Centennial Coal

Angus Place Colliery

Angus Place Mine Extension Project

State Significant Development 5602

Environmental Impact Statement

Volume 1: Report

07 April 2014

STATEMENT OF VALIDITY

Submission of Environmental Impact Statement prepared under *Part 4 of the New South Wales Environmental Planning and Assessment Act 1979.*

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In respect of:	Angus Place Mine Extension Project, Environmental Impact Statement	

Applicant name:	Centennial Angus Place Pty Ltd
Applicant address:	Level 18, BT Tower, 1 Market St Sydney
Proposed development:	Angus Place Mine Extension Project (refer Chapter 4.0)
Land to be developed:	Refer to attached schedule of land (refer Appendix C).
Environmental Assessment:	An environmental impact statement is attached, which addresses all matters in accordance with *Part 4 of the Environmental Planning and Assessment Act, 1979*.
Preparation	This Environmental Impact Statement has been prepared by Golder Associates Pty Ltd on behalf of Centennial Angus Place Pty Limited. In preparing the Environmental Impact Statement, Golder Associates has relied upon data, designs and plans and other information provided by Centennial Angus Place Pty Limited and other individuals and organisations referenced herein.
Declaration:	I certify that I have prepared the contents of this EIS and to the best of my knowledge: ■ It is in accordance with clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000;* ■ It contains all available information that is relevant to the environmental impact statement assessment of the development to which this statement relates; and ■ It is true in all material particulars and does not, by its presentation or omission of information, materially mislead.
Signature	 
Date	7 April 2014

Record of Issue

Company	Client Contact	Version	Date Issued	Method of Delivery
Golder Associates	Centennial Coal Iain Hornshaw	Rev 1	18.11.14	Electronic (Email)
Golder Associates	Centennial Coal Iain Hornshaw	Rev 2 (updated by Golder based on adequacy comments)	10.02.14	Electronic (Email)
Golder Associates	Centennial Coal Iain Hornshaw	Rev 3 (revised and updated by Golder for post adequacy submission)	25.03.14	Electronic (Email)
Golder Associates	Centennial Coal Iain Hornshaw	Rev 4 (updated with minor comments for DoPI submission)	07.04.14	Electronic (Email)

EXECUTIVE SUMMARY

Introduction and Overview

Angus Place Colliery is owned by Centennial Springvale Pty. Limited (as to 50%) and Springvale SK Kores Pty Limited (as to 50%) as participants in the Springvale unincorporated joint venture. Angus Place Colliery is operated by Centennial Angus Place Pty Limited (Centennial Angus Place), for and on behalf of the Springvale joint venture participants. Centennial Angus Place is the Applicant for the Project.

Angus Place Colliery is an existing underground coal mine producing high quality thermal coal for domestic markets. It is located 15 kilometres to the northwest of the regional city of Lithgow and 120 kilometres west northwest of Sydney in New South Wales. Underground coal mining commenced at Angus Place Colliery in 1979 initially as a bord and pillar operation. The mine's current approval (PA06_0021) was granted in September 2006 under Part 3A of the *Environmental Planning and Assessment Act, 1979*. PA06_0021 and its subsequent modifications remain in force and authorises the extraction of up to 4 million tons of run-of-mine coal per annum. The development consent will expire in August 2024. A project approval is required to ensure Angus Place Colliery is operational beyond this date.

The Angus Place Mine Extension Project (the Project) is State Significant Development in accordance with Clause 8 and Schedule 1 (Item 5) of *State Environmental Planning Policy (State and Regional Development) 2011*. Centennial Angus Place, as the Applicant of the Project, is seeking approval under Part 4 Division 4.1 of the *Environmental Planning and Assessment Act 1979.*

Director General Requirements (DGRs) for the Project (SSD_5602) were issued on 6th November 2012. As the Project had the potential to impact on matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act), an EPBC referral was submitted to the Department of Sustainability, Environment, Water, Population and Communities (formerly SEWPAC now DoE) on the 20th May 2013. The Project was subsequently declared a controlled action on 7th July 2013, and supplementary DGRs were issued on 30th August 2013.

This Environment Impact Statement (EIS) has been prepared in support of the development application for the Project. It is informed by a wide range of technical assessments determined using a risk based approach. The technical assessments identify, assess and provide management and mitigation measures for potential environmental impacts associated with the Project. The technical assessments and the EIS have been prepared to meet the DGRs, the supplementary DGRs, and the environmental assessment requirements of other Government agencies.

Project Description

The components of Angus Place Colliery's existing operations are an underground longwall mine, the pit top, and supporting surface infrastructure on Newnes Plateau within the Newnes State Forest.

The Project will not significantly alter the nature of the existing operations at Angus Place Colliery. The Project will:

- in general, include all currently approved operations, facilities and infrastructure of the Springvale Mine, except as otherwise indicated in this EIS;
- continue to extract up to 4 million tonnes per annum of run of mine (ROM) coal from the Lithgow Seam underlying the Project Application Area;
- develop underground access headings and roadways from the current mining area to allow access to the proposed mining area;
- undertake secondary extraction by retreat longwall mining for the proposed longwall panels LW1001 to LW1019;
- continue to use the existing ancillary surface facilities at the Angus Place pit top;

- continue to manage the handling of ROM coal through a crushing and screening plant at the Angus Place pit top and the subsequent loading of the coal onto the existing road haulage trucks for dispatch to offsite locations;
- continue to operate and maintain the existing ancillary surface infrastructure for ventilation, electricity, water, materials supply, and communications at the Angus Place pit top and on Newnes Plateau;
- install and operate seven additional dewatering borehole facilities on Newnes Plateau and associated power and pipeline infrastructure;
- upgrade and extend the existing access tracks from Sunnyside Ridge Road to the dewatering borehole facilities;
- install and operate dewatering reinjection boreholes and pipeline infrastructure at the existing ventilation facility site (APC-VS2);
- construct and operate a downcast ventilation shaft (APC-VS3) and upgrade the existing access track to the proposed facility from Sunnyside Ridge Road;
- manage mine inflows using a combination of direct water transfer to the Wallerawang Power Station, via the Springvale Delta Water Transfer Scheme (SDWTS), and discharge water through Angus Place Colliery's licensed discharge point LDP001 and Springvale Mine's LDP009;
- continue to undertake existing and initiate new environmental monitoring programs;
- continue to operate 24 hours per day, seven days per week, up to 52 weeks per year;
- continue to provide employment to a full time workforce of up to 300 direct employees and contractors;
- progressively rehabilitate disturbed areas at infrastructure sites no longer required for mining operations;
- undertake life-of-mine rehabilitation at the Angus Place pit top and the Newnes Plateau infrastructure disturbance areas to create final landforms commensurate with the surrounding areas and the relevant zonings of the respective areas; and
- transfer the operational management of coal processing and distribution infrastructure to the proposed Centennial Western Coal Services Project.

Mine Design and Minimisation of Impacts to Sensitive Surface Features

The mine design has been revised in order to minimise impacts to sensitive surface features. It is based on extensive and long term monitoring of subsidence and related consequences to groundwater, surface water, biodiversity, cliffs and pagodas. The design is supported by detailed geological and geotechnical monitoring and analysis over many years of mining. The mine plan has sought to avoid undermining the majority of sensitive surface features and where this was not feasible, specific proven designs have been proposed to minimise environmental consequences.

Project Benefits

The EIS outlines a range of positive benefits that will accompany the Project at a local, regional and state level. Notable benefits are:

- Sustainable mining of coal whilst keeping adverse environmental impacts to a minimum. The mine plan has been optimised for maximum resource recovery while concurrently minimising subsidence impacts on the natural and built environment.
- Improved understanding:

  - of the existing groundwater and surface water systems;
  - of the biodiversity within the Project Application Area and the surrounds; and
  - management of Aboriginal heritage issues within the Project Application Area.
- sustained employment at Angus Place Colliery which currently has 300 full time employees and contractors;
- the indirect benefit of the provision of coal for domestic use and export to provide for local and international energy requirements;
- injection of approximately $699 (net) million into the local, regional, state and national economies for the life of the Project. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities; and
- Centennial`s operations, and the broader mining industry, are critical to the economic sustainability of the Lithgow Local Government Area and the surrounding region.

Consultation

Angus Place Coal maintains an open two-way communication with the local community, consent authorities and other government agencies. A dedicated Stakeholder Engagement Plan was established for the Project. Numerous opportunities for input into the EIS development process were provided to all stakeholders identified in the Stakeholder Engagement Plan. Issues raised by the stakeholders have been addressed in the EIS. Consultation with the identified stakeholders will be ongoing and will be undertaken in accordance with the Stakeholder Engagement Plan. The Angus Place Colliery website will provide updates on the Project for all stakeholders while the internal stakeholders (Angus Place and other Centennial Coal employees) will also be given information on the Project via information sessions and meetings.

Key Environmental Issues and Assessment

Potential environmental issues associated with the Project were identified through a Broad-Brush Risk Assessment for the EIS, completed in March 2011, and was supplemented by a subsidence constraints risk assessment in November 2012 attended by a team of specialist consultants. Environmental aspects identified for assessments were prioritized. Subsidence impacts on groundwater, surface water, biodiversity and geodiversity were assessed to have significant potential impact.

The table below presents an overview of the key environmental outcomes of the technical assessments undertaken for the EIS.

Summary of Environmental Impacts

Environmental Issue	Overview of Key Findings
Cliffs	▪ Localised spalling is predicted to 1% of one cliff adjacent to LW1014B. No impacts are predicted for the other two cliffs (AP-CL1 and CL2) that occur within the angle of draw. All other cliffs have been avoided by mine plan modifications
Pagodas	▪ Localised spalling to 1% of the surface area of pagodas within the angle of draw is predicted.
Watercourses	▪ No significant fracturing, ponding or scouring is predicted for watercourses.
Conservation Areas	▪ The closest conservation reserve, Gardens of Stone National Park could experience very small vertical and horizontal movements but is not predicted to experience any measurable conventional tilts, curvatures or strains.
Swamps	▪ Longwall mining by the Project is unlikely to have a significant impact on swamps.

Groundwater	▪ The significant depressurisation of aquifers in strata overlying the coal seam has been shown to have minimal impact on the shallow and perched aquifer systems across Newnes Plateau;
	▪ groundwater monitoring data shows that mining induced groundwater level impacts in the deeper aquifer units are limited to areas close to or directly overlying the mined area;
	▪ Mine water inflow rates are predicted to increase as a consequence of the mine extension. This increased mine water make will continue to provide the critical base water supply for the power stations in the catchment.
	▪ Groundwater modelling (CSIRO, 2013) has shown that:
	  ▪ there is a separation in response to mining above and below the Mount York Claystone aquitard; and
	  ▪ there is a lack of propagation of mine-induced impacts through the Mount York Claystone aquitard.

Surface Water	▪ The predicted depressurisation of aquifers in strata overlying the coal seam will have minimal impact on the shrub and hanging swamps on Newnes Plateau and the surface drainage network of the water supply catchments; and ▪ Mine water discharges will increase as a result of the Project and this water will be piped into the Coxs River for reuse by local power stations. The consequence of increased discharge to the Coxs River is not significant since there is excess demand for this water resource in this catchment. Mine water discharges into the surface catchment have a neutral effect on water quality since the beneficial use of that water as potential drinking water is maintained.
Ecology	▪ No significant impacts are predicted to threatened species or EECs; and ▪ No significant impacts are predicted on aquatic habitats, flora, fauna or stygofauna.
Aboriginal Heritage	▪ No significant consequences are predicted to the three Aboriginal heritage sites that are sensitive to subsidence and are predicted to experience subsidence of 20 mm or more.
Traffic	▪ There will be no change to pit top traffic; and ▪ There will be no significant impact upon the capacity, efficiency and safety of the local, sub-regional and regional road network as a result of construction traffic to and from the surface infrastructure sites.
Socio-Economic	▪ The Project will enable operations to continue over a period of approximately twenty five years. This will secure ongoing employment opportunities and socio-economic flow on benefits over this time for the local community and up to 300 direct employees and contractors; and ▪ The net estimate of economic benefit is approximately $699 million.
Noise	▪ noise from construction of Newnes State Forest surface infrastructure will be within the Project specific noise criteria; ▪ noise from the operation of Newnes State forest infrastructure will meet Project specific noise criteria apart from a small area of Sunnyside Ridge Road to the east of the APC-VS2; and ▪ noise from operation of the pit top will be within the Project specific noise criteria.
Air Quality	▪ Dust levels from the Project are predicted to meet relevant air quality criteria for TSP, PM10, PM2.5 or dust deposition.

Environmental Issue	Overview of Key Findings
Greenhouse Gas Emissions	▪ There will be a negligible increase in the annual direct (Scope 1) emissions and the Project represents approximately 0.03% of NSW GHG emissions and 0.01% of Australia's total GHG emissions.
Soils and Land Capability / Agricultural Suitability	▪ Minimal impact to the soils, land and soil capability across the Project Application Area are predicted; and ▪ There is no biophysical strategic agricultural land within the Project Application Area.
Visual	▪ Minimal impacts on the visual character and amenity of the Project Application Area are predicted. Post-mining, the pit top area (excluding the water management structures), as well as components of infrastructure areas from the Newnes Plateau will be rehabilitated to woodland and so reduce existing visual impacts.
Waste Management	▪ No change to the annualised waste materials volumes will occur due to the Project.
Hazards Management	▪ No increased environmental or safety risk from hazardous materials, spontaneous combustion, bushfire or public safety will occur due to the Project.

Environmental Management System

Angus Place Colliery will continue to implement its well established Environmental Management System (EMS) developed in accordance with the Centennial Coal's EMS Framework. The EMS ensures the effective management of environmental issues and compliance with all regulatory requirements. The EMS incorporates a large number of Environmental Management Plans (EMPs) designed to assist in meeting community expectations and regulatory conditions, including the conditions of the Environment Protection Licence for Angus Place Colliery.

These EMPs will be reviewed and updated for the Project, as appropriate, and will take into consideration the environmental assessments undertaken as part of this EIS, the commitments made in the EIS and all relevant consent conditions.

Justification and Conclusion

Angus Place Colliery has a long history in the area, with well-established community relationships. Due to knowledge gained from historical operations, Angus Place Colliery has an excellent understanding of mine design principles and requirements for the protection of surface features, and management of potential environmental impacts. This is provided for by a range of management plans and a conservative, proven mine design that has been successfully implemented in adjacent mining areas with minimal adverse impacts.

The potential environmental impacts of the Project have been minimised through:

- Obtaining a detailed understanding of the key environmental issues. The multi-disciplinary assessment and consultation has been to a level of detail commensurate with the scale of the Project, industry standards and the legislative framework under which the Project is considered.
- A mine design with a successful and proven history of elimination or minimisation of surface subsidence impacts and one that is safe for the underground workforce and visitors to the surface.
- Expert subsidence predictions and impact assessment used to inform impact assessments.
- The development of a robust numerical groundwater model which commenced development in 2004 and which has been validated with extensive mine water inflow and groundwater level data, and that is capable of predicting mine inflows and potential groundwater impacts with a high level of certainty.
- Continued implementation of the existing proactive strategies and management plans employed at Angus Place Colliery to avoid, minimise, mitigate, offset or manage potential impacts.

Centennial Angus Place has shown a commitment to the principles of Ecologically Sustainable Development (ESD) and understands that social, economic and environmental objectives are interdependent. Centennial

Angus Place acknowledges that a well-designed, safe and effectively managed operation will avoid significant and/or costly environmental impact or degradation. The Project design and the suite of existing EMPs have been developed on a risk-basis to appropriately identify, mitigate and manage environmental risk. These demonstrate environmental due diligence and provide procedures for on-going management and monitoring of the operation in-line with the objectives of ESD.

The socio-economic output of the Project, particularly in terms of direct and indirect employment and flow-on benefits, is anticipated to make a positive contribution to the Lithgow Local Government Area and the surrounding region, and as a continuing operation, the Project will not significantly influence social and community infrastructure requirements.

Accordingly, it is considered that the Project will meet environmental performance and socio-economic benefit requirements in order for the Project to be considered for approval.

GLOSSARY OF TERMS

Term	Definition
20 mm subsidence	The 20 mm subsidence contour is an industry defined limit and represents the practical measurable limit of subsidence.
Air dispersion model	A computer-based software programme which provides a mathematical prediction of how pollutants from a source will be distributed in the surrounding area under specific conditions of wind, temperature, humidity and other environmental factors.
Ambient	Pertaining to the surrounding environment or prevailing conditions.
Angle of draw	The angle measured from the vertical, connecting the edge of the mining void to the surface expression of the lateral limit of subsidence (usually defined as less than 20 mm/m).
Aquifer	Underground water storage within either disturbed or undisturbed strata.
Aquitard / Aquiclude	Less permeable strata, not permeable enough to yield economic quantities of water.
Atmosphere	A gaseous mass surrounding the planet Earth that is retained by Earth's gravity. It is divided into five layers. Most of the weather and clouds are found in the first layer.
Atmospheric stability	The tendency of the atmosphere to resist or enhance vertical motion.
Atmospheric pressure	The force per unit area exerted against a surface by the weight of air above that surface in the Earth's atmosphere.
Background	The condition (e.g. noise levels) already present in an area before the commencement of a specific activity.
Baseflow	The discharge of sub-surface water into a stream (i.e. groundwater seepages).
Baseline monitoring	Monitoring conducted over time to collect a body of information to define specific characteristics of an area (e.g. species occurrence or noise levels prior to commencement of a specific activity.
Biological diversity	The diversity of different species of plants, animals and micro-organisms, including the genes they contain, in the ecosystem of which they are part.
Bord and pillar mining	Method of underground coal mining where the coal seam is divided into regular block array (pillars) by driving headings and cut-throughs. In some cases, the pillars are removed in a concurrent or later operation.
Bore dewatering facility	A facility with a number of boreholes drilled from the surface to the coal seam and fitted with submersible pumps that enable the underground water to be transferred to the surface.
Caving	A collapse of the overburden or strata overlying the coal seam and occurs when the coal is extracted resulted in a goaf.
Catchment	The entire land area from which water (rainfall runoff) drains to a specific watercourse or water body.
Chain pillar	A block of coal left un-mined between two longwall panels. The chain pillar holds up the roof between panels while regular cut throughs allows the passage of air, materials and staff.
Clean water	Water that has not come into physical contact with disturbed areas (sedimentation), coal or mined carbonaceous material.
Cliff line	Refers to sub-vertical rock slopes. They are also usually longer than their height.
Climatological	The science dealing with climate and climatic phenomena.
Closure	The subsidence-induced reduction in distance between two valley sides.

Coal Handling Plant (CHP)	A facility where coal is screened and prepared for transport off-site.
Coal Preparation Plant (CPP)	A facility where coal is beneficiated (washed) to improve coal quality and prepared for transport off-site.
Coal Handling and Preparation Plant (CHPP)	A facility comprising a Coal Preparation Plant for the beneficiation of coal, and a conveyor system for transport of product coal off-site.
Community Enhancement Fund	Established by Centennial Angus Place Pty Ltd under the existing Project Approval. It provides a structured approach to supporting community activities and involves guidelines for funding and a panel made up of local representatives to assess funding applications.
Combustion	The process of thermal oxidation (burning). A chemical change accompanied by the production of heat and conversion of chemical species.
Continuous miner	The electric powered cutting machine used to form underground roadways by removing coal from the working face.
Conventional movements	Those smooth subsidence movements that can be explained and predicted by expected caving mechanisms in areas of consistent geology and topography.
Conveyor	Fixed mechanical apparatus consisting of a continuous moving belt used to transport coal from one place to another.
Critical width	Removal of a small area of coal will form a small void, into which the roof will rarely fracture sufficiently to subside the surface. This is commonly evident in bord and pillar mines, but is also the case if longwall panels were sufficiently narrow. As these panels widen, they reach a critical width, which is when goafing is sufficient to cause maximum possible surface subsidence. A sub-critical width panel is one which did not allow maximum subsidence.
Cross-section	A two-dimensional diagram of an object presented as if the object had been cut along its length.
Curvature	The difference in slope of two sections of land surface divided by half the sum of their lengths, usually measured as the inverse of the radius of curvature in 1 over kilometres. Curvature can be convex (hogging) or concave (sagging). Hogging causes compression of surface materials while sagging causes tension. The larger the radius or curvature (or the smaller the inverse), the smaller the potential for damage to rigid natural or built structures.
Depth of cover	The vertical thickness of rock and soil above the mining area.
Dewatering	Transfer of water from underground workings to the surface by a pump.
Development	The extraction of coal to produce underground roadways enabling access to future longwall extraction areas. Mains development extraction is undertaken using continuous miner units, which cut coal and bolt the headings.
Dirty water	Water that has come into physical contact with coal, mined carbonaceous materials or otherwise contains an elevated sediment load.
Down dip	A direction that is downwards and parallel to the dip direction of the strata.
Dust deposition	Settling of particulate matter out of the air through gravitational effects (dry deposition) and scavenging by rain and snow (wet deposition).
Dispersion	The spreading and dilution of substances emitted in a medium (e.g. air or water) through turbulence and mixing effects.
Ecologically Sustainable Development (ESD)	Using, conserving and enhancing resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
Ecosystem	An interacting system of animals, plants, other organisms and non-living parts of the environment.

Electrical Conductivity	A measure of concentration of dissolved salts in water.
Emission	The discharge of a substance into the environment.
Emission factor	A measure of the amount of a specific pollutant or material emitted by a specific process, fuel, equipment, or source based on activity data such as the quantity of fuel burnt, hours of operation or quantity of raw material consumed.
Emission inventory	A database that lists, by source, the amount of air pollutants discharged into the atmosphere from a facility over a set period or raw material consumed.
Environmental Study Area	Part of the Project Application Area, Environmental Study Areas (ESAs) are the areas within which the proposed infrastructure would be located.
Evapotranspiration	The process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces.
Far-field movements	The measured horizontal movements due to mine-induced subsidence in areas above solid, un-mined coal.
Fossil fuel	A fuel such as coal, oil or gas, formed in the geological past from the remains of living populations.
Fugitive emissions	Pollutants which escape from an industrial process due to leakage, materials handling, transfer, or storage.
Goaf	The area of fractured rock within the mined out void. The process is referred to as goafing.
Greenhouse Gases	Gases with the potential to cause climate change (e.g. Methane, carbon dioxide and other as listed in the *National Greenhouse and Energy Reporting Act 2007*). Expressed in terms of carbon dioxide equivalent.
Groundwater	All waters occurring below the land surface derived from aquifers.
Hydrogeology	The area of geology that deals with the distribution and movement of groundwater in soils and rocks.
Infiltration	Natural flow of surface water through ground surfaces as a result of rainfall events.
Licensed Discharge Point	A location where water is discharged in accordance with conditions stipulated within the respective EPL issued under the NSW *Protection of the Environment Operations Act 1997.*
Longwall mining	A method of coal mining that employs large articulated hydraulic roof supports that provide a safe working environment while allowing a powered shearer to mechanically cut coal.
Longwall panel	A large block of coal marked out for extraction by longwall mining.
Long term stable	A standard of geotechnical and engineering design which results in negligible subsidence and long term stability.
Meteorological	The science that deals with the phenomena of the atmosphere, especially weather and weather conditions.
Non-conventional movements	Are irregular subsidence movements often associated with shallow depth of cover, abrupt changes in geology, steep topography or in valleys.
Permian Age	The youngest geological period of the Palaeozoic era, covering a span between approximately 290-250 million years.
Pillar failure	In most cases, the chain pillars will partially crush and deform but remain substantially intact and so support the strata above. In some cases, usually due to poor mine design, the chain pillars may totally fail, and in even rarer cases, adjacent chain pillars may sequentially fail.
Pollutant	A substance or energy introduced into the environment that has undesired effects, or adversely affects the usefulness of a resource.
Project Application Area	The area in which development consent is being sought, as bounded by the red line in **Figure 1.3**.

Project	Extension of underground coal mining and associated activities within the Project Application Area.
Qualitative assessment	An assessment of impacts based on a subjective, non-statistical oriented analysis.
Quantitative assessment	An assessment of impacts based on estimates of emissions rates and air dispersion modelling techniques to provide estimate values of ground level pollutant concentrations.
Rehabilitation	The restoration of a landscape and especially the vegetation following its disturbance.
Rock formations	Individual rock features > 5 m and < 20 m high which are not cliff lines. They include sandstone pagodas or micro-buttes and these are usually higher than their width.
Run of Mine coal (ROM)	Raw or unprocessed coal production.
Sedimentation Pond	An open pond designed to treat surface runoff water which contains solids attributable to sedimentation. The water is held within the pond and most of the solids drop out of suspension.
Sensitive Receptor	A sensitive receptor is defined by DECCW as location where a person (may or does) work or reside, including residential, hospitals, hotels, shopping centres, play grounds, recreational centres or similar.
Springvale Coal Services Site	An infrastructure site, currently part of Springvale Mine but to be administered in the future by the proposed Centennial Coal's Western Coal Services Project, for the processing and stockpiling of ROM coal, and despatch of processed coal to the Lidsdale Siding Rail Loading Facility for export to overseas markets.
Strain	The changing tension or compression in rocks and soil. Strain is measured by the change in the horizontal distance between two points divided by the original horizontal distance between the points. If this distance increases, it shows tensile strain. If the distance decreases, it shows compressive strain. Strain can be estimated by multiplying predicted curvature by 10.
Subsidence	The difference between the pre-mining surface level and the post-mining surface level at a point.
Surface Water	Water that is derived from precipitation or pumped from underground and may be stored in dams, rivers, creeks and drainage lines.
Tilt	The change in ground slope measured by the difference in height of two points divided by their distance apart, usually measured in mm/m. Positive tilt is defined as being tilt towards the direction of measurement.
Threatened species	Includes all species with legislative protection under state and federal Acts, including threatened, vulnerable, endangered and critically endangered species under the *Fisheries Management Act 1994, Threatened Species Conservation Act 1995* and *Environment Protection Biodiversity Conservation Act 1999*.
Underground roadways	Headings, roadways and cut-throughs mined using continuous miners (development activities) which are designed to be long term stable from a subsidence perspective. The surface subsidence from forming underground roadways is typically undetectable.
Up dip	A direction that is upwards and parallel to the dip direction of the strata.
Ventilation shaft	A cylindrical vertical passageway from the mine workings to the surface which conveys fresh airflow into the mine or expels used air from the mine.
Western Coal Services Project	The Project that will manage the handling and transport logistics of ROM coal from Springvale pit top (and Angus Place Colliery) to Wallerawang and Mount Piper Power Stations.
Wind direction	The direction from which the wind is blowing.

Wind erosion	Detachment and transportation of loose topsoil or sand due to action by the wind.
Wind rose	A meteorological diagram depicting the distribution of wind direction and speed at a location over a period of time.

ACRONYMS, UNITS AND ABBREVIATIONS

Acronyms	Definition
%	percent
%ile	Percentile
oC	Degrees Celsius
AADT	Annual average daily traffic
ABS	Australian Bureau of Statistics
AEMR	Annual Environmental Management Report
AGL	Above ground level
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australian and New Zealand Environment Conservation Council
AWS	Automatic weather station
BOD	Biochemical Oxygen Demand
BOM	Bureau of Meteorology
CCL	Consolidated Coal Lease
CEMP	Construction Environmental Management Plan
CH4	Methane
CHP	Coal Handling Plant
CL	Coal Lease
cm	centimetre
CMA	Catchment Management Authority
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dB	decibels
dB(A)	Decibels, A weighted (a filter has been applied to the measured result to mimic the human response to noise)
DoE	Federal Department of the Environment (formerly SEWPAC)
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DECCW	(Former) Department of Environment, Climate Change and Water (NSW) (now known as Office of Environment and Heritage (OEH))
DEUS	Department of Energy Utilities and Sustainability (USA)
DGRs	Director General's Requirements

Acronyms	Definition
DoP	(Former) Department of Planning
DP&I	Department of Planning and Infrastructure (NSW)
DRE	Division of Resources and Energy (within DTIRIS)
DTIRIS	Department of Trade & Investment, Regional Infrastructure and Services (NSW)
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EL	Exploration Licence
EMS	Environmental Management System
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPA	Environment Protection Authority
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
FM Act	*Fisheries Management Act 1994* (NSW)
FMA Act	*Fisheries Management Amendment Act 1997 (*NSW)
g	gram
g/m^2/month	grams per square metre per month
GDE	Groundwater Dependent Ecosystem
GIS	Geographic Information System
GJ	Gigajoule
GHG	Green House Gas
GPS	Geographic Positioning System
GSSE	GSS Environmental
ha	Hectare
hr	hour
INP	Industrial Noise Policy
Infrastructure SEPP	State Environmental Planning Policy (Infrastructure) 2007
IPCC	International Panel on Climate Change
kg	kilogram
kL	kilolitre
km	kilometres
km^2	Square kilometres
LCC	Lithgow City Council

Acronyms	Definition
LDP	Licensed Discharge Point
LEP	Local Environmental Plan
LGA	Local Government Area
m	metre
M	million
m/s	Metres per second
m^2	Square metre
m^3	Cubic metre
min	Minute
mg/L	Milligrams per litre
ML	Megalitre
MLA	Mining Lease Application
MNES	Matter of National Environmental Significance
mm	millimetre
mm/m	millimetres per metre
MOP	Mining Operations Plan
Mt	Million tonne
Mtpa	Million tonnes per annum
NES	National Environmental Significance
NEPM	National Environment Protection Measure
NPI	National Pollutant Inventory (Australia)
NGA	National Greenhouse Account
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NoW	NSW Office of Water
NPW Act	*National Parks and Wildlife Act 1974*
NO_2	Nitrogen Dioxide
N_2O	Nitrous Oxide
NPI	National Pollution Inventory
NPV	Net Present Value
NP&W Act	*National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
Pa	Pascal – a unit of pressure
PM_{10}	Particulate matter less than 10 microns
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 10 microns or less

Acronyms	Definition
POEO Act	*Protection of the Environment Operations Act 1997*
PRP	Pollution Reduction Programme
RBL	Rated Background Level
RMS	NSW Roads and Maritime Service (former RTA)
ROM	Run of Mine (unprocessed coal output)
RPS	RPS Australia East Pty Ltd
RTA	NSW Roads and Traffic Authority (now RMS)
SAL	Strategic Agricultural Land
SDWC	Sydney Drinking Water Catchment
SDWTS	Springvale – Delta Water Transfer Scheme
SEPP	State Environmental Planning Policy
SEWPAC (now DoE)	The former Department of Sustainability, Environment, Water, Population and Communities (Commonwealth) now Department of the Environment
SF_6	Sulphur hexafluoride
SLR	SLR Consulting Australia Pty Ltd.
SMEP	Springvale Mine Extension Project
SMP	Subsidence Management Plan
SoC	Statement of Commitments
sp.	species
subsp.	sub-species
SPL	Sound Power Level
SWMP	Site Water Management Plan
t	Tonne
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
TEOM	Tapered element oscillating microbalance
THPSS	Temperate highland peat swamps on sandstone
TSC Act	*Threatened Species Conservation Act 1995*
TSP	Total Suspended Particulates
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
WM Act	*Water Management Act 2000*
µg	Micrograms
$\mu g/m^3$	Micrograms per cubic metre
µm	Micrometre or micron

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CHAPTER 1.0
Introduction

1.0 INTRODUCTION

This chapter provides an introduction to Angus Place Colliery, an overview of the Angus Place Mine Extension Project (the Project) and the approval process for the Project. The purpose and content of the Environmental Impact Statement (EIS) prepared in support of the development application for the Project is also presented.

1.1 Background

Angus Place Colliery is an existing underground coal mine producing thermal coal that is supplied to domestic markets. It is located 15 kilometres to the northwest of the regional city of Lithgow and 120 kilometres west northwest of Sydney in New South Wales (NSW) (**Figure 1.1**). Angus Place Colliery commenced production in 1979, after being developed as an extension of the Newcom Mine at Kerosene Vale. This initially was a bord and pillar operation, but converted to longwall mining due to the depth of cover and geotechnical environment.

Angus Place Colliery's existing approval (PA06_0021) was granted on 13 September 2006 pursuant to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act), and provided for extension of the mining area with a production limit of 3.5 million tonnes per annum of coal from the Lithgow seam.

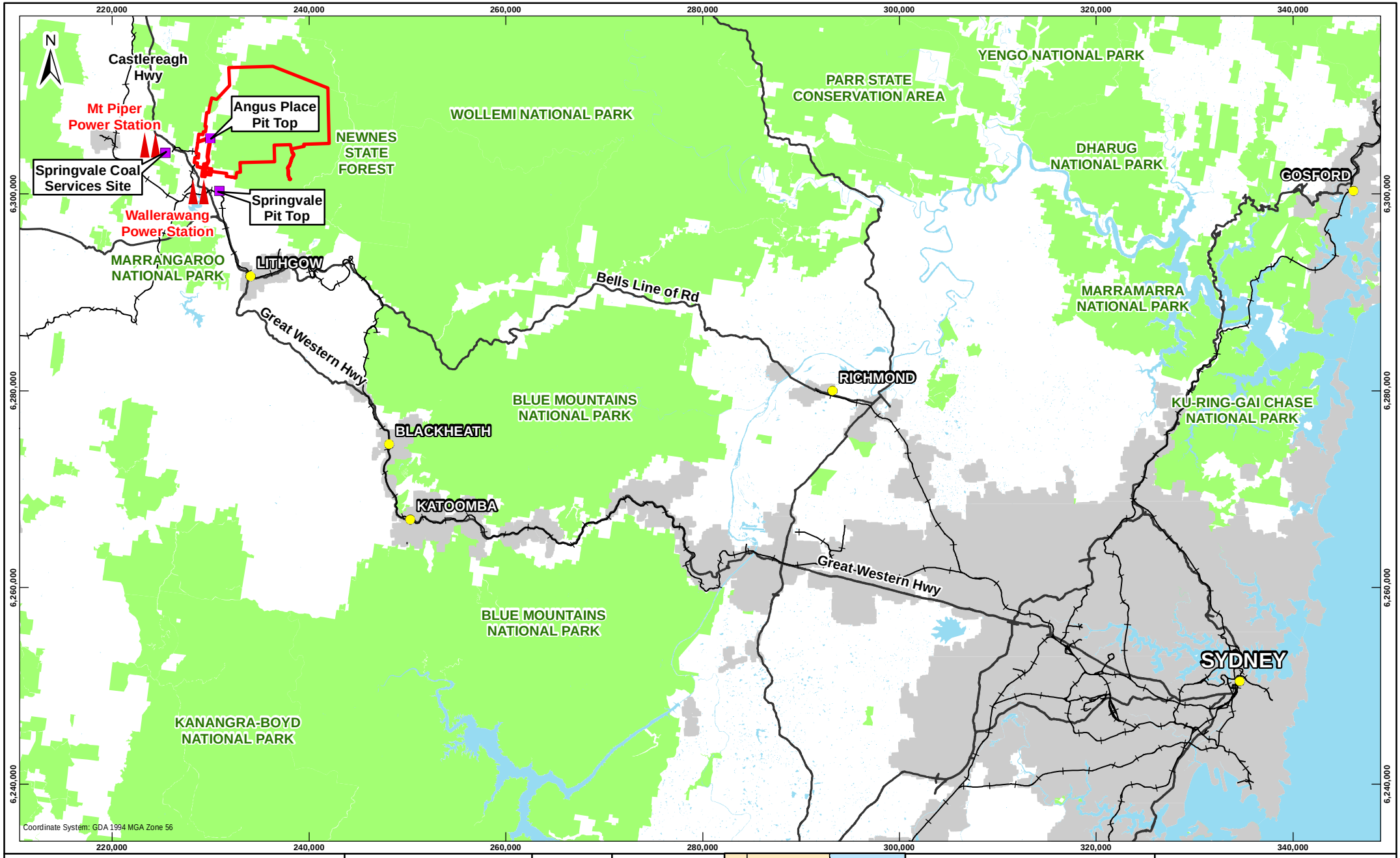
Modifications to PA06_0021 were approved for Angus Place Colliery in 2011 and 2013 and are associated with ongoing operations of the mine, the extraction of additional longwall panels, a production limit increase to 4 million tonnes per annum and the construction and operation of a ventilation facility. A third modification was approved in December 2013 to extend the length of Longwall 980 and 900W by 43.4 metres and 104.8 metres respectively and to increase the extraction height from 3.25 metres to 3.425 metres.

Scheduled longwall mining in approved mining areas will end in April 2016. The Project seeks to provide for the continuation of longwall mining to the east of the current workings for a further 25 years with additional rehabilitation undertaken after this period and within the existing mining lease boundary (**Figure 1.2**).

Angus Place Colliery has existing contracts with the two local power stations: Wallerawang and Mount Piper. All coal is distributed to these sites via dedicated private haul roads connecting the Angus Place pit top with both power stations.

The main components of Angus Place Colliery`s existing operations are an underground longwall mine, accessed via the Angus Place pit top, and supporting surface infrastructure within the pit top area and on Newnes Plateau within the Newnes State Forest (**Figure 1.3**). Newnes Plateau infrastructure sites are accessed for light vehicles via State Mine Gully Road and Sunnyside Ridge Road, and Old Bells Line of Road though Clarence for light and heavy vehicles.

Angus Place Colliery currently employs a full time workforce of 300 direct employees and contractors. An upgrade to the Springvale Coal Services site is currently being assessed by the Department of Planning and Infrastructure (DP&I) (State Significant Development 12_5579). All operational management of coal processing and transport will be undertaken by the Western Coal Services Project.



LEGEND

- Project Application Area
- Town
- Rail
- Main Road
- Urban Area
- Waterbody
- State Forest / Reserve / Park

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F015 APC Rev 0
SCALE	1:500,000

Figure 1.1: Regional Location Map

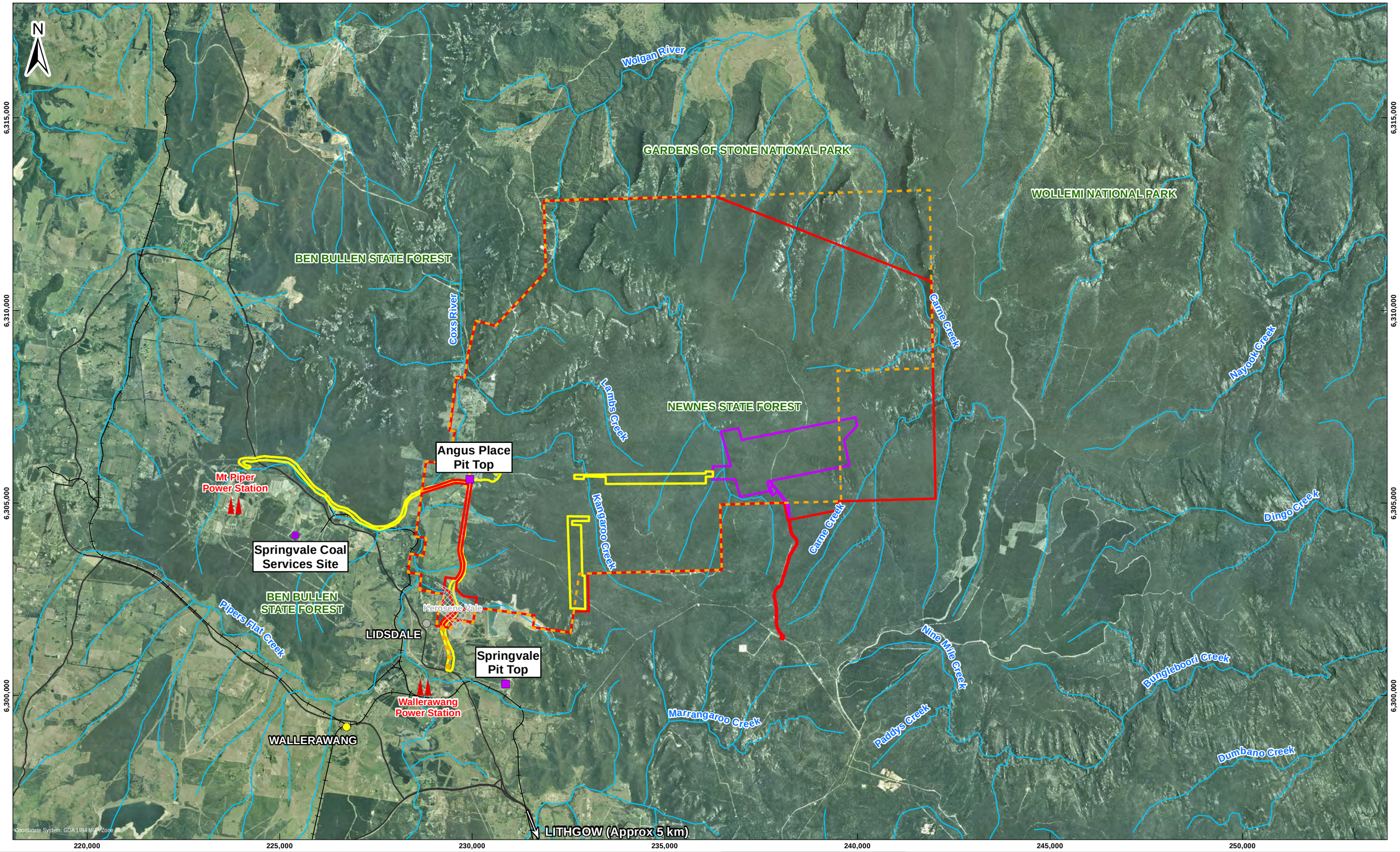
0 5 10 15 20 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 15

A4



LEGEND

- Project Application Area
- Mod 1 Consent Area
- Mod 2 Consent Area
- 2006 Development Consent Area
- Former Mine Workings
- Village
- Town
- Rail
- Main Road
- Watercourse

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F025 APC Rev 0
SCALE	1:90,000

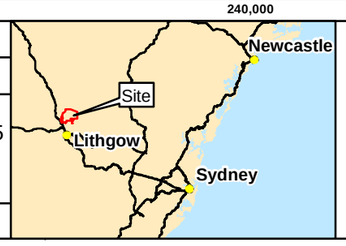


Figure 1.2: Angus Place Colliery Development Approvals

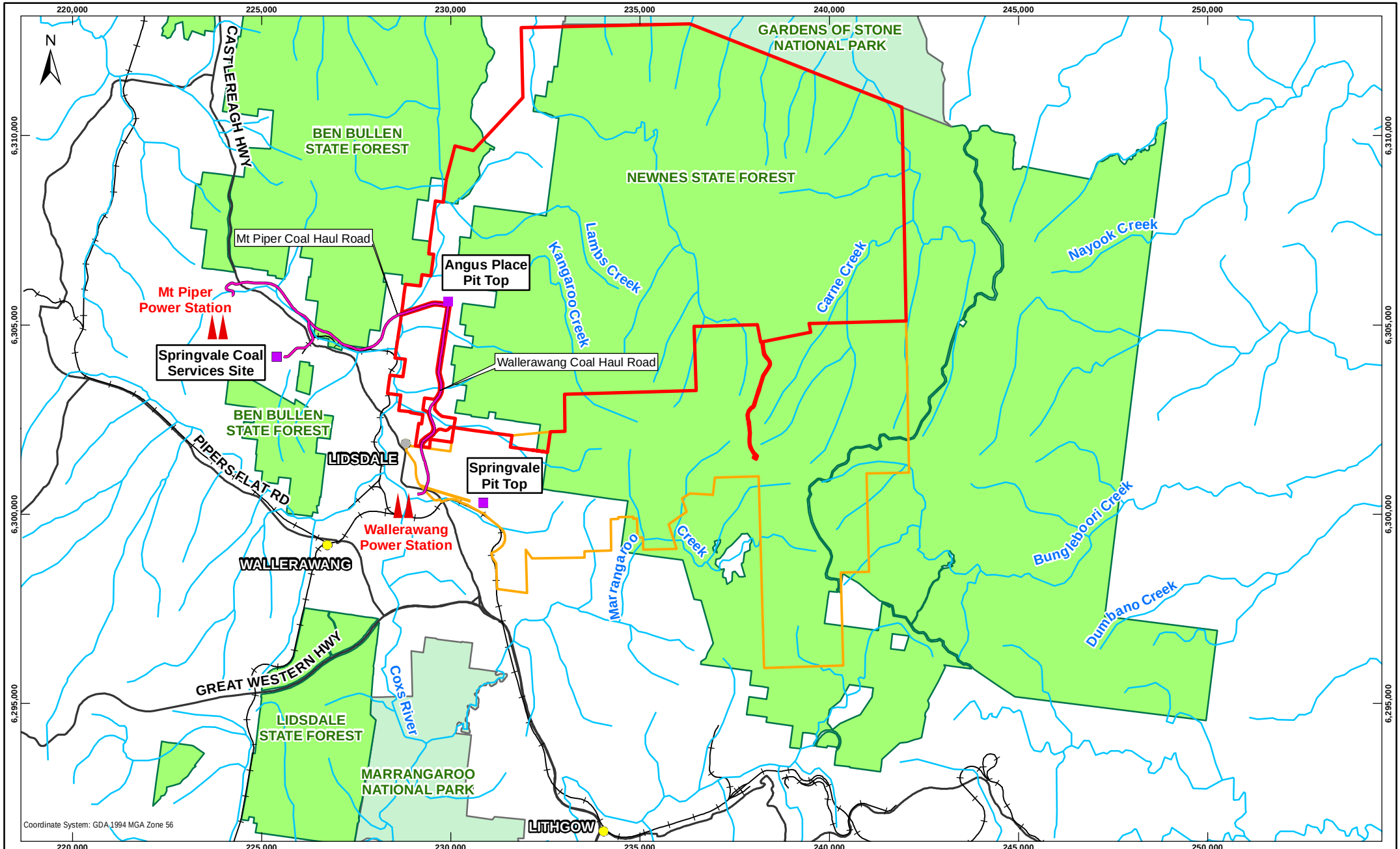
0 1 2 3 4 5 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 25

A3



LEGEND

- Project Application Area
- Village
- Town
- Springvale Mine Extension Project Application Area
- Rail
- Main Road
- State Forest
- National Park
- Watercourse

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F011 APC Rev 0
SCALE	1:130,000

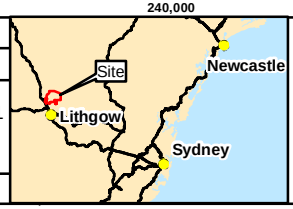


Figure 1.3: Project Application Area

0 1 2 3 4 5 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 11

A4

1.2 The Applicant

Angus Place Colliery is owned by Centennial Springvale Pty Limited (as to 50%) and Springvale SK Kores Pty Limited (as to 50%) as participants in the Springvale unincorporated joint venture. The Angus Place Colliery is operated by Centennial Angus Place Pty Limited (Centennial Angus Place), for and on behalf of the Springvale joint venture participants.

Centennial Angus Place is the applicant for the Project. The relevant postal address is:

Centennial Angus Place Pty Ltd
Level 18,
BT Tower,
1 Market St
Sydney NSW 2000

1.3 Document Purpose

This EIS has been prepared by Golder Associates Pty Ltd on behalf of Centennial Angus Place to support an application to permit the continuation and extension of underground longwall mining and associated surface operations at Angus Place Colliery beyond April 2016.

The EIS has been prepared in accordance with clauses 6 and 7, Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and the Director General's Requirements (DGRs), issued by the Department of Planning and Infrastructure on 6 November 2012, and Supplementary DGRs issued on 30 August 2013 in relation to referral EPBC 2013/6889, as detailed in **Section 1.6**.

The EIS has been prepared using a risk-based assessment approach to identify and evaluate environmental, social and economic aspects relevant to the Project. This has been achieved through a process of ongoing consultation with stakeholders from government agencies, industry, and the surrounding community, risk assessments to appropriately identify and scope risk, robust specialist technical assessments and mitigation and management measures as appropriate for the Project.

1.4 Document Structure

The EIS is provided in two volumes. Volume 1 is the main EIS document. It sets out the Project in the context of the existing and approved environment, planning consideration, key environmental issues, potential impacts, mitigation measures and residual impacts. It is informed by the technical assessments contained in Volume 2, and provides a concise, integrated summary of these specialist assessments.

The structure and content of the EIS is summarised in **Table 1.1**.

Table 1.1 Structure and Content of the Environmental Impact Statement

Volume 1 Main EIS	
Chapter	**Description**
Preliminaries	▪ Statement of Validity ▪ Executive Summary ▪ Glossary of terms ▪ Acronyms
Chapter 1: Introduction	▪ Discusses the background to the Project. ▪ Introduces the Project and the Applicant. ▪ Provides the document structure. ▪ Overview of the approval process and the relevant milestones.

Volume 1 Main EIS

Chapter	Description
Chapter 2: Site Description	▪ Describes the Project Application Area and existing mining areas and the general surrounds. ▪ Identifies the main natural features and climatic conditions of the surrounding landscape and an overview of land ownership and land use in the vicinity of the Project Application Area. ▪ Includes monitoring data and other relevant information, sourced from Springvale Mine and Angus Place Colliery, as relevant to the Project and history of operations at the sites.
Chapter 3: Existing Operations	▪ Details the existing mine operations. ▪ Identifies the relevant licences and approvals and mining processes utilised at Angus Place Colliery. ▪ Consists of the history and extent of operations, mining undertaken to date, water management and the supporting surface infrastructure. ▪ Incorporates broader considerations of the Project in its local context including the environmental management procedures currently employed by Centennial Angus Place.
Chapter 4: Project Description	▪ Describes the Project and aspects of the existing mining operations at Angus Place Colliery that will continue as a result of the Project. ▪ Provides an overview of considerations for mine closure, the life-of-mine rehabilitation, the nominated end land use and the final landforms.
Chapter 5: Planning Considerations	▪ Discusses local, State and Commonwealth planning considerations relevant to the permissibility of the Project.
Chapter 6- Socio-Economic Analysis	▪ Discusses the methodology used for the social and economic assessments. ▪ Provides and analyses the findings of the social and economic costs and benefits of the Project.
Chapter 7: Stakeholder Engagement	▪ Discusses the engagement strategies of the existing operation and the Project. ▪ Details the outcomes of consultation undertaken and how it has been addressed in the EIS.
Chapter 8: Mine Design and Mine Subsidence	▪ Discusses the development of the mine plan. ▪ Describes the design philosophy and mine constraints that have influenced the existing mine layout and the Project mine design principles. ▪ Discusses subsidence predictions and controls, which have been fundamental in determining the mine design.
Chapter 9: Identification of Key Environmental Issues	▪ Discusses the process undertaken to identify the key environmental impacts, the risk rating for each environmental aspect resulting from a broad-brush risk assessment undertaken for the Project, together with a subsidence constraints risk assessment. ▪ Discusses the process of assessing and appropriately managing potential environmental risks.
Chapter 10: Assessment and Management of Key Environmental Issues	▪ Discusses the assessment of key environmental issues through identification of the existing environment particular to the specific environmental aspect, the potential impact of the Project upon the environmental aspect, and the consequence of the relevant impact upon the environmental aspect. ▪ Describes the management measures proposed to mitigate and reduce environmental risk of the Project and/or offset any unavoidable impacts.
Chapter 11- Statement of Commitments	▪ Provides a Statement of Commitments regarding the Project's construction, operation, maintenance, closure and rehabilitation of Angus Place Colliery.
Chapter 12- Justification and Conclusion	▪ Discusses the conclusions for the EIS and justification of the Project with regard to environmental, social and economic considerations. ▪ Provides an overall balance of impacts and benefits ▪ Sets out the alternatives considered for the Project. ▪ Summarises how the objectives of Ecological Sustainable Development have been achieved for the Project.

Volume 1 Main EIS	
Chapter	**Description**
References	▪ Contains source references used throughout this EIS.
Volume 2 Appendices	
Appendix A	Director General's Requirements and Supplementary Director General's Requirements
Appendix B	State Significant Development Application Form and Political Donations Disclosure Statement
Appendix C	Schedule of Lands of the Project Application Area
Appendix D	Subsidence Impact Assessment
Appendix E	Groundwater Impact Assessment
Appendix F	Surface water Impact Assessment
Appendix G	Aquatic Ecology and Stygofauna Impact Assessment
Appendix H	Flora and Fauna Impact Assessment
Appendix I	Regional Biodiversity Strategy
Appendix J	Traffic Impact Assessment
Appendix K	Cultural Heritage Impact Assessment
Appendix L	Noise Impact Assessment
Appendix M	Air Quality and Greenhouse Gas Impact Assessment
Appendix N	Social Impact Assessment
Appendix O	Economic Impact Assessment
Appendix P	Decommissioning and Rehabilitation Strategy
Appendix Q	Visual Impact Assessment
Appendix R	Soils and Land Capability Assessment
Appendix S	Agricultural Impact Statement

1.5 Overview of the Project

The components of Angus Place Colliery's existing operations are an underground longwall mine, accessed via the Angus Place pit top, and supporting surface infrastructure within the pit top area and on Newnes Plateau within the Newnes State Forest.

Centennial Angus Place proposes to extend its mining operations, using longwall mining techniques to the east of its existing workings at Angus Place Colliery.

The Project will:

- in general, include all currently approved operations, facilities and infrastructure of the Angus Place Colliery, except as otherwise indicated in this EIS;
- continue to extract up to 4 million tonnes per annum of run of mine (ROM) coal from the Lithgow Seam underlying the Project Application Area;
- extend the life of the mine for an additional 25 years with rehabilitation to be undertaken after this period.
- develop underground access headings and roadways from the current mining area to the east to allow access to the proposed mining area;
- undertake secondary extraction by retreat longwall mining for the proposed longwall panels LW1001 to LW1019;

- continue to use the existing ancillary surface facilities at the Angus Place pit top;
- continue to manage the handling of ROM coal through a crushing and screening plant at the Angus Place pit top and the subsequent loading of the coal onto the existing road haulage trucks for dispatch to offsite locations (refer to **Section 4.1**);
- continue to operate and maintain the existing ancillary surface infrastructure for ventilation, electricity, water, materials supply, and communications at the Angus Place pit top and on Newnes Plateau;
- install and operate seven additional dewatering borehole facilities on Newnes Plateau and the associated power and pipeline infrastructure;
- upgrade and extend the existing access tracks from Sunnyside Ridge Road to the dewatering borehole facilities;
- install and operate dewatering reinjection boreholes and pipeline infrastructure at the existing ventilation facility site (APC-VS2);
- construct and operate a downcast ventilation shaft (APC-VS3) and upgrade the existing access track to the proposed facility from Sunnyside Ridge Road;
- continue to use the existing Springvale Delta Water Transfer Scheme (SDWTS);
- manage predicted increase in mine inflows using a combination of direct water transfer to the Wallerawang Power Station, via the SDWTS, and discharge water through Angus Place Colliery's licensed discharge point LDP001 and Springvale Mine's LDP009;
- continue to undertake existing and initiate new environmental monitoring programmes;
- continue to operate 24 hours per day, seven days per week, 52 weeks a year;
- continue to provide employment to a full time workforce of up to 300 direct employees and contractors;
- progressively rehabilitate disturbed areas at infrastructure sites no longer required for mining operations;
- undertake life-of-mine rehabilitation at the Angus Place pit top and the Newnes Plateau infrastructure disturbance areas to create final landforms commensurate with the surrounding areas and the relevant zonings of the respective areas; and
- transfer the operational management and physical infrastructure regarding coal processing and distribution infrastructure to the Centennial Western Coal Services Project (when approved).
- continue exploration activities, predominately borehole drilling, to further refine the existing geological model.

1.6 Director General's Requirements

The Director General`s Requirements (DGRs) for the Project were issued by the Director General of the DP&I on 6 November 2012. Further to the submission of an *Environment Protection and Biodiversity Act 1999* (EPBC Act) referral (EPBC 2013/6889) to the Minister of the Environment on 20 May 2013, the Project was declared a controlled action under the EPBC Act on 7 July 2013 To ensure that sufficient information be provided to enable an appropriate level of assessment of relevant matters of National Environmental Significance in accordance with the EPBC Act, the Director General issued supplementary requirements for the EIS under section 78A(8A) of the EP&A Act on the 30 August 2013.

The Federal Minister's delegate determined that the Project will be assessed by the accredited assessment under the EP&A Act on 7 July 2013.

This EIS has been prepared in accordance with the DGRs for the Project and the supplementary DGRs (DP&I reference State Significant Development_5602). **Table 1.2** lists the DGRs and references the relevant chapter and/or section of the EIS where they have been assessed by using the State process.

The supplementary DGRs for the Project are provided in **Table 1.3** and in full in **Appendix A**.

Table 1.2: Director General's Requirements for the Project

Director General's Requirements	EIS Chapter and Appendix Reference
General Requirements The Environmental Impact Statement (EIS) for the development must meet the form and content requirements in Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. In addition, the EIS must include:	
■ a detailed description of the development, including: a) need for the proposed development; b) likely staging of the development - including construction, operational stage/s and rehabilitation; c) likely interactions between the development and any approved and proposed mining operations, including detailed assessments of any required modifications to the approvals for these operations; d) likely interactions with other approved developments/projects at the site; and e) plans of any proposed building works.	a) Section 12.1 b) Chapter 4.0 c) Section 1.8 and Section 4.1 d) Section 1.8 e) Chapter 4.0
■ consideration of all relevant environmental planning instruments, including identification and justification of any inconsistencies with these instruments.	Chapter 5.0
■ a risk assessment of the potential environmental impacts of the development, identifying the issues for further assessment.	Chapter 9.0
■ a detailed assessment of the key issues specified below, and any other significant issues identified in this risk assessment, which includes: a) a description of the existing environment, using sufficient baseline data; b) an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes; and c) a description of the measures that would be implemented to avoid, minimise and, if necessary, offset the potential impacts of the development, including proposals for adaptive management and/or contingency plans to manage any significant risks to the environment.	a) Chapter 2.0 b) Chapter 10.0 c) Chapter 10.0
■ consolidated summary of all the proposed environmental management and monitoring measures, highlighting commitments included in the EIS.	Chapter 10.0
■ The EIS must be accompanied by a report from a qualified quantity surveyor providing: a) a detailed calculation of the capital investment value (as defined in clause 3 of the Environmental Planning and Assessment Regulation 2000) of the proposal, including details of all the assumptions and components from which the CIV calculation is derived; b) a close estimate of the jobs that will be created by the development during the construction and operational phases of the development; and c) certification that the information provided is accurate at the date of preparation.	a) Chapter 6.0 b) Chapter 6.0 c) Chapter 6.0

Director General's Requirements	EIS Chapter and Appendix Reference
■ **Subsidence** – including a detailed quantitative and qualitative assessment of the potential conventional and non-conventional subsidence impacts of the development that includes: a) The identification of the natural and built features that may be affected by subsidence, and an assessment of the respective values of these features; b) Predications of the subsidence effects and impacts of the development, including a robust sensitivity analysis of these predictions; c) Assessment of the potential subsidence impacts of these effects and impacts on both the natural and built environment, particularly features that are considered to have significant economic, social, cultural or environmental values; and d) Description of the measures that would be implemented to avoid, minimise, remediate and/or offset subsidence impacts and the environmental consequences (including adaptive management and proposed performance measures).	a) Chapter 2.0 b) Chapter 8.0 c) Chapter 8.0, Chapter 10.0 and Appendix D d) Chapter 10.0
■ **Land Resources** – including a detailed assessment of impacts to: a) soils and land capability (including erosion and land contamination); b) landforms and topography, including cliffs, rock formations, steep slopes; and c) land use, including agricultural, forestry, conservation and recreational use.	a) Chapter 2.0 b) Section 2.3 c) Section 2.5.1

Director General's Requirements	EIS Chapter and Appendix Reference
■ **Water Resources** – including: a) detailed assessment of potential impacts on the quality and quantity of existing surface water and ground water resources in accordance with the NSW Aquifer Interference Policy, including; - impacts on affected licensed water users and basic landholder rights; - impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including groundwater dependent ecosystems and environmental flows; and - whether the development can operate to achieve a neutral or beneficial effect on water quality in the drinking water catchment, consistent with the provisions of State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011; b) a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply and transfer infrastructure and water storage structures; and c) identification of any licensing requirements, including existing or future Environment Protection Licences (EPLs) or Pollution Reduction Programs (PRPs), and approvals under the *Water Act 1912* and/or *Water Management Act 2000*; d) demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP); e) a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo; f) a detailed description of the proposed water management system (including sewage), water monitoring regime, beneficial water re-use programme and all other proposed measures to mitigate surface water and groundwater impacts.	a) Section 10.2.3, Appendix E and Section 10.3 b) Appendix F and Section 3.11.3 c) Section 10.2.2.3 d) Section 10.2.2.3 e) Section 5.6.4 f) Section 10.2.5 and Section 3.11.5
■ **Biodiversity** – including: a) accurate estimates of direct vegetation impacts, such as clearing and subsidence and indirect impacts such as 'edge effects'; b) a detailed assessment of potential impacts of the development on: - Temperate Highland Peat Swamps; - other terrestrial or aquatic threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems; and - regionally significant remnant vegetation, or vegetation corridors; and c) measures that would be taken to avoid, reduce or mitigate impacts on biodiversity, particularly Temperate Highland Peat Swamps; and d) an offset strategy, which is clearly quantified, to ensure that the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term.	a) to d) Chapter 2.0 and Section 10.3

Director General's Requirements	EIS Chapter and Appendix Reference
■ **Heritage** – including: a) an Aboriginal cultural heritage assessment (including both cultural and archaeological significance) which must: – demonstrate effective consultation with the Aboriginal community in determining and assessing impacts, and developing and selecting mitigation options and measures; and – outline any proposed impact mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures); and b) a Historic heritage assessment (including archaeology) which must: – include a statement of heritage impact (including significance assessment) for any State significant or locally significant historic heritage items; and – outline any proposed mitigation and management measures (including an evaluation of the effectiveness and reliability of the measures).	a) to b) Chapter 2.0 and Section 10.4
■ **Air Quality** – including a quantitative assessment of potential: a) construction and operational impacts, with a particular focus on dust emissions including $PM_{2.5}$ and PM_{10} emissions and dust generation from coal transport; b) reasonable and feasible mitigation measures to minimise dust emissions, including evidence that there are no such other available measures; and c) monitoring and best practice management measures, in particular real-time air quality monitoring.	a) to c) Section 2.9 and Section 10.7
■ **Greenhouse Gases** – including: a) a quantitative assessment of potential Scope 1, 2 and 3 greenhouse gas emissions; b) a qualitative assessment of the potential impacts of these emissions on the environment; and c) an assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency.	a) to c) Section 10.8
■ **Noise** – including a quantitative assessment of potential: a) construction, operational and off-site transport noise impacts; b) reasonable and feasible mitigation measures, including evidence that there are no such other available measures; and c) monitoring and management measures, in particular real-time and attended noise monitoring.	a) to c) Section 10.6
■ **Traffic & Transport** – including: a) an assessment of potential traffic impacts on the capacity, efficiency and safety of the road network; and b) a description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network in the surrounding area over the life of the development.	a) to b) Section 10.5
■ **Visual** – including: c) a detailed assessment of the potential visual impacts of the development on private landowners in the surrounding area as well as from key vantage points in the public domain, in particular those available to recreational users from State forests, State conservation areas and national parks; and; d) a detailed description of the measures that would be implemented to minimise the visual impacts of the development.	a) to b) Section 10.12

Director General's Requirements	EIS Chapter and Appendix Reference
■ **Waste** – including: a) accurate estimates of the quantity and nature of the potential waste streams of the development; and b) a description of measures that would be implemented to minimise production of other waste, and ensure that that waste is appropriately managed.	a) to b) Section 10.13
■ **Hazards** – Paying particular attention to public safety, including bushfires	Section 10.14
■ **Social & Economic** – including an assessment of the: a) potential direct and indirect economic benefits of the development for local and regional communities and the State; b) potential impacts on local and regional communities, including: – any increased demand for local and regional infrastructure and services (such as housing, childcare, health, education and emergency services); and – impacts on social amenity, particularly impacts on local residents of and other nearby landowners and residents; c) a detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the development, including any infrastructure improvements or contributions and/or voluntary planning agreement or similar mechanism; and d) a detailed assessment of the costs and benefits of the development as a whole, and whether it would result in a net benefit for the NSW community.	a) to d) Chapter 6.0
■ **Rehabilitation** – including the proposed rehabilitation strategy for the site, having regard to the key principles in Strategic Framework for Mine Closure, including: a) rehabilitation objectives, methodology, monitoring programmes, performance standards and proposed completion criteria; b) nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; c) a conceptual final landform design, including a detailed figure depicting relevant site features; and d) the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.	a) to d) Section 3.13, Section 4.14 and Section 10.11
Director General's Requirements	**EIS Chapter and Appendix Reference**
Plans and Documents	
■ Relevant plans, architectural drawings, diagrams and relevant documentation required under Schedule 1 of the EP&A Regulation 2000.	Throughout the EIS
Consultation Requirements	

Director General's Requirements	EIS Chapter and Appendix Reference
■ During the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with the: a) Commonwealth Department of Sustainability, Environment, Water, Population and Communities; b) Office of Environment and Heritage (including the Heritage Branch); c) Environment Protection Authority; d) Division of Resources and Energy within the Department of Trade and Investment, Regional Infrastructure and Services; e) Department of Primary Industries (including the NSW Office of Water, Forestry NSW, NSW Agriculture, Fisheries NSW and Catchments and Lands (Crown Lands Division)); f) Transport for NSW (including the Centre for Transport Planning, Roads and Maritime Services); g) NSW Health; h) Sydney Catchment Authority; i) Hawkesbury-Nepean Catchment Management Authority; j) Lithgow City Council; k) Delta Electricity; and l) relevant Aboriginal stakeholders. The EIS must describe the consultation process and the issues raised, and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, justification should be provided.	a) to l) Chapter 7.0

Table 1.3 Supplementary Director General's Requirements

Director General Requirements	EIS Chapter and Appendix Reference
■ **General Information:** 1. The background of the action, including: a) the title of the action; b) the full name and postal address of the designated proponent; c) a clear outline of the objective of the action; d) the location of the action; e) the background to the development of the action; f) how the action related to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action; g) the current status of the action; and h) the consequences of not proceeding with the action.	a) Section 1.1 b) Section 1.2 c) Chapter 4.0 d) Section 2.1 e) Section 1.1 f) Section 1.8 g) Section 1.5 h) Chapter 12.0
■ **Description of the controlled action** 2. A description of the action, including: a) all the components of the action; b) the precise location (including coordinates) of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts; c) how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts; d) the timing and duration of the works to be undertaken; and e) to the extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including: i) if relevant, the alternative of taking no action; ii) a comparative description of the impacts of each alternative on the matters protected by the controlling provision for the action; iii) sufficient detail to clarify why any alternative is preferred to another. Short, medium and long- term advantages and disadvantages of the options should be discussed.	a) to d) Chapter 4.0 e) Chapter 12.0

Director General Requirements	EIS Chapter and Appendix Reference
■ **Description of the existing environment** 3. A description of the existing environment of the proposal location and the surrounding areas that may be affected by the action, including but not limited to: a) surveys using accepted methodology for targeting listed threatened species, ecological communities and their respective habitat, including but not limited to OEH's Survey and assessment guidelines (2009) and the Department of Sustainability, Environment, Water, Populations and Communities (formerly SEWPAC now DoE) species- specific survey guidelines for nationally threatened species. b) a description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat (including breeding, foraging, roosting habitat, habitat critical to the survival of threatened species) within the site and in surrounding areas that may be impacted by the proposal. c) the regional distribution and abundance of suitable and potential habitat for threatened species and ecological communities surround the site. d) a description of the important water resources within the site and in surrounding areas, including detailed information addressing the department's Water Resources Terms of Reference, currently in preparation. e) a description of water related assets that are dependent on any important water resources, including an estimation of the water requirements of those assets (i.e. regional water use).	a) Section 10.3.2 b) Section 10.3.3 c) Appendix G and Appendix H d) Section 10.2 e) Section 10.2
■ **Description of the relevant impacts of the controlled action** 4. An assessment of all relevant impacts with reference to the EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of national Environmental Significance (2009) and species specific guidelines as relevant that the controlled action has will have or is likely to have. Information must include specific items listed in 4a-e in Appendix A. 5. Where there is a potential habitat for EPBC Act listed species, surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person. A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the: a) population of the species at the site; b) area of occupancy of the species; c) habitat critical to the survival of the species; d) breeding cycle of the population; and e) availability or quality of habitat for the species. f) If an endangered ecological community or threatened species is not believed to be present on the proposed site, detailed information must be included in the EIA to demonstrate that this community will not be impacted. 6. A description of the relevant impacts on the Temperate Highland Peat Swamps on Sandstone (THPSS) should include a detailed description of the potential and likely hydrological changes that may occur as a result from the proposed action, including from subsidence. Direct and indirect impacts must be included. Cumulative and facilitative impacts should also be included. Impacts to be included are listed in 6 a-f in Appendix A. The impacts should be described for the construction operation al and decommissioning phases of the controlled action. This information should be described with reference to the ecological community as it is defined and listed under the EPBC Act. 7. An assessment of all relevant impacts to the World and National listed values of the Greater Blue Mountains World Heritage Area (CBMWHA). 8. An assessment of all relevant impacts on water resources and water related values.	4) Section 10.3.4 and Section 10.3.5 5) Section 10.3.2, Section 10.3.3, Section 10.3.4 and Section 10.3.5 6) Section 10.3.4 7) Section 10.1.4 and Section 10.2.3 8) Section 10.2.3

Director General Requirements	EIS Chapter and Appendix Reference
■ **Proposed safeguards and mitigation measures** 9. A description of feasible mitigation measures, changes to the action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimize relevant impacts. Information must include items listed in 9a-h in Appendix A.	9. Section 10.3.7
■ **Offsets** 10. Where impacts cannot be avoided or mitigated, an offset package to compensate for any predicted or potential residual significant impacts on matters of national environmental significance. Offsets should demonstrate consistency with the Commonwealth EPBC Act Environmental Offsets Policy (October 2012, or subsequent version).	10. Section 10.3.6.4
■ **Other approvals and conditions** 11. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action.	11. Chapter 5.0
■ **Economic and social matters** 12. A description of the short-term and long-term social and economic implications and/or impacts of the Project.	12. Chapter 6.0

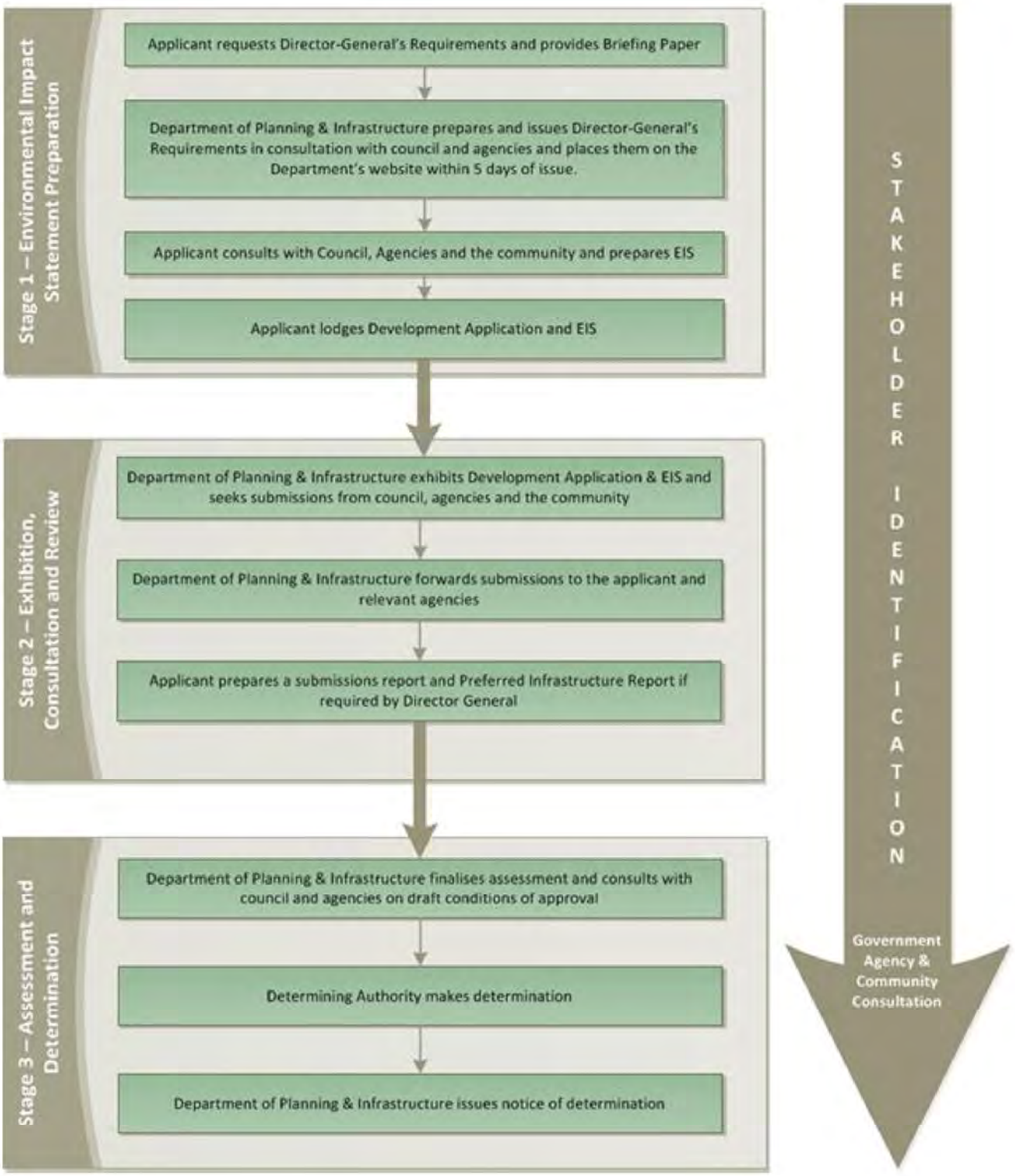
Director General Requirements	EIS Chapter and Appendix Reference
■ **Environmental record of person proposing to take the action** 13. Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: a) the proponent; and b) for an action for which a person has applied for a permit, the person making the application. 14. Details of the proponent's environmental policy and planning framework.	13. Section 2.8.4 14. Section 3.12.2
■ **Information sources** 15. For information given in an environmental assessment, the draft must state: a) the source of the information; b) how recent the information is; c) how the reliability of the information was tested; and d) what uncertainties (if any) are in the information.	15. References
■ **Consultation** 16. Any consultation about the action, including: a) any consultation that has already taken place; b) proposed consultation about relevant impacts of the action; c) if there has been consultation about the proposed action- any documented responses to, or result of, the consultation. 17. Identification of affected parties, including a statement mentioning any communities that may be affected and describing their views.	16. to 17. Chapter 7.0

1.7 Approval Process and Indicative Timeline

The Project is to be assessed as a State Significant Development (State Significant Development) in accordance with Clause 8 and Schedule 1 (Item 5) of *State Environmental Planning Policy (State and Regional Development) 2011*. Centennial Angus Place is seeking approval of the Project in accordance with the provisions of Part 4 Division 4.1 of the EP&A Act. **Chapter 5.0** details the key aspects of the Project that trigger the requirement for State Significant Development approval under the EP&A Act.A summary of the Project State Significant Development assessment pathway is provided in **Figure 1.4**. Based on the State Significant Development Assessment pathway, **Table 1.4** outlines the process and approval pathway.

Table 1.4: Angus Place Colliery Approval Pathway and Indicative Timeline

Action	Indicative Timeline
Submit Briefing Report to the Department of Planning and Infrastructure (DP&I)	September 2012
Receive Director General Requirements	6 November 2012
Lodge referral to SEWPAC (now DoE) and determined as a 'controlled action'	17 April 2013
Receive Supplementary Director General's Requirements	30 August 2013
Submit EIS for adequacy review	November 2013
Exhibit EIS and invite public submissions (minimum 30 days)	April 2014 until May 2014
Submit a response to submissions (if required)	June 2014
Department of Planning and Infrastructure assessment and Planning Assessment Commission (PAC) determination (90 days)	August 2014



DATE	19/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F091 APC Rev 0
SCALE	NOT TO SCALE

Figure 1.4: State Significant Development Assessment and Approval Pathways

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1.8 Interaction with Centennial Projects in the Western Coalfield

1.8.1 Introduction

As is referred to elsewhere in this EIS, Centennial Coal Company Limited's operations in the Western Coalfields include the following key interrelated components:

- the Springvale Mine (currently operated pursuant to Development Consent DA 11/92 and Development Consent DA 461/02);
- the Angus Place Colliery (currently operated pursuant to Project Approval PA 06_0021);
- the Springvale Coal Services Site (currently operated pursuant to Development Consent DA 11/92); and
- a coal transport system comprising haul roads and overland conveyors linking the Springvale Mine, Angus Place Colliery, Springvale Coal Services Site, Mount Piper Power Station and Wallerawang Power Station (currently operated pursuant to Development Consent DA 11/92, Development Consent DA 326/02 and Project Approval PA 06_0021).

Centennial has developed a long-term strategy for its future operations in the Western Coalfields to provide the infrastructure and flexibility required to meet future opportunities in both the domestic and export coal markets. As part of this strategy, Centennial Coal is seeking development consent for this Project in conjunction with:

- the Springvale Mine Extension Project; and
- the Western Coal Services Project.

Springvale Mine and Angus Place Colliery have the potential to cumulatively produce up to 8.5 million tonnes per annum of ROM coal, which is approximately 50% of Centennial's annual ROM coal production.

Centennial Coal has consulted with the DP&I and other State and local government agencies to explain the interrelated nature of the relationship between the Angus Place Mine Extension Project, Springvale Mine Extension Project and the Western Coal Services Project. The DGRs for all three projects were issued at the same time, 6 November 2012. Centennial Coal submitted the Western Coal Services Project EIS to the DP&I in May 2013, with exhibition of the EIS for the Western Coal Services Project ending on 26 September 2013.

For the purpose of explaining the interrelationship between the Angus Place Mine Extension Project, Springvale Mine Extension Project and the Western Coal Services Project, high-level summaries of those three Projects are provided in the following sections and shown on **Figure 1.5**. Each of the summaries includes an explanation of the implications the particular Project will have in respect of:

- the existing planning approvals for the Angus Place Colliery and Springvale Mine; and
- the planning approvals sought for these three Projects.

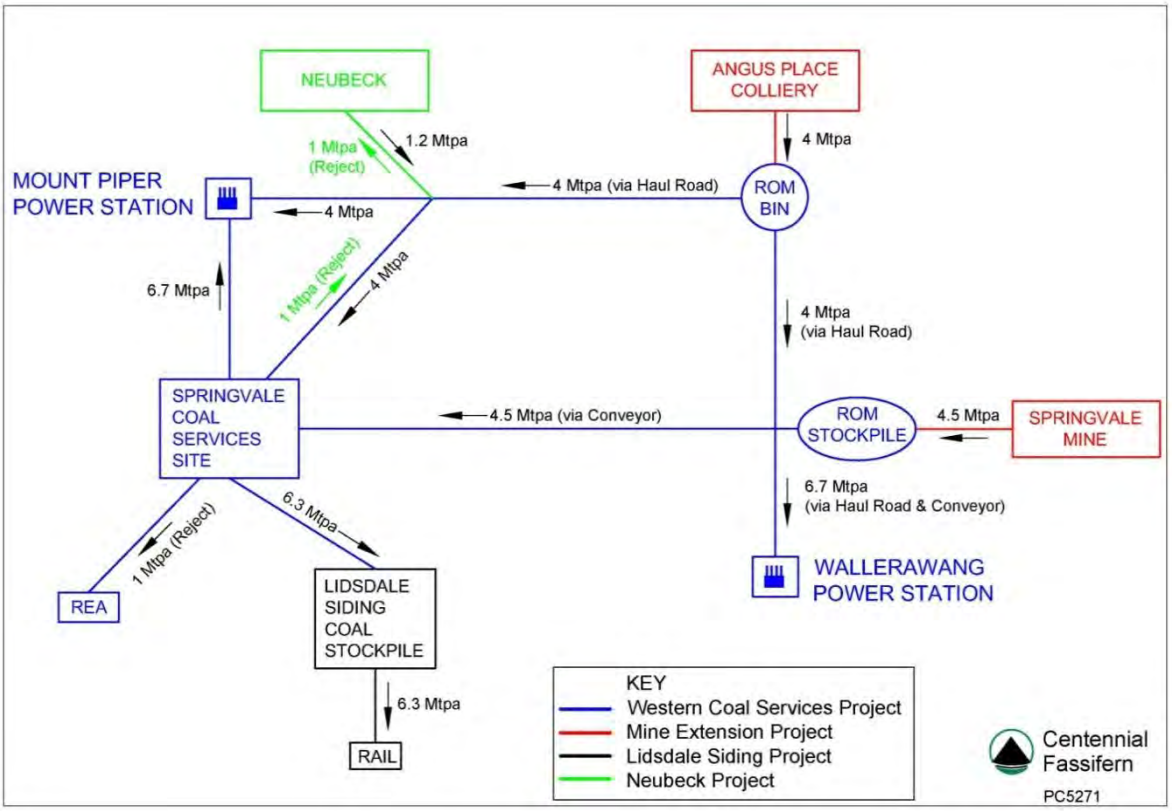


Figure 1.5 Interrelated Centennial Coal Projects in the Western Coalfield

1.8.2 The Angus Place Mine Extension Project

1.8.2.1 *Summary of Project*

The Angus Place Colliery currently operates under Project Approval PA 06_0021 which was granted on 13 September 2006. This Part 3A Approval allowed for the consolidation of previous development consents, the extension of the mining area and for an increase in the production limit to 3.5 million tonnes per annum, with later modifications to allow 4 million tonnes per annum production. Project Approval PA 06_0021 is due to lapse on 18 August 2024.

Project Approval PA 06_0021 has been modified three times in 2011 and 2013 in accordance with Section 75W of the EP&A Act to facilitate continued mining at Angus Place Colliery. A Federal environmental approval was required in respect of the 2011 modification. That Federal environmental approval (EPBC 2011/5952) was granted by the Minister under the EPBC Act on 17 April 2012.

In brief, the Angus Place Mine Extension Project includes:

- all currently approved operations, facilities and infrastructure of the Angus Place Colliery pursuant to:
  - Project Approval PA 06_0021 (as modified);
  - EPBC 2011/5952; and
  - the various approvals, licences, permits, certificates and authorities listed in **Table 3.2** and **Table 3.3** of this EIS, including an existing approved SMP.

  except as otherwise indicated in this EIS (for instance, see **Table 4.1** in this EIS). The principal components of the currently approved operations that will not form part of the Angus Place Mine Extension Project are the ROM coal transport operations and the operational management and rehabilitation of the Kerosene Vale stockpile currently authorised by Project Approval PA 06_0021;
- extension and continuation of longwall mining for 25 years from the date consent is granted for the Angus Place Mine Extension Project, with rehabilitation to be undertaken following this period; and
- modifications to existing facilities and infrastructure, and construction and operation of new facilities and infrastructure, within the Project Application Area for the Angus Place Mine Extension Project that are required to support the Project.

1.8.2.2 Implications for the Existing Planning Approvals

It is intended that:

- the development consent granted in respect of the Angus Place Mine Extension Project will authorise and regulate, amongst other things, the mining operations currently approved under Project Approval PA 06_0021;
- however, regulation of the ROM coal transport operations and the operational management and rehabilitation of the Kerosene Vale stockpile currently authorised by Project Approval PA 06_0021, will in effect be "transferred" to the development consent to be granted in respect of the Western Coal Services Project.

As such, it is anticipated that the development consent granted in respect of the Angus Place Mine Extension Project would contain a condition which has the effect of requiring the surrender of Project Approval PA 06_0021, but with such surrender only to occur after the grant of a development consent in respect of the Western Coal Services Project that authorises (among other things) ROM coal transport operations and the operational management and rehabilitation of the Kerosene Vale stockpile currently authorised by Project Approval PA 06_0021.

This would enable the continuation of approved surface infrastructure operations at the Angus Place Colliery so as to support the approved (pursuant to Project Approval PA 06_0021) and extended (pursuant to the new development consent) mining operations, pending the grant of the development consent for the Western Coal Services Project. For such continuation to occur, it will be necessary for the development consent granted for the Angus Place Colliery Extension Project to specify that its conditions do not prevail to the extent that there is any inconsistency with Project Approval PA 06_0021, while the latter planning approval is still on foot.

1.8.3 The Springvale Mine Extension Project

1.8.3.1 Summary of Project

The Springvale Mine was originally granted development consent (DA 11/92) by the then Minister for Planning on 27 July 1992. That consent has been modified on four occasions. Other development consents for the Springvale Mine are Development Consent DA 326/02 (for the construction and operation of a coal conveyor from the existing overland conveyor to Wallerawang Power Station) and Development Consent DA 461/02 (for the construction and operation of Ventilation Shaft 3 Facility on the Newnes Plateau) (together, the "Other Springvale Mine Planning Approvals").

In brief, the Springvale Mine Extension Project includes all currently approved operations, facilities and infrastructure of the Springvale Mine pursuant to:

- Development Consent DA 11/92 (as modified) (including transport of up to 50,000 tonnes per annum of coal to local domestic customers by road haulage);
- Development Consent DA 461/02 (as modified); and
- the various approvals, licences, permits, certificates and authorities listed in **Table 3.2** and **Table 3.3** of the EIS for the Springvale Mine Extension Project, including an existing approved SMP

except as otherwise indicated in the EIS for the Springvale Mine Extension Project (for instance, see **Table 4.1** in this EIS).

The principal components of the currently approved operations that will not form part of the Springvale Mine Extension Project are the existing infrastructure and operations at the surface of the Springvale Coal Services Site currently authorised by Development Consent DA 11/92 and the construction and use of the overland conveyor from the Castlereagh Highway to Wallerawang Power Station currently authorised by Development Consent DA 326/02;

- extension and continuation of longwall mining for a further 13 years beyond the current expiry date of Development Consent DA 11/92 with rehabilitation to be undertaken following this period; and
- modifications to existing facilities and infrastructure, and construction and operation of new facilities and infrastructure, within the Project Application Area of the Springvale Mine Extension Project that are required to support the Project.

1.8.3.2 Implications for the Existing Planning Approvals

It is intended that:

- the development consent granted in respect of the Springvale Mine Extension Project will authorise and regulate, amongst other things, the mining operations currently approved under Development Consent DA 11/92 and the Other Springvale Mine Planning Approvals;
- however, the operational management of coal processing and transport of coal from the Springvale Mine that is currently authorised under Development Consent DA 11/92 and Development Consent DA 326/02, will in effect be "transferred" to the development consent to be granted in respect of the Western Coal Services Project. The exception to this is that it will be the development consent granted in respect of the Springvale Mine Extension Project (and not the development consent granted in respect of the Western Coal Services Project) that will authorise the transport of up to 50,000 tonnes per annum of coal to local domestic customers by road haulage.

As such, it is anticipated that the development consent granted in respect of the Springvale Mine Extension Project would contain a condition which has the effect of requiring:

- the surrender of Development Consent DA 461/02; and

- the surrender of Development Consent DA 11/92 and Development Consent DA 326/02, but with such surrender only to occur after the grant of a development consent in respect of the Western Coal Services Project that authorises (among other things):
  - the existing infrastructure and operations at the surface of the Springvale Coal Services Site presently authorised by Development Consent DA 11/92; and
  - the construction and use of the overland conveyor from the Castlereagh Highway to Wallerawang Power Station presently authorised by Development Consent DA 326/02.

This would enable the continuation of approved surface infrastructure operations at the Springvale Mine and the Springvale Coal Services Site so as to support the approved (pursuant to Development Consent DA 11/92 and the Other Springvale Mine Planning Approvals) and extended (pursuant to the new development consent) mining operations, pending the grant of the development consent for the Western Coal Services Project. For such continuation to occur, it will be necessary for the development consent granted for the Springvale Mine Extension Project to specify that its conditions do not prevail to the extent that there is any inconsistency with Development Consent DA 11/92, while the latter planning approval is still on foot.

1.8.4 The Western Coal Services Project

1.8.4.1 Summary of Project

The Western Coal Services Project seeks development consent for all operational management of coal processing and transport of coal from the Angus Place Colliery and Springvale Mine, including any such activities currently approved pursuant to:

- Springvale Mine's Development Consent DA 11/92 (excluding the transport of up to 50,000 t per annum of coal to local domestic customers by road haulage, which will be authorised pursuant to the development consent granted in respect of the Springvale Mine Extension Project);
- Springvale Mine's Development Consent DA 461/02; and
- Angus Place Colliery's Project Approval PA 06_0021.

These facilities are integral to the ongoing handling, processing and transport of coal from the underground workings of Angus Place Colliery and Springvale Mine into domestic and export markets.

The development consent for the Western Coal Services Project would authorise the following activities (among other things):

- Upgrade of the existing Washery and supporting infrastructure within the Springvale Coal Services Site by constructing a new Washery adjacent to the existing facility that will remain operational to provide a total processing capacity of up to 7 million tonnes per annum.
- Construction of processing infrastructure including additional conveyors and transfer points and other coal handling requirements to cater for the upgraded Washery facility within the existing surface disturbance footprint of the Springvale Coal Services Site.
- Extension and enlargement of the existing reject emplacement area on the Springvale Coal Services Site to enable sufficient reject disposal capacity for a 25 year life.
- Utilisation of the existing overland conveyor system to enable up to 6.3 million tonnes per annum of coal to be delivered to Lidsdale Siding and 6.7 million tonnes per annum to be delivered to Mount Piper Power Station.
- Construction of a private haul road, approximately 1.3 kilometres in length, linking the Springvale Coal Services Site with the existing private haul road from Angus Place Colliery to Mount Piper Power Station. This private Link Haul Road will cross a section of the existing Pine Dale Mine operation and over the Castlereagh Highway via the construction of a road bridge.

- Improvement of the current water management systems on the Springvale Coal Services Site by separating clean and dirty water streams prior to either reuse or discharge off site.
- Integration of the existing approved transport of coal at Springvale Mine and Angus Place Colliery into the one consent, including coal stockpiling activities at the Kerosene Vale Coal Stockpile Site (excluding the transport of up to 50,000 tonnes per annum of coal to local domestic customers by road haulage, which will be authorised pursuant to the development consent granted in respect of the Springvale Mine Extension Project).
- Integration of the remaining rehabilitation, monitoring, water management and reporting requirements associated with the now closed Lamberts Gully Open Cut Mine which occupies the Springvale Coal Services Site.
- Continued use of all existing approved infrastructure, facilities and activities associated with the transport and processing of coal from each mine gate and the point of delivery to the power stations and Lidsdale Siding. This infrastructure includes the existing conveyors, private haul roads, reject emplacement areas, services, access roads, car parks and buildings.

1.8.4.2 Implications for the Existing Planning Approvals

As noted above, it is intended that the development consent granted in respect of the Western Coal Services Project will authorise and regulate, among other things, the operational management of coal processing and transport of coal from the Angus Place Colliery and Springvale Mine currently approved pursuant to Springvale's Development Consent DA 11/92 (excluding the transport of up to 50,000 tonnes per annum of coal to local domestic customers by road haulage, which will be authorised pursuant to the development consent granted in respect of the Springvale Mine Extension Project) and Development Consent DA 461/02, and Angus Place's Project Approval PA 06_0021.

As such, it is anticipated that the development consent granted in respect of the Western Coal Services Project would contain a condition which has the effect of requiring the surrender of Development Consent DA 11/92 and Project Approval 06_0021, but with such surrender only to occur after the grant of development consent in respect of the Springvale Mine Extension Project and the Angus Place Mine Extension Project.

CHAPTER 2.0
Site Description

2.0 SITE DESCRIPTION

2.1 Site Location

Angus Place Colliery is an existing underground longwall mining operation located in the Western Coalfield of New South Wales, 15 kilometres northwest of the city of Lithgow and 120 kilometres west northwest of Sydney. Angus Place pit top is accessed via the Castlereagh Highway and is located 5 kilometres north of the village of Lidsdale, and 7.4 kilometres northeast of Wallerawang.

Angus Place Colliery is bordered by Newnes State Forest to the east, Springvale Mine to the south, Lidsdale to the west and the Gardens of Stone National Park to the north (**Figure 2.1**).

The characteristics of the Project Application Area and surrounds include existing Angus Place Colliery, rural land, Newnes State Forest, coal handling transport and infrastructure, power stations and natural areas.

2.2 Project Application Area

The Project Application Area comprises an area of 10,460 ha and is defined by the Mining Lease (ML 1434) and Exploration Licence boundaries (EL6856 and EL6293) (**Figure 2.1**). It is located within the Lithgow Local Government Area and in the parishes of Cox, Clwydd, Cook, Marrangaroo and Lidsdale within the County of Cook. The area is characterised by environmental features (refer **Section 2.3**) such as pagodas, cliff lines, swamps, creeks, and deep valleys.

Coordinates of key infrastructure within the Project Application Area have been included in **Table 2.1**.

Table 2.1 Coordinates of Key Infrastructure within the Project Application Area

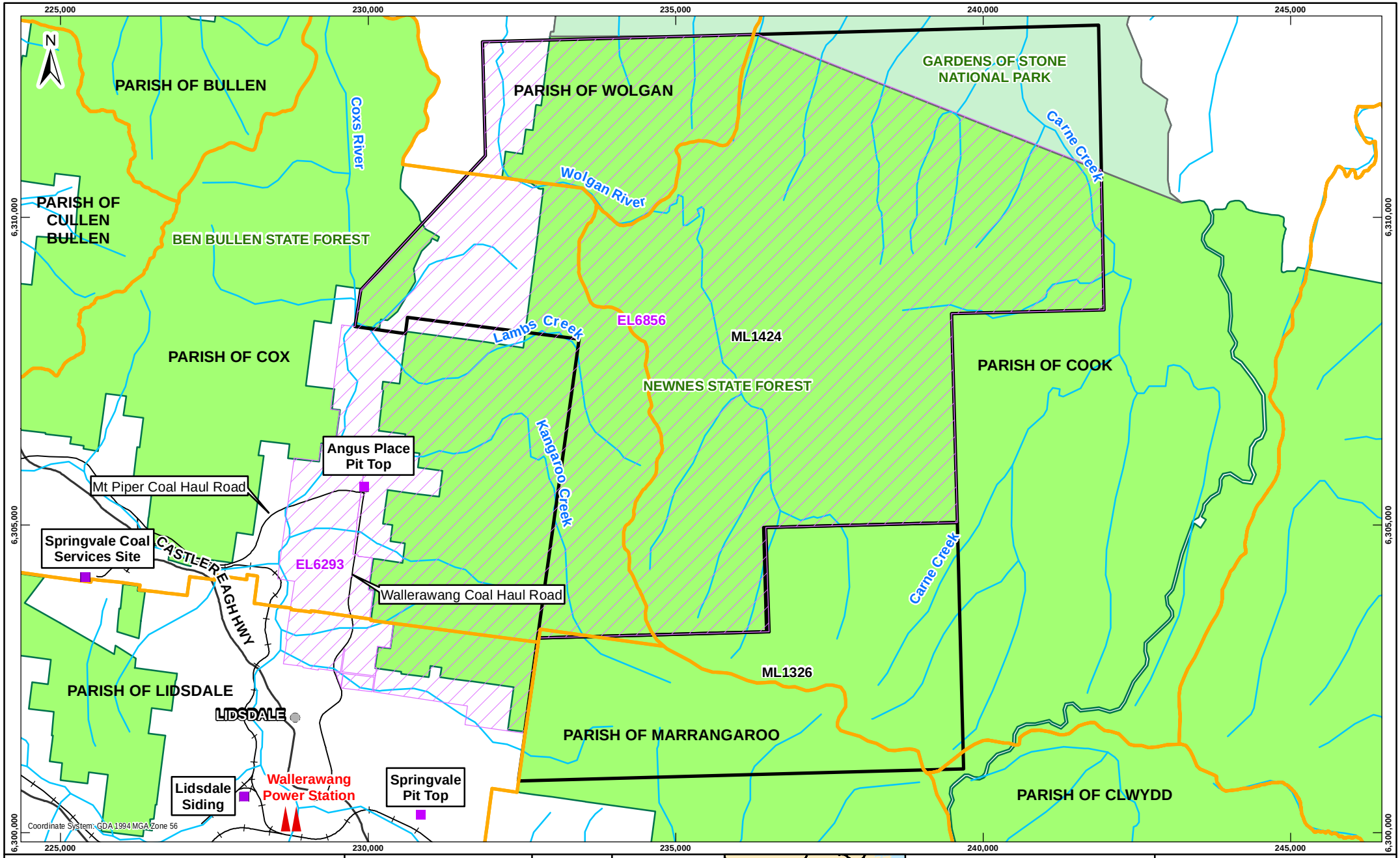
Name	Easting (MGA 56)	Northing (MGA 56)
Angus Place pit top	230154	6305920
AP-VS3	235929	6309288
AP-VS2	237211	6305593
Bore 940 dewatering facility	236306	6304617
Substation	237820	6305317

2.3 Landscape Features

The Project Application Area contains significant natural landscape features formed by the combination of geology, topography and vegetation. Topographically the Project Application Area can be divided into the Newnes Plateau and areas of lower elevation in Wolgan Valley and the Coxs River valley west of the pit top.

The principal geology of the Newnes Plateau is a sedimentary sequence of sandstone, claystone and siltstone dating from the early Permian to the late Triassic, while topographically lower areas are commonly deposited with more recent sediments.

Angus Place Colliery is located in an area of significant topographical variation. Most of the land surface within the Project Application Area and its environs lies within the Newnes Plateau at elevations from 900 m to greater than 1175 m Australian Height Datum (AHD). Topography within the Newnes Plateau comprises narrow gorges with high undulating ridgelines and sandstone cliffs, which range between 10 m and 40 m in height. The floors of creeks and gullies lie at elevations of between 960 m and 980 m AHD. The pit top is at a lower elevation of approximately 930 m AHD. Relatively open and flat valleys of the upper Coxs River and tributaries characterise the Angus Place pit top area.



LEGEND

- Village
- Watercourse
- Rail
- Main Road
- National Park
- State Forest
- Parish Boundary
- Exploration Licence
- Mining Lease Boundary

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F047 APC Rev 0
SCALE	1:80,000

Figure 2.1: Existing Mining Tenements

0 1 2 3 km

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Long term erosion of the Newnes Plateau has formed the following features:

- cliffs, defined as rock faces from 5 m high with a minimum slope of 63 degrees; and
- pagodas, defined as isolated freestanding rock formations more than 5 m high.

Cliffs and pagodas predominate around the Wolgan River and Carne Creek and tributaries in the Narrabeen sandstones. According to Washington et at (2011), pagodas (referred to within that paper as geo-diversity) form at greater than 1000 m elevation within the Banks Wall and Burra Moko Head Sandstone units of the Newnes Plateau. This finding is consistent with the mapping that has been undertaken across the Newnes Plateau by both the Springvale Mine Extension Project and the Angus Place Colliery Extension Project. Whilst little is known about the formation of pagodas, their significance has been established in both Washington et al (2011) and the Coalpac Consolidation Project Planning Assessment Commission Report.

To assist in developing a mine plan that minimises impacts, locations of cliffs and pagodas have been plotted from 1 m resolution Light Detection and Ranging (LiDAR) survey, aerial photography and detailed site survey. The pagodas and cliffs have specific plant and animal habitat values (further detailed in **Section 2.2**) as well as visual value. **Photograph 2.1** shows pagodas east of the pit top and **Photograph 2.2** shows cliffs and pagoda complexes in the east of the Project Application Area. **Photograph 2.3** shows typical local rock formations near Blackfellows Hands Cave.

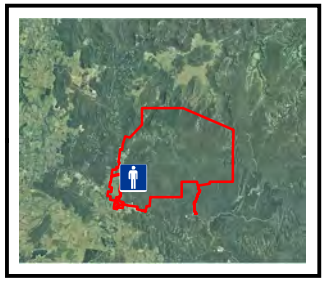
The intrinsic value of cliffs and pagodas has been increasingly recognised over the years and to some extent the gazettal of the Gardens of Stone National Park adjacent to the Project Application Area and Mugii Murum-ban State Conservation Area 18 kilometres to the north reflects these values.

The Wolgan River is a fifth order stream that bisects the Project Application Area and flows north via Wolgan Falls into the Wolgan Valley and eventually into the Colo River System, that flows into the Hawkesbury River. Both the river and the falls are difficult to access by vehicle owing to very rough tracks. The Wolgan Valley is enclosed by sheer sandstone cliffs and vegetated talus slopes. The Valley (**Photograph 2.4**) has been partially cleared for grazing, and is the site of the Emirates Wolgan Valley Resort. **Photograph 2.5** shows the Wolgan River crossing in the centre of the Project Application Area.

The surface water catchments in the Project Application Area are the Coxs River in the west, Wolgan River West in the centre, and Carne Creek (or Wolgan River East) in the east. Coxs River flows generally south past Lithgow skirting the western flanks of the Blue Mountains before entering Lake Burragorang and eventually the Nepean River. Carne Creek and Wolgan River both flow generally northwards before joining and eventually emptying into the Colo River, which joins the Hawkesbury River near Lower Portland. **Section 2.7** details these catchments further. The majority of Angus Place Colliery's historic mining areas have been under the Coxs and Wolgan River West catchments. The proposed longwalls are under the Wolgan River West and East catchments.

The 15,100 hectare Gardens of Stone National Park adjoins the northern boundary of the Project Application Area, while the 501,700 hectare Wollemi National Park is further north and east. The 248,000 hectare Blue Mountains National Park is located south east of the Project Application Area. Together these and other reserves in the region (Nattai, Kanangra-Boyd and Thirlmere Lakes National Parks and Jenolan Caves Reserve) make up the 103,000 hectare Blue Mountains World Heritage Area, which was listed as a World Heritage Area in 2000 for significant biological evolutionary processes and the importance and diversity of habitats including wet and dry sclerophyll forest, mallee heathlands, swamps, wetlands and grasslands. The Area supports 10% of Australia's vascular plant species including 100 species of eucalypts and at least one relict species, the Wollemi Pine. The World Heritage listing grants international recognition to Australia's eucalypt forests within the largest protected and most intact sclerophyll forest wilderness remaining in a broad range of temperate climates. The Area "*provides an exceptional living example of evolution of the modern Australian flora, to its present distinctive character in the classic Australian circumstance of low fertility soils, a drying climate and geographic isolation*…" (The Blue Mountains World Heritage Institute, 2011). The World Heritage Area is administered by the Greater Blue Mountains World Heritage Area Advisory Committee and is supported by the 2009 to 2019 World Heritage Area Strategic Plan.

Newnes Plateau shrub swamps (Mapping Unit MU50) (DEC 2006)) and hanging swamps (Mapping Unit MU51 (DEC 2006) occur within the Project Application Area (**Figure 2.2**). The distribution of these swamps across the Project Application Areas is discussed in **Section 2.8.2**. The shrubs swamps occur in valley floors while the hanging swamps occur on hillsides, and both are endemic to the Newnes Plateau. The shrub swamps are listed as an endangered ecological community (EEC) under the *Threatened Species and Conservation Act 1995* (TSC Act) and provide important habitat for a range of plants and animals. The shrub swamps and the hanging swamps are referred to collectively as the Temperate Highland Peat Swamps on Sandstone (THPSS) in accordance with the EPBC Act. In this document, where the term “shrub swamps” is used, reference is made specifically to Newnes Plateau shrub swamps (MU50), and where the acronym “THPSS” is used it refers collectively to the Newnes Plateau Shrub Swamps (MU50) and Newnes Plateau hanging swamps (MU51).



Visual Receptor Information

Direction:	West
Easting:	231174 m
Northing:	6305218 m
Elevation:	1044 m

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R APC Rev 0
SCALE	NOT TO SCALE

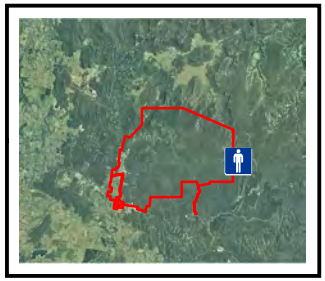
Photograph 2.1: Pagodas east of the pit top

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 1

A4



Visual Receptor Information

Direction: West
Easting: 242593 m
Northing: 6307326 m
Elevation: 961 m

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R APC Rev 0
SCALE	NOT TO SCALE

Photograph 2.2: Cliffs and Pagodas in the east of the Project Application Area

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 2

A4

Visual Receptor Information
Easting: 231914 m
Northing: 6309525 m
Elevation: 994 m

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R APC Rev 0
SCALE	NOT TO SCALE

Photograph 2.3: Rock formations near Blackfellows Hands Cave

PLOTFILE No.

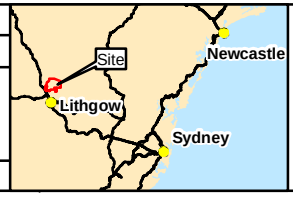
Centennial Coal
Angus Place

DRG No. 3

A4

Visual Receptor Information
Easting: 231103 m
Northing: 6309956 m
Elevation: 924 m

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R APC Rev 0
SCALE	NOT TO SCALE



Photograph 2.4: Looking north in Wolgan Valley

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 4

A4

Visual Receptor Information

Direction:	South
Easting:	235433 m
Northing:	6309919 m
Elevation:	986 m

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R APC Rev 0
SCALE	NOT TO SCALE

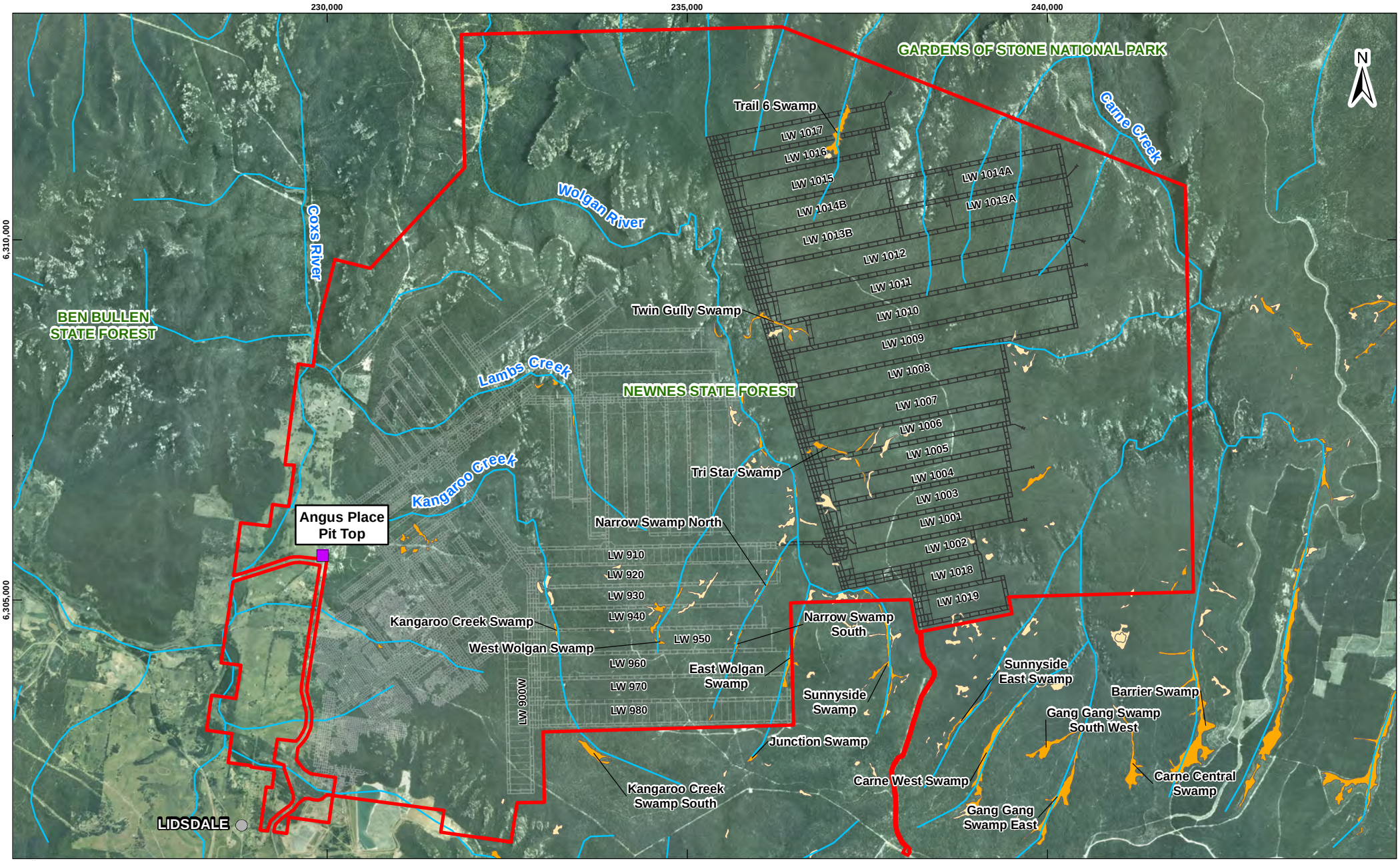
Photograph 2.5: Wolgan River crossing in the centre of the Project Application Area

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 5

A4



LEGEND

- Project Application Area
- Village
- Watercourse
- Shrub Swamp
- Hanging Swamp
- Proposed Workings
- Existing Workings

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F051 APC Rev 0
SCALE	1:70,000

Figure 2.2: Mine Plan and Distribution of Swamps Across the Project Application Area

0 1 2 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 51 | A4

2.4 Study Areas

The study area for the majority of the technical assessments undertaken for the Project is the Project Application Area, with the exception of subsidence, terrestrial ecology and visual impact assessments. For these technical assessments, the study areas are defined as follows and are illustrated on **Figure 2.3**.

2.4.1 Subsidence Impact Assessment

In the subsidence impact assessment the study area is referred to as the 'Extension Area' and is defined as the surface area that is likely to be affected by the extraction of the proposed LW1001 to LW1019 in the Lithgow Seam. The extension area has been defined by combining the areas bounded by the following limits:

- the 26.5 degree angle of draw line from the extents of the proposed LW1001 to LW1019; and
- the predicted limit of vertical subsidence, taken as the 20 mm subsidence contour resulting from the proposed longwalls.

2.4.2 Terrestrial Ecology Impact Assessment

The study area for the flora and fauna assessments comprised the predicted subsidence extents (as described in MSEC (2013) and defined as Extension Area above), and Environmental Study Areas (ESA). The survey area for the MSEC (2013) Extension Area included a buffer of at least 100 m around the 26.5 degree angle of draw line.

The ESAs represent the boundaries within which surface facilities will be located and were therefore subject to intensive targeted flora and habitat surveys in order to inform avoidance measures. The general approach was to assess an ESA that was larger than required for the proposed infrastructure. A 20 m wide corridor incorporating existing access track (10 m either side of the centreline of each track), or a new 20 m corridor for new sections of proposed tracks in addition to the locations of the proposed infrastructure was included in the ESAs. The ESAs include the infrastructure footprint which is used to describe the vegetation clearing associated with the establishment of the surface infrastructure.

2.4.3 Visual Impact Assessment

A viewshed model was prepared for the Project to determine those areas that may be able to clearly view the Project components. The study area of this viewshed is shown on **Figure 2.3**.

2.4.4 Exploration Activities

Exploration activities (**Section 3.2**) at Angus Place Colliery have been to date undertaken within EL6856 and EL6293 boundaries (refer **Figure 2.1**). The Project will continue to undertake exploration within these boundaries (**Table 4.1**).

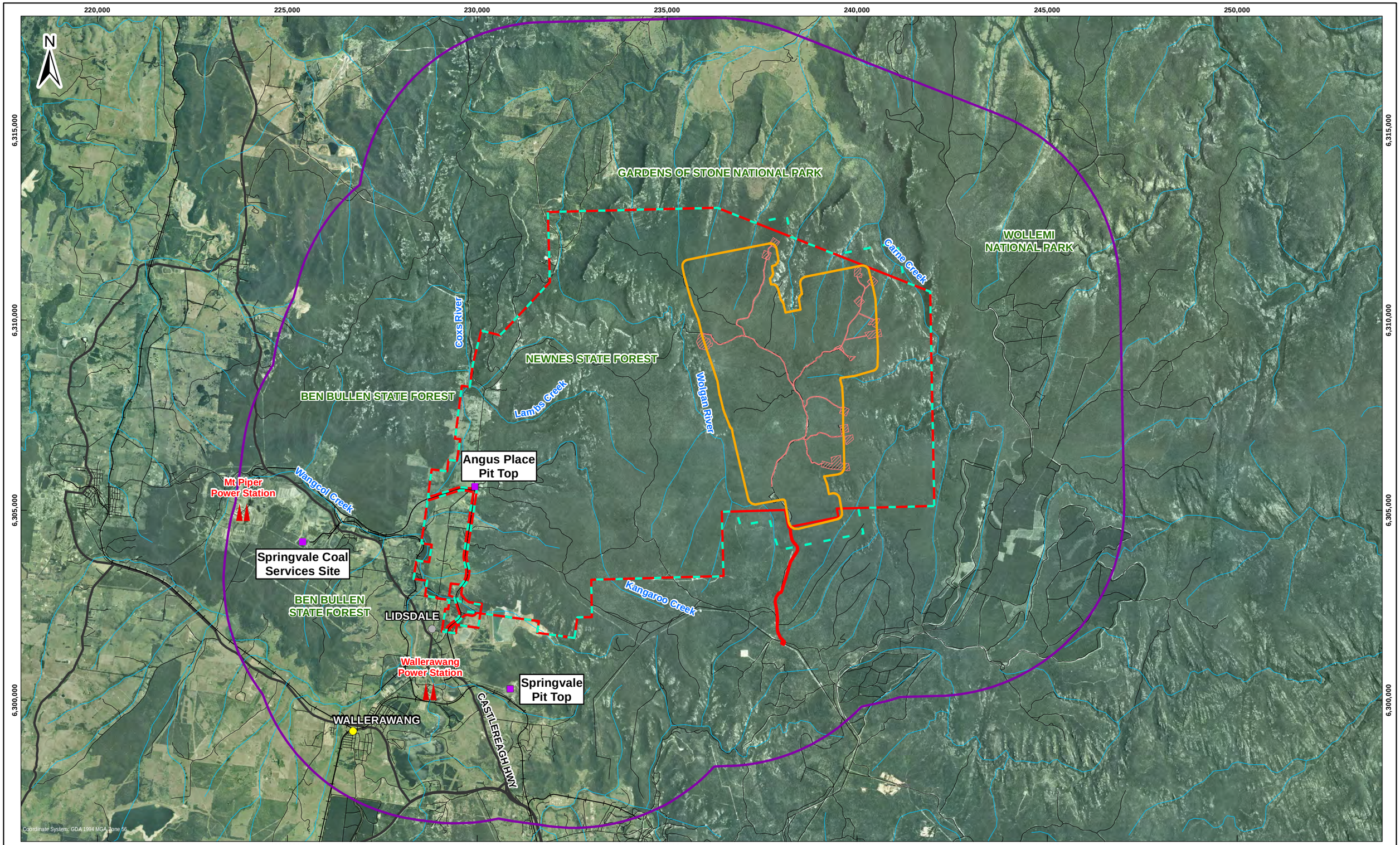
2.5 Land Use and Ownership

2.5.1 Land Use

2.5.1.1 Land use in the vicinity

Land use in the vicinity of the Project Application Area consists of residential uses, agriculture, open cut and underground coal mining, coal handling infrastructure, transport infrastructure, commercial forestry and power generation (**Figure 2.4** and **Photograph 2.6**). Wallerawang is the closest retail and commercial centre, located 7 kilometres south west of the pit top.

The Lidsdale Siding Coal Loading Facility at Wallerawang has been used as a coal storage and rail loading facility since 1974 to distribute coal by rail from Centennial Coal's western region mines to ports on the NSW coast. Lidsdale village is located to the west of the Project Application Area and provides a rural fire service, park amenities and a church.



LEGEND

- Project Application Area
- Village
- Town
- Rail
- Main Road
- Street / Track
- Watercourse
- 26.5 Degree Angle of Draw
- Environmental Study Area
- Terrestrial Ecology Study Area
- Visual Study Area

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F055 APC Rev 0
SCALE	1:90,000

Figure 2.3: Project Study Areas

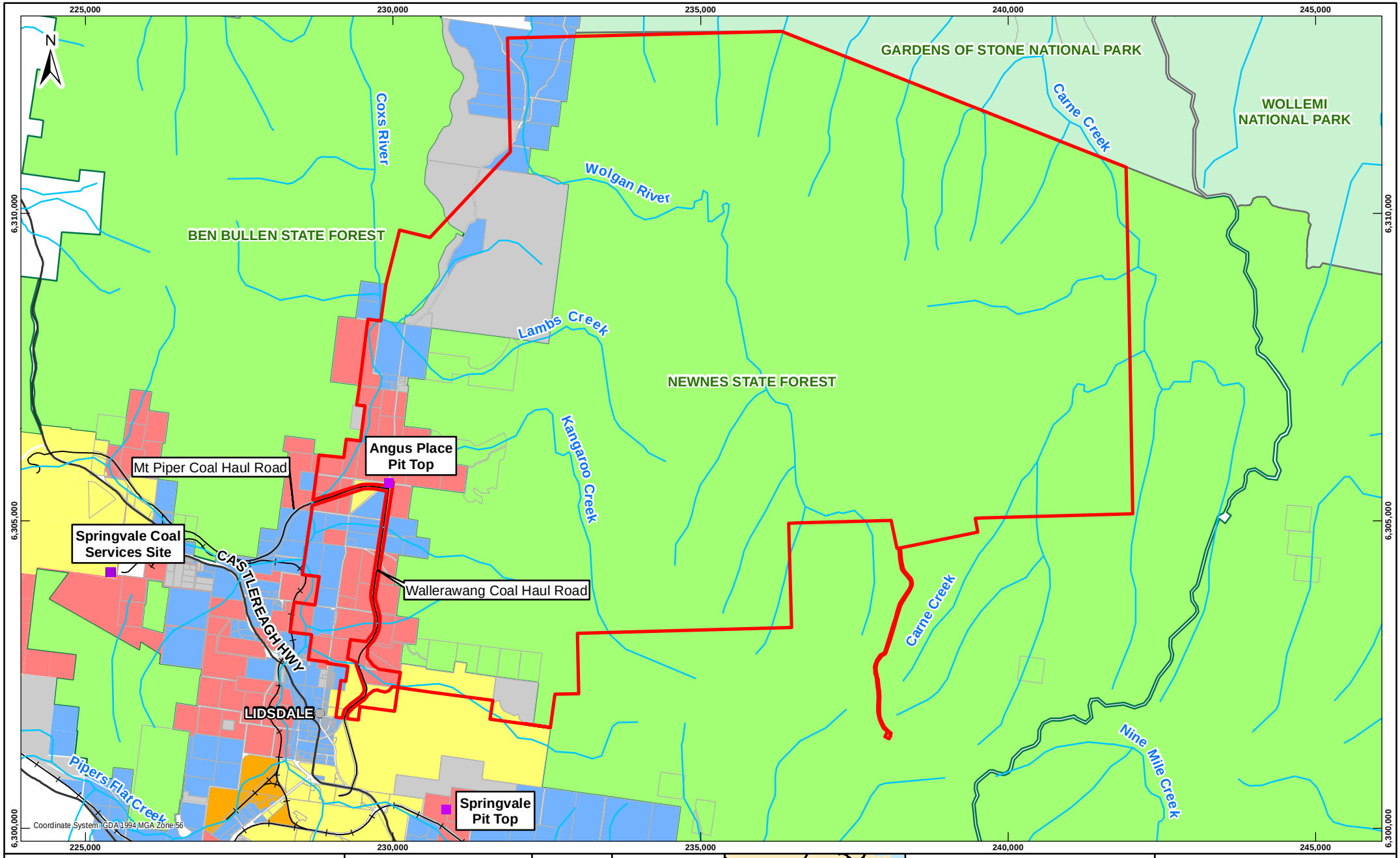
0 1 2 3 4 5 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 55

A3



LEGEND

- Project Application Area
- Village
- Watercourse
- Rail
- Main Road
- Property Boundary

Owner	Main Land Uses
Centennial Freehold	Coal Mining
Crown Land	Pastoral, Farming, Defence
Delta Freehold	Power Industry
Private Freehold	Pastoral, Farming, Residential
SRA Freehold	Transport Infrastructure
Forestry Corporation	Forestry
No Data	Unknown

*SRA - State Rail Authority

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F012 APC Rev 0
SCALE	1:80,000

Figure 2.4: Land Use and Ownership

0 1 2 3 km

PLOTFILE No.

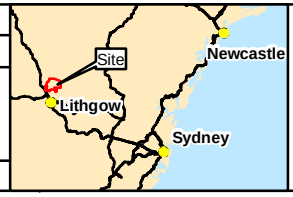
Centennial Coal
Angus Place

DRG No. 12

A4

Photograph 2.6: Main Street Wallerawang, rock pagodas, shrub swamp and coal handling infrastructure at Lidsdale Siding

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R APC Rev 0
SCALE	NOT TO SCALE



PLOTFILE No.

Centennial Coal
Angus Place

DRG No. A4

The nearest large urban centre is Lithgow with a population of 21,000. Lithgow is recognized as a tourist destination and meets the higher order retail, commercial and professional service needs of the area. Lithgow was established on coal mining; however, steel manufacturing and other industrial enterprises have also been carried out in the region. Agriculture accounts for 31% of land use area within the Lithgow Local Government Area.

The area around Angus Place Colliery has been subject to extensive mining operations in the past, with a number of active or completed mines in the vicinity, including Centennial's existing operations (**Figure 2.4**)

2.5.1.2 Land Use in the Project Application Area

Land use within the Project Application Area predominantly consists of historical and existing mining operations and commercial forestry in the Newnes State Forest. Newnes State Forest comprises approximately 25,000 ha of pine plantation and native forest that is selectively logged under the Forestry Corporation of NSW tenure and management. In addition to the timber industry, the Newnes State Forest also supports a number of recreational land uses. Public access is permitted in the Newnes State Forest with common recreational activities consisting of motorcycle riding, four wheel driving, bushwalking, camping, mountain bike riding, canyoning, photography, bird watching and other such recreational and adventure activities.

A small portion of land along the western boundary of the Project Application Area is cleared and is used for agriculture. There is no intensive cropping in the area.

2.5.2 Land Ownership

Land ownership within and surrounding the Project Application Area consists of Crown Land, privately owned land and land owned and managed by the Forestry Corporation of NSW (**Figure 2.4**). Parcels of freehold land are located within the western boundaries of the Project Application Area and generally in the vicinity of Angus Place pit top.

A schedule of land within and adjacent to the Project Application Area is provided in **Appendix C.**

2.5.3 Land Zoning

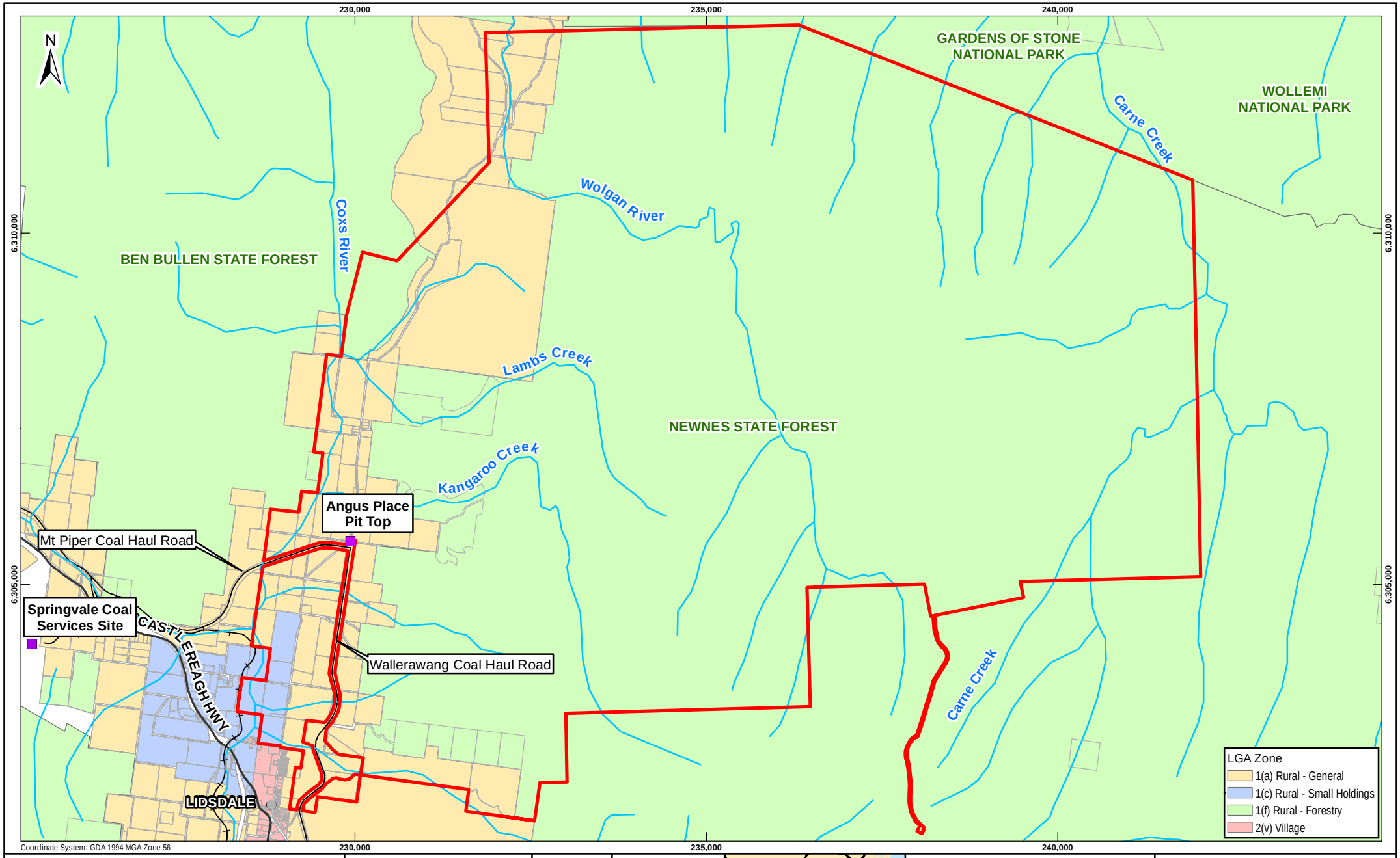
Under the Lithgow Local Environmental Plan 1994, land within the Project Application Area is zoned as 1(a) Rural (General), 1(c) Rural (Small holdings) and 1(f) Rural (Forestry) (refer **Figure 2.5**).

Lithgow City Council has recently developed a Draft Lithgow Local Environmental Plan 2013, which concluded its exhibition period on the 6 August 2013. Submissions are currently being reviewed. Under the Draft Lithgow Local Environmental Plan, zones are renamed with additional objectives and land uses to better reflect the characteristics of the Lithgow Local Government Area. Under the Lithgow Local Environmental Plan 1994 small areas of Zone 1(a) Rural (General) are located near the western and southern boundaries of the Project Application Area with the majority of area within the Project Application Area zoned as 1(f) Rural – Forestry and 1(c) Rural – Small Holdings.

Table 2.2 provides a summary comparison of the existing proposed zones.

Table 2.2 Zonings

Lithgow Local Environmental Plan (1994)	Draft Lithgow Local Environmental Plan 2013
Zones 1(a) Rural (General)	RU1 Primary Production
Zones 1(c) Rural (Small Holdings)	SP2 Infrastructure
Zone 1(f) Rural (Forestry)	RU3 Forestry



LEGEND

- Project Application Area
- Property Boundary
- Village
- Rail
- Main Road
- Watercourse

**NOTE: The following zoning maps were gazetted under Lithgow's Local Environmental Plan 1994. The plans were considered accurate at the date of their gazettal and may have been amended since. Council recommends that these maps be used as a guide only and that a Section 149 zoning certificate be obtained where formal clarification of the zoning is required.

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F046 APC Rev 0
SCALE	1:70,000

Figure 2.5: Land Zoning

0 1 2 3 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 46

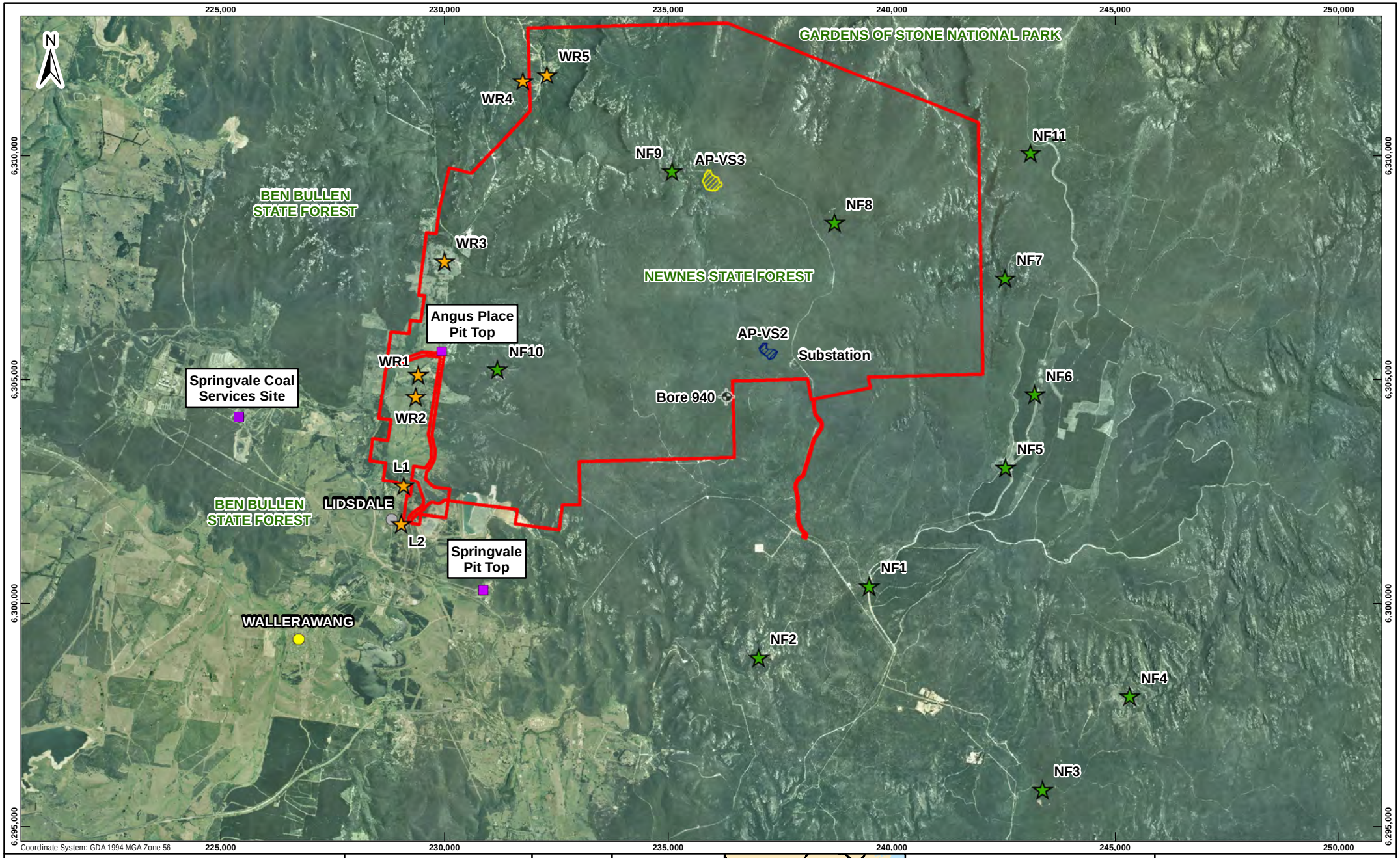
A4

2.5.4 Nearest Sensitive Receptors

There are a number of sensitive residential and recreational receptors in the vicinity of the Project (**Figure 2.6**). A number of residential receptors are located to the north, north east, east and south west of Angus Place pit top. There are also a number of recreational receptors located in the wider area of Newnes State Forest, such as areas used for sightseeing and camping. A list of these receptors is provided in **Table 2.3**. The prefix L refers to residential receptors in the vicinity of Lidsdale, WR refers to residential receptors along Wolgan Road and NF refers to recreational receptors in the Newnes State Forest.

Table 2.3 Sensitive Receptors

Residential Receptor	Receptor Type	Approximate distance to nearest site component
L1	Residential	3.4 kilometres (Angus Place pit top)
L2	Residential	4.3 kilometres (Angus Place pit top)
WR1	Residential	1.1 kilometres (Angus Place pit top)
WR2	Residential	1.6 kilometres (Angus Place pit top)
WR3	Residential	1.7 kilometres (Angus Place pit top)
WR4	Residential	4.8 kilometres (APC-VS3)
WR5	Residential	4.4 kilometres (APC-VS3)
NF1	Recreational	5.9 kilometres (APC-VS2)
NF2	Recreational	7.0 kilometres (APC-VS2)
NF3	Recreational	10.9 kilometres (LW 1004 tailgate)
NF4	Recreational	9.9 kilometres (LW 1004 tailgate)
NF5	Recreational	4.1 kilometres (LW 1004 tailgate)
NF6	Recreational	3.8 kilometres (LW 1004 tailgate)
NF7	Recreational	2.8 kilometres (LW 1001 tailgate)
NF8	Recreational	2.0 kilometres (LW 1001 tailgate)
NF9	Recreational	950 m (950 m APC-VS3)
NF10	Recreational	1.3 kilometres (Angus Place pit top)
NF11	Recreational	7.3 kilometres (APC-VS3)



LEGEND

- Project Application Area
- Existing Dewatering Facility
- Village
- Town
- Recreational Receptor
- Residential Receptor
- Proposed Ventilation Facility
- Existing Ventilation Facility

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F048 APC Rev 0
SCALE	1:110,000

Figure 2.6: Sensitive Receptor Locations

0 1 2 3 4 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 48

A4

2.6 Soils and Geology

2.6.1 Soils and Land Capability

Reference within the SLR Soil and Land Capability Assessment (2013) to the Soil Landscapes of the Wallerawang (1:100,000) series shows that thirteen principal landscape units overlie the Project Application Area. These are listed in **Table 2.4**, together with their agricultural limitation ratings in terms of grazing or cultivation potential, and associated soil type. The major soil orders present are Tenosols covering 9,060 ha (86.8%) of the Project Applications Area and which represent the Hassans Walls, Warragamba, Wollangambe, Medlow Bath, Newnes Plateau and Long Swamp Soil Landscape units. Other minor soil orders include Kandosols covering 588 ha (5.3%), Kurosols covering 335 ha (3.2%) and Rudosols covering 412 ha (3.9%).

The major soil types within the proposed surface infrastructure areas are Tenosols. Other minor soil types include Kandosols and Rudosols.

Table 2.4: Soil Landscape Units and Soil Types

Soil Landscape Unit	Soil Name	Agricultural Limitation Rating	
		Grazing	Cultivation
Mount Sinai	Tenosol	Severe	Severe
Deanes Creek	Dermosol	Severe	Severe
Deanes Creek Variant	Kandosol	Severe	Severe
Warragamba	Kandosol	Severe	Severe
Hassan Walls	Tenosol	High – Severe	Severe
Coco	Rudosol	High – Severe	Severe
Long Swamp	Tenosol	Moderate	Severe
Wollangambe	Tenosol	Moderate – High	High
Newnes Plateau	Dermosol	Low	Moderate
Medlow Bath	Kandosol	Low	Moderate
Cullen Bullen	Kandosol	Low	Moderate
Glen Alice	Kandosol	Low	Moderate
Lithgow	Kurosol	Low	Moderate

Soils across the Project Application Area have low inherent fertility and low agricultural potential. Further details on soil landscape and land capability are provided in **Section 10.9**.

2.6.2 Geology and Hydrogeology

2.6.2.1 Generalised Stratigraphy

The Lithgow area is located towards the western edge of the NSW Western Coalfields. The Illawarra Coal Measures are relatively thin in this area with an average thickness of 110 m from the Katoomba to the Lithgow seam at Angus Place. Above the coal measures, the Narrabeen Group is the only member of the Triassic sequence present in the area, having a maximum thickness of 340 m. Depth of cover to the Lithgow seam generally ranges between 350 m and 420 m, hence, the upper Narrabeen Group will usually comprise the surface strata above future workings.

The sedimentary strata (Illawarra Coal Measures and Narrabeen Group) lies above older Silurian and Devonian Proterozoic rocks of the Lachlan fold belt. The Lithgow coal seam at Angus Place and Springvale is stratigraphically the lowest economic seam with the depth to the older basement strata beneath this seam being shallow, up to 100 m, compared to other parts of the Sydney Basin, which can be many hundreds of metres.

The generalised stratigraphy of the region is presented in **Figure 2.7** and **Table 2.5**.

Table 2.5 Regional Hydrostratigraphic Summary and Hydrogeological Components

	Formation	Groundwater System	Aquifer Unit	Lithology	Hydraulic Properties	Importance
Narrabeen Formation (Triassic)	Burralow Formation	PERCHED	AQ6	Sandstone	Unconfined aquifer overlies YS1 claystone. Siltstone/claystone aquitards direct groundwater laterally into adjacent gullies. Burralow Formation is consistent in the region, up to 100m thick in the south.	Formation within which swamps are formed (NPSS and NPHS). Without the Burralow Formation and the aquitard layers within it, swamp communities would not exist. The thicker the Burralow Formation, the larger and more laterally extensive the swamp.
			SP4	Fine grained sandstone/siltstone/ Aquitard.	Separates AQ6 claystone units (YS4) and AQ5	
		PERCHED	AQ5	Medium to coarse grained sandstones interbedded with sandstone / siltstone / claystone	Siltstone/claystone aquitards direct groundwater laterally into adjacent gullies. Burralow Formation is consistent in the region, up to 100m thick in the south.	
			YS6	Thin semi-permeable claystone layer	Separates AQ5 and AQ4	
	Banks Wall Sandstone	SHALLOW	AQ4	Medium to coarse grained sandstone	Sandstone aquifer, consistent in nature and thickness, averaging 90m thick across the region.	Aquifer that underlies some of the swamp communities . Swamps formed in Banks Wall Sandstone have less access to seepage due to lack of Burralow Formation aquitards and are generally narrower and less extensive than those with Burralow

						Formation substrate .
	Mount York Claystone		SP3	Interbedded claystone and sandstone. Aquiclude	Separates AQ4 and AQ3. Averages 22m thick across the region	Significant regional aquitard that separates the shallow and deep groundwater systems
	Burra – Moko Head Sandstone	DEEP	AQ3	Predominantly sandstone, with several thick claystone bands	Sandstone units with consistent thickness in the region. Lowest stratigraphic unit above the coal measures.	Sandstone unit where A Zone height of fracturing terminates
	Caley Formation			Interbedded siltstone and sandstone		
Illawarra Coal Measures (Permian)	Farmers Creek Formation	DEEP	AQ3	Katoomba seam	Hydraulically connected to the overlying Caley Formation and Burra-Moko Head Sandstone	
			SP2	Sandstone, claystone, siliceous claystone. Aquiclude	Separates AQ3 and AQ2	
	Gap Sandstone	DEEP	AQ2	Sandstone with laminated siltstone		
	State Mine Creek Formation			Coal, mudstone, claystone (Middle River Seam)		
	Watts Sandstone			Sandstone		
	Denman Formation		SP1	Interbedded mudstone / sandstone, claystone, mudstone. Aquitard	Separates AQ2 and AQ1	
	Glen Davis Formation	DEEP	AQ1	Coal, claystone (Lithgow / Lidsdale / Irondale Seams)	Includes the Lithgow / Lidsdale Seam which is hydraulically connected with the Berry Siltstone and Marrangaroo Formations beneath and the Long Swamp Formation and Irondale Coal Seam above	

Non coal-bearing Triassic strata directly overlie the Illawarra Coal Measures. These strata comprise the Narrabeen Group of rocks which have the following sequence of rock formations in descending order:

- Burralow Formation
- Banks Wall Sandstone
- Mount York Claystone
- Burra-Moko Head Sandstone
- Caley Formation

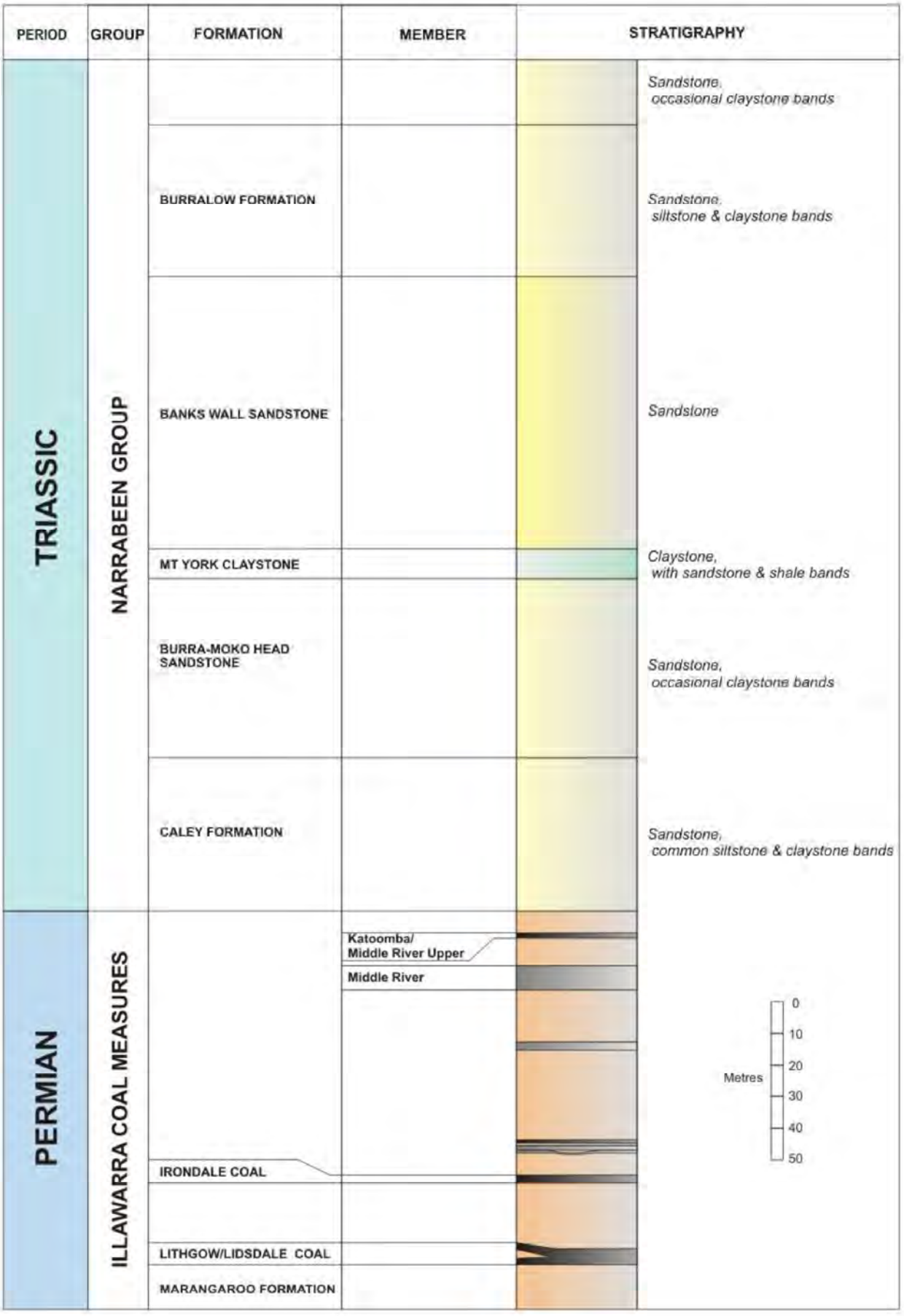
These formations comprise interbedded siltstone, sandstone and conglomeratic sandstone, with occasional claystone bands, as observed in the characteristic cliffs that occur throughout the area. Within the Narrabeen Group of rocks, the Burralow Formation and the Mount York Claystone are key stratigraphic horizons in terms of their hydrogeological significance.

The groundwater system underlying the Project Application Area is relatively complex with multi-layered units of variable permeability resulting in a number of discrete groundwater flow systems.

A number of key hydrostratigraphic units have been identified from past investigations. To further elaborate on the stratigraphic sequence presented in **Figure 2.7**, this comprises a series of horizontally layered and bedded, highly laminated and flat-lying sedimentary layered lithologies, which form a complex layered sequence of less-permeable and more-permeable horizons. Each layered sequence has differing grain size, lithification and strength properties which define their range in permeability.

Geological modelling of these units has enabled the identification of the major aquifers (AQ 1-6), aquicludes and semi-permeable horizons (SP1-4) in the hydrogeological system. The generalised stratigraphy of the area as presented in **Table 2.5**, together with corresponding aquifer designations and less permeable horizons. This hydrostratigraphic sequence has been incorporated into the hydrogeological model developed for the site by Commonwealth Scientific and Industrial Research Organisation (CSIRO, 2013).

The stratigraphic sequence is further subdivided into three groundwater systems, separated by the Burralow Formation (SP4) and the Mount York Claystone (SP3), and in the natural environment, are largely independent of each other. These groundwater systems are denoted as perched, shallow and deep groundwater systems respectively.



DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F089 APC Rev 0
SCALE	NOT TO SCALE

Figure 2.7: Typical Stratigraphy (Palaris 2013a)

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 89

A4

2.6.2.2 Geological Structures

The study of geological structures in the Western Coalfields has been summarised in Palaris (2011) and has been based on aerial photography, remote imaging techniques and correlation of underground mining conditions to surface features dating back to the 1970s.

Landsat photo imagery provides detail on the extent of surface lineaments, based on topography and surface or vegetation trends and their coincidence with poor mining conditions underground. Mapping geological features and mining conditions in the underground workings enables the identification of trends in geological structures. Further research conducted by the CSIRO has contributed to the understanding of significant geological structure zones and lineaments and their link with anomalous mining conditions.

The geological structural fabric of the overlying Permian strata in the Lithgow area is controlled by underlying features in the older, basement strata. Significant analysis, using aeromagnetic data has been used to map the basement structures, which has enabled accurate prediction of the location of structures in both the Permian strata and the surface. This aspect is reflected in the alignment of valleys, cliff lines, distribution of vegetation and weathering patterns.

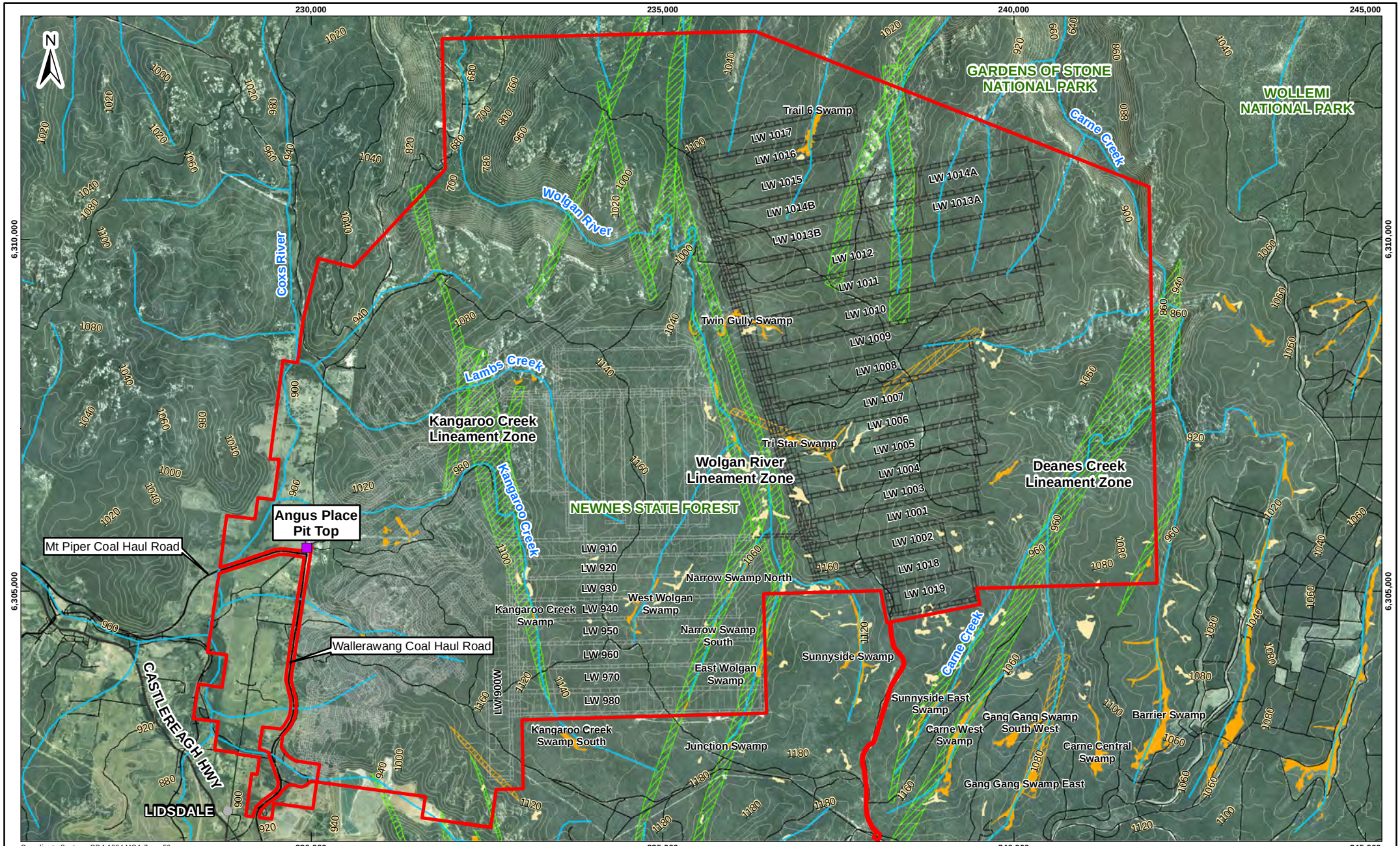
There is a high level of confidence in the knowledge of the geological structure of the region because of the link between topographic alignment on the surface, mapped geological structures in the mine workings and the identification of basement faults using aeromagnetic data; there is a high level of confidence in the knowledge of the geological structure of the region. **Figure 2.8** shows the locations of the major geological structure zones, or lineaments, in the Project Application Area and relative to the proposed mine plan.

The main structural zones are interpreted to be structures that penetrate from the basement strata, through the coal measures, to the surface. Main structural zones include the northeast trending Kangaroo Creek Lineament and the Wolgan River Lineament, which run through some of Angus Place Colliery's eastern longwalls. The importance of the lineaments is shown by their relation to zones of geological structure (faults, shear zones and jointing), and poor mining conditions in various Lithgow area mines. Less prominent zones are noted to occur to Lithgow seam level or within the basement.

Subsidence measurement over the history of mining at Angus Place and Springvale indicated that increased subsidence levels have occurred around major geological structure zones. A thorough review of subsidence data over history of mining at Springvale and Angus Place found that recorded subsidence impacts had occurred only at locations with both major fault zones and incised valleys (with slope gradients > 18°), More detail on subsidence effects around major geological structure zones is included in **Section 8.2**.

Investigations have been conducted into the interactions of mine subsidence with major geological structure zones and their combined effects on groundwater systems. Localised mining related hydrological impacts have been measured at two locations (within East Wolgan Swamp and Kangaroo Creek Swamp). These cases are discussed in detail in **Section 2.6.2.6**. Investigations have concluded that, at both locations, the presence of major fault zones and incised valleys in combination with mine design factors caused localised hydrological impacts. Mine planning and mine design processes used for the Springvale and Angus Place Mine Extension Projects have specifically avoided the combination of factors which caused impacts in historical mining areas. Measurements indicate that there have been no historical cases in similar geological conditions and depths of cover to those in the Project Application Area where the Mount York Claystone aquitard has allowed significant depressurisation of the overlying shallow and perched groundwater systems.

Structure in the Western Coalfield is relatively undeformed, with seams dipping at 1°C to 2°C towards the northeast. Together with the main structural lineaments, dominant structures include north-south trending regional monoclines and associated sub-parallel faults. Igneous intrusions are present in the centre and northeast of the Western Coalfields (**Section 8.2**).



LEGEND

- Project Application Area
- Village
- Rail
- Main Road
- Street / Track
- 20m Contour Interval
- Watercourse
- Shrub Swamp
- Hanging Swamp
- Proposed Workings
- Existing Workings
- Major Geological Structure
- Structure Type 1
- Structure Type 2

DATE	19/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F019 APC Rev 0
SCALE	1:70,000

Figure 2.8: Mine Plan and Major Geological Structure Zones

0 1 2 3 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 19

A4

2.6.2.3 Newnes Plateau Geology Related to Swamp Formation

The geology of the Newnes Plateau is critical in shrub and hanging swamp formation. In order to better understand the near surface stratigraphy of the Newnes Plateau and its relationship to the formation of the shrub and hanging swamps, collectively known as the Temperate Highland Peat Swamps on Sandstone (THPSS), studies were undertaken by Springvale Mine and Angus Place Colliery to:

- create a detailed three dimensional model of significant geological units; and
- identify if there was a correlation between the geological model, surface topography and the position of THPSS.

In recognition of the need to understand the near-surface stratigraphy and aquifer systems, a specific exploration program was conducted in 2011 and 2012 to better define the upper stratigraphy. This program comprised 17 fully cored holes, which were drilled at the larger than normal size, in order to improve core recovery. The holes were drilled from ridges between Newnes Plateau Shrub Swamps in the Project Application Area.

Detailed analysis of the lithology was undertaken and the data was incorporated into the Minex geological database to allow three-dimensional modelling of correlatable stratigraphic units (i.e. stratigraphic units which are present on a regional scale). The analysis of the near surface stratigraphy also involved the use of geophysical data from 84 exploration boreholes (i.e. a total of 101 exploration boreholes). The location of these boreholes can be seen in **Figure 2.12**.

Burralow Formation

A key finding of the study (McHugh, E., 2013, The Geology of the Shrub Swamps within Angus Place / Springvale Collieries) was the identification and detailing of the stratigraphy of the Burralow Formation, which overlies the Banks Wall Sandstone throughout the Project Application Area. Most previous studies of the Angus Place/Springvale area do not typically include the presence of the Burralow Formation, and instead refer to the Banks Wall Sandstone as the uppermost outcropping unit. At a maximum thickness of approximately 110 m, the Burralow Formation within the Project Application Area, is thicker than previously proposed in the general Lithgow region.

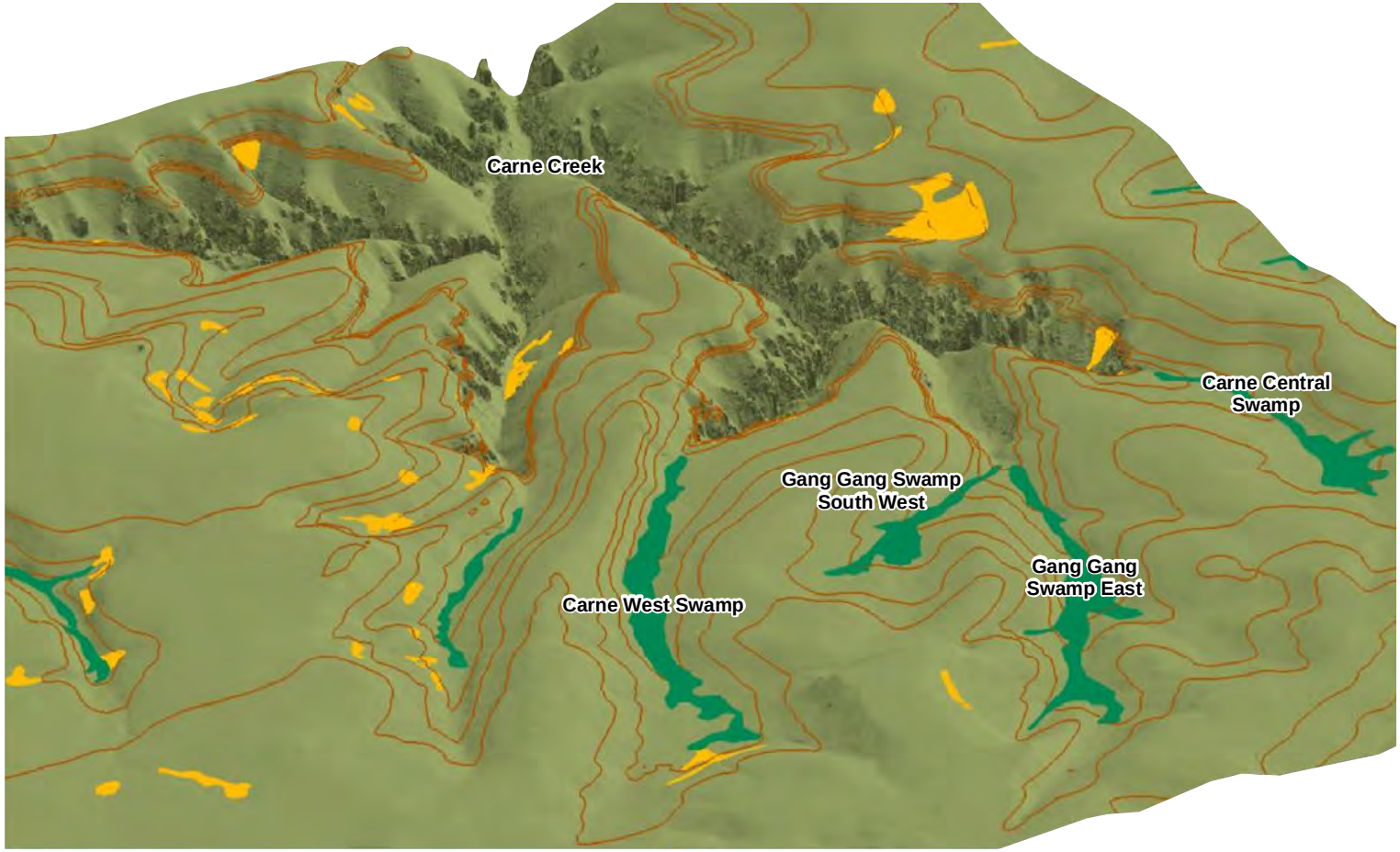
This formation consists of medium to coarse-grained sandstones interbedded with frequent sequences of fine-grained, clay-rich sandstones, siltstones, shales and claystones. The Burralow Formation, in all bores that enabled a detailed analysis to be made, contained multiple fine-grained lithological units.

These fine-grained units can be several metres in thickness and their presence differentiates the Burralow Formation from the underlying Banks Wall Sandstone. Correlation of the finer-grained units within the Burralow Formation identified at least seven units, named YS1 to YS6 (including YS5A).

Several of the claystone horizons, together with clay-rich, fine-to-medium grained sandstones and shales were found to be acting as aquitards, or semi-permeable layers. These aquitards retard the vertical movement of groundwater into underlying strata. Instead, much of the groundwater present within the Burralow Formation is redirected laterally down-dip to discharge points in nearby valleys (valley wall seepage), which creates a permanent water source for the formation and maintenance of the Newnes Plateau Hanging Swamps. In the case of Newnes Plateau Shrub Swamps, precipitation is supplemented by moisture from groundwater sources to form several discharge horizons along the course of the host creek in which a shrub swamp is located.

As can be observed in **Figure 2.9**, by virtue of the regional dip, the aquitard horizons of the Burralow Formation (represented as brown lines) are often present along the sides of ridges and thus follow the gully sides of the host creek below. The presence of aquitards at these locations leads to the occurrence of valley wall seepage which is an important source of moisture for the shrub swamps in the upper reaches of both Carne Creek and the Wolgan River. Valley wall seepage together with direct in-gully input of groundwater via aquitards permits continuity of hydration for the THPSS during periods of drought.

McHugh (2013) concluded that the presence of the Burralow Formation is essential to the formation and persistence of both hanging and shrub swamps.



LEGEND

- Burralow Isopatch
- Hanging Swamp
- Shrub Swamp

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F078 APC Rev 0
SCALE	NOT TO SCALE

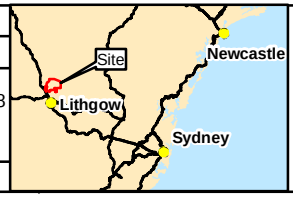


Figure 2.9: View of Carne Creek Shrub Swamps from 3D Geology Model

PLOTFILE No.

Centennial Coal
Angus Place

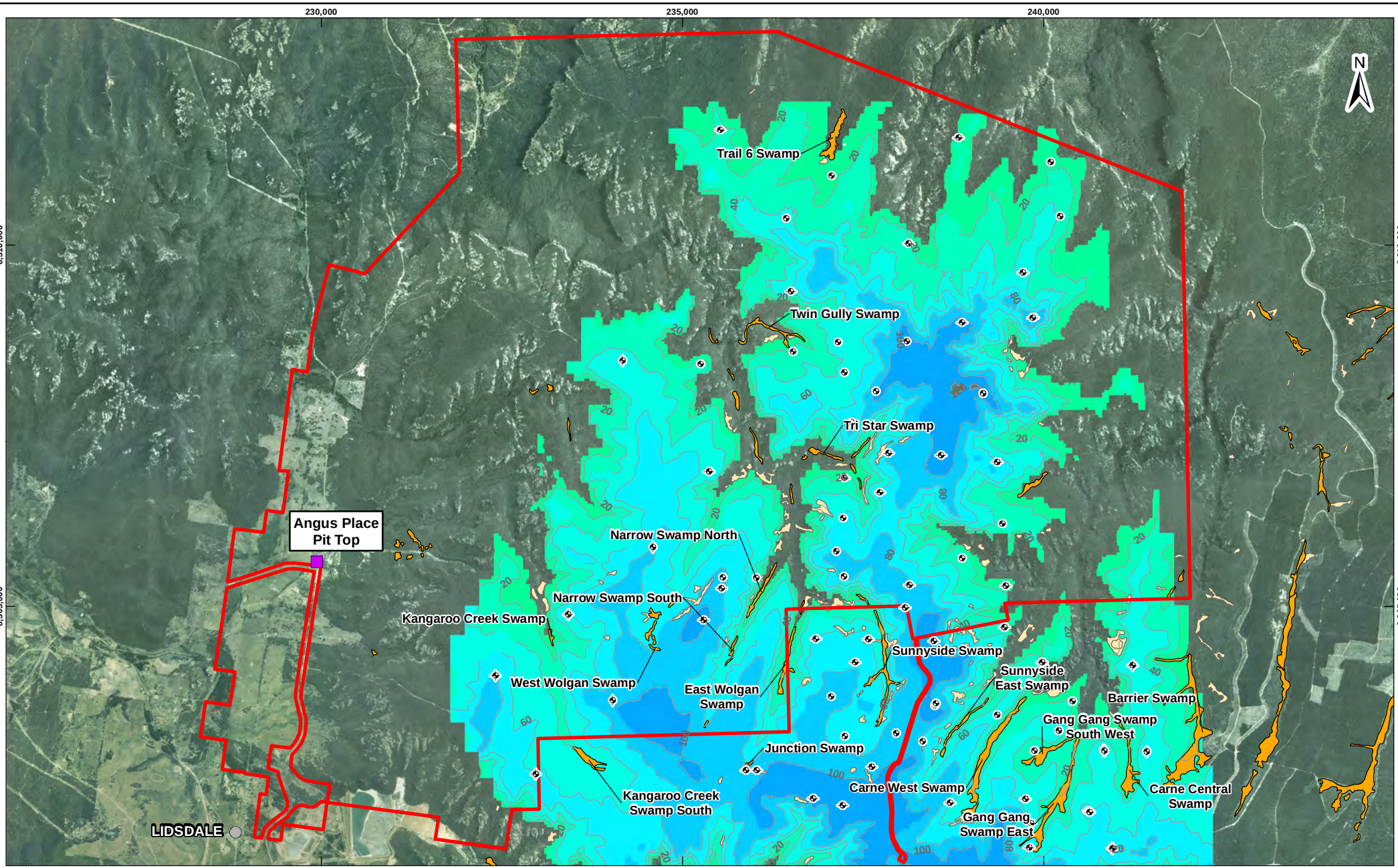
DRG No. 78

A4

Figure 2.10 is an isopach drawing of the Burralow Formation, which shows maximum thicknesses of approximately 110 m, principally in the northeast of Angus Place and the southeastern extent of Springvale Mine at the headwaters of East Wolgan, Sunnyside, Sunnyside East, Carne West, and Gang Gang Shrub Swamps. The extensive ridge system in the Springvale lease, where the Burralow Formation is at its thickest, provides both a substantial precipitation recharge zone plus an array of aquitards to promote groundwater retention in the streams which flow from this watershed area. It is for this reason that shrub swamps in the southeast of the Springvale Project Application Area are, in general, wetter and broader than those in the remainder of both leases (including Tri-Star, Twin Gully and Trail Six Swamps in the Angus Place Project Application Area.

In the upper reaches of Burralow-type shrub swamps, there is less opportunity for sequential aquifers to supply seepage, thus the upper reaches are typically periodically waterlogged. In the lower reaches, where the valleys have eroded deeper into the strata and moved lithologically downwards, cumulative seepage from multiple sequential aquifers combines and the lower reaches of these swamps are typically permanently waterlogged.

Recent hydrogeological modelling includes the Burralow Formation (RPS, 2013a; CSIRO, 2013). The presence of these near surface aquitards has been demonstrated to explain measured pre and post mining groundwater levels (which have been calibrated and validated against piezometer data). Data from piezometers and vegetation monitoring indicates that the vertical permeability of claystone layers is not affected by subsidence.



LEGEND

- Project Application Area
- Borehole
- Village
- Watercourse
- Shrub Swamp
- Hanging Swamp

Burralow Formation Thickness: 120, 100, 80, 60, 40, 20, 0

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F076 APC Rev 0
SCALE	1:70,000

Figure 2.10: Burralow Formation Isopach Plan within Angus Place Project Application Area

0 1 2 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 76 | A4

Banks Wall Sandstone

The Banks Wall Sandstone consists almost entirely of medium-to coarse-grained sandstone. It is consistent in nature and thickness across the Project Application Area and the Springvale Project Application Area, averaging 90m in thickness. The Project Application Area does contain shrub swamps which are stratigraphically located solely within the Banks Wall Sandstone. These swamps occur primarily in steep-sided, narrow gullies due to the underlying Banks Wall Sandstone substrate, which is less easily eroded than the lithologies which comprise the overlying Burralow Formation. This can be seen in **Figure 2.11** which allows comparison of the geology and topography of East Wolgan and Narrow Swamps (largely Banks Wall Sandstone substrate) to Sunnyside Swamp (Burralow Formation substrate). Where shrub swamps occur wholly within the Banks Wall Sandstone, they have less access to seepage at discharge points along creek beds due to the absence of aquitard horizons. This restricts the size and breadth of this shrub swamp type. **Figure 2.11** shows that with the exception of shrub swamps in the Wolgan River and other perennial watercourses, the Banks Wall-type shrub swamps are invariably adjacent to subcrops of the lower Burralow Formation aquitard sequence and therefore receive substantial groundwater seepage from these horizons.

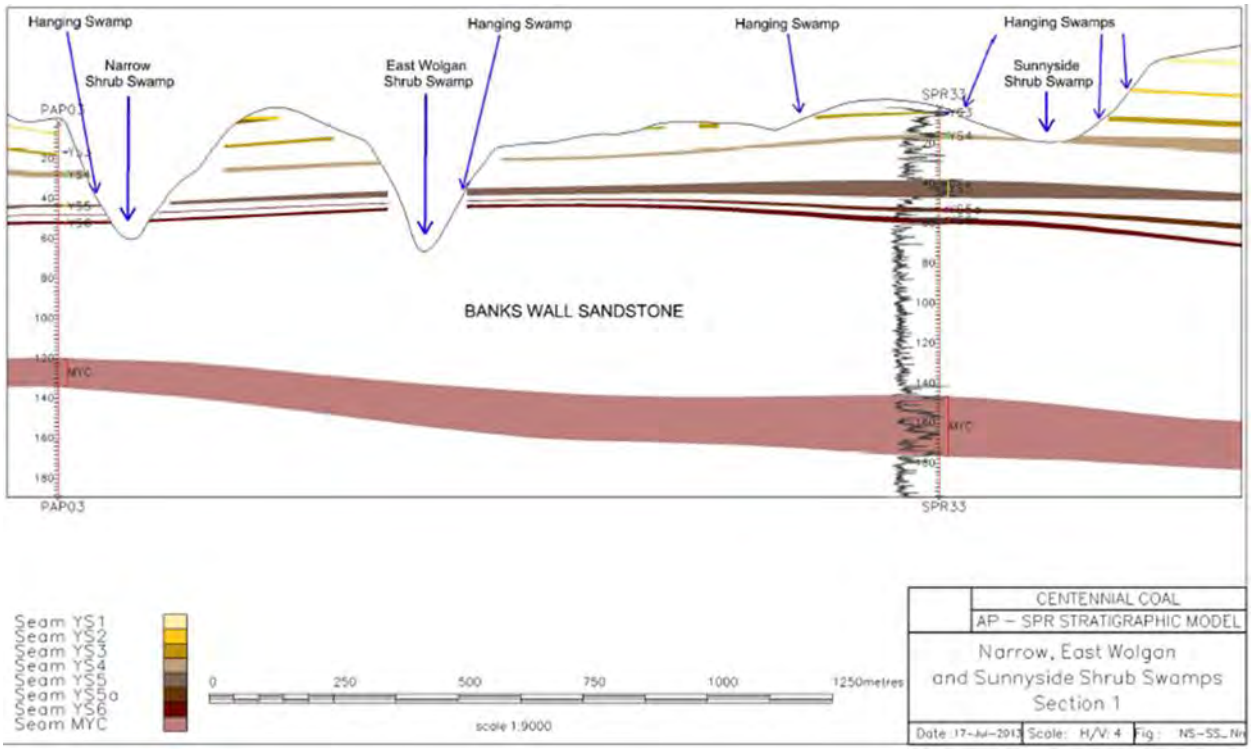
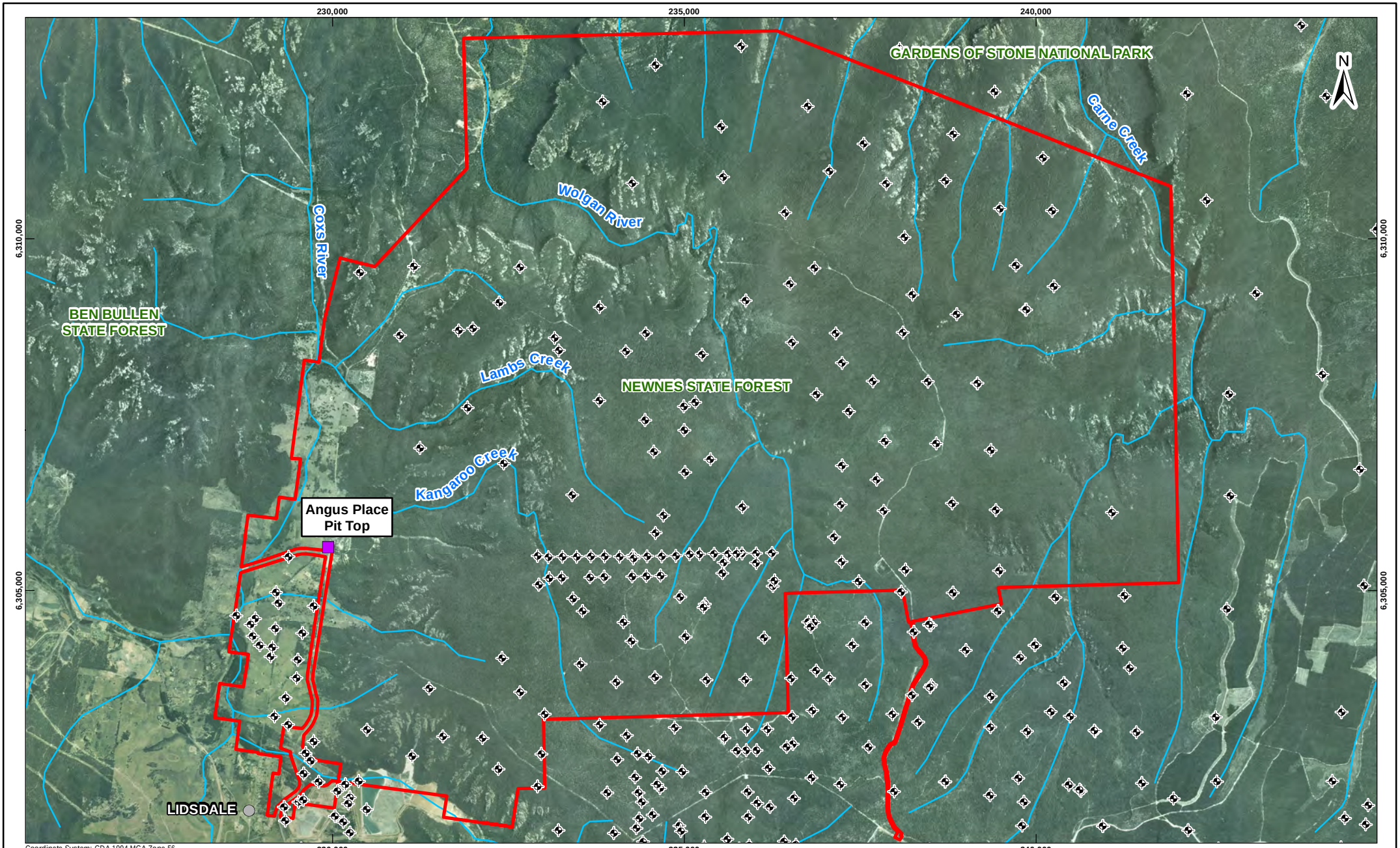


Figure 2.11 Cross Section through Geology and Topography of Narrow Swamp, East Wolgan Swamp and Sunnyside Swamp



LEGEND

- Project Application Area
- Village
- Watercourse
- Exploration Borehole

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F077 APC Rev 0
SCALE	1:70,000

Figure 2.12: Locations of Exploration Boreholes used for Geological Modelling within Project Application Area

0 1 2 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 77

A4

Mount York Claystone

The Mount York Claystone has been found to be an important aquitard in hydrogeological modelling studies. Piezometer data indicates that aquifer interference above the Mount York Claystone as a result of longwall mining is very minor (as discussed in **Section 10.2.**2). As part of recent hydrogeological modelling studies (McHugh, E., 2013), a re-correlation of the data available across the Springvale, Angus Place and Clarence leases was conducted. As a result of this investigation the areal consistency and thickness of the Mount York Claystone unit was established with much greater confidence than in previous studies.

The database of information used to model the thickness and lateral consistency of the Mount York Claystone across the Angus Place, Clarence and Springvale area is based on 501 exploration boreholes (**Figure 2.12**) is illustrated in **Figure 2.13**. The average thickness of the full correlated Mount York Claystone unit is 22 m throughout the lease areas. **Figure 2.13** shows the consistent thickness and lateral extent of the Mount York Claystone in the Springvale, Angus Place and Clarence lease areas. The top of the unit is generally 190 m to 210 m above the Lithgow seam, and has a gradational boundary with the Burra-Moko Sandstone below. The figure also shows the Burralow aquitards YS4 and YS6 (shown as blue and green lines respectively) used in the development of the hydrogeological model (CSIRO, 2013).

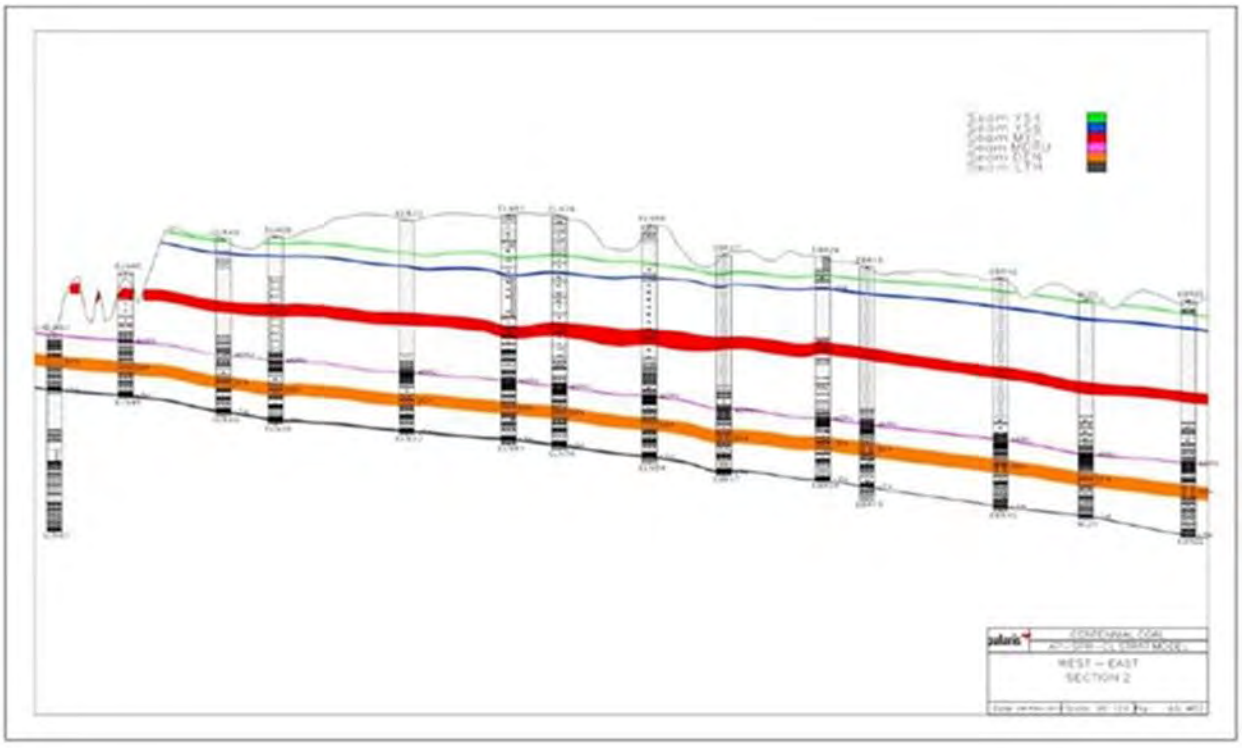


Figure 2.13 WE Cross Section showing consistency of thickness and extent of Mount York Claystone (red) and Burralow Aquitards YS4 & YS6 (blue and green) used in hydrogeological model (CSIRO 2013)

Burra-Moko Sandstone

This formation consists predominantly of sandstone, but also includes several thick claystone bands, which are similar in nature and thickness to the bands within the Mount York Claystone. The Burra-Moko Sandstone is approximately 60 m in thickness and typically lies 130 m to 150 m above the Lithgow Seam. A review of piezometer and extensometer data from Longwalls 411 and 412 (which are immediately to the east of Angus Place 900 Area in the Springvale mining lease) indicates that the height of continuous fracturing above longwall mining areas in the Lithgow Seam is truncated at 132 m height above the workings at the interface of the Burra-Moko Head Sandstone.

2.6.2.4 Major Geological Structure Zones

Major geological structure zones are known to influence the subsidence behaviour of strata overlying mining areas. Studies have been conducted to identify major geological structure zones to enable accurate prediction of subsidence. There is a high level of confidence in predicting the existence of geological structure over the Angus Place Colliery and Springvale Mine mining areas due to the on-going work by CSIRO, SRK Consulting and the mines since the 1970's.

Major geological structure zones are characterised by their size and length and can be projected for many kilometres. The zones:

- Have a strong surface expression that includes linear segments of deep valleys/gorges, however, these zones may also extend beneath surface plateaux (known as lineaments)
- Are recognised as basement faults from aeromagnetic data (in the older geological strata underlying the Lithgow Seam)
- Are recognised in underground workings as faulted or highly fractured ground.

Major geological structure zones identified in the Project Application Area are related to the Wolgan River and Deanes Creek lineaments.

Four types of geological criteria are used to predict geological structures:

- Type 1 - are major geological structural zones that are characterised by their size and length and can be projected for many kilometres.
- Type 2 - similar to Type 1 with evidence of geological structure in the basement and mine workings except that the structure zone and the overlying topographic relief alignment extend only a limited distance – approximately a few kilometres.
- Type 3 - these geological structures are predicted from mapped underground structures (faults, joint zones or stress zones), and basement features. There is no associated surface topographic relief.
- Type 4 - identified basement structures. This geological structure type has no corresponding structures recognised in mine workings nor is it associated with surface relief. This type of structure prediction is the most common and is regarded as benign with respect to mining.

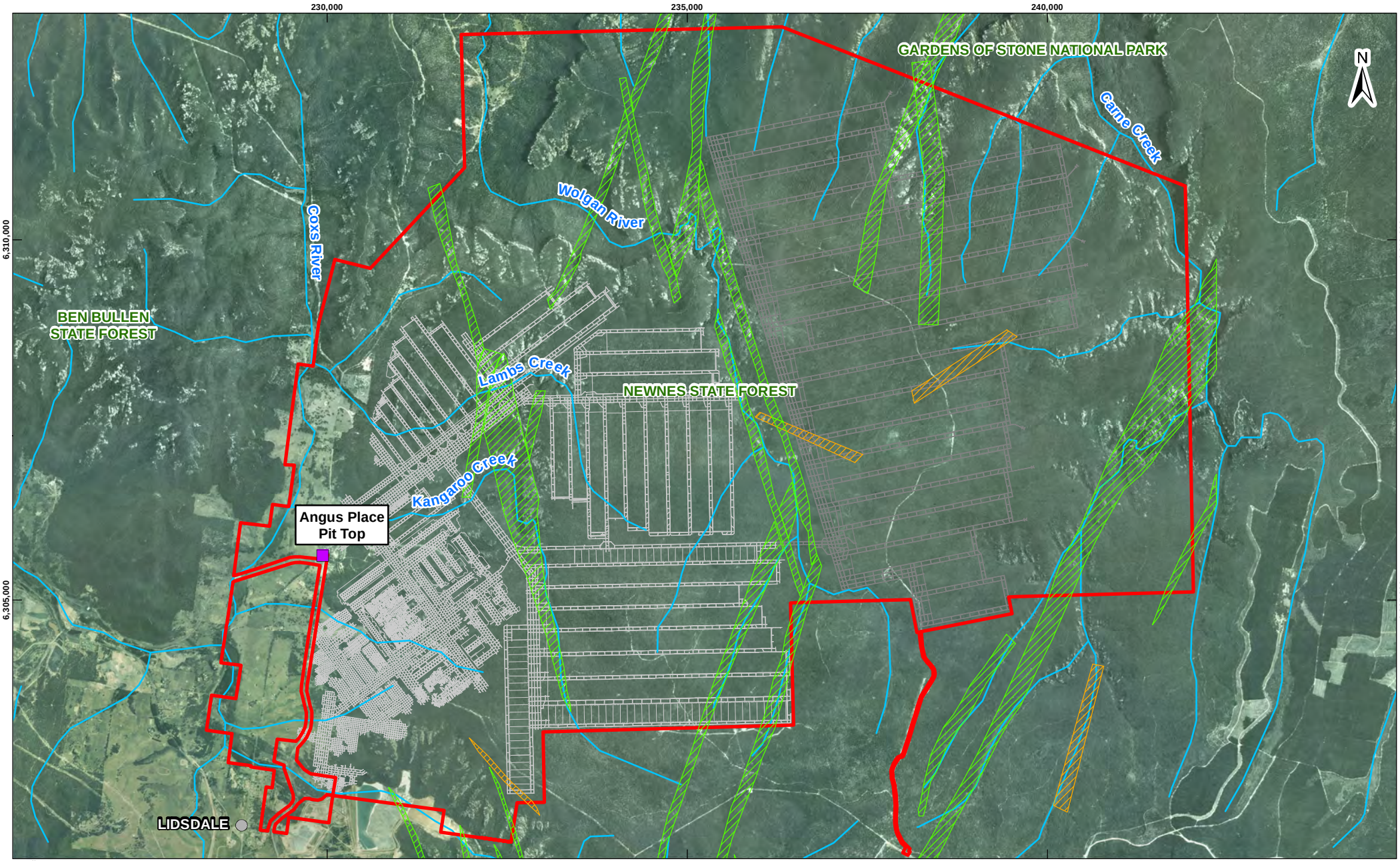
Three Type 1 structure zones are recognised in the Angus Place Colliery and Springvale Mine existing workings (Kangaroo Creek lineament, Wolgan River lineament and the Deanes Creek lineament). Whilst each of the four types is also present in the proposed Angus Place Colliery and Springvale Mine mining areas, albeit to limiting influence, the major influencing geological structures are Type 1 structures.

Normal, reverse and strike-slip faulting are associated with the Kangaroo Creek and Wolgan River lineaments. Structures associated with these lineaments are mid angled to sub-vertical (ie dip angles are between 35 and 80 degrees) and are oriented on a NE:SW, N:S and NW:SE strike. Normal and reverse fault throws range between 0.1 m and 1 m typically in the lineament zones, however, the strike-slip faults may have displacements of several metres.

The Deanes Creek lineament consists of normal and reverse faulting, have similar dip angles to Kangaroo Creek and Wolgan River lineaments and is orientated on a NE:SW and N:S strike.

Because of the link between topographic alignment on the surface, mapped geological structures in the mine workings and the identification of basement faults using aeromagnetic data; there is a high level of confidence in the knowledge of the geological structure of the region. **Figure 2.14** shows the locations of the lineaments in the Project Application Area.

More detail on the interactions of major geological structure zones, longwall mining and groundwater systems is presented in **Section 2.6.2.2** and **2.6.6**.



LEGEND

- Project Application Area
- Village
- Watercourse
- Proposed Workings
- Existing Workings

Major Geological Structure

- Structure Type 1
- Structure Type 2

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F079 APC Rev 0
SCALE	1:70,000

Figure 2.14: Major Geological Structure Zones Identified in the Project Application Area

0 1 2 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 79

A4

2.6.2.5 Hydrogeology

The hydrogeology in the Springvale and Angus Place Colliery region was investigated by CSIRO between 2004 and 2008 and is described in ACARP reports C14033 and C18016.

The most recent and detailed groundwater and aquifer modelling was conducted by CSIRO and RPS between 2011 and 2013. This modelling is based on the latest groundwater and geological data, which has been significantly improved since the initial CSIRO reports were published. The geological model includes data from 501 exploration boreholes. The groundwater model includes data from 142 piezometers in 31 boreholes over a period of up to 10 years and mine water inflow data which has been recorded over a period of 20 years.

Groundwater modelling indicates that the Mount York Claystone is the main aquitard in the region. As discussed in **Section 2.6.2.2**, this layer is continuous and thick over the entire region. The key trend is that there is a separation in responses to mining above and below the Mount York Claystone, and there is a lack of propagation of hydrogeological impacts through the Mount York Claystone. Piezometer data indicates that the strata above the Mount York Claystone remains saturated and in a state of equilibrium after mining. Piezometer data shows variable pressure responses indicating aquifer depressurisation below the Mount York Claystone after mining.

The Burralow Formation and the Mount York Claystone are key to the hydrogeological regime of the area and swamp formation. Both of these units are characterised by the presence of impermeable claystone/shale bands, and provide the hydraulic barriers between the perched and shallow groundwater systems and the shallow and deep groundwater systems, respectively. Each of the three groundwater systems (perched, shallow and deep), defined by these stratigraphic units display independent hydraulic behaviours, and are discussed in detail below.

Perched Groundwater System

The perched groundwater system comprise discontinuous, surficial systems, which are generally hydraulically independent of the underlying regional groundwater system. They are located above the regional water table, on a series of low permeability bands, beds and lenses within the Burralow Formation. They are generally limited to topographically elevated areas and are completely reliant on rainfall to sustain them through direct recharge.

Rainfall infiltrates the upper horizons of the Burralow Formation until it is largely prevented from further vertical flow by the lower permeability units that consist of claystone or siltstone lenses. This flow then becomes predominantly horizontal and travels laterally along the lenses before discharging along the valley flanks.

Shallow Groundwater System

The shallow groundwater system is a regional system located in the Banks Wall Sandstone and generally extends to a depth of 90 m below the Burralow Formation (i.e. 90m to 200m below the ground surface). Most groundwater flow is horizontal and it is predominantly recharged by direct infiltration where the aquifer outcrops beneath a weathered section.

The shallow groundwater system is underlain by the Mount York Claystone. This horizon comprises a low permeability layer that restricts infiltration downwards. At an average of 22m thick, the Mount York Claystone acts as a significant regional aquitard isolating the shallow and perched groundwater systems from the deep groundwater system.

Deep Groundwater System

The deep groundwater system is located in the strata underlying the Mount York Claystone and includes the Illawarra Coal Measures which generally lie at a depth of 200m to 500m below the ground surface. Aquifer zones, which occur at depth are typically fractured rock aquifers or jointed coal seams. It is this system which produces the mine water inflows when groundwater in this system is drained into the goaf following coal extraction.

2.6.2.6 Groundwater Response to Longwall Mining

THPSS related groundwater monitoring commenced in 2002 and has been conducted continuously since this time. The monitoring program involved swamp piezometers, shallow aquifer piezometers and multi-level vibrating wire piezometers. The data collected from this monitoring program has been reviewed and analysed by CSIRO, Aurecon, RPS and The University of Queensland, and provided to both the NSW Office of Environment and Heritage and the Federal Department of the Environment for their review.

Swamp Piezometers

There are 36 swamp piezometers installed in Newnes Plateau Shrub Swamps in the Angus Place and Springvale Project Application Areas. Those located in the Project Application Area are shown on **Figure 3.8**.

Piezometers are installed in swamps on the Newnes Plateau in hand augered boreholes to minimise environmental impacts associated with their installation. The boreholes are drilled using the hand auger to a point of "refusal", where it is not possible to continue drilling. This point is often reached at the bedrock at the base of the swamp (although there are examples where dense clays or coarse gravels cause refusal). The peat / soil material excavated from the boreholes are logged in terms of soil type and other installation details, including location, relative level (RL), bore depth, instrument type are recorded. The piezometer instrument is installed at the base of the borehole and thus usually measures the standing water level above the bedrock beneath the swamp (although this depends on whether the borehole refused on bedrock). Hydrographs are prepared based on trending of standing water levels (below the ground surface) over time at the instrument locations. Technically, the flat horizontal lines in the hydrographs do not represent the standing water level, as this may be anywhere below the base of the bore. They are included in the figures in this report to indicate continuity of monitoring at the instrument location. It is important to understand that where the hydrographs show a flat horizontal line trend (which is at variable depths below ground level due to variable depths of the peat / soil profile at different locations within the swamps), the standing water level is at or below the base of the borehole (which generally represents the bedrock of the swamp).

Baseline data from the piezometers indicates that swamp hydrology is variable along individual swamps and standing water levels are typically influenced by rainfall in the upper reaches and by groundwater in the lower reaches.

As discussed above, the shrub swamps in the upper reaches of the Burralow Formation are typically periodically waterlogged. Of the 36 piezometers installed within the Shrub Swamps, 20 display periodically waterlogged behaviour. These swamps are:

- Kangaroo Creek Swamp (upper reaches);
- West Wolgan Swamp;
- Junction Swamp;
- Narrow Swamp;
- East Wolgan Swamp;
- Sunnyside West Swamp;
- Sunnyside East Swamp (upper and middle reaches);
- Carne West Swamp (upper reaches); and
- Tri-Star Swamp (upper and middle reaches).

Of these swamps, Kangaroo Creek Swamp, West Wolgan Swamp, Narrow Swamp, East Wolgan Swamp, Tri-Star Swamp are located in the Angus Place Project Application Area (as shown on **Figure 2.2**).

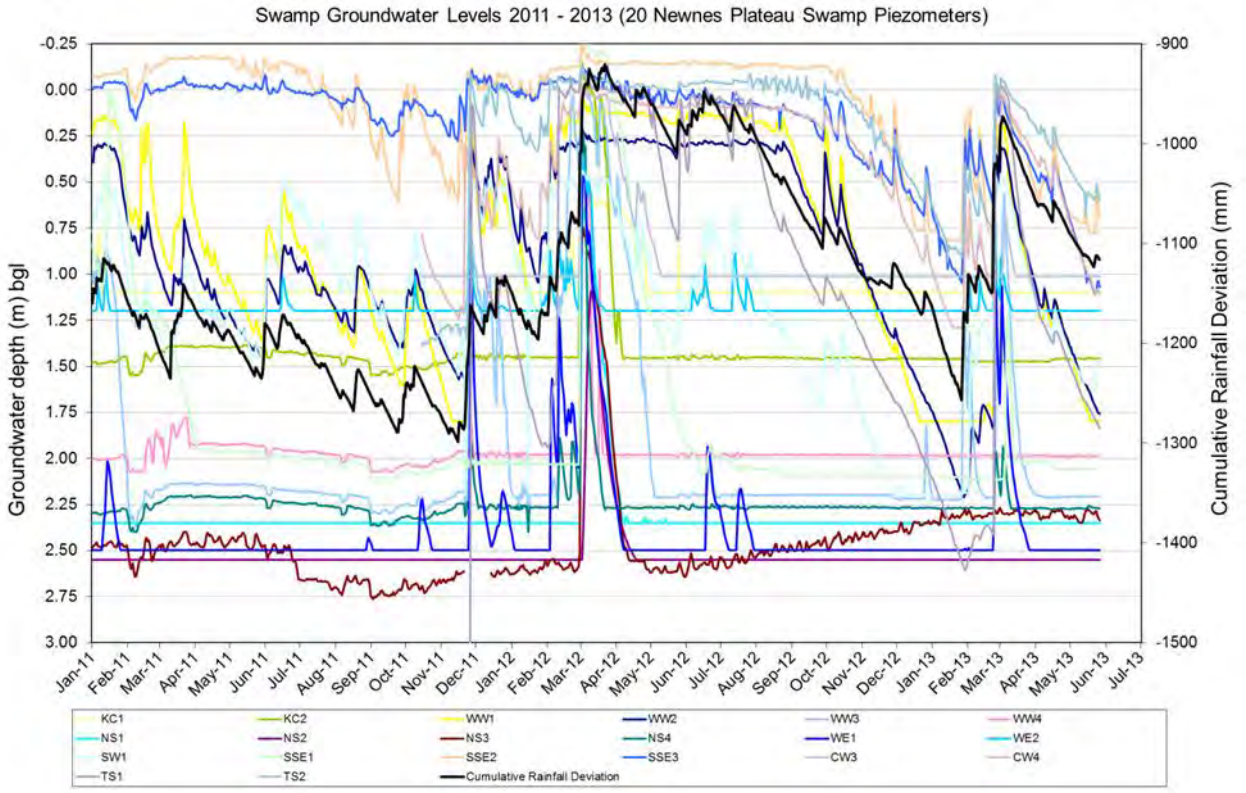


Figure 2.15: Hydrographs of periodically waterlogged swamp piezometers

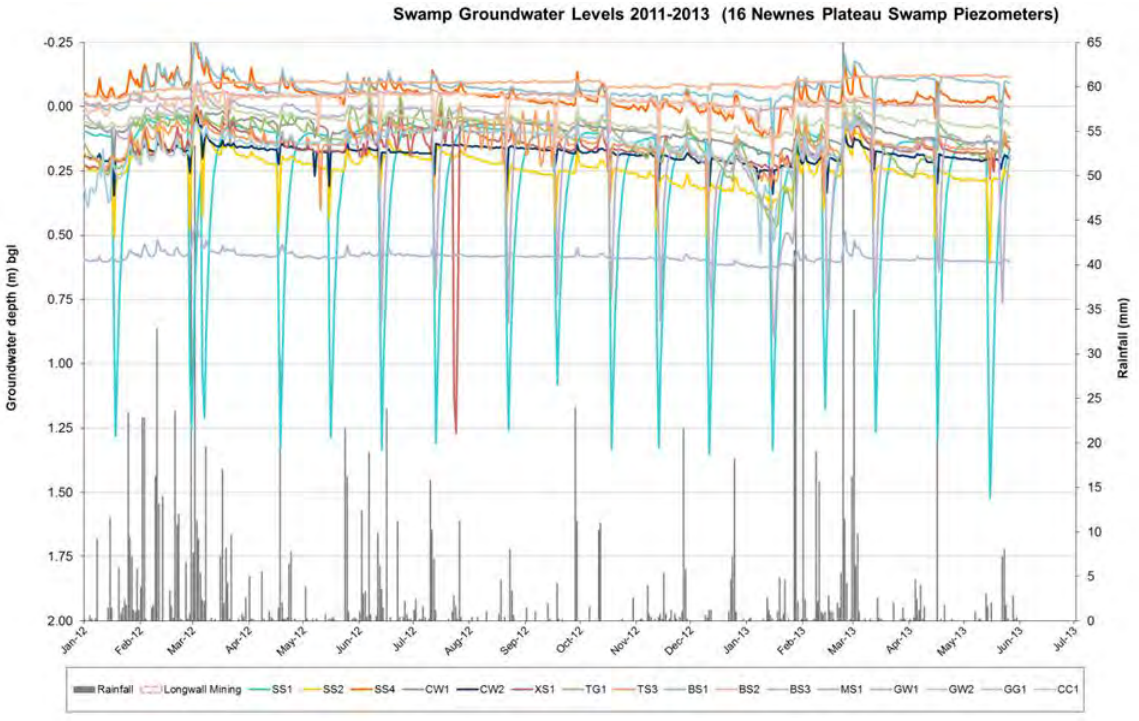


Figure 2.16: Hydrographs of permanently waterlogged swamp piezometers.

Figure 2.15 shows hydrographs of periodically waterlogged Newnes Plateau Shrub Swamp piezometers, noting the highly variable depth of the Standing Water Level and long duration between rainfall induced "spikes" in many of the hydrographs. There is a strong correlation between piezometer response and cumulative rainfall deviation trendline (in black). The Cumulative Rainfall Deviation trend is calculated from difference between the measured rainfall and the long term average rainfall. Where the trend is negative, measured rainfall is less than average and where it is positive measured rainfall is greater than average. The Cumulative Rainfall Deviation trend is calculated from the commencement of groundwater level monitoring activities on the Newnes Plateau in 2002.

In the lower reaches, where valleys have eroded deeper into the strata and seepage from multiple aquifers combines, the swamps are typically permanently waterlogged. **Figure 2.16** shows hydrographs of the 16 permanently waterlogged Newnes Plateau Shrub Swamp piezometers. These swamps are: Sunnyside Swamp, Carne West Swamp (lower reaches), Gang Gang Swamp, Gang Gang West Swamp, Carne Central Swamp, Nine Mile Swamp, Pine Swamp, Marrangaroo Swamp, Twin Gully Swamp, Tri-Star Swamp (lower reaches), Trail Six Swamp.

Note that the distinct negative spikes in the Sunnyside SS1, SS2, Carne West CW2, MarrangarooMS1, Carne Central CC1 swamp hydrographs (at co-incident dates) are indicative of water quality sampling at the piezometer boreholes in several swamps, where samples are drawn from the boreholes for testing purposes. There is a distinctive pattern, where bailing results in immediate drawdown of the hole, followed by recovery of water level in an asymptotic manner over periods varying between a day and two weeks. Water levels completely recover on each occasion before the next sampling episode.

Monitoring of Mining Effects Using Swamp Piezometers

The time when mining occurs under a particular monitoring location is recorded on the hydrograph in order to determine if there is any immediate response to mining activities. It also allows a division between all pre-mining and post-mining data to establish longer term data trends. Where the monitoring site has been directly undermined, a vertical black line indicates the period in which the site was undermined. Where mining has been conducted within the angle of draw of the monitoring site, vertical grey lines or shading indicate the period when mining was conducted within the angle of draw.

Sunnyside Swamp

Figure 2.17 shows that mining has been conducted within the angle of draw of Sunnyside Swamp.

Figure 2.18 shows hydrographs of the five Sunnyside Swamp piezometers. They are generally classified as permanently waterlogged (although SS1 and SS2 water levels dropped in response to the drought of 2006 and SS3 water levels dropped in response to dry periods in 2010 and 2013). There is generally not a strong correlation between piezometer response and cumulative rainfall deviation trendline (in black).

The grey shaded areas of the graph indicate where mining was conducted within the angle of draw of the monitoring site, The hydrographs from the five Sunnyside Swamp piezometers clearly show that there has been no impact to standing water levels in this permanently waterlogged swamp as a result of longwall mining within the angle of draw.

Note that the distinct negative spikes in the SS1, SS2 hydrographs (at co-incident dates) in **Figure 2.18** (and **Figure 2.16**) are indicative of water quality sampling at the piezometer boreholes in several swamps, where samples are drawn from the boreholes for testing purposes. There is a distinctive pattern, where bailing results in immediate drawdown of the hole, followed by recovery of water level in an asymptotic manner over periods varying between a day and two weeks. Water levels completely recover on each occasion before the next sampling episode.

Surface water flow rates from Sunnyside Swamp before, during and after mining within the angle of draw were compared with those from Carne West Swamp (unaffected by mining) and trends were found to be very similar (as shown in **Figure 2.18**). The data clearly shows that there has been no impact to surface water flows in Sunnyside Swamp as a result of longwall mining within the angle of draw.

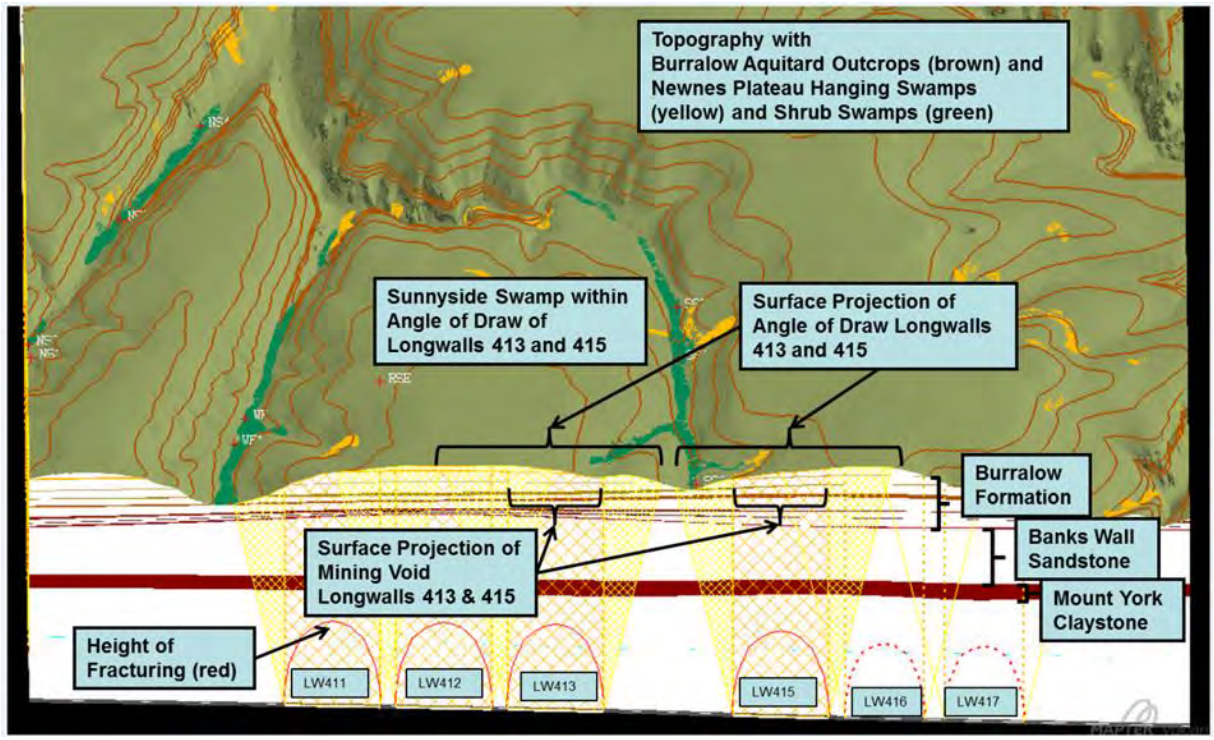


Figure 2.17 Mining Within Angle of Draw of Sunnyside Swamp

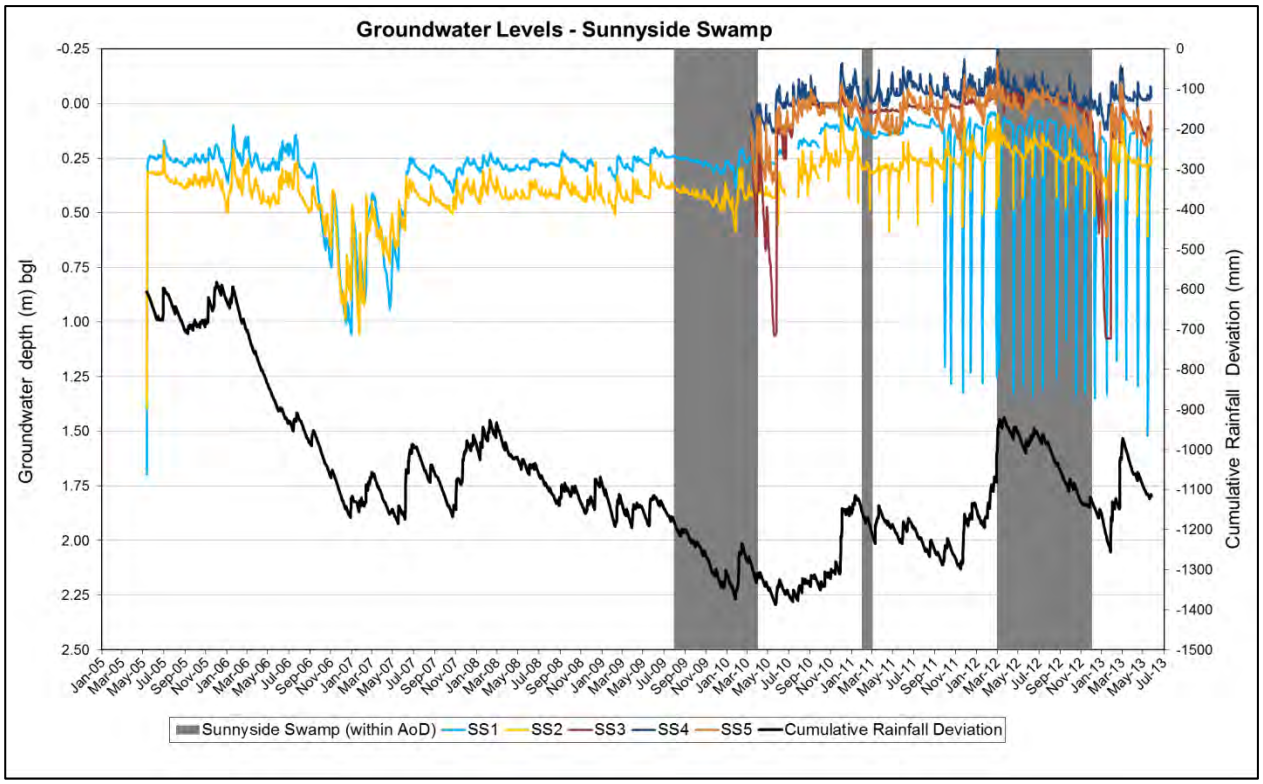


Figure 2.18:Hydrographs of Sunnyside Swamp piezometers

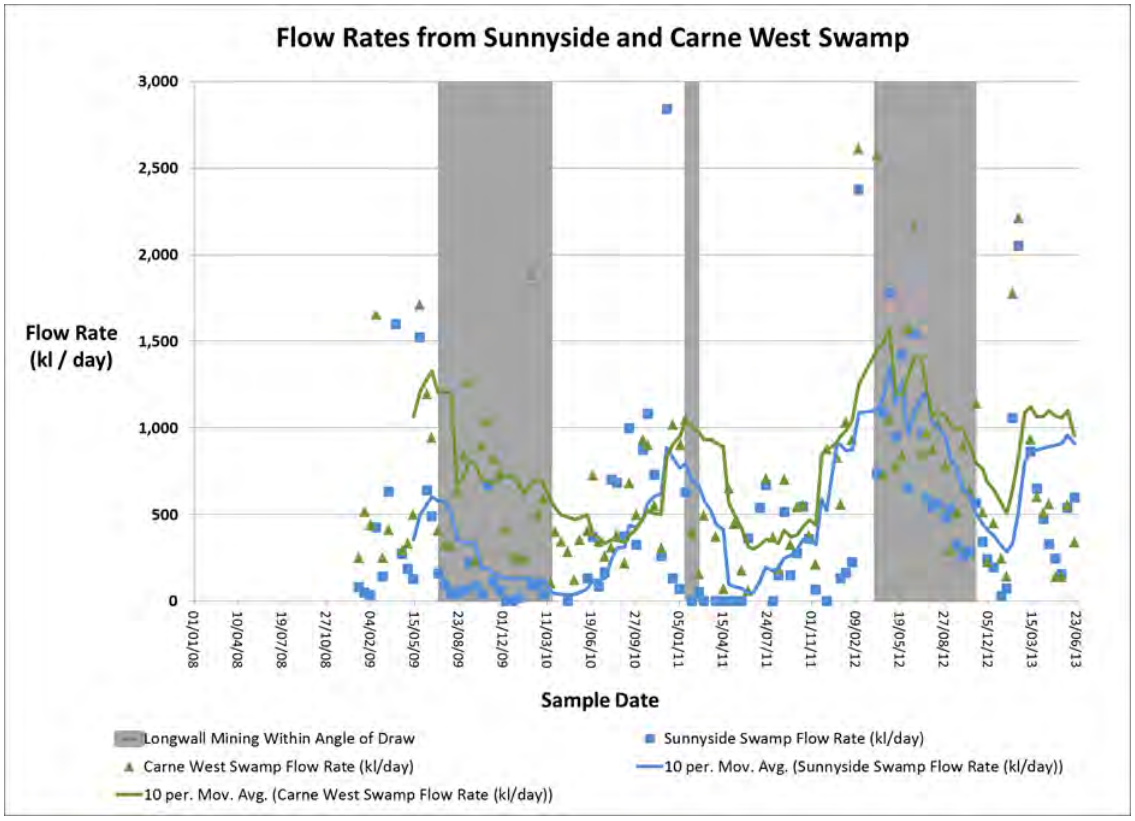


Figure 2.19: Surface Water Flows from Sunnyside and Carne West Swamps

Longwall Mining Under Newnes Plateau Shrub Swamps

Monitoring of swamp piezometers located in the following shrub swamps have not detected changes to swamp hydrology in response to mining related activities:

- Junction Swamp
- West Wolgan Swamp
- Sunnyside West Swamp
- Sunnyside Swamp

Changes to swamp hydrology have been detected in three swamps (Narrow Swamp, East Wolgan Swamp and Kangaroo Creek Swamp) in response to mining related activities.

This section provides a case study on an example of a swamp where long term hydrology has not been affected, and two swamps affected by mining related activities.

Junction Swamp Case Study

Figure 2.20 shows hydrographs of the swamp piezometers installed at Junction Swamp (indicated by the red, blue and green trendlines) together with the time of longwall mining beneath the piezometers (indicated by the vertical black lines) and the Cumulative Rainfall Deviation which is indicated by the black trendline. Note that the swamp was undermined directly by two adjacent longwalls (LW408 in May 2003 and LW409 in April 2004) and the timing is reflected by the vertical black lines. There is a very strong correlation between the trendlines of standing water levels beneath the swamp and the Cumulative Rainfall Deviation trendline for all swamp piezometers over the eleven years of monitoring at this location. This data indicated that the swamp is periodically waterlogged (standing water levels respond to rainfall). The data also indicates that

there have been no significant impacts to swamp hydrology in response to longwall mining (standing water levels are similar to pre-mining levels).

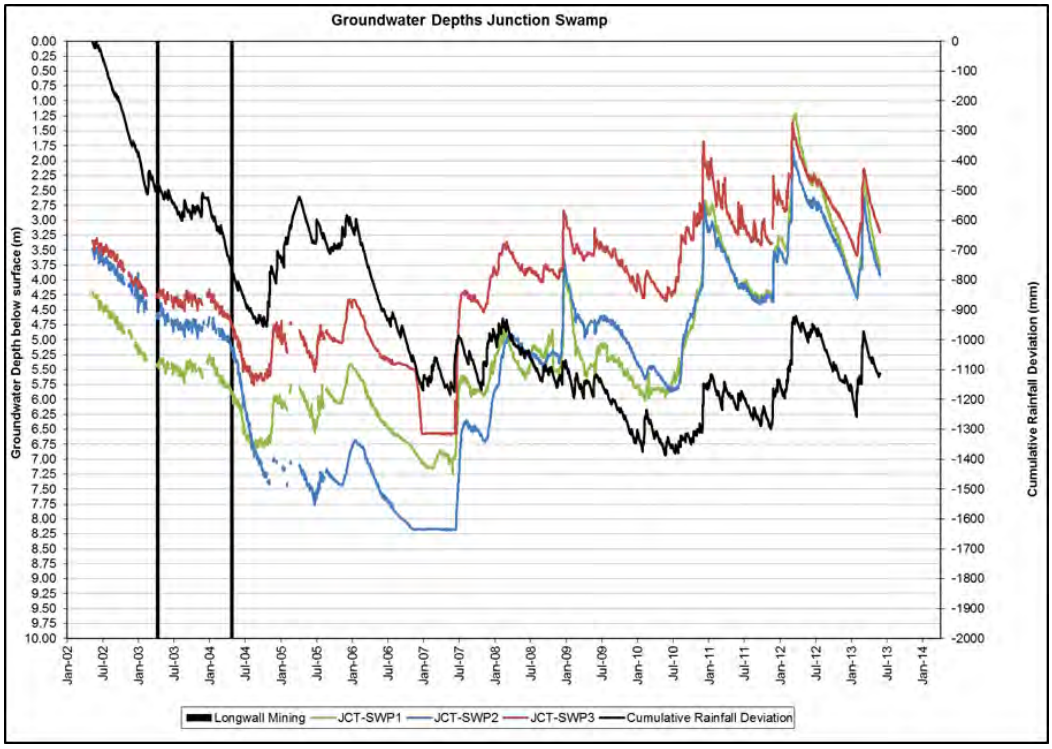


Figure 2.20: Hydrographs of Swamp Piezometers at Junction Swamp with timing of longwall mining beneath the piezometers and Cumulative Rainfall Deviation

East Wolgan Swamp Case Study

Based on previous investigations conducted and recent studies, there are a number of changes to East Wolgan Swamp which have resulted from mining related activities (mine water discharge and mine subsidence), which can be seen in **Photograph 2.7**. The individual photos were taken between the cavity location and approximately 200 m upstream. The impacts are summarised below:

- dieback of vegetation (along path of mine water flows);
- changes to swamp soil water chemistry (changes due to EC (800 µS/cm -1,000 µS/cm) and high pH (8-9) of mine water flows);
- changes in swamp hydrology (wetting / drying cycles due to mine water discharge);
- erosion (along path of mine water flows);
- elevated sediment loads (along path of mine water flows);
- slumping of peat due to erosion of sub-surface sediments (two locations); and
- cavity beneath swamp (where loss of mine water discharge occurred).

Photograph 2.7: Impacts to East Wolgan Swamp from Mining Related Activities

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Piezometers at both Narrow Swamp and East Wolgan Swamp indicated that changes to swamp hydrology were specifically related to the release of mine water discharge into the swamps at licensed discharge points on the Newnes Plateau between 1997 and 2006.

Figure 2.21 shows hydrographs of East Wolgan Swamp Piezometers WE1 and WE2 showing the timing of mine water discharge and longwall mining as well as the Cumulative Rainfall Deviation trend. Following the cessation of mine water discharges, the hydrograph trends can be seen to be strongly influenced by rainfall.

Figure 2.21 also shows the periods (in excess of two years) during which pre-mining data for WE1 piezometer was not influenced by mine water discharge, which may be used to characterise the pre-mining hydrology of East Wolgan Swamp. It is important to note that at both piezometer locations, the data shows that the standing water level was at or below the WE1 piezometer instrument (indicated by the flat horizontal line in the hydrograph trend) for most of the periods not influenced by mine water discharge. The Standing Water levels rise in response to rainfall events which are in excess of the long term average trends and fall in response to less than average rainfall trends. The responses are typically immediate and of short duration, indicated by the "spikes" in the hydrograph trends. When the data recorded during mine water discharged is removed, the same trend can be seen in the pre-mining baseline data. Based on this baseline data it is concluded that East Wolgan Swamp was a periodically waterlogged swamp before commencement of mining activities

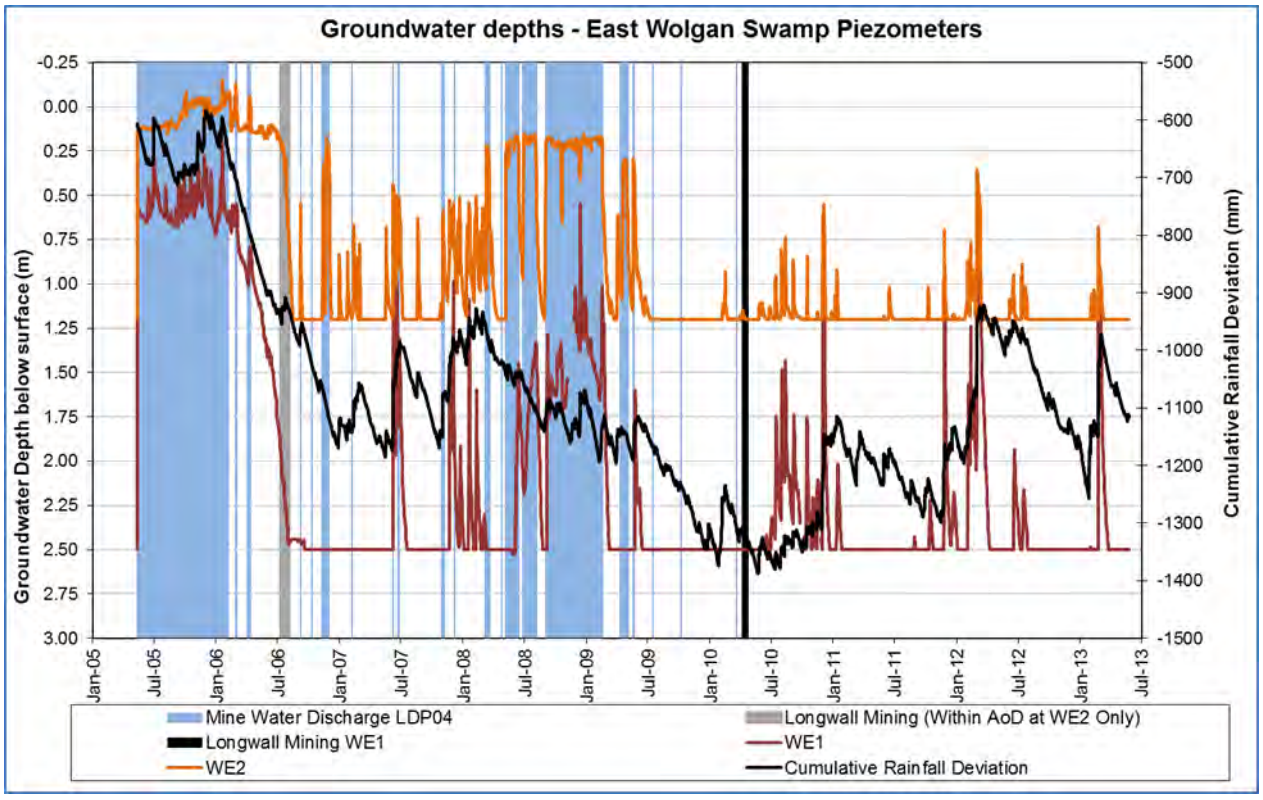

Figure 2.21 Hydrographs of East Wolgan Swamp Piezometers WE1 and WE2 showing the timing of mine water discharge and longwall mining as well as the cumulative rainfall deviation trend.

A detailed investigation, spanning several years, was undertaken to identify the causal factors that lead to these effects. The results of these investigations concluded that the primary cause of impacts to East Wolgan Swamp was mine water discharge. Mine water was discharged into this swamp via licensed discharge points LDP004 and LDP005 on Newnes Plateau between 1997 and 2006 (as shown on **Figure 2.22**). The sustained mine water discharges changed the swamp hydrology and vegetation community from periodically waterlogged to a permanently waterlogged. When mine water discharge was initially removed in 2006, the resultant drying of the swamp caused a major impact to swamp vegetation.

Between May 2008 and March 2009 emergency mine water discharge was released at up to 12Ml/day into East Wolgan Swamp. Centennial Coal ceased discharging into East Wolgan and Narrow Swamps in April 2010.

There are no records of vegetation composition in East Wolgan Swamp between 1997 and 2006 (i.e. prior to mine water discharge and following commencement of mine water discharge), so it is not possible to ascertain changes in response to introduction of mine water discharge. The high proportion of sedges (an amphibious species under the Wetland Plant Functional Groups (WPFG) classification) around the mine water discharge flow path (**Photograph 2.9**) in the EW01 flora monitoring quadrat is consistent with permanent waterlogging, as is their dieback in response to removal of the continuous water source (mine water discharge). It is not consistent with a periodically waterlogged swamp (which is the baseline hydrological classification of East Wolgan Swamp), where amphibious species are less abundant.

There is evidence that rapid change to vegetation communities in response to changed hydrology can occur. **Photograph 2.8** shows photos of Braeside Swamp remediation between October 2007 and April 2009. The changes to vegetation composition in response to the changed hydrology caused by introduction of water retention level spreaders are obvious. Weeds were present before remediation. Sedges are the first colonisers (with no seeding or other propagation) and grow rapidly in the period of less than two years.

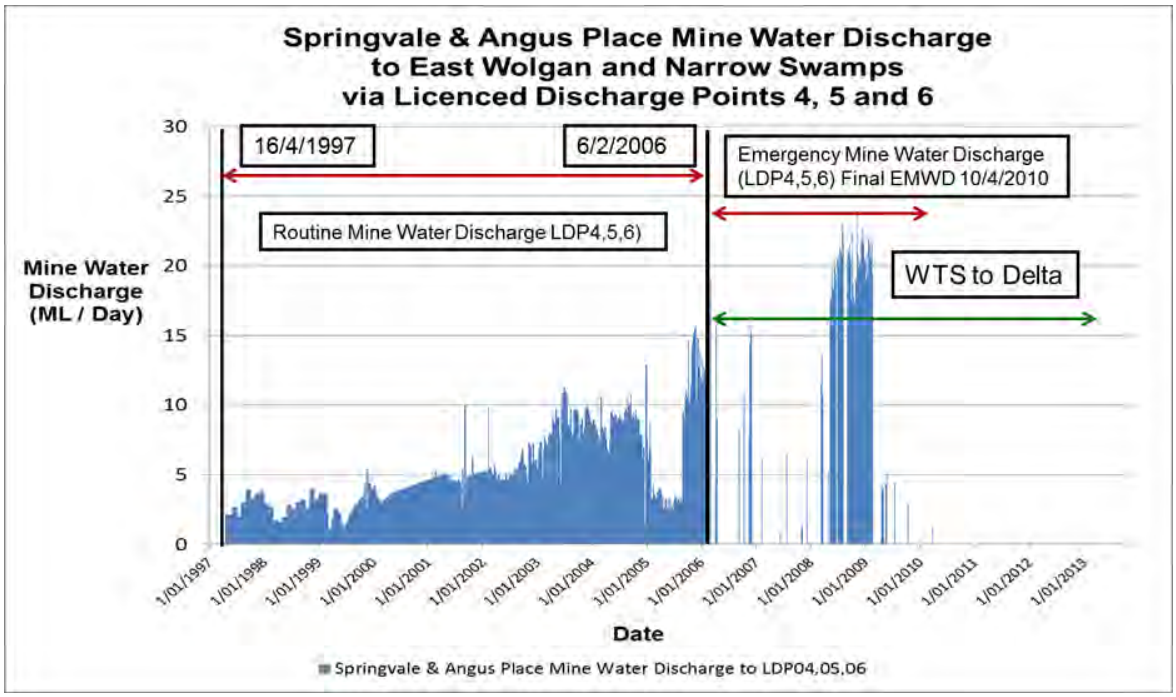

Figure 2.22 Mine Water Discharge to East Wolgan and Narrow Swamps

As a result of extended periods of mine water discharge, the pH values (8-9) measured in soil samples taken from East Wolgan Swamp in 2013 remain significantly higher than those typical for a Newnes Plateau Shrub Swamp (4-6) i.e. alkaline throughout the soil profile, where expected range for an organic rich humus containing horizon is acidic. This appears to have hindered regrowth of swamp vegetation in the mine water discharge flow path.

The images in **Photograph 2.9** were taken between the cavity location and approximately 1 kilometre upstream. They indicate a similar trend of swamp vegetation outside the mine water discharge flow path remaining in healthy condition. The proposed remediation strategy for East Wolgan Swamp includes measures to assist with the “flushing” of contaminants (e.g. sodium bicarbonate) remaining in the peat / soil through retention and spreading of surface water flows from rainfall.

Photograph 2.8: Photos of Braeside Swamp remediation between October 2007 and April 2009

Photograph 2.9: Time Series Photos Taken at EW01 Flora Monitoring Quadrat Between June 2005 and November 2006, showing the impact to vegetation of removal of mine water discharge

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Photograph 2.10: Photos of East Wolgan Swamp in 2013 showing healthy swamp vegetation outside mine water discharge flowpath

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Further investigations identified a number of co-incident causal factors, which, when combined with mine water discharge, could result in similar impacts in other swamps. These factors are detailed in **Table 2.6** along with the current management response. These combined factors are not evident for any swamps within the Project Application Area. Centennial's key management responses were as follows:

- Development of subcritical long-wall panel design was implemented in 2011 (detailed in **Section 8.3.3**).
- Cessation of mine water discharge into East Wolgan and Narrow Swamps in April 2010.

Table 2.6 Causal Factors leading to impacts to East Wolgan Swamp

Causal Factors	Springvale Coal Management Response
Mine water discharge	Cease mine water discharge to Newnes Plateau (including proposed underground water storage for future emergency mine water discharges). NB No Newnes Plateau discharges since April 2010.
Intersection of major geological fault structures	Major geological structure zones identified through detailed topographic, geological and geophysical analysis, The relationship between mine subsidence, geological faulting and groundwater response is well understood from historical monitoring data(based on piezometers, extensometers, subsidence monitoring (terrestrial and LIDAR), exploration borehole data). This understanding is used in the mine planning and design process to ensure that combinations of risk factors do not occur in future mining areas in the Project Application Area
Orientation of longwall panels sub-parallel to major structures	Angle of orientation increased for future swamps e.g increase to 24^{o} for Carne West and 51^{o} for Sunnyside East.
Steepness and depth valley containing swamps	Surface topography is well understood from Digital Terrain Model. Analysis of topographic and subsidence data identified no measured impacts at slope angles <18° (see **Section 8.2.1** of this EIS).
In situ stress direction and magnitude	Horizontal stress orientation mapped through exploration borehole geophysical testing / analysis. Horizontal stress magnitude measured through installation of instrumentation in surface to seam boreholes and in the roof at seam level.
Critical width longwall panel design	Future longwalls in the vicinity of swamps are based on Subcritical panel design.
Location and orientation of geological structure adjacent to the permanent barrier pillar	Future Mine workings designed to avoid alignment of major geological structure zones sub-parallel with edge of permanent barrier pillar subject to multiple panel subsidence effects.
Subsidence Interaction of Adjacent Angus Place and Springvale Workings	Springvale and Angus Place future mining areas are not adjacent to each other (separated by over 500m) thus interaction will be avoided.

Height of Fracturing Measured Adjacent to East Wolgan Swamp

Reviews of the extensometer and piezometer data for LW411 and LW412 have identified three distinct zones of sub-surface fracturing that indicate continuous fracturing between strata units (A-Zone), discontinuous fracturing and strata dilation (B-Zone) and a deformed elastic zone (C-Zone). The relationships of these zones to overlying strata are illustrated in **Figure 2.23**

In addition to the measurements of anchor movements in extensometers installed in borehole SPR40, the response of the piezometers in borehole SPR39 to mining effects and Emergency Mine Water Discharges via LDP004 and LDP005 on Newnes Plateau in 2009 have enabled the heights of fracturing zones to be confidently defined.

The measured heights of fracturing for the A-Zone (height of continuous fracturing) and B-Zone (strata dilation) horizons were estimated to be 132 m and 256 m, respectively, above the longwalls. The upper boundary of the A-Zone (height of continuous fracturing) is coincident with the base of Burra-moko Head Sandstone unit, which is approximately 63 m thick.

Strata dilation (B-Zone) has developed a further 124 m above the A-Horizon into the Banks Wall Sandstone or 99 m below the surface above LW411.

Interaction of Major Fault Zones and Groundwater with Subsidence Effects Measured Adjacent to East Wolgan Swamp

Data from piezometers and extensometers and surface water flow monitoring stations located near East Wolgan Swamp was used to determine where mine water discharges which disappeared from the surface in East Wolgan Swamp flowed.

The depth of fault dilation due to interaction with LW411 and LW412 subsidence deformations was able to be determined from the response of the piezometers in borehole SPR39 to mining effects and Emergency Mine Water Discharges in 2009 (refer **Figure 2.24**).

Piezometer data demonstrates the following:

- Water is being stored in the dilated strata and is not draining below the Burra Moko-Head sandstone at greater rates than would normally be expected.
- Groundwater in the Banks Wall and Burra Moko-Head Units (B / C Zones) are connected by a network of jointing, however, compressive strains due to natural arching above panels have controlled the rock mass permeability between dilated bedding partings and limited vertical flows into the A-Zone.
- Surface waters were being stored in the B and C-Zones and then compressed by strata consolidation. The lag time of approximately one week between discharge dates and piezometer response also indicates the pooling of groundwater higher up in the strata has increased the pressure at the piezometers below the point of groundwater entry only.
- At the time of monitoring, the fault was open near the surface and allowed water to surface waters to move deeper into the strata than it normally would have. The piezometers also indicate that fault dilation did not extend to depths greater than 140 m (which is above the Mount York Claystone).
- Increased groundwater pressure will have been dissipated laterally, along the natural iron-stained horizontal fractures within the Banks Wall Sandstone into storage or seepage out to the north into the Wolgan River where the Banks Wall Sandstone outcrops. This can be seen on **Figure 2.24**, where additional water entered the Wolgan River between the Sunnyside Swamp downstream monitoring point and East Wolgan Swamp Downstream Junction with the Wolgan River during periods of mine water discharge, but reduced to near zero levels in the 12 months of monitoring following cessation of discharges.

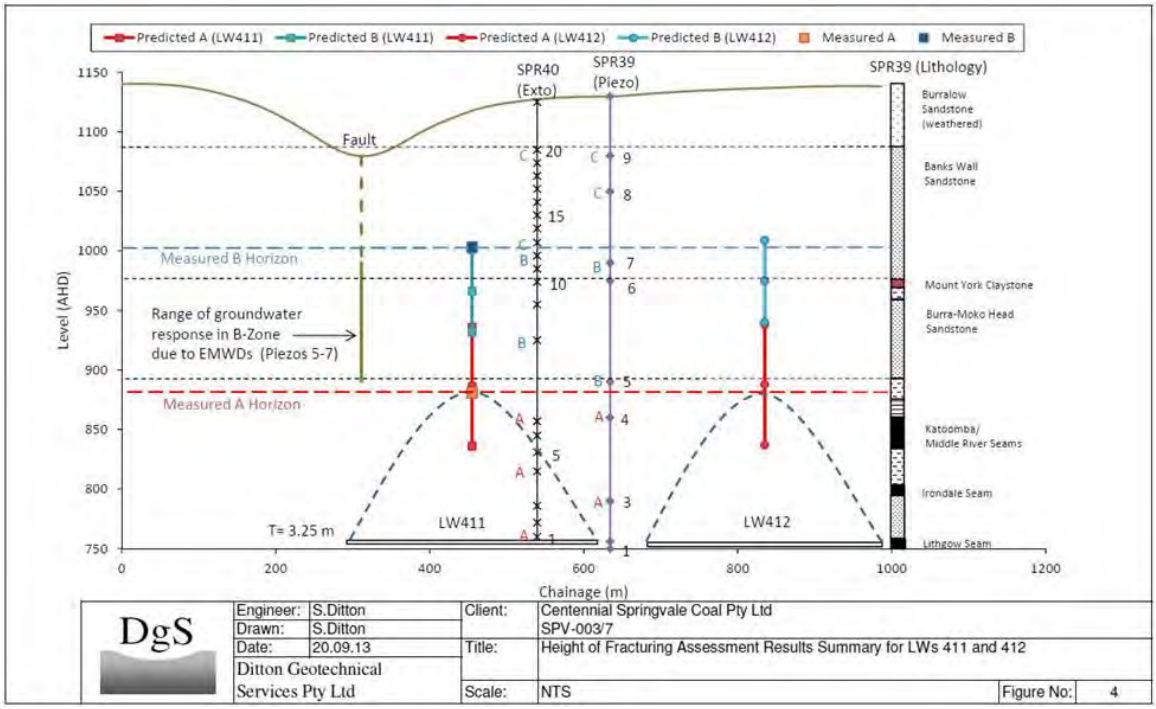


Figure 2.23: Height of Fracturing Relative to Overlying Stratigraphy

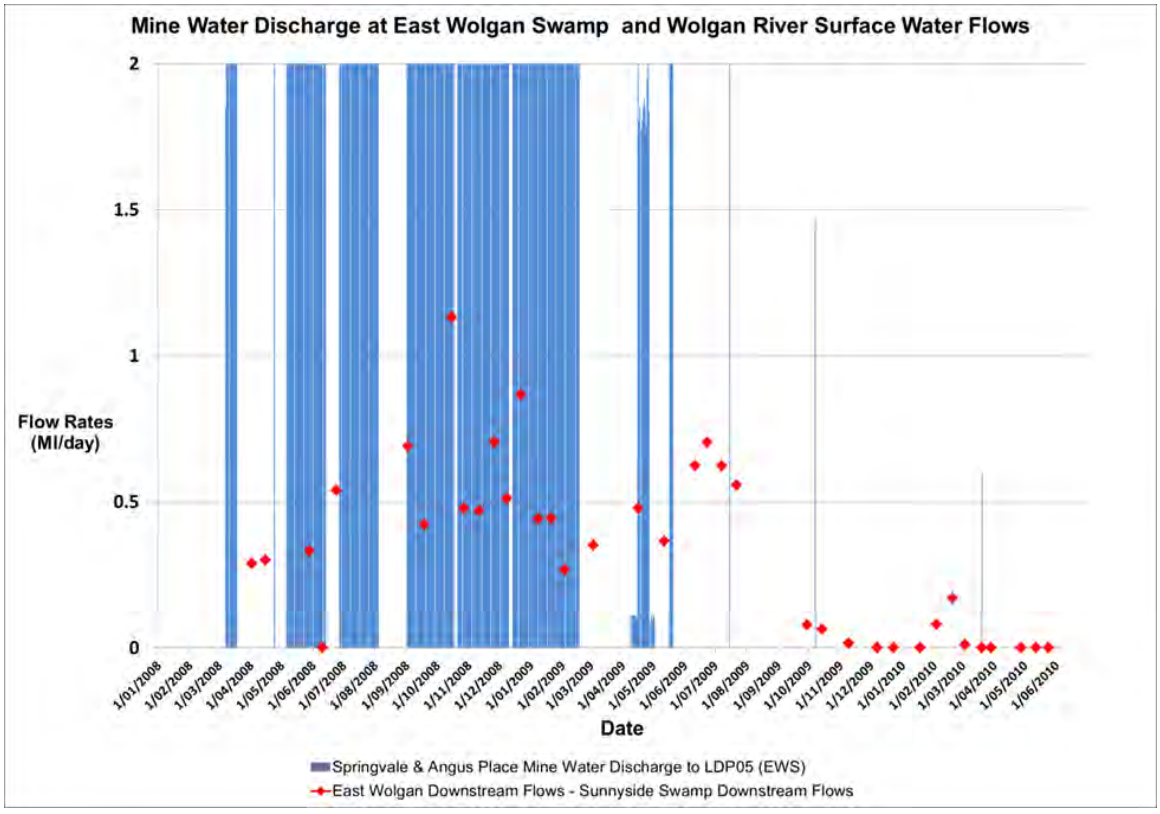
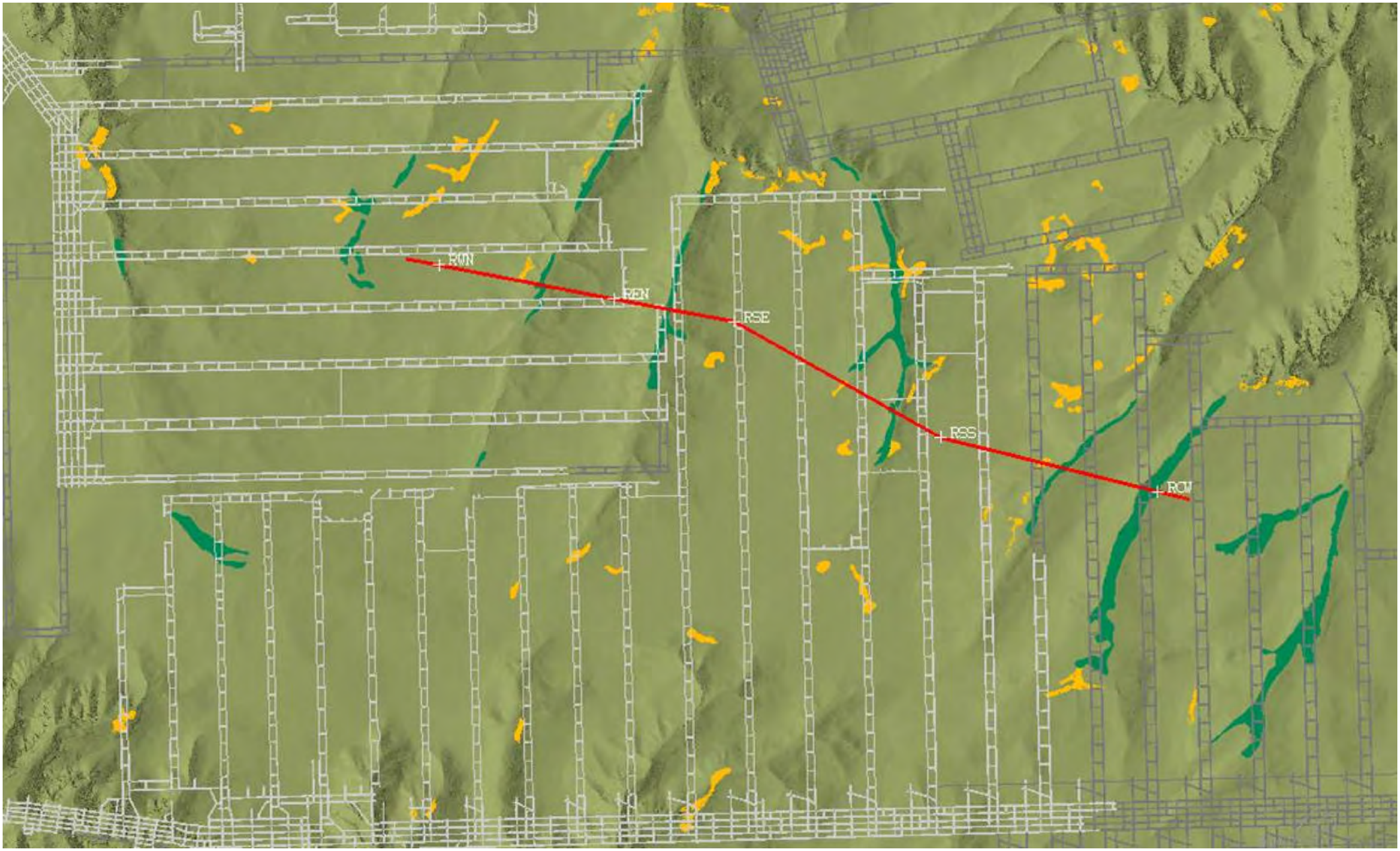


Figure 2.24: Timing of Mine Water Discharges and Difference Between East Wolgan Downstream Flows - Sunnyside Swamp Downstream Flows (East Wolgan Swamp Seepage to Wolgan River)

Water Level Data from Ridges Between Valleys Containing Newnes Plateau Shrub Swamps

Five water level monitoring boreholes were drilled in 2005 from the topographic ridges which lie between the valleys containing the following shrub swamps: West Wolgan Swamp, Narrow Swamp, East Wolgan Swamp, Sunnyside Swamp, Sunnyside East Swamp, Carne West Swamp and Gang Gang Swamp. **Figure 2.25** is a plan showing the location of each of these bores (along the transect marked in red). **Figure 2.26** shows the hydrographs of each of these boreholes since monitoring commenced in December 2005. The vertical lines on the hydrographs show the timing of mining beneath the borehole locations (in colours corresponding to the hydrographs). The black dashed line indicates the measured cumulative rainfall deviation. **Figure 2.27** shows a cross section though the strata between the Lithgow Seam and the surface (along the transect indicated on **Figure 2.25**, including the location of mined longwall panels and the height of connected fracturing above them. The piezometer locations are also shown with the minimum and maximum standing water levels monitored at each location over the life of the monitoring installation. Monitoring of standing water levels at bores installed from the ridges between the shrub swamps indicates that there is very little change in response to mine subsidence and that minor fluctuations correspond with the cumulative rainfall deviation trend. This trend is the same for the ridges on either side of East Wolgan Swamp. The data indicates that the Burralow Formation aquifer system has not been significantly affected by mining over the period since 2005.

The effect of the Mount York Claystone is evident in **Figure 2.27**, where mine design limits the height of connected fracturing to well below this stratigraphic unit. This design ensures no connection through the Mount York Claystone between the mine workings and the shallow groundwater system (even in areas affected by major geological lineament fault zones). The re-design of mine workings at both the Springvale Mine and Angus Place Colliery is more conservative than the historical mine workings in the area of the transect shown in **Figure 2.25**, such that a high level of certainty can be placed on the geological and hydrogeological conditions that lead to swamp related impacts and the risk of future impact to these features is significantly reduced.



LEGEND

- Existing Workings
- Proposed Workings
- Hanging Swamp
- Shrub Swamp

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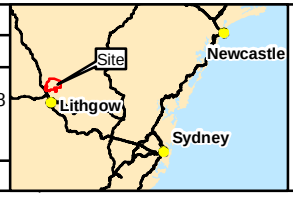

Figure 2.25: Plan View of Transect Through Ridge Piezometers

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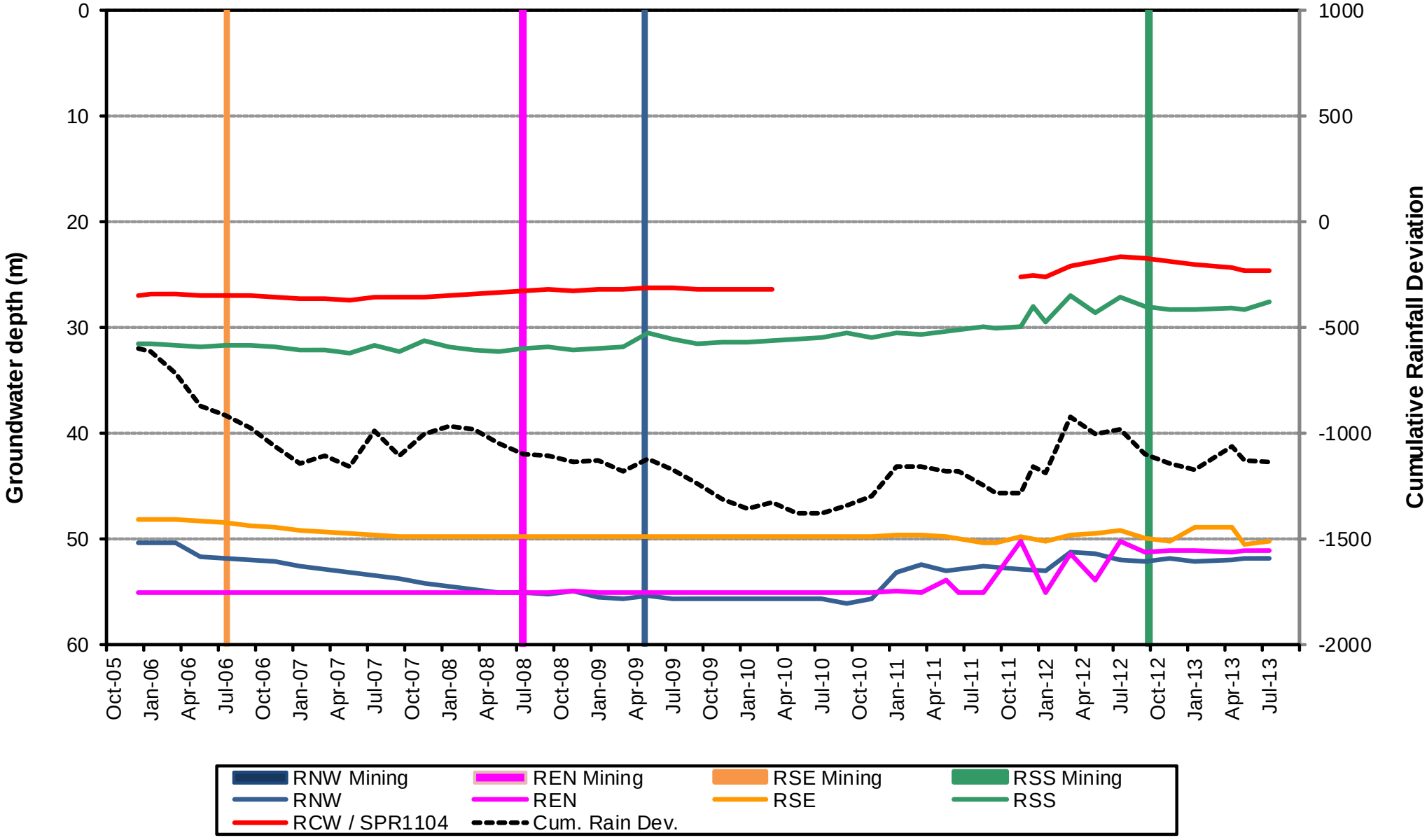

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Figure 2.26: Hydrographs of Ridge Water Level Monitoring Bores Related to Timing of Mining

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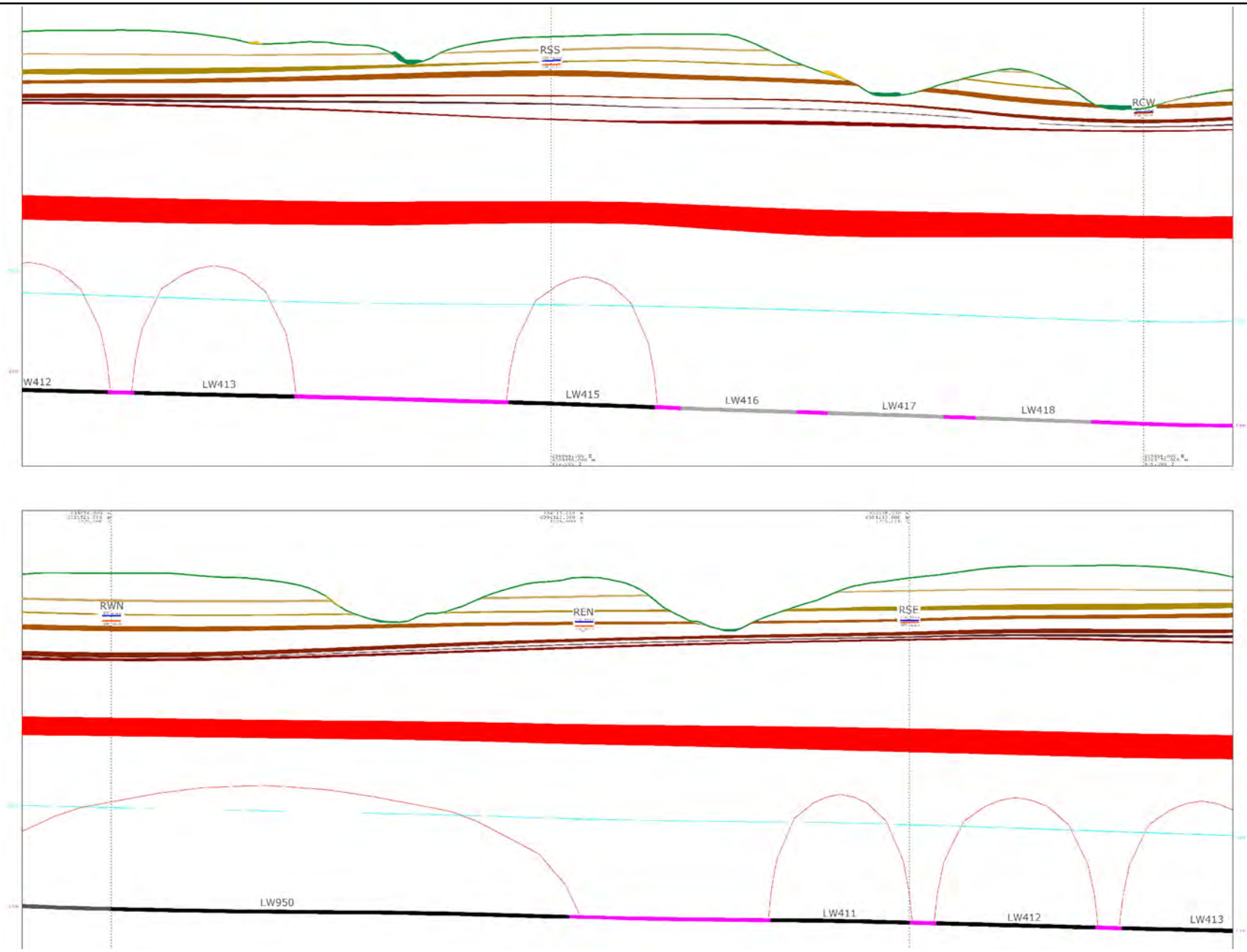

Topography - 2012 Lidar Survey

Burralow Formation
- Aquitards
- YS2
- YS3
- YS4
- YS5
- YS5A
- YS6

- Mount York Claystone
- Katoomba Seam
- Lithgow Seam
- Lithgow Seam - Mined Lonwall Block
- Lithgow Seam - Proposed Longwall Block

Height of Fracturing above Longwall Block
- Hanging Swamps
- Shrub Swamps

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Figure 2.27:
Cross Section Through Narrow Swamp and East Wolgan Swamp showing Topography, Geology, Mining Areas and Related Height of Fracturing

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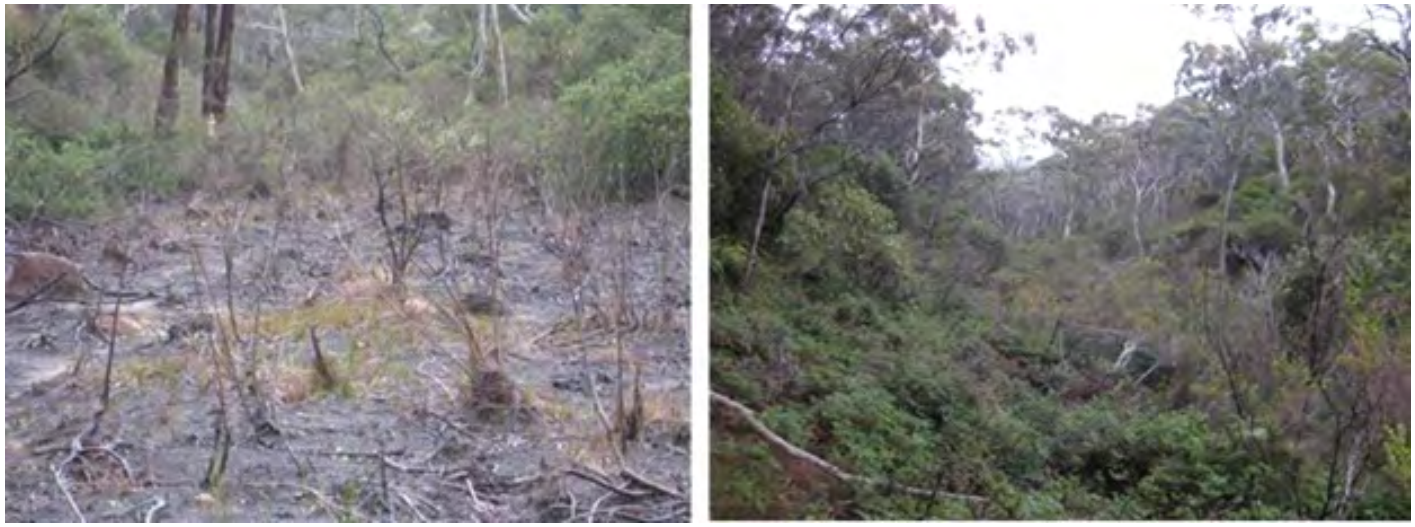
The hydrological impacts of the cavity are summarised below:

- localised impacts to the perched groundwater system associated with the Burralow Formation (no observed anomalous fluctuations in adjacent ridge piezometers).
- at the time of loss of surface water flows, the fault was open near the surface and allowed surface waters to move deeper into the strata than it normally would have. The piezometers indicate that fault dilation did not extend to depths greater than 140 m (which is above the Mount York Claystone).
- lateral dissipation of water in the strata above the Mount York Claystone into aquifer storage or seepage out to the north into the Wolgan River (see **Figure 2.29**).
- no evidence of direct hydraulic connection from surface to mine workings (mine water inflows remained within predictions).
- no evidence of impacts to vegetation downstream of the cavity (see **Photograph 2.11**)).
- evidence of infilling of cracking which caused the cavity through natural sedimentation processes.
- evidence of hydrological recovery of East Wolgan Swamp, with surface water consistently recorded downstream of the cavity since August 2010.



Photograph 2.11: Photos (2013) of East Wolgan Swamp immediately upstream (left) and downstream (right) of the cavity into which surface water flows were lost between 2008 and 2010

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As detailed above and in **Section 8.2**, in the case of East Wolgan Swamp, the combined impacts of long term and then intermittent high flow mine water discharge, incised valleys with steep slopes, major geological structure zones, mine design and mine subsidence caused formation of a cavity which led to the loss of surface water flows between 2008 and 2010. The cracking which caused the cavity subsequently infilled through natural sedimentation processes and surface water flows have been recorded downstream of the cavity since August 2010.

The proposed decrease in longwall panel or void width from 315 m to 260 m for the future longwalls retreating below similar geological fault structures are therefore likely to significantly reduce the potential for surface waters to penetrate deep into the overburden due to the increased compression arching behaviour that will develop above sub-critical longwall panel geometries.

East Wolgan Swamp Rehabilitation

Springvale Coal has applied for approvals from SEWPaC (now DoE) and OEH to enable rehabilitation works on East Wolgan Swamp to be carried out. These applications were made on 16 August 2012. Springvale Coal obtained approval from the former Federal Department of Sustainability, Environment, Water, Populations and Communities on 21 September 2012.

OEH approved the undertaking restoration actions at East Wolgan Swamp and issued a certificate under Section 95 of the Threatened Species Conservation Act 1995 (TSC Act) on 25 November 2013.

Rehabilitation Works

Rehabilitation works at East Wolgan Swamp have commenced in January 2014 and the following activities are being undertaken:

- detailed vegetation mapping (before rehabilitation)
- swamp re-hydration works- construction and strategic placement of coir logs, sandbag and jute mesh weirs (refer **Photograph 2.12**).
- direct seeding - collecting seeds off targeted species already within the swamp and placing in rehabilitation area (refer **Photograph 2.13**).
- brush matting - collecting branches from vegetation in the area adjacent and placing it in the rehabilitation area to encourage and provide cover for new growth (refer **Photograph 2.13**).

Excavation and rehabilitation of the slumping sites will be conducted after the summer thunderstorm season, which has caused high intensity rainfall events over the past several years. These events have caused significant erosion of swamp peat / soil at the slumping sites in East Wolgan Swamp and it is intended to avoid rehabilitation works of these sites during this period.

Photograph 2.12: (2014) East Wolgan Swamp Rehabilitation – Water Level Spreader / Retainer Structures

Photograph 2.13: (2014) East Wolgan Swamp Rehabilitation – Direct Seeding and Brush Matting

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Kangaroo Creek Shrub Swamp Hydrology

Figure 2.28 shows hydrographs of the swamp piezometers installed at Kangaroo Creek Swamp together with the time of longwall mining beneath the piezometers (indicated by the vertical black lines) and the Cumulative Rainfall Deviation which is indicated by the black trendline. The Cumulative Rainfall Deviation trend is calculated from difference between the measured rainfall and the long term average rainfall. Where the trend is negative, measured rainfall is less than average and where it is positive measured rainfall is greater than average. The Cumulative Rainfall Deviation trend is calculated from the commencement of groundwater level monitoring activities on the Newnes Plateau in 2002. Note that there is a very strong correlation between the trendline of standing water level beneath the swamp and the Cumulative Rainfall Deviation trendline for the KC2 piezometer over the eight years of monitoring at this location. This data indicated that the swamp is periodically waterlogged at this location (standing water levels respond to rainfall). The data also indicates that there have been no significant impacts to swamp hydrology in response to longwall mining at KC2.

Groundwater levels at KC1 appear to have been affected by the longwall mining of Angus Place LW940 which was below the lower reaches of the swamp, as there was a sudden reduction in groundwater levels in June 2008, unrelated to rainfall. As shown in **Figure 2.28** measured groundwater levels respond to rainfall events, and standing water levels reach pre-mining levels after significant rainfall events. However, for KC1 measured groundwater levels have yet to completely return to pre-mining levels.

Kangaroo Creek Shrub Swamp is fed by a perennial spring. This spring, which in turn is fed by the aquifer-aquitard systems within the Burralow Formation, was unaffected by mining and the creek remained permanently wet below the spring. This, together with the presence of healthy hanging swamps along the valley walls surrounding Kangaroo Creek Shrub Swamp, indicates that the water supply from the spring and valley wall seepage has not been interrupted by longwall mining and that groundwater inputs to the swamp hydrological system remain intact.

Photographs 2.14, **2.15** and **2.16** illustrate the Burralow Formation aquifer / aquitard system have not been affected by longwall mining evidenced by the Spring, Waterhole and Hanging Swamps surrounding Kangaroo Creek Shrub Swamp. Flora monitoring at Kangaroo Creek Shrub Swamp indicated no trend of decreasing condition and that species abundance is not declining. The available evidence indicates that underground mining has not resulted in any negative effects on Kangaroo Creek Shrub Swamp.

Investigation of mining related impacts at Kangaroo Creek Swamp showed that high levels of differential subsidence movements were measured, including strains (up to 6mm/m tensile and 26mm/m compressive) and tilts (up to 13 mm/m). The reasons for the high levels of differential movement are as follows:

- Mine Design – Longwall Void Width (w) to Depth of Cover (H) ratio of 0.94 to 1.04 (Critical Width). NB These are the highest w/H ratios of any of the longwalls at Angus Place and Springvale.
- Major Geological Structure Zone – Kangaroo Creek is located within the Kangaroo Creek lineament, which has been identified as “Type 1” Geological Structure Zone
- Topography – Valley slope angles >18 degrees
- Location of Swamp near Western end of Longwalls 940 and 950

Investigations have concluded that, Kangaroo Creek Swamp, the presence of major fault zones and incised valleys in combination with mine design factors caused localised hydrological impacts. Mine planning and mine design processes used for the Springvale and Angus Place Mine Extension Projects have specifically avoided the combination of factors which caused impacts in historical mining areas.

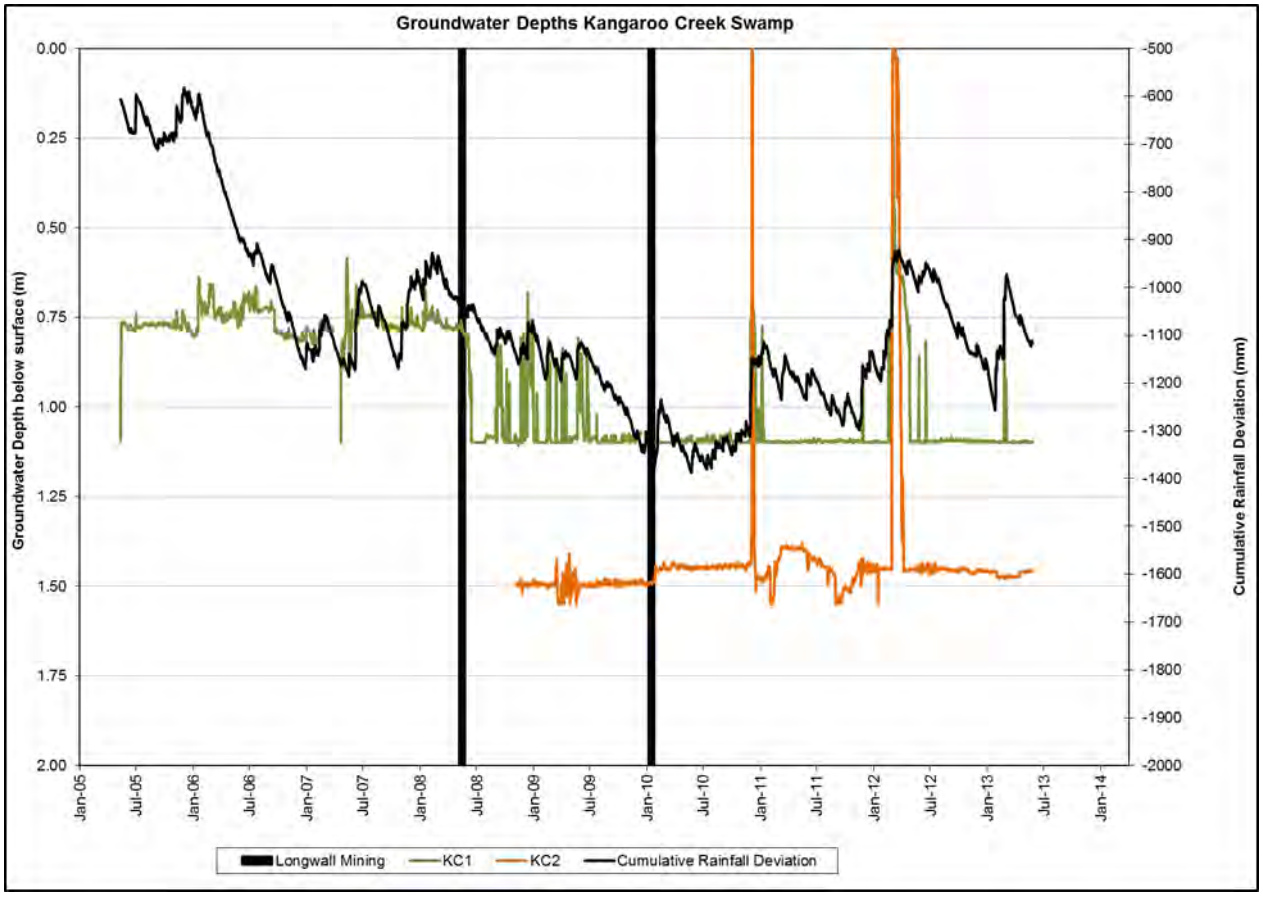

Figure 2.28 Hydrographs of the swamp piezometers installed at Kangaroo Creek Swamp showing timing of longwall mining and Cumulative Rainfall Deviation

Photograph 2.14: Spring at Kangaroo Creek Shrub Swamp

Photograph 2.15: Hanging Swamp above Kangaroo Creek Shrub Swamp

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Photograph 2.16: Waterhole Upstream of Kangaroo Creek Shrub Swamp

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2.6.2.7 Summary of Historical Impacts to Swamps From Mining Related Activities

There are water courses within the Project Application Area which have been exposed to mine-induced subsidence. Longwalls have been extracted directly or partially beneath 13 shrub swamps and 26 hanging swamps. Surface impacts have been observed at five swamps including Kangaroo Creek Swamp, Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp.

These have been investigated and where impacts have been observed, these have been identified as largely the result of mine water discharge.

Mine Water Discharge Impacts to Newnes Plateau Shrub Swamps

Investigations have identified that erosional and flora dieback impacts at Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp and Junction Swamp were caused by changes to swamp hydrology related to mine water discharge and were not related to subsidence. As a result of this finding, future mine dewatering systems have been designed to ensure that discharge of mine water to Newnes Plateau Shrub Swamps is avoided.

Subsidence Effects to Swamp Hydrology

Subsidence effects to aspects of swamp hydrology have been noted at two swamps (Kangaroo Creek Swamp and East Wolgan Swamp). In both of these cases investigations have revealed that mine design was a primary causative factor. The ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical subsidence behaviour range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in areas where sub-critical mine design has been used in the past.

Kangaroo Creek Swamp

Changes to standing water levels as measured by KC1 swamp piezometer were recorded following mining. Swamp hydration from a spring upstream of the swamp and valley wall seepage associated with the Burralow Formation geology has not been affected by longwall mining. Vegetation monitoring at Kangaroo Creek Swamp has not demonstrated changes to the flora community within the swamp.

With the one exception of Kangaroo Creek Swamp, analysis indicates no significant difference in water level variability between swamps that have been undermined and those that have not. As discussed above, mine design changes have now been implemented to prevent any future subsidence impacts to Newnes Plateau Shrub Swamps, as identified at Kangaroo Creek.

East Wolgan Swamp

In the case of East Wolgan Swamp as discussed below, the combined impacts of long term and then intermittent high flow mine water discharge, incised valleys with steep slopes, major geological structure zones, mine design and mine subsidence caused formation of a cavity which led to the loss of surface water flows between 2008 and 2010. The cracking which caused the cavity subsequently infilled through natural sedimentation processes and surface water flows have been recorded downstream of the cavity since August 2010. At East Wolgan Swamp, the following impacts were found to be caused by mine water discharge: East Wolgan Swamp, the following impacts were found to be caused by mine water discharge:

- Dieback of Vegetation (along path of mine water flows)
- Possible changes to swamp Soil/Water Chemistry (changes due to elevated EC (800-1000µS/cm) and high pH (8-9) of mine water flows)
- Changes in Swamp Hydrology (wetting / drying cycles due to mine water discharge)

- Erosion (along path of mine water flows)
- Elevated sediment loads (along path of mine water flows)
- Slumping of peat due to erosion of sub-surface sediments (in two locations)

As a result of these findings, future mine dewatering systems have been designed to ensure that discharge of mine water to Newnes Plateau Shrub Swamps is avoided.

As discussed above, mine design changes have now been implemented to prevent future subsidence impacts to Newnes Plateau Shrub Swamps.

A specific rehabilitation strategy has been prepared to prevent further impacts to East Wolgan Swamp and to assist the recovery of the swamp vegetation community.

This strategy has been approved by DoE and OEH and rehabilitation works are currently being conducted.

2.7 Hydrology

The Project Application Area traverses both the Wolgan River/Carne Creek and Coxs River catchments. The Coxs River Catchment and the Wolgan River Catchment are both under the jurisdiction of the Hawkesbury-Nepean Catchment Management Authority, although the Coxs River is listed within the boundary of the Sydney Drinking Water Catchment under the *State Environmental Planning Policy (Sydney Drinking Water Catchment)*. Spatial details of these surface water catchments and their boundaries are presented in **Figure 2.30**.

Both the Wolgan River and the Coxs Rivers have contributions from watercourse and creeks within the Project Application Area.

Details of the catchments and associated watercourses are summarised in **Table 2.7**.

Table 2.7 Spatial Extent of sub-Catchments

Main Catchment	Sub Catchment	Associated Watercourses	Sub Catchment area (ha)	% sub catchment area within Project boundary (approx.)
Coxs River Catchment	Coxs River	Wangcol Creek, Springvale Creek, Kangaroo Creek, and Lambs Creek	13,026	30
	Marrangaroo Creek	Unnamed watercourses south of Project boundary	5,495	30
	Pipers Flat Creek	Unnamed watercourses south of Project boundary	5, 948	0
Wolgan River Catchment	Wolgan River Western Branch	Wolgan River	8, 526	35
	Wolgan River Eastern Branch	Carne Creek	8,597	35
Colo River Catchment	Nine Mile Creek/ Bungleboori	Nine Mile Creek.	4,839	0

Angus Place Colliery is regulated by the Greater Metropolitan Region Water Sharing Plan established under Section 50 of the *Water Management Act 2000*. It is situated across the boundary of the Sydney Basin Coxs River Groundwater Source and the Sydney Basin Richmond Groundwater Source, which are both regulated with water extraction entitlements of 6,926 ML/yr and 15,923 ML/yr respectively. The Project location in relation to the Water Sharing Plan Region and the groundwater source catchment is shown in **Figure 2.30**.

The Project Application Area lies across the boundary of two River Management Zones, the Wywandy River Management Zone of the Upper Nepean and Upstream Warragamba Water Source, and the Colo River Management Zone of the Hawkesbury and Lower Nepean Water Source. Each of these water sources are situated within the Greater Metropolitan Region Water Sharing Plan.

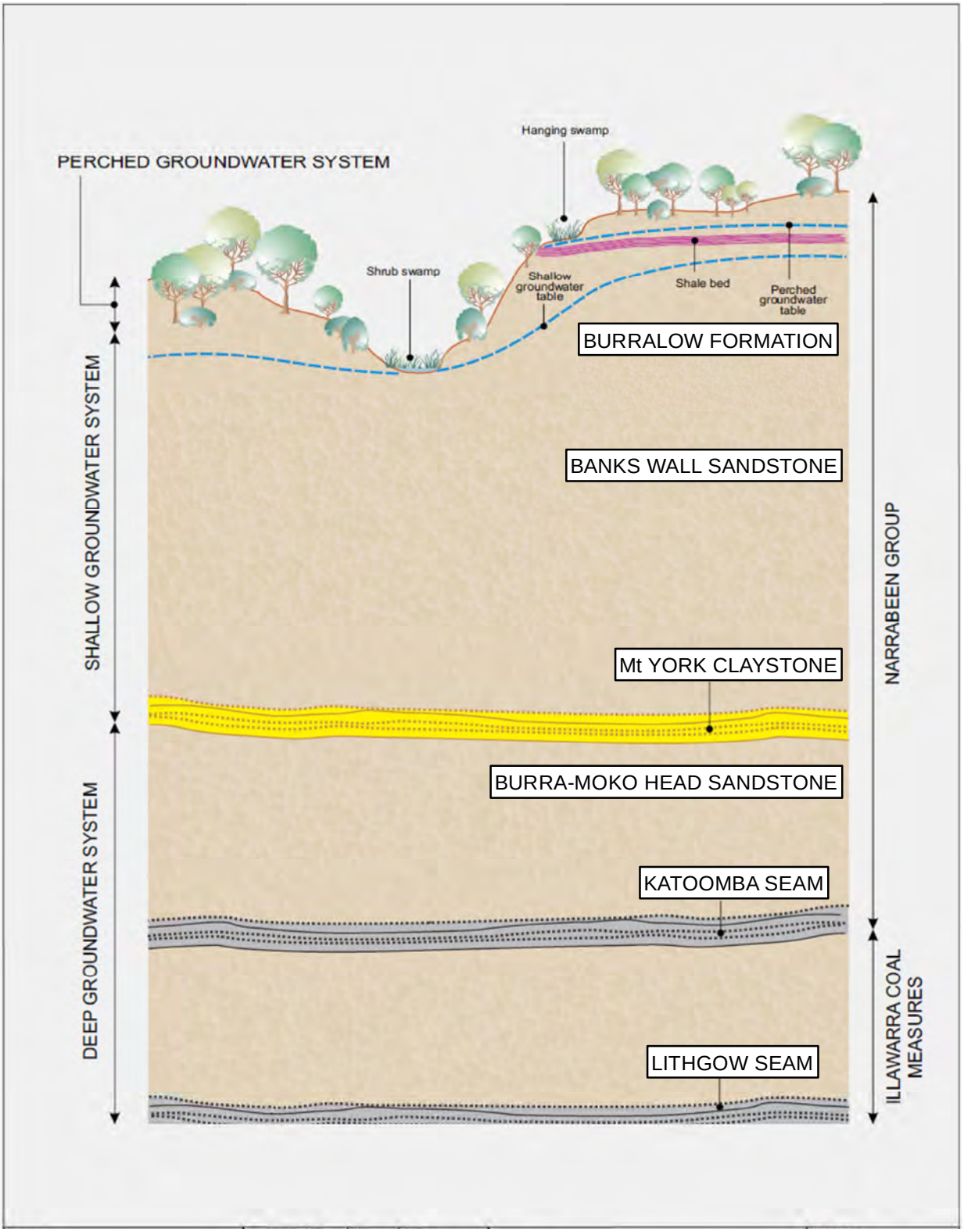

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Figure 2.29: Conceptual Cross Section Through Relevant Strata

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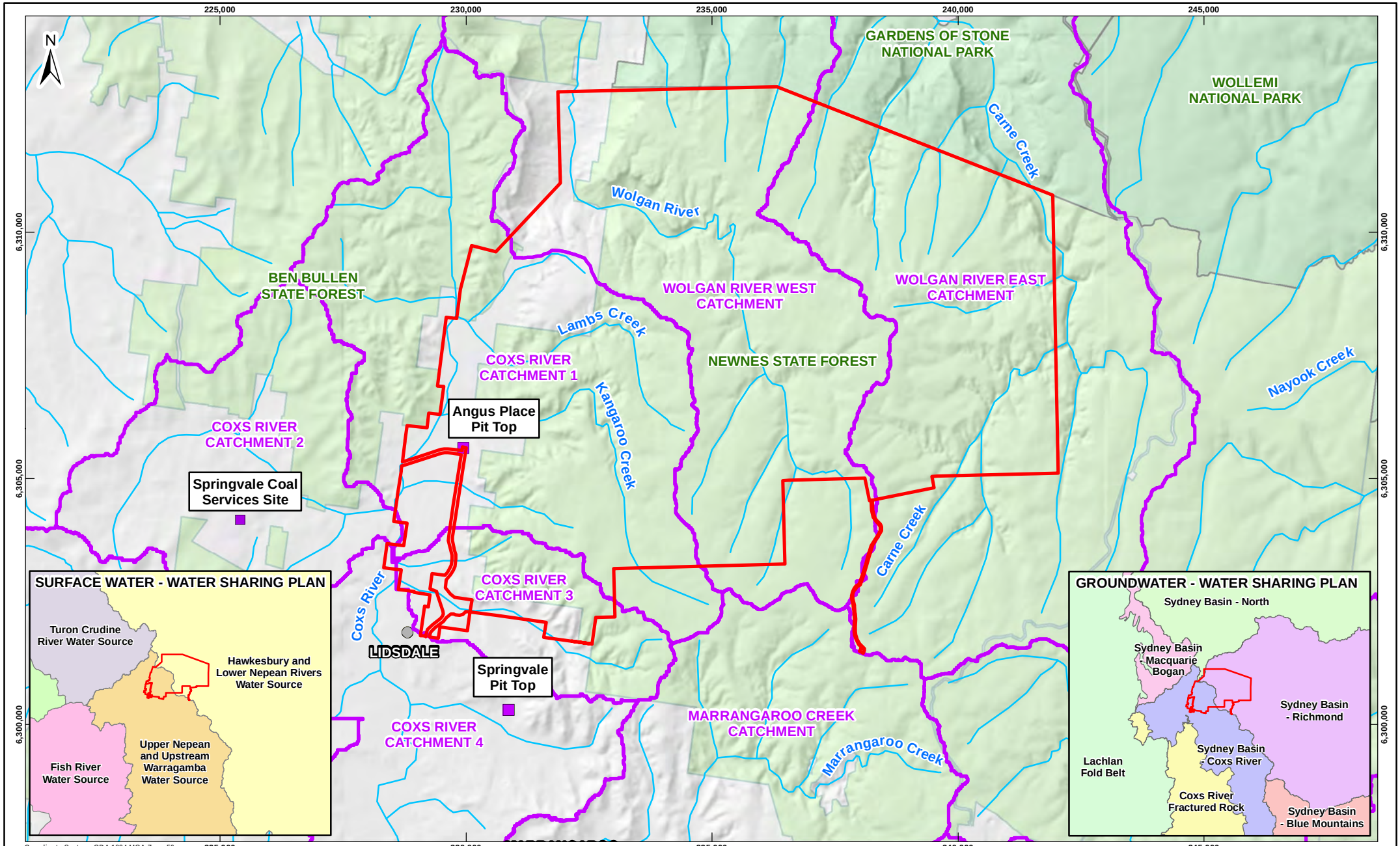

LEGEND

- Project Application Area
- Village
- Town
- Watercourse
- National Park
- State Forest
- Catchment Boundary

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F050 APC Rev 0
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Figure 2.30: Surface Water Catchments and Water Sharing Plan Boundaries

0 1 2 3 km

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Angus Place

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2.8 Ecology

2.8.1 Habitat

The Project Application Area is part of a larger contiguous area of native vegetation and is characterised by open forests, exposed rocky areas, riparian zones and swamps. Groundcover exhibits diverse assemblages of grasses, herbs and prostrate shrubs.

The majority of the Project Application Area has been subject to Forestry Corporation of NSW selective timber harvesting for a sustained period of time. Recent fires are evident in some parts of the Project Application Area. As a consequence of forest harvesting and fires, large areas of forest are relatively young with a low to moderate density of hollow-bearing trees.

Fallen timber, groundcover and leaf litter provide shelter and foraging for a number of fauna types. Habitats within the Project Application Area support a diversity of faunal types.

2.8.2 Threatened Flora and Fauna

Literature reviews and database searches including NPWS Atlas of NSW Wildlife (TSC Act) and EPBC Act reveal 25 threatened flora species and 57 threatened fauna species within 10 kilometres of the Project Application Area that are listed under the TSC Act and/or the EPBC Act. Listed species and their distribution across the Project Application Area are provided in **Chapter 10.0**.

A variety of field survey techniques were employed over the course of fieldwork for this assessment to record a representative sample of flora and fauna guilds across the defined study area (**Section 2.4**).

In addition to these ecological surveys, other surveys for other projects in the locality were reviewed and used in consideration of adequacy of survey effort and potential for occurrence of threatened species. Apart from Project specific survey, seasonal vegetation monitoring has been undertaken at the site since 2003 and annual fauna monitoring at the site since 2004 in both shrubs swamps and surrounding woodlands.

Threatened Flora Species

Of the threatened flora species identified in the database searches and field surveys across the Ecology Study Area, the following have potential to be impacted by the Project:

- *Acacia bynoeana;*
- *Boronia deanei subsp. Deanei;*
- *Eucalyptus pulverulenta ;*
- *Prasophyllum fuscum;*
- *Persoonia acerosa;*
- *Persoonia hindii*
- *Prostanthera cryptandroides subsp. cryptandroides; and*
- *Thesium australe.*

Threatened Fauna Species

Of the threatened fauna species identified in the database searches and field surveys across the Ecology Study Area, the following have potential to be impacted by the Project:

- *Anthochaera phrygia;*
- *Chalinolobus dwyeri;*
- *Dasyurus maculatus maculatus;*
- *Eulamprus leuraensis;*
- *Heleioporus australiacus;*
- *Hoplocephalus bungaroides;*
- *Isoodon obesulus obesulus;*
- *Litoria littlejohni;*
- *Mixophyes balbus;*
- *Petrogale penicillata;*
- *Phascolarctos cinereus; and*
- *Pseudomys novaehollandiea.*

2.8.3 Endangered Ecological Communities and Swamps

Flora surveys, including ground- truthing of vegetation communities were undertaken within the Project Application Area. Those areas within the Project Application Area that were not sampled have been mapped using the Vegetation of the Western Blue Mountains (DEC 2006). **Table 2.8** lists the vegetation communities within the Project Application Area and DEC (2006) mapping units.

Table 2.8 Vegetation Communities within the Project Application Area

Community	Area (ha)
MU3 Hillslope Talus Mountain Gum - Brown Stringybark - Grey Gum - Broad-leaved Hickory Moist Forest	91.17
MU4 Sheltered Gully Brown Barrel Ferny Forest	11.18
MU7 Newnes Plateau Narrow-leaved Peppermint - Mountain Gum - Brown Stringybark Layered Forest	1124.84
MU8 Newnes Sheltered Peppermint - Brown Barrel Shrubby Forest	586.95
MU11 Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest	60.46
MU14 Tableland Mountain Gum - Snow Gum - Daviesia Montane Open Forest	142.43
MU15 Tableland Hollows Black Gum - Black Sally Open Forest	57.44
MU19 Capertee Box- Narrow-leaf Ironbark- Callitris Grassy Woodland	1.90
MU20 Capertee Rough-barked Apple- Redgum- Yellow Box Grassy Open Forest	5.45
MU21 Capertee- Wolgan Slopes Red Box- Grey Gum- Stringybark Grassy Open Forest	317.20
MU26 Newnes Plateau Narrow-leaved Peppermint - Silver-top Ash Layered Open Forest	1955.42
MU26a Newnes Plateau Gum Hollows variant: Brittle Gum - Mountain Gum, Scribbly Gum - Snow Gum Shrubby Open Forest	175.25
MU28 Sandstone Plateau And Ridge Scribbly Gum - Silver-top Ash Shrubby Woodland	1317.19
MU29 Sandstone Slopes Sydney Peppermint Shrubby Forest	693.29
MU30 Exposed Blue Mountains Sydney Peppermint - Silver-top Ash Shrubby Woodland	1662.71
MU32 Tableland Hills Scribbly Gum- Narrow-leaved Stringybark Shrubby Open Forest	64.30
MU33 Tableland Broad-leaved Peppermint- Brittle Gum- Red Stringybark Grassy Open Forest	7.87
MU35 Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest	93.98
MU37 Coxs Permian Red Stringybark - Brittle Gum Woodland	348.42
MU43 Pagoda Rock Sparse Shrubland	524.88
MU44 Sandstone Plateaux Tea Tree - Dwarf Sheoak - Banksia Rocky Heath	392.08
MU45 Newnes Plateau Tea Tree - Banksia - Mallee Heath	18.03
MU46 Newnes Plateau Dwarf Sheoak - Banksia Heath	11.31
MU49 Rock Outcrop	2.92
MU50 Newnes Plateau Shrub Swamp	39.26
MU51 Newnes Plateau Hanging Swamp	39.75
MU53 Mountain Hollow Grassy Fen	42.66
MU54 Capertee- Wolgan Riparian Rough- barked Apple- River Oak Open Forest	7.01
MU59 Non-native Vegetation - Pine plantation / woodlot / shelter	13.34
MU60 Non-native Vegetation - Other exotics (willow etc)	0.24
MU61 Unclassified (<1ha patch of remnant vegetation adjacent / within cleared lands)	14.82
MU62 Cleared and Severely Disturbed Lands	647.14
Total	**10470.89**

A number of vegetation communities that have been mapped by DEC (2006) were not sampled due to difficult terrain or the vegetation occurring well outside of any proposed activities within the Project. Those vegetation communities that were not sampled include:

- MU3 Hillslope Talus Mountain Gum - Brown Stringybark - Grey Gum - Broad-leaved Hickory Moist Forest;
- MU4 Sheltered Gully Brown Barrel Ferny Forest;
- MU11 Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest;
- MU15 Tableland Hollows Black Gum - Black Sally Open Forest;
- MU19 Capertee Box - Narrow-leaf Ironbark - Callitris Grassy Woodland;
- MU20 Capertee Rough-barked Apple - Redgum - Yellow Box Grassy Woodlands;
- MU21 Capertee - Wolgan Slopes Red Box - Grey Gum - Stringybark Grassy Open Forest;
- MU32 Tableland Hills Scribbly Gum - Narrow-leaved Stringybark Shrubby Open Forest;
- MU33 Tableland Broad-leaved Peppermint - Brittle Gum - Red Stringybark Grassy Open Forest;
- MU35 Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest;
- MU37 Coxs Permian Red Stringybark - Brittle Gum Woodland;
- MU49 Rock Outcrop;
- MU53 Mountain Hollow Grassy Fen;
- MU54 Capertee - Wolgan Riparian Rough-barked Apple - River Oak Open Forest;
- MU60 Non-native Vegetation - Other exotics; and
- MU61 Unclassified (<1 ha patch of remnant vegetation adjacent / within cleared lands).

Five EECs are present including:

- Temperate Highland Peat Swamps on Sandstone;
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion (Newnes Plateau Shrub Swamp);
- Montane Peatland and Swamps of the Sydney Basin Bioregion (Montane Peatlands and Swamps);
- and Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and SNW South Western Slopes Bioregions (Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland); and
- Box – Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

The distribution of swamp types across the Project Application Area is provided in **Figure 2.2**.

Temperate Highland Peat Swamps on Sandstone is listed as an EEC under the EPBC Act. Vegetation communities recorded within the Project Application Area that correspond to this EEC are MU50 – Newnes Plateau Shrub Swamp, MU51 – Newnes Plateau Hanging Swamp and MU52 – Newnes Plateau Rush – Sedge Snow Gum Hollow Wooded Heath as described and mapped within DEC (2006).

Newnes Plateau Shrub Swamp is listed as an EEC under the TSC Act. One vegetation community recorded within the Project Application Area correspond to this EEC, namely MU50 – Newnes Plateau Shrub Swamp.

Montane Peatlands and Swamps is listed as an EEC under the TSC Act. MU53 Mountain Hollow Grassy Fen is regarded by DEC (2006) as forming part of this EEC.

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland is an EEC listed under the TSC Act. Vegetation communities recorded within the Project Application Area that correspond to this EEC are MU11 – Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest and MU15 – Tableland Hollows Black Gum – Black Sally Open Forest.

MU19 Capertee Box – Narrow-leaf Ironbark – Callitris Grassy Woodland and 20 Capertee Rough-barked Apple – Redgum - Yellow Box Grassy Woodlands may potentially be commensurate with White box yellow box Blakely's red gum woodland (TSC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act).

2.8.3.1 MU50- Newnes Plateau Shrub Swamps

Shrub swamps develop on the Newnes Plateau at altitudes in excess of 1,000 m in the bases of valleys which are subject to periodic to permanent waterlogging from groundwater, surface water and direct rainfall. The bases of these swamps characteristically have low slope angles which means that surface water flows have a relatively low velocity and water retention is high. Claystone units of the Burralow Formation also reduce the rate of percolation of water into the deeper sediments. The Burralow Formation with its suite of aquitards decreases the hydraulic gradient and thus reduces the degree of percolation of groundwater to the units below. Instead, much of the groundwater present within the Burralow Formation is redirected laterally down-dip to discharge points in nearby gullies. Precipitation is thus supplemented by moisture from groundwater sources to form several discharge horizons along the course of the host creek in which a shrub swamp is located.

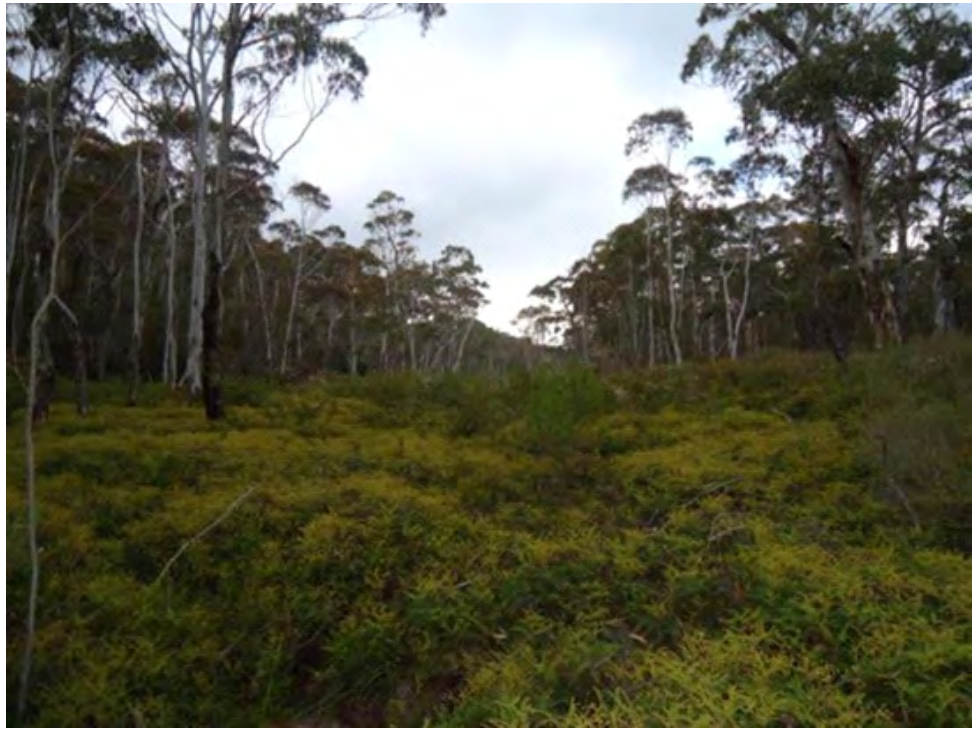
Ten shrub swamps are within the Project Application Area.

The shrub swamps in which water level monitoring is carried out across the Project Application Area, have been classified into two broad types based on the predominant source of water supplying the swamp. The classifications have been made by Aurecon (2012) and are used to help identify water level trends. The two classifications are:

- '*Type A – periodically waterlogged*', show large and reasonably rapid variations in water level in response to significant rainfall events.
- '*Type C – permanently waterlogged*', display a reasonably static water level that is relatively unaffected by climatic conditions but depend largely on groundwater sources. Since the percentage of groundwater contribution to the swamp hydrogeology will vary from swamp to swamp, there may be a range of hydrogeological conditions observed for this swamp type.

Many shrub swamps in the Project Application Area show characteristics of both Type A and Type C classification or "mixed-type" swamps. The occurrence and sustainability of the shrub swamps are multifactorial, involving a complex interplay between topography, hydrological regimes and geology. The formation and persistence of the shrub swamps are intrinsically associated with the aquitard units within the Burralow Formation as noted above. **Section 8.2.6** describes in detail several cases studies with regards to the impacts of mining on swamps on the Newnes Plateau.

Many swamps in the Project Application Area show characteristics of both classification types. A photograph of a typical shrub swamp in the Project Application Area is provided in **Photograph 2.17**.



Photograph 2.17: Typical Shrub Swamp in the Project Application Area

Photograph 2.18: Typical Hanging Swamp in the Project Application Area

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2.8.3.2 MU51 – Newnes Plateau Hanging Swamps

Hanging swamps develop on the Newnes Plateau at altitudes in excess of 1000 m on the flanks of valleys which are subject to infrequent waterlogging from perched groundwater systems, surface runoff and direct rainfall. These swamps have a characteristic floral assemblage which is largely a result of the physical location on the flanks of valleys and the hydrological regime. The floral assemblage differs from that of shrub swamps. The base of hanging swamps is generally at a steeper slope angle than shrub swamps, which means that hanging swamps are less able to retain water as it discharges away along the greater slope angles.

A total of 53 hanging swamps were recorded within the Project Application Area, covering a total of approximately 20.76 ha.

Photographs of typical hanging swamps in the Project Application Area are provided in **Photograph 2.18**

The correlation of local geology and the position of THPSS is evident in the conceptual geological cross section presented in **Figure 2.29**. The importance of Newnes Plateau geology in swamp formation and hydrology has been investigated extensively. Most recently, McHugh (2011, 2013) studied the upper stratigraphy of the Springvale and Angus Place leases and identified that there is a lithological and topographic link between the presence of the Burralow Formation and the occurrence of the hanging swamps. Several of the claystone horizons have been found to act as aquitards, or semi-permeable layers and decrease the hydraulic gradient of rainwater and groundwater movement percolating through the weathered and semi-weathered strata. This provides a permanent water source for the formation and maintenance of the hanging swamps. The presence of these aquitards in the Burralow sequence is also vital in determining the presence and persistence of the Newnes Plateau Shrub Swamps as discussed in **Section 2.8.3.1**. Details of the importance of Newnes Plateau geology and hydrogeology and interactions with Newnes Plateau swamps is detailed in **Section 2.6.2.3**.

2.8.3.3 Past Undermining of Swamps

Angus Place and Springvale Collieries have mined beneath 13 shrub swamps and 26 hanging swamps. A summary of the mining geometries for the longwalls which have been extracted beneath these swamps is provided in **Table 2.9**. Surface impacts have been observed at five of these swamps, being Narrow Swamp North, Narrow Swamp South, East Wolgan Swamp, Kangaroo Creek Swamp and Junction Swamp (**Figure 2.2**). Investigations into these impacts were undertaken by Goldney et al (2010), who was engaged by the Federal Department of the Environment, Water, Heritage and the Arts (which changed to SEWPAC and is now Department of the Environment) Goldney found that swamp impacts were due to a combination of factors, the most important being mine water discharge and subsidence, although the relative contribution of each could not be determined. The Project will not discharge mine water into watercourse upstream of swamps and the longwall void widths have been narrowed to reduce the potential for subsidence effects.

Table 2.9 Mining Geometries for Previously Extracted Longwalls at Angus Place and Springvale Collieries

Longwalls	Void Width (m)	Depth of Cover (m)	Width-to Depth Ratios	Extracted Seam Thickness (m)	Maximum Subsidence (m)	Strains (mm/m)	Number of Swamps Undermined
Angus Place (LW16 to LW24)	210, 230 and 260	220 ~ 360	0.70 ~ 0.95	2.8 ~ 3.2	1.0 ~ 1.2	Typically between 3 tensile and 5 comp.	1 shrub swamp, and 1 partial hanging swamp
Angus Place (LW920 to LW970)	260 and 290	220 ~ 380	0.75 ~ 1.0	3.1 ~ 3.4	1.0 ~ 1.2	Typically between 3 tensile and 5 comp.	7 fully and 2 partial shrub swamps, and 9 fully and 2 partial hanging swamps
Springvale (LW1 and LW401 to LW414)	255, 265 and 315	220 ~ 420	0.75 ~ 1.0	2.8 ~ 3.4	1.0 ~ 1.4	Typically between 1 tensile and 5 comp.	1 fully and 2 partial shrub swamps, and 11 fully and 3 partial hanging swamps

2.8.4 Enforceable Undertakings

On 12 October 2011, Springvale Coal Pty Limited and Centennial Angus Place Pty Limited entered into an Enforceable Undertaking under section 486DA of the EPBC Act.

Without conceding that is has breached the EPBC Act or any other Act, but acknowledging at the time that the Minister considered that through underground mining and mine water discharges, Centennial Coal's operations had a significant impact on THPSS, a federally listed endangered ecological community, Springvale Coal and Angus Place Pty Limited undertook to pay $1,450,000 for a four year research program.

The objectives of this research program are to:

1. Provide the necessary knowledge to conserve, manage and restore THPSS;
2. Use that knowledge to promote best management practices for these areas;
3. Transfer knowledge gained in the program to agencies, land managers and relevant stakeholders; and
4. Maximise the educational and training opportunities of the Program.

The funding is administered by the Australian National University and the research program is supported by a Steering Committee. The Steering Committee includes representatives from the federal Department of the Environment (then SEWPAC), Centennial Coal, the Australian National University, a specialist swamp ecologist and a community representative from the Colong Foundation for Wilderness.

The research themes under the program are:

1. Understanding the THPSS which includes detailed mapping, location, distribution and extent of the swamps, including those under threat.
2. Understanding swamp systems, including water balance and dynamics, the functionality of peatland swamps, environmental history and origins, ecology/biodiversity of major structural species and contribution of THPSS to the landscape.
3. Understanding land management and impacts, including condition status mapping and trends.
4. Application of understanding, including monitoring of reference sites and thresholds for recovery and resilience.

In 2012, approximately $900,000 of the research fund had been allocated to five projects, with additional funding set aside to support swamp hydrology research when a suitable project was identified by the Steering Committee. The Committee meets twice annually and holds an annual workshop to review the status of the research findings and outcomes.

2.8.5 Aquatic Ecology

The aquatic macroinvertebrate fauna within the Wolgan River and Carne Creek consists primarily of insect families plus some crustacean, worm, bivalve mollusc and mite taxa. Coxs River supports a diverse range of aquatic macroinvertebrates, with 62 taxa being recorded in recent surveys. The fauna consisted of 44 insect families, five crustacean taxa (Cladocera, Cyclopidae, Atyidae, Parastacidae and Ostracods), four different worm taxa (Oligochaeta, Nemertea, Temnocephalidae and Dugesiidae), six mollusc taxa (Corbiculidae, Sphaeriidae, Ancylidae, Lymnaeidae, Physidae and Planorbidae) and one taxon each of springtails (Collembola), freshwater mites (Hydracarina) and leeches (Erpobdellidae). The fauna in Kangaroo Creek sites is less diverse, with a total of 45 taxa recorded in recent surveys.

Eastern Banjo Frogs and Spotted Marsh Frogs have been heard at the Wolgan River (upstream) and tadpoles have been recorded at two sites on the river. The eel (*Anguilla* sp.) is the only fish species observed in the Wolgan River in recent aquatic surveys. Fish and larvae, most likely Mountain Galaxias, have been sighted in Carne Creek (refer to **Appendix G**).

The macroinvertebrate fauna downstream of the shrub swamps is quite diverse. Fauna consists primarily of insect families, crustaceans, worms, bivalves, freshwater mites, leeches and springtails.

Filamentous green alga, Swamp Clubrush and Charophytes were observed at the Wolgan River. Jointed Rush has been recorded at Wolgan River on one occasion during the surveys. No macrophytes or algae were observed at Carne Creek.

2.8.6 Stygofauna

Stygofauna is a collective term for subterranean aquatic fauna, including crustaceans, worms, snails, insects, other invertebrate groups and fish.

Stygofauna were sampled by hand bailer from four shallow bores in Tri-Star and Twin Gully Swamps, with the volume of water sampled varying from 2 litres to 15 litres. The swamp samples collected 310 invertebrates, only one of which, a cyclopoid copepod, was considered to be likely stygofauna. Another two each of mites and water bears were classified as possible stygofauna.

In addition, samples were collected from four boreholes in the unconfined Banks Wall aquifer, with samples ranging from 8 to 15.5 L. The Banks Wall samples collected nine invertebrates, of which one syncarid crustacean was a identified as a likely stygofauna, while one Acarina and one nematode were considered possible stygofauna (refer to **Appendix G**).

Water quality measurements were taken at all bores during sampling.

There is limited occurrence of Stygofauna across the Project Application Area. To date, samples collected from boreholes on Tri Star Swamp yielded two likely (*Cyclopoid Copegoda* and *Ostracoda*) and three possible stygofauna taxa (*Acarina, Nematoda* and *Tardigrada*). Samples from the unconfined aquifer in the Banks Wall Sandstone showed the presence of (*Bathynellid syncarid*) and two potential stygofauna taxa (*Acarina* and *Nematoda*).

Section 10.3.3.3 provides information on the expected presence of stygofauna in shallow aquifers and the predicted lack of stygofauna in deeper aquifers such as those below the Mount York Claystone.

2.9 Climate

The climate in the region is typical of a cool temperate mountain climate, characterised by cold winters and warm summers. The highest temperatures occur throughout December, January and February, with the coolest temperatures occurring in July. Snow and/or sleet are common in winter months.

2.9.1 Data Sources

Long-term average climate data has been sourced from the Bureau of Meteorology (BoM) website (http://www.bom.gov.au/climate/data/).

A number of weather stations have been identified near the Project Application Area and are listed below in order of preference, taking into consideration locality, altitude and quality of data;

- Lidsdale (Maddox Lane) – Station No. 63132. Located just 5 kilometres from the pit top. This is the most representative and up to date dataset for Angus Place Colliery. Data recorded from 01/08/1959 to present;
- Lithgow (Birdwood Street) – Station No. 63224. Located 15 kilometres to the south of the pit top. Data recorded from 01/04/1889 to 30/06/2006; and
- Bathurst Agricultural Station – Station No. 63005. Located approximately 47 kilometres to the west of the pit top.

2.9.2 Rainfall

Rainfall throughout the year is relatively uniform (**Table 2.10**), however, rainfall is slightly higher during the months of October through to March. January and February are the wettest months. The intensity of the rainfall is locally affected by the orographic influence of the Great Dividing Range. The long term average annual rainfall from the collated record is 766.1 mm at Lidsdale and 1,072 mm at Newnes Plateau.

Table 2.10 Long Term Rainfall Summary (mm) at Lidsdale (Maddox Lane), Station 63132 (1959 – 2013)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	85.1	80.1	63.8	42.1	50.6	48.8	51.6	65.5	53.7	68.4	73.4	72.9	766.1
Lowest	8	5.6	3.8	1.2	2.6	2.6	2.7	1.8	3.4	2.4	7.6	0	329.8
5th %ile	19.3	11.7	8.7	3.2	5.7	7.7	11.4	8.0	11.0	11.0	13.0	20.4	465.4
10th %ile	24.9	18.2	14.2	6.3	7.7	16.5	18.0	16.0	19.6	14.6	18.7	25.7	515.1
Median	76.6	71.1	50.4	32.0	45.0	39.8	43.2	51.6	52.0	73.1	62.5	62.3	765.3
90th %ile	171.3	132.7	119.7	83.8	102.1	83.5	91.2	121.7	91.2	124.2	142.1	133.4	972.7
95th %ile	191.5	178.4	180.7	122.1	123.9	113.2	98.4	202.6	99.7	132.7	151.9	161.7	1165.6
Highest	213.6	270.4	270.4	202.6	131.2	228.3	214	363.8	123	228.4	164.7	217	1260.3

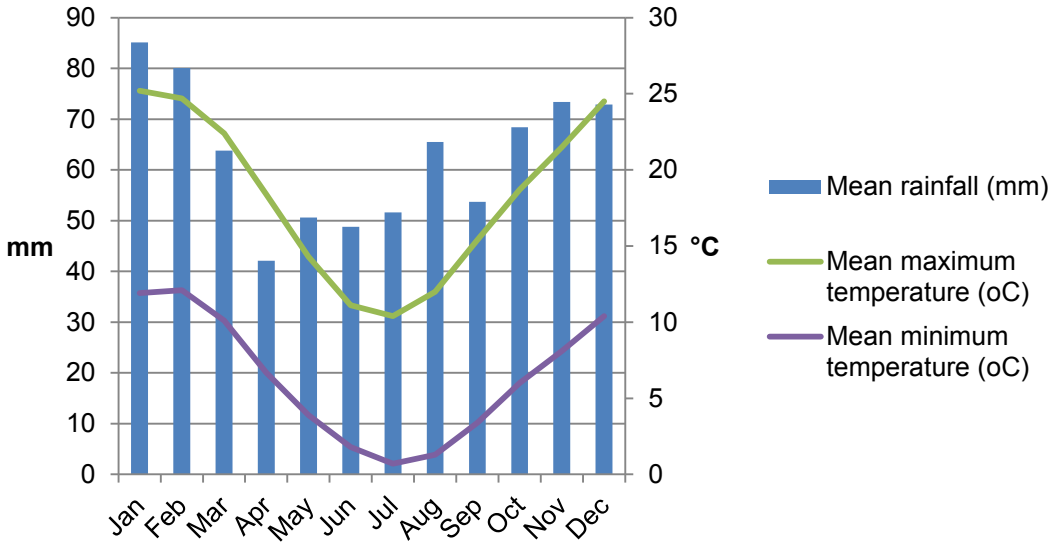


Figure 2.31 Graph of mean monthly rainfall and temperatures (Maddox Lane, Lidsdale)

The Newnes Forest Centre on the Newnes Plateau has been recording meteorological data since 1938. **Table 2.11** provides the long term rainfall means for this station from 1938 to 2002.

Table 2.11: Newnes Forest Centre Rainfall Data (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean monthly	121	114	103	79	81	83	68	84	68	92	89	91	1072
10th percentile	133	91	79	59	63	63	54	67	64	81	79	68	1138
Median	233	254	222	153	189	180	129	193	112	190	168	202	1484
90th percentile	34	24	23	16	19	13	19	22	22	21	25	21	727
Mean no. of raindays	12	13	12	9	11	11	10	11	10	11	11	11	131
Highest	281	339	519	299	287	320	241	412	207	267	209	303	

2.9.3 Temperature and Humidity

Average monthly temperatures at Lithgow (Birdwood Street) from 1889 to 2006 are presented in **Table 2.12** and **Figure 2.31**. The warmest month of the year is January with a mean maximum temperature of 25.2° C and a mean minimum of 11.9°C. The coolest month of the year is July with a mean maximum temperature of 10.4°C and a mean minimum temperature of 0.7°C. Rainfall and temperature trends are seasonally distributed with the highest falls and the maximum temperatures occurring in the summer months, and the lowest rainfall and minimum temperatures experienced during the winter months.

Table 2.12 also presents the long term monthly average humidity in the region surrounding the Project Application Area. The mean 9 a.m. relative humidity varies between 60% and 82%, while the 3 p.m. relative humidity varies between 50% and 67% throughout the year.

Table 2.12 Average Monthly Temperature (°C) at Lithgow (Birdwood Street), Station 63224

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature													
Mean maximum temperature (°C)	25.2	24.7	22.4	18.4	14.3	11.1	10.4	12.0	15.4	18.7	21.5	24.5	18.2
Mean minimum temperature (°C)	11.9	12.1	10.1	6.7	3.9	1.8	0.7	1.3	3.4	6.0	8.1	10.4	6.4
Relative Humidity													
Mean 9am relative humidity (%)	64	70	73	76	81	82	79	73	64	60	60	61	70
Mean 3pm relative humidity (%)	54	58	60	59	66	67	66	56	54	51	53	50	58

2.9.4 Evapotranspiration

Daily pan evaporation has been recorded at Bureau of Meteorology Station 63005, Bathurst Agricultural Station, from 1966 to December 2011 (refer to **Table 2.13**). This is the closest station to the Project site that records evaporation data. The average daily pan evaporation is 3.7 mm/day.

Table 2.13 Average Daily Pan Evaporation (mm) from Bathurst Agricultural Station, Station 63005

Stat.	Jan	Feb	Mar	Apr	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	6.8	5.8	4.5	2.9	1.7	1.1	1.2	1.8	4.0	5.2	6.5	3.7

2.9.5 Wind

Angus Place experiences predominantly light to moderate winds, with the prevailing wind direction from the southwest and southeast (SLR, 2013). A Calmet analysis (SLR, 2013) calculated the wind rose diagrams for the site (refer **Figure 2.32**) and the flowing summary data:

- in spring, winds are light to moderate (1.5 m/s to 8 m/s). Prevailing wind direction is from the southwest and the northeast;
- in summer, winds are light to high (1.5 m/s to 10.5 m/s). Prevailing wind direction is from the southeast;
- in autumn, winds are light to moderate. Prevailing wind direction is from the southeast; and
- in winter, winds are light to high. Prevailing wind direction is predominantly from the southwest.

Wind speed frequencies are provided in **Table 2.14**.

Table 2.14 Seasonal Frequency of Occurrence of Wind Speed Intervals

Period	Season	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Daytime	Summer	0.4%	ENE±45	2.8%	7.3%	10.1%
	Autumn	1.2%	E±45	4.0%	8.1%	12.1%
	Winter	0.5%	W±45	2.8%	6.2%	9.0%
	Spring	0.5%	NE±45	2.8%	5.1%	8.0%
Evening	Summer	0.7%	E±45	3.4%	13.9%	17.3%
	Autumn	1.6%	E±45	7.2%	13.9%	21.0%
	Winter	1.2%	WSW±45	4.1%	10.5%	14.6%
	Spring	1.0%	E±45	3.1%	11.9%	15.0%
Night	Summer	2.8%	E±45	8.4%	15.3%	23.7%
	Autumn	4.0%	SW±45	11.7%	9.7%	21.4%
	Winter	1.8%	SW±45	8.8%	9.1%	17.9%
	Spring	2.2%	WSW±45	6.4%	9.0%	15.5%

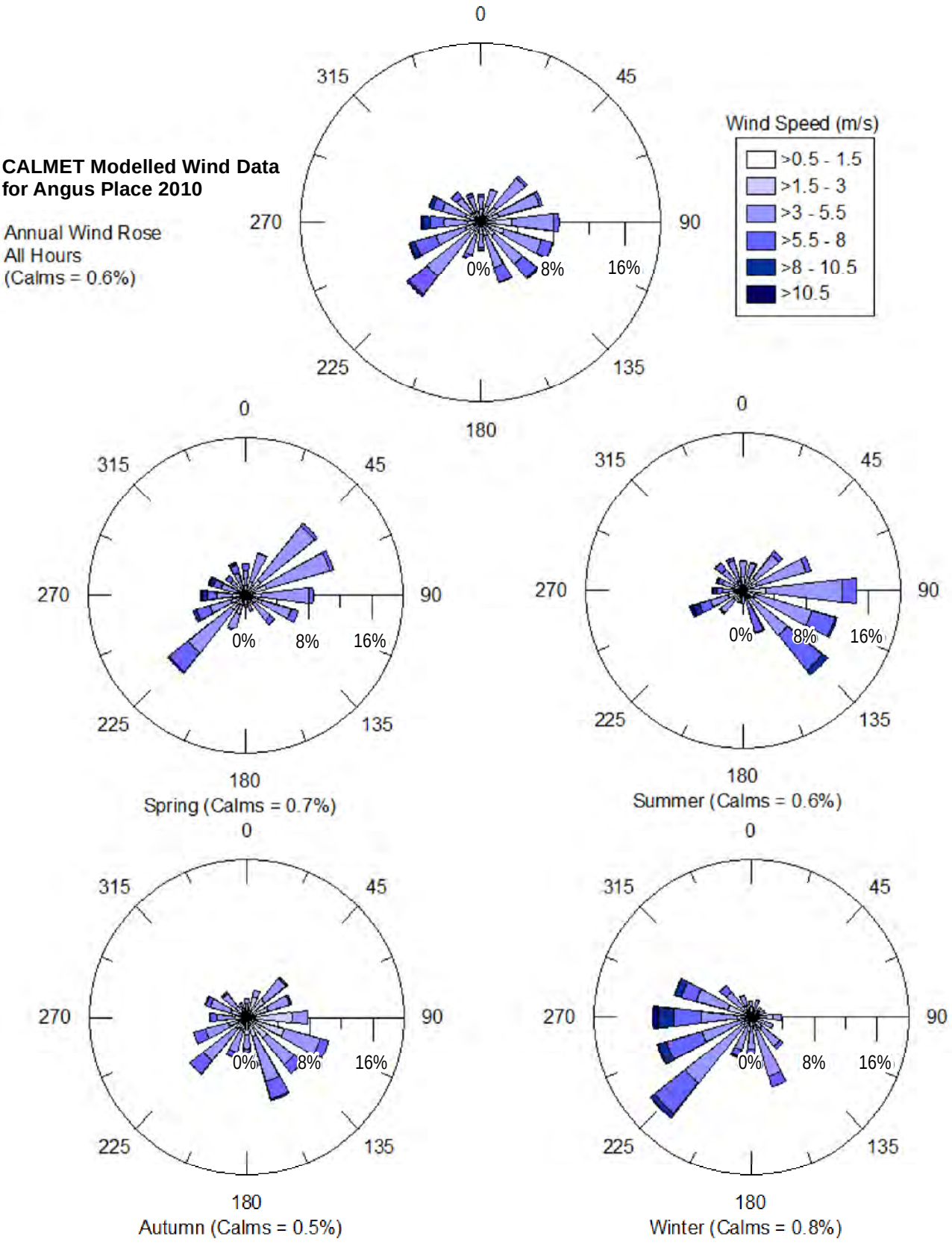
2.9.6 Atmospheric Stability Classes and Temperature Inversion

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six stability classes, A to F, to categorise the degree of atmospheric stability (**Table 2.15**). These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models.

Table 2.15 Atmospheric Stability Classes

Atmospheric Stability Class	Category Description
A	Very unstable, low wind, clear skies, hot daytime conditions
B	Unstable, clear skies, daytime conditions
C	Moderately unstable, moderate wind, slightly overcast daytime conditions
D	Neutral, high winds or cloudy days and nights
E	Stable, moderate wind, slightly overcast night-time conditions
F	Very stable, low winds, clear skies, cold night-time conditions

According to SLR (2013), the Project Application Area has a high frequency Stability Class D, which is indicative of neutral conditions, conducive to a moderate pollutant dispersion.



Source: SLR 2013.

DATE	18/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F049 APC Rev 0
SCALE	NOT TO SCALE

Figure 2.32: Wind Roses for the Project Site (SLR, 2013)

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 49

A4

CHAPTER 3.0
Existing Mine Operations

3.0 EXISTING MINE OPERATIONS

This chapter provides a description of the existing operations and infrastructure at Angus Place Colliery and relevant approvals currently held by the mine relating to the operations.

3.1 Existing Approvals

3.1.1 Development Consents and EPBC Act Approval

In 1949 Newcom Mine commenced production of coal for domestic power supply using bord and pillar mining techniques. In 1976 Blaxland Shire Council approved the construction and operation of an underground coal mine and associated ancillary facilities at Newcom Mine, Kerosene Vale. Angus Place Colliery was developed as an extension of the Newcom Mine and commenced production in 1979 using longwall mining techniques. The mine operated at an approved limit of 1.3 million tonnes per annum and supplied coal to the Wallerawang Power Station.

A development application (DA81/11090) by the Mine Development Department of the NSW Electricity Commission (then owner of the former Newcom Collieries Pty. Ltd). was supported by an EIS and approval was granted in 1984 to increase production to 2.3 million tonnes per annum and expand the mining area to allow coal supply to the then proposed Mount Piper Power Station, while still supplying Wallerawang Power Station.

Table 3.1 identifies a number of further consents which were granted to allow for the continuation and extension of Angus Place Colliery since the mid 1970`s. The mine currently operates under Project Approval (PA) 06_0021 which was granted on 13 September 2006 pursuant to a Part 3A application in accordance with the EP&A Act. This development consent allowed for the consolidation of previous consents, the extension of the mining area and for an increase in the production limit to 3.5 million tonnes per annum. PA 06_0021 is due to lapse on 18 August 2024.

PA 06_0021 has been modified three times in 2011 and 2013 in accordance with Section 75W of the EP&A Act to facilitate continued mining at Angus Place. Modification 1 related to the development of two new longwall panels, LW910 and LW900W and provided for an increase to the mine tonnage to 4 million tonnes per annum. An EPBC Referral was submitted to the Federal Minister in support of Modification 1 on the basis of mine subsidence potential beneath the Endangered Ecological Communities (shrub swamps and hanging swamps) and the resulting potential to impact on Matters of National Environmental Significance under the EPBC Act. This was determined as a controlled action requiring consideration under the EPBC Act. On the 17th of April 2012 Angus Place Colliery subsequently received approval from the Federal Minister to extract coal using longwall mining techniques in the above mentioned panels (EPBC 2011/5952). This action is subject to conditions of approval.

Centennial Angus Place also prepared an Environmental Assessment in support of Modification 2 to its existing Part 3A approval regarding the construction and operation of a ventilation facility and supporting infrastructure. As Modification 2 also had the potential to impact on Matters of National Environmental Significance, Angus Place referred the action to the Federal Minister under the EPBC Act. The proposed action was not considered by the Federal Minister's delegate to be a controlled action. This modification was approved under the EP&A Act on the 17th of April 2013.

Modification 2 also included approval for trial mining, to support the existing and approved surface exploration programme and pre-feasibility assessment for the available resource within the Angus Place mining lease. Trial mining uses the underground roadways developed from the eastern extent of LW910 with approximately 709,575 tonnes of coal to be extracted over a period of 3.5 years within the approved production limit of 4 million tonnes per annum.

A Modification 3 was approved in December 2013 to extend the length of Longwall 980 and 900W by 43.4 metres and 104.8 metres respectively and to increase the extraction height from 3.25 metres to 3.425 metres.

Figure 1.2 displays the existing approved areas of Angus Place Colliery.

Table 3.1 Angus Place Colliery Existing Development Approvals

Ref No.	Description	Issued By	Date	Expiry/ Review Date
1975 (DA number unknown)	Development consent permitting the construction and operation of an underground coal mine including: ■ bathhouse, coal handling infrastructure materials storage and office buildings; and ■ produce up to 1.3 million tonnes per annum.	Blaxland Shire Council	1975	Surrendered
DA 81/11090	Production of 2.3 million tonnes per annum coal by longwall methods from the Lithgow Seam	Minister for Planning	October 1984	Surrendered
DA 218/89	Development consent to construct an additional coal storage area and coal-handling infrastructure west of Wolgan Road.	Lithgow City Council	1990	Surrendered
DA 413/03	Development consent to construct and operate a conveyor, stockpile and associated infrastructure.	Lithgow City Council	2003	Surrendered
PA 06_0021	Project Approval to consolidate previous development consents and increase the mining area and annual production limit to 3.5 million tonnes per annum.	Minister for Planning	13 Sept 2006	18 Aug 2024
PA 06_0021 Modification 1	Modification of PA 06_0021 to include: ▪ the development of two longwall panels, north of longwall panel 900 and west of the 900 district main headings; ▪ increasing the annual extraction rate to 4 million tonnes per annum; ▪ development of an additional dewatering borehole and augmentation of the existing road, power and water management infrastructure; ▪ increase in full time staff from 215 to 225; and ▪ increase the life of mine to 2016.	Minister for Planning	29 August 2011	18 Aug 2024
EBPC 2011/5952	EPBC Referral. _On the basis of potential impact on MNES under the EPBC Act.	Federal Minister for the Environment	17 April 2012	19 March 2032
PA 06_0021 Mod 2	Modification of PA 06_0021 to include: ▪ development of underground roadways and trial mining; ▪ development of a ventilation facility and supporting surface infrastructure.	Minister for Planning	April 2013	18 Aug 2024
PA 06_0021 Mod 3	Extension of Longwalls 980 and 900W and increase in extraction height.	Minister for Planning	9 December, 2013	18 Aug 2024

Angus Place Colliery's project approval (PA 06_0021) will lapse on 18 August 2024.

3.1.2 Other Regulatory Requirements

Angus Place Colliery has a number of other regulatory requirements for operation. These consist of management plans, approvals, licences, permits and certificates as listed in **Table 3.2**.

Table 3.2 Other Regulatory Requirements for Operation

Type	Approval Number	Regulatory Authority	Issue Date	Details
Mining Operations Plan (MOP)	-	DTIRIS	10/07/13	The MOP is a working reference for the activities of the mine in accordance with the guidelines of the DTIRIS for the period July 2013 – May 2015. It is consistent with approved Subsidence Management Plan commitments, EPL 467 and the PA 06_0021 approval.
Subsidence Management Plan (SMP) Approval	04/1675	DTIRIS	9/12/2005	SMPs are prepared to consider the potential subsidence impacts of underground mining and identify measures to manage such impacts. This is the initial SMP Approval for LW 930 – 980. There have been a number of approved SMP variations as outlined in **Table 3.4**.
Environment Protection Licence (EPL) (*Protection of the Environment Operations Act 1997*)	EPL 467	EPA	Annual	Angus Place Colliery`s EPL 467 for the mining of coal and coal works up to 5 million tonnes per annum. The Licence allows for four utilisation/discharge points.
Occupation Permit (*Forestry Act 2012*)	Level 2- Exploration Level 3 - Infrastructure	Forestry Corporation of NSW	1/02/2018	Permit to occupy Newnes State Forest for activities associated with mineral exploration and construction of infrastructure.
	PB 03797	Forestry Corporation of NSW		Occupation Permit PB 03797 extends into the Ben Bullen Forest to the west of the Pit top.
Radiation Licence	29229	EPA	7/07/2014	Radiation licence for measuring product ash percentage in the coal handling plant and fixed radiation gauge RR11830.
Water Licences	10BL601852 10BL601851 10BL601838 10BL601829 10BL603236 10BL603802 10BL604512	NOW	3/09/12 3/09/12 3/09/12 Indefinite	Angus Place Colliery has three extractive water licences associated with the 930 dewatering bore (decommissioned) (10BL601852), the 940 dewatering bore (10BL601851) and the pit top collection system (10BL601838). These are approved under the Water Act 1912. Groundwater monitoring licences approved under the *Water Management Act 1912* are also held for a series of shallow and deep groundwater monitoring piezometers.
Exploration Licences	EL6856 EL6293	DTIRIS	8/09/12 16/09/14	The exploration licences for Angus Place enable Centennial Angus Place to extract coal. EL6856 is applicable to majority of the lease area across the Newnes State Forest. EL6293 is applicable to areas surrounding the Wolgan Road.

An Extraction Plan is currently being developed for LW900W/910. This will include a Coal Resource Recovery Plan, a Subsidence Monitoring and Reporting Programme, a Built Features Management Plan, a Public Safety Engagement Plan and a Rehabilitation Management Plan.

3.1.3 Mining Tenements

Centennial Angus Place operates under a number of mineral authorities (**Table 3.3**). These consist of mining leases, coal leases, authorisations and exploration licences, each granted by the Minister for Resources and Energy. The areas to which these authorities apply are shown in **Figure 2.1**

Table 3.3 Angus Place Colliery Mineral Leases and Licences

Reference	Title Holder	Title	Expiry Date	Area (ha)
ML1424	Centennial Springvale Pty Ltd	Mining Lease 1424	18 Aug 2024	7729
ML1326	Centennial Springvale Pty Ltd & Springvale SK Kores Pty Ltd	Mining Lease 1326	18 Aug 2024	29.97
CCL702	Coalpac Pty Ltd	Consolidated Coal Lease 702 (sublease agreement)	24 Nov 2024	25
CCL704	Centennial Springvale Pty Limited	Consolidated Coal Lease 704	14 Jan 2023	2540
EL6856	Centennial Springvale Pty Ltd and Springvale SK Kores Pty Limited	Exploration licence 6856	8 Aug 2017	9053
EL6293	Springvale SK Kores Pty Limited	Exploration Licence 6293	16 Sept 2014	485

The area held by Angus Place under mining title is 10,278 ha, of which 175 ha is surface title including the pit top, surface infrastructure areas and Kerosene Vale. Coal extraction utilising the longwall method of mining is currently undertaken within the Mining Lease (ML) 1424 and Consolidated Coal Lease (CCL) 704 and part of CCL702 from Invincible Colliery.

On 16 December 2010 approval was granted for the addition of 29.97 ha of ML 1326 to the Angus Place holding and the simultaneous removal of this area from the Springvale Mine holding. This allows for the mining of LW900W and associated gate roads.

3.1.4 Evolution of Mine Design

There has been significant effort to prioritise the reduction of potential impacts and to consider the constraints of surface features and geological and geotechnical issues, while considering mine feasibility and optimisation at Angus Place Colliery.

The existing mine plan for the 900 district longwall panels (LW920-980) at Angus Place is within the existing ML1424 and CCL704. The 900 panels are oriented in an east west direction with extraction starting from the eastern boundary. The lengths of the panels are governed by the Springvale lease to the east and south and the old Angus Place workings to the west and north. Void widths are up to 293 m, pillar widths are between 31 m to 55 m, and the depth of cover ranges between 260 m to 380 m.

Figure 3.1 shows the existing mining area and all workings that have been developed at Angus Place. To date extraction up to LW980 has been completed. Approved panels LW 910 and LW 900W are scheduled to be developed following LW980. **Table 3.4** lists the specific approvals granted in regard of the mine design refinements undertaken to date.

The width-to-depth ratio (W/H) has been used in the mine design at Angus Place Colliery as an important predictor of subsidence behaviour (refer **Section 8.3.3** for further details). W/H<0.9 (sub-critical longwall panels) cause lower magnitudes of subsidence, 0.9<W/H<1.4 (critical longwall panels) represents cases where yielding of the overburden starts to occur and maximum subsidence is likely to develop if the panel widths are increased further, and lastly, with W/H>1.4 (supercritical longwall panels) yielding of the overburden and maximum subsidence is likely to occur.

Following a review in 2011 of subsidence monitoring results regarding extracted longwalls at the adjacent Springvale Mine, it was determined that subsidence impacts as a result of underground longwall mining had only been experienced where the ratio of longwall mining void width to depth of cover over mine workings was identified to be in the critical design range. Following this investigation, the mine design was modified for all future proposed mining areas in the vicinity of Newnes Plateau Shrub Swamps to ensure that the ratio of longwall mining void width to depth of cover (W/H) over mine workings was in the sub-critical subsidence behaviour range. No subsidence effects to swamp hydrology or flora communities have been identified in

areas where sub-critical mine design has been used in the past. The mine design modifications involved narrowing longwall widths and/or increasing chain pillar widths.

The mine design consequence for Angus Place Colliery is that subcritical panel design are proven to minimise impacts on sensitive surface features.

Table 3.4 Mine Design Refinement and SMP Variations

SMP	Approval Number	Regulatory Authority	Issue Date	Description
Subsidence Management Plan (SMP) Approval	04/1675	DTIRIS	9/12/2005	Initial SMP Approval for LW 930 – 980.
SMP Variation	04/1675	DTIRIS	29/12/2006	Amendment to SMP 04/1675 to allow for: ▪ revisions to the installation position of LW 940 and 950; ▪ revisions to the take-off positions of LW 940 to 980; ▪ variation to the gate road pillar widths.
SMP Variation	04/1675	DTIRIS	17/04/2008	Amendment to SMP 04/1675 to allow for: ▪ variation of chain pillar dimension LW 960 panels; ▪ minor increase in the width of LW 960.
SMP Variation	04/1675	DTIRIS	20/04/2009	Amendment to SMP 04/1675 to allow for: ▪ variation of the chain pillar width of 970 and 980 panel; ▪ increase in the width of LW 970; ▪ decrease in the width of LW 980.
SMP Variation	04/1675	DTIRIS	25/03/2010	Amendment to SMP 04/1675 to allow for: ▪ minor variation to chain pillar lengths 970 and 980 Panel.

3.2 Exploration Programme

Angus Place Colliery has an ongoing exploration programme to obtain specific geological information in terms of geotechnical conditions, coal seam quality and thickness, through core sampling. Information obtained is used for the ongoing refinement of the site's existing geological model which then allows detailed mine planning. The exploration programme also allows the installation of piezometers in the aquifers of interest for ongoing groundwater monitoring.

All exploration activities are carried out in accordance with the requirements of the *Mining Act 1992.* Approval for the exploration activities is currently sought under Part 5 of EP&A Act from DTIRIS following the preparation of *Review of Environmental Factors* to assess the potential environmental impacts of the proposed activity.

Angus Place has developed area-based assessment procedures for the management of exploration activities to ensure that they are conducted in an environmentally responsible manner and with due consideration to the community. This includes a risk-based process for the selection, assessment and environmental management of proposed drillhole sites and access tracks based on environmental, geological, logistical and other operational constraints. The locations of the drillhole sites and access tracks are reviewed in light of the environmental assessments undertaken and relocated where possible to avoid any environmental impacts.

Following vegetation clearing at the drillhole site appropriate erosion and sediment controls are installed and maintained around disturbed areas in accordance with the Blue Book (Landcom, 2004). Felled trees are stockpiled for use in rehabilitation.

A process pond is constructed to allow storage and recycling of drilling fluid and clean water in two separate compartments. The compartment used to store drilling fluid, comprising a mixture of water and mud or a biodegradable polymer, is lined with plastic sheets. Water required for drilling is sourced from one of the dewatering bore facilities and is transported to the drill sites using trucks.

The drilling fluid is continuously pumped to the drill head to facilitate the removal of cuttings, stabilise the borehole, cool the cutting head and lubricate the passage of the product pipe. The drilling fluid is generally sent into a reclaimer which removes the drill cuttings and maintains correct viscosity of the fluid. All drilling fluid recovered that cannot be recycled will be vacuum pumped and removed from site following OEH's *Waste Classification Guidelines* (DECC, 2009) and the use of a licensed waste transporter and a receiving facility.

Spoils or cuttings generated during drilling are stockpiled on site for use in rehabilitation including for back-filling drilled holes in cases where no piezometer installation occurs. Sealing of the drill holes is undertaken in accordance with the DTIRIS requirements.

Rehabilitation of the drill site commences soon after completion of drilling activity and follows on from decommissioning of equipment and removal of waste materials. Following re-profiling within the disturbed areas, the stockpiled topsoil is re-spread onto areas requiring rehabilitation, to a minimum depth of 0.1 m to 0.3 m, depending on availability. Stockpiled cleared vegetation is spread over the re-profiled areas.

3.3 Land Preparation

Angus Place Colliery is a well-established underground mine with adequate support infrastructure. All areas required to construct the pit top have been cleared and managed in accordance with the current project approval (PA_00621) and Angus Place MOP (2013-2015).

Land preparation works as required for additional surface infrastructure on Newnes Plateau will involve land for dewatering boreholes and associated infrastructure corridors comprising trenched pipelines and power cable, ventilation facilities and geological exploration boreholes. This involves the clearing of of vegetation, the removal and stockpiling of topsoil, the establishment of temporary and permanent water management systems within the site compounds, and temporary surface stabilisation of construction areas. Appropriate sediment and erosion controls in accordance with the Blue Book (Landcom, 2004) are installed and maintained around disturbed areas. Cross banks and mitre drains are constructed at appropriate intervals to

convey runoff away from the access road alignment. Progressive rehabilitation of land not required for operations is undertaken on completion of construction activities, both at the site compounds and along access tracks. Long term compounds are fenced and locked.

3.4 Hours of Operation and Workforce

Angus Place Colliery operates 24 hours a day, seven days a week, 52 weeks per year with a workforce of up to 300 direct employees and contractors.

3.5 Site Access

Angus Place pit top is accessed via the Wolgan Road from the Castlereagh Highway and is 5 kilometres north of the village of Lidsdale. Access to Wolgan Road from the sub-regional road network is provided via the intersection of Castlereagh Highway and Wolgan Road and Main Street or via the intersection of Castlereagh Highway and Ian Holt Drive.

Access to infrastructure in Newnes State Forest is available via light and heavy vehicle access routes from the sub-regional network. Heavy vehicles are required to use a designated route into Newnes State Forest via the intersection of Chifley Road and Old Bells Line of Road at Clarence. Light vehicles can access Newnes State Forest via Clarence or via State Mine Gully Road to Lithgow.

These access routes are illustrated in **Figure 3.3**.

3.6 Mining

Angus Place Colliery is approved to extract the Lithgow coal seam using the longwall method of mining. Longwall mining is a form of underground coal extraction where continuous miners are used to develop pairs of parallel roadways along with interconnecting cut-throughs to allow access to the coal resource. The process of development mining requires the installation of strata support such as roof bolts and mesh to maintain a safe working environment. The underground roadways are designed to be long term stable.

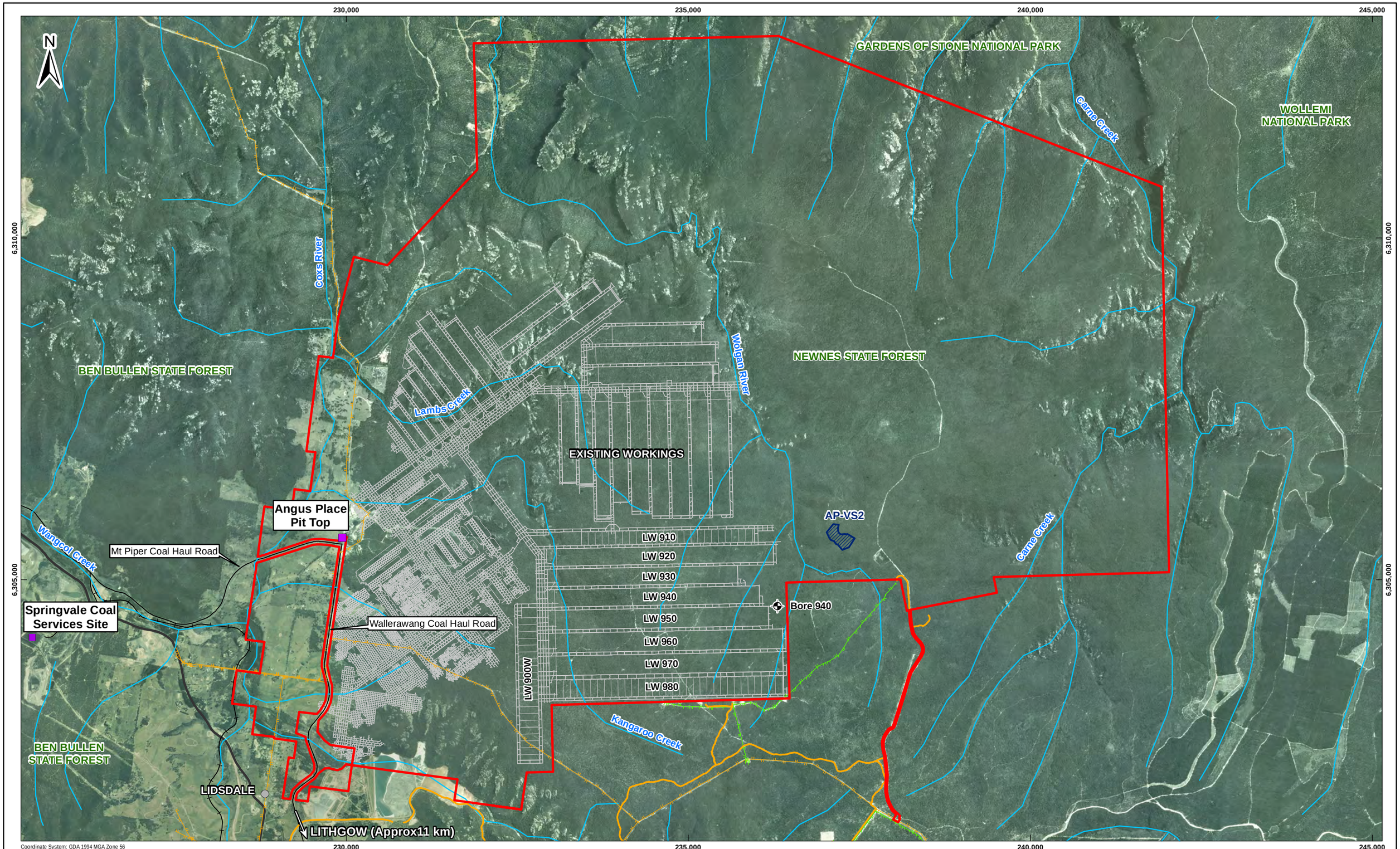
Once development is completed, the panels of coal are mined by a shearer that operates under a series of hydraulic roof supports. As the coal face is cut away, the shearer and the adjacent sequence of roof supports advance for the next cut, and the unsupported roof strata behind the coal face collapse into the void or goaf.

The blocks of coal between adjacent roadways and cut throughs are known as chain pillars. The chain pillars are not mined and assist with subsidence management. The pairs of roadways are developed around the perimeter of rectangular blocks of coal (known as panels). Longwall panel dimensions at Angus Place are up to 3,317 m (length) and up to 283.5 m (width).

Angus Place Colliery utilises the retreat mining configuration whereby the longwall face equipment is established at the end of the panel that is remote from the main headings and coal is extracted within the panel as the longwall equipment moves towards the main headings. The coal between the development headings and between the main headings is left in place as pillars to protect the roadways as mining proceeds.

The current longwall operation extracts coal to a nominal working height of 3.3 m.

Angus Place Colliery has five main headings connecting the mine entries to the existing workings and the roadways.



LEGEND

- Project Application Area
- Village
- Rail
- Main Road
- Watercourse
- Existing Workings
- 11 KV Power Supply
- 66 KV Electrical Transmission
- SDWTS Pipeline
- Dewatering Facility
- Ventilation Facility

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F003 APC Rev 0
SCALE	1:50,000

Figure 3.1: Angus Place Colliery Existing Workings and Infrastructure

0 1 2 3 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 3

A3

3.7 Coal Handling, Processing, Stockpiles and Dispatch

3.7.1 Coal Handling and Stockpiling at Angus Place Pit Top

Coal extracted during development by continuous miners and the longwall system is transported to the surface onto the ROM coal stockpile at the pit top which has a current capacity of 90,000 tonnes.

The only processing operation at Angus Place Colliery is coal crushing and sizing. No coal washing occurs as the mine delivers sized ROM coal to Wallerawang and Mount Piper power stations.

From the pit top, ROM coal is conveyed to the sizer at the coal handling plant (**Figure 3.2**). After sizing, coal is then fed onto the product coal conveyor and sent to the product coal bin to be loaded into road trucks. The ROM coal is then transported to either Wallerawang or Mount Piper power stations along private, sealed haul roads.

There are no reject losses from the operation and saleable coal yield is 100%.

3.7.2 Coal Handling and Stockpiling at Kerosene Vale

The Kerosene Vale site has an approved stockpile capacity (under Project Approval PA 06_0021) for up to 500,000 tonnes of coal. It is used to temporarily store coal when either Wallerawang or Mount Piper Power Stations are unable to accept coal.

3.7.3 Coal Transport

All ROM coal produced is loaded into trucks from the product bin after stockpiling and sizing. Coal is transported along two private haul roads to either Wallerawang or Mount Piper Power Stations.

The Mount Piper Haul Road is owned by Coal> Link Pty Ltd. The Wallerawang Haul Road is owned by Angus Place Colliery.

In accordance with PA06_0021, Wallerawang Haul Road is only used during the hours of 07:00 to 22:00. The Mount Piper Haul Road's development consent allows for trucking 24 hours/day, 7 days a week, but is limited to 5 loaded trucks per hour between 21:30 and 07:00 hours.

Schedule 3 Condition 26 of PA06_0021 requires Angus Place to maintain the surface of the haul road to Wallerawang power station to minimise the generation of noise and dust impacts.

3.8 Plant and Equipment

Coal is extracted during development by continuous miners and one longwall system. Shuttle cars and an armoured face conveyor are used for the transport of coal during development and coal extraction, respectively, to the drift conveyor. Additional mobile underground plant and equipment includes auxiliary fans, roof bolting rigs, equipment handlers, equipment transporters and loaders, underground personnel transporters and associated pumping and electrical reticulation equipment. A network of pipelines, valves and pumps are used to manage water and compressed air.

3.9 Mine Support Facilities and Underground Access

The surface facilities and mining related infrastructure which support the underground operations at Angus Place Colliery consist of:

- site access road and car park;
- mine access and associated infrastructure;
- coal handling, preparation and transport infrastructure;
- workshop, services and administration infrastructure;
- water management infrastructure;
- pollution control infrastructure;
- ancillary infrastructure; and
- non-mine owned infrastructure

The existing layout of the Angus Place pit top surface facilities and infrastructure is shown in **Figure 3.2**.

LEGEND

- Licensed Discharge Point
- Watercourse
- 66 KV Electrical Transmission
- Pollution Control Structure
- Constructed Wetland

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F027 APC Rev 0
SCALE	1:5,000

Figure 3.2: Angus Place Pit Top: Existing Surface Infrastructure

0 50 100 150 200 metres

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 27

A4

3.9.1 Underground Mine Access

Access to the underground mine is via existing workings. Personnel access to the mine is via a drift equipped with a winder operated rail car. Underground workings are then accessed by specialised mining vehicles.

3.9.2 Workshop, Services and Administration Infrastructure

Management of the Angus Place Colliery operations is controlled from the pit top. Workshop, services and administration infrastructure consists of:

- administration building and portable offices;
- bathhouse with adequate facilities and services for the workforce;
- workshops, service buildings and material storage sheds;
- visitor and employee parking areas;
- personnel and materials drift winder for access to underground workings;
- service boreholes and compressor units; and
- telecommunications systems.

Power to the pit top is supplied by an electrical network connection at a substation located at Lidsdale. This together with the 66 kV power line (located on Newnes Plateau), supplies all of Angus Place Colliery's operational electrical requirements.

3.10 Infrastructure

3.10.1 Water Management Infrastructure

The water management system at Angus Place Colliery is discussed in detail in **Section 3.11**. Principal components of water management infrastructure are:

- a surface water management system (including separate dirty and clean water flow paths) (**Figure 3.7**);
- licensed discharge points at the pit top (LDP001, LDP002 and LDP005), and at Kerosene Vale (LDP003) as permitted by EPL 467;
- incoming water supply from Lithgow City Council;
- sewage treatment works; and
- mine dewatering infrastructure located on Newnes Plateau.

3.10.2 Pollution Control Infrastructure

The pit top pollution control infrastructure comprises a dirty and clean water management control system comprising;

- diversion bunds and drains;
- grit traps, oil/water separators and settling ponds; and
- diesel, solcenic and oil storage facilities.

3.10.3 Waste Management Infrastructure

Production Waste

There is no reject material produced at Angus Place Colliery.

Non-Production Waste

The major general waste streams from the mine include water, coal fines from surface runoff, packaging material including plastic, waste and cardboard, wood, waste oil, oil filters, oil drums, scrap metal, hoses, bottles (plastic and glass) sewage effluent, as well as general putrescible rubbish.

General waste is disposed of to landfill by licensed waste contractors. Recyclable materials, for example, plastic, paper and cardboard products, are recycled whenever possible at the site Oil drums and filters are recycled with other waste metals, and are removed from site by a metal recycling company. Waste oil and oily water are disposed of by licensed waste transporters to a licensed waste treatment plant. Sewage is treated in the on-site sewage treatment plant and applied to land at the pit top.

Paper, plastic and cardboard are recycled both from bulk packaging from the store and the site offices, either at the pit top or other infrastructure areas or transferred to a recycling facility.

Waste Management is managed in accordance with the existing Mining Operations Plan with all potentially hazardous material stored and/or bunded appropriately in accordance with relevant standards. Where possible, all quantities of waste or recyclable material are quantified and recorded for benchmarking and continuous improvement purposes as well as reporting in accordance with the National Greenhouse and Energy Reporting Scheme.

3.10.4 Other Infrastructure

Ventilation Facilities

The underground ventilation system consists of three intake drifts and one upcast shaft equipped with a fan, ensuring a continuous stream of fresh air to the mine. These facilities are all located within the vicinity of the pit top.

Angus Place Colliery has approval (part of PA 06_0021 Mod 2) for the construction and operation of an additional ventilation facility APC-VS2, located on Newnes State Forest. This comprises an upcast and downcast ventilation shaft east of the Wolgan River near LW910 within Newnes State Forest. Access to AP-VS2 is via a track from Sunnyside Ridge Road. Infrastructure associated with APC-VS2 includes a 66/11 kV electrical substation (with buried feed cables), diesel storage, access tracks and hardstand area, a demountable office block, a maintenance shed, a security fence and a 40 m bushfire asset protection zone.

APC-VS2 also includes a mine services boreholes to deliver concrete, ballast, stone dust, emulsion (for longwall roof supports), compressed air and diesel to underground operations. The mine services boreholes also provides a route for communications cables, atmospheric monitoring tube bundles, and compressed air.

Pit Top Collection System

The pit top is equipped with pipe works and a pumping system that draws water from existing underground workings to fire tanks at the pit top from where it is pumped to the 930 Dam. A portion of this water is recirculated back underground for fire fighting, cooling and dust suppression. Some of it is also used in the CHP with surplus water directed into Kangaroo Creek via LDP001.

The pit top Collection System is licensed as a dewatering bore by the NSW Office of Water (10BL601838).

Springvale Delta Water Transfer Scheme and Bore Dewatering Facilities

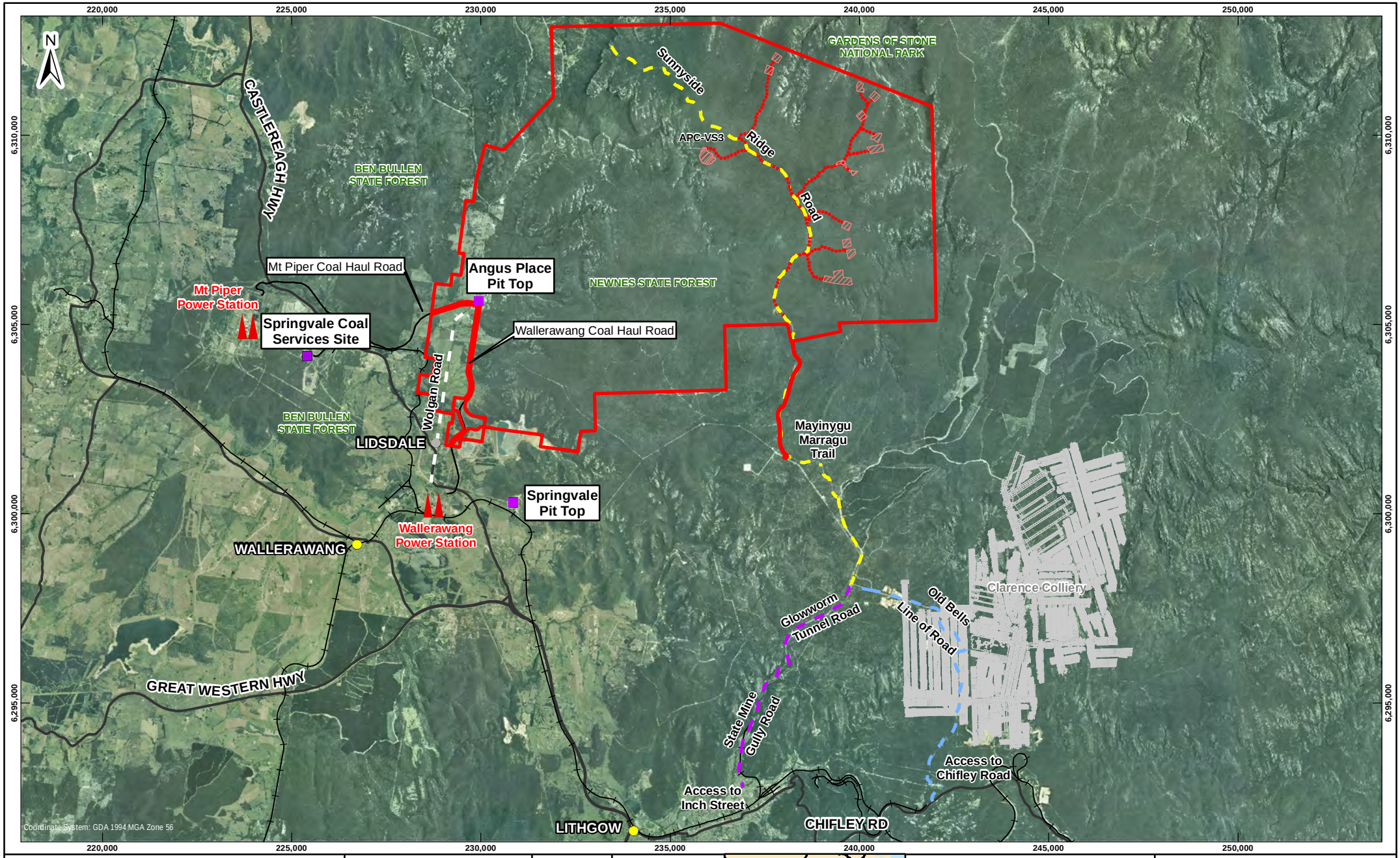
Angus Place Colliery mines the Lithgow Seam which is a water bearing zone and so there is groundwater flow into the workings. The management of mine inflows underground is required to reduce operational risk during mining. Groundwater gravitating in the direction of the coal seam dip (north east) is extracted by dewatering bore 940 (**Figure 3.4**) at the eastern end of LW940. Bore 940 pumps water to the surface and into a network of buried pipelines that connect to the SDWTS for delivery to the Wallerawang Power Station for use in its cooling towers (or LDP006 for emergency situations). Angus Place Colliery has approval to discharge into the SDWTS. The previous dewatering bore (Bore 930) was decommissioned in 2008.

The SDWTS was commissioned as part of a pollution reduction programme in 2006. Angus Place Colliery water entered the system at this time. It is owned by Springvale Mine. The SDWTS has a maximum total capacity of 30 ML/day and functions to reduce the volume of water sourced by the power station from surface rivers and lakes, which feed into the Sydney drinking water catchment. The SDWTS has a mean annual water discharge of 1325 ML per annum. In 2012, water was transferred to the SDWTS from Angus Place Colliery at an average rate of 4.43 ML/day (51.32 l/sec).

A typical dewatering facility such as Bore 940 comprises typically two to four submersible pumps used to manage mine inflows and associated surface infrastructure of electrical control systems and amenity facilities. Each borehole, equipped with the submersible pump, is cased to below the Lithgow Coal Seam, and pumps clean water to the surface. Staging tanks (portable) are used to collect dirty water produced from the extraction panels for temporary storage prior to being pumped into the goaf for purification though percolation through the workings and subsequently clean water runs under gravity to the submersible pumps for transfer to the surface. The configuration of the existing 940 dewatering bore is illustrated in **Figure 3.4**. It is licensed as a mining dewatering bore by the NSW Office of Water (10BL601851).

3.10.5 Non-mine Owned Infrastructure

There are a number of items of non-mine owned infrastructure within and surrounding the Project Application Area. These include overhead powerlines (11 kV and 66 kV), telecommunications towers the external road network, and the Newnes State Forest.



LEGEND

- Project Application Area
- Village
- Town
- Rail
- Main Road
- Environmental Study Area
- Proposed Infrastructure Corridor
- All Vehicle Access Route
- Light Vehicle Access Route
- Heavy Vehicle Access Route
- Pit Top Access Route

DATE	13/03/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F026 APC Rev 0
SCALE	1:130,000

Figure 3.3: Site Access Routes

0 1 2 3 4 5 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 26

A4

LEGEND

- Dewatering Borehole
- 1m Contour Interval
- Access and Entry
- Security Fence

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F006 APC Rev 0
SCALE	1:800

Figure 3.4: Dewatering Facility Bore 940

0 5 10 15 20 25 metres

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 6

A4

3.11 Water Management

The water management system at Angus Place Colliery comprises surface (clean and dirty water), process, potable, waste and underground (clean and dirty water) mine water elements and is operated in accordance with the Angus Place Water Management Plan. This plan was developed in accordance the conditions of PA 06_0021, EPL 476 and the "Statement of Commitments" which were committed to as part of the approval process. As a result of the approved modification in August 2011, this Site Water Management Plan has been updated accordingly.

The primary objective of the existing site water management system is to manage and minimise the impact of mining operations on surface and groundwater resources**. Figure 3.5** illustrates an overall schematic of the Angus Place Colliery water management system.

3.11.1 Licensed Discharge Points

EPL 467 defines the volumetric and concentration limits for water discharge offsite and the recording and reporting of data requirements. In accordance with EPL 467, water is discharged from Angus Place Colliery through Licenced Discharge Points (LDPs). The locations of LDPs provided by PA06_0021 are shown on **Figure 3.6** and consist of:

- LDP001 – discharge for mine water and runoff that is directed into Kangaroo Creek via wetlands and settling ponds (2 ML/day).
- LDP002 – discharge from the pit top surface water management system to Coxs River through settling ponds and an oil/water separator.
- LDP003 – Rainfall event based discharge of surface water from the Kerosene Vale site and discharges to the Coxs River through a settling pond.
- LDP005 – discharge of treated sewage effluent via a spray irrigation network to a designated utilisation area within the Angus Place pit top area.

PA06_0021 requires the following (**Table 3.5**) limits of monitoring of these LDPs.

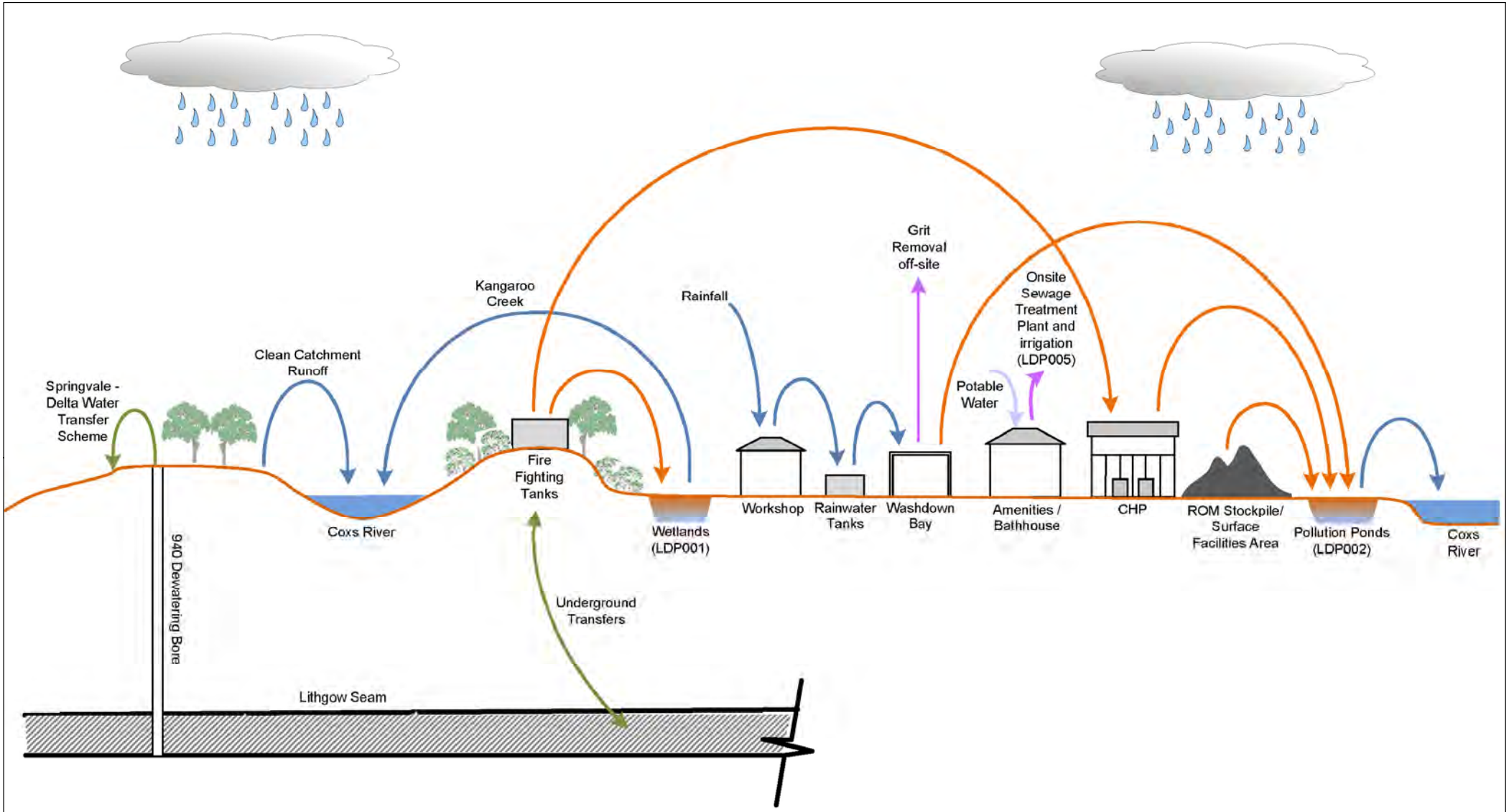
Table 3.5 Discharge Limits

Pollutant	Units of measure	100 percentile concentration limit
pH	pH	6.5 ≤ pH ≤ 8.5
Non-filterable residue	Mg/litre	NFR ≤ 30
Oil and Grease	Mg/litre	10

3.11.2 Surface Water Management

The surface water management system at the pit top relies on the separation of clean and dirty water and the effective management of water through collection, treatment and discharge. Surface water storages include primary, secondary and filter ponds at the pit top and the settling ponds, dams and wetlands to the east of the pit top. These surface facilities and ponds are illustrated in **Figure 3.7**.

The surface water management system at Kerosene Vale relies on the separation of clean and dirty water. All runoff from disturbed areas of Kerosene Vale is filtered through gabion baskets and ballast prior to being treated with flocculant. Water is then collected in a settling pond where water levels are managed to provide capacity to capture dirty water runoff.



Water Management Schematic as provided by GHD – Water Balance Assessment

Dirty Water
Clean Water
Underground Water
Potable Water
Waste Water

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F028 APC Rev 0
SCALE	NOT TO SCALE

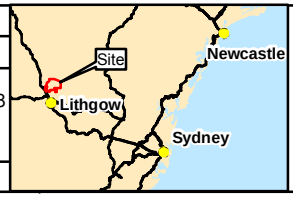


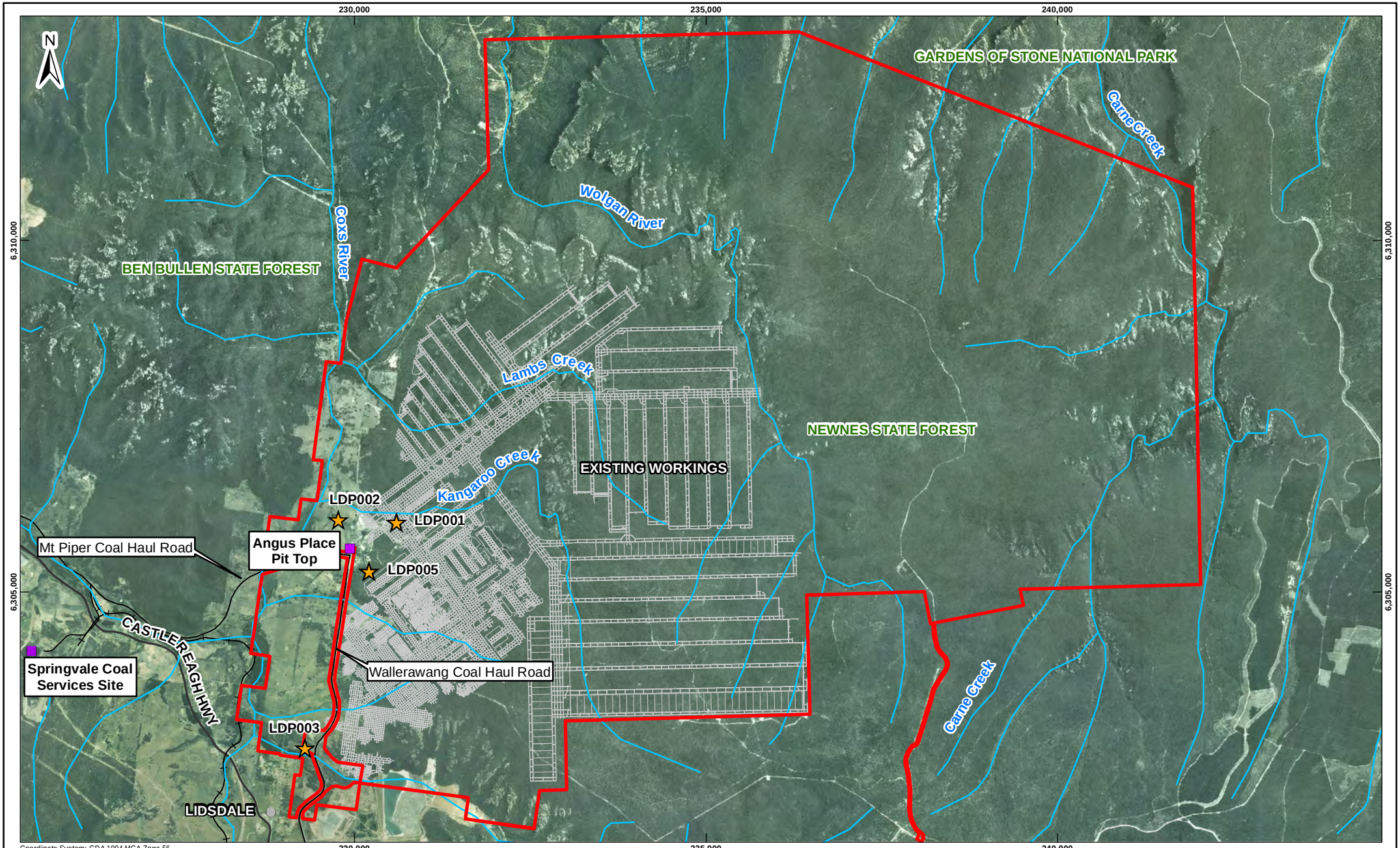
Figure 3.5: Schematic of Angus Place Water Management Plan (GHD 2013)

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 28

A4



LEGEND

- Project Application Area
- Village
- Rail
- Existing Workings
- Main Road
- Watercourse
- Licensed Discharge Point

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F029 APC Rev 0
SCALE	1:70,000

Figure 3.6: Licensed Discharge Points

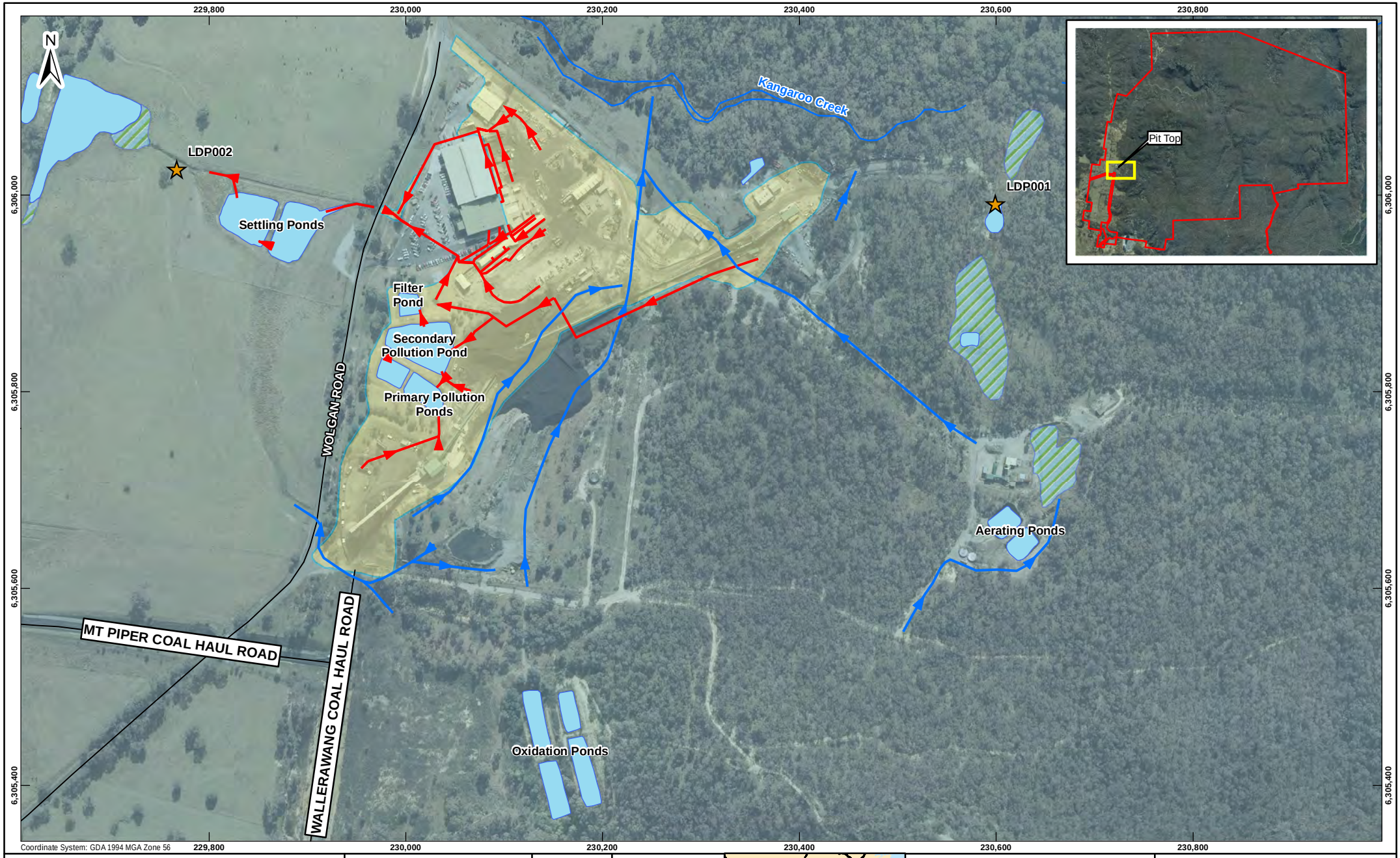
0 1 2 3 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 29

A4



LEGEND

- Clean Water Diversion with Flow Direction
- Process Water Diversion with Flow Direction
- Watercourse
- Licensed Discharge Point
- Pollution Control Structure
- Dirty Water Catchment
- Clean Water Catchment
- Pollution Control Wetland

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F007 APC Rev 0
SCALE	1:5,000

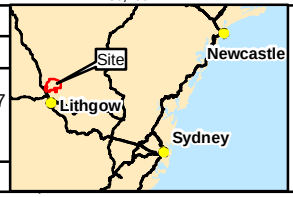


Figure 3.7: Clean and Dirty Water Flow Paths and Catchments

0 50 100 150 200 metres

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 7

A4

3.11.2.1 Surface Water Management at Angus Place Pit Top

Surface water storages for both clean and dirty water at the pit top are illustrated in **Figure 3.7** and include the following.

- **Primary Pollution Ponds** (1.9 ML capacity): Receives runoff from the coal processing plant and its own dirty water catchment. It overflows to the secondary pollution pond prior to discharge via LDP002;
- **Secondary Pollution Pond** (2.2 ML capacity): Receives overflow from the primary pollution pond and its own dirty water catchment. It overflows to the filter pond;
- **Filter Pond** (1.2 ML capacity) **:** Receives overflow from the secondary pollution pond and its own dirty water catchment. It overflows to LDP002.
- **Settling Ponds (7.5 ML):** Receives overflow from the Filter Pond and its own natural catchment. Overflows are discharged to LDP002 and thence into Coxs River. The ponds are flocculated and have a designed residence time to allow the full effect of the added flocculants. Additional flocculants dosing is used when rain is forecast to reduce the necessary residence time.
- **Oil/Water Separator**: Excess water from the Grit Trap, wastewater from the machinery wash-down bay, hardstand areas, oil storage areas, and workshop, and run-off from the contributing dirty water catchment is collected in a common wastewater collection drain, which gravity feeds to an oil/water separator unit. Water from the oil/water separator is transferred to the settling ponds.

  The oil/water separator is designed to accommodate a 1 in 5 year storm event, based on the first flush principle, without overflow. Oil and grease from the separator is disposed off–site by a licensed contractor.

The clean water diversion channels within the pit top area are diverted to wetlands and water is discharged via LDP001 into Kangaroo Creek. The clean water from the existing workings runs under gravity (refer **Section 3.10.1**) to the submersible pumps to allow transfer of water to the surface at Bore 940. Dewatered mine inflows at these bore sites are fed directly into the SDWTS for transfer to the Wallerawang Power Station for use in their cooling towers. A maximum of up to 30 ML/day of mine water can be transferred to Wallerawang Power Station via the SDWTS.

The volume of dirty water that is treated is minimised by limiting the contamination of clean water through use of diversions bunds and capturing dirty water in settling dams for treatment prior to re-use or discharge off site. The use of clean water is minimised through maximising the re-use of mine water underground for dust suppression and other process water requirements.

3.11.2.2 Surface Water Management within Newnes Plateau Infrastructure Sites

Each Newnes Plateau infrastructure site has its own surface water management system to ensure no dirty water discharges off site. Each site has clean water diversion bunds and level spreaders which divert clean storm water away from the disturbed areas. Sediment dams and sumps capture dirty water run-off from the respective sites for treatment prior to discharge of clean water off site.

3.11.3 Underground Water Management

Mine inflows, encountered during mining operations, are required to be managed so that water levels can be kept at safe levels underground, and therefore operational risks can be reduced. Both clean and dirty water are generated underground. Clean water is water make from the goaf areas that do not experience machine movements. Dirty water comprises water that runs along roadways and mine inflows from production panels. The dirty water is collected into portable staging tanks and pumped into the existing workings for the sediment to settle out before being diverted to the clean water system for transfer to the surface.

The clean water from the existing workings runs under gravity to the submersible pumps to allow transfer of water to the surface via the 940 dewatering borehole facility. Dewatered mine inflows at these bore sites are fed directly into the SDWTS for transfer to power stations.

A maximum of up to 30 ML/day of mine water can be transferred to Wallerawang Power Station. If the power station is unable to take any water then the mine inflows are discharged into Coxs River via Springvale's LDP009 in accordance with EPL 3607 volumetric limit of 30 ML/day.

In the event that the SDWTS is unavailable for extended periods provisions exist in EPL 3607 to discharge mine inflows to the maximum of 30 ML/day each at LDP004 and LDP005 on Newnes Plateau. Discharges at LDP004 and LDP005 have not occurred since April 2010.

Underground water from the existing workings and Kerosene Vale Colliery workings is also pumped to the surface via the pit top collection system to meet operational requirements, both for underground operations and surface facilities.

3.11.4 Site Water Requirements - Existing

A comprehensive site water balance assessment has been conducted to quantify surface and groundwater budgets for existing (and future) operations. The water balance (refer **Appendix F**) reviews the site water requirements, available water storage and discharge volumes for Angus Place Colliery. The largest water transfers are associated with mine water make, including underground transfers and transfers from the underground to the surface. Total site water requirements are illustrated in **Table 3.6** while **Table 3.7** show the water discharges or transfers from the site. The data show Angus Place Colliery is a net water producer.

The mean annual discharges from Angus Place Colliery are 3,497 ML through LDP001, 106 ML through LDP002 and 1,325 ML through the SDWTS. Operational site water requirements, together with surface water runoff are much less than the volume of mine water make. Angus Place Colliery is a net water producer.

Table 3.6 Site Water Requirements- Existing

Facility Usage	Annual Value (ML)
Bath House and Administration Building portable water	28
Process water (dust suppression, underground operations, screening and crushing plant)	237
Washdown Bay and workshop area	2.374
Coal Handling Plant	85.3
Total	**352**

Table 3.7 Site Water Discharges or Transfers- Existing

Discharges	Annual Value (ML)
LDP001	732.1
LDP002	106.3
LDP005	26.6
Washdown losses	1.2
Grit Trap	0.4
SDWTS	2354.9
Losses from CHP	17.1
Evaporation	15.6
Total	**3254**

3.11.5 Potable Water

Potable water is supplied to Angus Place Colliery from Lithgow City Council. This water is primarily used in the bathhouse and administration building. Additional bottled drinking water for employees is sourced from a local commercial drinking water supplier. This is immaterial to the water balance.

3.11.6 Wastewater Collection and Treatment

Sewage and grey water from the bathhouse and administration buildings is treated through a series of oxidation ponds and thence into a maturation pond prior to spray irrigation over a utilisation area at LDP005. This facility is licensed by the EPA under EPL 467.

Soil moisture is monitored at LDP005 to ensure that the irrigation applied does not result in surface water runoff. The location of the sewage treatment plant and effluent irrigation system are shown on **Figure 3.2**.

3.12 Environmental Management

3.12.1 Introduction

Angus Place Colliery has an established Environmental Management System (EMS) that has been developed in accordance with the Centennial Framework. The EMS provides an environmental management framework for all activities and areas managed at Angus Place Colliery.

The EMS applies to:

- Angus Place Colliery lease area – all surface and underground operations;
- all personnel who have specific responsibilities and duties within the EMS and associated standards and procedures; and
- all mine employees, contractors and external parties.

3.12.2 Centennial Environmental Policy

Angus Place Colliery has adopted the Centennial Environmental Policy that sets out Centennial Coal's aims and values applicable to all employees and contractors. The Policy underpins the Centennial Environment and Community Management Standards. The Environmental Policy has been endorsed by the Board of Directors and Mine Manager and is a commitment from top management to the community and the Mine's employees.

3.12.3 Environmental Management System and Management Plans

The EMS is a comprehensive set of environmental management plans, which have been developed in accordance with approval requirements.

Table 3.8 Environmental Management Plans

Management Plan or System	Purpose
Environmental Management Strategy	The Environmental Management Strategy provides an overall structure for environmental management at Angus Place including the strategic context, statutory requirements and roles and responsibilities of key personnel.
Public Safety Management Plan	This plan describes the processes to ensure public safety in surface areas that may be affected by subsidence arising from longwall mining.
Infrastructure Management Plan	This plan assists in the management of the risks to infrastructure as a result of subsidence and mining.
Land Management Plan	This plan describes management measures for surface cracking, erosion, soil slumping and land degradation caused by subsidence and/or associated activities.
Subsidence Management Plan (SMP)	The SMP provides significant detail around the management of subsidence impacts on the natural and built environment.
Subsidence Monitoring and Reporting Programme	This programme provides a means to measure how the effects of subsidence are monitored. The programme includes monitoring pre and post mining and ensures ongoing baseline data collection, investigation assessment and regular review with relevant stakeholders.
Subsidence Community Consultation Process	The subsidence community consultation process fulfils the requirements of the SMP approval. The objectives of this process are to: ■ effectively communicate with relevant stakeholders regarding subsidence on the Newnes Plateau; ■ define responsible parties within Centennial in respect of the communication paths and forums; ■ monitor and manage issues from relevant stakeholders; and ■ maintain a complaints protocol.
Flora and Fauna Management Plan	The purpose of this plan is to protect threatened species and communities, minimise impact on native flora and fauna, manage clearing, control weeds, and control access to environmentally sensitive areas.
Persoonia hindii Management and Research Program	This program has involved investigations and trials on *Persoonia hindii* and is ongoing. The outcomes this research and monitoring programme will provide information to inform future management decisions regarding potential impacts to *Persoonia hindii.*
Newnes Plateau Shrub Swamp Management Plan	The purpose of this plan is to measure and manage potential subsidence impacts from longwall mining (within the Subsidence Management Plan) on the Newnes Plateau Shrub Swamps.
Kangaroo Creek Management Plan	This plan describes monitoring, reporting and management of potential subsidence impacts from longwall mining on Kangaroo Creek. This includes baseline data collection, investigation, assessment and regular reviews. The plan also identifies management measures to remediate or mitigate any subsidence impacts.
Environmental Monitoring Programme	The Environmental Monitoring Programme consolidates all monitoring requirements developed in the individual management plans and monitoring programmes. The purpose of environmental monitoring is to gather data on the performance of the operation and determine the need for improvements or additional mitigation measures.
Air Quality Management Plan	This plan provides for the monitoring and management of air quality at Angus Place.
Noise Monitoring Programme	This programme sets out procedures for monitoring noise impacts at residential neighbours.

Site Water Management Plan	This plan coordinates the management of all surface water within the Angus Place holding boundary in an efficient and sustainable manner.
Groundwater Management Plan	This plan coordinates the management of all groundwater within the Angus Place holding boundary in an efficient and sustainable manner as per relevant bore licences.
Erosion and Sediment Control Plan	This plan, covering the pit top and Newnes State Forest, has been prepared in accordance with the Department of Housing's "Managing Urban Stormwater: Soils and Construction Manual" (2008) (the 'Blue Book'). It is also required under Schedule 3 Condition 10 of the PA 06_0021 and ensures that water discharged off site complies with suspended solids limits as detailed in EPL 467. It includes the following: ■ identification of sources of sediment; ■ description of management principles to be implemented; ■ description of the erosion sediment control structures in place; and ■ descriptions of measures to be implemented to decommission structures over time.
Contractor Environmental Management Plan	This plan ensures that all activities carried out on behalf of Centennial Angus Place comply with internal and external practices and guidelines.
Wallerawang Haul Road Inspection Protocol	This plan directs haul road inspections to assess surface conditions and identify areas requiring maintenance or repair.
Wallerawang Haul Road Landscape Management Plan	This plan provides for the establishment and maintenance of landscaping measures to minimise visual impacts of the haul road.
Bushfire Management Procedure and Management of Bushfire Assets Procedure	These set out the procedures for reporting fire and for the inspection and maintenance of firebreaks and asset protection zones at the pit top and on the Newnes Plateau.
Ventilation Management System	In accordance with Clause 21 of the *Coal Mine Health and Safety Regulation 2006,* Centennial Angus Place has implemented a Ventilation Management System (that includes a Ventilation Monitoring Arrangement) to ensure as far as reasonably practicable the safety of all persons present at the coal operation with regard to mine ventilation.
Strata Failure Management Plan	In accordance with Clause 28b (ii) of the *Coal Mine Health and Safety Regulation 2006* the objectives of this management system are to ensure as far as reasonably practicable the safety of all persons present at the coal operation with regard to underground strata.
Coal Mine Particulate Matter Report	This includes an emissions estimation and the identification and justification of particulate control measures for the site.

3.12.4 Monitoring and Reporting

The management plans are supported by an environmental monitoring network, monitoring noise, dust, groundwater, surface water and subsidence. Monitoring locations are illustrated in **Figure 3.8**. An overview of the monitoring programmes is provided below. Details of the monitoring results are provided in **Chapter 10.0**.

Subsidence

A subsidence monitoring programme is in place at Angus Place Colliery to measure maximum vertical subsidence induced by previous and current mining, and includes ground surveys along representative subsidence monitoring lines. The locations of the subsidence monitoring lines are shown in **Figure 3.8**.

The results of the monitoring programmes are reported in:

- Annual Reviews (formerly Annual Environmental Management Reports);
- Annual Returns for EPL 467;
- Subsidence Management Status Reports;
- Longwall End of Panel Reports;
- National Pollutant Inventory reports; and
- National Greenhouse Gas Emissions Report.

Noise

Since May 2008, the noise monitoring programme at Angus Place Colliery has provided quarterly background noise levels at the site at the representative residential receivers W1, L2 and L2. This is in compliance with the requirements of EPL 467.

Swamp Monitoring

A THPSS Management Plan was prepared in 2012 to:

- analyse monitoring data and previous studies collected in the THPSS since 2003;
- evaluate current monitoring programmes and the capacity of the monitoring programmes to deliver the outcomes requested in approval 2011/5949;
- use the monitoring data to determine the likelihood of mining related impacts on the Newnes Plateau THPSS;
- provide an ongoing monitoring programme to determine whether mining causes impacts on the THPSS;
- provide a series of response triggers to determine whether any mining related impacts occur and to address any mining related impacts if any occur;
- provide a series of management actions if any mining related impacts occur;
- provide an overview of remediation strategies to be used on the THPSS if any mining related impacts occur; and
- provide a framework for reporting on the performance of the strategies.

Ongoing THPSS monitoring has been undertaken in accordance with this plan.

Dust

Static dust monitoring commenced in 2011 at eight monitoring locations across the site.

Groundwater

Groundwater monitoring programmes at Angus Place commenced in 2002 and comprise groundwater level monitoring details for swamps, shallow aquifers and deep aquifers. The current monitoring network comprises:

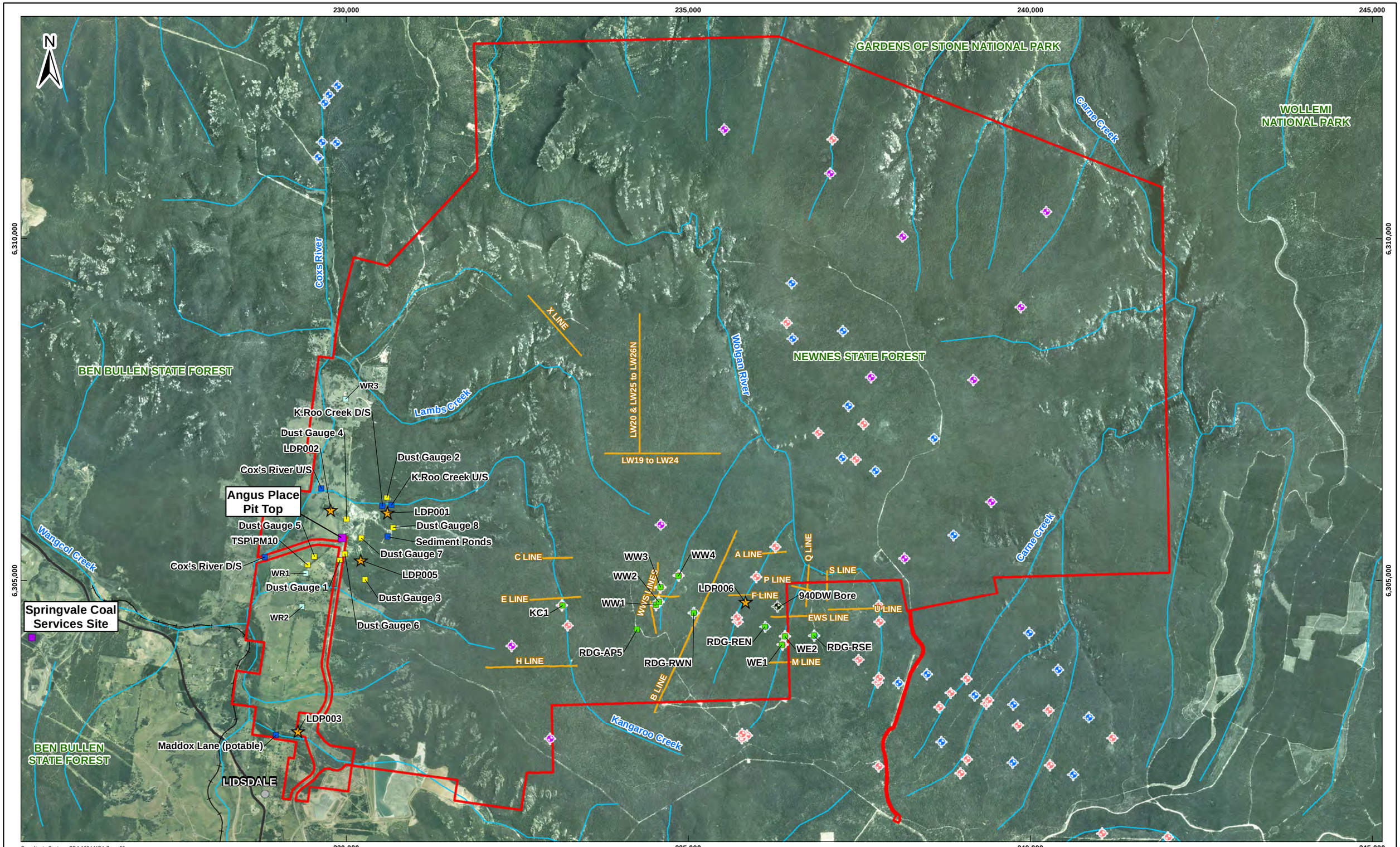
- 17 standpipe piezometers that monitor water levels in seven swamps;
- 5 standpipe piezometers to monitor shallow groundwater levels in the Banks Wall Sandstone;
- Bore 940 dewatering facility; and
- 12 vibrating wire piezometers to monitor pore water pressures in units underlying the Mount York Claystone and different horizons in the shallow aquifers;

Additional monitoring points are also being continually added to the network.

Surface Water

The surface water monitoring programme at Angus Place comprises flow and quality and includes:

- 4 surface water flow monitoring stations are installed at swamp discharge points;
- 5 Licensed Discharge points; and
- Watercourses, upstream and downstream of points of discharge such as Coxs River, Kangaroo Creek (upstream and downstream), the confluence of Coxs River with Kangaroo Creek, Lambs Creek and the Wolgan River.



LEGEND

- Project Application Area
- Village
- Subsidence Monitoring Line
- Rail
- Main Road
- Watercourse
- Existing Dewatering Facility

Monitoring Sites

- Air
- Groundwater
- Surface Water
- Dust Gauge and Noise
- Licensed Discharge Point
- Standpipe Piezometer
- Swamp Piezometer
- VWP Piezometer

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F010 APC Rev 0
SCALE	1:50,000

Figure 3.8: Environmental Monitoring Locations and Subsidence Monitoring

0 1 2 3 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 10

A3

3.12.5 Audits and Continuous Improvements

Centennial Coal has developed an environmental management strategy supported by an Environmental Policy, the EMS Framework and a series of corporate objectives and targets. At the corporate level, the Centennial Coal EMS Framework describes actions required to be undertaken by Centennial Angus Place to meet the minimum expectations of Centennial Coal in delivering environmental performance outcomes. These actions are required to ensure environmental performance is measured, monitored, trended, tracked and reported.

Internal audits are completed periodically to ensure the EMS is operating in accordance with the Centennial EMS Framework with continuous improvement identified and implemented where feasible.

The EMS at Angus Place focusses on ensuring compliance with approval conditions through these internal audits and continued implementation of management plans and monitoring programmes in accordance with Project Approval requirements. This includes continuous improvements to water management and noise management, and EMS training to all staff to heighten environmental awareness at the site.

In 2012 the following strategies, and management plans were reviewed by the Angus Place to incorporate the 2011 Modification for Longwalls 900W and 910N (Mod 1):

- Environment Management Strategy;
- Environmental Management Plan;
- Noise Monitoring Programme;
- Air Quality Programme;
- Site Water Management Plan; and
- Flora and Fauna Management Plan.

Following consultation with relevant government stakeholders all of the above were approved by DP&I on the 25th of June 2012. The Site Water Management Plan was approved on the 8th of November 2012. Continuous improvement activities for ongoing operations at the mine are summarised in **Table 3.9**.

Table 3.9 Continuous Improvement Activities

	Item
1	Development of the Extraction Plan for 900W and 910N. This will include a Coal Resource Recovery Plan, Subsidence Monitoring and Reporting Programme, Built Features Management Plan, Public Safety Engagement Plan and a Rehabilitation Management Plan.
2	Preparation of a new MOP. The current MOP has expired (July 2013). The new MOP will be prepared in accordance with latest DITRIS *Interim Mining Operations Plan Guidelines* (Interim MOP Guideline), proposed for release in November 2012.
3	Noise management works. A traffic light system will be installed on the Wallerawang Haul Road to assist in the distribution of trucks to prevent bunching which has caused noise exceedances.
4	Implement outcome of Dust (Pollution Reduction Programme) PRP Audit. This will include the development to a plan for stockpile storage and windbreak at the Kerosene Vale site.
5	Continue to action the requirements of Project Approval 06_0021. This will include but not be limited to a review of management plans and the preparation of a rehabilitation strategy.
6	Continue to undertake contaminated land assessments to enable rehabilitation of the site.
7	Continue to improve water management controls. This will included the utilisation of s water clarifier, investigating changes in coagulant dosing, and investigating additional sedimentation dams. The site water balance and hydrogeological model has also been updated as part of Project.

Centennial Coal has identified two actions to further improve the management of groundwater (mine inflows) from its mines in the Western Operations and to enhance the current understanding of the environmental values associated with any proposed water management scenarios. In summary, these actions were:

- Completing impact assessments for the proposed Life of Mine Water Management Strategy as part of the EISs the Springvale and Angus Place Mine Extension Projects; and
- Investigating the feasibility of potentially removing Newnes Plateau emergency discharge points from the applicable EPL

The Life of Mine Water Management Strategy, which has been now been assessed in this EIS (refer Section 10.2.4), concluded that beneficial reuse of the mine inflows intercepted by Springvale Mine and Angus Place Colliery for an industrial purpose is the most suitable use.

3.12.6 Pollution Incident Response Management Plan

A Pollution Incident Response Management Plan (PIRMP) has been developed and implemented at Angus Place Colliery to satisfy the requirements of section 153A of the *Protection of the Environment Operations Act 1997* (POEO Act) which requires the preparation, implementation and publication of a PIRMP. The PIRMP is available on the Centennial Coal website.

3.12.7 Pollution Reduction Program

Pollution Reduction Programs (PRPs) have been issued by the EPA and conditioned under the Angus Place Colliery Environment Protection Licence 467. Condition U1.1 of EPL 467 requires Angus Place Colliery to prepare and submit to the EPA for review, a report identifying all reasonable and feasible options for either the cessation of the discharge of groundwater generated by the licensee (as a result of mine dewatering activities) to the environment or, for treating the groundwater generated by the licensee (as a result of mine dewatering activities) prior to discharge to the environment at Licenced Discharge Point 1 (LDP001).

In addressing these matters Centennial identified two actions that are being progressed to further improve the management of water from its mines and to enhance the understanding of the environmental values associated with water generated by Centennial's mining operations. In summary, these actions were:

- Completing EISs to support the Extension Projects for Angus Place Colliery and Springvale Mine, including a life of mine water management strategy; and
- Remove LDP006 from EPL 467 (Newnes Plateau emergency discharge).

The Life of Mine Water Management Strategy which has been assessed in this EIS concluded that beneficial reuse for an industrial purpose is the most suitable use for the water generated by Centennial's activities in the Western Coalfield. This conclusion of beneficial reuse was determined through this environmental impact assessment process as the most appropriate water management option and is supported by the water management strategy outlined in **Section 10.2.3**.

As noted in the Section 7 *Stakeholder Consultation*, Centennial will continue to discuss PRP matters with the EPA.

3.12.8 Persoonia Hindii Management and Research Program

Recent investigations and trials on *Persoonia hindii*, as part of the *Persoonia hindii* Management and Research Program have found the following:

- approved translocation of plants from impact areas to an interim location, and then re-translocation back to original site, was forecast by experts to not be successful.
- recent translocations on the Newnes Plateau, have largely been unsuccessful.

- variation on translocation requirements, now includes measures such as cutting and propagation, and harvesting of seed for germination and establishment. 10% of cuttings have been successfully struck which is a positive outcome given the challenge of propagating this species.
- 100 fruit have been collected to identify appropriate fruit maturity state to maximise productive seed and overcome seed senescence. It is anticipated that propagation from seed is likely to improve plant establishment.
- Comprehensive mapping utilising a newly developed survey methodology adapted to the plant growth habit has found more plants that previously mapped.

It is anticipated that the Project will require some further focused mapping, however, the current investigation of propagated cuttings and seed establishment is likely to ensure successful plant establishment.

3.13 Rehabilitation and Final Landform

The approved MOP details the proposed rehabilitation objectives to ensure the final landform is commensurate with the surrounding topography and relevant zoning requirements of the time.

Angus Place Colliery has adopted a progressive approach to rehabilitation to reduce and mitigate potential environmental impacts. Exploration sites, ventilation and dewatering facilities and access tracks are rehabilitated promptly with periodic inspections and maintenance as necessary based upon evidence of endemic regrowth, weeds and soil disturbance. Rehabilitation acceleration techniques are undertaken, if required following approval from the Forestry Corporation of NSW.

The success of progressive rehabilitation activities is monitored against appropriate performance indicators identified within the Angus Place EMS framework and relevant legislative requirements.

Minor rehabilitation activities are carried out at the pit top. This includes the seeding of the area surrounding the carpark and adjacent to the conveyor. Given that Angus Place Colliery is well established with little ongoing construction requiring the implementation of additional erosion and sediment controls, there is no requirement for the regular progressive rehabilitation at the pit top. It is envisaged that the current pollution control structures will remain in place for the life-of-mine.

CHAPTER 4.0
Project Description

4.0 PROJECT DESCRIPTION

4.1 Overview of the Project

As noted in **Section 1.8**, in brief, the Angus Place Mine Extension Project includes:

- all currently approved operations, facilities and infrastructure of the Angus Place Colliery pursuant to:
  - Project Approval PA 06_0021 (as modified);
  - EPBC 2011/5952; and
  - the various approvals, licences, permits, certificates and authorities listed in **Table 3.1** and **Table 3.2** of this EIS, including an existing approved SMP.

Except as otherwise indicated in this EIS (e.g. see **Table 4.1**).

The principal components of the currently approved operations that will not form part of the Angus Place Mine Extension Project are the ROM coal transport operations and the operational management and rehabilitation of the Kerosene Vale stockpile currently authorised by Project Approval PA 06_0021;

- extension and continuation of longwall mining for 25 years from the date consent is granted for the Angus Place Mine Extension Project, with rehabilitation to be undertaken following this period; and
- exploration activities within the Project Application Area;
- modifications to existing facilities and infrastructure, and construction and operation of new facilities and infrastructure, within the Project Application Area for the Angus Place Mine Extension Project that are required to support the Project.

The Project will continue to employ the retreat longwall mining method. It will continue to use the existing surface and underground infrastructure at the pit top and Newnes Plateau.

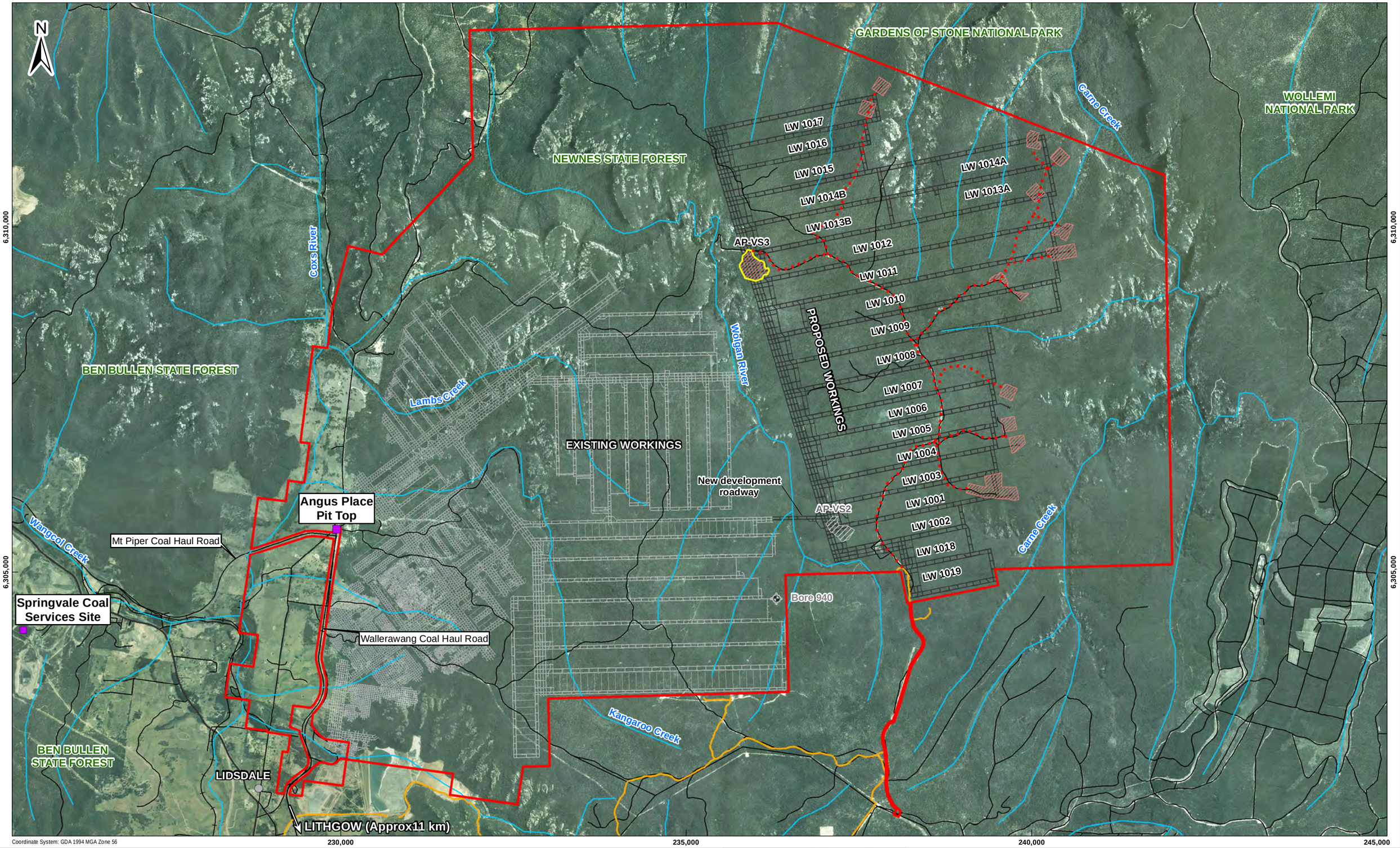
The Project is proposing to construct or establish and operate new infrastructure both on the surface and underground, as appropriate (**Table 4.1**). The Project will progressively decommission infrastructure and rehabilitate associated disturbance areas no longer required for operations.. The Project will not significantly alter the nature of the existing operations at Angus Place Colliery. On cessation of mining activities the Project will rehabilitate all disturbed areas associated with the pit top and the Newnes Plateau infrastructure areas to create final landforms commensurate with the surrounding areas.

A comparison of the existing operations and the Project are summarised in **Table 4.1**. New infrastructure and elements to support continued operations at Angus Place Colliery are illustrated in **Figure 4.1**. The proposed mine plan is illustrated in **Figure 4.2.**

Table 4.1 Comparison of Existing Operations and the Project

Key Feature	Existing Operations	The Project
Mine Life	▪ Existing consent (PA06_0021) within ML 1424 expires 18 August 2024. ▪ Planned longwall mining in accordance with the current mine design and consent will end in March 2016.	▪ Seeking approval for continued operations for 25 years from date of consent. Rehabilitation activities may be completed following this period.
Hours of Operation	▪ Mine operates 24 hours per day, 7 days per week.	▪ No change.
Employment	▪ 300 direct employees and contractors.	▪ No change.
Coal Production	▪ Annual extraction limit of 4 million tonnes per annum of ROM coal.	▪ No change.
Mining Method	▪ Retreat longwall mining.	▪ No change.
Pit Top	▪ Access via Wolgan Road from the Castlereagh Highway for employee and contractor parking areas. ▪ Three mine portal entries, for personnel, materials and coal conveyor. ▪ Administration buildings with amenities, office and training areas. ▪ Bathhouse. ▪ Workshops, hardstand areas, vehicle and equipment wash down areas. ▪ Diesel, solcenic hydraulic fluid and oil storage facilities. ▪ Mining supplies and conveyor equipment storage areas. ▪ Sewage treatment plant. ▪ Coal stockpile area, coal processing facility and truck loading facility. ▪ Air compressor and electrical switchyard; ▪ A dirty and clean water management systems in addition to potable and waste water services. ▪ Licence Discharge Points LDP001 and LDP002. ▪ Sewage treatment works. ▪ ROM coal stockpile area. ▪ Telecommunications facilities. ▪ Electrical distribution Network (66kV Electrical transmission). ▪ Ancillary infrastructure	▪ No change
Underground Mine Access	▪ Access to the mine extraction areas is via existing headings and roadways.	▪ No change to access to the underground from the pit top. ▪ Extension of main headings to the east. ▪ Development of new headings and roadways to access extraction areas.
Mining Area	▪ LW980 extracted in accordance with PA06_0021 and SMP 04/1675. ▪ LW910 and LW900 are scheduled for development and extraction following LW980 in accordance with PA06_0021 and EPBC 2011/5952.	▪ Continued construction of ventilation facility (APC-VS2) ▪ Continued mining of LW900 and LW910. ▪ Proposed development and extraction of LW1001 to LW1019.
ROM Coal Handling	▪ Coal conveyed from the underground mine and deposited on the pit top ROM stockpile prior to being crushed and transported off site. No reject material is generated at Angus Place. ▪ Approved stockpile capacity is 90,000 at the pit top and 500,000 tonnes at Kerosene Vale.	▪ No change to pit top coal handling or stockpile. ▪ The Kerosene Vale stockpile and its operational management will in effect be "transferred" to the development consent to be granted in respect of the Western Coal Services Project (refer **Section 1.8**).

ROM Coal Transport	▪ Angus Place Colliery hauls coal to Wallerawang Power Station via the Wallerawang Haul Road. A second haul road to Mount Piper Power Station is owned by Coal>Link Pty Ltd and used by Centennial Angus Place. No coal is transported via public roads.	▪ Operational management of ROM coal transport will in effect be "transferred" to the development consent to be granted in respect of the Western Coal Services Project (refer **Section 1.8**).
Mine Ventilation	▪ Vent Shaft 1 and Vent Shaft 2 (located in the vicinity of the Angus Place pit top) are both downcast and fresh air intake shafts. ▪ One upcast and downcast shaft site (AP-VS2) is located east of the Wolgan River within Newnes State Forest.	▪ Continued use of existing Vent Shaft 1 and Vent Shaft 2. ▪ Construction and operation of a downcast shaft (intake) ventilation facility (AP-VS3) on Newnes State Forest.
Dewatering Bore Facilities	▪ Dewatering Bore 940 extracts groundwater from the underground mine, which is transferred into the existing SDWTS or LDP009 (emergency discharge only).	▪ Continued use of Bore 940. ▪ Continued use of SDWTS. ▪ Dewatering bores and associated infrastructure will constructed and operated at the eastern end of specific longwall panels (LW1001 – LW1019). ▪ No change to extraction of mine inflows at the pit top. ▪ Mine water will be discharged by through LDP001, and/or transfer to the SDWTS. ▪ Install and operate dewatering reinjection boreholes and pipeline infrastructure at APC-VS2.
Rehabilitation	▪ Progressive rehabilitation of infrastructure and exploration sites at the pit top, Newnes Plateau and Kerosene Vale undertaken as required.	▪ No change to progressive rehabilitation on the Newnes Plateau. ▪ Life of mine rehabilitation to be undertaken of all disturbed areas associated with the pit top and Newnes Plateau. ▪ Rehabilitation at the Kerosene Vale site to be undertaken separate to this Project, as proposed in the EIS of the Western Coal Services Project (refer **Section 1.8**).
Exploration	▪ Exploration activities undertaken within EL6856 and EL6293. Approval for activity sought under Part 5 of the EP&A Act	▪ Exploration activities to be undertaken within EL6856 and EL6293 boundaries. Approval sought in this Project under Part 4 of the EP&A Act..



LEGEND

- Project Application Area
- Village
- Rail
- Main Road
- Street / Track
- Watercourse
- Existing SDWTS Pipeline
- Existing Dewatering Facility
- Existing Ventilation Facility (AP-VS2)
- Environmental Study Area
- Ventilation Facility (AP-VS3)
- Infrastructure Corridor
- Existing Workings
- Proposed Workings

DATE	13/03/2014
SEAM	LITHGOW
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SCALE	1:50,000

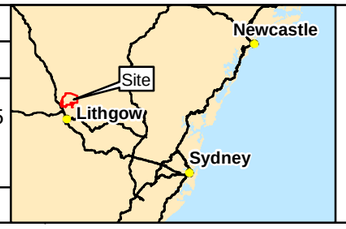


Figure 4.1: New Surface Infrastructure

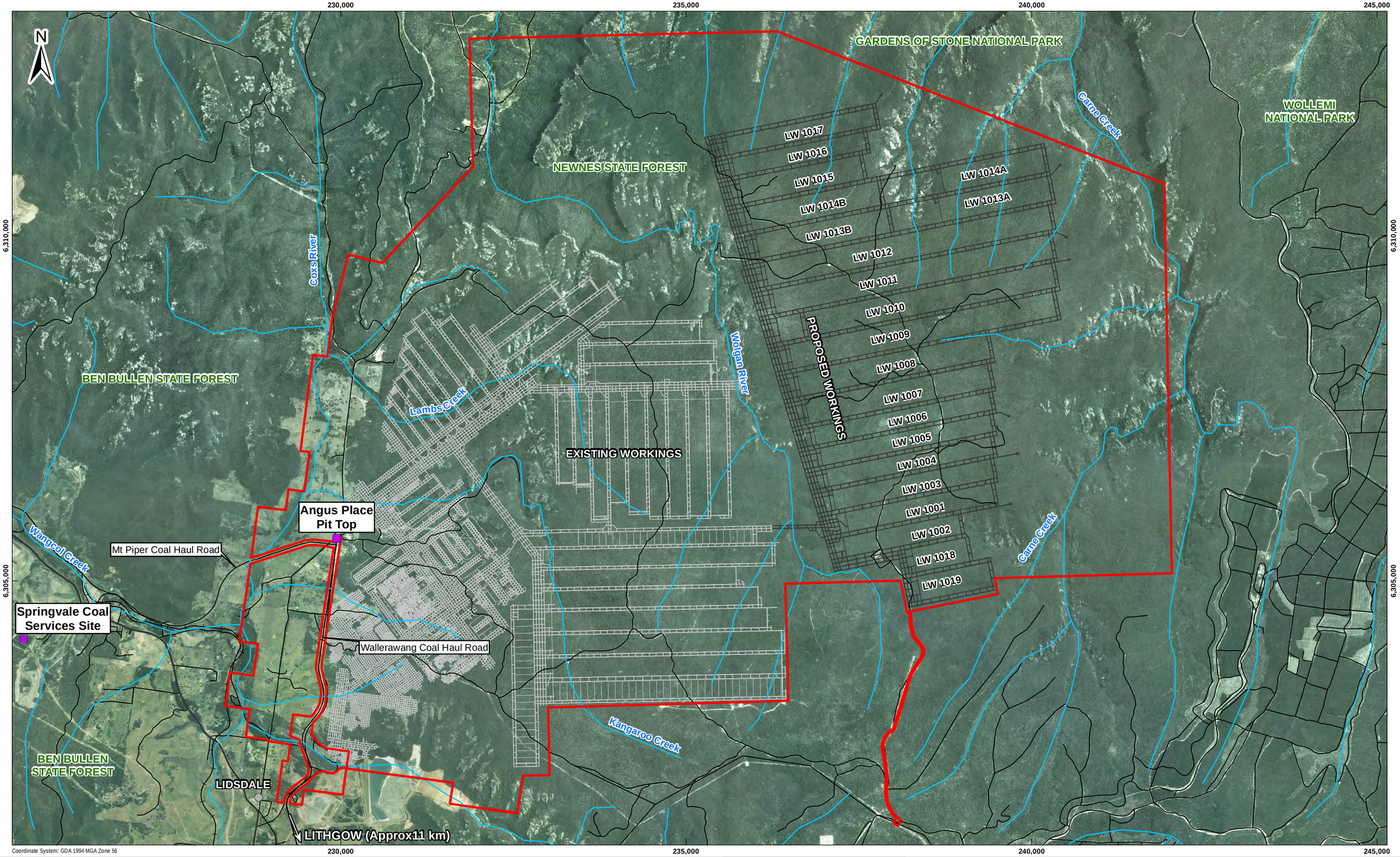
0 1 2 3 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 5

A3



LEGEND

- Project Application Area
- Village
- Rail
- Main Road
- Street / Track
- Watercourse
- Existing Workings
- Proposed Workings

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F087 APC Rev 0
SCALE	1:50,000

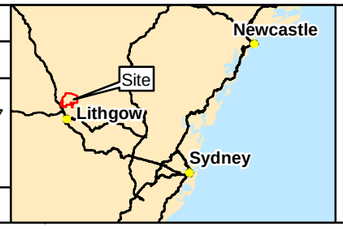


Figure 4.2: Mine Plan

0 1 2 3 km

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 87

A3

4.2 Exploration Programme

Exploration activities will continue throughout the life of the Project within the Project Application Area with a view of refining the site's existing geological model used for detailed mine planning. The exploration programme will be undertaken throughout the life of the Project and approval for these activities is sought as part of the Project.

All exploration activities will be carried out in accordance with the requirements of the *Mining Act 1992* and relevant mineral authorities, including environmental impact assessment and development consent. Angus Place Colliery will continue to utilise area-based assessment procedures for the management of exploration activities to ensure that they are conducted in an environmentally responsible manner and with due consideration to the community. This will include a risk-based process for the selection, assessment and environmental management of proposed drill pad sites and access tracks based on environmental, geological, logistical and other operational constraints.

Due-diligence field inspections and targeted surveys of the proposed drill sites and associated access tracks will be undertaken by appropriate qualified ecologist and heritage specialists prior to commencement of works to ensure the potential for localised impacts and risks are minimised and, where necessary, appropriately managed. Noise assessments will be undertaken when proposed drill sites are in proximity to residential receptors. The combination of environmental sensitivity risk mapping and targeted due-diligence surveys of potential drill sites will provide greater flexibility in selecting the most suitable final drill site locations with minimal impact on the local environment and surrounding populace.

Drill sites and associated access tracks will be located where possible to:

- avoid threatened flora species;
- avoid hollow bearing trees;
- avoid endangered ecological communities;
- minimise clearing; and
- avoid identified Aboriginal heritage sites.

Mitigation measures and management strategies will be implemented to address the potential for erosion and downstream sedimentation, noise emissions and bushfire risk as appropriate. The drilling will be undertaken as described in detail in **Section 3.2**. On completion of exploration, all boreholes and surface disturbance will be sealed and rehabilitated in accordance with the appropriate guidelines and legislation at the time.

The location of proposed geological exploration boreholes is currently unknown, and as a consequence, detailed environmental and social impact assessment cannot be undertaken at this time. As the required drill hole locations are determined, Centennial Angus Place will undertake a series of due diligence assessments to consider ecology, archaeology and noise as relevant. The appropriate industry and legislative guidelines and policies in force at the time will be referenced and the assessments provided to the Department of Planning and Infrastructure.

The general approach of the due diligence assessments will be to conduct site investigation to ensure that significant impacts are avoided. For example, should the preferred drill hole location coincide with an endangered ecological community or Aboriginal artefact site, the drill hole location will be moved wherever possible. Following this micro-siting process, the due diligence reports will make a clear statement as to impact. In most cases, it is expected that only archaeology and ecology will be addressed; acoustic assessments will only be prepared by exception, should proposed drill holes be within an envelope likely to affect receivers.

4.3 Land Preparation

Land preparation, including vegetation clearing, will be required for the following proposed activities on Newnes Plateau:

- the construction of several dewatering facilities;
- the establishment of access tracks and ancillary infrastructure corridors to the dewatering facility sites, comprising upgrade of the existing tracks and creation of new sections of tracks;
- the establishment of a downcast shaft (intake) ventilation facility (AP-VS3);

The vegetation clearing required for the proposed activities is approximately 23.25 ha, and involves vegetation communities listed in **Table 4.2**.

Table 4.2 Native Vegetation Communities to be Cleared

Mapping Unit	Vegetation Community	Area (ha)
7	Newnes Plateau Narrow - Leaved Peppermint - Mountain Gum - Brown Stringybark Layered Forest	1.06
14	Tableland Mountain Gum - Snow Gum - Daviesia Montane Open Forest	0.16
26	Newnes Plateau Narrow-leaved Peppermint - Silvertop Ash Shrubby Woodland on Ridges	8.25
26a	Newnes Plateau Gum Hollows variant: Brittle Gum - Mountain Gum, Scribbly Gum - Snow Gum Shrubby Open Forest	0.11
28	Sandstone Plateau and Ridge Scribbly Gum - Silvertop Ash Shrubby Woodland	5.45
29	Sandstone Slopes Sydney Peppermint Shrubby Forest	1.84
30	Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland	6.38
Total		23.25

Dewatering Facilities and Infrastructure Corridors

The construction footprint of each bore site will be approximately 90 m x 110 m while the final constructed footprint will be 50 m x 70 m. Drilling of the boreholes using the blind boring method will be undertaken as described for exploration drilling in **Section 3.2**.

Following vegetation clearing over the entire construction footprint infrastructure site locations, and prior to the mobilisation of the drill rig and other plant required for the construction of the boreholes, erosion and sediment controls will be implemented. These controls, to mitigate any potential water quality impact on the receiving environment from surface disturbance, will be described in a detailed Construction Environmental Management Plan. The localised erosion and sediment controls (for example, sediment fences, clean and dirty water diversion structures), to be implemented at the drill pad sites (and the infrastructure corridors described below) will be consistent with the objectives of Angus Place Colliery's *Water Management System* and will be carried out in accordance with the industry best practice principles for the region and guidelines for erosion and sediment control (Landcom, 2004). During construction a temporary sediment basin will be installed to capture dirty water runoff from disturbed areas via clean water diversion bunds installed on the perimeter of the site compound.

Cut-and-fill will be undertaken on the cleared land to create a level area. All disturbed areas will be stabilised as soon as practical after excavation using standard design guidelines (Landcom (2004), DECC (2008)). The topsoil and subsoil stripped from the area will be stockpiled separately for subsequent use in rehabilitation. Best practice methodology will be employed during topsoil stripping and transportation to prevent excessive soil deterioration.

A sump to be installed for the storage and recycling of the drilling fluid during drilling of boreholes will be retained for operations and once the dewatering facility has been established and part rehabilitated to form a constructed footprint with a 20 m Asset Protection Zone around it. The sump will serve to capture dirty water run-off from the disturbed areas for treatment prior to discharge off site.

Vegetation clearing along the existing access tracks will create a 10 m wide track which will be part rehabilitated to a final 5 m track. Sediment and erosion controls will be installed within the infrastructure corridors encompassing access tracks to the drill pad sites and trenched SDWTS pipelines and power cables. Cross-banks and mitre drains will be constructed along sections of the access tracks at appropriate distances as dictated by topography, in accordance with DECC (2008) to convey run-off away from the road alignment. The infrastructure corridor will be graded to a crown to shed water in accordance with Landcom (2004).

The backfilled trench within the infrastructure corridor will be thoroughly compacted to avoid settlement/subsidence of the fill material and inadvertent channelisation of water. The top 150 mm of fill may subsequently be scarified or roughened (if required) to assist topsoil adhesion and vegetation establishment.

4.4 Hours of Operation, Workforce and Project Life

Angus Place Colliery will continue to operate 24 hours a day, seven days a week, 52 weeks per year. The Project will continue to employ 300 direct employees and contractors.

The Project will extend the life of Angus Place Colliery by 25 years from the date of consent.

4.5 Site Access

Angus Place pit top will continue to be accessed via the Wolgan Road from the Castlereagh Highway and is 5 kilometres north of the village of Lidsdale. Access to Wolgan Road from the sub-regional road network is provided via the intersection of Castlereagh Highway and Wolgan Road and Main Street or via the intersection of Castlereagh Highway and Ian Holt Drive.

Access to infrastructure in Newnes State Forest will continue to be available via light and heavy vehicle access routes from the sub-regional network. Heavy vehicles will be required to use a designated route into Newnes State Forest via the intersection of Chifley Road and Old Bells Line of Road. Light vehicles will access Newnes State Forest via Clarence or via State Mine Gully Road to Lithgow.

These access routes are illustrated in **Figure 3.3**.

4.6 Mining

4.6.1 Mining Method

To continue operations at Angus Place Colliery, the Project will develop and extract LW1001 to LW1019 to the east of the existing mining area. Proposed workings are illustrated on **Figure 4.2**. The longwalls are oriented in an east northeast to west southwest direction, which aligns with the horizontal stress direction of the Lithgow seam.

Development of new roadways will be undertaken ahead of longwall extraction to enable access to LW1001 to LW1019 panels.

The Project will not result in a change to the existing annual extraction rate of 4 million tonnes per annum ROM coal.

Mine planning and design has considered sensitive surface features such as swamps, cliff-lines, significant rock features, watercourses and sites of cultural significance overlying the proposed mining areas on Newnes Plateau (refer **Chapter 8.0**). Through conservative mine planning, Angus Place Colliery has sought to reduce impacts upon these sensitive surface features.

As an engineering design control to manage subsidence, LW1001, LW1002 and LW1003 will be 285 m wide with minimum cutting heights of 2.6 m by longwall mining. LW1004 to LW1006 will be narrower with 261 m voids. The depths of cover directly above these proposed longwalls range from 330 m to 430 m with resulting void width to depth critical ratios of 0.60 to 0.85, which is less than previous longwall development at Angus Place.

As LW1007 to LW1019 are not situated directly underneath sensitive natural features, they will be 350 m wide, with chain pillars 55 m wide. Depths of cover range from 360 m to 420 m. The resulting void width to depth ratios are within the range of 0.85 to 1.0, which is similar to those for the previously extracted longwalls at Angus Place. LW1010 has been shortened to avoid undermining Twin Gully Swamp.

The longwall panel dimensions have been optimised based on experience from the neighbouring Springvale Mine's existing mining operations in addition to numerical subsidence predictions and impact assessment models (refer **Chapter 2.0**). The proposed panel widths are equal to or less than, those previously extracted longwalls at Angus Place Mine and are predicted to have the effect of increasing underground stability and significantly reducing the risk of environmental impacts upon natural surface features. The predictions are based upon the significant research that has been undertaken on previous longwalls at Angus Place and Springvale Mine and across the Western Coalfields as discussed in **Chapter 8.0**.

4.6.2 Mining Sequence

On approval, longwall mining at Angus Place Colliery will progress generally northwards from LW1001 to LW1017, and then southerly to LW1018 and 1019. LW910 to the west will be extracted last.

4.7 Coal Handling, Processing, Stockpiles and Transport

There will be no change to coal handling and stockpiling at Angus Place Pit top, which will be undertaken as described in **Section 3.7**.

The existing drift conveyor will continue to transport ROM coal from the underground to the surface for stockpiling and sizing at the pit top. ROM coal will continue to be transported via trucks on private haul roads to either Mount Piper or Wallerawang power stations, or to a coal stockpile area at Kerosene Vale.

The operational management of both the transportation of coal either by haul road or to Kerosene Vale stockpile will be undertaken by the Western Coal Services Project (State Significant Development 12_5579).

ROM coal will continue to be transported via trucks on private haul roads to either Mount Piper or Wallerawang power stations, or to a coal stockpile area at Kerosene Vale. However, as noted above the operational management of both the transportation of coal either by haul road or to Kerosene Vale stockpile will be undertaken by the Western Coal Services Project (State Significant Development 12_5579).

4.8 Plant and Equipment

The Project will result in no change to the type of plant and equipment used at Angus Place Colliery. Underground support services (dewatering, ventilation facilities and compressed air supply) and existing conveyor systems will be modified to access the new extraction areas of the Project as appropriate.

4.9 Mine Support Facilities and Underground Mine Access

No change to existing infrastructure and operations associated with Angus Place pit top management, pit top access or pit top mine services will occur as part of the Project. New surface infrastructure to support mining in the new areas is proposed on Newnes Plateau. Access to Newnes Plateau infrastructure areas will not change as a result of the Project.

4.9.1 Underground Mine Access

No changes to underground mine access are proposed in the Project. The existing three portals located at the pit top will continue to be utilised for personnel and materials.

4.9.2 Workshop, Services and Administration Infrastructure

No changes to the workshop, services and administration infrastructure at the pit top are proposed. Infrastructure described in **Section 3.9** will continue to be utilised.

4.10 Infrastructure

4.10.1 Water Management Infrastructure

The existing surface water management systems comprising clean and dirty water flows paths and storages, described in **Section 3.11.2**, will continue to be utilised and maintained on an ongoing basis. No changes are proposed to the sewage treatment works and the potable water supply infrastructure.

The mine dewatering infrastructure located on Newnes Plateau will be extended and upgraded, as described in **Section 4.10.3**.

4.10.2 Pollution Control Infrastructure

No changes to the pollution control infrastructure at the pit top described in **Section 3.10.2** are proposed in the Project.

4.10.3 Other Mine Infrastructure

Ventilation Facilities

No changes to the existing ventilation facility (AP-VS2) are proposed in the Project.

Mine planning has identified that additional ventilation capacity is required to ensure compliance with Clause 13(h) of the NSW Coal Mine Health and Safety Regulation 2006. To optimise the existing ventilation system, an air intake ventilation facility (downcast) will be required to deliver fresh air to the underground mine. This is identified as Angus Place Ventilation Site 3 (APC-VS3) (**Figure 4.1**). The facility has been located to fit with the layout of the proposed underground roadways and the existing surface infrastructure within Newnes State Forest (i.e. forest roads and tracks). The subsidence predictions and ecological assessment completed for the Project have also informed the design layout in that the area will not be subject to subsidence and known sensitive surface features have been avoided.

APC-VS3 will have a surface footprint of approximately 14 ha and will have a suitable asset protection zone. It will be constructed using a blind boring technique and lined with concrete. The cuttings (or blind bore tailings) will be brought to the surface and temporarily stored in rehabilitated mounds at the shaft site, and used to backfill the shaft when decommissioned. Once constructed, AP-VS3 will not require any supporting infrastructure such as electrical power.

Pit Top Collection System

No changes to the pit top collection system, used to pump groundwater from the existing workings for operational requirements (refer **Section 3.10.1**), are proposed in the Project.

Dewatering Bore Facilities

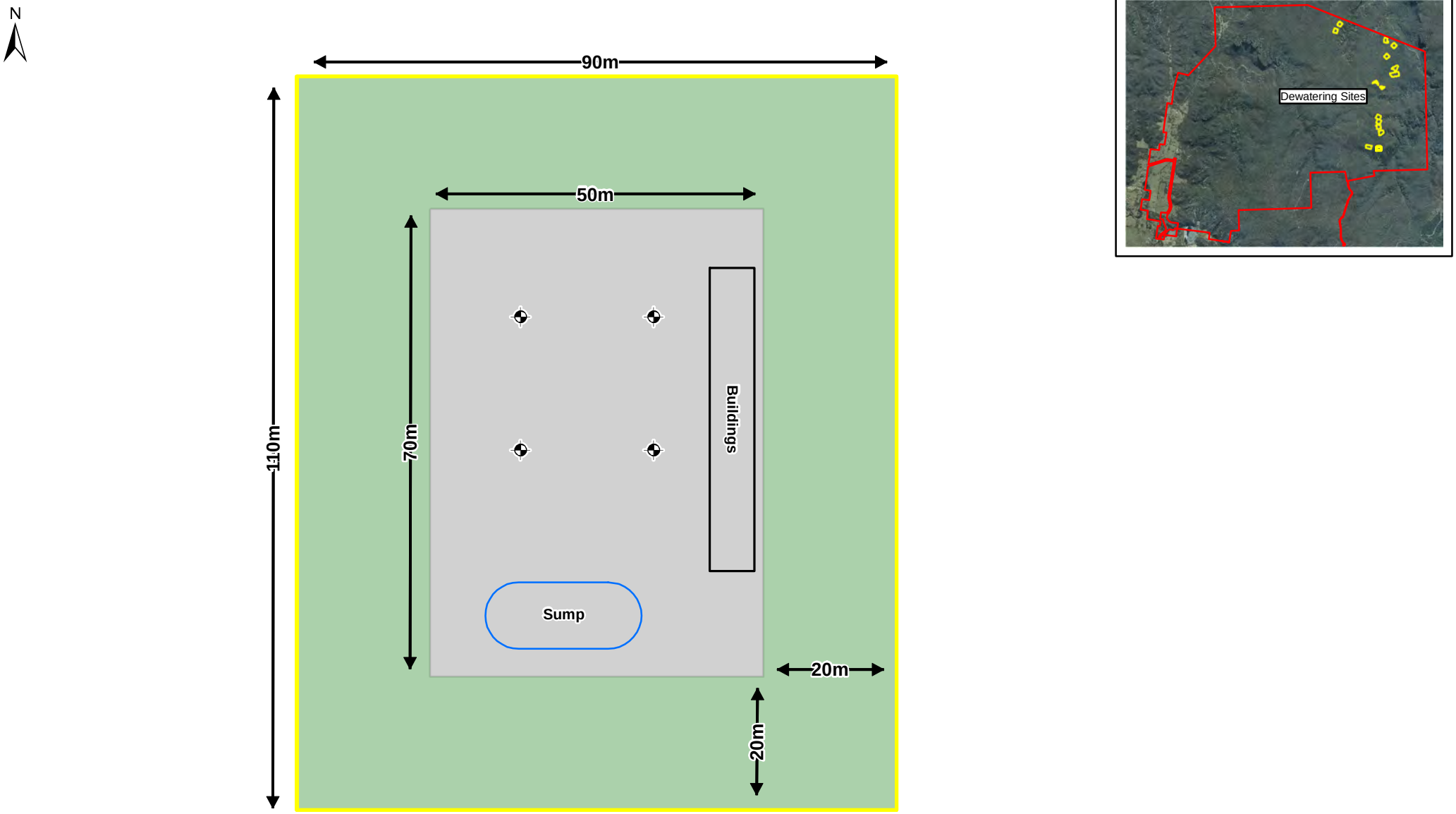
The Project will require control of the increased volume of mine water make to meet underground safety and operational requirements. Several new dewatering bore facilities will be required to continue to deliver water into the SDWTS (which will continue to be utilised as part of the Project). Each dewatering facility site will be constructed and operated in series, with construction, operation, decommissioning and rehabilitation staged and contingent upon the progression of underground workings.

Dewatering bore facility sites are identified in **Figure 4.1** and will be located within the designated environmental study areas (ESA), which have been based upon mine design requirements, and environmental constraints from a desktop analysis. Extensive studies of each ESA have assessed potential environmental impacts (such as ecology, archaeology, surface water and topography), to identify the surface constraints for the final placement of the dewatering boreholes. The preferred options will balance dewatering needs with potential environmental impact.

A concept plan for a typical dewatering bore facility is illustrated in **Figure 4.3**. A number of boreholes founded on concrete pads and equipped with submersible pumps will extend from the surface to below the Lithgow Coal Seam. The bore site will have cuttings sump and ancillary surface electrical control equipment. Each site will be installed with erosion and sediment controls, and water management structures to separate dirty water runoff from clean water to minimise pollution of receiving waters. The construction footprint of each bore facility will be 1 ha. A 20 m Asset Protection Zone will be established around each facility. Each bore site will be fenced with a lockable gate for public safety and security.

Ancillary Infrastructure

The dewatering facility bore pumps will require mains power, with buried 11 kV power lines to be located alongside existing and new tracks within an infrastructure corridor. These will extend from existing 66/11kV substation along Sunnyside Ridge Road via buried 11 kV power lines alongside Sunnyside Ridge Road. The dewatering facilities will also require an interconnection via pipeline with the SDWTS. This pipeline would be polyethylene with a nominal diameter of 450 mm. The pipeline will be trenched underground and exist adjacent to existing access tracks where possible as illustrated on **Figure 4.1**.



LEGEND

- Dewatering Borehole
- Construction Footprint
- Asset Protection Zone
- Final Footprint

DATE	23/01/2014
SEAM	LITHGOW
REFERENCE	127623060-R-F009 APC Rev0
SCALE	1:800

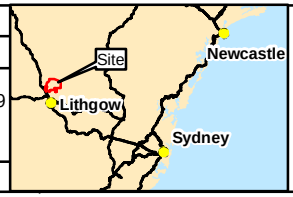


Figure 4.3: Dewatering Facility Concept Plan

0 5 10 15 20 25 metres

PLOTFILE No.

Centennial Coal
Angus Place

DRG No. 9

A4

4.10.4 Non-mine Owned Infrastructure

The Project will continue to utilise additional non-mine infrastructure within and surrounding the Project Application Area. These will include overhead powerlines (11 kV and 66 kV), telecommunications towers, the external road network and access track networks within Newnes State Forest

The Project will upgrade and extend the existing access tracks from Sunnyside Ridge Road to the dewatering bore facilities and APC-VS3. In some cases, there will be no existing tracks close enough to the required surface facilities location. While dependent upon the final bore facility locations, it is anticipated that up to 2 kilometres of new access tracks be built. The work area to permit the upgrading access roads and infrastructure corridor will be approximately 32 ha. The power lines and the water pipeline will be buried within a 10 m infrastructure corridor to be established adjacent to the access tracks. This infrastructure corridor would include vegetation clearance and temporarily increasing the width of access tracks to allow for the movements of large equipment during construction.

Following the trenching of the pipelines and power lines, the infrastructure corridor would be rehabilitated to create approximately 5 m wide access tracks to the facilities.

4.11 Water Management

The overall configuration of water management at the pit top, as shown in **Figure 3.7** will not be modified by the Project. The management of all water elements, comprising process, clean and dirty water, potable and waste water management will continue to be undertaken in accordance with the Site Water Management System.

Modifications to underground water management associated with the Project are limited to the management of predicted increases in mine water make.

4.11.1 Licensed Discharge Points

The Project will retain LDP001, LDP002 and LDP005 within EPL 467. LDP003 will in effect be transferred to the Western Coal Services Project (State Significant Development 12_5579). LDP006 has been rescinded.

No new LDPs are proposed.

4.11.2 Surface Water Management

No changes are proposed in the surface water management at the pit top. Clean and dirty water will continue to be managed as described in **Section 3.11.2**.

4.11.3 Underground Water Management

The existing water underground water management infrastructure will continue to be utilised in the Project. However, modifications will be undertaken as appropriate to manage mine inflows from the new proposed mining areas. Mine inflows within existing mine workings, following treatment comprising de-silting, will be pumped to the surface either via the 940 dewatering borehole and into the SDWTS or to the pit top via the pit top collection system. For all proposed mine workings, the mine inflows will be pumped into the SDWTS via the proposed dewatering facilities.

Angus Place Colliery (in conjunction with Springvale Mine) has developed a life of mine water management strategy that will collectively manage mine inflows from the two mines. It essentially comprises direct transfer of the mine inflows from the workings into the SDWTS via the dewatering sites. From the SDWTS the fed water will be managed by a combination of discharges through LDP009, and/or transfer to Wallerawang Power Station via the SDWTS. Transfer of water to Wallerawang Power Station up to a maximum of 30 ML/day will take precedence over discharges into Coxs River at LDP009.

If the power station is unable to take any water then the entire mine inflows fed into the SDWTS (from both Springvale Mine and Angus place Colliery) is proposed to be discharged on a continuous basis into Coxs River via LDP009. The maximum mine inflows proposed to be discharged into Coxs River is approximately 43.8 ML/day in year 2023 which corresponds to the year of maximum water make from both mines (refer

Section 10.2.3.1 and Figure 10.11). The SDWTS duplication to increase the capacity of the scheme to 50 ML/day would have been undertaken by this time (refer Section 4.10.3).

When the predicted water make exceeds 30 ML/day, and when Wallerawang Power Station is able to take the maximum 30 ML/day, then the balance of the water make (in excess of 30 ML/day, refer Figure 10.11) will be discharged on a continuous basis into Coxs River via LDP009.

In the event that the Springvale Mine Extension Project is not approved management of mine inflows from Angus Place Colliery will rely on the discharge of the entire water make from the proposed workings via the existing LDP001 into Kangaroo Creek which flows into Coxs River. The maximum water that will be discharged into Kangaroo Creek will be approximately 25 ML/day on a continuous basis.

If required, the Project will have the capacity to redirect emergency mine inflows from the SDWTS underground into the Angus Place Colliery 900 water storage area via the existing Angus Place 940 Bore facility. In-seam pumping infrastructure from the 940 Bore location underground will be constructed to allow this redirection of the mine inflows. Approval for this infrastructure is being sought as part of the Project.

Underground water from the existing workings and Kerosene Vale Colliery workings will continue to be pumped to the surface via the pit top collection system to meet operational requirements, both for underground operations and surface facilities.

4.11.4 Site Water Balance – Proposed

A site water balance assessment to quantify the surface and groundwater budgets for the Project is summarised in **Table 4.3** and **Table 4.4.**

The water balance model was simulated over the predicted life of mine including both existing and proposed conditions, and considering operations at the adjacent Springvale Mine and the SDWTS. Results for the proposed case for the year 2023 were used as this corresponds to the point in time when combined water make from Angus Place and Springvale is predicted to be at a maximum.

During 2023 the predicted mean annual discharge from Angus Place Colliery to the SDWTS will be 5318 ML/day through LDP001 and 106 ML/day through LDP002.

For the potable system, it is proposed that 28 ML/yr will be sourced through the Lithgow City Council potable system. 26 ML/yr will be disposed of through the on-site treatment system and LDP005 irrigation area.

The Project will be running a net surplus of water even during dry years.

Table 4.3 Site Water Requirements – Proposed

Facility Usage	Annual Value (ML)
Bath House and Administration Building portable water	28
Process water (dust suppression, underground operations, screening and crushing plant)	237
Washdown Bay and workshop area	1.2
Total	**266.2**

Table 4.4 Site Water Discharges or Transfers – Proposed

Discharges	Annual Value (ML)
LDP001	732.1
LDP002	106.3
LDP005	26.6
Losses from the Grit Trap	0.4
SDWTS	9741.8
Evaporation	15.6
Losses from the CHP	17.1
Losses from vehicle washdown	1.2
Total	**10607.4**

4.11.5 Potable Water

Potable water will continue to be sourced from Lithgow City Council for bathhouse and administration buildings. Additional drinking water for employees will continue to be sourced from a local commercial drinking water supplier.

4.11.6 Wastewater Collection and Treatment

Sewage and grey water at the pit top area will continue to be treated on site within the sewage treatment works. The treated effluent will continue to be pumped via LDP005 to a sprinkler system in the onsite utilisation area.

4.12 Waste Management

No production waste comprising reject materials from ROM coal processing will arise from the Project. Non-production waste generated at the pit top, and existing and new infrastructure areas on Newnes Plateau will continue to be managed as described in **Section 3.10.3**.

4.13 Environmental Management

Angus Place Colliery will continue to undertake environmental management and monitoring as described in **Section 3.12** and in accordance with the following.

- Angus Place Colliery's EMS comprising Angus Place Colliery Environmental Management Plans, listed in **Table 3.7**, following a review and updating of the plans, as appropriate. The review will take into consideration the environmental assessments undertaken as part of this EIS, the commitments made in this EIS and all relevant consent conditions.
- Centennial Environmental Policy.
- Angus Place Colliery will undertake monitoring and reporting in accordance with an updated environmental monitoring network, monitoring noise, dust, groundwater, surface water and subsidence. Monitoring results will continue to be reported monthly on Centennial's website and on an annual basis in an Annual Review.

4.14 Rehabilitation and Final Landform

4.14.1 Progressive Rehabilitation

The approved MOP details the proposed rehabilitation objectives to ensure the final landform is commensurate with the surrounding topography. These are further detailed specific to the Project in the "Decommissioning and Rehabilitation Strategy" (**Appendix P** and **Section 10.11**).

The new infrastructure components of the Project will require rehabilitation as a result of surface disturbance during construction. The progressive approach to rehabilitation as outlined in **Section 10.11.4** (and **Appendix P**) will continue to be applied. The success of existing and future rehabilitation will be monitored against appropriate performance indicators identified within the rehabilitation strategy and MOP.

Where appropriate the rehabilitation strategy will prioritise native vegetation integration with undisturbed native vegetation to provide consolidated areas and wildlife corridors, which will enable the Newnes State Forest to return to the end land use of grassland and woodland in agreement with the landholder of the Forestry Corporation of NSW.

Regular monitoring of the rehabilitated areas will occur during the initial vegetation establishment period and beyond, to ensure the objectives of the Rehabilitation Strategy are being achieved. Further detail on life-of-mine and rehabilitation is provided in **Section 10.11**.

4.14.2 Life of Mine Rehabilitation

On cessation of all mining activities the disturbance areas will be fully rehabilitated to create stable and self-sustaining landform for the nominated end land uses of woodland (Newnes Plateau) and grassland (Angus Place pit top). The creation of the proposed final landforms will ensure they are commensurate with the surrounding topography and relevant zoning requirements of the time.

CHAPTER 5.0
Planning Considerations

5.0 PLANNING CONSIDERATIONS

The Angus Place Colliery Extension Project has been assessed with full consideration of the applicable legislative requirements of the Commonwealth and State, along with the local planning and environmental frameworks of the Lithgow LGA, where applicable. This section describes the relevant regulatory framework and the application to the Project.

5.1 Approval Pathway and Permissibility

The development assessment and approval system in NSW is set out in Parts 4 and 5 of the EP&A Act. Division 4.1 in Part 4 provides for the assessment and determination of State significant development (SSD). Pursuant to Section 89C of the EP&A Act, projects are classified as SSD if they are declared to be such by the *SEPP (State and Regional Development) 2011* (SRD SEPP). Schedule 1 of the SRD SEPP identifies development for the purpose of coal mining as SSD, and as outlined in **Section 5.5**, the Project is permissible with development consent. As a result, pursuant to clause 8(1) of the SRD SEPP, the Angus Place Colliery Extension Project comprises SSD.

The Minister for Planning and Infrastructure (or his delegate) determines development applications for SSD under Part 4 of the EP&A Act. The Minister has delegated his consent authority function to the NSW Planning Assessment Commission for development applications made by private proponents for SSD.

A Project Briefing Paper was submitted to the DP&I, along with various other State and local government agencies, in September 2012 seeking the DGRs for the form and content of the EIS to accompany the development application. The DGRs were issued by the DP&I on 6 November 2012 outlining the general requirements and key issues to be addressed within the EIS.

An EPBC Act referral was made to the Federal Minister of the Environment on 20 May 2013 (Reference: EPBC 2013/6889) and was declared a controlled action under the Act on 7 July 2013. The Federal Minister's delegate determined that the Project will be assessed by the accredited assessment under the EP&A Act The Supplementary DGRs for the Project in relation to EPBC 2013/6889 was issued by the Director- General under section 78A(8A) of the EP&A Act on 30 August 2013.

The DGRs, the Supplementary DGRs, and the input received from other consulted government agencies are contained within Appendix A and summarised in **Section 1.6** and **Chapter 7.0**.

5.2 Commonwealth Legislation

5.2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC, now Department of Environment) and provides a legal framework to protect and manage nationally important flora, fauna, ecological communities and heritage places defined as matters of 'national environmental significance' (NES). An action that "*has, will have or is likely to have a significant impact on a matter of National Environmental Significance*" may not be undertaken without prior approval from the Commonwealth Minister, as provided under Part 9 of the EPBC Act. Approval under the EPBC Act is also required where actions are proposed on, or will affect, Commonwealth land and its environment.

An assessment of whether the Angus Place Colliery Extension Project may have a significant impact on any matters of NES or on the environment of Commonwealth land was undertaken during the EIS investigations and preparation. Specifically, RPS, conducted an on-line search of the EPBC Act Protected Matters Search Database (accessed in February 2013) to generate a list of those matters of NES within a 10 kilometre radius of the Project Application Area. RPS used this data, together with other local knowledge and records, to assess whether the Project will have, or is likely to have, a significant impact upon a matter of NES or on the environment of Commonwealth land.

The Flora and Fauna Assessment Report (**Appendix H**) concludes that the Angus Place Colliery Extension Project potentially has a likely significant impact on any of matters of national environmental significance listed under the EPBC Act. For this reason a referral to the DoE (former) SEWPAC was made (**Section 5.1**).

5.2.2 Native Title Act 1993

The *Native Title Act 1993* recognises that Aboriginal people may have rights and interests to certain land and waters which derive from their traditional laws and customs. Native title may be recognised in places where Indigenous people continue to follow their traditional laws and customs and have maintained a link with their traditional country. Most of the lands within the Project Application Areas are subject to an Ancillary Deed which was entered into on the 31 January 2003 by the Gundungurra Native Title Claim Group, the Gundungurra Tribal Council Aboriginal Corporation and Centennial Springvale Pty Ltd, Springvale SK Kores Pty Ltd, Coalex Pty Ltd, Centennial Coal Company Ltd, Centennial Angus Place Pty Ltd and Ivanhoe Coal Pty Ltd. As such, these Centennial Companies are bound by the terms of this Deed.

The Deed is subject to a confidentiality clause and as such detailed commentary regarding the Deed is not provided in this document.

Any Native Title matters that are not dealt with within the existing Ancillary Deed are required to be resolved prior to the grant of a new the mining lease required for the Project.

5.2.3 National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) provides a single national framework for the reporting and dissemination of information about the greenhouse gas emissions, greenhouse gas projects, and energy use and production of corporations. It makes registration and reporting mandatory for corporations whose energy production, energy use or greenhouse gas emissions meet specified thresholds. Centennial reports emissions from the corporation on an annual basis, including those from the Angus Place Colliery, in accordance with the NGER Act.

5.3 NSW State Legislation

5.3.1 Environmental Planning and Assessment Act 1979

Objects of the EP&A Act

The EP&A Act is the principal piece of legislation overseeing the assessment and determination of development proposals in NSW. It aims to encourage the proper management, development and conservation of resources, environmental protection and ecologically sustainable development.

The objects of the EP&A Act generally seek to promote management and conservation of natural and artificial resources, while also permitting appropriate development to occur. The principles of ecologically sustainable development and public participation are also objects of the EP&A Act. The consistency of the Project with these objects is summarised in **Table 5.1**.

Table 5.1 Objectives of the EP&A Act

Objects of the EP&A Act	Consistency of the Project
(a) to encourage:	
(a) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,	Specialist consultants have been engaged to assess and report on the potential for the Project to impact upon the natural and artificial resources within the vicinity of the Project Application Area. Notably: ▪ The impacts on the natural environment have been addressed within Sections 10.2, 10.3, 10.10 and 10.11. ▪ The impacts on agricultural land have been addressed within Section 10.10. ▪ The social and economic implications have been addressed within Chapter 6.0.
(b) the promotion and co-ordination of the orderly and economic use and development of land,	The orderly and economic use of land is best served by development which is permissible under the relevant planning regime and predominantly in accordance with the prevailing planning controls. The Project comprises a permissible development which is consistent with the statutory and strategic planning controls. As detailed in this EIS, the proposal will result in positive economic impacts, with appropriate mitigation measures and management strategy being proposed to reduce adverse environmental impacts.
(c) the protection, provision and co-ordination of communication and utility services,	The Project will not affect public communication networks or utilities.
(d) the provision of land for public purposes,	Not applicable to the Project.
(e) the provision and co-ordination of community services and facilities, and	Not applicable to the Project.
(f) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and	Specialist consultants have been engaged to assess and report on the potential for the Project to impact upon the local environment. Notably, the impacts on flora and fauna have been addressed within Section 10.3.
(g) ecologically sustainable development, and	The proposal is consistent with the principles of ecological sustainable development as outlined in Chapter 12.0, addressing both this object of the EP&A Act and clause 7(1)(f) in Schedule 2 of the EP&A Regulation.
(h) the provision and maintenance of affordable housing, and	Not applicable to the proposal.
(i) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and	As outlined in Section 5.1, the SSD Project is subject to the provisions of Part 4 of the EP&A Act, where the Minister for Planning and Infrastructure is the consent authority.
(j) to provide increased opportunity for public involvement and participation in environmental planning and assessment.	As outlined in Chapter 7.0, Centennial Angus Place has undertaken significant consultation in relation to the Project with government agencies, the local community and other stakeholders. This consultation process is continuing with respect to the progression towards obtaining development consent and a mining lease for the Project. Any relevant public representations will need to be considered by the DP&I during the assessment of the development application.

Section 79C Evaluation

Section 79C of the EP&A Act applies to the determination of development applications for SSD. In determining the Project, the consent authority is required to consider the matters listed in Section 79C(1) of the EP&A Act as are of relevance to the development. Each of the relevant matters has been addressed in the EIS and will need to be considered by the consent authority during the assessment of the Project.

Other Approvals

Pursuant to Section 89J of the EP&A Act, the following authorisations are not required for approved SSD proposals:

- the concurrence under Part 3 of the *Coastal Protection Act 1979* of the Minister administering that Part of the Act;
- a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*;
- an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977*;
- an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974*;
- an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or under any Act to be repealed by that Act) to clear native vegetation or State protected land;
- a bush fire safety authority under section 100B of the *Rural Fires Act 1997*;
- a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*; or
- an order under Division 8 of Part 6 of the *Heritage Act 1977* restricting harm to buildings, works or relics that are not protected by a heritage listing.

Pursuant to Clause 89K of the EP&A Act, an authorisation of the following kind cannot be refused if it is necessary for carrying out an approved SSD proposal, and must be granted "substantially consistent" with the SSD consent:

- an aquaculture permit under section 144 of the *Fisheries Management Act 1994;*
- an approval under section 15 of the *Mine Subsidence Compensation Act 1961*;
- a mining lease under the *Mining Act 1992*;
- a production lease under the *Petroleum (Onshore) Act 1991*;
- an environment protection licence under Chapter 3.0 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act);
- a consent under section 138 of the *Roads Act 1993;* and
- a licence under the *Pipelines Act 1967.*

The need to obtain any of the above approvals for the Project is outlined in **Section 5.3.2**.

5.3.2 Other Key NSW State Legislation

The existing approvals relevant to the Project are described in **Section 3.1**. In addition to the requirement for development consent under Part 4 of the EP&A Act, the Angus Place Colliery Extension Project will require approvals, licences and/or authorities under various other pieces of NSW State legislation **Table 5.2** lists the key relevant pieces of NSW State legislation and indicates the implications, if any, for the Project.

Table 5.2 Relevant NSW State Legislation

NSW State Legislative Act	Project Implications (approvals, licences and/or authorities)
Protection of the Environment Operations Act 1997 (POEO Act)	Angus Place Colliery is a premises-based "scheduled activity" under Schedule 1 of the POEO Act and currently operates under the provisions of EPL 3607. The Project will operate under an EPL, which will include LDP001, 002 and 005, all in EPL 467. Details of these LDPs are provided in **Section 3.11.1** and **Figure 3.6**. Under the POEO Act, the regulatory authority is required to consider the matters listed in clause 45 of the Act. The regulatory authority is required to take into consideration the following matters as are of relevance: ▪ Any protection of the environment policies; ▪ The objectives of the EPA as referred to in section 6 of the Protection of the Environment Administration Act 1991; ▪ The pollution caused or likely to be caused by the carrying out of the activity or work concerned and the likely impact of that pollution on the environment; ▪ The practical measures that could be taken to prevent, control, abate or mitigate the pollution and to protect the environment from harm as a result of the pollution; ▪ The environmental values of water affected by the activity or work, and the practical measures that could be taken to restore or maintain those values; and ▪ Any guidelines issued by the EPA to the authority These matters have been addressed within this EIS.
Mining Act 1992	To permit the extraction of coal within the Project Application Area a new mining lease will be required over the Project Application Area under the *Mining Act 1992*. It is expected that the conditions of the new mining lease and SSD consent will require a new Mining Operations Plan (MOP) and Extraction Plan to be prepared and approved for the Project.
Water Act 1912	The *Water Act 1912* governs access, trading and allocation of licences associated with surface water and groundwater sources where a Water Sharing Plan is not in place. Angus Place Colliery has three extractive water licences associated with the 930 dewatering bore (decommissioned) (10BL601852), the 940 dewatering bore (10BL601851) and the pit top collection system (10BL601838). These are approved under the *Water Act 1912*.
Water Management Act 2000 (WM Act)	The WM Act is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. Water sharing plans prepared in accordance with the WM Act include rules for protecting the environment and administrating water licensing and trading. The Project Application Area is within an area covered by Greater Metropolitan Region Water Sharing Plan (refer **Section 10.2**). Angus Place Colliery holds groundwater monitoring licences approved under the *Water Management Act 1912* for a series of shallow and deep groundwater monitoring piezometers. Appendix E lists the ground water and surface water licencing required for the Project under the WM Act as a result of the Project. By the operation of Section 89J of the EP&A Act, the Project will not require water use approvals under Section 89 of the WM Act, water management approvals under Section 90 or a controlled activity approval under Section 91. However, it may require an aquifer interference approval under Section 91 of the WM Act.
Coal Mine Health and Safety Act 2002 (CMH&S Act)	Centennial Angus Place currently holds all necessary approvals under the CMH&S Act, which aims to assist in securing and promoting the health, safety and welfare of people at work at coal operations. Gas drainage and management at Centennial Angus Place will continue to be regulated under the provisions of the Act.

Mine Subsidence Compensation Act 1961	The Project Application Area is not located within a Mine Subsidence District. No surface improvements will require approval by the MSB prior to construction.
Dams Safety Act 1978	The Project does not propose any underground mining or surface disturbance on or in the vicinity of any dams prescribed under the *Dam Safety Act 1978*
Crown Lands Act 1989	There is Crown land within the Project Application Area. The Project will not require a licence to use Crown Land under the provisions of the *Crown Lands Act 1989*.
Roads Act 1993	Section 138 of the *Roads Act 1993* requires consent be obtained prior to disturbing or undertaking work in, on or over a public road. The Project proposes limited widening of public roads within the Newnes State Forest. By operation of Clause 89K of the EP&A Act, consent under Section 138 of the *Roads Act 1993* cannot be refused if it is necessary for carrying out an approved SSD proposal, and must be granted substantially consistent with the SSD consent.
Threatened Species Conservation Act 1995 (TSC Act)	The TSC Act provides protection for threatened plants and animals native to NSW excluding fish and marine vegetation) and integrates the conservation of threatened species into development control processes under the EP&A Act (refer to Appendix H and **Section 10.3**.
National Parks and Wildlife Act 1974 (NPW Act)	The NPW Act contains provisions for the protection and management of national parks, historic sites, nature reserves and Aboriginal heritage. By operation of Section 89J of the EP&A Act, the Project does not require any additional approvals under the NPW Act. An Aboriginal Heritage Assessment is provided in Section 10.4 and the management of sites is detailed in **Section 10.4.6.**
Aboriginal Land Rights Act 1983	The *Aboriginal Land Rights Act 1983* provides for the constitution of local, regional and State Aboriginal Land Councils and a mechanism for Land Councils to claim Crown land. There are no known granted claims over Crown land in the Project Application Area.
Heritage Act 1977	Historical archaeological relics, buildings, structures, archaeological deposits and features are protected under the *Heritage Act 1977*. There are no heritage items in the Project Application Area within the World Heritage List, NSW Heritage Register, Australian Heritage Database or the relevant Local Environmental Plans (RPS 2013b). In any event, Approval is not required under Part 4 of the Heritage *Act 1977* due to the operation of Section 89J of the EP&A Act.
Contaminated Land Management Act 1997	The relevance of this legislation to the Project is outlined in **Section 5.4.4.**
Forestry Act 2010	Access permits will be required to allow access to surface infrastructure sites in the Newnes State Forest.

5.4 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) are Environmental Planning Instruments (EPIs) prepared by the Minister to address issues significant to NSW. The SEPPs outlined in the below sub-sections contain provisions that are relevant to the Project and therefore are matters to be taken into consideration by the consent authority.

5.4.1 SEPP (State and Regional Development) 2011

SEPP (State and Regional Development) 2011 (SRD SEPP) came into effect upon the repeal of Part 3A of the EP&A Act and identifies development to which the SSD assessment and determination process under Division 4.1 in Part 4 of the EP&A Act applies. The relevance of the SRD SEPP for the purposes of the Project is outlined in **Section 5.1**.

5.4.2 SEPP (Mining, Petroleum Production and Extractive Industries) 2007

SEPP (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) aims to provide for the proper management and development of mineral, petroleum and extractive material resources for the social and economic welfare of NSW. **Section 5.5** discusses the permissibility of the Project due to the application of clauses 7(1) (a) and 5(3) of the Mining SEPP.

Part 3 of the Mining SEPP stipulates matters for consideration by the consent authority before determining an application for consent in respect of development for the purposes of mining. Specifically, Clauses 12 to 17 (inclusive), requires consideration to be given to the significance of the resource, the compatibility of projects with other surrounding land uses, including the existing and potential extraction of minerals, natural resource management and environmental management, resource recovery, transportation and rehabilitation.

The information presented in this EIS addresses each of the matters for consideration prescribed in the abovementioned clauses, and the assessment undertaken has been multi-disciplinary and involved consultation with various government agencies and stakeholders. Emphasis has been placed on anticipation and prevention of potential environmental and social impacts, with various mitigation measures, management strategies, and monitoring activities proposed to minimise adverse impacts.

5.4.3 SEPP (Infrastructure) 2007

SEPP (Infrastructure) 2007 (Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across NSW by improving regulatory certainty and efficiency through a consistent planning regime and greater flexibility in the location of infrastructure and service facilities. Clause 45 of the Infrastructure SEPP provides that for a development application in respect of development carried out:

- within or immediately adjacent to an easement for electricity purposes (whether or not the electricity infrastructure exists), or
- immediately adjacent to an electricity substation, or
- within 5m of an exposed overhead electricity power line,

The consent authority must give written notice to the electricity supply authority for the area and invite comments about potential safety risks, and take into consideration any response to that notice received within 21 days after the notice is given.

This EIS assesses the Project's impact on relevant electricity transmission lines and describes the consultation that has been undertaken to date in respect of the Project.

5.4.4 SEPP No. 55 – Remediation of Land

SEPP No. 55 – Remediation of Land (SEPP 55) provides for a state-wide planning approach to the remediation of contaminated land in order to reduce the risk to human health or any other aspect of the environment.

Clause 7(1) of SEPP 55 provides that a consent authority must not consent to the carrying out of any development on land unless:

- it has considered whether the land is contaminated;
- if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out; and
- if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

Further, clause 7(2) of SEPP 55 provides that before determining an application for consent to carry out development that would involve a "change of use" in respect of certain land specified in clause 7(4) of SEPP 55, the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines (being the 1998 publication *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land*).

Centennial Coal undertook a contaminated site assessment across all its sites including Angus Place Colliery in accordance with the *Contaminated Land Management Act, 1997* to determine whether any site triggered the Duty to Report criteria. A three phase approach was adopted as follows:

- Phase 1 desk top assessment completed in December 2010;
- Phase 2 intrusive sampling and analysis programme, completed in February 2012; and
- Phase 3 implementation of remediation plans.

In February 2012, Centennial Coal notified DECCW of the contamination status of Angus Place Colliery on the basis that there was visible evidence of limited soil contamination but that some potential existed for contamination associated with a fuel dispensing area adjacent to an above ground diesel storage tank, and the drum crushing area. Angus Place Colliery was categorised as a medium priority for Phase 2 investigations.

The area above the proposed longwalls has not been used for industrial purposes, and so the potential for contamination in these areas is significantly lower. Construction and operation of the surface facilities in the Newnes State Forest will involve the storage and handling of hydrocarbon fuels, and to reduce the potential for contamination, all pipework and tanks will be constructed to Australian Standard AS 1692. Refuelling of mobile equipment during construction will be via mobile tankers, equipped with spill kits.

Centennial Angus Place will implement best management practices for hydrocarbons, along with the approved EMS and occupation health and safety management systems to ensure the potential for contamination and associated issues remains low.

5.4.5 SEPP No. 44 – Koala Habitat Protection

SEPP No. 44 – Koala Habitat Protection provides for the protection of koala habitat by ensuring that areas subject to development proposals are considered for their value as habitat or potential habitat for koalas. The Greater Lithgow LGA is listed under Schedule 1 of SEPP No. 44 as an area to which the SEPP applies. RPS 2013, **Appendix H** considers the Project Application Area contains core koala habitat.

5.4.6 SEPP No. 33 – Hazardous and Offensive Development

SEPP No. 33 - Hazardous and Offensive Development (SEPP 33) regulates, amongst other things, the determination of development applications to carry out what is defined in SEPP 33 as development for the purposes of a "potentially hazardous industry" or "potentially offensive industry". With the continued implementation of best management practices for hydrocarbons and explosives used within the Project Application Area and the other measures outlined in this EIS to reduce or minimise the impact of the Project, as well as effective implementation of the approved EMS and occupation health and safety management systems, the Project would not pose any significant risk, in relation to its locality, to human health, life or property or to the biophysical environment.

Further, by employing the management and mitigation measures outlined in this EIS during the Project's operation, the Project would not result in the emission of a polluting discharge in a manner which would have a significant adverse impact in its locality or on the existing or likely future development on other land.

On the above bases, the Project is not considered to comprise a "potentially hazardous industry" or a "potentially offensive industry" within the meaning of these expressions in SEPP 33, and therefore a preliminary hazard analysis was not prepared as required by clause 12 of SEPP 33 and nor does clause 13 of SEPP 33 apply to the consent authority's determination of the Project's development application.

5.4.7 SEPP (Sydney Drinking Water Catchment) 2011

SEPP (Sydney Drinking Water Catchment) 2011 applies to land within the Sydney drinking water catchment. The Project Application Area is in part located within the Sydney drinking water catchment.
The aims of SEPP (Sydney Drinking Water Catchment) 2011 are:

(a) to provide for healthy water catchments that will deliver high quality water while permitting development that is compatible with that goal, and

(b) to provide that a consent authority must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality, and

(c) to support the maintenance or achievement of the water quality objectives for the Sydney drinking water catchment.

Clause 9(1) of this SEPP provides that any development or activity proposed to be carried out on land within the Sydney drinking water catchment should incorporate the Sydney Catchment Authority's current recommended practices and standards. **Section 10.2** addresses this. Alternatively, clause 9(2) of this SEPP provides that if such practices and standards are not incorporated, it needs to be demonstrated to the satisfaction of the consent authority how the practices and performance standards proposed to be adopted will achieve outcomes not less than those achieved by the Authority's current recommended practices and standards, **Section 10.2** addresses this.

Clause 10(1) of this SEPP provides that a consent authority must not grant consent to the carrying out of development on land within the Sydney drinking water catchment unless it is satisfied that the carrying out of the proposed development would have a neutral or beneficial effect on water quality. For the purposes of determining whether the carrying out of the proposed development on land in the Sydney drinking water catchment would have a neutral or beneficial effect on water quality, the consent authority must, if the proposed development is one to which the NorBE Tool applies, undertake an assessment using that Tool. The "NorBE Tool" is set out in **Appendix 1** of the document titled Neutral or Beneficial Effect on Water Quality Assessment Guideline 2011 prepared by the Sydney Catchment Authority and **. Appendices E** and **F** address the "NorBE" test].

5.5 Local Environmental Plans

Local Environmental Plans (LEPs) are instruments that guide planning decisions for LGAs and allow Councils to manage the ways in which land is used through zoning and development consents.

5.5.1 Lithgow City Local Environmental Plan 1994

The aims of the Lithgow City Local Environmental Plan 1994 (Lithgow City LEP) include the encouragement of the proper management, development and conservation of natural resources and the built environment within the City of Lithgow, by protecting, enhancing or conserving, amongst other things, timber, minerals, soil, water quality, stream environment and other natural resources.

The land use zonings of the Project Application Area pursuant to the Lithgow City LEP are Zone 1(a) Rural (General), Zone No 1(c) Rural (Small Holdings) and Zone No 1(f) Rural (Forestry). Development for the purposes of "mining" is permissible with development consent under the Lithgow City LEP within Zone No 1(c) Rural (Small Holdings) and Zone No 1(f) Rural (Forestry). Mining is not prohibited in Zone 1(a) Rural (General).

Under the LEP the majority of area within the Project Application Area is zoned as 1(f) Rural - Forestry.

Sub-clause 7(1)(a) of the Mining SEPP (see **Section 5.4.2**) also states that development for the purpose of underground mining may be carried out on any land with development consent. In relation to any inconsistency between the Mining SEPP and an LEP, sub-clause 5(3) provides that the Mining SEPP prevails to the extent of the inconsistency. On this basis, any provision in the Lithgow City LEP that would otherwise operate to prohibit the Project has no effect, and accordingly, the Project is permissible with development consent on the land in which the Project will be carried out that is within the Lithgow LGA.

The Lithgow City LEP notes that the consent authority must not grant consent unless it is of the opinion that the development is consistent with the objectives for the zone in which it is proposed to be carried out

(clause 9(2)). The objectives of Zone 1(a) Rural (General) is to promote the proper management and utilisation of natural resources by:

(a) protecting, enhancing and conserving:

(i) rural land, in particular prime crop and pasture land, in a manner which sustains its efficient and effective agricultural production potential,
(ii) soil, by controlling and locating development in accordance with soil capability,
(iii) forests of existing and potential commercial value for timber production,
(iv) valuable deposits of minerals, coal and extractive materials, by controlling the location of development for other purposes in order to ensure the efficient extraction of those deposits,
(v) trees and other vegetation in environmentally sensitive areas, where the conservation of the vegetation is significant for scenic amenity or natural wildlife habitat or is likely to control land degradation,
(vi) water resources for use in the public interest, preventing the pollution of water supply catchment and major water storages,
(vii) localities of significance for nature conservation, including places with rare plants, wetlands and significant wildlife habitat, and
(viii) items of heritage significance,

(b) preventing the unjustified development of prime crop and pasture land for purposes other than agriculture,

(c) facilitating farm adjustments,

(d) minimising the cost to the community of:

(i) fragmented and isolated development of rural land, and
(ii) providing, extending and maintaining public amenities and services,

(e) providing land for other non-agricultural purposes, in accordance with the need for that development, and

(f) providing for the separation of conflicting land uses.

The objectives of Zone No 1(c) Rural (Small Holdings) are:

(a) to allow development of land for rural small holdings if the land is identified as suitable for that purpose,

(b) to ensure that allotments created for rural small holdings are of an area and subject to arrangements that:

(i) enable the provision of an adequate water supply,

(ii) enable effective disposal of domestic waste,

(iii) minimise the creation of traffic hazards,

(iv) do not contribute to pollution of water supply catchments, and

(v) do not impact unfavourably on water quality within the Nepean-Hawkesbury River System,

(c) to ensure that development is carried out in a way that is sensitive to the environmental characteristics of the land,

(d) to minimise the cost to the community of providing, extending and maintaining public amenities and services,

(e) to ensure that rural small holdings development does not prejudice the interests of agricultural producers in the vicinity, and

(f) to allow development for a range of purposes which are compatible with the environmental capabilities of the land and which are unlikely to adversely affect land or other development in the vicinity or create unscheduled demands for service infrastructure.

The objectives of Zone No 1(f) Rural (Forestry) are:

(a) to identify land managed by the Forestry Commission under the *Forestry Act 1916*,

(b) to preserve existing forests within the City of Lithgow, while allowing compatible development, and

(c) to prevent pollution of water supply catchments and water quality in major water storages;

Clause 11 of the Lithgow City LEP provides that before determining a development application within Zone No 1(a) Rural (General),Zone No 1(c) Rural (Small Holdings), and Zone 1(e) Outer Rural, the consent authority must take into consideration the effect the proposed development would have on:

(a) the present use of the land, and the potential for sustained agricultural production of so much (if any) of the land as is prime crop and pasture land,

(b) vegetation, timber production, land capability and water resources (including the quality of the water, stability of water courses, ground water storage and riparian rights),

(c) the future recovery from known or prospective areas of valuable deposits of minerals, coal, petroleum, sand, gravel or other extractive materials,

(d) the protection of areas of nature conservation significance or of high scenic or recreational value, and of items of heritage significance,

(e) the cost of providing, extending and maintaining public amenities and services,

(f) development on adjoining land and on other land in the locality, including any cumulative impact, and

(g) the future expansion of settlements in the locality.

Certain relevant provisions in Parts 3 and 4 of the Lithgow City LEP that operate as controls in respect of the decision-making function of the consent authority, including certain development standards.

The operation of the above provisions in respect of the Project is subject to the application of clause 8 of the Mining SEPP, which provides:

8 Determination of permissibility under local environmental plans

(1) If a local environmental plan provides that development for the purposes of mining, petroleum production or extractive industry may be carried out on land with development consent if provisions of the plan are satisfied:

(a) development for that purpose may be carried out on that land with development consent without those provisions having to be satisfied, and

(b) those provisions have no effect in determining whether or not development for that purpose may be carried out on that land or on the determination of a development application for consent to carry out development for that purpose on that land.

(2) Without limiting subclause (1), if a local environmental plan provides that development for the purposes of mining, petroleum production or extractive industry may be carried out on land with

development consent if the consent authority is satisfied as to certain matters specified in the plan, development for that purpose may be carried out on that land with development consent without the consent authority having to be satisfied as to those specified matters.

Notwithstanding the application of clause 8 of the Mining SEPP, the assessment of the Project in this EIS:

- enables the consent authority to form the opinion that the development is consistent with the objectives for the zones in which the Project is to be carried out;
- enables the consent authority to take into consideration the effect of the Project on the matters set out in clause 11 of the Lithgow City LEP; and
- demonstrates that the Project is consistent with any relevant controls set out in Parts 3 and 4 of the Lithgow City LEP.

5.5.2 Draft Lithgow City Local Environmental Plan 2013

Lithgow City Council has prepared a planning proposal for the Draft Lithgow City Local Environmental Plan 2013 (Draft LEP 2013), which was lodged with the NSW Department of Planning and Infrastructure in April 2013. It is intended that the Draft LEP 2013 would implement the Standard Instrument LEP across the Lithgow LGA, and repeal the Lithgow City LEP. The existing and proposed new zonings are detailed in **Section 2.5.3**.

Under the draft Lithgow Local Environmental Plan, zones are renamed with additional objectives and land uses to better reflect the characteristics of the Lithgow Local Government Area.

The Draft LEP 2013 will seek to implement the key strategic directions of the Lithgow Land Use Strategy 2010-2030 (see **Section 5.5.2**).

The planning proposal for the Draft LEP 2013 received its Gateway Determination from the NSW Department of Planning and Infrastructure in May 2013, after which the Draft LEP 2013 was prepared in compliance with the conditions of the Gateway Determination, and then publicly exhibited. The exhibition period concluded on 6 August 2013.

5.6 Other Considerations

5.6.1 Lithgow Land Use Strategy 2010-2030

Lithgow City Council's *Lithgow Land Use Strategy 2010-2030* (LLUS) was adopted by Council on 31 October 2011 and endorsed by the NSW Department of Planning and Infrastructure on 24 May 2012.

The LLUS is a combined Land Use Issues Paper and Strategy. It explores the issues that currently face the Lithgow LGA and recommends a new planning approach to address these issues. The Strategy will be implemented through the planning system, primarily through the Draft Lithgow LEP 2013 and Development Control Plan, as well as Council's other policy, regulatory and governance functions. This Strategy is significant to Council and the community because it will set directions and policy for the LGA's settlement and land use management for the next 20 years. The Strategy will be reviewed throughout this period every five years to ensure that its findings and recommendations remain relevant, are in keeping with sound planning principle and are continuing to meet the needs and expectations of the community.

5.6.2 Water Sharing Plans

Water sharing plans prepared in accordance with the *Water Management Act 2000* include rules for protecting the environment, extractions, managing licence holders' water accounts, and water trading within defined areas and specified water sources.

Angus Place Colliery is regulated by the Greater Metropolitan Region Water Sharing Plan established under Section 50 of the *Water Management Act 2000*. The Project Application Area straddles the boundary of the Sydney Basin Coxs River Groundwater Source and the Sydney Basin Richmond Groundwater Source. The

Project location in relation to the Sydney Basin Richmond and Sydney Basin Coxs River Groundwater Source geographical boundaries are shown, as an inset, in **Figure 2.34**.

The Project Application Area lies across the boundary of two River Management Zones, the Wywandy River Management Zone of the Upper Nepean and Upstream Warragamba Water Source, and the Colo River Management Zone of the Hawkesbury and Lower Nepean Water Source. Each of these water sources are situated within the Greater Metropolitan Region Water Sharing Plan.

There is no direct extraction of surface water from either Water Sharing Plan, however, reduction in baseflow contribution to surface watercourses from local groundwater systems require licensing, as per the requirements of the NSW Aquifer Interference Policy.

5.6.3 Strategic Regional Land Use Policy

The NSW Government's *Strategic Regional Land Use Policy* was introduced in September 2012 and sets out a range of initiatives to better balance growth in the mining industry with the need to protect agricultural land and water resources. The Policy includes a package of measures including the following key elements:

- the preparation of Strategic Regional Land Use Plans (SRLUPs) for both the Upper Hunter and the New England North West regions of NSW which identify and map Strategic Agricultural Land (SAL) and Critical Industry Clusters (equine and viticulture land uses) within these areas;
- the introduction of the NSW Aquifer Interference Policy (see **Section 5.6.4**); and
- the requirement for Agricultural Impact Statements to accompany SSD applications for mining projects that have the potential to affect agricultural resources (see **Section 10.10**).

The proposed key policy response for resolving land use conflict between mining and coal seam gas proposals and agricultural land is a 'gateway process'. Under this process, a panel of independent experts would assess proposals involving mining or coal seam gas development on mapped SAL at an early stage before the lodgement of a development application. The outcome of the 'gateway process' would be that the proposal either meets the gateway criteria relating to agricultural and water impacts, or the proposal does not meet the criteria and therefore stringent requirements will be imposed that must be addressed at the development application stage. The 'gateway process' will commence when the relevant amendments to the Mining SEPP and EP&A Regulation are made.

The existing SRLUPs do not apply to the Project Application Area. Notwithstanding, matters relating to soil landscapes, land use impacts, land capability and agricultural suitability have been addressed within this EIS in **Sections 10.9** and **10.10**. There is no land defined as Biophysical Strategic Agricultural Land within the Project Application Area.

5.6.4 NSW Aquifer Interference Policy

The *NSW Aquifer Interference Policy* (AIP) is a key component of the NSW Government's *Strategic Regional Land Use Policy*. The AIP clarifies the water licensing and approval requirements for aquifer interference activities, including the taking of water from an aquifer in the course of carrying out mining, and defines the considerations for assessing potential impacts to key water-dependent assets.

The AIP indicates that where mining results in the loss of water from an overlying source that is covered by a WSP, a water access licence is required under the WM Act to account for this take of water. According to the AIP, proponents of a mining project seeking development consent under Part 4 of the EP&A Act must provide estimates of all quantities of water likely to be taken from any water source during and following cessation of the activity and all predicted impacts associated with the activity. Hydrogeological modelling for the Project has been undertaken by RPS and is contained in **Appendix E**.

The AIP requires that potential impacts on groundwater sources, including their users and groundwater dependent ecosystems (GDEs), be assessed against minimal impact considerations. If the predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable. **Appendix E** and **Section 10.2.4** consider groundwater impacts and aquifer interference requirements and clarifies that the Project is compliant with Level 1 Minimum Harm Criteria of the NSW Aquifer Interference Policy for Porous Rock Water Sources.

Any impacts on potential GDEs, basic landholder rights and existing registered bores are addressed in **Appendix E**.

CHAPTER 6.0
Socio-economic Analysis

6.0 SOCIO-ECONOMIC ANALYSIS

This chapter specifically responds to the Director General's Requirements (DGRs), which provide the following in regard to social and economic aspects:

The Director General's requirements

Social & Economic – including an assessment of the:

- potential direct and indirect economic benefits of the development for local and regional communities and the State;
- potential impacts on local and regional communities, including:
  - any increased demand for local and regional infrastructure and services (such as housing, childcare, health, education and emergency services); and
  - impacts on social amenity, particularly impacts on local residents of and other nearby landowners and residents;
  - a detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the development, including any infrastructure improvements or contributions and/or voluntary planning agreement or similar mechanism; and
  - a detailed assessment of the costs and benefits of the development as a whole, and whether it would result in a net benefit for the NSW community.

Further to the above, supplementary requirements to these DGRs were issued on 30 August 2013 stating that a description of the short-term and long-term social and economic implications and/or impacts of the Project are also required.

The assessment of the social and economic costs and benefits of the Project are inter-related and as such are addressed together within this chapter. With this in mind, the socio-economic analysis has not been developed as a mutually exclusive component of the EIS but has been considered throughout the development of the Project including its feasibility, mine design, identification and management of environmental impacts, to ensure that ESD principles and been applied throughout the decision making process and incorporated into the EIS.

6.1 Social Impact Assessment

6.1.1 Methodology

The Social Impact Assessment of the Project has been completed by James Marshall and Co (**Appendix N**) and provides for a systematic approach to the identification, consideration and assessment of the social impacts of the Project. The Social Impact Assessment identifies and develops mitigation measures to address these potential impacts. The methodology is summarised as follows:

1) Profiling: Understanding the scale and scope of the project, parameters of the Social Impact Assessment and identifying the stakeholders (determined by the areas of affectation) (refer **Section 6.1.2**).

2) Scoping: Identifying the potential impacts as a result of the Project through consultation and feedback with identified stakeholders. As identified in **Chapter 7.0** of the EIS, consultation has been undertaken in accordance with an engagement strategy utilising a range of consultation methods such as informal and formal direct consultation, surveys and print media. (refer **Section 6.1.3** and **Chapter 7.0**).

3) Assessment: Utilising the outcomes of the Project engagement strategy to determine the extent to which the Project is perceived to impact upon local, regional and State stakeholders. (refer **Section 6.1.4** and **Appendix N**).

4) Management: Identification and development of mitigation measures where feasible. These management measures are for not only potential adverse or detrimental social impacts, but also where those identified as positive can be enhanced and developed. This allows for an assessment as to whether the Project meets a net community benefit criteria. (**Section 6.4, Appendix N** and **Appendix O**).

5) Monitoring: Strategies to monitor identified impacts to ensure that management strategies are adhered to and that the potential cumulative impacts are identified and monitored where relevant (**Section 6.1.6**).

6.1.2 Profiling

The Social Impact Assessment has considered the strategic objectives of the Lithgow Local Government Area (Lithgow LGA). It has found that the Lithgow region has a long history with mining and as identified in the most recent Australian Bureau of Statistics (ABS) Census (2011) data, mining is the largest industry of employment and is the economic base of the Lithgow Local Government Area employing 11.6% of the population aged 15 years and over. The importance of the coal mining industry to the regional economy is clearly defined within Lithgow City Council's "Economic Development Strategy (EDS) 2010-2014", identifying "…only the mining sector had a greater percentage contribution to gross regional product (27%) than its share of employment (12%)".

Even with the regional focus on the importance of the industry, through a review of the Lithgow Land Use Strategy 2010 – 2030 (Land Use Strategy), which has informed the Draft Lithgow City Local Environment Plan 20132, it is found that the principles applied to the Land Use Strategy represent a shift towards consolidating residential settlement and away from Lithgow's industrial traditions to creating a more diverse economy via transparent land use planning principles, policies and strategies.

The existing and potential for tourism growth was identified in the Land Use Strategy and has been considered within the Social Impact Assessment. According to the EDS "tourism is becoming of increasing importance for economic growth and has caused governments and industry to engage in aggressive and intense promotional activities in order to develop and increase the effectiveness and quality of the sector. Lithgow LGA is a place endowed with significant natural and cultural resources that can capture the interests of visitors and therefore increased tourism investment".

Table 6.1 summarises some of the key changes highlighted in the Land Use Strategy and the potential impacts from the Project.

Table 6.1 Lithgow Land Use Strategy and Potential Areas of Impact for Centennial Coal

Activities	Reason for Potential Impact
There is an increased number of people living in rural areas	■ Usually in-migration characterised by people from areas outside of the Lithgow LGA. ■ Landholders in rural areas not always resident of the Lithgow LGA. ■ Emergence of different values and connections to Lithgow – ie not share the areas mining history. ■ Small lifestyle farms meaning that land holders will actively protect water and other resources if they feel they are being threatened. ■ Fear in loss of land value.
Addressing land use conflict, especially between industrial uses and residential land uses.	■ There are a number of examples where communities and industry has co-existed for many years. However the shift in demographics, differing community expectations away from Lithgow's industrial past, and the desire to preserve social amenity has led to increasing land use conflict.

Activities	Reason for Potential Impact
Protection of sensitive environmental areas.	■ Centennial's Western Operations has a number of activities within identified sensitive environmental areas (Mugii Murrum-ban State Conservation Area, Newnes State Forest; Capertee Valley). ■ There is an increasing move to protect these areas by a range of stakeholders which are not limited to NGOs (eg Colong; Blue Mountains Conservation Society) but also include land holders who have moved into the area (e.g. the rural areas of Glen Alice / Glen Davis have experienced large population increases since 2001).
Support and protection of other industries such as tourism.	■ There is a move to recognise and pursue other industry sectors that are not related to mining and power generation to broaden and stabilise the economic profile of the Lithgow LGA. Tourism is one such sector. ■ Therefore moves to retain and protect key 'gateways' and scenic landscapes for visitors / travellers will become a priority.

The Social Impact Assessment identifies the mechanisms employed by Centennial Coal to avoid and mitigate, where possible, the potential impacts identified in **Table 6.1**.

In juxtaposition with community concern is the benefit brought to local communities through ongoing employment within the region. Employment in the mining industry provides flow-on effects for local support services via direct and indirect employment opportunities across a range of sectors. The flow-on effect of mine related employment and importance to the wider regional community is demonstrated in a recent survey of Angus Place employees which found the following:

- Over 81% of Angus Place employees live in the Lithgow LGA and 62% of these employees live in Lithgow, Wallerawang and Portland.
- 45% of those surveyed have been employed in the mining industry for over 10 years.
- 37% have worked in the industry for two or more generations.
- 79% own their own home.
- On average, each employee surveyed spends 33.5% of their total weekly income in their local residential community.
- Over 40% of mine employees' partners participated in some type of work.
- Most employees and their families participate in some local regular sport or social activities.
- The majority of employees' children, who do not currently attend school, participated in sporting activities in their local community.
- Employees have strong connections to their local communities demonstrated via shopping in the communities where they live, coaching junior sport, participating in social activities, supporting local fundraising activities.
- Employees are members of the local bush fire brigade and NSW State Emergency Service, and members of local clubs.

- Employees are aware of and utilise the natural assets throughout the area such as state forests and national parks for family outings.

Mine employees contribute to the overall social capital of the Lithgow Local Government Area meaning the sustainability of the mining sector and its related employment is vital to the broader economic wellbeing of the Lithgow LGA. Furthermore, the life of mine is an important consideration in an employees' future planning for factors such as their children's education and major purchases such as motor vehicles and homes.

6.1.3 Scoping

The Social Impact Assessment was supported by a number of site visits, review of the minutes of the Community Consultative Committee, review of the complaints register and ongoing consultation records and discussions. The scope of the Project would result in no change to the pit top and no social amenity impacts were identified.

The proposed mining area is to be located wholly within the Newnes State Forest, away from private landholdings and residences. How individuals and groups utilise the proposed mining area in relation to the Newnes State Forest and Newnes Plateau were again based upon site visits, feedback and outcomes from community stakeholder engagement. It was identified that potential impacts of the Project upon local, regional and State stakeholders are those who primarily:

- access Newnes State Forest for recreation including 4WD, motorcycling and mountain biking that has an impact on the environment;
- access Newnes State Forest for recreation including bushwalking, bird watching and other passive uses that has a lower impact on the environment;
- aim to preserve the environmental value of the area from threats to sensitive surface features and ecosystems via opposing activities such as mining and restricting public access to certain areas;
- access Newnes State Forest as Angus Place employees; and
- access Newnes State Forest as employees of the Forest Corporation of NSW.

A large proportion of public access remains within designated trails because access to main recreation / camping areas and lookouts is the primary goal for the majority of visitors. However, public access has had an adverse impact on some features in Newnes State Forest, in particular as a result of 4WD and motorcycles that operate off designated tracks. Sensitive surface features and ecosystems (such as the THPSS) have been adversely impacted upon and Forestry Corporation of NSW is currently undertaking rehabilitation to these areas. This has been supported by raising public awareness of the sensitive environment and promoting that visitors remain on formed tracks, trails and roadways.

The Colong Foundation for Wilderness is concerned about the impact of both mining and public access in the Blue Mountains area. These concerns have been documented in a number of publications, including the most recent "*The Impacts of Coal Mining on the Gardens of Stone*" (Muir, 2010), which includes:

- cliff and pagoda damage arising from subsidence impacts from longwall mining resulting in the collapsing of cliffs; and
- loss of ground and surface water; the subsequent impact on sensitive swamps, creeks and drainage lines and subsequent impact on various ecosystems.

Further concerns raised by the Colong Foundation for Wilderness include (but are not limited to):

- damage caused by off-road vehicles (4WD and motor cycles) when driven in areas other than designated trails; and

- commercialisation of tourism and recreation activities (eg adventure tourism) that create intensive public access in certain areas.

The *2010 Caring for Country Save our Swamps Project* undertook the Newnes Plateau Shrub Swamp Aerial Assessment to gain a better understanding of the overall health status of the swamps. The project identified concerns relating to ongoing land management and the impacts created from pine plantations, public vehicle access via the extensive road and track network and underground mining.

In 2010, the then Department of Environment, Climate Change and Water prepared a report as part of the Planning Assessment Commission's review of the Bulli Coal Seam Project titled, Review of the Piezometer Monitoring Data in Newnes Plateau Shrub Swamps and their Relationship with Underground Mining in the Western Coalfield. This report identified concerns regarding the impacts of mining to swamps on the Newnes Plateau.

The concerns expressed through these reports echoed those raised by the Colong Foundation for Wilderness in its 2010 report.

6.1.4 Social Impact Assessment

The potential impacts of the Project are identified and addressed in detail in the technical assessments and discussed within the EIS with relevant mitigation measures identified. Based on the review of specialist consultants reports, it is determined that the extent of long term social change arising from the Project is minimal and will not adversely impact on how people use the area.

The mine design and other mitigating factors have minimised the extent of the change to the physical environment to an extent that the Project will not adversely impact on the existing land use, its physical characteristics including surface features and the manner in which the public utilise/access the area for recreation.

Based on the review of specialist consultants' reports, it is determined that the extent of long term social change arising from the Project is minimal and will not adversely impact on how people use the area. There will be no long term change to the social amenity of the area arising from this Project brought about by noise, dust and visual impacts.

The continuation of employment of the workforce is a positive social impact of the Project. Employee surveys undertaken at Angus Place Colliery have found that mine related employment directly contributes to the local financial and social economy. As the Project is a continuation of the existing mine, workforce numbers will be maintained 300 direct employees and contractors. Therefore the employment profile does not indicate any adverse impact on existing services or facilities or create any demand for additional services or facilities.

Newnes Plateau is identified as being an important feature of the Lithgow LGA by the local, regional and State stakeholders who access the area for activities noted in **Section 6.1.3**. Centennial Coal is a key stakeholder in preserving the Newnes State Forest as an important asset for tourism. While no change in the land use is predicted it is important to note that Centennial Coal is committed to:

- undertaking rehabilitation of cleared areas promptly to minimise visual impacts; and
- locating, where possible, surface infrastructure away from walking / access tracks and areas where visual intrusion is likely (i.e. from lookouts and walking paths).

There will be no change to the social amenity of the area arising from this Project bought about by noise, dust, visual impacts whereby the use of conventional management strategies identified in the EIS will not be effective.

6.1.5 Management

The mine design is the means in which changes to the environmental, economic and social conditions are determined. With regards to the social impact, the likelihood and extent of these changes are key factors in determining the scale of social impact. As mining has progressed at Angus Place Mine, the alignment and dimensions of longwall panels have been developed and refined for a range of mine designs in order to prioritise avoidance and minimisation of potential impacts and constraints of surface features and geological and geotechnical issues, while considering mine feasibility and optimisation.

In the context of the Social Impact Assessment consideration was given to:

- Environmental impacts in sensitive areas caused by mine subsidence. This includes surface features such as cliff lines, pagodas, swamps, groundwater dependant ecosystems, surface ecology and Aboriginal and European heritage sites.
- Adverse impacts to the amenity of the area. This relates to noise, dust, visual impacts that adversely affects visitor experience. This would also consist of:
  - traffic impacts on forest tracks and local road networks during construction and operations;
  - change in land use that results in restricted access to certain areas (i.e. by surface infrastructure);
  - noise impact etc. having an adverse impact on recreation users of the area (e.g. when camping); and
  - siting of infrastructure creating a visual impact at sensitive receptor sites.

When finalising the mine design, options reviewed were:

- adoption of bord and pillar mining methods. This was not viable due to the greater depths of cover and due to the geotechnical environment that does not allow a safe application of this mining method;
- shortening longwalls or stepping around shrub swamps as in the case of Sunnyside Swamp overlying LW413. The latter is not economically viable due to the much higher development costs and discontinuity of mining operations; and
- narrowing the longwall widths and/or increasing the chain pillar widths. This was the most viable option which provided both impact mitigation and financially sound operation.

The combination of a weak roof and a high stress environment means that longwall mining in the Lithgow seam at Project is the only viable and safe mining method. The subsidence impacts of underground mining are predicted to be low and will minimise the impacts on swamps. The potential environmental and social impacts of the Project have been minimised through:

- obtaining a detailed understanding of the key environmental issues. The multi-disciplinary assessment and consultation has been to a level of detail commensurate with the scale of the Project, industry standards and the legislative framework under which the Project is considered; and
- a mine design with a successful and proven history in previously mined areas of elimination or minimisation of surface subsidence impacts, and that is safe for the underground workforce and visitors to the surface.

Conservative measures in mine design are:

- consideration of sensitive surface features such as swamps, cliff lines, significant rock features, watercourses and sites of cultural significance that overlie the proposed mining areas;

- optimisation of mine design such as narrowing longwall widths and increasing chain pillar widths. Narrower void widths are tested and proven to minimise subsidence and occurrence of subsidence effects;
- the selection of infrastructure sites, although somewhat dictated by the mine plan, but using existing tracks and with the least clearing of native forest, and realigning tracks where avoidance mapping has identified threatened species. Optimal locations for the infrastructure with least environmental impact within the ESAs have been selected; and
- consideration of alternative mining methods.

In conclusion it is found that the principles of ESD have been considered and achieved in all aspects of the Project. With regards to the specific requirements of the DGRs the findings are outlined in **Table 6.2**.

Table 6.2: Social Impact Assessment Findings

Assessment	Findings
Any increased demand for local and regional infrastructure and services (such as housing, childcare, health, education and emergency services).	No adverse social impact identified due to the continuation of employment of existing employees and contractors. The continuation of employment would be a factor in minimising the risk of population out-migration and therefore population decline. The existing population accesses social infrastructure and services such as housing, childcare, health, education and emergency services and no further demand has been identified.
Impacts on social amenity, particularly impacts on local residents of and other nearby landowners and residents.	No adverse impact on social amenity identified at either the pit top or within the Project Application Area.
A detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the development, including any infrastructure improvements or contributions and/or voluntary planning agreement or similar mechanism.	The performance of the Project as outlined in the various specialist consultants reports and the supporting Statement of Commitments is the benchmark in which this Social Impact Assessment has been based. If these factors change and the potential risk to the environment increase, there is a potential for adverse social impact. If these factors do change, a subsequent analysis of potential social impact would be undertaken.

6.1.6 Monitoring

As discussed in **Section 4.13**, Centennial Angus Place will continue to undertake monitoring in accordance with approved EMPs. A review of the existing EMPs will be undertaken, and plans undated as appropriate, to take into consideration the environmental assessments undertaken as part of this EIS, the Statement of Commitments, and all relevant consent conditions. Reviews of the monitoring data will be undertaken on a regular basis to ensure that management strategies are adhered to and that the potential cumulative impacts are identified and monitored where relevant.

6.2 Economic Assessment

6.2.1 Methodology

The Economic Impact Assessment for the Project has been completed by the AIGIS Group and the report entitled "*Angus Place Colliery Extension Project Economic Impact Assessment"* (AGIS, 2013) is provided in **Appendix O**. The assessment:

- addresses the relevant economic assessment requirements in accordance with the DGRs;
- addresses the relevant legislation principally through providing an assessment of the direct and regional economic benefits and costs of the Project; and
- identifies the Project's net cost or benefit to the NSW community.

The assessment approach has been to apply a 'triple bottom line' framework to considering the interdependent social, economic and environmental benefits and costs associated with the Project. This approach is consistent with consideration of the requirements of ESD in accordance with relevant legislation.

In order to estimate the net cost or benefit of the Project, all technical reports that address the key environmental issues associated with the Project (as identified in the dot points above, the DGRs and the broad brush risk assessment (refer **Chapter 9.0**)) have been subject to qualitative and quantitative analysis as part of the Economic Impact Assessment. This has resulted in the Economic Impact Assessment providing monetised estimates of key aspects of the Project, based on specialist assessments of their magnitude, and relevant valuation methodologies.

For a full description of the valuation methodology and the sensitivity analyse utilised to quantify aspects of the Project, refer to the Economic Impact Assessment in **Appendix O**.

6.2.2 Social and Economic Benefits and Costs

In the context of the Project, potential risks to social amenity are:

- impact on the intrinsic value of the area;
- direct impact on the social amenity of the area (brought about by noise, dust, visual impacts etc.) that requires the use of conventional mitigation strategies, or where conventional mitigation strategies are not effective; and
- direct impact on the social amenity of the area (brought about by noise, dust, visual impacts etc.) where conventional mitigation strategies are not effective.

In this context, the social impacts of the Project are minimal (refer **Section 6.1**). This is because the extent of the change to the physical environment will have a low adverse impact on the existing land use, the physical characteristics and the manner in which the public utilise / access the area (such as mountain biking, motorcycle riding and four wheel drive driving).

Stakeholders who access the area for passive recreation such as bushwalking and bird watching may experience minor amenity impacts at proposed surface infrastructure locations of the Project predominantly due to noise and visual impacts during construction. However, this will be temporary and cleared areas will be progressively rehabilitated, as sites are decommissioned.

With no change to existing employment numbers, the Project will not result in any increased demand for local and regional infrastructure services. However, the extension of operations will sustain this level of employment, and the derived stimuli to local and regional economies over the life of the mine. As identified by Lithgow City Council, the role of the mining industry is critical to the functioning and economic wellbeing of the Lithgow Local Government Area economy. While the employment profile does not indicate any adverse impact on services or facilities, by allowing for the continuation of employment at Angus Place, the Project will have a positive community benefit with the direct spending from mining employees resulting in direct and indirect employment opportunities to occur across a number of non-energy and resources sectors including

retail and accommodation. The benefit from mine related employment is not restricted to spending. Employees and their families participate in a range of work, education, social and recreational activities across the local community and region.

The NSW Department of Planning and Infrastructure has determined that the appropriate planning authority to determine if a Voluntary Planning Agreement (VPA) or S94 contribution is applicable to Lithgow City Council. Discussions between the Centennial Coal and Lithgow City Council are underway with a VPA to be finalised prior to determination of the Project.

6.2.3 Estimated Economic Benefits

The benefit – cost analysis (BCA) data presented in the Economic Impact Assessment are net present values (NPV), at an assumed discount rate of 7% (consistent with the NSW Treasury economic appraisal guidelines (NSW Treasury, 2007), except as otherwise noted. The key economic benefits that accrue to the local and State communities, as distinct from the proponent corporation, are the following:

- salaries and wages paid to contract workers in the construction phase of the Project. These incomes then support additional activity in other sectors of the economy.
- salaries and wages paid to full time employees at Angus Place Colliery, with similar flow-on effects to those noted above.
- royalties on product coal which are remitted to the State. These are then redistributed across the State community in the form of publicly-provided goods and services.
- A range of federally-levied taxes, a proportion of which is similarly redistributed across the State community. This does not include provision for the carbon tax, or the Mineral Resources Rent Tax (MRRT) due to uncertainty as to their continuity.
- various State (e.g. payroll tax) and Local Government (e.g. council rates) taxes, rates and charges.

Table 6.3 shows the valuation of economic benefits.

Table 6.3: Estimate of Economic Benefit

Economic Benefit	Estimation assumptions	Estimate
Mine operation-stage additional/sustained employment	Direct operations employment sustained..	$418 million.
Coal royalties (State Government)	Based on assessed output over mine life extension period 2016-2041, and royalty rate of 7.2%	$203 million
Other State taxes/Local Government rates & charges	e.g. Payroll tax; council rates	$16 million
Federal taxes (e.g. Corporate income taxes)	Based on assessed corporate income & corporate tax rates	$39 million
Project impact controls and mitigation provisions	Particulars included in Appendix O	$38 million
Total economic benefit		**$770 million**

6.2.4 Estimation of Economic Costs

The DGRs issued for the Project identifies key issues that the EIS prepared for the Project must address. These relate to:

- subsidence;
- land resources;

- water resources;
- biodiversity;
- heritage;
- air quality;
- greenhouse gases (GHG);
- noise;
- traffic and transport;
- visual;
- social and economic; and
- rehabilitation.

Where possible, valuation methodologies are derived from studies accessed through relevant government bodies. This may be considered as placing some greater level of reliability on these studies.

The identified valuation methodologies have been selected to as closely represent similar existing conditions for this Project as was achievable. However, in some instances the valuation methodologies are either more general, or related to projects of a different nature that retain some level of comparability. In this regard it is important to emphasise that the Project relates to the development of a limited amount of industrial infrastructure and continued operations on a site, and in a geographic area that already features existing similar infrastructure and activity, particularly that associated with present mining at Springvale Mine. This fact of itself may be considered as a mitigating factor in terms of valuing the extent of impacts on social amenity in this area.

There remains an unquantified element of social impact. This may be described as the 'intrinsic value of certain impacts or effects, as attributed by individual stakeholders. This aspect can be highly individualised and subjective and consequently cannot be accurately quantified, as the estimation techniques applied, although based on valid methodologies, may not align with individual stakeholders' values.

Table 6.4 itemises the estimated assumptions and costs associated with the impacts of the Project and **Appendix O** provides further details on the calculation methodologies.

Table 6.4 Estimate of Economic Costs of the Project

Economic Cost	Estimated cost to the Community	Estimate of Cost
Noise	$29,128 (2014 estimate)	$386K
Subsidence	$1,310,396 (2016 estimate)	$14.3M
Soil and land capability	$1,235,174 (2014 estimate)	$16.4M
Surface water and groundwater	$1,310,396 (2016 estimate)	$14.3M
Air	$19,804 (2014 estimate)	$263K
GHG emissions	$980,881 (2014 estimate)	$10.1M
Archaeological heritage	$7,060 (2014 estimate)	$94K
Natural Heritage	$1,310,396 (2016 estimate)	$14.3
Biodiversity	$46,119 (2014 estimate)	$612K
Visual amenity	$31,874 (2014 estimate)	$423K
Economic cost		**$71 million**

6.2.5 Net Present Value

The net present value of the Project is outlined in **Table 6.5**.

Table 6.5 Net Present Value

Economic benefit (PV)	$699 million
Economic cost (PV)	$71 million
Net Present Value (NPV)	$699 million
Benefit-Cost Ratio (BCR)	10.8

6.2.6 Net Contribution of the Mining Sector

Clearly the mining sector is of significant importance in the context of such a relatively small regional economy. This is suggested by a number of matters raised in the Lithgow City Council EDS. The comparison of employment to output identified previously is indicative of a number of factors. Firstly, mining is relatively capital intensive, so the labour input may be comparatively lower. The EDS notes however that as much of the mining in the area is underground mining, this is relatively more labour intensive than open cut mining. Secondly, in terms of regional output, the sector stands out from the remainder of the local economy on the basis of its productivity and income effects relative to labour.

The EDS also notes that there is scope for expansion in the coal industry, however "there is still pressure for coal industry downsizing from efficiency rationalisation and this may ameliorate the benefits of increased exports" (p. 87). The proposal to extend the Angus Place Colliery's mining lease area represents a commitment to maintaining operations and the associated employment in the Lithgow LGA.

These sustained operational and additional construction-related positions associated with the application are of regional significance. The EDS emphasises the potential for severe impacts on the local economy that are likely to result from any premature curtailment of mining activity, as is exemplified in the following statements from the EDS:

- *"The major concern here is that many of these mining jobs are concentrated into a handful of businesses hence, as has been experienced in the past, any job losses tend to be on a large scale and hence may have an immediate impact upon the community"*
- *"This may have an impact upon the level of disposable income available to the Lithgow Resident Workforce in the future should the number of people in the mining industry decline further".*
- *"This industry sector* [mining] *has also been shown as having a propensity to fluctuate mainly due to its sensitivity to international market forces. A critical impact of this is local business being heavily reliant upon a relatively small proportion of the community which has disposable income but one which can also be severely affected by changes to employment status. These families can also be considered as transient due to the specialised nature of their skills base. In other words a workforce with niche skills such as those in the mining industry are more likely to move from one region to another for work taking their disposable income with them".*

In the application of the above methodology the both the Economic Impact Assessment (**Appendix O**) and Social Impact Assessment (**Appendix N**) have considered the broader socio-economic impacts of the Project. The sustainability of the mining sector and its related employment is clearly vital to the broader economic wellbeing of the area. As is established, the Project will have a direct and positive impact on economic sustainability over the period in which coal resources can be economically extracted, both directly for employees and their households and indirectly for the broader regional economy.

Employment in the mining industry provides flow-on effects for local support services via direct and indirect employment opportunities across a range of sectors. The flow-on effect of mine related employment and importance to the wider regional community is demonstrated by the application of multiplies for both the ongoing employment and engagement of contractors during construction.

6.2.7 Employment Multipliers

The NSW Department of Trade, Investment, Regional Infrastructure and Services (Division of Resources and Energy) has previously identified output and employment multipliers for mining and related services. While acknowledging the aforementioned limitations on multiplier analysis observed by, for example the ABS, the application of the relevant NSW Government Department's declared multipliers adds validity to the analysis. The relevant multipliers are displayed in **Table 6.6** and **Table 6.7**.

Table 6.6 Type 2A Multipliers Mining – Mining and Services

Description	Multiplier Value
Output Multiplier – mining & services	2.136
Gross Value Added Multiplier – mining & services	4.099
Income Multiplier – mining & services	2.839
Employment Multiplier – mining & services	3.977

Table 6.7 Type 2A Multipliers – Construction

Description	Multiplier Value
Output Multiplier – construction	2.694
Gross Value Added Multiplier - construction	4.369
Income Multiplier - construction	2.899
Employment Multiplier – construction	2.727

The relatively large gross value added multiplier value (4.099) demonstrates the importance of incomes generated by the Project. In addition to these mining multipliers, similar multipliers for construction activity were also identified. These are relevant for assessment of the impacts of the initial stimulus associated with the various construction works required for the Project.

6.2.8 Alternatives Considered

The proposed mine plan and design of the Project has been developed to maximise resource recovery and economic benefits to the State (royalties and taxes), while reducing the potential impacts within the Project Application Area and the regional area, particularly in regard to potential subsidence impacts. Centennial Coal has foregone more profitable mine planning options with the aim of ensuring that potential impacts are reduced and managed to an acceptable level. Comparative analyses of the alternatives are included in AGIS (2013).

6.3 Conclusion

Benefits associated with the Project include the broad social benefit gained as a consequence of the continued operation of Angus Place Coal in terms of the royalties and taxes that are provided to the State. These are subsequently redistributed across Local Government Areas, including Lithgow LGA. Similarly, the existing workforce at Angus Place will be sustained by the Project with the incomes received by employees resulting in further direct and indirect benefits across the regional community.

Centennial Coal has considered alternative mine plans and designs with the mine plan. This stage of the Project involved consideration of the principles of ecologically sustainable development and adopting the 'triple bottom line' paradigm. As a consequence, the design of the Project is expected to result in a beneficial outcome for the State and the Applicant, in addition to maximising the positive social benefits of the Project and minimising environmental and social effects. Due to the detailed mine design planning process, adoption of relevant mitigation strategies and commitments by the Applicant (refer **Chapter 11.0**); the potential negative impacts associated with the Project will be significantly less magnitude than the benefits that will be generated by the Project. This is demonstrated through the qualitative and quantitative analysis completed within the Economic Impact Assessment.

With no change to existing employment numbers, the Project will not result in any increased demand for local or regional infrastructure services. The Project will have a low impact upon social amenity as it seeks to continue operations of Angus Place and will therefore make no significant change to the existing land use or surface characteristics and will not change the manner in which the public utilise and access land within the Project Application Area.

The continued operation of Angus Place Colliery has provided substantial socio-economic benefits throughout the region. Although there will be no increase in employment numbers as a result of the Project, it will enable continuation of the existing benefits during the period of active mining at Angus Place Colliery. This is key to the socio-economic wellbeing of Lithgow LGA with the Project providing a net benefit to the community with regard to social, economic and environmental impacts and benefits.