined based on a field assessment conducted on 15 and 16 February 2012, aerial photography, topographic and vegetation data, as well as a computer-generated analysis of these mediums.

Visual Effect

The magnitude of the visual effect measured the visual contrast and integration of the Project with the existing environment; and the proportion of the Primary View Zone (PVZ) that is occupied by elements of the Project. The PVZ is the most critical central part of a view.

If there is significant contrast between the elements of the Project and surrounding landscape and a high percentage of the Project in the PVZ, the visual effect will be high. Conversely, if the elements of the Project can be substantially integrated into the existing landscape and the area occupied by the development forms only a small percentage of the total view, the visual effect will be low. The existing landscape contains visual elements of form, shape, line, colour and texture; and in the case of the Project, will include the existing mining operations, which reduces the visual effect.

Visual Impact

The visual impact of the Project is assessed using a qualitative assessment of the visual sensitivity of the viewing locations and the visual effect caused by activities associated with the Project. The relationship between visual sensitivity, visual effect and visual impact is depicted in **Table 46**.

Lighting

Lighting impacts were evaluated qualitatively with consideration to both direct lighting effects and diffuse light effects during the night period. Direct lighting effects occur where there is a direct line of sight between the light source and the viewing location. Indirect lighting effects or diffuse light refers to the night glow created when light is reflected into the atmosphere.

8.5.3 Impact Assessment

The Project will result in a number of visual impacts, which will vary in each sector over the life of the Project. A review of the Project mine plans, aerial photography and the photomontages developed was used to determine the visual impacts discussed below.

Northern View Sector

The Northern Sector as shown in **Figure 34** contains parts of the Hunter River Floodplain, Foothills and Town Areas (Aberdeen) VCUs. A number of sensitive private rural receptors are situated along Wybong, Kayuga and St. Helliars Road and other minor roads off these roads as well as the New England Highway and Aberdeen. Much of the Northern View Sector within the PVC consists of lands that are part of the, approved but not yet operational, Mount Pleasant Project (see **Figure 2**), which creates a low sensitivity based on approved land use.

Views to the Project from the Northern View Sector will be limited due to the screening of current operations by the extent of the Main OEA and its rehabilitated outer edges and slopes.

The Hunter River Floodplain supports a number of rural lots with improved pasture and cropping land, along with scattered rural receptors along roadways and a limited number in the foothills. Many are screened by the adjoining foothills to the north of the Project Boundary. The open nature of the floodplain and associated rural lots in other areas means views in any direction are unobstructed by topographical features.

Receptors in the foothills are mostly screened by the adjoining topography to the west of Kayuga Road. Closer receptors adjacent to Wybong Road are owned by BMC or Coal & Allied and only have views onto approved rehabilitated OEA eastern face areas.

The southern edge of Aberdeen is over 10 km away from the Project Boundary, which decreases visibility and hence sensitivity. Views from Aberdeen will be unobstructed by middle-ground topography or vegetation and are over the existing rehabilitated OEA. Here views onto the proposed changes would be negligible and as such receptors at this distance are ascribed a low to moderate sensitivity.

The only major road in this sector is the New England Highway, which runs adjacent to or within the Hunter River Floodplain VCU. The views to the Project Boundary in a southerly direction from the road are often unobstructed (see **Figure 35**). At its closest point within the Northern View Sector, it is over 5 km from the Project Boundary. Views are limited to the rehabilitated eastern and northern faces with very minor views to the north-western edge of the Main OEA. As the road travels closer to Bengalla, its sensitivity level will increase.

Within the Northern View Sector sensitivity will generally remain low to moderate due to distance and lack of visibility to the Project and visual effect low creating a low impact. Receptors located in the Hunter River Floodplain VCU may have a high sensitivity to any potential views to the Project. This rating is also true of the Main Northern Railway Line north of Muswellbrook for trains travelling south.

The photomontage from the New England Highway (PM1) depicts the existing view which contains small portions of the OEA north-eastern face that are still active and remains active in the first year of the Project (**Figure 35** to **Figure 37**). By Year 4 much of the visible OEA has been rehabilitated, although a sliver of active OEA is still visible (**Figure 36**). The eastern face as seen from the New England Highway is completely rehabilitated by Year 8 and from that time there is no discernible mining activity visible from this location.

Visual effects will be low in the north and north-east as land is largely owned by Coal & Allied for the Mount Pleasant Project. Sensitive receptors in the north-west on Wybong Road are screened by the ridge in the vicinity of Roxburgh Road. Any visual impacts on rural receptors in the Northern View Sector that have any views would be low.

Eastern View Sector

The Eastern Sector contains the highest number of potentially sensitive receivers. This sensitivity relates to the residential nature of Muswellbrook and the tourist / main road function of the New England Highway and parts of the commercial centre. The sector is dominated by Muswellbrook, the river floodplain and some foothills to the east of Muswellbrook (**Figure 34**).

On the basis of land use, receptors in Muswellbrook are generally assessed as having a moderate to high sensitivity depending on the viewing distance to the Project. A small number of areas in South Muswellbrook south of Calgaroo Avenue and parts of Ironbark Ridge Estate will have limited views onto the southern edge of the extraction area for the Project.

Where these houses are less than 7.5 km away from the Project, sensitivity is high. Where there is adjacent screening, the sensitivity level of these receptors may decrease to moderate and low.

Receptors along and around Ironbark Road, which are less than 7.5 km away from the Project, will have some visibility to the Project as foreground vegetation is limited. The elevation of this area also places viewing locations higher than the proposed Project. As such, their sensitivity levels will be high.

The receptors at Racecourse Road and rural receptors on the floodplain will have a high sensitivity depending on the extent of visibility to the Project. Visibility to the Project from this sector is for the greater part screened by the existing and approved OEA, which is generally in a rehabilitated state. Visual effects will be low when seen from the southern part of this sector.

Those receptors along Wybong Road, Kayuga Road and parts of Denman Road as well as those to the east of the highway (that are not mine owned) have been ascribed a high sensitivity due to their proximity to the Project Boundary, as well as their sensitive land use type. However, these receptors would have minimal views to the Project due to their orientation and the screening effect of the existing approved and rehabilitated OEA.

Beyond Year 8, views from the New England Highway as it extends into Muswellbrook from the south-east will be screened from the Project by the existing rehabilitated OEA in the eastern part of the Project Boundary. Denman Road within the sector is further than 2.5 km and will have limited views from the western part of the road, creating a moderate sensitivity. Other roads in this sector are local, rural and urban roads within the sector including Wybong and Kayuga Roads and Thomas Mitchell Drive, which are screened from, or have limited views (being further than 2.5 km away) from the Project. These roads will have a low sensitivity.

Despite the sensitive nature of the viewing locations in the Eastern View Sector, the visual effect will be low as there is minimal visibility from the east, as the Project is active on the western edge only. Further, the maturing of the tree planting on the eastern side of the OEA greatly improves the visual outcomes towards the Project.

The extension of the OEA to the north-east of the existing rehabilitated area can be seen from View Place (PM2) in Year 1. The extension from this viewing location is minor and partially hidden by foreground vegetation. By Year 4, the extension has been rehabilitated and no further views toward the active OEA are visible from this location for the remainder of the Project. The photomontages developed from View Place are included in **Appendix I**.



BENGALLA MINE

Photomontage Location 1
New England Highway (Existing and Year 1)

FIGURE 35



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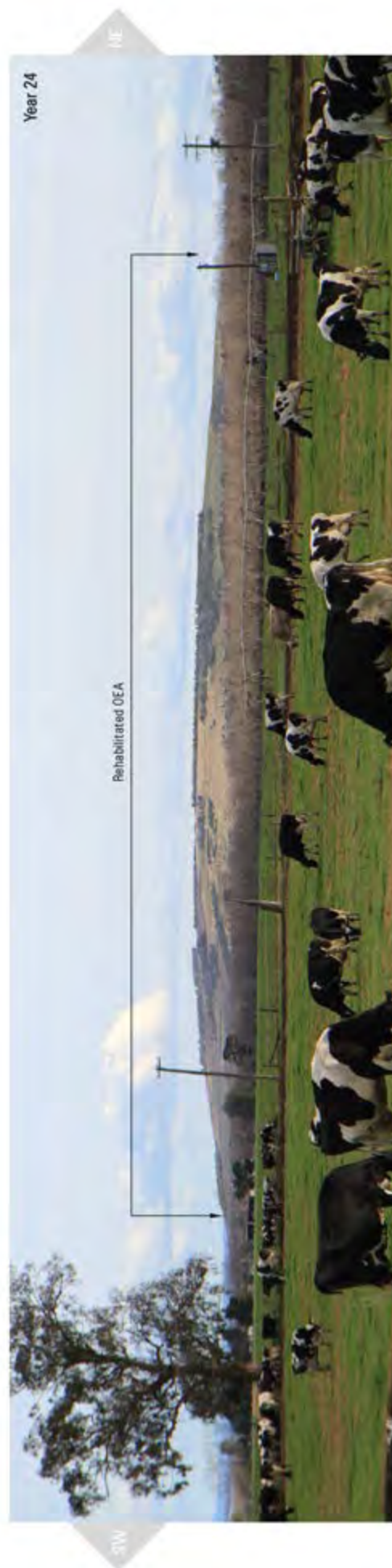
BENGALLA MINE

Photomontage Location 1
New England Highway (Year 4 and Year 8)

FIGURE 36

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BENGALLA MINE

Photomontage Location 1
New England Highway (Year 15 and Year 24)

FIGURE 37



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The photomontage from Ironbark Road (PM3) shows the rehabilitation of the existing southern faces of the OEA while mining activities toward the west become visible from Year 8 (see **Figure 38** and **Figure 39**). The completion of rehabilitation of the existing OEA which is closer to this viewing location also occurs in Year 8. Mining activity progresses toward the west in Year 15 and by Year 24, the majority of visible mining activity is rehabilitated (see **Figure 40**). The proportion of view that the proposed mining activity occupies between years 8 to 24 is minimal and less than currently visible, which would create a moderate to low visual impact. The photomontages from Ironbark Road are included in **Appendix I**.

The Muswellbrook Racecourse itself is also ascribed a high sensitivity as it is a recreation area, although views to the Project are reduced due to the screening effect of the existing Main OEA. Receptors and recreation uses in this location are given a low sensitivity rating due to lack of visibility of the Project. The view from Racecourse Road (PM4) toward new mining activity is also screened by the existing Main OEA (see **Figure 41**) which is rehabilitated completely by Year 4 (**Figure 42**) with only a minor view toward new mining activity above the rehabilitated OEA. This has been reduced by Year 8 and continues to remain out of sight for the life of the Project.

Southern View Sector

The visual effects on the Southern View Sector vary. In the eastern portions of the sector, the views are onto the rehabilitated OEA creating moderate to low visual contrast and moderate to high integration. In the western portion of the sector, the initial view will be onto the active face of the OEA creating high visual contrast and low integration.

The most sensitive view locations in the Southern Foothills VCU include a limited number of receptors (see **Figure 6**), approximately 6 km away from the Project, on the western edge of the PVC. These areas and ones similar to them that have open views to the Project will be highly sensitive up to distances of 7.5 km away. From greater distances in the background, a moderate sensitivity will be experienced.

This sector also contains the historic European receptors of Edinglassie and Rous Lench, both are under the ownership and management of HVEC. Edinglassie and Rous Lench will retain visibility to the Project; however the implementation of existing mitigation strategies of these properties would eliminate these views. Edinglassie and Rous Lench will continue to be managed by HVEC in accordance with the European Heritage Management Plan.

The main road within this sector is Denman Road, which will have a high sensitivity up to 2.5 km and a moderate sensitivity up to 7.5 km, after which sensitivity will reduce to low. The private properties along Denman Road within this sector are approximately 4.5 km away from the Project Boundary and active mining areas, will have some visibility toward the Project.

The increased level of sensitivity is due to the road supporting numerous receptors (see **Figure 6**). Other roads include Edderton Road and Thomas Mitchell Drive and have been assessed as having a low sensitivity due to lack of visibility of the Project and usage type.

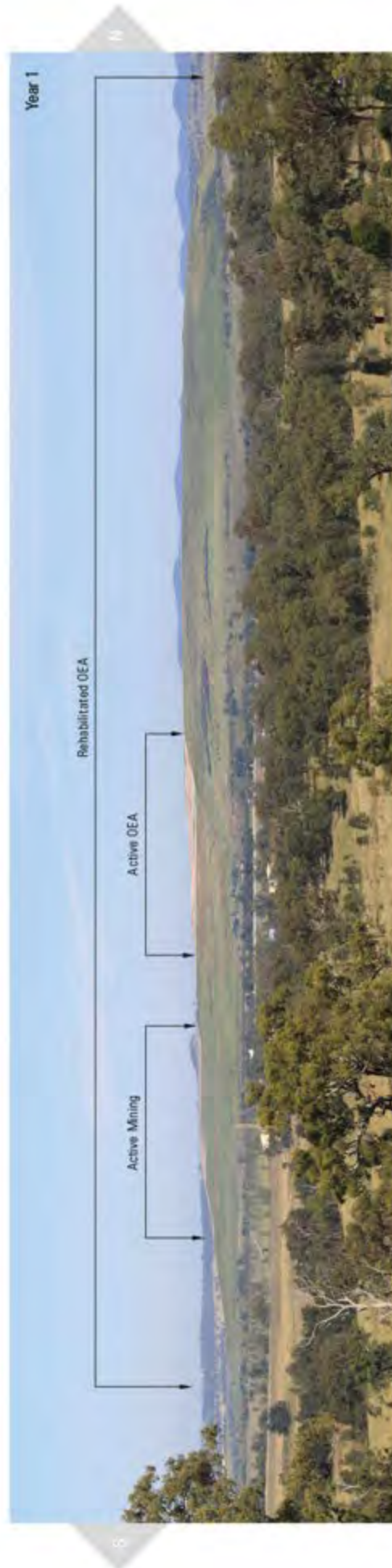
Western View Sector

There are limited sensitive receptors within the most exposed Western View Sector. However some receptors will have high visual exposure and sensitivity. Significantly, views of the Project for the Western Sector will be smaller in scale (OEA elevation of less than 180 m) although in closer proximity than the current view (OEA elevation of 270 m). The visual impact on receptors with views to the Project in this sector will continue to be moderate to high.

View locations include elevated sections on Roxburgh and Wybong Roads and a limited view corridor from the relocated Bengalla Link Road to the west of the CHPP. Receptors along these roads are also potential viewing locations. Potential views are confined to the more elevated parts of the road for approximately the first 1 km from the intersection between Roxburgh Road and Wybong Road as well as from elevated parts of Wybong Road itself before the intersection. The proximity of operations (approximately 1 km at Year 24) will create high potential visibility, although topography and roadside vegetation will screen views toward operations. This will result in a moderate sensitivity, while both Wybong Road and Bengalla Link Road will have moderate sensitivity adjacent to the Project.

Denman Road in the sector will be further than 2.5 km away and have moderate sensitivity. There will be views from the road travelling east, especially from hill areas west of Pukara Estate. Views will also be obtained from the road within the floodplain area including Pukara Olive Estate (see residence ID 103 and 107 on **Figure 6**).

Pukara Olive Estate is located in the most southern extremity of the Western View Sector on Denman Road approximately 5 km south-west of the Project which, although is owned by HVEC, supports several tourist-based elements. The trees in the olive groves have the effect of creating enclosed landscapes with the exception of views from the edges of the plantation to the Project. Views from the estate will have a high sensitivity and a moderate to high visual effect; however there is a lack of visibility from many estate areas due to screening. As time progresses this visual effect is decreased as views onto the active face reduce and rehabilitated areas of the OEA increase and visually dominate the pre-rehabilitation areas (**Figure 43** to **Figure 45**). In addition, intervening hills screen views past Year 15 and possibly before from this location.



BENGALLA MINE

Photomontage Location 3
Ironbark Road (Existing and Year 1)

FIGURE 38



BENGALLA MINE

Photomontage Location 3
Ironbark Road (Year 4 and Year 8)

FIGURE 39

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Photomontage Location 3
Ironbark Road (Year 15 and Year 24)

FIGURE 40



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BENGALLA MINE

Photomontage Location 4
Racecourse Road (Existing and Year 1)

FIGURE 41



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BENGALLA MINE

Photomontage Location 4
Racecourse Road (Year 4 and Year 24)

FIGURE 42



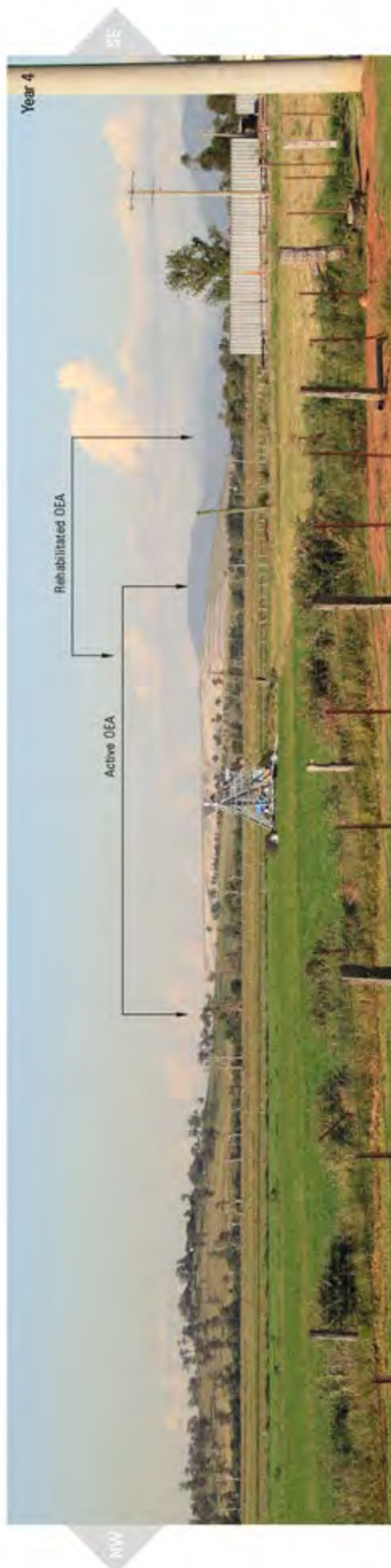
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BENGALLA MINE

Photomontage Location 5
Denman Road (Existing and Year 1)

FIGURE 43



BENGALLA MINE

Photomontage Location 5
Denman Road (Year 4 and Year 8)

FIGURE 44

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BENGALLA MINE

Photomontage Location 5
Denman Road (Year 15 and Year 24)

FIGURE 45

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There are several rural receptors along Roxburgh Road; however most are screened from the Project elements by topography and vegetation with the exception of Receptor 158 (PM6) (see **Figure 6**). This residence currently has views to the active face of the OEA. As this face progresses west it will come closer although lower in elevation and to varying degrees be dominated by rehabilitated OEA further to the east. Even though this property is currently entitled to acquisition by Coal & Allied associated with the Mount Pleasant Project, the property remains as private freehold, its sensitivity to changes in the landscape remains high. However, visibility will be restricted to a portion of a topographic dip in the ridge line to the east that currently allows for views to the existing active face of the Main OEA and to a larger extent Mt Arthur Coal Mine. Photomontages developed from PM6 are presented on **Figure 46** to **Figure 48**.

The progression of mining activity toward the west will alter the position of the active mining face and the rehabilitated OEA over time. The visual effect in the Western View Sector will be high in certain locations such as the higher elevation areas on Roxburgh Road (including PM6), however this effect is similar to existing visual effects although will be closer and of larger scale, albeit at a lower elevation.

Other receptors along Roxburgh Road that are in elevated positions have potential views in an easterly direction of the Project. The distances to views will become less over the life of the Project; however the elevation of the Main OEA will progressively decrease from RL 270 m to RL 180 m. This may mean that visibility is screened by the intervening elevated topography and vegetation which will inhibit overlooking onto the active extraction area. A limited number of houses along the lower part of Roxburgh Road will have high visibility and sensitivity if there is strong visual orientation and exposure to the Project and its elements.

Some receptors on west Denman Road, especially the elevated Receptor 93, as referenced on **Figure 6** could have views to the Project. These receptors that are within 7.5 km and orientated to or have open views of the Project will have a high sensitivity. Other receptors will generally have a low sensitivity due to a lack of visibility.

The town of Denman is outside the PVC due to its distance from the Project, which is over 18 km away. It does have potential views to the Project across the Hunter River Floodplain, although the sensitivity of such views would be low.

Visibility of Explosive Storage Facility and Reload Facility

The explosives storage facility and reload magazine will be located within the Main OEA to maintain operational efficiency and safety and for security. To evaluate the visibility of this element, cross sections were completed to critical areas in Muswellbrook.

These sections enabled the determination of whether the topography of the OEA will screen view lines and what mitigation measures may be required.

To investigate the potential for visibility from sensitive locations, especially eastern locations at Muswellbrook and South Muswellbrook, inter-visibility diagrams were created with cross section lines from critical view points at:

- PM2 - View Place, representative of northern views;
- PM3 - Ironbark Ridge estate, representative of eastern views; and
- PM5 - Denman Road, representative of southern and western views.

Figure 49 presents the cross section developed for the explosive storage facility. A cross section developed for the reload facility is included in **Appendix I**.

These visual cross sections indicate that views of each of the facilities from PM2 are not possible due to the shielding provided by the Main OEA shoulder to the east of the facilities. Results from PM3 indicate that the reload facility and to a lesser extent the explosives storage facility would be visible from this location. The PM5 view line indicates that both the explosive storage facility and reload facility are visible from this location however are located over 8 km away and at this scale would not be noticeable.

Tree screening, micro-land shaping and backgrounding mitigation measures will minimise the potential views to sensitive receivers. In this case, it has been determined that there is not a significant visual issue associated with the location of the explosive storage facility and reload facility with the measures taken and the visual effect will be low.

Lighting Impacts

Lighting effects may be experienced if there is a direct line of sight between a viewing location and a light source at the Project or from the general night-glow (diffuse light). Diffuse light can create a strong local focal point and the effect will vary with distance and atmospheric conditions such as fog, low cloud and/or dust particles that reflect light.

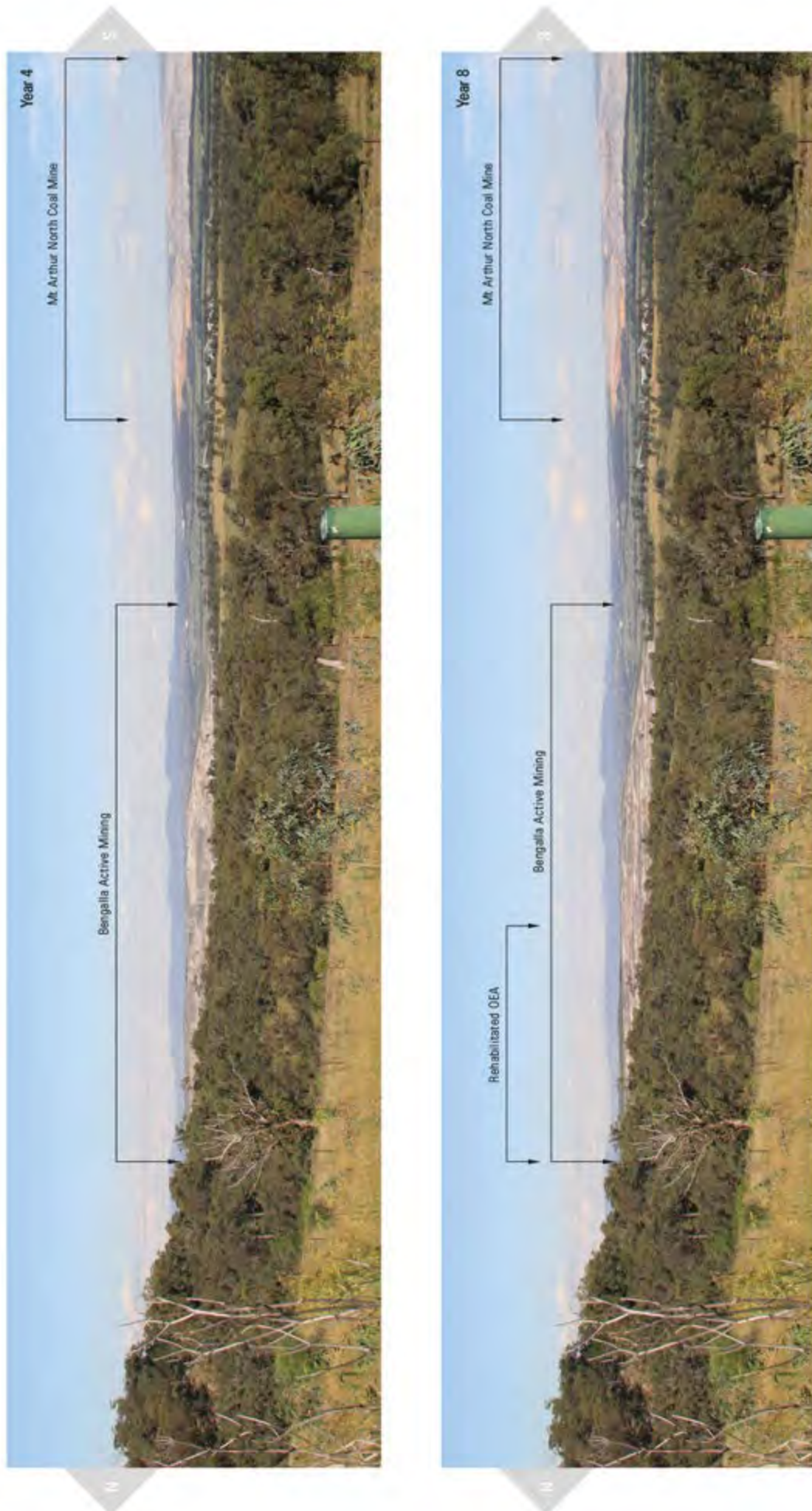
The visual effect of lighting surrounding the Project will remain similar to that experienced as part of the current operation and would vary depending on the locality of operations on site, the relative level at which the viewing location is situated and the presence of any off site barriers such as topographic features and/or vegetation. Operational lighting will move further west during the Project and could marginally increase lighting effects to the west while decreasing them in the east. Some direct lighting impacts will occur when operational areas located on the southern parts of the OEA are not screened by overburden or topography.



BENGALLA MINE

Photomontage Location 6
Roxburgh Road (Existing and Year 1)

FIGURE 46



BENGALLA MINE

Photomontage Location 6
Roxburgh Road (Year 4 and Year 8)

FIGURE 47

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BENGALLA MINE

Photomontage Location 6
Roxburgh Road (Year 15 and Year 24)

FIGURE 48

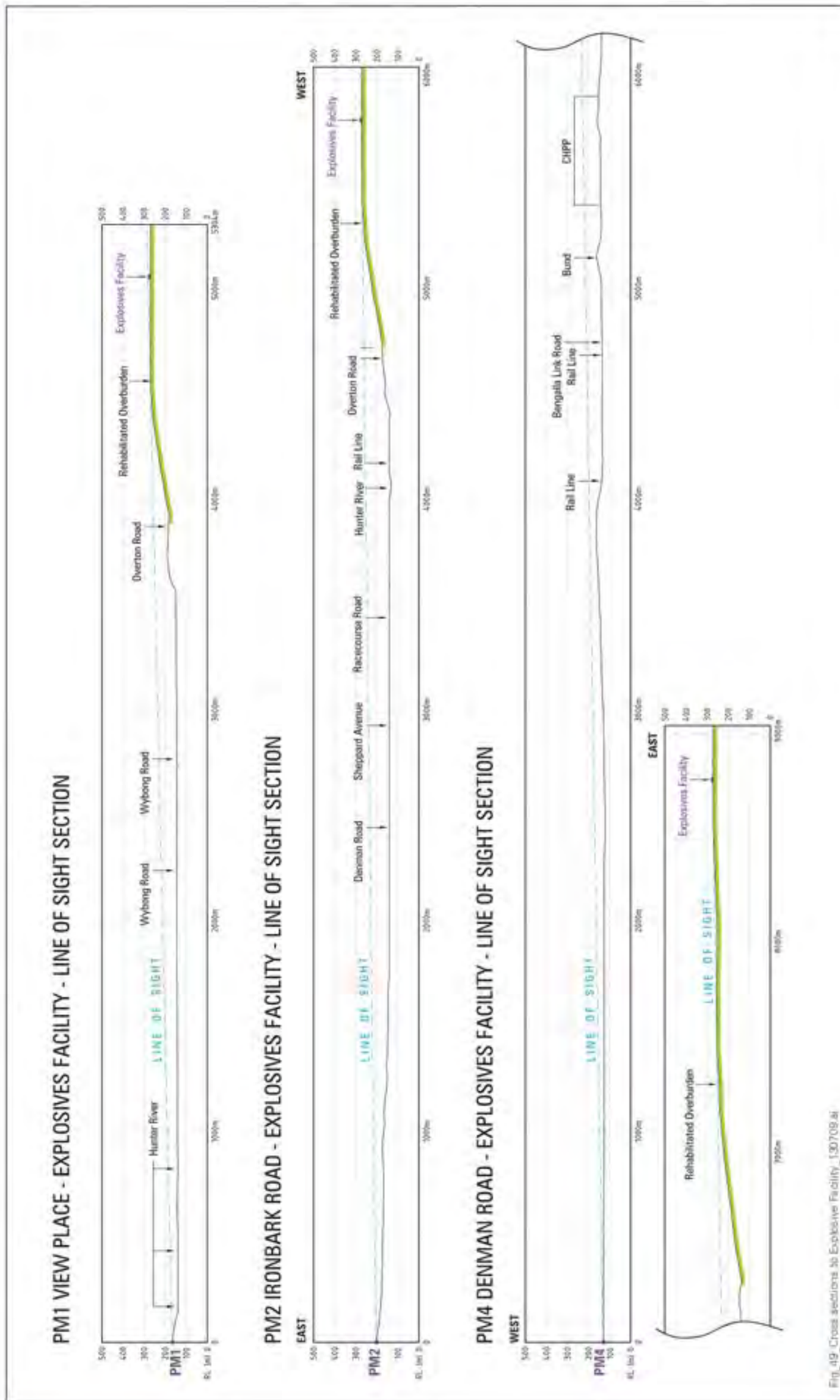


Fig. 49 Cross sections 30 Explosive Facility_130709.ai

The only locations that will have direct line of sight to night lighting are elevated locations such as Roxburgh Road. Such lighting from Bengalla is currently experienced at these locations. As is currently experienced, any direct night lights in this viewing zone may also include Drayton Mine and Mt Arthur Coal Mine lighting.

A diffuse effect of light and its interaction with atmospheric conditions may from time to time create a glow around the Project.

Cumulative Visual Impacts

The Project will not add significantly to the cumulative visual impact created by open cut mining in the locality as it is a visual catchment that also currently supports other mines. The high visual effect mine face and active face of the OEA on Denman Road and western view areas will be similar in extent to current approved operations. Rather, the high visual effect will move west while the visual effects and impacts on eastern sensitive areas, including Muswellbrook and Aberdeen as well as the New England Highway, will decrease.

In the context of the SRLUP and the MSC LUDS the Project does not impact significantly on strategic tourist locations over and above that of the existing approved mine. Although the Project will move operations closer to Pukara Estate olive grove, the visual impact on this facility is low due to screening of the mine from most areas within the grove, including the cafe/shop and driveway by the grove of trees itself and intervening topography. The exception is the outer edge of the grove that is not screened by adjacent olive trees. The visual effects impacts will decrease for areas such as the Muswellbrook Racecourse and surrounding training facilities, which will continue to view the rehabilitated OEA.

8.5.4 Mitigation and Management

Visual impact mitigation strategies were developed for both onsite and offsite situations to ensure that visual effects and / or visibility / visual sensitivity factors are decreased in appropriate time frames to achieve appropriate impact mitigation.

Throughout the life of the Project, the progressive rehabilitation of the Main OEA is the most significant element in relation to visual effects and impacts on the surrounding landscape. This will decrease the visual contrast of the operation to the existing landscape in addition to rehabilitation strategies that emulate patterns, shapes, line and colour of the existing landscape. The final design for the rehabilitation of the final landform will be developed in consultation with relevant visual specialists and included in the revised Rehabilitation Management Plan.

Reducing visual sensitivity is achieved by conducting treatments to minimise visibility to the Project. Due to the scale of open cut coal mining components of the Project, such as the OEA and active extraction area, screening is most effectively achieved at or close to the point of viewing.

Such screening treatments can also be used to re-direct views to areas not affected by mining, as well as generally enhancing the landscape at the viewing point.

On completion of mining operations and following rehabilitation, a final landform will be created. This new landform will reflect the pre-mining agricultural land use.

Onsite Treatments

The following on site rehabilitation and visual screening treatments will be maintained or implemented for the Project:

- The preparation of detailed landscape plans to achieve outcomes that emulate the grassland open woodland/ scattered tree landscapes of surrounding hills as generally described in **Section 8.21** to achieve a minimum of 10% tree cover with a higher density coverage on the eastern face of the overburden emplacement area (or as otherwise agreed with MSC);
- As part of above, complete landscape design for the realigned Dry Creek along with the OEAs, incorporating the ecological mitigation strategies for the Project to achieve a more natural riparian setting;
- Early, progressive establishment and rehabilitation of the outer faces of the Main OEA, particularly the southern slopes adjacent to the Main Northern Rail Line and CHPP. This will minimise the pre-rehabilitation areas to external sensitive view locations;
- Maintenance of existing tree planting areas and development of new areas (or equivalent mitigation measure) (as shown on **Figure 14** to **Figure 18**) and the preparation of landscape design for planting areas to achieve the best visual outcome to critical eastern and southern views inclusive of planting patterns consistent with the limited, woodland and grassland of the existing landscape (not subject to coal mining);
- Temporarily seeding the Western OEA to establish grass cover as soon as practical, commencing from the western and northern sides to reduce visibility;
- Re-establishment of rehabilitated areas for agricultural use consistent with successful tree establishment upon completion of mining;
- Design drop down drainage structure alignments to vary with the topographic form of the Main OEA and avoid extensive straight line drop downs;
- Utilisation of tree areas to assist in breaking up views to drainage structures;
- Finished new fixed infrastructure developments in forest tones such as olive green or grey as far as practical to reduce visual contrast with the surrounding landscape, consistent with regulatory and safety requirements; and
- Completion of topographic and tree planting design around the explosive storage facility and reload facility to reduce its visibility in the landscape.

The following lighting treatments will be maintained or implemented for the Project:

- Where consistent with health and safety requirements, lights will be hooded or directed away from sensitive receptors to avoid direct light spillage from within the Project Boundary;
- The design of fixed night lighting will be to the minimum level necessary for operations and safety;
- Low flux lamps will be used with the direction of fixed lights orientated towards the ground, where practical;
- Work procedures related to the use of mobile lighting plants will continue to be relied upon to avoid adverse off site lighting impacts; and
- Where possible, operations will be conducted in shielded locations, especially at night and particularly on the Main OEA to avoid adverse off site lighting impacts.

Offsite Treatments

The following offsite treatments will be implemented to account for visual impacts of the Project:

- Tree screen planting (or equivalent mitigation measure) along Wybong Road will be extended to the western edge of the Project Boundary as generally shown on **Figure 18**;
- Landscape plans for screening the eastern side of Bengalla Link Road will be prepared and implemented. Planting (or equivalent mitigation measure) already established on Bengalla Link Road along the deviation and Roxburgh Road will be extended to the western end of the Project Boundary;
- Where appropriate, tree screen planting (or equivalent mitigation measure) will be implemented along Denman Road, Roxburgh Road, Wybong Road in consultation with local receptors and the RMS;
- Complete a site inspection and where required, prepare landscape strategies for receptors that will experience prolonged high levels of visual impact, where requested;
- Ensure offsite landscape treatments at Edinglassie and Rous Lench create visual separation between these elements and active faces of the OEA in consultation with Mt Arthur Coal Mine; and
- The reinforcement of plantings close to viewing locations will be undertaken where night lighting is visible.

Landscape Management Plan

BMC will update its existing Landscape Management Plan for the Project in consultation with relevant regulators in consideration of the commitments above. The Landscape Management Plan will be prepared to consider specific impact mitigation strategies for sensitive viewing locations.

8.6 Surface Water

8.6.1 Background

A Surface Water Impact Assessment was undertaken by WRM Water & Environment (WRM) and is provided in **Appendix J**. The objectives of the assessment included:

- Undertaking a detailed site water balance to predict external water requirements and discharge volumes;
- Assessing impacts on the hydrology and geomorphology of watercourses;
- Assessing impacts on the flooding behaviour of watercourses;
- Assessing impacts on water quality;
- Determining licensing requirements under the Water Act and WM Act; and
- Recommending measures to manage and account for the impacts of the Project.

Catchment Description

The Project is located within the Hunter River catchment, which has a total area of approximately 4,200 km² to Muswellbrook. The Hunter River is regulated upstream of Bengalla by Glenbawn Dam, which commands a catchment area of 1,300 km². Since increasing the capacity of Glenbawn Dam in 1988, the Hunter River has been perennial. The minimum flow rate is now approximately 10 ML/day and the median flow rate is approximately 380 ML/day.

The main channel of the Hunter River varies in width from 50 m to 100 m, whereas the alluvial floodplain is approximately 2 km wide. The Hunter River passes immediately to the south of the Project.

The local drainage network generally consists of relatively steep gullies draining from the surrounding hills into flat, meandering tributaries across the Hunter River floodplain. The eastern and southern limits of the Project Boundary are located within the Hunter River alluvium.

The western portion of the area within the Project Boundary is drained by Dry Creek. The creek consists of a single main channel, which flows southwards through the site within the confines of a lower terrace floodplain and discharges into the Hunter River to the south-west of the Project. Dry Creek is ephemeral and has a total catchment area of about 18 km². Dry Creek was determined to be a 3rd order stream under the Strahler stream classification system.

Riparian vegetation along Dry Creek within the Project Boundary is generally limited and consists of scattered trees and brush. The main channel and overbank areas are grassed, which is typical of the wider Hunter region due to extensive clearing for agriculture.

The Soil and Land Capability Impact Assessment (see **Section 8.19**) identified the soil characteristics adjacent to Dry Creek as consisting of primarily Deep Brown to Brown Sodosols, which has an inherently high erosion risk due to potential for localised flooding and active bank erosion is evident at some locations along the alignment of the main channel.

Within the Project Boundary, the main channel of Dry Creek has the following characteristics:

- An average bed width of 7.9 m (varying between 4.2 m and 14.7 m);
- A varying channel depth between approximately 0.4 m and 2.5 m, with an average of 1.1 m. Generally, the channel depth decreases downstream;
- A relatively uniform bed slope and hydraulic gradient of 1% for the reach between Wybong Road and the haul road crossing adjacent to the mine infrastructure area. Downstream of the train load out area, the slope flattens to approximately 0.1% until the confluence of Dry Creek with the Hunter River;
- The channel reach downstream of the haul road crossing has been previously modified during the development of the existing project infrastructure; and
- The bank-full capacity of the Dry Creek channel in the Project area is approximately 20 m³/s. Downstream of the haul road crossing, the bank-full capacity is reduced due to the smaller channel depth and flatter gradient.

Existing Water Quality

BMC undertakes water quality monitoring at four locations along the Hunter River and two locations along Dry Creek, as shown on **Figure 12**. Monitoring is conducted at an additional three locations along Dry Creek during discharge events. Both the Hunter River and Dry Creek are monitored for pH, EC and TSS. Sampling of the Hunter River is conducted on a monthly basis, with additional sampling on days where rainfall exceeds 15 mm. Since Dry Creek is ephemeral, sampling is only undertaken during rainfall events. Between 2008 and 2011, there were only two occasions where the flow in Dry Creek was sufficient for sampling purposes. A flow monitor was installed in Dry Creek in late 2012 to collect additional data. The limited monitoring data for Dry Creek indicates that the water is slightly alkaline and brackish and has a mean TSS concentration of 185 mg/L.

Monitoring data from 2006 to 2011 indicates that the Hunter River is alkaline and has a mean TSS of approximately 53 mg/L. The maximum EC recorded in this period was 670 µg/cm indicating that the water is fresh (low salinity). The water quality downstream of Bengalla is slightly more saline than the water upstream.

The water quality of the Hunter River is also monitored by NOW. This data set indicates regular exceedances of the ANZECC water quality guidelines for total nitrate, total phosphorous, zinc and pH. All other water quality parameters are below the trigger levels. A summary of the water quality data is provided in **Appendix J**.

Water Management System

The key objective of the Bengalla water management system is to minimise the reliance on fresh water from the Hunter River. This is achieved by using treated mine water for operational purposes, including coal processing and dust suppression. Rainfall runoff from mining and industrial areas is also captured in catch drains before being treated and reused on site.

The main components of the Project water management system are described below:

- The Washery Dam supplies water to the CHPP and truck fill stations. It also receives excess mine water, which can be subsequently transferred to the Staged Discharge Dam;
- The Staged Discharge Dam retains water for high demand periods and also in very wet years for releases under the HRSTS;
- The East and West Facility Dams capture CHPP return water and runoff from the industrial area;
- The Wantana West Dam and Endwall Dam receive mine water pumped from the mining areas. This water is transferred to the Washery Dam;
- The Bengalla Waste Water Treatment Plant treats sewage and runoff from industrial areas. The treated water is used for coal processing;
- Sediment traps, drainage channels and sediment dams collect and treat runoff from spoil and hardstand areas;
- Clean water drains divert water from undisturbed areas around disturbed and industrial areas;
- CW₁ will capture flows in Dry Creek during the diversion of the creek. The captured water will be diverted around mining areas via a pipeline and released into a tributary of Dry Creek; and
- The Raw Water Dam stores fresh water extracted from the Hunter River.

The capacities of storages within the water management system are listed in **Table 47**. The indicative locations and capacity of these storages are shown in **Figure 50**.

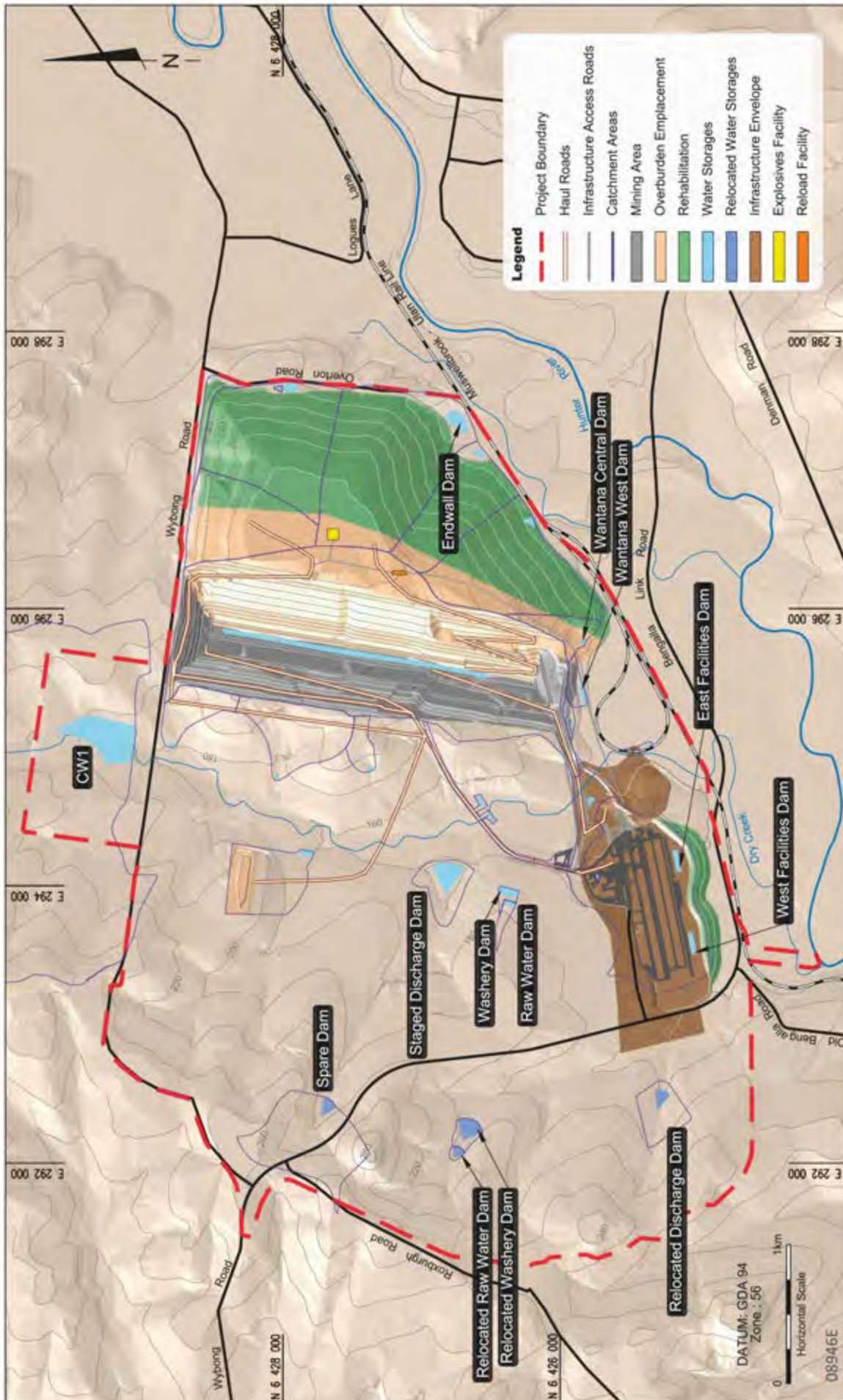
The operational water demands at Bengalla are satisfied using water from four sources. The first priority source of water is mine water make. This is continually recycled through the CHPP. The second priority water source is dirty runoff captured from disturbed areas on site and the third priority is clean water from sediment dams.

Table 47 Indicative Water Management System Storage Capacities

Storage	Indicative Capacity (ML)	Classification	Status
Dry Creek Clean Water Dam (CW1)	900	Clean water	New
Satellite Dam	500*	Clean water	New
Diversion Dam	400*	Clean water	New
Raw Water Dam	5	Clean water	Relocation
Discharge Dam [^]	300	Mine water	Relocation
Washery Dam	25	Mine water	Relocation
Spare Dam [^]	100*	Clean water	New
Endwall Dam	80	Mine water	Existing
Ramp Dam	16	Mine water	Existing
East Facilities Dam	24	Mine water	Existing
West Facilities Dam	24	Mine water	Existing
Additional Facilities Dam	100	Mine water	New
Additional Stockpile Area Dam	50	Mine water	New
Train Load out Sump	0.5	Mine water	Existing
Facilities Sump	0.5	Mine water	Existing
Hot Tyre Park up Dam	0.2	Mine water	Existing
Wantana West Dam	16	Mine water	Existing
Windmill Sedimentation Dams	3	Sediment dam	Existing
Wybong Road Sedimentation Dam	0.4	Sediment dam	Existing
Twin Gullies Sedimentation Dam	32	Sediment dam	Existing
North Dump Sedimentation Dam	0.5	Sediment dam	Existing
Water Overflow Bypass	10	Sediment dam	Existing
South Loop Road Sedimentation Dam	0.5	Sediment dam	Existing
ROM North Sedimentation Dam	0.5	Sediment dam	Existing
ROM South Sedimentation Dam	0.5	Sediment dam	Existing
Wantana East Sedimentation Dam	5	Sediment dam	Existing
Bengalla East Sedimentation Dam	43	Sediment dam	New
Bengalla North Sedimentation Dam	106	Sediment dam	New
Wantana Central Sedimentation Dam	22	Sediment dam	New
Western OEA Sedimentation Dam A	26	Sediment dam	New
Western OEA Sedimentation Dam B	17	Sediment dam	New
Creek Sedimentation Dam	36	Sediment dam	New

* Capacity will be finalised during detailed design.

[^] BMCs nominated harvestable rights dam.



BENGALLA MINE

Proposed Water Management System

FIGURE 50

Hansen Bailey
ENVIRONMENTAL CONSULTANTS



Raw water for most site demands is only extracted from the Hunter River when all other sources have been exhausted. Only the vehicle wash bay uses raw water preferentially.

The Project will involve the relocation of the existing Raw Water Dam, Washery Dam and Staged Discharge Dam to the locations shown on **Figure 50**. As discussed in detail in **Section 4**, BMC also seeks approval to construct the Mount Pleasant Project Discharge Dam as mitigation for removing a section of Dry Creek (which the Mount Pleasant Project is approved to discharge water into).

The Mount Pleasant Project Discharge Dam will not be used as part of the Bengalla water management system. As such, no further assessment of the Mount Pleasant Project Discharge Dam has been undertaken in the Surface Water Impact Assessment.

Conceptual drainage and water management structures have been designed for each of the representative mine stages (see **Appendix J**). These drains have been designed to minimise clean water runoff into mining areas. Due to safety considerations, all drains and water storages have been located at least 100 m from the crest of the highwall. Actual water management infrastructure will be refined as the Project progresses and will be detailed in the Water Management Plan, which will be updated in consultation with the relevant regulators.

Hunter River Salinity Trading Scheme

The HRSTS was introduced in 2002 to manage the salinity of the Hunter River. The scheme only permits discharges of saline water during periods of high flow or flood flow in the Hunter River. BMC holds a licence to discharge saline water under the HRSTS. Bengalla generally operates with a net water deficit, resulting in low discharge volumes. The volumes of saline water discharged to date in accordance with the HRSTS are listed in **Section 8.6.3**.

8.6.2 Methodology

Water Balance

The water balance modelling was designed to reflect changes in the water management system over the Project life. This includes both the construction and operating phases of the Project.

A computer-based simulation model (OPSIM) was used to simulate all components of the proposed water management system on a daily basis over the life of the Project. The inflows and outflows for the water management system are presented on **Figure 51** and outlined in **Table 48**.

Rainfall data records for the region commencing in 1893 were divided into 95 different climatic sequences, referred to as “realisations”. Each realisation represents a different 24 year sequential period within the historical rainfall data. The first realisation consists of rainfall data from 1893 to 1917. The second realisation is based on data from 1894 to 1918, with every subsequent realisation being offset by one year. The OPSIM model performed a simulation for each of the 95 realisations, with each simulation reflecting the Project life.

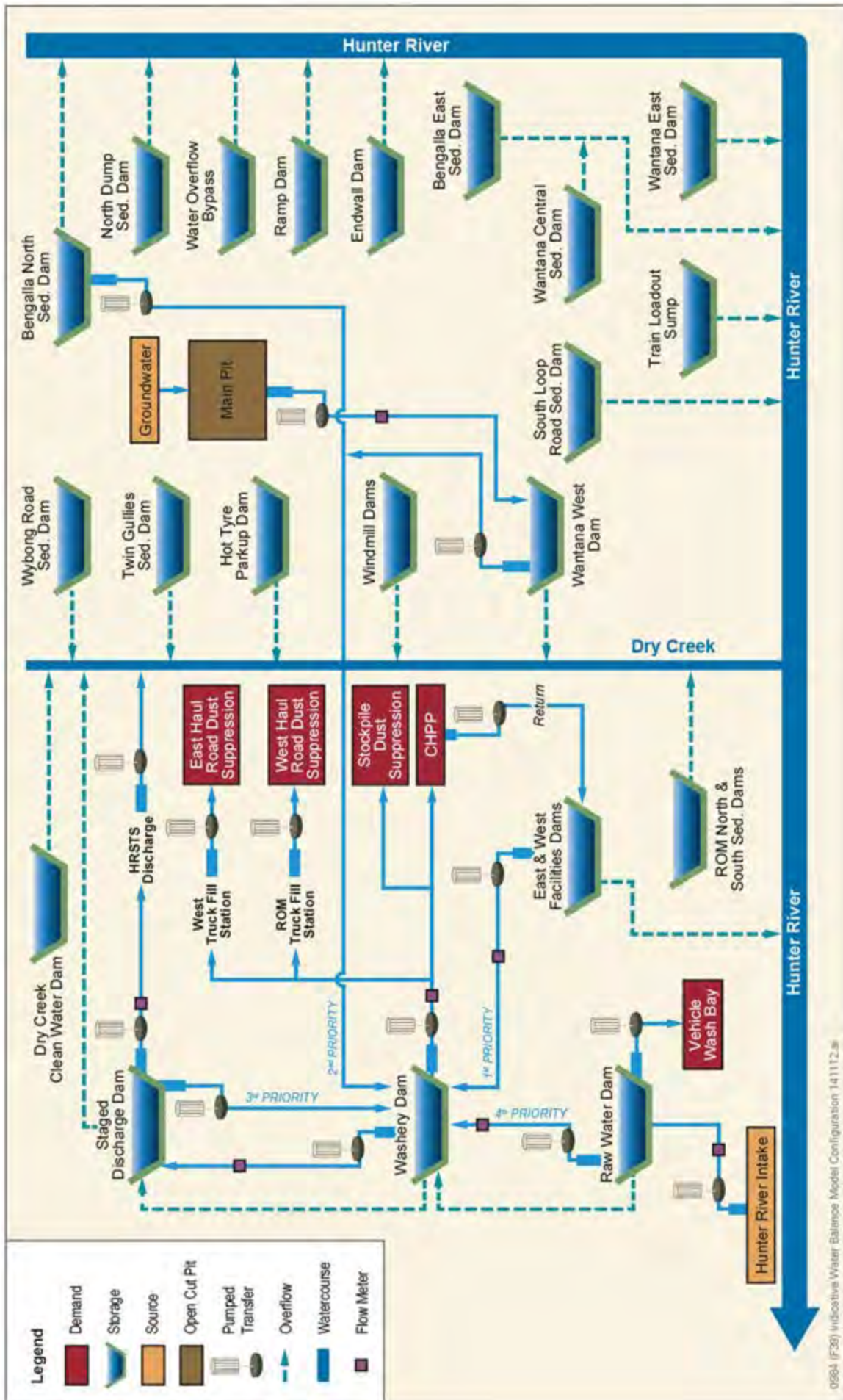
The water balance modelling provides an assessment of surface water impacts under the full range of wet and dry conditions that have historically been experienced in the region. The model results are presented as a statistical summary of the results from different realisations, represented as percentiles. For example, the 50th percentile value represents the median of all realisations. The 10th percentile value represents the result that is exceeded in 90 percent of the model realisations.

Five different stages of the Project life were considered in the modelling (Years 1, 4, 8, 15 and 24). Although the catchment areas will continually change as mining progresses, these modelled years will provide a good representation of conditions over the 24 year Project life. The surface water runoff volumes used in the water balance model were estimated using the Australian Water Balance Model (Boughton, 1993).

The Australian Water Balance Model calculates daily runoff values using measured rainfall and estimates of evapotranspiration. The model also considers the effect of groundwater recharge and discharge on surface flows. The Australian Water Balance Model was verified using recorded storage volumes for the period from January 2010 to December 2011. There was good agreement between the predicted and measured storage volumes within the water management system.

Table 48 Simulated Inflows and Outflows for the Water Management System

Inflows	Outflows
Direct rainfall onto water surface of storage	Evaporation from water surface of storages
Catchment Runoff	Water demands (CHPP, dust suppression, vehicle wash down)
Groundwater Inflows	Overflows from storages
Raw water extracted from the Hunter River	Controlled releases under the HRSTS
	Clean water pumped from clean water dams



BENGALLA MINE

Indicative Water Balance Model Configuration

FIGURE 51

Hansen Bailey



Groundwater inflows were sourced from the Groundwater Impact Assessment prepared by AGE (see **Section 8.7**). The “pumpable” groundwater inflows for the representative model years are presented in **Table 49**. The “pumpable” volume is the total volume of inflows minus evaporative losses. In Years 8 and 24, the evaporation rate exceeds the seepage rate. As a result, the volume of pumpable inflows is zero.

Controlled discharges have been modelled in accordance with the rules of the HRSTS. That is, the water balance model only simulated releases of water during periods when the flow rate in the Hunter River exceeded 1,000 ML/day and river salinity was below the release threshold value. Operational water demands were estimated using historical data collected by BMC. The estimated water requirements for coal processing, dust suppression and vehicle washing are presented in **Table 50**.

Salt Balance

The water balance model also included a salt balance to assess the salinity of waters discharged from the site. Salt generation rates for the surrounding catchments, both disturbed and undisturbed, were calculated using water quality monitoring data for the onsite storages. Salt generation rates for groundwater inflows were also sourced from groundwater monitoring data.

Flooding

The flood extent of the Hunter River was estimated using historical flood data. The largest recorded flood is the February 1955 event. WRM had previously undertaken a flood frequency analysis to determine the frequency of the February 1955 flood.

The flood frequency analysis found that the February 1955 flood was approximately equal to a 100 year ARI design flood event. Accordingly, the extent of the February 1955 flood was adopted as the 100 year ARI design flood extent.

8.6.3 Impact Assessment

Simulated Water Balance

The results of the site water balance for Years 1, 4, 8, 15 and 24 are provided in detail in **Appendix J**. These results are summarised in the following sections. The water balance model was used to predict the inflows and outflows for the water management system using the 118 years of recorded rainfall data. The predicted average inflows and outflows for the representative mine stages are shown in **Table 51**.

Drought Conditions

This assessment also considered the water balance for very dry conditions as requested by NOW. **Table 52** lists the predicted inflows and outflows based on climatic data for the year 1980, which was the driest year on record. Due to the low rainfall, there is no need to discharge water under the HRSTS and overflows from sedimentation dams are minimal. The reduced rainfall and runoff yield would result in a higher demand on raw water from the Hunter River.

Water Demand from External Sources

The operation is expected to achieve the maximum production rate of 15 Mtpa ROM coal between Years 4 and 24. Wherever possible, operational demands will be met using recycled water and water stored within the water management system. Raw water will only be extracted from the Hunter River when there is a water shortage on site. The exception is the vehicle wash bays, which rely directly on raw water. The annual water consumption for the wash bays is estimated at 97 ML/year to 132 ML/year. Better quality water is required at the wash bays to maintain the operability of mobile plant.

The water balance model predicts that raw water will need to be sourced from the Hunter River in all years of the Project. Under median conditions, the Project will require approximately 1,500 ML/year from external sources. Under very dry conditions, the external water requirement is predicted to be approximately 2,257 ML/year. The external water requirement is greater than the maximum water demand (1,974 ML/year) due to the need to account for evaporative losses.

Table 49 Predicted Groundwater Inflows

Project Year	Groundwater Inflows	
	ML/day	ML/year
Year 1	0.544	199
Year 4	0.038	14
Year 8	0.000	0
Year 15	0.008	3
Year 24	0.000	0

Table 50 Predicted Mining Water Demands

Year	Site Demands (ML/year)				
	CHPP Net Demand	Stockpile Dust Suppression	Haul Road Dust Suppression	Net Vehicle Washdown	Total Site Demand
Year 1	830	115	408	97	1,450
Year 4	1,164	150	457	132	1,903
Year 8	1,164	150	437	132	1,883
Year 15	1,164	150	527	132	1,973
Year 24	1,164	150	509	132	1,955

Table 51 Water Balance Summary – Average Conditions

Year	Year 1	Year 4	Year 8	Year 15	Year 24
Water Inputs (ML/year)					
Rainfall/Runoff Yield					
<i>Mine Water System</i>	210	299	443	453	342
<i>Clean Water System</i>	3	765	733	468	64
<i>Sedimentation System</i>	344	336	294	435	325
Total	557	1,400	1,469	1,356	731
Groundwater Inflows	199	14	0	3	0
Hunter River Intake	972	1,323	1,267	1,263	1,345
Gross Water Inputs	1,727	2,736	2,736	2,622	2,076
Water Outputs (ML/year)					
Evaporation from Storages					
<i>Mine Water System</i>	19	35	21	22	19
<i>Clean Water System</i>	4	9	9	9	9
<i>Sedimentation System</i>	92	50	27	45	40
Total	115	93	57	75	68
Dam Overflows (offsite)					
<i>Mine Water System</i>	0	0	0	0	0
<i>Clean Water System</i>	0	0	0	0	0
<i>Sedimentation System</i>	145	69	74	136	110
Total	145	69	74	136	110
HRSTS Discharges	19	19	82	85	44
CHPP Demand (Loss)	830	1,164	1,164	1,164	1,164
Stockpile Dust Suppression	115	150	150	150	150
Haul Road Dust Suppression	409	458	438	528	510
Vehicle Wash	97	132	132	132	132
Clean Water Pumped to Dry Creek	0	779	728	464	60
Gross Water Outputs	1,730	2,864	2,825	2,735	2,239
Water Balance (ML/year)					
Change in Storage Volumes	0	0	0	0	0
Gross Water Balance (Deficit)	3	128	89	114	163

Table 52 Water Balance Summary – 1980 Drought Conditions

Year	Year 1	Year 4	Year 8	Year 15	Year 24
Water Inputs (ML/year)					
Rainfall/Runoff Yield					
<i>Mine Water System</i>	22	35	45	45	35
<i>Clean Water System</i>	1	88	84	54	8
<i>Sedimentation System</i>	40	38	31	48	37
Total	62	161	160	147	81
Groundwater Inflows	199	14	0	3	0
Hunter River Intake	1,205	1,676	1,666	1,709	1,710
Gross Water Inputs	1,466	1,851	1,826	1,859	1,791
Water Outputs (ML/ year)					
Evaporation from Storages					
<i>Mine Water System</i>	13	41	11	11	11
<i>Clean Water System</i>	5	9	9	9	9
<i>Sedimentation System</i>	23	9	7	15	14
Total	40	59	27	34	34
Dam Overflows (offsite)					
<i>Mine Water System</i>	0	0	0	0	0
<i>Clean Water System</i>	0	0	0	0	0
<i>Sedimentation System</i>	1	0	0	0	0
Total	1	0	0	0	0
HRSTS Discharges					
CHPP Demand (Loss)	830	1,164	1,164	1,164	1,164
Stockpile Dust Suppression	115	150	150	150	150
Haul Road Dust Suppression	435	487	466	563	543
Vehicle Wash	97	132	132	132	132
Clean Water Pumped to Dry Creek	0	88	82	52	7
Gross Water Outputs	1,520	2,081	2,022	2,095	2,031
Water Balance (ML/ year)					
Change in Storage Volumes	-51	-33	-9	-9	-9
Gross Water Balance (deficit)	3	197	186	227	231

An analysis was undertaken to determine the water requirements for lower production rates. This analysis determined that BMC's existing allocation will be sufficient until the production rate exceeds 9.5 Mtpa ROM under drier conditions. **Table 53** shows the predicted water requirements for production rates of 9.5 Mtpa, 10.7 Mtpa, 13.0 Mtpa and 15.0 Mtpa.

BMC will hold all relevant licences, share component and allocation required to comply with the WM Act and Water Act at all times water is taken, whether during or after the life of the Project (see **Section 5.4.4**).

Reduction in Catchment Areas

The water management system will capture runoff that would have otherwise flowed to either Dry Creek or the Hunter River. This effectively reduces the catchment areas of these streams. The magnitude of the reductions in catchment areas will vary as mining progresses to the west. **Table 54** shows the reduction in the Hunter River and Dry Creek catchments over the Project life.

The maximum reduction in the Dry Creek catchment occurs in Year 15. In this year, the water management system captures runoff from 983 ha of the catchment area, resulting in a 39% reduction in the Dry Creek catchment. The final landform will capture 551 ha (22%) of the Dry Creek catchment.

The reduction in the Hunter River catchment during mining is negligible. The final landform will restore the Hunter River catchment to its pre-mining area.

Uncontrolled Offsite Discharges

The results of the water balance model show that the mine water dams are not expected to overflow during the Project life. Therefore, there will be no uncontrolled releases of saline water. The only storages that are expected to overflow are the sedimentation dams. Overflows from sedimentation dams are expected to have a lower salinity than mine affected water and will be treated for TSS for events up to the design event. Up to 143 ML/year of treated water is predicted to overflow from sediment dams in an average rainfall year.

HRSTS Controlled Discharges

BMC is licensed to discharge water under the HRSTS. The water balance model has calculated the total annual discharges for all possible 24 year historical climate sequences on record.

Table 53 Production Levels and Predicted External Water Requirements

ROM Production (Mtpa)	Predicted Water Requirement (ML/year)	
	Average	Maximum (Drier Conditions)
9.5	1,120	1,449
10.7	1,220	1,680
13.0	1,374	2,000
15.0	1,500	2,257

Table 54 Reduction in Catchment Areas

Mine Stage	Dry Creek (to Hunter River Confluence)		Hunter River (to Dry Creek Confluence)	
	Area (km ²)	Proportion of Pre-mining Area	Area (km ²)	Proportion of Pre-mining Area
Pre-Mining	25.15	100%	4,177	100%
Approved as at 2011	22.42	89%	4,172	99.9%
Year 1	22.12	88%	4,172	99.9%
Year 4	20.47	81%	4,172	99.9%
Year 8	17.58	70%	4,172	99.9%
Year 15	15.32	61%	4,172	99.9%
Year 24	18.44	73%	4,173	99.9%
Final Landform	19.64	78%	4,177	100%

The results of the water balance indicate the following:

- There are no discharges from the mine water system for the median model result;
- There is a 10% probability that more than 350 ML would need to be discharged from the mine water management system in any year; and
- Under very wet conditions, there is a 1% likelihood that more than 1,000 ML would need to be discharged from the mine water management system in any year.

Under all rainfall scenarios, the amount of water that needs to be discharged by the Project increases significantly in Year 8. This is due to a large increase in the catchment area reporting to the water management system.

Controlled discharges are limited to a flow rate of 200 ML/day by EPL 6538. Due to the ephemeral nature of Dry Creek, controlled discharges are likely to occur when there is no flow in the creek. The existing operations at Bengalla have discharged water at up to the maximum flow rate. Therefore, the impacts on the condition of Dry Creek are not expected to exceed what is currently experienced.

The Project will require the relocation of the Staged Discharge Dam and the discharge point to the location shown on **Figure 50**. The new discharge point will be located and designed so that excessive erosion is not caused by the water as it flows into Dry Creek. The impacts on ecology due to the relocation of the Discharge Dam are discussed in **Section 8.11**.

The detailed design of the Staged Discharge Dam discharge point is discussed in the Dry Creek interim management system and conceptual re-establishment study provided in **Appendix X**.

The HRSTS limits controlled discharges to periods of high flow. The maximum discharge rate of 200 ML/day is significantly less than the minimum flow in the Hunter River of 1,000 ML/day when discharges are allowed under the HRSTS. As a result, the controlled discharges are unlikely to result in a significant increase in bed and bank erosion.

The adopted release rate and release rules will remain the same as under existing conditions.

Reduction in Flow

The reduction in the catchment areas of Dry Creek and the Hunter River will result in reduced flow volumes to these streams. Discharges under the HRSTS will replace some of the water taken out of the catchment. However, there will still be a net reduction in flow volumes in the Hunter River and Dry Creek. During the Project life, average flows to the Hunter River are predicted to be reduced by 458 ML/year (similar to existing conditions) to 923 ML/year, depending on the stage of the Project. The maximum predicted water capture (923 ML/year) equates to a 0.5% reduction in the flow volume at Denman. After the completion of mining, the average reduction in flows is estimated at 423 ML/year. This represents a 0.2% reduction in the flow volume at Denman. The controlled discharges to Dry Creek and the Hunter River have the potential to alter the flow regime of these streams. The water balance indicated that controlled discharge volumes are greatest in Years 15 to 23. Even during this period, the changes to the flow regime of the Hunter River are negligible.

Impacts on Water Quality

The Bengalla water management system has been designed so that there are no overflows from the mine water dams. The results from the water balance modelling have confirmed that this will remain the case for the Project. Only the sedimentation dams are expected to overflow. The conditions of the HRSTS ensure that the salt concentration is less than 600 µS/cm in the Hunter River upstream of Denman. BMC will continue to discharge water in accordance with the HRSTS and EPL 6538. This will allow salt concentrations to be maintained at acceptable levels.

The results of the salt balance are summarised in **Table 55**. Due to the reduction in the Dry Creek and Hunter River catchments, the salt load generated by catchment runoff will decrease slightly.

Table 55 Predicted Surface Water Salt Balance

Mining Stage	Hunter River Salt Load (t/day)			
	Catchment Runoff	Sediment Dam Overflows	HRSTS Discharges	Total
Pre-Mining	130.92	-	-	130.92
Existing (2011)	130.68	0.07	0.06	130.81
Year 1	130.67	0.28	0.04	130.99
Year 4	130.62	0.36	0.04	131.02
Year 8	130.53	0.18	0.21	130.92
Year 15	130.46	0.18	0.21	130.85
Year 24	130.55	0	0.14	130.69
Final Landform	130.75	-	-	130.75

This will be balanced to an extent by the salt load generated by sediment dam overflows and discharges under the HRSTS. The salt balance indicates that the net impact of the Project will not significantly alter the salt load in the Hunter River.

Releases from Clean Water Dams

The water management system utilises four clean water dams (CW1, Satellite Dam, Diversion Dam and Spare Dam) to capture runoff from undisturbed catchments and to divert clean water around disturbed areas. The water management system proposes to maintain the clean water dams in an empty state. This minimises the impact on flow volumes in the Hunter River and Dry Creek. The proposed operation of CW1 is discussed further in Section 4.9.

A pump rate of up to 1,085 ML/day has been proposed for CW1. This rate will allow the water from a 200 year Average Recurrence Interval (ARI) storm event to be pumped out in 14 days. The design parameters for CW1 are discussed further in Appendix X.

Flooding Impacts

The largest recorded flood event for the Hunter River in the vicinity of Bengalla is the February 1955 flood. The Flood Frequency Analysis undertaken by WRM indicates that the February 1955 flood was approximately equal to a 100 year ARI event. The maximum extent of a similar flood would not impact on any activities associated with the Project. Furthermore, the February 1955 flood occurred prior to the construction of Glenbawn Dam. The 100 year ARI flood extent of the Hunter River after the construction of Glenbawn Dam is likely to be smaller than the extent of the February 1955 flood. Therefore, the Project is not expected to affect the behaviour of flood flows in the Hunter River.

Water will be conveyed through a pipeline during the interim diversion of Dry Creek. The later permanent realignment of Dry Creek will pass through rehabilitated areas as detailed in Section 8.21.

Final Void Storage and Water Quality

The OPSIM water balance model was also used to predict the water level and salinity in the final void.

The final void water level is predicted to stabilise at RL 64 m to 71 m, which is approximately RL 90 m below the crest of the final void. As a result, the final void will not overflow. This is comparable to the findings of the Groundwater Impact Assessment which also predicted that the final void is very unlikely to overflow. The water level in the final void was also predicted in the Ground Water Impact Assessment and is discussed in Section 8.7.3.

The salinity of the final void is predicted to increase at a rate of 5 $\mu\text{S}/\text{cm}$ for the first 1,000 years after mining. The salinity will ultimately stabilise below 20,000 $\mu\text{S}/\text{cm}$.

Water Licensing Requirements

The clean water diversion dams capture runoff from undisturbed catchments and divert this water away from disturbed areas. This water is pumped to the CW₁ discharge location and released into Dry Creek. Due to the exemption for excluded works, a WAL is not required for the catchment areas of the clean water diversion drains. The other dams in the water management system are solely for the capture, containment and re-circulation of mine affected water for the purpose of preventing water contamination. The exemption for excluded works also applies to water captured in these dams. A WAL is only required for water taken from the residual catchment between the clean water diversion dams and the highwall. Water draining to the Raw Water Dam, Staged Discharge Dam and Washery Dam will also require a WAL. This water is taken from the Muswellbrook Water Source under the Hunter Unregulated and Alluvial Water Sources WSP. The Muswellbrook Water Source has a total share component of 1,816 units, including a share component of 636 units for unregulated river access licences.

In addition, a WAL will be required for the extraction of water from the Hunter River to address operational water shortages. Table 53 shows that the external water requirement is dependent on the production rate. BMC and the Bengalla Joint Venturers currently hold WALs for the Hunter Regulated River Water Source with share components totalling 1,449 high security units and 4,562 general security units. The predicted surface water requirements for the Project are summarised in Table 56.

Table 56 Predicted Surface Water Requirements

Water Sharing Plan	Water Source	ROM Coal Production (Mtpa)	Predicted Annual Take (ML/year)		Predicted Annual Impact on Water Source (%)	
			Average	Max	Average	Max
Hunter Regulated River Water Source	Hunter Regulated River Water Source	9.5	1,120	1,449	1.3	1.7
		10.7	1,220	1,680	1.4	2.0
		13.0	1,374	2,000	1.6	2.3
		15.0	1,500	2,257	1.8	2.6
Hunter Unregulated River Water Source	Muswellbrook Water Source	N/A	20	39	3.1	6.1

8.6.4 Mitigation and Management

Water Management Plan

BMC will update the existing Surface Water Management Plan as a section of the Water Management Plan, for the Project to the approval of relevant regulators to include the commitments in this EIS. The Water Management Plan will also include:

- Detailed baseline data on surface water flows and quality for water bodies that could potentially be impacted by the Project;
- Surface water and stream health impact assessment criteria including trigger levels for investigating any potentially adverse surface water impacts; and
- A program to monitor and assess:
 - Surface water flows and quality;
 - Impacts on water uses;
 - Stream health; and
 - Channel Stability.

BMC will hold all relevant licences, share component and allocation required to comply with the WM Act and Water Act at all times water is taken, whether during or after the life of the Project (see Section 5.4.4).

Water Management System

BMC will generally implement the revised water management system described in Section 8.6.1 and assessed in the water balance model. The water management system has been designed to minimise the Project's impacts on surface water. The key principles of the water management system are:

- Diversion of clean surface water runoff away from areas disturbed by mining activities;
- Operation of the mine water system to ensure no uncontrolled releases of mine water from the site;
- Collection of potentially sediment-affected runoff in sediment dams for treatment prior to discharges from site or reuse in the mine water management system;
- Transfer of mine water (groundwater inflows) to the Washery Dam for reuse as a water supply;
- Collection of contaminated water from industrial areas for treatment in an oil and grease separator prior to recycling in the mine water management system; and
- Minimisation of fresh water usage by recycling water from the mine water system before taking additional water from the mine's external supply source.

Dry Creek Temporary Diversion

Water from the Dry Creek catchment will be captured in CW₁ during the temporary diversion of the creek. In order to maintain safe operating levels in CW₁, the pump and pipeline system has been designed to accommodate a flow rate of 1,085 L/s. An energy dissipater structure will be constructed

at the end of the pipeline to prevent erosion of the natural drainage line. The temporary diversion of Dry Creek is discussed in greater detail in Section 4.9.

Dry Creek Re-establishment

The permanent re-alignment of Dry Creek has been designed to mimic the current alignment of Dry Creek. Channel meanders have been incorporated into the design to control flows. The re-establishment of Dry Creek is discussed further in Section 8.21 and Appendix X.

Drainage of Final Landform

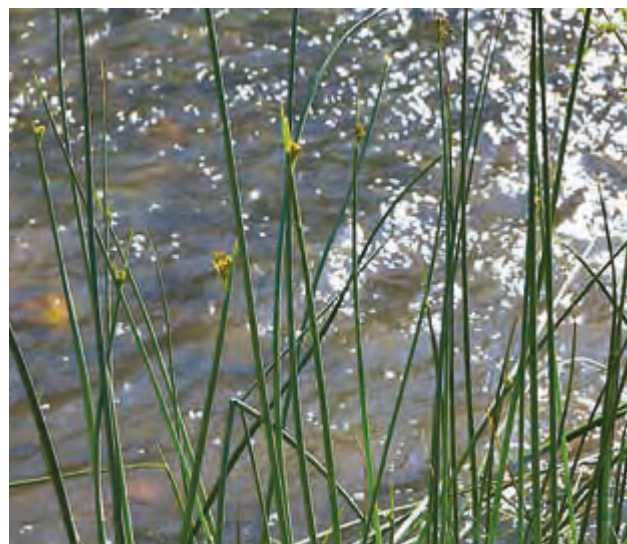
The rehabilitated overburden to the east of mining operations will be drained using the approach currently adopted at Bengalla. This process is described further in Section 8.21 and involves:

- Topsoiling and revegetation of the final landform;
- Construction of contour drains across the batter slope to minimise the potential for rilling and gullying of the finished landform;
- Collection of inflows from contour drains in rock chutes (flowing downslope); and
- Discharge from rock chutes to sediment basin prior to discharge from the site.

Surface Water Monitoring Program

The existing Surface Water Monitoring Program described in Section 3.14 will be revised and implemented throughout the duration of the Project. BMC will continue to monitor the quantity and quality of water in onsite storages, the Hunter River and Dry Creek (until mined through).

Monitoring locations will be relocated to accommodate the diversion of Dry Creek and the relocation of Washery Dam, Staged Discharge Dam and Raw Water Dam. The sampling frequency and parameters monitored will be consistent with current monitoring. An indicative revised surface water management system is shown on Figure 50.



8.7 Groundwater

8.7.1 Background

A Groundwater Impact Assessment was undertaken by AGE and is provided in **Appendix K**. The objectives of this assessment included:

- Characterising the existing groundwater regime;
- Predicting changes to groundwater levels in the vicinity of the Project;
- Predicting impacts on other water users;
- Quantifying groundwater inflows into mining areas;
- Estimating the water level in the final void; and
- Recommending measures to manage and account for these impacts.

Existing Groundwater Regime

The Groundwater Impact Assessment considered the following legislation, policies and guidelines:

- Water Act;
- WM Act and associated water sharing plans;
- *Water Management (General) Regulation 2011*;
- *NSW Groundwater Quality Protection Policy* (1998);
- *NSW Groundwater Dependent Ecosystems Policy* (2002);
- *NSW Groundwater Quantity Protection Policy* (undated); and
- AIP.

Existing Groundwater Systems

The regional groundwater regime in the vicinity of the Project consists of three groundwater systems:

- Quaternary alluvium along the Hunter River;
- Weathered bedrock (regolith); and
- Permian coal measures.

The alluvial deposits of the Hunter River are a significant source of groundwater. The Hunter River alluvium is comprised of a basal sand and gravel aquifer, overlain by a less permeable silty / clayey upper unit. Pumping tests have measured the hydraulic conductivity of the basal gravel unit at between 5 m/day and 40 m/day, with a median value of 8 m/day. This indicates that the basal gravel forms a moderately to highly productive aquifer system.

In the vicinity of the Project, the Hunter River alluvium is up to 14 m thick, with the basal gravel being 2.5 m to 4 m thick. The saturated thickness of the alluvium ranges from 2 m to 10 m, which is considered low. As a result, the registered bores in the vicinity of the Project have recorded yields of 0.1 L/s to 7 L/s.

The Hunter River alluvium is recharged by direct rainfall, runoff from higher areas, leakage from the Hunter River and upward leakage from the underlying coal measures. Measured groundwater levels indicate that there is a shallow hydraulic gradient towards the Hunter River. The water within the Hunter River alluvial aquifer is typically fresh to slightly brackish (EC less than 1,500 $\mu\text{S}/\text{cm}$). The alluvial deposits of gullies and creeks within the Project Boundary, including Dry Creek, are very thin and comprised of unconsolidated silts, sands and minor fine gravels of mixed colluvial-alluvial origin. Due to the limited thickness and aerial extent of these deposits, their groundwater storage capacities are low. As a result, the alluvial deposits of minor creeks and gullies cannot be classified as productive water yielding aquifers.

The shallow bedrock water bearing zone consists of surficial soils and weathered bedrock. The depth of the water bearing zone is dependent upon the depth of weathering and the distribution of permeable fracture systems.

The unweathered sandstone and siltstone strata within the Whittingham Coal Measures are characterised by a very low permeability. Testing indicates a hydraulic conductivity of between 5×10^{-3} m/day and 8.6×10^{-5} m/day for the overburden and interburden materials. The coal seams are also of low to moderate permeability and act as the prime water bearing strata within the coal measures sequence. The EC of groundwater within the coal measures typically ranges from 4,000 to 8,000 $\mu\text{S}/\text{cm}$. This water is considered brackish and is only suitable for stock watering.

Monitoring

BMC has been monitoring groundwater levels and quality in the vicinity of Bengalla since 1992. The groundwater monitoring network has been gradually expanded to accommodate the development of mining operations. The current Bengalla groundwater monitoring network consists of 35 monitoring sites and includes monitoring of the alluvial, regolith, Permian and coal seam groundwater systems. The locations of BMC's monitoring bores are illustrated on **Figure 12**. AGE identified the need for additional sites to monitor the coal seams in the western portion of the Project Boundary. Accordingly, three vibrating wire piezometers (BE1, BE2 and BE3) were installed in December 2011. These piezometers will be used to monitor the depressurisation of coal seams and the overlying strata. The groundwater monitoring network operated by BMC is discussed further in **Section 3.14**.

Existing Water Users

A search of the NOW database was conducted to identify bores in the vicinity of the Project. **Figure 54** shows the registered bores and wells located within the Hunter River alluvial plain and within 5 km of Bengalla.

The majority of these are shallow wells (54) with the remainder being bores (22). The average depth of the wells and bores is 11.5 m, which highlights the thin nature of the alluvium. BMC land ownership extends from the proposed mining area, about 2 km to the south and east, 3 km to the west and generally less than 0.5 km to the north. To the south, the land ownership extends to the edge of the Hunter River. The majority of the registered water bores are located on land owned by BMC, the Mount Pleasant Project or Mt Arthur Coal Mine. Only a small number of bores are located on private land and these are relatively distant from the proposed mining area.

8.7.2 Methodology

Desktop Assessment

AGE conducted a review of previous groundwater assessments to develop an understanding of the characteristics of the regional groundwater system. The following groundwater studies were considered:

- Australian Groundwater Consultants (1979) for the Bengalla area;
- Australian Groundwater Consultants (1980) and Laurie, Montgomerie and Pettit (1982) for the Mt Arthur North Coal Project;
- Mackie, Martin and Associates (1993) for the Bengalla Mine;
- Mackie Environmental Research (2000) for the Mt Arthur Coal and Dartbrook mines;
- AGE (2006) for the Mt Arthur Coal South Mining area Extension; and
- AGE (2007) and AGE (2010) for the Bengalla Mine.

Groundwater Modelling

AGE used a FEFLOW model to simulate the impact of the Project on the groundwater regime. FEFLOW is a computer based modelling package that is capable of simulating two and three-dimensional, density coupled groundwater flow. This model was used to predict the drawdown in the potentiometric surface and seepage rates into mining areas. FEFLOW was previously used in the groundwater impact assessment for the Wantana Extension (AGE, 2007).

The modelling was based on a conceptual model of the groundwater regime illustrated in **Figure 52**. The Hunter River alluvium is considered the only significant aquifer system in the vicinity of the Project. The Hunter River alluvial aquifer is an unconfined aquifer, although the clay and silt overlying the gravel base can act as a confining layer. The coal seams are a confined groundwater system due to the low permeability of the interburden strata that act as aquitards.

Rainfall sourced recharge was calculated using the infiltration rates adopted for the Wantana Extension (AGE, 2007), namely:

- 76 mm/year for the Hunter River alluvium (12% of average annual rainfall);
- 12 mm/year for coal seam subcrops (2% of average annual rainfall); and
- 1 to 6 mm/year for the Permian (less than 1% of average annual rainfall).

Evapotranspiration was accounted for in the net recharge applied to the model.

The FEFLOW model was calibrated using monitoring data collected at Bengalla. The AGE model (2007) developed for the Wantana Extension was tested using water levels recorded after 2007. This verification process indicated that further improvements could be made to the calibration of this model. The AGE model (2007) was subsequently recalibrated using the PEST automated parameter estimation code. The AGE (2007) model was recalibrated using water level data sourced from 54 different bores, including locations that were not used in the initial calibration of the model. A transient calibration was also undertaken and the model successfully reproduced the trend of declining water levels observed in some bores.

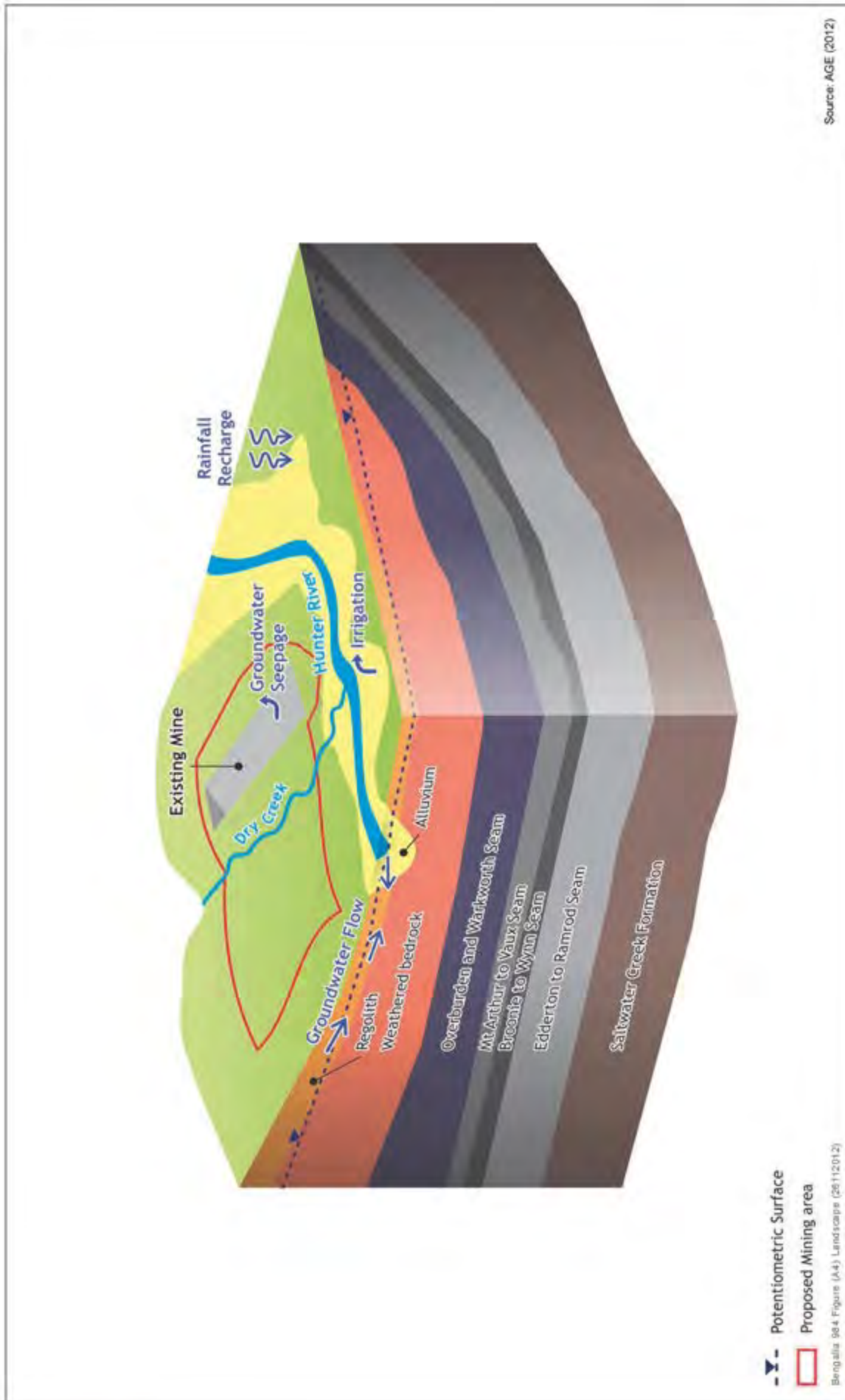
The modelling simulated the impacts of a 24 year mine plan mining at a rate at up to 15 Mtpa. The impacts are presented for Years 1, 4, 8, 15 and 24 of the mine plan. The impacts show the movement of the zone of depressurisation throughout the Project life.

In order to assess cumulative groundwater impacts, the Mount Pleasant Project and Mt Arthur Coal Mine have been considered as operating for the life of the Project in the simulation. It was assumed that the Mount Pleasant Project commenced in 2008 consistent with the existing model. Mt Arthur Coal Mine and Mount Pleasant Project were modelled based on publicly available data for these developments (i.e. Mt Arthur Coal EA (2009a) and Mount Pleasant Project 1997 EIS).

Sensitivity Analysis

A sensitivity analysis was undertaken to quantify the uncertainty in the calibrated model. The calibrated values for horizontal hydraulic conductivity, vertical hydraulic conductivity, specific yield and recharge were varied by $\pm 25\%$ and $\pm 50\%$ in the sensitivity model runs.

The groundwater inflows predicted by the sensitivity model runs were generally lower than the predictions made by the calibrated model. The results of the sensitivity model runs mimicked the trends predicted by the calibrated model for groundwater inflows and leakage to the alluvium.



The drawdowns predicted by the sensitivity model runs were similar to the calibrated model predictions, with the exception of areas to the west and north-west. These variations occur in areas where the water table is unaffected by the Project.

The sensitivity analysis determined that the calibrated model satisfied the criteria for the Class 2 confidence level, under the classification system developed by Barnett et al (2012). This classification is considered adequate for predicting impacts of proposed developments in medium value aquifers.

Peer Review

An independent peer review of the AGE Groundwater Impact Assessment and 3D groundwater modelling was undertaken by Dr Frans Kalf of Kalf and Associates Pty Limited in accordance with the National Water Commission 2012 'Australian Groundwater Modelling Guidelines'. Dr Frans Kalf has 43 years' experience in hydrogeological investigations and flow and solute transport modelling.

The peer review examined the content of the Groundwater Impact Assessment with a key focus on the model conceptualisation, calibration, verification, predictions and sensitivity analysis. The outcomes of the peer review were incorporated into the Groundwater Impact Assessment.

The peer review concluded that the groundwater model was fit for the purpose of assessing the impacts on the groundwater regime. Both the model calibration and the impacts predicted by the model were considered to be reasonable. Dr Frans Kalf approved of the hydrogeological description, conceptualisation, model design, simulation and reporting in the Groundwater Impact Assessment. The stated objectives of the modelling study were deemed to have been addressed satisfactorily. A copy of the peer review report is provided in Appendix B of Appendix K.

8.7.3 Impact Assessment

Impacts on Alluvial Aquifers

The flow of Permian groundwater into the Hunter River alluvial aquifer is likely to be reduced by the cumulative impact of the Project, Mt Arthur Coal Mine and Mount Pleasant Project. The maximum reduction in groundwater flow to the alluvium occurs in Year 1. The reduction in flow peaks at approximately 0.63 ML/day at the beginning of Year 1. This rate consistently decreases throughout Year 1, resulting in a maximum annual reduction of approximately 220 ML/year. As mining moves away from the alluvium, the reduction in leakage decreases to approximately 0.25 ML/day. The average annual reduction in flow to the alluvium is predicted to be 112 ML/year.

Figure 53 shows the variation in the groundwater flux to the Hunter River alluvial aquifer during the Project life. This illustrates that the reduction in groundwater flow to the alluvium decreases as the endwall moves away from the alluvium.

The reduction in groundwater flow to the alluvium will persist after the completion of mining. The evaporation of water from the final void lake results in a constant flux of groundwater into the final void.

This generates a permanent zone of depressurisation in the Permian around the final void, which reduces the groundwater flux from the Permian to the alluvium. The flux to the alluvium is predicted to be reduced by 0.6 ML/day at 1,000 years after the completion of mining. This is lower than the reduction in groundwater flow during the Project.

Cumulative mining activities at Bengalla, Mt Arthur Coal Mine and the Mount Pleasant Project are expected to take water from the Hunter River alluvial aquifer. The maximum drawdown is expected to occur at the beginning of the Project, when the mining area is closest to the alluvium. In Year 1, the 1 m and 2 m drawdown contours extend below the Hunter River alluvium and combine with the drawdown induced by Mt Arthur Coal Mine's operations.

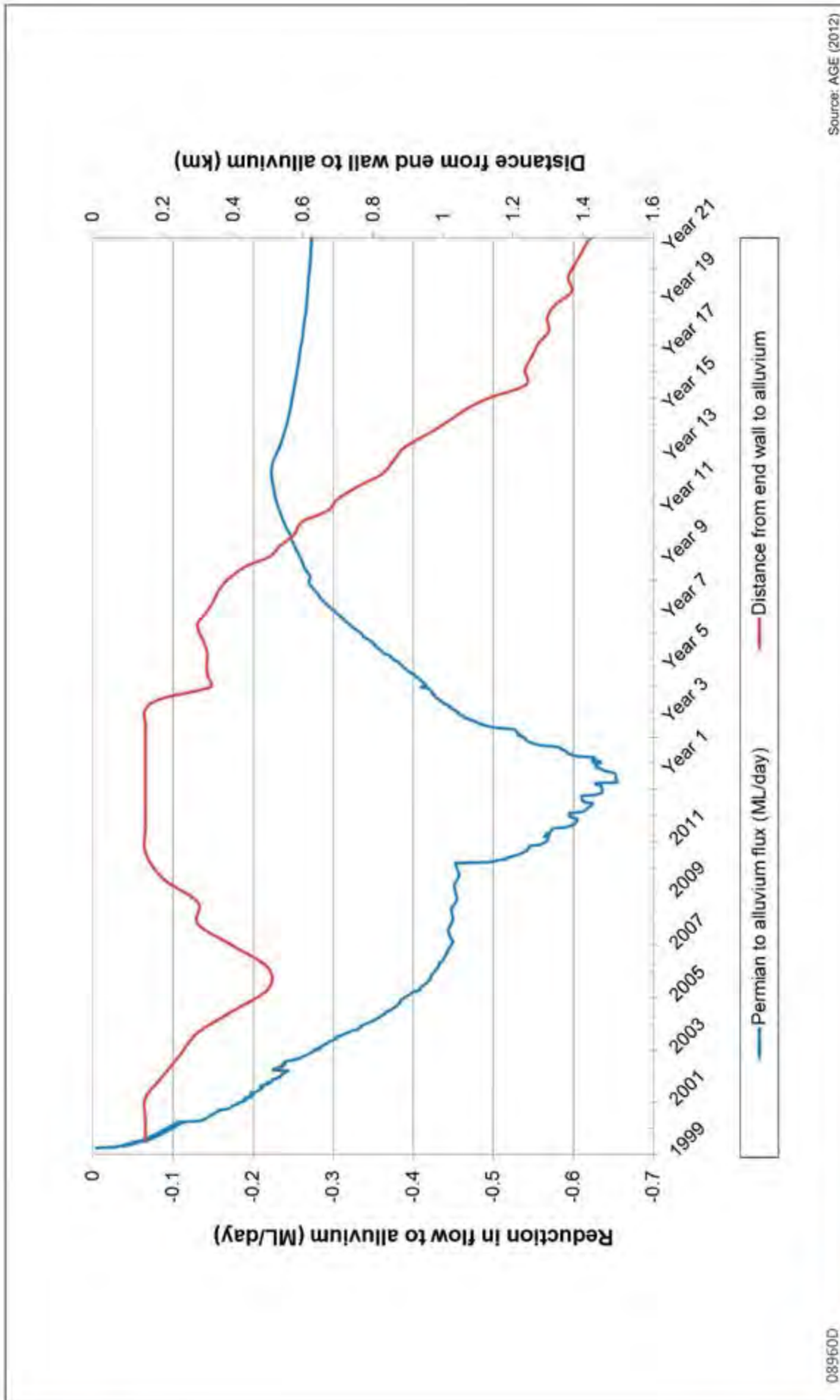
Mining at Bengalla will continue to advance in a westerly direction. As mining moves away from the Hunter River alluvium, the drawdown of the Hunter River alluvium will progressively decrease. By Year 4, the drawdown generated by the Project ceases to combine with the drawdown generated by Mt Arthur Coal Mine. The area of the Hunter River alluvium within the 1 m and 2 m drawdown contours will continue to decrease as mining progresses to the west. The 1 m cumulative drawdown contour associated with the Project and the adjacent Mount Pleasant Project and Mt Arthur Coal Mine at the end of mining is illustrated in Figure 54. The predicted drawdown contours for each of the modelled years are presented in Appendix K.

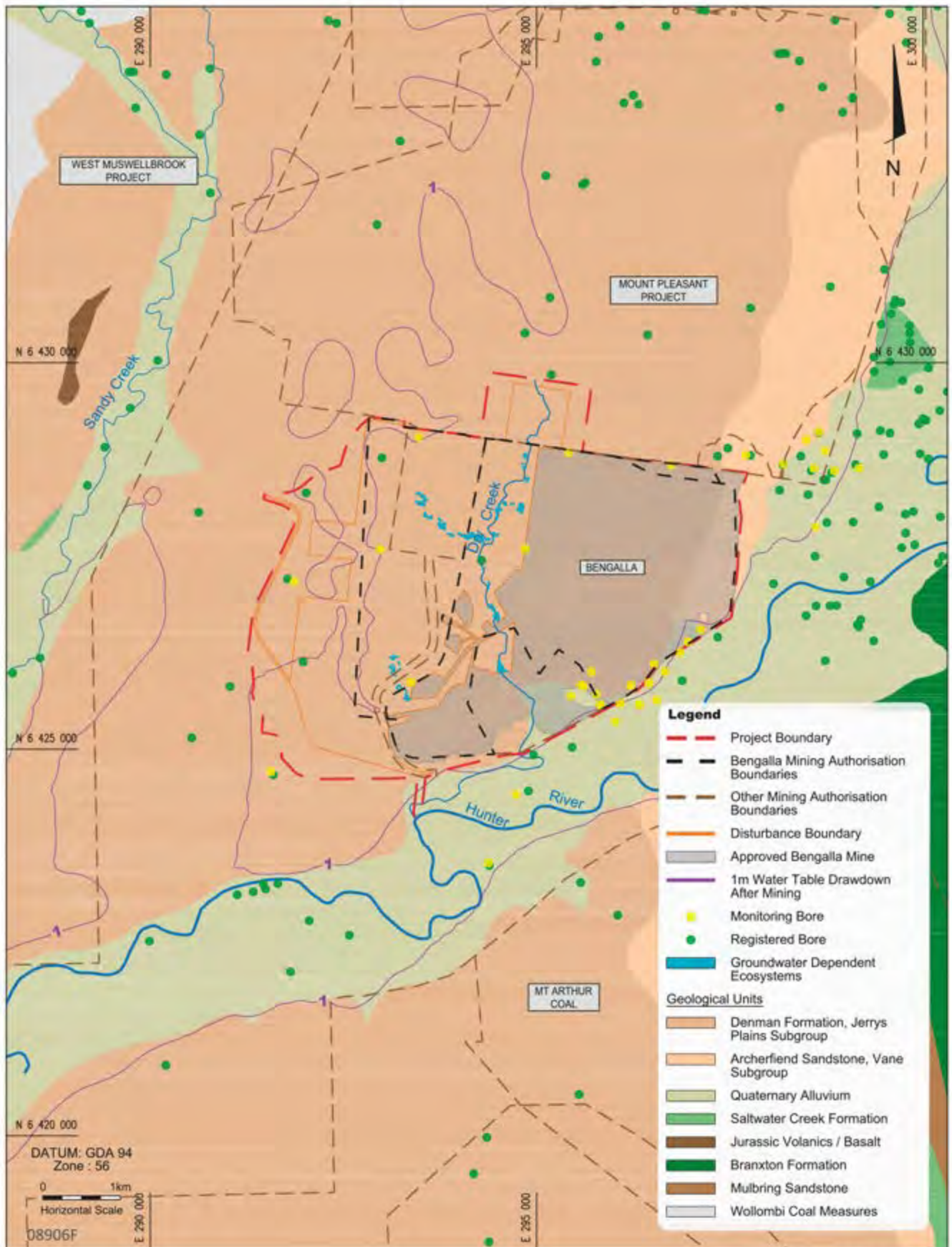
Dry Creek does not intersect the water table and therefore does not have any baseflow. As a result, Dry Creek is not impacted by the depressurisation caused by the Project.

Inflows into Mining Areas

There is a direct correlation between drawdown of the Hunter River alluvial aquifer and inflows into the mining area. Volumes of groundwater inflows are expected to be greatest in the early stages of the Project life, when mining is closest to the Hunter River alluvium. The total volume of inflows is expected to peak at 1 ML/day in Year 2. This water is taken from the Permian coal measures. As mining moves away from the alluvium, the hydraulic gradient from the alluvium to the mining area will progressively decrease, resulting in lower inflow volumes.

During the last 10 years of mining, the total volume of inflows is expected to be approximately 0.2 ML/day. Evaporative losses have been estimated at 0.3 ML/day. As a result, virtually no 'pumpable' inflows are expected during the last 10 years of mining. The pumpable volume of inflows is the total inflow volume minus evaporative losses.





BENGALLA MINE

Predicted Groundwater Drawdown

FIGURE 54

Table 49 lists the pumpable volumes for the representative years in the Project life. The average annual volume of groundwater inflow is predicted to be 110 ML/year. Annual groundwater inflows are predicted to peak at 365 ML/year in Year 2. BMC currently holds a licence (20BL169789) for 125 ML. This licence will be sufficient for the average inflow volume, but not the peak inflow volume. Groundwater licensing is discussed further in **Section 5**.

Impacts on Groundwater Users

The zone of depressurisation in the Permian extends approximately 0.5 km from the highwall at the end of mining. The zone of depressurisation extends to the north and south due to mining activities at Mt Arthur Coal Mine and Mount Pleasant Project. One registered bore (GW 073576) is located on private land within the zone of depressurisation associated with the Project. The property containing this bore is currently entitled to acquisition by Mt Arthur Coal Mine (upon request by the land owner). The predicted drawdown at GW 073576 is approximately 2 m. The AIP states that the cumulative water table and pressure head decline must not exceed 2 m. The predicted drawdowns at all bores located on private land are within the 2 m trigger prescribed by the AIP.

Groundwater Dependent Ecosystems

An assessment of the potential impacts on terrestrial GDEs was undertaken by Cumberland Ecology. Hunter Floodplain Red Gum Woodland was the only GDE identified in the vicinity of the Project (see **Figure 54**). The drawdown is predicted to be less than 1 m in most of the Hunter River floodplain. A drawdown of this magnitude is unlikely to significantly impact this ecosystem (see **Section 8.11**).

An assessment of the potential impacts on stygofauna was undertaken by Eco Logical. Stygofauna were identified at multiple locations in the Hunter River alluvium, confirming that the Hunter River alluvial aquifer is a GDE. The drawdown in the Hunter River alluvium is largely less than 1 m, resulting in no significant impacts on this GDE. Stygofauna is discussed further in **Section 8.12**.

Recovery of Groundwater Levels

After the completion of mining, groundwater seepage from the spoil and the Permian strata will accumulate in the final void. The FEFLOW model predicted that the water level in the final void would reach RL 30 m to RL 37 m after 1,000 years. This water level is significantly lower than the crest of the final void, making it very unlikely that it will overflow. The long term water level is also below the regional water table. The final void will behave as a “sink”, which means that water will only flow into the void. Therefore, saline water will not flow from the void into the surrounding groundwater systems.

The water level in the final void was also predicted in the Surface Water Impact Assessment (see **Section 8.6.3**).

The Surface Water Impact Assessment also assessed the rate of water level recovery in the final void using the OPSIM modelling software (see **Section 8.6**). The water balance methodology used by this method estimated that the long term water level would vary between RL 64 m and 71 m. The OPSIM model approach has several advantages over using a groundwater model including the ability to use daily rainfall records and better represent the geometry of the final void.

Differences in final void levels between the two methods can be attributed to slight differences in input data sets and the method in which the void is simulated. Of particular note is the OPSIM model which utilises daily rainfall records including storm events while the AGE FEFLOW model uses average rainfall throughout the recovery period. The evaporative volume of water removed using each technique will be different, with the average rainfall method used in FEFLOW having increased evaporative volumes. Subsequently the Groundwater Impact Assessment has reduced inflow to the final void and a reduced final void level over the Surface Water Assessment.

Both the groundwater model and the OPSIM model indicate that the water level in the final void will stabilise well below the crest of the final void. Therefore spillage of water into the environment will not occur. The final void will act as a sink for groundwater, which will prevent any poor quality water that develops within the void from migrating into the surrounding groundwater system.

Aquifer Interference Policy

The Minimal Impact Considerations in the AIP state that:

- (a) Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity;
- (b) No increase of more than 1% per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity. Redesign of a highly connected surface water source that is defined as a “reliable water supply” is not an appropriate mitigation measure to meet considerations 1.(a) and 1.(b);
- (c) No mining activity to be below the natural ground surface within 200 m laterally from the top of high bank or 100 m vertically beneath (or the three dimensional extent of the alluvial water source - whichever is the lesser distance) of a highly connected surface water source that is defined as a “reliable water supply”; and
- (d) Not more than 10% cumulatively of the three dimensional extent of the alluvial material in this water source to be excavated by mining activities beyond 200 m laterally from the top of high bank and 100 m vertically beneath a highly connected surface water source that is defined as a “reliable water supply”.

Groundwater quality monitoring conducted at Bengalla has indicated a stable to falling salinity in the Hunter River alluvial aquifer. Since mining will move further away from the alluvium during the Project life, there is not expected to be a significant change in the quality of water in the alluvial aquifer. Therefore, the Project will not lower the beneficial use category of the water source.

No mining will be undertaken within 200 m of the high bank of the Hunter River, consistent with the AIP and the *Management of Stream/Aquifer Systems in Coal Mining Developments guidelines for the Hunter Region* (DIPNR, 2005). In addition, the Project will not involve the excavation of alluvial material. Therefore, the Project complies with the “Minimal Impact Considerations” in the AIP. Additional detail in relation to the regulatory framework surrounding the Projects compliance with the AIP is provided in Section 5.

Groundwater Quality

The quality of Permian groundwater is generally brackish, with an EC in the range of 4,000 µS/cm to 8,000 µS/cm. Under pre-mining conditions, Permian groundwater would flow to the alluvial aquifer, however the rate of flow is reduced by the mining and may be reversed in a small area at the fringe of the alluvial aquifer. Therefore, the Project is unlikely to increase the salinity of alluvial groundwater.

Groundwater Licensing

The Project will cause water to be taken out of the Hunter River alluvial aquifer by reducing flow from the Permian to the alluvium. Since the Hunter River alluvial aquifer is regulated by the WM Act, a WAL will be required. BMC and the Bengalla Joint Venturers hold WALs for the Hunter Regulated River Alluvial Water Source with a share component of 442 ML/year.

The Project will also take water from the Permian groundwater system via inflows to the mining areas. This water source is not regulated by a WSP. Consequently, a licence under the Water Act will be required to account for this taking of water. There is no embargo on the increase in the volumetric extraction limit on the BMC bore licence. BMC will make the required application to amend its bore licence conditions under the Water Act. A summary of the current and the anticipated groundwater take and hence licence requirements for the Project are described in Table 57.

Table 57 Current Groundwater Licensing Summary

Legislation	Water Sharing Plan	Predicted Average Annual Take (ML/year)	Predicted Maximum Annual Take (ML/year)	Current Licensed Allocation	Licensed Allocations Required
Water Act	N/A	110	365	125	240
WM Act	Hunter Unregulated and Alluvial Water Sources	112	220	442	0

8.7.4 Mitigation and Management

BMC will update the existing Groundwater Management Plan as a section of the Water Management Plan, for the Project to the approval of relevant regulators to include the commitments in this EIS. The Water Management Plan will also include (at least):

- Detailed baseline data on groundwater levels, yield and quality in the region;
- Groundwater impact assessment criteria, including trigger levels for investigating potentially adverse groundwater impacts;
- A program to monitor and assess:
 - Groundwater inflows to the mining operations;
 - Impacts on local (including alluvial) groundwater systems;
 - Impacts on the groundwater supply of potentially affected landowners; and
 - Impacts on any groundwater dependent ecosystems and riparian vegetation

The Groundwater Management Plan will be revised for the Project and will address the following:

- Increased zone of depressurisation in the Permian;
- Drawdown in the Hunter River alluvium;
- Groundwater seepages into the open cut mining area;
- Health of GDEs;
- Water licensing; and
- Groundwater quality in the final void and aquifers.

8.8 Geochemical

8.8.1 Background

A Geochemical Impact Assessment has been undertaken for the Project by RGS Environmental Pty Ltd (RGS) and is included in full in **Appendix L**. The RGS report details the geochemical characterisation findings of the overburden and coal reject material likely to be generated by the Project. These findings were derived from previous geochemical studies and the analysis of ongoing exploration drill core samples as well as selected coal reject samples from the Bengalla CHPP.

A comprehensive understanding of geochemical characteristics at the Project has been made and a suitable geochemical sampling and testing program undertaken. A summary of the report is presented below.

8.8.2 Methodology

RGS completed a review of all available geochemical, geological and water quality data associated with the Project to assist in the development of the overburden sampling and testing program. Technical guidelines for geochemical assessment of mine waste in Australia (AMIRA, 2002; DITR, 2007 and ACARP, 2008) and worldwide (INAP, 2009) were used by RGS as a framework for developing the sampling (and geochemical testing) program for the Project. The sampling strategy was developed by utilising:

- Existing knowledge;
- The results of previous geochemical investigations, most recently an RGS assessment completed for the Bengalla 2010 EA;
- The potential for significant environmental or health impacts;
- The size of the operation;
- Sample representation requirements;
- Material volumes to be mined;
- The level of confidence in predictive ability; and
- Cost.

In a program coordinated by RGS and supervised by a BMC Senior Geologist, 105 representative overburden samples were selected from eight drill holes in the area to be mined and likely to be emplaced at the Project. Additionally, nine coal reject samples were selected by BMC personnel from the CHPP to represent the coal seam being processed at the time of sampling (Vaux, Bayswater and Wynn).

Samples were subjected to a series of static and kinetic geochemical tests at ALS Brisbane. The geochemical test program was designed to assess the presence of and degree of risk posed from oxidation of pyrite, acid generation and leaching of soluble metals and salts.

The static geochemical assessment test program also included characterisation of standard soil parameters, including salinity, cation exchange capacity and major metal compositions.

All of the samples collected were subjected to Acid Base Account (ABA) geochemical testing as part of an initial screening process. Specifically, each sample was tested for pH and EC, total sulphur, Acid Neutralising Capacity (ANC) and Net Acid Producing Potential (NAPP).

After the results of the ABA tests were received and reviewed, 14 overburden and six coal reject (composite and individual) samples were prepared and then subjected to additional multi-element testing was completed on solid and soluble fractions of pulverised composite samples. The samples were tested for:

- pH and EC;
- Alkalinity;
- Total metals (Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, N, Ni, P, Sb, Se, Zn) in solids;
- Total cations (Ca, Mg, Na, K) and exchangeable cations (Ca, Mg, Na, K);
- Soluble metals (Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, P, Sb, Se, Zn);
- Soluble cations (Ca, Mg, Na, K) and soluble anions (Cl, SO₄);
- Cation Exchange Capacity (eCEC); and
- Exchangeable Sodium Percentage (ESP).

Two composite samples of overburden and six coal reject samples (crushed material passing nominal 10 mm sieve size) were subjected to Kinetic Leach Column (KLC) tests at the RGS in-house laboratory. All leachate collected was sent to ALS Brisbane for multi-element analysis.

8.8.3 Impact Assessment Overburden

All overburden and interburden material (except Archerfield Sandstone material located between the Wynn and Bayswater coal seams) is likely to be Non Acid Forming (NAF) and have a high factor of safety in respect to potential acid formation. Overall, from an acid-base perspective, the overburden material tested (except Archerfield Sandstone) can be regarded as a NAF-barren unit as samples were found to have a negligible ($\leq 1\%$) total sulphur or sulphide sulphur content, with the majority classified as NAF-barren. Most overburden materials have excess acid buffering capacity ANC, which is typically moderate and should more than compensate for any acid that could theoretically be generated from these materials.

The Archerfield Sandstone interburden material is likely to be Potentially Acid Forming (PAF) and have a low factor of safety in respect to potential acid formation.

This particular material, which has a lower pH, higher EC and higher sulphur content than other overburden at the Project, was recognised prior to the commencement of mining at Bengalla in 1998. The Wynn seam and Archerfield Sandstone samples returned the highest salinity values. If Archerfield Sandstone interburden materials were to be left exposed to atmospheric conditions for a significant period of time, it is likely that the sulphate concentration of surface runoff/seepage would increase over time.

The results of multi-element testing for total metal concentrations in overburden samples are well within the NEPC (1999) guideline criteria for soils (parks, recreation open spaces and playing fields). Most trace metals in overburden from the Vaux and Bayswater seams are sparingly soluble at the predicted neutral to alkaline pH of surface runoff/seepage, when compared to the applied water quality guideline criteria (ANZECC, 2000) for livestock drinking water. Hence, materials represented by these composite samples should not present a significant risk to the environment with respect to total metal concentrations in solids or revegetation and rehabilitation.

It is expected that runoff/seepage from all materials will initially be dominated by sodium, carbonate, bicarbonate, chloride and sulphate and that the concentration of all these ions would decrease over time. Likewise, the salinity of runoff/seepage will be low and is expected to decrease with time as soluble salts are flushed from exposed materials. These levels are comparable with background concentrations and therefore the potential impact on surface water and groundwater from the Project should be low for overburden materials.

Overburden materials have elevated ESP values, which indicate that these materials may be sodic and therefore prone to dispersion and erosion. In this case, overburden materials that report to emplacement area at the Project may have structural stability problems. The ESP values were obtained for samples comprising a range of overburden lithologies and it is possible that some lithologies are less sodic than others and may be more suitable for revegetation and rehabilitation activities.

Coal Rejects

The coal reject samples returned total sulphur content results, which ranged from low to high (0.3 to 8.1%) and were typically elevated (median 1.7%). High results are attributed to samples from Wynn coal seam reject and are classified as PAF with an increased risk of acid generation, which is likely to occur in a relatively short period of time (weeks to a few months). Coal reject samples from the Vaux and Bayswater seams occur within the NAF geochemical classification category and have a lower risk of acid generation. The mean ANC of bulk rejects is estimated to be 1.5 times greater than the Maximum Potential Acidity (MPA) and the combined overburden and coal reject is estimated to NAF with a high factor of safety (ANC/MPA ratio of 12).

The pH results for coal reject samples were typically neutral (median 7.8) and the salinity is relatively low (median EC 484 $\mu\text{S}/\text{cm}$). Ongoing surface runoff/seepage from coal reject materials from the Vaux and Bayswater seams is likely to be pH neutral to alkaline. Most trace metals in coal reject from the Vaux and Bayswater seams are sparingly soluble at the predicted neutral to alkaline pH of surface runoff/seepage.

As indicated from KLC test results, ongoing runoff/seepage from the PAF Wynn seam coal rejects is likely to be acidic if left uncovered and generate elevated EC and sulphate levels as they oxidise, which can impact upon vegetation growth and surface water/groundwater quality. It is also expected that this reject material would generate elevated concentrations of several trace metals (Al, Cd, Co, Cu, As, Ni, Se and Zn) if exposed to oxidising conditions.

8.8.4 Mitigation and Management

BMC will review the existing Acid Mine Drainage Management Plan for the Project in consultation with relevant regulators. The Acid Mine Drainage Management Plan will include a number of overburden and coal reject mitigation and management measures as described below.

Overburden

The ongoing management of overburden will consider the geochemistry of the material with respect to its potential risk to cause harm to the environment and its suitability for use in construction and revegetation. BMC will ensure:

- The current management methods for PAF Archerfield Sandstone overburden will continue. This will occur in the Main OEA open mining area by covering Archerfield Sandstone material with acid neutralising and inert overburden to a depth of at least 5 m;
- That no Archerfield Sandstone materials will be placed in the Western OEA to avoid any potential connectivity with the adjacent Dry Creek; and
- The current practice of pre-stripping of topsoil from areas to be disturbed will continue as outlined in **Section 3.4**. The topsoil cover will then be utilised as part of the final rehabilitation to limit the risk of dispersion and erosion of potentially sodic overburden.

Further to the above, surface water and groundwater monitoring associated with runoff or seepage from OEAs will be incorporated into the Water Management Plan and revised EMP and monitored on a regular basis for pH, EC, TSS, dissolved trace metals and major ions including sulphate as described in **Section 8.8.3**

Potential Coal Reject

The ongoing management of co-disposed coal reject with overburden in the Main OEA will consider the geochemistry of the materials with respect to its potential risk to cause harm to the environment and their suitability for use in construction and revegetation. Co-disposed coal reject materials make up approximately 5% of the total overburden emplacement mass.

BMC will implement the following management measures:

- No coarse reject materials will be emplaced in the Western OEA to avoid any potential connectivity with the adjacent Dry Creek;
- Consistent with current practice, coal reject materials will not be co-disposed with overburden materials within any part of the Main OEA that have been identified to overlie alluvial soils. There may be some scope for co-disposal of coal rejects in some areas that drain towards the open mining area, however only if existing groundwater/hydrogeological studies completed by BMC clearly demonstrate a low risk of seepage connectivity to alluvial soils; and
- Current management methods for coal reject materials (burial under NAF overburden) within the open mining area will continue. This practice has been determined through monitoring to be successful in minimising the risk of any significant impact to the environment.



8.9 Aboriginal Archaeological and Cultural Heritage

8.9.1 Background

AECOM have prepared an Aboriginal Archaeology and Cultural Heritage Impact Assessment for the Project which is reproduced in **Appendix M**. The aim of the assessment was to identify the Aboriginal heritage values of the Study Area, assess potential Project impacts to those values and provide appropriate management and/or mitigation options. For the purposes of the Aboriginal Archaeology and Cultural Heritage Impact Assessment, the Study Area is comprised of the land within the Project Boundary excluding the Approved Bengalla Mine.

8.9.2 Methodology

The assessment process was divided into three broad sets of tasks and is described in detail below.

Desktop Study

A comprehensive desktop assessment was undertaken, which included:

- A review of the landscape context of the Study Area, which influences the patterning of Aboriginal sites;
- A search of OEH's Aboriginal Heritage Information Management System (AHIMS) database for all registered archaeological sites within the Study Area;
- A review of relevant archaeological and ethno historic information for the Study Area and surrounding area; and
- Development of a predictive model for Aboriginal archaeological sites within the Study Area.

Previous Aboriginal archaeological investigations undertaken within the Project Boundary and its immediate vicinity were reviewed to gain an understanding of the Aboriginal heritage and cultural values of the area, including the following:

- Rich (1993) surveyed area extending from Wybong Road in the north, to the Muswellbrook – Merriwa Railway Line in the south and from Bengalla Road in the east, for the Bengalla 1993 EIS (existing Project Boundary). A total of 56 Aboriginal sites were recorded with the most significant being Aboriginal quarry site B10. Most recorded sites were assessed as being in poor condition due to previous land uses. Consent to Destroy Permit dated 12 March 1997 was then granted under Section 90 of the NPW Act to salvage those sites that were to be directly impacted upon the development of Bengalla Mine;
- White (1998) undertook a salvage excavation of previously identified quarry site B10 and artefact scatter B33 (located 2.8 km North of B10) at Bengalla Mine in 1998. The excavation of B10 and B33 resulted in the collection of 4,676 and 523 artefacts respectively;

- ERM (2007) undertook a surface collection at quarry site B10 for Section 90 application # 2621. A total of 166 stone artefacts were collected during the surface collection and 39 during the excavation;
- ENSR and AECOM (2008) undertook a program of surface collection and grader scrapes of Aboriginal sites identified along the route of the Bengalla Link Road Stage 2. Nine Aboriginal sites were salvaged, resulting in the recovery of 56 artefacts. All salvaged sites were low density artefact scatters; and
- Central Queensland Cultural Heritage Management (2010) undertook a survey associated with the transport corridor for the Mount Pleasant Project across both BMC and Coal & Allied owned land. Within the Project Boundary approximately 130 isolated artefacts, four artefact scatters, four scarred trees and three potential scarred trees were identified. All identified sites were attributed low or moderate archaeological significance.

A search of the AHIMS database identified a total of 215 registered Aboriginal sites within the Study Area. Of these 19 were listed as deleted, destroyed, or were duplicates. The remaining 196 sites comprise 112 (57%) artefact scatters, 79 (40%) isolated artefacts, four (2%) scarred trees and one stone quarry (1%). A list of these sites has been provided in **Table 58**.

Aboriginal Stakeholder Consultation

Aboriginal stakeholder consultation was conducted in accordance with the Aboriginal Consultation Requirements. Details of the consultation program in **Section 6.5**.

Field Methodology

The archaeological survey was undertaken over 15 days between 14 May and 6 June 2012 and covered an area of 1,356 ha which incorporated the entire Disturbance Boundary of 964 ha. The field team consisted of two AECOM archaeologists and 28 rostered RAP representatives.

The aims of the archaeological survey were to:

- Relocate and re-record all previously recorded archaeological sites within the Study Area;
- Comprehensively survey, by pedestrian transects, land within the Study Area;
- Inspect where appropriate areas of known or potential Aboriginal cultural value, including AHIMS sites and areas identified by RAP representatives; and
- Provide sufficient data to facilitate the development of appropriate management and mitigation measures for Aboriginal sites and areas of archaeological sensitivity.

A comprehensive archaeological survey methodology was adopted whereby equally spaced pedestrian transects were undertaken over the Study Area. All survey was undertaken on foot, with the archaeological survey team walking abreast at approximately 10 m intervals. Individual linear transect widths were dependant on the number of RAP representatives and archaeologists participating each day. Each transect was recorded using a handheld Differential Global Positioning System (DGPS). Landscape, soils and surface exposure characteristics along transects were recorded through descriptive notes and photographs.

All archaeological sites identified during the survey were recorded to a standard comparable to that required by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b). For each site that was located or revisited, individual artefact locations associated site attribute data (site location, type and content) was documented. During the assessment an archaeological site definition was adopted whereby two or more artefacts within 100 m of each other were recorded as a 'site'.

Table 58 Previously Recorded AHIMS Registered Aboriginal Sites within the Study Area

Site Type	Number of Features	Percentage (%)
Artefact Scatters	112	57
Isolated Artefacts	79	40
Scarred Trees	4	2
Quarry	1	1
Total	196	100

While a sampling strategy was not adopted for the assessment, the Study Area was divided into discrete landform based areas for the purpose of site description and analysis. Landform elements in the Study Area are provided in **Table 59**.

8.9.3 Impact Assessment

Archaeological Resource

The previously recorded archaeological resource of the Study Area included 196 AHIMS sites and 39 sites that were recorded during previous assessments but not registered on AHIMS. An attempt was made to relocate these during the survey. During the survey, approximately 121 sites were not located due to grass cover and /or geomorphic processes which may have moved or transported the artefact material from its recorded location.

A total of 54 new sites were identified within the Study Area (see **Figure 55** and **Table 60**). These included 29 artefact scatters and 25 isolated artefacts. In instances where additional artefacts were found within 100 m of previously recorded AHIMS sites, the AHIMS sites were expanded to include those artefacts and were subsequently not recorded as new sites. In total the assessment identified 145 artefact scatters, 139 isolated artefacts, four scarred trees and one stone quarry within the Study Area, a total which included AHIMS registered sites, previously recorded sites and newly recorded sites.

Four previously recorded AHIMS registered scarred trees and four potential Aboriginal scar trees noted by the Aboriginal community were identified within the Study Area. The four potential scar trees were subject to an aborist inspection by Global Soils Systems in conjunction with AECOM archaeologists and Aboriginal community members on 15 August 2012. The investigation determined that the scarring identified on the trees was a result of natural causes. Accordingly, these were not registered on AHIMS or managed as Aboriginal archaeological sites. A copy of the aborist assessment can be viewed in **Appendix M**.

As a result of the Project, a total of 263 archaeological sites within the Study Area will be directly impacted. The remaining 26 sites within the Study Area, outside the Disturbance Boundary, will not be impacted and will be subject to appropriate management and mitigation as discussed in **Section 8.9.4**.

Statement of Significance

In Australia, the primary guide to the assessment of cultural significance is the Burra Charter, which defines “cultural significance” as the “aesthetic, historic, scientific, social or spiritual value for past, present or future generations” of a site or place. The significance of Aboriginal archaeological sites and places can be determined through two avenues; the assessment of scientific significance by archaeologists and the assessment of cultural or social significance by Aboriginal people.

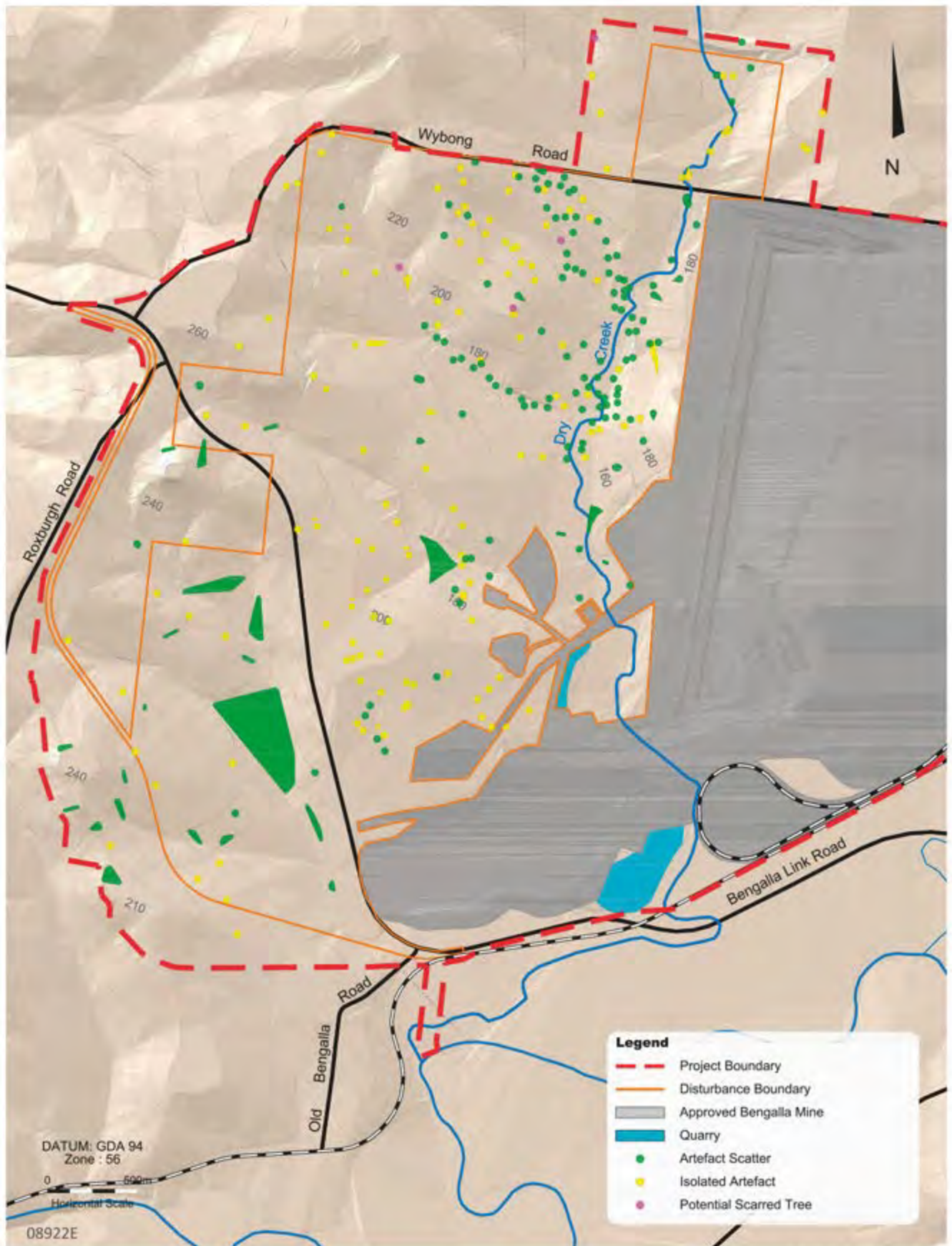
Scientific Significance

Scientific value refers to the contribution that the heritage resource (i.e. an Aboriginal archaeological site) can make to knowledge and understanding of the past. A heritage resource is assessed according to three criteria; rarity, representativeness and research potential. Within the Study Area:

- The southern portion of B10 quarry site (37-2-0579) has been assessed as highly significant due to its rarity and high research value, given its ability to answer questions related to raw material use and procurement;
- Six sites have been rated as moderately significant. Two of which are artefact scatter sites (BM-AS16-12 and 37-2-0599) as a result of their relatively large counts of artefacts. While site BM-AS16-12 is considered to have low potential for subsurface deposit, site 37-2-0599 has been assessed as having high potential for subsurface deposit and on that basis it is considered of moderate significance. The four identified scarred trees (37-2-2903, 37-2-3064, 37-2-3095 and 37-2-3107) have been assessed as moderately significant, both in this assessment and as part of the Central Queensland Cultural Heritage Management (2010) assessment, due to their relative rarity in the region; and
- The remaining sites ($n = 282$), have been rated as having low significance as they are common in the local and regional area, are highly disturbed, or have few artefact numbers. In addition, the northern mapped portion of B10 quarry site (37-2-0579) has been assessed of low significance. This assessment is based on the lack of identified surface archaeology directly within the area, past excavations and past disturbances. Combined, these factors indicate the northern portion of B10 is of low research value.

Table 59 Landform Elements Identified in the Study Area

Landform Element	Description
Hilltop / Ridge / Crests	Landform that stands above all, or almost all, points in the adjacent terrain
Upper Slope	Slope element adjacent below a crest
Mid Slope	Slope element lying between the upper slope and lower slope
Lower Slope	A waning slope, below a mid slope and above a flat



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Aboriginal Archaeological Sites

FIGURE 55

Table 60 Significance Assessment of Aboriginal Heritage Sites within the Study Area

Site Type	Significance			
	High	Moderate	Low	Total
Artefact Scatters	0	2	143	145
Isolated artefacts	0	0	139	139
Scarred Trees	0	4	0	4
Stone Quarry*	1 (southern section)	0	1 (northern section)	1
Total	1	6	283	289

* B10 quarry site (37-2-0579) has been split into two areas, which were assessed separately

The scientific significance rating associated with each archaeological site identified in the Study Area is detailed in Table 60.

Social (Cultural) Significance

The social (cultural) significance determined by the Aboriginal stakeholders is reflected in their responses to the assessment, which are provided in **Appendix M**. Of the 30 RAPs, 15 provided a response to the draft Aboriginal Archaeology and Cultural Heritage Impact Assessment report. A summary of the cultural significance of the responses is provided below.

The archaeological survey for the Project identified a rich landscape of past Aboriginal activity as evidenced from the numbers of stone artefacts recorded over the Study Area. Surface artefacts, which form Aboriginal archaeological and cultural sites, were recorded over the entire landscape but most intensely associated with creek lines and drainage lines, including Dry Creek. While having varying degrees of scientific significance, these stone artefacts are of cultural importance to Aboriginal people as they attest to the occupation and use of the Study Area by Aboriginal people in the past and provide an important tangible link to their heritage.

The identification of stone artefacts and archaeological sites notwithstanding, RAPs involved in the assessment process have not disclosed any specific knowledge related these artefacts or sites. However, during the archaeological survey, RAP representatives noted the importance of B10 quarry site for its rarity in the Hunter Region, being one of only a handful of these site types found locally. In addition, RAPs highlighted several key landscape features as important on the basis of their associated archaeological record. Dry Creek was highlighted by RAP representatives as a focal point for past Aboriginal activity due to higher artefact numbers identified in association with it. RAPs expressed interest at finding artefact scatter BM-AS26-12 on the crest of a hill on the western boundary of the Study Area. This highlighted the importance of vantage points in Aboriginal site selection.

WLALC stated that the Study Area was important to Aboriginal people due to its proximity to an Aboriginal song line, which Mt Arthur was one of the guiding landmarks. In addition, WLALC noted the Study Area is important as it is within walking distance to a number of known ceremonial areas (not identified).

Additional detail in relation to the Aboriginal stakeholder consultation program undertaken for the Project is discussed in **Section 6.5**.

Cumulative Impacts

A search of the AHIMS database for a 30 x 30 km region (study region) centred on the Study Area provides a method of assessing the cumulative impact of the Project on the existing Aboriginal heritage resource of the study region. A search of the database was undertaken on 14 June 2012 and returned 2,883 records of currently valid Aboriginal sites. These comprised 2,838 open artefact sites (i.e. artefact scatters and isolated finds), 45 scarred trees and six stone quarries.

Of the 289 Aboriginal archaeological sites identified within the Study Area, 259 artefact scatters and isolated finds are to be impacted as part of the Project. Based on the current AHIMS search results, these sites represent 8.9% of all known artefact scatters and isolated sites within the study region. Additionally, three scarred trees will be impacted by the Project representing 6.6% of all known scarred trees sites in the study region. These impacts have been assessed to constitute a moderate impact to the identified Aboriginal heritage resource of the region.

Further to the known Aboriginal heritage resource within the study region, a potential archaeological resource exists not recorded on the AHIMS database. Using aerial photographs, topographic maps and GIS data, a preliminary assessment of the potential Aboriginal heritage resource of the study region was undertaken. The assessment identified that land within study region comprised 69% low-intensity rural land use and 22% undisturbed 'natural' terrain suggesting that 91% of the study region has the potential to retain additional evidence of past Aboriginal occupation and/or activity.

8.9.4 Mitigation and Management

To manage and account for Project impacts to Aboriginal sites within the Study Area, the existing BMC ACHMP will be revised in consultation with RAPs and relevant regulators to incorporate commitments from this EIS. The revision of the ACHMP will include:

- Detailed salvage methodologies to be carried out prior to the commencement of the Project, including:
 - Surface collection (salvage) of stone artefacts; and
 - Scarred tree assessment and removal.
- Identification of appropriate long term management options for recovered artefacts which will be developed in consultation with RAPs;
- Procedures for the protection and conservation of archaeological sites that are not impacted by the Project by means of fencing and other appropriate management measures;
- Protocols for the updating of BMCs existing Aboriginal site database, including its ongoing maintenance, throughout the life of Project;
- Provisions regarding the appropriate management action(s) for previously unrecorded Aboriginal sites identified within the Project Boundary; and
- A standard procedure to be detailed in the ACHMP in the event that skeletal remains are identified within the Project Boundary throughout the operational life of the Project.

BMC remains committed to maintaining regular consultation with the Aboriginal community for the duration of the Project associated with all Aboriginal cultural heritage matters within the Project Boundary. **Figure 56** and **Table 61** presents the proposed management and mitigation measures for each Aboriginal site identified within the Project Boundary.

Surface Collection (Salvage)

To account for Project's impacts to Aboriginal sites within the Disturbance Boundary surface collection will be undertaken for all 259 artefact scatters and isolated finds to be directly impacted by the Project. This will occur prior to the commencement of ground disturbance works and with the involvement of RAP representatives. A list of the 259 sites that are to be surface collected is provided in **Table 61**.

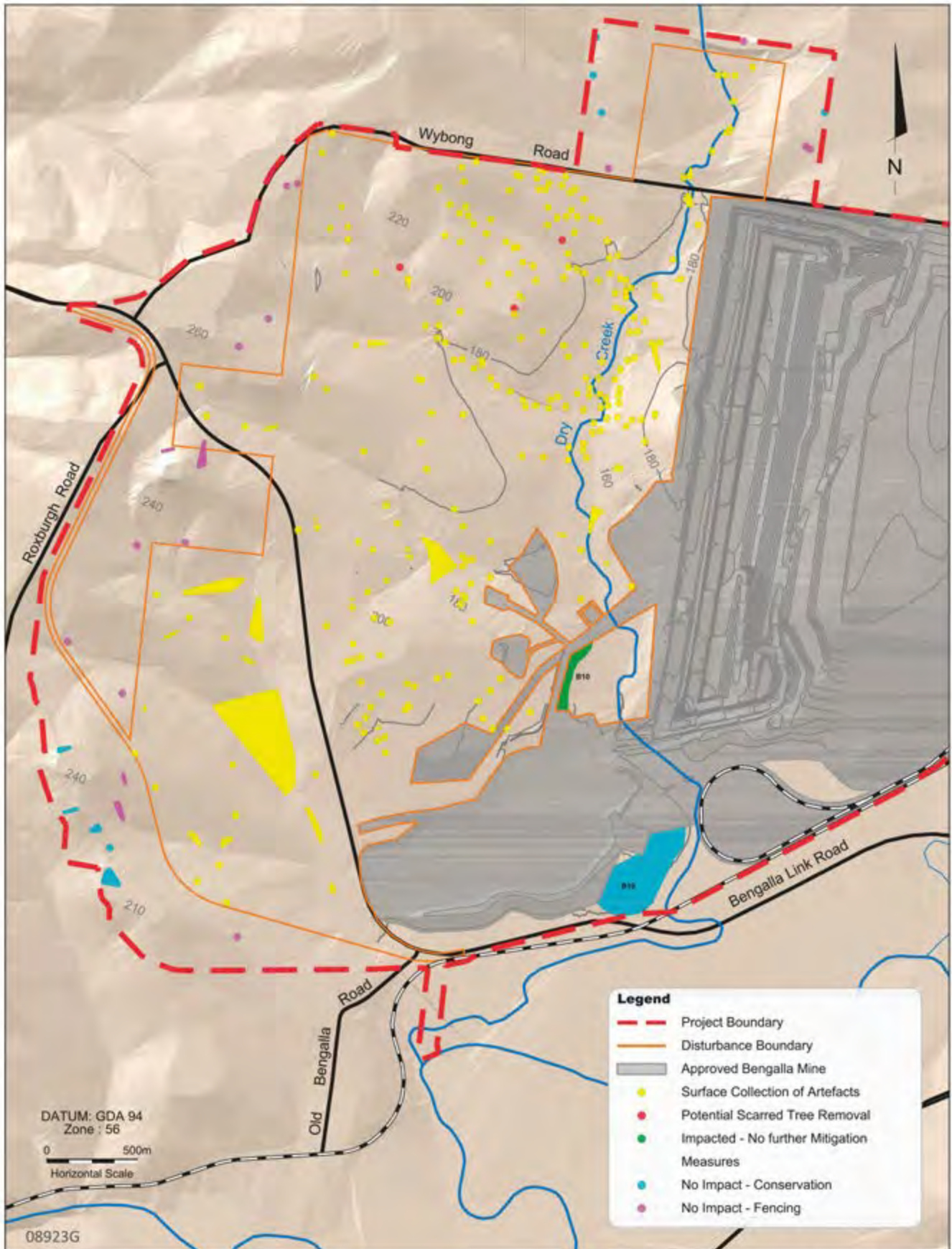
Scarred Tree Assessment and Removal

Prior to disturbances the three potential scarred trees to be impacted by the Project will be subject to an aborist inspection, with the participation of RAPs, in order to assess their status as Aboriginal scarred trees. If the scars on the trees are determined to be of Aboriginal origin, they will be removed under the supervision of a qualified aborist, archaeologist and RAP representatives prior to impact.

Conservation and Management

Conservation and management will be undertaken for all archaeological sites ($n = 26$) within the Project Boundary that will not be impacted by the Project. These sites listed in **Table 61**, will be identified on site plans to avoid their accidental destruction and details for the care of these sites will be included in the revised ACHMP. Aboriginal archaeological sites that will not be impacted by the Project but occur within 200 m of proposed impacts (i.e. mine activities ($n = 9$) are to be protected via permanent stock-proof fencing and appropriate associated signage).





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ENVIRONMENTAL CONSULTANTS

Management of Aboriginal Archaeological Sites

FIGURE 56

Table 61 Project Impact and Management Measures for Aboriginal Heritage Sites

Management Mitigation Measures	Site ID	Site Type
Surface Collection of Artefacts	37-2-0578	Artefact Scatter
	37-2-0583	Artefact Scatter
	37-2-0584	Artefact Scatter
	37-2-0585	Artefact Scatter
	37-2-0586	Artefact Scatter
	37-2-0587	Artefact Scatter
	37-2-0589	Artefact Scatter
	37-2-0590	Artefact Scatter
	37-2-0591	Artefact Scatter
	37-2-0592	Artefact Scatter
	37-2-0593	Artefact Scatter
	37-2-0594	Artefact Scatter
	37-2-0595	Artefact Scatter
	37-2-0596	Artefact Scatter
	37-2-0597	Artefact Scatter
	37-2-0598	Artefact Scatter
	37-2-0599	Artefact Scatter
	37-2-0600	Artefact Scatter
	37-2-0602	Artefact Scatter
	37-2-0603	Artefact Scatter
	37-2-0604	Artefact Scatter
	37-2-1463	Artefact Scatter
	37-2-2097	Isolated Artefact
	37-2-2098	Isolated Artefact
	37-2-2099	Isolated Artefact
	37-2-2100	Isolated Artefact
	37-2-2101	Isolated Artefact
	37-2-2102	Isolated Artefact
	37-2-2103	Isolated Artefact
	37-2-2560	Artefact Scatter
	37-2-2843	Isolated Artefact
	37-2-2844	Isolated Artefact
	37-2-2845	Isolated Artefact
	37-2-2846	Isolated Artefact
	37-2-3041	Artefact Scatter
	37-2-3042	Artefact Scatter
	37-2-3043	Artefact Scatter
	37-2-3044	Isolated Artefact
	37-2-3045	Artefact Scatter
	37-2-3046	Isolated Artefact
	37-2-3047	Isolated Artefact

Management Mitigation Measures	Site ID	Site Type
Surface Collection of Artefacts cont'	37-2-3048	Isolated Artefact
	37-2-3049	Artefact Scatter
	37-2-3050	Isolated Artefact
	37-2-3051	Artefact Scatter
	37-2-3052	Artefact Scatter
	37-2-3053	Artefact Scatter
	37-2-3054	Artefact Scatter
	37-2-3055	Isolated Artefact
	37-2-3056	Artefact Scatter
	37-2-3057	Isolated Artefact
	37-2-3058	Artefact Scatter
	37-2-3059	Isolated Artefact
	37-2-3060	Isolated Artefact
	37-2-3061	Artefact Scatter
	37-2-3062	Isolated Artefact
	37-2-3063	Isolated Artefact
	37-2-3065	Artefact Scatter
	37-2-3066	Artefact Scatter
	37-2-3067	Artefact Scatter
	37-2-3068	Isolated Artefact
	37-2-3069	Artefact Scatter
	37-2-3070	Isolated Artefact
	37-2-3071	Artefact Scatter
	37-2-3072	Artefact Scatter
	37-2-3073	Artefact Scatter
	37-2-3074	Isolated Artefact
	37-2-3075	Isolated Artefact
	37-2-3076	Isolated Artefact
	37-2-3077	Artefact Scatter
	37-2-3078	Isolated Artefact
	37-2-3079	Isolated Artefact
	37-2-3080	Isolated Artefact
	37-2-3081	Artefact Scatter
	37-2-3082	Artefact Scatter
	37-2-3083	Artefact Scatter
	37-2-3084	Isolated Artefact
	37-2-3085	Artefact Scatter
	37-2-3086	Artefact Scatter
	37-2-3087	Artefact Scatter
	37-2-3088	Artefact Scatter
	37-2-3089	Artefact Scatter
	37-2-3090	Artefact Scatter

Management Mitigation Measures	Site ID	Site Type
Surface Collection of Artefacts cont'	37-2-3091	Artefact Scatter
	37-2-3092	Artefact Scatter
	37-2-3093	Isolated Artefact
	37-2-3094	Artefact Scatter
	37-2-3096	Isolated Artefact
	37-2-3097	Artefact Scatter
	37-2-3098	Artefact Scatter
	37-2-3099	Artefact Scatter
	37-2-3100	Artefact Scatter
	37-2-3101	Artefact Scatter
	37-2-3102	Artefact Scatter
	37-2-3103	Artefact Scatter
	37-2-3104	Artefact Scatter
	37-2-3105	Artefact Scatter
	37-2-3106	Isolated Artefact
	37-2-3108	Isolated Artefact
	37-2-3109	Isolated Artefact
	37-2-3110	Artefact Scatter
	37-2-3111	Isolated Artefact
	37-2-3112	Artefact Scatter
	37-2-3113	Isolated Artefact
	37-2-3114	Artefact Scatter
	37-2-3115	Artefact Scatter
	37-2-3116	Artefact Scatter
	37-2-3117	Isolated Artefact
	37-2-3118	Artefact Scatter
	37-2-3119	Artefact Scatter
	37-2-3120	Artefact Scatter
	37-2-3121	Isolated Artefact
	37-2-3122	Artefact Scatter
	37-2-3123	Isolated Artefact
	37-2-3124	Artefact Scatter
	37-2-3125	Artefact Scatter
	37-2-3126	Artefact Scatter
	37-2-3127	Artefact Scatter
	37-2-3128	Artefact Scatter
	37-2-3129	Artefact Scatter
	37-2-3130	Artefact Scatter
	37-2-3131	Artefact Scatter
	37-2-3132	Isolated Artefact
	37-2-3133	Artefact Scatter
	37-2-3134	Artefact Scatter

Management Mitigation Measures	Site ID	Site Type
Surface Collection of Artefacts cont'	37-2-3135	Artefact Scatter
	37-2-3136	Artefact Scatter
	37-2-3137	Artefact Scatter
	37-2-3138	Isolated Artefact
	37-2-3139	Artefact Scatter
	37-2-3140	Artefact Scatter
	37-2-3141	Artefact Scatter
	37-2-3142	Artefact Scatter
	37-2-3143	Isolated Artefact
	37-2-3144	Artefact Scatter
	37-2-3145	Isolated Artefact
	37-2-3146	Artefact Scatter
	37-2-3147	Artefact Scatter
	37-2-3148	Artefact Scatter
	37-2-3149	Artefact Scatter
	37-2-3150	Artefact Scatter
	37-2-3151	Isolated Artefact
	37-2-3152	Artefact Scatter
	37-2-3153	Isolated Artefact
	37-2-3154	Artefact Scatter
	37-2-3155	Artefact Scatter
	37-2-3157	Isolated Artefact
	37-2-3158	Artefact Scatter
	37-2-3159	Artefact Scatter
	37-2-3160	Artefact Scatter
	37-2-3161	Isolated Artefact
	37-2-3162	Artefact Scatter
	37-2-3163	Isolated Artefact
	37-2-3164	Isolated Artefact
	37-2-3281	Artefact Scatter
	37-2-3282	Isolated Artefact
	37-2-3283	Isolated Artefact
	37-2-3287	Isolated Artefact
	37-2-3288	Isolated Artefact
	37-2-3289	Isolated Artefact
	37-2-3534	Isolated Artefact
	37-2-3535	Isolated Artefact
	37-2-3536	Artefact Scatter
	37-2-3537	Artefact Scatter
	37-2-3538	Isolated Artefact
	37-2-3539	Isolated Artefact
	37-2-3540	Isolated Artefact

Management Mitigation Measures	Site ID	Site Type
Surface Collection of Artefacts cont'	37-2-3541	Isolated Artefact
	37-2-3542	Isolated Artefact
	37-2-3543	Artefact Scatter
	37-2-3544	Isolated Artefact
	37-2-3545	Isolated Artefact
	37-2-3546	Isolated Artefact
	37-2-3547	Isolated Artefact
	37-2-3548	Artefact Scatter
	37-2-3549	Isolated Artefact
	37-2-3550	Isolated Artefact
	37-2-3551	Isolated Artefact
	37-2-3552	Isolated Artefact
	37-2-3840	Isolated Artefact
	37-2-4060	Isolated Artefact
	37-2-4061	Artefact Scatter
	37-2-4062	Artefact Scatter
	37-2-4063	Artefact Scatter
	BM-AS01-12	Artefact Scatter
	BM-AS02-12	Artefact Scatter
	BM-AS03-12	Artefact Scatter
	BM-AS04-12	Artefact Scatter
	BM-AS05-12	Artefact Scatter
	BM-AS06-12	Artefact Scatter
	BM-AS07-12	Artefact Scatter
	BM-AS11-12	Artefact Scatter
	BM-AS12-12	Artefact Scatter
	BM-AS13-12	Artefact Scatter
	BM-AS14-12	Artefact Scatter
	BM-AS16-12	Artefact Scatter
	BM-AS17-12	Artefact Scatter
	BM-AS18-12	Artefact Scatter
	BM-AS19-12	Artefact Scatter
	BM-AS24-12	Artefact Scatter
	BM-AS25-12	Artefact Scatter
	BM-IA01-12	Isolated Artefact
	BM-IA02-12	Isolated Artefact
	BM-IA03-12	Isolated Artefact
	BM-IA04-12	Isolated Artefact
	BM-IA05-12	Isolated Artefact
	BM-IA07-12	Isolated Artefact
	BM-IA08-12	Isolated Artefact
	BM-IA09-12	Isolated Artefact

Management Mitigation Measures	Site ID	Site Type
Surface Collection of Artefacts cont'	BM-IA11-12	Isolated Artefact
	BM-IA12-12	Isolated Artefact
	BM-IA13-12	Isolated Artefact
	BM-IA16-12	Isolated Artefact
	BM-IA17-12	Isolated Artefact
	BM-IA18-12	Isolated Artefact
	BM-IA20-12	Isolated Artefact
	BM-IA21-12	Isolated Artefact
	BM-IA22-12	Isolated Artefact
	MTP-1403	Artefact Scatter
	MTP-1404	Isolated Artefact
	MTP-1405	Isolated Artefact
	MTP-1406	Isolated Artefact
	MTP-1407	Isolated Artefact
	MTP-1408	Isolated Artefact
	MTP-1409	Isolated Artefact
	MTP-1411	Isolated Artefact
	MTP-1412	Artefact Scatter
	MTP-1415	Isolated Artefact
	MTP-1416	Isolated Artefact
	MTP-1417	Isolated Artefact
	MTP-1418	Isolated Artefact
	MTP-1420	Isolated Artefact
	MTP-1428	Isolated Artefact
	MTP-1429	Isolated Artefact
	MTP-1432	Isolated Artefact
	MTP-1433	Isolated Artefact
	MTP-1437	Isolated Artefact
	MTP-1438	Isolated Artefact
	MTP-1439	Isolated Artefact
	MTP-1440	Isolated Artefact
	MTP-1442	Isolated Artefact
	MTP-1443	Isolated Artefact
	MTP-1444	Isolated Artefact
	MTP-1445	Isolated Artefact
	MTP-1447	Isolated Artefact
	MTP-1448	Isolated Artefact
	MTP-1449	Isolated Artefact
	MTP-1450	Isolated Artefact
	MTP-1451	Isolated Artefact
	MTP-1452	Isolated Artefact
	MTP-1455	Artefact Scatter

Management Mitigation Measures	Site ID	Site Type
Surface Collection of Artefacts cont'	MTP-1456	Artefact Scatter
	MTP-1458	Isolated Artefact
	MTP-1459	Isolated Artefact
	MTP-AS01-12	Artefact Scatter
	MTP-AS02-12	Artefact Scatter
	MTP-AS03-12	Artefact Scatter
	MTP-IA01-12	Isolated Artefact
	MTP-IA02-12	Isolated Artefact
Scarred Tree Removal	37-2-3064	Scarred Tree
	37-2-3095	Scarred Tree
	37-2-3107	Scarred Tree
No Impact - Fencing	37-2-2561	Artefact Scatter
	37-2-2916	Isolated Artefact
	37-2-3285	Isolated Artefact
	37-2-3286	Isolated Artefact
	BM-AS08-12	Artefact Scatter
	BM-AS09-12	Artefact Scatter
	BM-AS10-12	Artefact Scatter
	BM-AS20-12	Artefact Scatter
	BM-AS21-12	Artefact Scatter
	BM-IA06-12	Isolated Artefact
	BM-IA10-12	Isolated Artefact
	BM-IA14-12	Isolated Artefact
	BM-IA15-12	Isolated Artefact
	BM-IA23-12	Isolated Artefact
	MTP-1401	Isolated Artefact
	MTP-1402	Isolated Artefact
	MTP-1410	Isolated Artefact
No Impact - Conservation	37-2-0579 (southern section)	Artefact Scatter
	37-2-2565	Isolated Artefact
	37-2-2892	Isolated Artefact
	37-2-2896	Isolated Artefact
	37-2-2903	Scarred Tree
	BM-AS15-12	Artefact Scatter
	BM-AS22-12	Artefact Scatter
	BM-AS23-12	Artefact Scatter
	BM-AS26-12	Artefact Scatter
	BM-IA19-12	Isolated Artefact

8.10 Historical Heritage

8.10.1 Background

A Historic Heritage Impact Assessment has been undertaken for the Project by AECOM Australia Pty Ltd (AECOM). The assessment report presents the results of the historical archaeological survey conducted in November 2011 and subsequent significance assessment of identified heritage sites within and surrounding the Project Boundary. A summary of the assessment findings is presented below and the full report is provided in **Appendix N**.

8.10.2 Methodology

The assessment was undertaken and final report compiled utilising the methods and principles contained in:

- *The Burra Charter* (Australia ICOMOS, 1999);
- *NSW Heritage Manual* (NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996a);
- *Heritage Curtilages* (NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996b);
- *Assessing Heritage Significance* (NSW Heritage Office, 2001);
- *Levels of Heritage Significance* (NSW Heritage Office, 2008); and
- *Assessing Significance for Historical Archaeological Sites and Relics* (NSW Heritage Branch, 2009).

Historical and archival research was undertaken to identify known and potential historical heritage items located within and adjacent to the Project Boundary, including a search of relevant Commonwealth, State, Regional and Local government heritage schedules. The historical context of the area was compiled through a synthesis of information gained from the State Library of NSW, local and BMC records and spatial plans.

A field survey was undertaken by AECOM between 27 November 2011 and 1 December 2011, to assess the area within the Project Boundary and to determine if there were any non-Aboriginal sites of heritage significance present. Items of known significance outside the Project Boundary were also included for assessment with regard to potential visual and vibration impacts. Based on the Statement of Significance of an item and the level of assessed potential impact, management recommendations were developed.

Historical Overview

An historical overview of the Hunter Valley assists in the understanding of the types of sites likely to be identified in the area and provides an indication of the region's land use and how it developed. The region was initially identified as an area of rich resources in 1797, when Lieutenant John Shortland found coal at the mouth of the Hunter River.

The 1810s saw increased pressure on farming land around Sydney, especially following several years of drought, which lead Governor Macquarie to be petitioned to allow exploration inland. Following the confirmation of an overland route through the Hunter Valley in 1820, Macquarie rewarded the exploration party land grants around what is today known as Singleton, with a following quick succession of surveyed land along rivers and creeks.

Jerrys Plains was surveyed as a town in 1829, however was not proclaimed until 1840. Muswellbrook was proclaimed in 1833 although there had been earlier settlement in the vicinity. The surrounding area was largely used for grazing and cropping with an increasing focus on dairying. Coal mining commenced in the 1890s however did not become intensive until the 1980s and 1990s.

The land on which Bengalla Homestead (see **Plate 5**) is sited was originally granted to Captain Samuel Wright (unknown -1852) and Captain Francis Allman (1780-1860). On the basis of Wright's service and position, he was granted 2,560 acres west of Muswellbrook in 1826, which he chose to name Bengalla. Wright improved his property by building Old Bengalla (now known as Dalama Stud) and running sheep and cattle, as well as growing wheat and planting over ten grape varieties. The building was a house of six rooms with detached kitchen, laundry and servant's room. Other buildings included a dairy with an attached storeroom and a stone store above two cellars, a barn, shearing shed, eight-stall stable with coach house, a box and yard for one horse, two cottages and a carpenter's shop. Additionally, there were four huts and three acres of vineyards (Turner, 1996). Of this vast complex the rear wall of the kitchen complex and a barn remain.

John Hudson Keys constructed the first stage of Inglebrae (now Bengalla Homestead) in 1877, utilising a typical Georgian style on the land originally granted to Captain Allman. The house contained five rooms and was linked to a detached kitchen and servant's quarters by a breezeway. The second stage was built in 1895, by Richard Thorn Keys who added four bedrooms and a second drawing room.

Plate 5 Bengalla Homestead



BMC purchased the estate in 1995 from inheritor Mrs Rosemary Reynolds. Since that time the Homestead has been primarily uninhabited being used occasionally for meetings and during the initial period of mine development.

Allman was granted 2,560 acres in 1835, which was originally named Kelso Place and later Overton. A stone cottage was built on the land sometime between 1840 and 1860 and is now known as Overdene. The land was used to carry sheep, cattle and horses. In 1903, a creamery was established at Overton by the Blunt family who then owned the property and was later extended to include a butter factory. Coal was mined on the property to run the factory for at least a short period of time. The Overdene Cottage was sold to BMC around 1995.

Construction of the Muswellbrook to Merriwa Railway commenced in June 1912 and by 1915, trains were running between Muswellbrook and Denman, which provided the coal mine opened by George Blunt with a greater market.

8.10.3 Impact Assessment

The NSW Heritage Council has adopted specific criteria for undertaking a significance assessment that are outlined in the guideline *Assessing Heritage Significance*, (NSW Heritage Office, 2001) which forms part of the *NSW Heritage Manual* (NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996). There are seven evaluation criteria (which reflect four categories of significance and whether a place is rare or representative) under which an item is evaluated with reference to State or local importance. All identified sites and their significance is provided in **Table 62**.

The location of heritage items within and adjacent to the Project Boundary are presented on **Figure 57**. A total of five historic sites were identified within the Project Boundary with a further six items with potential historic heritage significance identified adjacent to the Project Boundary. The Project will directly impact on three sites including the Stockyard, House Site 1 and House Site 2. House Sites 1 and 2 were assessed as having no heritage significance. The Stockyard has been determined to be of local significance.

Potential indirect impacts to heritage items, such as blasting and visual effects were also assessed. It was determined by the Acoustics Impact Assessment (see **Section 8.4**) that the Project is unlikely to exceed the relevant ground vibration and overpressure criteria at all heritage structures. Furthermore, as significant items of historic heritage are located further away from the Project than at the approved mine since operations commenced in 1998, they will be subject to lower vibration and overpressure levels than previously experienced.

No visual impacts resulting from the Project were identified as views from sensitive heritage receptors (Bengalla, Overdene, Edinglassie and Rous Lench Homesteads) are generally consistent with current approvals. See Visual Impact Assessment in **Section 8.5** for further discussion.

The continuation of mining will indirectly impact on Bengalla and Overdene Homesteads, through continuing vacancy due to limited access, dust and noise concerns.

House Site 3, Keys Family Cemetery, Old Bengalla and Blunt's Butter Factory will not be impacted, directly or indirectly as a result of the Project.

Statements of Heritage Impact

Statements of Heritage Impact have been prepared for each of the Stockyard and Bengalla and Overdene Homesteads as impacts have been identified for these items that have associated historical significance in **Appendix N**. The objective of the Statements of Heritage Impact is to evaluate and explain how the Project will affect the heritage value of the item and/or place. Additionally, the Statements of Heritage Impact addresses how the heritage value of the item/place can be conserved or maintained, or preferably enhanced, by the proposed works. Conservation, mitigation and management for historical sites that will incur impact are detailed in **Section 8.10.4**.

Demolition and removal of the Stockyard from the landscape has been assessed to have a moderate negative impact, as it will result in the irreversible loss of fabric and values of local historical significance. The Bengalla and Overdene Homesteads have been assessed to incur a minor negative impact due to their ongoing vacancy. The indirect impacts to the homesteads have been determined to be acceptable given that ongoing maintenance and the repairs contained in the Conservation Management Plan are to be continued and are to be included in the revised European Heritage Management Plan.

8.10.4 Mitigation and Management

The indirect impacts will continue to be managed through the existing European Heritage Management Plan that includes a Conservation Management Plan for both Bengalla and Overdene Homesteads, which will be revised for the Project. The European Heritage Management Plan will be updated for the Project in consultation with relevant regulators.

The Conservation Management Plans contain conservation policies and schedules for works to maintain the properties. Following approval of the Project, the Conservation Management Plans will continue to ensure continued maintenance of the homesteads occurs while they remain vacant. The current Conservation Management Plan includes ongoing periodic maintenance, such as annual structural inspections, quarterly inspections of the roofs, gutters, downpipes and drainage, annual pest inspections and cleaning and frequent security inspections. In addition, the schedules of work describe the restoration and repairs to be undertaken to maintain the homesteads at a standard in which they will be maintained with view to occupancy once mining operations have ceased.

Table 62 Identified Historic Heritage Sites

Site Name	Listed Significance	Located Within Disturbance Boundary	Site Description
Located within the Project Boundary			
Bengalla Homestead	Local*	No	Homestead buildings: the 1877 building, 1895 extension and the 1960s additions combined with gardens, outbuildings, tennis court, farm sheds and archaeological sites
House Site 1	Not Listed	Yes	The site consists of a flat area, a septic tank and above ground concrete tank
House Site 2	Not Listed	Yes	The site consists of a flat area scattered with bricks and timber
House Site 3	Not Listed	No	Concrete slabs mark the location of the house and a dairy Ceramic and bricks nearby provide an approximate date of the late 19 th century
Stockyard	Not Listed	Yes	The stockyard, constructed of post and rails, is centred on a long run, terminating in a loading ramp Probably constructed in the late 19 th or early 20 th century
Located in the vicinity of the Project Boundary			
Keys Family Private Cemetery	Local and Regional	No	Contains ten funerary monuments (stone altar type markers, obelisks and marble headstones) enclosed by a fence constructed of timber and chicken wire, with a metal swinging gate
Dalama Stud (Old Bengalla)	Local	No	A stone and brick retaining wall in a state of ruin. The wall has been identified as the rear wall of a kitchen and bathroom complex dating from as early as the 1840s A timber structure with a corrugated iron roof is also present and was possibly once the stable and coach house associated with Old Bengalla
Overdene	Local and National [^]	No	Overdene is a modest sized sandstone house in the classic Georgian style, with the curtilage defined by a fence
Blunt's Butter Factory	Local	No	Concrete foundations, fragmentary portions of walls and rubble are all that remain of the Factory Some of the remaining concrete sections have glazed white tiles attached
Edinglassie Homestead	n/a	No	Two storey sandstone house with hipped iron roof in simplified Italianate style with outbuildings (service wing/kitchen, stables, meat house, killing shed and dovecote). Construction was in two stages (c1880 and c1895) (Archaeology Australia, 2008)
Rous Lench	n/a	No	Low cottage homestead of rendered brick/sandstone and corrugated iron roof in Italianate style (Archaeology Australia, 2008)

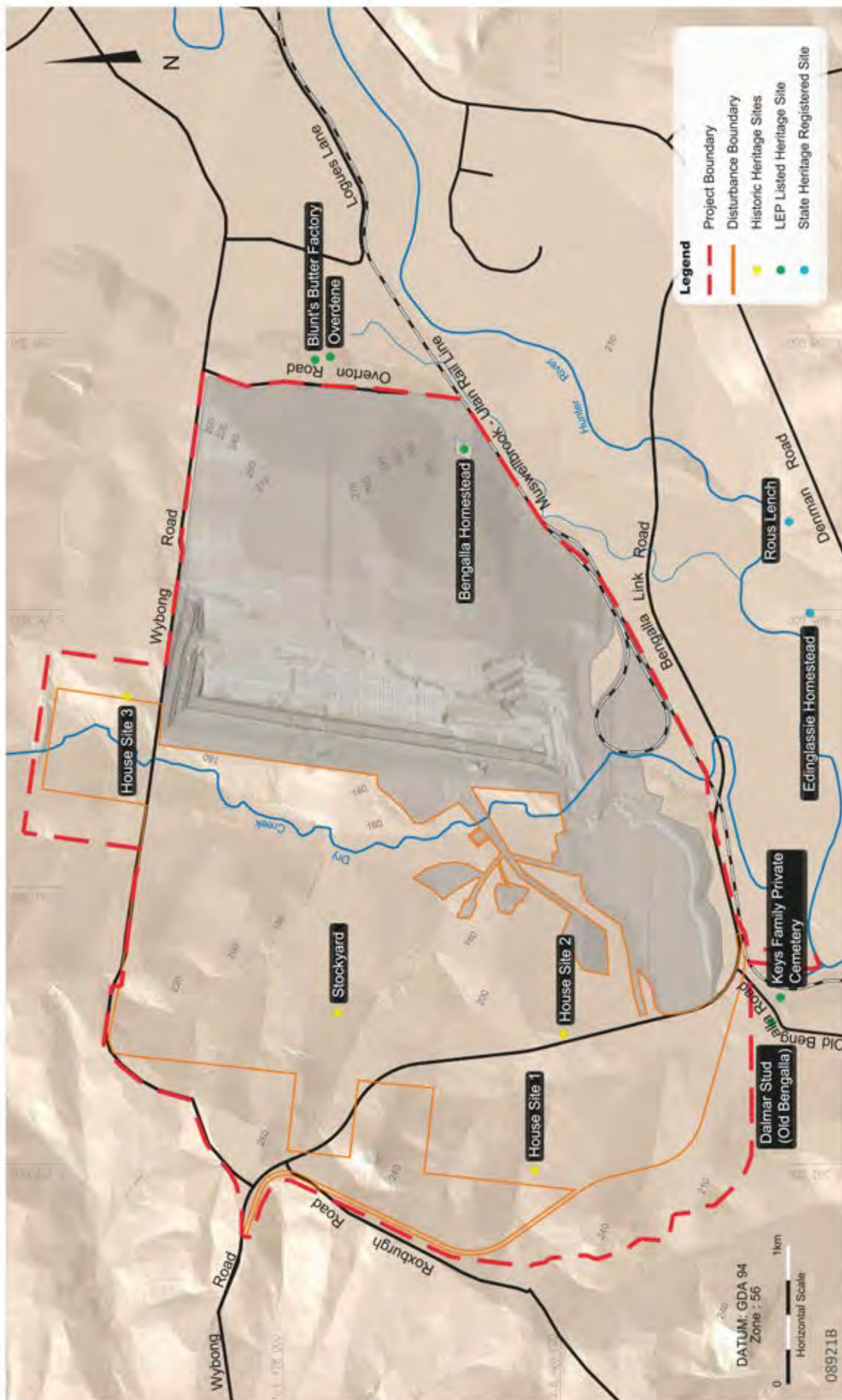
* Bengalla Homestead has been assessed as having local significance in the Muswellbrook LEP. It is also listed on Schedule 4 of the Hunter REP, which indicates that there is insufficient information to assess its significance. [^]Listed on the National Heritage List, which is no longer a statutory register.

As the Stockyard is located within the proposed Disturbance Boundary, archival recording of the site will be undertaken to account for the significance of the item and ensure that information pertaining to this item is retained into the future. The recording will comply with the Heritage Branch guidelines *How to Prepare Archival Records of Heritage Items* (1998) and *Photographic Recordings of Heritage Items using Film or Digital Capture* (2006). House sites 1 and 2 were assessed as having no heritage significance and therefore do not require mitigation or management on heritage grounds.

Although ground vibration and overpressure impacts have been considered unlikely, any residual blasting impacts will be managed through the revision of the existing European Heritage Management Plan and Blast Management Plan. House Site 3, Keys Family Cemetery,

Old Bengalla and Blunt's Butter Factory will not be impacted, directly or indirectly as a result of the Project and as such no mitigation is proposed.

The revised European Heritage Management Plan will be utilised to manage the other heritage items within the Project Boundary that are not directly affected by the Project (Bengalla Homestead and House Site 3, for example when nearby dam construction and associated works are being carried out) and adjacent items that are located on land owned by BMC (Keys Family Cemetery, Old Bengalla, Overdene and Blunt's Butter Factory) or are impacted by BMC operations (Edinglassie and Rous Lench).



BENGALLA MINE

Historic Heritage Sites

FIGURE 57

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8.11 Ecology

8.11.1 Background

An Ecological Impact Assessment has been undertaken for the Project by Cumberland Ecology and is included in **Appendix O**. The assessment investigated the impacts of the Project on current biodiversity values, including threatened species, populations and ecological communities protected under the TSC Act, the *Fisheries Management Act 1994* and SEPP 44.

The assessment also addresses potential impacts to MNES as listed under the EPBC Act in a single appendix of **Appendix O**. Assessments have been undertaken in accordance with applicable NSW and Commonwealth legislation and planning policies relevant to the protection of biodiversity as discussed in **Section 5**.

The Ecological Impact Assessment considers the Project's impacts on terrestrial flora and fauna, particularly threatened species, populations and ecological communities within the Study Area. For the purposes of the Ecological Impact Assessment the Study Area comprises 1,325 ha of mine-owned land and refers to all land within the Project Boundary (excluding the Approved Bengalla Mine). The Assessment was developed to update existing knowledge of biodiversity values within the Study Area in line with current legislation, regulatory survey guidelines and new protected species listings.

Detailed flora and fauna surveys within and surrounding the Study Area and on neighbouring Mount Pleasant Project lands were completed during the period 2010 to 2011, in accordance with accepted conventional guidelines (DEC, 2004b) and included quadrat sampling, habitat assessments, random meander surveys, targeted threatened plant species searches, winter migratory bird surveys, trapline surveys, nocturnal surveys and bat surveys. Floristic sampling was designed to meet SEWPaC guidelines for identifying EPBC Act listed Critically Endangered Ecological Community (CEEC) Box Gum Woodland (DEH, 2006) due to the presence of this community in the locality.

The existing vegetation contained within the Study Area is significantly altered from its original (pre-European) condition and vegetation communities are now quite fragmented. The current landscape generally consists of native perennial grassland of variable diversity and floristic composition, with remnant woodland patches.

Dry Creek and its unnamed tributary are minor ephemeral gully lines that have little associated with vegetation located within the Study Area. The banks are highly eroded, contain scattered patches of open forest and support an exotic understorey. A full photographic record of the existing Dry Creek is shown in Appendix A of **Appendix X**.

8.11.2 Methodology

Literature Review

A desktop review of previous studies undertaken within and surrounding the Study Area was undertaken to identify key ecological attributes and issues including Key Threatening Processes occurring as a result of activities associated with the Project. Key documentation reviewed for the Project included:

- Mount Pleasant Project 1997 EIS;
- Mount Pleasant Project 2010 EA;
- Mt Arthur North Coal Project EA (Dames & Moore, 2000);
- Mangoola Coal Mine Project Approval (Umwelt, 2008)
- Mt Arthur Coal Consolidation Project EA (Hansen Bailey 2009a);
- Muswellbrook Coal EIS (HLA-Envirosciences 2002);
- Drayton Mine Extension EA (Hansen Bailey 2007b); and
- Drayton Mine Project Approval Modification EA (Hansen Bailey, 2009b).

The findings of these studies assisted in gaining a comprehensive understanding of the local environment and were incorporated into the Ecological Impact Assessment where appropriate.

Other existing information on the biodiversity values within the Study Area and its surrounds were obtained via interrogation of the *Atlas of NSW Wildlife* (OEH, 2012b) and the *EPBC Act Protected Matters Search Tool* (SEWPaC, 2012). The Atlas of NSW Wildlife enabled a list to be created of all the threatened species recorded within a 20 km radius of the Study Area. The *Protected Matters Search Tool* provides a list of MNES that are predicted to occur within the locality of the Study Area based on the presence of suitable habitat. The results of these investigations were used to inform threatened species searches during field survey.



Field Surveys

Dedicated flora and fauna surveys were undertaken in the field for the Project in 2010 and 2011 to enhance previous work in the area and are summarised in **Table 63**. The survey times were established to account for flowering schedules, breeding times and patterns, seasonal migration and other factors that may affect species detection.

Flora and Vegetation Community Surveys

In order to obtain an understanding of the vegetation communities present and prepare initial vegetation mapping within the Study Area, a review of aerial photographs and available satellite imagery was conducted. Field investigation of vegetation and flora species mapping within and/or surrounding the Study Area included:

- Sampling of 38 flora quadrats (20 x 20 m), recording species composition and structure to confirm the distribution of vegetation map units present;
- Targeted surveys for threatened ground orchids;
- Detailed traverses of vegetation units to record boundaries; and
- Random meander surveys undertaken as part of the vegetation mapping ground-truthing and quadrat sampling within selected vegetation areas to compile plant community composition and survey threatened species.

The surveys were conservatively designed to meet SEWPaC guidelines for identifying the White box – Yellow box – Blakeley's red gum Grassy woodlands and Derived Native Grasslands (hereafter referred to as 'Box Gum Woodland') (DEH, 2006) and have been assumed to meet both Federal and State listings. Box Gum Woodland is listed as CEEC under the EPBC Act and/or an Endangered Ecological Community (EEC) under the TSC Act and collectively referred to as C/EEC. All information gathered during field surveys was synthesised using a Geographical Information System to create a database of spatial records; then analysed to produce a detailed vegetation unit map for the Project.

Fauna Survey Methods

Fauna surveys were undertaken over a number of time periods, different seasonal conditions and at a range of locations within the Study Area to maximise the likelihood of detecting fauna species present. The surveys were conducted where possible, in accordance with OEH guidelines for ecological assessment (DEC, 2004b), species appropriate guidelines published by SEWPaC and incorporated various detection methods including:

- Trapping of terrestrial and arboreal species (via use of Elliot and cage trapping);
- Spotlighting and call playback for nocturnal mammals and birds;
- Use of motion sensor, infra-red cameras to focus on baited stakes in the ground to identify fauna species;
- Microchiropteran bat surveys (via the use of anabat echo-location recording units and harp trapping);
- Diurnal active searches for reptile and amphibian species identification;
- Diurnal and nocturnal bird surveys; and
- Collection and analysis of scats and raptor pellets collected during the course of field studies.

Groundwater Dependent Ecosystems

Cumberland Ecology also conducted a desktop assessment of the vegetation communities within the Study Area utilising existing data on vegetation communities, location and topography to identify potential GDEs that may be impacted by the Project. Vegetation-type GDEs can be classified as: terrestrial vegetation, river base flow systems, aquifer and cave ecosystems (in which stygofauna may occur) or wetlands.

Of these GDEs, those with the most relevance to the Study Area are terrestrial vegetation and in aquifers (as part of the aquifer and cave ecosystem classification). No permanently flowing rivers are present in the Study Area, and therefore no River Base Flow System GDEs are present. Similarly, no wetlands are present in the Study Area.

Table 63 Ecological Survey Effort Summary

Survey Dates	Tasks Completed
15 – 17 February 2010	Threatened Flora Searches, Quadrat Sampling and Fauna Survey
19 March 2010	Threatened Flora Searches, Quadrat Sampling and Fauna Habitat Assessments
11 – 13 October 2010	Threatened Flora Searches (focus on orchids and spring flowering species), Quadrat Sampling and Fauna Habitat Assessments
21 – 25 February 2011	Fauna Survey (summer Trapping Session)
13 – 15 April 2011	Threatened Flora Searches, Quadrat Sampling and Fauna Habitat Assessments
18 – 19 August 2011	Fauna Survey (specifically targeting winter migratory birds)

The occurrence of Hunter Floodplain Red Gum Woodland in scattered patches along Dry Creek is considered to be an example of a partially dependent GDE, as it may rely on groundwater resources during periods of drought or low rainfall. However, it is unlikely that this woodland is completely dependent on groundwater as the canopy tree species *Eucalyptus tereticornis* (Forest Red Gum) and *Angophora floribunda* (Rough-barked Apple) contained within these floodplain and riparian communities are likely to draw on soil water as well as shallow groundwater and use groundwater opportunistically. The understorey within this community is considered unlikely to be groundwater-dependent.

Vegetation Communities

Although the native vegetation communities have been degraded by contemporary land practices described in Section 2.4 a number of vegetation communities were identified during the ecological field assessment. Of the 1,325 ha of vegetation occurring within the Study Area, 426 ha of this belong to the various forms of open forest and woodland present. An additional 776 ha of grassland referred to as Derived Native Grassland also occurs within the Study Area. The remaining areas of vegetation are represented by Low Diversity Derived Native Grassland, exotic pasture and planted vegetation and total 123 ha. Of the vegetation communities present, several are listed under the TSC Act, including Hunter Floodplain Red Gum Woodland, Narrabeen Foothills Slaty Box Woodland, Central Hunter Spotted Gum-Ironbark Woodland and a large portion of the vegetation is classified as Box Gum Woodland, which is listed under the TSC Act and EPBC Act. The remaining area of woodland comprises of Upper Hunter Exposed Ironbark Woodland which is not listed under either Act. Figure 58 and Table 64 outline the extent of the vegetation types identified within the Survey Area and the status of each under the TSC Act or EPBC Act.

Flora

There is a relatively low diversity of native species, predominately resultant from past land clearance and cattle grazing. The dominant flora families recorded include Myrtaceae, Poaceae, Fabaceae and Asteraceae. Targeted searches were undertaken for threatened flora that have been previously recorded within the area and were considered to have the potential to occur in the Study Area. Taking into account the availability of suitable habitat, threatened flora species that are considered most likely to occur within the Study Area are listed in Table 65.

Two threatened flora species / populations were recorded within the Study Area:

- *Bothriochloa biloba* (Lobed Blue Grass) - a grass species listed as 'vulnerable' under the EPBC Act; however it has been de-listed from the TSC Act due as the abundance and distribution of the species now appears to be greater than is indicated by previous records. *Bothriochloa biloba* is fairly tolerant of grazing and grows in partially cleared eucalypt forests and grassland derived from the clearing of such forests (NSW Scientific Committee, 2004). A large number of individuals also exist adjacent the Study Area nearby Wybong Road and Roxburgh Road reserve; and
- *Cymbidium canaliculatum* (Tiger Orchid) - an epiphytic orchid species that grows on trees, predominantly eucalypts, as has been recorded at a few locations within and north of the Study Area. *Cymbidium canaliculatum* in the Hunter Valley are listed under the TSC Act as an 'Endangered Population'.

The locations of threatened flora species identified in the assessment are shown on Figure 59.

A full list of the flora species identified during the Project assessment is provided in Appendix O.

Fauna

A high diversity of fauna species is not supported within the Study Area due to the simplified and highly modified habitat present. However, there is still an offering of some broad habitat features for native fauna including remnant and regenerating woodlands, grasslands, blossom-producing trees, fragmented riparian vegetation and limited understorey vegetation, leaf litter, rocky outcrops and tree hollows.

Field surveys demonstrated that the majority of species were found in areas of forest and woodland, with the most abundant faunal group being woodland birds. A low number of reptile, amphibian and mammal species were recorded, with most of the mammals being highly mobile bat species, which are currently widespread in locality's agricultural landscapes. Introduced (feral) animals (foxes, feral cats and rabbits) were observed throughout the Study Area, which prey upon or compete with native fauna.

Dry Creek, its tributaries and farm dams provide limited aquatic/fish habitat or major occurrences of macrophytes. A visual habitat assessment broadly based on the Australian River Assessment System (AUSRIVAS) (Turak et al. 2004) was completed of Dry Creek for the purpose of identifying potential impacts from the proposed diversion. No threatened aquatic species were observed or considered likely to occur within the Study Area (including Dry Creek and its tributaries).

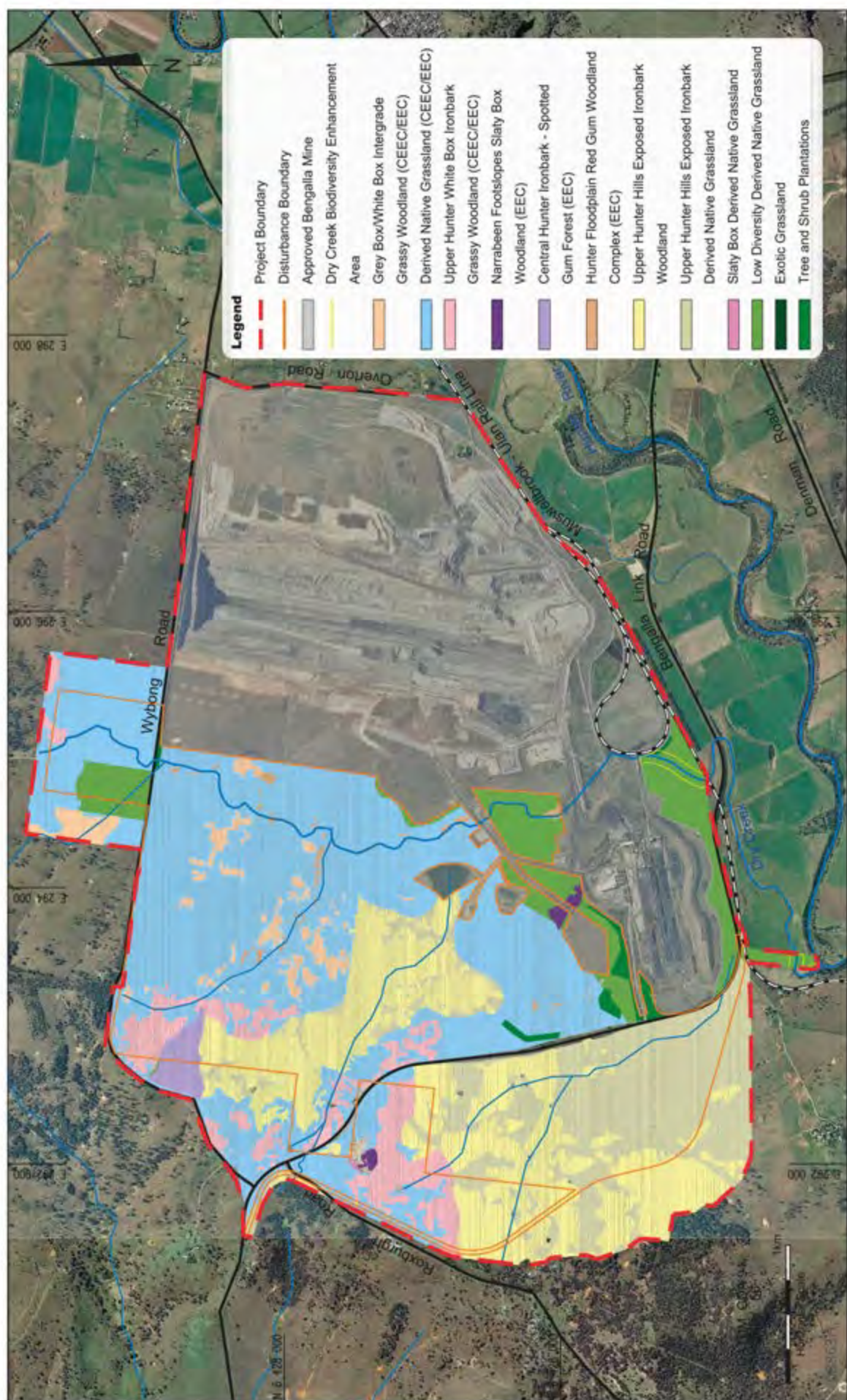


FIGURE 58

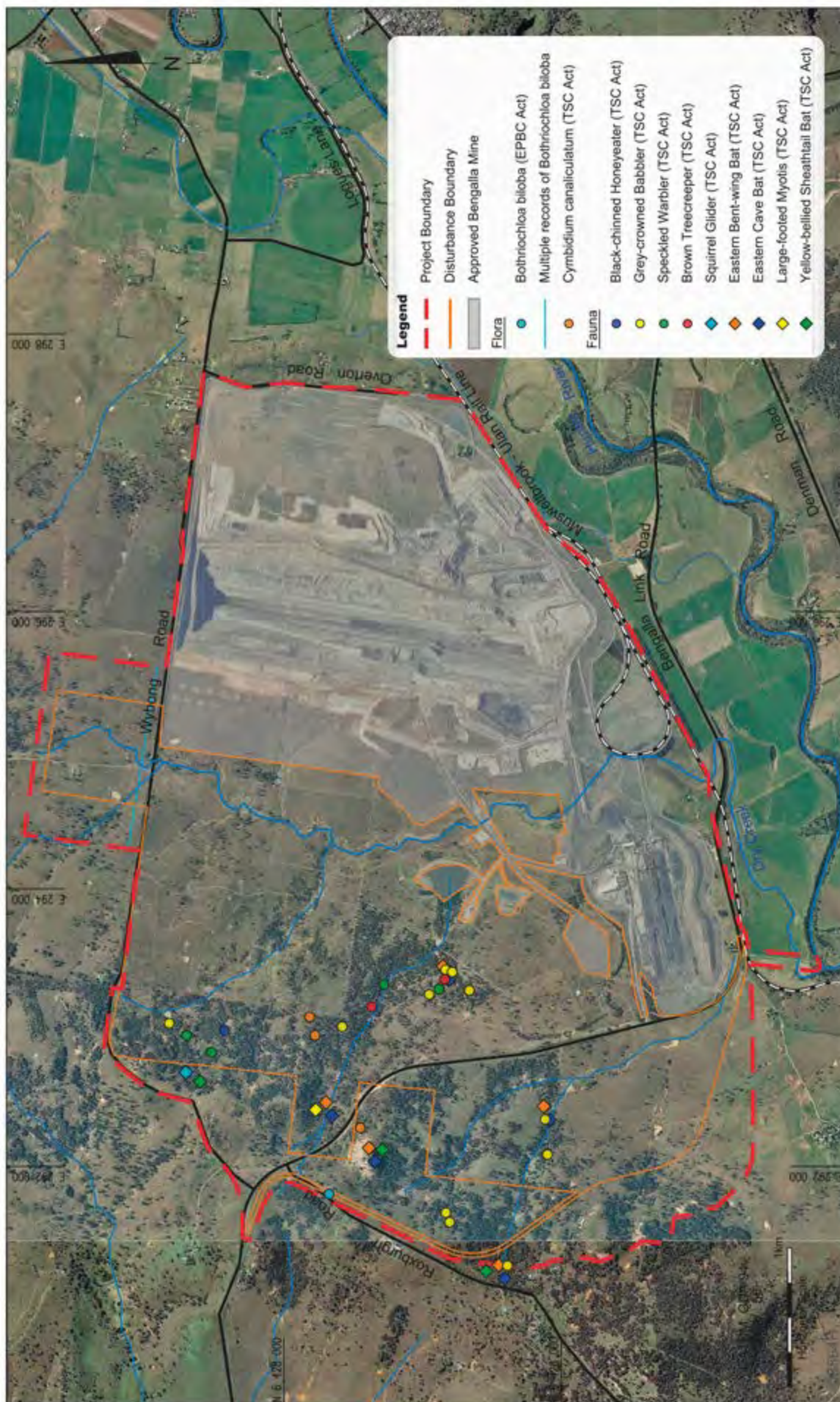
Table 64 Vegetation Communities within the Study Area

Specific Vegetation Community Names	TSC Status	EPBC Status	Study Area (ha)
Threatened Vegetation Communities			
Grey Box/White Box Intergrade Grassy Woodland (Box Gum Woodland)	Endangered	Critically Endangered	37.4
Upper Hunter White Box - Ironbark Grassy Woodland (Box Gum Woodland)	Endangered	Critically Endangered	93.2
Derived Native Grassland (Box Gum Woodland)	Endangered	Critically Endangered	554.8
Central Hunter Ironbark - Spotted Gum Forest	Endangered	Not Listed	14.3
Narrabeen Foothills Slaty Box Woodland	Vulnerable	Not Listed	4.3
Hunter Floodplain Red Gum Woodland	Endangered	Not Listed	9.4
Total C/EEC			713.4
Non Threatened Vegetation Communities			
Upper Hunter Hills Exposed Ironbark Woodland	Not Listed	Not Listed	267.6
Derived Native Grassland (Slaty Box)	Not Listed	Not Listed	0.6
Derived Native Grassland (Upper Hunter Hills Exposed Ironbark)	Not Listed	Not Listed	220.7
Low Diversity Derived Native Grassland/Exotic Pasture	Not Listed	Not Listed	109.6
Tree and Shrub Plantation	Not Listed	Not Listed	12.6
Exotic/Riparian vegetation	Not Listed	Not Listed	0.7
Total Non C/EEC			611.8
Total Vegetation*			1,325.2

*The Survey Area contains approximately 19 ha of cleared areas associated the Bengalla Link Road, farm dams and infrastructure that have been excluded from vegetation calculations.

Table 65 Threatened Flora Species with Potential to Occur within the Study Area

Scientific Name	Common Name	TSC Status	EPBC Status
<i>Acacia pendula</i>	Weeping Myall	Endangered Population in Hunter Catchment	N/A
<i>Diuris tricolor</i>	Pine Donkey Orchid	Vulnerable. Endangered Population in Muswellbrook LGA	N/A
<i>Prasophyllum</i> sp. Wybong (c. Phelps ORG 5269)	A leek-orchid	N/A	Critically Endangered
<i>Thesium australe</i>	Austral Toadflax	Vulnerable	Vulnerable



BENGALLA MINE

Threatened Flora and Fauna

FIGURE 59

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A list of the threatened fauna species recorded during the field surveys or identified as having some potential to occur within the Study Area, based on the presence of suitable habitat are outlined in **Table 66**. Species listed in **Table 66** have been recorded either in surrounding properties or frequently within the locality. The locations of threatened fauna species identified in this assessment are also shown on **Figure 59**.

Within the Study Area, the following threatened species were observed: four woodland bird species, four microbat species and a Squirrel Glider. All threatened fauna species recorded within the Study Area were listed as vulnerable under the TSC Act with none listed under the EPBC Act.

8.11.3 Impact Assessment

The land assessed within the Study Area demonstrates evidence of substantial alteration by historical long-term vegetation clearing for agricultural activities, which has resulted in a highly disturbed and fragmented landscape. Despite this, the area has been shown to support a number of threatened flora, fauna and ecological communities which are locally significant (see **Figure 58**). Over the life of the Project, approximately 881 ha of native vegetation will be removed, consisting of open forest and woodland communities and large areas of open grassland and scattered trees located within the Disturbance Boundary.

Additionally, 69 ha of non-native vegetation including tree and shrub plantation, exotic grasslands and Low Diversity Derived Native Grassland/Exotic Pasture will be removed. **Table 67** provides a summary of disturbance associated with the Disturbance Boundary

Vegetation Communities

Within the Study Area, approximately 61% of the treed areas will be progressively removed by the Project. Areas of vegetation to be directly impacted due to the Project are summarised in **Table 67**. A significant proportion (554 ha) of vegetation to be cleared comprises Threatened Ecological Communities. In particular, 535 ha of C/EEC Box Gum Woodland located within the Disturbance Boundary will be removed, which is approximately 9% of the community extent in the Hunter region (Peake, 2006) and less than 0.2% state wide (NSW Scientific Committee, 2006). However, the extent of the community occurrence has been estimated on woodland areas alone and when the vast areas of Derived Native Grasslands are considered, the percentages impacted by the Project are likely to be considerably lower.

The Project will also result in the temporary diversion of Dry Creek and the removal limited habitats that currently occur within it, in particular the loss of the Hunter Floodplain Red Gum Woodland (as shown on **Figure 58**).

Table 66 Threatened Fauna Species Recorded or have Potential to Occur within the Study Area

Scientific Name	Common Name	TSC Status	EPBC Status	Recorded with Study Area (2010-2011)
Birds				
<i>Apus pacificus</i>	Fork-tailed Swift	N/A	Migratory	No – Potential to occur
<i>Chthonicola sagittata</i>	Speckled Warbler	Vulnerable	N/A	Yes
<i>Circus assimilis</i>	Spotted Harrier	Vulnerable	N/A	No – Potential to occur
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	Vulnerable	N/A	Yes
<i>Hieraaetus morphnoides</i>	Little Eagle	Vulnerable	N/A	No – Potential to occur
<i>Hirundapus caudacutus</i>	White-throated Needle-tail	N/A	Migratory	No – Low potential to occur
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	Vulnerable	N/A	Yes
<i>Merops ornatus</i>	Rainbow Bee-eater	N/A	Migratory	No – Low potential to occur
<i>Ninox connivens</i>	Barking Owl	Vulnerable	N/A	No – Potential to occur
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	Vulnerable	N/A	Yes
Mammals				
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Vulnerable	Vulnerable	No – Potential to occur
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	Vulnerable	N/A	No – Potential to occur
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	Vulnerable	N/A	Yes
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	Vulnerable	N/A	No – Potential to occur
<i>Myotis macropus</i>	Large-footed Myotis	Vulnerable	N/A	Yes
<i>Nyctophilus corbeni</i> (formerly <i>N. timoriensis</i>)	Greater Long-eared Bat	Vulnerable	Vulnerable	No – Potential to occur
<i>Petaurus norfolcensis</i>	Squirrel Glider	Vulnerable		Yes
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox	Vulnerable	Vulnerable	No – Potential to occur, however, no roosting place recorded in Study Area
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail Bat	Vulnerable	N/A	Yes
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Vulnerable	N/A	No – Potential to occur
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	Vulnerable	N/A	Yes

Table 67 Direct Vegetation Disturbance for the Project

Vegetation Communities	Status	Total in Survey Area (ha)	Disturbance Boundary (ha)	Proportion to be cleared (%)
Grey Box/White Box Intergrade Grassy Woodland (Box Gum Woodland)	C/EEC	37.4	27.9	74.6
Upper Hunter White Box - Ironbark Grassy Woodland (Box Gum Woodland)	C/EEC	93.2	45.3	48.6
Derived Native Grassland (Box Gum Woodland)	C/EEC	554.8	462.1	83.3
Central Hunter Ironbark - Spotted Gum Forest	EEC	14.3	6.7	46.9
Narrabeen Foothills Slaty Box Woodland	Vulnerable	4.3	2.9	67.4
Hunter Floodplain Red Gum Woodland	EEC	9.4	9.4	100.0
Upper Hunter Hills Exposed Ironbark Woodland	Not Listed	267.6	167.9	62.7
Derived Native Grassland (Slaty Box)	Not Listed	0.6	0.0	0.0
Derived Native Grassland (Upper Hunter Hills Exposed Ironbark)	Not Listed	220.7	159.2	72.1
Low Diversity Derived Native Grassland/ Exotic Pasture	Not Listed	109.6	57.5	52.1
Tree and Shrub Plantation	Not Listed	12.6	11.4	90.5
Exotic/Riparian vegetation	Not Listed	0.7	0.0	0.0
Total Area*	1325.2	950.3	71.7	
Total C/EEC (EPBC Act and TSC Act)	713.4	554.3	77.7	

*The total area contains approximately 19 ha of cleared areas associated the Bengalla Link Road, farm dams and infrastructure that have been excluded from vegetation calculations.

It is proposed that Dry Creek will be reinstated in a condition at least ecologically equal to or better than currently present (see further discussion in **Section 8.21**).

The removal of the EECs and CEECs within the Disturbance Boundary contribute to the cumulative loss of these vegetation communities and exacerbate existing threatening processes.

In addition to direct impacts caused as a result of the Project, a range of indirect ecological impacts could potentially occur. Potential indirect impacts to vegetated areas and biodiversity values of the Project located outside of the Disturbance Boundary may include:

- Noise generated by construction and operation of the Project;
- Increased night-lighting levels;
- Increased likelihood of vehicle strike;
- Reduction of interior habitat of remaining areas of woodland;
- Erosion and sediment/dust movement by wind or water resultant from vegetation clearing; and
- Competition from weeds and feral animals, which results from vegetation clearing and regenerating areas.

Flora

Suitable habitat is present within the Study Area for two known threatened flora species listed under the EPBC Act and TSC Act. Impacts to these species as a result of the Project include the removal of:

- 260 ha of potential open forest and woodland habitat for the Tiger Orchid; and
- 881 ha of potential open forest, woodland and grassland habitat for the Lobed Blue-grass.

Habitat suitable for five additional threatened flora species listed under the EPBC Act and/or TSC Act recorded in the locality that are considered to have potential or are likely to occur were also considered in the Ecological Impact Assessment.

All the native vegetation in the Project Disturbance Boundary was considered to provide habitat for all of these potential species and as such, 881 ha has been assumed to be removed by the Project.

Fauna

The Project will result in the staged removal of predominately of Derived Native Grasslands and to a lesser extent, open forest and regenerating woodland, which provides foraging, food, shelter and breeding habitat for fauna species in the area. The woodland in the western portion of the Study Area contributes to a larger diffuse patch of woodland, which extends west outside the Study Area.

As outlined in **Table 66** nine known threatened TSC Act listed fauna species were recorded during field surveys for the Ecological Impact Assessment and have been determined to be impacted by the removal of approximately 272 ha of potential forest and woodland habitat. Although not identified within the Study Area, a number of other threatened species listed under the TSC Act and/or EPBC Act were also considered to have the potential, or were likely to occur.

Approximately up to 881 ha of potential woodland and grassland habitat preferred by these species will be removed as a result of the Project. Additional species identified as having the potential to occur are listed in **Appendix O**.

The potential impacts of the Project on fauna habitats are mostly related to the removal of:

- Understorey vegetation;
- Fallen logs, woody debris and leaf litter;
- Hollow-bearing living trees and stags;
- Nectar-producing trees and shrubs;
- Shrubs and grasses;
- Ecotonal (edge) communities;
- Ephemeral drainage lines; and
- Constructed farm dams with limited aquatic vegetation.

Key Threatening Processes

Some of the above impacts constitute Key Threatening Processes as listed under the TSC Act, which have contributed to a continuing decline in habitats. Key Threatening Processes relevant to the Project include clearing of native vegetation, loss of hollow bearing trees, removal of dead wood and dead trees and anthropogenic climate change.

The Project will impact on potential fauna habitat through the disturbance of 945 ha of vegetation and fauna habitat features. Of the known threatened and potentially occurring fauna species, the removal of grassland areas for habitat was not considered to comprise an important impact. Further, woodland habitat that is to be removed for the Project also occurs immediately west of the Study Area. However, some of the threatened bird species recorded within the Study Area, including the Grey-crowned Babbler, Speckled Warbler and Brown Treecreeper are relatively sedentary and have been considered susceptible to diminishing habitat sizes and connectivity.

This may also impact the Squirrel Glider, one of the threatened mammal species.

Follow on effects from the Project's disturbance include:

- The removal of rare or important habitat features, thereby placing pressure on remaining habitats to provide forage, shelter or breeding opportunities for fauna;
- A declining available area of interior habitat. This will cause an increase in the patch edge to area ratio that increases the vulnerability of resident fauna to either the Disturbance Boundary or to external predators and/or competitors, particularly along linear patches of vegetation; and
- Exacerbating fragmentation and isolation of already patchy areas of woodland and forest. Vegetation connectivity will be reduced within the Study Area.

Groundwater Dependent Ecosystems

As described in **Section 8.11.2**, the occurrence of GDEs in the Study Area is likely to be represented by Terrestrial Vegetation and by Cave and Aquifer Ecosystems. The terrestrial vegetation GDE is likely to comprise areas of Hunter Floodplain Red Gum Woodland that occur along Dry Creek and its tributaries.

Hunter Floodplain Red Gum Woodland is likely to have a partial reliance, but not a total dependence on groundwater. Cave and aquifer ecosystems have the potential to act as habitat for stygofauna.

The floodplain areas to the south of the Study Area would have historically supported 'terrestrial vegetation' GDEs, consisting of floodplain vegetation such as Hunter Floodplain Red Gum Woodland. The Project will directly impact on 9.4 ha of Hunter Floodplain Red Gum Woodland. The Project will result in the temporary diversion then reinstatement of Dry Creek where these communities are present, albeit as small, scattered and highly degraded examples. However, their removal will add to a minor cumulative loss of forest and woodland habitats.

Potential indirect impacts to GDEs also include the expected drawdown on the Hunter River alluvial aquifer to the south of the Study Area. This dewatering may impact Hunter River floodplain native vegetation, although it is noted that little native vegetation exists on the floodplain immediately south of the Study Area, therefore a significant impact is unlikely. Further, riparian 'riverfront' vegetation of the Hunter River is not likely to be impacted as drawdown effects are only expected along the northern margin of the alluvium as described in the Groundwater Impact Assessment provided in **Appendix K**.

The Hunter River alluvium, both upstream and downstream of the Project, is known to be suitable habitat for Stygofauna (see **Section 8.12**). Eco Logical Australia sampled 13 bores and wells for stygofauna over two seasonal conditions in July and September 2012, both in alluvial aquifers and Permian rock aquifers. Stygofauna were recorded in 10 of the bores.

A relatively high abundance of stygofauna from four taxa were recorded during one sampling period in the bore location on BMC owned land closest to the Wantana Extension (within the Approved Bengalla Mine), which is a bore that has been experiencing significant drawdown (see **Section 8.7**).

Eco Logical Australia concluded that the stygofauna community is therefore persisting in this location despite the current drawdown of the alluvial aquifer. As the mine moves westward for the Project, the extent of dewatering in the alluvial aquifer will decline, reducing any impact the current level of dewatering has on the stygofauna community. Accordingly, the Project is not considered likely to pose a direct threat to the stygofauna community that may be present in the groundwater.

A full description of the Stygofauna Impact Assessment is provided in **Section 8.12**.

Dry Creek Diversion and Reinstatement

The assessment has considered Dry Creek to be essentially a dry gully that only carries water during and immediately after heavy rain and supports limited habitat for flora or fauna. To maintain flow to the lower reaches, water will be captured and diverted via a pipe network around the Disturbance Boundary as described in **Section 4.9**. Diverted water will be dissipated at the release point to minimise any potential erosion impacts.

Prior to the completion of mining, the creek will be reinstated into a position similar to the original alignment and revegetated. A detailed design and interim management system for the creek is described in **Section 8.21**.

Hunter River Catchment Impacts

The assessment considered that the volume of water to be extracted and impact of related pumping infrastructure will have a minimal effect on the long-term health of the Hunter River or wider catchment. The Project will have limited interaction with the Hunter River and vegetation clearing impacts for the construction, operation and maintenance of Project pipelines will be minimal in terms of threatened flora and fauna or disturbing fish habitat.

Water requirements for the Project will be met by mine site catchments, in-mining area dewatering and allocated water supplies. The discharge of water from site will continue to be in strict accordance with EPL 6538 and the HRSTS. Therefore, it is not expected that there will be any adverse impact on the ecology of the Hunter River. Discussions on water capture, holding and release for the Project is provided in **Section 8.6**.

Outlet structures for the relocated Bengalla Staged Discharge Dam have been designed as trenched installations to be constructed below the dam foundation and cut off trench. Pipe trenches would be backfilled using appropriate clay based material to prevent seepage paths developing along the pipe trench. A concrete plug 5 m long would be provided directly below the dam cut off trenches.

Additional erosion protection is provided at the discharge point, comprising an impact energy dissipater and a precast concrete headwall with downstream rip rap protection for the raw water pipeline. The pipeline has also been sized so as to restrict the maximum discharge rate when the dam is full to equate to a pipeline velocity of less than 4.5 m/s.

A 600 m section was assessed as requiring reduced velocities to minimise erosion potential. As such, a 10 m wide channel has been designed to accommodate these flows with rock scour protection also nominated in sections. Further detail in relation to the reinstatement and rehabilitation of Dry Creek is provided in **Section 8.21**.

Cumulative Impacts

Extensive vegetation clearing has already occurred in the locality as a result of agriculture, urban development, forestry and mining projects. These processes are still occurring and impacting on the biodiversity of the area. The assessment determined that much of the vegetation to be impacted by the Project comprises locally significant, EEC that have been over cleared in the Central Hunter region. Project operations will clear 260 ha of regenerating open forest and woodland, which will add to the cumulative loss of vegetation in the region. Due to this cumulative clearing, it has been assessed that less than one third of their original distribution remains.

The scale of vegetation clearance that will occur as a result of the Project in conjunction with other established and proposed nearby mines, including Mt Arthur Coal Mine, the Mount Pleasant Project and Mangoola Coal, have the potential to exacerbate these existing ecological impacts. More than 4,060 ha (excluding 2013 modifications) of forest, woodland and derived native grasslands could be removed based upon currently available mining proposals in the vicinity of the Project. Within and surrounding the Disturbance Boundary and other proximate mining projects, the direct impact of habitat removal and indirect effects of dust, noise and erosion will cause the greatest pressure to remaining forest and woodland patches.

The assessment determined that although the collective impacts are detrimental to local biodiversity, the Project was considered unlikely to directly threaten the occurrence of threatened species and ecological communities from within the Study Area or the region. This is due to the remaining large areas of habitat within the Study Area and rural areas of Hunter Valley region.

Assessments of Significance

Assessment tests were undertaken in accordance with the guidelines for assessment of MNES (DEH, 2006) and **Section 5A** of the EP&A Act for each of the threatened species, populations and communities listed under the TSC Act and EPBC Act and identified as having the potential to occur in the Project's Ecological Impact Assessment.

These tests were undertaken as a risk assessment tool to determine which listed threatened flora and fauna species may be most at risk as a result of the Project.

MNES assessment tests for relevant listed species are provided in **Appendix O**.

Impacts to Matters of National Environmental Significance

As the Project has been declared a 'controlled action' under the EPBC Act and in response to SEWPaC's submission on Project DGRs, the Ecological Impact Assessment considered the impacts of the Project on MNES. **Appendix B** of the Ecological Impact Assessment includes a full assessment against EPBC matters and specifically, the assessment considered relevant MNES species recorded within the Study Area, as well as those considered to have some potential to occur or requested to be assessed by SEWPaC in the Supplementary DGRs.

The EPBC significant impact criteria (DEH, 2006) were used to assess particular impacts on MNES. The assessment concluded that without implementing mitigation and offset measures, Project impacts are likely to be significant for

Box Gum Woodland, Swift Parrot and Regent Honeyeater. Details of the Assessments of Significance are provided in **Appendix O**.

A summary of potential impacts as a result of impacts associated with the Disturbance Boundary provided in **Table 68**.

8.11.4 Mitigation & Management

Management measures proposed for the Project have followed a hierarchy of principles, with the aim to avoid, account for or offset all identified impacts, as follows:

- **Avoid:** to the extent possible, developments should be designed to avoid or minimise ecological impacts;
- **Mitigate:** where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the proposed development; and
- **Compensate:** the residual impacts of the Project should be compensated for in some way.

Each of these principles have been applied to the Project and addressed below where reasonable and feasible.

Table 68 EPBC MNES Habitat Loss

MNES	Presence	Area of Direct Impact (ha)
Ecological Communities		
Box Gum Woodland	Known	535
Flora Species		
<i>Prasophyllum</i> sp. Wybong (c. Phelps ORG 5269) – a leek orchid	Potential	881
Lobed Blue-grass	Known	881
Austral Toadflax	Potential	881
Fauna Species		
Red Goshawk	Potential	270
Swift Parrot	Potential	270
Regent Honeyeater	Potential	270
White Throated-Needletail	Likely	950
Fork-tailed Swift	Likely	950
Eastern Great Egret	Potential	673
Cattle Egret	Potential	673
White-bellied Sea-eagle	Potential	950
Latham's Snipe	Potential	673
Rainbow Bee-eater	Likely	950
Satin Flycatcher	Potential	270
Black-faced Monarch	Potential	270
Spotted-tail Quoll	Potential	270
Grey-headed Flying-fox	Likely	270
Large-eared Pied Bat	Likely	270
Greater Long-eared Bat	Likely	270

Avoid

The Project is bounded by the Approved Bengalla Mine to the east, Wybong Road in the north and existing infrastructure and the Main Northern Rail Line to the south (see **Figure 18**). The valuable coal resource is directly below flora and fauna habitats, west of the current operation and changes to mine plans are highly impractical to attempt avoidance. Therefore, due to the nature of the Project it is not possible to completely avoid the identified impacts to flora and fauna. However, the Project will continue to use largely existing infrastructure (with upgrades) to minimise the disturbance to biodiversity as far as practicable. Any relocated or new infrastructure has been sited within areas proposed to be mined at a later date, where practical.

Additional discussion on alternatives considered for the Project are described in **Section 4.13**.

Mitigate

Biodiversity Management Plan

Mitigating impacts to ecology have been favoured through Project pre-clearance and clearance protocols, which will be contained in a Biodiversity Management Plan (BMP) to be prepared prior to the commencement of the Project, to the satisfaction of DP&I. The BMP is the key document that will ensure that the conservation objectives of the Project are met and that impacts to biodiversity are adequately managed and mitigated for the life of the Project.

Proposed management measures to account for impacts to sensitive flora and fauna include:

- Continued use of an updated Land Disturbance Permit Process (described in **Section 3.13**) to ensure compliance with relevant licences and approvals and that appropriate environmental safeguards and mitigation measures are implemented prior to any disturbance;
- Limiting vegetation disturbance areas as far as practical so as to minimise the loss of habitat at any one time;
- Safe relocation of animals occupying trees to nearby woodlands in advance of disturbance by an appropriately qualified person;
- Removal (and relocation within the Project Boundary) of key habitat features such as tree hollows, large logs and boulders from within Disturbance Boundary;
- Provision of nesting boxes or tree hollows in nearby woodland proportionate to those removed;
- Progressive high quality rehabilitation and revegetation of disturbed areas, which will in the long-term, replace lost habitats for threatened fauna. Disturbed areas will be reinstated following mining to agricultural land with at least 10% open woodland corridors across the majority of the Disturbance Boundary and higher density coverage of the eastern face of the OEA to provide fauna habitat and movement;

- Planting, relocation and/or propagation of species conforming to Box Gum Woodland and Derived Native Grassland in rehabilitated areas and/or other suitable sites within the Study Area to assist in the recovery of their populations (see **Appendix O** for a full list of plant species);
- Planting of treed areas principally on either side of the Dry Creek frontage, along paddock fence lines and as copses in paddocks and also as large patches of treed vegetation, located on the eastern face of the OEA;
- Translocating and direct placement of topsoil for rehabilitation when practical to conserve the native seed bank and assist diversity;
- Implementation of dust and noise minimisation measures to reduce potential indirect impacts to vegetation condition and habitat quality in areas outside the Disturbance Boundary;
- Implementation of dam drainage protocols (safe relocation of animals, timing of works to non-breeding seasons for target species and disease transmission reduction initiatives) prior to any dam decommissioning;
- Erosion and sediment controls to maintain habitat integrity/function and reduce the potential spread of weeds;
- Weed and pest management; and
- Visual and lighting management, to reduce potential indirect impacts to nocturnal fauna in areas nearby operations.

An ongoing ecological monitoring program will be in place as a component of the BMP to monitor the ongoing status and health of flora and fauna communities that will be retained within the Study Area as well as previously disturbed rehabilitated areas, in order to assess the success of the mitigation and compensation measures. Reference (control) sites that contain similar ecological communities that are not impacted by the Project will also be selected to further assist in the management of biodiversity within the Study Area.

Potential for Integration with other Offset Strategies and Areas of Remnant Vegetation

There is potential for the proposed rehabilitation and restoration activities to be integrated with other regional and local rehabilitation and offset strategies. Once active mining commences and rehabilitation is required there is an opportunity to link the proposed vegetation of the eastern face of the OEA to future Mount Pleasant rehabilitation areas where practical.

In addition, Mt Arthur Coal Mine has an established offset area known as the 'Constable Offset Area' approximately 500 m west of the Project Boundary. Future rehabilitation and tree corridors proposed for the Project will be established on land within the Project Boundary in consideration of this offset area (if under a permanent conservation agreement).

The potential for the integration of rehabilitation and restoration activities for the Project with other strategies in the region will be investigated further during the preparation of the BMP, through the 'Upper Hunter Strategic Assessment'. Further potential avenues for collaboration with other Projects will be identified in the future.

Further discussion in relation to the final landform and rehabilitation objectives is included in **Section 8.21**.

Reinstatement of Dry Creek

A Dry Creek Reinstatement Management Plan will be developed in conjunction with relevant regulators to ensure a relevant, natural and functioning ecological community. BMC has an aim to reproduce Dry Creek of quality greater to that which currently exists by using collected pre-mining baseline ecological information. The revegetation of Dry Creek's riparian zone will be undertaken to create a vegetation corridor to assist in fauna movement between areas of forest and woodland habitat to broader areas of Derived Native Grassland north of Wybong Road. Native grasses, reeds and shrub species that are characteristic of the Hunter Floodplain Red Gum Woodland community will be planted in the reconstructed bed and riparian areas of the realigned Dry Creek.

Mine-owned riparian areas of Dry Creek nearby the Hunter River and a retained area (adjacent the CHPP) within the Project Boundary that were not affected by mine disturbance will also be rehabilitated. An indicative area depicting the proposed Dry Creek / Hunter River restoration area is presented on **Figure 58**. It is proposed that this indicative rehabilitation area not extend beyond the Project Boundary in this location to minimise impacting on existing farm practices associated with the highly productive Hunter River Floodplain. This will include the planting of the regionally endangered population *Eucalyptus camaldulensis* (River Red Gum). Rehabilitation, monitoring and maintenance protocols will be conducted in accordance with the BMP. Fencing will be undertaken to exclude livestock with regular weeding schedules and key performance indicators developed. In addition to these mitigation works, the loss of Hunter Floodplain Red Gum Woodland as a Threatened Ecological Community will be compensated through Strategic Biodiversity Offsets as described below.

An additional indicative remediation area is proposed to extend from the confluence of Dry Creek north to reconnect the Hunter River to remnant areas of vegetation located in the west of the Project Boundary. It is considered that that this assist in re-establishing fauna corridors extending from the Hunter River whilst minimising impacts to existing farm practices associated with the Hunter River Floodplain.

Further discussion in relation to the final landform and rehabilitation objectives is included in **Section 8.21**.

Hunter River Frontage Rehabilitation

Beneficial ecological outcomes will also result from BMC maintaining and enhancing habitat along selected areas of Hunter River frontage on which BMC owns land (approximately 15 km). A Hunter River Frontage Rehabilitation Plan will be prepared as a component of the Biodiversity Management Plan in consultation with the Hunter-Central Rivers Catchment Management Authority, OEH and MSC.

Any enhancement and maintenance of habitat along the Hunter River will be funded by the Trust associated with the development of the Upper Hunter Strategic Assessment.

Compensate

Upper Hunter Strategic Assessment

Strategic Biodiversity Offsets are a compensatory measure provided in response to the predicted ecological impacts for the Project, particularly those associated with direct disturbance to threatened vegetation communities and threatened species habitat as outlined in **Section 8.11.3**. BMC has elected to participate in the Upper Hunter Strategic Assessment. The Upper Hunter Strategic Assessment process is discussed below.

The Commonwealth and NSW State governments have entered into an agreement to undertake a 'Strategic Assessment' of Upper Hunter Biodiversity Plan for coal mining in the Upper Hunter Valley. The Strategic Assessment will be undertaken in accordance with the provisions of Part 10 of the EPBC Act and be implemented under the EP&A Act as an overarching policy framework.

A coordinated and strategic biodiversity assessment will be undertaken of the biodiversity values of the Upper Hunter Valley and of the expected impacts for current and future mining proposals in the region. In order to inform the preparation of the Upper Hunter Biodiversity Plan, participating companies are required to survey and assess the area of land for which they nominate as part of the 'Biodiversity Assessment Area'. The Biodiversity Assessment Area nominated by each mine includes potential future project areas. Individual Biodiversity Assessment Reports will be prepared by each participating company, and will be submitted to OEH for review. The Biodiversity Assessment Reports and data layers created will be incorporated, where appropriate into the Upper Hunter Biodiversity Plan.

For the Bengalla Biodiversity Assessment Area the Project Boundary (excluding the Approved Bengalla Mine) has been nominated for inclusion in the Upper Hunter Biodiversity Plan. A draft Biodiversity Assessment Report has been prepared according to specific requirements outlined by OEH and the current credit calculator (to be revised) and is presented as an appendix in **Appendix O**.

The Upper Hunter Strategic Assessment involves the development of a Biodiversity Plan which identifies impacts and likely offset requirements for participating mining companies in the Upper Hunter. Participating Companies will be able to contribute to the Upper Hunter Offsets Fund (established under the Environmental Trust) to satisfy any offset requirements that are imposed as a condition of approval. The offset funding will meet state and Federal ecological objectives by conserving offset land in perpetuity, managing strategically located land to high ecological standards and restoring the condition and/or extent of terrestrial and aquatic habitats to ensure there is no net loss to biodiversity within the region.

The Terms of Reference (ToR) associated with the Upper Hunter Strategic Assessment were recently publically exhibited on the DP&I website with comments due on 5 July 2013. Following the exhibition period, the ToR will be agreed between the NSW and Commonwealth Governments. It is currently anticipated that a final Upper Hunter Biodiversity Plan will be completed in late 2013.

The Upper Hunter Strategic Assessment process provides two avenues for projects to progress, including:

- **Path 1** - Approval to clear is required before the draft Upper Hunter Biodiversity Plan has been released for public exhibition and the proposed offset fund is not operational. In this case approvals by NSW and the Commonwealth may be issued on a case by case basis and conditioned to cover any uncertainties about expected outcomes of the Upper Hunter Biodiversity Plan and the proposed offset fund; or
- **Path 2** - Approval to clear is required in the period after public exhibition of the draft Upper Hunter Biodiversity Plan but before the plan has been finalised or endorsed (or classes of actions approved by the Commonwealth). In this case approvals may be issued by NSW and the Commonwealth that reflect consistency with outcomes anticipated by the draft Upper Hunter Biodiversity Plan. If the offset fund is operational, payments may be made to the fund or companies could still use their own offset properties as appropriate.

It is anticipated that BMC will follow the Path 1 process requiring approval to clear before the draft Upper Hunter Biodiversity Plan has been released for public exhibition. In this case, approvals by NSW and the Commonwealth may be issued on a case by case basis and conditioned to cover any uncertainties about expected outcomes of the Biodiversity Plan and the proposed offset fund.

The Upper Hunter Strategic Assessment process is presented on **Figure 60** with the target areas for suitable offsets are presented on **Figure 61**. The Upper Hunter Strategic Assessment is intended to satisfy both Commonwealth and State biodiversity impact assessment requirements and utilises the Biodiversity Certification Assessment Methodology (BCAM) as the key assessment tool. The BCAM builds on the

existing BioBanking Scheme methods to provide a quantitative assessment of project impacts and required offsets to match biodiversity values lost through land clearing.

Offsets will be secured by the Upper Hunter Offset Fund Manager through a combination of mechanisms including:

- Purchasing and retiring of BioBanking Scheme credits;
- Purchasing land containing the appropriate biodiversity values to BioBank under agreement. Land then would be sold to a new owner, who would use BioBank Trust annual payments to manage the land in perpetuity;
- Establish purchased land for the national reserve under the NSW National Parks and Wildlife Service, in which it considers the land to be an identified priority;
- Negotiating a Conservation Agreement with the OEH under the NPW Act, with private land holders or public authorities; and/or
- Negotiating a Nature Conservation Trust agreement under the *Nature Conservation Trust Act 2001* with private landholders.

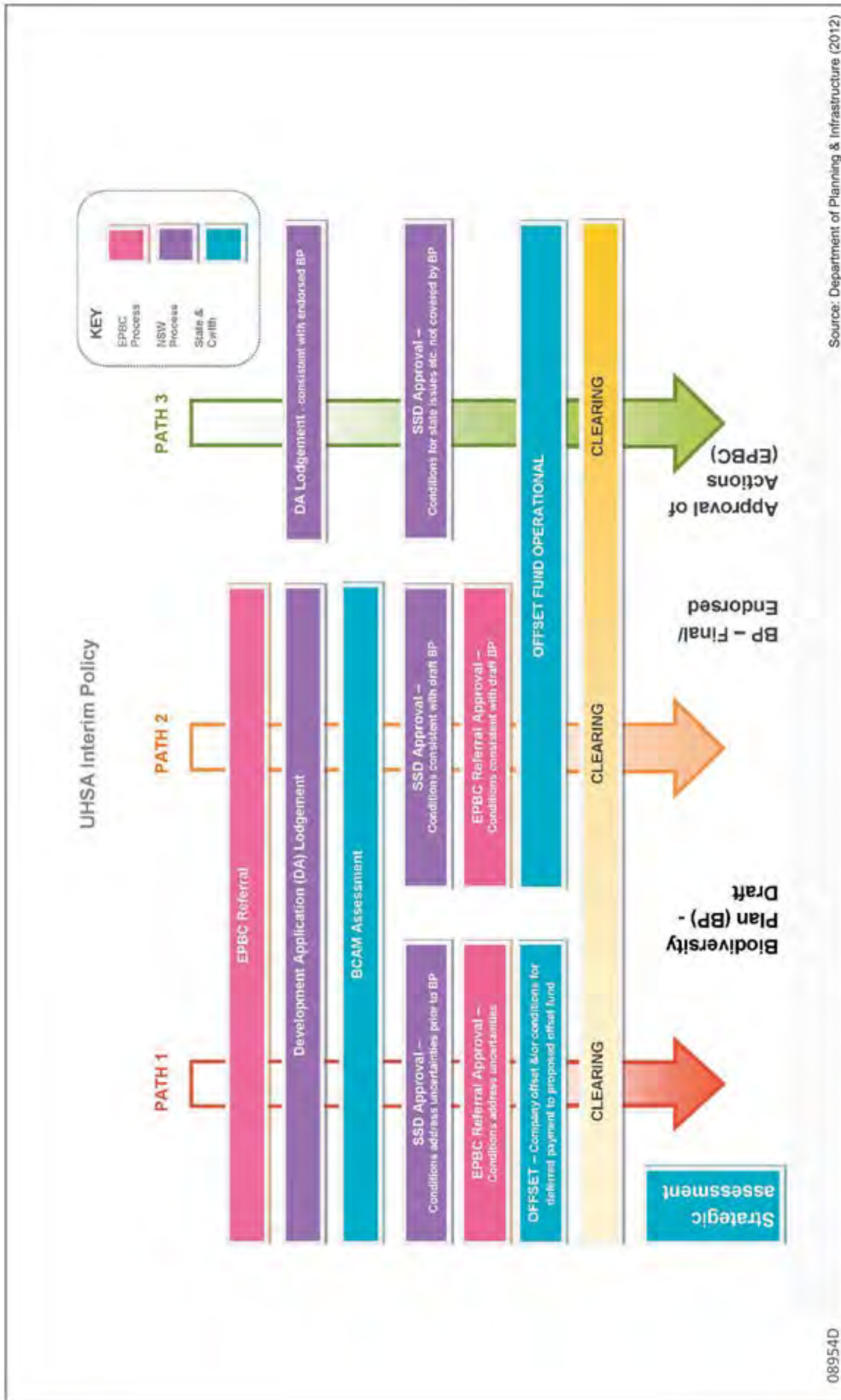
Additionally, it is proposed that under the Upper Hunter Biodiversity Plan, mining companies could meet up to 25% of their offset obligations through specific Upper Hunter region supplementary measures, including the restoration of mine-owned land, recovery actions or restoration works for threatened species and environmental research.

Contributions to the Upper Hunter Offset Fund are based on an estimate of land value plus the cost of ongoing management. The contributions have been estimated in consultation with OEH personnel and by utilising the *Biodiversity Certification spreadsheet_v0.8* (OEH, 2012c) was used in conjunction with the BCAM.

The Upper Hunter Offset Fund includes provisions to potentially enable MSC to utilise up to 25% of the final contribution amount for rehabilitation projects within the LGA.

An estimation prepared on the preliminary methodologies provided by OEH anticipates that approximately 2,310 ha of land would be contributed on behalf of BMC and strategically located within the Upper Hunter Valley and immediate surrounds to the north and west. When the Upper Hunter Biodiversity Plan is finalised in 2013, the figure for credit and offset can be further validated.

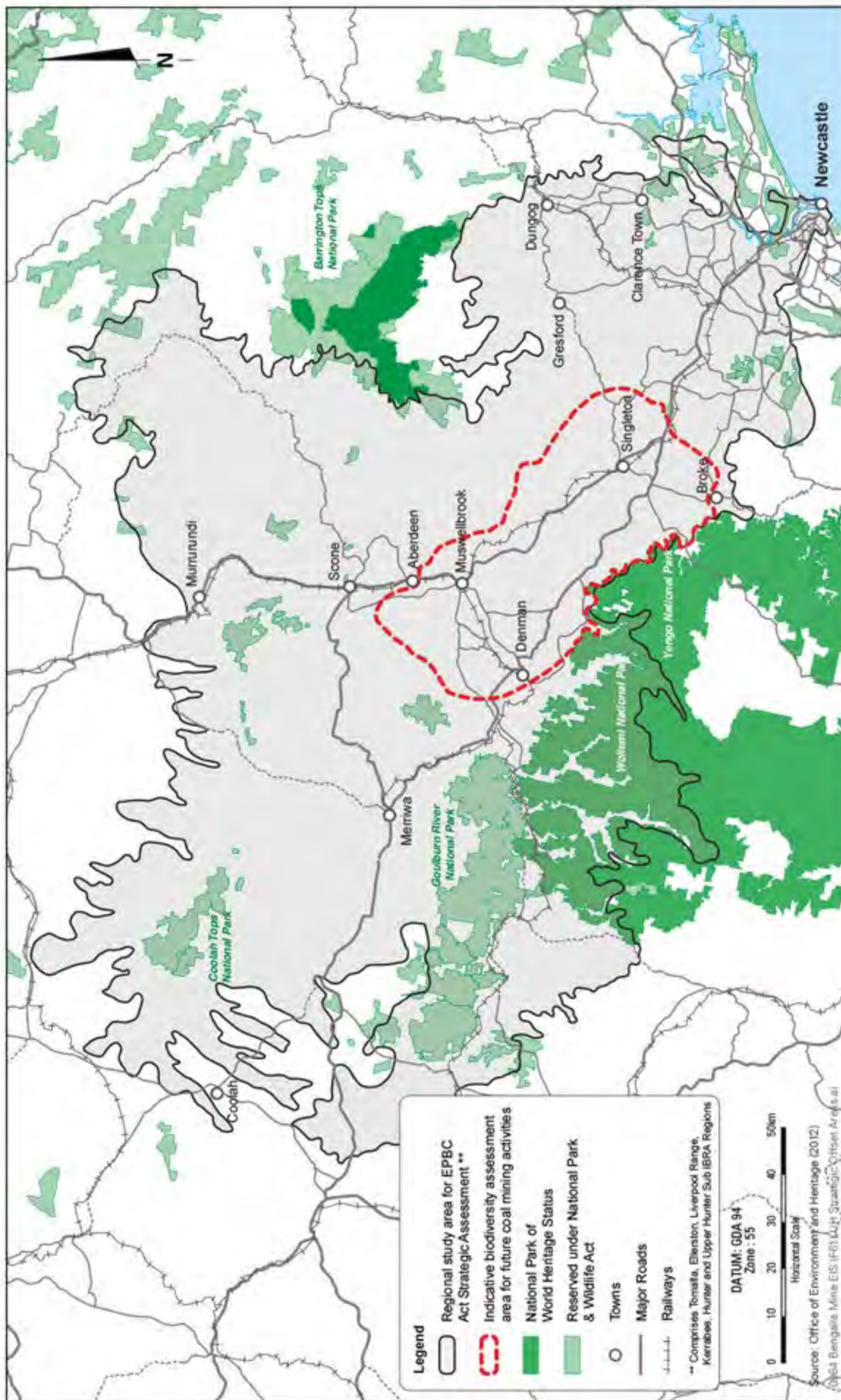
Due to the cumulative nature and funding of the Upper Hunter Offset Fund, the contribution by BMC to the fund is expected to, as a result of the application by the Fund towards acquisition of appropriate offset land and management of that (and other) biodiversity offset lands in the Upper Hunter region, there will be a net benefit to flora and fauna within the region and State by substantially increasing the proportion of native forest and woodland in conservation tenure.



BENGALLA MINE

Upper Hunter Strategic Assessment Process

FIGURE 60



BENGALLA MINE

Upper Hunter Strategic Offset Areas

FIGURE 61

The Upper Hunter Biodiversity Plan is currently being finalised by OEH and DP&I in consultation with SEWPaC and is expected to comply with the current principles for offsetting set out by SEWPaC's *Environmental Offsets Policy Environment Protection and Biodiversity Conservation Act 1999* (SEWPaC, 2012) and the OEH *Principles for the Use of Biodiversity Offsets in NSW* (DECC, 2008a) and will offset the Project impacts to MNES as well as TSC Act listed species, populations and communities.

Biodiversity Certification Assessment Methodology

The Upper Hunter Strategic Assessment employs the BCAM which has been developed by OEH. This methodology outlines various field survey requirements and defines on-ground methods for surveying threatened species habitat and vegetation condition and outlines where offsets may be located. It also contains provisions for the calculation of impacts and offsets.

BCAM assesses general biodiversity values for their conservation significance including native vegetation types, condition and spatial configuration such as connectivity and extent of native vegetation in the Biodiversity Assessment Area. This will be utilised to calculate the financial contributions of each participating company to the Upper Hunter Offset Fund. When finalised the BCAM will contain a 'Credit Converter' that converts offset biodiversity credit requirements into a dollar amount. The credit converter will be based on an estimate of land value plus the cost of ongoing management. Calculations for contributions using the Credit Calculator will be made on completion of the UHSA process. Further details pertaining to the BCAM methodology are provided in the manual (DECCW, 2011).



Upper Hunter Strategic Assessment Ecosystem Credits

BMC intends to contribute to the Upper Hunter Offset Fund (to be set up under the NSW Environmental Trust and managed by the OEH on behalf of the Trust) that will be used to secure sufficient offset land and contribute to the cost of its ongoing management. BMC will participate to compensate for the direct removal of 950 ha of vegetation (including 881 ha of native vegetation) comprised of open forest and woodland communities including Box Gum Woodland. Contributing to the Fund will fulfil BMC's statutory offsetting requirements under the TSC Act and EPBC Act.

Preliminary results associated with the Disturbance Boundary have been calculated. They indicate the total ecosystem credits required to offset the Project is clearing of vegetation for the Disturbance Boundary is estimated at 27,830. The credit requirements were based on preliminary calculations only using available information at the time of printing the EIS. The current BCAM tool is presently undergoing revision which will alter the final credit requirements. The process of credit and offset calculation will be completed in 2013 and 2014 when the Upper Hunter Biodiversity Plan is finalised.

Upon the successful finalisation of the Upper Hunter Biodiversity Plan to BMC's satisfaction, BMC will recalculate the credit requirements for the Project in consultation with relevant regulators.

The draft BCAM inputs and assumptions used to generate the preliminary credit requirements for the Project are presented in **Appendix O**.

Alternative Offset Strategy

As at July 2013, the Upper Hunter Strategic Assessment process and associated credit converter calculator had not yet been finalised and the Project's final ecosystem credits and resulting financial contribution amount remain preliminary. It is anticipated that the scheme will be based upon the determination of the Project.

Upon finalisation of an acceptable Upper Hunter Strategic Assessment process, BMC will recalculate the credit requirements for the Project in consultation with relevant regulators and contribute the commensurate amount to the Upper Hunter Strategic Assessment Trust Fund.

In the event that the Upper Hunter Strategic Assessment process is not implemented or is not acceptable to BMC, it will consult with the relevant regulators to determine an alternative offset strategy for the Project to be completed within two years following the receipt of Development Consent for the Project.

8.12 Stygofauna

8.12.1 Background

A Stygofauna Impact Assessment for the Project was undertaken by Eco Logical Australia Pty Ltd and is provided in **Appendix P**. The purpose of the assessment was to determine the potential impacts on stygofauna and to recommend measures to account for and manage these impacts where appropriate.

8.12.2 Methodology

Desktop Assessment

A desktop assessment was conducted to determine the likelihood of stygofauna occurring within the vicinity of the Project, based on a review of previous surveys in the Hunter Valley region and an assessment of likelihood of occurrence for species previously identified.

Previous stygofauna studies in the Hunter Valley region commenced in 2000 and investigated the presence of stygofauna in the hyporheic zone (an area of the river bed where groundwater and surface water mix) over a period of four years along the Hunter River, Goulburn River and Wollombi Brook. These surveys have confirmed the existence of a diverse array of stygofauna in the Hunter Valley region, including crustaceans, flat worms and aquatic worms.

Following the initial hyporheic survey, additional work was undertaken from the period from 2004 to 2008 for bores in the Hunter River, Pages River, Dart Brook and Kingdon Ponds alluvial aquifers, which found additional species. The findings of the desktop assessment and the location of the Project in relation to the Hunter River alluvium suggested that stygofauna were likely to occur within the vicinity of the Project Boundary and as such, a field sampling program was conducted.

Sampling Program

The field sampling program for the Project was undertaken in two periods during July and September 2012 to target the Hunter River alluvial aquifer and the underlying Permian aquifer. Sampling methods exceeded the minimum requirements of the *Draft Guidance Statement 54a – Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia* (WA EPA, 2007) in that netting was complemented with pump sampling for a selection of bores.

In total, 13 bores were sampled for stygofauna during July 2012 in areas within and surrounding the Project Boundary. This included eight bores in the Hunter River alluvial aquifer and five bores in the Permian rock aquifer. Ten of these bores were sampled again during the September 2012 component of the survey giving a total of 23 samples. All samples collected were subjected to laboratory analysis to identify the species present where possible and to quantify the numbers of each species present in each sample.

8.12.3 Impact Assessment

Species Present

Of the 13 bore locations sampled in 2012, stygofauna was present at 10 sites, of which nine were within the alluvial aquifer. The tenth site was a disused windmill hole to the east of the Project that entered the shallow hard rock aquifer. The presence of stygofauna in this bore indicates that the hard rock aquifer may be connected to an overlying lens of sediment at this location.

Six invertebrate taxa were collected (all from the alluvial aquifer) with cyclopoid copepods being the most abundant. Cyclopoids were collected from nine bores (including site BG45). There were 1,018 cyclopoids collected over the two sampling rounds, with 609 occurring at site SMB₁. Bore BG3 had the second highest cyclopoid abundance, with 195 specimens. Cyclopoids could not be identified to species level without further expertise as there are no suitable taxonomic keys for eastern Australia. As such identification was taken to family level. Although the cyclopoids were morphologically similar to each other, it is possible that several species were present. None of the taxa collected during the sampling found to be endemic to the Project Boundary.

Potential Stygofauna Impacts

While both the rate and magnitude of water table drawdown has the potential to impact stygofauna communities, the Project is not expected to significantly increase drawdown in the Hunter River alluvial aquifer above that which was occurring at the time of sampling. The high numbers of fauna and the presence of all six taxa in the immediate vicinity of current mining operations at Bengalla indicate that the current level of drawdown has had minimal impact on the stygofauna community.

As noted in **Section 8.7** the extent of current drawdown should decrease as mining moves westward away from the alluvium (**Appendix K**). With this westward movement, the aquifer water level will move towards the pre-mining levels and provided there are no significant changes to water quality, stygofauna should recolonise the currently dewatered sediments. An exception to this could be at site WAN8A, where there have been rapid changes in pH and EC since 2009.

8.12.4 Mitigation and Management

The Hunter River alluvial aquifer adjacent to Bengalla Mine contains at least six species of stygofauna, with none of the taxa collected during the sampling found to be endemic to the Project Boundary. It is very unlikely that there will be endemic species whose distribution is confined solely to the narrow band of alluvium predicted to be dewatered by the Project.

As the Project is predicted to result in only very limited impacts to the stygofauna community present in the Hunter River alluvium, no additional surveys or management and mitigation measures are required.

8.13 Traffic And Transport

8.13.1 Background

A Traffic and Transport Impact Assessment was undertaken by DC Traffic Engineering and is provided in full in **Appendix Q**. The objectives of the assessment were to:

- Predict the additional road traffic generated by the Project;
- Assess the impacts of the additional traffic on the local and regional road network;
- Assess the impacts of the proposed Bengalla Link Road realignment on traffic;
- Assess the road safety implications of the Project;
- Assess the impacts of the Project on rail traffic; and
- Recommend measures to account for and manage the identified impacts.

Existing Road Network

The major road in the Upper Hunter region is the New England Highway, which provides a link between Newcastle and Brisbane. This is an Auslink route and a freight route of strategic national importance. Most vehicles travelling to Bengalla from the east will use the New England Highway. The highway carries approximately 15,500 vehicles/day. The road is managed by RMS on behalf of the Commonwealth government. The road network in the vicinity of the Project is shown in **Figure 2**.

Denman Road provides a link between the Golden Highway near Denman and the New England Highway near Muswellbrook. Denman Road is an undivided two-lane road with a sealed width of 7 m to 9 m. Denman Road carries approximately 6,700 vehicles/day to the east of Thomas Mitchell Drive and 4,900 vehicles/day in the section between Thomas Mitchell Drive and Bengalla Link Road. Heavy vehicles account for 11% of all traffic along this road. Denman Road is a State road and as such is under the jurisdiction of RMS.

Bengalla Link Road was constructed by BMC to provide access to Bengalla. The road was initially 6.2 km in length, joining Denman Road and Bengalla Mine Access Road. The section of road between Bengalla Mine Access Road and Wybong Road was completed in 2009. The construction of the 2.9 km Stage 2 Extension was undertaken to fulfil BMC's commitment to the MSC '*Western Roads Strategy*' (MSC, 1997).

The Stage 2 Extension completes the link between Denman Road and Wybong Road, providing access to other mining developments. Under the '*Western Roads Strategy*' (MSC, 1997), Bengalla Link Road is designated as the principle route for traffic associated with mining operations (Bengalla, Mangoola and the undeveloped Mount Pleasant Project). Bengalla Link Road is under the jurisdiction of MSC.

Bengalla Mine Access Road is a two-lane-two-way road that extends east from Bengalla Link Road. Bengalla Mine Access Road is owned and managed by BMC. All vehicular access to Bengalla is via Bengalla Link Road and Bengalla Mine Access Road.

Thomas Mitchell Drive is an 11 km local road linking Denman Road and the New England Highway. The road has a two-lane-two-way configuration and a width of approximately 7 m. The speed limit varies from 80 km/h to 100 km/h along the road. Thomas Mitchell Drive carries approximately 5,400 vehicles/day at its western end and 3,100 vehicles/day at its eastern end. MSC is responsible for the management of the Thomas Mitchell Drive.

Skellatar Stock Route – Ironbark Road – Rutherford Road is a collector road which passes from Denman Road (Sydney Road) to the New England Highway. This route provides access to residential, sporting and retail areas. The speed limit is 50 km/hr along the entire route. A 10 t load limit applies to the section from the intersection with Denman Road to west of the retail strip on Rutherford Road. Vehicles travelling from Denman Road to the New England Highway (and vice versa) are more likely to use Thomas Mitchell Drive due to the directness of the road and the higher speed limit. As a result, the Project is unlikely to generate a significant volume of traffic along Skellatar Stock Route.

Roxburgh Road is a two-lane-two-way rural road situated to the west of the Project. The road runs from north-east to south-west, connecting Bengalla Link Road and Mangoola Road. Prior to the completion of the Bengalla Link Road Stage 2 Extension, the northern end of Roxburgh Road extended off Wybong Road. Mangoola has imposed a restriction which prohibits its traffic from using Roxburgh Road. As a result, traffic volumes on Roxburgh Road are very low. The road is under the jurisdiction of MSC.

Wybong Road is a two-lane-two-way rural road that runs from east to west near the Project Boundary. The western end of the road intersects with the Golden Highway at Sandy Hollow and the eastern end intersects with Kayuga Road at Muswellbrook. The 16 km section of the road between Sandy Hollow and Xstrata Mangoola experiences a low volume of traffic. The 7 km section of road between Xstrata Mangoola and Bengalla Link Road carries approximately 1,000 vehicles each day.

Edderton Road is a 15 km long rural road linking Denman Road and the Golden Highway. Edderton Road has a two-lane-two-way configuration but is unmarked and has a load limit of 14 t. Edderton Road carries approximately 760 vehicles/day at its northern end and 680 vehicles/day at its southern end. Heavy vehicles account for approximately 19% of all traffic.

Due to the availability of more convenient routes, it is unlikely that a significant volume of traffic would use Edderton Road to access Bengalla. Heavy vehicle movements generated by the Project are precluded from using Edderton Road due to the load limit.

Existing Rail Network

Product coal is transported from mines in the Hunter and Western Coalfields to the Port of Newcastle via the Main Northern Railway Line (see **Figure 62**). There is a dedicated double track between Newcastle and Maitland, a shared double track between Maitland and Muswellbrook and a shared single track between Muswellbrook and Ulan. **Table 69** shows the carrying capacity of the sections of the Main Northern Railway Line in the vicinity of the Project (ARTC, 2011).

The large majority of trains on the Main Northern Railway Line are comprised of 120 t wagons. These are restricted to a speed of 60 km/hr when loaded and 80 km/hr when empty. The average payload per train on the Bengalla Rail Loop is 7,700 t (ARTC, 2011). In 2011, BMC dispatched 746 loaded trains with payloads ranging from 7,200 to 8,500 t (BMC, 2012b).

Along the section of the Main Northern Railway Line between Singleton and Muswellbrook there are level crossings at three locations:

- Hebden Road, Ravensworth;
- Glennies Creek Road, Camberwell; and
- Dights Crossing Road, Oak Park.

All three level crossings (see **Figure 62**) are controlled using flashing lights and boom barriers. Significant queuing is unlikely to occur at these crossings due to the low volumes of traffic along these roads. There is sufficient storage length along the road approaches to prevent short stacking risks. If the queue along Hebden Road reaches 300 m, the one-lane bridge over Bowmans Creek may become congested. It is very unlikely that there will be sufficient traffic along Hebden Road to generate a queue of this length.

8.13.2 Methodology

Desktop Assessment

Existing road traffic conditions were ascertained through a review of previous traffic surveys. The RTA conducted numerous traffic surveys between 1980 and 2004 at two locations on the New England Highway. The traffic volumes were expressed as annual average daily traffic values, which represent the number of vehicle movements in both directions per day. Annual traffic growth rates were calculated using the data from these traffic surveys. From 1980 to 2004, traffic volumes increased at an average rate of 2.5% per year. The traffic modelling has adopted this growth rate for forecasting increases in background traffic (non-Project related).

Traffic Surveys

Midblock traffic surveys were conducted at the following locations to measure traffic volumes on the key roads in the vicinity of the Project:

- Bengalla Link Road, approximately 200 m north of Denman Road;
- Bengalla Link Road, approximately 300 m north of Bengalla Mine Access Road;
- Denman Road, 300 m east of Bengalla Link Road;
- Thomas Mitchell Drive, 200 m south of Denman Road; and
- Thomas Mitchell Drive, 200 m west of New England Highway.

The midblock traffic surveys were conducted 24 hours per day from 8 to 14 September 2011.

In addition, a turning movement survey was conducted at the intersection of Bengalla Link Road and Denman Road. The turning movement survey was undertaken between the hours of 6:00 am to 10:00 am and 3:00 pm to 7:00 pm on 8 September 2011.

Turning traffic volumes for the Denman Road / Thomas Mitchell Drive intersection were determined using the results of the midblock traffic surveys and the proportions of turning traffic observed on 13 October 2011. For the intersection of Thomas Mitchell Drive and the New England Highway, traffic volumes for Thomas Mitchell Drive were provided by the midblock traffic surveys.

Table 69 Main Northern Railway Line Carrying Capacities

Section	2011		2015	
	Trains / day	Mtpa	Trains / day	Mtpa
Bengalla Rail Loop (Bengalla and Mount Pleasant Project)	15	41	21	60
Bengalla Rail Loop to Muswellbrook	21	59	36	104
Muswellbrook to Antiene	47	132	47	132



FIGURE 62

Hunter Valley Rail Network

FIGURE 62

Traffic volumes for the New England Highway were determined by applying a growth rate of 2.5% to the volumes measured by the RTA in 2004. Turning traffic volumes for this intersection were calculated based on turning traffic behaviour observed on 13 October 2011.

The traffic surveys indicated that the AM peak occurs from 6:00 am – 7:00 am and the PM peak occurs from 4:00 pm – 5:00 pm.

Traffic Modelling

The SIDRA software was used to model the performance of key traffic intersections during the life of the Project. The intersections assessed in the modelling were selected based on the routes most likely to be used by vehicles travelling to and from Bengalla.

The primary route for vehicles travelling to the north of Muswellbrook is via Bengalla Link Road, Denman Road and the New England Highway. The alternative route is via Wybong Road, Kayuga Road, Aberdeen Street and the New England Highway. The first route has been adopted as the preferred route because the Bengalla Link Road has a higher speed limit than Wybong Road and Kayuga Road and is in better condition. This is consistent with the '*Western Roads Strategy*', which designates Bengalla Link Road as the primary route for traffic to and from Bengalla.

For vehicles travelling to Sandy Hollow, Merriwa and further west, the primary route is via Bengalla Link Road, Denman Road and the Golden Highway. The alternate route for accessing the Golden Highway is Wybong Road. Bengalla Link Road is preferred over Wybong Road due to its superior condition.

For locations to the south of Muswellbrook (i.e. Singleton and Lower Hunter) the primary route is via Bengalla Link Road, Denman Road, Thomas Mitchell Drive and the New England Highway. Vehicles are unlikely to use Skelletar Stock Route as an alternative to Thomas Mitchell Drive because the route is less direct and has a significantly lower speed limit. The alternative route to Singleton and the Lower Hunter is via the Golden Highway. However, this is unlikely to be used as the New England Highway is more direct.

Based on the primary routes identified above, the key intersections for providing access to the Project are:

- Denman Road / Bengalla Link Road;
- Denman Road / Thomas Mitchell Drive; and
- New England Highway / Thomas Mitchell Drive.

The performance of these three intersections has been assessed using the SIDRA model. Although it is possible that other routes and intersections could be used by vehicles travelling to and from the Project, these are the most critical intersections for accessing the site.

The SIDRA model was used to evaluate the performance of the key intersections during the peak construction and operations periods. The performance of the intersections under existing conditions was also assessed. The change in intersection performance represents the impact of the Project.

The SIDRA model assesses the performance of each intersection using four performance indicators:

- Average delay per vehicle;
- Level of Service (LoS) which is a rating based on the average delay;
- Degree of Saturation (DoS) which is the ratio of traffic demand to intersection capacity; and
- Maximum queue length.

The assessment of cumulative traffic impacts considered the effect of developments at Mt Arthur Coal Mine, Mount Pleasant Project, Drayton Mine and Mangoola Coal Mine.

An assessment of the potential impacts of the Project on the existing rail network with regard to capacity, efficiency, travel time and safety was completed. Additional consideration of the strategic objectives and cumulative impacts for the passenger and freight rail network including a review of impacts to relevant railway level crossings was also conducted for the Project.

8.13.3 Impact Assessment

Intersection Performance for the Approved Bengalla Mine

Existing Conditions

The performance of the key intersections under existing traffic conditions is outlined in **Table 70**. The model results indicate that the Denman Road / Bengalla Link Road and Denman Road / Thomas Mitchell Drive intersections are performing satisfactorily. The DoS for these intersections is less than 0.5, which indicates that the intersections have at least 50% residual capacity. The average delay at these intersections is less than 14 seconds, which translates to a LoS of A or B.

The New England Highway / Thomas Mitchell Drive intersection is currently performing poorly, particularly during the AM peak period. The DoS is greater than 1, which indicates that the traffic volume is greater than the capacity of the intersection. As a result, the average delay is over 40 seconds (LoS F) and maximum queue length is over 260 m. The worst delay is experienced by right-turning vehicles in the Thomas Mitchell Drive approach to the intersection.

HVEC is obligated to carry out further improvements to Thomas Mitchell Drive as part of their Open Cut Consolidation Project. Item 47 (Schedule 3) of Project Approval 09_0062 requires HVEC to “fund the upgrade of Thomas Mitchell Drive as outlined in the RTA’s Review of Thomas Mitchell Drive Route Assessment” (Department of Planning, 2010b).

This will involve the following improvement works relevant to the Project:

- Upgrade of the Denman Road/ Thomas Mitchell Drive intersection to a seagull configuration with an indented right-turn lane for access into Thomas Mitchell Drive, a protected acceleration lane for right-turns out of Thomas Mitchell Drive and retention of the existing left-turn deceleration lane on Denman Road by December 2019; and
- Upgrade of the New England Highway/ Thomas Mitchell Drive intersection to a seagull configuration with right-turn and left-turn deceleration and acceleration lanes on the New England Highway.

At the time of writing this EIS, HVEC has commenced the upgrade to the New England Highway / Thomas Mitchell Drive intersection as outlined above. As a result of this upgrade the Project has assumed that this will be fully operational by Year 1 of the Project and has been modelled in the Traffic and Transport Impact Assessment accordingly (see **Appendix Q**).

Base Case Scenario

The traffic volumes measured in the September 2011 traffic surveys are not truly reflective of the volumes that could potentially be generated by the Approved Bengalla Mine.

Bengalla is approved to extract up to 10.7 Mtpa of ROM coal and employ 400 full-time equivalent personnel. In 2011, Bengalla produced 7.0 Mt of ROM coal and employed 358 full-time equivalent personnel. In order to assess the traffic impacts of the Bengalla Mine (as approved) the measured traffic volumes were adjusted to account for these differences. In addition, the CHPP was being upgraded during the traffic surveys. This work generated additional traffic that is not associated with the operations of the mine. The traffic generated by the CHPP upgrades was subtracted from the measured traffic volumes to better reflect the conditions during the operational phase of the mine. The overall effect of the adjustments provided a true base case scenario which included an additional:

- 10 inbound light vehicle trips during the AM peak;
- 12 outbound light vehicle trips during the AM peak;
- 10 inbound light vehicle trips during the PM peak; and
- 12 outbound light vehicle trips during the PM peak.

The adjusted traffic volumes were used to assess the traffic impacts under the base case scenario (i.e. Bengalla operates as approved). The results of the model for the base case scenario are shown in **Table 71**. Due to the adjustments to the measured traffic volumes, the delays and queue lengths under the base case scenario are only slightly greater than the corresponding values under existing traffic conditions (see **Table 70**). The LoS for these intersections remain the same.

Table 70 Performance of Key Intersections under Existing Traffic Conditions

Intersection	Period	DoS	Average intersection delay (sec/vehicle)	LoS	Maximum Queue length (m)
Denman Road / Bengalla Link Road	AM Peak	0.285	8.0	A	11.4
	PM Peak	0.175	5.9	B	6.4
Denman Road / Thomas Mitchell Drive	AM Peak	0.307	11.1	B	11.5
	PM Peak	0.496	9.6	B	28.0
New England Highway / Thomas Mitchell Drive	AM Peak	1.397	40.3	F	264.5
	PM Peak	0.682	6.7	C	33.0

**Base case did not account for the upgrade to Thomas Mitchell Drive / New England Highway Intersection.*

Table 71 Performance of Key Intersections under Base Case Scenario

Intersection	Period	DoS	Average Intersection Delay (sec/vehicle)	LoS	Maximum Queue Length (m)
Denman Road / Bengalla Link Road	AM Peak	0.293	8.1	A	11.7
	PM Peak	0.181	6.1	B	6.7
Denman Road / Thomas Mitchell Drive	AM Peak	0.316	11.1	B	11.9
	PM Peak	0.503	9.6	B	28.5
New England Highway / Thomas Mitchell Drive	AM Peak	1.426	42.5	F*	276.5
	PM Peak	0.691	6.8	C	33.7

**Base case conditions did not account for the for upgrade to the Thomas Mitchell Drive / New England Highway Intersection as discussed in Section 8.13.3.*

Road Traffic Generated by the Project Construction Phase

The peak of the Project construction phase will likely occur in quarter 1 of Year 2, when up to 315 workers would report to the site each day. A 100% car usage factor (with 1 person/vehicle occupancy) has been applied to an assumed 80% of the workforce that will access and egress the site during both the AM and PM peak periods. This traffic volume was added to the base case to determine a 'peak construction' traffic scenario, in addition to a two years' worth of background traffic growth expected to be experienced.

The trip distribution for vehicles was based on the places of residence for the existing workforce:

- 40% of trips distributed to Muswellbrook via Denman Road;
- 28% of trips distributed to Scone and Aberdeen via Wybong Road;
- 27% of trips distributed to Singleton and the Lower Hunter via Thomas Mitchell Drive; and
- 5% of trips distributed to Denman via Denman Road.

The results of the SIDRA model for the peak construction case scenario are shown in **Table 72**. The modelled performance of the all the modelled intersections were determined to be acceptable and have sufficient capacity to accommodate the peak construction traffic demands.

Operational Phase

The maximum ROM production for the Project has been modelled from Year 4 and sustained for the remainder of the Project life. Therefore, the peak operational traffic volume for the Project will occur from Year 4 onwards. Year 15 has been adopted as the peak operational period because production from neighbouring mines is expected to peak in this year.

The increase in product coal yield to 12.3 Mt is known to intensify rail traffic, however has also been expected to create an additional 12 truck movements (six inbound and six outbound) each weekday for ancillary services and supplies. It was assumed that the trucks would have trip origins from the south-east (Singleton, Maitland and Newcastle).

It has been assumed that all vehicle trips will occur during the AM and PM peak periods. That is, the inbound trip for the day shift and the outbound trip for the night shift will occur during the AM peak. Similarly, the outbound trip for the day shift and the inbound trip for the night shift have been assumed to occur during the PM peak. Since vehicle trips will, in reality, occur outside of the peak periods, these assumptions are considered conservative.

Intersection Performance during the Operational Phase

Project Only Case

The SIDRA model was used to assess the performance of the three key intersections during the peak operational period (Year 15). The results indicate that the Denman Road / Bengalla Link Road intersection will perform at a LoS rating of 'good' or 'acceptable' (LoS A or B). The average delay at the Denman Road / Thomas Mitchell Drive intersection will increase as a result of the additional operational traffic. Despite this, the intersection will perform at a LoS rating of 'satisfactory' (LoS C). Therefore, the intersections of Denman Road with Bengalla Link Road and Thomas Mitchell Drive have sufficient capacity to accommodate the traffic demands of the Project (see **Table 73**).

Cumulative Case

The cumulative operational phase includes the combined impacts of Project-related traffic growth, foreseeable traffic growth from neighbouring coal mining projects and the background traffic growth. The results of the SIDRA modelling for the cumulative case are presented in **Table 74**.

The SIDRA model indicates that the upgrade to a seagull configuration (due for completion by Year 1 of the Project) will improve the LoS rating from 'unsatisfactory with excessive queuing' (LoS F) to 'satisfactory' (LoS B). The maximum queue length for the right turn from Thomas Mitchell Drive onto the New England Highway will decrease significantly to 54 m for the AM peak and 30 m for the PM peak (see **Table 74**).

Table 72 Performance of Key Intersections under Peak Construction Case

Intersection	Period	DoS	Average Intersection Delay (sec/vehicle)	LoS	Maximum Queue Length (m)
Denman Road / Bengalla Link Road	AM Peak	0.482	9.6	A	24.0
	PM Peak	0.369	8.0	B	12.9
Denman Road / Thomas Mitchell Drive	AM Peak	0.389	11.3	B	13.4
	PM Peak	0.633	10.3	B	31.9
New England Highway / Thomas Mitchell Drive	AM Peak	0.402	5.2	B	8.5
	PM Peak	0.325	4.2	B	8.9

When traffic increases due to other mining developments is considered, the Denman Road / Thomas Mitchell Drive intersection will perform at a 'poor' LoS. With consideration of the current upgrades to the New England Highway / Thomas Mitchell Drive intersection it will perform at a LoS of B. HVEC is also obligated to upgrade the Denman Road / Thomas Mitchell Drive intersection to a seagull configuration. This work is expected to be completed in 2019. The LoS for the intersection will improve from 'unsatisfactory with excessive queuing' to 'acceptable', with a LoS of B. The maximum queue length for the right turn from Thomas Mitchell Drive onto Denman Road will be reduced to 20 m for the AM peak and 27 m for the PM peak. A summary of the key intersections under the cumulative case following the upgrades described above is presented in Table 75.

Midblock Traffic Performance

The midblock traffic performance is the LoS along a midblock section of road (between two intersections). The midblock LoS for the principal routes was determined using the 'Highway Capacity Manual' method for two-lane highways. The midblock LoS reflects the impact of traffic volumes on travel speed.

The closer the actual travel speed is to the speed under free-flow conditions, the better the LoS. The midblock LoS for the principal routes under existing conditions and the cumulative case is presented in Table 76.

The section of Wybong Road to the west of Bengalla Link Road will retain a LoS of B. This is due to the low traffic volumes and significant spare capacity along this road. The midblock LoS for Bengalla Link Road and Thomas Mitchell Drive will drop by one rating. The LoS rating for these roads is at least a 'D', which indicates that these roads are not exceeding their capacity.

Impacts to Road Pavement

Impacts to the road pavement are measured using Equivalent Standard Axles (ESAs). Since heavier vehicles will have a greater impact than lighter vehicles, the number of vehicles is not an accurate measure of the total impact to the road pavement. Heavier vehicles will generally possess a higher number of axles. Measuring the impact in ESAs will therefore account for the greater impacts caused by heavier vehicles.

Table 73 Performance of Key Intersections under Peak Operational Case

Intersection	Period	DoS	Average intersection delay (sec/vehicle)	LoS	Maximum queue length (m)
Denman Road / Bengalla Link Road	AM peak	0.495	9.3	B	31.5
	PM peak	0.365	7.2	A	15.9
Denman Road / Thomas Mitchell Drive	AM peak	0.546	11.7	C	23.8
	PM peak	0.819	12.5	C	62.1
New England Highway / Thomas Mitchell Drive	AM peak	0.596	5.1	B	22.6
	PM peak	0.483	3.75	B	14.6

Table 74 Performance of Key Intersections under Cumulative Case

Intersection	Period	DoS	Average intersection delay (sec/vehicle)	LoS	Maximum queue length (m)
Denman Road / Bengalla Link Road	AM peak	0.729	12.1	B	72.8
	PM peak	0.561	9.6	B	41.6
Denman Road / Thomas Mitchell Drive	AM peak	1.13	44.3	F	201.5
	PM peak	1.446	113.9	F	665.2
New England Highway / Thomas Mitchell Drive	AM peak	0.799	8.0	C	53.6
	PM peak	0.650	7.3	B	29.5

Table 75 Performance of Key Intersections Following Upgrades

Intersection	Period	DoS	Average intersection delay (sec/vehicle)	LoS	Maximum queue length (m)
Denman Road / Thomas Mitchell Drive	AM Peak	0.418	9.5	B	20.1
	PM Peak	0.444	8.0	B	27.0
New England Highway / Thomas Mitchell Drive	AM Peak	0.799	8.0	C	53.6
	PM Peak	0.650	7.3	B	29.5

The quantity of ESAs was calculated using the results of the September 2011 traffic surveys and the ESA multipliers prescribed by Main Roads Western Australia (Mid West Regional Road Group – Local Road Project Funding Distribution Model). It was determined that each heavy vehicle associated with the Project will impart a loading of 1.62 ESA on the road pavement.

Road Safety

A search of the CRASHLINK database was conducted to identify crashes on the routes that may be used by Project related traffic. The crash dataset used in this assessment was for the five year period from 1 July 2006 to 30 June 2011. This is the most recent period for which there is fully validated crash data. There were no crashes on Bengalla Link Road during this five year period.

The crash rates for Denman Road, Wybong Road and the New England Highway were lower than the State-wide average for rural two-lane-two-way roads. The crash rate on the Golden Highway was slightly higher than the state average.

The crash rates for Edderton Road and Thomas Mitchell Drive were substantially higher than the State-wide average for rural two-lane-two-way roads. Approximately 80% of the length of Edderton Road will be realigned as part of the Drayton South Coal Project and the Mt Arthur Coal Open Cut Consolidation Project. The realigned sections of Edderton Road will be of a higher standard than the existing, improving the safety of the road. The safety of Thomas Mitchell Drive will be improved by the upgrades to the intersections with the New England Highway and Denman Road.

Table 76 Midblock Levels of Service at Intersections

Midblock	Assessment Period	LoS for Existing Conditions	LoS for Cumulative Case
Bengalla Link Road, south of Bengalla Access Road	AM	C	D
	PM	B	C
Wybong Road, west of Bengalla Link Road	AM	B	B
	PM	B	B
Thomas Mitchell Drive, west of New England Highway	AM	C	D
	PM	C	C

Table 77 Predicted Project Train Movements

Detail	Base Case	Project Case
Product coal yield (Mtpa)	8.4	12.3
Average Train Payload	7,700 t/train	8,600 t/train
Number of loaded trains per year	1,090	1,435
Number of loaded trains per day*	3.5	4.6
Number of train movements per day (including empty inbound)	7.0	9.2
Number of train movements per hour**	0.29	0.38

* Assumes 310 haulage days per year. ** Assumes 24 hour rail load out operations

Realignment of Bengalla Link Road

The realignment of Bengalla Link Road in approximately Year 15 of the Project will increase the length of the road by 900 m (see **Figure 24**). Assuming an average travel speed of 90 km/hr, travel times will increase by 36 seconds per vehicle. The access to Bengalla is currently provided by the Bengalla Link Road / Bengalla Mine Access Road intersection. After the realignment of Bengalla Link Road, access will be provided by the intersection of the realignment with the existing Bengalla Link Road. This intersection will be constructed to a capacity, configuration and safety standard similar to the Bengalla Link Road / Bengalla Mine Access Road intersection.

A section of Roxburgh Road will be realigned to achieve a perpendicular intersection with the realigned Bengalla Link Road. This new intersection (see **Figure 24**) will provide similar features as the existing Roxburgh Road / Bengalla Link Road intersection. The “like for like” replacement of this intersection is acceptable since the Project is not expected to generate additional traffic along Roxburgh Road.

Rail Impacts

Compared to the base case scenario, the product coal output is expected to increase from 8.4 Mtpa to 12.3 Mtpa.

Based on an average payload, the annual number of loaded train movements will increase from 1,090 to 1,540. The number of daily train movements (including unloaded inbound trips) will increase from seven to 10 resulting in the generation of an additional three train movements per day compared with the base case. **Table 77** provides a summary of the base case and forecast train movements required as a result of the Project.

In addition to assessment of the additional train movements associated with the Project, potential impacts to the existing rail network were considered. Generally, a development is considered to have a potentially significant impact over those parts of the rail network where traffic associated with that development makes up 10% or more of the overall traffic volume. When assessed against the ARTC (2012) rail traffic forecast for the Muswellbrook Junction in 2016, rail traffic associated with the haulage of product coal from the Project would make up 9.8% of the total volume of coal trains only. The area of significant influence of the Project on the wider rail network is therefore not significant, being considered to extend from Bengalla Mine rail loop to the Muswellbrook Junction. While this section of the rail network does not include any railway level crossings over public roads, a review of the following sites between Muswellbrook and Singleton was completed to consider the potential for wider impacts:

- Hebden Road (southern occurrence), Ravensworth;
- Glennies Creek Road, Camberwell; and
- Dights Crossing Road, Oak Park.

All three level crossings are similar in terms of traffic management controls, storage length available in the road approaches and the volume and function of road approaches. Each has sufficient sight distances and extensive storage length in road approaches to prevent short stacking risk and as such significant build up of queues at these sites due to passing rail traffic is not expected.

Proposed developments at Drayton South Coal Project, Xstrata Mangoola and Mt Arthur Coal Mine (under the approved operations) will not alter the number of train movements generated by these operations. The commencement of mining operations at the Mount Pleasant Project will generate an additional six daily train movements (including inbound trips). Therefore, the cumulative rail impacts will be an additional nine daily train movements along the Main Northern Railway Line. The rail network is expected to be able to accommodate this cumulative increase in rail traffic.

8.13.4 Mitigation and Management Intersection Upgrades

The right turn from Thomas Mitchell Drive onto the New England Highway is the most significantly impacted movement. Under the existing T intersection configuration, right turning vehicles on the Thomas Mitchell Drive approach must give way to northbound and southbound traffic on the New England Highway, as well as right turning vehicles from the New England Highway onto Thomas Mitchell Drive. As discussed in **Section 8.13.2** HVEC has commenced the upgrade of this intersection which is scheduled to be completed by Year 1 of the Project.

HVEC is also obligated to upgrade the Denman Road / Thomas Mitchell Drive intersection to a seagull configuration. This work is expected to be completed in 2019. The LoS for the intersection will improve from 'unsatisfactory with excessive queuing' to 'satisfactory', with a LoS of B or better. The maximum queue length for the right turn from Thomas Mitchell Drive onto Denman Road will be reduced to 20 m for the AM peak and 27 m for the PM peak.

Therefore, the current upgrades of the New England Highway / Thomas Mitchell Drive and Denman Road / Thomas Mitchell Drive intersections will resolve the predicted traffic issues during the peak operational phase. Since HVEC is undertaking these upgrades, no further mitigation measures are necessary.

Bengalla Link Road Realignment

MSC is undertaking a 'Mine Affected Road Study' with the view to revisiting the Western Roads Strategy originally prepared in 1997. Whilst this document has not yet been finalised, BMC remains committed to liaising with MSC and RMS to appropriately contributing towards the Roads Study (with other coal mine operators regarding any future realignment of the Bengalla Link Road and the ongoing management of the surrounding road network. BMC will provide MSC a single contribution of \$50,000 to assist in the development of the Mine Affected Road Study to assist in guiding the future location for the relocated Bengalla Link Road.

BMC will continue to be responsible for the costs of the maintenance of the Bengalla Link Road to the Bengalla Mine Access Road for the life of the Project. BMC will also ensure that all road signs are maintained and provide at least 24 hrs of notice of road closure on Wybong Road and Bengalla Link Road.

Over-dimensioned Loads

Prior to the transportation of over-dimensioned loads on State roads, BMC will obtain the necessary approvals from RMS. Similarly, approvals from local councils will be obtained prior to transportation of over-dimensioned loads on local roads.

Rail Upgrades

ARTC (2011) identified a number of deficiencies in the existing Hunter Valley rail network and has proposed upgrades to accommodate predicted increases in coal production in the region. BMC will consult with ARTC regarding the scheduled implementation of rail infrastructure upgrades and the allocation of train path availability.

BMC will also continue to liaise with the Mount Pleasant Project with regard to the rail infrastructure needs and rail traffic generation.

8.14 Social

8.14.1 Background

Martin & Associates Pty Ltd prepared a Social Impact Assessment for the Project which is presented in full in **Appendix R** and summarised below. The objectives of the Social Impact Assessment were to:

- Assess implications of relevant government policy and guidelines;
- Characterise the existing community, current behaviour and interactions of residents;
- Characterise and assess perceptions of the Project by those within the Primary Study Area (Muswellbrook LGA);
- Assess the potential impacts of the Project on population, temporary accommodation, commuter behaviour and longer term housing;
- Identify the present use of social infrastructure and observed or perceived gaps from a community perspective;
- Discuss implications for the Muswellbrook township, particularly the likely spatial distribution of any non-local operational and construction work forces and their impacts on the community;
- Discuss implications for the broader Secondary Study Area (Muswellbrook, Singleton and Upper Hunter LGAs) in terms of relative employment and population impacts; and
- Prepare a social management and monitoring program to account for potential impacts.

8.14.2 Methodology

The methodology of the Social Impact Assessment included setting the Study Area for the Project and analysing the baseline community and social environment. The next stages included considering how local community behaviour and interactions may change with the influence of the Project, assessing the impacts of the Project on local employment, housing and community infrastructure and making recommendations to account for the social impact of the Project. The main sources of data for the Social Impact Assessment were:

- The Australian Bureau of Statistics 2001, 2006 and 2011 Census data;
- MSC social planning reports;
- Bengalla EIS community stakeholder engagement program (see **Section 6**); and
- Review of the MSC community attitude surveys of 400 residents via a telephone survey and 186 residents via an online survey within the Primary Study Area in 2011.

As described in **Section 6** consultation was held with key relevant MSC staff and other relevant organisations within the Muswellbrook community, including:

- Local businesses and the Chamber of Commerce;
- The Principal of Muswellbrook High School;
- Muswellbrook Local Health District;
- Real estate agents;
- Local developers; and
- Accommodation operators.

Study Area

The Project is located in the Muswellbrook LGA. The Study Area of the Social Impact Assessment is illustrated on **Figure 63** and comprises the following components:

- *Directly Affected Area (DAA)* - which is smaller in area within the Primary Study Area and includes those who:
 - *Primary Study Area* - which comprises Muswellbrook LGA and includes the urban centres of Muswellbrook and Denman; and
 - Those who live nearby the Project who will experience the Project and its effects on a daily basis.
- *Secondary Study Area* - comprising the Muswellbrook, Singleton and Upper Hunter LGAs, which is the statistical area within which the majority of the operational workforce currently resides.

In addition to the Secondary Study Area, the following regions were also examined as comparative areas for demographic statistics:

- NSW; and
- The Hunter Region (excluding Newcastle LGA) – includes the LGAs within the Secondary Study Area; and Maitland, Cessnock, Lake Macquarie, Port Stephens, Dungog, Gloucester and Great Lakes LGAs.

Directly Affected Area

The DAA is made up of those communities and/or individual residents who live near the Project. These people currently experience the existing Project and its effects on a daily basis.

There are also a number of other operating mines and proposed projects which surround the Muswellbrook township to the east and south and overlap with the Project DAA and contribute to the existing setting. Over the last decade with the increasing production of surrounding operations, mining has become much more part of the character of Muswellbrook even though Muswellbrook Coal Company has been operating to the east of the town since the last century. Before then, the area was perceived as a rural town with a few coal mines.



BENGALLA MINE

Social Assessment Study Area

FIGURE 63



Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Even though the area still has elements of a rural landscape and character, it is now functioning as one with an essentially urban and industrial form and character. In this regard, the character of this area has been changing from one which was predominately rural to a diverse mix of urban, industrial and rural land use. The population within the DAA in 2011 is in the vicinity of 11,800, which makes up almost 75% of the population within the LGA.

Migration into the area has been a significant component of the growth over the past five years to 2012. The population of the area has been growing steadily over the previous two census periods (i.e. 2006 to 2011). Even though the proportion of residents migrating into the area as a percentage of total population has not changed significantly, the rate of migration into the area has been significantly higher than at the Hunter Statistical Division (excluding Newcastle). Population has consistently been attracted into the area to live and work as a direct result of the mining and power generation industries and the necessary service workforce.

Workforce Scenarios

Two workforce scenarios were used in order to identify and appropriately assess potential social impacts associated with the Project. Workforce numbers were established from existing BMC employment data. Both scenarios assume that there will be some non-local portion of the workforce which will relocate to the Primary Study Area. The key differing factor between scenarios is the extent of the share of commuters and non-locals expected to relocate into the Primary Study Area.

Scenario 1 is the 'Expected Case' and assumes that:

- Construction:
 - 20% of the construction workforce associated with the Project is sourced from the Secondary Study Area and are assumed to have the same residential address throughout the construction period;
 - 40% of the construction workforce associated with the Project are work week commuters sourced from outside the Secondary Study Area and will utilise temporary accommodation in the Primary Study Area; and
 - 40% of the construction workforce associated with the Project are daily commuters sourced from outside the Secondary Study Area;
- Operations:
 - 20% of the operational workforce associated with the Project is sourced from the Primary Study Area;
 - 37% of the operational workforce associated with the Project is sourced from outside the Primary Study Area, however will relocate to the Primary Study Area;

- 34% of the operational workforce associated with the Project is sourced from outside the Primary Study Area, however will reside in the Secondary Study Area; and
- 9% of the operational workforce is commuters sourced from outside the Secondary Study Area.

Scenario 2 is an 'Alternative Case', designed to test the sensitivity of the assumptions utilised for Scenario 1 and assumes that:

- Construction:
 - 20% of the construction workforce associated with the Project is sourced from the Secondary Study Area and are assumed to have the same residential address throughout the construction period;
 - 40% of the construction workforce associated with the Project are work week commuters sourced from outside the Secondary Study Area and will utilise temporary accommodation in the Primary Study Area; and
 - 40% of the construction workforce associated with the Project are daily commuters sourced from outside the Secondary Study Area.
- Operations:
 - 20% of the operational workforce associated with the Project is sourced from the Primary Study Area;
 - 56% of the operational workforce associated with the Project is sourced from outside the Primary Study Area, however will relocate to the Primary Study Area;
 - 16% of the operational workforce associated with the Project is sourced from outside the Primary Study Area, however will reside in the Secondary Study Area; and
 - 8% of the operational workforce are commuters sourced from outside the Secondary Study Area.

Existing Socio-Economic Environment

Current and Future Population Growth

The 2011 population of the Muswellbrook LGA was 16,098 (Place of Enumeration Data) (ABS, 2012a). The LGA had grown at an annual average growth rate of 0.85% for the previous ten years (2001 to 2011). The growth rate has remained relatively stable over the previous five years (2006 to 2011), only increasing to 0.86% per year (Place of Enumeration Data) (ABS, 2012a).

The Muswellbrook LGA annual average growth rate (0.56% from 2001 to 2011 and from 2006 to 2011), was significantly lower from 2001 to 2011 than the Singleton LGA (1.22%) and the Upper Hunter LGA from 2006 to 2011 (1.39%). The average annual growth rate of the Hunter Region, excluding Newcastle, (1.45% from 2001 to 2011 and 1.54% from 2006 to 2011) is significantly greater than the average annual growth rate of the Primary Study Area and Secondary Study Area.

According to DP&I population projections Muswellbrook LGA

will increase to a 2036 population of 18,300; while Singleton LGA will increase to 31,800 and Upper Hunter LGA to 12,900, making a total population in the Secondary Study Area in 2036 of 63,000 (compared to 54,000 in 2011) (Department of Planning, 2010a). Meanwhile, the population of the Hunter Region is projected to increase from 100,000 in 2006 to 128,000 by 2036 (i.e. a 28% increase). Annual population increase is projected to be around 1,000 for the first few years of the projection horizon, with the increase easing slowly during the 2020s and 2030s to about 800 by 2035 to 2036.

Demographic Profile

Table 78 shows that in 2011 the median individual, household and family income of the Muswellbrook and Singleton LGAs were significantly higher than the Hunter Region and NSW, whilst median household mortgage repayments and rental payments were similar levels in Muswellbrook and Singleton LGAs, the Hunter Region and NSW. The median individual, household and family income of the Upper Hunter LGA was similar to the Hunter Region and NSW, whilst median household mortgage repayments and rental payments were significantly lower than in Muswellbrook and Singleton LGAs, the Hunter Region and NSW. On average, the population of the Muswellbrook and Singleton LGA was also younger than that of the Upper Hunter LGA, the Hunter Region and NSW.

Labour Force and Skill

The 2011 Census showed that the most significant industries in terms of employment in the Muswellbrook LGA were mining (employing 21.3% of employed people over 15 years of age), retail trade (9.2%), agriculture, forestry and fishing (7.1%), health care and social assistance (6.9%), accommodation and food services (6.9%) and construction (6.7%) (ABS, 2012a). A similar employment structure was apparent in the Secondary Study Area.

The proportion of employed people in the mining industry in the Muswellbrook LGA has increased significantly since the 2006 Census, which showed that 12.7% of employed people over 15 years of age were employed in the mining industry (ABS, 2007).

This is likely to be attributed to an increase in coal extraction in the Muswellbrook LGA over the last 10 years, from 4 Mtpa in 2001 to 37 Mtpa in 2011. Recent approvals, proposed modifications and proposed new operations were projected to increase coal production to 80 Mtpa by 2014, which is likely to increase the proportion of employed people in the mining industry in the Muswellbrook LGA.

Employment and Trends

A significant shift in the unemployment rate in the Muswellbrook LGA has occurred over the last 12 months (i.e. to June 2013) associated with the downturn in the coal mining industry. In June 2012, the unemployment rate for the Muswellbrook LGA was 2.8% (233 people), which was slightly higher compared to the Singleton and Upper Hunter LGAs, which were 1.2% and 1.3% respectively although significantly lower than NSW (5.2%) (DEEWR, 2012).

In contrast, the unemployment rate in December 2012 in the Muswellbrook LGS was 4.7% (412 people). These figures have been trending upward consistent with the Secondary Study Area where unemployment levels have returned to similar levels as in 2008 with almost 1,000 persons unemployed. This is in marked contrast to the situation in June 2012 when it was considered that the local economy was close to full employment with any remaining unemployment considered to represent long term unemployed or structural unemployment. The current unemployment numbers suggest that there are significant numbers of unemployed people available with appropriate skills to support the Project (as at 2013).

The unemployment rate in the neighbouring LGAs in the Secondary Study Area in December 2012 was still comparatively low compared to Muswellbrook with a rate of 2.7% in both the Singleton and Upper Hunter Shire compared to 5.2% at the NSW level. There is some local excess capacity appearing within the Secondary Study Area which would be able to absorb new jobs with unemployed from within the area. As in the Muswellbrook LGA, the rate had trended slightly upward and had increased in absolute terms from the previous June quarter by 179 people (from 233 to 412).

Table 78 Selected Demographic Characteristics 2011

Selected Demographic Characteristics	Muswellbrook LGA	Singleton LGA	Upper Hunter LGA	Hunter Region	NSW
Median age of persons	34	35	39	38	38
Median individual income (\$/weekly)	646	661	563	528	561
Median family income (\$/weekly)	1,697	1,927	1,392	1,407	1,477
Median household income (\$/weekly)	1,416	1,687	1,070	1,158	1,237
Median housing loan repayment (\$/monthly)	1,733	2,000	1,600	1,733	1,993
Median rent (\$/weekly)	230	260	170	240	300
Average number of persons per bedroom	1.1	1.1	1.1	1.1	1.1
Average household size	2.6	2.7	2.4	2.6	2.6

Source: ABS, 2011

These unemployment numbers suggest that there are significant numbers of unemployed people available with appropriate skills to support the Project (as at 2013).

Housing Market

Median prices for both separate houses and units in the Muswellbrook LGA in the period September 2011 to May 2013 have virtually the same median prices which suggests a buoyant property market particularly attracting investors with relatively high rents and a consistent price of around \$250,000 to \$300,000 which have been yielding strong returns (Real Estate Monitor website, 2012).

Muswellbrook has a significantly higher proportion of rental housing than the rest of the Secondary Study Area, the region and the State of NSW. The combination of the high demand for employees in the mining and power industries and health and safety commuting requirements led to a situation where the system was just coping even though it was not considered to be at "critical mass". Within the town of Muswellbrook the rental market for both houses at the cheaper to moderate end of the market and units had been sought after by many individual small scale investors who were attracted to longer term rental income rather than capital gains. The local market had also been supported by a large development which had relied on investors from Sydney and Melbourne to maintain its impetus (Eastbrook Links Estate).

The higher end of the market particularly in the existing town had not been as strong due to a more subdued level of interest for investors. Once the market price exceeds \$400,000, there was found to be far less demand for the property due to the higher mortgage costs compared to rental return.

This is reflected in the Census data on the housing stock which shows housing tenure and total housing stock for the Primary and Secondary Study Area. The exception is that of Muswellbrook LGA which has been consistently drifting lower over the past 10 years. Muswellbrook LGA has 35% rental housing and for Muswellbrook the proportion of rental housing is even higher at 37.6% of the total housing stock (ABS Census, 2011).

In the period January 2011 to December 2012, the Muswellbrook LGA had a strong property and housing situation. However, since that time this has significantly changed with supply considerably exceeding demand, particularly for the rental market. This is likely due to world coal prices and uncertainty about the economy.

Table 79 shows that the percentage of housing stock both owned or mortgaged in the Secondary Study Area has remained similar across the 2001 to 2011 period at around or above 60% for the Secondary Study Area, and the Region and State in 2011. The percentage of housing stock owned or mortgaged in the Muswellbrook LGA has been constantly decreasing since 2001.

Table 79 Housing Tenure and Total Housing Stock (2011)

Tenure	Muswellbrook LGA			Upper Hunter LGA			Singleton LGA			Secondary Study Area			Hunter Region	NSW
	2001	2006	2011	2001	2006	2011	2001	2006	2011	2001	2006	2011	2011	2011
Owned outright	34.9%	29.2%	25.8%	43.9%	37.4%	34.2%	38.8%	31.5%	29.6%	39.2%	32.7%	29.8%	34.2%	33.2%
Owned with a mortgage	24.0%	30.1%	31.0%	19.6%	27.3%	29.5%	27.8%	37.1%	38.0%	23.8%	31.5%	32.8%	35.3%	33.4%
Sub Total	58.9%	59.4%	56.8%	63.5%	64.7%	63.7%	66.6%	68.6%	67.6%	63.0%	64.2%	62.7%	69.5%	66.6%
Rented:														
Real estate agent	14.4%	15.7%	19.3%	9.2%	9.3%	9.8%	12.4%	13.1%	15.1%	12.0%	12.7%	14.7%	15.0%	17.4%
State or territory housing authority	7.3%	6.3%	5.1%	2.5%	2.9%	2.7%	5.4%	4.8%	4.5%	5.1%	4.7%	4.1%	4.0%	4.4%
Person not in same household	6.7%	5.1%	5.1%	9.1%	8.0%	8.3%	5.1%	3.5%	4.0%	7.0%	5.5%	5.8%	4.9%	5.8%
Housing cooperative/ community /church group	0.3%	0.5%	1.1%	1.2%	0.8%	0.9%	0.4%	0.2%	0.1%	0.6%	0.5%	0.7%	0.5%	0.7%
Other landlord type	4.5%	2.8%	3.3%	6.6%	4.9%	5.2%	3.4%	2.8%	2.5%	4.8%	3.5%	3.7%	2.0%	1.1%
Landlord type not stated	0.9%	1.5%	1.2%	1.7%	2.9%	2.3%	0.8%	1.0%	0.8%	1.2%	1.8%	1.4%	0.7%	0.6%
Total	34.1%	31.8%	35.0%	30.4%	28.8%	29.2%	27.4%	25.3%	27.1%	30.6%	28.6%	30.4%	27.2%	30.1%
Other tenure type	1.3%	0.9%	0.8%	1.8%	1.2%	1.2%	1.4%	0.5%	0.6%	1.5%	0.9%	0.9%	0.0%	0.0%
Tenure type not stated	5.7%	7.9%	7.4%	4.4%	5.3%	5.9%	4.6%	5.5%	4.8%	4.9%	6.2%	6.0%	0.8%	0.8%
Total Housing Stock	5,394	5,642	5,995	5,172	5,195	5,514	6,987	7,638	8,164	17,553	18,475	19,673	88,034	2,471,276

Source: ABS, 2012a

In 2011, there were 2,100 properties being rented in the Muswellbrook LGA which represents 35% of the total housing stock in the LGA. This is significantly higher than the ratio of rented properties in the Singleton LGA, the Upper Hunter LGA and the state of NSW (ABS, 2012a).

In the period December 2012 to July 2013, the situation for rental housing has turned around significantly so that in the last quarter reported from the NSW Office of Housing to December 2012 showed rents for units and flats dropping by 13.8%. Local real estate agents reported that there are now (July 2013) a large number of rental properties available and the pressure on rents to continue to decline will intensify. This is due to a very large decline in employment as current mining operations address the current less attractive market conditions.

Temporary Accommodation

The temporary accommodation occupancy rate for the Secondary Study Area in June 2012 was higher than the Hunter Regional and NSW occupancy rates (ABS, 2012b). As described previously, a significant shift in the unemployment rate for Muswellbrook has occurred over the last 12 months associated with the downturn in the coal mining industry. Recent data for temporary tourist accommodation for the June Quarter of 2012 and the March Quarter of 2013 indicates the majority of the temporary accommodation rooms are located in the Singleton LGA (323). Muswellbrook has the next highest share within the Secondary Study Area with 269 rooms.

Occupancy rates for the Secondary Study Area are now lower than the Hunter Regional and NSW rates where as previously these were significantly higher during the June Quarter. The current occupancy rate of the Secondary Study Area is 48% and if these trends were to continue the capacity of these facilities will have continued to increase. There are now an estimated 403 units available on a daily basis in the Secondary Study Area and 125 units for the Primary Study Area with occupancy rates trending downward.

Temporary accommodation is available in the form of hotels, motels and two caravan park/resorts, one of which has been recently significantly expanded. The increase in availability of temporary accommodation will allow more drop in tourists to use these facilities.

Mining services and construction contractors not directly employed were considered to be the main market for group rental housing in Muswellbrook township and the caravan parks, which are priced at weekly rates significantly lower than the higher priced hotel/motel rates.

Community Services and Facilities

An assessment of current community services and facilities in the Primary and Secondary Study Areas found the following key points:

- There are a number of both MSC and privately run early childhood centres within the Primary Study Area; however, they are nearing maximum capacity. Discussions with MSC social planning representatives indicated that there are approximately 149 to 154 available child care enrolment positions and 80 available pre-school enrolment positions in the Primary Study Area;
- There are seven primary schools within the Primary Study Area. Discussions with MSC social planning representatives indicate that enrolments are stable and there are no capacity issues at these primary schools;
- There are two secondary schools within the Primary Study Area. Discussions with the Principal of Muswellbrook High School indicate that enrolment has reached over 800 students for the first time since 2004 with 850 students currently enrolled. Capacity issues would begin if the enrolment at the school reached 950 students;
- Hunter TAFE Muswellbrook campus is the tertiary institution available in the Primary Study Area. Hunter TAFE Muswellbrook hosts a Mining Skills Centre, which offers an innovative full time course for new apprentices in basic engineering, safety and lifestyle skills;
- Hunter New England Health manages the Muswellbrook Hospital and two community health centres in the Primary Study Area. Discussions with Muswellbrook Hospital representatives indicate that there are 50 to 100 beds in the hospital, dependant on seasonal demand.
- Discussions with MSC social planning representatives indicate that there are excessive waiting times to see the 27 General Practitioners in the Muswellbrook LGA;
- Delays along the New England Highway which connects Newcastle to the Secondary Study Area influences peak hour traffic to seek alternative routes on secondary and local road systems. As a high percentage of the workforce in the Muswellbrook LGA are commuters, the low peak hour levels of service tend to force many commuters to stay in cheap temporary accommodation in Muswellbrook on a shift by shift basis;
- Muswellbrook LGA and the remainder of the Secondary Study Area are well serviced by urban standard services for police, ambulance and fire;
- The sewage treatment plant for the Muswellbrook township is operating at near capacity and may require upgrading in the future;
- The Muswellbrook township has a considerable variety of retail and household services, however entertainment services are limited in comparison to Singleton, which has a larger department store and a movie theatre; and

- Discussions with temporary accommodation personnel at Muswellbrook indicate that there has been no unusual rise in rowdy or anti-social behaviour caused by workers using temporary accommodation.

Community Values and Perceptions

Comprehensive stakeholder consultation has been undertaken by BMC in relation to Bengalla's current operations. In addition, engagement with community members of the DAA were undertaken for the Project as discussed in **Section 6**. Issues related to social impact raised by community members in the DAA during stakeholder consultation undertaken as part of the Project included:

- The extent of acquisition liability in the immediate area of the mine affected which were perceived to be leading to the breakdown in family connections and community cohesion;
- Noise, blasting and air quality impacts and cumulative environmental issues when combined with other neighbouring mines; and
- Economic and financial issues, which include significant differences in worker wage rates and the inflated cost of local housing.

A community attitude survey was conducted within the Primary Study Area by Jetty Research (commissioned by MSC) from January 2011 to February 2011. The survey comprised a telephone survey of 400 residents and an online survey of 186 residents. Online respondents were generally younger, more likely to be employed and more likely to live in an urban setting than those interviewed by telephone.

The main conclusion of the survey was that local community infrastructure in the vicinity of the Project is very limited, particularly in regards to a youth activity centre, entertainment facilities (particularly a cinema), retail outlets, traffic servicing (particularly installation of a Muswellbrook bypass, and local parks and gardens. Some respondents also reported tension between local residents and 'drive-in' workers in the mining industry.

Some online respondents wanted to see a broadening of the economy away from mining. Other issues raised during the survey include:

- Provision of additional TAFE courses and a university campus;
- Need for parks, reserves and open spaces;
- Need for improved public transport;
- Noise and dust generation by the mining industry and availability / transparency of monitoring results;
- Improved medical services;
- Provision of recreational and cultural facilities;
- Increased law and order;

- Improved youth services and aged care facilities;
- Increased youth employment opportunities; and
- Greater controls to preserve the 'look and feel' of Muswellbrook.

8.14.3 Impact Assessment

Construction Phase

The construction phase of the Project is expected to generate initial and flow on employment as shown in **Table 80**. It is projected that approximately 90 semi-permanent and / or short term households / units will be required as a result of the direct construction workforce. The total population increase to the Muswellbrook LGA during peak construction was estimated at 348.

As a significant portion of the Project construction workforce will be commuting on a daily basis and on a work week basis, limited impacts are anticipated on the various elements of community infrastructure. There may be slight impacts on the outpatient health services facilities at Muswellbrook Hospital and at the two General Practitioner community health centres due to servicing of the normal needs of the construction workforce on a daily basis but these impacts are considered to be manageable within the normal facility planning assumptions. Demand for schooling and childcare facilities of these employees would not exceed 10 school students and childcare places at the peak of construction which is considered to be well within current planning assumptions.

Table 80 shows that in Year 2 the construction phase of the Project is expected to generate approximately 427 jobs, with 20% of them being local (within the Secondary Study Area).

Operational Phase

Impacts of the operational phase of the Project were assessed under workforce Scenarios 1 and 2 described in **Section 8.14.2**. **Table 81** and **Table 82** show the initial and flow on employment expected to be generated by the operations phase of the Project under the two workforce scenarios and the predicted increase in population and consequent housing requirements associated with the non-local hires that will either relocate to the area or be weekly commuters in the operations phase.

Table 81 and **Table 82** show that the operations phase is expected to generate a total of approximately 1,164 jobs, 491 being direct and an additional 673 being flow-on jobs. Both scenarios will result in 118 jobs being generated for local workers and an additional 862 being generated for non-local workers (residing outside the Secondary Study Area). The total number of indirect jobs has been adjusted to consider the influence commuting has on job creation in the Muswellbrook LGA.

Table 80 Estimated Employment Impacts from the Construction Phase at Peak Year 2

Type of Job Created	Total Workforce	Local Component	Non Local Component	Permanent employees and Work Week Commuters	Daily Commuters	Total Residential Units Impacted *	Population Impact
Direct	218	44	174	87	87	46	181
Multiplier	209	42	167	84	84	44	167
Total Job Impact	427	86	341	171	171	90	348

Table 81 Estimated Employment Impacts from the Operational Phase – Scenario 1 'Expected Case'

Predicted Location of Workforce	Workforce (%)	Number of New Employees and Multiplier Jobs			Work Week Commuters	Daily Commuters	Total Housing Units Required Years 1 to 4		Total Residential Units Impacted	Population Impact
		Direct	Multiplier	Total			Families/Couples	Singles		
Relocated to Primary Study Area	37	182	217	399	0	0	243	78	321	788
Relocated to Secondary Study Area	34	167	199	366	92	275	0	46	46	92
Reside outside of the Secondary Study Area	9	44	53	97	73	24	0	36	36	73
Total non-local workforce	80	393	469	862	164	299	243	160	403	952
Total local workforce	20	98	20	118	0	0	0	0	0	0
Total increased workforce	100	491	673	1,164	164	299	243	160	403	952

Table 82 Estimated Employment Impacts from the Operational Phase – Scenario 2 'Sensitivity Case'

Predicted Location of Workforce	% of Workforce	Number of New Employees and Multiplier Jobs			Work Week Commuters	Daily Commuters	Total Housing Units Required Years 1 to 4		Total Residential Units Impacted	Population Impact
		Direct Jobs	Multiplier Jobs	Total Jobs			Families/Couples	Singles		
Relocated to Primary Study Area	56	275	377	652	0	0	398	127	525	1,288
Relocated to Secondary Study Area	16	79	108	186	47	140	0	23	23	47
Reside outside of the Secondary Study Area	8	39	54	93	70	23	0	35	35	70
Total non-local workforce	80	393	538	931	116	163	398	185	583	1,404
Total local workforce	20	98	135	233	0	0	0	0	0	0
Total increased workforce	100	491	673	1,164	116	163	398	185	583	1,404

Work week commuters and daily commuters do not require the same level of consumption services as those of a worker who is permanently located in the Secondary Study Area.

As shown in **Table 81**, the 'Expected Case' of Scenario 1 will result in a total population increase of 952 and the need for 403 residential units of which 243 would be for families and/or couples and the remaining 160 to accommodate the needs of singles and work week commuters. Scenario 2 (see **Table 82**) would result in a total population increase of 1,404 and the need for 583 residential units of which 398 would be suitable for families and couples and the remaining 185 suitable for singles and work week commuters.

Under the "expected" case of Scenario 1, the approximate time lag for the Muswellbrook LGA development sector to be able to produce the estimated number of permanent houses under current constraints using historic growth rates would be just under four years. For the 'Sensitivity Case' of Scenario 2, the time required to produce the required number of houses would be just under five years.

The results suggest that Scenario 1- the 'Expected Case' is sustainable within the current mine plan with a new workforce scheduled to build up over a period of 4 to 5 years, provided that there are no cumulative pressures from other proposals which require significant numbers of new housing. Scenario 2 would be difficult to achieve without extending the current scheduled build up of the workforce.

The social impacts of the operational phase of the Project are expected to be across both the Primary and Secondary Study Areas, and are predicted to be:

- Moderate but manageable impacts on the health services presently operating in the Primary Study Area;
- Some impacts on childcare and education services, estimated to be approximately 61 (Scenario 1) to 100 (Scenario 2) positions required per year spread across primary schooling, secondary schooling, tertiary training and child care areas combined. Childcare services are at full capacity in the Primary Study Area. The total impacts over four years would put both primary and high schools at near capacity at the end of the third year. Discussion with education representatives suggest that it would be necessary for some schools to start to increase the number of class rooms either using demountables or permanent structures being required;
- An increase in traffic volumes of employees as discussed in **Section 8.13**;

- The sewerage treatment works is currently reaching its planned capacity and MSC is currently considering options to upgrade these facilities. The lack of capacity acts as a constraint on the rate of development of new housing;
- Manageable increase in the demand for emergency services; and
- An increase in concerns regarding community cohesion.

Cumulative Impacts

The Upper Hunter Valley contains extensive mining and resource operations and further developments in this sector are expected. As such, nearby current and future developments will operate at the same time as the Project, contributing to cumulative social impacts in the Primary and Secondary Study Areas.

The Social Impact Assessment has assumed the developments will occur as listed in **Table 1** at their maximum approved impacts (minus the not yet approved modifications to Xstrata Mangoola and Mt Arthur Coal Mine operations). It should be noted that since the completion of the Social Impact Assessment which includes 2011 census data collated at the height of the 'mining boom', the industry is experiencing a significant downturn and subsequent redundancies. As such, the following cumulative discussion represents a significant worst-case base in the current economic climate.

Assuming the full scale operation of all mining operations, as per **Table 1**, potential cumulative impacts include:

- Local construction labour would become increasingly scarce. The construction workforce would be increasingly reliant on a commuter workforce which in a corresponding way would need to be recruited from outside the Secondary Study Area and thus being more likely to operate as work week commuters;
- Additional stress on the temporary accommodation sector, especially for construction workers;
- A total cumulative need for new dwellings estimated at 105 dwellings; and
- An exacerbation of impacts on community infrastructure including impacts on child care and on some elements of physical infrastructure such as the sewerage treatment facilities will further increase demand on facilities which are already considered to be at capacity. The cumulative impact on primary and particularly secondary education facilities would also change the situation from manageable to a situation where current physical facilities would need to be expanded.

Impact on Agricultural and Tourism Related Industries

Review of the employment trends in both the agricultural and mining industries over the past 15 years suggest that employment recruited from the agriculture sector to the Project will be limited.

In the most recent intercensal period 2006 to 2011 the declining trend in agriculture has slightly accelerated but still represents only 36 jobs per year whereas mining has increased by 301 jobs per year. Employment of mining companies to support their supplementary farming and grazing operations may well exceed the size of these losses and may not be recorded as a new job in the agriculture sector.

There are also farmers working within the mining operations which also own and operate smaller family farming properties which continue to be viable operations because of the availability of capital to support the farm from higher mining sector wages and salaries. This trend of off farm wage and salary income supporting agricultural enterprises and farm families is indicative of a general trend across Australian agriculture as a whole.

Consequently, the impact of mining on the loss of agricultural jobs is considered to be a factor but only a marginal issue as the loss of jobs in agriculture remained at around 10% of the total increase in mining jobs. In the latter period the proportion has dropped further to around 8%. Losses in agricultural employment could be entirely explained by productivity and efficiency gains over the 15 year period through technology and the increase in scale of agricultural enterprises. It should also be noted that the agricultural employment sector also includes forestry and fisheries which also further reduces the degree of losses from agriculture itself.

It should also be emphasised that the BMC continues to operate large farming operations as part of its business models by leasing out extensive areas of land that are not required for mining operations (see **Section 8.20**).

A key informant survey was conducted within the Primary Study Area and the participants considered that the local tourism industry was characterised as having the following components:

- Adventure tourism (e.g. National Parks);
- Equine tourism (Horse Stud Tours);
- Gourmet tourism (Pukara Estate, Hunter Belle Wine & Cheese, Wine Cellar Doors);
- Regional arts (Regional Art Gallery); and
- Special events tourism (weekend short term sports, monthly local markets).

The impact of the Project was not seen as having a significant on current tourist destinations.

8.14.4 Mitigation and Management

Construction Phase

The following measures will be undertaken to assist MSC in its policy and planning to account for the potential cumulative social impacts of the construction phase of the Project in consideration of the status of other mining operations:

- Monitoring of the proportion of non-local operational workforce hires;
- Provide applicable construction workforce data to assist MSC in monitoring local housing demand and supply, housing prices and affordability and plan appropriately for land and housing provision; and
- Include contract specifications to include provisions for a high loading for the cost of temporary accommodation in order to encourage sustainable accommodation practices, where practical.

Due to the expected high incidence of commuting among construction workers, other social impacts such as education, health care services and emergency services are considered to be manageable and within current capacity constraints.

Operational Phase

BMC will provide timely and appropriate operations workforce information to MSC, to assist Council to plan for future needs in relation to housing and accommodation, affordable housing and child care.

BMC will continue to utilise its already long running procedures (revised as necessary) in relation to social components of the operation including:

- Rio Tinto Relocation Policy Australia (Version 1.3);
- Aboriginal Employment at Rio Tinto Coal Australia;
- Rio Tinto Coal Australia Fatigue Management Framework; and
- Priority Relocations – Setting up Your Employee in the Hunter Valley.

These procedures will ensure that BMC continues to assist in managing issues associated with employee relocations to the Muswellbrook LGA (including housing and general assistance), ensuring ongoing Aboriginal employment positions are available for the Project and providing a robust framework for managing fatigue issues (primarily associated with shift work).

Voluntary Planning Agreement

As discussed in **Section 6.1.1** discussions with MSC for the Project have commenced in relation to the revision of the existing VPA and establishment of a new VPA for the Project.

8.15 Economics

8.15.1 Background

An Economics Impact Assessment was undertaken by Gillespie Economics and is provided in **Appendix S**. Further as part of the AIS, Gillespie Economics also undertook an assessment of the potential economic implications of the Project on agricultural resources. This assessment provided a comparison of the economic efficiencies of utilising the required land and water for the Project, including the biodiversity offsets, to that of utilising the same land for its most productive agricultural potential. The findings of this report are summarised in **Section 8.20** and provided in full in Appendix 6 of **Appendix W**.

8.15.2 Methodology

From an economic perspective there are two important aspects of the Project that can be considered:

- The economic efficiency of the Project (i.e. consideration of the economic costs and benefits of the Project); and
- The economic impacts of the Project (i.e. the economic activity that the Project will provide to the regional or NSW economy).

The *Draft Guidelines for Economic Effects and Evaluation in Environmental Impact Assessment in 2002* (Economic EIA Guidelines) (James and Gillespie, 2002) identifies economic efficiency as the key consideration of economic analysis. Benefit Cost Analysis (BCA) is the method used to consider the economic efficiency of proposals. The Economic EIA Guidelines also identifies BCA as essential to undertaking a proper economic evaluation of proposed developments that are likely to have significant environmental impacts. The NSW Government (2012c) *Draft Guideline for the use of cost benefit analysis in mining and coal seam gas proposals* also endorses BCA as the appropriate methodology for evaluating mining proposals. This latter guideline does not provide guidance on other forms of economic assessment. The DP&I's draft guideline indicates that economic impact assessment may provide additional information as an adjunct to the economic efficiency analysis. Economic activity to the regional and NSW economy can be estimated using Input-Output (I-O) analysis, Computable General-Equilibrium (CGE) models or macro-econometric simulation models.

It is important not to confuse the results of the economic impact assessment, which focuses on indicators of economic activity i.e. direct and indirect output (expenditure/revenue), value-added, income and employment, in a specific region, with the results of BCA which is concerned with the net economic efficiency benefits from the Project.

Benefit Cost Analysis

BCA is concerned with a single objective of the EP&A Act and governments (i.e. economic efficiency). BCA provides a comparison of the present value of aggregate benefits to society, as a result of a project, policy or program, with the present value of the aggregate costs. These costs and benefits are defined and valued based on the microeconomic underpinnings of BCA. In particular, it is the values held by individuals in the society that are relevant, including both financial and non-financial values.

Provided the present value of aggregate benefits to society exceed the present value of aggregate costs (i.e. a net present value of greater than zero), a project is considered to improve the well-being of society and hence is desirable from an economic efficiency perspective.

BCA involves the following key steps:

- Identification of the base case;
- Identification of the Project and its implications;
- Identification and valuation of the incremental benefits and costs;
- Consolidation of value estimates using discounting to account for temporal differences;
- Application of decision criteria;
- Sensitivity testing; and
- Consideration of non-quantified benefits and costs.

Regional and State Economics Impact Assessment

Predicted economic stimulus to the regional and State economies can be estimated using I-O. I-O analysis essentially involves two steps:

- Construction of an appropriate I-O table (regional transaction table) that can be used to identify the economic structure of the region and multipliers for each sector of the economy; and
- Identification of the initial impact or stimulus of the Project (construction and/or operation) in a form that is compatible with the I-O equations so that the I-O multipliers and flow-on effects can then be estimated (West, 1993).

The regional economic impact assessment is primarily concerned with the effect of an impacting development on an economy in terms of a number of specific indicators, such as gross regional output, value added, income and employment. These indicators can be defined as follows:

- *Gross regional output* – the gross value of business turnover;
- *Value-added* – the difference between the gross regional output and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output;

- *Income* – the wages paid to employees including imputed wages for self-employed and business owners; and
- *Employment* – the number of people employed (including full-time and part-time).

The Economic Impact Assessment impacts have been estimated for two regions:

- The regional economy comprising the LGAs of Muswellbrook, Singleton and the Upper Hunter; and
- The NSW economy.

8.15.3 Impact Assessment Benefit Cost Analysis

The Project will have the potential incremental economic benefits and costs shown in **Table 83**. The main potential economic benefit is the producer surplus (net production benefits) generated by the Project and any non-market employment benefits it provides, while the main potential economic costs relate to any environmental, social and cultural costs.

The main decision criterion for assessing the economic desirability of a Project to society is its net present value, which is the present value of benefits less the present value of costs. A positive net present value indicates that it 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 Project.

The BCA confirms that when production costs (acquisition costs for affected land, opportunity cost of land, operating costs, decommissioning costs, etc.) and production benefits (revenues from production, residual values of land, etc.) are considered, the Project will have net production benefits to Australia of \$1,790 M.

This net production benefit is distributed amongst a range of stakeholders including:

- BMC shareholders in the form of after tax (and after voluntary contributions) profits;
- The local and regional community in the form of voluntary contributions to community infrastructure and services;
- The Commonwealth government in the form of any Company tax payable (\$509 M present value) and the Minerals Resource Rent Tax from the Project, which is subsequently used to fund provision of government infrastructure and services across Australia and NSW, including the regional area; and
- The NSW government via royalties (\$778 M present value) which are subsequently used to fund provision of government infrastructure and services across the State, including the regional area.

The main external economic costs associated with the Project relate to Aboriginal heritage, greenhouse gas emissions and surface water and groundwater impacts. These impacts are estimated to cost \$217 M globally or \$24 M to Australia, considerably less than the estimated net production benefits of the Project.

Other environmental and social costs, including air quality, noise, blasting, ecology, traffic and transport, historic heritage, visual and agricultural production were quantified and incorporated into the estimation of net production benefits via acquisition costs for affected properties and mitigation costs.

The external benefits associated with employment provided by the Project to the NSW economy have been estimated at \$346 M.

Table 83 Benefit Cost Analysis

Category	Costs	Benefits
Net production benefits	• Opportunity costs of capital equipment • Opportunity cost of land ¹ • Development costs including labour, capital equipment and acquisition costs for impacted properties and offsets ¹ • Operating costs of mine including labour and mitigation measures • Rehabilitation and decommissioning costs at end of the Project life	• Avoided decommissioning and rehabilitation costs in 2017 • Value of coal production • Residual value of capital equipment and land at end of Project life
Potential environmental, social and cultural impacts	• Noise and blasting impacts • Air quality and greenhouse gas impacts • Surface water and groundwater impacts • Agricultural impacts¹ • Geochemical impacts • Ecology impacts • Road transport impacts • Aboriginal heritage impacts • Historic heritage impacts • Visual impacts	• Any non-market benefits of employment • Value of ecological offsets

¹ The value of foregone agricultural production is included in the value of the land.

Overall, the Project is estimated to have net social benefits to Australia of between \$1,766 M and \$2,112 M and hence is desirable and justified from an economic efficiency perspective.

Regional and State Economics Impact Assessment

The I-O analysis found that the operation of the Project is estimated to make up to the following contribution to the regional economy for 24 years:

- \$1,486 M in annual direct and indirect regional output or business turnover;
- \$789 M in annual direct and indirect regional value added;
- \$155 M in annual indirect household income; and
- 1,745 direct and indirect jobs.

The output, value added and income flow-on will be most pronounced on the regional basis. The contribution of the Project will extend to the ownership of dwellings sector, agricultural and mining machinery manufacturing sector, retail trade sector, wholesale trade sector, construction trade services sector, health services sector and education sector.

For the NSW economy, the operation of the Project is estimated to make up to the following contributions:

- \$2,408 M in annual direct and indirect regional output or business turnover;
- \$1,223 M in annual direct and indirect regional value added;
- \$441 M in annual indirect household income; and
- 4,868 direct and indirect jobs.

The contribution of the Project to the NSW economy is substantially greater than for the regional economy. The NSW economy is able to capture more mine and household expenditure and there is a greater level of inter-sectoral linkages.

8.15.4 Mitigation and Management

Cessation of the Project operation may lead to a reduction in economic activity. The significance of these Project cessation impacts will depend on:

- The degree to which any displaced workers and their families remain within the region;
- The economic structure and trends in the regional economy at the time; and
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

Given the uncertain circumstances at the time of Project cessation, it is important for government to effectively utilise the economic benefits, skills and expertise generated by the Project to further strengthen and broaden the region's economic base.

Mitigation measures for the specific environmental issues are addressed within other sections throughout this EIS.

8.16 Preliminary Hazard Analysis

8.16.1 Introduction

Hansen Bailey has completed a Preliminary Hazard Analysis for the Project, which is provided in **Appendix T**. This study aimed to identify any potential hazards associated with the Project, assess the significance of each and develop possible management and control procedures as specified in the relevant legislation.

This assessment was undertaken in accordance with *SEPP 33 – Hazardous and Offensive Development Application Guidelines* (DUAP, 1994). The *Hazardous Industry Planning Advisory Papers* (HIPAPs) developed under SEPP 33 were also considered throughout the assessment. HIPAPs of particular relevance to the Project hazard assessment included the:

- *Hazardous Industry Planning Advisory Paper No 3 – Risk Assessment* (DOP 2011a);
- *Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Planning* (DOP, 2011b); and
- *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (DOP, 2011c).

8.16.2 Methodology

The Preliminary Hazards Analysis required the key components of the Project to be reviewed against the threshold values and screening procedure required under SEPP 33 and HIPAPs. The methodology applied as per the HIPAPs included:

- Identification of potentially hazardous materials and events associated with the Project;
- Examine the potential consequences of identified hazards;
- Qualitatively estimate the likelihood of Project hazards occurring;
- Examine any proposed mitigation measures;
- Qualitatively assess the risks to the environment, safety of members of the public and their property arising from sudden and unexpected incidents and compare these to the applicable qualitative criteria. Specifically considering location, land use planning implications and existing;
- Develop any further risk mitigation, management or remedial measures as required for the Project in consideration of the relevance and adequacy of proposed safeguards; and
- Determine the acceptability and level of risk associated with the Project to allow industry classification and the implementation of appropriate management procedures.

8.16.3 Impact Assessment

Potentially Hazardous Materials

The key hazardous materials required for the Project include explosives, hydrocarbons and other hazardous chemicals. The key hazardous chemicals are predicted to include, however are not limited to, fuels such as diesel and petrol, degreaser, kerosene, oils, greases and explosives.

Explosives

The Project will continue to require the use of explosives and other related materials to support ongoing mining operations. The key potential hazards associated with explosives include onsite storage location, proximity to fuel and workshop and possible explosions as a result of mixed materials. As noted in **Section 4.1**, the Project will require the relocation of the existing explosives storage facility and reload facility from the existing location approved under DA 273/2006 to a location on the Main OEA. These facilities will be relocated in approximately Year 2 of the Project and the indicative locations for this infrastructure are shown on **Figure 15**.

Potential hazards to the surrounding environment during the transport, storage and use of explosives at Bengalla will continue to be managed in accordance with the AS 2187.1 – 1998: *Explosives – Storage, Transport and Use – Storage, the Australian Explosives Industry and Safety Group Code of Practice – Precursors for Explosives* (AEISG, 1999) and the relevant BMC management plans and procedures.

Fuels

Diesel is a combustible liquid as classified by AS 1940 – 2004: *The Storage and Handling of Flammable and Combustible Liquids* (Class C1) for the purposes of storage and handling. However, this hazardous material is not classified as a dangerous good under the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2007).

Petrol is classified as a flammable liquid (Class 3) by AS 1940:2004 and as such is classified as a dangerous good by the criteria of the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2007). Only very small volumes of petrol will be required for Project related activities such as some site maintenance equipment (i.e. light vehicles and mowers) and in workshop areas.

Other Hazardous Materials

Some other hazardous materials will also be utilised and stored within the workshop areas. The Project will require the use of a number of hazardous chemicals, which will include, but not limited to, the use of oil, degreaser, kerosene and oil.

Oil is classified as a combustible liquid (Class C2) by AS 1940:2004. All hazardous materials will continue to be managed in accordance with AS 1940:2004 and any relevant Project management plans and procedures.

Potentially Hazardous Activities

The key potentially hazardous activities associated with the Project include:

- Storage of hazardous materials onsite;
- Transportation of materials including onsite and offsite handling;
- Spill, leakage or runoff causing land contamination; and
- Natural events.

Storage

BMC currently holds two licences to store explosives and associated materials, issued under the OH&S Act, 07-100151-001 and XSTR100151 for the existing Bengalla explosive precursor storage facility and explosives storage facility (as shown on **Figure 9**). As noted above, the storage of explosives and other related materials within the existing explosives storage facility will continue until Year 2. The explosives storage facility will be required to be relocated to a new location at the Main OEA as illustrated on **Figure 18** and will be designed in accordance with the relevant standards and guidelines (listed above).

BMC will ensure the relocated explosives storage facility is securely fenced and enclosed by a vegetated earthen safety bund. The products stored at these facilities will continue to be stored and handled in accordance with AS2187.2-2006 – *Explosives – Storage, Transport and Use, Part 2: Use of Explosives*.

BMC holds an *Acknowledgement of Notification of Dangerous Goods on Premises* 35/033746 for the diesel currently stored on site. The existing Bengalla diesel storage facilities located at the workshop infrastructure area and will continue to be utilised. Additional storage tanks with a total volume of 1,320,000 L will be constructed for the Project. These tanks will be housed in self-bunded storage facilities and will be constructed adjacent to the existing diesel storage tanks in the workshop infrastructure area in accordance with the relevant Australian Standards, including (although not limited to) NSW OH&S regulations and AS1940-2004. The location of the additional fuel storage facilities is conceptually illustrated on **Figure 22** and the anticipated construction timing outlined in **Table 13**.

Any other smaller volumes of potentially hazardous materials required for the Project will be stored within infrastructure areas in accordance with relevant Australian Standards and Guidelines.

Substances will be stored on site in above ground facilities in the MIA, at a suitable distance from diesel or explosive storage areas to minimise any potential risks. These substances will be located in a bunded area in accordance with the NSW OH&S Regulations, which will minimise the risk and consequence should a fire or explosion occur and prevent any toxic contamination of the surrounding environment.

Transport

All bulk materials will continue to be transported to Project by a licensed contractor in accordance with the relevant contractor's transport codes and standards and site operation procedures. The vehicles used for the transport of hazardous substances will continue to have appropriate signage displayed in accordance with the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2007) the *Australian Code for the Transport of Explosives by Road and Rail 3rd Edition* (Workplace Relations Ministers' Council, 2009) and relevant NSW legislation.

Spills / Leakage and Contaminated Runoff

Any hazardous material releases will be managed in accordance with BMC emergency response procedures. These procedures provide specific handling techniques and storage requirements which are implemented to prevent spills and leakages from occurring and ensure that prompt and effective clean-up practices are employed should any spills occur.

BMC will continue to implement current practice for emergency spills, which incorporates regular training and the implementation of best practice management, mitigation and response procedures for hazardous materials.

Emergency Oil Spill Response Kits are readily available; particularly in areas where work involving activities require the use of hydrocarbons. BMC also maintains a contaminated sites register.

Natural Events

Natural events such as floods, bushfires and landslides can also create hazardous conditions. It is possible that the Project and its associated activities may increase the risk of fires occurring and spreading to the surrounding environment. The potential risk of fires will continue to be managed in accordance with the existing Coal & Allied Bushfire Management Plan. BMC has installed and maintained fire control infrastructure, with fire fighting equipment at key points and has an emergency team in place to respond in the event of a bushfire.

Conclusions

A number of potential hazards have been identified for the Project. The potential hazards identified and adequacy of the proposed safeguards for each have been analysed to assess the risks to the environment and public safety.

Predicted impacts associated with potentially hazardous activities for the Project are assessed in full in **Appendix T** which details:

- The level of risk associated with the identified potential hazards and hazardous activities;
- A consequence analysis; and
- An estimated likelihood of occurrence.

The qualitative risk assessment has identified potential hazards associated with the Project and ensures that adequate risk mitigation and response measures have been considered and will be implemented for each. The assessment has confirmed that the Project will not impose any unacceptable level of risk to the environment or the public.

8.16.4 Mitigation and Management

The Project is not considered hazardous or offensive and no offsite impacts are predicted. Management procedures will be implemented to ensure that all potential hazards are minimised and their likelihood of occurrence decreased by ensuring compliance with relevant legislation, regulations and guidelines. The hazard management measures for the Project are summarised below:

- BMC will develop a Hazard Management Plan to support an application for a notification from WorkCover for the Project. This will outline procedures for the transport and storage of hazardous substances, management of storage locations for the Project and detailed response procedures should an event such as fire, explosion or spill occur;
- BMC will continue to maintain a database to assist in the recording and management of chemicals and other hazardous materials stored on site. This chemical management system will contain a Material Safety Data Sheet for all chemicals used on site;
- All hazardous materials associated with the Project will be transported by a licensed contractor in accordance with the relevant Australian Standards and legislation;
- Storage facilities, vehicles and transport vessels will be regularly inspected for leaks, spills and other damage or faults;
- All storage facilities for explosives, diesel, oil and other hazardous materials identified will be designed in accordance with applicable Australian Standards to minimise potential for any offsite impacts, toxic contamination of the surrounding area and minimise the severity of an incident in the case of fire, explosion or hazardous substance spills;
- Explosive storage facilities will be located a minimum of 200 m from private roads, receptors or site facilities;
- Storage areas will be located at a sufficient distance from the Project Boundary to ensure there will be no offsite impacts; and
- All explosives will be stored in a purpose built magazine, built and maintained to appropriate standards.

8.17 Waste Management

8.17.1 Background

BMC has an existing Waste Management System which was developed to manage the disposal, tracking and reporting of waste at Bengalla. This assessment aimed to review the existing BMC internal management systems and requirements by identifying any potential waste predicted to be generated by the proposed Project related activities requiring onsite management and storage.

The review was undertaken in accordance with the legal and strategic framework for managing wastes in New South Wales including the:

- POEO Act;
- *Waste Avoidance and Resource Recovery Act 2001* (WARR Act); and
- *Protection of the Environment Operations (Waste) Regulation 2005*.

8.17.2 Waste Management System

BMC currently manage waste in accordance with a number of internal Coal & Allied and Rio Tinto Environmental Performance Standards including:

- E7 Non Mineral Waste Management;
- E8 Mineral Waste Management;
- 6.1 Waste Management; and
- 7.2 Waste Discharge.

The existing waste management procedures aim to manage any regulated and industrial waste streams generated by the existing approved operations. The key objective of the existing BMC Waste Management System is to ensure the most effective methods for minimisation, handling, transport, storage, segregation, recycling and reuse of materials are considered.

To ensure the Waste Management System continues to work effectively. Regular inspections and monitoring of waste management measures is conducted by environmental personnel. Any spills that may occur within the Mine Infrastructure Area are designed to be contained within bunds and other pollution control structures.

To achieve BMC key objectives, regulatory compliance and improve upon waste recycling performance, employees are provided with regular training and awareness courses on different aspects of waste management.

Regular inspections of the Waste Management System are conducted to ensure compliance with regulatory requirements. Performance of the Waste Management System is reported in the Annual Review, which is then made publicly available on the BMC website.

8.17.3 Methodology

The potential waste streams associated with the Project have been classified in accordance with the *Waste Classification Guidelines Part 1 Classifying Waste* (DECC, 2008b). The quantity of each waste stream was assessed in consideration of the recorded waste generated at Bengalla and the estimated increase based on the proposed Project activities as shown in **Table 84**.

The key waste management options for the Project have been considered against the following priorities:

- Avoidance including reducing the amount of waste generated by the Project;
- Resource recovery including reuse, recycling, reprocessing and energy recovery; and
- Disposal including management of all disposal options in the most environmentally responsible manner.

Waste management, storage, transport, processing, recovery and disposal procedures have been developed in accordance with any relevant legislative requirements.

8.17.4 Impact Assessment

Waste generating activities associated with the Project have been assessed to determine the type and approximate quantities of waste which may be generated by the Project. **Table 84** details the indicative potential waste streams and approximate quantities. Actual waste streams and quantities generated by the Project may vary. The key waste generating activities have been described in detail below.

Coal Rejects

Tailings and reject material generated by the Project during the processing phase will be managed by way of co-disposal to prevent the requirement for any tailings dam facilities. Reject material is stored in a reject bin before being hauled back to the mining area where it is dried in cells, buried within the OEA and finally capped with a minimum of 5 m of inert overburden material. Any chemically reactive mineral wastes will continue to be encapsulated to ensure isolation from the surface environment and minimise impacts to runoff water quality.

In accordance with the Bengalla EMS overburden is managed in a manner that will provide for effective and progressive rehabilitation of disturbed areas. The existing OEA areas will continue to be utilised for the management of overburden material. To help manage the increased overburden capacity requirements an additional OEA will be constructed to the west of Dry Creek which may be utilised for excess overburden material until it is intercepted by mining.

Table 84 Indicative Waste Stream and Quantities Predicted to be Generated by the Project

Waste Stream	Example	Existing Generated Waste (t)*	Project Estimated Waste (t)
Special waste	Small Waste Tyres (and conveyor belt)	0.9	1.3
Liquid Waste	Sewage/effluent	1,360.0	1,906.5
	Oily water	52.0	72.9
	Waste oil	375.5	526.4
	Degreaser	2.0	2.8
	Engine coolant	18.0	25.2
General Solid Waste (putrescible)	Food Waste	0.2	0.3
General Solid Waste (non-putrescible)	Municipal Waste	33.0	46.3
	Paper and cardboard	1.0	1.3
	Wood Waste	8.5	11.9
	Concrete Waste	250.6	351.4
	Building and demolition waste	127.5	178.7
	Scrap metal	1,357.0	1,902.3
	Air filters	4.0	5.6
Hazardous Waste	Batteries	22.4	31.4
	Oily rags / materials	9.0	12.6
	Oil filters	21.7	30.4
	Empty oil drums	8.3	11.6
	Waste grease	52.3	73.4
	Hydrocarbon contaminated sludge/soil	7,451.1	10,445.5

* The existing generated waste is the maximum average annual waste recorded by BMC for existing operations between 2006 and 2011.

Sewage Treatment

BMC operates a fully automated water management system including real time monitoring of water management, quality and usage across the site and includes alarms and safeguards to detect potential discharges, leaks or water related incidents (see Section 3.15).

BMC will continue to manage sewage and effluent associated with Project related activities, in accordance with the existing water management system. Sewage effluent is treated on-site at the waste water treatment plant and all treated effluent is directed into the process water circuit and utilised in the CHPP. The waste water treatment plant is managed in accordance with the relevant Australian Standards to ensure no effluent will be discharged from the Project unless in accordance with the EPL.

Hazardous Waste

Contaminated materials generated at the workshop such as grease and bulk waste oil will be held in storage tanks in a bunded area prior to removal from the site by a licensed contractor for recycling or disposal at a licensed facility. These wastes products will continue to be recorded on the waste tracking register to help assess the performance of the waste management system. Any spills that occur within collection areas will be contained within bunds and managed appropriately.

Hazardous materials will be handled, transported and disposed of in accordance with the *Waste Classification Guidelines* (DECC, 2008b) and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Division, 2007). Hazards associated with the Project including possible management and control procedures have discussed further in Section 8.16.

General Waste

Scrap metal, batteries, empty drums, wooden pallets, timber, green waste and mixed recyclables (including paper cardboard, glass and aluminium cans) are typical of the general waste collected on site at Bengalla. Each waste material will be separated into the appropriate receptacle for reuse, recycling or disposal.

In 2010, the total weight of material disposed at landfill sites was 232 t. In 2010 material recycling from existing Bengalla operations was 1,203 t and equated to a recycling percentage of 83.8%. The major waste streams recycled at Bengalla in 2010 included effluent, scrap metal, waste oil and general waste.

The volume of general waste is predicted to increase due to the increased workforce and mining operations sought for the Project. However any potential increase in general waste volumes will also be minimised, where practicable, by implementation of more efficient strategies for reuse and recycling.

8.17.5 Mitigation and Management

The waste management system and procedures will continue to be utilised for the Project and enhanced as required to reflect the additional workforce and operational areas as detailed below. The waste management system will continue to promote waste avoidance and resource recovery by developing appropriate strategies and programs in accordance with the WARR Act and the POEO Act.

Appropriate mitigation and management measures have been proposed in accordance with the existing waste management system and the WARR Act. Regular inspections and monitoring will be conducted by qualified personnel to ensure adequate maintenance and operation of the waste facilities and to ensure management practices are sufficient to manage any waste products. BMC will ensure that each major waste stream is segregated in the appropriate receptacles for recycling, reuse and / or disposal. The following measures will be implemented to minimise the production of waste on site including:

Training designed to improve efficiency in the minimisation of waste streams, reuse and recycling options and management strategies for each major waste stream relevant to key work areas;

- Maximising the recycling of suitable materials where possible into designated bins;
- Treated wastewater will be monitored in accordance with the Environmental Guidelines – *Use of Effluent by Irrigation* (DECC, 1995);
- An internal spill response procedure will be developed to describe the measures to be followed in the event of a spill incident. Any spills that occur within collection areas will be contained within bunds and managed by BMC pollution control systems, whilst regular inspections of the waste facilities will ensure compliance with regulatory requirements; and
- New improved technologies will be used in conjunction with the water management system to ensure wastes are minimised and reused within the mining activities.

A full list of BMC's existing environmental procedures are presented in **Table 7** which ensure the minimisation, storage, transport, disposal, tracking and reporting of all waste and hazardous materials generated on site is in accordance with all relevant legislative requirements and in consideration of the management and mitigation measures proposed above.

Table 85 Contamination Assessment of Historic Heritage Items

Site Name	Potential Sources of Contamination
House Site 1	In-ground septic tank, above ground concrete tank and scatter of material to the north of the former house site
House Site 2	Former house site and waste material
House Site 3	Former house site (demolition rubble pile), dairy site, scatter of waste material to the north of the former house site
Stockyard	Chemical use for livestock management

8.18 Contamination

8.18.1 Background

A Preliminary Contamination Assessment was undertaken by Hansen Bailey and is provided in **Appendix U**. The purpose of the assessment was to identify all past and present potential contamination sources within the Project Boundary via a desktop analysis and assess the need for further investigations.

8.18.2 Methodology

The Preliminary Contamination Assessment was undertaken in accordance with Clause 7 of SEPP 55 and the *Guidelines for Consultants Reporting on Contaminated Sites* (OEHL, 2011).

A desktop assessment was undertaken to identify past and present potential for contamination within the Project Boundary. The assessment involved a review of a soil landscape map, relevant impact assessments completed for the region, land ownership information, historical aerial photographs, the register of the NSW contaminated sites notified to the EPA (EPA, 2012) and the Historical Heritage Impact Assessment prepared for the Project (see **Section 8.10** and **Appendix N**).

8.18.3 Impact Assessment

On the basis of the available site history and a review of observations presented in the Historic Heritage Impact Assessment, the principal sources of potential contamination are former receptors within and adjacent to the Disturbance Boundary, as summarised in **Table 85**. The locations of these former receptors are shown on **Figure 57**.

8.18.4 Mitigation and Management

Although potential sources of contamination were identified within the Disturbance Boundary, these were associated with structures and activities likely to be identified on other properties with a history of agricultural land uses.

The results of the Preliminary Contamination Assessment identified the need for an additional investigation to be undertaken to assess the extent of contamination within the Disturbance Boundary. An appropriate contamination investigation will be undertaken by a licensed contractor to further assess the extent of contamination throughout the Disturbance Boundary, in particular the areas of potential contamination associated with the sites of current and former rural receptors, prior to commencement of mining.

Following the contamination investigation, a remedial action plan will be prepared for the Project to manage any identified contamination.

8.19 Soil and Land Capability

8.19.1 Background

A Soil and Land Capability Impact Assessment was undertaken by GSS Environmental and is provided in **Appendix V**. The purpose of the assessment was to:

- Review existing information gathered during previous soils assessments;
- Classify and provide a description and mapping of the soil types within Project Boundary excluding the Approved Bengalla Mine (referred to as the Study Area for the purposes of this section);
- Provide a description and mapping of the pre and post mining land capability within the Study Area;
- Provide a description and mapping of the pre and post mining agricultural suitability within the Study Area;
- Assess the soil fertility in accordance with the *Draft Inherent General Fertility of NSW Mapping* (OEH, 2012d);
- Assess the potential impacts of the Project in accordance with the SRLUP with specific consideration for verifying BSAL;
- Determine the available topsoil resource and provide recommendations for stripping depths of proposed disturbance areas, including any recommendations for topsoil handling and stockpiling management measures and amelioration for reuse in rehabilitation; and
- Describe necessary erosion and sediment control measures to manage disturbed in-situ and stockpiled soil resources.



8.19.2 Methodology

A desktop assessment was undertaken to gain an initial understanding of the different soil and landscapes types across the Study Area. This involved a review of aerial photography, topographic maps, reference information, previous reports and stratified observations. A preliminary soil reference map (reference map) was developed based on the available information and was used to guide the field survey.

A total of 10 exposed soil profiles were extracted and 31 samples collected across the Study Area with a focussed assessment of the Project Disturbance Boundary. Soil profiles were assessed in accordance with the procedure adapted from Elliott and Reynolds (2007) and the *Australian Soil and Land Survey Handbook* (NCST, 2009) for the recognition of suitable topsoil material. This procedure assesses soils based on grading, texture, structure, consistency, mottling and root presence.

Samples collected from the layers of each soil profile were utilised in a laboratory testing program with results used in conjunction with field assessment to verify physical and chemical characteristics (including fertility) and assist in determining the depth of suitable topsoil material for stripping and re-use for the rehabilitation of disturbed areas.

Appendix V provides a comprehensive set of results from the field survey and laboratory testing program, including fertility testing in accordance with the relevant mapping.

The land capability assessment was conducted in accordance with *Systems Used to Classify Rural Lands in New South Wales* (Cunningham et.al, 1988). The system consists of eight classes, which classifies land generally based on soil erosion, stability hazard and decreasing versatility of use. These classes correspond to land suitability for cultivation, grazing and rural production.

The agricultural land suitability assessment was conducted in accordance with the *Agricultural Suitability Maps – Uses and Limitations* (NSW Agricultural and Fisheries, 1990). The mapping consists of five classes, which have been designed to assess land on the basis of increasing suitability and potential for agricultural production. As well as assessing land capability, agricultural suitability considers industry specific factors that may influence potential production.

8.19.3 Impact Assessment

Table 86 presents an overview of the seven each soil type identified, its appropriate fertility class and the area each occupies within the Study Area. Figure 64 illustrates the spatial distribution of the soil types within the Study Area, each of which is discussed further below.

Soil Types

Soil Type 1- Brown Chromosol

Soil Type 1 is a Brown Chromosol and covers 42% of the Study Area and 46.2% of the Disturbance Boundary and is located on the less steep waning slopes (slope <5%). This soil type complex has well developed duplex profiles with fine loamy surfaces overlying dark brown clay subsoils containing red mottles. It exhibits moderately low fertility and are less susceptible to sheet and gully erosion when managed to their correct capacity, as compared to the soil covering the steeper waxing slopes. Land that is accessible for agriculture has been grazed in the past.

The topsoil is highly suitable for stripping to a depth of 0.1 m and reuse as topdressing in rehabilitation.

Soil Type 2 – Red Chromosol

Soil Type 2 is a Red Chromosol and covers 13% of the Study Area and 7.6% of the Disturbance Boundary and is located on the steeper waxing slopes (slope >5%). This soil type has well developed duplex profiles with silty clay loam surfaces overlying heavy clay to silty clay subsoils. It exhibits moderately low fertility and are less susceptible to sheet and gully erosion when managed to their correct capacity, as compared to the less steep waning slope soils. They do not have sodic subsoils which are highly susceptible to sheeting when the surface is exposed or disturbed. Land that is accessible for agriculture has been grazed in the past.

The topsoil is highly suitable for stripping to a depth of 0.15 m and reuse as topdressing in rehabilitation.

Soil Type 3 – Brown Vertosol

Soil Type 3 is a Brown Vertosol and covers 12% of the Study Area and 12.6% of the Disturbance Boundary and is located on the plateau benches of lower and mid-slopes, as well as lower slopes in the south of the Project Boundary. This soil type exhibits a gradational profile and has a silty clay topsoil with cracking evident at the surface and heavy clay subsoil. It exhibits moderate fertility and is generally not susceptible to sheet or gully erosion when managed to their correct capacity, as compared to duplex soils with sodic characteristics. The land associated with this soil type has been extensively cleared for grazing, however, vegetation cover on the soil has largely been continual and this has prevented enhanced runoff and sheet erosion that is commonly associated with agricultural activities.

The topsoil is highly suitable for stripping to a depth of 0.2 m and reuse as topdressing in rehabilitation.

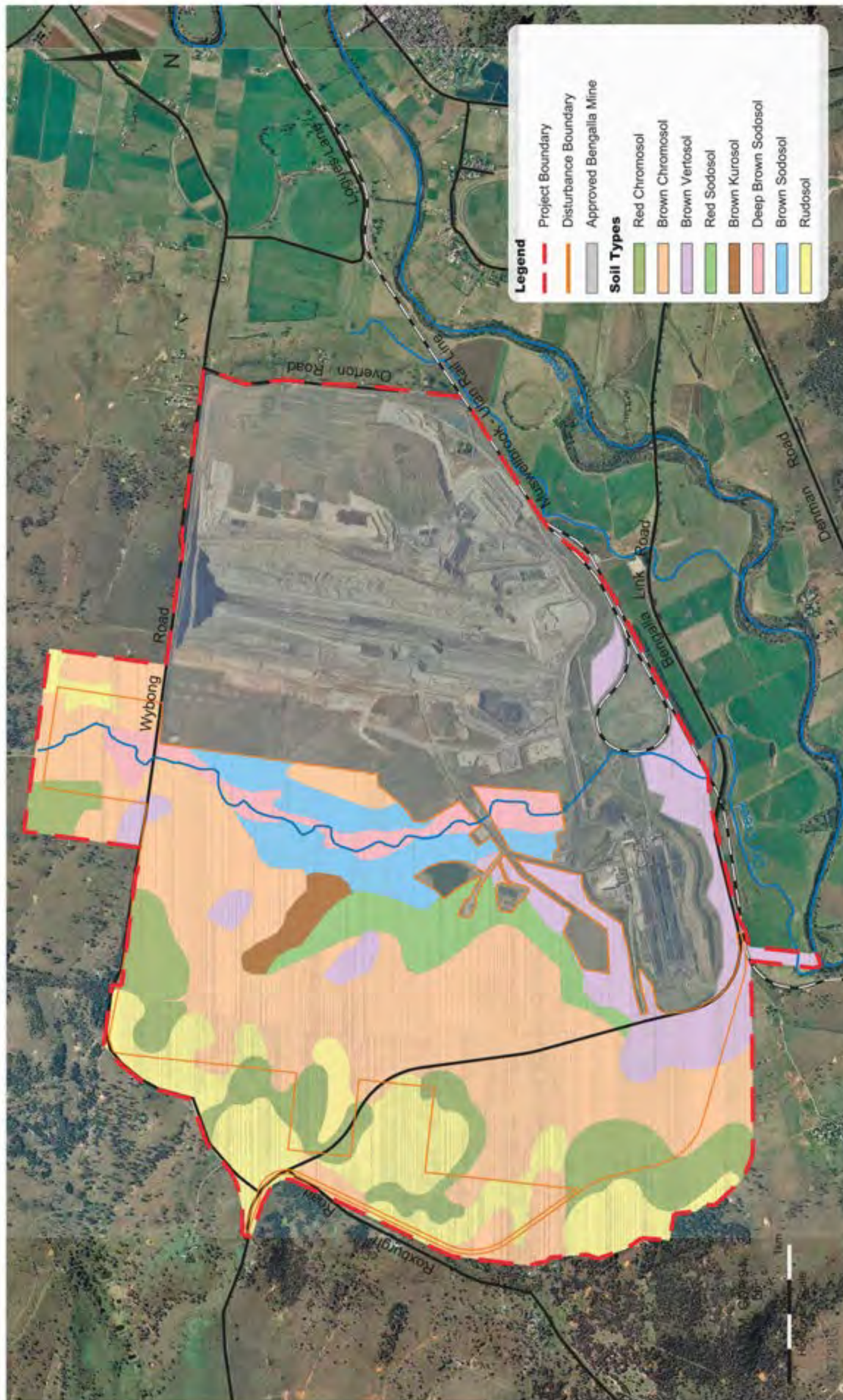
Soil Type 4 – Red Sodosol

Soil Type 4 is a Red Sodosol and covers 5% of the Study Area and 13.9% of the Disturbance Boundary and is located on the gently to very gently inclined mid-slopes (slope 3 - 10%). This soil complex has well developed duplex profiles with clay loam surfaces overlying heavy clay subsoils. It exhibits moderately low fertility and is susceptible to sheet and gully erosion due to the dispersive nature of their subsoils. Incorrect management practices can lead to the topsoil being detached and cause enhanced erosion rates when the subsoil is exposed. Land that is accessible for agriculture has been grazed in the past but currently is not used for agriculture and the condition of the soil is improving due to the increased ground cover of native pastures and invading weeds.

The topsoil is highly suitable for stripping to a depth of 0.2 m and reuse as topdressing in rehabilitation.

Table 86 Soil Types and Distribution

Soil Type #	Australian Soil Classification Name	Fertility	Survey Area	
			Area (%)	Area (ha)
1	Brown Chromosol	Moderately Low	42	571
2	Red Chromosol	Moderately Low	13	179
3	Brown Vertosol	Moderate	12	161
4	Red Sodosol	Moderately low	5	69
5	Brown Kurosol	Moderately Low	1	20
6	Deep Brown Sodosol	Moderately Low	4	60
6(V)	Brown Sodosol	Moderately Low	7	89
7	Rudosol	Low	16	221
Total			100	1,370



Soil Type 5 – Red Brown Kurosol

Soil Type 5 is a Brown Kurosol and covers 1% of the Study Area and 3.1% of the Disturbance Boundary and is located on the level to very gently inclined slopes of lower slopes and drainage lines (slope 0 - 3%). This soil complex has well developed duplex profiles with loam to sandy loam surfaces overlying sandy clay subsoils. It exhibits moderately low fertility and is susceptible to sheet and gully erosion due to the high erodibility and dispersive nature of their subsoils. Incorrect management practices can lead to the topsoil being detached and cause enhanced erosion rates when the subsoil is exposed. Land that is accessible for agriculture has been grazed in the past but currently is not used for agriculture.

The topsoil is suitable for stripping to a depth of 0.1 m and reuse as topdressing in rehabilitation.

Soil Type 6 – Brown Sodosol

Soil Type 6 is a Brown Sodosol; mapped at two depths within the Study Area. The Brown Sodosol – Deep (>100 cm) to weathered material covers 4% of the Study Area and 5.9% of the Disturbance Boundary and occurs on level to slightly undulating flats and gullies. Sheet erosion and gully erosion is likely if protective vegetative cover is removed due to localised flooding. The Brown Sodosol - Moderately Deep is located on the less steep waning slopes (slope <5%). These lower slope soils have a moderately low fertility and are less susceptible to sheet and gully erosion when managed to their correct capacity, as compared to soils on steeper waxing slopes. Land that is accessible for agriculture is grazed.

A variant of this soil type (Soil Type 6V) is present as a Brown Sodosol - Moderately Deep (<75 cm). It covers 7% of the Study Area or 10.8% of the Disturbance Boundary. The laboratory and physical characteristics of the Brown Sodosol - Deep are representative for the variation (excluding depth range). The topsoil is highly suitable for stripping to a depth of 0.6 m and reuse as topdressing in rehabilitation.

Soil Type 7 – Rudosol

Soil Type 7 is a Rudosol mapped from aerial reconnaissance information and existing soils maps. As such, no laboratory results are available. Rudosols, with a variable depth to bedrock, cover 16% of the Study Area and 16.1% of the Disturbance Boundary.

Rudosols have low fertility and occur primarily in the western area of the Project Boundary and occur on upper slopes to crests. Sheet and gully erosion is likely if protective vegetative cover is removed, however native vegetation is still commonly found on steeper, rockier slopes. Land that is accessible for agriculture is lightly grazed. Rudosols are not suitable for use as topdressing in rehabilitation primarily due to its variable depth to bedrock and texture.

Acid Sulphate Soils

Acid sulphate soils are naturally occurring soils, sediments or organic substrates (e.g. peat) formed under waterlogged conditions that contain iron sulphide minerals (predominantly as the mineral pyrite) or their oxidation products. When exposed to the air following the lowering of the water table (through, for example, dewatering, groundwater abstraction, drainage or excavation) the sulphides in these soils readily oxidise, releasing sulphuric acid and iron into the soil and groundwater. This acid can, in turn, release aluminium, nutrients and heavy metals (particularly arsenic) held within the soil matrix (Ahern et al., 2004).

Acid sulphate soils, which are the main cause of acid generation within the soil mantle, are commonly found less than 5 m above sea level, particularly in low-lying coastal areas. As the Project is located within Upper Hunter Valley Region (approximately 130 km from the coast) with elevation ranging between 40 m and 220 m above sea level it is unlikely that acid sulphate soils are present within the Study Area.

Dry Creek

The predominant soil type identified in Dry Creek is a deep Brown Sodosol (Soil Type 6) with the original soil profile buried by eroded material up to 50 cm in depth. This material is a clay loam with minimal profile development. It is likely that this is colluvial material that has been transported through the creek catchment from the adjacent low hills.

Topsoil Availability and Suitability

Recommended stripping depth for each soil unit within the Disturbance Boundary together with the land area occurrence for each soil type and the calculated volume of available soil for reuse in rehabilitation activities is provided in **Table 87**. Allowing for a 10% handling loss approximately 1,549,800 m³ of suitable topdressing is available for use in rehabilitation, within the Disturbance Boundary.

The Dry Creek re-alignment will require the application of approximately 0.4 m of topsoil, for which there are adequate resources available from the stripping regime. An additional 0.4 m of subsoil will be utilised in the Dry Creek realignment area. For the low slope Class IV land, a minimum of 0.2 m of topsoil over 0.4 m of subsoil will be re-instated. Additional detail in relation to the rehabilitation of Dry Creek is provided in **Section 8.21**.

The recommended stripping depth and the consequent topsoil balance for the Project is summarised in **Table 88**.

Table 87 Topsoil Stripping Depths

Soil Type	Recommended Stripping Depth (m)	Stripping Area (ha)	Soil Volume (m ³)
1	0.10	42	42,000
2	0.15	356	534,000
3	0.20	81	162,000
4	0.20	68	136,000
5	0.10	20	20,000
6, 6(V)	0.60	138	828,000
7	0	0	0
Total Volume			1,722,000
Total Volume with 10% handling loss allowance			1,549,800

Source: DEC, 2005

Table 88 Final Landform Topsoil Balance

Land Class	Area (ha)	Topsoil Depth (m)	Required Volume (m ³)	Soil Type For Use	Available Volume (m ³)
Class IV	118	0.2	236,000	1, 2	576,000
Class V + VI	117	0.2	234,000	1, 2	576,000
Dry Creek Reinstatement	38	0.4	152,000	3, 6, 6(V)	990,000

Source: DEC, 2005

Land Capability

Currently the land capability classification within the Study Area ranges from Class II to Class VII with Class V dominating the existing landscape (see Figure 65). Overall, the major limitations impacting land capability classification for the Project Boundary are slope, soil depth, sodicity, acidity / alkalinity, water logging potential and erosion risk.

Table 89 quantifies the relevant pre mining land capability classification within the Study Area. The post mining land capability classification is indicative only as the baseline data provided is representative of the conceptual Year 24 mine plan.

The Year 24 mining surface design predominately flats and slopes commonly up to 18% and occasionally up to 32%. These landforms are typically associated with Classes II to VI.

Agricultural Suitability

Table 90 quantifies the relevant pre mining agricultural suitability classes within the Study Area. The conceptual post mining landforms are typically associated with agricultural suitability classes 3 and 4. Given the dominant existing land uses, the post mining land use within the Study Area is best suited to low intensity grazing. On areas of steeper slopes occur, cattle grazing should be minimised and a good cover of pasture maintained.

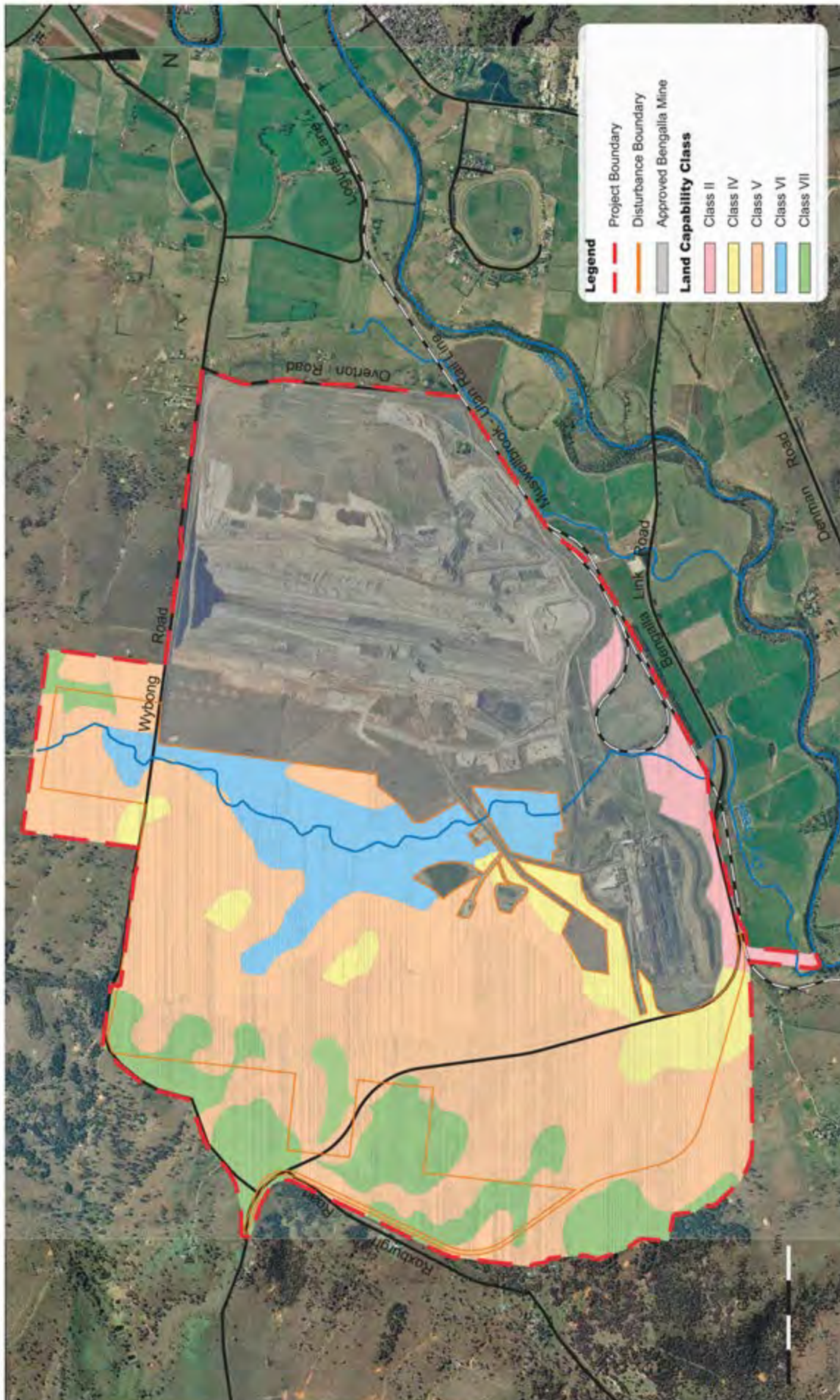
Biophysical Strategic Agricultural Land

The Study Area has been assessed against the maps and criteria provided with the SRLUP and ground truthed during the soil and land capability survey, to gain an appreciation of the extent and likely impact of the Project on potential BSAL.

The assessment of soil fertility results conducted on nine of the samples for the soil survey indicates that all soils have low to moderate fertility under the Draft Inherent General Fertility of NSW Mapping (OEH, 2012). With the exception of the Brown Vertosol, all soil types are extremely low to very low in nitrogen and phosphorus.

The Project Boundary contains only 56 ha is mapped as Class II land, which is largely associated with the southern portion of the Project Boundary around the rail loop, with all the remaining land mapped as Class IV or higher. Some land in the south of the Project Boundary is Class II land, given its location relative to Hunter River alluvials and other soils in the area being mapped as Class II land in similar landscape locations. However, only 1 ha of Class II land is located within the Disturbance Boundary, the remaining Class II land will remain undisturbed and continue to be used for agricultural purposes.

The Project is located adjacent to the Hunter River alluvial floodplain which is mapped under the criteria for BSAL, based on Map 6 of the SRLUP (see Figure 30). Approximately 28 ha of mapped BSAL occur within the Project Boundary.



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Table 89 Pre-mining Land Capability

Class	Soil Type	Study Area	
		%	ha
I	-	Nil	Nil
II	3	4.1	56
III	-	Nil	Nil
IV	3	11.7	105
V	1, 2, 4	59.8	819
VI	5, 6, 6(V)	12.3	169
VII	7	16.1	221
VIII	-	Nil	Nil
M	-	Nil	Nil
Total		100%	1,370

Table 90 Pre-mining Agricultural Suitability

Agricultural Suitability Class	Land Capability Class	Soil Type Number	Study Area	
			ha	%
2	II	3	56	4.1
3	IV, V	1, 2, 3, 4	924	67.5
4	VI, VII	5, 6, 6(V), 7	390	28.4

This area of mapped BSAL within the Project Boundary is largely associated with the Approved Bengalla Mine or is currently used for grazing associated with dairying. A small area of approximately 1 ha of BSAL mapped land is located within the Disturbance Boundary and is associated with the realignment of Bengalla Road.

In accordance with Table 1 of the SRLUP, BSAL is represented in part by:

- Soil fertility classes high, moderately high or moderate under the Fertility Guidelines. The assessment of soil fertility from the samples collected within the Study Area indicates 161 ha of Soil Type 3 (Brown Vertosol) exhibits moderate fertility; and
- Land capability classes I, II or III under the *Land and Soil Capability Mapping of NSW* (OEH, 2012e). The Study Area contains 56 ha of mapped Class II land, which is largely associated with the rail loop in the vicinity of the Hunter River alluvials. Of this land, only 1 ha of Class II land is located within the Project Disturbance Boundary. The remaining Class II land will remain undisturbed and continue to be used for agricultural purposes. All remaining land within the Study Area is mapped as Class IV or higher.

For the land within the Study Area and Project Disturbance Boundary to represent BSAL it must conform to all criteria outlined in Table 1 of the SRLUP. A complete verification of the land is provided in Section 8.20 having regard to the above criteria relevant to soil and land capability.

8.19.4 Mitigation and Management

BMC will continue to comply with the land mitigation and management measures provided for in accordance with the Coal & Allied EMS, Rio Tinto Environmental Performance Standard 9 – Land Use Stewardship and the Coal & Allied Environmental Procedure 5.1 – Disturbance and Rehabilitation.

In addition, BMC has in place comprehensive rehabilitation commitments and these are outlined in the existing Rehabilitation Management Plan. BMC will update the Rehabilitation Management Plan for commitments below and build on successful techniques developed and currently undertaken on site. The mitigation and management measures included within the Rehabilitation Management Plan that will be provided in the revised plan include:

- Suitable topsoil from each of the soil types will be stripped prior to overburden emplacement. To ensure that the better quality topsoil is not mixed with the inferior subsoil, selective soil stripping practices will occur;
- Prior to any surface disturbance a relevant GDP will be completed to ensure that the limits of these works are pegged and delineated by a suitably qualified person;
- Topsoil will be maintained in a slightly moist condition during stripping;
- Stripped material will be placed onto reshaped overburden and spread immediately, if practical;

- Grading or pushing soil into windrows with graders or dozers for later collection for loading into rear dump trucks by front-end loaders;
- Soil transported by overburden trucks may be placed directly into storage;
- If long-term stockpiling is planned (i.e. greater than 12 months), these will be seeded and fertilised;
- As a general rule, a maximum stockpile height of 3 m will be maintained. Clayey soils will be stored in lower stockpiles for shorter periods of time compared to coarser textured sandy soils;
- Prior to re-spreading stockpiled topsoil onto reshaped overburden, an assessment of weed, infestation on stockpiles will be undertaken to limit any potential distribution of weed species; and
- Topsoil should be spread to a minimum depth range of 0.1 m (steep slopes) to 0.2 m (flatter areas).

The land within the Disturbance Boundary has a moderate erosion hazard rating and as such appropriate erosion and sediment controls will be implemented to ensure the adverse effects of construction and operations activities are minimised.

General vegetation clearing and soil stripping will not be undertaken until earthwork and construction operations are ready to commence. All proposed erosion and sediment control measures will be implemented in advance of or in conjunction with clearing activities. Re-grading will be undertaken where required to produce slope angles, lengths and shapes that are compatible with the proposed land use and not prone to an unacceptable rate of erosion. This will be done in conjunction with a drainage pattern that is capable of conveying runoff from the newly created catchments whilst minimising the risk of erosion and sedimentation.



8.20 Agriculture

8.20.1 Background

An AIS was undertaken by Scott Barnett & Associates and is provided in **Appendix W**. The purpose of the AIS was to:

- Identify agricultural resources and enterprises within the Study Area and surrounding locality;
- Identify the agricultural domains within the Study Area;
- Assess the current and maximum agricultural potential for each agricultural domain in terms of the quantum, gross value and net value of production;
- Assess the applicability of the SRLUP categories for SAL;
- Assess the loss of agricultural production within from within the Study Area;
- Assess the use of the Project's regulated water supply and compare it to its use for agricultural purposes;
- Assess potential impacts on agricultural resources and enterprises within the locality; and
- Recommend appropriate mitigation and management measures.

For the purposes of the AIS, the Study Area is comprised of the land within the Project Boundary, excluding the Approved Bengalla Mine; and the general locality is defined as the area within a 2 km radius of the Project Boundary. The locality boundary has been considered to provide a representative selection of primary land uses adjacent to the Project Boundary.

Regional Setting

Surrounding Locality

The Project is situated in the Upper Hunter region, which has a long history of rural land use for a variety of agricultural and industrial activities. The surrounding locality is no different, with the dominant land uses including open cut coal mining, dairying, lucerne hay production, thoroughbred horse breeding and cattle grazing (see **Section 2.4**). There are no forestry enterprises, designated conservation areas, designated recreation / tourism areas or privately owned wineries within 10 km of the Project Boundary. The major landholders in the locality are primarily coal mining companies (HVEC, Coal & Allied and Xstrata Mangoola). Xstrata Mangoola in particular, under various management regimes, have agricultural enterprises (primarily beef cattle grazing) occurring on non-operational land. There are also a number of small-scale privately owned farming operations which are located primarily to the west of the Project Boundary.

Significant agricultural resources in the locality include the Hunter Regulated River Water Source (Hunter River) and the Hunter Alluvial soil landscape grouping. The Hunter River is located to the south of the Project Boundary and is a major agricultural asset for the locality and the region in general, serving as a highly reliable water source for industries (mining and power generation), town water, irrigation and stock and domestic supply.

The Project is located in Zone 1 under the Hunter River WSP, which was developed under the WM Act. At 100% allocation, one unit share is equivalent to 1.0 ML of water (DIPNR, 2004). WALs are held by BMC for mining and agricultural purposes (see Appendix 1 of Appendix W).

BMC Owned Land

BMC has a long and proud history of maintaining agricultural production on its agricultural lands. Between 1995 and 2004 Bengalla Agricultural Company was established to manage the agricultural land acquired by BMC. During this period, Bengalla Agricultural Company became one of the largest milk producers in the Hunter Valley operating three dairies with milk production peaking at over 5.3 ML in 2002 compared to the 3.3 ML produced in 1992 from the same area. In addition to the dairies, Bengalla Agricultural Company also operated a thoroughbred stud standing three stallions as well as broodmares and weanling and yearling preparation along with dryland beef grazing. Irrigated cropping was also carried out.

In 2004 the Bengalla Agricultural Company was restructured which permitted the management of all BMC owned agricultural enterprises to be transferred to individual licensees. This practice continues today with productive agricultural land operated under seven individual licensing agreements. The private licensing arrangements have ensured the ongoing success of the dairy operations, a thoroughbred stud and brood mare farm, beef cattle breeding, lucerne hay production and industrial hemp production.

To assist in these agricultural activities, BMC also leases out WALs totalling 4,114 units (addition to the WALs, BMC owns for mining purposes) to ensure productivity can be maintained. This provides licensees to access to 3,392 of General Security shares from the Hunter Regulated River Water Sources well as 5.1 High Security shares, 596.9 Supplementary Flow shares and 20.4 and 20.4 ML of Stock and Domestic water. Current (2012) agricultural operations leased under private licensing arrangements include:

- Dairying and calving approximately 900 cows per year on the Hunter River Alluvials producing 4.7 M litres of milk;
- Operate a thoroughbred stud and brood mare farm, standing three stallions and agisting 38 mares and 26 young horses permanently, increasing in the season;

- Over 1,500 t of hay (mainly lucerne) for sale as well as producing hay for on farm use;
- Harvest 100 t of industrial hemp as an experimental crop for the embryonic Hunter Valley hemp fibre industry; and
- Beef breeding cows selling over 900 fat and store stock per year.

This varied production base is based on 2,196 ha of land of which 823 ha outside the Project Boundary. Based on interviews with licensees and gross margin budgets (DTIRIS, 2011) the gross value of this production from BMC owned agricultural land is estimated at \$3.1 M per year with a net value of \$1.4 M per year.

8.20.2 Methodology

Field Assessment

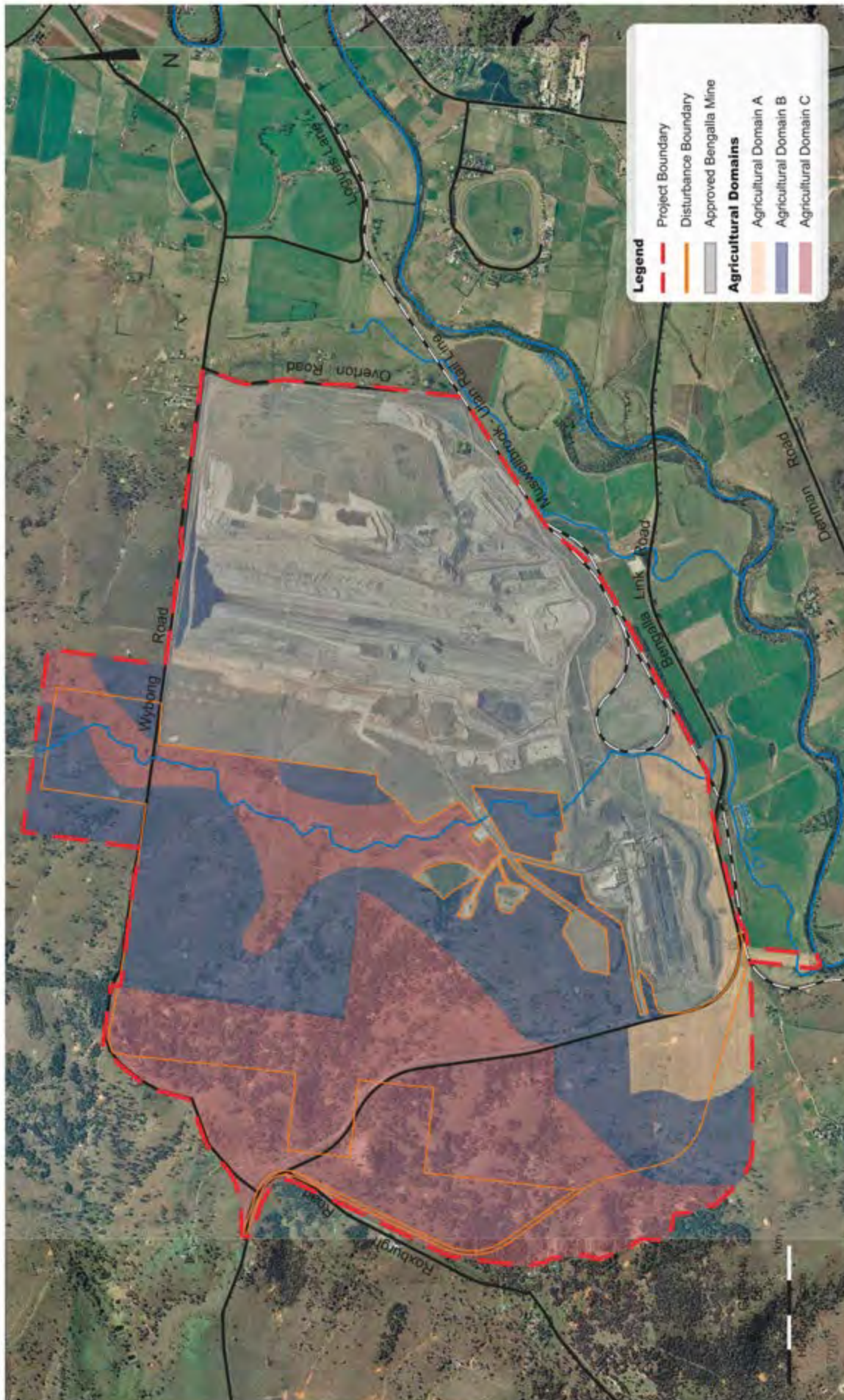
A field assessment was undertaken on the 17 May 2012 to inspect the land within the Study Area. The purpose of the site visit was to verify existing information and to inspect current agricultural production of the land. Interviews were conducted with licensees to ascertain the details of the various agricultural enterprises currently in operation and to obtain an understanding of the potential levels of agricultural production that could be achieved.

Desktop Assessment

The agricultural domains for the Project were mapped utilising the information gathered during field assessment and the Soil and Land Capability Impact Assessment (Appendix V). In order to divide and described the mapped domains these were assigned generic letters (A, B or C) for description purposes only (Figure 66). The NSW Agriculture *Agfact AC25: Agricultural Land Classification* (Hulme et al. 2002) guidelines and the Soil Conservation Service of NSW *Rural Land Capability Mapping* (Cunningham et al. 1988) document were also used in the identification of the agricultural domains.

The current quantum and value of each agricultural enterprise was calculated by domain for the Study Area using the *Gross Margin Budgets* prepared by DTIRIS (2011). These values were then reviewed against the regional, state and national agricultural production outputs to understand the contribution of each enterprise.

The assessment of the potential impacts was undertaken in consideration of the SRLUP and the *Guidelines for Agricultural Impact Statements* (AIS Guidelines) (DP&I, 2012a). Consultation with regulatory stakeholders (DP&I, Agriculture NSW) were used to draw conclusions regarding the impact of the Project on agriculture. Inputs from various other EIS impact assessments were also used to draw conclusions regarding the impact of the Project on agriculture.



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The potential quantum and value of agricultural production, which would result from the use of water from the Hunter River Water Source as compared to use by the Project was also investigated.

The risk assessment undertaken for the AIS also utilised 'AS/NZS 4360:2004 Risk Management'.

Further as part of the AIS, Gillespie Economics undertook an assessment of the potential economic implications of the impacts of the Project on agricultural resources (see Appendix 5 of **Appendix W**). The assessment provided a comparison of the economic efficiencies of coal mining and the agricultural industry, including the consideration of the use of land and resources.

8.20.3 Impact Assessment

This section assesses the potential impacts on agricultural land within the Disturbance Boundary and water resources removed from agriculture as a result of the Project. As part of the AIS, Gillespie Economics were engaged to undertake an economic review of the potential agricultural impacts of the Project. A summary of the findings of this review are incorporated into this section.

Risk Assessment

The AIS Guidelines requires a risk-based assessment to be developed with consideration of:

- The effects of the project on agricultural resources;
- Consequential productivity effects of this on agricultural enterprises, including productivity impacts of any water moved away from agriculture and any water quality issues as they affect agriculture;

- Uncertainty associated with the predicted impacts and mitigation measures, as well as consequences and the likelihood that these uncertainties will be realised; and
- Further risks such as weed management, biosecurity, subsidence, dust, noise, vibration and traffic.

To assist in identifying the key environmental impacts to agricultural resources and enterprises within the Study Area and locality of the Project, a risk assessment was completed utilising the risk assessment tool, *The Risk Matrix* (Standards Australia, 2004). This risk assessment is presented in full in Appendix 5 of **Appendix W**. Each of the potential environmental issues was ranked as either being of low, medium, significant or high risk with no issues considered high as shown in **Table 91**.

Agricultural Domains

Land within the Study Area was dissected into three agricultural domains as outlined in **Table 92**.

The land capability classes within the Study Area range from Class IV to Class VII as discussed in **Section 8.19**. Over half of the land (716 ha or 52.8%) within the Study Area is composed of Domain C. This land is suited to grazing by beef cows for weaner production and is typically associated with land capability Classes V, VI and VII and agricultural land suitability Class 4. The majority of the remaining portion (527 ha or 38.9%) has been determined as Domain B, which is suitable for limited pasture improvement and capable of supporting reasonable levels of pasture production, such as beef cattle grazing for weaner production. This land has a capability class of V and VI and an agricultural land suitability class of 3 and 5. Domain A contains the highest quality, yet least abundant agricultural land with a capability class of IV and agricultural suitability of 3.

Table 91 Risk Assessment of Impacts on Agriculture

Category	Issues
High	N/A
Significant	Availability and productivity of agricultural land
Medium	Surface water, groundwater and water usage
Low	Air quality, noise, visual, labour, traffic and transport, impact on agricultural businesses, weeds and pests

Table 92 Agricultural Domains Within the Study Area

Agricultural Domain	Description	Project Boundary		Disturbance Boundary	
		ha	%	ha	%
A	Area adjacent to the Hunter River alluvials to the south of the Project Boundary - lower slopes of dryland country suited to grazing and pasture improvement.	113	8.3	43	4.4
B	Area associated with lower to mid slopes, requires soil conservation works/minimum tillage techniques to establish improved pastures or grazed as unimproved pasture.	527	38.9	448	46.5
C	Area associated with steeper slopes, not suited to any cultivation due to erosion risk, restricted to native pasture, occasional rotational grazing required to avoid soil erosion issues.	716	52.8	473	49
Total		1,356	100	964	100

Availability and Productivity of Agricultural Land

The development of the Disturbance Boundary will result in a decrease in potential per annum agricultural output which is equivalent to a reduction of:

- 237 less cattle;
- 2,831 t less of hay; and
- 445 t less of grain.

This change in agricultural production will result in a decrease of purchased agricultural inputs at a range of suppliers, estimated to be \$0.8 M per annum (being the difference between gross value of production and net value of production). Input suppliers with the potential to be impacted may include:

- Agricultural input resellers;
- Transport companies;
- Stock and station agents;
- Saleyards;
- Service providers;
- Fuel suppliers; and
- Farm machinery suppliers and servicing businesses.

The predominant agricultural enterprise operating within the Study Area is beef cattle breeding for the weaner and domestic market. Assuming that all of the cattle are sold to the saleyards at Singleton and Scone, production within the Study Area accounts for 0.44% of Scone's and 0.59% of Singleton's throughput and 0.25% of their combined throughput (prime and store). The Upper Hunter Shire Council imposes a yard charge of \$8.18 per head (2011/12). As a result, cattle production from within the Study Area contributes \$2,732 to the Scone saleyard (assuming all 334 cattle are sold at Scone). Yard charges for Singleton were not available; however a similar contribution is expected if all cattle were to be sold at Singleton.

As outlined in Table 93 the gross value of current agricultural (beef cattle) production within the Study Area is \$186,048 per year and the net value of \$142,347 per year. The agricultural productivity could be improved through pasture improvement and paddock subdivision to allow for more intensive grazing. With improvements to the land, the gross value and net value of potential agricultural production could increase to \$259,678 per year and \$199,789 per year, respectively as a result of selling an extra 125 head of cattle. Cattle may also be sold directly to slaughter works, at Scone and Singleton or works outside the Hunter region, or grown out and / or fattened by other producers.

The gross value of production (beef slaughtering) from the impacted land is \$0.2 M per year as shown in Table 94. This value is considered to illustrate a relatively small magnitude in comparison to the total agricultural production of the Hunter region, state and nationally.

The gross value of production in the Hunter for hay, field crops excluding hays and livestock slaughtering is \$268 M (ABS, 2008). Based on the same allocation of costs to gross income for each sector, the value of inputs compares to the value of agricultural inputs used for cropping and livestock for the Hunter of \$103 M. The Project is estimated to reduce the value of agricultural inputs by 0.77% of the total value of agricultural production for the Hunter region.

With a capital expenditure of approximately \$278,000 for a 10 ha site irrigation system and the further enhancement of fencing and stock water reticulation, alternate agriculture could be considered. In addition, WALs for irrigation would need to be secured and purchased. This would result in a greater pasture base that would support other beef enterprises, dry mares or other young thoroughbred stock. Intensive irrigation could provide wine grape vineyard or pasture production for beef grazing or dairying.

Table 93 Current Agricultural Enterprises and Value within Study Area

Agricultural Domain	Enterprise	Carrying Capacity (DSE/ha) ¹	Stocking Rate (ha/Breeding Cow)	Number Animals Sold ²	Gross Value of Production (\$ per annum)	Net Value of Production (\$ per annum)
A	Yearlings	8.0	2.1	45	32,275	26,549
B	Inland weaners	5.1	2.9	150	79,750	60,056
C	Inland weaners	3.5	4.3	139	74,022	55,742
Total				334	186,048	142,347

¹ DSE – Dry Sheep Equivalent, the equivalent daily energy requirement of a 50 kg wether not losing or gaining weight. ² Includes culled breeding stock.

Table 94 Current Value of Agricultural Production

Enterprise	Bengalla Study Area	Hunter Region	NSW	Australia
Beef slaughtering (\$)	0.2 M	95.5 M	1,487.6 M	6,550.5 M
Total agricultural production (\$)	0.2 M	311.7M	8,359.2 M	39,645.1 M

Source: ABS, 2008; ABS 2011

If dairying, a cattle purchase of \$63,000 (35 milking cows) would also be made, therefore for an investment of \$341,000 the marginal return on assets projected is 8.6% over an 11 year payback period.

Only land within the Disturbance Boundary (964 ha) will be removed from agricultural production. The annual gross value of agricultural production from the Disturbance Boundary was estimated to be \$129,000 and the net value was \$98,000 per year based on the sale of 237 cattle. It was conservatively assumed that agricultural production from the entire Disturbance Boundary is removed for perpetuity (Appendix 5 of Appendix W). The net present value of gross production foregone is \$1.7 M (using a 7% discount rate) and the net present value of agricultural production foregone is \$1.3 M (using a 7% discount rate).

Value of Agricultural Water

Surface Water

BMC currently holds 1,449 high security share units of water from the Hunter River Regulated Water Source to supplement mining operations and when at 100% allocation, this equates to 1,449 ML pa. This water could potentially be used for agriculture. In addition to the water shares used for mining, BMC holds 369 general security and five high security water shares, which are used by BMC agricultural licensees and a further 45 shares for racecourse licensees.

For the Project, it has been calculated that up to a maximum of 2,257 ML pa are required from the Hunter River Intake for all years of the Project life (see Section 8.6). The maximum (99th percentile) external water requirement is approximately 2,257 ML per year between Years 5 to 24. The median (50th percentile) external water requirement is approximately 1,500 ML per year. The 10th percentile external water requirement is approximately 1,000 ML per year.

The maximum quantum is 808 ML greater than the 1,449 ML BMC holds under WAL 001106 (assuming 100% allocation). This maximum (2,257 ML) is that required to meet the maximum mine production of 15 Mtpa. The agricultural value of this water was determined by calculating the value (crop yield, gross value and net return) this water could gain by irrigating and producing cash

crops (lucerne hay and maize grain) using 100% allocation.

The total current water entitlement of 1,449 ML is enough to irrigate approximately 132 ha of lucerne and 54 ha of maize based on a crop rotation of five years lucerne and two years maize. The value of production from 186.5 ha of cash crops has a gross value production of \$797,000 and a net value of \$211,000 with further details provided in Table 95.

Based on a lucerne hay and maize grain cropping rotation the additional (above 1,449 ML) maximum of 808 ML could be expected to produce 1,242 t of lucerne hay and 276 t of maize grain from 96.9 ha. The gross value of production from this 96.9 ha would be \$413,000 pa and a net value of production of \$109,000 pa. The dryland quantum and value of production of the same area is 809 t of lucerne hay production and 134 t of grain sorghum with a gross value of \$298,000 and a net value of \$98,000. The quantum and value of agriculture production lost by utilising this water for mining is 2,831 tonnes of Lucerne hay and 445 tonnes of grain with a gross value of \$912,000 and a net value of \$222,000.

Based on a lucerne hay and maize grain cropping rotation, the maximum surface water requirement (2,257 ML) for the Project could be expected to irrigate 283.1 ha to produce 3,639 t of lucerne hay and 809 t of maize grain combining to produce a gross value of production of \$1.2 M and net value of production of \$320,000.

Groundwater

For the Project, it has been calculated that up to a maximum of 220 ML/units are predicted to be taken annually by the Project from the Hunter River alluvial aquifer (see Section 8.7).

Based on the same assumptions used for assessing the impact of surface water the quantum and value of production from 220 ML of irrigation water over 28.3 ha is 364 t of lucerne hay and 81 t of maize grain for a gross value of production \$99,000 and net value of \$23,000. The dryland quantum and value of production of the same area is 81 t of lucerne hay production and 36 t of grain sorghum with a gross value of \$29,846 and a net value of \$10,000.

Table 95 Potential Value of Production from Cash Crops Using Water Allocation

Crops grown	Lucerne	Maize	Total	Value/ML
Years grown	5	2	7	-
ML/ha	8.0	7.2	-	-
Weight average ML/ha	5.7	2.1	7.8	-
Ha grown	132.5	54.0	186.5	-
Yield (t)	2,397	533	-	-
Gross value	\$654,719	\$142,769	\$797,488	\$550/ML
Net value	\$151,570	\$59,843	\$211,413	\$146/ML

The quantum and value of agriculture production lost by utilising this water for mining is 283 t of lucerne hay and 44 t of grain with a gross value of \$91,000 and a net value of \$22,000. The combined quantum and value of agricultural production lost by utilising both water sources (2,477 ML) for mining is 3,114 t of lucerne hay and 489 t of grain with a gross value of production of \$1 M per year and a net value of \$244,000 per year.

At the end of the Project this water will be available for agricultural use. Assuming that this water is not available to agriculture for the total life of the Project, the present value of the gross value of production foregone is \$10.8 M (using a 7% discount rate) and the present value of the net value of agricultural production foregone is \$2.6 M (using a 7% discount rate) (see Appendix 5 of **Appendix W**).

Compared with total agricultural production for the region, state and national scale, the water resource earmarked for the Project is small and the reduced availability and productivity of this land will have a minimal impact to the industry.

Regional Impacts of Agriculture Foregone as a Result of the Project

The regional impacts of the level of annual agricultural production foregone as a result of the Project were estimated from the sectors in the Upper Hunter regional input/output table by Gillespie Economics (2013) (see Appendix 5 of **Appendix W**).

The annual regional production and economic impacts associated with the Project with the level of annual agricultural production that would be foregone as a result of the Project are compared in **Table 96**. Further details are provided within Appendix 5 of **Appendix W**. The direct annual output of the Project is estimated at \$1,174 M pa. In contrast, the direct annual output of future use of agricultural land and water resources that would be utilised by the Project is estimated at \$1.1 M per annum.

Gillespie Economics also undertook a BCA which included an estimation of the present value of production costs and benefits of the Project over a 24 year period. The present value of net production benefits of the Project to Australia are estimated at \$1,773 M (7% discount rate). In contrast, the present value of future use of agricultural lands that would be utilised by the Project is estimated at \$12.5 M (7% discount rate). Based on these comparative values, the Project is considered to be significantly more efficient when compared to continued agricultural production.

Assessment of Impacts on the Locality

Surface Water

As described in **Section 8.6**, BMC holds approximately 1,449 high security units of Hunter River water shares. Water will continue to be sourced as necessary for the Project to minimise cumulative impact on water supplies in the Hunter River catchments. BMC already holds licences with 4,562 units of general security share components to account for the additional Hunter River water demands. The surface water model for the Project has also determined that over the life of the Project and that under certain circumstances, the Project will need to discharge excess water into the Hunter River in accordance with the HRSTS.

Overall the Surface Water Impact Assessment for the Project has determined that the Project will not impact significantly on receiving waters (see **Section 8.6**).

Table 96 Economic Impacts of the Foregone Agriculture and the Project

Item	Agriculture Land	Project
Area (ha)	964 ¹	964
Production Type	Beef cattle production	Coal
Direct Output Value	\$0.1 M	\$1,174 M
Direct Income	\$0.1 M	\$92
Direct Employment (full time equivalent)	1	738
Direct and Indirect Output Value	\$0.2 M	\$1,479 M
Direct and Indirect Income	\$0.1 M	\$186 M
Direct and Indirect Employment (full time equivalent)	1	1,800

¹ This is the area of agricultural land that would be impacted in perpetuity by the Project assuming all Disturbance Boundary remains removed from agriculture

Groundwater

As described in **Section 8.7**, the groundwater model predicts that there will be a drawdown on the Hunter River aquifer adjacent to the Project during Years 1 to 4, which is expected to recover over the life of the Project. The maximum predicted reduction of groundwater discharge rates into the Hunter River alluvium is 220 ML/year. This drawdown has been assessed in the AIS to have a minimal impact on the agricultural use of the water, which is currently used for stock water and dairy use.

Dust

In most cases the impacts of dust on agricultural resources and enterprises in the locality can be assessed as minimal as the Project will meet legislative criteria governed for air quality. The implementation of real time monitoring systems within the vicinity of the Project will also ensure that dust emission targets are not exceeded. This will be accompanied by the establishment of progressive rehabilitation as each mining area advances, thereby, minimising the extent of dust emissions.

Doley and Rossato (2010) report that “Deposition of mining, quarry and road dust on vegetation canopies has been observed to inhibit plant growth when dust burdens exceed 7 g/m²”. They also reported that there is a linear relationship of increase plant dry matter (production) and net dust deposition up to 1g/m²/day while in cotton (which matures in hot sunny weather) estimated net rates of dust deposition of 0.5g/m²/day reduced canopy photosynthesis by 11% and cotton yield by 3%. A dust deposition rate on a leaf of 0.5g/m²/day is equivalent to a monthly deposition rate of 15g/m²/month, greatly above the levels predicted for all privately owned land surrounding the Project Boundary.

Based on the findings of the Air Quality Impact Assessment (**Appendix G**) and work conducted by Doley and Rossato (2010), the predicted dust deposition rates will have nil to minimal impact on the productivity of privately owned land surrounding the Project Boundary due to the Project individually or as part of a cumulative effect with other dust sources.

Potential air quality impacts on livestock performance were also considered as part of the AIS. Based on the findings of the Air Quality Impact Assessment (**Appendix G**), depositional dust levels will generally range from 2 g/m²/month – 4 g/m²/month (worst case all years) across the active grazing land within the Project Boundary and the Hunter Valley alluvial flats currently used for dairying on BMC owned land. The Bengalla Stud lies outside the 2g/m²/month (worst case all years) contour. Based on the studies of Andrews and Skriskandarajah (1992) and Kannegieter (2006) the level of dust impacts predicted for the Project will not impact on the animal performance of any grazing enterprises (dairy, beef or equine) in the locality.

Noise and Vibration

Since mining commenced in 1998, BMC owned land within close proximity to the mine has been used to raise beef cattle, operate dairy farms and thoroughbred breeding enterprises. This demonstrates that livestock are not sensitive to environmental noise. As such it is unlikely that livestock on privately owned grazing properties within the locality of the Project will be affected by noise. Similarly, livestock quickly become accustomed to vibration from blast events, which would limit the potential for impacts on livestock health.

Predicted noise levels experienced by livestock will vary depending on the location of the livestock within each grazing property. In general, livestock located in an area of a property closest to the Project will experience slightly higher noise levels up to 40 dBA while livestock in more remote areas of a property will experience lower noise levels. The additional impacts of noise on agricultural resources and enterprises in the locality (up to 10 dBA above rating background levels) are assessed as minimal as the Project will satisfy the legislative criteria governing industrial noise.

Heffner and Heffner (1983) documented the sensitivity of livestock to a range of noise frequencies. Based on the sensitive noise frequencies of cattle and horses it is considered that the predicted noise impacts of the Project (see **Appendix H**) would not result in any significant reduction in the health or productivity of cattle within the locality.

Kannegieter (2012) reviewed the literature for the impact of blast vibration on horses and found that animal models evaluating the effects of whole body vibration (WBV) suggest that WBV can be used as a performance enhancing tool on traits related to athletic performance and bone strength. Kannegieter cited one study which indicated that WBV may have an anabolic effect on bone and muscle.

Kannegieter postulated that the intermittent blasting experienced by animals (horses) close to a coal project such as Bengalla would be less than which may be experienced by animals during activities such as transportation. It is also noted that the grazing of dairy cows has been undertaken on lands adjacent to the existing operations of Bengalla Mine, with no interruption of grazing and/or ruminating behaviour as a result of blast vibration.

Visual

A Visual Impact Assessment undertaken for the Project addresses the extent of changes to the landscape and visual amenity in further detail (see **Appendix I**).

The Project will increase screening from sensitive locations to the north, east (particularly Muswellbrook township and Racecourse Road) and to the south. The Main OEA will continue to be rehabilitated throughout the life of the Project.

The Main OEA will continue to reduce views of the mine extraction area from most sensitive receptors to the north-east, east and south-east.

As part of the visual impact assessment due consideration was given to the Gateway criteria as prescribed under the SRLUP. It is recognised that scenic and landscape diversity is a key resource base for tourism and associated agricultural pursuits such as viticulture and thoroughbred horse breeding. No sensitive receptors will experience significant impacts as a result of the Project.

The EIS visual impact assessment describes the Project's impact on the visual aesthetics of the surrounding environment at sensitive receptors in further detail (see **Appendix I**).

Traffic and Support Infrastructure and Services

As described in **Section 8.13**, the Project's impacts on traffic and support infrastructure and services indicates that the traffic generated by the construction and operational phases of the Project will be absorbed into the existing traffic stream. Increased traffic use on Bengalla Link Road will not impact the dairy farm on the BMC-owned lane as cattle use road and rail underpasses to access the pasture on either side of the Road.

Despite the minimal disruption during the construction phase, the Bengalla Link Road realignment will result in an improved support infrastructure route to services in the north. The Bengalla Link Road realignment will result in a net increase of approximately 900 m of additional road length. For through traffic travelling along this road, this would result in a worst-case additional 36 seconds per vehicle of travel time under normal operating conditions of the road. Agricultural enterprises in the locality utilise the road network to transport products to domestic markets or to intermediate delivery locations. In addition, support services directly employed by agricultural enterprises, including those by the Equine and Viticulture CIC, will not be shared by the Project and therefore will not be impacted.

The Traffic and Transport Impact Assessment discusses the traffic regime in further detail (see **Appendix Q**).

Labour Supply

As described in **Section 4**, the Project will utilise the existing Bengalla workforce plus up to an additional 500 personnel to support the increase in production. The Social Impact Assessment indicates that in the past six months there has been an increase in unemployment (see **Section 8.14**). These unemployment numbers suggest there are some unemployed persons available for the Project.

The Project will result in employees to be sourced from a number of areas including:

- Reliance on additional employees to be sourced from areas outside the Primary and Secondary Study Areal;
- Rely more heavily on commuting from outside the Study Area;
- Recruitment from other mines; and
- Seek employees from other sectors.

Review of the employment trends in both the agricultural and mining industries over the past 15 years suggest that any employment recruited from the agriculture sector will be of marginal significance.

Strategic Agricultural Land

Biophysical Strategic Agricultural Land

The Project is located adjacent to the Hunter River alluvial floodplain which is mapped as BSAL. **Figure 30** has been developed based on Map 6 of the SRLUP and indicates that an area of approximately 28 ha of BSAL falls within the Project Boundary. This area of mapped BSAL within the Project Boundary is largely associated with the Approved Bengalla Mine or is currently used for grazing associated with dairying.

Table 97 presents the SRLUP criteria for verifying BSAL and how the Project interacts with these criteria. From the results of the Soils and Land Capability Impact Assessment (see **Section 8.19**) a total of 1 ha of verified BSAL is located within the Disturbance Boundary. This 1 ha of verified BSAL is situated on land largely associated with the realignment of Bengalla Link Road. The area of verified BSAL is presented on **Figure 67**.

Critical Industry Cluster (Equine and Viticulture)

Under the SRLUP a CIC is defined as one which meets the following criteria:

- There is a concentration of enterprises that provides clear development and marketing advantages and is based on an agricultural product;
- The productive industries are interrelated;
- It consists of a unique combination of factors such as location, infrastructure, heritage and natural resources;
- It is of national and/or international importance;
- It is an iconic industry that contributes to the region's identity; and
- It is potentially substantially impacted by coal seam gas or mining proposals.

Based on special definition of Equine and Viticulture CIC the Project Boundary contains areas of both Viticulture and Equine CIC. However, it is doubtful that there is a genuine 'concentration of enterprises' in the way in which there is at Pokolbin (in the case of Viticulture) and Scone (in the way of Equine.)

Table 97 BSAL Site Verification

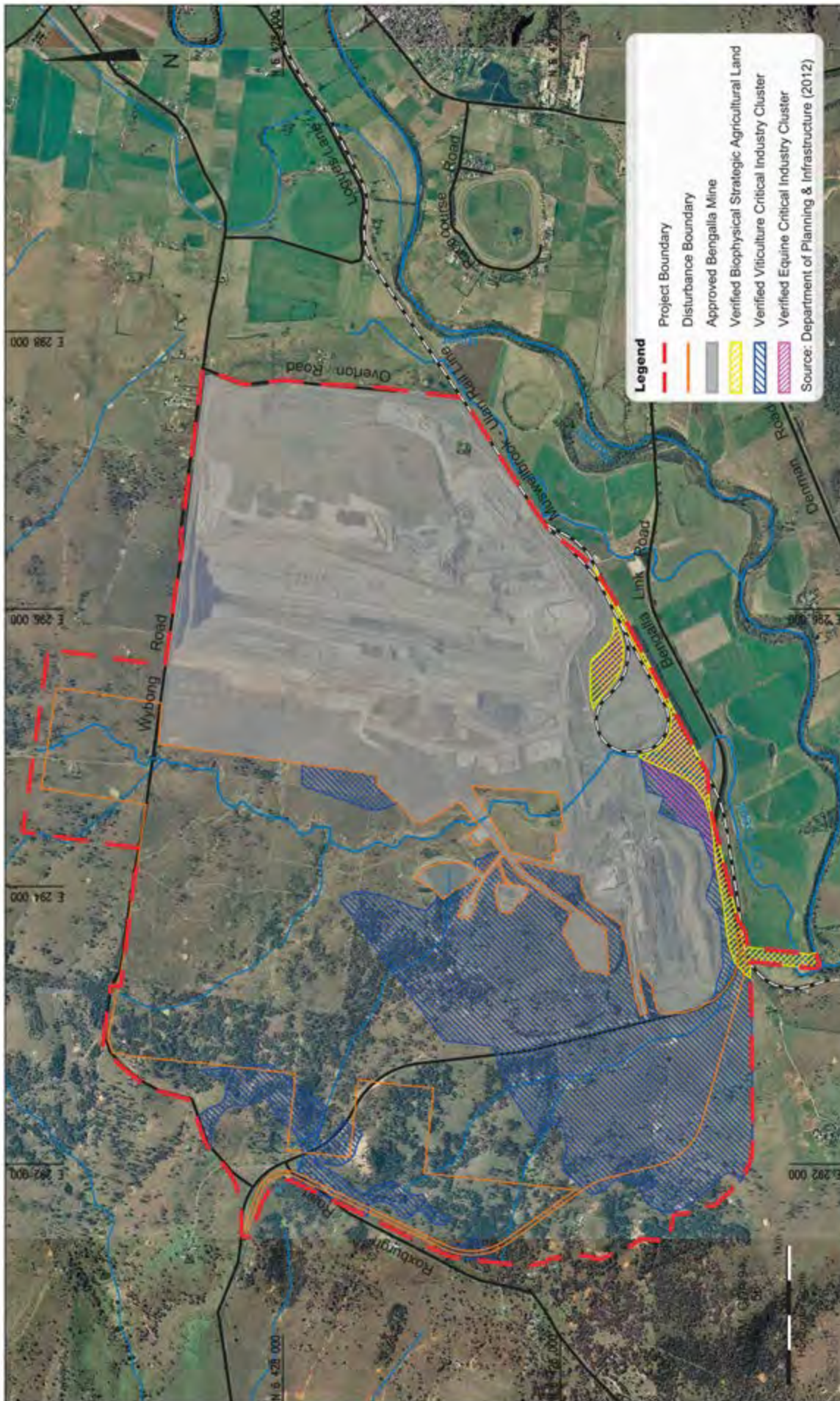
Criteria	Applicable to the Project	Site Verification
Biophysical Strategic Agricultural Land		
Land that falls under soil fertility classes 'high' or 'moderately high' under the Draft Inherent General Fertility of NSW (OEH) and	No	The Soils and Land Capability Impact Assessment determined that no soils within the Project Boundary are considered 'high' to 'moderately high' fertility see Section 8.19
Land capability classes I, II or III under the Land and Soil Capability Mapping of NSW (OEH) and	No	Not Applicable as a result of Point 1
Reliable water of suitable quality, characterised by land having rainfall of 350mm or more per annum (9 out of 10 years); or properties within 150 m of a regulated river, or unregulated rivers where there are flows for at least 95% of the time (i.e. the 95 th percentile flow of each month of the year is greater than zero) or 5 th order and higher rivers; or groundwater aquifers (excluding miscellaneous alluvial aquifers, also known as small storage aquifers) which have a yield rate greater than 5L/s and total dissolved solids or less than 1,500 mg/L	No	Not Applicable as a result of Point 1
OR		
Land that falls under soil fertility classes 'moderate' under the Draft Inherent General Fertility of NSW (OEH) and	Yes	The Soils and Land Capability Impact Assessment determined that Brown Vertosols found within the Project Boundary have a 'moderate' fertility see Section 8.19 and Table 86
Land Capability classes I or II under the Land and Soil Capability Mapping of NSW (OEH) and	Yes	The Soils and Land Capability Impact Assessment determined that Brown Vertosols constituted the requirements for Class II within 1 ha of Class II land located within the Disturbance Boundary see Section 8.19 and Table 89
Reliable water of suitable quality, characterised by land having rainfall of 350mm or more per annum (9 out of 10 years); or properties within 150 m of a regulated river, or unregulated rivers where there are flows for at least 95% of the time (i.e. the 95 th percentile flow of each month of the year is greater than zero) or 5 th order and higher rivers; or groundwater aquifers (excluding miscellaneous alluvial aquifers, also known as small storage aquifers) which have a yield rate greater than 5L/s and total dissolved solids or less than 1,500 mg/L	Yes	The area surrounding the Project complies with one or more of these requirements see Section 8.6 and Section 8.7

The nearest privately owned equine enterprise (other than BMC's own stud) is located 3.5 km south-west from the Project. The nearest privately owned viticulture enterprise is located 12 km south-west of the Project.

A discussion in relation to the verification process for each is provided below.

Equine Critical Industry Cluster

As discussed in **Section 5** the extent of the Equine CIC is defined on Map 6 of the SRLUP. In the Muswellbrook LGA, the Equine CIC includes the land within a 2 km buffer of the Muswellbrook Denman Road and the New England Highway north of Muswellbrook. The Project Boundary contains 35 ha of Equine CIC which is largely associated with the Approved Bengalla Mine (including the existing CHPP and administration facilities to be utilised by the Project).



Verified Strategic Agricultural Land

FIGURE 67

However, new mining disturbance associated with the Project does not occur within the spatial limits of the Equine CIC. In summary, no Equine CIC is located within the Disturbance Boundary.

Viticulture Critical Industry Cluster

As discussed in **Section 5** the extent of the special definition of Viticulture CIC is defined on Map 6 and page 84 (Appendix) of the SRLUP (see **Figure 30**). This definition and how it has been used to verify the Viticulture CIC within the Project Boundary provided in **Table 98**.

Based on special definition on page 84 (Appendix) of the SRLUP the Project Boundary contains 494 ha of Viticulture CIC that meets all the criteria presented in **Table 98**. The area of verified Viticulture CIC within the Disturbance Boundary is 369 ha. The area of verified Viticulture CIC is presented on **Figure 67**. It remains doubtful that there is a 'concentration of enterprises' in proximity to the Project as described on page 21 of the SRLUP.

There are no vineyards within the Project Boundary. The Project lies on the north-east extremity of the Viticulture CIC with the nearest vineyards being 6 km (though is owned by HVEC) and 12 km to the south and 14.5 km to the west of the Project Boundary. The AIS (**Appendix W**) indicates the Project will not impact significantly on the Upper Hunter Valley viticulture industry or any viticulture enterprises.

Gateway Criteria Assessment

As discussed in **Section 5** the SRLUP proposes the 'Gateway criteria', which must be considered in its assessment of any proposal. As part of the assessment process, a site verification process must be undertaken for the land mapped as SAL. The assessment aims to determine any potential significant impacts on the BSAL and / or the CIC as a result of the Project.

Table 17 lists the assessment criteria in Table 2 of Chapter 11 of the SRLUP against the reference to the relevant section of this EIS, in which the potential issue is addressed. The Project has been assessed to have no significant impact on any element of the listed gateway criteria for BSAL or Viticulture CIC.

As there is no Equine CIC land within the Project Boundary the AIS determined that the Project will not impact on any element of the listed Gateway criteria for Equine CIC.

8.20.4 Mitigation and Management

BMC will revise the existing Rehabilitation Management Plan for the Project in consultation with relevant regulators. The revised Rehabilitation Management Plan will contain a strategy, as appropriate, to implement an invasive weed and pest (feral animal) management plan in consultation with the Hunter Livestock Health and Pest Authority. This plan will include a monitoring and reporting system and will see the commitment of appropriate resources (physical, financial and labour) to ensure it is implemented in an effective manner.

A total of 964 ha of agricultural land situated within the Disturbance Boundary will be progressively removed by the Project. Prior to disturbance, the land will as long as practicable be kept as agricultural land using sustainable farming practices.

In areas that have been disturbed by mining, land will be rehabilitated to land capability classes II to VI (with the majority class IV) and agricultural suitability classes 3 and 4 as the Project progresses. Agriculture will be reintroduced into appropriate, safe and stable areas of rehabilitated land as soon as practicable in line with mining operations legislative requirements.

Table 98 Viticulture Critical Industry Cluster Verification

Criteria	Applicable to the Project	Site Verification
Land (excluding National Park and State Forests) within 20 km of Denman; and	Yes	The Project is located within 20 km of Denman
Falls under soil fertility classes 'high', 'moderately high', 'moderate' or 'moderately low' under the Draft Inherent General Fertility of NSW (OEH); and	Yes	The Soils and Land Capability Impact Assessment determined that all soils within the Project Boundary have a fertility of 'Moderately Low' or 'Moderate' see Section 8.19 and Table 86 .
Land capability classes I, II, III, IV or V under the Land and Soil Capability Mapping of NSW (OEH); and	Yes	The Soils and Land Capability Impact Assessment determined that four soil types constitute Land Capability Classes I to V including: • Brown Chromosol (Class V) • Red Chromosol (Class V) • Brown Vertosols (class II and IV) • Red Sodosol (Class V) See Section 8.19 and Table 89
Is within 2 km of a mapped alluvial water source.	Yes	The Project Boundary is located within 2 km of the Hunter River Alluvial Aquifer see Section 8.7

The options for agricultural use will remain open with the conceptual landform that is proposed, however landforms near the final void will have steep slopes unsuitable for agriculture. Based on current agricultural land use within the locality the most likely use for the land would be for beef cattle grazing at varying levels of stocking pressure sympathetic to the landform and reinstated soil type. In addition, BMC will implement a number of mitigation and management measures including:

- Developing a final landform that is consistent with pre mining agricultural land use;
- Continuing, where possible, with the existing licensee arrangements for BMC agricultural land;
- Continuing with arrangements for sustainable farming practices, in collaboration with licensees and the Hunter-Central Rivers Catchment Management Authority. This will include the implementation and monitoring of annual farm plans, BMC financial support for programs and the effective management of land situated outside the Disturbance Boundary;
- Ongoing real-time monitoring for air quality, noise and vibration from blasting, with appropriate preventative and corrective actions implemented for exceedances as discussed **Section 8.1**, **Section 8.3** and **Section 8.4** respectively; and
- Monitoring the Hunter River alluvial aquifer drawdown and if impacts differ from predicted levels appropriate corrective actions will be implemented where possible.



8.21 Rehabilitation and Mine Closure

Rehabilitation at Bengalla is currently undertaken in accordance with the existing Rehabilitation Management Plan, MOP and relevant the standards provided by the Bengalla EMS. These document sets out objectives and procedures for the rehabilitation and conservation management of all rehabilitation efforts at Bengalla and a framework for mine closure and final void development.

As part of a detailed review of the Disturbance Boundary undertaken as part of this EIS, the rehabilitation strategies described in the following sections have been developed in consideration of relevant specialists, including:

- The Ecological Impact Assessment summarised in **Section 8.11** and presented in full in **Appendix O**; and
- The Soils and Land Capability Impact Assessment summarised in **Section 8.19** and presented in full in **Appendix V**.

8.21.1 Rehabilitation Framework & Objectives

The strategic framework for the Project's rehabilitation and mine closure is described in the existing Rehabilitation Management Plan. In the revision of these plans to consider the Project as proposed, key objectives and techniques will also be guided by the following guidelines and policies (or latest version):

- *EDG03 – Guidelines to the Mining, Rehabilitation & Environmental Management Process* (DTIRIS, 2012);
- *Strategic Framework for Mine Closure* (ANZMEC & MCA, 2000);
- *Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry* (DITR, 2006a);
- *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (DITR, 2006b); and
- *A Rehabilitation Manual for Australian Streams* (Vol 2) (Rutherford et al., 2000).

The objectives for the rehabilitation and closure of Bengalla are outlined in the existing Rehabilitation Management Plan and Landscape Management Plan. These objectives are followed during rehabilitation activities to ensure:

- The achievement of an acceptable post-mining land use suitability;
- The development of a landform that is free draining and stable, with pasture cover;

- That suitable chemical, physical and nutrient properties in rehabilitation areas provide for the growth of vegetation, establishment of pasture or habitat;
- That the quality of downstream waters is preserved;
- All hazards associated with the final highwall and low wall are controlled; and
- That the final low wall is shaped, stable and maintains pasture cover.

8.21.2 Strategic Framework

Rehabilitation processes implemented for the Project will be undertaken generally in accordance with the *Strategic Framework for Mine Closure* (ANZMEC & MCA, 2000) and the *Mine Rehabilitation and Mine Closure and Completion* handbooks both developed as part of the Leading Practice Sustainable Development Program by the Department of Industry, Tourism and Resources.

Planning objectives for rehabilitation activities for the Project will be based on those management measures already in place, including:

- The development of an updated Rehabilitation Management Plan;
- Early characterisation of materials to avoid any future issues associated with materials used in rehabilitation; and
- Understanding the external environment and how it may affect the success of rehabilitation.

The key objectives for mine closure include:

- Enabling all relevant stakeholders to have their interests considered within the mine closure process;
- Ensuring the mine closure process is timely, cost effective and in consideration of future land-use plans;
- Ensuring the cost of mine closure is reflected in the budget adequately and that the community is not left with a liability;
- Ensuring there is effective implementation of the mine closure process including adequate resources and clear accountability;
- The establishment of a set of indicators and a rehabilitation monitoring program to ensure mine closure can be demonstrated as a successfully completed process where completion criteria are met;
- Establishing a point where all agreed criteria is deemed successfully met by the relevant Authorities;

- Ensuring future public health and safety, environmental resources, post mining land use and socio-economic assets are not unduly negatively affected and enhanced where possible; and
- The implementation of sustainable development considerations in corporate decision making processes and the reduction of risk through management strategies based on sound data.

8.21.3 Relevant Planning Instruments

As discussed in **Section 5.2.3**, the Project is located within land zoned under the Muswellbrook LEP which outlines development zones and permitted land use.

Zoning for the lands within the Project Boundary is illustrated on **Figure 27** and includes:

- RU1 Primary Production;
- E3 Environmental Management; and
- SP2 Rail Infrastructure Facilities.

The conceptual final landform and rehabilitation strategy will provide consideration of the relevant objectives from each of the above zones from the Muswellbrook LEP.

The Project has also been designed in consideration of the 'Final Landform' principles of the MSC LUDS. Further discussion into the way in which the Project has considered and adopted these key principles is provided in **Section 8.21.4**.

As described in **Section 8.11**, the Project will impact on Box-Gum Woodland. In order to compensate for this loss, the Project will rehabilitate, restore and conserve Box-Gum Woodland on site. This will be guided by the *Draft National Recovery Plan for Box-Gum Woodland and Derived Native Grassland* (DECCW, 2010).

8.21.4 Rehabilitation Techniques

Rehabilitation for the Project will continue to be undertaken by BMC in accordance with Coal & Allied and Rio Tinto Environmental Performance Standards and the Bengalla EMS. Those environmental procedures (EP) specific to rehabilitation and related activities include:

- EP 5.1 - Rehabilitation;
- EP 2.1 - Cultural Heritage Management; and
- EP 10.2 - Flora and Fauna.

Land Clearance Protocol

As discussed in **Section 8.11** the Project Boundary generally consists of native perennial grassland of variable diversity and floristic composition, with remnant woodland patches with vegetation types illustrated on **Figure 58**.

Prior to disturbing any new areas for the Project, a site inspection and GDP is required to be completed by BMC environmental personnel to identify any issues associated with the disturbance of the area, in accordance with EP 5.1. During the preparation of GDPs for the Project, each disturbance area will be reviewed for threatened flora and fauna species, known sites of Aboriginal archaeology or cultural heritage, potential habitat trees for collection to use in future rehabilitation and appropriate topsoil stripping depths prior to any approval.

The total area of disturbance will continue to be minimised during Project operations by clearing the smallest practical area of land ahead of active mining operations, as well as ensuring the land is disturbed for the shortest possible and practical time.

Rehabilitation

The progressive rehabilitation of land within the Disturbance Boundary will continue to be undertaken as an integral component of Bengalla operations. These activities will continue to be undertaken in accordance with the requirements of the management plans and procedures noted above, which will be updated for the Project. As mining operations progress over the life of the Project, the OEAs will be progressively established to the east of active open cut areas, as shown in **Figure 14** to **Figure 18**. Once established, the OEAs will be shaped to allow the progressive implementation of rehabilitation as soon as practicable. Rehabilitation development will include a range of measures, including topsoil management and relocation, establishment of erosion and sediment controls, habitat reinstatement and revegetation works.

Topsoil resources in areas to be disturbed will be stripped to the depth recommended and stockpiled ahead of mining activities in accordance with the Bengalla EMS, EPs and the management measures outlined in **Section 8.21**. Generally, topsoil material is used in available rehabilitation areas as soon as practicable after stripping to preserve native seed banks and soil microflora.

If longer-term storage of topsoil is required (i.e. longer than a period of three months), stockpiles will be revegetated prior to resspreading in rehabilitation areas in order to maintain their viability. The construction and management of erosion and sediment controls will be a key component of Project design. This will include the development of regular contour banks and other drainage structures on rehabilitated landform slopes to control surface flows and the reinstatement of Dry Creek. The design and management of the realigned Dry Creek following the completion of Project mining operations in this area is discussed further in **Section 8.21.8**.

Revegetation

The revegetation strategy at Bengalla has been developed as a result of previous rehabilitation experience and in accordance with current leading practice. As noted above, revegetation works will occur as soon as practical after the shaping of OEAs, topsoil spreading and the construction of required erosion and sediment controls. BMC will continue to complete the revegetation of rehabilitation areas using specific seed mixes for pastoral and native vegetation areas, which contain native species and have proven successful in previous use. To promote effective links between site rehabilitation and remnant vegetation, a series of native vegetation corridors will be established across the site, in consultation with DRE and in accordance with the principles presented in the *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (Synoptic Plan) (DMR, 1999).

Monitoring

In accordance with existing site procedures, rehabilitation areas will continue to be monitored on a regular basis to ensure that rehabilitation objectives are being met and that revegetation and long term landform sustainability is achieved. Rehabilitation monitoring will include regular inspections of rehabilitated areas to:

- Assess the long term viability of the rehabilitation; and
- Collect data that demonstrates that standards, milestones and overall objectives for Project rehabilitation have been met.

Current rehabilitation monitoring methodologies and objectives are derived from an Australian Coal Association Research Program Hunter Valley Project C13048 *Development of Rehabilitation Completion Criteria for Native Ecosystem Establishment on Coal Mines in the Hunter Valley* (ACARP, 2005). Soil and vegetation results are compared to proposed completion criteria as outlined in the Rehabilitation Management Plan and summarised in **Table 99**. These criteria will be reviewed and the Rehabilitation Management Plan updated as required for the Project, should it be approved.

Maintenance and management works in rehabilitation areas will be completed as required to address any issues of concern or recommendations identified during monitoring. Maintenance activities may include a range of responses, including the application of fertiliser, supplementary seeding of revegetated areas, the management of erosion and sediment control structures and weed and feral animal control. The results of rehabilitation monitoring and the effectiveness of any maintenance activities conducted and reported in the Annual Review.

Table 99 Preliminary Rehabilitation Criteria

Objective	Long-term Completion Criteria (i.e. Life of Mine)	Medium-term Success Indicators (i.e. < 5 years)
Overburden Emplacement		
Landform is free draining and stable, with pasture cover	- Internal slopes <10 degrees - External slope gradients <14 degrees - Low wall slope gradient 19 – 21 degrees	Overburden reshaped to relevant slopes and gradients
	Drainage structures are stable and retaining dirty water on site	- Appropriately designed water management structures incorporated into final landform - No evidence of failed water management structures
	Minimum of 10% vegetative cover over rehabilitated areas. The eastern face of the OEA will contain higher density natural woodland similar to that presently found within the Disturbance Boundary.	- Suitable pasture species dominant - Minimal presence of weeds
Rehabilitation provides suitable chemical, physical and nutrient properties for growth of vegetation, establishment of pasture or habitat	- Soil properties EC <0.6 uS/cm * - pH between 4.5 and 9.0 *	- Minimum of 100 mm topsoil depth - Soil properties approaching completion levels
	Surface litter layer present over rehabilitated areas	Indications and increasing presence of surface litter layer
	Presence of rocks and fallen trees and their use by fauna	Selective placement of rocks and fallen trees on rehabilitation & their use by fauna
	Minimum of 10% vegetative cover over rehabilitated areas. The eastern face of the OEA will contain higher density natural woodland similar to that presently found within the Disturbance Boundary.	- Suitable pasture species dominant - Minimal presence of weeds (esp. <i>Galenia sp</i>)
	Tree plots recruitment rates are equal to or exceed mortality rates	Tree plots indicating good growth and mortality rates – nearing completion criteria
	Grazing conducted in accordance with land classes	Successful small trials of grazing
Surface run-off is not polluting waters off site	Water leaving site must meet EPL 6538 criteria of pH between 6.5 and 9.5 and TSS of < 120 mg/L	Water monitoring results within limits of EPL 6538 and all dirty water retained on site
Final Void		
All hazards associated with the final highwall and low wall are controlled	Design to stable gradient by geotechnical personnel, if necessary blast	- Final highwall meets design requirements, geotechnical stable - Monitoring confirms stability
	Fencing established along the entire length of the final highwall, preventing pedestrian and livestock access	- Implementation and ongoing maintenance of fencing - Exclusion of access
	Berms, trenches and catch benches established at appropriate intervals where necessary	- Implementation of berms and trenches at regular intervals - Stability of berms and trenches
Final low wall is shaped, stable and maintains pasture cover	Low wall slope gradient is at 19 – 21 degrees	Low wall overburden shaped to 19 – 21 degrees
	Water management structures constructed and working to full capability, conveying runoff	Appropriate water management structure incorporated in design
	Minimum of 10% vegetative cover over rehabilitated areas	- Minimum 100 mm topsoil depth - Suitable pasture species dominant - Minimal presence of weeds (especially <i>Galenia sp.</i>)

* Conceptual completion criteria as provided by the ACARP (Nichols, 2004).

8.21.5 Mine Closure

As noted above, the main objective of rehabilitation at Bengalla is to develop an undulating, free-draining landform (excluding the final void) with an optimum land capability to support the nominated final land use for the site. BMC will seek the relevant approvals necessary to allow the continuation of mining operations at Bengalla prior to the completion of the Project life. Should approval be granted for the continuation of mining operations to develop additional areas and coal reserves then mine closure planning and the final landform and associated void design would be revisited at that time.

To provide for the management of the mine closure process in the event that approval for the continuation of mining at Bengalla following the completion of the Project mining operations is not sought or granted, a mine closure plan will be prepared for Bengalla within five years of the end of the Project life. This document will reflect the contemporary expectations of Project stakeholders, relevant regulatory requirements and guidelines, current management practices and technologies and the final mine plan for the site.

A number of post-mining land use options have been investigated for the Project site following consultation with regulators, near neighbours and the local community and these will be reviewed in the preparation of the Project mine closure plan. The investigations were undertaken to determine feasible land uses on rehabilitated land considering land slope, class, water requirements and soil types.

The potential land uses identified in the review were then evaluated based on a number of selection criteria, including:

- Community and stakeholder acceptance;
- Health and safety considerations;
- Potential environmental impacts;
- Regulatory requirements and legal liability; and
- Contribution to the local economy and employment.

Potential post-mine closure land use options which were considered include:

- Viticulture;
- Commercial forestry;
- Adaptive reuse;
- Native forest and woodland revegetation; and
- Cattle grazing.

After consideration of the above selection criteria and extensive feedback from community consultation, a mixture of native bushland and cattle grazing were identified to be the most suitable post-mining land uses for the majority of land within the Project Boundary with the exception of the eastern face of the OEA.

The eastern face of the OEA will be revegetated to contain higher density natural woodland similar to that presently found within the Disturbance Boundary. Grazing and native bushland regeneration was therefore been adopted as the preferred post-mining land use in suitable areas of the site, with a focus on linking remnant vegetation with rehabilitation. This combination of agricultural (cattle grazing) and conservation land use is the preferred option for mine closure as illustrated in Figure 5.

As part of the mine closure process, BMC is committed to the achievement of leading practice completion criteria, as this will ensure the long term protection and management of the post mine landscape and its biodiversity conservation values. A list of preliminary rehabilitation completion criterion for Bengalla is presented in the Rehabilitation Management Plan. Preliminary medium and long-term completion criteria are outlined in Table 99.

Final rehabilitation completion criteria for mine closure will be developed and agreed in consultation with the relevant government agencies and community and incorporated into the final Mine Closure Plan (developed as part of the Rehabilitation Management Plan). These criteria will continue to be revised and developed to demonstrate that the rehabilitation objectives have been achieved. The achievement of the completion criteria post closure will be monitored and reported to relevant stakeholders.

8.21.6 Conceptual Final Landform

The Project has been designed with consideration of the final landform principles of the LUDS. The way in which the Project has considered and adopted these key principles is as follows:

Final Void

- Final void design at Bengalla has been engineered to including stable highwalls and the development of a single final void; and
- The Project final void will have sufficient freeboard and as such, will not require a spillway and is not free draining.

Overburden Emplacement Area

- Final landforms OEA has been designed to ensure contours will be as natural as possible, developing a free-draining landform, as far as practicable. This will ensure the stability of the final void highwalls and will minimise natural erosion and sedimentation;
- The final landform design has incorporated the re-establishment of the pre-disturbance catchment areas as far as practicable; and
- Rehabilitation of the eastern face of the OEA directed towards Muswellbrook will consist of a higher percentage of woody vegetation designed to replicate the species found within the Box Gum Woodland community present within the Disturbance Boundary.

The conceptual final landform illustrated on **Figure 68** was prepared on the assumption that mining operations would cease at the end of the approval period sought for the Project. As noted in **Section 4**, it is assumed that BMC will seek the relevant approvals necessary to allow the continuation of mining operations at Bengalla prior to the completion of the Project.

The final landform is designed to result in an undulating landscape generally consistent with the surrounding environment with slopes generally to 10 degrees and up to a maximum of 21 degrees on the low wall. Progressive rehabilitation of disturbed areas will incorporate the construction of erosion and sediment control and water management structures. To minimise surface water catchment as far as practical, the conceptual final landform has been designed to include diversion drains and contour banks to redirect surface water runoff away from low lying areas.

It is anticipated that the landform will be predominately rehabilitated to grazing pasture, with plantings of native woodland vegetation to achieve a minimum of 10 % vegetation cover and higher density tree coverage of the eastern face of the OEA. Where possible, any tree planting will be connected to remnant areas of forest or woodland, so as to provide corridors and habitat for fauna migration and colonisation. BMC is continuing to investigate the development of vegetation plantings in conjunction with DTIRIS and in accordance with the Synoptic Plan.

BMC will continue to liaise with DRE and MSC with regard to the end mine landform design and establishment of the final landform for the Project following the granting of Development Consent.

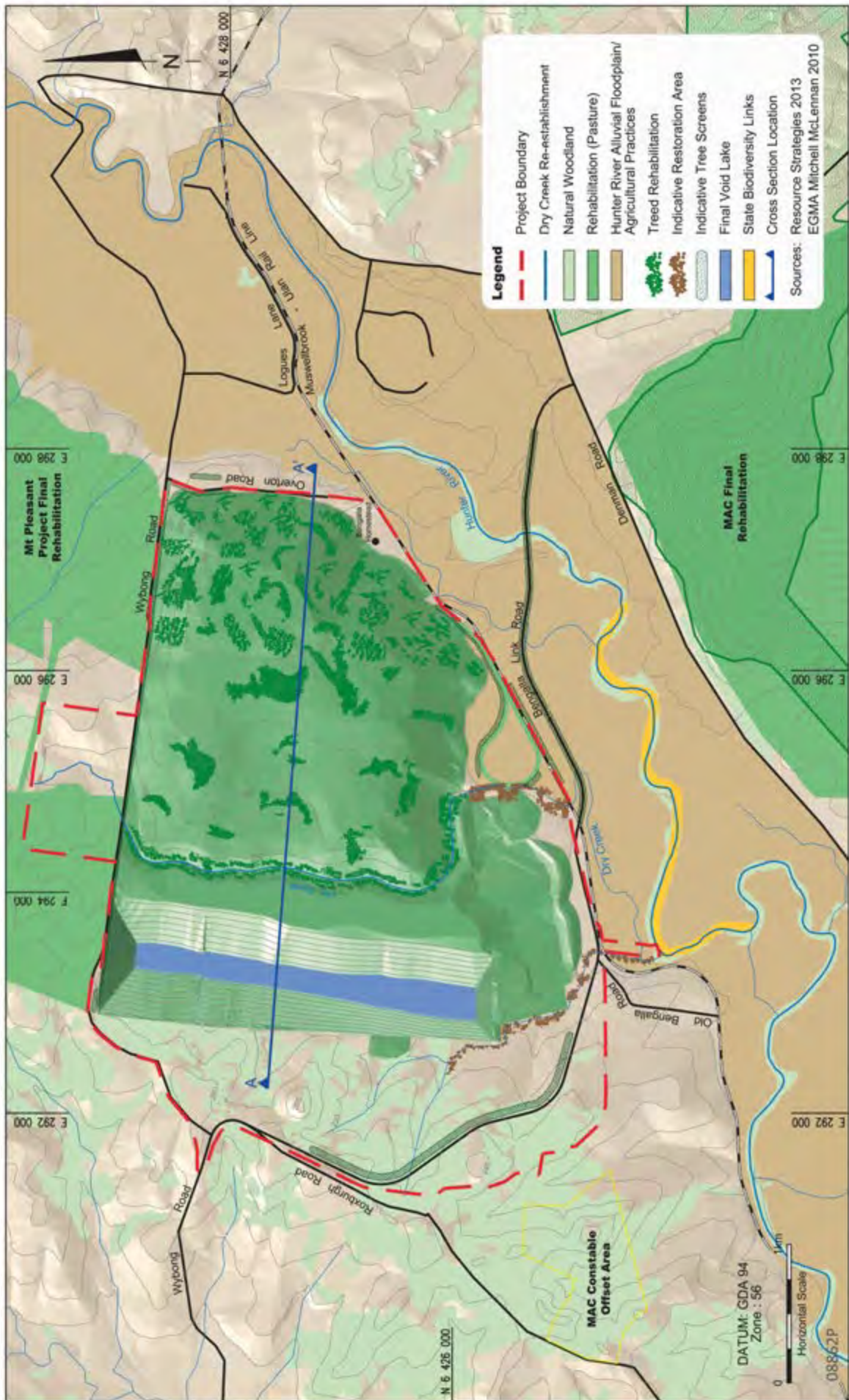
Connectivity of Rehabilitation to Existing Woodland and Offset Areas

Due to previous agricultural land use the nature of the environment surrounding the Project there is limited scope for future rehabilitation to be connected to areas of existing natural vegetation. The Project Boundary is largely surrounded by areas of agricultural land associated with the Hunter River Floodplain (see **Figure 68**) along with approved mining projects, road networks and privately owned land. However, several opportunities exist and have been considered including:

- Rehabilitate disturbed areas largely back to pre mining conditions (agricultural land) with some opportunities to maintain ecological values including the higher density planting on the eastern face of the OEA;
- Opportunity to connect future rehabilitation into the Mount Pleasant Project (once completed) rehabilitated final landform;
- Reinstatement and rehabilitation of Dry Creek (see **Section 8.21.8**);
- Remediation of the approximate 1 km section of Dry Creek that will remain intact south to the Project Boundary so as not to impede on any agricultural land associated with the Hunter River Floodplain (see **Section 8.11.4**);
- Remediation of selected areas of the Hunter River using funding provided by the UHSA Trust with focus provided on areas associated with the UHSA State Biodiversity Link if finalised (see **Section 8.11.4**);
- Establishment of a tree corridor from the Hunter River back to the areas west of the final void without the need to significantly impact on agricultural land associated with the Hunter River Floodplain, should mining cease after Year 24 (**Figure 68**); and
- Potential to link tree corridors from the Hunter River to areas of remnant vegetation in the west of the Project Boundary.

The above mentioned rehabilitation opportunities are presented on **Figure 68** and shall be refined with relevant regulators during the development of the Project Biodiversity and Rehabilitation Management plans.





Conceptual Final Landform

FIGURE 68

8.21.7 Final Void

Optimisation of Void

As discussed in Section 4.3.1 an additional coal resource is known to occur west of the Disturbance Boundary however is not proposed to be extracted as part of the Project. It is anticipated that subject to market factors and resource confirmation, BMC will seek the relevant approval for the extraction of these additional resources in the future. However, should a future approval not be sought or approval not be granted, a single final void has been developed for the Project following the completion of mining in Year 24. The development of a single void ensures that number of residual landform voids are minimised, which is a key principle of the LUDS.

As mentioned above, the conceptual final landform for the Project has been developed should mining not continue beyond the Project 24 years. Consideration was also provided to the current approvals associated with the adjacent Mount Pleasant Project and Mt Arthur Coal Mine (see Section 2.4.1).

Alternatives Considered

In consideration of MSC's LUDS, a number of options for final void development and rehabilitation were considered during the development of the Project mine plan. An assessment of each option considered the economic costs and environmental constraints associated with each, including overburden volumes, overburden rehandle requirements and the potential coal resource sterilisation. The options considered the following alternatives for the development of a final void:

- **Option 1** – 'Blast and Doze' to a stable final landform (the Project);
- **Option 2** – Backfill the void to the original surface level; and
- **Option 3** – Backfill to re-establish natural drainage.

Option 1

Option 1 considered utilising the 'Blast and Doze' method in combination with backfilling to shape the final void. Approximately 4 Mlcm of waste would be required to backfill the upper surfaces of the final highwall as in some areas the upper bench is above the level required for a consistent slope. A total of 9 Mlcm of waste in the highwall and endwalls is required to be drilled and blasted to achieve a consistent angle. Approximately 14 Mlcm of waste would be required to be dozed both in the highwall, endwall and low walls to ensure a consistent slope angle within the final void.

The base of the dozed final void is approximately 20 m above the base of the original void with depths ranging from RL 180 m to 240m. An estimated cost to complete this option has been calculated using an excavator and trucks for rehandle of the upper benches, drill and blast to achieve the slopes below the final highwall and endwall and dozers for total reshaping. This option using the 'Blast and Doze' method was nominated for the development of the final void in consideration of economic cost and environmental constraints associated with each, including overburden volumes, overburden rehandle requirements and the potential coal resource sterilisation. This option is reflected in the final landform shown on Figure 68.

Figure 69 illustrates a conceptual cross-section of the Project final landform should further approval not be granted or sought after Year 24.

Option 2

Option 2 involves backfilling the void to original surface level. This option would require the rehandle of overburden material from the OEA after coal extraction has been completed. The required volume to backfill the void to original surface level has been calculated to be 339 Mlcm. This material would be required to be sourced from the already rehabilitated and shaped dumps and will require the rehandle of 785 ha of shaped material. The area disturbed would be shaped so as to reinstate the Dry Creek alignment and allow drainage to the creek line.

This option was rejected as it was deemed not economically feasible and would also result in significant noise and air quality impacts associated with the rehandle of overburden material.

Option 3

Option 3 considered the minimum backfill required to fill the void and maintain drainage so that the final surface does not hold water. This option reduces the required backfill by 47 Mlcm to 292 Mlcm in relation to Option 2. No dozer push is required for this option as the 10 degree slopes can be formed as part of the dumping operation, rather than pushing down from the highwall.

This option was rejected as it was deemed not economically feasible and, as with Option 2, would also result in significant noise and air quality impacts associated with the rehandle of overburden material.

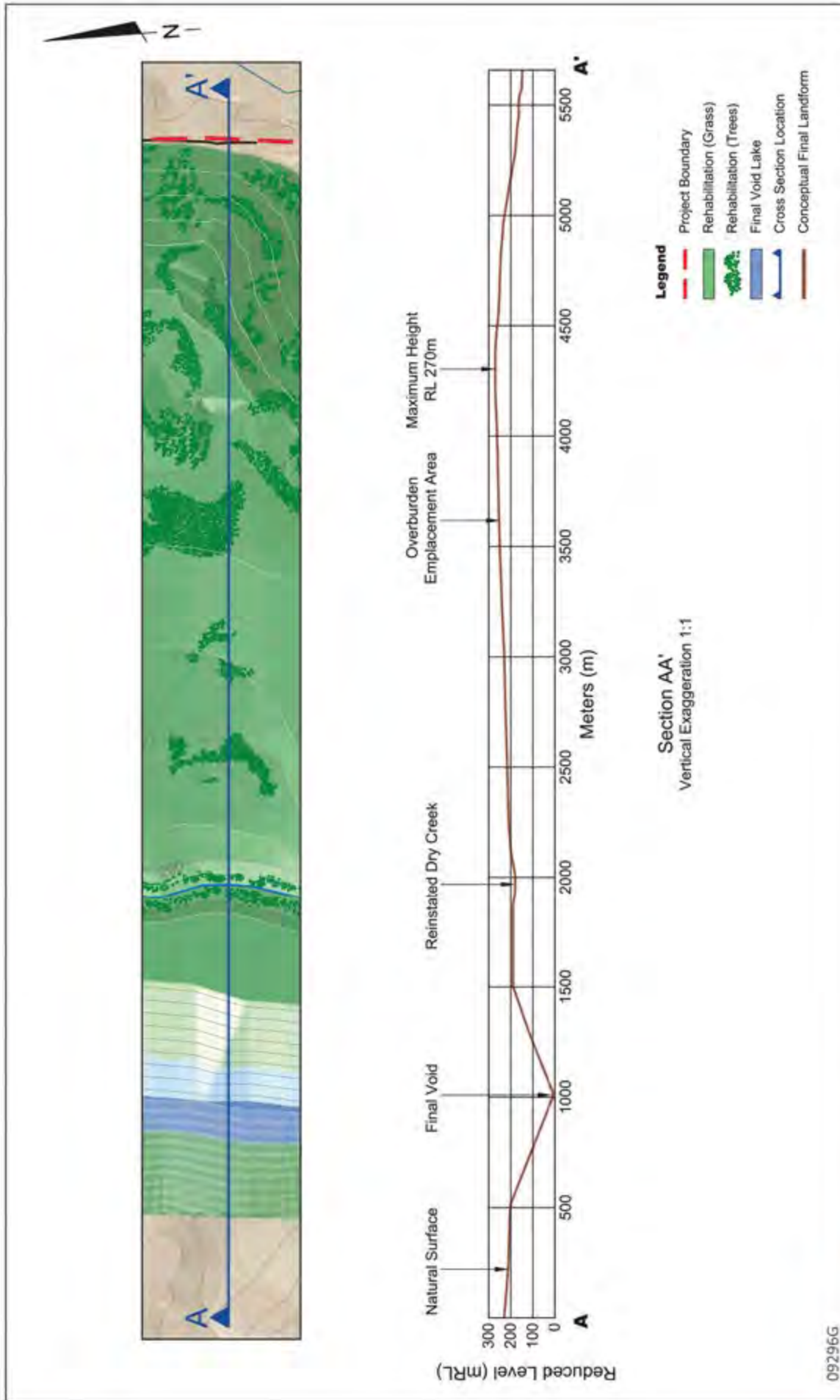


FIGURE 69

Slope and Stability

Should further mining approvals not be granted or sought at BMC after Year 24, for the preferred Option 1. Following the cessation of mining, the low wall, which is the side of the void containing overburden and disturbed material, will be stabilised in the following manner (following consultation and agreement with relevant regulators):

- The low wall will be battered back from the angle of repose to ensure the long term geotechnical stability of the face, with the determination of geotechnical stability and recommendations as to the final slope undertaken by a qualified geotechnical engineer. This will be based on an assessment of the overburden material, the likely degree of settlement, and the degree of weathering expected in the long term. However, it is expected that the low wall sides of the final voids will be battered back to 10 degrees where practical or a maximum of 21 degrees;
- The highwall is the actively mined side of the void and is generally comprised of undisturbed, solid material generally above the economically lower-most limits of the mineable seam. As part of the final landform it is planned that the final void will have the majority of the highwall blasted back to improve the safety and stability to an angle of repose of between 23 and 25 degrees;
- The endwalls proposed for the final void will be blasted back to improve the safety and stability to an angle of repose of approximately 33 degrees;
- Surface water drainage on and over the low wall will be minimised through the construction of drainage control structures and the aim of diverting as much of the catchment as possible away from the final void and back into the surface water system; and
- Erosion of the low wall will be controlled by limiting the length of slope through the use of contour and graded drains, minimising the slope, and by the establishment of suitable vegetation.

Final Void Lake and Final Use

As discussed in Section 8.6.3 and Section 8.7.3 surface water runoff and groundwater seepage will settle in the remaining void, creating a lake up to approximately RL 70 m at 1,000 years following the cessation of mining (see Figure 68). The freeboard between the water level surface and the void spill height is predicted to be over 100 m under worst case conditions and as such does not warrant a spillway.

Various other options would also be considered in consultation with relevant regulators and other stakeholders in a Final Closure Plan (including ash disposal or waste disposal, etc) should further approvals not be granted or sought after Year 24.

Water quality aspects of the final void lake are discussed in Section 8.6.3 and Section 8.7.3.

8.21.8 Dry Creek Reinstatement

The preliminary design for the proposed reinstatement of Dry Creek has been completed by Parsons Brinckerhoff and is provided in Appendix X. In order to obtain the best possible outcome for the reinstatement within the constraints of the existing environment and Project mine plan, a number of alternative options were assessed and discussed in Section 4.13.9. The alignment proposed for the reinstatement of Dry Creek following mining operations progressing to the west of the current alignment of the creek is shown on Figure 70. A typical cross section of the realigned creek is presented in Figure 71.

Description

Bengalla is located within the upper catchment of the Hunter River and adjacent to the river's floodplain. The western portion of the Project Boundary drains into Dry Creek, an ephemeral stream which flows south through the Project Boundary and discharges to the Hunter River main channel to the southwest of Bengalla. As presented in Figure 14 to Figure 18, the proposed layout of mining operations extends to the west of Approved Bengalla Mine and would include the disturbance of the Dry Creek catchment. As discussed in Section 8.6, the Project impacts a maximum of 42% of the total catchment to the confluence of the Hunter River being captured during Year 15 of the Project.





BENGALLA MINE

Dry Creek Reinstatement
Conceptual Plan View

FIGURE 70

Hansen Bailey
ENVIRONMENTAL CONSULTANTS



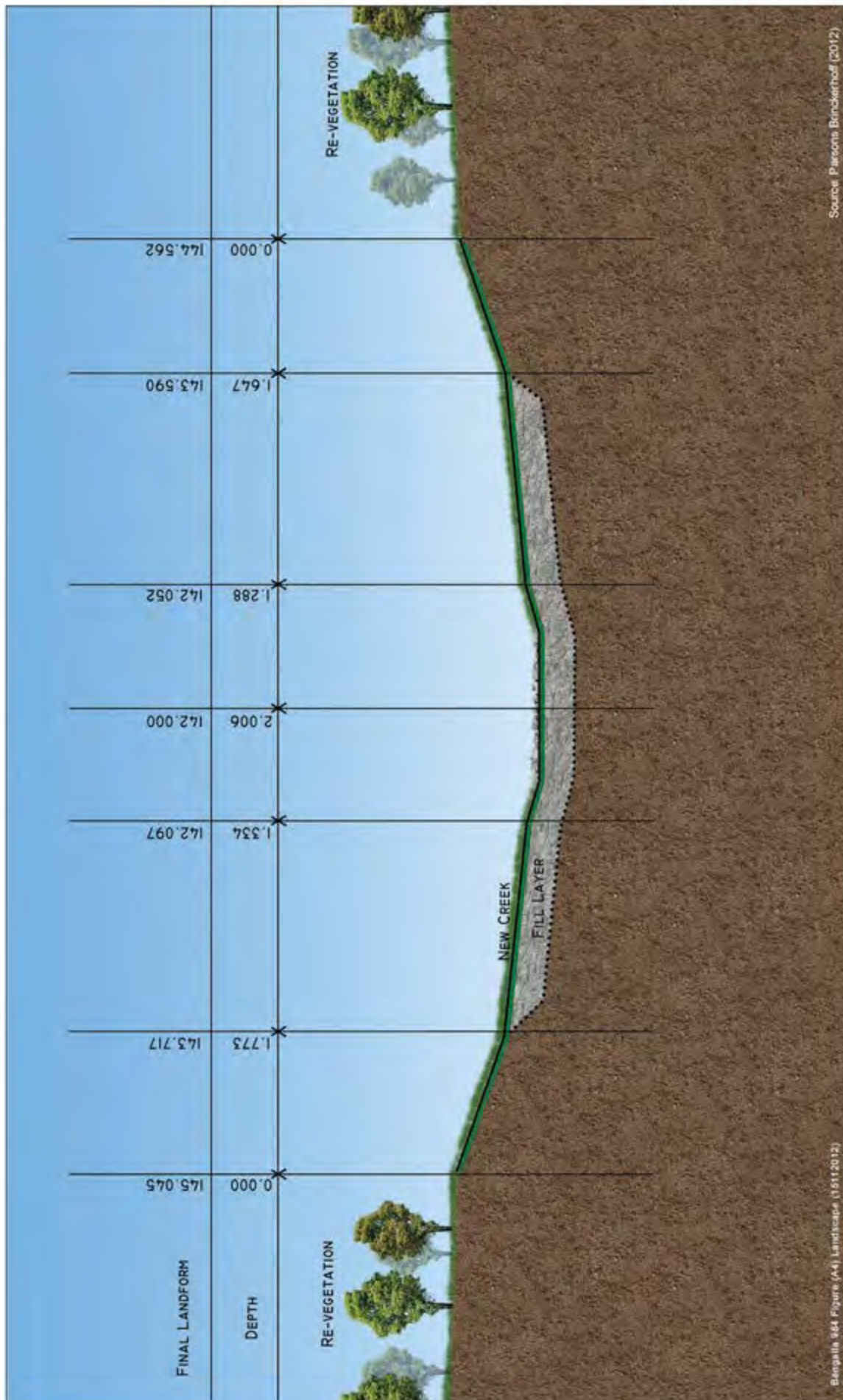


FIGURE 71

Design Criteria

The environmental and surface water management design criteria adopted for the reinstatement of Dry Creek (PB, 2012) are below:

- The reinstated channel is to follow as close as possible the plan / horizontal alignment indicated in the Year 24 mine plan (see **Figure 70** for a plan view);
- A 2 m thick select clay fill layer would be required for the length of the alignment to maintain drainage;
- Stabilisation of the top 300 mm of select clay fill with 2% gypsum would be required;
- The creek must provide a two-stage flow channel with the lower stage capable of safely conveying flood events to and including the two year ARI event and the upper stage capable of safely conveying events up to and including the 100 year ARI event, consistent with good practice flood management guidelines;
- Development of a channel cross section and roughness that allows opportunity for environmental rehabilitation and enhancement;
- Provision of a channel with a horizontal and vertical alignment that minimises flow velocities and erosion potential and allows opportunities for environmental enhancement;
- Provision of a table channel that would resist erosion and scour under flood events up to and including the 50 year ARI flood event, consistent with good practice erosion and sedimentation control guidelines; and
- The reinstated Dry Creek would be topsoiled, seeded and hydro mulched to the extents of the select clay fill.

The geomorphology of the reinstated channel has been designed to be similar to that of the existing Dry Creek channel (see **Section 8.6.1**), with the exception of the channel slope, which is flatter for the majority of the re-established reach and with a short reach of increased slope towards the downstream end. The modifications to the channel slope morphology of the reinstated creek will likely result in the more efficient conveyance of surface water flows than the existing creek. To account for the effect of increased flow efficiency, a longer stream length has been introduced (see **Figure 70**).

Reinstatement

The section of Dry Creek proposed to be reinstated for the Project is approximately 4.5 km in length. This includes all areas of Dry Creek from CW₁ (that captures water in the Dry Creek catchment north of Wybong Road) to the existing alignment of the creek outside of the Disturbance Boundary to north of the confluence with the Hunter River. The proposed reinstatement design works have been based on the current alignment and ephemeral nature of the Dry Creek.

Opportunities to incorporate channel meanders have been maximised to control flows and replicate existing conditions while at the same time recognising existing constraints such as the existing morphologically sound sections of creek, the extent and sequence of the Project mine plan and the existing and rehabilitated topography and catchments in the surrounding areas. Where possible, the reinstated areas will be implemented to mimic existing conditions at the site while maintaining the potential for stream energy during peak flows to be dissipated through bed friction and minimised movements. An indicative representation of the reinstated Dry Creek is included in **Figure 72**.

The reinstated form of Dry Creek would generally consist of two sections (see **Figure 71**). These include a low flow channel to cater for relatively frequent flood events up to the two year ARI event and a larger high flow channel to contain flows up to and including the 100 year ARI event. The channel cross section incorporates a wide flow channel with shallow gradient side slopes in both the low and high flow channels. This minimises flood depths and velocities, therefore minimising the level of flood hazard and erosion potential within the channel when conveying significant flows. The wide, open and shallow gradient features of the cross section provide opportunity for environmental enhancement of the channel through establishment of vegetation.

A relatively high value of Manning's roughness has been assumed which would allow significant riparian vegetation growth to establish within and adjacent to the reinstated channel in the long term without affecting flood capacity. The design parameters are represented conceptually on **Figure 71**.

A summary of the characteristics of the reinstated form of Dry Creek are included in **Table 100**.

Table 100 Conceptual Reinstated Dry Creek Characteristics

Parameter	Design size
Channel length	4,500 m
Base width	8 m
Low flow channel side slopes	1V:4H
Low flow channel depth	0.77 m
High flow channel side slopes	1V:10H
High flow channel depth	Variable
Manning's n	0.04
Channel slope	Varies
Rock scour protection	Where velocity > 2m/s for the 1 in 50 ARI event

Source: PB, 2013



BENGALLA MINE

Dry Creek Reinstatement - Indicative Imagery

FIGURE 72



Hansen Bailey
ENVIRONMENTAL CONSULTANTS

8.21.9 Management and Mitigation

BMC will develop a Dry Creek Reinstatement Management Plan within five years of the proposed construction in consultation with relevant regulators to ensure that effective management measures are employed during the construction and reinstatement and revegetation of Dry Creek. The Dry Creek Reinstatement Management Plan (see Section 8.11) will describe the monitoring and rehabilitation techniques and provide erosion and sediment control measures to be implemented. Indicative mitigation measures are described further below.

Rehabilitation

The primary objective of the techniques employed in the rehabilitation of the reinstated channel of Dry Creek will be undertaken to replicate aspects of the existing riparian vegetation and conditions as closely as possible. This will also include planting additional vegetation or undertaking further compaction of the creek bed to provide stability to the creek realignment and prevent the loss of surface flows (see Figure 72).

Periodic monitoring of the creek will identify locations within the bed and banks where settlement has occurred leading to excessive infiltration. This may be localised settlement or settlement along a length of the diverted creek channel. The reinstatement of Dry Creek will be monitored on a regular basis to ensure that objectives are being met and that sustainable revegetation and long term landform sustainability is achieved. Rehabilitation monitoring will include regular inspections of rehabilitated areas to assess:

- Structural stability;
- The effectiveness of erosion and sediment control measures;
- The effectiveness of the realigned section of Dry Creek;
- Revegetation success of mine rehabilitation; and
- The effectiveness of weed and pest management measures.

..

Maintenance works in rehabilitation areas will be completed as required to address any issues of concern identified during monitoring. Maintenance activities may include a range of responses, including supplementary seeding and fertilising of vegetated areas, weed and pest control; maintaining or repairing drainage structures and dams; and the infill and regrading of any eroded areas.

Monitoring

Monitoring of each of the permanent creek reinstatements will be regularly carried out to ensure that areas within the realigned creek where excessive aggregation of soils, erosion or inhibited plant growth may be occurring are identified. This will facilitate the application of appropriate remediation techniques.

In addition, the identification of those locations within the reinstated creek channel that will function as ponded areas or slower flowing meanders are appropriately designed to minimise the potential for surface fractures. Since the channel would be clay-lined during construction, it is expected that any fracture zones which may develop would generally be sealed by the properties of the clay.

However, monitoring of the creek lines will determine any construction issues and allow the implementation of appropriate contingency measures if required, in consultation with relevant regulators.

Erosion and Sediment Controls

At the downstream end of each reinstated section of the creek channel, a sediment trap will be installed which will be maintained while the new creek line is being constructed and rehabilitated. This will allow for the capture and repatriation of the erosion of sediments while the creek channel is still being established and joined with the existing section of Dry Creek at the confluence of the Hunter River.

In locations where excessive erosion is found to occur within the reconstructed creek channel, rock, rip-rap or other suitable material will be used to provide protection to the creek bed and banks, anchor finer bed sediments and prevent erosion.





9

Management and Monitoring Summary

In addition to the conditions of the existing Development Consent, the following is a summary of operational controls for all activities associated with the Project. A summary of predicted air quality and noise impacts outlined in Section 8 is also included.

9.1 Summary of Project Air Quality and Noise Impacts

A summary of the air quality impacts above relevant criterion as identified in Section 8.1.3 and significant noise impacts as described in Section 8.3.3 for the Project are provided in Table 101. Table 101 provides a summary of receptors predicted to experience either (or both) significant air quality and noise impacts as a result of the Project.

An additional 15 properties owned by 11 individual landholders are also predicted to be impacted by the Project as detailed in Section 8.1.3 and Section 8.3.3, however already have rights to acquisition upon request by another mining company.



Table 101 Project Air and Noise Impacts above Criteria

Receptor ID	Description	Air Quality	Noise
106*	MJ & MJ Duncan	✓	
110N#	GR & MK Walsh	✓	✓
110S#	GR & MK Walsh	✓	
152	MR Peel		✓
153	PR Ellis		✓
154	PSJ Murray		✓
156E	NJ & RY Ellis		✓
156S	NJ & RY Ellis	✓	✓
25 % Contiguous Property			
111*	GR & MK Walsh	✓	✓
211	TM Peel		✓
109*	EJ & CA Denton	✓	
245, 246, 249 & 250	JS & NM Lonergan	✓	

Denotes property affected by cumulative air quality impacts only if Mt Arthur Coal Mine seeks further approvals after 2026.
No privately owned receptors are predicted to experience significant impacts from blasting (see Section 8.4.3)

9.2 Summary of Management and Monitoring Measures

Table 102 provides a consolidated summary of the major proposed environmental management and monitoring measures proposed in this EIS.

Table 102 Summary of Management and Monitoring Measures

Ref	Commitment	Section
Mining Operations		
1.	BMC will extract coal at a rate of up to 15 Mtpa of ROM coal for 24 years, generally in accordance with this EIS.	4
2.	Prior to carrying out any activity that requires a licence or approval listed in Table 18, BMC will ensure that such a licence is obtained.	5.9
Environmental Management		
3.	BMC will revise their existing Environmental Management Strategy in consultation with the relevant regulators (and the Aboriginal community where relevant) consistent with Section 8 of this EIS to the approval of DP&I which shall comprise: • Environmental Monitoring Program (incorporating groundwater, surface water, air quality, meteorological, blast and noise monitoring); • Air Quality and Greenhouse Gas Management Plan; • Noise Management Plan; • Blast Management Plan (incorporating Road Closure Management Plan); • Rehabilitation Management Plan (including Mine Closure Management Plan); • Bushfire Management Plan; • Landscape Management Plan; • Water Management Plan (incorporating Surface Water and Groundwater); • Aboriginal Cultural Heritage Management Plan; • European Heritage Management Plan (incorporating Conservation Management Plans for Bengalla Homestead and Overdene Homestead); • Biodiversity Management Plan; and • Dry Creek Reinstatement Management Plan.	8
4.	The existing environmental monitoring program as shown in Figure 11 and Figure 12 shall be revised and updated in consultation with relevant regulators over the life of the Project in consideration of operations and the location of private receivers.	3.13
Air Quality and Greenhouse Gas		
5.	The existing Air Quality and Greenhouse Gas Management Plan will be revised for the Project in consideration of the management and mitigation measures described in this EIS and will incorporate the following: • Continued use of all feasible and reasonable air quality controls for reducing dust emissions; • Best practice dust management techniques; • The use of automated monitoring systems situated in and around active mining areas that detect adverse dust and meteorological conditions and proactively manage operations during periods of high dust to reduce the potential for further dust impacts; • Commitment to achieving 85% control on primary haul roads; and • Address interim and long term energy and greenhouse management plans and initiatives, including monitoring, reporting and continuous improvement	8.1.4
6.	BMC will update the existing dust and blast management systems with a real time air quality management system combined with predictive meteorological forecasting.	8.1.4
Noise		
7.	The existing Noise Management Plan will be revised for the Project in consideration of the management and mitigation measures described in this EIS and will incorporate the following: • Continued use of all feasible and reasonable mitigation measures; • Proactive management of mobile equipment to operate on elevated and exposed sections of the OEA during the day/ evening and on lower and (where required on) more shielded sections of the OEA during the night period; and • Mining machinery to generally work below the surface during the sensitive night period, undertaking surface work during the day where practical.	8.3.4
8.	BMC will upgrade the existing noise monitoring system with a contemporary real time noise management system at representative receptors to facilitate ongoing and proactive noise management.	8.3.4

Ref	Commitment	Section
Blast		
9.	The existing Blast Management Plan will be revised for the Project in consideration of the management and mitigation measures described in this EIS.	8.4.4
10.	Blasting for the Project is proposed to occur at the rate of up to 12 blast events per week, during the hours of 7:00 am to 5:00 pm, Monday to Saturday.	4.3.3
11.	Blasting on Sundays will be undertaken at up to one blast event per day when within 500 m of the infrastructure areas in accordance with Blast Management Plan.	4.3.3
12.	MSC along with all privately owned residents located within the Project noise management zone (see Table 40 and Table 41) will be offered to be notified of a Sunday blast.	8.4.4
13.	BMC will investigate and implement an appropriate real time blast system combined with predictive meteorological forecasting capabilities.	8.4.4
Visual and Lighting		
14.	The existing Landscape Management Plan will be revised for the Project in consideration of the management and mitigation measures described in this EIS and will incorporate the following: • The rehabilitation of the eastern face of the OEA to open woodland/scattered tree landscapes with higher density natural woodland; • Detailed design for the development of new visual plantings areas (or equivalent mitigation measure) or extensions to existing areas for planting areas to achieve a good visual outcome to critical eastern and southern views inclusive of planting patterns consistent with the limited, woodland and grassland of the existing landscape; and • Detailed topographic and tree planting design around the explosive storage facility and reload facility to reduce its visibility in the landscape.	8.5.4
15.	Where appropriate, tree screen planting (or equivalent mitigation measure) will be implemented along Denman Road, Roxburgh Road, Wybong Road in consultation with local receptors and the RMS.	8.5.4
Surface Water		
16.	The existing Water Management Plan (surface water section) will be revised for the Project in consideration of the management and mitigation measures described in this EIS including: • Detailed baseline data on surface water flows and quality for water bodies that could potentially be impacted by the Project; • Surface water and stream health impact assessment criteria including trigger levels for investigating any potentially adverse surface water impacts; and • A program to monitor surface water flows and quality, impacts on water uses, stream health and channel stability.	8.6.4
17.	The existing Surface Water Monitoring Program will be revised and implemented throughout the duration of the Project. BMC will continue to monitor the quantity and quality of water in onsite storages, the Hunter River and Dry Creek (until mined through).	8.6.4
18.	Monitoring locations will be relocated to accommodate the diversion of Dry Creek and the relocation of Washery Dam, Staged Discharge Dam and Raw Water Dam. The sampling frequency and parameters monitored will be consistent with current monitoring.	8.6.4
19.	To account for the maximum amount of surface water taken by the Project at any one point during its life, BMC will make the required application to NOW to hold relevant licences as required.	5
Groundwater		
20.	The existing Water Management Plan (groundwater section) will be revised for the Project in consideration of the management and mitigation measures described in this EIS and will incorporate the following: • Groundwater impact assessment criteria, including trigger levels for investigating potentially adverse groundwater impacts; • A program to monitor and assess groundwater inflows to the mining operations; • Impacts on local (including alluvial) groundwater systems including drawdown from the Hunter River alluvium; and • Impacts on any groundwater dependent ecosystems and riparian vegetation.	8.7.4
21.	The existing Groundwater Monitoring Program will be revised and implemented throughout the duration of the Project.	8.7.4
22.	To account for the maximum amount of groundwater taken by the Project at any one point during its life, BMC will make the required application to NOW to hold relevant licences as required.	5

Ref	Commitment	Section
Geochemical		
23.	BMC will review the existing internal Acid Mine Drainage Management Plan and will include mitigation and management measures to minimise the potential risk of overburden and coal reject the to cause harm to the environment and ensure their suitability for use in construction and revegetation.	8.8.4
24.	No Archerfield Sandstone or coarse reject materials will be placed in the Western OEA.	8.8.4
25.	Current management including burial under NAF overburden methods for Wynn coal reject and other coal reject materials within the mining void will continue.	8.8.4
Aboriginal Archaeology and Cultural Heritage		
26.	The existing Aboriginal Cultural Heritage Management Plan will be revised for the Project in consultation with the RAPs with consideration of the management and mitigation measures described in this EIS and will incorporate the following: • Detailed salvage methodologies to be carried out prior to the commencement of the Project for the surface collection of stone artefacts, scarred tree assessment and removal; • Identification of appropriate long term management options for recovered artefacts which will be developed in consultation with RAPs; • Procedures for the protection and conservation of archaeological sites that are not impacted by the Project by means of fencing and other appropriate management measures; and • Provisions regarding the appropriate management actions for previously unrecorded Aboriginal sites identified within the Project Boundary.	8.9.4
European Heritage		
27.	The existing European Heritage Management Plan will be revised for the Project with consideration of the management and mitigation measures described in this EIS and will continue to incorporate Conservation Management Plans for the Bengalla Homestead and Overdene Homestead.	8.10.4
28.	Complete detailed archival recording of the Stockyard site in accordance with the Heritage Branch guidelines 'How to Prepare Archival Records of Heritage Items' (1998) and 'Photographic Recordings of Heritage Items using Film or Digital Capture' (2006).	8.10.4
Ecology		
29.	BMC will develop a Biodiversity Management Plan for the Project with consideration of the management and mitigation measures described in this EIS.	8.11.4
30.	An regular ecological monitoring program will be developed as a component of the Biodiversity Management Plan to monitor the ongoing status and health of flora and fauna communities that will be retained within the Study Area as well as previously-disturbed rehabilitated areas.	8.11.4
31.	BMC will develop a Dry Creek Reinstatement Management Plan for the Project with consideration to the management and mitigation measures described in this EIS and will: • Aim to reproduce Dry Creek to a quality similar or greater to that which currently exists by using collected pre-mining baseline ecological information; • Ensure revegetation of Dry Creek's riparian zone will be undertaken to create a vegetation corridor to assist in fauna movement between areas of forest and woodland habitat to broader areas of Derived Native Grassland north of Wybong Road (in the absence of the Mount Pleasant Project); • Provide appropriate rehabilitation, monitoring and provide timing for regular maintenance protocols; and • Ensure that native grasses, reeds and shrub species that are characteristic of the Hunter Floodplain Red Gum Woodland community will be planted in the reconstructed bed and riparian areas of the reinstated Dry Creek.	8.11.4
32.	BMC will provide a financial contribution to the Upper Hunter Offset Fund in accordance with the credits generated under the Upper Hunter Strategic Assessment (or alternative offset strategy as agreed with relevant regulators) to secure sufficient offsets to compensate for the direct removal of native vegetation.	8.11.4
33.	Mine-owned riparian areas of Dry Creek nearby the Hunter River and a retained area (adjacent the CHPP) within the Project Boundary that were not affected by the Disturbance Boundary will also be rehabilitated (including the planting of the regionally endangered population River Red Gum).	8.11.4
34.	BMC will enhance the habitat along selected areas of Hunter River frontage on which BMC land as part of the Upper Hunter Strategic Assessment.	8.11.4
35.	Prior to the clearing of any native vegetation, a Ground Disturbance Permit will be prepared.	8.11.4

Ref	Commitment	Section
Traffic and Transport		
36.	The existing Road Closure Management Plan (as a component of the Blast Management Plan) will be revised for the Project consideration of the management and mitigation measures described in this EIS.	8.13.4
37.	The Road Closure Management Plan will include protocols for the temporary closure of Wybong Road associated with the construction of CW1 and will be developed in consultation with MSC.	8.13.4
38.	BMC will construct the approximate 6 km realignment of the Bengalla Link Road to replicate the existing two lane, two way rural road that was constructed by BMC in 2009. BMC will consult with MSC prior to undertaking the realignment of Bengalla Link Road.	8.13.4
39.	The design will include a 'like for like' replacement of the current Bengalla Mine Access Road intersection approximately 900 m south. The intersection will consist of a channelised right turn with a minimum 160 m right turn lane with a slight uphill grade.	8.13.4
40.	BMC will construct an intersection from the existing Roxburgh Road onto the realigned section of the Bengalla Link Road. This intersection will require Roxburgh Road to be altered to allow a 90 degree angle of intersection.	8.13.4
41.	Prior to the transportation of over-dimensioned loads on State roads, BMC will obtain the necessary approvals from RMS and MSC.	8.13.4
Social		
42.	BMC will continue to implement the existing internal policies to issues associated with employee relocations to the Muswellbrook LGA (including housing and general assistance), ensuring ongoing Aboriginal employment positions are available for the Project and continuing to provide a framework for managing fatigue issues.	8.14.4
43.	BMC will revise its existing Voluntary Planning Agreement with MSC.	8.14.4
44.	BMC will provide timely and appropriate operations workforce information to MSC, to assist Council to plan for future needs in relation to housing and accommodation, affordable housing and child care.	8.14.4
45.	BMC will continue to operate the BMC Community Consultative Committee.	8.14.4
Hazards		
46.	BMC will continue to maintain a database to assist in the recording and management of chemicals.	8.16.4
47.	Explosives, diesel, oil and hazardous materials will be transported, stored and used in accordance with relevant Australian Standards and legislation.	8.16.4
Waste		
48.	The existing BMC Waste Management System will be enhanced as required to reflect the additional workforce and operational areas as they are commissioned.	8.17.5
Contamination		
49.	An appropriate contamination investigation will be undertaken by a licensed contractor to further assess the extent of contamination throughout the Disturbance Boundary in the areas of potential contamination associated with the sites of current and former rural residences.	8.18.4
50.	Weed and pest (feral animal) management will continue in consultation with the Hunter Livestock Health and Pest Authority as per the Landscape Management Plan.	8.18.4
Rehabilitation		
51.	The existing Rehabilitation Management Plan will be revised for the Project with consideration of the management and mitigation measures described in this EIS.	8.21
52.	Rehabilitation will be designed to permit the reintroduction of relevant agricultural activities into appropriate the rehabilitated landform as soon as practicable.	8.21
53.	Final rehabilitation completion criteria for mine closure will be developed and agreed in consultation with the relevant government agencies and community and incorporated into the Final Void and Mine Closure Plan (developed as part of the Rehabilitation Management Plan).	8.21
54.	Should BMC wish to cease operations at Year 24 a Mine Closure Plan will be developed within five years of the scheduled mine closure.	8.21
Training and Reporting		
55.	BMC will provide regular and relevant training to all employees and contractors in relation to EIS commitments.	8



10

Project Justification

10.1 Overview

This EIS has assessed the potential impacts of the Project in accordance with the DGRs issued on 13 March 2012 and the supplementary DGRs issued on 12 July 2012. All relevant regulatory requirements and the findings from the consultation program undertaken for the Project have also been considered in its preparation.

The Project as designed, after considering all options, will maximise the continued social and economic benefits from the extraction of this NSW government owned coal resource. At the same time it will minimise any impacts to the natural environment.

Further, the Project is consistent with the objects of the EP&A Act when its resultant social and economic benefits are weighed carefully against its predicted social and environmental costs.

When the management and mitigation measures committed to in this EIS are adopted, the residual environmental impacts of the Project are within acceptable limits. These impacts are justifiable when considered against the need for the Project and its social and economic benefits.

10.2 Approved Operations

In 1990, the NSW government called for expressions of interest from mining companies to develop the in-situ coal resource at Bengalla. BMC won this open and transparent tendering process.

Following a rigorous assessment process, Bengalla was granted planning approval in 1995 for the development of the Bengalla Coal Mine and in 1996 was granted a mining lease over the area. Mining operations commenced in 1998 with the first coal exported in 1999.

Bengalla is arguably considered one of the most technically advanced and productive coal mining operations in NSW with real time noise and air monitoring systems in place since 1999 and the first coal mine in Australia to gain EMS accreditation to ISO14001 standards. Since commencement of production in 1999, Bengalla has produced 78 Mt of thermal coal (BMC, 2012a) the majority of which is exported.

BMC has maintained a commitment to coexist within neighbouring agricultural enterprises since its approval in 1995.

Approximately 2,200 ha of the land not required for mining is used for agricultural purposes including dairying, cattle production and horse stud industries. The BMC has made a commitment to maintain the agricultural productivity of its land holdings which it has done since 1995. There are also a variety of agricultural enterprises present adjacent to the Project Boundary including grazing, dairying, equine industries, viticulture and an olive grove.

Approved mining operations at Bengalla are scheduled to continue until the expiry of the DA 211/93 in 2017. The Bengalla 1993 EIS recognised that significant coal reserves occur to the west beyond the 21 year mining extent as follows:

'The coal reserves continue to the west of the limit of excavation and beyond the edge of the Authorisation area. It is anticipated that these reserves will be mined by open cut methods in the future, subject to appropriate approvals'.

As such, approval of the Project will allow up to 316 Mt of ROM coal to continue to be mined at Bengalla, ensuring security of employment for the existing workforce and continuity of the socio-economic benefits currently experienced in the Hunter region, NSW and Australia. The Project will facilitate the recovery of a valuable coal resource in an area that has long been set aside for mining by the NSW government on land acquired by BMC for the specific purpose of the continuation of coal mining.

10.3 Project Need

10.3.1 Continued Employment and Social Benefits

During its operation, BMC has been a major employer of the local community, employing 358 full time equivalent workers of which approximately 46% reside in the Muswellbrook LGA; and 89% within the Muswellbrook, Upper Hunter and Singleton LGAs as at September 2011. A large proportion of the existing Bengalla workforce were employed as 'clean-skins' (i.e. workers without coal mining experience which BMC has afforded significant training).

Approved mining operations at Bengalla will continue until the expiry of DA 211/93 in 2017. The Project will allow mining to continue at Bengalla, ensuring security of employment for the existing workforce and continuity of socio-economic benefits for the Hunter Valley region, NSW and Australia.

The Project will facilitate the continuing recovery of a valuable coal resource in an area that has long been set aside for mining by the NSW government and acquired by BMC for the specific purpose of facilitating the continuation of mining at Bengalla.

Estimated total wages, in present value terms, is in the order of \$186 M with current wage payments in the order of \$124 M pa. Amounts paid to local contractors represent a major contribution to the local economy. Total rates and royalties paid to the Commonwealth and NSW State Government are in excess of \$509 M (present value) and \$778 M (present value) respectively.

BMC has worked in partnership with the local community in an endeavour to provide positive long term outcomes for the Hunter Valley region. Since operations commenced, BMC has directly contributed over \$700,000 to community based sponsorship programs. Additionally, the VPA between MSC and BMC allows annual funding of \$400,000 for the Bengalla Coal Community Fund, \$125,000 for Council Roads Maintenance Fund, \$15,000 to assist in employing a Council Environmental Officer and four apprentices each year.

Since commencement of production in 1999, the Coal & Allied Community Development Fund has contributed over \$11 M to projects aimed at providing benefits for the local community. Specific objectives have been identified based on an understanding of the local and economic environment, as well as through direct feedback from members of the community. Due to the quality of applications for funding, Coal & Allied has increased this voluntary funding commitment to \$4.5 M for the 2012 to 2014 period.

The Project maximises resource recovery and economic returns from capital invested in Bengalla and minimises environmental costs by utilising the existing infrastructure at Bengalla. The Project provides continuity for the existing workforce, services and supply contracts and maintains the beneficial social and economic interactions between Bengalla and the local community. The Project will not cause the community disruption and the environmental costs that would otherwise be associated with the establishment of a new mine.

10.3.2 Demand for Energy and Coal World

Bengalla primarily produces a high quality (12% to 13% ash content) thermal coal primarily used internationally for electricity generation. A relatively small amount of a lesser quality (approximately 27% ash product) steaming coal is also produced for the domestic electricity generation market. The average strip ratio at Bengalla is very low when compared to most other NSW open cut coal mines at approximately 3.5 bcm of overburden to each ROM t of coal recovered.

There is general acceptance, including from the United Nations sponsored International Energy Agency (2012) and Australian Energy Market Operator (2011), that there will be a continuing need for thermal coal to meet anthropological basic energy needs, in particular electricity generation (at least 1.7 per cent annual growth). International and local predictions are that the need for coal as a source of energy for electricity production will increase for some years to come, despite an expectation of an increase in energy generated by alternate sources.

Whilst there are steps being taken across the world to reduce the reliance on the use of fossil fuels generally, particular for electricity production, the forecasts are that increasing energy production from alternate energy sources (such as wind and solar) and energy saving actions will not match the anticipated increased demand for electricity particularly from the developing countries of south-east Asia, Africa and South America. The result will be an increase in demand for energy from coal over (at least) the next 20 years.

Whilst there is expected to be an increase in the contribution of alternate sources of energy in the form of wind and solar as well as the lesser greenhouse contributing natural gas it is predicted that a substantial source of the required energy will continue to come from the burning of coal.

Coal remains a highly sought after global energy source. The International Energy Agency of the United Nations (2012) acknowledges that coal has met nearly half of the rise in global energy demand over the last decade, growing faster even than total renewable. It is anticipated that the demand for world coal is set to rise to approximately 2020 with the key drivers being China and India.

The United States Energy Information Agency (2013) highlights that coal remains the largest source of electricity generation with consumption predicted to reach 14.7 quadrillion British Thermal Units in 2040. Although there is anticipated to be short term decline in the market share, coal production in the reference case increases by an average of 0.6 percent per year from 2016 through 2040 as a result of growing coal exports and increasing use of coal in the electricity sector as electricity demand grows and natural gas prices rise.

The United States Energy Information Agency predicts that world energy consumption will increase by 53 per cent from 2008 to 2035 from 505 quadrillion British Thermal Units in 2008 to 770 quadrillion British Thermal Units in 2035 (United States Energy Information Agency, 2011).

The International Energy Agency of the United Nations projects that the worlds demand for coal will increase at an average annual rate of 1.9% between 2007 and 2030. The share of coal-fired electricity generation is projected to increase from 42% in 2007 to 45% in 2030 (Geosciences Australia and the Australian Bureau of Agricultural and Resource Economics, 2010).

Australia

Coal's contribution to Australia's electricity generation was approximately 75% in 2007-2008, but is projected to decrease to 43% in 2029–30. Australia is fortunate in its relatively abundant quantities of energy sources in the form of coal, natural gas and even wind, solar and uranium. Australia has 8.9% of the world's recoverable coal reserves as compared to 27.6% by the United States, 18.2% by Russia, 13.3% by China and 7.0% by India (World Energy Council, 2010). Due to its relatively smaller population, Australia has the largest per capital coal reserves in the world and, unlike other jurisdictions, more coal than it needs for its own use.

Being a politically stable society with its coal reserves being close to the coast, Australia is currently a desirable low cost provider of coal to the world markets resulting in material economic benefits for Australia. With relatively stable agricultural production and diminishing manufacturing, mining (including coal mining) is increasingly important to Australia's economy and the maintenance of Australia's standard of living. In the 2010, and 2011 financial year, a national total of 405 Mt black coal was produced and after processing, 326 Mt of this coal was available for both domestic use and for export (ACA, 2013a).

NSW and the Hunter Coalfield

NSW's demand for electricity is met 89% from locally mined thermal coal. NSW has a recoverable coal resource of approximately 16,640 Mt (Montoya and Wales, 2011) of which currently some 157 Mt is produced annually. Of this, approximately 122 Mt is exported and 33 Mt is used domestically and primarily for electricity generation for the State (NSW Minerals Council Ltd, 2011).

In 2009 the known coal resource of the Hunter coalfield was 6,832 Mt, equating to approximately 41% of the NSW recoverable coal resource, of which 116.9 Mt was produced in that year (DTIRIS – DRE, 2011a). The majority of coal product from the Hunter coalfields is exported, with the remainder of the product used domestically and primarily for electricity generation (DTIRIS – DRE, 2011a). In NSW alone, coal accounts for approximately 90% of the State's energy production (ACA, 2013b).

In addition to the critical function of supporting the production of electricity the coal mining within NSW and the region provide significant economic contributions to their respective communities and underpin the economy of particularly NSW and the Hunter region.

10.3.3 Economic Benefits

The Australian and NSW economies are increasingly reliant on mining in a world that is experiencing and will continue to experience fiscal and economic challenges. The Project will result in material beneficial effects on the economies of Australia, NSW and the Hunter region. The economic consequences of the Project are assessed in **Appendix S** and discussed in **Section 8.15**.

The Project will facilitate the recovery of a valuable, export quality thermal coal. Thermal coal remains a highly sought after energy source in Asian countries, including Japan, Korea, Taiwan, China and India. These countries continue to be the world's largest coal importers and will largely account for the growth in total coal imports through to 2035 (International Energy Agency of the United Nations, 2012). This increasing demand supports the need for the Project and justifies further investment in the thermal coal mining industry.

To this end the Project will continue to:

- Assist Australia to continue to meet the international demand for thermal coal for at least the next 24 years, during which time it is expected that there will continue to be a strong world demand for coal for the purposes of generating electricity;
- Support Australia in maintaining its reputation as a consistent and reliable supplier of thermal coal to its existing and expanding markets; and
- Contribute materially to sustaining the Australian economy and maintaining the economic stability of NSW and the Hunter region.



The Project will deliver substantive socio-economic benefits to the Muswellbrook LGA but in doing so will create a need for additional supporting infrastructure and services. To this end, BMC is working with MSC with the view of revising the existing Bengalla VPA pursuant to Section 93F of the EP&A Act. The operational phase of the Project is expected to generate approximately 900 full time equivalent jobs in the local Muswellbrook LGA. On a regional basis (Muswellbrook, Upper Hunter and Singleton LGAs) the Project is expected to contribute approximately 1,745 annual direct and indirect jobs.

Additionally, should the Project be approved, BMC will implement the following strategies which will result in tangible social benefits to the Muswellbrook and its surrounding LGAs:

- The continued use of best endeavours to achieve the majority of its permanent workforce residing within the Muswellbrook, Upper Hunter and Singleton LGAs;
- A workforce recruitment strategy which addresses the needs of the semi-skilled and unskilled workforce which is available locally but will require on the job and more specific operator training;
- Continue to provide apprenticeships, traineeships and graduate placement programs to local Muswellbrook and surrounding LGA residents;
- Provide part time and/or flexible employment opportunities to encourage a higher rate of labour force participation;
- Encourage skilled partners of the incoming mining workforce to also relocate to the local area to skilled jobs that are required outside the mining industry; and
- Revise the existing VPA with MSC for the Project to provide contributions to address demands on local community infrastructure from the Project.

When the Project production costs (acquisition of affected land, opportunity cost of land, operating costs, environmental costs, decommissioning costs, etc.) are considered in the context of production benefits (revenues from production, residual values of land, etc.), the net production benefits of the Project accruing to Australia are approximately \$1,790 M.

The Project will deliver significant socio-economic benefits to the region and the State of NSW through the provision of employment, taxes and fees.

The Project is estimated to make up to the following contribution to the local economy:

- \$1,486 M in annual direct and indirect regional output or business turnover;
- \$789 M in annual direct and indirect regional value added;
- \$155 M in annual direct and indirect household income; and
- 1,745 direct and indirect jobs.

The Project is estimated to make the following contribution to the NSW economy:

- \$2,408 M in annual direct and indirect regional output or business turnover;
- \$1,223 M in annual direct and indirect regional value added;
- \$441 M in annual direct and indirect household income; and
- 4,868 direct and indirect jobs.

10.4 Project Development

10.4.1 Mine Plan Alternatives Considered

A number of options were developed and analysed with the primary objective being to develop a mine plan adhering to the principles of ESD whilst providing the best possible environmental, social, physical and economic outcomes for the Project.

Each of the alternatives investigated were refined according to the environmental impacts, the approvals required, operational practicality, timing and economic limitations. The various Project alternatives that were considered during this process are described below and will be described in detail in the EIS.

Option 1 – Do Nothing Approach

Under Option 1, Bengalla would cease operations in 2017. This would result locally in the loss of approximately 400 full time equivalent jobs and associated future employment opportunities. It would also lead to the loss of local socio-economic benefits created by Bengalla in addition to the loss of ongoing benefits and royalties and other payments to both the Federal and NSW State Government.

Option 2 – 24 Years at production of 10.7 Mtpa

Option 2 includes continuation of mining for a further 24 years at a maximum ROM coal production rate of up to 10.7 Mtpa. This would result in no additional increase in wealth generation and employment numbers and hence reduced economic and social flow on effects when compared to 15 Mtpa (Option 3).

Option 3 – 24 Years at 15 Mtpa down to the Basal Seam

Option 3 includes continuation of mining for a further 24 years at a maximum ROM coal production rate of up to 15 Mtpa however mining the entire coal resource down to the Ramrod Creek seam. This option would involve mining to a greater depth and would require the subsequent increase in height of the existing OEA above the current RL 270 m. Detailed mine planning has indicated that there are no economically viable coal seams available for extraction via open cut methods as proposed by the Project beyond the Edderton seam.

Option 4 – Continuation of Mining Retaining the Existing Bengalla Link Road

Development of a viable mine plan that does not impact on the Bengalla Link Road would result in the sterilisation of approximately 8 Mt of coal reserves and would impede the efficiency of the dragline strip operation.

Option 5 – Underground Operation

An assessment was undertaken of the underground mining potential of the resource proposed to be extracted via open cut methods in this EIS. The study concluded that the Edinglassie seam is the only seam currently capable of supporting large scale longwall mining and that the Edinglassie seam could not support a standalone underground operation at Bengalla under current market conditions.

Option 6 – Production Levels Greater than 15 Mtpa

Option 6 considered the development of a production levels greater than 15 Mtpa from Bengalla. High level studies revealed that the mining area is too confined to enable efficient operations and resource extraction to occur and as a result was not considered any further.

Option 7 – The Project

Option 7 represents the preferred Project for which Development Consent is sought, which includes the continuation of mining directly to the west for a period of 24 years at a maximum ROM coal production rate of 15 Mtpa achieved from Year 4 onwards.

Coal mining extraction is constrained by Wybong Road and Mount Pleasant Project to the north, Roxburgh Road to the west and alluvium associated with the Hunter River to the south.

The Project proposes to utilise largely established infrastructure, personnel and equipment currently employed at Bengalla. The Project is mostly within existing mining authorities held by and land owned by BMC. Further, this option, although increasing the socio-economic benefits to society does not proportionally increase the environmental impact envelope of the Project. In fact, due to mining efficiencies and better utilisation of existing infrastructure there is relatively little increased impact on the surrounding environment.

10.4.2 Dry Creek Reinstatement

Dry Creek is an ephemeral creek that generally only flows following periods of intense rainfall due to its relatively small catchment area. Dry Creek only occasionally holds small pools of water for a few days following rainfall events. Dry Creek drains to the Hunter River approximately 1 km south of the Project Boundary.

Dry Creek will be intercepted as mining progresses to the west. To maintain the ongoing safety of operations in the mining area, the construction of a water storage dam and temporary diversion of Dry Creek will be required to temporarily divert clean water around mining operations through the use of a pipe network. A permanent reinstatement of Dry Creek will be constructed using best practice engineering design to ensure its successful stabilisation following mining.

Since 2007, a range of engineering studies were undertaken to assess the feasibility of diverting the creek and to determine the preferred option from at least seven considered. Considerations were made in relation to environmental impacts, engineering and cost perspectives to determine the preferred reinstatement of Dry Creek as assessed in this EIS.

10.5 Environmental Impacts

The Project has been assessed based on a worst case scenario and assuming that operations will be undertaken at a maximum ROM coal production rate of 15 Mtpa, with all feasible and reasonable management and mitigation measures applied (as described in this EIS). The Project mine plan has been prepared to facilitate resource extraction and economic productivity within the constraints of the site and all relevant environmental impact criteria.

The environmental assessment of the Project has adopted the following general methodology:

- Considering the objects of the EP&A Act, including the principles of ESD and leading practice environmental and social standards (Section 5.2.1);
- Consultation with stakeholders to identify any additional issues to be addressed in this EIS (Section 6);
- Performing a Project risk assessment (Section 7);
- Undertake a detailed technical assessment to quantify potential environmental impacts with certainty (Section 8); and
- Develop environmental management and mitigation measures (Section 8 and Section 9).

Project impacts are outlined in Section 8 with the most significant environmental impacts (despite the application of all reasonable and feasible management controls) summarised below.

10.5.1 Amenity

Air Quality

The assessment determined that any impacts caused by construction activities would be short and sporadic and the total dust generated by construction is minor compared to operational dust emissions. As a result, construction activities are not expected to cause any discernible impacts above the predicted operational impacts.

Air quality modelling for the operational phase indicates that no exceedances of the TSP or Dust Deposition criteria are predicted at any private receptor (which does not currently have a right to acquisition upon request by a mining company). The cumulative annual average PM_{10} criterion is predicted to be exceeded at three private receptors (Receptors 106, 110N and 110S) (excluding 13 properties currently entitled to acquisition by another neighbouring mining development). At all 16 receivers, the annual average PM_{10} concentrations resulting from the Project alone are below the criterion. A total of six (excluding properties currently entitled to acquisition by another neighbouring mining development) private owned receptors are predicted to experience exceedances of the maximum 24-hour average PM_{10} criterion during the Project life. Of these a systematic exceedance (i.e. more than 5 days in any year) of the maximum 24-hour average PM_{10} is predicted at only one private receptor (Receptor 156C).

An additional five private properties owned by two landholders (Receptors 109 and 245/246/249/250) (excluding one property currently entitled to acquisition by another neighbouring mining developments) are predicted to experience exceedances of the PM_{10} annual average criteria over greater than 25% of vacant land in a single, contiguous ownership.

In summary the Project will impact on four private receptors (Receptor 106, 110N, 110S, 156S) and six private properties owned by three landholders (Receptors 109, 111 and 245/246/249/250) that are not entitled to acquisition upon request by another neighbouring mining development.

No privately owned receptors are predicted to experience annual average $PM_{2.5}$ concentrations above the advisory reporting standard of $8 \mu g/m^3$. No exceedances of the advisory reporting standard for the maximum 24-hour average $PM_{2.5}$ concentration are predicted to occur at privately owned properties which do not have a right to acquisition upon request.

An assessment of fugitive fume and particulate matter emissions from blast activities determined that blasting at 7:00 am, 4:00 pm and 5:00 pm has the potential to result in blast fume impacts. With consideration of the existing stringent and proposed blast management practices, no blast fume impacts are expected to occur at private receptors.

BMC will implement real-time dust monitoring and management

system for the Project including a predictive meteorological forecasting system. BMC will also update its existing Air Quality and Greenhouse Gas Management Plan to minimise and manage air quality impacts associated with the Project.

Noise

Despite BMC continuing to implement best practice noise management and mitigation measures for the Project, noise modelling indicates that a significant noise impact (greater than 5 decibels above the intrusive criteria) is predicted to occur at six private receptors (110N, 152, 153, 154, 156E, and 156S) owned by five landowners that are not currently subject to acquisition by other mining companies upon request of the landowner.

An additional 11 private receptors (105, 106, 108, 110S, 126N, 146, 156W, 161, 186N, 180 and 184) owned by nine landowners would be moderately affected (between 2 - 5 decibels above the intrusive criteria) by the Project under a worst-case noise modelling scenario. A total of 12 private receptors have been predicted to experience mild noise impacts (between 1 - 2 decibels above the intrusive criteria) from the Project.

There are two additional properties (111 and 211) predicted to experience a significant noise impact from the Project in one or more modelled years over more than 25% of vacant land in contiguous landownership that is not currently subject to acquisition by another mining company on request.

BMC will revise the existing real-time monitoring and management system for the Project to include a predictive meteorological forecasting system. BMC will also update its existing Noise Management Plan to minimise and manage noise impacts associated with the Project.

Visual

Since operations commenced at Bengalla in 1998, BMC has established the Main OEA to provide a barrier to sensitive public viewing locations east of Bengalla. The Approved Bengalla Mine, as part of the Mine and Industrial Uses VCU is currently a visible part of the landscape in this locality. The Project will continue to progress in a westerly direction as operational areas continue for the Project and the height of the Main OEA will not increase above the currently approved maximum elevation of RL 270 m.

Private sensitive receptors are primarily located to the east and west of the Project. The Visual Impact Assessment determined that visual sensitivity of the Project from Northern and Southern View Sectors would be low to moderate due to a number of factors including existing land use, distance from the Project, the already established Main OEA and continued westerly progression of mining. Areas associated with the eastern and western VCUs including Ironbark Road, Racecourse Road and Roxburgh Road were assigned a high sensitivity as a result of their elevation and proximity to the Project.

Throughout the life of the Project, the progressive rehabilitation of the Main OEA will provide for the most significant element in relation to visual effects and impacts on the surrounding landscape. The eastern face of the main OEA will be revegetated with higher density natural woodland. This will decrease the visual contrast of the operation to the existing landscape in addition to rehabilitation strategies that emulate patterns, shapes, line and colour of the existing landscape.

Various onsite and offsite mitigation measures are proposed to reduce the visibility of the Project to sensitive receivers. The final design and for the rehabilitation of the final landform will be developed in consultation with relevant visual specialists and included in the revised Rehabilitation Management Plan and Landscape Management Plan.

10.5.2 Aboriginal and Historic Heritage

A total of 263 Aboriginal archaeological sites within the Disturbance Boundary will be directly impacted by the Project. These comprise 259 artefact scatters and isolated finds, three potential scarred trees and one remnant quarry site (where no Aboriginal heritage items have been previously recorded).

The 26 sites within the Project Boundary but outside the Disturbance Boundary will not be impacted as a result of the Project and will be protected.

To manage and account for impacts to Aboriginal archaeological and cultural heritage, BMC will update its existing ACHMP that will detail the appropriate salvage methodology and long term management options for remaining artefacts in consultation with Aboriginal stakeholders and relevant regulators.

There are five historic sites within the Project Boundary and a further six items with potential historic heritage significance adjacent to the Project Boundary. The Project will directly impact on three historic heritage sites, with House Sites 1 and 2 assessed as having no heritage significance. The Stockyard has been determined to be of local significance and an archival recording will be undertaken of this site.

Both the direct and indirect impacts associated with the Project will continue to be managed through a revised European Heritage Management Plan in consultation with relevant regulators for the Project.

10.5.3 Ecology

A total of 12 vegetation communities were identified within the Project Boundary of which three are listed as CEEC under the EPBC Act and six are listed as EEC under the TSC Act. One flora species listed as Vulnerable under the EPBC Act with a further one flora species listed as an Endangered Population under the TSC Act were identified in the Project Boundary.

Eight fauna species all listed as Vulnerable under the TSC Act was recorded within the Project Boundary. Although not recorded during field surveys, a number of other fauna species listed as threatened or migratory under the TSC Act and/or the EPBC Act are considered to have potential to occur.

The Project will disturb a total of 950 ha of native vegetation consisting of 554 ha of vegetation communities (the majority of which is derived native grassland) listed under the EPBC Act and / or the TSC Act.

A biodiversity offset strategy has been formulated to compensate for ecological impacts of the Project that will achieve a net gain in biodiversity in the bioregion in the long term. Offsets will be sourced in accordance with the planned Upper Hunter Strategic Assessment which involves the development of a Biodiversity Plan which identifies impacts and likely offset requirements for participating mining companies in the Upper Hunter. Participating Companies will be able to contribute to the Upper Hunter Offsets Fund (established under the Environmental Trust) to satisfy any offset requirements that are imposed as a condition of approval.

The ToR associated with the Upper Hunter Strategic Assessment were recently publicly exhibited on the DP&I website with comments due on 5 July 2013. Following the exhibition period, the ToR will be agreed between the NSW and Commonwealth Governments. It is currently anticipated that a final Upper Hunter Biodiversity Plan is to be completed by 31 December 2013.

The Upper Hunter Strategic Assessment process provides two avenues for projects to progress to enable projects. It is anticipated that BMC will follow the Path 1 process requiring approval to clear before the Draft Biodiversity Plan has been released for public exhibition. In this case approvals by NSW and the Commonwealth may be issued on a case by case basis and conditioned to cover any uncertainties about expected outcomes of the Biodiversity Plan and the proposed offset fund.

The Upper Hunter Strategic Assessment is intended to satisfy both Commonwealth and State biodiversity impact assessment requirements and utilises the BCAM as the key assessment tool. The Upper Hunter Biodiversity Plan has been developed and is currently being finalised by OEH and DP&I in consultation with SEWPac and is expected to comply with the current principles for offsetting set out by SEWPac's *Environmental Offsets Policy* (SEWPac 2012) and the OEH *Principles for the Use of Biodiversity Offsets in NSW* (DECC, 2008a).

BMC intends to provide a contribution under this Plan to the Upper Hunter Offset Fund (to be set up under the NSW Environmental Trust and managed by the OEH on behalf of the Trust) that will be used to secure sufficient offset land and contribute to the cost of its ongoing management.

This contribution will provide for offsets to compensate for the direct removal of 950 ha of vegetation, including 881 ha of native vegetation, including woodland, forest and Box Gum Woodland. Contributing to the Fund will fulfil BMC's statutory offsetting requirements.

The offset funding will meet state and federal ecological objectives by conserving offset land in perpetuity, managing strategically located land to high ecological standards and restoring the condition and/or extent of terrestrial and aquatic habitats to ensure there is no net loss to biodiversity within the region.

Should the Upper Hunter Strategic Assessment not be established or not to BMC's satisfaction, the preparation of an alternative offset strategy would be conducted in consultation with relevant regulators and will be completed within two years following the determination of Development Consent for the Project.

10.5.4 Soils and Agricultural Resources

BMC has a history of maintaining agricultural production on its lands with seven individual licensees currently operating a dairy, thoroughbred stud and brood mare farm, beef cattle breeding, lucerne hay and industrial hemp production. BMC will continue to implement the private licensing arrangements to ensure the ongoing success of agricultural enterprises on BMC land.

The land within the Disturbance Boundary lost to agricultural production represents a gross value of \$1.1 M pa. This equates to 0.36% of the total agricultural production of the Hunter Valley region, 0.014% of NSW and 0.003% of Australia. As such there will not be any material reduction in agricultural productivity of the Hunter Valley region or the State as a result of the Project.

Strategic Regional Land Use Plan Gateway Criteria

The Project is located adjacent to the Hunter River alluvial floodplain which is mapped under the criteria for BSAL. The SRLUP indicates that an area of approximately 28 ha of mapped BSAL falls within the Project Boundary (including the Approved Bengalla Mine). The consideration of the gateway criteria within this EIS draws from the reports of various technical specialists. The "Site Verification" concludes that there is 1 ha of verified BSAL within the Disturbance Boundary.

In order to verify the mapping associated with the Viticulture CIC as outlined in the SRLUP Appendix, the relevant criteria were investigated. The Soils and Land Capability Impact Assessment (to determine soil fertility and land capability) and the Groundwater Impact Assessment (to determine the extent of any alluvial aquifer) were investigated to determine if land within the Project Boundary conformed to the requirements of Viticulture CIC. These verification criteria in relation to determining the extent of Viticulture CIC are presented in Section 8.20.

Following the verification process, the Project Boundary contains 494 ha of Viticulture CIC that meets the criteria. The "Site Verification" conducted in accordance with the criteria described on page 84 (Appendix) of the SRLUP concluded that there is approximately 369 ha of the Viticulture CIC within the Disturbance Boundary. The area of verified Viticulture CIC is presented on **Figure 67**. The total area mapped as Viticulture CIC within region covers 107,135 ha. As a result, the area of verified Viticulture CIC within the Project Boundary and Disturbance Boundary represents 0.46% and 0.34% respectively of the total Viticulture CIC.

No existing vineyards occur within the Project Boundary and all land is owned by BMC (or another mining company). The nearest privately owned and operating vineyards are located approximately 12 km to the south-west, thus the Project was determined to have a minimal impact to the total land available for viticulture. In addition, as there is no discernible concentration of either viticulture or equine enterprises in proximity to the Project Boundary, the Project will have no impact on these CICs.

There is no land within the Disturbance Boundary which falls into the Equine CIC.

Benefit Cost Analysis

The direct annual output of the Project is estimated at \$1,174 M pa. In contrast, the direct annual output of the continued use of the agricultural lands and water for agricultural purposes that will be utilised by the Project is estimated at \$1.1 M pa. The direct and indirect regional employment provided by the Project will be up to 1,745 jobs compared to up to 1 agricultural-related job that would be foregone as a result of the Project.

Gillespie Economics also undertook a benefit cost analysis which included an estimation of the present value of production costs and benefits of the Project over a 24 year period. The present value of net production benefits of the Project to Australia are estimated at \$1,773 M (7% discount rate). In contrast, the present value of the continued use of the agricultural lands and water for agricultural purposes that will be utilised by the Project is estimated at \$12.5 M (7% discount rate). Based on these comparative values, the Project is considered to be a significantly more efficient land use than continued agricultural production.

10.5.5 Water Resources

Surface Water

The water balance model predicts that raw water will continue to be sourced from the Hunter River in all years of the Project. Under median conditions, the Project will require approximately 1,500 ML/year from external sources. BMC currently holds water access licences with a total share component of 1,449 High Security Units and 4,562 General Security Units. Under very dry conditions, the maximum external water requirement is predicted to be approximately 2,257 ML/year.

The peak operational water demand is expected to occur between Years 5 and 24, when the operation achieves the maximum production rate of 15 Mtpa ROM. Wherever possible, operational demands will be met using recycled water and water stored within the water management system, consistent with current practices. Raw water will only be extracted from the Hunter River when there is a water shortage on site and additional licences will be sought on an as need basis which will be primarily influenced by production levels.

BMC is licensed to discharge water under the HRSTS and EPL 6538. The results of the water balance indicate that under median rainfall conditions there is no requirement to discharge from the mine water management system. In addition, there is a 10% probability that more than 350 ML would need to be discharged from the mine water management system in any year up to a maximum of 1,000 ML (during extremely wet conditions). Under all rainfall scenarios, the amount of water that needs to be discharged by the Project increases significantly in Year 8. This is due to a large increase in the catchment area reporting to the water management system.

Due to the ephemeral nature of Dry Creek, controlled discharges are likely to occur when there is no flow in the creek. The existing operations at Bengalla have discharged water at up to the maximum flow rate. Therefore, the impacts on the condition of Dry Creek are not expected to exceed what is currently experienced.

Groundwater

The flow of Permian groundwater into the Hunter River alluvial aquifer is likely to be reduced by the cumulative impact of the Project, Mt Arthur Coal Mine and Mount Pleasant Project. The maximum reduction in groundwater flow to the alluvium is approximately 0.63 ML/day at the beginning of Year 1. The maximum annual reduction in flow to the alluvium is predicted to be 220 ML/day, occurring in Year 1. As mining moves away from the alluvium, the reduction in leakage decreases to approximately 0.25 ML/day. The maximum annual volume of groundwater inflow is predicted to be 365 ML/year which is predicted to peak in Year 2.

During the last 10 years of mining, the total volume of inflows is expected to be approximately 0.2 ML/day. Evaporative losses have been estimated at 0.3 ML/day. As a result, virtually no 'pumpable' inflows are expected during the last 10 years of mining. Mining at Bengalla will continue to advance in a westerly direction. As mining moves away from the Hunter River alluvium, the drawdown of the Hunter River alluvium will progressively decrease. By Year 4, the drawdown generated by the Project ceases to combine with the drawdown generated by Mt Arthur Coal Mine. The area of the Hunter River alluvium within the 1 m and 2 m drawdown contours will continue to decrease as mining progresses to the west.

Dry Creek does not intersect the water table and therefore does not have any baseflow. As a result, Dry Creek is not impacted by the depressurisation caused by the Project.

After the completion of mining, groundwater seepage from the overburden and the Permian strata will accumulate in the final void before stabilising at RL 30 m to RL 37 m after 1,000 years. This water level is significantly lower than the crest of the final void, making it very unlikely that the final void will overflow. The long term water level is also below the regional water table. The final void will behave as a "sink", which means that water will only flow into the void. Therefore, saline water will not flow from the void into the surrounding groundwater systems.

10.6 Consistency with the Objects of the EP&A Act

Section 5 of the EP&A Act describes its objects which are reproduced below followed by a consideration as to how the Project achieves these:

"To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment."

The Project will facilitate the environmentally acceptable recovery of an additional 316 Mt of ROM coal reserves within the Whittingham Coal Measures and the already established mining area will appreciate the existing infrastructure and workforce. The social and economic benefits of the Project will include the generation of up to 1,745 direct and indirect jobs for the local economy and have a net production benefit to Australia of \$ 1,790 M of economic activity.

At the same time, the Project will provide for the proper management of land owned by BMC and the establishment of a Biodiversity Offset Strategy to conserve forests and natural systems. The Project will not materially affect local surface water or groundwater regimes and through the additional employment generated will assist in sustaining the socio-economic viability of the nearby population, towns and the Hunter region. Mining developments are a major driver of development for towns and villages in regional areas.

The rehabilitation of the final landform will ensure that the agricultural resources will be reinstated to the same quality and capability as pre Project for future use.

"To encourage the promotion and co-ordination of the orderly and economic use and development of land."

The Project will result in the recovery of a valuable coal resource within NSW's identified coal reserves. The recovery of this coal resource as assessed in this EIS demonstrates that the Project can occur with identified, manageable and acceptable environmental and social impacts resulting in material social and economic benefit to NSW.

The mining land use will be the highest value land use available with the present value of net production benefits of the Project to NSW and Australia estimated at \$1,773 M (7% discount rate) as compared to the present value of the continued use of the same land and water resources for agricultural being \$12.5 M (7% discount rate).

The Project will generally stimulate the economy with regional spending for production related costs and with wages for labour which will also contribute to the regional economy.

"To encourage the protection, provision and co-ordination of communication and utility services."

The Project will expand utility services in the local area, improving the potential for increased connectivity by other users. The provision of services such as water, power and telecommunications to this location is already in place as part of the Approved Bengalla Mine. The Project will not threaten or diminish any existing communication and utility services.

"To encourage the provision of land for public purposes."

The Project will result in the establishment of a Biodiversity Offset Strategy which will include the conservation, restoration and rehabilitation of lands in accordance with the Upper Hunter Strategic Assessment. These areas will be set aside for scientific and conservation purposes in perpetuity.

"To encourage the protection, provision and co-ordination of community services and facilities."

The net economic benefit of the Project will encourage and support the provision and co-ordination of community services and facilities to the Hunter region. In particular, the Project

will also generate an estimated \$778 M (present value) in royalties, which will be used by the State government to provide community services and facilities across NSW.

The Project will also implement a revised VPA, which is being developed in consultation with MSC for the ongoing provision of community services, facilities and other local infrastructure commensurate with the impacts of the Project.

"To encourage the protection of the environment, including the protection and conservation of native animals and plants, including the Threatened species, populations and ecological communities and their habitats."

The Project will result in the loss of CEEC, EEC and some habitat relied upon by threatened species. In order to compensate for these impacts, BMC will participate in the Upper Hunter Strategic Assessment which will provide a contribution to the Upper Hunter Offset Fund (to be set up under the NSW Environmental Trust and managed by the OEH on behalf of the Trust) that will be used to secure sufficient offset land and contribute to the cost of its ongoing management. This cost will provide for offsets to compensate for the direct removal of 950 ha of vegetation, including 881 ha of native vegetation, including woodland, forest and Box Gum Woodland. Contributing to the Fund will fulfil BMC's statutory offsetting requirements.

"To encourage ecologically sustainable development."

The Project has been developed through a comprehensive planning, stakeholder engagement and environmental assessment process to ensure that the principles of ESD are addressed. The Project has been determined by a careful consideration of the alternatives. The impacts of the Project have been predicted with certainty in a detailed assessment process outlined in this EIS. Management measures to address the impacts that will occur have been incorporated into the Project as required, thus addressing the Precautionary Principle.

The environmentally optimised recovery of the in situ coal resource and the establishment of the Biodiversity Offset Strategy address the principles of Intergenerational Equity and Improved Valuation. The Biodiversity Offset Strategy proposed for the Project also addresses the principle of the Conservation of the Biological Diversity and Ecological Integrity.

The Project is consistent with the principles of ESD as discussed further in **Section 5.2.1**.

"To encourage the provision and maintenance of affordable housing."

The revenues for the NSW government generated through mining royalties will assist the government in the provision and maintenance of affordable housing.

"To promote the sharing of the responsibility for the environmental planning between the different levels of government in the state."

The stakeholder engagement process undertaken during the preparation of this EIS included ongoing consultation with State government agencies and the relevant Local governments (MSC). Further details of consultation with government stakeholders are provided in **Section 6**.

"To provide increased opportunity for public involvement and participation in environmental planning and assessment."

Section 6 describes the stakeholder engagement process relied upon during the preparation of this EIS. This process was extensive and hence fulfils this objective of the EP&A Act.

10.7 Consistency with the Principles of ESD

The objects of the EP&A Act adopt the principles of ESD in the application of the Act. The principles of ESD are also articulated in Section 6 (2) (a) of the *Protection of the Environment Administration Act 1991* where it is stated that "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: ..."

The Principles of ESD are listed below with a summary of how the Project seeks to address each.

10.7.1 Precautionary Principle

The precautionary principle is "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. In the application of the precautionary principle, public and private decisions should be guided by:

- (i) "careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment and
- (ii) an assessment of the risk-weighted consequences of various options..."

Adherence to the precautionary principle requires avoiding serious or irreversible environmental damage by properly assessing potential impacts and taking the necessary mitigation measures. This EIS identifies, with certainty, all environmental impacts from the development of the Project, which has been designed to avoid serious or irreversible environmental damage.

To ensure this, actions involving unquantifiable and unacceptable environmental consequences have been avoided. Environmental consequences have been assessed on a 'worst case scenario' basis, where if potential serious or irreversible damage was identified, an appropriate re-design of the Project was implemented to avoid those consequences. Additionally, this EIS adopted a risk-based approach to assessment whereby key aspects of the Project with the highest risk profile have been peer reviewed by authoritative experts to ensure certainty over the predicted impacts of the Project.

10.7.2 Intergenerational Equity

This principle requires "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".

The Project design, determined through the examination of the alternatives along with the commitments to environmental management systems and the management and mitigation measures, will operate to ensure that there is no significant effect on the environment as a result of the Project which would diminish the health, diversity or productivity of the environment for future generations. The cost of environmental effects will be borne through the Project life and will not be left to be borne by future generations.

Cumulative air and noise modelling presented in this EIS is conservative in that it has included indicative mine plans operating in conjunction with the Project for the Mount Pleasant Project and Mt Arthur Coal Mines, the planning approvals for which cease in 2020 and 2026 (underground until 2030) respectively. Should further approvals not be granted or delayed for these operations, cumulative impact predictions in this EIS would be significantly less.

Long term ecological conservation areas will be established for the Project as part of the Biodiversity Offset Strategy. Expert peer review of key scientific studies have confirmed with certainty that the Project will not measurably impact on the productivity of the region's groundwater resources.

10.7.3 Biodiversity Conservation

This principle requires the "conservation of biological diversity and ecological integrity - namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration" of any development proposal.

The Project is bounded by the Approved Bengalla to the east, Wybong Road in the north and existing infrastructure and the Main Northern Rail line to the south. The coal resource is directly below flora and fauna habitats, west of the current operation and changes to mine plans are highly impractical to attempt avoidance. Therefore, due to the nature of the Project it is not possible to completely avoid the identified impacts to flora and fauna.

However, subject to appropriate legislation, the participation of BMC in the Upper Hunter Strategic Assessment demonstrates adherence to this principle. These actions will ensure that the Project will not threaten the preservation of biodiversity and ecological integrity of the area and that the biodiversity and ecological value of the area is maintained and potentially improved in the long term.

10.7.4 Improved Valuation

This principle addresses “improved valuation, pricing and incentive mechanisms” —namely that environmental factors should be included in the valuation of assets and services, such as:

- (i) *“polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
- (ii) *the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
- (iii) *environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.”*

Since BMC will be a producer of coal, only the ‘polluter pays principle’ is applicable through:

- The requirement to obtain WALs in accordance with the relevant WSP to ensure water extraction limits are not exceeded;
- Capital investment in the acquisition of offset lands under the Upper Hunter Strategic Assessment and the establishment of rehabilitation programs to protect and enhance local and regional ecological biodiversity values;
- Establishment of the perpetual protection of the offset lands via the Upper Hunter Strategic Assessment;
- The maintenance of an EPL under the POEO Act; and
- Direct payments to the Commonwealth government in accordance with requirements of the Carbon Tax.

BMC also accepts the cost of mitigation measures designed to reduce impacts, such as air quality management and dust suppression and as such abides by this principle to the extent that it is applicable.

10.8 Matters for Consideration Under Section 79C of EP&A Act

The Minister for Planning and Infrastructure (or delegate) is to take into consideration the following matters in Section 79C of the EP&A Act as are of relevance to the Project:

“(a) *the provision of:*

- (i) *any environmental planning instrument and*
- (ii) *any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Director-General has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved) and*
- (iii) *any development control plan and*
- (iiia) *any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F and*
- (iv) *the regulations (to the extent that they prescribe matters for the purposes of this paragraph) and*
- (v) *any coastal zone management plan (within the meaning of the Coastal Protection Act 1979), that apply to the land to which the development application relates,*
- (b) *the likely impacts of that development, including environmental impacts on both the natural and built environments and social and economic impacts in the locality,*
- (c) *the suitability of the site for the development,*
- (d) *any submissions made in accordance with this Act or the regulations,*
- (e) *the public interest.”*

The sections below describe how this EIS has addressed each in relation to the Project.

10.8.1 Permissibility and Planning Controls

The Project is located entirely within the Muswellbrook LGA. The majority (66%) of the land within the Project Boundary is zoned as “RU1 Primary Production” under the Muswellbrook LEP. The majority of the remaining land is zoned as “E3 Environmental Management” with lesser amount of land zoned “SP2 Rail Infrastructure Facilities”.

The land use table in the Muswellbrook LEP provides that open cut mining is permissible with Development Consent in zone RU1. Therefore, mining is permissible with Development Consent on all land within the Project Boundary on which mining or mining operations would occur. The land within the Project Boundary which is zoned SP2 would contain only the rail infrastructure which is part of the Approved Bengalla Mine or “*development ordinarily incidental or ancillary to...*” rail infrastructure facilities which, under the Muswellbrook LEP is permissible in that zoning. Therefore, the provisions of section 89E do not prohibit the development.

The Muswellbrook LEP provides that development for the purposes of “extensive agriculture” is permissible within zone E3. By virtue of clause 7(1)(b)(i) of the Mining SEPP, mining is also permissible within zone E3. This is inconsistent with the land use table in the Muswellbrook LEP. Clause 5 of the Mining SEPP states that where there is an inconsistency between the SEPP and another EPI, the SEPP will prevail to the extent of the inconsistency. Therefore, the Mining SEPP will override the Muswellbrook LEP, resulting in mining being permissible in zone E3. The land use table in the Muswellbrook LEP provides that open cut mining is permissible with Development Consent in zone RU1. Therefore, mining is permissible with development consent on all land within the Project Boundary and the provisions of section 89E do not prohibit the development.

Section 93F enables a VPA to be established which may replace the imposition of a condition under Section 94 or Section 94A. BMC has commenced discussions with MSC in relation to updating the existing VPA to meet the required contributions in relation to the Project under Division 6 of Part 4 of the EP&A Act.

This EIS has been prepared in accordance with Part 2 of Schedule 2 of the EP&A Regulation as shown in **Section 6.4.1**. Detailed design as required under Schedule 1 of the EP&A Regulation is provided in **Appendix C**. DGRs were issued for the Project under Part 2 of Schedule 2 of the EP&A Regulation on 13 March 2012 (with supplementary DGRs issued 30 April 2012). **Section 6.4.1** lists each DGR and indicates where each is addressed in this EIS.

10.8.2 Natural and Built Environment Impacts

This EIS provides a detailed assessment of identified potential impacts on the natural and built environments. **Section 8** provides a summary of the predicted impacts associated with the Project. The Project design minimises the environmental impacts to the natural and built environment whilst maximising resource recovery.

10.8.3 Site Suitability

The Upper Hunter region has a long history of rural land use for a variety of agricultural and industrial activities, predominantly coal mining and grazing. The dominant land uses within and adjacent to the Project Boundary include open cut coal mining (Mount Pleasant Project to the north, Mt Arthur Coal Mine to the south, Xstrata Mangoola to the further west and the West Muswellbrook Coal Assessment Lease immediately west). The Project is not likely to have a significant impact regarding land use trends or be incompatible with any of those existing, approved or likely preferred uses of land surrounding the Project Boundary.

The Project will largely rely upon the currently approved and constructed mine site infrastructure including the CHPP, rail loop and loading facility, workshop and administrative buildings. All land within the Project Boundary is owned by BMC (with minor areas owned by another coal mining company). Existing coal authorisations exist over the entire Project Boundary.

Coal mining operations at Bengalla have occurred since 1998. The Bengalla 1993 EIS recognised that significant coal reserves occur to the west beyond the 21 year mining extent of that approval. The Project will facilitate the recovery of a valuable coal resource in an area that has long been set aside for mining by the NSW government on land acquired by BMC for the specific purpose of the continuation of coal mining.

A significant buffer of approximately 2 km exists to the closest private landholder, located to the west of the Disturbance Boundary. The closest private landholder to the east, towards the township of Muswellbrook is over 2.5 km from mining in Year 1 of the Project. The Project is therefore consistent with the surrounding land use and is suitable to the continuation of coal mining and related activities.

10.8.4 Submissions

It is assumed that the Minister will consider any submissions made in accordance with the EP&A Act or the EP&A Regulation.

10.8.5 Public Interest

On the basis of this EIS which has quantified the Project's social and environmental impacts with a high degree of scientific certainty, it is available to conclude that the Project is consistent with the objects of the EP&A Act, the principles of ESD and that the economic and social benefits of the Project outweigh its social and environmental costs. As such, it may be concluded that the Project is in the public interest.

10.9 Conclusion

The Project has been rigorously environmentally assessed in accordance with the EP&A Act, its 'objects', including the principles of ESD and by processes and in the manner required by the DGRs. This EIS has concluded that the Project should be approved under the EP&A Act.

There are environmental costs, which have been identified and which are capable of being acceptably managed by operational controls, land acquisition and management plans that would be established and adopted as approved by the Director-General of Planning & Infrastructure and appropriate other government agencies and authorities. Ecological and long term costs have been minimised and will be accounted for by management strategies to maintain and improve vegetation and ecological values in the long term. The Project will maximise the economic and social value from the remaining coal resource by a mine plan that will appropriately address the environmental and socio-economic constraints and the objects of the EP&A Act, including the principles of ESD.

The Project will provide net production benefits to Australia of \$1,790 over the 24 year Project life and will:

- Maximise the recovery of a high quality, thermal coal resource for which there is an increasing global demand;
- Create approximately 1,745 (direct and indirect) jobs in the regional economy;
- Create approximately 4,868 (direct and indirect) jobs in NSW
- Continue and extend financial support to the region, NSW and Australia with taxation and royalty benefits of \$1,278 M over the Project life; and
- Achieve the most efficient economic use of the land.

It has been demonstrated that the Project represents a low strip ratio, low ash content product which will continue to provide thermal coal for current and future generations and will generate significant economic benefits in the process. The Project's social and environmental impacts have been minimised as far as practicable by implementing all reasonable and feasible management and mitigation measures. As a consequence, the socio-economic benefits of the Project will outweigh its social and environmental costs. Therefore, the Project is in the public interest.





11

Abbreviations

Table 103 provides a list of abbreviations used in this EIS.

Table 103 Abbreviations

Abbreviation	Description
µg	Microgram
µm	Micrometre
µS	Microsiemens
ABA	Acid Base Account
ACCC	Australian Competition and Consumer Commission
Aboriginal Consultation Guidelines	<i>Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010</i> (DECCW, 2010a)
ACHMP	Aboriginal and Cultural Heritage Management Plan
ACDF	Aboriginal Community Development Fund
AECOM	AECOM Australia Pty Ltd
AGE	Australasian Groundwater and Environmental Consultants
AIP	<i>Aquifer Interference Policy</i> (NOW, 2012)
AIS	Agricultural Impact Statement
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ANC	Acid Neutralising Capacity
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZECC Guidelines	<i>Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration</i> (ANZECC, 1990)
A	Authorisation
AL	Assessment Lease
ARTC	Australian Rail Track Corporation
ARI	Average Recurrence Interval
AS	Australian Standard
ASS	Archerfield Sandstone
AUSRIVAS	Australian River Assessment System
BCA	Benefit Cost Analysis
BCAM	Biodiversity Certification Assessment Methodology
bcm	Bank cubic metres
Bengalla 2008 EA	<i>Bengalla Mine Development Consent Modification Environmental Assessment</i> (Hansen Bailey, 2008)
Bengalla 2010 EA	<i>Bengalla Mine Development Consent Modification Environmental Assessment</i> (Hansen Bailey, 2010)
Bengalla 1993 EIS	<i>Environmental Impact Statement for the Bengalla Coal Mine</i> (Envirosciences, 1993)

Abbreviation	Description
Bengalla 2006 SEE	<i>Bengalla Mining Company Modifications to Mining Operations Statement of Environmental Effects</i> (Hansen Bailey, 2006a)
BMC	Bengalla Mining Company Pty Ltd
BMP	Biodiversity Management Plan
BoM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
CALMET	A diagnostic meteorological modelling system known as California Meteorological
CALPUFF	A dispersion model used to predict the maximum 24 hour PM ₁₀ , annual average PM ₁₀ , annual average TSP and annual average dust deposition
CCC	Community Consultative Committee
CEEC	Critically Endangered Ecological Community
CGE	Computable General-Equilibrium
CHPP	Coal Handling and Preparation Plant
CIC	Critical Industry Cluster
cm	Centimetre
UHCMA	Upper Hunter Catchment Management Authority
CO	Carbon monoxide
CO ₂ -e	Carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAA	Directly Affected Area
DA	Development Application
Dams Safety Act	<i>Dams Safety Act 1978</i>
dBA	The peak sound pressure level, expressed as decibels (dB) and scaled on the 'A-weighted' scale, which attempts to closely approximate the frequency response of the human ear
DCCEE	Federal Department of Climate Change and Energy Efficiency
DGRs	Director-General's Environmental Assessment Requirements
DP&I	NSW Department of Planning and Infrastructure (formerly Department of Planning, DIPNR, Planning NSW and DUAP)
Draft RING	<i>Draft Rail Infrastructure Noise Guideline</i> (OEH, 2012a)
DSC	NSW Dams Safety Committee
DSE	Dry Sheep Equivalent
DoS	Degree of Saturation
DTIRIS	NSW Department of Trade & Investment, Regional Infrastructure and Services (formerly I&I NSW)
DTIRIS - DRE	NSW Division of Resources and Energy (within the Department of Trade & Investment, Regional Infrastructure and Services)
E-BAM	A portable beta attenuation mass monitor used for the measurement of the mass concentration of dust particles
EC	Electrical Conductivity
eCEC	Cation Exchange Capacity
EEC	Endangered Ecological Community
Economic EIA Guidelines	<i>Draft Guidelines for Economic Effects and Evaluation in Environmental Impact Assessment</i>
EIS	Environmental Impact Statement
EL	Exploration Licence

Abbreviation	Description
EMP	Environmental Monitoring Program
EMS	Environmental Management System
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPI	Environmental Planning Instrument
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
ESP	Exchangeable Sodium Percentage
FEFLOW	A computer based modelling package that is capable of simulating two and three-dimensional, density coupled groundwater flow
GDE	Groundwater Dependent Ecosystem
GDP	Ground Disturbance Permit
GWh	Gigawatt hours
HIPAPs	Hazardous Industry Planning Advisory Papers (Guidelines for Hazard Analysis)
ha	Hectares
Hansen Bailey	Hansen Bailey Environmental Consultants
Heritage Act	<i>Heritage Act 1977</i>
HRSTS	Hunter River Salinity Trading Scheme
HSEQ	Health, Safety, Environment and Quality
Hunter REP	<i>Hunter Regional Environmental Plan 1989</i> (Heritage)
Hunter River WSP	<i>Water Sharing Plan for the Hunter Regulated River Water Source 2003</i>
Hunter Unregulated WSP	<i>Water Sharing Plan for the Hunter Unregulated and Alluvial River Water Sources 2009</i>
HVAS	High Volume Air Sampler
HVCCC	Hunter Valley Coal Chain Coordinator
HVEC	Hunter Valley Energy Coal Pty Ltd
ICNG	<i>Interim Construction Noise Guideline</i> (DECC, 2009)
INP	<i>NSW Industrial Noise Policy 2000</i> (EPA, 2000)
Interim Policy	<i>Interim Strategic Agricultural Land Policy for State Significant and Transitional Part 3A Mining and Coal Seam Gas Proposals in the Upper Hunter and New England North West Regions</i>
I-O	Input-Output (I-O) analysis
ISO	International Organisation for Standardisation
Kg	Kilogram
KLC	Kinetic leach column
km	Kilometres
kV	Kilovolt
kVA	Kilovolt-ampere
KW	Kilowatt
LA ₁	The noise level exceeded for 1% of the time
LA ₁₀	The noise level exceeded for 10% of the time
LA ₉₀	Commonly referred to as the background noise, this is the noise level exceeded for 90% of the time.

Abbreviation	Description
LA _{eq}	The summation of noise over a selected period of time. It is the energy average noise from a source and is the equivalent continuous sound pressure level over a given period
L	Litres
LEP	Local Environment Plan
LGA	Local Government Area
LOX	Limit of oxidation
LoS	Level of Service
LUDS	Muswellbrook Shire Council Land Use Development Strategy
m	Metres
M	Million
Mt Arthur Coal Mine	HVEC's Mt Arthur Coal Mine
Mbcm	Million bank cubic metres
mg	Milligram
ML	Megalitres
Mlcm	Million loose cubic metres
mm	Millimetre
MNES	Matters of Environmental Significance
MOP	Mining Operations Plan
MPA	Maximum Potential Acidity
MIA	Mine Infrastructure Area
MIC	Maximum Instantaneous Charge
Mining SEPP	<i>State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2011</i>
Mount Pleasant 2010 EA	<i>Mount Pleasant Project Modification Environmental Assessment Report (EMGA Mitchell McLennan, 2010)</i>
Mount Pleasant 1997 EIS	<i>Mount Pleasant Mine Environmental Impact Statement (ERM Mitchell McCotter, 1997)</i>
MSC	Muswellbrook Shire Council
Mt	Million tonnes
Mtpa	Million tonnes per annum
Muswellbrook LEP	<i>Muswellbrook Local Environment Plan 2009</i>
MW	Megawatt
NAF	Non Acid Forming
NAPP	Net acid producing potential
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NGA	National Greenhouse Accounts
NO ₂	Nitrogen dioxide
NOW	NSW Office of Water
NO _x	Nitrogen oxides
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NPC	Newcastle Port Corporation
NT Act	<i>Native Title Act 1993</i>
NV Act	<i>Native Vegetation Act 2003</i>

Abbreviation	Description
OEA	Overburden Emplacement Area
OEH	NSW Office of Environment and Heritage
OH&S	Occupational Health and Safety
OPSIM	A surface water computer-based simulation model.
PAC	Planning Assessment Commission
PAF	Potentially Acid Forming
PM ₁	Particulate Matter <1 micron
PM ₁₀	Particulate Matter <10 microns
PM _{2.5}	Particulate Matter <2.5 microns
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
PVC	Primary Visual Catchment
PVS	Peak Vector Sum
PVZ	Primary View Zone
PWCS	Port Waratah Coal Services
RAP	Registered Aboriginal party
RGS	RGS Environmental Pty Ltd
RL	Reduced Level
RMS	NSW Roads and Maritime Services
RNP	<i>NSW Road Noise Policy</i> (DECCW, 2011)
Roads Act	<i>Roads Act 1993</i>
ROM	Run of Mine
RTA	NSW Roads and Traffic Authority (abolished mid-2012, responsibilities transferred to NSW Roads and Maritime Services)
RTCA	Rio Tinto Coal Australia
RTEMS	Real Time Environmental Management System
SAL	Strategic Agricultural Land
SEPP	State Environmental Planning Policy
SEPP 33	<i>State Environmental Planning Policy 33 - Hazardous and Offensive Development Application Guidelines</i>
SEPP 44	<i>State Environmental Planning Policy 44 - Koala Habitat Protection</i>
SEPP 55	<i>State Environmental Planning Policy 55 - Remediation of Land</i>
SEWPac	Federal Department of Sustainability, Environment, Water, Population and Communities (formerly Commonwealth Department of Environment, Water, Heritage and the Arts)
SO ₂	Sulphur dioxide
SRD SEPP	<i>State Environmental Planning Policy (State and Regional Development) 2011</i>
SRLUP	<i>Strategic Regional Land Use Plan - Upper Hunter</i>
SSD	State Significant Development
t	Tonne
TDS	Total Dissolved Solids
TEOM	Tapered Element Oscillating Microbalance
The Project	Bengalla Continuation of Mining Project
ToR	Terms of Reference
tpa	Tonnes per annum

Abbreviation	Description
tph	Tonnes per hour
TSC Act	<i>Threatened Species Conservation Act 1995</i>
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
UHSA	Upper Hunter Strategic Assessment
US EPA	United States Environmental Protection Agency
VCU	Visual Character Units
VPA	Voluntary Planning Agreement
WAL	Water Access Licence
WLALC	Wanaruah Local Aboriginal Land Council
WM Act	<i>Water Management Act 2000</i>
WM Regulation	<i>Water Management (General) Regulation 2011</i>
WMS	Waste Management System
WRM	WRM Water & Environment
WSP	Water Sharing Plan
Xstrata Mangoola	Xstrata Mangoola Pty Limited
ZOA	Zone of Affection



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Study Team

Section	EIS Component / Role	Team Member and Company	
Project Management			
	General Manager	Dan Janney	Bengalla Mining Company
	Technical Services Manager	James Davison	
	Environmental Approvals Specialist	Craig White	
EIS Management			
	Project Director	Dianne Munro	Hansen Bailey
	Project Manager	Jason Martin	
	Project Coordinator	Andrew Wu	
	Advisor and Peer Review	James Bailey	
Stakeholder Engagement			
	Environmental Approvals Specialist	Craig White	Bengalla Mining Company
	Project Director	Dianne Munro	Hansen Bailey
	Project Manager	Jason Martin	
EIS Sections			
	Executive Summary	Dianne Munro and Jason Martin	Hansen Bailey
1	Introduction	Jason Martin	
2	Existing Environment	Jason Martin	
3	Approved Operations	Jason Martin	
4	The Project	Jason Martin	
5	Regulatory Framework	Dianne Munro	
6	Stakeholder Engagement	Andrew Wu	
7	Risk Assessment	Jason Martin	
8	Impacts, Management and Mitigation	Dianne Munro, Jason Martin, Joanna Graham, Andrew Wu, Elisabeth Webster, Dorian Walsh and Amy Porter	
9	Management and Monitoring Summary	Jason Martin	
10	Project Justification	Dianne Munro	
11	Abbreviations		
12	References		
13	Study Team		
Appendices			
Appendix A	Existing Development Consents		Hansen Bailey
Appendix B	Schedule of Land to which this EIS Applies		Hansen Bailey
Appendix C	Detailed Design Drawings		SKM
Appendix D	Regulatory Correspondence		Hansen Bailey
Appendix E	Stakeholder Engagement		Hansen Bailey
Appendix F	Revised Environmental Risk Assessment	Jason Martin and Kyle Prowse	Hansen Bailey

Section	EIS Component / Role	Team Member and Company	
Appendices cont'			
Appendix G	Air Quality and Greenhouse Gas Impact Assessment	Aleks Todoroski and Philip Henschke	Todoroski Air Sciences
Appendix H	Acoustic Impact Assessment	Mark Bridges	Bridges Acoustics
Appendix I	Visual Impact Assessment	John Van Pelt	JVP Visual Planning and Design
Appendix J	Surface Water Impact Assessment	David Newton and Tallulah Kaegi	WRM
Appendix K	Groundwater Impact Assessment	James Tomlin and Douglas McAlister	AGE
		Frans Kalf	Frans Kalf and Associates
Appendix L	Geochemical Impact Assessment	Alan Robertson	RGS Environmental
Appendix M	Aboriginal Archaeology and Cultural Heritage Impact Assessment	Geordie Oakes	AECOM
Appendix N	Historical Heritage Impact Assessment	Susan Lampard	AECOM
Appendix O	Ecological Impact Assessment	David Robertson	Cumberland Ecology
Appendix P	Stygofauna Impact Assessment	Peter Hancock	Eco Logical Australia Pty Limited
Appendix Q	Traffic and Transport Impact Assessment	Damien Chee	DC Traffic Engineering
Appendix R	Social Impact Assessment	Doug Martin	Martin and Associates Pty Ltd
Appendix S	Economic Impact Assessment	Robert Gillespie	Gillespie Economics
Appendix T	Preliminary Hazard Analysis	Elisabeth Webster	Hansen Bailey
Appendix U	Contamination Assessment	Dorian Walsh	Hansen Bailey
Appendix V	Soil and Land Capability Impact Assessment	Rhys Worrall and John Lawrie	GSS Environmental
Appendix W	Agricultural Impact Statement	Scott Barnett	Scott Barnett & Associates
Appendix X	Interim Dry Creek Diversion and Reinstatement Report	Cesar Martinez and Andrew Russell	Parsons Brinkerhoff
Legal Advice provided by Andrew White of Sparke Helmore Drafting and Graphics Design by: Hansen Bailey, Pegasus Technical Pty Limited and Greenpond TSG			