HUMECOAL
PROJECT

Hume Coal Project

Preliminary Environmental Assessment

Prepared for Hume Coal Pty Limited | July 2015

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Preliminary Environmental Assessment | Final

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Executive Summary

ES1 Background

Hume Coal Pty Limited (Hume Coal) proposes to develop and operate an underground coal mine and associated mine infrastructure (Hume Coal Project) in the Southern Coalfield of New South Wales (NSW). The Southern Coalfield has a long history of mining and a number of mines currently operating.

Hume Coal holds exploration Authorisation 349 (A349) approximately 100 kilometres (km) south-west of Sydney and 3 km west of Moss Vale, in the Wingecarribee local government area. Coal exploration and mining in the Moss Vale area dates back to the 19th century. Extensive exploration has been undertaken within A349 since the 1950s and the current exploration authorisation was granted in 1985. It was acquired by Hume Coal in 2010. The underground mine is proposed to be developed within part of A349 and associated surface facilities within and north of A349.

ES2 Evolution of the project

ES2.1 Research and design process

The project has been developed following several years of detailed geological, engineering, environmental, financial and other technical investigations to define the mineable resource, and to identify and address environmental and other constraints. Baseline environmental monitoring and surveys are near complete and, therefore, the existing environment is well understood.

Numerous alternative designs have been examined, all evaluated against the objectives of technical, financial and environmental optimisation. At any stage, if a project design could be significantly improved against any one of these objectives, the project was redesigned. Hume Coal understands the importance of protecting the environment and has therefore been working closely with environmental specialists to develop a project that avoids and/or minimises impacts. The company has also been engaging with the community and other interest groups, and this continues to provide valuable local knowledge to assist in project planning.

ES2.2 Leading practice measures and innovations

The process described above has allowed development of a well-considered, practical and economic project design that will enable resource recovery, while minimising environmental and social impacts and potential land use conflicts, and delivering socio-economic benefits to the local community. The project incorporates a number of leading practice innovations, some of which set a new benchmark for underground coal mining in NSW. These measures go beyond those required to comply with regulatory standards. For example, the rail wagons used to transport product coal off-site will be covered and all coal reject material (the stone that is separated out of the coal during processing), will be returned underground to partially backfill the mined-out void and reduce visual and other environmental impacts.

To minimise environmental impacts, Hume Coal has devised a distinctively innovative ‘non-caving’ coal extraction method (akin to first workings) which will have negligible subsidence impacts and will, therefore, protect the overlying aquifer and surface features. The strata overlying the mine will remain intact and supported, rather than collapsing into the mined-out void and causing subsidence, as occurs at mines that use ‘caving’ systems. By avoiding disruption to the overlying strata, associated groundwater impacts will also be minimised. A combination of innovative engineering solutions is proposed to achieve this and further mitigate impacts, including:

- A system of engineered coal pillars will be left in place, designed to provide long-term stability to the overlying strata. This will also ensure void spaces are kept open, so that they can be partially backfilled with the coal reject material, thus avoiding the need for permanent surface emplacement areas.

- Each panel will be sealed immediately after extraction and backfilling. This will allow groundwater to recover and fill the voids, further enhancing pillar stability factors, albeit that the system is designed to be long-term stable with or without backfill and sealing. Sealing the panels will also minimise groundwater inflows to the active mine workings.

To avoid any perception that primary dwellings or the Hume Highway could be affected by future, long-term ground movements, no mining will occur beneath these features, other than development of underground roadways required for access. The only exception would be if an agreement was entered into with a landowner.

Surface infrastructure is proposed to be developed on predominately cleared land owned by Hume Coal, or for which there are appropriate access agreements in place with the landowner, at sites that are relatively free from environmental and other constraints. The design integrates with the existing topography and landform and is set back from sensitive receptors where possible, to minimise the potential for visual, noise, dust and amenity impacts.

Particular emphasis has been given to maximising the project's direct benefits to the local community. The project therefore includes initiatives such as local apprenticeship, training and community investment programs, which have already commenced, as well as policies to maximise recruitment of locals and use of local businesses. This includes a policy for all operational employees to live within the Southern Highlands region and immediate surrounds (within a 45-minute commute of the mine).

ES2.3 Outcome

The objective of the planning and design process has been to determine the most appropriate method for the efficient and economic extraction of the coal resource in a way that minimises adverse impacts to the environment and community, and delivers socio-economic benefits to the local community. The resulting project design addresses all constraints, is practical and cost efficient, and maximises opportunities for local business participation.

The site is well suited to the proposed development, given the presence of an economic coal resource and its proximity to key services and infrastructure, particularly rail infrastructure and Port Kembla. Resource extraction in the manner proposed avoids land use conflicts by allowing continuation of the existing land uses at the surface. It also avoids impacts to significant environmental features, which in any case are limited in the locality.

ES3 Project description

The Hume Coal Project involves:

- Exploration and resource definition activities, along with geotechnical and engineering testing and fieldwork to facilitate detailed design.
- Development and operation of an underground coal mine over an approximate 22 year-period, which extracts approximately 50 million tonnes of coal from the Wongawilli Seam, followed by a closure and rehabilitation phase of nominally two years. Low impact mining methods will be used which will have negligible subsidence impacts.
- Production of nominally up to three million tonnes per annum of metallurgical and thermal coal for international and domestic markets.
- Construction and operation of associated mine infrastructure, including:
    - mine access and ventilation systems and shaft(s);
    - a Mine Infrastructure Area (MIA), including administration, workshop and other facilities;
    - water management and treatment facilities;

  - coal handling and preparation plant;
  - overland conveyors;
  - rail load-out facilities;
  - communications and electricity reticulation infrastructure; and
  - environmental management and monitoring equipment.
- Coal reject emplacement underground, in the mined-out voids.
- Peak workforces of approximately 400 full-time equivalent employees during construction and approximately 300 full-time equivalent employees during operations.
- Once mining is completed, decommissioning mine infrastructure and rehabilitating the area so that it can support land uses similar to current land uses.

Product coal will be transported by rail to domestic markets or to Port Kembla for shipment to domestic or international markets. Rail works and use are the subject of a separate development application.

The large investment proposed to construct and operate the project will provide substantial economic stimulus and benefits to the Australian, NSW and local economies.

ES4 Stakeholder engagement

Hume Coal has been consulting and engaging with stakeholders since 2011, when its exploration program began. This will continue during preparation of the environmental impact statement (EIS) and the project's development, construction, operation and closure phases. Hume Coal has focused on ensuring stakeholders are informed about the project, built relationships and sought feedback in order to address their views in the project's planning, design and environmental assessment. Community consultation will continue to be key to mine planning and understanding the project's role within the local community.

Feedback to date indicates that many local community members recognise the project's potential to make positive economic and employment contributions. The importance of ensuring benefits go to local people has been emphasized. Key community concerns include potential impacts to water resources and agriculture, and potential traffic, noise, air quality and general nuisance impacts, as well as contributions to greenhouse gas emissions. Hume Coal is proactively addressing these matters and will continue to keep the community informed as results come to hand.

ES5 Approval process and this document's purpose

The project requires approval under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Concurrent with lodging this document, a referral is being made to the Commonwealth Department of the Environment to determine whether or not approval is also required under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

An EIS is a requirement of the approval process. Before preparing an EIS, a request for environmental assessment requirements (terms of reference for the EIS) must be made to the Secretary of the NSW Department of Planning and Environment (DP&E). This document accompanies Hume Coal's request for environmental assessment requirements. Its purpose is to brief government agencies, the community and other stakeholders about the project, identify the key matters which will be addressed in the EIS and describe the proposed assessment methodologies.

It is noted that under provisions of the NSW Environmental Planning and Assessment Regulation 2000, a gateway certificate or a site verification certificate (SVC) is needed before the project's development application can be lodged, depending on whether or not it is to be developed on 'strategic agricultural land'. The Hume Coal Project is not being developed on strategic agricultural land and therefore a SVC is needed, certifying that the land is not biophysical strategic agricultural land. An application for a SVC is being made to DP&E accordingly.

ES6 Matters for consideration in the EIS

The EIS will describe the project in detail, along with its potential environmental, social and economic effects. Importantly, it will also describe the measures to be implemented to enhance the project's benefits and mitigate and manage any impacts. The EIS will be prepared in accordance with relevant guidelines, policies and assessment requirements issued by DP&E. This document includes a preliminary assessment of environmental, social and economic attributes and identifies and prioritises matters for detailed assessment in the EIS.

A key matter to be addressed in the EIS is water management. There will be groundwater inflows to the mine and associated temporary drawdown in groundwater levels, which require management and mitigation to address potential impacts such as to groundwater users. The mine plan has been designed to minimise these impacts as much as is practically possible and additional mitigations are currently being investigated which will be detailed in the EIS. For example, in accordance with the NSW Aquifer Interference Policy (AIP), "make good provisions" apply in certain circumstances, such as if a cumulative decline in the water level within a water supply work (such as a supply bore or well) of more than two metres is predicted (NSW Office of Water 2012). In these cases, Hume Coal would offer any affected third parties appropriate compensatory arrangements such as access to an equivalent water supply through enhanced infrastructure or other means such as deepening an existing bore.

Groundwater inflows to the mine will vary from year to year during mining. Total inflow volumes are currently estimated to vary between approximately 0.3 and 3.2 gigalitres per annum, depending on the year of mining (and decrease to zero within around six years following completion of mining). Some of this groundwater inflow will be to active mining areas. The possibility of collecting and reinjecting it back into the groundwater system is being investigated and would further mitigate impacts such as drawdown. However, around two thirds of the peak inflow will be unhandled groundwater that fills panels after they have been mined and sealed (that is, groundwater recovery within the mined panels), and so will remain within the groundwater system at this location. Furthermore, full recovery of groundwater levels is predicted following completion of mining, such that the change from existing levels would be minimal, in accordance with definitions given in the AIP.

In addition to water, the EIS will include detailed assessments of each of the other environmental and socio-economic aspects identified for consideration in this document, specifically:

- terrestrial and aquatic ecology;
- noise and vibration;
- traffic and transport;
- Aboriginal and historic heritage;
- visual amenity;
- socio-economic factors;
- hazards; and
- geochemistry.

Low-risk considerations such as air quality, energy use and greenhouse gases, soils and land resources, bushfire and waste will also be assessed in the EIS.

The EIS will be assessed by the determining authority(ies) in deciding whether to approve the project, and if so, under what conditions. It will also be made publicly available for review and comment.

ES7 Next steps

The project is in the early stages of the comprehensive assessment and approval processes required by Commonwealth and State legislation. This briefing document accompanies Hume Coal's request to the Secretary of DP&E for environmental assessment requirements (terms of reference for the EIS). It is expected that DP&E will circulate it to the relevant government agencies and convene a planning focus meeting to brief them on the project and invite them to recommend assessment requirements. The Secretary for DP&E will then issue environmental assessment requirements, identifying matters which must be addressed in the EIS.

The project's environmental assessment is underway. Baseline monitoring and surveys began in 2011 and are near complete. The next step is to complete the EIS, inclusive of detailed impact assessments and environmental mitigation, management, monitoring and offset measures to enhance the project's benefits and address any impacts. This includes, but is not limited to, detailed groundwater; surface water; ecology; air quality; greenhouse gas; acoustic; soils and land resources; heritage; visual; traffic and transport; social; hazard; bushfire; waste; geochemistry; rehabilitation and mine closure; and economic assessments. The assessments will be prepared in accordance with relevant guidelines, policies and assessment requirements issued by DP&E, and in consultation with government agencies and other stakeholders.

Extensive consultation and engagement with the community, government agencies and other stakeholders will continue during preparation of the EIS. This will include seeking feedback on the project and the proposed approaches to minimising impacts. Multiple mechanisms are provided for participation in the project planning and EIS processes and for ongoing communication and feedback. The project will continue to be refined in response to the outcomes of ongoing technical investigations and stakeholder consultation, and the EIS will be an integral part of this.

The EIS, scheduled for completion in 2016, will accompany Hume Coal's development applications for the project. It will be made publicly available for review and comment. In the meantime Hume Coal will continue to keep the community informed about the project and its role within the local community as results come to hand.

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1 Introduction

1.1 Project overview

Hume Coal Pty Limited (Hume Coal) proposes to develop and operate an underground coal mine and associated mine infrastructure (Hume Coal Project) in the Southern Coalfield of New South Wales (NSW). Hume Coal holds exploration Authorisation 349 (A349) to the west of Moss Vale, in the Wingecarribee local government area (LGA). A349 covers approximately 8,900 hectares (ha) (refer to Figure 3.3), though mining is not proposed across its full extent; the proposed underground mining area is approximately 3,400 ha. The project area and its regional and local setting are shown in Figures 1.1 and 1.2.

The project has been developed following several years of detailed geological, engineering, environmental, financial and other technical investigations to define the mineable resource, and to identify and address environmental and other constraints. This has included two stages of environmental and engineering investigations and three stages of opportunities and constraints analysis and workshops. Numerous alternative designs have been prepared and evaluated. This process has allowed development of a well-considered, practical and economic project design that will enable resource recovery, while minimising environmental impacts and potential land use conflicts, and delivering socio-economic benefits to the local community.

The project incorporates leading practice innovations, some of which set a new benchmark for underground coal mining in NSW. For example, the rail wagons used to transport product coal off-site will be covered and all coal reject material (the stone that is separated out of the coal during processing) will be returned underground to partially backfill the mined-out void and reduce visual and other environmental impacts. A low impact mining system will be used which leaves pillars of coal in place so that the overlying strata is supported (rather than collapsing into the mined-out void) and surface subsidence impacts will be negligible. By minimising disruption to the overlying strata, associated groundwater impacts will also be minimised. Furthermore, to avoid any perception that primary dwellings or the Hume Highway could be affected by future, long-term ground movements, no mining will occur beneath these features, other than development of underground roadways required for access. The only exception would be if an agreement was entered into with a landowner.

A full project description is provided in Chapter 3. In summary it involves:

- Exploration and resource definition activities, along with geotechnical and engineering testing and fieldwork to facilitate detailed design.
- Development and operation of an underground coal mine over an approximate 22 year-period, followed by a closure and rehabilitation phase of nominally two years. It will extract approximately 50 million tonnes (Mt) of run of mine (ROM) coal from the Wongawilli Seam at a rate of nominally up to 3.4 million tonnes per annum (Mtpa). Low impact mining methods will be used which will have negligible subsidence impacts.
- Production of nominally up to 3 Mtpa of metallurgical and thermal coal for international and domestic markets.
- Construction and operation of associated mine infrastructure within and north of A349, mostly on cleared land. This will include:
    - a Mine Infrastructure Area (MIA), including administration, bathhouse, workshop and related facilities;
    - mine access and ventilation systems and shaft(s);
    - surface and groundwater management and treatment facilities, including storages, pipelines, pumps and associated infrastructure;
    - coal handling and preparation plant (CHPP);

  - overland conveyor system;
  - rail load-out facilities;
  - communications and electricity reticulation infrastructure; and
  - environmental management and monitoring equipment.
- Coal reject emplacement underground, in the mined-out voids.
- Peak workforces of approximately 400 full-time equivalent employees during construction and approximately 300 full-time equivalent employees during operations.
- Rehabilitation and mine closure activities.

Product coal will be transported by rail to domestic markets or to Port Kembla for shipment to domestic or international markets. Rail works and use are the subject of a separate development application.

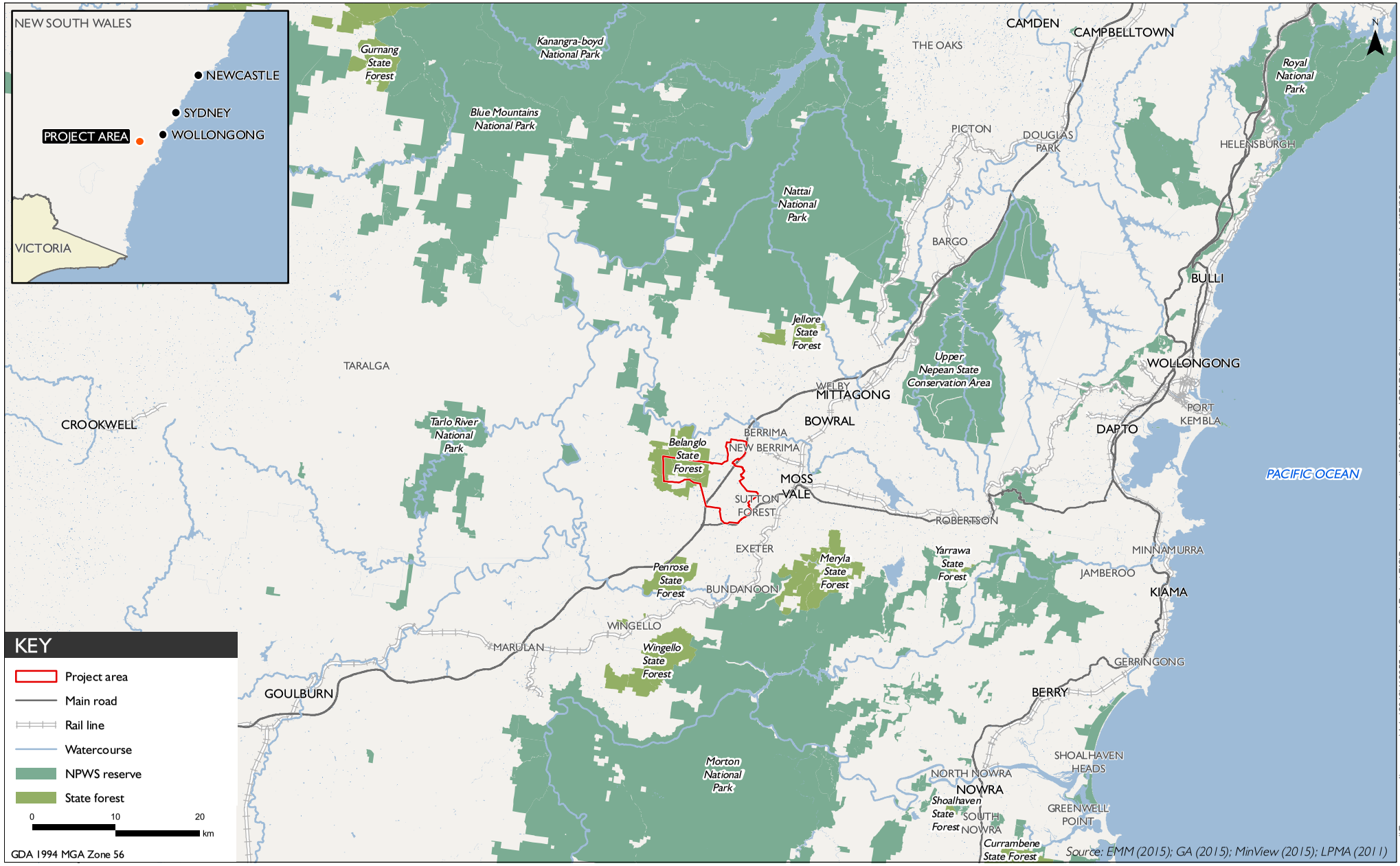
The large investment proposed to construct and operate the project will provide substantial economic stimulus and benefits to the Australian, NSW and local economies. Particular emphasis in project planning has been given to enhancing local socio-economic benefits. The project therefore includes initiatives such as local apprenticeship, training and community investment programs, which have already commenced, as well as policies to maximise recruitment of locals and use of local businesses. This includes a policy for all operational employees to live within the Southern Highlands region and immediate surrounds (within a 45-minute commute of the mine). For this reason, the project will provide significant direct benefits to the local community.

The project is a State Significant Development (SSD), pursuant to Schedule 1 of State Environmental Planning Policy (State and Regional Development) 2011 (State and Regional Development SEPP). Accordingly, approval is needed under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). It is noted that two separate approvals will be sought under the EP&A Act, as follows:

- development consent for the mine and associated facilities under Part 4 of the EP&A Act; and
- an activity approval for proposed electricity supply works under Part 5 of the EP&A Act.

In addition, as mentioned previously, associated rail works and use (the 'Berrima Rail Project') will be subject of a separate development application. This is because it will include rail infrastructure and/or upgrades which are used by other rail users, being Boral, Ingham, Omya and/or the Hume Coal Project. These activities will be described in detail in documentation accompanying that application. They will include construction and use of a rail spur and loop to connect the Hume Coal Project to the Berrima Branch Line (within the Moss Vale Enterprise Corridor), use of existing rail infrastructure and potentially upgrades to the Berrima Branch Line.

The project is also likely to require approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A referral will be made to the Commonwealth Department of the Environment (DoE) to determine whether or not this is the case.



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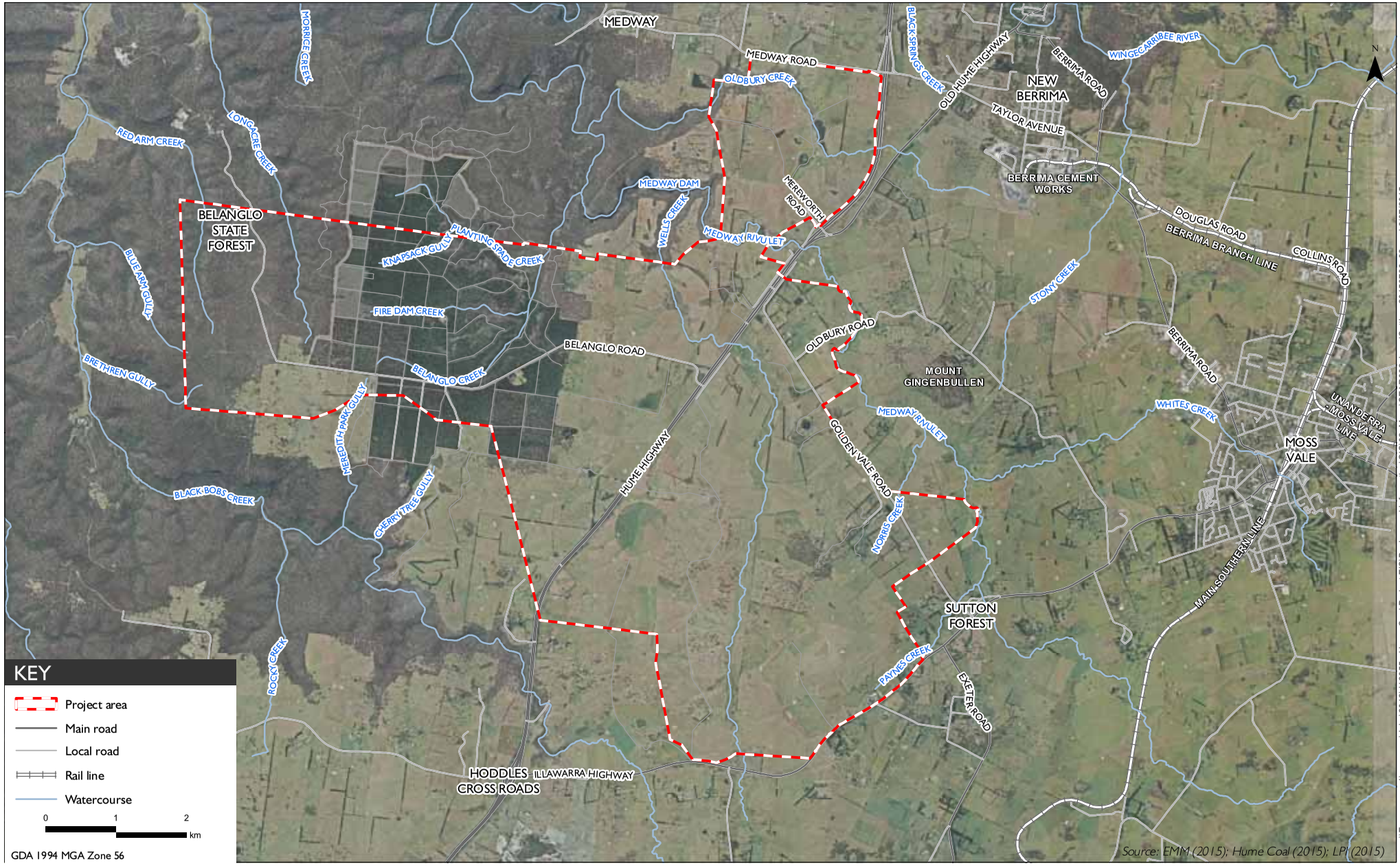
Regional setting

Hume Coal Project

Preliminary Environmental Assessment

Figure 1.1



Local setting

Hume Coal Project

Preliminary Environmental Assessment

Figure 1.2

1.2 The proponent

The proponent is Hume Coal, a wholly-owned subsidiary of POSCO Australia (POSA), the Australian subsidiary of POSCO. POSCO is a leading multi-national steel manufacturer and one of the largest buyers of Australian coal and iron ore, purchasing an average of US$6.2 billion worth per annum in the period 2012 to 2014.

POSCO, through POSA, has already invested around $1.9 billion in coal and iron ore projects in Western Australia, Queensland and NSW. POSCO is set to make a substantial investment in the Hume Coal Project if approved, making it an important part of the company's plans to increase its Australian investment portfolio.

Hume Coal was formed in 2010, as a joint venture company between POSA and Cockatoo Coal Limited (ASX: COK). POSA subsequently acquired Cockatoo Coal's stake and is now 100% owner of the project.

Hume Coal's headquarters and community shop front are in Moss Vale, east of the project area. Hume Coal is an active member of the local community and supports and participates in various groups including the Berrima District Rotary Club, Southern Highlands Manufacturing Cluster, Moss Vale Chamber of Commerce and Southern Highland Chamber of Commerce and Industries.

Hume Coal also owns around 1,760 ha of land within and adjacent to the project area, making it one of the largest landholders in the area. The company has licensed the properties to a pastoral company that is now running a productive farming business (principally beef cattle) on these properties and is currently investing in weed control and other initiatives to improve the land's agricultural productivity from that prior to Hume Coal ownership. This includes investigating the potential to diversify into cropping. In keeping with the current land use, it is expected that most of this land will continue to be used for farming during and following mining.

The project will last some decades and the company is committed to making a meaningful and lasting contribution to the region's prosperity. Hume Coal is therefore actively promoting and supporting local businesses, industries and education facilities.

A charitable trust is in place, focused on initiatives that directly benefit the local community. Over the past three years, Hume Coal has supported more than 40 local organisations, including KU Donkin Pre-school, Wingecarribee Family Support Service, Youth Radio MVH-FM, Kollege of Knowledge Kommittee for Kids, BDCU Children's Foundation, Challenge Southern Highlands, Moss Vale Dragons Junior Rugby League Club, Moss Vale Cricket Club, Bundanoon Highlanders Rugby League Football Club and Bowral Rugby Club.

The Hume Coal Charitable Foundation provides the wider community opportunities to have informed input into the company's community investment. The foundation currently invests $450,000 per annum in the local community, with priority funding areas being education, indigenous programs and not for profit pre-school providers.

The company's community support program includes the Hume Coal Apprenticeship Program, established in 2015 to support training and development within the local community. It is focused on building skills within local businesses. The apprenticeship/traineeship program provides opportunities for local people to upskill and gain employment by placing funded apprentices and trainees in local businesses, up to the value of $250,000 per annum.

Hume Coal is conscious of the role it plays in the local community and committed to making a positive social and economic contribution. The project is bringing, and will continue to bring, significant economic benefits to the region.

1.3 History of exploration and environmental investigations

Coal exploration and mining in the area dates back to the 19th century. Historic records of the early mining operations give conflicting information on their exact dates and locations. However, the following summary is based on online records at www.illawarracoal.com and the NSW Government's DIGS database at http://digsopen.minerals.nsw.gov.au/.

Cataract Mine operated intermittently on the banks of Medway Rivulet from the 1860s until the late 1870s. The Wongawilli Seam was also mined north of A349, around Medway Rivulet, at Flying Fox Mine in the early to mid 1900s, the nearby Loch Catherine Colliery from the early 1920s until the 1950s, and at Berrima Colliery from 1924 until 2013, although mine workings at the southern end of Berrima Colliery are thought to date back to the 1870s. Berrima Colliery's mining lease adjoins A349.

To the west of the project area, the Southern Extended Colliery (also referred to as Murrimba Colliery) operated in the 1950s, off Black Bobs Creek north of Canyonleigh Road. The Southern Colliery operated at the headwaters of Emu Creek near Canyonleigh in the 1960s, in what is thought to be the Tongarra Seam.

The Wongawilli Seam was also mined to the south, near Bundanoon, intermittently from the mid 1800s until the early 1900s. This included at Rock Roof Mine, Erith Colliery and Ringwood Colliery, which later became Collins Colliery and then Federal Colliery.

Evidence of one small mining operation has been found within the area now encompassing A349, in the form of two small adits in the eastern bank of the Longacre Creek valley, within the Belanglo State Forest. No written record of this operation has been found.

Exploration within A349 began in the 1950s and approximately 155 exploration boreholes had been drilled by various companies prior to Hume Coal acquiring the lease, including the following:

- Illawarra Coke Company drilled eight boreholes in 1956 (OB Series and BE Series);
- Southern Portland Cement (Blue Circle Southern Cement), a subsidiary of BHP at the time, completed seven boreholes (SF 1-7) in 1958;
- The Bellambi Coal Company, owned by Shell Coal, completed a further 55 boreholes (SF 8-78) between 1968 and 1971;
- Austen & Butta completed 73 boreholes (NB1-73) in the early 1970s, before becoming a joint venture partner with Bellambi Coal Company in 1985; and
- A349 was formally granted on 23 September 1985 to the Bellambi Coal Company and Austen & Butta, which completed a further 12 boreholes in 1986 (DDH series).

Historical exploration has also included additional boreholes in close proximity to A349.

Anglo Coal acquired A349 in 2001 and completed an aeromagnetic survey and a geological model (which has since been updated with data from Hume Coal's more recent exploration program). POSA and Cockatoo Coal Limited formed a joint venture under the name Hume Coal Pty Limited and acquired A349 in 2010. POSA acquired Cockatoo Coal's 30% stake in Hume Coal in 2013.

Hume Coal has undertaken a detailed program of geological, engineering, environmental, financial and other technical investigations to develop and refine the project, and arrive at the current design. Numerous project designs have been examined, including mining methods and layouts, and surface infrastructure locations and designs, and all evaluated against the objectives of technical, financial and environmental optimisation. At any stage, if a project design could be significantly improved against any one of these objectives, the project was redesigned. Because of this rigorous and multi-faceted evaluation, the project contains a number of distinctive and innovative features. These and the overall planning process, including the main alternatives considered, are discussed further in Section 3.2.

Hume Coal's exploration program began in 2011 and has included airborne surveys, as well as 139 exploration boreholes (additional to the boreholes previously drilled by others which are listed earlier) to further define the geology and the resource. The company also commenced baseline environmental investigations in 2011. To date these have included groundwater, surface water, air quality, noise and meteorological monitoring, and ecology, heritage and soil surveys. In addition, advisory groups have been convened which are principally made up of community members. A Water Advisory Group (WAG) was established to advise on matters related to the project's water studies and a Social Reference Group (SRG) to advise on local social and economic development matters. Further discussion on the role of these groups is provided in Section 5.2.3(ii).

Hume Coal understands the importance of protecting the environment. Environmental constraints and sensitivities have been identified and have been a fundamental consideration in planning and designing the project. Throughout its baseline studies, Hume Coal has also been engaging with the community and other interest groups, and this continues to provide valuable local knowledge to assist in project planning (refer to Chapter 5). Hume Coal's investigations and stakeholder consultation are ongoing and the project will continue to be refined in response to the outcomes.

1.4 Purpose and content of this document

This document has been prepared in accordance with the requirements in Part 2 of Schedule 2 of the NSW Environmental Planning and Assessment Regulation 2000 (EP&A Regulation), to accompany a request to the Secretary of the NSW Department of Planning and Environment (DP&E) for environmental assessment requirements.

The document's purpose is to brief government agencies, the community and other stakeholders about the project, and identify key matters to be addressed in the environmental impact statement (EIS) and the proposed assessment methodologies. It is expected that DP&E will circulate this document to relevant government agencies and convene a planning focus meeting (PFM). It will assist both discussions at the PFM and government agencies in preparing their advice to DP&E on matters they want addressed in the EIS. These matters must then be taken into account by the Secretary in preparing the Secretary's environmental assessment requirements (SEARs).

This report describes:

- the proponent (Chapter 1);
- the project area's location, history and existing environment (Chapters 1, 2 and 7);
- the project, its justification and alternatives considered during project development thus far (Chapters 3 and 8);
- the regulatory framework for the project's assessment (Chapter 4);
- stakeholder consultation and engagement undertaken to date and that planned throughout the environmental assessment (Chapter 5); and
- key matters proposed to be assessed in the EIS and the proposed assessment methodologies (Chapters 6 and 7).

2 Existing environment

2.1 Project setting and land use

The project area is in the Southern Highlands region of NSW, approximately 100 kilometres (km) south-west of Sydney and 3 km west of Moss Vale. It is in the Wingecarribee LGA and within the Moss Vale subregion of the Sydney Basin Biogeographic Region.

The project area is in a semi-rural setting, characterised by grazing properties, small-scale farm businesses, hobby farms, natural areas, forestry, scattered rural residences, villages and towns and some industries and major infrastructure. A number of State and locally listed heritage places are present in the local area.

The villages of Sutton Forest and Exeter are within A349, but both have been excluded from the project area. Medway, New Berrima and Berrima villages are also nearby (Figure 1.2), while Moss Vale, Bowral and Mittagong, located between approximately 3 and 15 km east and north-east of the project area, are the LGA's main regional centres (Figure 1.1).

Industrial and manufacturing facilities in the locality include the substantial Berrima Cement Works and Berrima Feed Mill on the fringe of New Berrima, as well as brickworks, metal fabrication, mining equipment manufacture and quarries. Berrima Colliery's mining lease (CCL 748) adjoins the project area's northern boundary. Berrima Colliery closed in 2013 after almost one hundred years of operation and is currently in care and maintenance.

The Wingecarribee LGA is also a retirement destination. It has an aging population, with approximately 42% aged over 50 – significantly higher than the NSW average of 33% (Australian Bureau of Statistics 2011). The highest growth forecast in the LGA is within the over 65 demographic group.

The health care and social assistance industry is the largest employer in the region, followed by retail, manufacturing, education and training, and construction. In addition, the region has an established tourist industry, particularly for daytrippers and weekenders from Sydney, Canberra and other nearby areas.

Surface infrastructure is proposed to be developed on predominately cleared land owned by Hume Coal. Over half of the remaining sections of the project area (principally land above the underground mining area) comprise cleared land that is, and will continue to be, used for livestock grazing, small-scale farm businesses and hobby farms. There are a small number of vineyards present, principally Cherry Tree Hill Wines, and Eling Forest, both adjacent to the Hume Highway. Belanglo State Forest covers the north-western portion of the project area and contains introduced pine forest plantations, areas of native vegetation and several creeks that flow through deep sandstone gorges. Native vegetation and threatened species habitat within the project area is largely restricted to Belanglo State Forest and some relatively undisturbed riparian corridors along watercourses such as parts of Oldbury Creek and Medway Rivulet.

The project area is traversed by several watercourses including Oldbury Creek, Medway Rivulet, Wells Creek, Wells Creek Tributary, Belanglo Creek and Longacre Creek, all of which ultimately discharge to the Wingecarribee River, located around 2 km north of the project area (Figure 1.2). The Wingecarribee River's catchment forms part of the broader Warragamba Dam and Hawkesbury-Nepean catchments. Medway Dam is also adjacent to the project area (Figure 1.2). Surface water interacts with (recharges and/or is recharged by) the underlying groundwater systems in places and at certain times. The main groundwater bearing unit in the area is the Hawkesbury Sandstone, which overlies the Wongawilli coal seam.

Built features across the project area include scattered rural residences and farm improvements such as outbuildings, dams, access tracks, fences, yards and gardens, as well as infrastructure and utilities including roads, electricity lines, communications cables and water and gas pipelines. Key roads that traverse the project area are the Hume Highway, Illawarra Highway and Golden Vale Road (Figure 1.2).

The main land uses within and adjacent to the project area are currently agricultural, industrial, extractive, forestry, rural residential and residential.

2.2 Climate

The climate is cool temperate, characterised by warm summers and cool winters with no distinct dry season. Average climate data recorded at the nearest long-term weather station, being the Bureau of Meteorology (BoM) station at Moss Vale (site number 068045), is summarised in Table 2.1.

The data in Table 2.1 shows that temperatures range from an average maximum of 25.8°C in January to an average minimum of 1.3°C in July. Average annual rainfall is approximately 967 millimetres (mm). Data from BoM's Moss Vale station indicates that dominant wind directions are from the west, west south-west, south-east and north to north-east.

Table 2.1 Climate data recorded at Moss Vale BoM station 068045

Parameter		Measurement	Month
Temperature			
Mean maximum	Annual	19.2°C	-
	Highest monthly	25.8°C	January
	Lowest monthly	11.8°C	July
Mean minimum	Annual	7°C	-
	Highest monthly	12.6°C	February
	Lowest monthly	1.3°C	July
Mean rainfall			
Annual		966.7 mm	-
Highest monthly		100.5 mm	June
Lowest monthly		59.7 mm	September
Mean 9am wind speed			
Annual		11.5 km/hour	-
Highest monthly		13.5 km/hour	September
Lowest monthly		9.3 km/hour	February

2.3 Topography and landform

The project area is situated on the elevated, relatively flat Woronora-Nattai Plateau. Elevations typically range from approximately 550 to 735 metres (m) above Australian Height Datum (AHD). Most of the central and eastern parts of the project area have very low rolling hills with occasional elevated ridge lines. There are, however, steeper slopes and deep gorges in the west of the project area, in Belanglo State Forest.

The region has some peaks of igneous origin. These include Mount Gingenbullen in the north-east of A349 (Figure 1.2), which has a maximum elevation of approximately 800 m AHD, and Mount Gibraltar near Bowral, which has an elevation of approximately 860 m AHD. They comprise erosion resistant igneous rocks.

2.4 Geology

The project area is in the Southern Coalfield, on the south-western edge of the Permo-Triassic Sydney Basin. The Southern Coalfield is one of the Sydney-Gunnedah Basin's five major coalfields and is the only source of premium quality hard metallurgical coal for steel production in NSW (Department of Planning 2008). There is a long history of mining in the Southern Coalfield, with a number of mines currently operating, as illustrated in Figure 2.1.

The project area's sedimentary rocks were deposited during the Permian and Triassic periods. The lower Permian sequences comprise the:

- basal Shoalhaven Group, which are sandstones of marine origin interbedded with latite, which are remnant igneous extrusions; and
- overlying Illawarra Coal Measures, which are a strata of freshwater origin approximately 50 m thick, composed of conglomerates, quartz, quartz-lithic sandstone, grey shales, carbonaceous shales and coal. The coal seam of economic significance in the locality is the Wongawilli Seam.

The overlying Triassic sequence comprises:

- Hawkesbury Sandstone, which is the main landform influence and generally comprises flat lying massive quartzose sandstone. It varies in thickness from approximately 60 to 150 m and is the main cliff forming sequence; and
- the overlying Wianamatta Group, which is a sequence of shales with minor interbedded sandstones, and reaches a maximum thickness of about 50 m in this area.

During the late Triassic to early Jurassic period, the region experienced episodes of volcanic activity. Accordingly, there are also igneous necks, sills, basalt flows, diatremes, dykes and faults in the project area.

It is noted that the normal sequence of Illawarra Coal Measures has, throughout the area, been eroded prior to deposition of the Hawkesbury Sandstone. In addition, the Narrabeen Group, which underlies the Hawkesbury Sandstone in places, has been removed by erosion over much of the project area.

Hawkesbury Sandstone is the dominant surface geology across the western side of the project area. The majority of the central and eastern parts are covered by unconsolidated clayey sands and weakly consolidated sandy clays interspersed with Bringelly shale, quaternary alluvial sand and silt, Ashfield shale, alkaline olivine basalt and conglomerate.

2.5 Coal resource

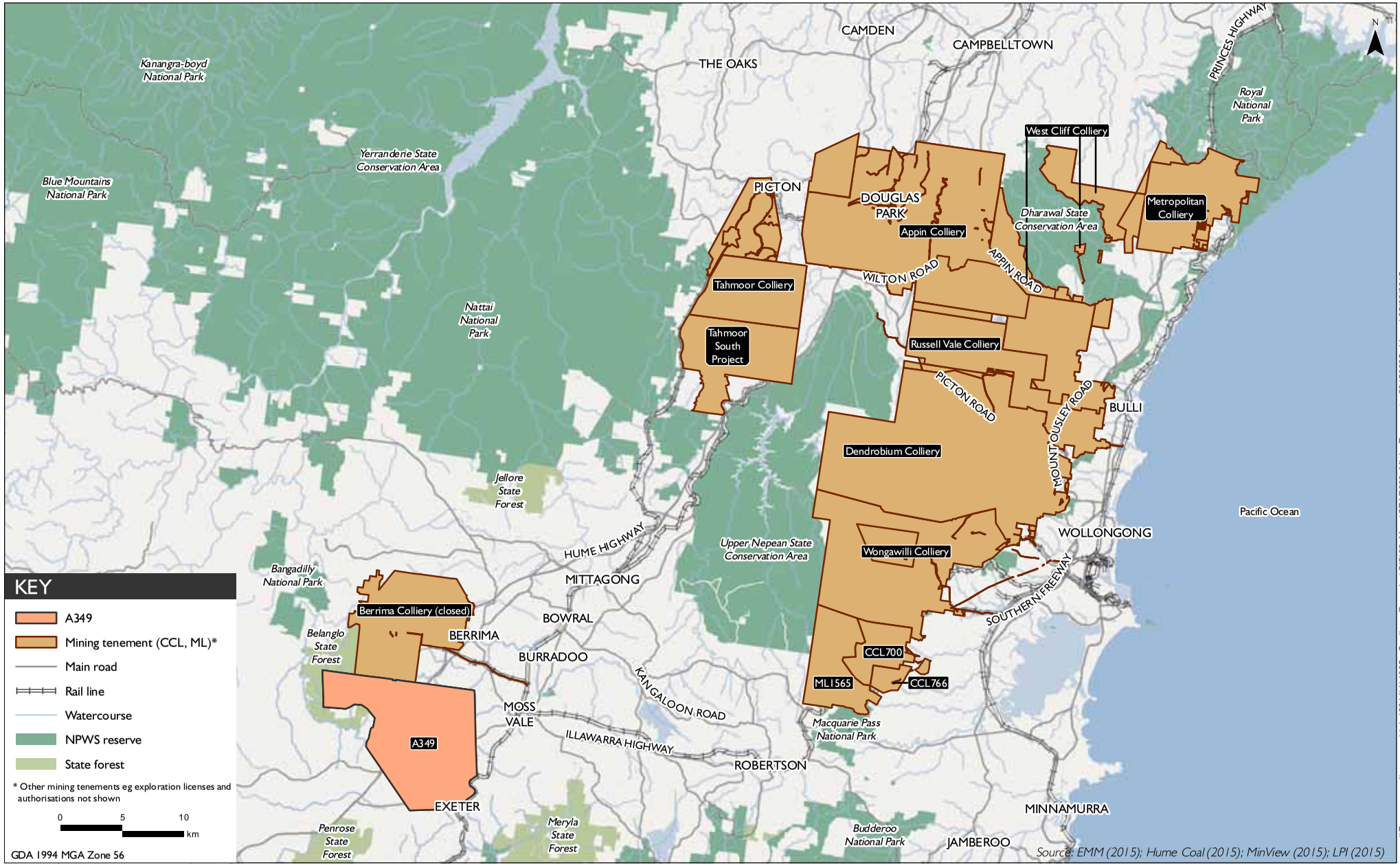
Extensive exploration has taken place within A349, dating back to the 1950s (refer to Section 1.3). The economic resource has been defined accordingly, though additional exploration is proposed to further define the resource and locations of geological structures such as dykes and faults.

The Wongawilli Seam lies at depths ranging from outcrop to 250 m and dips to the east at gradients between 1° and 2° across the project area. The seam thickness ranges from less than 1.8 m in the south-west of A349 to in excess of 8 m in places.

The most economically significant portion of the seam is the lower 3.5 m. There are three stone bands in the lower section of the seam. Coal towards the roof of the seam generally contains a high proportion of non-coal partings and has higher ash content.

The seam floor generally ranges from carbonaceous mudstone and siltstone to sandy siltstone, and varies in thickness. The seam roof can vary. It comprises a thin Permian siltstone, although direct contact with the erosional Hawkesbury Sandstone occurs in areas.

The coal has good fluidity and swell and low phosphorus content. Its raw ash content is higher than typical Australian export metallurgical coal, but the ROM coal will be washed on-site to meet export coking coal market specifications as required, including ash content specifications. The primary product will be marketed as a metallurgical coal.



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Mining tenements in the Southern Coalfield

Hume Coal Project

Preliminary Environmental Assessment

Figure 2.1

In summary, the primary product coal's general characteristics are:

- vitrinite reflectance (Ro max) – 0.8%;
- vitrinite content – 65%;
- fluidity – approximately 1080 dial divisions per minute;
- ash content – 10%;
- phosphorus content – 0.005%;
- sulphur content – 0.6%; and
- crucible swelling number – 7.

The estimated recoverable resource within the project area is 50 Mt of ROM coal within the Wongawilli Seam, at depths of between approximately 70 m and 180 m.

2.6 Land ownership

The project area covers approximately 5,043 ha (Figure 1.2). The majority is freehold land, around 1,243 ha of which is owned by Hume Coal (Hume Coal's total landholding within and adjacent to the project area is approximately 1,760 ha). The north-western corner of the project area (Belanglo State Forest) is owned by State Forests of NSW, covering approximately 1,295 ha. The remainder, principally being road reserves, is variously owned by the Crown and Wingecarribee Shire Council.

3 Project description

3.1 Overview

The project involves developing and operating an underground coal mine, along with associated mine infrastructure, including:

- mine infrastructure area;
- mine access and ventilation systems and shaft(s);
- water management and treatment facilities;
- coal handling and preparation plant;
- overland conveyor system;
- rail load-out facilities;
- communications and electricity reticulation infrastructure; and
- environmental management and monitoring equipment.

Product coal will be transported by rail to domestic markets or to Port Kembla for shipment to domestic or international markets. Rail works and use are the subject of a separate development application.

The project's objective is to maximise extraction of the coal resource in a manner that is efficient and economical, while minimising adverse impacts to the environment and community and delivering socio-economic benefits to the local community.

Indicative mine and surface infrastructure plans are provided in Figures 3.1 and 3.2. An overview of project components, as currently proposed, is provided in Table 3.1, but it is important to note that the project will continue to be refined as technical investigations and stakeholder consultation continues.

Table 3.1 Project overview

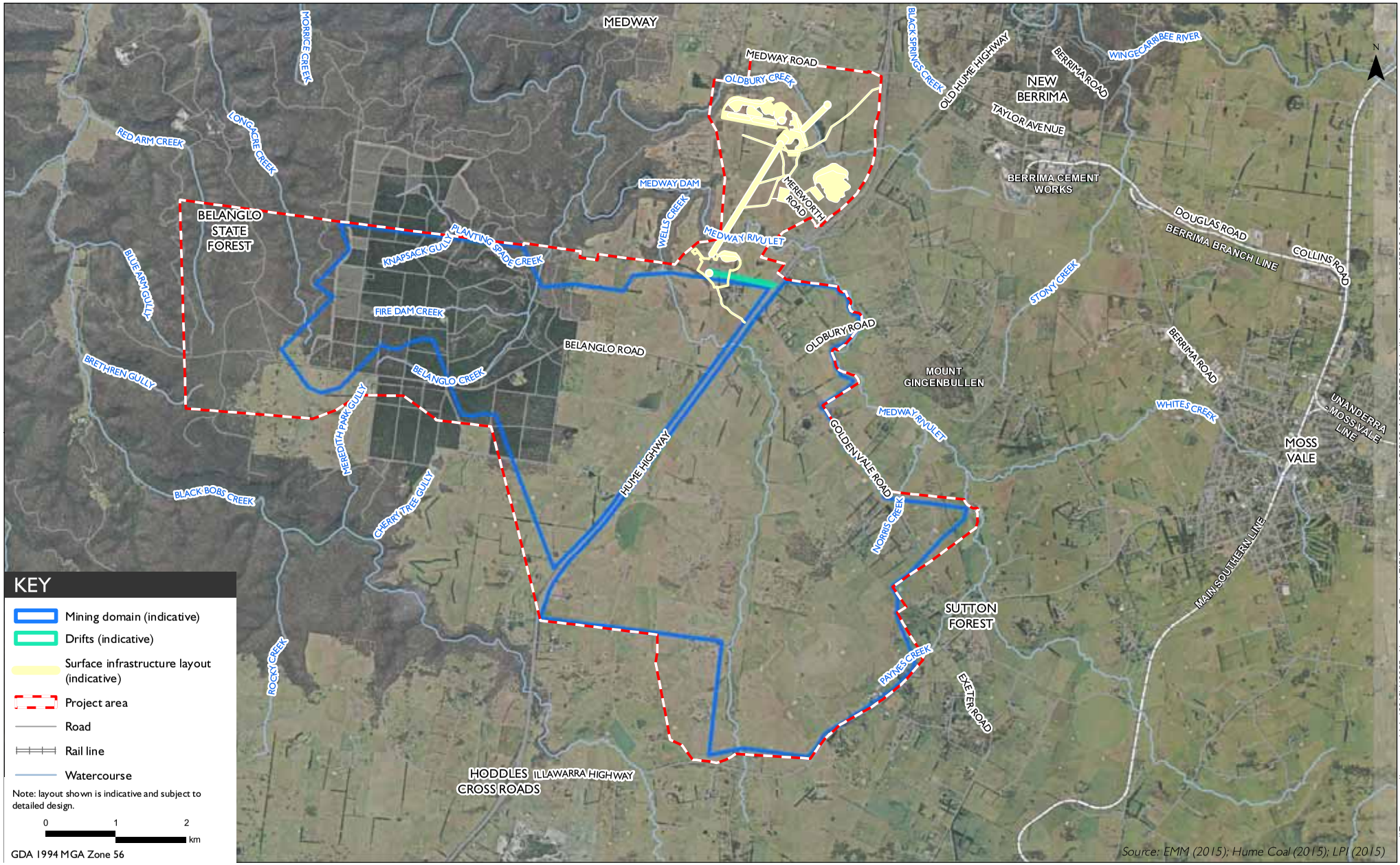
Aspect	Description
Project duration	Construction: around three years, including pre-construction.
	Mine operating life: approximately 19 years plus a rehabilitation phase of nominally two years.
Resource	Estimated 50 Mt of recoverable ROM coal within the Wongawilli Seam, at depths of between approximately 70 m and 180 m.
Annual production rate	Nominally up to 3.4 Mtpa ROM coal.
Product coal	Nominally up to 3.0 Mtpa, comprising a mix of metallurgical and thermal coal.
Mining methods	Low impact mining methods, specifically a 'Pine Feather' mining system, consisting of alternating web pillars and drives.

Table 3.1 Project overview

Aspect	Description
Mine infrastructure area and access	Construction and operation of a MIA comprising administration offices, bathhouse, control room, workshop, warehouse and laydown area, fuel and lubrication storage, refuelling facilities, washdown facilities, car park, internal access roads, helipad, security fences, water and wastewater management infrastructure, electricity reticulation, communications infrastructure, dust suppression and firefighting systems, compressors, back-up generators, explosives magazine and environmental management and monitoring equipment.
	Construction and operation of access and coal conveyor drifts between the MIA and underground workings.
	Construction and operation of a borehole compound, to allow communication of bulk materials, water and electricity between the surface and underground workings.
	Road access to the MIA and CHPP principally from Mereworth Road with secondary access from the Hume Highway and intersection and access track upgrades where required. Other access points to the project area will also be used during construction and intermittently during operations.
Coal handling, processing and transport infrastructure	Construction and operation of coal handling infrastructure for processing ROM coal, including conveyors, transfer points, breaker station, coal preparation plant (CPP) with a capacity of 600 tonnes per hour, reject paste plant and ROM, product and emergency reject stockpile areas.
Product coal transport	Product coal will be transported by rail to domestic markets or to Port Kembla for shipment to markets.
Ventilation and gas drainage	Initial installation of at least one upcast ventilation shaft and fans, with up to two additional shafts potentially installed over the life of the mine.
	Gas drainage is not required given the low gas content of the coal.
Water supply	Water demands will be met by groundwater and surface water runoff captured and treated on-site, with some potable water potentially trucked to site initially.
Water and wastewater management	Development of water and wastewater management and treatment systems comprising water storages, sumps, pumps, pipelines, drains, sediment control, mine dewatering, sewage treatment facility and a water treatment plant.
	Water captured and treated on-site, including mine water recovered from underground workings, will be re-used on-site where possible.
	Various options are being investigated for management of excess mine water (predominately groundwater that flows into the mine). These include returning it into the mined-out voids or the overlying groundwater system, supply to others, for example for irrigation of farmland, and/or release to a nearby watercourse(s) under licence.
Communications and electricity supply	Installation of communications and electricity reticulation infrastructure, including high voltage electricity lines and substations.
Coal reject management	Coarse and fine rejects from the CHPP will be processed at the reject paste plant and then pumped underground and emplaced in void spaces.
	Initially, while void space is being created, co-mingled rejects will be stored at a temporary surface emplacement area(s), which will be progressively constructed, and when full, revegetated and top dressed.
	Once mining is completed, rejects stored in the surface emplacement will be removed, reprocessed and placed underground in the remaining voids. The surface emplacement area(s) will then be rehabilitated to integrate with the natural landform.
	There will also be an emergency reject stockpile area at the CHPP precinct, to allow coal processing operations to continue in the advent of an interruption to paste operation, such as during maintenance at the paste plant.

Table 3.1 Project overview

Aspect	Description
Exploration and other investigations	Ongoing exploration activity within the coal exploration authorisation (currently A349) and geotechnical and engineering investigations within the project area more broadly.
Disturbance area	Approximately 115 ha (conservative estimate, to be refined in the EIS).
Operating hours	24 hours per day, seven days a week.
Operational workforce	Construction: estimated peak workforce of 400 full-time equivalent employees. Operations: approximately 300 full-time equivalent employees at peak production.
Infrastructure relocations	Minor road realignments and relocation of existing utilities where required to accommodate project infrastructure.
Temporary construction facilities	Establishment of temporary construction facilities including offices, stores and laydown areas in the vicinity of the MIA and CHPP and a temporary accommodation village for non-local construction employees on Hume Coal-owned land (where specialist skills are unable to be sourced locally).
Rehabilitation	The rehabilitation strategy will be developed in consultation with stakeholders, taking into account outcomes of investigations during the EIS. However, conceptually it is proposed to include: • dismantling the temporary construction facilities, including the accommodation village, at the completion of construction and then rehabilitating the site(s); • progressively rehabilitating minor surface disturbance areas (eg drill pads); • emplacing all reject material underground and rehabilitating the temporary surface emplacement area(s) at the end of the mine's life, to integrate with the natural landform; • filling and sealing mine accesses (drifts and shafts) to the then applicable guideline or standard (currently MDG 6000); and • removing mine infrastructure and rehabilitating surface disturbance areas, including the MIA and CHPP, at the end of the project's life.
Project capital cost	Approximately $682 million.
Sustaining capital (eg for equipment replacement)	Approximately $300 million over the life of the project.



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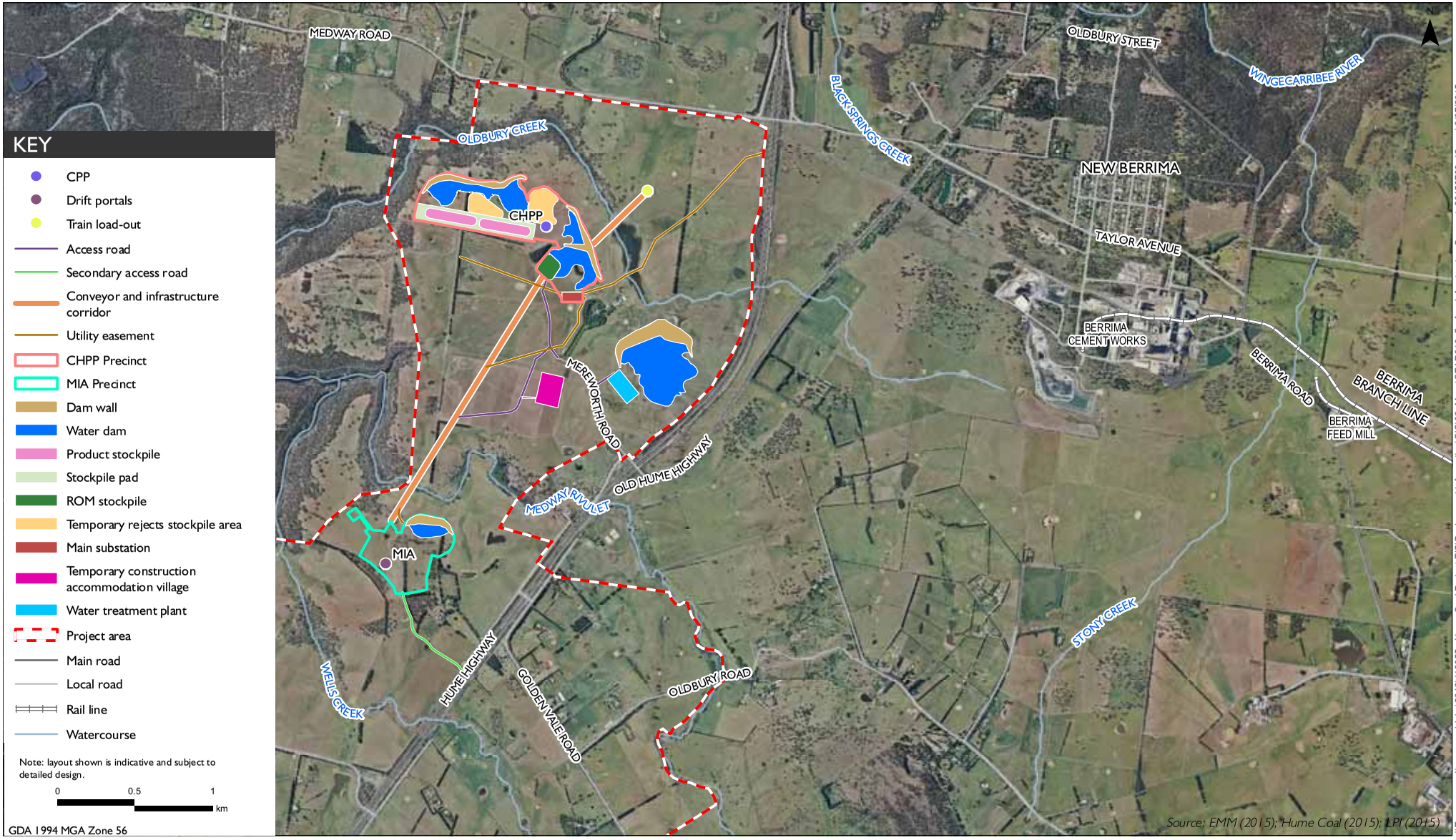
Indicative project layout

Hume Coal Project

Preliminary Environmental Assessment

Figure 3.1



Surface infrastructure concept plan

Hume Coal Project
Preliminary Environmental Assessment

Figure 3.2

3.2 Evolution of the project

3.2.1 Project planning and design

i Principles and process

Hume Coal has devoted considerable effort to preparing a mine plan that responds to three considerations:

1. The coal resource is a publicly owned asset (held by the NSW Government) and, as such, optimising resource recovery is in the public interest.

2. Valuable environmental and social features of the locality should be protected from damage.

3. The local community as the host of the project should benefit in tangible ways from its construction and operational phases.

The ways that each of these key considerations have been addressed during the mine plan's evolution are discussed in the following sections.

As mentioned in Section 1.3, extensive geological, engineering, environmental, financial and other technical investigations have taken place over several years to develop and refine the project, and arrive at the current design. The baseline environmental investigations, which began in 2011, include groundwater, surface water, ecology, air quality, noise, soils, agricultural, heritage, subsidence, visual and socio-economic studies. The results have been considered in a number of workshops with mining and infrastructure engineers and geologists. This process enabled numerous alternative conceptual designs to be prepared and evaluated. These included various mining methods and extents, and surface infrastructure locations and designs. Once preferred options were identified they were tested by way of consultation with key stakeholders.

Investigations and stakeholder consultation are ongoing and the project will continue to be refined in response to the outcomes. The EIS will be an integral part of this.

ii Leading practice innovations

Hume Coal decided early that the project was to be leading practice. This included adoption of environmental and social management measures above and beyond the standard measures used at Australian coal mines, and beyond those required to comply with regulatory standards. Five examples of leading practice innovations already adopted are given in the following sections.

Other innovations are currently being investigated, notably the potential for collecting groundwater that flows into the active mine workings and reinjecting it back into the groundwater system. This would provide environmental benefits including reducing net groundwater 'take' from the system and associated groundwater drawdown impacts to other users.

<u>Mine design and process</u>

To minimise environmental impacts, Hume Coal proposes to use an innovative 'non-caving' coal extraction method which will have negligible subsidence impacts and will, therefore, protect the overlying aquifer and surface features. The mine design also incorporates bulkheads, which will be used to seal each panel immediately after extraction and backfilling, enabling groundwater recovery at each mined-out area to begin shortly after mining. The mining method and its advantages are described in detail in Sections 3.2.2(vi) and 3.4.1.

Underground reject emplacement

Hume Coal proposes to return all its coal reject material underground, to partially backfill the mined-out void, rather than keeping it at the surface, or trucking it off-site for emplacement elsewhere. This technology has so far only been adopted at one other Australian coal mine and is considered leading practice internationally. Whilst complex from an engineering perspective, and with higher operating costs than surface emplacement, it was selected due to the following environmental and social benefits:

- significantly reduced potential for visual, dust and noise impacts compared to more conventional surface emplacement practices;
- reduced surface disturbance footprint (by avoiding the need for large above-ground reject stockpiles);
- provision of additional ground support and pillar confinement in backfilled areas;
- eliminates the requirement for tailings ponds or cells on the surface; and
- directly responds to an expressed preference from regulatory officials that above-ground reject stockpiles be minimised.

Covering rail wagons

Hume Coal is proposing to cover the rail wagons used to transport its product coal, to reduce dust emissions from trains travelling to and from the Hume Coal Project. If approved, this would make Hume Coal the first coal mining company in Australia to do so.

Advanced high performance locomotives

Hume Coal is also proposing to use latest generation rail locomotives and wagons. They use less fuel and generate fewer emissions than older locomotives commonly used in Australia, which is beneficial from an air quality and greenhouse gas (GHG) perspective. The locomotives also have isolated engine and operator cab mountings which reduce vibration and noise transmission.

Apprenticeships, training and local procurement

Hume Coal is implementing specific programs and policies to maximise the project's direct benefits to the local community. These include local apprenticeship, training and community investment programs which are already underway. Due to these programs, it is anticipated that around 70% of the operational workforce will be sourced locally, from the Wingecarribee LGA and immediately adjacent areas. In addition, all operational employees will be required to live within the Southern Highlands region and immediate surrounds (within a 45-minute commute of the mine). A local procurement policy is also proposed, which will require use of local goods and services in the project's construction and operation where possible, thereby maximising opportunities for local business participation. These initiatives are discussed further in Sections 1.2 and 7.13.

3.2.2 Underground mine

Hume Coal is well aware of the significance of the State-owned coal resource within A349 and the importance of optimising its recovery. This, along with environmental and economic factors, has been a determining consideration in planning the mine.

Hume Coal has considered numerous alternative mining methods and layouts, evaluating each of them against the objectives of technical, financial and environmental optimisation. The objective of this iterative process (which is described in the following sections) was to develop a mine plan that minimised the trade-offs between project economics, resource utilisation and environmental impacts.

Due to the nature and location of the deposit, open cut mining methods were never considered to be appropriate.

i Concept study

A concept study was completed in 2011 and recommended a combination of longwall and bord and pillar mining methods.

ii Pre-feasibility study

A pre-feasibility study, completed by consultants in March 2013, recommended a combination of 300 m wide longwall panels and first workings across the entirety of A349. It included mining under potentially sensitive structures such as State significant heritage properties. While this would have maximised resource recovery, it was considered by Hume Coal that the environmental impacts were unacceptable and this option was rejected.

iii Pre-feasibility study review

Following the 2013 pre-feasibility study, Hume Coal commissioned a detailed review of the pre-feasibility study (the PFS review).

The first stage of this review defined a more conservative set of constraints and mine design criteria. An environmental opportunities and constraints analysis was undertaken as part of this process. The constraints evaluated included resource quality, geology, engineering, logistical, land ownership, environmental and social considerations. Based on the analysis, potential constraints were mapped, including:

- areas where the coal seam thickness or coal quality may be unsuitable for mining or require special consideration in developing the mine plan;
- areas with depths of cover less than 70 m;
- geological structures such as Mount Gingenbullen;
- residential areas such as Exeter;
- roads and other sensitive surface infrastructure;
- watercourses (with stream order differentiated);
- threatened ecological features;
- Aboriginal heritage items; and
- State-listed heritage items.

The resultant constraints plan informed the development and evaluation of alternative mining systems and mine plans.

iv Reduced panel widths

Investigations undertaken as a precursor to commencing the PFS review identified surface features that would be sensitive to subsidence impacts. Accordingly, Hume Coal then examined mining systems which would reduce subsidence and environmental impacts (from those predicted with the 300 m wide longwalls).

Different panel widths were investigated including 50 m and 100 m wide miniwall panels, and 150 m wide longwalls. The potential surface subsidence impacts for 50 and 100 m wide panels were assessed and considered generally acceptable for most of A349, provided that secondary extraction beneath the most sensitive surface features was avoided.

Hume Coal also looked at using different mining methods in different parts of the mine, depending on each area's sensitivity to subsidence impacts. The main multi-system mine plan developed had some first workings panels, with 90 m wide miniwalls east of the Hume Highway and modified Wongawilli-style bord and pillar extraction west of the Hume Highway.

These options were ultimately rejected due to the potential subsurface subsidence characteristics and associated groundwater and other impacts, as determined on the basis of current knowledge of the geological and environmental conditions.

v Low impact mining methods

The next step was to evaluate low impact mining methods. Mining systems were evaluated that enable economic resource recovery while eliminating 'caving', which is the process where the roof of the extracted area is allowed to collapse following mining, resulting in surface and subsurface subsidence impacts. Eliminating caving has the added advantage of keeping void spaces open so that they can be used for reject emplacement underground. The mining systems investigated included:

- traditional first workings only;
- pillar 'pocketing' system, which essentially involves first workings, followed by progressive extraction of additional coal from the pillars left during first workings development, such that the pillars are reduced in size in a 'non-caving' manner; and
- 'Pine Feather' system, which is described in the following section and in Section 3.4.1.

The Pine Feather system was found to meet the goals outlined at the start of this section and provide a better set of outcomes than the other two systems. Accordingly, it was selected for more detailed investigation.

vi Pine Feather system

A distinctively innovative 'non-caving' coal extraction method has been devised to address all of the constraints identified.

The proposed 'Pine Feather' design, described in detail in Section 3.4.1, enables economic resource recovery whilst leaving sufficient coal in place in the form of web and barrier pillars to keep the overlying strata supported and ensure long-term stability. The void spaces are kept open, thus allowing reject emplacement underground.

Surface subsidence impacts will be negligible. The very minor levels of ground settlement above mines with similar levels of extraction are typically limited to pillar compression resulting from the combined effect of increased loading and depressurisation of the coal seam, and are typically imperceptible. The overburden will remain intact, and so disturbance to overlying aquifers and associated groundwater impacts will also be minimised, and a rapid post-mining recovery facilitated.

The Pine Feather mining system proposed includes further innovations to reduce environmental impacts. For example, each mining panel will be separated from adjacent panels by solid coal barrier pillars and will be partially backfilled with coal reject and then sealed with bulkheads immediately after it is mined. This will allow groundwater to commence immediate recovery to levels similar to pre-mining levels and fill the voids. Long-term pillar stability will be further enhanced once the mine workings fill with groundwater and a full hydrostatic pressure head has been re-established, albeit that the system is designed to be long-term stable with or without backfill and hydrostatic pressure. The bulkheads will also minimise inflows to the active mining area.

The proposed mining method is flexible. It can be modified as required to avoid specific features, for instance geological structures such as faults and diatremes, including any which may not yet have been identified. This facilitates an adaptive management strategy. Notwithstanding, to avoid any perception that primary dwellings or the Hume Highway could be affected by future, long-term ground movements, Hume Coal has already committed to avoiding extraction beneath these features, other than development of underground roadways (first workings development) for access to other parts of the resource. The only exception would be if an agreement was entered into with a landowner.

Further refinements to the mine plan will continue over the life of the mine as knowledge of environmental, geological and resource conditions increases. For example, geological structures discovered during mining may preclude certain areas from further mining or necessitate changes to the mine plan. In addition, where mining is to be carried out under sensitive features such as the Moomba to Sydney high pressure gas pipeline, risk assessments will be undertaken on a case-by-case basis and the asset owners consulted, to determine any requirement for special management measures.

3.2.3 Surface infrastructure

Numerous surface infrastructure locations and designs have been examined over the past four years, each evaluated against the aforementioned criteria of technical, financial and environmental optimisation. This has broadly been by a two stage process, to firstly identify a suitable site and to then refine the surface infrastructure design within that site, as described below.

Alternatives were also considered for a range of other project elements not discussed here. For example, whether to use existing local accommodation for the temporary construction workforce or build a temporary construction accommodation village. More detail on alternatives assessed and justification for those chosen will be provided in the EIS.

i Locations considered

Some of the key requirements in identifying a suitable location for the project's surface infrastructure were:

- proximity to the underground mining area;
- proximity and access to connect to key services and infrastructure, particularly the rail network;
- land availability, that is Hume Coal must already own or likely be able to purchase the land; and
- a suitably sized area, relatively free from environmental, urban and other constraints to development. For instance Hume Coal was seeking to:
    - avoid more densely populated areas and areas with fragmented land ownership;
    - avoid flood-prone land, in this case defined as land that would be inundated by a 1% annual exceedance probability (AEP) rainfall event, that is, an event that on average occurs once every 100 years;
    - avoid large tracts of native vegetation;
    - integrate with the existing topography and landform as much as possible, ideally by selecting a relatively flat site (minimising cut and fill requirements), surrounded by landforms and/or vegetation that minimise inward views from the Hume Highway and other sensitive receptors;
    - minimise the number of watercourse and road crossings by project infrastructure; and

- set back surface infrastructure from sensitive receptors where possible, to minimise the potential for visual, noise, dust and amenity impacts.

Hume Coal looked for options within and adjacent to A349 and identified several sites that met all or most of the above criteria. While numerous locations and variations to these were considered, for simplicity they have been identified here as the four general areas shown indicatively in Figure 3.3. The preferred option (Option 4) is that shown in Figure 3.2 and described in this report. It has the advantage of meeting each of the afore-mentioned criteria and is also viable in terms of functionality, cost and efficiency. The main reasons for rejecting the other three options are outlined in Table 3.2.

Table 3.2 Alternative surface infrastructure locations considered

Location		Main reasons rejected
1.	Between Exeter and the Illawarra Highway[1]	Proximity to village - associated potential for visual, noise, dust and amenity impacts. Longer section of Main Southern Rail Line to traverse than other options, with limited train paths available.
2.	Central A349, east of Hume Highway	Distance from the rail line - extensive overland conveyors required over numerous properties, with substantial cost and increased disturbance footprint.
3.	North of A349, near Berrima Cement Works	Potential cumulative noise and dust impacts, including at New Berrima, given proximity to other industry, including the Berrima Cement Works and Austral Bricks shale quarry. Limited land available for purchase.
4.	Central northern A349, west of Hume Highway, and extending north of A349	N/A – selected as preferred option.

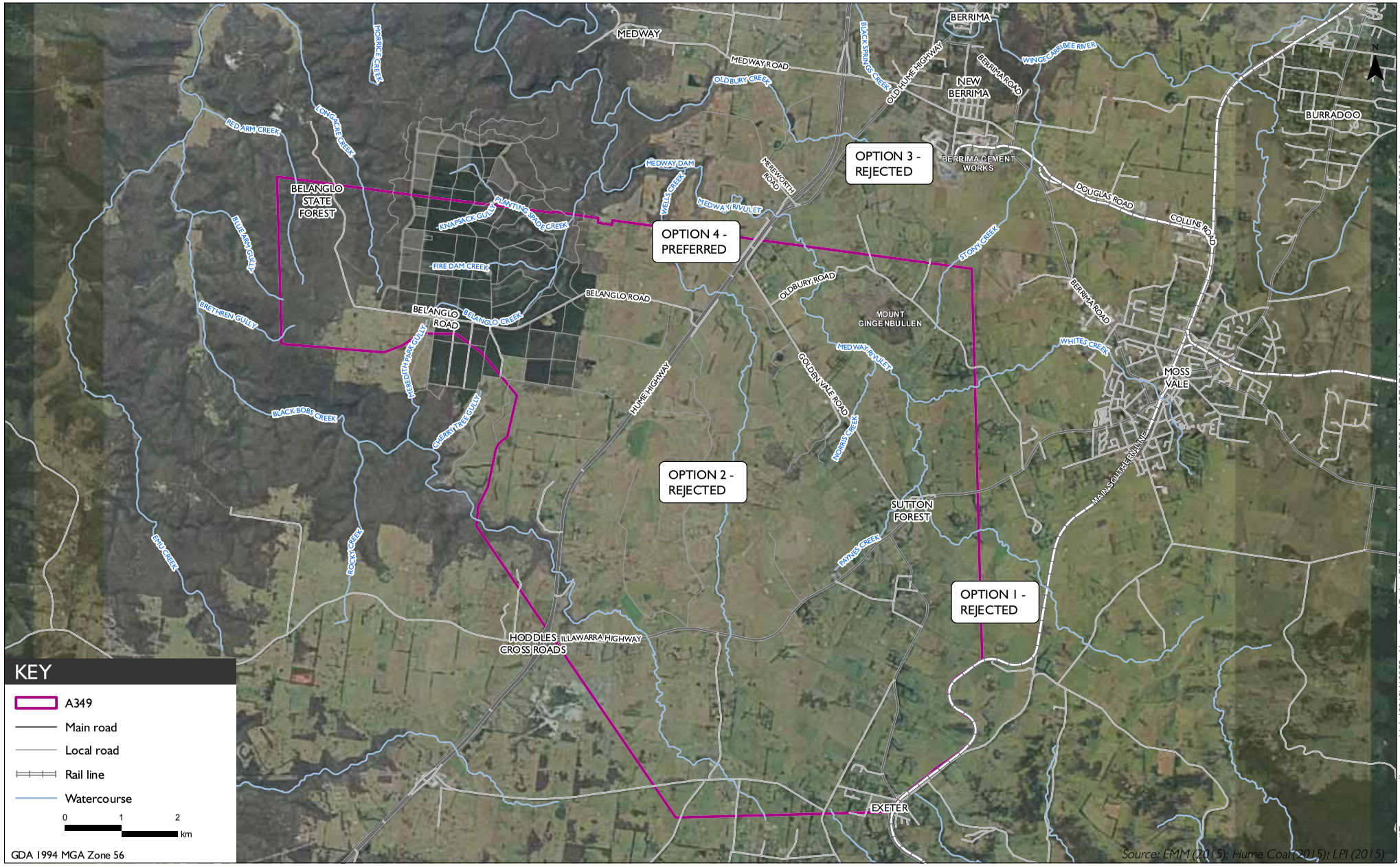
Note. 1. This option was close to the site of the previously proposed Austen and Butta rail spur and pit top, and was rejected by Hume Coal very early on.

ii Designs considered

Alternative designs were evaluated at each of the surface infrastructure locations under consideration. Once the preferred location was chosen, Hume Coal worked with engineering and environmental specialists to develop and refine the project components and their layout within that site. The design had to satisfy the same requirements listed in the preceding section for selecting a location. Hume Coal was also seeking to:

- minimise the disturbance footprint as much as practicable and avoid direct impacts on features like Mereworth House and gardens, which is a locally listed heritage place owned by Hume Coal;
- position the drift portals (for mine access and egress) and associated mine infrastructure close to the underground mining area; and
- position the CHPP and coal stockpiles outside Medway Dam's catchment and close to rail. While the project's water and wastewater management system is designed to avoid off-site movement of contaminants and sediment, it was considered that there could be community concerns associated with having these in its catchment.

Conceptual layouts were developed similar to that currently proposed. Additional environmental investigations were then undertaken and a series of workshops held to further optimise the design and mitigate potential impacts. This included preliminary air, noise and visual modelling and assessment of various designs, and heritage, flora and fauna surveys. Examples of the refinements made to the initial concepts are given in the following sections.



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Indicative surface infrastructure locations considered

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Figure 3.3

Examples of refinements in response to heritage and ecology investigations

Archaeologists and ecologists surveyed proposed surface infrastructure areas. They identified areas of potential sensitivity such as Aboriginal sites and threatened species habitat, as well as areas of 'low constraint', which represented opportunities for positioning surface infrastructure with minimal impact. In particular, the narrow corridor of vegetation along Oldbury Creek (north of the CHPP) was found to provide potential habitat for threatened microbats and Koalas and some Aboriginal sites were found there. The original design extended much closer to Oldbury Creek than what is now proposed. Management and mitigation measures were recommended to address potential impacts. However, Hume Coal went beyond these measures and moved the proposed CHPP site south to avoid this area (and the potential for Aboriginal heritage and ecological impacts) as much as possible. The layout was reconfigured to fit within a smaller footprint and so still avoid Medway Dam's catchment.

The surface infrastructure layout was modified specifically to avoid a number of individual sites containing Aboriginal heritage items and Paddy's River Box (*Eucalyptus macarthurii*) trees, which are listed as endangered under NSW legislation.

The resultant design avoids most threatened fauna habitat, endangered tree species and Aboriginal heritage sites. It also completely avoids State-listed heritage items and direct impacts to locally-listed heritage items.

Examples of refinements in response to preliminary air, noise and visual modelling

MIA location modified

The MIA, inclusive of the ventilation fans, was originally proposed to be closer to the Hume Highway but was shifted west to increase its set-back from sensitive receptors on the highway's eastern side. This was to reduce the potential for adverse noise, dust and amenity impacts.

Conveyors

Hume Coal initially committed to enclosing transfer points and drives for all major surface conveyors. Hume Coal then took this a step further by committing to install state-of-the-art low noise idlers. This technology is considered leading practice and has been demonstrated to significantly reduce noise compared to conventional conveyors (Brown 2004).

Dozers removed from stockpiles

As is commonplace at Australian coal mines, dozers were initially proposed to be used to stack and reclaim coal at the stockpiles. Preliminary air and noise modelling showed that they would be the dominant emission source. Accordingly, it was decided to instead use stackers and reclaimers for both ROM and product stockpiles.

Other dust and noise mitigations

Other innovative and leading practices and equipment introduced as the project evolved include:

- enclosing drives, pump motors and processing equipment on-site to minimise noise and dust propagation;
- reducing the proposed heights of stockpiles, conveyors and processing equipment as far as practicable;
- restricting certain activities such as shaping of the temporary reject stockpile by dozer to the daytime only; and
- minimising use of surge bins (typically a dust and noise contributor) as much as possible.

3.2.4 Outcome

The objective of the planning and design process has been to determine the most appropriate method for the efficient and economic extraction of the coal resource in a way that minimises environmental impacts and delivers benefits to the local community. The resulting project design addresses all constraints, is practical and cost-efficient and maximises opportunities for local business participation.

The site is well suited to the proposed development, given the presence of an economic coal resource and its proximity to key services and infrastructure, particularly rail infrastructure and Port Kembla. Resource extraction in the manner proposed avoids land use conflicts by allowing continuation of the existing land uses at the surface.

The siting and design of surface infrastructure satisfies operational, environmental and economic criteria. It is proximal to infrastructure and services such as rail, avoids most native vegetation and heritage sites and minimises the potential for adverse noise, dust and visual impacts.

A key environmental consideration is that connectivity between the Wongawilli Seam and Hawkesbury Sandstone means there will be some groundwater inflows to the mine and associated temporary drawdown in groundwater levels, which require management and mitigation to address potential impacts such as to groundwater users. The mine plan has been designed to minimise these potential impacts as much as is practically possible. In addition, various methods to further mitigate impacts, such as collecting groundwater that flows into active mining areas and reinjecting it back into the groundwater system, are being investigated. Groundwater inflows to the mine will vary from year to year during mining, though are currently estimated at between approximately 0.3 and 3.2 gigalitres (GL) per annum, depending on the year of mining (and decreasing to zero within around six years following completion of mining). Around two thirds of the peak inflow will, however, be unhandled groundwater that fills panels after they have been mined and sealed (that is, groundwater recovery within the mined panels), and so will remain within the groundwater system at this location. The proposed groundwater assessment approach is described in Section 7.2.2.

3.3 Exploration and resource definition

Ongoing exploration, geotechnical and engineering investigations are proposed, including:

- exploration drilling to evaluate coal quality and geotechnical parameters and delineate geological structures;
- geophysical surveys using surface magnetic and other low-impact techniques;
- seismic surveys;
- surveying and mapping by aerial and ground-based methods, including geological mapping;
- test pits and bore holes for geotechnical assessments; and
- other pre-construction test work.

Where relevant this work will be subject to land access agreements with affected land holders. Prospecting will only take place with a coal exploration lease area.

3.4 Mining operations

3.4.1 Mining system and development

The project will involve construction and operation of an underground mine that produces nominally up to 3.4 Mtpa of ROM coal and 3 Mtpa of product coal (a mix of metallurgical and thermal coal). The underground construction phase will involve:

- construction of seam access via two 1 in 8 grade drifts, one for the conveyor and one for rubber-tyred vehicles, with cross-cuts connecting the two;
- initial construction of a main upcast ventilation shaft, with up to two additional ventilation shafts progressively installed during the mine life;
- development of underground main roadways and gate roads for panels; and
- installation of mining equipment, conveyors and ancillary equipment.

Extraction will involve underground mining of a working section within the Wongawilli Seam using the low impact Pine Feather mining system, which optimises coal extraction while simultaneously managing underground and surface constraints. The indicative mining domains are shown in Figure 3.1.

The Pine Feather mining system involves the initial development of traditional, underground main roadways or 'mains', then developing sets of three-heading gate roads off the mains (together forming the trunk and limbs of the mine). A traditional continuous miner is used for gate road and main roadway development at typical widths in standard drivages (5.2 to 5.5 m).

Following development of the gate roads, a narrow head continuous miner and continuous haulage system is used to develop series' of parallel 'drives' or 'plunges' off the outside edges of the gate roads (refer to Figure 3.4). In the current design, the plunges are each 4 m wide and angled at 70 degrees to the gate roads, to facilitate use of a continuous haulage system.

Webs of coal are left in place between the plunges, at varying widths depending on depth of cover. Between each series of plunges, a wider barrier pillar is left in place, the width of which also varies with depth of cover, based on pillar design formulae. The system is designed to provide long-term stability to the overburden and the pillars also provide hydraulic separation between individual panels. Varying the widths of the pillars in response to varying depths of covers allows stability factors to be maintained. Further discussion on this aspect is provided in Section 3.2.2(vi).

A schematic diagram of the proposed Pine Feather panels is provided in Figure 3.4. This diagram shows three heading gate roads, with plunges driven off the outside roadways and barrier pillars left between individual panels. The cut-throughs and drives are designed to be sub-perpendicular (at 70 degrees), as discussed above.

After mining, each panel will be partially filled with coal reject material and sealed with bulkheads to allow immediate commencement of groundwater recovery.

This method of coal extraction has higher productivity than traditional first workings and has been designed to meet the following objectives:

1. Provide stable, open voids for the emplacement of coal reject materials.
2. Provide a high productivity, non-caving production system.
3. Provide negligible surface and subsurface subsidence impacts.

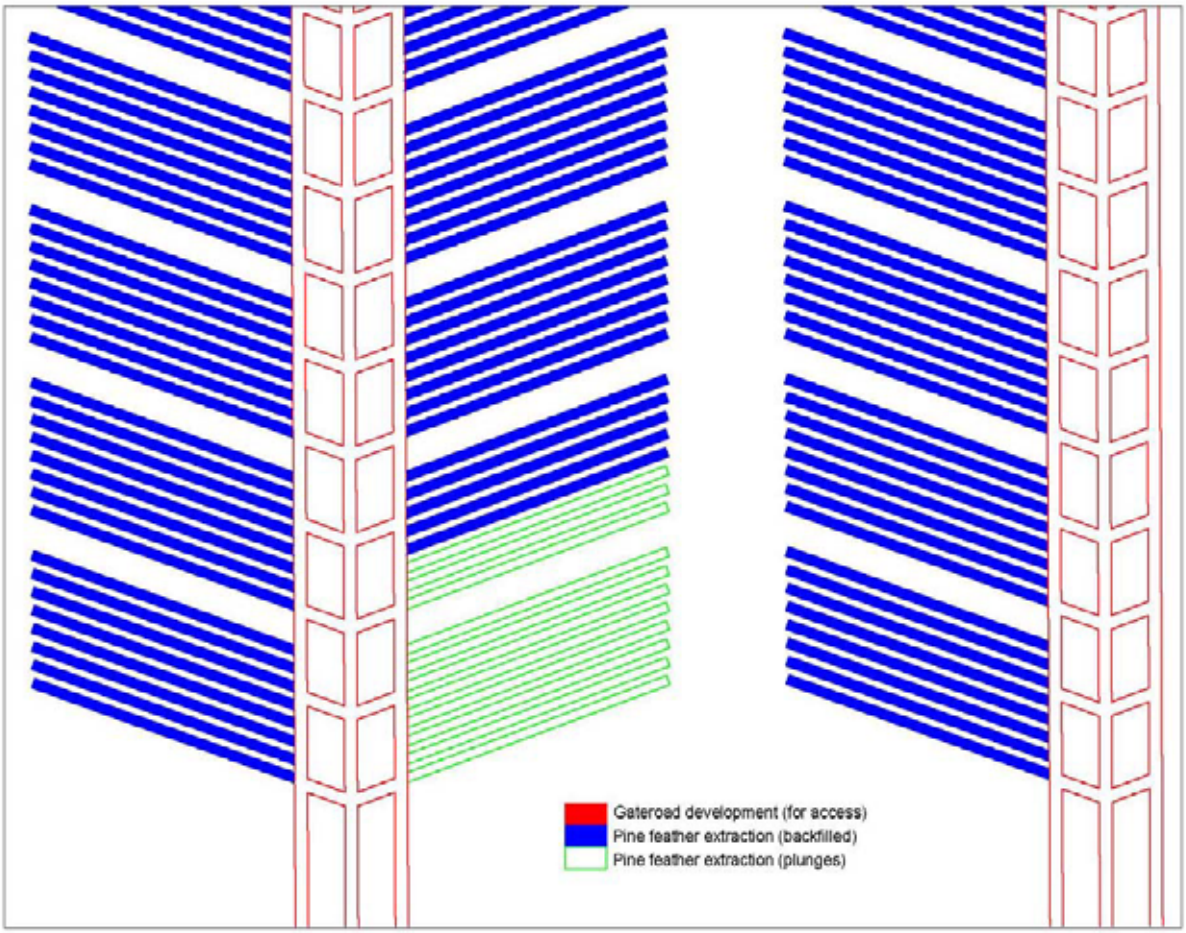


Figure 3.4 Pine Feather extraction layout – schematic diagram showing extraction in adjacent panels

3.4.2 Gas

Testing of coal within the project area has confirmed that, similar to the neighbouring Berrima Colliery, the gas content in the Wongawilli Seam within the project area is extremely low (0.25 to 0.5 cubic metres [m^3] of gas per tonne, of which 96 to 100% comprises carbon dioxide). Therefore, gas drainage wells are not required for the project. Given the extremely low gas content of the coal seam, any gas liberated by mining would be controlled by dilution through ventilation. In any case it is noted that the coal characteristics are such that these extremely low levels of gas are unlikely to actually be released from the coal.

3.4.3 Ventilation

A ventilation system will be installed, including:

- five heading mains (two intake travel roads, one intake conveyor road and two returns);
- two intake air drifts at 1 in 8 grade (which also form the personnel and materials access and egress and conveyor drifts for the mine);
- a main upcast ventilation shaft close to the bottom of the drifts, with surface fans at the MIA precinct (Figure 3.2); and
- potentially, up to two additional shafts later in the mine life.

3.4.4 Personnel and materials access and egress

Personnel and materials access into (and egress from) the underground mine will be by a drift, with a portal to be constructed at the MIA precinct. A second drift will be constructed parallel to the personnel and materials drift (and connected to it through periodic cross-cuts) to house a conveyor belt. The conveyor drift will also provide a secondary access and egress to and from the underground workings. The drifts will connect the MIA with the mains headings.

3.5 Coal processing and transport

3.5.1 Coal handling and preparation plant

The project will include constructing and operating a CHPP and associated facilities capable of handling and processing up to 3.4 Mtpa of ROM coal (refer to Figure 3.2).

As shown in Figure 3.2, ROM coal will be delivered by conveyors from the underground mine to a ROM coal stockpile. From there it will be reclaimed and transferred by conveyor to a fully enclosed rotary breaker station for sizing and then to a surge bin. It will then be conveyed to the coal preparation plant (CPP) for washing to remove stone and other non-coal materials (coal reject). The CPP will have a design capacity of 600 tonnes per hour. The resultant product coal will be conveyed to a transfer station and on to the product stockpiles.

3.5.2 Product transport

Product coal will be recovered from the stockpiles by a reclaimer and transferred onto a series of overland conveyors to a train load-out bin (Figure 3.2). A sampling station will be fitted to the conveyor to collect coal samples for chemical analysis and monitor ash and moisture content. The train load-out bin will incorporate a weighing facility to allow accurate loading of each train wagon. The load-out facility will be partially enclosed to control noise and dust emissions.

Product coal will be transported by train to domestic markets, or to Port Kembla via the Berrima Branch Line, Main Southern Line, Moss Vale to Unanderra Line and Illawarra Line (refer to Figure 3.1). This will generally require up to eight train paths per day (four in each direction), depending on throughput at the time.

3.6 Coal reject management

During the life of the project approximately 11 Mt of coarse and fine reject material will be produced. Initially, while void space is being created underground, a small volume of comingled rejects will be stored at a temporary surface emplacement area(s), adjacent to the CHPP. This temporary emplacement area will be used until sufficient void space has been created to allow emplacement of rejects underground. It will be progressively constructed, contoured, and when full, revegetated and top dressed. During periods when reject is being stored at the surface, belt press filters are proposed to be used to remove water from the coal reject fines, which will avoid the need for a tailings storage facility at the surface.

Once sufficient void space is created, coarse reject will be crushed and/or milled and combined with the fine reject and water to form a paste or slurry. This material will then be pumped underground into the void spaces left after the coal is extracted, using a system of pumps and pipelines. The paste infrastructure will incorporate dosing facilities to allow addition of cement or limestone as required. Once the mine is operating at peak production, this process will be a continuous part of the production system and backfill operations will follow more or less immediately after mining.

In the advent of an interruption to paste operation, for example during maintenance at the paste plant, the reject materials will be temporarily diverted to an emergency surface stockpile area at the CHPP precinct, for later reprocessing (Figure 3.2). This will allow coal processing operations to continue throughout the paste interruption. The belt press filters will be used again during these periods.

Once mining is completed, rejects stored at the surface will be removed, reprocessed and pumped underground to partially fill the remaining voids. The surface emplacement area(s) will then be rehabilitated to integrate with the natural landform.

3.7 Surface infrastructure

Surface facilities and activities to service the mine are proposed near the northern boundary of A349, on land owned by Hume Coal (refer to Figure 3.2). There will be two primary components, an MIA precinct and a CHPP precinct.

The MIA precinct will have a disturbance footprint of around 20 ha, as shown in Figure 3.2, and is proposed to contain:

- rubber tyred access and conveyor drift portals and associated infrastructure (refer to Section 3.4.4);
- main ventilation shaft and fans; and
- administration offices and ancillary infrastructure, including:
    - bathhouse;
    - control room;
    - car park;
    - workshop;
    - warehouse/store and laydown area;
    - fuel and lubrication storage and refuelling facilities;
    - washdown facilities;
    - security fencing;
    - internal access roads;
    - sewage treatment facility;
    - water supply, storage and management infrastructure;
    - electricity supply and communications infrastructure;
    - back-up generators;
    - air compressors;
    - dust suppression and firefighting systems;
    - emergency response facilities;
    - explosives magazine;
    - helipad;
    - service borehole compound; and
    - environmental management and monitoring equipment.

The CHPP precinct will have a disturbance footprint of around 45 ha, as shown in Figure 3.2, and is proposed to contain:

- CPP and associated conveyors, breaker station, transfer points and surge bin(s) (refer to Section 3.5);
- ROM and product coal stockpiles and associated conveyors (refer to Section 3.5);
- reject paste plant and emergency and temporary reject storage facilities (refer to Section 3.6); and
- ancillary infrastructure including:
    - employee car park and internal access roads;
    - CHPP office;
    - electricity supply and communications infrastructure;
    - water supply, storage and management infrastructure, including coal contact water dams;
    - dust suppression and firefighting systems; and
    - environmental management and monitoring equipment.

A water treatment plant, raw water dam and train load-out facilities will also be located near the CHPP precinct (Figure 3.2).

3.8 Utilities and services

3.8.1 Electricity supply

The project will include installation of electricity reticulation infrastructure, including high voltage electricity lines and substations.

Off-site electricity connection will be provided by Endeavour Energy from either its Moss Vale or Fairfax Lane substation. Some augmentation works at the substation are expected. Electricity lines will be installed or upgraded from the main substation to a new substation to be constructed within the project area. The electricity lines will be constructed within existing utility and infrastructure easements where practical. As noted in Section 1.1, works required to construct the off-site electricity lines will be subject to a separate approval process under Part 5 of the EP&A Act. Hume Coal is liaising with Endeavour Energy regarding this approval.

A series of substations, buried and overhead electricity lines will be constructed around the project area to supply power to the mine, including the train load-out area, overland conveyors, MIA, CHPP and underground workings.

3.8.2 Telecommunications

A communications network will be installed, using either fibre-optic cable or microwave link.

3.8.3 Utility and infrastructure relocations

Some existing utilities and infrastructure will be relocated and minor road realignments made as part of the project. This will include part of the water pipeline between Medway Dam and Berrima, which crosses the proposed surface infrastructure area. The proposed realigned route along the southern edge of the CHPP precinct, to the Hume Highway, is shown indicatively in Figure 3.2. Some existing electricity lines, communications cables and/or gas pipelines may also be relocated.

Temporary road diversions may also be necessary during construction, where infrastructure crosses roads. Where this is the case, the temporary road diversion will be constructed immediately adjacent to the existing road, and the original alignment rehabilitated and reinstated when construction of the culvert or crossing is completed.

3.9 Water and wastewater management system

3.9.1 Water supply

The project will require water for a range of uses including:

- dust suppression;
- coal and reject processing;
- belt cleaning;
- washdown of vehicles, machinery and conveyors;
- amenities and other potable water uses; and
- fire protection systems.

A detailed water balance model is currently being prepared to confirm water demands and the results will be reported in the EIS.

During construction and the initial years of operations, water supply will principally be from groundwater bores, existing surface water rights and/or rain water harvested on-site, and will be treated as required before use. Potable water may also be trucked to site, including to the construction accommodation village, at least until Hume Coal's water treatment plant is commissioned.

For the remainder of operations, water requirements will be met by water captured and treated on-site, comprising either that pumped from the underground mine workings or runoff captured from surface infrastructure areas.

3.9.2 Water management and treatment system

The planned water management and treatment system will minimise the potential for contamination of surface water and groundwater, and maximise recycling and re-use of water captured on-site. It will include a series of mine water dams, diversion drains, pipelines, sedimentation dams, sumps, pumps and culverts that capture runoff from surface infrastructure areas including the MIA, CHPP and train load-out areas. Water inflows to the active parts of the underground mine will be captured and stored in a 6 megalitre (ML) capacity underground sump. It may be pumped to the surface for treatment followed by re-use, reinjection, supply to others or release, as explained below.

Water from the mine water dams will be piped to the raw water dam south-east of the CHPP and treated to a quality suitable for its end use (refer to water treatment plant location shown in Figure 3.2). Once treated, it may then be pumped to the MIA, CHPP or underground, for re-use.

Various options are being investigated to manage any excess mine water and surface water runoff that is unable to be re-used on-site. These include reinjection back into the groundwater system, supply to others (such as for irrigation of farmland), and/or release to a nearby watercourse(s), under licence. The preferred option(s) will be documented and assessed in the EIS.

3.9.3 Sewage management

During the initial construction phase, it is likely that sewage will be collected in a buffer tank and trucked off-site by a suitably licensed contractor, although other options will be investigated during detailed design. During the rest of the project life, sewage will be treated at a treatment plant constructed on-site. The treated water from this plant will be managed within the mine's water management system. Sludge from the plant will be collected and disposed of at an appropriately licensed off-site facility.

3.10 Site access

The primary road access point to the MIA, CHPP and temporary construction accommodation village will be from Mereworth Road (Figure 3.2). Other access points to infrastructure areas will be used during construction and intermittently during operations, for instance for maintenance activities. These will be from Medway Road, Belanglo Road and the Hume Highway. Access points will be constructed to a standard in keeping with their proposed use.

The project will also include internal access roads to service key surface infrastructure areas, including the MIA, CHPP, reject handling and storage facilities, water treatment plant and alongside conveyors.

3.11 Construction activities and facilities

A range of temporary facilities will be established during construction including:

- construction offices;
- car parking areas;
- stores and laydown areas;
- equipment assembly areas;
- fuel facilities;
- power;
- communications;
- water services;
- compressed air station;
- borrow pits;
- shaft construction site;
- drift construction site;
- bunding, drainage and sediment management systems;
- explosives magazine; and
- temporary construction accommodation village.

The layout of temporary construction facilities will generally match the ultimate surface infrastructure layout, so that they can be augmented with minimal disruption and cost impact. Where possible, infrastructure and facilities used during construction will be those which are ultimately used during operations.

3.12 Workforce

To avoid a 'drive-in-drive-out' or 'fly-in-fly-out' workforce and assist in managing fatigue, all operational employees will be required to live within the Southern Highlands region and immediate surrounds (within a 45-minute commute of the mine). This will not only assist in managing safety and wellbeing of employees but will ensure greater socio-economic benefits flow directly to the local community. Local suppliers and contractors will also be used wherever possible, although it is expected that some specialist tasks of fixed duration may require a workforce sourced from further afield.

3.12.1 Construction

It is estimated that a workforce of up to 400 people will be required to construct the mine. Non-local construction employees will reside in the temporary construction village while rostered-on to avoid putting pressure on the local rental and tourism accommodation market.

3.12.2 Operations

A workforce of around 100 full-time equivalent employees will be required during the first year of operations, rapidly increasing to around 300 at peak production. Hume Coal's training and recruitment programs will aim to maximise local employment. During the peak of operations it is anticipated that around 70% of the workforce will be sourced from the Wingecarribee LGA and immediately adjacent areas, with the balance relocating to the area for employment.

3.13 Hours of operation

3.13.1 Construction

Construction activities will occur 24 hours a day, seven days a week. These activities will be conducted in accordance with the relevant guidelines, standards and construction environmental management plans, to minimise the potential for adverse impacts such as light, noise or dust impacts.

3.13.2 Operations

The mine will operate 24 hours a day, seven days a week. This will include maintenance activities, deliveries, coal processing, coal transport and mining operations. These activities will be conducted in accordance with the relevant guidelines, standards and operational environmental management plans, to minimise the potential for adverse impacts such as light, noise or dust impacts.

3.14 Rehabilitation and final landform

Post-mining, the mine infrastructure will be decommissioned and the area rehabilitated such that it can support land uses similar to the current land uses. This outcome will be assisted by the surface infrastructure design, which retains as much of the existing landscape as possible. The rehabilitation strategy will be developed in consultation with stakeholders, taking into account outcomes of detailed environmental investigations during the EIS. However, conceptually it is proposed to include:

- dismantling the temporary construction facilities, including the accommodation village, at the completion of construction and rehabilitating the site(s);
- progressively rehabilitating minor surface disturbance areas (eg drill pads and access tracks) to their previous land use; and

- at the completion of mining:
    - emplacing all remaining stored reject material underground and rehabilitating the temporary surface emplacement area(s) to integrate with the natural landform;
    - where appropriate, removing underground plant and equipment;
    - filling and sealing mine accesses (drifts and shafts) to the relevant guideline or standard (currently MDG 6000); and
    - removing mine infrastructure and rehabilitating surface disturbance areas, including the MIA and CHPP.

Further discussion on rehabilitation and mine closure is provided in Section 7.18.

4 Approval requirements

4.1 Introduction

The project requires approval under NSW legislation and potentially also under Commonwealth legislation. Concurrent with lodging its request for SEARs (and this document), Hume Coal is making a referral to DoE to determine whether or not this is the case. If Commonwealth approval is required, it is likely that this would be facilitated by a bilateral agreement between the Commonwealth and State governments which accredits the State's EP&A Act assessment process, meaning only one EIS would need to be prepared.

This section describes the project's approval process and outlines applicable legislation and policies, which will be considered in the EIS.

4.2 Commonwealth legislation

4.2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides the legal basis for protection and management of internationally and nationally important flora, fauna, ecological communities, heritage places and water resources which are deemed to be matters of national environmental significance (MNES). MNES, as defined under the EPBC Act, are:

- World Heritage properties;
- places listed on the National Heritage Register;
- wetlands of international significance listed under the Ramsar Convention;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, actions that will, or are likely to, have a significant impact on a MNES are deemed to be controlled actions and can only proceed with the approval of the Commonwealth Minister for the Environment. An action that may potentially affect a MNES is to be referred to DoE for determination as to whether or not it is a controlled action.

It is considered that the project is likely to have a significant impact on MNES, based on its potential impacts to water resources. Accordingly, a referral will be made to DoE. If the Minister determines that the project is a controlled action, approval will be required under Part 9 of the EPBC Act. As mentioned above, it is likely that the Commonwealth will accredit the assessment process under Part 4 of the EP&A Act under the bilateral agreement and so a separate Commonwealth-specific EIS would not be required.

4.2.2 Commonwealth Native Title Act 1993

The Commonwealth *Native Title Act 1993* provides for the recognition and protection of native title rights in Australia. It allows a native title determination application (native title claim) to be made in respect of land or waters where native title has not been validly extinguished, for example, extinguished by the grant of freehold title to land.

Applications for compensation for extinguishment or impairment of native title rights can also be made. All native title claims are subjected to a registration test and will only be registered if claimants satisfy a number of conditions. A register of native title claims is maintained by the National Native Title Tribunal.

Proposed activities or development that may affect native title are called 'future acts'. Claimants whose native title claims have been registered have the right to negotiate about some future acts, including mining and granting of a mining lease over the land subject of their native title claim. Where a native title claim is not registered, a development can proceed through mediation and determination processes, though claimants will not be able to participate in future act negotiations.

There are currently no native title applications over the project area. Notwithstanding, Hume Coal will comply with any requirements under this act as part of its mining lease application process.

4.3 NSW legislation

4.3.1 NSW Environmental Planning and Assessment Act 1979

The EP&A Act and EP&A Regulation provide the legal basis for environmental planning and assessment in NSW. Part 4 of the EP&A Act prescribes the processes for development assessment. Division 4.1 relates specifically to the assessment of development deemed to be significant to the State (or SSD).

Section 89C(2) of the EP&A Act says that a:

> State environmental planning policy may declare any development, or any class or description of development, to be State significant development.

Schedule 1 of the State and Regional Development SEPP identifies developments which are significant to the State, one of which is "development for the purpose of (coal) mining". Therefore, the Hume Coal Project meets the requirements for SSD.

Under section 89D of the EP&A Act, the Minister for Planning is the consent authority for SSD. The Minister may, however, delegate the consent function to the NSW Planning Assessment Commission (PAC), Secretary of DP&E or any other public authority under section 23 of the EP&A Act.

A development application for SSD must be accompanied by an EIS, prepared in accordance with the EP&A Regulation. Before preparing an EIS, an applicant must request SEARs, which are the terms of reference for the EIS. This document accompanies Hume Coal's request for SEARs.

The main steps in the SSD approvals process are given in Table 4.1.

Table 4.1 SSD approvals process

Step	Description
1. Request SEARs	The applicant lodges a request for SEARs with a supporting document to DP&E. The Major Projects Panel considers and then declares whether the application is SSD.
2. Planning focus meeting	DP&E may convene a PFM with the relevant local council and other agencies to brief them on the project and invite them to recommend assessment requirements.
3. SEARs	The Secretary issues SEARs following consultation with council and other relevant agencies.
4. Prepare draft EIS	The applicant prepares a draft EIS which addresses the SEARs, at a minimum. The applicant consults with stakeholders including council, other government agencies and the community during preparation of the draft EIS.
5. Adequacy review	DP&E may review the EIS to determine if the minimum assessment requirements are met and allow the applicant to make any desirable changes prior to accepting it for exhibition.
6. Public exhibition	DP&E exhibits the EIS for a minimum of 30 days and invites submissions from council, agencies and the community.
7. Response to submissions	DP&E forwards submissions to the applicant who lodges a response to submissions. The applicant may also lodge a preferred project report if significant changes to the project have been made following exhibition, for example to address matters raised in submissions.
8 DP&E preliminary assessment	DP&E undertakes a preliminary assessment of the project giving consideration to the EIS, submissions and the applicant's response to submissions report.
9. PAC merit review	The Minister may request, or approve a request by the applicant, for the PAC to review the merits of the project and for a public hearing to be undertaken by the PAC. Where a public hearing is undertaken, this removes the right for a merits appeal by a third party and the proponent. In its review of the project, the PAC is provided terms of reference by the Minister. These terms of reference usually request consideration of the EIS, issues raised in submissions, response to submissions report and the DP&E's preliminary assessment report. The PAC then provides a formal response to the Minister on the merits of the project.
10. Assessment	Upon receipt of the PAC review report, DP&E finalises its assessment and, if the department considers that approval is appropriate, consults with council and other regulators on draft conditions of consent. DP&E may request further information from the applicant to respond to the PAC review report. DP&E's finalised assessment report is forwarded to the consent authority (the Minister or PAC if the relevant local council objects, more than 25 objections are received during exhibition, or the applicant has reportable political donations).

As noted in Section 1.1, two approvals are required under the EP&A Act:

- development consent for the mine and associated facilities under Part 4 of the EP&A Act; and
- an activity approval for proposed electricity supply works under Part 5 of the EP&A Act.

In addition, as mentioned previously, associated rail works and use (the 'Berrima Rail Project') will be subject of a separate development application. This is because it will include rail infrastructure and/or upgrades which are used by other rail users, being Boral, Ingham, Omya and/or the Hume Coal Project. These activities will be described in detail in documentation accompanying that application. They will include construction and use of a rail spur and loop to connect the Hume Coal Project to the Berrima Branch Line (within the Moss Vale Enterprise Corridor), use of existing rail infrastructure and potentially upgrades to the Berrima Branch Line.

4.3.2 NSW Mining Act 1992

The NSW *Mining Act 1992* makes provision for the granting of mining authorities, leases and licences. It also places controls on methods of exploration and mining, disposal of mining waste, land rehabilitation, and environmental management activities. The project will require a mining lease. Section 89K of the EP&A Act mandates that a mining lease for SSD cannot be refused and its terms must be substantially consistent with the terms of development consent for the SSD.

4.3.3 NSW Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) is the principal NSW environmental protection legislation and is administered by the NSW Environment Protection Authority (EPA). Schedule 1 lists the 'scheduled activities' which require an environment protection licence (EPL). An EPL prescribes management standards and monitoring requirements to control environmental pollution. Schedule 1 includes 'mining for coal', meaning the mining, processing or handling of coal at open cut or underground mines that disturb a total surface area of more than 4 ha of land.

The project meets the definition of a scheduled activity and will require an EPL. Pursuant to section 89K of the EP&A Act, if development consent is granted for the project, an EPL cannot be refused and its terms must be substantially consistent with the terms of the development consent.

4.3.4 NSW Water Act 1912 and NSW Water Management Act 2000

The NSW *Water Act 1912* (Water Act) and NSW *Water Management Act 2000* (WM Act) regulate the management of water in NSW. The WM Act applies to licences to use water once a water sharing plan for that water source has commenced. Alternatively, in those water sources where a water sharing plan has not yet commenced, the Water Act applies.

Both the Water Act and the WM Act regulate water via granting of licences, approvals for taking and using water, and trading of both groundwater and surface water. Water sharing plans have commenced for most areas of NSW.

The project area is within the area covered by the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011,* which commenced on 1 July 2011. The water sharing plan is divided into a number of groundwater source areas. The project area is within the Sydney Basin Nepean Groundwater Source (Nepean Management Zone 1).

Water management will be an important aspect of the assessment process and the principal regulatory authority concerned will be the NSW Office of Water (NOW). However, section 89J of the EP&A Act removes the need for a number of approvals under the WM Act when development consent has been granted for a SSD. These are a water use approval under section 89, a water management work approval under section 90 and an activity approval (other than an aquifer interference approval) under section 91.

Authorisations required for the project are water access licences and aquifer interference approvals under the WM Act and bore licences under the *Water Act 1912*. Pursuant to section 89K of the EP&A Act these licences and approvals cannot be refused if development consent is granted for a SSD and their terms must be substantially consistent with the terms of the development consent. Details of the relevant water sharing plan and licences and approvals required under the Water Act and WM Act will be provided in the EIS.

4.3.5 NSW National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act 1974* (NPW Act) provides for nature and cultural heritage conservation in NSW, including protection of native flora and fauna and the conservation of places, objects and features of significance to Aboriginal people.

Part 8A of the NPW Act provides for protection of threatened flora and fauna. Section 118A (1a) states that a person must not harm any animal that is, or is part of, a threatened species, an endangered population or an endangered ecological community (EEC). Impacts to flora and fauna will be assessed as part of the EIS.

A person must not harm or desecrate an Aboriginal object or place without an Aboriginal heritage impact permit under section 90 of the NPW Act. However, a section 90 permit is not required for SSD by virtue of section 89J of the EP&A Act. Notwithstanding, the project's potential impacts to Aboriginal heritage will be fully assessed as part of the EIS.

4.3.6 NSW Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) aims to conserve biological diversity in NSW through the protection of threatened flora and fauna species, populations and EECs. Potential impacts to threatened species, populations and EECs will be assessed as part of the EIS.

4.3.7 NSW Native Vegetation Act 2003

The NSW *Native Vegetation Act 2003* (NV Act) provides for the promotion, improvement and protection of native vegetation in NSW. Approval to clear native vegetation in NSW is required under the NV Act. However, under section 89J of the EP&A Act, SSD is exempt from an authorisation to clear native vegetation under section 12 of the NV Act if development consent has been given. Notwithstanding, potential impacts to native vegetation will be assessed as part of the EIS.

4.3.8 NSW Roads Act 1993

The NSW *Roads Act 1993* (Roads Act) regulates activities that may impact on public roads in NSW. Consent is required from the relevant roads authority under section 138 of the Roads Act for any work in, on or over a public road. In the case of SSD, section 89K of the EP&A Act stipulates that a consent under section 138 cannot be refused and must have terms that are substantially consistent with the development consent for the SSD. Nevertheless, a referral to the NSW Roads and Maritime Services (RMS) will be required as the project is classified a traffic-generating development pursuant to the State Environmental Planning Policy (Infrastructure) 2007 (refer to Section 4.4.1).

4.3.9 NSW Crown Lands Act 1989

The NSW *Crown Lands Act 1989* (CL Act) sets out how Crown land is to be managed. Applications to use Crown land generally need to be authorised by a lease, licence or permit. Approval of the NSW Crown Lands Division will be required under the CL Act for any works or mining in Crown land. This also applies to Crown roads in the project area.

4.3.10 NSW Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) aims to protect and conserve the natural and cultural history of NSW, including scheduled heritage items, sites and relics. Approvals under Part 4 or an excavation permit under section 139 of the Heritage Act are not required for SSD by virtue of section 89J of the EP&A Act. Nevertheless, potential heritage impacts will be assessed as part of the EIS.

4.3.11 NSW Dams Safety Act 1978

The role of the Dams Safety Committee is to approve and maintain records of 'prescribed dams' in NSW. Prescribed dams are defined in Schedule 1 of the NSW *Dams Safety Act 1978* (Dams Safety Act). The Dams Safety Committee will be consulted to determine if any dams proposed for the project are prescribed dams and require inclusion in Schedule 1 of the Dams Safety Act. Also, effects of underground mining on prescribed dams will be examined.

4.3.12 NSW Work Health and Safety Act 2011 and NSW Work Health and Safety (Mines) Act 2013

The NSW *Work Health and Safety Act 2011* establishes a consistent approach to ensuring the health and safety of workers in NSW. The NSW *Work Health and Safety (Mines) Act 2013* supplements the provisions of the NSW *Work Health and Safety Act 2011* by providing additional health and safety requirements specifically for mining operations. The project will implement the necessary policies, training and procedures required under these Acts, including obtaining licenses for storage and handling of dangerous goods.

4.3.13 NSW Forestry Act 1916

The NSW *Forestry Act 1916* (Forestry Act) provides the statutory framework for the dedication, reservation, control and use of state forests. Under section 31 of the Forestry Act, an occupation permit is required for any component of the project within a state forest, for example, Belanglo State Forest, which falls within the project area.

4.4 Environmental planning instruments

Section 79C(a)(i) of the EP&A Act requires the consent authority to consider the provisions of relevant environmental planning instruments (EPIs) which includes both State and local EPIs. Consideration will be given to each of these in the EIS.

4.4.1 State environmental planning policies

Relevant State environmental planning policies are identified below.

- State Environmental Planning Policy (State and Regional Development) 2011: identifies development that is SSD or State significant infrastructure. Section 89C, part 2 of the EP&A Act enables an EPI to declare a development to be SSD. The project is SSD pursuant to Schedule 1 of the State and Regional Development SEPP, as it is "development for the purpose of (coal) mining".

- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP): 'in recognition of the importance to NSW of mining, petroleum production and extractive industries' provides for the orderly development of these resources to promote the social and economic welfare of NSW. It also establishes planning controls to encourage ecologically sustainable development. Under Part 2, underground mining may be carried out on any land with development consent, irrespective of local zoning provisions. Part 3 specifies certain non-discretionary standards for management of impacts associated with mining and the project's compliance with these will be assessed in the EIS. The Mining SEPP requires that, in determining whether to grant consent for a mining development, the significance of the resource is to be the consent authority's principal consideration.

- State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33): requires the consent authority to consider a project's potential to cause hazards or be offensive, including consideration of the location of the development and the way in which it is to be carried out. The project will be assessed to determine if it is classified as potentially hazardous or offensive development, including consideration of DP&E's guideline *Applying SEPP 33* (Department of Planning [DoP] 2011a). If the answer is positive, an assessment of hazards will be included in the EIS, covering those elements discussed in Section 7.14.2.

- State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44): encourages the conservation and management of Koala (*Phascolarctos cinereus*) habitat, to ensure permanent free-living Koala populations are maintained over their present range. SEPP 44 requires the consent authority to consider if the land covered by a development application is 'potential Koala habitat' or 'core Koala habitat'. The project's potential impact on Koala habitat will be assessed in the EIS.

- State Environmental Planning Policy No 55 – Remediation of Land: provides a state-wide approach to the remediation of contaminated land for the purpose of minimising the risk to human health and the environment. Potential impacts on any contaminated land will be assessed in the EIS.

- State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011: provides that a consent authority must not grant consent to a proposed development in Sydney's drinking water catchment unless it is satisfied that it will have a neutral or beneficial effect on the catchment's water quality. A detailed water quality assessment will be made as part of the EIS, including by use of the '*Neutral or Beneficial Effect on Water Quality Assessment Tool 2011'* (Sydney Catchment Authority 2011).

- State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP): aims to facilitate the effective delivery of infrastructure across the State. The Infrastructure SEPP includes provisions for development in rail corridors and within or adjacent to road corridors and road reservations, which will be relevant for the project and addressed in the EIS. As described in Section 4.3.8, Schedule 3 of the Infrastructure SEPP identifies traffic-generating development to be referred to RMS. The project meets the minimum size (5,000 square metre) requirement for industrial development at sites which have access to a classified road and, therefore, the project will be referred to RMS.

4.4.2 Local environmental plans

The proposed mining and infrastructure areas are variously on land zoned E3 Environmental Management, RU2 Rural Landscape, RU3 Forestry and SP2 Infrastructure pursuant to the *Wingecarribee Local Environmental Plan 2010* (Wingecarribee LEP). Under the Wingecarribee LEP, the proposed activities are prohibited in these zones. However, the project remains permissible with development consent in all zones under the provisions of the Mining SEPP, which prevails over any inconsistencies with a local environmental plan. The EIS will consider the project's permissibility in detail as well as its consistency or otherwise with the existing and planned future character of the area, and the zoning objectives.

4.5 Strategic policies

4.5.1 Strategic Regional Land Use Policy

i Overview

In 2012 the NSW Government released its Strategic Regional Land Use Policy (SRLUP), which aims to 'provide greater protection for valuable agricultural land and better balance competing land uses' (Department of Planning and Infrastructure 2012). It seeks to do this by 'identifying and protecting strategic agricultural land, protecting valuable water resources and providing greater certainty for companies wanting to invest in mining and coal seam gas projects in regional NSW'. The SRLUP provides a strategic framework and a range of initiatives to balance agriculture and resource development.

The SRLUP applies to State significant mining proposals, such as the Hume Coal Project, that require a new or extended mining lease under the *Mining Act 1992*. Under provisions of the EP&A Regulation, a gateway certificate or a site verification certificate (SVC) certifying that the land on which the proposed development is to be carried out is not biophysical strategic agricultural land (BSAL) is needed before the project's development application can be lodged. SVCs are issued by the Secretary of DP&E and certify that, in the Secretary's opinion, the subject land is or is not BSAL, and therefore whether or not it is subject to the gateway process under the SRLUP. This process was established by an amendment to the Mining SEPP. The type of certificate required depends on whether or not the proposed development is to be on 'strategic agricultural land'.

There are two categories of strategic agricultural land. First, land with a rare combination of natural resources which make it highly suitable for agriculture, known as BSAL. Second, land shown on the Strategic Agricultural Land Map to be a critical industry cluster (CIC), being land that is important to a highly significant and clustered industry such as winemaking or horse breeding.

ii BSAL

The NSW Government mapped BSAL across NSW at a desktop level, although stated that 'due to the regional scale of the maps, it is important that appropriate processes are in place to verify that particular sites are in fact BSAL' (NSW Government 2013). The Mining SEPP requires certain types of development (including the Hume Coal Project) to undertake 'site verification' to confirm whether or not they are to be situated on BSAL. Detailed site-specific surveys are required following methods prescribed in the NSW Government (2013) *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (Interim Protocol) to verify whether or not that part of the development application area which requires a mining lease meets the specified criteria for being BSAL.

The maps accompanying the Mining SEPP indicate that there is no BSAL in the project area. BSAL has been mapped nearby (though not confirmed by site verification), in the south-eastern corner of A349 and at a hill (Mount Gingenbullen) in its north-eastern corner. It is noted that, based on review of LiDAR data, there is less than 20 ha of land at Mount Gingenbullen with slopes less than or equal to 10% and so it does not comprise BSAL. Furthermore, the hill includes rocky outcrops and is the site of an old Trachyte quarry. Nonetheless, the project does not involved mining under either of these areas and they are outside the project area.

Site verification has been undertaken in accordance with the Interim Protocol and confirmed that there is no BSAL within those parts of A349 and land to the north over which Hume Coal intends to seek a mining lease (including a lease for mining purposes). This is consistent with the NSW Government's BSAL mapping. Hume Coal must therefore apply for a SVC under Part 4AA of the Mining SEPP, to certify its findings, as opposed to a gateway certificate. An application for a SVC is being lodged accordingly. The verification process and outcomes are documented in the BSAL Verification Assessment Report (EMM 2015), which was prepared in accordance with the Interim Protocol and accompanies Hume Coal's SVC application.

iii CIC

Maps accompanying the Mining SEPP also show that there are no CICs in the vicinity of the project area. Only two have been identified (an equine and a viticulture CIC), both in the Upper Hunter region, more than 200 km to the north. The NSW Government (2012) *Draft guideline for site verification of critical industry clusters* states that 'projects located outside the mapped CIC are not required to seek site verification'. The Hume Coal Project is outside the mapped CIC. Therefore, the project area does not contain CICs and Hume Coal is not required to seek a site verification or gateway certificate in respect of CICs.

4.5.2 NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (AIP) was released by NOW in 2012. It defines the regime for protecting and managing the impacts of aquifer interference activities (such as underground mining) on water resources in NSW. The AIP seeks to strike a balance between the water needs of towns, farmers, industry and the environment.

The policy clarifies water licensing and impact assessment requirements for aquifer interference activities under NSW legislation, principally the Water Act and WM Act. This includes defining criteria or 'minimal impact considerations' for water table, pressure and quality that are to be applied in assessing the potential impacts of aquifer interference activities on water resources. That is, to evaluate whether or not more than minimal impacts might occur to a water-dependent asset as defined in the AIP, for example a water supply work or high priority groundwater dependent ecosystem.

The AIP also sets out the information that must be provided by the proponent to enable appropriate assessment of the activity by the Minister for Natural Resources, Lands and Water.

The EIS will describe the project's water licensing requirements and include a detailed water resources assessment that addresses the AIP requirements. This will include assessing the project's potential impacts against the AIP's minimal impact considerations.

5 Stakeholder engagement

5.1 Background

The project has the potential to generate considerable interest from stakeholders including all levels of government, the local community, special interest groups and direct beneficiaries such as local businesses, suppliers and potential employees.

Hume Coal has been actively engaging with stakeholders since 2011, when its exploration program began. Hume Coal has wanted to ensure stakeholders are informed about the project and has sought to build relationships and seek feedback in order to address stakeholders' views in the project's planning, design and environmental assessment. This has included convening advisory groups where there is strong interest in a particular topic. A Water Advisory Group (WAG) was established to advise on matters related to the project's water studies and a Social Reference Group (SRG) to advise on local social and economic development matters. To date Hume Coal has had more than 550 separate meetings with stakeholders. Ongoing consultation and engagement will occur throughout the project's development, construction, operations and closure phases.

The project has been designed to accommodate stakeholder feedback wherever possible, for example to enable emplacement of reject material underground, rather than at the surface (refer to Section 3.2.1(ii)). Further refinements are anticipated in response to future stakeholder input.

5.2 Stakeholder engagement and consultation strategy

5.2.1 Approach and objectives

A systematic process has been used to identify stakeholders, assess their likely level of interest and determine to what extent and in what way they might like to be involved, as described in Sections 5.2.2 and 5.2.3. Tailored engagement strategies have then been developed for each stakeholder or stakeholder group. Engagement techniques and the level of involvement range from information dissemination, to consultation, to involvement and collaboration on aspects such as community investment programs and development of mitigation measures.

The stakeholder engagement and consultation strategy and plan prepared specifically for the Hume Coal Project aims to:

- identify relevant stakeholders and provide them with clear, timely information about the project and its potential impacts in an open and transparent manner;
- seek feedback on the project and the proposed approaches to minimising impacts;
- ensure stakeholders' views are understood, appropriately managed and considered in the project's planning, design and implementation and the EIS;
- provide feedback on how matters raised have been considered and addressed; and
- establish long-term relationships with key stakeholders, based on trust and mutual respect, which can be utilised for mutual benefit, for example partnering in community enhancement projects.

The engagement and consultation plan sets out who, how, why and when various stakeholders are to be engaged. It assists Hume Coal in planning, implementing and reviewing stakeholder engagement actions. The effectiveness of consultation activities in achieving their objectives is routinely monitored and evaluated, and the approach revised as required in response to changing needs or circumstances. The plan is internally reviewed and updated quarterly and is externally peer reviewed annually. It is also flexible to respond to new matters as they arise.

Information gathered through consultation is used to identify and assess potential issues, opportunities, risks and concerns, and to help develop a community profile. It is key in learning what is important to people in the local community and profiling their socio-economic conditions, aspirations, fears and perceptions about the project. This information will be used in the project's social impact assessment and enable development of informed mitigation and management measures.

5.2.2 Initial stakeholder identification

Project stakeholders have been systematically identified and a comprehensive stakeholder list compiled for targeted engagement.

Stakeholders are those who may be affected by or interested in the project and those who can affect it. Broad stakeholder groups identified include Commonwealth and State government agencies, ministers and local members; Wingecarribee Shire Council; landholders within the project area; local community members and businesses; those who travel to the Southern Highlands for work; industry representative groups; special interest groups; Aboriginal groups; utility, port and service providers; existing and potential future Hume Coal employees and apprentices; and the media.

The stakeholder list will continue to be regularly reviewed and updated.

5.2.3 Stakeholder assessment and engagement activities

Following initial stakeholder identification, an assessment was conducted to understand the extent to which various parties were likely to be impacted by and/or have an interest in the project, and how much and in what way they might like to be involved. Stakeholders were categorised according to how they view the project, their influence and the extent to which they will be impacted (positively or negatively). This approach ensures that time and effort is appropriately focused and the most effective engagement technique(s) are selected for each stakeholder.

Tailored stakeholder engagement strategies, methods and schedules were then developed for each stakeholder or stakeholder group.

An overview of engagement activities undertaken and planned is provided in the following sections. Full details will be provided in the EIS.

i Government agencies

Hume Coal has met with the following government agencies and discussed the project and, where appropriate, key areas for investigation in the EIS:

- Commonwealth DoE;
- DP&E;
- Trade & Investment – Regional Infrastructure and Services, Mineral Resources Branch (Trade & Investment – MR);
- NSW Office of Water (NOW);
- NSW Office of Environment and Heritage (OEH);
- Environment Protection Authority (EPA);
- Water for NSW (formerly the Sydney Catchment Authority);
- Roads and Maritime Services (RMS);

- Australian Rail Track Corporation (ARTC);
- Endeavour Energy;
- Forestry Corporation of NSW; and
- Wingecarribee Shire Council (WSC).

Trade & Investment - MR has provided in-principle support for the conceptual project development plan, which was presented at a meeting on 13 May 2015.

It is expected that DP&E will circulate this briefing report to key regulatory agencies and convene a PFM. The PFM will likely include a presentation by Hume Coal on the project and discussion of potential impacts and key matters for consideration in the EIS. This will inform government agency inputs to the SEARs on matters they want addressed in the EIS.

Throughout the EIS process, further meetings will be held with government on the project and the assessment requirements, methodologies and results, to ensure they meet the relevant agency and statutory requirements. This will include consulting with all relevant agencies, including those listed above and others such as Transport for NSW.

ii Community

Hume Coal has actively engaged with community members since 2011. This has included open days, information sessions, face-to-face and telephone meetings and briefings, media releases, newsletters, fact sheets, community surveys and focus groups and convening ongoing advisory groups where there is strong interest in a particular topic, as discussed below.

Two specific initiatives are the establishment of an SRG and a WAG. The SRG was formed in 2014. It is chaired by Paul Mitchell OAM and is made up of community representatives. Hume Coal and its technical advisors have so far met with the SRG on three occasions to discuss the project, its environmental and social impact assessments, workforce characteristics and recruitment, employment and training opportunities and needs, housing and accommodation, and opportunities for enhancing local benefits. The group's main objective is to provide an informed perspective on the local community's social and economic characteristics and needs, as well as to determine how the project's local economic effects can be enhanced.

The WAG is made up of representatives from government, local business, landowners, special interest groups and Hume Coal and its technical advisors. It was formed in 2011 and is independently chaired by the Hon. Gary Nairn. The WAG facilitates collaboration and engagement with the community and advises on matters specifically related to the project's water studies, including water monitoring. The WAG has so far met 11 times. Meeting minutes are posted on Hume Coal's website.

A community shop front has been established in Moss Vale for people to visit, view project information and speak directly with project staff. In addition, a Hume Coal Project website has been developed which provides relevant information and contact details if people want to raise concerns or request further information.

Feedback to date indicates that many local community members recognise the project's potential to make positive economic and employment contributions. Project support is highest within the working age population younger than 44, while those aged 45 and older are more likely to oppose the project. Commitment to the local community's future through scholarships, sponsorships and employment generation are viewed favourably. The importance of ensuring benefits go to local people has also been emphasized. Key community concerns include potential impacts to water resources and agriculture, and potential traffic, noise, air quality and general nuisance impacts, as well as contributions to GHG emissions. Hume Coal is proactively addressing these matters and will continue to keep the community informed as results come to hand.

Community consultation has been, and will continue to be, key to mine planning and understanding the project's potential impacts on the local community. It will inform the social impact assessment and EIS more broadly. Proposed communication tools are outlined in Table 5.1 and the engagement and consultation activities and outcomes will be described in detail in the EIS.

Consultation with the local community is also important in planning and implementing Hume Coal's local investment, education, training and sponsorship initiatives (for example, the Hume Coal Charitable Foundation and Apprenticeship Program) in a meaningful way that maximises the benefits to the local community. These programs have been developed following reviews of leading practices in other Australian states and internationally. Their focus is decided based on community consultation, surveys and facilitated focus groups, to ensure they are responsive to the needs of the community and deliver lasting value.

iii Aboriginal stakeholders

Consultation with Aboriginal stakeholders began in 2012, as part of the project's Aboriginal cultural heritage assessment. It is being undertaken in accordance with the Department of Environment, Climate Change and Water (DECCW - now OEH) (2010a) *Aboriginal cultural heritage consultation requirements for proponents 2010*. The process and outcomes will be documented in the EIS.

5.3 Stakeholder engagement tools

Multiple mechanisms are provided for participation by stakeholders in the project planning and EIS processes and for ongoing communication and feedback. Key stakeholder engagement tools used to date are listed in Table 5.1, and these will continue to be used throughout the EIS process.

Table 5.1 Communication tools

Item	Summary
Project website: www.humecoal.com.au	Hume Coal has a dedicated project website which provides up to date information about the project, environmental matters and local engagement initiatives. Project fact sheets, bulletins and newsletters are available on the website, as well as links and contact details for people to provide feedback or request further information.
Community shop front Shop 7, 256 Argyle Street Moss Vale 02 4868 1233	Community members are able to speak directly with Hume Coal's community liaison team by phone or at the shop front in Moss Vale, where an information display and fact sheets are also available.
Hume Coal head office Unit 7-8 Clarence House 9 Clarence Street Moss Vale 02 4869 8200	Community members are able to speak directly with Hume Coal's project team by phone or at the head office in Moss Vale.
Community information sessions, fairs and events	Open days, information sessions, presentations to groups, fairs and events are held to provide information about the project and its environmental studies.
Personal communications	Phone calls and face-to-face meetings, presentations, interviews and briefings with stakeholders are ongoing.
Communication materials	Formal letters and notifications are issued as required. Newsletters, monthly community bulletins and fact sheets are distributed locally and available in the community shop front and on Hume Coal's website. Community updates are also published in local newspapers and emailed to those registered on Hume Coal's distribution list.
Media communications	Project information is communicated through media releases, local newspaper publications and radio segments.
Surveys and focus groups	Telephone surveys and facilitated focus groups are undertaken to gauge public opinion and understand peoples' views on the project.
Advisory groups	Hume Coal currently has two advisory groups, the SRG and WAG, which meet regularly and include community representatives. These groups' respective scopes are discussed in Section 5.2.3(ii).

The public exhibition and submissions process, where the entire EIS, including details of all predicted impacts and mitigations, will be presented to stakeholders and submissions invited, is also fundamentally important. It provides a further opportunity for stakeholders to have a say on all aspects of the project and responses will be provided by both the proponent and regulatory agencies. This formal process is conducted entirely in the public realm and so is completely transparent.

6 Environmental attributes prioritisation

6.1 Method

A qualitative assessment of environmental, social and economic attributes has been undertaken to identify and prioritise matters to consider in the project's planning and to inform an appropriately focussed EIS.

Potential environmental impacts have been identified and ranked as low, medium or high priority for assessment, depending on their likelihood of occurrence and the potential consequences of the impact to people, property, environment and/or community if they occurred. The matrices used are provided in Appendix A and the results are provided in Table 6.1.

This task was done during a project planning workshop, based on knowledge of the existing environment from baseline monitoring, previous environmental studies and preliminary environmental assessments prepared for the workshop, and consideration of the project's footprint and activities. Initial impact identification and analysis was for a hypothetical unmitigated scenario. That is, it did not consider the environmental safeguards and measures Hume Coal will implement to address potential impacts.

6.2 Prioritisation

Identification and ranking of key environmental matters, together with preliminary consultation with stakeholders has enabled the key matters requiring assessment to be prioritised. The matters identified and their priority for assessment are presented in Table 6.1, with '1' being the highest priority. Environmental assessments of each aspect will be undertaken for the EIS, though the high and medium matters (ranked '1' and '2') will be given most attention and targeted for management and mitigation. The attributes and the proposed assessment approach for each are described in Chapter 7.

Table 6.1 Priorities for environmental assessment

Priority	Aspect
1	Groundwater, surface water.
2	Flora and fauna, noise and vibration, traffic and transport, Aboriginal heritage, historic heritage, visual, socio-economic, hazards, geochemistry.
3	Air quality, energy use and greenhouse gases, soils and land resources, subsidence, bushfire, waste.

6.3 Conclusions

In summary, most environmental considerations have a medium to low priority for assessment, however, groundwater and surface water are considered to be high priority. Hume Coal has already made substantial modifications to the project to avoid and minimise environmental impacts and has committed to a range of leading practice environmental management measures. Hume Coal seeks to further reduce potential impacts by project refinements and development of management and mitigation measures throughout the EIS process. The management and mitigation measures will be documented in the EIS and impact assessments made considering these measures and the residual risks.

7 Preliminary environmental assessment

7.1 Subsidence

7.1.1 Background

As described in Sections 3.2.2 (v) and (vi), the mine is designed to be non-caving so that subsidence impacts are avoided and, therefore, the overlying aquifers and surface features are protected. A combination of innovative engineering solutions is proposed which will ensure the overlying strata remains intact and supported, rather than collapsing into the goaf and causing subsidence of the ground surface, as occurs at mines that use 'caving' systems.

Notably, a system of coal pillars will be left in place, engineered to provide long-term support and stability of the overlying strata. Partially backfilling the voids, sealing them and allowing recovery of groundwater (and a full hydrostatic pressure head) will further enhance long-term stability, albeit that the system will be designed to be long-term stable with or without backfill and hydrostatic pressure.

It is noted that, to avoid any perception that primary dwellings or the Hume Highway could be affected by future, long-term ground movements, no mining will occur beneath these features, other than development of underground roadways (first workings development) required for access. The only exception would be if an agreement was entered into with a landowner.

7.1.2 Proposed assessment approach

The mining method proposed means there is negligible potential for mine subsidence impacts (refer to Sections 3.2.2(vi) and 3.4.1. Some pillar compression is anticipated, with associated ground settlement expected to be in the order of magnitude of that which occurs naturally as soils shrink and swell in response to moisture changes and other natural phenomena.

In the EIS, it is therefore proposed to focus on the mechanism which will prevent subsidence impacts from occurring, being the stability of the pillar system, and describe the precautionary monitoring and adaptive management program to be implemented to validate the assessment findings. The EIS will include a pillar stability assessment that incorporates:

- stability calculations for the pillar system, based on the range of variables likely to be encountered;
- an assessment of global pillar stability of the mine, including measures to prevent or mitigate all known potential modes of failure;
- assessment of the influence of groundwater hydraulic heads developed behind bulkheads, and other site-specific factors, on pillar stability;
- a sensitivity analysis based on the likely variability of actual pillar dimensions compared to the design dimensions;
- documentation of the levels of risk to sensitive surface features, including calculation of factors of safety and associated probabilities of pillar instability; and
- a description of the monitoring and adaptive management program that will be implemented to validate the assessment findings and confirm that adverse impacts are not occurring.

The pillar stability assessment will be closely integrated with other studies, including the ecology, Aboriginal heritage, historic heritage, land resources and surface water assessments. This will be to identify sensitive features and the level of risk to them (however small it may be), taking into account the pillar design criteria adopted for that part of the mine. Also, to identify any precautionary monitoring and adaptive management measures required in respect of these features.

7.2 Groundwater

7.2.1 Existing environment

Hume Coal has undertaken extensive groundwater investigations to characterise the existing hydrogeology of the project area and surrounds, including groundwater depth, quality, flow and uses. Investigations are ongoing, though approximately 65 groundwater monitoring points have been established to date, comprising mainly purpose-built groundwater monitoring bores, as well as vibrating wire piezometers (refer to Figure 7.1). Data from NOW monitoring bores in the locality have also been obtained.

A conceptual geological cross-section is presented in Figure 7.2. The Hawkesbury Sandstone is the main groundwater bearing unit in the region, though groundwater is also present in other units. The Narrabeen Group underlies the Hawkesbury Sandstone in places, however has been removed by erosion over much of the project area. Where the Narrabeen Group is not present, the Hawkesbury Sandstone directly overlies the Wongawilli Seam. Water bearing zones within the Hawkesbury Sandstone are often associated with bedding plane joints, sub-vertical joints and faults, and thus groundwater flow is largely via secondary porosity. The water bearing zones are often separated by lower permeability zones of siltstone, claystone, fine grained sandstone and shale found within the Hawkesbury Sandstone.

Investigations to date indicate that groundwater yields are typically in the range of 0.1 to 1 litres per second (L/s) in the north-west of the project area to 5 L/s in its south-east, which is typical for that type of geology. The Hawkesbury Sandstone in the project area's north-west is partially unsaturated, but in the east the strata dips to the east and this results in an increased saturated thickness. In the east of the project area the Hawkesbury Sandstone is overlain by the Wianamatta Group. In the west there is no overlying shale, and so this is where the unsaturated Hawkesbury Sandstone occurs.

The regional groundwater flow direction is generally from south to north, reflecting the topography (Ross 2014). On a more localised scale, groundwater flow within the project area is generally from areas of high elevation to the south-east, towards the north. The exceptions are in the west of the project area, where it flows towards Black Bobs Creek and associated tributaries, and, in the north-west, where it flows north towards either Berrima Colliery or Medway Rivulet.

Sandstone outcrops in the north-west of the project area and these ridgelines are zones of groundwater recharge. The primary recharge mechanism is rainfall. Ross (2014) reports that recharge is relatively rapid in areas where fractured Hawkesbury Sandstone is exposed at the surface, such as at the nearby Kangaloon site. Groundwater recharge in areas where shale is exposed occurs but at a lower rate. The primary discharge mechanisms are evapotranspiration, to streams in places and at seeps and springs in places, such as along escarpments. Extraction through existing bores is also considered to be a discharge mechanism.

Groundwater quality is similar within the Hawkesbury Sandstone and Wongawilli Seam, and is typically fresh. Salinity is higher in some areas due to infiltration of more saline water from the overlying Wianamatta Group shales, which are of marine origin.

Hydraulic connection between surface water and groundwater exists in places at certain times. This is generally where rivers or creeks are in direct contact with the underlying aquifer via a zone of saturated material, or where the river is separated from the aquifer by a narrow unsaturated zone, generally less than twice the stream width (Bouwer and Maddock 1997). Where the groundwater level is much deeper than the base of the river, fluctuations in the water table have little or no effect on the stream.

Groundwater uses within and adjacent to the project area include:

- water supply bores (for stock, domestic, irrigation and other purposes), most of which access groundwater in the Hawkesbury Sandstone, though some have screened intervals in (and therefore access) water bearing zones in the overlying Wianamatta Group shales, and some in the underlying Wongawilli Seam; and

- potentially, by flora and fauna in certain places and at certain times. Ecosystems that potentially utilise groundwater are discussed in Section 7.4.1(iii).

7.2.2 Proposed assessment approach

As described in Section 3.2.2(vi), the proposed mining methods will ensure disruption to the overlying strata is minimised, such that groundwater impacts are also minimised. Sealing each panel immediately after extraction and backfilling will allow groundwater recovery at each mined-out area to begin shortly after mining and minimise inflow volumes to the active mine workings. Minimising groundwater impacts has been one of the key considerations in designing the mine.

A numerical groundwater model (MODFLOW) has been developed to simulate the regional groundwater systems and predict the project's potential impacts to groundwater. The model will be refined as part of the EIS process and the detailed methodology and results will be reported in the EIS. The preliminary simulations predict:

- Variable groundwater inflow rates to the mine, increasing from approximately 0.3 to an estimated peak of 3.2 GL/annum after around 13 years of mining, before decreasing and reaching zero within around six years following completion of mining. Around two thirds of the peak inflow is predicted to be unhandled groundwater that fills panels after they have been mined and sealed and so will remain within the groundwater system at these locations.

- Temporary, transient groundwater drawdown, that is, a decrease in groundwater levels (piezometric and water table levels) in areas above and surrounding the active mining areas. The location of drawdown at any one time will vary depending on the location of mining.

- Full recovery of groundwater levels to within 2 m of their pre-mining levels (which is below the AIP's threshold for minimal impacts) following completion of mining.

As described earlier, some groundwater inflows will be to active mining areas. The possibility of collecting and reinjecting these inflows back into the groundwater system is being investigated and would further mitigate impacts such as drawdown.

A detailed conceptual model will be completed as part of the EIS, which will further improve understanding of the hydrogeological regime. It will be informed by the investigations to date, baseline groundwater level and quality data, geological appraisals and completed hydraulic testing programs.

The numerical groundwater model will be refined based on the detailed conceptual model and will be used to predict the project's potential impacts, including consideration of:

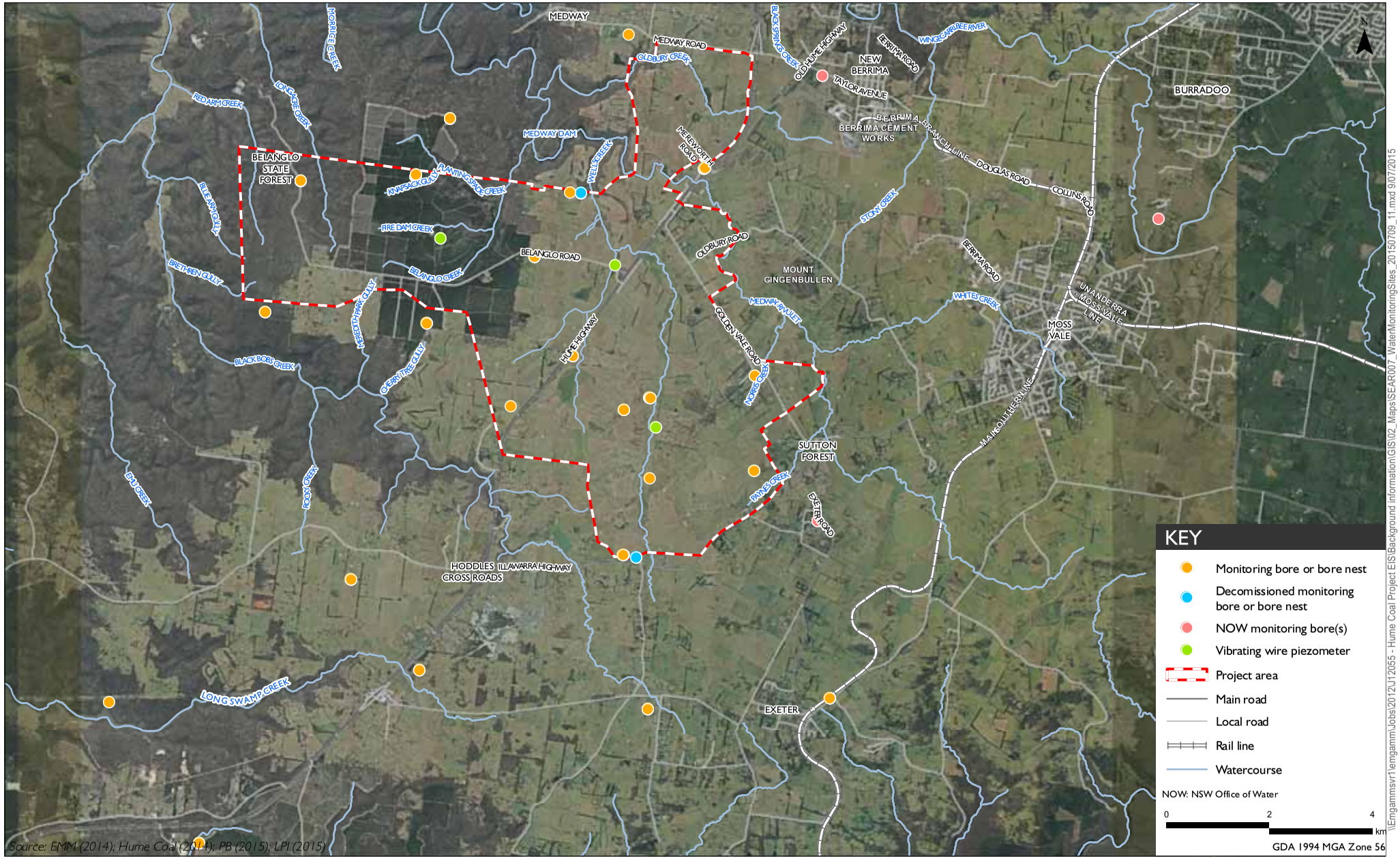
- groundwater flow direction and quality;

- rate and volume of groundwater inflows to the mine;

- groundwater drawdown, including the spatial extent and magnitude;

- baseflow to surface watercourses; and

- ecosystems that potentially rely on groundwater.



Source: EMM (2014); Hume Coal (2014); PB (2015); LPI (2015)

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Groundwater monitoring locations

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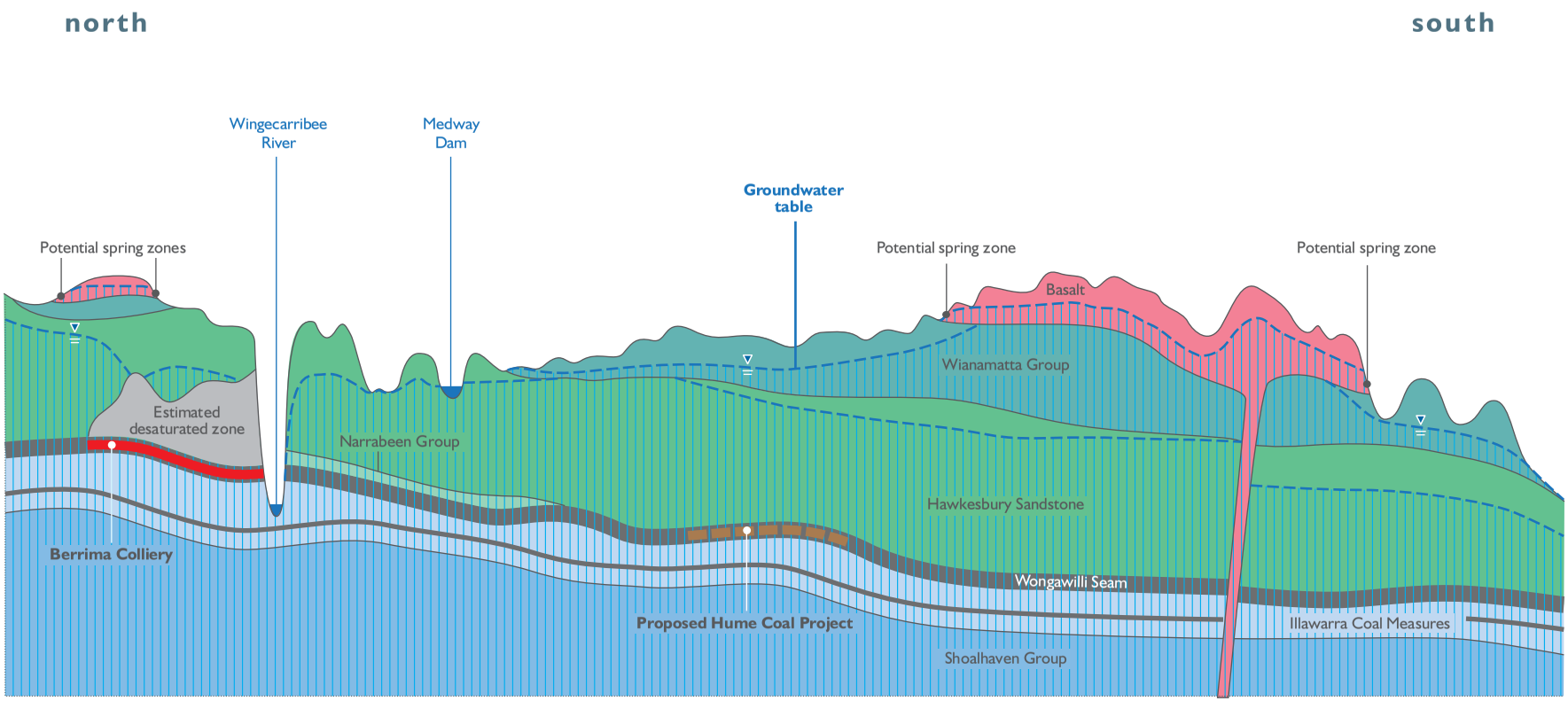
Figure 7.1



Source: EMM (2015)

Conceptual cross-section: north to south

Hume Coal Project
Preliminary Environmental Assessment

Figure 7.2

Following the numerical modelling, a groundwater impact assessment will be completed to interpret the model results and address the potential impacts to groundwater users and the environment. This will include:

- detailing the predicted impacts to groundwater quality and levels (both piezometric and water table levels);
- preparing a water balance;
- describing water licensing requirements;
- predicting and assessing potential impacts to groundwater users and ecosystems that potentially rely on groundwater in the area, including any changes to groundwater conditions or surface and groundwater connectivity which could affect stream baseflows; and
- describing the proposed water management and monitoring program and any additional measures required to mitigate predicted impacts. For example, in accordance with the AIP, "make good provisions" apply in certain circumstances, such as if a cumulative decline in the water level within a water supply work (such as a supply bore or well) of more than 2 m is predicted. In these cases, Hume Coal would offer any affected third parties appropriate compensatory arrangements such as access to an equivalent water supply through enhanced infrastructure or other means such as deepening an existing bore.

7.3 Surface water

7.3.1 Existing environment

The project area is within the Hawkesbury-Nepean basin, which covers around 21,400 square kilometres (km^2). It is traversed by several drainage lines, all of which ultimately discharge to the Wingecarribee River, located around 2 km north of the project area (refer to Figure 7.3).

The Wingecarribee River's catchment is approximately 225 km^2 and forms part of the 9,051 km^2 Warragamba Dam catchment, which supplies water to Sydney. The catchment is managed by Water for NSW. Around one quarter of Warragamba Dam's catchment comprises 'special areas' where public access and activities are restricted to protect water quality. The project area is not within a special area, nor is the nearby Medway Dam.

Medway Dam, shown in Figure 7.3, is outside the project area and no mining will occur beneath it or its Notification Zone. Medway Dam is a prescribed dam under Schedule 1 of the *Dams Safety Act 1978*. It is relatively small, with a capacity of approximately 1,300 ML (WSC 2012). It has an 8 ML/day capacity water treatment plant which supplies water to Berrima and supplementary supply to parts of Bowral and Mittagong and the Wingecarribee system, though blue-green algae outbreaks in the past have necessitated periodic shut-downs of the Medway Dam supply system (WSC 2012). The main water supply for these communities and the locality more broadly is from Wingecaribbee Reservoir, around 14 km east of the proposed underground mining area, which has a 40 ML/day capacity water treatment plant (WSC 2012). Additional supplementary supply is from Bundanoon Creek Dam.

Surface water in the project area forms part of the Upper Nepean and Upstream Warragamba Water Source, which is managed under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* and WM Act.

Average annual rainfall for the area is approximately 967 mm (refer to Table 2.1), and provides runoff to streams and recharge to groundwater systems. The surface drainage network is shown in Figure 7.3. Most streams in the project area only flow intermittently, and comprise isolated pools at most times. Groundwater provides baseflow to Medway Rivulet and some streams in incised gullies in the north and west of the project area at times.

Most of the project area is within the Wells Creek and Medway Rivulet sub-catchments, though small areas drain to the Wingecarribee River and Black Bobs Creek. Using the Strahler (1952) stream classification system, watercourses that are third order and above within the project area are:

- Wells Creek, Wells Creek Tributary, Belanglo Creek and Longacre Creek, which flow north and north-west above the proposed mining area. Wells Creek and Wells Creek Tributary are shallow and run through agricultural land while Belanglo and Longacre creeks are in steep, heavily vegetated gullies in the state forest.

- Medway Rivulet, which flows north-west along the project area's eastern boundary before crossing it just north of the proposed MIA precinct. Medway Rivulet has a sandy, grassy channel with steep, rocky banks at this location.

- Oldbury Creek, just north of the proposed CHPP precinct, which flows west through a deeply incised sandstone gully and joins Medway Rivulet around 2.5 km downstream of the project area.

The project area also contains a number of farm dams and lower order (Strahler Class 1 and 2) drainage paths (Figure 7.3).

Other noteworthy surface water features are Jumping Rock Swamp and the Paddys River Swamps (Hanging Rock, Mundego, Long and Stingray swamps) between approximately 7 and 15 km south-west of the project area. The Paddys River Swamps are listed in DoE's Directory of Important Wetlands in Australia.

Hume Coal has been monitoring surface water levels and quality in and around the project area since 2012. The monitoring network is shown in Figure 7.3 and covers each of the main watercourses in the vicinity of proposed mining and surface infrastructure areas. It was developed in consultation with NOW and comprises:

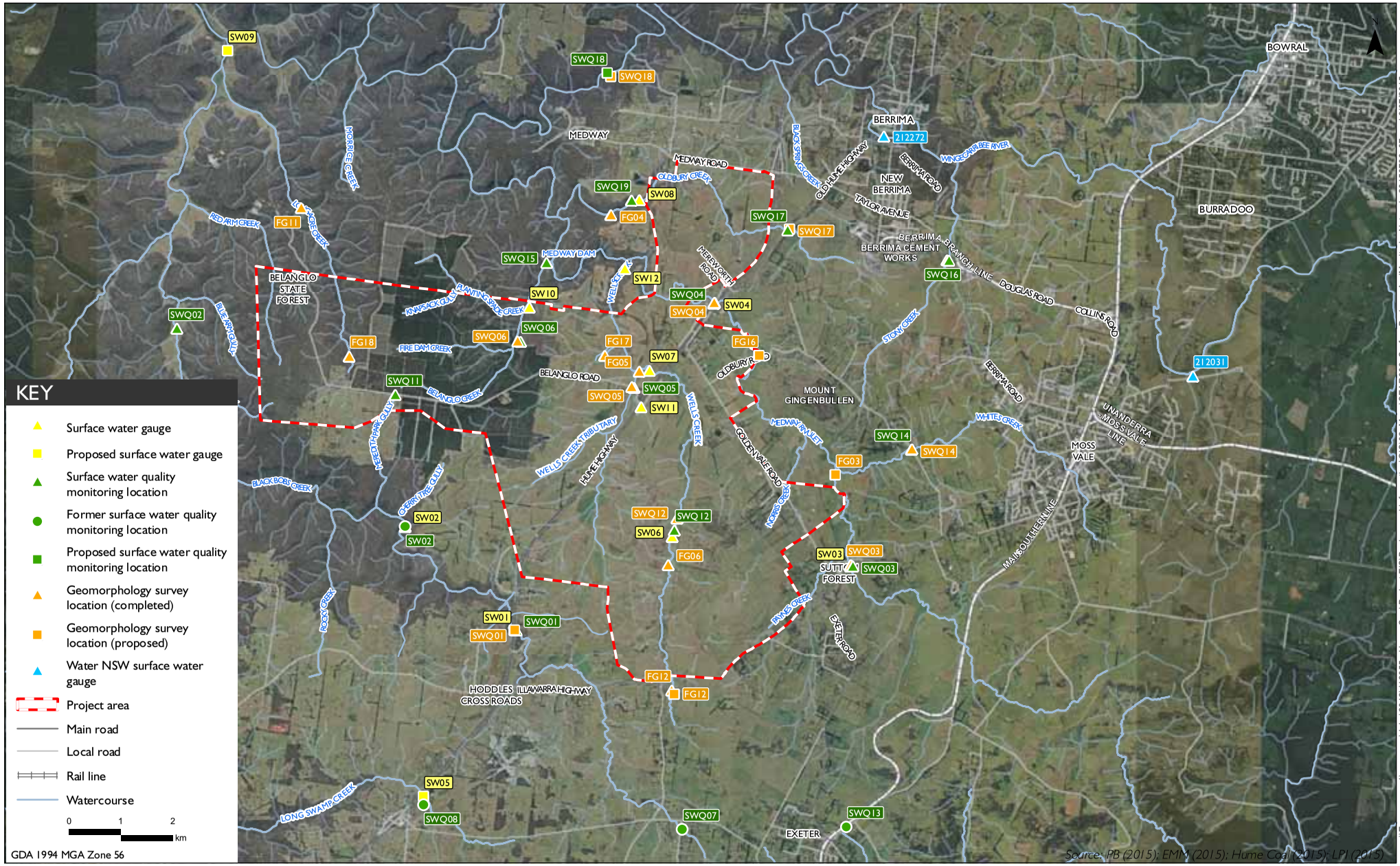
- ten stream gauges, with a further two proposed (the gauges record water levels, enabling calculation of flows); and

- 19 surface water quality monitoring locations, with one additional location proposed.

Longer-term stream flow and water quality monitoring data for the Wingecarribee River have been obtained from Water for NSW and Berrima Colliery's monitoring sites. Surface water quality varies, however it is generally fresh with slightly acidic to neutral pH. Elevated nutrient concentrations have been recorded, probably associated with local agricultural activities.

Baseline geomorphology surveys have also been completed at the 15 locations shown in Figure 7.3, and four additional locations are proposed to be surveyed.

The monitoring data provides a good understanding of the existing surface water environment and the additional monitoring and surveys proposed will further improve this understanding.



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Surface drainage and monitoring locations

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Preliminary Environmental Assessment

Figure 7.3

7.3.2 Proposed assessment approach

The project design contains a number of measures to minimise impacts on surface waters. These include:

- a water management and treatment system (described in Section 3.9) which will minimise the potential for contamination of surface water, for example by containing and treating surface runoff from operational areas and incorporating erosion, sediment, spill and leak controls;
- maximising recycling and re-use of water captured on-site, meaning that the project will not increase demands on town water supplies. Some potable water may be trucked to site initially, however water requirements will generally be met by surface and groundwater collected on-site;
- low impact mining methods that have negligible risk of causing subsidence-induced changes to surface drainage and watercourses;
- no extraction within Medway Dam's Notification Zone or under its stored waters;
- no diversions or direct modification of watercourses, other than construction of a culvert over Medway Rivulet and utility crossings over Oldbury Creek and other minor drainage lines; and
- avoidance of flood-prone land in siting most surface infrastructure.

Notwithstanding the above measures, the project still has the potential to affect surface water and a number of aspects require further investigation. They include the potential for:

- changes to groundwater conditions or surface and groundwater connectivity which affect stream baseflows;
- catchment and drainage modifications from construction of surface infrastructure, particularly for Oldbury Creek and Medway Rivulet which are close to surface infrastructure;
- changes to in-stream conditions, for instance from the proposed culvert or utility crossings of creeks;
- water quality impacts during construction or operation of surface infrastructure, such as from erosion and sediment entrainment in surface runoff; and
- impacts to receiving environments from any release of treated water to nearby watercourses (under licence) or supply to others for irrigation or other uses (if either of these options is adopted to manage water not re-used on-site).

A surface water assessment will be prepared as part of the EIS, which will investigate each of the above aspects. It will:

- Characterise existing flow paths and regimes; water quality, quantity and users; fluvial geomorphology; and flooding and catchment characteristics. The baseline survey and monitoring data will be important inputs.
- Assess the potential surface water impacts of the project's construction and operation including:
    - geomorphology impact assessment;
    - water quality impact assessment, including to demonstrate that the project will have a neutral or beneficial effect on water quality within Sydney's drinking water catchment, in accordance with State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011;
    - hydrologic modelling and assessment to determine potential impacts on stream flows; and

- flood modelling and assessment to predict whether the project is likely to impact flooding behaviour and confirm that the project is adequately protected from any risk of inundation by flood waters.

- Develop a site water balance model to simulate and assess the effectiveness of the proposed site water management system. The model will incorporate anticipated mine inflows, surface runoff, water demands, rainfall, evaporation and catchment characteristics. It will be used to optimise dam sizing to achieve a balance between minimising their disturbance footprints while providing enough storage capacity to prevent overflows and meet site water demands. The results will be used to predict the likely frequency and volume of water discharges, that is, when surface runoff and mine inflow volumes exceed demand and storage capacity.

- Describe the proposed water management and monitoring system in detail.

Given the interaction between surface and groundwater in places, these two studies will be closely linked.

7.4 Terrestrial ecology

7.4.1 Existing environment

i Native vegetation and plant communities

Baseline terrestrial flora and fauna surveys commenced in April 2013 and are near complete. Considerable ecological data has been collected and provides a solid understanding of the existing environment.

The majority of the project area, including proposed surface infrastructure areas, has been cleared and contains exotic grassland. Native vegetation is mainly restricted to the north-west of the project area, in parts of Belanglo State Forest. However, some remnant native vegetation patches occur in the central northern part of the project area, associated with creeks (refer to Figure 7.4) and there are scattered remnant paddock trees in places. There are also scattered patches of poorer condition native vegetation in the centre of the project area (refer to Figure 7.4). To date, 353 native and 90 exotic flora species have been recorded in the project area and its immediate surrounds.

Of the native plants recorded in the project area, one species, Paddy's River Box (*Eucalyptus macarthurii*), is listed as endangered under the TSC Act. The locations where it has been recorded are shown in Figure 7.5. The project area is also likely to contain habitat for the endangered Dwarf Phyllota (*Phyllota humifusa*), though it has not been recorded.

The following plant species listed in the register of Rare or Threatened Australian Plants (ROTAP) have been recorded:

- *Olearia burgesii* (3K);
- *Pseudanthus divaricatissimus* (2RCa);
- *Geranium graniticola* (3RCi); and
- *Eucalyptus apiculata* (3RC-).

Native vegetation communities present within the project area generally comprise eucalypt forest and woodland. They have been classified into specific plant community types (PCTs) in accordance with Section 5.2 of the *Framework for Biodiversity Assessment* (OEH 2014). Table 7.1 lists the vegetation types and the PCT assigned and their distribution is shown in Figure 7.4.

Table 7.1 Vegetation types in the project area

Vegetation type	Plant community type
River Peppermint (*E. elata*) Narrow-leaved Peppermint (*E. radiata*) tall open forest	PCT 1107 River Peppermint Narrow-leaved Peppermint open forest on sheltered slopes, Sydney Basin and South East Corner Bioregions
Grey Gum (*E. punctata*) Blue-leaved Stringybark (*E. agglomerata*) open forest	PCT 858 Grey Gum Blue-leaved Stringybark Open Forest on gorge slopes of the southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion
Gully Gum (*E. smithii*) Scribbly Gum (*E. racemosa*) open woodland	PCT 969 Narrow-leaved Peppermint Sydney Peppermint Gully Gum open forest/woodland in the Sydney Basin Bioregion[1]
Gully Gum Narrow-leaved Peppermint open forest	PCT 969 Narrow-leaved Peppermint Sydney Peppermint Gully Gum open forest/woodland in the Sydney Basin Bioregion[1]
Brittle Gum (*E. mannifera subsp. gullickii*) Scribbly Gum shrubby woodland	PCT 1093 Red Stringybark Brittle Gum Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
Broad-leaved Peppermint (*E. dives*) Argyle Apple (*E. cinerea*) grassy woodland	PCT 731 Broad-leaved Peppermint Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion
Snow Gum (*E. pauciflora*) Black Sallee (*E. stellulata*) grassy woodland	PCT 677 Black Gum grassy woodland of damp flats and drainage lines of the eastern Southern Tablelands, South Eastern Highlands Bioregion

Notes: 1. For vegetation communities containing Gully Gum, the most similar PCT has been assigned (PCT 969), however it does not correlate well with these communities. PCT 969 is normally associated with Mount Gibraltar Forest endangered ecological community, which the vegetation types in the project area do not represent.

Broad-leaved Peppermint Argyle Apple Woodland and Snow Gum Black Sallee Grassy Woodland are components of the endangered ecological community (EEC) Southern Highlands Shale Woodland in the Sydney Basin Bioregion, which is listed under the TSC Act. These vegetation types occur on clay soils derived from Wianamatta Shale. They both contain characteristic eucalypt species of the EEC including Narrow-leaved Peppermint, Paddy's River Box, Snow Gum, White Stringybark (*E. globoidea*), Cabbage Gum (*E. amplifolia*), Gully Gum, Forest Red Gum (*E. tereticornis*), Brittle Gum and Argyle Apple and a variable understorey of small trees, shrubs and grasses described in the NSW Scientific Committee's final determination for the community.

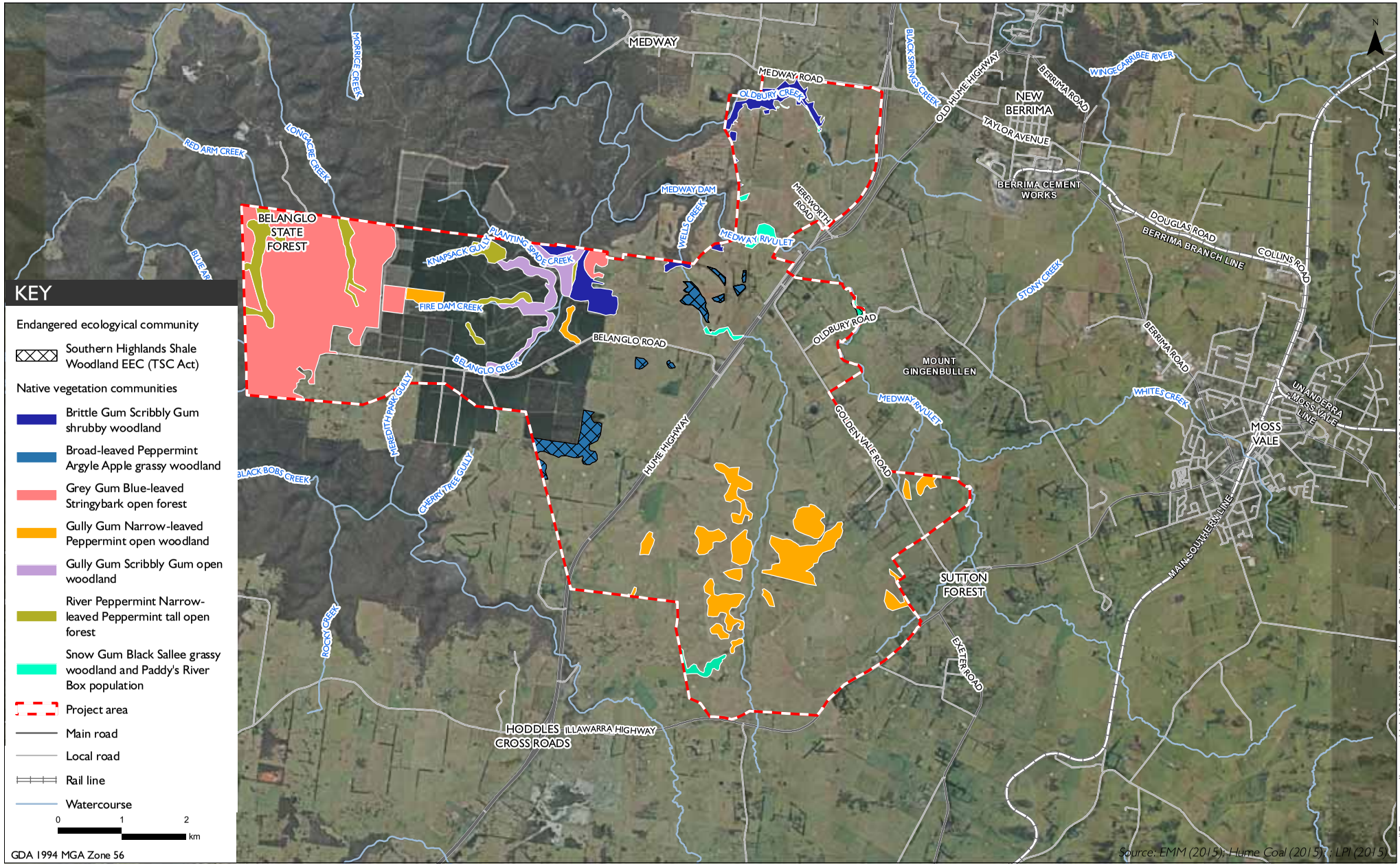
ii Fauna and habitat

There is limited fauna habitat in the central and eastern parts of the project area, though scattered trees may provide hunting and nesting habitat for raptors and foraging habitat for granivorous birds. Farm dams also provide habitat for aquatic birds.

Higher quality fauna habitat is present in remnant native vegetation in Belanglo State Forest and the lower reaches of Medway Rivulet and Oldbury Creek. Fauna habitat in these areas occurs in:

- gully forests with dense ground cover;
- fallen timber and hollows; and
- ridgelines, creeks and gullies containing caves and rocky overhangs.

These areas include a variety of foraging resources for fauna, including flowering plants, seeds, fruits, insects and prey species. Creeks in the project area provide a drinking source for fauna in deeper pools or more widely when flowing. However, the nearby Medway Dam is a permanent water source which provides higher quality fauna habitat. Raptors including the White-bellied Sea Eagle (*Haliaeetus leucogaster*) and Little Eagle (*Hieraeetus morphnoides*) have been observed in the vicinity of Medway Dam.



Surveyed vegetation communities

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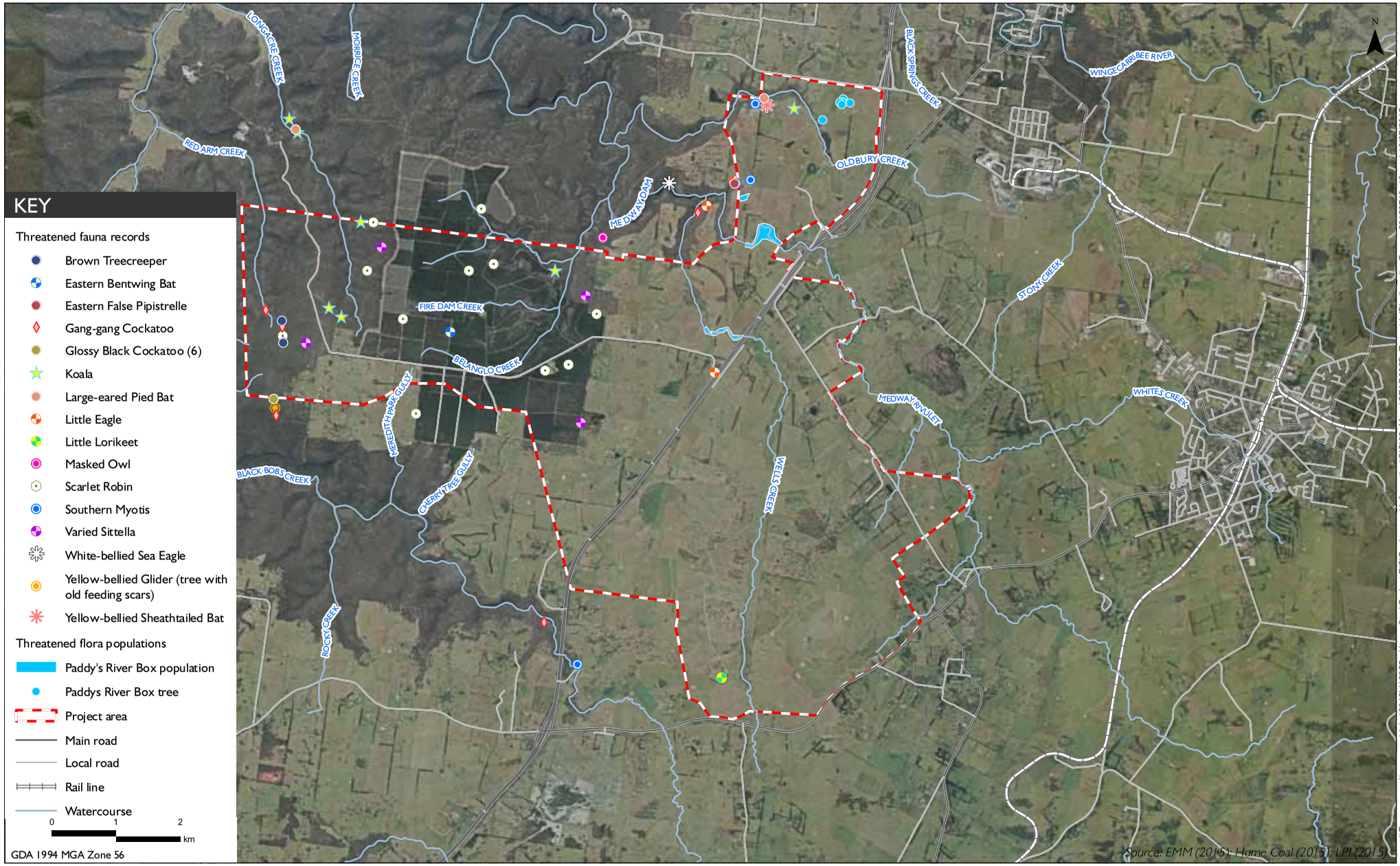
Figure 7.4



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Threatened species and populations

Hume Coal Project

Preliminary Environmental Assessment

Figure 7.5

A total of 183 terrestrial fauna species have been recorded in the project area and its immediate surrounds, comprising:

- 119 native and three introduced bird species;
- 11 native reptile species;
- 10 native frog species; and
- 32 native mammal species (15 microbat, six arboreal, ten ground-dwelling and one semi-aquatic) and eight introduced mammal species.

Of the species recorded, the following are listed under the TSC Act:

- Woodland birds: Little Eagle, Glossy Black Cockatoo (*Calyptorhynchus lathami*), Gang-gang Cockatoo (*Callocephalon fimbriatum*), Little Lorikeet (*Glossopsitta pusilla*), Powerful Owl (*Ninox strenua)*, Masked Owl (*Tyto novaehollandiae*), Scarlet Robin (*Petroica boodang*) and Varied Sittella (*Daphoenositta chrysoptera*).
- Mammals: Koala (*Phascolarctos cinereus*), Southern Myotis (*Myotis macropus*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Little Bentwing Bat (*Miniopterus australis*) and Large-eared Pied Bat (*Chalinolobus dwyeri*).

Two of these species, the Koala and Large-eared Pied Bat, are also listed as vulnerable under the EPBC Act.

iii Ecosystems that potentially rely on groundwater

A desktop assessment was completed to identify ecosystems which potentially utilise groundwater in the project area and broader surrounding region. It included reviewing the Groundwater Dependent Ecosystem Atlas (Bureau of Meteorology 2013), previous studies completed in the region, groundwater monitoring data and groundwater modelling results. Ecosystems with potential for reliance on either the surface or subsurface expression of groundwater are those associated with:

- creeks where groundwater is connected and provides baseflows at times, for instance Medway Rivulet and some streams in incised gullies in the north and west of the project area;
- springs associated with basalt hills south of the project area;
- upland swamps in the wider locality, namely Jumping Rock Swamp and the Paddys River Swamps (described in Section 7.3.1);
- vegetation where groundwater is shallow (within the vegetation's root zone); and
- aquifers.

Native vegetation intersects shallow groundwater (0 to 10 m below ground level) in some places in and around the project area, mainly at creeks. These include Medway Rivulet, Wells Creek, Belanglo Creek, Longacre Creek and Red Arm Creek. Six of the native vegetation types in the project area occur where the depth to groundwater is less than 10 m and so have potential to access groundwater from time to time at these locations. One of these, namely Broad-leaved Peppermint Argyle Apple grassy woodland, contains the endangered Paddy's River Box. However, vegetation within and directly surrounding the project area is considered to be mainly dependent on rainfall. A number of threatened fauna species utilise the resources provided by vegetation where shallow groundwater is present and would be considered to form part of the ecosystem which accesses groundwater at these locations. These include the Glossy Black Cockatoo, Koala, Large-eared Pied Bat and Southern Myotis.

7.4.2 Proposed assessment approach

Hume Coal has been working closely with EMM's ecologists to develop a surface infrastructure design that avoids and/or minimises impacts to terrestrial biodiversity. As mentioned in Section 3.2.3, ecologists surveyed proposed surface infrastructure areas and the layout was subsequently modified to avoid the removal of Paddy's River Box trees and a corridor of native vegetation along Oldbury Creek as far as possible. The selected design avoids direct impacts to most, if not all, Paddy's River Box trees, and minimises direct impacts to EECs and most native vegetation.

The EIS will include a terrestrial ecology assessment which determines residual impacts to biodiversity, particularly threatened biodiversity, after avoidance and minimisation. It will follow relevant guidance in the *Framework for Biodiversity Assessment* (OEH 2014), *Threatened species assessment guidelines: the assessment of significance* (DECC 2007) and *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoE 2013). As mentioned, the terrestrial ecology surveys are near complete. They are being conducted in accordance with relevant DoE and OEH survey guidelines (DEC 2004, DEWHA 2010abc and SEWPAC 2011ab).

The impact assessment for surface infrastructure areas will focus on determining residual impacts to biodiversity after avoidance and minimisation, based on:

- estimates of vegetation clearing;
- the number of threatened plants impacted by vegetation clearing (if any);
- fauna habitat and habitat features directly impacted by vegetation clearing;
- indirect impacts to fauna such as from increased noise, light and dust; and
- key threatening processes operating in the project area currently, for example clearing of native vegetation, and assessment of the project's impact on these, particularly any potential to exacerbate them.

The other key area for investigation will be ecological impacts from any changes to surface water or groundwater conditions, particularly those that may affect ecosystems which potentially rely on groundwater. This assessment will be made in conjunction with the groundwater, surface water and aquatic ecology assessments described in Sections 7.2.2, 7.3.2 and 7.5.2. For example, groundwater monitoring data for locations where ecosystems reliant on groundwater potentially occur will be analysed to determine seasonal variability in groundwater levels and the degree of groundwater reliance. Groundwater modelling results, particularly drawdown predictions, will be used to assess potential impacts on these ecosystems.

Due to the low impact mining methods proposed, there is negligible potential for impacts to terrestrial biodiversity across the majority of the project area, including fauna habitat on ridgelines in the north-west. Nonetheless, ecological features will be considered in the pillar stability assessment discussed in Section 7.1.2.

7.5 Aquatic ecology

7.5.1 Existing environment

Surface water features in and around the project area are described in Section 7.3.1 and shown in Figure 7.3. The groundwater environment is described in Section 7.2.1 and ecosystems that potentially rely on groundwater in Section 7.4.1(iii). Baseline aquatic ecology surveys have so far taken place over three seasons, Autumn 2013, Spring 2013 and Autumn 2014 and are near complete.

Surveys and habitat assessments have been completed at 32 sites, including within Wells, Belanglo, Longacre and Oldbury creeks, Medway Rivulet, Medway Dam and others. Several sites coincide with surface water quality monitoring locations shown in Figure 7.3. Surveys have included macroinvertebrate, fish and turtle surveys, as well as water quality tests.

Habitat condition for aquatic species ranges from low to moderate quality within the project area. Medway Rivulet is considered to provide Class 2 (moderate) fish habitat in places however other creeks in the project area provide only Class 3 (minimal) or 4 (unlikely) fish habitat. No threatened aquatic species have been recorded within the assessed watercourses and based on habitat quality, they are unlikely to support any.

Aquatic macroinvertebrates from 41 families have been recorded, along with common fish, crayfish and turtle species. These are the Longfin Eel (*Anguilla reinhardtii*), Mountain Galaxia (*Galaxius olidus*), Freshwater Crayfish (*Cherax destructor*), Eastern Snake-necked Turtle (*Chelodina longicollis*), Firetail Gudgeon (*Hypseleostris galii*) and introduced Mosquitofish (*Gambusia holbrooki*). All taxa recorded are common species.

Stygofauna surveys have been undertaken at 20 groundwater bores. Only one individual stygofauna has been found. It was a common crustacean species (*Bathynella* sp.). One terrestrial and two aquatic invertebrates have also been recorded in the bores, in the Ant (Formicidae), Springtail (Hypogastruridae) and Riffle Bug (Vellidae) families.

7.5.2 Proposed assessment approach

The potential for aquatic ecology impacts is low due to the project design which is for an underground mine that uses low impact mining methods which will have negligible subsidence impacts. It does not involve any direct aquatic habitat modifications other than to farm dams within the surface infrastructure footprint, construction of a culvert over Medway Rivulet and utility crossings over Oldbury Creek and other minor drainage lines. The low potential for impacts is also because no rare or threatened species have been detected and habitat is low to moderate quality and so unlikely to support listed species.

Nonetheless, potential impacts to aquatic biodiversity and stygofauna will be assessed as part of the EIS, with consideration given to relevant guidelines, including:

- *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge 2003);
- *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management* (NSW Department of Primary Industries [DPI] 2013);
- *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI undated); and
- *Aquatic Ecology in Environmental Impact Assessment* (DoP 2003).

Key areas for investigation include the effects of any changes to surface water or groundwater conditions, principally the potential for impacts to:

- aquatic biodiversity, associated with any change to water quality, runoff, catchment characteristics or hydrology; proximity to infrastructure; or any habitat disturbance from replacing farm dams with larger mine dams; and
- stygofauna, associated with any change to groundwater conditions, such as water levels, water pressure or connectivity with surface water.

The aquatic ecology assessment will be conducted in conjunction with the groundwater and surface water assessments described in Sections 7.2.2 and 7.3.2.

7.6 Air quality and greenhouse gases

7.6.1 Existing environment

The project is in a semi-rural area characterised by agricultural and forestry land uses, though there are also urban areas and industrial facilities.

The region's air quality is influenced by anthropogenic and natural sources including domestic fuel burning, vehicle emissions and windblown dust. As is typical for NSW, regional events such as dust storms and bushfires periodically contribute to short-term elevated concentrations of suspended particulates. Notable local emission sources which will be considered in the project's cumulative assessment are the Berrima Cement Works, proposed New Berrima Shale Quarry (under construction), Dux Hot Water Moss Vale manufacturing factory, Omya Australia Moss Vale limestone processing facility and Ingham's Berrima Feed Mill.

Hume Coal has been monitoring meteorology and air quality in and around the project area since 2011, to understand the existing (baseline) conditions (refer to Figure 7.6 for monitoring locations). This includes monitoring dust deposition levels and continuous monitoring of fine particulate matter concentrations by a tapered element oscillating microbalance (TEOM) monitor. Also, longer-term particulate matter monitoring data from OEH's stations at Bargo and Camden have been obtained.

Data from Hume Coal's on-site weather station and the BoM station at Moss Vale indicate that the dominant wind directions are from the west, west south-west, south-east and north to north-east.

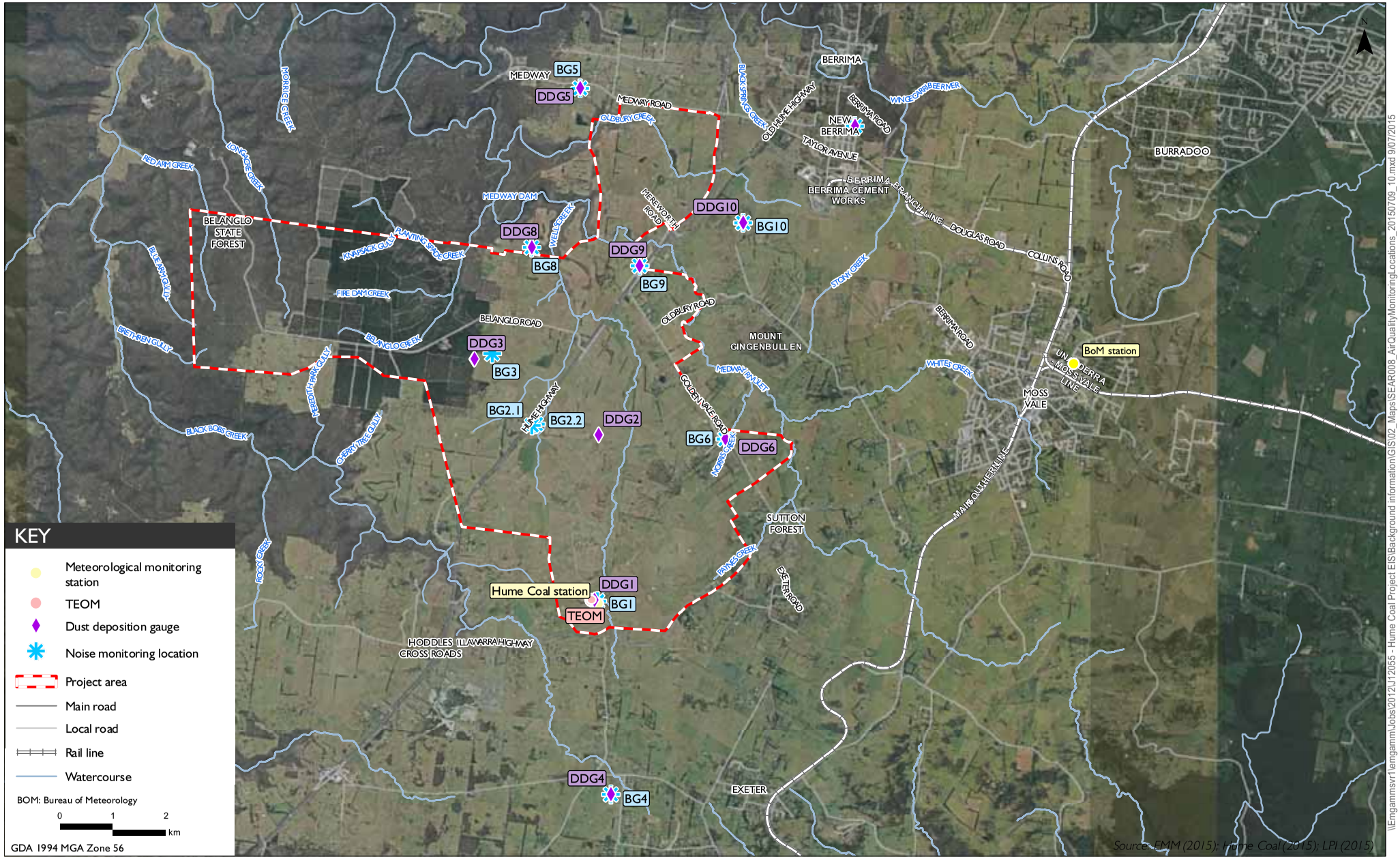
This data provides a good understanding of existing air quality and dispersion characteristics in the local area. Hume Coal is installing an additional particulate matter monitor and dust deposition gauges which will further enhance this understanding.

7.6.2 Proposed assessment approach

The proposed coal mine is underground, which limits the potential for air quality impacts. In addition, Hume Coal has been working closely with air quality specialists to develop and refine the surface infrastructure design, to minimise the potential for dust impacts. This has included preliminary modelling of numerous surface infrastructure options to predict the resulting dust levels. Examples of refinements made in response to the modelling results and leading practice mitigations incorporated are given in Sections 3.2.1(ii) and 3.2.3(ii). The design selected is the lowest impact of all options modelled.

Potential dust-generating activities will principally be associated with constructing and operating surface facilities in the northern part of the project area (Figure 3.1). This includes short-term impacts from ground disturbance and vehicle movements on unpaved surfaces during construction, and operational impacts from processing, handling and transporting coal and rejects. Parameters used to assess potential impacts will be as follows:

- particulate matter (dust): total suspended particulates (TSP), particulate matter than 10 microns in aerodynamic diameter (PM_{10}) and less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$) and dust deposition;
- diesel combustion emissions: oxides of nitrogen, sulfur dioxide, carbon monoxide and selected volatile organic compounds such as benzene, toluene, xylene and ethylbenzene; and
- potentially odourous emissions such as from ventilation shafts.



Meteorology, air quality and noise monitoring locations

Hume Coal Project

Preliminary Environmental Assessment

Figure 7.6

The detailed air quality and GHG assessment prepared as part of the EIS will assess the potential for impacts during both construction and operations, including:

- Quantifying the project's potential air quality impacts, including emission calculations and atmospheric dispersion modelling to predict ground-level concentrations of particulate matter (dust) and other air pollutants in the surrounding area. The model will incorporate local meteorology and air dispersion characteristics (eg wind speeds, wind directions and atmospheric stability), terrain, emission source locations, plant and equipment types, operating hours and dust controls. Cumulative assessments will be made, considering:
  - existing (background) air quality in the local area, established from the monitoring data;
  - predicted incremental concentrations due to the project's emissions; and
  - predicted impacts from other existing and proposed industrial developments in the local area.
- Evaluating the risk of spontaneous combustion, albeit that based on the coal properties and evidence from the long history of mining the Wongawilli Seam at other operations, there is virtually no risk of this occurring.
- Quantitatively assessing potential GHG emissions.
- Developing mitigation and management measures to minimise the potential for off-site air quality impacts, minimise GHG emissions and improve energy efficiency.

Hume Coal will incorporate leading practice dust controls into the project's design and implementation including using latest generation rail locomotives (which use less fuel and generate fewer emissions than older locomotives commonly used in Australia), covering rail wagons and the other measures outlined in Sections 3.2.1(ii) and 3.2.3(ii).

7.7 Noise and vibration

7.7.1 Existing environment

As mentioned previously, Hume Coal has been monitoring local meteorology since 2011. Background noise levels have also been monitored at several locations representative of the nearest private residences in and around the project area (refer to Figure 7.6), to quantify background and ambient noise levels.

The existing acoustic environment is generally characterised by traffic noise from the Hume Highway, local roads and rail lines; urban and industrial noise in some areas, such as near the Berrima Cement Works; and rural and natural sounds such as birds, cattle and wind in vegetation. Background noise levels are lowest during the night (10 pm to 7 am) at all locations monitored.

Background noise levels are generally typical of a rural setting in areas away from the Hume Highway and existing industry, measured to be around 30 to 32 dB(A) during the night and 30 to 35 dB(A) during the day. Higher noise levels prevail closer to the highway and industrial sites, generally recorded at 35 to 45 dB(A) during the day and 35 to 40 dB(A) during the night.

The existing baseline data provides a good understanding of the acoustic environment. Hume Coal will undertake additional background noise monitoring near proposed surface infrastructure areas which will further improve this understanding.

7.7.2 Proposed assessment approach

The proposed coal mine is underground, which limits the potential for noise impacts. In addition, Hume Coal has been working closely with EMM's acoustic engineers to develop and refine the surface infrastructure design, to minimise the potential for noise impacts. This has included preliminary modelling of numerous surface infrastructure options to predict noise levels. Examples of refinements made in response to the modelling results and leading practice noise mitigations incorporated are given in Sections 3.2.1(ii) and 3.2.3(ii). The design selected is the lowest noise of all options modelled.

Potential noise-generating activities to be assessed in the EIS will principally be associated with constructing and operating surface facilities in the northern part of the project area (Figure 3.1). The main operating noise sources are expected to be at the MIA and CHPP precincts, as well as the conveyors and train loading facilities. Other key areas for investigation will be the potential for vibration impacts during construction and noise from additional road traffic generated by the project.

The EIS will assess the potential for noise and vibration impacts, including:

- Using background noise monitoring data to determine appropriate noise criteria for sensitive receptors, in accordance with applicable guidelines and policies.
- A construction noise assessment in accordance with the EPA's *Interim Construction Noise Guideline* (DECC 2009).
- Modelling and assessing operating noise, using EPA-endorsed modelling software, to predict future noise levels at surrounding sensitive receptors in accordance with the EPA (2000) *Industrial Noise Policy* (INP). Impact assessments will be made by comparing results against existing noise levels and the relevant criteria. The noise model will incorporate site-specific data including topography, groundcover, atmospheric characteristics and proposed plant and equipment types, locations, operating hours and noise controls. Assessments will be made for calm weather and other meteorological conditions that are a feature of the area (as defined in the INP) and could enhance noise propagation, being temperature inversion and prevailing winds. Cumulative assessments will be made, considering:
  - existing industrial noise levels, established from contemporary monitoring data;
  - predicted incremental noise levels from the project; and
  - predicted future noise emissions from other existing and proposed industrial developments in the local area.
- Quantitatively assessing the potential for other noise or vibration impacts during construction, following the Australian and New Zealand Environment Council (1990) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* and DEC (2006) *Assessing Vibration: a technical guideline*.
- A road traffic noise assessment in accordance with the DECCW (2011a) *Road Noise Policy*.
- Developing mitigation and management measures to minimise the potential for off-site noise impacts.

Hume Coal will incorporate effective noise controls into the project's design and implementation including using latest generation rail locomotives, conveyors with low noise idlers and other leading practice mitigations outlined in Sections 3.2.1(ii) and 3.2.3(ii).

7.8 Traffic and transport

7.8.1 Existing environment

i Road network

The road network in and around the project area is shown in Figure 1.2. Key roads are as follows:

- Hume Highway (State Highway [SH]2), which is a four lane dual carriageway that runs north-south through the project area. It is known as the Hume Motorway north of its intersection with Mereworth Road, and forms part of the main inland arterial route between Sydney, Canberra and Melbourne. The Hume Highway has local access intersections at Mereworth Road, Golden Vale Road, Belanglo Road and some private properties, which permit right and left turn traffic movements from both the northbound and southbound carriageways.
- Illawarra Highway (SH25), which branches off the Hume Highway and runs along the southern boundary of the project area, and then through Sutton Forest and Moss Vale to the coast, at Albion Park.
- Medway Road, Taylor Avenue, Berrima Road, Douglas Road and Collins Road, north and east of the project area, which provide B-double approved routes between the Hume Highway, New Berrima and Moss Vale.
- Old Hume Highway, which provides local access and distribution for towns like Berrima, and a non-motorway connection between Berrima and Mittagong.
- Golden Vale Road, which is a local collector road that traverses the project area between the Hume Highway and Sutton Forest.
- Oldbury Road and Mereworth Road, which are both local roads that provide access to rural properties. Oldbury Road is unsealed in places. Mereworth Road also provides access to the proposed surface infrastructure and temporary construction accommodation village locations.
- Belanglo Road (currently unsealed), which intersects the Hume Highway about 2 km south of Mereworth Road and provides access to rural properties and Belanglo State Forest.

The project area is also traversed by a number of unsealed farm and forestry tracks.

Based on 2011 and 2012 traffic count data for the Hume Highway, Old Hume Highway, Illawarra Highway and Berrima Road, these roads operate well, with minimal congestion and considerable spare capacity. Additional traffic counts are being undertaken for the current study.

ii Rail network and capacity

The project area is close to the regional rail network and also has the advantage of being relatively close to port (around 80 km by rail). As mentioned earlier, product coal transport will be by rail and will be fully assessed in the Berrima Rail Project's development application.

7.8.2 Proposed assessment approach

Road traffic generation will principally be cars and trucks for deliveries of equipment and consumables and employee, contractor, service provider and visitor movements to and from site. Proposed site access arrangements are described in Section 3.10.

A detailed road traffic impact assessment will be conducted, generally in accordance with the Roads and Traffic Authority (now RMS) (2002) *Guide to Traffic Generating Developments*. It will evaluate the potential for traffic generated by the project's construction and operation to impact on performance (capacity, congestion and safety) of surrounding roads.

The assessment will include:

- site inspections and traffic counts to determine existing (base) traffic flows and conditions on surrounding roads, including at the proposed site access points;
- modelling and assessing existing and predicted future traffic conditions on the surrounding road network, including computerised analysis of key intersections' peak-hour performance with the SIDRA program. The assessment will consider existing traffic conditions, projected background growth in traffic volumes and the predicted project-related construction and operational traffic;
- consideration of any road diversions, temporary or otherwise;
- assessing the adequacy of the proposed site access intersections, parking and internal circulation network to cater for predicted site traffic; and
- identifying any mitigation or management measures required.

No modifications to the existing road network are proposed at this stage other than potentially some minor road realignments and modifications at site access intersections to ensure they can adequately cater for their proposed use. Details will be provided in the EIS.

7.9 Soils and land resources

7.9.1 Existing environment

Considerable soil and landform data has been collected across the project area, including from field-based soil surveys at hundreds of sites. These field investigations are continuing and include extracting and describing soil cores, test pits and chemical analyses. They are being supplemented by analysis of high-resolution remotely-sensed data, including LiDAR, radiometric, geological and ASTER data and satellite imagery to further characterise soils and landforms.

Based on investigations to date, the following soil types have been identified in the project area:

- Dystrophic Yellow Kandosol (duplex, loams over mottled non-sodic clay subsoils);
- Paralithic Leptic Tenosol (poorly developed sands);
- Lithic Leptic Rudosol (shallow weakly developed sands);
- Eutrophic Grey Dermosol (silty loam over medium to heavy clay); and
- Kandosolic Redoxic Hydrosol (light to medium poorly drained clays).

Most of the project area is, and will continue to be used for forestry and agriculture, principally pine plantations, livestock grazing and small-scale farm businesses. There are a small number of vineyards, principally Cherry Tree Hill and Eling Forest, both located alongside the Hume Highway. However, as described in Section 4.5.1, there is no BSAL or CIC within Hume Coal's proposed mining lease areas. Most areas and/or soils fail the BSAL tests on multiple criteria. These variously include steep slopes and soil limitations such as low fertility, poor drainage, soil profile depths less than 750 mm, high acidity and/or high salinity.

All soils within the project area have a shallow 'A' horizon. Accordingly, careful and selective management will be required during land disturbance to ensure that sufficient soil resource is available for the closure and rehabilitation phases.

A review of the Australian Soil Resource Information System (ASRIS) acid sulfate soil (ASS) maps showed small areas along some watercourses that are mapped as potential ASS. However, given the elevation, it is evident that it has not been subject to seawater intrusion (which is a prerequisite for ASS formation) and so is unlikely to contain ASS. ASRIS is considered to be large scale reconnaissance level mapping and may or may not be supported by laboratory data. Many soils in the project area are acidic, that is, have a pH less than 5.5, however this is different to comprising ASS. If disturbed and exposed to air, ASS has potential to oxidise, releasing acid and metals, while an acidic soil has very limited potential to liberate acidity.

7.9.2 Proposed assessment approach

The potential for impacts to land and soil capability and agricultural enterprises is limited by the project design which is for an underground mine that uses mining systems designed to avoid subsidence impacts. Direct surface disturbance will be largely restricted to surface infrastructure areas shown in Figure 3.1, either owned by Hume Coal or for which they have appropriate access agreements in place with the landowner. Direct surface disturbance elsewhere in the project area will be limited to small temporary disturbance areas such as for drill pads or any additional ventilation shafts installed over the life of the mine. Nonetheless, a detailed soil and land resources assessment will be undertaken as part of the EIS, including:

- assessing and mapping soil types across the entire project area, based on:
  - desktop investigations including review of studies by others in the project area and surrounds and analysis of the remotely sensed datasets mentioned in Section 7.9.1; and
  - field-based investigations, including soil observations and test pits, conducted in accordance with the applicable guidelines (Department of Land and Water Conservation 2001, Isbell 2002, McKenzie et al. 2008, National Committee on Soil and Terrain 2009, NSW Government 2013 and OEH 2012);
- pre- and post-mining land and soil capability assessment in accordance with relevant government guidelines;
- an agricultural impact assessment in accordance with relevant government guidelines;
- assessment of available topsoil resources for rehabilitation of infrastructure areas; and
- identification of any impact mitigation, management and monitoring measures required.

Key areas proposed for investigation include the potential for impacts on soil, land capability and agricultural productivity associated with:

- surface disturbance from constructing surface infrastructure;
- any impacts on soil fertility, drainage or other soil properties including potential disturbance of either acidic soil or ASS; and
- any fragmentation of agricultural land uses, for example associated with a land use change in surface infrastructure areas from agricultural to mine industrial for the duration of the project.

7.10 Aboriginal heritage

7.10.1 Existing environment

Investigations into the Aboriginal cultural heritage values associated with the project area are well advanced. Existing heritage reports and records of Aboriginal sites in the local area have been reviewed, along with aerial photographs, topography and geology to identify landforms conducive to habitation and/or preservation of sites. Consultation with Aboriginal stakeholders began in 2012 and three weeks of archaeological field survey have been undertaken.

Field investigations have identified a number of Aboriginal sites, comprising open artefact sites, grinding groove sites and rock shelters, some containing archaeological deposit and/or art. Rock shelters are confined to the western portion of the project area; they do not occur in proposed surface infrastructure areas. A number of potential archaeological deposits (PADs) have also been identified at rock shelters, open artefact sites and elevated landforms near watercourses. PADs are sites where archaeological deposits could occur but this has not been confirmed. For example, they could be buried or covered with vegetation which restricts ground surface visibility.

Most of the Aboriginal sites were recorded near watercourses, typically on landforms such as low hill spurs, which have gently inclined elevated topography and good outlook across the surrounding environment. Artefact scatters have also been recorded on ridgelines, but generally in lower densities than those adjacent to watercourses. Areas of moderate to high archaeological sensitivity occur on outcropping sandstone geology within the Belanglo State Forest. The sandstone escarpment and low hills with scarp landform features in this area support rock shelters and grinding grooves.

The investigations to date have not identified any places of specific cultural significance in the project area.

7.10.2 Proposed assessment approach

Hume Coal has been working closely with EMM's archaeologists to develop and refine the surface infrastructure design to avoid Aboriginal heritage impacts where possible. As mentioned in Section 3.2.3, archaeologists and site officers from the Registered Aboriginal Parties (RAPs) surveyed proposed surface infrastructure areas and the infrastructure layout was subsequently modified to avoid a number of individual Aboriginal sites and areas of higher archaeological sensitivity along Oldbury Creek. The selected design avoids most Aboriginal heritage sites and will have a lower impact than previous layouts considered.

The key area for further investigation is the potential for impacts to surface or subsurface Aboriginal sites which were unable to be avoided at surface infrastructure areas (principally stone artefact sites). This may include additional surveys and test excavation to characterise the subsurface archaeological record in areas to be impacted.

There is negligible potential for impacts to Aboriginal sites across the remainder of the project area, given that there is negligible risk of subsidence impacts. Nonetheless, the archaeological survey so far has covered all accessible land predicted to support rock shelter, grinding groove and water hole sites, so that they can be comprehensively addressed. These features will be considered in the pillar stability assessment discussed in Section 7.1.2. Other site types such as modified trees (carved or scarred), burials, stone arrangements, and ceremonial areas have not been identified in the project area but are unlikely to be impacted by the proposed underground mining if they exist.

The Aboriginal cultural heritage assessment, which will form part of the EIS, is being guided by the:

- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (DECCW 2011b);
- *Code of Practice for the Archaeological investigation of Aboriginal Objects in New South Wales* (DECCW 2010b); and
- *Draft guidelines for Aboriginal cultural heritage impact assessment and community consultation* (DEC 2005) (being used for the archaeological impact assessment, not Aboriginal consultation).

Consultation with Aboriginal stakeholders is an important part of the assessment and began in 2012. It is being undertaken in accordance with the DECCW (now OEH) (2010a) *Aboriginal cultural heritage consultation requirements for proponents 2010*. RAPs have participated in fieldwork and a number of workshops are proposed to discuss the methods, results and management recommendations; the workshops will also be a forum where RAPs are encouraged to identify cultural significance. The consultation process and outcomes will be documented in the EIS.

The objectives of the Aboriginal cultural heritage assessment are to:

- identify Aboriginal cultural heritage values associated with the project area, through archival research, survey and consultation with RAPs. These may include:
    - Aboriginal objects and sites;
    - PADs; and
    - Aboriginal socio-cultural values, including sites with intangible values.
- conduct an archaeological survey that targets proposed surface infrastructure areas and areas with moderate to high potential for Aboriginal sites associated with sandstone outcropping, though also provides representative coverage of other parts of the project area;
- based on the field survey results, and in consultation with OEH and RAPs, potentially conduct test excavation in areas of PAD at proposed surface infrastructure locations;
- assess the project's impacts on the identified Aboriginal cultural heritage values; and
- document the measures already incorporated into the project design to avoid impacts to Aboriginal cultural heritage values and identify any additional mitigation, management or monitoring measures to be implemented.

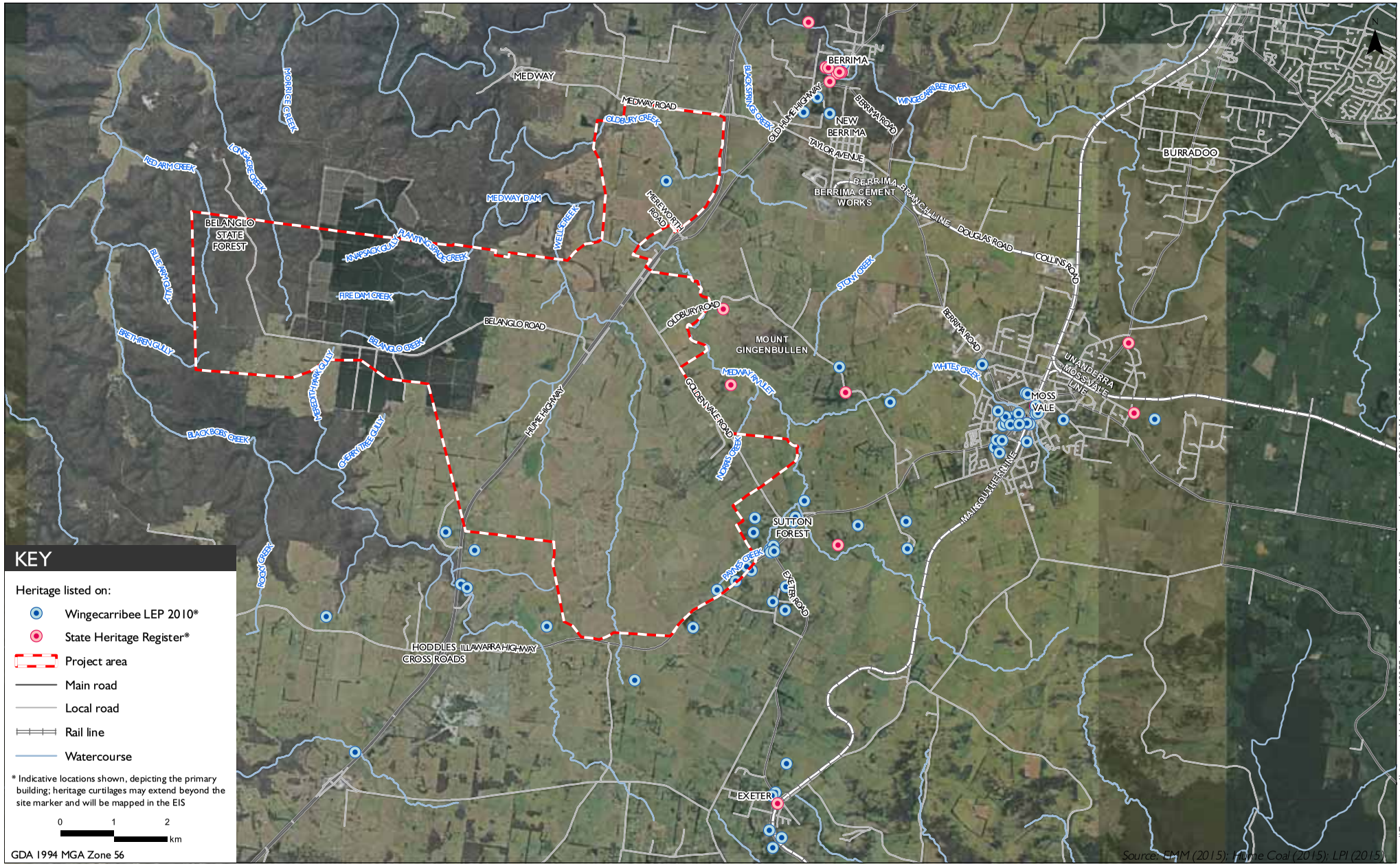
7.11 Historic heritage

7.11.1 Existing environment

European settlement in the present-day Wingecarribee LGA began in the 1820s. There are a number of historic heritage items and landscapes across the region, including buildings, streetscapes, gardens and tree plantings that date back to the nineteenth century.

A study into historic heritage values associated with the project area and surrounds is well advanced. Heritage databases and reports have been reviewed, field surveys undertaken and some longstanding community members interviewed about the area's history. The key findings are as follows:

- The project area does not contain any items listed on the State Heritage Register though several are present nearby (refer to Figure 7.7).
- Numerous heritage items listed on the Wingecarribee LEP are present in the vicinity of the project area, but mainly in the neighbouring areas of Sutton Forest, Berrima and Moss Vale, and on Golden Vale Road. These are mostly houses, cottages, gardens, agricultural complexes including sheds and other outbuildings, and functional buildings such as post offices. There are some locally listed heritage items and their curtilages along the southern boundary of the project area, and one, 'Mereworth house and gardens' built circa 1964, near the proposed surface infrastructure area in the north (refer to Figure 7.7).



EMM

HUMECOAL

Listed historic heritage items

Hume Coal Project

Preliminary Environmental Assessment

Figure 7.7

- While not heritage listed, a *Wingecarribee Heritage Study*, prepared by JRC Planning Services (1993) for WSC and DP&E (then DoP) identified the township of Sutton Forest and its surrounds as a 'cultural landscape'. This landscape appears to cover at least part of the project area. The study cited features such as pastoral properties, introduced tree plantings and homesteads as contributing to a 'montage or composite picture resulting from 170 years of occupation ... [and] a strong feeling of continuity and also participation in history'.

- EMM's field surveys identified scatters of bricks, glass fragments and other relics at two locations, both near Oldbury Creek and the proposed surface infrastructure area. These two sites are both considered to have archaeological potential. No other sites where relics are anticipated were identified during the archival research or field surveys.

7.11.2 Proposed assessment approach

Hume Coal has been working closely with EMM's heritage specialists to design a project that avoids historic heritage impacts. Even though subsidence impacts are anticipated to be negligible, Hume Coal's current mine plan avoids mining beneath State-listed heritage items and they are excluded from the project area. The project also avoids direct impacts to locally-listed heritage items.

Some surface infrastructure is proposed to be established on the Mereworth property, which is owned by Hume Coal. No modifications or direct impacts to the locally listed house or gardens are proposed. However, further investigation into the potential for indirect impacts, such as to views from the house, will be made as part of the EIS, and management measures will be developed and implemented during the project to ensure its character is retained.

There is negligible potential for impacts to heritage items outside the immediate vicinity of surface infrastructure areas, due to the fact that there is negligible risk of subsidence impacts. Nonetheless, the impact assessment will be integrated with the pillar stability assessment (refer to Section 7.1.2) to ensure relevant features are considered in that assessment and identify any precautionary monitoring and management measures required.

The historic heritage assessment will include the following:

- identification of historic heritage values associated with the project area, through archival research, survey and consultation with longstanding community members, including the potential for cultural landscapes, such as pastoral landscapes, or heritage values associated with the two potential archaeological sites identified;

- assessment of the potential for surface infrastructure to impact heritage items or historic cultural landscapes;

- assessment of the potential for archaeological remains to be impacted by ground disturbance during construction of surface infrastructure; and

- documentation of the measures already incorporated into the project design to avoid historic heritage impacts and identification of any additional mitigation, management or monitoring measures required.

7.12 Visual amenity

7.12.1 Existing environment

i Visual setting

The project area is on the undulating Woronora-Nattai Plateau. There are hills of igneous origin in the region, including Mount Gingenbullen (refer to Figure 1.2), which peaks at around 800 m AHD. However, elevations within the project area typically range from approximately 550 to 735 m AHD.

The region's visual character is formed by a mixture of natural, semi-rural and built landscapes, including some picturesque aspects which contribute to its popularity with tourists. The main elements are:

- Dense bushland on relatively rugged terrain with sandstone cliffs and drainage lines through deep sandstone valleys. Along with pine forest plantations, this is characteristic of the project area's western side.

- Cleared grazing land and occasional small-scale vineyards on low rolling hills and elevated ridge lines. These landscapes are interspersed by gullies, watercourses, rock outcrops, isolated tree stands and farm infrastructure including outbuildings, dams, access tracks and fences. There are scattered residences including some large historic houses and gardens. These semi-rural vistas are typical of the central and eastern parts of the project area.

- Villages and towns, including historic settlements such as Berrima.

- Industrial facilities and infrastructure, including the cement works and feed mill at New Berrima. They include large sheds, silos, material stockpiles and administration buildings, similar in appearance to those proposed for the Hume Coal Project.

Other visible features in the locality include infrastructure such as roads, rail lines and high voltage electricity transmission lines. Dense rows of introduced tree plantings such as pine trees are also prominent and obstruct views in places.

ii Viewpoints

The MIA and CHPP precincts have been sited away from roads and other areas exposed to public viewing, at locations where the existing landform and vegetation will shield them from view of most potentially sensitive receptors. They are not expected to visible from villages or towns including Medway and New Berrima. However, there may be partial views to project elements from some adjacent properties and roads (for example some points along Medway Road) and from more distant elevated areas.

7.12.2 Proposed assessment approach

The potential for visual impacts is limited by the project design which is for an underground mine, with surface infrastructure that is largely shielded. Also, as discussed above and in Section 3.2.3, surface infrastructure has been sited and designed to minimise the potential for visual impacts, including by reducing equipment and stockpile heights, and there are limited viewing opportunities of the proposed MIA and CHPP precincts.

The visual impact assessment will:

- describe the existing visual character of the project area and surrounds;

- model and predict the project's visual impact, including overlaying three-dimensional models of the terrain and project infrastructure to identify where project elements may be visible. Field visits and assessments will be made and photomontages developed that show existing viewscapes from representative viewpoints and those predicted once the project is constructed;

- evaluate the significance of any predicted changes to viewscapes and visual amenity at the representative viewpoints, considering factors such as the predicted magnitude of change, contrast, viewing distance and direction, length of viewing time and receptor sensitivity; and

- develop measures to incorporate into the project's design to avoid, ameliorate or minimise the potential for visual impacts, for example planting tree screens.

The visual impact assessment will focus on the appearance of surface facilities and lighting, including elevated infrastructure such as stackers and reclaimers at the coal stockpiles.

7.13 Social

7.13.1 Existing environment

i Community profile

The project area is in the Wingecarribee LGA, in a largely semi-rural setting, characterised by grazing properties, small-scale farm businesses, hobby farms, natural areas, industrial facilities and scattered rural residences, villages and towns. The main regional centres are Moss Vale, Bowral and Mittagong, where retail and community facilities, infrastructure and services are concentrated. Smaller villages near the project area are Sutton Forest, Exeter, Medway, New Berrima and Berrima (Figure 1.2).

In addition to agriculture and manufacturing industry, the region has an established tourism industry, particularly for daytrippers and weekenders from Sydney, Canberra and other nearby areas. This includes for events such as Tulip Time Festival.

Based on 2011 census results (unless otherwise indicated), key socio-economic characteristics of the Wingecarribee LGA include the following:

- Approximately 44,395 residents in 2011 with 1.0% annual growth since 2006.
- Approximately 42% of the population is aged over 50, significantly higher than the NSW average of 33%. The LGA is a retirement destination with an aging population and its highest growth is forecast to be within the over 65 demographic group.
- Approximately 11.8% of the LGA's population is aged between 20 and 34, significantly lower than the NSW average of 20.1%. Anecdotally, young people move away from the area due to a lack of higher education and employment opportunities.
- Generally high levels of health, wellbeing, education and income.
- Low unemployment rates, reported as 3.4% in December 2014 (Commonwealth Department of Employment 2015).
- Key employment industries are health care and social assistance; retail trade; manufacturing, education and training; and construction, though the relative dominance varies by locality. For instance the dominant employment industry is manufacturing in Moss Vale and New Berrima; construction in Sutton Forest; retail trade in Berrima; health care and social assistance in Bowral; and education and training in Exeter.
- The most common occupations are professionals, technicians, trades workers and managers.

Development activity in the region includes residential subdivisions, infrastructure and industrial developments. Property values are relatively high and there is limited rental property availability. A community strategic plan, entitled *Wingecarribee 2031+ Our Future Our Choice* (WSC 2010), has been developed for the Wingecarribee LGA and sets out a vision and goals for the LGA's future, along with strategies for implementation by Council to achieve them. The project's compatibility with these goals will be evaluated in the EIS.

The biggest landholders within the project area are the State Government and Hume Coal (refer to Section 2.6). A number of landholders are organisations and/or based in Sydney, while others permanently reside within the project area. Landholders in the project area are a focus for consultation about the project.

As discussed in Section 3.12, the project's operational workforce will be required to reside within a 45-minute commute of the mine. This workforce 'catchment' encompasses most of the Wingecarribee LGA as well as parts of the surrounding LGAs, all of which will be described in the EIS.

ii Responses to the project and its existing local contribution

As outlined in Chapter 5, Hume Coal is consulting with the community and this will continue throughout the project. There have been varied responses to the project to date, ranging from active opposition to support. Concerns have been expressed about aspects such as potential impacts to water resources and agriculture, while reasons given for support include its potential economic and employment contributions, helping to reduce migration of young people away from the area. Project support is highest within the working age population younger than 44, while those aged 45 and older are more likely to oppose the project.

Hume Coal's existing operations contribute to the local and regional economies by providing direct and indirect employment, income and business stimulus. The company is actively supporting local businesses, education facilities and other community initiatives. It currently makes substantial local investment each year, including $450,000 through its Charitable Foundation to a range of initiatives including education, indigenous programs and not-for-profit pre-school providers, as well as its local apprenticeship/traineeship program. Further discussion on these initiatives is provided in Section 1.2.

7.13.2 Proposed assessment approach

Particular emphasis in project planning has been given to enhancing local socio-economic benefits. Hume Coal has been engaging with its Social Reference Group, local people, businesses and others to form partnerships and identify opportunities for local business participation and community enhancement. The project includes policies to maximise recruitment of locals and use of local businesses, as discussed in Section 3.2.1(ii). For example, local firms including trades, cleaning and catering services will be used to service the construction accommodation village. The direct benefits of these initiatives to the local community will be documented in the EIS, and other opportunities for maximising local benefits explored.

Key areas for investigation in the EIS will be the potential social impacts associated with those people and their families that move to the area to work at the mine, principally:

- any increased demands on community facilities, infrastructure and services such as health and education; and
- housing and accommodation availability and affordability.

These types of impacts are not expected during construction as the construction workforce will be temporary and those recruited from outside the local area (where specialist skills are unable to be sourced locally), will be housed at the accommodation village. These types of impacts will however be a focus in assessing social impacts during operations. While Hume Coal will aim to fill most (around 70%) of the operational positions with existing local residents, supported by long-term training programs, some will need to be sourced from outside the local area. For instance, this may include people with formal qualifications in underground coal mining. Those that move to the area are, however, expected to mostly settle in the larger towns closest to the project area and not result in a significant population increase or pressure on rental availability at any specific location.

The project's social impact assessment will include the following:

- a baseline profile of the local community including its history, settlement pattern, socio-economic characteristics, workforce skills, infrastructure, services, housing and accommodation market, values and perspectives on the project. This will include analysing demographic data and consulting stakeholders such as landholders, community members, councils and service providers;
- the estimated future residential distribution of the project's workforce and their families, including those that move to the region to work at the mine, and the associated population change;

- the project's potential social impacts, both positive and negative. This will take into account the planned local procurement and participation opportunities; any additional demands on housing and community and social facilities, infrastructure and services; and potential impacts to existing land uses and other activities such as by competition for labour with local businesses; and

- ways to enhance the project's benefits and mitigate and manage any potential impacts, including ongoing reporting and consultation to ensure the community remains well informed and engaged.

Community consultation will continue to be integral to understanding the local community's values, socio-economic conditions, aspirations, fears and perceptions about the project and in this way, the project's potential impacts on the local community. The outcomes of other studies such as noise, air quality, visual and traffic will be considered, in conjunction with community consultation outcomes, to comment on actual and perceived impacts on amenity and community values.

7.14 Hazards

7.14.1 Background

The project will require coal handling and transport and the delivery, storage and use of hydrocarbons such as fuel and oil, explosives (occasional use only) and other potentially hazardous substances. Storage and handling of potentially hazardous materials will be in accordance with statutory requirements. Appropriate controls will be in place to prevent spills and leaks.

Atypical events with potential to cause a hazard are spills or leaks of hazardous materials, such as due to equipment failure, and fires or explosion, for example, an equipment fire. There is no risk of outburst underground due to the extremely low gas content of the Wongawilli Seam (refer to Section 3.4.2) and virtually no risk of spontaneous coal combustion, given the coal properties (refer to Section 7.6.2). Safety systems and procedures will be in place to minimise the potential for any such incidents and to manage and respond to them if they do occur, including a firefighting system and other systems required by law.

7.14.2 Proposed assessment approach

Risk screening will initially be done using criteria and guidance in DP&E's *Applying SEPP 33* (DoP 2011a), to confirm whether or not the project is classified as potentially hazardous, requiring a preliminary hazard analysis (PHA) and if so, the level of assessment required. The screening criteria relate to factors such as the types and quantities of hazardous materials to be stored on-site, how and where they will be stored, and anticipated frequency of road movements of this material to and from the facility.

If a PHA is required, it will be conducted in accordance with SEPP 33 requirements, following guidance in DP&E's *Hazardous Industry Planning Advisory Paper No. 6 – Hazard Analysis* (DoP 2011b)*, Multi-level Risk Assessment* (DoP 2011c) and *Applying SEPP 33* (DoP 2011a).

The PHA would identify potential hazards associated with the project and estimate the likelihood and consequences of them occurring, taking into account Hume Coal's proposed controls, such as bunding and firefighting systems. This information would then be combined to assess the level of off-site risk to people, property and the environment. Additional risk mitigation measures would be incorporated into the project design if required and the assessment process repeated. This would ensure that the proposed safeguards are adequate and the proposed operation does not pose an unacceptable level of risk.

The risk of spontaneous combustion will be assessed in the air quality assessment (refer to Section 7.6.2) and a standalone bushfire hazard assessment will be prepared (refer to Section 7.15.2). The EIS will also describe other measures to be in place to protect public safety, such as security fencing.

7.15 Bushfire

7.15.1 Existing environment

The project area and surrounds are predominantly undulating, cleared grazing land which has a relatively low bushfire risk. However, more than half of the Wingecarribee LGA has been mapped as bushfire prone on the NSW Rural Fire Service (2011) *Wingecarribee Shire Council – Bushfire Prone Land Map*. This includes Belanglo State Forest, sections of Medway Rivulet and Oldbury Creeks' riparian vegetation, and some other tree stands in and around the project area. Some surface infrastructure will be in the vicinity of this vegetation.

7.15.2 Proposed assessment approach

A bushfire hazard assessment will be prepared for the EIS, in accordance with the applicable guidelines, standards and policies, including the NSW Rural Fire Service (2006) *Planning for Bush Fire Protection* guideline. The assessment will:

- identify the presence and extent of the bushfire hazard in the vicinity of proposed surface infrastructure, taking into account vegetation characteristics (for example the type and amount of vegetation present), slope and the area's bushfire history;
- determine appropriate asset protection zones, that is, the separation distances required between structures and vegetation which could pose a bushfire hazard, to minimise the bushfire risk and enable fire fighting vehicle access; and
- identify other measures to reduce the risk of a bushfire impacting the project or an incident at the mine starting a bushfire. For example, this would include maintenance requirements to reduce the fuel load in asset protection zones, and emergency access and egress provision.

Hume Coal's proposed mine safety system includes firefighting systems, equipment and water storages. These will be taken into account in the assessment and described in the EIS.

7.16 Waste

7.16.1 Background

Waste generated during construction will include timber and packaging, domestic waste, scrap steel, green waste, asphalt and concrete. Operational waste will include coal reject material, special waste (eg tyres), liquid waste (eg wastewater and waste oil), hazardous waste (eg batteries), general waste (eg timber pallets, steel, cardboard, glass and food scraps), sewage and minor amounts of green waste from landscaping. The proposed wastewater and reject management systems are described in Sections 3.6 and 3.9.

7.16.2 Proposed assessment approach

The EIS will document the anticipated types and volumes of waste to be generated by the project, along with proposed waste minimisation, management and disposal strategies. These strategies will satisfy requirements of the *Waste Avoidance and Resource Recovery Act 2001* and POEO Act. The standard waste control hierarchy currently employed by Hume Coal will be applied. That is, priority will be given to avoiding and reducing waste, followed by resource recovery (reuse, recycling or energy recovery), with treatment and/or disposal as a last resort.

7.17 Geochemistry

7.17.1 Existing environment

The project's geochemical assessment is well advanced and provides a good understanding of the geochemistry of mine material to be handled. That is, the coal, coal reject and soil and rock excavated during construction of the drifts (drift spoil). A total of 77 representative samples of coal and potential mining waste material collected from 12 drill hole locations have undergone full geochemical analysis. In addition, more than 5,000 samples from drill holes have been analysed for total sulfur.

Access to the coal seam from the surface will be gained using a standard drift technique and therefore waste material (drift spoil extracted from the tunnels) will be generated and brought to the surface. The drift spoil will mainly comprise Hawkesbury Sandstone material. The analysis results to date indicate that this material is geochemically benign and so does not require any special management procedures in this respect. Furthermore, it has the potential to be beneficially used in various construction and rehabilitation activities proposed in the project area.

Both raw and washed (product) coal will be temporarily stockpiled on-site before processing and dispatch to market respectively. Mining waste material will principally be coal reject originating from the coal washing and processing at the CHPP. Characterisation data indicates that the coal and potential coal reject materials represent a variety of geochemical material types ranging from non-acid forming to potentially acid forming (PAF).

A conservative approach to management of the coal and coal reject will be taken to reduce the risk of acid generation. For instance, the preliminary geochemical and geotechnical study results to date indicate that addition of materials such as cement and limestone to the coal reject material (via the dosing facilities at the reject paste plant) is likely to be beneficial to provide geotechnical stability and prevent acid generation. Underground storage of coal reject (that is, returning them to their original environment) is likely to be the most appropriate management strategy for this material. This is because the underground voids quickly become oxygen deficient, due to physical adsorption of oxygen onto coal surfaces, thus avoiding the potential for sulfide to oxidise and generate acidity. Furthermore, sealing the partially backfilled panels with bulkheads and allowing groundwater to recover will result in an anoxic environment. That is, oxygen will be excluded from the remnant coal and coal reject underground and the potential for any future acid generation from sulfide oxidation is essentially eliminated.

7.17.2 Proposed assessment approach

The EIS will incorporate a geochemical assessment that:

- Describes the geochemistry of the coal, coal reject and drift spoil, based on geological and geochemical data, including laboratory analyses.
- Assesses the potential for handling and storage of coal, coal reject and drift spoil to impact the surrounding environment, considering their geochemical properties.
- Identifies management and monitoring measures required at coal stockpiles and for long-term storage of rejects, to avoid environmental impacts. This will principally be measures to reduce the potential for Acid and Metalliferous Drainage, Neutral Mine Drainage and/or saline drainage from coal and coal reject. For instance, addition of materials such as cement and limestone to coal rejects may be warranted to provide geotechnical stability and prevent acid generation. A water quality monitoring program will also be recommended to confirm that adverse impacts do not occur down-gradient of any areas used to store PAF mine materials.

7.18 Rehabilitation and mine closure

7.18.1 Overview

Post-mining, the mine infrastructure will be decommissioned and disturbed areas rehabilitated to a state where they are compatible with the surrounding landscape and can support land uses similar to the current land uses. This outcome will be assisted by the surface infrastructure design, which retains as much of the existing landscape as possible.

The rehabilitation and mine closure strategy will include those elements listed in Section 3.14. Where appropriate, underground plant and equipment will be removed and the mine accesses filled and sealed. However, a focus will be the surface disturbance areas, principally the surface infrastructure areas shown indicatively in Figure 3.2, but also any areas disturbed above the underground mine, for instance drill pads, access tracks and ventilation shafts. Subsidence impacts will be negligible and so no rehabilitation activities will be required across the majority of the project area. It is important to note that the remaining coal pillars have been designed from the outset to remain long-term stable.

The surface infrastructure areas will include mine infrastructure (refer to Section 3.7 for details), cleared land including areas that have been re-profiled, dams and potentially soil stockpiles. Land disturbance in these areas will be temporary and able to be reversed. After mining is finished, above-ground structures will be removed and where required, the ground will be ripped, with the surface layer of soil replaced and seeded. Stored topsoil (in bunds or stockpiles) will be replaced during the rehabilitation phase. Some project elements such as dams and access tracks may remain after mine closure, if a valuable post-mining use exists for the element and if agreed by the landowner.

7.18.2 Proposed assessment approach

The EIS will include a detailed description of the proposed rehabilitation and mine closure strategy, having regard to the principles in the *Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council 2000). The strategy will be developed in consultation with stakeholders and take into account outcomes of other technical studies, principally the soils and land resources, geochemistry, groundwater, surface water and ecology assessments. It will describe the:

- nominated potential post-mining land use(s), having regard to any strategic land use planning or resource management plans or policies;
- conceptual landform, including the anticipated final topography, vegetation, drainage, infrastructure and any project elements to be retained, such as dams or access tracks;
- stakeholder engagement strategy to ensure stakeholder interests are considered in mine closure planning, including seeking feedback on the proposed strategy and potential future land use(s) and minimising the impacts of closure on local businesses, employees and others;
- rehabilitation objectives, consistent with the potential post-mining land use(s) and conceptual landform;
- conceptual completion criteria, which will be simple, measureable and auditable, designed to demonstrate that rehabilitation objectives are being achieved;
- rehabilitation methods proposed to achieve the objectives;
- monitoring and maintenance program to be implemented to evaluate rehabilitation progress and ensure ongoing achievement of the objectives, including provision for adaptive management responses if required to improve performance;
- closure planning schedule, being the sequence of activities needed to take closure planning from conceptual through to detailed design; and

- potential for integrating this strategy with any other rehabilitation and/or ecological offset strategies in the region.

7.19 Economics

7.19.1 Overview

If approved, the project will make a substantial economic contribution to the region for some decades. Construction of the project will involve capital investment of approximately $682 million and there will be significant ongoing expenditure during operations. This will provide economic stimulus and benefits to the Australian, NSW and local economies. Expenditure on goods and services will be focused locally where possible. Some goods and services will however need to be procured from elsewhere within NSW, interstate and overseas. The project will also provide significant revenue to the Commonwealth and State governments through taxes and usage charges for government-owned assets, for example the rail line, and to the State Government through royalties.

The project will directly employ peak workforces of approximately 400 full-time equivalent employees during construction and 300 during operations, which will also have economic benefits.

In addition to the direct economic benefits of the project's employment, revenue and purchases of goods and services, there will be indirect flow-on effects to each of these aspects. For example, there will be indirect flow-on employment opportunities and expenditure within the companies which supply goods and services to the project and those providing housing and goods and services for employees.

The project will temporarily transfer land use in the surface infrastructure footprint from agriculture to mining. It will also result in transfer of some water entitlements from purposes such as stock, domestic and irrigation, to mining purposes. The effect of these matters on local industries and agriculture will be considered in the EIS.

7.19.2 Proposed assessment approach

An economic assessment will be prepared in accordance with the relevant guidelines. DP&E is currently preparing guidelines specifically for the economic assessment of mining and coal seam gas proposals, which will be used if available. Detailed economic modelling and analysis will be undertaken to predict, quantitatively, where feasible, the economic effects of the project's construction and operation at various community levels, including a local and state-wide level. The assessment will include:

- A cost-benefit analysis which estimates and compares the project's costs (such as environmental externalities) and benefits (such as taxes, asset usage charges, royalties and employee economic benefits) to NSW. This will include sensitivity analysis to estimate the effect of varying key assumptions. Depending on provisions of the guidelines, the analysis may also consider other scales, such as the costs and benefits to Australia more broadly.

- Analysis of the project's local effects, including:

    - local employment effects, considering factors such as the number of local jobs created and the flow-on income and employment that local expenditure of any net increase in their income will create;

    - local income effects, considering factors such as the project's direct purchases of goods and services in the locality and the flow-on income and employment this will create, for example by the suppliers that also spend their increased income locally;

    - effects on other local industries, for instance the economic effects of substituting agricultural land uses at the surface infrastructure area with mining land uses; and

    - local externality effects or environmental impacts.

The economic assessment will use data and pricing assumptions provided by DP&E in any detailed practice notes or similar released over the study period. Alternatively, if these are unavailable, DP&E and any other relevant agencies will be consulted about key variables prior to their application.

The economic analysis will be undertaken in light of the NSW Land and Environment Court's judgement on the Warkworth Extension Project, that is, its outputs will be a guide to, but not a conclusive statement on the project's impacts.

8 Conclusions

8.1 The proposal

The Hume Coal Project is proposed to be developed in the Southern Coalfield of NSW, where there is a long history of mining, and a number of mines currently operating. It will be developed within and north of coal exploration authorisation A349, which was originally granted in 1985 and is now held by Hume Coal. Coal exploration and mining in the area dates back to the 19th century.

The project involves development and operation of an underground coal mine and associated mine infrastructure over a period of approximately 22 years. It will produce metallurgical and thermal coal for international and domestic markets. Low impact mining methods will be used which will have negligible surface or subsurface subsidence impacts. The mine will employ around 300 personnel at peak production. Post-mining, it will be decommissioned and the area rehabilitated over a nominal two year period, to a state where it can support land uses similar to current land uses. This outcome will be assisted by the surface infrastructure design, which retains as much of the existing landscape as possible.

The project, being SSD, requires approval under Part 4, Division 4.1 of the EP&A Act. It is likely to also constitute a controlled action, requiring approval under the EPBC Act. A referral will be made to DoE to determine whether or not this is the case.

8.2 Project evolution and outcomes

The project has been developed following several years of detailed geological, engineering, environmental, financial and other technical investigations to define the resource and identify and address environmental and other constraints. Baseline environmental monitoring and surveys are near complete and, therefore, the existing environment is well understood. Numerous alternative designs have been examined, all evaluated against technical, financial and environmental objectives.

Hume Coal has also been consulting stakeholders, which provides valuable knowledge to assist in project planning. Consultation will continue throughout the EIS and the project's development, construction, operation and closure phases.

The process adopted has allowed development of a well-considered, practical and economic project design that will enable resource recovery, while minimising adverse impacts to the environment and community and potential land use conflicts. It addresses all constraints and will deliver socio-economic benefits to the local community.

The project incorporates a number of leading practice innovations, some of which set a new benchmark for underground coal mining in NSW. These measures go beyond those required to comply with regulatory standards. For example the rail wagons used to transport product coal off-site will be covered and all coal reject material returned underground to partially backfill the mined-out void and reduce visual and other environmental impacts.

To minimise environmental impacts, Hume Coal has devised a distinctively innovative 'non-caving' coal extraction method which will have negligible subsidence impacts and will, therefore, protect the overlying aquifers and surface features. The strata overlying the mine will remain intact and supported, rather than collapsing into the mined-out void and causing subsidence. By avoiding disruption to the overlying strata, associated groundwater impacts will also be minimised. Keeping the void spaces open immediately following mining will also allow the coal reject material to be returned underground, thus avoiding the need for permanent surface emplacement areas. A combination of innovative engineering solutions is proposed to achieve the negligible subsidence outcome, including a system of engineered supporting coal pillars. The proposed use of bulkheads to seal each panel immediately after extraction and backfilling will allow full groundwater recovery at each mined-out area to begin shortly after mining. Also, allowing the voids to fill with groundwater will further enhance pillar stability factors, albeit that the system is designed to be long-term stable with or without backfill and hydrostatic pressure. Sealing the panels will also minimise groundwater inflows to the active mine workings.

Surface infrastructure is proposed to be developed on predominately cleared land owned by Hume Coal or for which there are appropriate access agreements in place with the landowner, at sites that are relatively free from environmental and other constraints. The design integrates with the existing topography and landform and is generally set back from sensitive receptors, to minimise the potential for visual, noise, dust and amenity impacts.

Emphasis has been given to maximising the project's direct benefits to the local community. The project therefore includes local apprenticeship, training and community investment programs, which have already commenced, as well as policies to maximise recruitment of locals and use of local businesses.

Feedback to date indicates that many community members recognise the project's potential to make positive economic and employment contributions. The importance of ensuring benefits go to local people has been emphasized. Key community concerns include potential water resources, agricultural, traffic, noise, air quality, general nuisance and GHG impacts. Hume Coal is proactively addressing these matters and will continue to keep the community informed as new information comes to hand.

8.3 Matters for consideration in the EIS

This document provides project particulars and accompanies a request to the Secretary of the DP&E for environmental assessment requirements (terms of reference for the EIS), as required by Part 2 of Schedule 2 of the EP&A Regulation. It identifies the key areas for investigation in the EIS and the proposed assessment methodologies. The EIS will be prepared in accordance with relevant guidelines and policies, including assessment requirements issued by DP&E.

The EIS will describe the project in detail, along with its potential environmental, social and economic impacts, both positive and negative. Importantly, it will also describe the measures to be implemented to enhance the project's benefits and mitigate, manage and offset any potential impacts.

A key matter to be addressed in the EIS is water management. There will be groundwater inflows to the mine and associated temporary drawdown in groundwater levels, which require management and mitigation to address potential impacts such as to groundwater users. The mine plan has been designed to minimise this as much as practically possible and additional mitigations are currently being investigated. In addition to water, the EIS will include detailed assessments of:

- terrestrial and aquatic ecology;
- noise and vibration;
- traffic and transport;
- Aboriginal and historic heritage;
- visual amenity;
- socio-economic factors;
- hazards; and
- geochemistry.

Low risk considerations such as air quality, energy use and GHG, soils and land resources, bushfire and waste will also be assessed in the EIS.

The EIS will be assessed by the relevant authority(ies) in deciding whether to approve the project, and if so, under what conditions. It will also be made publicly available for review and comment.

8.4 Preliminary justification

The site is well suited to the proposed development, given the presence of an economic coal resource and its proximity to key services and infrastructure, particularly rail infrastructure and Port Kembla. Resource extraction in the manner proposed avoids land use conflicts by allowing continuation of the existing land uses at the surface. It also avoids impacts to significant environmental features, which in any case are limited in the locality. Given the public ownership of coal resources and the royalty benefits that will flow to the State, the proposed resource recovery is in the public interest.

The preliminary environmental assessment contained in this document identifies a number of areas for further investigation and the methodologies proposed to conduct these investigations. All of these matters will be comprehensively addressed in the EIS and mitigation, management and offset measures developed accordingly.

If approved, the large investment to construct and operate the project will provide substantial economic stimulus and benefits to the Australian, NSW and local economies, including through increased government revenue. The project will make an important social and economic contribution to the region for some decades. This will include through ongoing employment and training opportunities for local residents with associated reduction in the loss of young people from the area; significant capital investment; purchase of goods and services from local companies; and continuation and expansion of Hume Coal's existing community investment programs.

Abbreviations

A349	exploration Authorisation 349
AEP	annual exceedance policy
AHD	Australian Height Datum
AIP	NSW Aquifer Interference Policy
ARTC	Australian Rail Track Corporation
ASRIS	Australian Soil Resource Information System
ASS	acid sulfate soil
BoM	Bureau of Meteorology
BSAL	biophysical strategic agricultural land
CCL	consolidated coal lease
CHPP	coal handling and preparation plant
CIC	critical industry cluster
CL Act	NSW *Crown Lands Act 1989*
CPP	coal preparation plant
Dams Safety Act	NSW *Dams Safety Act 1978*
DEC	former NSW Department of Environment and Conservation
DECC	former NSW Department of Environment and Climate Change
DECCW	former NSW Department of Environment, Climate Change and Water
DoP	former NSW Department of Planning
DoE	Commonwealth Department of the Environment
DP&E	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
EEC	endangered ecological community
EIS	environmental impact statement
EMM	EMGA Mitchell McLennan Pty Limited
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW Environmental Planning and Assessment Regulation 2000
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPI	environmental planning instrument
EPL	environment protection licence
Forestry Act	NSW *Forestry Act 1916*
GHG	greenhouse gas
GL	gigalitres
ha	hectares
Heritage Act	NSW *Heritage Act 1977*
Hume Coal	Hume Coal Pty Limited
Infrastructure SEPP	State Environmental Planning Policy (Infrastructure) 2007
INP	Industrial Noise Policy
Interim Protocol	*Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (NSW Government 2013)
km	kilometres
km^2	square kilometres
L/s	litres per second
LGA	local government area
m	metres
m^3	cubic metres
MIA	mine infrastructure area

Mining SEPP	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
ML	megalitres
mm	millimetres
MNES	matters of national environmental significance
Mt	million tonnes
Mtpa	million tonnes per annum
NOW	NSW Office of Water
NPW Act	NSW *National Parks and Wildlife Act 1974*
NSW	New South Wales
NV Act	NSW *Native Vegetation Act 2003*
OEH	NSW Office of Environment and Heritage
PAC	NSW Planning Assessment Commission
PAD	potential archaeological deposit
PAF	potentially acid forming
PCT	Plant Community Type
PFM	planning focus meeting
PHA	preliminary hazard analysis
$PM_{2.5}$	particulate matter than 2.5 microns in aerodynamic diameter
PM_{10}	particulate matter than 10 microns in aerodynamic diameter
POEO Act	NSW *Protection of the Environment Operations Act 1997*
POSA	POSCO Australia
RAP	Registered Aboriginal Party
RMS	NSW Roads and Maritime Services
Roads Act	NSW *Roads Act 1992*
ROM	run of mine
ROTAP	Rare or Threatened Australian Plants
SEARs	Secretary's environmental assessment requirements
SEPP 33	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
SEPP 44	State Environmental Planning Policy No. 44 – Koala Habitat Protection
SH	State Highway
SRG	Social Reference Group
SRLUP	Strategic Regional Land Use Policy
SSD	State significant development
State and Regional Development SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SVC	site verification certificate
t	tonnes
TEOM	tapered element oscillating microbalance
Trade and Investment - MR	NSW Trade & Investment – Regional Infrastructure and Services, Mineral Resources Branch
TSC Act	NSW *Threatened Species Conservation Act 1995*
TSP	total suspended particulates
WAG	Water Advisory Group
Water Act	NSW *Water Act 1912*
Wingecarribee LEP	*Wingecarribee Local Environmental Plan 2010*
WM Act	NSW *Water Management Act 2000*
WSC	Wingecarribee Shire Council

References

Australian Bureau of Statistics (2011) *Census of Population and Housing*.

ACIL Tasman 2011a, *Maldon to Dombarton Railway Line Feasibility Study: Working Paper*. Report prepared by ACIL Tasman for the Australian Government Department of Infrastructure and Transport.

2011b, *Maldon to Dombarton Railway Line Feasibility Study: Final Report*. Report prepared by ACIL Tasman for the Australian Government Department of Infrastructure and Transport.

Australian and New Zealand Environment Council 1990, *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration.*

Australian and New Zealand Minerals and Energy Council 2000, *Strategic Framework for Mine Closure*.

Bouwer H and Maddock T 1997, 'Making Sense of the Interactions Between Groundwater and Streamflow: Lessons for Water Masters and Adjudicators', *Rivers*, 6:1, pp. 19-31.

Brown 2004, 'Conveyor noise specification and control', paper presented at the Annual Conference of the Australian Acoustical Society, Gold Coast, 3-5 November.

Bureau of Meteorology (BoM) 2013, Atlas of Groundwater Dependent Ecosystems, http://www.bom.gov.au/water/groundwater/gde/map.shtml.

Commonwealth Department of Employment 2015, Small Area Labour Markets – December Quarter 2014, https://employment.gov.au/small-area-labour-markets-publication)

Department of Environment and Climate Change (DECC) 2007, *Threatened Species Assessment Guidelines: the Assessment of Significance*, NSW Government.

2009, *Interim Construction Noise Guideline,* NSW Government.

Department of Environment and Conservation (DEC) 2004, *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities.* NSW Government.

2005, *Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation.* NSW Government.

2006, *Assessing Vibration: a technical guideline*. NSW Government.

Department of Environment, Climate Change and Water (DECCW) 2010a, *Aboriginal cultural heritage consultation requirements for proponents 2010,* NSW Government.

2010b, *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales*. NSW Government.

2011a, *NSW Road Noise Policy,* NSW Government.

2011b, *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*. NSW Government.

Department of Environment, Water, Heritage and the Arts (DEWHA) 2010a, *Survey Guidelines for Australia's Threatened Bats.* Australian Government.

2010b, *Survey Guidelines for Australia's Threatened Birds*. Australian Government.

2010c, *Survey Guidelines for Australia's Threatened Frogs*. Australian Government.

Department of Land and Water Conservation 2001, *Soil Data Entry Handbook*, Third edition, Department of Land and Water Conservation, Sydney.

Department of Planning (DoP) 2003, *Aquatic Ecology in Environmental Impact Assessment.* NSW Government.

2008, *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield: Strategic Review*, NSW Government.

2011a, *Applying SEPP 33,* NSW Government.

2011b, *Hazardous Industry Planning Advisory Paper No 6 - Hazard Analysis.* NSW Government.

2011c, *Assessment Guideline - Multi-level Risk Assessment.* NSW Government.

Department of Planning and Infrastructure 2012, *Strategic Regional Land Use Policy,* NSW Government.

Department of Primary Industries n.d., *Policy and Guidelines for Fish Friendly Waterway Crossings,* NSW Government.

2013, *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management,* NSW Government.

Department of Sustainability, Environment, Water Population and Communities (SEWPAC) 2011a, *Survey Guidelines for Australia's Threatened Mammals*. Australian Government.

2011b, *Survey Guidelines for Australia's Threatened Reptiles*. Australian Government.

Department of the Environment 2013, *Matters of National Environmental Significance: Significant Impact Guidelines 1.1*, Australian Government.

EMM 2015, *Hume Coal Project Biophysical Strategic Agricultural Land Verification Assessment*. Prepared for Hume Coal Pty Limited.

Environment Protection Authority (EPA) 2000, *NSW Industrial Noise Policy,* NSW Government.

2013, *Rail Infrastructure Noise Guideline,* NSW Government.

Fairfull, S & Witheridge, G 2003, *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings,* NSW Fisheries.

Isbell RF 2002, *The Australian Soil Classification*, Revised edition, CSIRO Publishing, Collingwood.

JRC Planning Services 1993, *Wingecarribee Heritage Study*. Prepared for Wingecarribee Shire Council and the Department of Planning.

McKenzie N, Grundy MJ, Webster R and Ringrose-Voase AJ 2008, *Guidelines for Surveying Soil and Land Resources*, Second edition, CSIRO, Australia.

National Committee on Soil and Terrain 2009, *Australian Soil and Land Survey Field Handbook*, Third Edition, CSIRO, Melbourne.

NSW Government 2012, *Draft guideline for site verification of critical industry clusters.*

2013, *Interim protocol for site verification and mapping of biophysical strategic agricultural land.*

NSW Office of Water 2012, *NSW Aquifer Interference Policy*, NSW Government.

NSW Rural Fire Service 2006, *Planning for Bush Fire Protection*, NSW Government.

2011, *Wingecarribee Shire Council – Bushfire Prone Land Map*.

Office of Environment and Heritage (OEH) 2012, *The land and soil capability assessment scheme*, NSW Government.

2014, *Framework for Biodiversity Assessment,* NSW Government

Roads and Traffic Authority 2002, *Guide to Traffic Generating Developments.* NSW Government.

Ross, JB 2014, '*Groundwater resource potential of the Triassic Sandstones of the Southern Sydney Basin: an improved understanding', Australian Journal of Earth Sciences: An International Geoscience Journal of the Geological Society of Australia*, 61:3, pp. 463-474

Strahler, AN 1952, 'Dynamic basis of geomorphology', *Geological Society of America Bulletin*, 63, pp. 923-938.

Sydney Catchment Authority 2011, *Neutral or Beneficial Effect on Water Quality Assessment Guideline.* Sydney Catchment Authority.

Wingecarribee Shire Council 2010, *Wingecarribee 2031+ Our Future Our Choice.*

2012, *Wingecarribee Shire Council Drought Management Plan*.

Appendix A

Assessment matrices

Table A.1 Qualitative measures of consequence

Level	Potential consequences			
	People	Property	Environment	Community
1 Catastrophic impact	Multiple fatalities. Major permanent negative health impacts on a large number of people.	Unplanned mine closure. Greater than $10M.	Disastrous environmental impact, where there is long-term effects, requiring remediation, regulatory intervention or premature closure of the operation.	Public international condemnation. Major breakdown of social order in affected communities.
2 Severe negative impact	Single fatality. Severe irreversible disability or impairment.	Could cause major damage $1M-$10M.	Serious environmental impact, with medium term effect, requiring significant remediation or resulting in prosecution.	Loss of community's economic viability. Significant damage to reputation of the operations.
3 Major negative impact	Major injury to one or more persons. Severe health impacts to several people.	Could cause major damage $100K-$1M.	Moderate reversible environmental impact with short-term effect, requiring moderate remediation. A reportable incident.	Significant public criticism, eg community complaints. NGO or media "taking up the issue". Major negative impact on economic viability.
4 Negative impact	Significant reportable injury. Major impact on individual health.	Could cause moderate damage $10K-$100K.	Minor reversible environmental impact, requiring minor remediation such as non reportable environmental incident.	Flare up of issue in affected communities. Media criticism.
5 Minor negative impact	Minor injury. Slight negative impact on individual health.	Could cause minor damage <$10K.	Negligible reversible environmental impact, requiring very minor or no remediation.	Slight negative impact on individuals in local community.

Table A.2 Qualitative measures of likelihood

Level	Likelihood
A	Almost certain to happen
B	Likely to happen at some point
C	Possible or could happen
D	Unlikely to happen
E	Practically impossible

Table A.3 Priority rating

	Likelihood				
Consequence	A	B	C	D	E
1	1	2	4	7	11
2	3	5	8	12	16
3	6	9	13	17	20
4	10	14	18	21	23
5	15	19	22	24	25

Priority classification:

High (Priority 1)	1-10
Medium (Priority 2)	11-19
Low (Priority 3)	20-25

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