APPENDIX LIST

Appendix A:	**Development Consent SSD 5594 and Federal Approval EPBC 2013/6811**
Appendix B:	**Correspondence from the Department of Planning and Environment**
Appendix C:	**Schedule of Lands**
Appendix D:	**Coal Stockpile Area Drainage Design GHD Pty Ltd**
Appendix E:	**Social Impact Assessment Centennial Coal Company Limited**
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Appendix G:	**Traffic Impact Assessment Anton Reisch Consulting Pty Ltd**
Appendix H:	**Air Quality and Greenhouse Gas Impact Assessment SLR Consulting Australia Pty Ltd**

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Development Consent SSD 5594

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Federal Approval
EPBC 2013/6811

APPENDIX – A

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Development Consent

Section 89E of the *Environmental Planning and Assessment Act 1979*

As delegate for the Minister for Planning, the Planning Assessment Commission of NSW approves the development application referred to in Schedule 1, subject to the conditions in Schedules 2 to 6.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- prevent, minimise and/or offset impacts on controlling provisions and matters protected under the EPBC Act;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the development.

Brian Gilligan
Member of the Commission

Abigail Goldberg
Member of the Commission

David Johnson
Member of the Commission

Sydney 21 September 2015

SCHEDULE 1

Application Number:	SSD_5594
Applicant:	Centennial Springvale Pty Limited
Consent Authority:	Minister for Planning
Land:	See Appendix 1
Development:	Springvale Mine Extension Project

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DEFINITIONS

Adaptive management	Adaptive management includes monitoring subsidence effects and impacts and, based on the results, modifying the mine plan (including potentially modifying mining height, longwall width or any other element of the mine plan) as mining proceeds to ensure that the effects, impacts and/or associated environmental consequences remain within the predicted and/or designated ranges and in compliance with the conditions of this consent
Annual Review	The review required by condition 12 of Schedule 6
Applicant	Centennial Springvale Pty Limited and Springvale SK Kores Pty Limited, or any other person/s who rely on this consent to carry out the development
ANZECC Guidelines	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000), or their latest version
BCA	Building Code of Australia
Built features	Includes any building or work erected or constructed on land, including dwellings, outbuildings and infrastructure such as any formed road, street, path, walk, or driveway and any pipeline, water, sewer, telephone, gas or other service main
CCC	Community Consultative Committee
Cliff	Continuous rock face, including overhangs, having a minimum length of 20 metres, a minimum height of 10 metres and a minimum slope of 2 to 1 (> 63.4°)
Conditions of this consent	Conditions contained in Schedules 2 to 6 inclusive
Construction	The demolition of buildings or works, carrying out of works and erection of buildings covered by this consent
Council	Lithgow City Council
Day	The period from 7 am to 6 pm on Monday to Saturday, and 8 am to 6 pm on Sundays and Public Holidays
Department	Department of Planning and Environment
Development	Springvale Mine Extension Project, as described in the EIS
DoE	Commonwealth Government Department administering the EPBC Act
DPI	Department of Primary Industries
DPI-Water	Department of Primary Industries - Water
DRE	Division of Resources and Energy, within the Department of Trade & Investment, Regional Infrastructure & Services
DSC	Dams Safety Committee
EEC	Endangered ecological community, as defined under the *Threatened Species Conservation Act 1995*
EIS	Environmental Impact Statement titled *Springvale Mine Extension Project – State significant Development 5594* (dated April 2014) including the associated Response to Submissions (dated September 2014), and the following additional information: - *Additional Simulations of the Regional Water Quality Impact Assessment Model* (25 March 2015) undertaken by Jacobs Group (Australia) Limited. - *Springvale Colliery Mine Extension Project, Economic Impact Assessment* (March 2015) undertaken by Aigis Group.
Environmental consequences	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; adverse water quality impacts; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding.
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence issued under the POEO Act
Evening	The period from 6 pm to 10 pm
Exploration activities	Prospecting operations, as defined under the *Mining Act 1992*
Feasible	Feasible relates to engineering considerations and what is practical to build or to implement
First workings	Extraction of coal from bord and pillar workings and development of main headings, longwall gate roads, related cut throughs and the like
GDE	Groundwater dependent ecosystem
Heritage item	An item defined under the *Heritage Act 1977* and/or an Aboriginal Object or Aboriginal Place as defined under the *National Parks and Wildlife Act 1974*
Incident	A set of circumstances that: • causes or threatens to cause material harm to the environment; and/or • breaches or exceeds the limits or performance measures/criteria in this consent
INP	*NSW Industrial Noise Policy* (NSW EPA, 2000)

Land	As defined in the EP&A Act, except for where the term is used in the noise and air quality conditions in Schedule 4 of this consent where it is defined to mean the whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this consent
Material harm to the environment	Actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial
Mine water	Water that accumulates within, or drains from, active mining areas, emplacements, stockpiles, tailings dams and infrastructure areas
Mining operations	Includes the extraction, processing, handling, storage and transportation of coal carried out on the site
Minister	Minister for Planning, or delegate
Minor	Not very large, important or serious
Minor cliff	A continuous rock face, including overhangs, which has a minimum length of 20 metres, a height between 5 metres and 10 metres, and a minimum slope of 2 to 1 (> 63.4°)
Mitigation	Activities associated with reducing the impacts of the development prior to or during those impacts occurring
Negligible	Small and unimportant, such as to be not worth considering
Night	The period from 10 pm to 7 am, Monday to Saturday, 10 pm to 8 am on Sundays and Public Holidays
OEH	Office of Environment and Heritage
Pagoda formations	Smooth or platy conical sandstone formations found in the Blue Mountains Region of NSW
POEO Act	*Protection of the Environment Operations Act 1997*
Privately-owned land	Land that is not owned by a public agency, a mining company (or its subsidiary)
Public infrastructure	Linear and related infrastructure and the like that provides services to the general public, such as roads, railways, water supply, drainage, sewerage, gas supply, electricity, telephone, telecommunications, etc
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Reasonable costs	The costs agreed between the Department and the Applicant for obtaining independent experts to review the adequacy of any aspects of the extraction plan, or where such costs cannot be agreed, the costs determined by a dispute resolution process
Rehabilitation	The restoration of land disturbed by the development to a good condition, to ensure it is safe, stable and non-polluting
Remediation	Activities associated with partially or fully repairing or rehabilitating the impacts of the development or controlling the environmental consequences of this impact
ROM coal	Run-of-mine coal
RMS	Roads and Maritime Services
Safe, serviceable & repairable	Safe means no danger to users who are present, serviceable means available for its intended use, and repairable means damaged components can be repaired economically
Second workings	Extraction of coal from longwall panels, mini-wall panels or pillar extraction
Secretary	Secretary of the Department, of any person authorised to act on their behalf
Site	Land to which the development consent applies (see Appendix 1)
Springvale Delta Water Transfer Scheme	Existing pipeline that transfers groundwater inflows from the underground workings and dewatering bores to licenced discharge point LDP009 (see also Appendix 2)
Statement of Commitments	The Applicant's commitments set out in Appendix 3
Steep slope	An area of land having a gradient between 1 in 3 (33% or 18.3°) and 2 in 1 (200% or 63.4°)
Subsidence	The totality of subsidence effects, subsidence impacts and environmental consequences of subsidence impacts
Subsidence effects	Deformation of the ground mass due to mining, including all mining-induced ground movements, including both vertical and horizontal displacement, tilt, strain and curvature
Subsidence impacts	Physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs
TARP	Trigger Action Response Plan
µS/cm EC	Microsiemens per centimetre Electrical Conductivity

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

OBLIGATION TO MINIMISE HARM TO THE ENVIRONMENT

1. In addition to meeting the specific performance measures and criteria established under this consent, the Applicant shall implement all reasonable and feasible measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the development.

TERMS OF APPROVAL

2. The Applicant shall carry out the development:
   (a) generally in accordance with the EIS;
   (b) in accordance with the Development Layout Plan and the Statement of Commitments; and
   (c) in accordance with the conditions of this consent.

   Notes:
   - *The Development Layout Plan is shown in Appendix 2*
   - *The Applicant's Statement of Commitments is shown in Appendix 3.*

3. If there is any inconsistency between the above documents, the more recent document shall prevail to the extent of the inconsistency. However, the conditions of this consent shall prevail to the extent of any inconsistency.

4. The Applicant shall comply with any reasonable requirement/s of the Secretary arising from the Department's assessment of:
   (a) any strategies, plans, programs, reviews, audits, reports or correspondence that are submitted in accordance with this consent;
   (b) any reviews, reports or audits undertaken or commissioned by the Department regarding compliance with this consent; and
   (c) the implementation of any actions or measures contained in these documents.

LIMITS ON CONSENT

Mining Operations

5. The Applicant may carry out mining operations on the site until 31 December 2028.

   Note: Under this consent, the Applicant is required to rehabilitate the site and perform additional undertakings to the satisfaction of both the Secretary and DRE. Consequently this consent will continue to apply in all other respects other than the right to conduct mining operations until the rehabilitation of the site and these additional undertakings have been carried out satisfactorily.

Coal Extraction

6. The Applicant shall not extract more than 4.5 million tonnes of ROM coal from the site per calendar year.

Hours of Operation

7. The Applicant may undertake mining operations 24 hours a day, 7 days a week.

Coal Transport

8. The Applicant shall not transport more than 50,000 tonnes of ROM coal by road from the site to local domestic customers in any calendar year.

Springvale Delta Water Transfer Scheme

9. Nothing in this consent allows duplication of pipelines or other increase in capacity of the Springvale Delta Water Transfer Scheme.

SURRENDER OF EXISTING DEVELOPMENT CONSENTS

10. The Applicant shall surrender all existing development consents for the site in accordance with section 104A of the EP&A Act within 12 months of the date of this consent, unless otherwise agreed by the Secretary.

    Prior to the surrender or lapsing of any existing development consents, the conditions of this consent shall prevail to the extent of any inconsistency with the conditions of these consents.

Note: This requirement does not extend to the surrender of construction and occupation certificates for existing and proposed building works under Part 4A of the EP&A Act. Surrender of a consent should not be understood as implying that works legally constructed under a valid consent can no longer be legally maintained or used.

STRUCTURAL ADEQUACY

11. The Applicant shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

Notes:

- *Under Part 4A of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for the proposed building works; and*
- *Part 8 of the EP&A Regulation sets out the requirements for the certification of the development.*

DEMOLITION

12. The Applicant shall ensure that all demolition work is carried out in accordance with *Australian Standard AS 2601-2001: The Demolition of Structures*, or its latest version.

PROTECTION OF PUBLIC INFRASTRUCTURE

13. Unless the Applicant and the applicable authority agree otherwise, the Applicant shall:
    (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and
    (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development.

Note: This condition does not apply to any damage to roads caused as a result of general road usage.

OPERATION OF PLANT AND EQUIPMENT

14. The Applicant shall ensure that all plant and equipment used on site is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient manner.

COMMUNITY ENHANCEMENT

15. From 31 March 2017, the Applicant shall pay a community contribution to LCC of $0.03 per saleable tonne of coal produced from the Springvale, Angus Place and Airly mines capped at a maximum payment of $200,000 in total (ie for all 3 mines collectively). The community contribution shall be paid on an annual basis to LCC and no later than 31 March each year (for the preceding year). The contribution shall be used for long-term community activities and projects to be agreed by both the Applicant and LCC and must be reported publicly.

SCHEDULE 3
SPECIFIC ENVIRONMENTAL CONDITIONS – UNDERGROUND MINING

SUBSIDENCE

Performance Measures – Natural and Heritage Features, etc

1. The Applicant shall ensure that the development does not cause any exceedances of the performance measures in Table 1, to the satisfaction of the Secretary.

Table 1: Subsidence Impact Performance Measures – Natural and Heritage Features, etc

Water Resources	***Performance Measure***
Wolgan River, and other watercourses located outside the site	Negligible subsidence impacts or environmental consequences including: • *negligible* diversion of flows or changes in the natural drainage behaviour of pools; • *negligible* reduction in water quality; • *negligible* increase in bank erosion or sediment load.
Carne Creek, Marrangaroo Creek and Paddys Creek	No greater subsidence impacts or environmental consequences than predicted in the EIS
All other watercourses	No greater subsidence impacts or environmental consequences than predicted in the EIS
Swamps	
Shrub swamps: Sunnyside and Nine Mile	Negligible environmental consequences including: • *negligible* change to the shallow groundwater regime when compared with control swamps; • *negligible* erosion of the surface of the swamp; • *negligible* change in the size of the swamp; • *negligible* change in the ecosystem functionality of the swamp; • *negligible* change to the composition or distribution of species within the swamp; and • *negligible* change to the structural integrity of the bedrock base or any controlling rockbar/s of the swamp.
Hanging swamps	Negligible environmental consequences including: • *negligible* change in the size of the swamp; • *negligible* change in the ecosystem functionality of the swamp; and • *negligible* change to the composition or distribution of species within the swamp.
Land	
Cliffs, minor cliffs, steep slopes and pagoda formations	No greater subsidence impacts or environmental consequences than predicted in the EIS.
Biodiversity	
Threatened species, populations or their habitats and EECs (except Sunnyside East, Carne West, Gang Gang South West, Gang Gang East, Pine, Pine Upper, Paddys, Marangaroo Creek and Marrangaroo Creek Upper Swamps)	Negligible environmental consequences.
Heritage Features	
Aboriginal heritage sites (except sites 45-1-0002, 45-1-005 and 45-1-0065)	Negligible subsidence impact or environmental consequences.
Aboriginal heritage sites 45-1-0002, 45-1-005 and 45-1-0065	No greater subsidence impact or environmental consequences than predicted in the EIS.
Historic heritage sites	Negligible subsidence impact or environmental consequences.
Mine workings	
First workings beneath any feature where performance measures in this table require negligible subsidence impact or environmental consequences. First workings within a 26.5 degree angle of draw of cliffs.	To remain long-term stable and non-subsiding
Second workings	To be carried out only in accordance with an approved Extraction Plan

Notes:

- *These performance measures apply to all mining taking place after the date of this consent.*
- *The Applicant will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this consent (see Condition 5 below).*
- *Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.*

2. The Applicant must assess and manage development-related risks to ensure that there are no exceedances of the performance measures in Table 1. Any exceedance of these performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation, notwithstanding actions taken pursuant to paragraphs (a)-(c) or condition 4 below. Where any exceedance of these performance measures has occurred, the Applicant must, at the earliest opportunity:
   (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
   (b) consider all reasonable and feasible options for remediation and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
   (c) implement remediation measures as directed by the Secretary,

   to the satisfaction of the Secretary.

Offsets

3. If the Applicant exceeds the performance measures in Table 1 and the Secretary determines that:
   (a) it is not reasonable or feasible to remediate the subsidence impact or environmental consequence; or
   (b) remediation measures implemented by the Applicant have failed to satisfactorily remediate the subsidence impact or environmental consequence;

   then the Applicant shall provide a suitable offset to compensate for the subsidence impact or environmental consequence, to the satisfaction of the Secretary.

   The offset must give priority to like-for-like physical environmental offsets, but may also consider payment into any NSW Offset Fund established by OEH, or funding or implementation of supplementary measures such as:
   - actions outlined in threatened species recovery programs;
   - actions that contribute to threat abatement programs;
   - biodiversity research and survey programs; and/or
   - rehabilitating degraded habitat.

   Note: Any offset required under this condition must be proportionate with the significance of the impact or environmental consequence.

Swamp Offset Bond for First Swamps Undermined

4. Prior to the commencement of mining, unless otherwise agreed by the Secretary, the Applicant shall lodge a Swamp Offset Bond of $2,000,000 with the Department.

   If, after 12 months of completion of all mining under this consent within 400 metres of either Sunnyside East or Carne West Swamps, monitoring demonstrates that no greater than 'negligible environmental consequences' have resulted to the swamp from mining under this consent, to the satisfaction of the Secretary, then the Secretary will release the half of the Bond that applies to that swamp.

   If monitoring demonstrates that greater than 'negligible environmental consequences' have resulted to either of these shrub swamps from mining under this consent, and that these consequences have stabilised for a period of at least 12 months, then the Applicant must offset the environmental consequences to that swamp to the satisfaction of the Secretary within any period specified by the Secretary.

   The offset liability will be set by the Secretary in consultation with OEH, following consideration of:
   (a) the estimated liability using the Framework for Biodiversity Assessment in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*; and
   (b) advice from the Independent Monitoring Panel that will be established by the Secretary for the development.

   Once the Applicant has offset the environmental consequences to the satisfaction of the Secretary, the relevant proportion of the Swamp Offset Bond will be returned to the Applicant.

   Notes:

   - *Alternative funding arrangements, such as provision of capital and management funding as agreed by OEH as part of a Biobanking Agreement or transfer to conservation reserve estate, can be used as part of the Swamp Offset Bond. A bank guarantee can be lodged in place of a cash bond.*

Swamp Offsets for all other Shrub Swamps

5. Prior to the commencement of mining operations under an approved Extraction Plan which are predicted to cause greater than negligible environmental consequences to either Gang Gang South West, Gang Gang East, Pine, Pine Upper, Paddys, Marangaroo Creek or Marrangaroo Creek Upper Swamp, the Applicant shall demonstrate that it can satisfy the maximum predicted offset liability for the total area of swamp(s) predicted to be impacted under that Extraction Plan.

   If, after 12 months of completion of all mining under this consent within 400 metres of any of these shrub swamps, monitoring demonstrates that no greater than 'negligible environmental consequences' have resulted to the swamp from mining under this consent, to the satisfaction of the Secretary, then the Applicant will not be required to secure the offset or retire the credits relating to that swamp.

   If monitoring demonstrates that greater than 'negligible environmental consequences' have resulted to any of these shrub swamps from mining under this consent, and that these consequences have stabilised for a period of at least 12 months, then the Applicant must offset the environmental consequences to that swamp to the satisfaction of the Secretary within any period specified by the Secretary.

   The offset liability will be set by the Secretary in consultation with OEH, following consideration of:
   (a) the estimated liability using the Framework for Biodiversity Assessment in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*; and
   (b) advice from the Independent Monitoring Panel that will be established by the Secretary for the development.

   Note: Alternative funding arrangements, such as provision of capital and management funding as agreed by OEH as part of a Biobanking Agreement or transfer to conservation reserve estate, can be used as part of the Swamp Offset.

6. As part of each Extraction Plan for mining within 400 metres of the swamps subject to condition 5 above, the Applicant must:
   (a) calculate the maximum predicted offset liability for any environmental consequences on these swamps that may result from the proposed mining using the Framework for Biodiversity Assessment in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*; and
   (b) demonstrate that it has suitable arrangements in place to deal with these liabilities quickly in the event that offsets are required.

Performance Measures – Built Features

7. The Applicant shall ensure that the development does not cause any exceedances of the performance measures in Table 2, to the satisfaction of the Secretary.

Table 2: Subsidence Impact Performance Measures

Built Features	***Performance Measures***
Key public infrastructure: Lithgow Water Supply Dam	No damage or additional risk.
Power transmission lines and associated towers, unsealed roads and road culverts, fire trails, other public infrastructure, fences and other built features	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.
Public safety	
Public Safety	Negligible additional risk

Notes:
- *These performance measures apply to all mining taking place after the date of this consent.*
- *The Applicant will be required to define more detailed performance indicators for each of these performance measures in the Built Features Management Plans or Public Safety Management Plan (see condition 10 below).*
- *Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.*
- *Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes.*

8. Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 2 is to be settled by the Secretary, following consultation with DRE. Any decision by the Secretary shall be final and not subject to further dispute resolution under this consent.

First Workings

9. Subject to condition 10 below, the Applicant may carry out first workings within the underground mining area, other than in accordance with an approved Extraction Plan, provided that DRE is satisfied that the first workings are designed to remain stable and non-subsiding in the long-term, except insofar as they may be impacted by approved second workings.

Note: The intent of this condition is not to require an additional approval for first workings, but to ensure that first workings are built to geotechnical and engineering standards sufficient to ensure long term stability, with negligible resulting direct subsidence impacts.

Extraction Plan

10. The Applicant shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Secretary. Each Extraction Plan must:
    (a) be prepared in consultation with DRE and by suitably qualified and experienced persons whose appointment has been endorsed by the Secretary;
    (b) be approved by the Secretary before the Applicant carries out any of the second workings covered by the plan;
    (c) include detailed plans of existing and proposed first and second workings and overlying surface features, including any applicable adaptive management measures;
    (d) include adequate consideration of mine roof and floor conditions, pillar width to height ratio, final pillar design dimensions and the long-term stability of pillars which has been undertaken in consultation with DRE;
    (e) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed mining covered by the Extraction Plan, incorporating any relevant information obtained since this consent;
    (f) provide revised predictions for potential environmental consequences on affected shrub swamps and the social and economic costs of avoiding these consequences;
    (g) describe in detail the performance indicators that would be implemented to ensure compliance with the performance measures in Tables 1 and 2, and manage or remediate any impacts and/or environmental consequences consequences to meet the rehabilitation objectives in condition 30 of Schedule 4;
    (h) include a:
        (i) *Subsidence Monitoring Program* which has been prepared in consultation with DRE to:
            - describe the ongoing conventional and non-conventional subsidence monitoring program:
            - provide data to assist with the management of risks associated with conventional and non-conventional subsidence;
            - validate the conventional and non-conventional subsidence predictions;
            - analyse the relationship between the predicted and resulting conventional and non-conventional subsidence effects and predicted and resulting impacts under the plan and any ensuring environmental consequences; and
            - inform the contingency plan and adaptive management process in paragraphs (ix) and (x) below;
        (ii) *Built Features Management Plan* which has been prepared in consultation with DRE, to manage the potential subsidence impacts of the proposed underground workings on built features, and which:
            - has been prepared in consultation with the owner/s of potentially affected feature/s;
            - addresses in appropriate detail all items of key public infrastructure and other public infrastructure and all classes of other built features;
            - recommends appropriate pre-mining mitigation measures to reduce subsidence impacts; and
            - recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate predicted impacts on potentially affected built features in a timely manner;
        (iii) *Water Management Plan* which has been prepared in consultation with DPI-Water, WaterNSW and the Independent Monitoring Panel (required by condition 11), which provides for the management of potential impacts and/or environmental consequences of the proposed underground workings on watercourses and aquifers, including:
            - detailed baseline data on:
                - surface water flows and quality in water bodies that could be affected by subsidence, including Wolgan River, Carne Creek, Marangaroo Creek, Coxs River and all major associated tributaries ;
                - groundwater levels, yield and quality in the region;
            - surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;
            - a surface water monitoring program to monitor and report on:
                - stream flows and quality;
                - stream and riparian vegetation health;
                - channel and bank stability;
            - a groundwater monitoring program to monitor and report on:

- springs, their discharge quantity and quality, as well as associated groundwater dependent ecosystems;
- groundwater inflows to the underground mining operations;
- the height of groundwater depressurization;
- background changes in groundwater yield/quality against mine-induced changes, in particular, on groundwater bore users in the vicinity of the site;
- permeability, hydraulic gradient, flow direction and connectivity of the deep and shallow groundwater aquifers;
- impacts of the development on upland swamps (refer to condition 10 below) and other groundwater dependent ecosystems;

- a description of any adaptive management practices implemented to guide future mining activities in the event of greater than predicted impacts on aquatic habitat;
- a program to validate the surface water and groundwater models for the development, and compare monitoring results with modelled predictions; and
- a plan to respond to any exceedances of the surface water and groundwater assessment criteria;

(iv) *Biodiversity Management Plan* which has been prepared in consultation with OEH and the Independent Monitoring Panel, which provides for the management of potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats and EECs, including a management and research program for the Blue Mountains Water Skink (*Eulamprus leuraensis*);

(v) *Swamp Monitoring Program* which has been prepared in consultation with OEH, DPI-Water, WaterNSW and the Independent Monitoring Panel, and which includes (as a minimum):

- further consideration of the location of existing piezometers and the installation of upslope and downslope piezometers in all shrub swamps, in order to better understand the down-slope movement of shallow groundwater;
- installation of flow monitoring points in all shrub swamps;
- measures to record the nature and condition of terrestrial and aquatic flora and fauna within all shrub swamps and selected hanging swamps;
- measures to characterise soils or peat layers within the swamps to determine:
  - porosity;
  - a basis for relating water levels to rainfall and evapotranspiration; and
  - the presence, or absence, of clay materials at the interface with the underlying bedrock;
- a program for monthly review of the water balance of all monitored swamps based on recorded rainfall, estimated evapotranspiration and recorded surface and shallow groundwater levels and outflow measurements;
- detailed performance indicators for the relevant performance measures in Table 1, including performance indicators relating to surface and shallow groundwater levels and outflow measurements;
- assessment of any post-mining impacts on the incision feature in Sunnyside East Swamp;
- specific consideration of subsidence impacts on and environmental consequences to hanging swamps;
- consideration of a minimum of 2 years of baseline data for swamp hydrology and swamp vegetation;
- hydrological and vegetative monitoring which fully satisfies Before After Control Impact (BACI) design principles;
- provision of raw piezometer and other monitoring data to the Department, OEH and the Independent Monitoring Panel, if requested; and
- incorporation of any relevant findings from swamp research projects into the swamp monitoring program;

(vi) *Land Management Plan* which has been prepared in consultation with OEH and any other affected public authorities, which provides for the management of potential impacts and/or environmental consequences of the proposed underground workings on land in general, with a specific focus on cliffs, minor cliffs, pagoda formations, steep slopes and gorges;

(vii) *Heritage Management Plan* which has been prepared in consultation with OEH and relevant stakeholders for both Aboriginal and non-Aboriginal heritage, which provides for the management of potential environmental consequences of the proposed second workings on Aboriginal and non-Aboriginal heritage and includes all requirements under condition 24 of Schedule 4;

(viii) *Public Safety Management Plan* which has been prepared in consultation with DRE and OEH, which ensures public safety and manages access on the site;

(ix) *TARPs* addressing all features in Tables 1 and 2, which contain:

- appropriate triggers to warn of increased risk of exceedance of any performance measure; and
- specific actions to respond to high risk of exceedance of any performance measure to ensure that the measure is not exceeded;
- an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures;

(x) *Contingency Plan* that expressly provides for:
- adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 1 and 2, or where any such exceedance appears likely; and
- an assessment of remediation measures that may be required if exceedances occur and the capacity to implement those measures;

(xi) proposes appropriate revisions to the Rehabilitation Management Plan required under condition 32 in Schedule 4; and

(xii) includes a program to collect sufficient baseline data for future Extraction Plans.

Notes:
- *This condition does not apply to first or second workings which are covered by an Extraction Plan or Subsidence Management Plan approved, or submitted for approval, as at the date of this development consent.*
- *In accordance with condition 7 in Schedule 6, the preparation and implementation of Extraction Plans may be staged, with each plan covering a defined area of underground workings. In addition, these plans are only required to contain management plans that are relevant to the specific underground workings that are being carried out.*
- *Due to the sensitive and rugged terrain of the Newnes Plateau, the Applicant may propose remote subsidence monitoring techniques.*

Independent Monitoring Panel

11. An Independent Monitoring Panel for the development will be established by the Secretary, and be comprised of suitably qualified experts in the fields of mining subsidence, upland swamps and landforms of the western Blue Mountains. The role of the Panel is to provide timely, accurate and focussed advice to the Applicant and the Secretary regarding the:
    (a) collection of relevant data to predict and monitor the potential subsidence impacts and environmental consequences of second workings;
    (b) achievement of performance measures in Table 1 in respect of Swamps, Land and Biodiversity, including relevant performance indicators, including avoidance of impacts where reasonable and feasible, rather than relying on remediation and offsets;
    (c) preparation, revision and implementation of Extraction Plans, particularly the Swamp Monitoring Program, Biodiversity Management Plan and Land Management Plan components;
    (d) undertaking iterative risk assessment in Extraction Plans, including consideration of all options for avoiding or minimising damage to swamps and all possible adaptive management measures;
    (e) appropriate implementation of the swamp and groundwater monitoring programs and adaptive management regime throughout the life of the project; and
    (f) calculation of swamp offset liability and verification of calculated swamp offset liability under conditions 4 and 5 of Schedule 3.

PAYMENT OF REASONABLE COSTS

12. The Applicant shall pay all reasonable costs incurred by the Department to:
    (a) engage suitably qualified, experienced and independent persons to review the adequacy of any aspect of an Extraction Plan; and
    (b) establish and operate the Independent Monitoring Panel for the development.

SCHEDULE 4
ENVIRONMENTAL PERFORMANCE CONDITIONS

NOISE

Noise Criteria

1. From the date of this consent until 30 June 2016, the Applicant shall ensure that the noise generated by the development does not exceed the criteria in Table 3 at any residence on privately-owned land.

Table 3: Noise Criteria dB(A)

Location Receiver Number	***Day***	***Evening***	***Night***	
	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{A1\ (1\ min)}$
S1	44	44	46	52
S2	43	43	46	53
S3	35	35	35	60
All other privately-owned land	35	35	35	45

Note: To interpret the locations referred to in Table 3 see the applicable figure in Appendix 4.

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 5 details the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has a negotiated agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

2. From 1 July 2016, the Applicant shall ensure that the noise generated by the development does not exceed the criteria in Table 4 at any residence on privately-owned land, or have notified, in accordance with Schedule 5, the owners of residences represented by Receiver Numbers S1 and S2 that they are entitled to acoustic treatment of their residence.

Table 4: Noise Criteria dB(A)

Location Receiver Number	***Day***	***Evening***	***Night***	
	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{Aeq\ (15\ min)}$	$L_{A1\ (1\ min)}$
S1	44	44	42	52
S2	43	43	43	53
S3	35	35	35	60
All other privately-owned land	35	35	35	45

Note: To interpret the land referred to in Table 4 see the applicable figure in Appendix 4.

Operating Conditions

3. The Applicant shall:
   (a) implement best management practice to minimise the construction, operational and road noise of the development;
   (b) minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 5); and
   (c) carry out regular monitoring to determine whether the development is complying with the relevant conditions of this consent,
   (d) regularly assess noise monitoring data and modify and/or stop operations on site to ensure compliance with the relevant conditions of this consent,

   to the satisfaction of the Secretary.

Noise Management Plan

4. The Applicant shall prepare and implement a Noise Management Plan for the development to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with EPA, and submitted to the Secretary for approval within three months of the date of this consent, unless otherwise agreed by the Secretary;
   (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions of this consent;
   (c) describe the proposed noise management system in detail;
   (d) include an investigation into the generation and perception of low frequency noise by the project;
   (e) include a noise monitoring program that:
      - evaluates and reports on:
         - the effectiveness of the on-site noise management system;
         - compliance against the noise criteria in this consent; and
         - compliance against the operating conditions in condition 3 above;
      - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents; and
      - outlines procedures to manage responses to any complaints or issues raised by the owners of affected residences

AIR QUALITY & GREENHOUSE GAS

Air Quality Criteria

5. The Applicant shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the development do not cause exceedances of the criteria in Table 5 at any residence on privately-owned land.

Table 5: Air quality criteria

Pollutant	***Averaging Period***	***Criterion***	
Particulate matter < 10 µm (PM_{10})	Annual	[a,d] 30 µg/m^3	
Particulate matter < 10 µm (PM_{10})	24 hour	[a] 50 µg/m^3	
Total suspended particulates (TSP)	Annual	[a,d] 90 µg/m^3	
[c] Deposited dust	Annual	[b] 2 g/m^2/month	[a,d] 4 g/m^2/month

Notes to Table 5:
a Cumulative impact (ie increase in concentrations due to the development plus background concentrations due to all other sources).
b Incremental impact (ie increase in concentrations due to the development alone, with zero allowable exceedances of the criteria over the life of the development.
c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.
d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.
e "Reasonable and feasible avoidance measures" includes, but is not limited to, the operational requirements in conditions 6 and 7 to develop and implement an air quality management system that ensures operational responses to the risks of exceedance of the criteria.

Operating Conditions

6. The Applicant shall:
   (a) implement all reasonable and feasible measures to minimise the:
      - odour, fume and dust emissions of the development; and
      - release of greenhouse gas emissions from the development;
   (b) minimise any visible off-site air pollution generated by the development;
   (c) minimise the surface disturbance of the site generated by the development;
   (d) regularly assess the air quality monitoring data, and modify operations on site to ensure compliance with the relevant conditions of this consent;
   (e) minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see note *d* to Table 5 above),

   to the satisfaction of the Secretary.

Air Quality & Greenhouse Gas Management Plan

7. The Applicant shall prepare and implement an Air Quality Management Plan for the development to the satisfaction of the Secretary. This plan must:
   (a) be prepared in consultation with the EPA, and submitted to the Secretary within 3 months of the date of this consent, unless otherwise agree by the Secretary;
   (b) describe all reasonable and feasible measures which would be implemented to ensure compliance with the air quality criteria and operating conditions of this consent;
   (c) describe the air quality management system in detail;
   (d) include an air quality monitoring program that:
      - uses monitors to evaluate the performance of the development against the air quality criteria in this consent;
      - adequately supports the air quality management system;
      - evaluates and reports on the:
         - the effectiveness of the air quality management system; and
         - compliance with the air quality criteria and operating conditions in condition 6 above; and
      - defines what constitutes an air quality incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any air quality incidents.

Meteorological Monitoring

8. Within 6 months of the date of this consent and for the life of the development, the Applicant shall ensure that there is a meteorological station in the vicinity of the site that:
   (a) complies with the requirements in the *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline and the *NSW Industrial Noise Policy;* and
   (b) is capable of continuous real-time measurement of atmospheric stability category determined by the sigma theta method in accordance with the *NSW Industrial Noise Policy*.

WATER

Water Supply

9. The Applicant shall ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of operations on site to match its available water supply.

   Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.

Water Pollution

10. Unless an EPL authorises otherwise, the Applicant shall comply with section 120 of the POEO Act.

Compensatory Water Supply

11. The Proponent shall provide a compensatory water supply to any landowner of privately owned land whose water supply is adversely and directly impacted (other than an impact that is negligible) as a result of the project, in consultation with DPI-Water, and to the satisfaction of the Secretary.

    The compensatory water supply measures must provide an alternative long-term supply of water that is equivalent to the loss attributed to the project. Equivalent water supply should be provided (at least on an interim basis) within 24 hours of the loss being identified.

    If the Proponent and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

    If the Proponent is unable to provide an alternative long-term supply of water, then the Proponent shall provide alternative compensation to the satisfaction of the Secretary.

Water Management Performance Measures

12. The Applicant shall comply with the performance measures in Table 6 to the satisfaction of the Secretary.

Table 6: Water Management Performance Measures

Feature	***Performance Measure***
Water Management – General	• Minimise the use of clean water on site • Minimise the use of water from external sources
Construction and	• Design, install and maintain erosion and sediment controls generally in

operation of infrastructure	accordance with the series *Managing Urban Stormwater: Soils and Construction* including *Volume 1, Volume 2A – Installation of Services* and *Volume 2C – Unsealed Roads* • Design, install and maintain the infrastructure within 40 m of watercourses generally in accordance with the *Guidelines for Controlled Activities on Waterfront Land (DPI 2012)*, or its latest version • Design, install and maintain creek crossings generally in accordance with the *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries, 2003) and *Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries 2003), or their latest versions
Clean water diversion	• Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site, except where clean water is captured for use on site
Sediment dams	• Design, install and maintain the new dams generally in accordance with the series *Managing Urban Stormwater: Soils and Construction – Volume 1* and *Volume 2E – Mines and Quarries*
Mine water storages	• Design, install and maintain mine water storage infrastructure to ensure no unlicensed or uncontrolled discharge of mine water off-site • Minimise discharges to surface waters as far as reasonable and practicable • New storages (mine infrastructure dams, groundwater storage and treatment dams) are suitably treated to comply with a permeability standard of < 1 x 10^{-9} m/s
Mine water discharges	• Discharge all groundwater inflow mine water (except from the Renoun workings) through the Springvale Delta Water Transfer Scheme • Meet limits for salinity of 700 (50th percentile), 900 (90th percentile) and 1,000 (100th percentile) µS/cm EC by 30 June 2017 • Meet a limit for salinity of 500 (90th percentile) µS/cm EC by 30 June 2019 • Eliminate acute and chronic toxicity from LDP009 discharges to aquatic species by 30 June 2017, with acute toxicity defined as >10% effect relative to the control group and chronic toxicity defined as >20% effect relative to the control group
Aquatic and riparian ecosystems	• Maintain or improve baseline channel stability • Develop site-specific water quality objectives in accordance with the ANZECC Guidelines and *Using the ANZECC Guidelines and Water Quality Objectives in NSW* procedures (DECC 2006), or its latest version
Chemical and petroleum storage	• Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards

Upper Coxs River Action & Monitoring Plan

13. The Applicant shall prepare an Upper Coxs River Action & Monitoring Plan for the development to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with DPI-Water, WaterNSW, EPA and Energy Australia;
    (b) be submitted to the Secretary for approval by 30 June 2016, unless otherwise agreed by the Secretary;
    (c) identify all available water management measures designed to achieve the mine water discharge criteria and associated timeframes required by condition 12 above, including potential transfer of mine water to Mt Piper Power Station and consideration of all licensed discharge points within the Upper Coxs River catchment (including at Springvale Mine, Lidsdale Siding, Western Coal Services and Angus Place Colliery);
    (d) include a financial justification and timetable for achieving reductions in salinity in the Upper Coxs River to 500 (90th percentile) µS/cm EC by June 2019 and identify enforceable mechanisms for the implementation of the proposed measures;
    (e) include a monitoring program which is based on:
        • water quality, macroinvertebrate and ecotoxicology monitoring across the Coxs River Catchment to measure performance against a long term water quality objective of 350 µS/cm EC and the impacts of salinity and toxicity changes on the aquatic ecology and ecosystem health of the Cox River;
        • water quality parameters to be monitored at all existing and proposed licensed discharge points (focusing on those parameters that have been identified as having potential to cause harm to the environment, the frequency of monitoring and concentration limits required by condition 12 above and any EPL that applies to the site);
        • a TARP identifying actions to be implemented should any concentration limits be exceeded (focusing on the extent to which exceedances might affect aquatic ecology); and
    (f) provide for status reports, to be submitted to the EPA and WaterNSW by 30 June 2017 and 30 September 2020, on the impact of the mine water discharges on the aquatic environment.

Water Management Plan

14. The Applicant shall prepare and implement a Water Management Plan for the development to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with DPI-Water, WaterNSW, OEH and the EPA, by suitably qualified and experienced person/s whose appointment has been approved by the Secretary;
    (b) be submitted to the Secretary for approval within 6 months of the date of this consent, unless otherwise agreed by the Secretary;
    (c) include detailed performance criteria and describes measures to ensure that the Applicant complies with the Water Management Performance Measures (see Table 6);
    (d) in addition to the standard requirements for management plans (see condition 2 of Schedule 6), this plan must include a:
        (i) Site Water Balance that:
            - includes details of:
                - sources and security of water supply, including contingency planning for future reporting periods;
                - water use and management on site;
                - any off-site water discharges; and
                - reporting procedures, including the preparation of a site water balance for each calendar year; and
            - investigates and implements all reasonable and feasible measures to minimise water use on site;
        (ii) Surface Water Management Plan, that includes:
            - detailed baseline data on water flows and quality in the waterbodies that could be affected by the development, including Wolgan River, Carne Creek, Marrangaroo Creek and Paddys Creek, Coxs River, Lake Lyell, Lake Wallace, Lake Burragorang and associated tributaries;
            - a detailed description of the water management systems on site, including the:
                - clean water diversion systems;
                - erosion and sediment controls; and
                - mine water management systems;
            - detailed objectives and performance criteria, including trigger levels for investigating any potentially adverse impacts associated with the development for:
                - the water management system;
                - downstream surface water quality;
                - downstream flooding impacts; and
                - stream and riparian vegetation health for rivers and creeks and their tributaries potentially impacted by the development;
                - design and management for the emplacement of coal reject materials;
                - restoration of an appropriate drainage network on the rehabilitated areas of the site; and
                - control of any potential water pollution from the rehabilitated areas of the site;
            - a program to monitor and report on:
                - the performance measures listed in Table 6;
                - the effectiveness of the water management system;
                - surface water flows, quality and geomorphology of the watercourses potentially affected by the development within and immediately outside of the site;
                - the seepage/leachate from on-site water storages; and
                - downstream flooding impacts;
            - consideration of any EPA review of licensed discharge points for the development and any further advice from WaterNSW in relation to water discharges;
            - an updated Regional Water Quality Impact Assessment Model having regard for variations in Lake Burragorang (salinity and volume) and spillages from Lake Lyell;
            - reporting procedures for the results of the monitoring program;
            - a program to validate the Regional Water Quality Impact Assessment Model, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions; and
            - a plan to respond to any exceedances of the performance measures, and repair, mitigate and/or offset any adverse surface water impacts of the development; and
        (iii) Groundwater Management Plan, which is consistent with DPI-Water's guideline entitled *Groundwater Monitoring and Modelling Plans – Introduction for prospective mining and petroleum activities*, and includes:
            - detailed baseline data of groundwater levels, yield and quality in the region that could be affected by the development, including licensed privately-owned groundwater bores and a detailed survey/schedule of groundwater dependent ecosystems;
            - groundwater assessment criteria including trigger levels for investigating any potentially adverse groundwater impacts;

- a program to monitor and report on:
  - springs and their discharge quantity and quality;
  - groundwater inflows transferred to the surface water management system;
  - the seepage/leachate from water storages and emplacements;
  - impacts of the development on:
    - regional and local (including alluvial) aquifers;
    - groundwater supply of potentially affected landowners; and
    - groundwater dependent ecosystems (including rules for the management of groundwater level impacts to protect GDEs), and riparian vegetation;
- a program to validate the groundwater model for the development, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions; and
- a plan to respond to any exceedances of the performance measures.

BIODIVERSITY

Biodiversity Offset Strategy

15. By the end of December 2016, the Applicant shall update the *Western Projects Biodiversity Strategy* (RPS Australia East Pty Ltd, 1 October 2014) to provide a suitable offset for:
    (a) the clearing of 4 hectares of native vegetation associated with the construction of Bore 8; and
    (b) the clearing of 8.94 hectares of native vegetation associated with surface infrastructure for the development;
    to the satisfaction of OEH and the Secretary.

    These offsets must be developed in accordance with the *NSW Biodiversity Offset Policy for Major Projects*, or its current version.

Long Term Security of Offset

16. By the end of December 2016, unless the Secretary agrees otherwise, the Applicant shall make suitable arrangements to protect the biodiversity offset areas referred to in condition 15(a)&(b) above in perpetuity, to the satisfaction of the Secretary.

Stygofauna Assessment

17. The Applicant shall prepare and implement a Regional Stygofauna Monitoring and Assessment Plan for the development to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with OEH, and be submitted to the Secretary for approval within 6 months of the date of this consent, unless otherwise agreed by the Secretary;
    (b) provide for ongoing monitoring for stygofauna in at least one borehole in each aquifer where stygofauna are known to occur;
    (c) monitor for the presence of stygofauna in the deep aquifer system (AQ1 to AQ3);
    (d) collate existing available information on groundwater bores, water quality and characteristics in Centennial Coal's mines throughout the Western Coalfield;
    (e) use this information to form a prioritisation list of likely areas for GDEs to occur;
    (f) use the prioritisation protocol to identify bores that can be sampled to provide data on the presence and significance of fauna both within and outside mine areas;
    (g) identify any stygofauna found to a minimum of Family level;
    (h) advise on the significance of the findings; and
    (i) examine relationship between bore characteristics and presence of stygofauna

Biodiversity Management Plan

18. The Applicant shall prepare and implement a Biodiversity Management Plan for the development to the satisfaction of the Secretary. This plan must:
    (a) be prepared in consultation with OEH, Forestry Corporation of NSW and DoE and be submitted to the Secretary for approval by the end of December 2016, unless otherwise agreed by the Secretary;
    (b) establish baseline data for existing remnant vegetation and habitat on site;
    (c) describe the short, medium, and long-term measures to be implemented to manage remnant vegetation and habitat on the site, including upland swamps;
    (d) describe an ongoing monitoring program and TARP for upland swamps and EECs with a particular focus on subsidence-related changes to surface and ground water drainage;
    (e) include a detailed description of the measures that would be implemented to:
        - minimise impacts to fauna on site, including undertaking pre-clearance surveys;
        - control weeds and feral pests (including goats, rabbits, foxes, cats and pigs);
        - control erosion;

- control access; and
- manage bushfire risk;

(f) include a program to monitor and report on the effectiveness of these measures and progress against detailed performance and completion criteria; and

(g) include details of who would be responsible for monitoring, reviewing, and implementing the plan.

TRANSPORT

Monitoring of Coal Transport

19. The Applicant shall monitor and report on:
    (a) the amount of coal transported from the site by conveyor, private haul roads and, if used, public roads (on a daily basis);
    (b) make these records publicly available on its website at the end of each calendar quarter.

    to the satisfaction of the Secretary.

Road Transport Restrictions

20. The Applicant shall ensure that any truck leaving the site:
    (a) does not carry dirt or mud onto public roads; and
    (b) is free of material that may fall on the road and create a road safety hazard or public nuisance,

    to the satisfaction of the Secretary.

Mine Access Road Intersection Upgrade

21. Unless the Secretary agrees otherwise, when peak two-way traffic volume on the Castlereagh Highway at its intersection with the Mine Access Road exceeds 400 vehicles per hour, the Applicant shall upgrade that intersection to include a Channelised Right Turn in accordance with Austroads standards, to the satisfaction of RMS.

    Note: Circumstances in which the Secretary may agree to vary the requirement to upgrade the intersection include limited remaining life for mining operations under this consent.

Forestry Roads

22. The Applicant shall maintain forestry access roads when being used for construction and/or exploration activities, to the satisfaction of the Forestry Corporation of NSW.

HERITAGE

Protection of Aboriginal Heritage Items

23. Unless otherwise authorised under the *National Parks and Wildlife Act 1974*, the Applicant shall ensure that the development does not cause any direct or indirect impact on identified Aboriginal heritage items located outside approved disturbance areas on the site.

    Note: Identified Aboriginal heritage items are shown on the figure in Appendix 6.

Heritage Management Plan

24. The Applicant shall prepare and implement a Heritage Management Plan for the development to the satisfaction of the Secretary. This Plan must:
    (a) be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Secretary;
    (b) be prepared in consultation with OEH, Council and local Aboriginal stakeholders (in relation to management of Aboriginal heritage values);
    (c) be submitted to the Secretary for approval within 6 months of the date of this consent, unless the Secretary agrees otherwise;
    (d) include a description of the measures that would be implemented for:
        - managing the discovery of human remains or previously unidentified heritage items, including historic heritage items, on site;
        - ensuring any workers on site receive suitable heritage inductions prior to carrying out any development on site, and that suitable records are kept of these inductions;
    (e) include the following for the management of Aboriginal heritage:
        - a description of the measures that would be implemented for:
            - protecting, monitoring and/or managing the heritage items identified in Table 1 (including any proposed archaeological investigations and/or salvage measures);
            - managing the discovery of previously unidentified Aboriginal items on site;

- conserving the sites outside approved disturbance areas (see Appendix 6), including measures that would be implemented to secure, analyse and record any sites at risk of subsidence impacts;
- maintaining and managing reasonable access for Aboriginal stakeholders to heritage items on site;
- ongoing consultation with the Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage on site; and

(f) include the following for the management of non-Aboriginal heritage items:

- a description of the measures that would be implemented for:
  - protecting, monitoring and managing the heritage items identified in Appendix 6; and
  - managing the discovery of previously unidentified cultural heritage items on site.

Note: This plan can be incorporated with any Aboriginal Cultural Heritage Management Plan for Centennial Coal's other mines and mine infrastructure in the Lithgow Local Government Area.

VISUAL

Visual and Lighting

25. The Applicant shall:
    (a) implement all reasonable and feasible measures to minimise the visual and off-site lighting impacts of the development;
    (b) ensure that all external lighting associated with the development complies with *Australian Standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting*, or its latest version;
    (c) ensure that the visual appearance of all buildings, structures, facilities or works (including paint colours and specifications) is aimed at blending as far as possible with the surrounding landscape,

    to the satisfaction of the Secretary.

BUSHFIRE MANAGEMENT

26. The Applicant shall:

    (a) ensure that the development is suitably equipped to respond to any fires on site; and
    (b) assist the Rural Fire Service and emergency services as much as possible if there is a fire in the surrounding area.

WASTE

27. The Applicant shall:
    (a) implement all reasonable and feasible measures to minimise the waste (including coal reject) generated by the development;
    (b) ensure that the waste generated by the development is appropriately stored, handled and disposed of; and
    (c) monitor and report on effectiveness of the waste minimisation and management measures in the Annual Review,

    to the satisfaction of the Secretary.

EXPLORATION ACTIVITIES & SURFACE INFRASTRUCTURE

Exploration Activities and Minor Surface Infrastructure Management Plan

28. The Applicant shall prepare and implement an Exploration Activities and Minor Surface Infrastructure Management Plan for the development to the satisfaction of the Secretary. This Plan must:
    (a) be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Secretary;
    (b) be prepared in consultation with DRE and the Forestry Commission of NSW;
    (c) be submitted to the Secretary for approval within 6 months of the date of this consent or prior to carrying out exploration activities causing surface disturbance or constructing surface infrastructure (whichever is the earlier), unless the Secretary agrees otherwise;
    (d) include a description of the measures that would be implemented for:
        - managing exploration activities;
        - managing construction and operation of minor surface infrastructure (including minewater drainage bores, service boreholes and infrastructure corridors) and associated access tracks;
        - consulting with and compensating affected landowners;
        - avoiding threatened species, populations or their habitats and EECs;
        - minimising clearance and disturbance of native vegetation;
        - minimising erosion and sedimentation;
        - achieving applicable standards and goals; and
        - rehabilitating disturbed areas.

Note: This condition does not apply to the construction of approved surface infrastructure in the Springvale Pit Top area.

REHABILITATION

Rehabilitation Objectives

30. The Applicant shall rehabilitate the site to the satisfaction of DRE. This rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the EIS, and comply with the objectives in Table 7.

Table 7: Rehabilitation Objectives

Feature	***Objective***
Mine site (as a whole)	• Safe, stable & non-polluting
Rehabilitation materials	• Materials from areas disturbed under this consent (including topsoils, substrates and seeds) are to be recovered, managed and used as rehabilitation resources
Surface infrastructure	• To be decommissioned and removed unless DRE agrees otherwise • All surface infrastructure sites are to be revegetated with suitable local native plant species to a landform consistent with the surrounding environment
Portals and vent shafts	• To be decommissioned and made safe and stable • Retain habitat for threatened species (eg bats), where practicable
Revegetated final landforms	• Stable and sustain the intended land use • Consistent with surrounding topography to minimise visual impacts • Incorporate relief patterns and design principles consistent with natural drainage
Native flora and fauna	• Flora species used in rehabilitation selected to re-establish and complement local and regional biodiversity • Rehabilitated areas contribute to achieving self-sustaining biodiversity habitats
All watercourses subject to mine-water discharges and/or subsidence impacts	• Hydraulically and geomorphologically stable, with aquatic ecology and riparian vegetation that is the same, or better than prior to grant of this consent
Cliffs, minor cliffs and steep slopes	• No additional risk to public safety compared to prior to mining
Other land affected by the development	• Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of local native plant species (unless DRE agrees otherwise)
Built features damaged by mining operations	• Repair to pre-mining condition or equivalent unless the: - owner agrees otherwise; or - damage is fully restored, repaired or compensated for under the *Mine Subsidence Compensation Act 1961*
Community	• Ensure public safety • Minimise the adverse socio-economic effects associated with mine closure

Notes:

- *These rehabilitation objectives apply to all subsidence impacts and environmental consequences caused by mining taking place after the date of this consent; and to all surface infrastructure parts of the development, whether constructed prior to or following the date of this consent.*

Progressive Rehabilitation

31. The Applicant shall rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time.

Rehabilitation Management Plan

32. The Applicant shall prepare and implement a Rehabilitation Management Plan to the satisfaction of DRE. This plan must:

(a) be prepared in consultation with the Department, DPI-Water, OEH, Council, WaterNSW and the CCC;
(b) be submitted to DRE for approval within 6 months of the date of this consent, unless DRE agrees otherwise;
(c) be prepared in accordance with any relevant DRE guideline;
(d) include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, and triggering remedial action (if necessary);

(e) describe the measures that would be implemented to ensure compliance with the relevant conditions of this consent, and address all aspects of rehabilitation including mine closure, final landform and final land use;
(f) include interim rehabilitation where necessary to minimise the area exposed for dust generation;
(g) include a program to monitor and report on the effectiveness of the rehabilitation measures and progress against the detailed performance and completion criteria; and
(h) build to the maximum extent practicable on the other management plans required under this consent.

Note: The Biodiversity Management Plan and Rehabilitation Management Plan require substantial integration to achieve biodiversity objectives for the rehabilitated mine site.

SCHEDULE 5

ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

1. As soon as practicable after obtaining monitoring results showing:
   (a) an exceedance of any relevant criteria in Schedule 4, the Applicant shall notify the affected landowners in writing of the exceedance, and provide regular monitoring results to these landowners until the development is again complying with the relevant criteria; and
   (b) an exceedance of any relevant air quality criteria in Schedule 4, the Applicant shall send a copy of the NSW Health fact sheet entitled "Mine Dust and You" (as may be updated from time to time) to the affected landowners and/or existing tenants of the land (including the tenants of any mine-owned land).

INDEPENDENT REVIEW

2. If an owner of privately-owned land considers the development to be exceeding the relevant criteria in Schedule 4, then he/she may ask the Secretary in writing for an independent review of the impacts of the development on his/her land.

   If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision the Applicant shall:
   (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Secretary, to:
      - consult with the landowner to determine his/her concerns;
      - conduct monitoring to determine whether the development is complying with the relevant criteria in Schedule 4;
      - if the development is not complying with these criteria then identify the measures that could be implemented to ensure compliance with the relevant criteria; and
   (b) give the Secretary and landowner a copy of the independent review.

SCHEDULE 6
ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING

ENVIRONMENTAL MANAGEMENT

Environmental Management Strategy

1. The Applicant shall prepare and implement an Environmental Management Strategy for the development to the satisfaction of the Secretary. This strategy must:
   (a) be submitted to the Secretary for approval within 6 months of the date of this consent, unless the Secretary agrees otherwise;
   (b) provide the strategic framework for the environmental management of the development;
   (c) identify the statutory approvals that apply to the development;
   (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the development;
   (e) describe the procedures that would be implemented to:
      - keep the local community and relevant agencies informed about the operation and environmental performance of the development;
      - receive, handle, respond to, and record complaints;
      - resolve any disputes that may arise during the course of the development;
      - respond to any non-compliance;
      - respond to emergencies; and
   (f) include:
      - copies of any strategies, plans and programs approved under the conditions of this consent; and
      - a clear plan depicting all the monitoring required to be carried out under the conditions of this consent.

Management Plan Requirements

2. The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:
   (a) detailed baseline data;
   (b) a description of:
      - the relevant statutory requirements (including any relevant approval, licence or lease conditions);
      - any relevant limits or performance measures/criteria;
      - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;
   (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;
   (d) a program to monitor and report on the:
      - impacts and environmental performance of the development;
      - effectiveness of any management measures (see c above);
   (e) a contingency plan to manage any unpredicted impacts and their consequences;
   (f) a program to investigate and implement ways to improve the environmental performance of the development over time;
   (g) a protocol for managing and reporting any:
      - incidents;
      - complaints;
      - non-compliances with statutory requirements; and
      - exceedances of the impact assessment criteria and/or performance measures; and
   (h) a protocol for periodic review of the plan.

   Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.

Application of Existing Management Plans

3. Prior to the approval of management plans under this consent, the Applicant shall manage development undertaken pursuant to this consent in accordance with any equivalent or similar management plan/s required under consent DA 11/92.

Relationships between Management Plans

4. The Upper Coxs River Action & Monitoring, Water, Biodiversity and Heritage Management Plans required by conditions 13, 14, 18 and 24 of Schedule 4, respectively, are to be prepared in respect of all parts of the development that are not covered by an Extraction Plan approved under condition 10 of Schedule 3. In particular, those management plans should address all areas subject to existing or proposed surface disturbance associated with the development.

Consolidation of Strategies, Plans or Programs

5. With the approval of the Secretary, the Applicant may incorporate any strategies, plans or programs required by this consent (except those required under condition 10 of Schedule 3) with the strategies, plans and programs required for Centennial Coal's mining operations in the Lithgow Local Government Area.

Revision of Strategies, Plans and Programs

6. Within 3 months of:
   (a) the submission of an incident report under condition 10 below;
   (b) the submission of an annual review under condition 12 below;
   (c) the submission of an audit under condition 13 below; or
   (d) any modification to the conditions of this consent (unless the conditions require otherwise),

   the Applicant shall review the strategies, plans, and programs required under this consent, to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted for the approval of the Secretary.

   Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.

Updating & Staging Strategies, Plans or Programs

7. To ensure that strategies, plans and programs required under this consent are updated on a regular basis, and that they incorporate any appropriate additional measures to improve the environmental performance of the development, the Applicant may at any time submit revised strategies, plans or programs for the approval of the Secretary. With the agreement of the Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis.

   With the agreement of the Secretary, the Applicant may prepare a revision of or a stage of a strategy, plan or program without undertaking consultation with all parties nominated under the applicable condition in this consent.

   Notes:
   - *While any strategy, plan or program may be submitted on a staged basis, the Applicant will need to ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.*
   - *If the submission of any strategy, plan or program is to be staged; then the relevant strategy, plan or program must clearly describe the specific stage/s of the development to which the strategy, plan or program applies; the relationship of this stage/s to any future stages; and the trigger for updating the strategy, plan or program.*

Adaptive Management

8. The Applicant shall assess and manage development-related risks to ensure that there are no exceedances of the criteria and/or performance measures in Schedules 3 and 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation.

   Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity:
   (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
   (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
   (c) implement remediation measures as directed by the Secretary,

   to the satisfaction of the Secretary.

Community Consultative Committee

9. The Applicant shall operate a Community Consultative Committee (CCC) for the development to the satisfaction of the Secretary. This CCC must be operated in accordance with the *Guidelines for Establishing and Operating Community Consultative Committees for Mining Developments* (Department of Planning, 2007), or its latest version or replacement.

   Notes:
   - *The CCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Applicant complies with this consent;*
   - *In accordance with the guideline, the Committee should be comprised of an independent chair and appropriate representation from the Applicant, Council, recognised environmental groups and the local community;*
   - *The requirement for this CCC may be fulfilled by the operation of a regional CCC for Centennial Coal's mines and mine infrastructure in the Lithgow Local Government Area, and*
   - *The Department will accept the continued representation from existing CCC members.*

REPORTING

Incident Reporting

10. The Applicant shall immediately notify the Secretary and any other relevant agencies of any incident. Within 7 days of the date of the incident, the Applicant shall provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.

Regular Reporting

11. The Applicant shall provide regular reporting on the environmental performance of the development on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this consent, and to the satisfaction of the Secretary.

ANNUAL REVIEW

12. By the end of March each year, unless the Secretary agrees otherwise, the Applicant shall review the environmental performance of the development to the satisfaction of the Secretary. This review must:
    (a) describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year;
    (b) include a comprehensive review of the monitoring results and complaints records of the development over the past calendar year, which includes a comparison of these results against the:
        - the relevant statutory requirements, limits or performance measures/criteria;
        - the monitoring results of previous years; and
        - the relevant predictions in the EIS;
    (c) identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
    (d) identify any trends in the monitoring data over the life of the development;
    (e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
    (f) describe what measures will be implemented over the next year to improve the environmental performance of the development.

INDEPENDENT ENVIRONMENTAL AUDIT

Independent Environmental Review

13. Prior to 30 June 2016, and every 3 years thereafter, unless the Secretary directs otherwise, the Applicant shall commission and pay the full cost of an Independent Environmental Audit of the development. This audit must:
    (a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary;
    (b) include consultation with the relevant agencies;
    (c) assess the environmental performance of the development and assess whether it is complying with the requirements in this consent and any other relevant approval, relevant EPL/s or Mining Lease/s (including any assessment, plan or program required under these approvals);
    (d) review the adequacy of strategies, plans or programs required under the abovementioned approvals; and
    (e) recommend appropriate measures or actions to improve the environmental performance of the development, and/or any strategy, plan or program required under these approvals.

    Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Secretary.

14. Within 6 weeks of the completion of this audit, or as otherwise agreed by the Secretary, the Applicant shall submit a copy of the audit report to the Secretary, together with its response to any recommendations contained in the audit report.

ACCESS TO INFORMATION

15. Within 3 months from the date of this consent, the Applicant shall:
    (a) make copies of the following publicly available on its website:
        - the EIS;
        - all current statutory approvals for the development;
        - approved strategies, plans and programs required under the conditions of this consent;
        - a comprehensive summary of the monitoring results of the development, which have been reported in accordance with the various plans and programs approved under the conditions of this consent;
        - a complaints register, which is to be updated on a monthly basis;
        - minutes of CCC meetings;

- the last five annual reviews;
- information provided to and recommendations made by the Independent Monitoring Panel;
- any independent environmental audit of the development, and the Applicant's response to the recommendations in any audit;
- any other matter required by the Secretary; and

(b) keep this information up-to-date,

to the satisfaction of the Secretary.

APPENDIX 1: SCHEDULE OF LAND

Land_Status	Created_date	Last_Update	Lot__DP
FREEHOLD	19930804	20041126	9//16283
FREEHOLD	19930804	20041126	10//16283
FREEHOLD	19930804	20041126	26//16283
FREEHOLD	19930804	20041126	23//16283
FREEHOLD	19930804	20041126	B//417872
FREEHOLD	19930804	20041126	14//16283
FREEHOLD	19930804	20041126	1//551636
FREEHOLD	19930804	20041126	19//16283
FREEHOLD	19930804	20041126	2//607402
FREEHOLD	19930804	20041126	28//16283
FREEHOLD	19930804	20041126	30//16283
FREEHOLD	19930804	20041126	1//421721
FREEHOLD	20010504	20041126	2//1018958
FREEHOLD	19930804	20041126	18//16283
FREEHOLD	19930804	20041126	8//16283
FREEHOLD	20000308	20041126	101//829410
FREEHOLD	19930804	20041126	1//607402
FREEHOLD	19960418	20041126	1//825124
FREEHOLD	19940418	20041126	3//829137
FREEHOLD	19930804	20041126	16//16283
FREEHOLD	19930804	20041126	24//16283
FREEHOLD	19930804	20041126	20//16283
FREEHOLD	19930804	20041126	29//16283
FREEHOLD	19930804	20041126	25//16283
FREEHOLD	19930804	20041126	3//607402
FREEHOLD	19930804	20041126	A//417872
FREEHOLD	19930804	20041126	12//16283
FREEHOLD	19930804	20041126	15//16283
FREEHOLD	19940418	20041126	2//829137
FREEHOLD	19930804	20041126	11//16283
FREEHOLD	19930804	20041126	C//417872
FREEHOLD	19930804	20041126	7//16283
FREEHOLD	19930804	20041126	17//16283
FREEHOLD	19930804	20041126	13//16283
FREEHOLD	19930804	20041126	27//16283
FREEHOLD	20060925	20060925	23//1101696
FREEHOLD	20060925	20060925	21//1101696
FREEHOLD	20060925	20060925	22//1101696
FREEHOLD	20081023	20081023	228//1131953
FREEHOLD	20090712	20090715	10//1139978
FREEHOLD	20090712	20090715	11//1139978
FREEHOLD	20010504	20041126	1//1018958
FREEHOLD	19940418	20041126	1//175470
FREEHOLD	19930804	20041126	4//805024
FREEHOLD	19930804	20041126	33//751655
FREEHOLD	19930804	20041126	32//751655
FREEHOLD	19930804	20041126	39//751655
FREEHOLD	19930804	20090407	72//751651
FREEHOLD	19930804	20090407	302//751651

FREEHOLD	19930804	20090407	68//751651
FREEHOLD	19930804	20090411	407//751651
CROWN	19930804	20090906	195//751651
FREEHOLD	19951010	20111223	1//787242
FREEHOLD	19990823	20111223	67//1004747
FREEHOLD	19930804	20041126	37//751655
FREEHOLD	19940418	20041126	5//829137
FREEHOLD	19930804	20041126	30//751655
FREEHOLD	19970520	20041126	21//868170
FREEHOLD	19960222	20041126	38//751655
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FREEHOLD	19970415	20041126	3//226790
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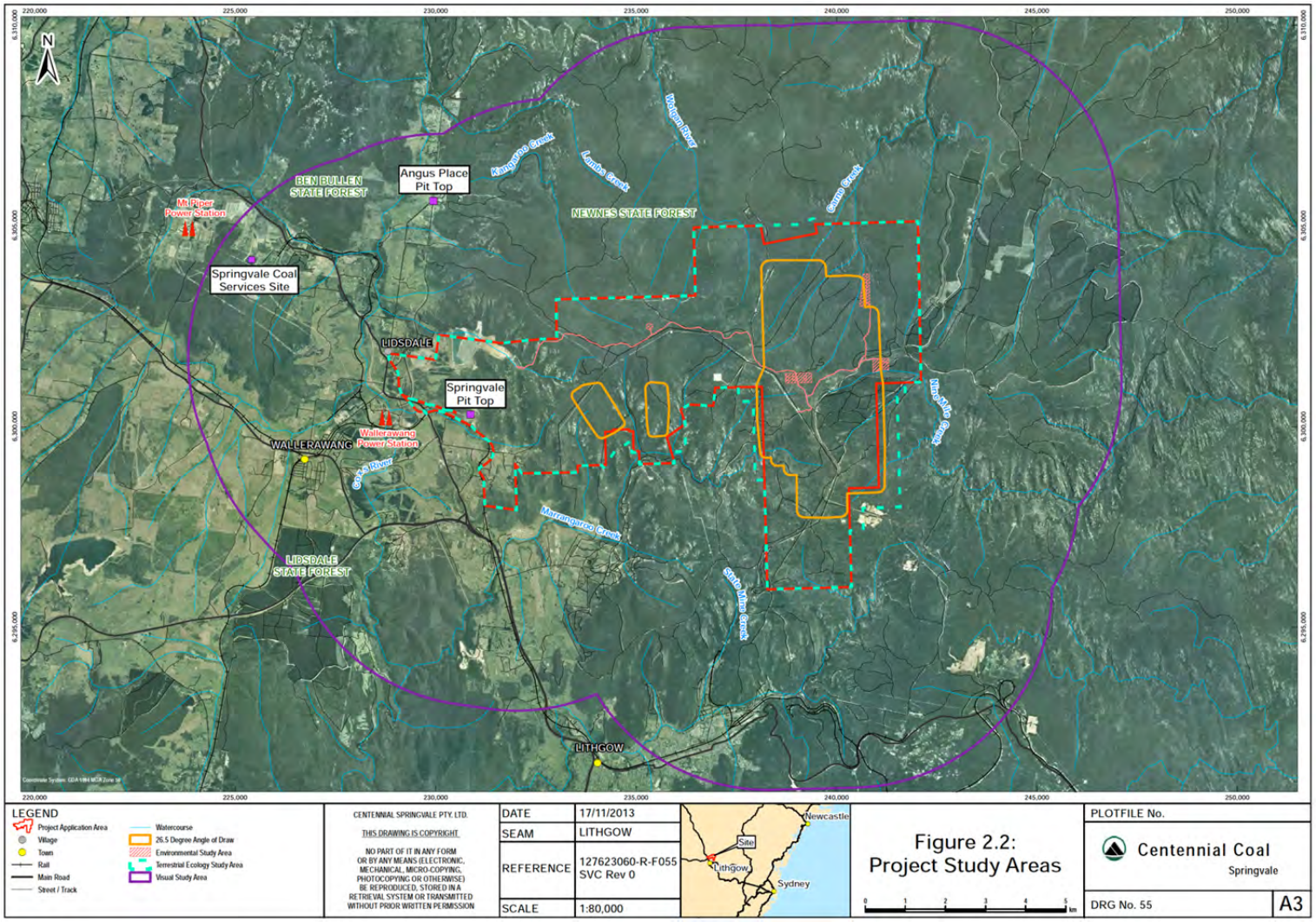
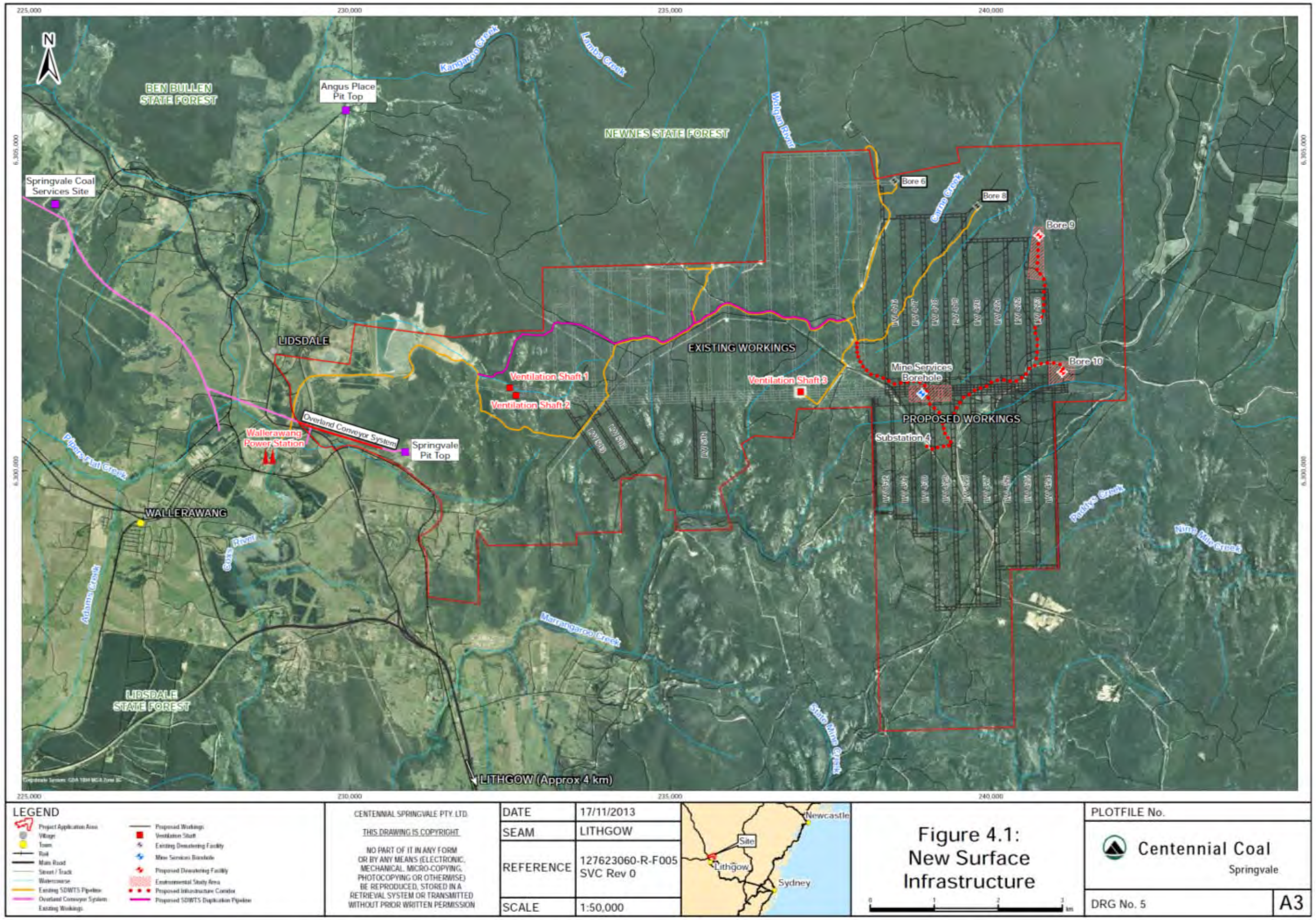
FREEHOLD	19930804	20041126	99//751655
FREEHOLD	19950215	20041126	2//835651
FREEHOLD	19970520	20041126	22//868170
FREEHOLD	19930804	20090411	73//751651
CROWN	19930804	20090829	129//751651
CROWN	20100322	20100617	7318//1149348
FREEHOLD	19930804	20100903	125//751651
STATE FORESTS OF NSW	19930804	20110313	201//751655
STATE FORESTS OF NSW	19930804	20110313	84//751655
FREEHOLD	19940415	20041126	1//576152
FREEHOLD	19930804	20041126	1//113040
FREEHOLD	19930804	20041126	50//751655
FREEHOLD	19930804	20041126	47//751655
STATE FORESTS OF NSW	19930804	20110313	35//751634
STATE FORESTS OF NSW	19930804	20110313	203//751655
STATE FORESTS OF NSW	19930804	20110313	52//751655
STATE FORESTS OF NSW	19930804	20110313	53//751655
STATE FORESTS OF NSW	19940810	20110313	51//751655
STATE FORESTS OF NSW	19930804	20110313	202//751655
STATE FORESTS OF NSW	19930804	20110313	54//751655

APPENDIX 2: DEVELOPMENT LAYOUT PLAN




BEN BULLEN STATE FOREST
Angus Place Pit Top
Springvale Coal Services Site
NEWNES STATE FOREST
LIDSDALE
EXISTING WORKINGS
PROPOSED WORKINGS
Ventilation Shaft 1
Ventilation Shaft 2
Ventilation Shaft 3
Mine Services Borehole
Substation 4
Bore 6
Bore 8
Bore 9
Bore 10
Wallerawang Power Station
Overland Conveyor System
Springvale Pit Top
WALLERAWANG
LIDSDALE STATE FOREST
LITHGOW (Approx 4 km)
Kangaroo Creek
Lambs Creek
Wolgan River
Carne Creek
Paddys Creek
Nine Mile Creek
Pipers Flat Creek
Coxs River
Adams Creek
Marrangaroo Creek
State Mine Creek
LEGEND
CENTENNIAL SPRINGVALE PTY. LTD.
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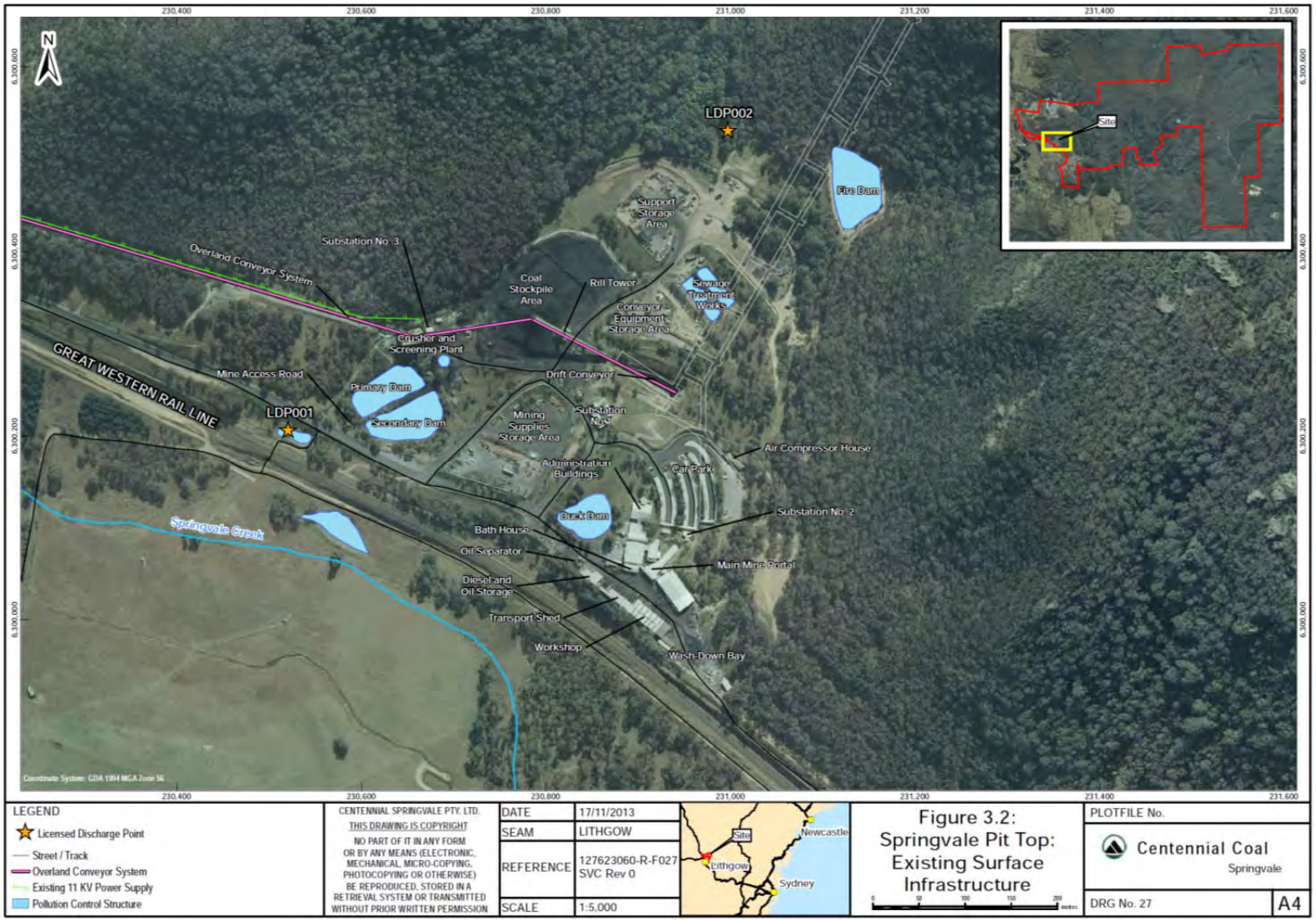
DATE 17/11/2013
SEAM LITHGOW
REFERENCE 127623060-R-F005 SVC Rev 0
SCALE 1:50,000
Newcastle
Site
Lithgow
Sydney
Figure 4.1: New Surface Infrastructure
PLOTFILE No.
Centennial Coal
Springvale
DRG No. 5
A3



Pit Top Surface Facility

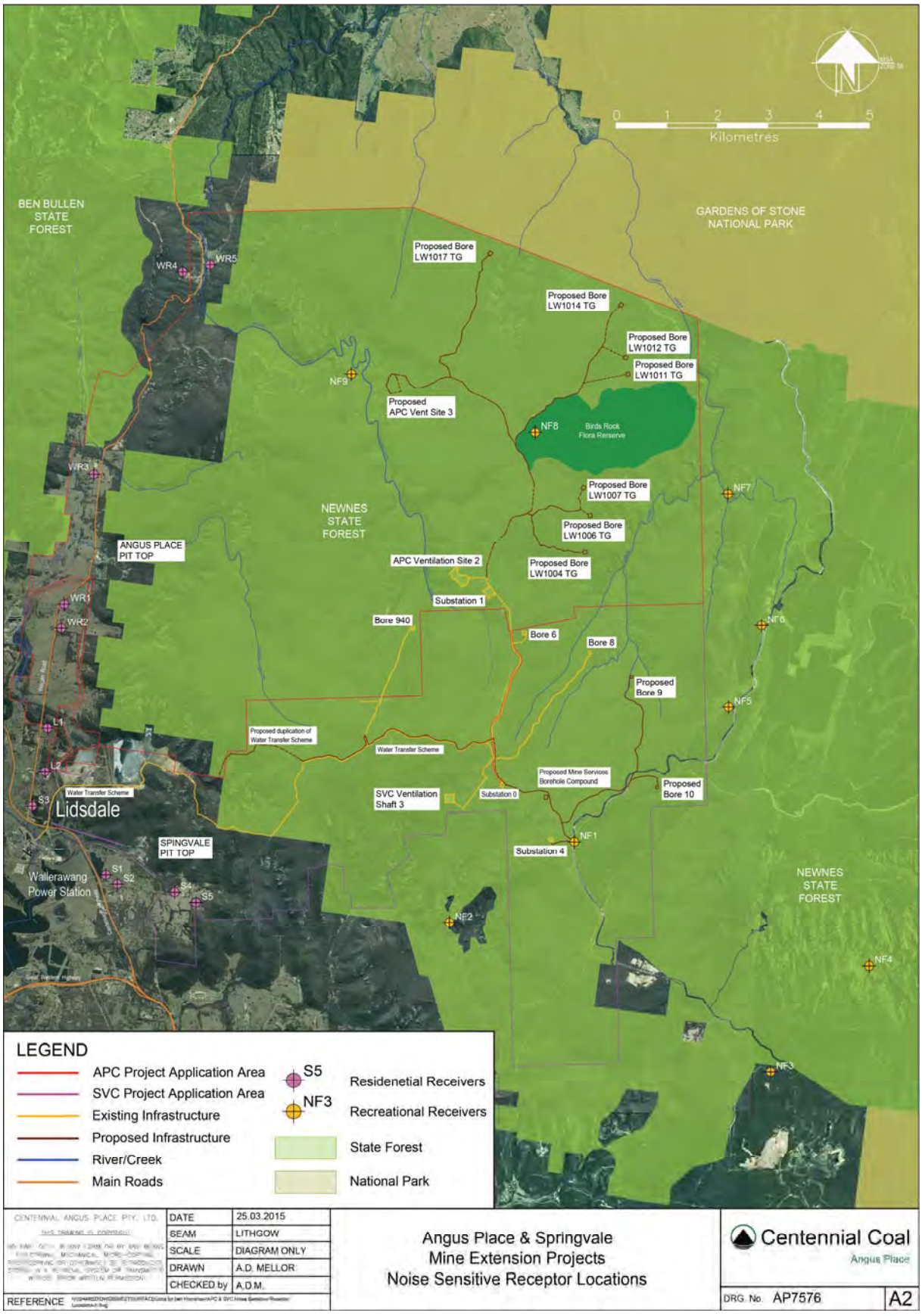
APPENDIX 3: STATEMENT OF COMMITMENTS

Desired Outcome	Action
1. General	
All operations are undertaken in a manner that will minimise the environmental impacts associated with the Project.	Operations will be undertaken in accordance with the description provided in this EIS. As the required exploration drill holes are determined, Springvale Coal will undertake a series of due diligence assessments to consider key impacts as relevant. The general approach of the due diligence assessments will be to conduct site investigations to ensure that significant impacts are avoided. Springvale Coal will develop Trigger Action Response Plans as part of the development of the certain management plans which will detail the response to be taken if mining induced impacts occur.
2. Development Phase	
All construction operations are appropriately undertaken to minimise potential impacts to the environment.	Prior to construction of surface facilities on the Newnes Plateau, a Construction Environmental Management Plan will be developed in consultation with the Forestry Corporation of NSW. This plan will include noise management in accordance with the Project Specific Noise Criteria detailed in Section 10.6.3 of the EIS. A copy of the Construction Environmental Management Plan will be provided to Lithgow City Council for their consideration.
3. Exploration	
All exploration activities are appropriately undertaken to minimise potential impacts to the environment.	Proposed exploration activities will be notified to DRE and where applicable to the Forestry Corporation of NSW. All required approvals will be obtained prior to the commencement of any exploration activities. Copies of any due diligence assessments will also be provided to DRE and Forestry Corporation (where applicable).
4. Hours of Operation	
All operations are undertaken within the approved operating hours.	Operations will be undertaken 24 hours a day 7 days a week, 52 weeks per year.
5. Surface Water, Groundwater, Geomorphology and Aquatic	
All surface water groundwater and aquatic impacts are minimised to the greatest extent possible.	Within six (6) months of development consent, a Water Management Plan will be developed that includes the monitoring requirements identified in Section 10.2.5 of the EIS. The Water Management Plan will be developed in consultation with the NSW Office of Water. Groundwater models will be updated every 6 months and a review will be included in the Annual Review. Copies of the Annual Review will continue to be provided to NOW. Throughout the life of the Project, stygofauna will be monitored using standing water levels within one borehole in each aquifer where stygofauna are known to occur (AQ4 to AQ6). Where available, monitoring of the deep aquifer system, AQ 1 to AQ3 will be undertaken to establish presence of stygofauna. Centennial Coal will undertake a regional stygofauna assessment which will: • Collate existing available information on groundwater bores, water quality and characteristics in Centennial Coal's area of operations throughout the

Desired Outcome	Action
	Western Coalfield. • Use this information to form a prioritisation list of likely areas for GDE to occur. • Use the prioritisation protocol to identify bores that can be sampled to provide data on the presence and significance of fauna both within and outside mine areas. • Identify any stygofauna found to a minimum of Family level. • Advise on the significance of the findings. • Examine relationship between bore characteristics and presence of stygofauna. Springvale Coal have commenced the process to secure the required surface water licences for the Project. Springvale Coal will commit to notify NSW Fisheries if any monitoring detects significant impacts to third order drainage lines as a result of subsidence. Springvale Coal will undertake further investigations into the toxicity of LDP009 water discharge to identify the cause of the toxicity. Springvale Coal will develop and implement a management program that includes: a) Water quality, macroinvertebrate and ecotoxicology monitoring across the Coxs River Catchment to measure the performance against the long term water quality objective and the impacts of change on the aquatic ecology and ecosystem health of the Coxs River. b) The water quality parameters to be monitored at all proposed Licenced Discharge Points, the frequency of monitoring and concentration limits focussed on those that have been identified as having potential to cause harm to the environment. c) A Trigger Action Response Plan should concentration limits be exceeded that focusses on the extent to which an exceedance of quality limits might affect aquatic ecology of the Coxs River catchment.
6. Terrestrial and Aquatic Ecology	
	Within two (2) years of development consent, a Biodiversity Management Plan will be developed and implemented. The Plan will be developed in consultation with DPE, OEH, DoE, Forestry Corporation of NSW, NPWS and will include the outcomes of the Research Strategy.
7. Aboriginal Heritage Management	
Ensure that identified and unidentified Aboriginal Sites are appropriately managed.	Aboriginal Heritage will be monitored and managed in accordance with Table 8.2 of this EIS. Within 6 months of the date of approval, the Cultural Heritage Management Plan will be updated.
8. Traffic and Transport	
Project-related impacts on the road network are limited.	Prior to the commencement of construction activities, a Construction Traffic Management Plan will be developed and implemented. The Plan will be developed in consultation with Lithgow City Council and Forestry Corporation of NSW.
9. Noise and Vibration	
All noise impacts are minimised to the greatest	The existing Noise Management Plan will be updated to include the noise criteria for the Project and a noise monitoring programme for the sensitive receptors identified in Figure 10.25 of the EIS. The noise monitoring programme will include continuous,

Desired Outcome	Action
extent possible.	unattended noise monitoring and operator attended quarterly noise monitoring.
10. Air Quality and Greenhouse Gas	
All air quality impacts are minimised to the greatest extent possible.	Within six (6) months of development consent, the Air Quality Management Plan will be updated to include the mitigation measures identified in Section 10.7 of the EIS. An additional TEOM will be installed as part of a regional air quality monitoring programme that is currently being developed by Centennial Coal.
11. Soils and Land Capability	
All soil and land impacts are minimised to the greatest extent possible	Soil stripping will be undertaken in accordance with the soil stripping depths in the Soils and Land Capability Report appended to this EIS. The following topsoil management measures will be applied: • topsoil will be stripped to depths in Table 10.44 of the EIS only when moist and stockpiled a maximum of 3 m high; • topsoil stripping will immediately precede construction to minimise the time that bare subsoils are exposed; • ameliorants for each soil type will be applied as per the Soils and Land Capability Report; • topsoil that is to be stockpiled for longer than 3 months with be stabilised with an annual cover crop; and • prior to re-spreading stockpiled topsoil, weeds will be removed.
12. Life of Mine and Rehabilitation	
Rehabilitation of the Springvale Coal Services Site is conducted in accordance with Industry Standards.	Progressive rehabilitation will be undertaken in accordance with the Rehabilitation Strategy appended to this EIS. Within 6 months of approval, the Mining Operations Plan will be updated to include the rehabilitation requirements outlined in the Rehabilitation Strategy of this EIS.
13. Hazards	
Safety of the underground personnel from the underground strata will be maintained.	The existing Hazard Plan, being part of the Strata Failure Management System, will be maintained and updated on an ongoing basis as required, in accordance with the Clause 28b (ii) of the *Coal Mine Health and Safety Regulation 2006*.
14. Community Contributions	
Meet Centennial's corporate social responsibility objectives	Centennial Coal will contribute three cents per saleable tonne of coal (exclusive of GST) produced from the Springvale, Angus Place and Airly Mines, as a 'Community Contribution' to Lithgow City Council. This Community Contribution will be capped at $200,000 annually and the funds allocated to long-term community activities and projects agreed by both parties and reported publicly. Commencement of the 'Community Contribution' will be from the date the first of the above three mines is granted consent.

APPENDIX 4: NOISE RECEIVER LOCATION PLAN



APPENDIX 5
NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in Tables 3 and 4 in Schedule 4 are to apply to a receiver under all meteorological conditions except under:
   (a) wind speeds greater than 3 m/s at 10 m above ground level; or
   (b) stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level; or
   (c) stability category G temperature inversion conditions.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station required under condition 8 of Schedule 4.

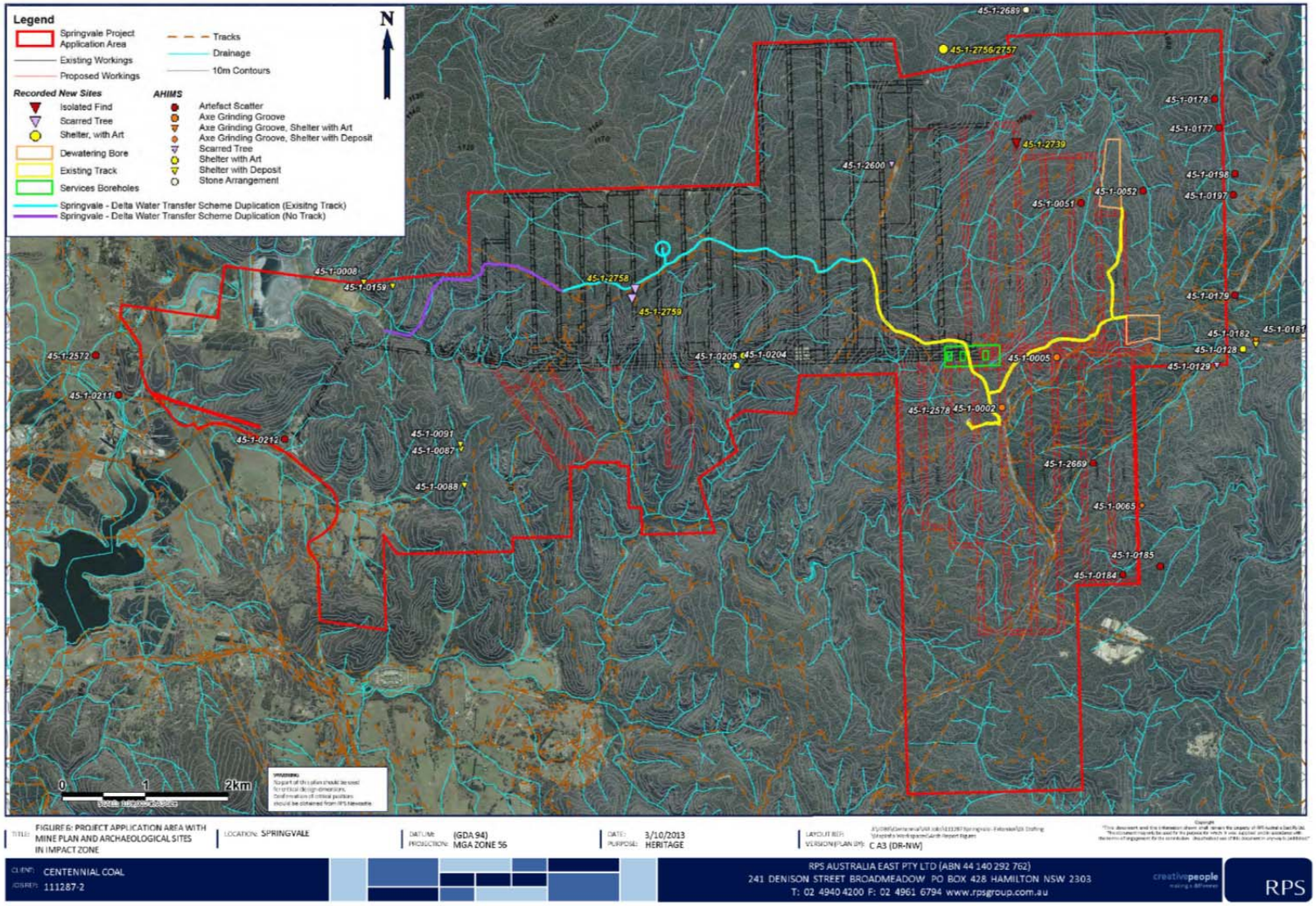
Compliance Monitoring

3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.

4. This monitoring must be carried out at least 4 times in each calendar year (ie at least once in every quarter), unless the Secretary directs otherwise.

5. Unless the Secretary agrees otherwise, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
   (a) monitoring locations for the collection of representative noise data;
   (b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment;
   (c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration; and
   (d) the use of an appropriate modifying factor for low frequency noise to be applied during compliance testing at any individual residence if low frequency noise is present (in accordance with the INP) and before comparison with the specified noise levels in the consent.

APPENDIX 6: ABORIGINAL HERITAGE SITES



Australian Government
Department of the Environment

Approval decision

Springvale Mine Extension Project, New South Wales (EPBC 2013/6881)

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Proposed action

person to whom the approval is granted	Springvale Coal Pty Ltd
proponent's ACN	ACN 052 096 769
proposed action	To expand underground mining operations at the existing Springvale Mine in the Western Coalfields of New South Wales, 8 kilometres north-east of Lithgow, New South Wales [see referral EPBC 2013/6881 and variation request letter dated 9 July 2014].

Approval of decision

Controlling provision	Decision
listed threatened species and communities (Sections 18 and 18A)	approved
listed migratory species (Sections 20 and 20A)	approved
World Heritage properties (Sections 12 and 15A)	approved
National Heritage places (Sections 15B and 15C)	approved
a water resource, in relation to coal seam gas development and large coal mining development (Sections 24D and 24E)	approved

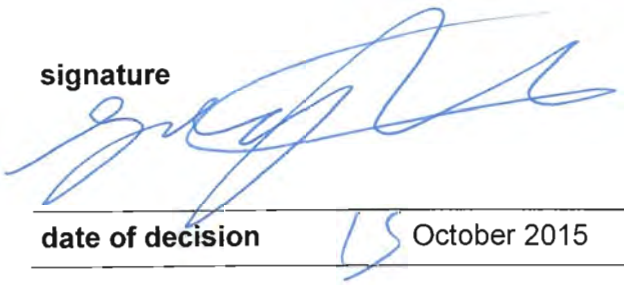
conditions of approval
This approval is subject to the conditions specified below.

expiry date of approval
This approval has effect until 8 October 2035.

Decision-maker

name and position	The Hon Greg Hunt MP Minister for the Environment

signature



date of decision	15 October 2015

Conditions attached to the approval

Compliance with conditions on the ***New South Wales development consent***

1. To minimise and compensate for impacts to **listed threatened species and communities**, the **approval holder** must comply with the following conditions of the **New South Wales development consent**:

schedule	condition	subject
3	1	general performance measures
4	15	biodiversity offset strategy
	16	long-term security of offsets
	18	biodiversity management plan
	30	rehabilitation
	31	
	32	
5	all	notification of landowners and independent review

2. To minimise and compensate for impacts on **Temperate Highland Peat Swamps**, the **approval holder** must comply with the following conditions on the **New South Wales development consent**:

schedule	condition	subject
3	1	general performance measures and risk management and assessment
	2	
	3	offsets for breach of performance measures
	4	offsets for first **undermined** swamps
	5	offsets for other **undermined** swamps
	6	
	10	extraction plans
	11	Independent Monitoring Panel
5	all	notification of landowners and independent review

3. To minimise impacts on **water resources**, the **approval holder** must comply with the following conditions on the **New South Wales development consent**:

schedule	condition	subject
3	1	general performance measures
	10(h)(iii)	water management plan
4	9	water supply
	10	water pollution
	12	water management performance measures
	14	water management plan
5	all	notification of landowners and independent review

Temperate Highland Peat Swamps

4. To minimise impacts on **Temperate Highland Peat Swamps**, in addition to Condition 1 (Schedule 3) on the **New South Wales development consent**, the **approval holder** must ensure that the action does not have greater than **negligible** environmental consequences on any **Temperate Highland Peat Swamps** within the **project area**, including in relation to their size, ecological functionality and species composition or distribution, unless those consequences are addressed through Condition 5.

5. To minimise impacts on **Temperate Highland Peat Swamps**, in addition to Conditions 4, 5 and 6 (Schedule 3) on the **New South Wales development consent**:

   a. Greater than **negligible** environmental consequences on **Temperate Highland Peat Swamps**, and therefore offset liabilities, must be initially determined based on changes to the shallow groundwater aquifer as measured using piezometers in accordance with Conditions 6 to 10.

   b. Where monitoring identifies a change to the shallow groundwater aquifer below an **undermined Temperate Highland Peat Swamp** and that change cannot be reasonably attributed to other specific factors to the satisfaction of the **Minister**, the swamp will be considered to have experienced a greater than **negligible** environmental consequence of the action.

   c. 90 *per cent* (by area) of offset liabilities for **Temperate Highland Peat Swamps** must be met with direct offsets, within the meaning of the **Commonwealth offsets policy**.

   d. If after five (5) years, the **approval holder** can demonstrate to the satisfaction of the **Minister** that a greater than **negligible** environmental consequence on **Temperate Highland Peat Swamps** identified under Condition 5a has been reversed, has not eventuated or has only partially eventuated, whether due to active remediation or passive (natural) equilibration, any offsets already provided in relation to that identified consequence may be held by the **approval holder** and used to offset future liabilities.

   e. Except in relation to **Sunnyside East** and **Carne West Swamps**, **the approval holder** must not **commence longwall mining** before the corresponding maximum predicted offset liability has been determined in accordance with Conditions 4 and 5 (Schedule 3) on the **New South Wales development consent** and approved in writing by the **Minister**.

6. This condition applies to all longwalls except **LW418** and **LW419**.

To minimise impacts on **Temperate Highland Peat Swamps**, in addition to Condition 10(h)(v) (Schedule 3) on the **New South Wales development consent**, swamp monitoring programs (or similar documents) must:

a. be capable of detecting any greater than **negligible** environmental consequence on any **Temperate Highland Peat Swamps** within the **project area**

b. include at least three (3) control swamps for each swamp to which the program applies, matched in terms of vegetation, geomorphology, hydrology and size, which must be monitored according to the same standards and protocols (a swamp may serve as a control for any number of suitably matched swamps to which the program applies)

c. have installed for each swamp to which the program applies and for each control swamp:

   i. a configuration of at least two (2) intersecting piezometer transects, the first along a line from the highest area of the swamp to the swamp outflow point and the second perpendicular to the first, located directly above a long wall panel, with each transect comprising at least three (3) piezometers (piezometers should not be installed immediately above longwall pillars); and

   ii. piezometers (at least one (1)) installed at the deepest point in the swamp's sediments and any other significant deep points to better understand potential mine-induced drainage; and

d. establish for each swamp proposed for **undermining** a monitoring regime that includes daily data collection from each swamp with data review at least weekly during **undermining** operations and at least monthly at all other times

The **approval holder** must not **commence longwall mining** before the corresponding swamp monitoring program has been approved in writing by the **Minister**. Each approved swamp monitoring program must be implemented for no less than five (5) years from the approval of the program.

7. This condition applies to longwalls **LW418** and **LW419**.

To minimise impacts on **Temperate Highland Peat Swamps**, in addition to Condition 10(h)(v) (Schedule 3) on the **New South Wales development consent**, swamp monitoring programs (or similar documents) must:

a. be capable of detecting any greater than **negligible** environmental consequence on any **Temperate Highland Peat Swamps** within the **project area**

b. include at least three (3) control swamps for each swamp to which the program applies, matched in terms of vegetation, geomorphology, hydrology and size, which must be monitored according to the same standards and protocols (a swamp may serve as a control for any number of suitably matched swamps to which the program applies)

c. have installed for each swamp to which the program applies and for each control swamp:

   i. a configuration of at least two (2) intersecting piezometer transects, the first along a line from the highest area of the swamp to the swamp outflow point and the second perpendicular to the first, located directly above a long wall panel, with each transect comprising at least three (3) piezometers (piezometers should not be installed immediately above longwall pillars); and

   ii. piezometers (at least one (1)) installed at the deepest point in the swamp's sediments and any other significant deep points to better understand potential mine-induced drainage; and

d. establish for each swamp proposed for **undermining** a monitoring regime that includes daily data collection from each swamp with data review at least weekly during **undermining** operations and at least monthly at all other times

The **approval holder** must not continue **longwall mining** beyond 31 March 2016 until the swamp monitoring program(s) has been approved in writing by the **Minister**. Each approved swamp monitoring program must be implemented for no less than five (5) years from the approval of the program.

8. Until Condition 7 has been met, the **approval holder** must monitor **LW418** and **LW419** consistent with *Temperate Highland Peat Swamps on Sandstone Monitoring and Management Plan for LW418*, August 2015, except that data collection must be consistent with Condition 7d from the **commencement** of **longwall mining** in **LW418** and **LW419**.

9. This condition applies to all longwalls except **LW418**.

To minimise impacts on **Temperate Highland Peat Swamps**, in addition to Condition 10(h)(ix) (Schedule 3) on the **New South Wales development consent**, trigger action response plans (or similar documents) must:

a. define specific triggers (exceedence thresholds), with reference to baseline data and control swamps, which will apply to each **Temperate Highland Peat Swamp** within the **project area**

b. define specific cease-work triggers, with reference to baseline data and control swamps, to respond to cases of sudden, unexpected or persistent exceedences, after which work may not recommence until the impact has been explained or offset to the satisfaction of the **Minister**

c. define protocols for investigation and appropriate treatment of early warning and cease-work triggers in a timely fashion

d. establish a protocol for reporting exceedences promptly to the **Department**; and

e. explain how the measures described in the trigger action response plan will protect **Temperate Highland Peat Swamps**.

The **approval holder** must not **commence longwall mining** before the corresponding trigger action response plan has been approved in writing by the **Minister**. The approved trigger action response plan must be implemented.

10. This condition applies to **LW418**, for which a trigger action response plan already exists.

At any time after an exceedence has been reported to the **Department**, the **Minister** may order the **approval holder** to cease work, after which work may not recommence until the exceedence has been explained or offset to the satisfaction of the **Minister**.

Biodiversity

11. To minimise impacts on **listed threatened species and communities**, the **approval holder** must not clear more than 13 hectares of habitat for threatened species within the **project area**.

12. This condition applies to all longwalls except **LW418**.

To minimise impacts on **listed threatened species and communities**, in addition to Condition 18 (Schedule 4) on the **New South Wales development consent**, the biodiversity management plan (or similar document) must:

a. include measures to avoid and / or mitigate impacts on **listed threatened species and communities** that may occupy landform habitats including cliffs, minor cliffs, pagodas and gorges – these measures must include pre-mining surveys and translocation and / or cease work protocols if any sites with potential as nursery caves for **Large-eared Pied Bat** are identified

b. include measures to control the spread of pathogens including chytrid fungus and *Phytophtora cinnamomi*

c. explain how the mitigation and management measures described will protect *specific* **listed threatened species and communities**; and

d. specify clear timeframes for all management and mitigation measures described.

The **approval holder** must not **commence** the action before the biodiversity management plan has been approved in writing by the **Minister**. The approved biodiversity management plan must be implemented.

13. The **approval holder** must prepare a management and research program for the **Blue Mountains Water Skink** at **Carne West Swamp**, including specific measures for monitoring that population and response measures to be implemented if a decline is detected. The **approval holder** must not **commence undermining** of **Carne West Swamp** before the management and research program has been approved in writing by the **Minister**. The approved management and research program must be implemented.

Administrative conditions

14. The **approval holder** must provide the **Department** with details of each offset area secured in accordance with Conditions 3 to 5 (Schedule 3) or Conditions 15 and 16 (Schedule 4), on the **New South Wales development consent**, within twenty (20) business days of securing each offset. Details to be provided must include but are not necessarily limited to:

    - textual descriptions and maps to clearly define the location and boundaries of the offset areas
    - written evidence of legal protection
    - management plans
    - **offset attributes** and **shapefiles**

15. Within ten (10) days after the **commencement** of the action, the **approval holder** must advise the **Department** in writing of the actual date of **commencement** of the action.

16. The **approval holder** must maintain accurate records substantiating all activities associated with or relevant to the conditions of this approval, including measures taken to implement **management documents** required by this approval, and make them available on request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, or used to verify compliance with the conditions of this approval. Summaries of audits will be posted on the **Department**'s website. The results of audits may also be publicised through the general media.

17. The **approval holder** must report potential non-compliance with any of the conditions of this approval to the **Department** within two (2) business days of becoming aware of the non-compliance.

18. Before 31 March each year, the **approval holder** must publish a report on its website addressing compliance with each of the conditions of this approval, including implementation of any **management documents** as specified in the conditions during the previous calendar year. Documentary evidence of the date of publication of the compliance report, as well as details of any reported potential non-compliance, must be provided to the **Department** at the same time as the compliance report is published.

19. Upon the direction of the **Minister**, the **approval holder** must ensure that an independent audit of compliance with the conditions of this approval is conducted and a report submitted to the **Minister**. The audit must not **commence** until the independent auditor and audit criteria have been approved by the **Minister**. The audit report must address the criteria to the satisfaction of the **Minister**.

20. The **approval holder** may choose to revise a **management document** approved by the **Minister** under Conditions 6, 7, 9 12 or 13 without submitting it for approval under Section 143A of **the EPBC Act**, if the taking of the action in accordance with the revised **management document** would not be likely to have a new or increased impact on a matter protected under the conditions of this approval. If the **approval holder** makes this choice, it must:

    a. notify the **Department** in writing that the approved **management document** has been revised and provide the **Department** with an electronic copy of the revised **management document**

    b. implement the revised **management document** from the date that it is submitted to the **Department**; and

    c. for the life of this approval, maintain a record of the reasons the **approval holder** considers that taking the action in accordance with the revised **management document** would not be likely to have a new or increased impact on a matter protected under the conditions of this approval.

21. The **approval holder** may revoke its choice under Condition 20 at any time by notice to the **Department**. If the **approval holder** revokes the choice to implement a revised **management document**, without approval under section 143A of the **EPBC Act**, the **approval holder** must implement the **management document** most recently approved by the **Minister**.

22. Condition 20 does not apply if the revisions to the approved **management document** include changes to offsets established under the conditions of the approval, unless otherwise agreed in writing by the **Minister**. This does not otherwise limit the circumstances in which the taking of the action in accordance with a revised **management document** would, or would not, be likely to have new or increased impacts.

23. If the **Minister** gives a notice to the **approval holder** that the **Minister** is satisfied that the taking of the action in accordance with the revised **management document** would be likely to have a new or increased impact on a matter protected by the conditions of this approval, then:

    a. Condition 20 does not apply, or ceases to apply, in relation to the revised **management documents**; and

    b. the **approval holder** must implement the **management documents** most recently approved by the **Minister**.

    At the time of giving the notice, the **Minister** may also notify that for a specified period of time that Condition 20 does not apply for one or more specified plans, programs or strategies required under the approval.

    To avoid any doubt, this condition does not affect any operation of Conditions 20 to 22 in the period before the day after the notice is given.

24. Conditions 20 to 23 are not intended to limit the operation of section 143A of the **EPBC Act** which allows the **approval holder** to submit a revised **management document** to the **Minister** for approval.

25. The **approval holder** must not **commence longwall mining** at any time after five (5) years from the date of this approval without the written agreement of the **Minister**.

26. Unless otherwise agreed to in writing by the **Minister**, the **approval holder** must publish all **management documents** on their website. Each **management document** must be published

on the website within one (1) month of being approved by the **Minister** or being submitted under Condition 20.

Definitions

Approval holder means the person to whom the approval is granted, or to whom the approval is transferred under section 145B of **the EPBC Act**.

Blue Mountains Water Skink means the species Eulamprus leuraensis, listed as endangered under the **EPBC Act**.

Carne West Swamp is identified on the map at Annexure 1.

Commencement (also **commence**) means the first instance of an activity. In relation to the action generally, it includes any vegetation clearing, demolition, construction, excavation or other earthworks associated with the action, excluding the erection of fences or signs and the conduct of environmental or other low impact surveys.

Commonwealth offsets policy is *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*, October 2012.

Department means the Australian Government department responsible for administration of **the EPBC Act**.

EPBC Act means the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*.

First workings has the meaning given in the **New South Wales development consent**.

Large-eared Pied Bat means the species Chalinolobus dwyeri, listed as vulnerable under the **EPBC Act**.

Listed threatened species and communities includes at least the following:

- the Temperate Highland Peat Swamps on Sandstone community, listed as endangered under the **EPBC Act**
- Austral Toadflax (*Thesium australe*), listed as vulnerable under the **EPBC Act**
- Deane's Boronia (*Boronia deanei*), listed as vulnerable under the **EPBC Act**
- Giant Burrowing Frog (*Heleioporus australiacus*), listed as vulnerable under the **EPBC Act**
- Stuttering Frog (*Mixophyes balbus*), listed as vulnerable under the **EPBC Act**
- Blue Mountains Water Skink (*Eulamprus leuraensis*), listed as endangered under the **EPBC Act**
- Broad-headed Snake (*Hoplocephalus bungaroides*), listed as vulnerable under the **EPBC Act**
- Regent Honeyeater (*Anthochaera phrygia*), listed as endangered under the **EPBC Act** (at the time of determination of controlling provisions).
- Spot-tailed Quoll [south-eastern mainland population] (*Dasyurus maculatus* subsp. *maculatus*) listed as endangered under the **EPBC Act**
- Southern Brown Bandicoot (*Isoodon obesulus* subsp. *obesulus*), listed as endangered under the **EPBC Act**
- Brush-tailed Rock Wallaby (*Petrogale penicillata*), listed as vulnerable under the **EPBC Act**
- Koala [combined populations of Queensland, New South Wales and the Australian Capital Territory] (*Phascolarctos cinereus*), listed as vulnerable under the **EPBC Act**
- Large-eared Pied Bat (*Chalinolobus dwyeri*), listed as vulnerable under the **EPBC Act**
- New Holland Mouse (*Pseudomys novaehollandiae*), listed as vulnerable under the **EPBC Act**

Longwall mining means any extraction of coal that is not defined as **first workings**.

LW418 and **LW419** are specific longwalls identified on the map at Annexure 1.

Management document(s) are any program, plan or other document explicitly required (whether directly or through a subordinate document) in fulfilment of the conditions of this approval.

Minister means the Australian Government minister responsible for administration of the **EPBC Act** and includes delegates.

Negligible, in the sense of environmental consequences, has the meaning given in the **New South Wales development consent**.

New South Wales development consent means the document recording the decision of the New South Wales Government to grant development approval to the Springvale Mine Extension Project under Section 89E of the (New South Wales) *Environmental Planning & Assessment Act 1979*, dated 21 September 2015.

Offset attributes means an '.xls' file capturing relevant attributes of the offset site, including the EPBC reference number, physical address, coordinates of the boundary points in decimal degrees, **listed threatened species and communities** for which the offset was established, other relevant biodiversity attributes and area in hectares.

Project area is defined by the boundary shown as a red line on the map at Annexure 1.

A **shapefile** is an ESRI Shapefile containing '.shp', '.shx' and '.dbf' files and other files capturing attributes including at least the EPBC reference ID number and EPBC protected matters present at

the relevant site. Attributes should also be captured in '.xls' format. A geographically referenced raster 'img' file/s must be provided to provide context for the shapefiles.

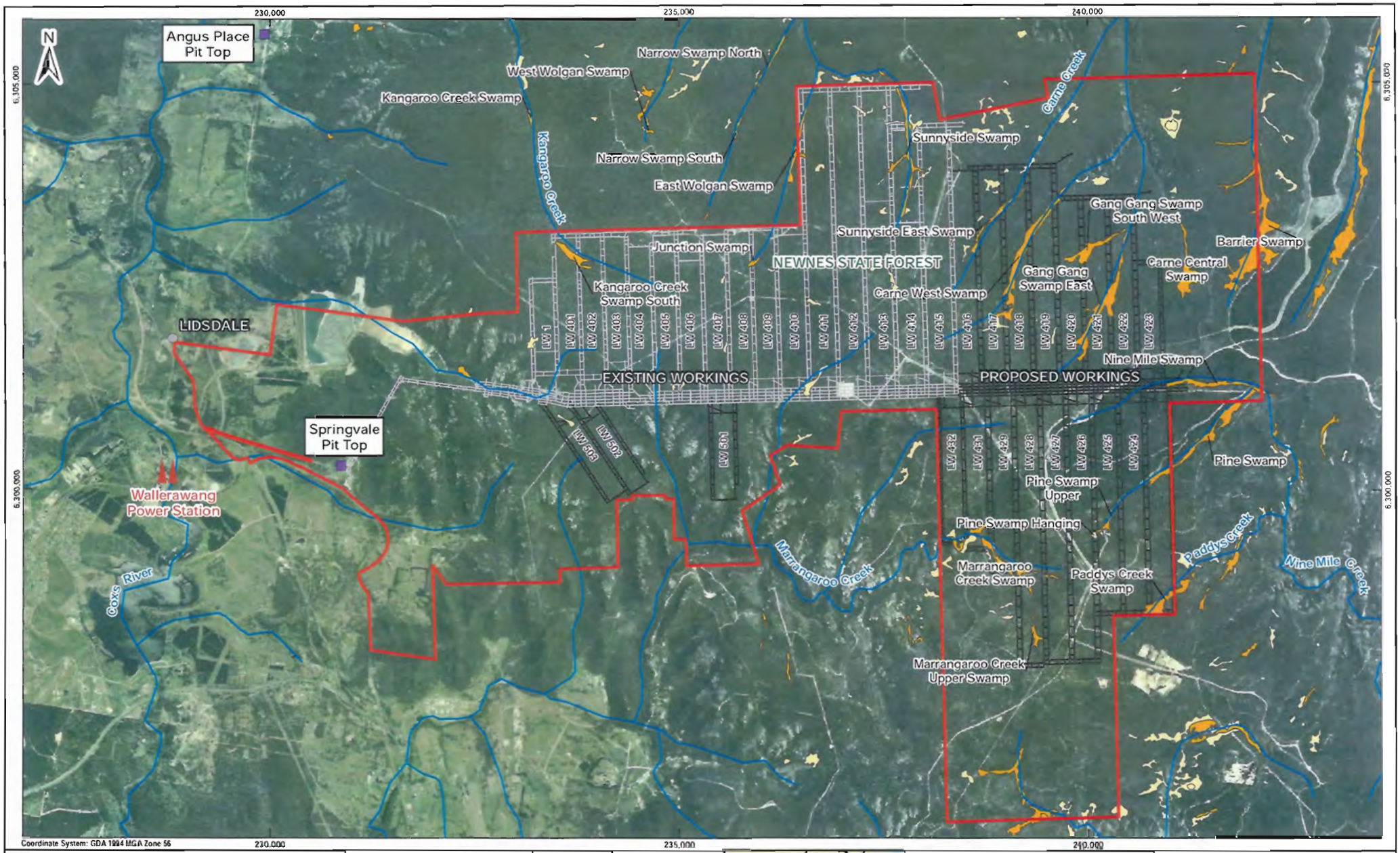
Sunnyside East Swamp is identified on the map at Annexure 1.

Temperate Highland Peat Swamps means the Temperate Highland Peat Swamp on Sandstone community listed as endangered under the **EPBC Act** and for the purposes of these conditions includes the following associated species:

- Deane's Boronia (*Boronia deanei*), listed as vulnerable under the **EPBC Act**
- Giant Burrowing Frog (*Heleioporus australiacus*), listed as vulnerable under the **EPBC Act**
- Blue Mountains Water Skink (*Eulamprus leuraensis*), listed as endangered under the **EPBC Act**

An **undermined** (also **undermine**, **undermining**) swamp is a swamp with an active or extracted longwall panel within a 26.5° angle of draw (or other angle of draw as defined in an approved management plan).

Water resources has the meaning given in the (Commonwealth) *Water Act 2007.*



LEGEND

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

DATE	17/11/2013
SEAM	LITHGOW
REFERENCE	127623060-R-F060 SVC Rev 0
SCALE	1:60,000

Figure 10.1:
Swamp Distribution Relative to Proposed Workings

0 1 2 km

PLOTFILE No.

Centennial Coal
Springvale

DRG No. 60 | A4

Annexure 1

Correspondence from Department of Planning and Environment

APPENDIX – B

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NSW GOVERNMENT | Planning & Environment

Planning Services
Resource Assessments and Business Systems
Contact: Paul Freeman
Phone: (02) 9228 6587
Email: paul.freeman@planning.nsw.gov.au

Mr James Wearne
Group Approvals Manager
Centennial Coal Company Limited
PO Box 100
Toronto NSW 2283

Dear Mr Wearne

Springvale Extension Project (SSD 5594)
Proposed Section 96(2) Modification

I refer to your letter dated 13 May 2016 seeking confirmation of the technical assessments required to be included in the Statement of Environmental Effects for a proposed modification to the Springvale Extension Project (SSD 5594).

The Department is satisfied that the proposal represents a modification to the original project, and that Section 96(2) of the *Environmental Planning & Assessment Act 1979* is the appropriate approval pathway for the modification application. I can confirm that the technical assessments listed in your letter are appropriate to support the proposed modification application.

I wish to remind you that the modification application should be made via the Department's online application portal at www.planning.nsw.gov.au

I would appreciate it if you could let the Department know as soon as possible when you are likely to submit the modification application, to allow any necessary administrative arrangements to be made.

If you wish to discuss the matter further, please call Paul Freeman on (02) 9228 6587.

Yours sincerely

21/6/16

Clay Preshaw
A/Director
Resource Assessments
as the Secretary's nominee

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Schedule of Lands
SSD 5594

APPENDIX – C

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Land_Status	Created_date	Last_Update	Lot__DP
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FREEHOLD	19930804	20041126	14//16283
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FREEHOLD	19930804	20041126	19//16283
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FREEHOLD	19930804	20041126	28//16283
FREEHOLD	19930804	20041126	30//16283
FREEHOLD	19930804	20041126	1//421721
FREEHOLD	20010504	20041126	2//1018958
FREEHOLD	19930804	20041126	18//16283
FREEHOLD	19930804	20041126	8//16283
FREEHOLD	20000308	20041126	101//829410
FREEHOLD	19930804	20041126	1//607402
FREEHOLD	19960418	20041126	1//825124
FREEHOLD	19940418	20041126	3//829137
FREEHOLD	19930804	20041126	16//16283
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CROWN	19930804	20090906	195//751651
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STATE FORESTS OF NSW	19930804	20110313	54//751655

Coal Stockpile Extension Area
Drainage Design Report

APPENDIX – D

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Memorandum

30 March 2016

To	Nagindar Singh		
Copy to	Natalie Gardiner		
From	Lachlan Hammersley	Tel	(02) 4979 9999
Subject	Drainage around Springvale ROM Stockpile Expansion	Job no.	22/18141

1 Introduction

Centennial Springvale (Springvale) propose to increase the ROM stockpile capacity at Springvale colliery from the approved 85,000 tonnes to 200,000 tonnes. The proposed increased ROM stockpile capacity will require an increase in the stockpile footprint of approximately 0.3 ha, which will require the removal of an area of clean water catchment located within the current pit top area.

The existing ROM stockpile is located within the catchment of the primary pond (refer to Figure 1 in Attachment A). As a result, the proposed increase in ROM capacity will result in an increase in the catchment area reporting to the primary pond.

Springvale have requested that GHD undertake a review of the existing clean and dirty water diversions to ensure they continue to provide sufficient capacities.

2 Clean Water Drain

An existing clean water drain is currently located to the north of the existing ROM stockpile, and serves to minimise the volume of water flowing into the ROM stockpile area and maximise the clean water flows into the downstream environment.

The existing clean water drain intercepts runoff from a small (approximately 0.3 ha) clean water catchment area located within the pit top area (refer to Figure 1 in Attachment A). Runoff intercepted by the clean water drain flows approximately west into the clean water diversion (refer to Figure 1 in Attachment A).

The existing clean water drain typically includes an approximately trapezoidal cross section (refer to Figure 1) with:

- Base width = 1 m.
- Depth = 0.6 m.
- 1 in 5 side slopes.
- Average bed slope = 0.017 m/m (1.7 %).
- Concrete lining, albeit poorly maintained or heavily silted (apparent from aerial imagery) (Manning's n roughness = 0.02).

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The maximum bank full flow capacity of the existing clean water drain was estimated (using Manning's equation) to be approximately 7.6 m^3/s (refer to Figure 2). The estimated capacity of the existing clean water drain is well above the peak runoff generated by the local catchment area for the 100 year ARI critical duration storm event (approximately 0.15 m^3/s). As the proposed increase to the ROM stockpile area will result in the removal of approximately 0.3 ha from the existing clean water drain catchment, the remaining portion of the clean water drain (refer to Figure 2 in Attachment A) is expected to have a capacity sufficient to safely convey runoff generated by the remaining clean catchment area for design storm events larger than the 100 year ARI critical duration design storm event.

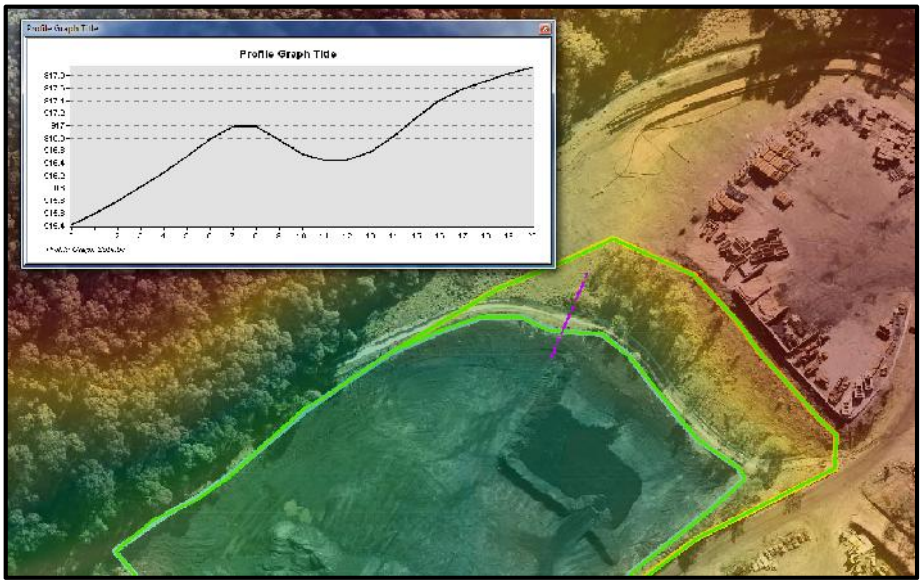


Figure 1 Existing clean water diversion cross section

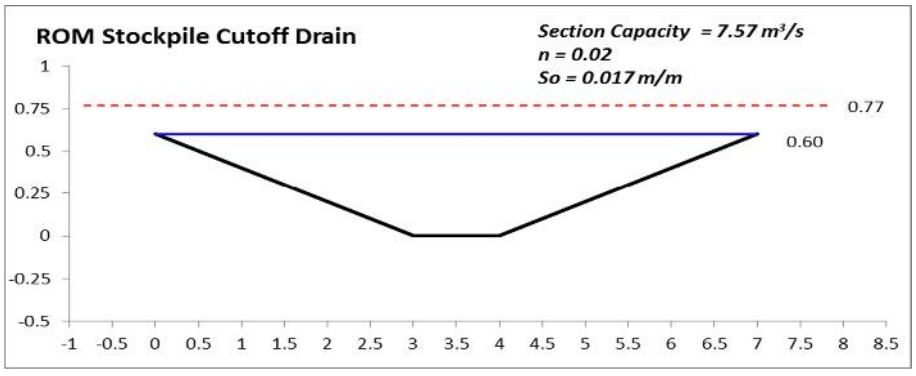


Figure 2 Mannings calculation section capacity

3 Dirty water diversions

The primary pond receives dirty water runoff from approximately 30 per cent of the pit top area, including the existing ROM stockpile (refer to Figure 1 in Attachment A).

Details of each dirty water diversion, determined from topographic information and aerial imagery (refer to Figure 2 in Attachment A) that flows to the primary pond is included in Table 1.

Table 1 Dirty water diversion details

Dirty water diversion	Length (m)	Average slope	Minimum slope	Manning n	Side batter	Catchment (ha)	
						Existing	Proposed
PDD1	212.6	4.7%	2 %	0.035	1 v : 2 h	1.6	1.6
PDD2	92.8	0.5%	1 %	0.035	1 v : 2 h	0.6	0.6
PDD3	98.0	4.6%	2 %	0.035	1 v : 2 h	0.6	0.6
PDD4	217.7	4.1%	2 %	0.035	1 v : 2 h	0.7	1.0
PDD5	251.1	7.2%	2 %	0.02	1 v : 2 h	3.8 [1]	3.8 [1]
PDD6	49.0	12.3%	2 %	0.02	1 v : 2 h	5.5 [2]	5.8 [2]

[1] cumulative catchment including PDD1, PDD2, PDD3 and PDD5.

[2] cumulative catchment including PDD1, PDD2, PDD3, PDD4, PDD5 and PDD6.

The proposed increased ROM stockpile area will result in an increase in the catchment area draining to the primary pond via the dirty water diversion that flows down the eastern side of the stockpile within the road corridor (i.e. PDD4: refer to Figure 2 in Attachment A).

The peak design flow depths for the 20 and 100 year ARI critical duration design storm events were estimated using the probabilistic rational method and Manning's equation (assuming a trapezoidal channel section). From Table 2 it can be seen that the proposed increased ROM stockpile will result in minor (up to 60 mm for the 100 year ARI critical duration design storm event) increases in flow depths within the dirty water diversions. Such increases in flow depths are considered to present a minimal risk to the management of dirty water within the site.

Table 2 Peak flow depths and freeboards

	20 year flow depth (m)		100 year flow depth (m)	
ID	Existing	Proposed	Existing	Proposed
PDD1	0.32	0.32	0.43	0.43
PDD2	0.33	0.33	0.45	0.45
PPD3	0.21	0.21	0.29	029

	20 year flow depth (m)		100 year flow depth (m)	
ID	**Existing**	**Proposed**	**Existing**	**Proposed**
PPD4	0.21	0.25 (+0.04)	0.29	0.35 (+0.06)
PPD5	0.35	0.35	0.45	0.45
PPD6	0.39	0.40 (+0.01)	0.52	0.53 (+0.01)

4 Conclusions and recommendations

As part of this assessment the following has been assessed:

- Review of existing and proposed catchment plan.
- Identify that a reduction in catchment will occur to the existing perimeter clean water drain.
- Identify the need to confirm the existing top of bank cut-off drain within the hardstand/equipment area.
- Identify the diversion of dirty water flow around the eastern edge of stockpile area down road.
- Identify a marginal increase to catchments to Primary Pond.
- Propose an expanded stockpile with two-way cross fall crowned in the centre.
- Quantification of flow rates from cascading catchments through to the Primary Pond.

Based on the above analysis, it is considered that additional dirty water runoff generated by the proposed extension to the ROM storage area will not have an appreciable impact on the performance of the existing dirty water drainage system. Further, the modification to the clean water diversion (i.e. the removal of a small reach of the clean water diversion upslope of the existing ROM area) is not expected to impact on the capacity of the existing clean water diversion system. It is noted that the above analysis assumes that the existing clean and dirty water systems are adequately maintained and functioning as designed.

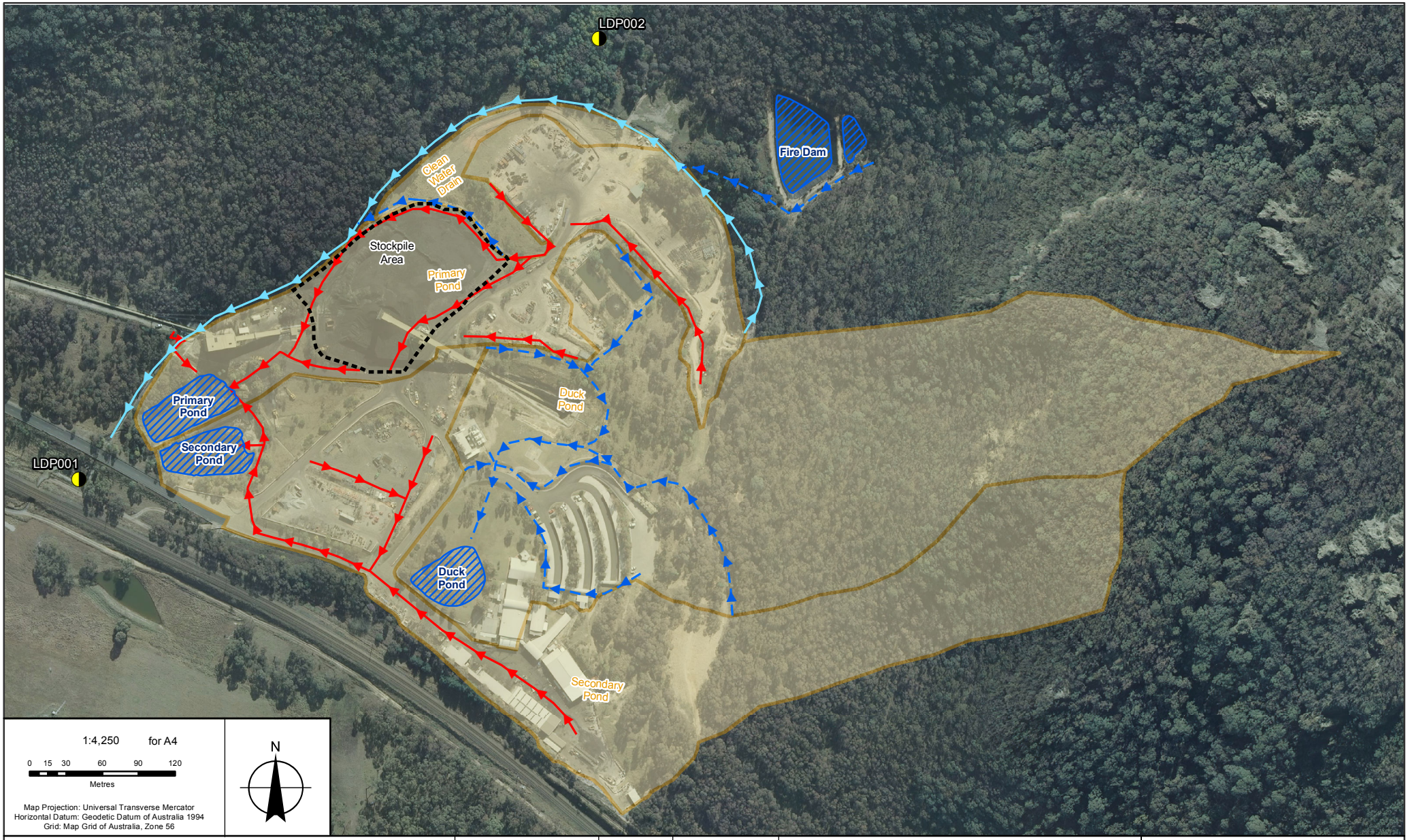
Regards

Lachlan Hammersley

Senior Environmental Engineer

ATTACHMENTS

A Figures



LEGEND

- Licensed Discharge Point
- Pollution Control Structure
- Pit Top Catchment
- Existing ROM Area
- Existing Dirty Water Flow Paths
- Clean Water Flow Paths
- Clean Water Diversion

LOCATION	Lidsdale
SEAM	Lithgow
DRAWN	S. MacDonald
CHECKED	A. Wyatt
APPROVED	L. Hammersley
SCALE	refer to scalebar

Springvale Mine
Drainage around Springvale ROM Stockpile Expansion

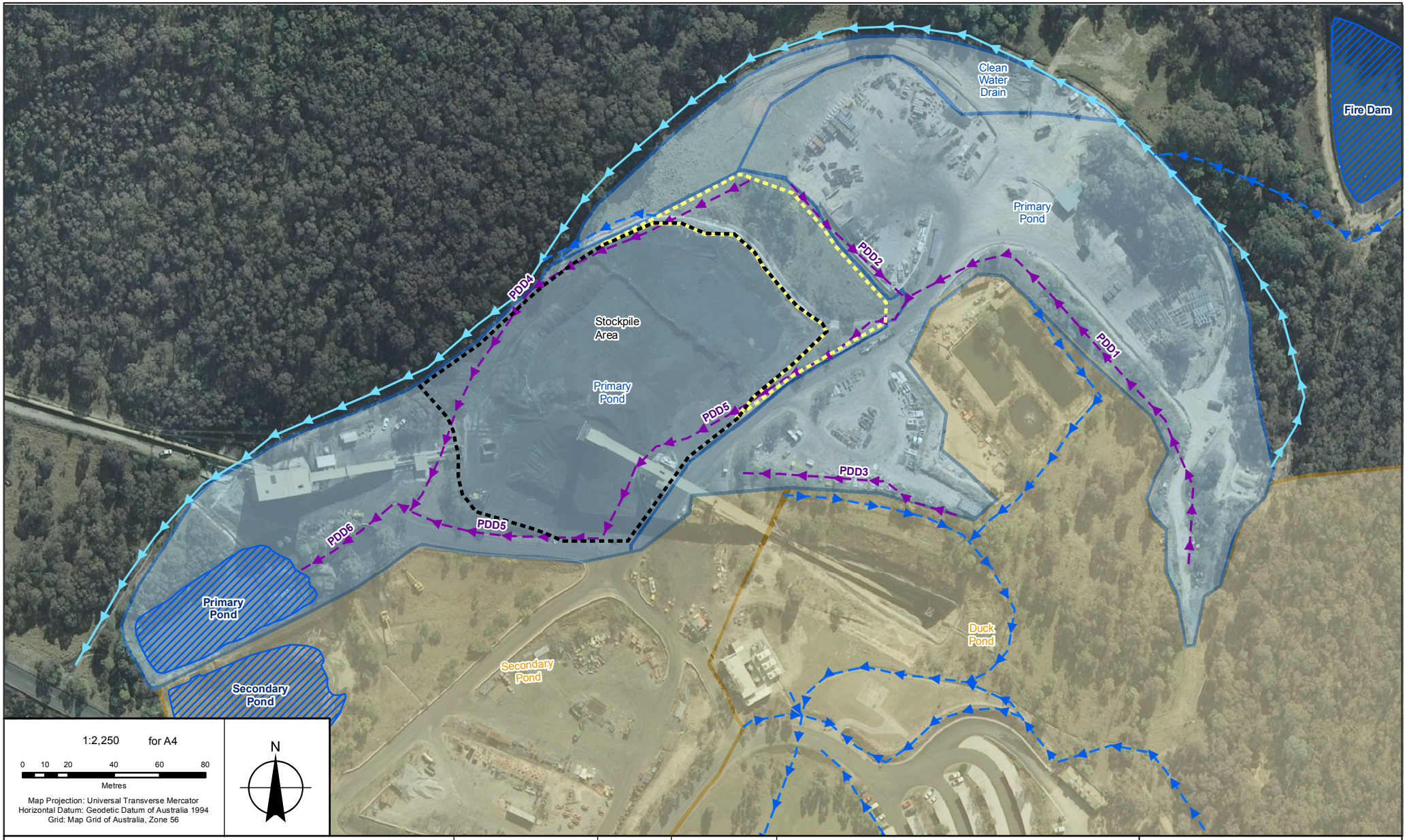
Existing pit top catchments and drainage

Centennial Springvale

DATE 5/05/2016

Figure 1

GIS Filename: G:\22\0105001\GIS\Maps\Deliverables\Western\Springvale\2218141\ROM Stockpile Expansion\2218141_SV_ROM_001_ExistingCatchmentsandDrainage_A.mxd



LEGEND

- Proposed Catchment Modifications
- Pit Top Catchment
- Pollution Control Structure
- Existing ROM Area
- Proposed ROM Area
- Proposed Dirty Water Flow Paths
- Clean Water Flow Paths
- Clean Water Diversion

LOCATION	Lidsdale
SEAM	Lithgow
DRAWN	S. MacDonald
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Springvale Mine
Drainage around Springvale ROM Stockpile Expansion

Proposed pit top catchments and drainage

Centennial Springvale

DATE 5/05/2016

Figure 2

GIS Filename: G:\22\0105001\GIS\Maps\Deliverables\Western\Springvale\2218141\ROM Stockpile Expansion\2218141_SV_ROM_002_ProposedCatchmentsandDrainage_A.mxd

Social Impact Assessment

APPENDIX – E

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Centennial Coal

Springvale Mine Extension Project

Modification 1

Social Impact Assessment

May 2016

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EXECUTIVE SUMMARY

This Social Impact Assessment has been undertaken to establish the level of change likely to arise from the modification to SSD 5594 that will allow for:

1. an increase in workforce from the approved 310 full time equivalent (FTE) to 450 FTE;

2. an increase in Run of Mine (ROM) coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa, with the transfer of coal off site continuing to occur using the overland conveyor system to the Springvale Coal Services Site and MPPS; and

3. an increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes (t) to 200,000 t and an accompanying extension in stockpile area footprint to the north of the existing footprint by approximately 20% or 0.3 ha.

The potential impacts investigated in this report are:

- Adverse impacts to the social amenity of the area caused by:
  - Increase traffic flow resulting in road safety risk, inadequate car parking and inadequate road capacity.
  - Adverse visual impact due to the increase in stockpile size.
  - Adverse ecological and cultural impacts due to the increase in stockpile size.
  - Dust / adverse air quality impact from the increased size of the coal stockpile and increase in the number of underground equipment, being an additional continuous miner unit.
  - Increase in greenhouse gas emissions due to the increase in ROM coal extraction rate.
- Change in the economic impact brought about by increased employment and increased spending within the community.

Due to the limited scope of the modification the SIA has concluded that there will be a negligible impact on social amenity.

The economic contribution is found to be positive and is summarised as follows:

- The approved 310 FTE positions represent a NPV of $105 million for the period 2016 - 2028. The increased workforce of 450 FTE positions represents a revised NPV of $113 million therefore representing an increase in NPV of $8 million.

- NSW Government royalties increase from an assessed NPV of $159 million to $167 million representing an increase of $8 million.

- Taxes (NSW State and local government) fall from an assessed NPV of $5.2 million to $4.7 million representing a loss of $0.5 million.

Therefore the overall economic benefit is an increase from an assessed NPV (SSD 5594) of $269.2 million to $284.7 million, representing an increase of $15.5 million for the proposed modification.

1. INTRODUCTION

This Social Impact Assessment (SIA) relates to an application by Springvale Coal Pty Limited (Springvale Coal), operator of Springvale Mine, to modify the State Significant Development (SSD) 5594 consent, which granted approval for the Springvale Mine Extension Project. The approval was granted on 21 September 2015 by the Planning Assessment Commission of NSW. Springvale Coal proposes to modify SSD 5594 to allow for:

- an increase in workforce from the approved 310 full time equivalent (FTE) to 450 FTE;
- an increase in Run of Mine (ROM) coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa, with the transfer of coal off site continuing to occur using the overland conveyor system to the Springvale Coal Services Site and Mount Piper Power Station (MPPS); and
- an increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes (t) to 200,000 t and an accompanying extension in stockpile area footprint to the north of the existing footprint by approximately 20% or 0.3 ha.

The proposed modification is the 'Project' for the purposes of this SIA. The proposed increase in ROM coal production is consistent with Springvale Mine's current five-year business plan. Given Springvale did not operate for eight weeks (21/08/15 – 16/10/15) while the Project was being assessed, Springvale Coal is now seeking to increase production output to make up shortfalls in revenue. This will result in increased output for the 2016 calendar year.

To adequately ensure further production efficiencies have been assessed, Springvale Coal has elected to increase its approved production limit to 5.5 Mtpa. The effect of this is that the current approved timeframe for mining does not change. In the event that efficiencies are gained and markets are available to accommodate those efficiency gains, the life of the mine will be reduced, and coal extraction could be completed by the end of 2023. The increase in production will be achieved through:

(i) the proposed increase in workforce;

(ii) the installation and operation of additional underground mining equipment; and

(iii) improved efficiencies associated with equipment utilisation and availability.

With respect to (ii) and (iii) there is no proposal to change the approved longwall mining technique or the approved mine plan to achieve the proposed increase in production. The proposed modification does not include any physical works nor significant changes (i.e. requiring further modification to existing approvals) to the existing mine operation. Additional equipment to be installed will comprise longwall equipment (increased from one to two) and continuous miners (increased from three to five).

While there will be two longwall's underground, only one longwall will operational. Similarly, while five continuous miners will be located underground, only four will be operated at a time. An advantage of having the additional longwall equipment underground will allow for the next longwall that is scheduled to be extracted to be pre-installed with the longwall mining equipment prior to the completion of the previous longwall being extracted. The average production downtime of around six weeks, when moving longwall equipment to a new

longwall, will therefore not occur. This will result in additional weeks available for ROM coal extraction. Table 1 summarises the proposed modification against approved conditions.

Table 1: Key Features of the Modification and Comparison with Approved Operations

Key Feature	Approved Operation	Proposed Change
Mine Life	Mining operations to be undertaken until 31 December 2028. Rehabilitation activities to be undertaken after this expiry date.	• No change
Hours of Operation	Mine to operate to up to 24 hours a day, 7 days a week	• No change
Employment	310 full time equivalent (fte) personnel	• Increase personnel to 450 fte personnel
Coal Production	4.5 Mtpa of ROM coal	• Increase ROM coal production to 5.5 Mtpa
Mining Method	Retreat longwall mining	• No change
Mining Area	SSD 5594 approved longwalls: LW416 to LW432 and LW501 to LW503.	• No change

Surface Infrastructure	Utilisation of existing surface infrastructure at the Springvale pit top and on Newnes Plateau.
	• Springvale pit top, including but not limited to:
	  ○ Site access, underground access, ROM coal conveyors
	  ○ Upcast ventilation shafts
	  ○ Coal handling, stockpiling and processing facilities
	  ○ Administration, bath house, storage and workshop facilities
	  ○ Water management and pollution control structures including licensed discharge points
	  ○ Sewer connection to the Lithgow City Council's main sewer system
	  ○ Telecommunications facilities, electrical distribution network and ancillary infrastructure.
	• Newnes Plateau infrastructure
	  ○ Dewatering bore facilities (Bores 6 and 8 (operational), Bore 9 and 10 (approved, not constructed)
	  ○ Upcast ventilation facility (existing Vent Shaft 3) and approved downcast ventilation shaft within the Bore 10 compound.
	  ○ Mine services borehole
	  ○ Substations.
		• Increase ROM coal stockpile capacity from the approved 85,000 tonnes to 200,000 tonnes.
		• Increase footprint of ROM coal stockpile by 0.33 ha to a total footprint of 1.78 ha.
		• Construct a dirty water diversion drain around the northern section of the stockpile extension area of the existing stockpile area to divert water to the existing dirty water catchment at the pit top.
		• Minimal change to the existing dirty and clean water management at the pit top.
		• No change to other infrastructure at the pit top and on Newnes Plateau .

Key Feature	Approved Operation	Proposed Change
ROM Coal Transport	▪ Sized ROM coal transported, using an overland conveyor system (part of the Western Coal Services Project (SSD5579) for stockpiling and further processing (beneficiation) at Springvale Coal Services Site, or direct transfer to Mount Piper Power Station. ▪ Transport of up to 50,000 tonnes per annum of ROM coal to local domestic market customers by road haulage from the pit top.	• No change
Rehabilitation and Final Landform	▪ Progressive rehabilitation of infrastructure and exploration sites at the pit top and Newnes Plateau infrastructure areas, undertaken as required. ▪ Life of mine rehabilitation of all disturbed areas associated with the pit top and Newnes Plateau infrastructure areas on completion of mining operations.	• No change
Exploration Activities	▪ Exploration activities within EL6974 and A460 boundaries.	• No change

2. SOCIAL IMPACT ASSESSMENT

2.1 Overview

A SIA is a systematic, staged approach of enquiry that identifies who may be affected by the project and how they are affected. It takes into account the scope of the proposed project and how the Project may change the way of life of individuals and communities (however the community is defined). These changes may be positive, negative, intended, unintended or a combination depending on the needs, issues, values and aspirations of the surrounding community stakeholders. Therefore the purpose of the SIA is to:

- Assess the social impacts of the Project including any impacts on local infrastructure and services.
- Assist in establishing the full facts about the Project, to support a well-informed decision about the appropriateness of the Project.
- Recommend mitigation measures to minimise adverse impacts and maximise benefits of the Project.
- Assess the impacts of the Project on future generations.
- Inform the community and facilitate participation by the community in the planning and assessment process.
- Facilitate the consideration of alternative Project proposals.
- Enhance existing data to inform the planning and development assessment process.

The core steps are:

1. Profiling: This involves understanding the scale and scope of the project, parameters of the Social Impact Assessment and identifying the stakeholders (determined by the areas of affectation).

2. Scoping: This involves identifying the likely impacts arising from the development and includes consultation and feedback from identified stakeholders. Consultation is undertaken in a range of ways and may include informal consultation, stakeholder engagement, surveys etc.

3. Assessment: This section explores the likely impacts that will arise. The scope of the assessment is determined by the likely impacts and as a guide may include (but not be limited to):

- Changes to the population and characteristics of the area.
- The community structure, its character or beliefs.
- The health and safety of those living and working in the vicinity of the development.
- An assessment of safety as it relates to crime, anti-social and nuisance behaviour.

- Social cohesion, in particular the quality of life of those living in the vicinity of the development.
- Cost of living, including housing affordability.
- Accessibility.
- Sense of place and community.
- The impact on existing services, including tourism etc.

4. Management: All impacts should be identified and those that are identified as having an adverse or detrimental affect need to be managed and mitigated where possible. It is not always possible to manage all adverse impacts however identification of these impacts and how they can be managed must be taken into account. Similarly, impacts that are identified as being positive need to also be identified and capitalised upon where possible and appropriate. This allows for an assessment as to whether the proposal meets net community benefit criteria.

5. Monitoring: Strategies to monitor identified impacts may need to be identified to ensure that management strategies are adhered to and those cumulative impacts are identified, monitored and taken into account with further development.

2.2 Authors Qualifications

This SIA has been prepared by James Marshall, Group Manager Stakeholder Engagement, Centennial Coal who has over twenty years' experience in the social planning sector with experience in local government (10 years), the NGO sector (5 years) and as a private consultant (7 years). During this time expert advice and support has been provided in relation to:

- Strategic social planning;
- Social Impact Assessment;
- Community and Stakeholder Engagement;
- Safer by Design (CPTED);
- Mediation;
- Community and Social Research;
- Feasibility Studies; and
- Urban Design and Master Planning.

2.3 Site Description

2.3.1 Site Location

Springvale Mine is an existing underground longwall mining operation located in the Western Coalfield of New South Wales, approximately 10 km northwest of the city of Lithgow and

120 kilometres west-northwest of Sydney. Springvale pit top is accessed via the Castlereagh Highway and is located 3 km east of Wallerawang. Springvale Mine is bordered by Angus Place Colliery to the north, the closed Lithgow State Mine to the south, grazing land and Wallerawang Power Station to the west, and Newnes State Forest to the east. Refer Figure 1.

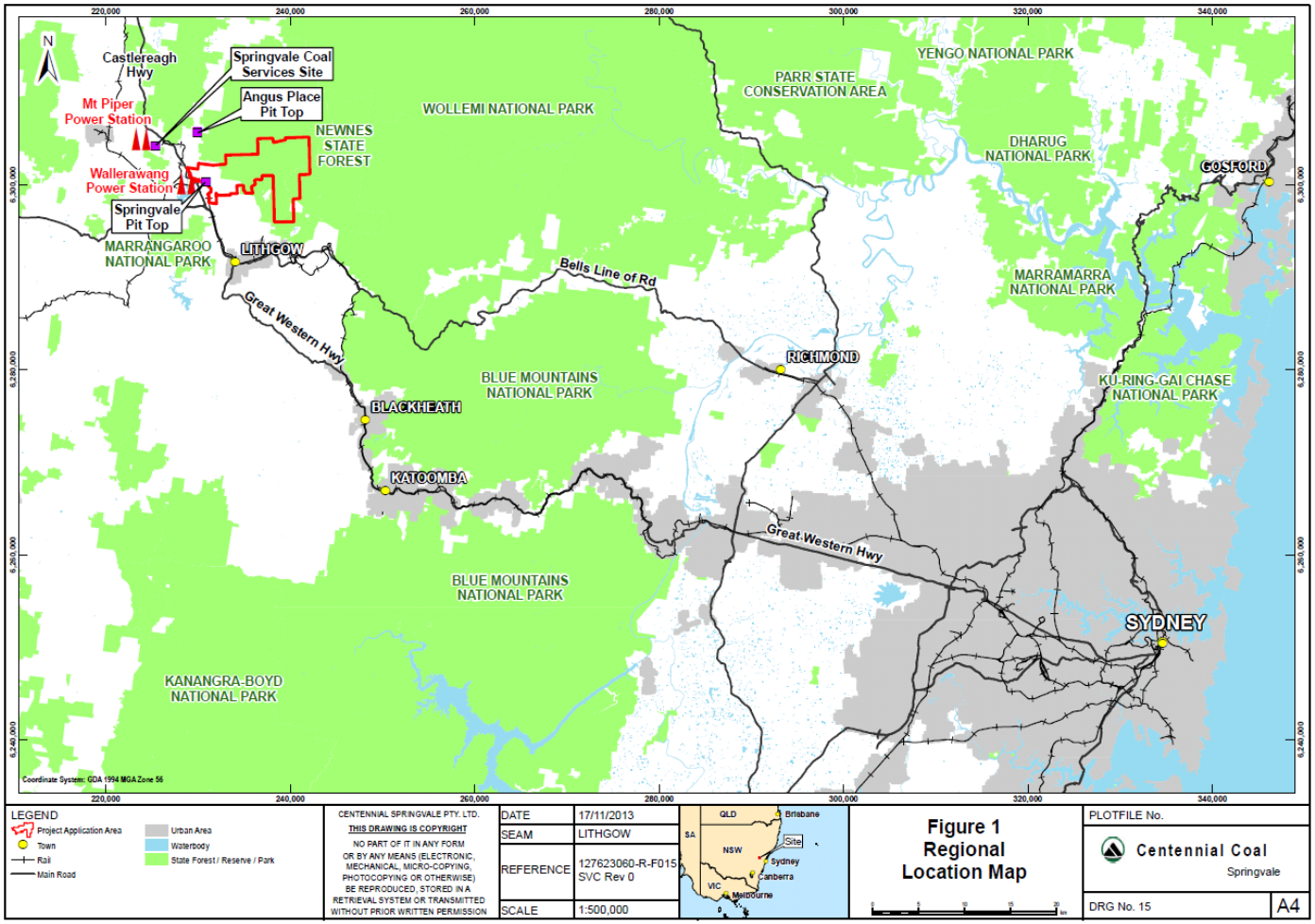

Figure 1: Springvale Mine Regional Context

2.3.2 The Project Application Area

The Project Application Area comprises an area of 5,811 ha and is defined by the Mining Lease and Exploration Licence boundaries of Springvale Mine. It is located within the Lithgow Local Government Area and the Parishes of Cox, Clwydd, Cook, Marrangaroo and Lidsdale within the County of Cook.

The characteristics of the Project Application Area and surrounds include rural land, Newnes State Forest, coal handling transport and infrastructure, power stations and natural areas. The area is characterised by environmental features such as pagodas, cliff lines, swamps, creeks, deep valleys, flora and fauna.

Marrangaroo Creek, the Wolgan River, Carne River, Lambs Creek, Paddys Creek and Kangaroo Creek overlie the Project Application Area. These swamps comprise both shrubs swamps that occur in valley floors and hanging swamps that occur on hillsides, and both are relatively common and widespread on the Newnes Plateau.

2.3.3 Land Zoning

The Project Application Area falls under the *Lithgow Local Environmental Plan 2014* (Lithgow LEP). Under the Lithgow LEP the Project Application Area encompasses the following zones:

- RU1 Primary Production
- RU2 Rural Landscape
- RU3 Forestry
- R1 General Residential
- SP2 Infrastructure

2.3.4 Land Uses

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. The Wallerawang Power Station (being decommissioned) and the Mount Piper Power Station, both owned and operated by Energy Australia (formerly Delta Electricity), are located to the west and northwest, respectively, of the Springvale pit top. Angus Place Colliery (on care and maintenance since March 2015) is located to the north from the Springvale pit top

Centennial Coal's 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.

The area around Springvale Mine has been subject to extensive mining operations in the past, with a number of active or completed mines in its vicinity, including Centennial Coal's existing operations.

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 hardwood forest that is selectively logged under the Forestry Corporation of NSW tenure and management. In addition to the timber industry, the Newnes State Forest supports a number of recreational land uses.

Public access is permitted in the Newnes State Forest with common recreation activities consisting of motorcycle riding, four wheel driving, bushwalking, camping, mountain bike riding, canyoning, photography, bird watching and other 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.

2.3.5 Springvale Mine Site Characteristics

Underground mining operations are undertaken wholly within the Newnes State Forest, away from private landholdings and residences. Newnes State Forest is located on Newnes Plateau and contains Pine Plantation of Radiator Pine, Natural Forest and Sandstone Escarpments. The area has high environmental value and is characterised by significant environmental features such as pagodas; cliff lines; swamps, creeks, deep valleys, flora and fauna.

Public access is permitted in the Newnes State Forest and the activities include motorcycle riding; four wheel diving; bushwalking; mountain bike riding; canyoning; photography; bird watching and other such recreational and adventure activities. The area is very popular with visitors on weekends and attracts a large number of domestic visitors from Sydney.

Visitor and tourist participation is an important outcome for Forestry Corporation of NSW, and is facilitated via the provision of infrastructure (roads, picnic areas, camp grounds, viewing platforms etc.), commercial licenses to tourism operators and the development of cultural heritage strategies.

Additional to public use, there are a number of lease holdings throughout the Newnes State Forest area which are primarily for designated mine lease areas, surface infrastructure sites held by mining companies, telecommunications etc. These lease holdings are all managed by Forestry Corporation of NSW.

Springvale Mine's pit top activities are located adjacent to the Castlereagh Highway near Lidsdale. The surrounding area is characterised by pastoral lands and dispersed large lot rural residential. Coal is transported from the underground workings to the pit top where it is transported via the overland conveyor system to Springvale Coal Services Site (part of Western Coal Services Project) at Blackmans Flat for transportation to either Mount Piper Power Station or Lidsdale Siding for export markets. Springvale Mine is also approved to transport up to 50,000 tonnes per annum of ROM coal to local domestic market customers by road haulage from the pit top.

Figure 2 shows the Springvale Mine and surrounding land uses and Figure 3 the pit top layout.

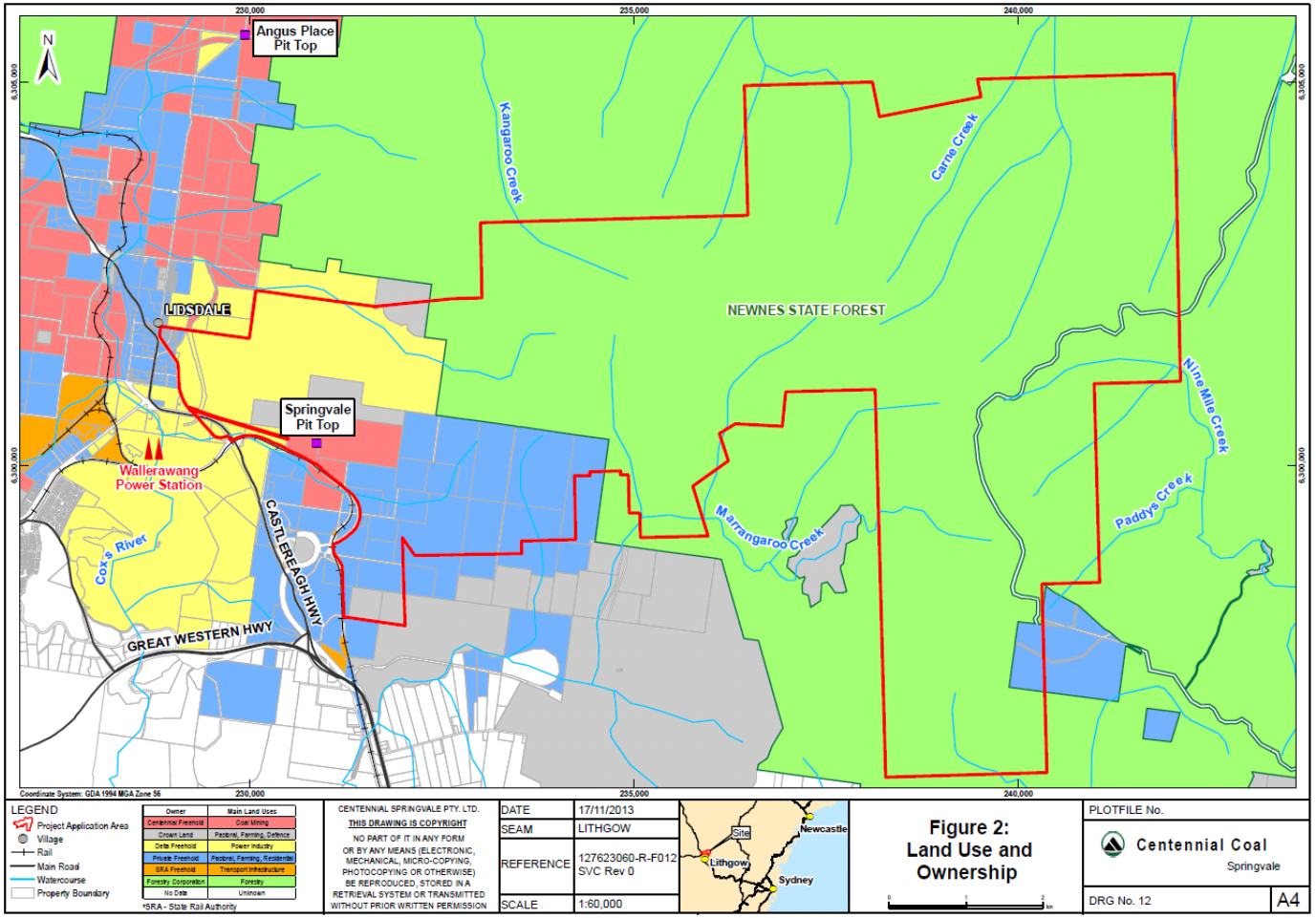

Figure 2: Map of Surrounding Land Uses

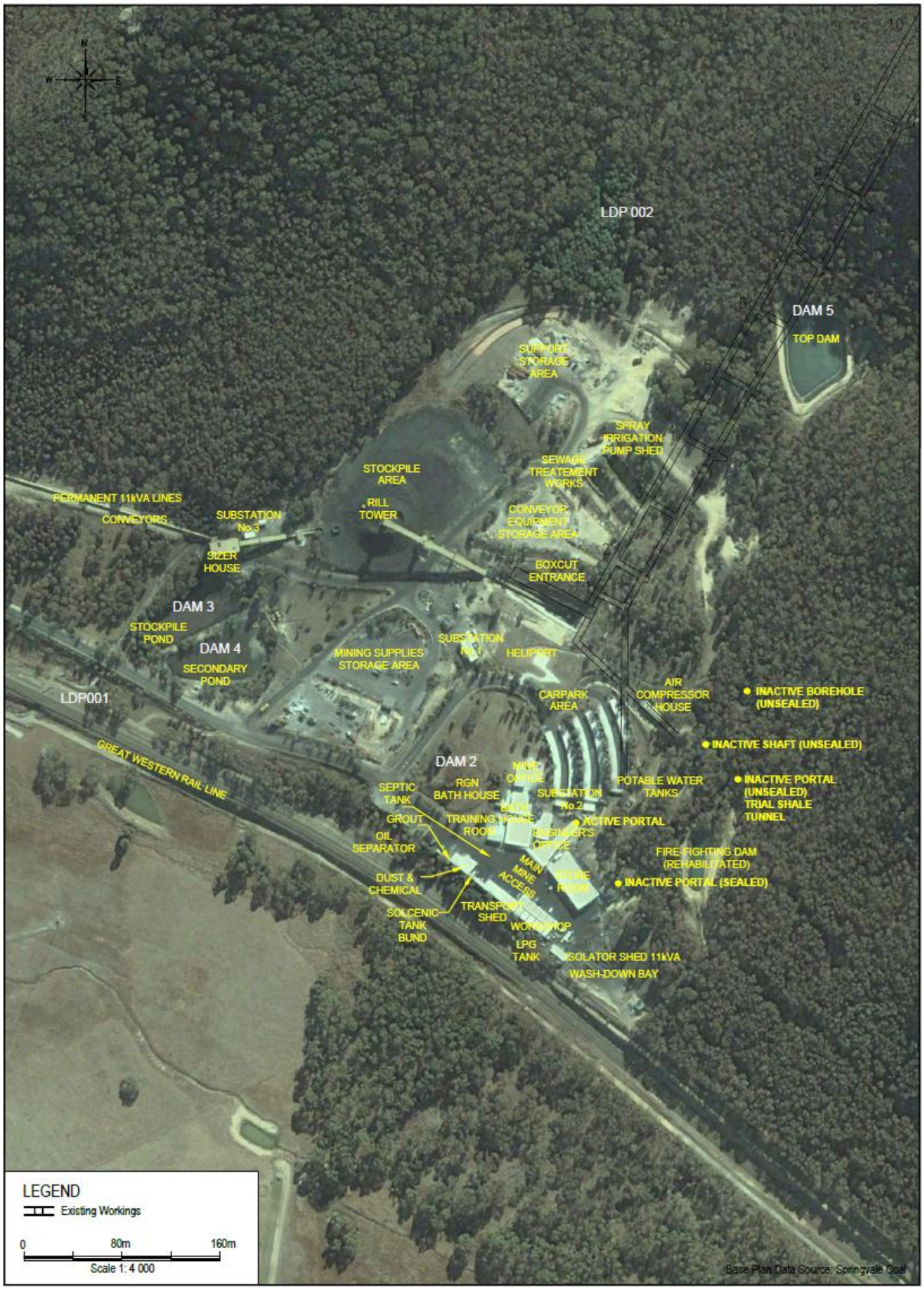

Figure 3: Springvale Mine Pit Top Layout

3. COMMUNITY PROFILE

3.1 Overview

The vision for the Lithgow LGA was developed in collaboration with the community and adopted by Council in 2006. It sets a vision for the next 10 to 20 years for the Local Government Area. The overarching vision statement is:

A centre of Regional excellence that:

- *Encourages community growth and development.*
- *Contributes to the efficient and effective management of the environment, community and economy for present and future generations.*

According to the most recent Australian Bureau of Statistics (ABS) Census (2011), the Lithgow LGA population on Census night was 20,161 which represent a 2.04% increase in population since 2006. The majority of the population live in Lithgow urban area (11,143 people), Wallerawang (1,855 people) and Portland (1,829 people). The remainder of the population (approximately 26%) live across the smaller villages, hamlets and rural localities across the LGA.

The LGA's population has undergone slight fluctuations since 1996. There was a small decrease in population recorded between the 1996 and 2001 census period and a slight increase in population between the 2001 and 2011 census period. The fluctuating population would be attributed to a number of factors which include:

- the changing employment characteristics of the area meaning that there is constant in/out migration, in particular families with young children;
- a trend for younger people (18 – 24 years of age) to move out of the area to seek lifestyle, education and/or employment opportunities;
- in-migration of mature age people seeking a rural lifestyle (tree change).

The major change in Lithgow's population has occurred in rural areas. Between 1996 – 2009 over 55% (699) of all dwelling approvals has occurred within rural areas, increasing the population in these areas by approximately 1,678 persons. The trend towards rural living is usually from people moving from outside of the LGA, seeking alternative lifestyle choices or securing land to be used as a place to visit (there are a large number of land holders who are not resident of the area). As with most regional areas in NSW and Australia, Lithgow's population is ageing; however is increasing at a higher rate than NSW and Australia. As illustrated in Table 2 the median age of the LGA is now 42 years and is much higher in some rural areas. The out migration of young people will exacerbate this trend.

The population are also earning a higher income and there is an increase in the amount paid for housing loans and rent. This trend will align with available employment opportunities and wage earnings. The key industry of employment is mining which offers a high wage when compared with other sectors. Retail, manufacturing, power generation, public safety all

remain strong employment sectors and there is an emerging growth in scientific and technical services, administration and health and social services. Table 2 summarises population characteristics of the LGA between 2001 and 2011.

Table 2: Time Series Data (2001 – 2011) – Lithgow LGA

Selected Medians	2001	2006	2011
Population	19,332	19,756	20,161
Median age of persons	37	40	42
Median total personal income ($ weekly)	$295	$356	$455
Median total family income ($ weekly)	$822	$1,027	$1,190
Median total household income ($ weekly)	$642	$751	$894
Median mortgage repayment ($ monthly)	$750	$1,083	$1,452
Median Rent ($ weekly)	$110	$135	$170
Average household size	2.5	2.4	2.3

Source: ABS Census

3.2 Local Characteristics

The characteristics of the Springvale Mine Extension Project Area and surrounds include the locality of Lidsdale, rural land and isolated rural residents, transport infrastructure and the Newnes State Forest. The town of Wallerawang is located to the south west of the Springvale Mine pit top, and is the closest retail and commercial centre, however Lithgow remains the main centre meeting higher order retail, commercial and professional service needs. A summary of the key services found in Wallerawang that would meet the day to day needs of residents are:

Community facilities:

- Council library and depot; medical and community health centres; recreational facilities including PJ Hall Memorial Park, Lake Wallace, playing fields and a skate park; police, fire services; the Country Women's Association; churches; primary school; bowling club.

Retail and commercial facilities /services:

- Supermarket; post office (with a pharmacy prescription service (drop in (am) and pick up (pm)); agency for the Commonwealth Bank; newsagent; bakery; butcher; service stations; hotels; takeaway store; hairdresser.

Lidsdale facilities:

- Rural Fire Service; petrol station; tennis courts; Ted Hughes Memorial Park; church.

3.3 Economic Profile

Lithgow has a long history with mining and power generation and today the economic base of Lithgow is still recognised as being the energy and resources sector. These sectors are major employers and subsequently make a significant contribution to the overall economy including retail and accommodation via direct and indirect employment opportunities occurring.

The mining and energy sectors also present some challenges brought about by fluctuations in coal prices. However, the importance of the coal mining industry and its related employment is clearly vital to the broader economic wellbeing of the area. The largest sectors in the Lithgow economy by total output include:

- Mining
- Construction
- Electricity
- Public Administration
- Manufacturing

Table 3: Estimated GDP: Lithgow LGA

Industry Sector	Lithgow LGA Estimated GDP	
	GRP* Value	GRP %
Mining	$625.3 million	40.6%
Construction	$186.6 million	12.1%
Electricity	$110.4 million	7.2%
Public Administration	$91.6 million	5.9%
Manufacturing	$63.1 million	4.1%

Sources: ABS Census (2011) ERP (2013), Cat 8731, Deewr (2014), Nieir (2014), Housing NSW (2014), A.P.Sheere Consulting (2015)
* GRP: Gross Regional Product

The main industries by employment in Lithgow are:

- Mining
- Health care
- Retail
- Public Administration
- Accommodation

Table 4: Employment by Industry Sector (top 5)

Industry Sector	% Employed
Mining	12.4%
Healthcare	10.9%
Retail Trade	9.9%
Public Administration	8.5%
Accommodation	8.3%

Sources: ABS Census 2011, Nieir (2014), A.P.Sheere Consulting (2015)

LCC website states that the emerging sectors of the LGA include:

- Artisan food producers – saffron, chocolates, baked products, olives, hazel nuts, condiments, fruit and vegetables.
- Creative industries – IT, graphic design, marketing, craft, photography, candles, soaps, music and performance.
- Financial Services, employment and training – accounting and conveyancing, industrial and mining sector labour hire and training services.
- Tourism services – bed and breakfast, short term accommodation, niche recreation providers.
- Independent Main St retailers – homewares, clothing, cafes, lifestyle

LCC website states that gaps in facilities and services include:

- Mid to large scale bulky goods businesses
- Patient care options
- Entertainment and recreation facilities
- Cafes, quality restaurants, menswear, ladies wear
- Tradespeople

4. SCOPING OF POTENTIAL SOCIAL IMPACTS

4.1 Social Impact Risk Assessment - Determining Factors

As stated in Section 1 of the SIA, the modification to SSD 5594 will allow for:

1. an increase in workforce from the approved 310 full time equivalent (FTE) to 450 FTE;

2. an increase in Run of Mine (ROM) coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa, with the transfer of coal off site continuing to occur using the overland conveyor system to the Springvale Coal Services Site and MPPS;

3. an increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes (t) to 200,000 t and an accompanying extension in stockpile area footprint to the north of the existing footprint by approximately 20% or 0.3 ha.

Increased coal production will be achieved by efficiencies in coal production with the main changes created by the increased size of the coal stockpile and increased staffing.

Considering the limited scope of the Project the potential impacts requiring investigation are identified in the following areas:

- Adverse impacts to the social amenity of the area caused by:
  - Increase traffic flow resulting in road safety risk, inadequate car parking and inadequate road capacity.
  - Adverse visual impact due to the increase in stockpile size.
  - Adverse ecological and cultural impacts due to the increase in stockpile size.
  - Dust / adverse air quality impact from the increased size of the coal stockpile and increase in the number of underground equipment, being an additional continuous miner unit.
  - Increase in greenhouse gas emissions due to the increase in ROM coal extraction rate.
- Change in the economic impact brought about by increased employment and increased spending within the community.

The assessment of potential change has been undertaken via review of specialist consultant reports to understand the scale of change if any as a result of the Project. The assessments undertaken to assess impacts were as follows:

- Air Quality and Greenhouse Gas Impact Assessment (SLR (2016))
- Traffic Impact Assessment (ARC (2016))
- Economic Impact Assessment (Aigis Group (2016)).

Ecology (RPS (206a) and cultural heritage (RPS (2016b) due diligence surveys were also undertaken over the proposed coal stockpile extension area.

This social impact assessment has been formatted using a bow-tie analysis to understand the potential initiating event and what control have been put in place to mitigate potential impacts. This assessment is outlined in Tables 5 to 12

It should be noted that as there are no changes to any operations being undertaken in the Newnes State Forest, the scope of this SIA has therefore not included an analysis of this area.

Table 5: Road Safety

Causes	Proactive Controls	Initiating Event	Mitigation / Reactive Controls	Consequence
Increased vehicle traffic at Castlereagh Highway and Springvale Mine Access Road intersection	Intersection on the corner of the Castlereagh Highway and the Springvale mine access road currently exists. Undertake a Traffic Impact Assessment (TIA) to understand the potential risk.	Risk to road safety.	The TIA undertaken by ARC (2016) has found that an upgrade of the intersection of Castlereagh Highway & Springvale Access Road to provide a Channelised Right turn (CHR) is currently required with reference to Condition 21 of the SSD 5594 approval. This warrant for a CHR is related to the increase in traffic flow on Castlereagh Highway due to regional growth. Springvale Coal has committed to the upgrade of the intersection in line within the provisions of GRD4A guidelines, and has commenced design planning for such, which would ultimately be finalised further to consultation with the RMS before implementation.	Increase risk of road accident

Table 6: Road safety

Causes	Proactive Controls	Initiating Event	Mitigation / Reactive Controls	Consequence
Inadequate parking for staff	Undertake a TIA to understand the potential risk.	Risk to road safety.	Provide adequate car parking. The TIA undertaken by ARC (2016) has found that the available capacity within the Pit Top staff car parks will continue to accommodate peak staff parking demands further to the Modification	Increased risk of road accident

Table 7: Road Safety

Causes	Proactive Controls	Initiating Event	Mitigation / Reactive Controls	Consequence
Increased traffic on the road network over and above its nominated capacity.	Undertake a TIA to understand the potential risk. Road network has capacity to cater for the increased traffic flow.	Risk to road safety.	The TIA undertaken by ARC (2016) has found that the upgrade of the intersection of Castlereagh Highway & Springvale Access Road to provide a CHR as per Condition 21 of the SSD 5594 approval is adequate in addressing this matter.	Increased risk of road accident along the network and Castlereagh Highway / Mine Access Road intersection.

Table 8: Visual Impact

Causes	Proactive Controls	Initiating Event	Mitigation / Reactive Controls	Consequence
Increased size of the coal stockpile.	Existing coal stockpile to be utilised – i.e. no new coal stockpile to be developed. Size increase relates to footprint (to the northeast) rather than height. (Refer to Figure 4). While the stockpile capacity will be increased modelling shows the stockpile will not exceed the existing coal stockpile heights or the Rill Tower (Figure 3) height from which the coal from underground is pushed out on to the surface. Location of the coal stockpile is approximately 800 metres from the Castlereagh Highway and obscured by topography and vegetation.	Adverse visual impact	Maintain coal stockpile in existing location. Ensure existing visual vegetation buffers are maintained.	Adverse impact on rural amenity enjoyed by residents and visitors.

Table 9: Ecology

Causes	Proactive Controls	Initiating Event	Mitigation / Reactive Controls	Consequence
Increase in size of the coal stockpile footprint.	Due diligence flora and fauna survey for the stockpile expansion undertaken (RPS 2016a). The area is highly modified with no native vegetation clearing or clearing of threatened species involved.	Loss of ecology	Monitor expansion when work occurs for any potential risk to ecology. Implement recommendations in RPS (2016a).	Adverse impact / loss of native vegetation, species including threatened species and fauna habitat.

Table 10: Cultural Heritage

Causes	Proactive Controls	Initiating Event	Mitigation / Reactive Controls	Consequence
Increase in size of the coal stockpile footprint.	Due diligence cultural heritage survey for the stockpile expansion undertaken (RPS 2016b). The area is highly modified. No Aboriginal objects or places have been identified within the stockpile extension area. Project Area and therefore an Aboriginal Impact Permit (AHIP) is not required for the proposed development	Loss of heritage items	Monitor expansion when work occurs for any potential risk to unrecorded heritage items. Implement recommendations in the RPS (2016b).	Adverse impact / loss of cultural heritage items not recorded in the assessment.

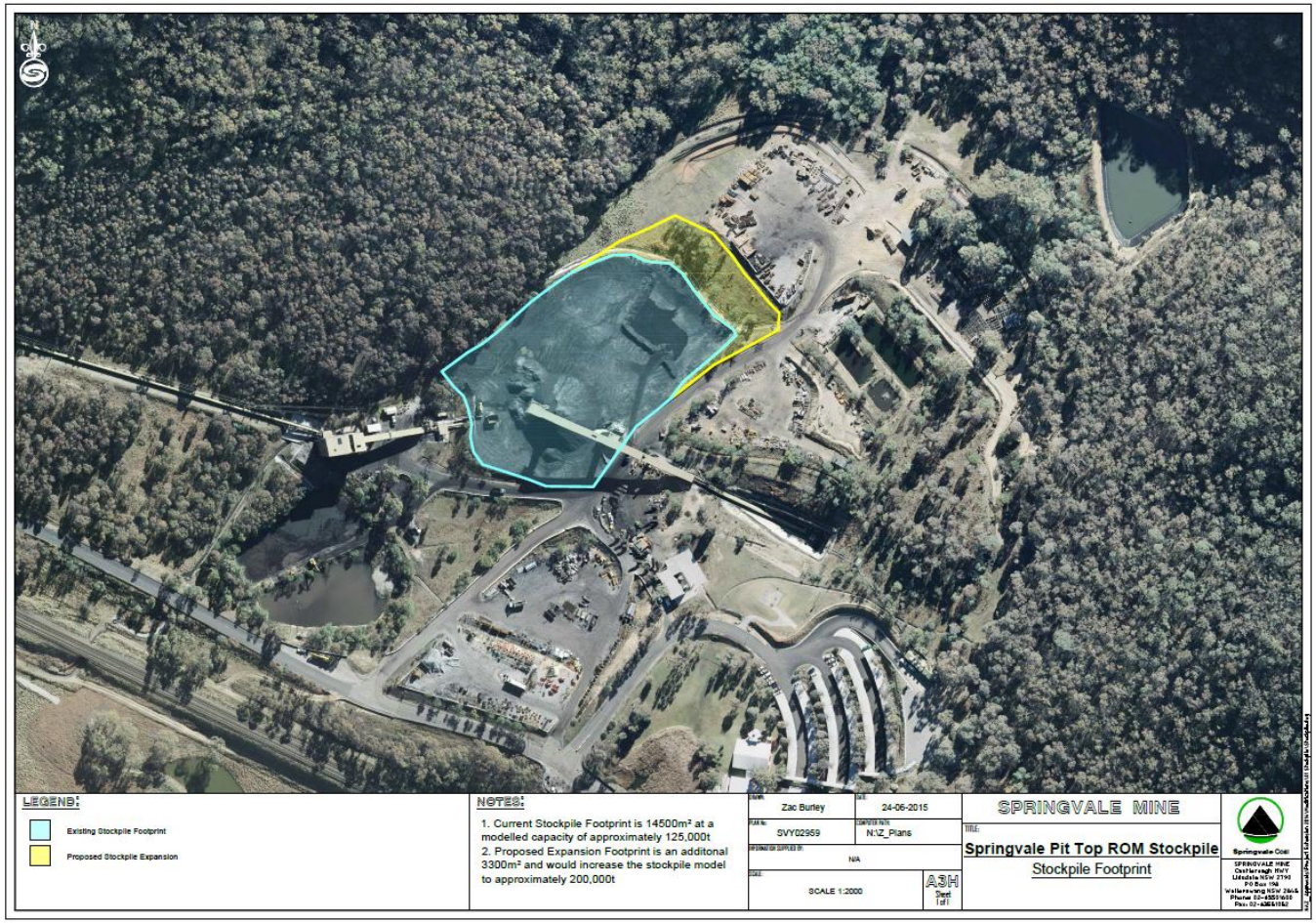

Figure 4: Increase in Existing Coal Stockpile Footprint at Springvale Mine Pit Top

Table 11: Air Quality

Causes	Proactive Controls	Initiating Event	Mitigation / Reactive Controls	Consequence
Increased coal placed on the coal stockpile	Undertake an air quality impact assessment. The air quality impact assessment undertaken by SLR (2016) has found that the predicted results showed that the proposed MOD 1 activities are unlikely to cause any exceedances of the relevant ambient air quality criteria for TSP, PM_{10} and $PM_{2.5}$ concentrations or dust deposition at any identified surrounding sensitive receptors.	Adverse impact on air quality	Ongoing monitoring of air quality as per the conditions of consent and performance criteria to be met. Mitigation measures noted in SLR (2016) will also be implemented.	Exceedance of air quality criteria

Table 12: Economic Contribution

Causes	Proactive Controls	Initiating Event	Mitigation / Reactive Controls	Consequence
Increased coal production. Increase available jobs	Sustain base employment level of 310 FTE positions (SSD 5594) represents a NPV of $105 million for the period 2016 - 2028. The increased workforce of 450 FTE positions represents a revised NPV of $113 million therefore representing an increase in $8 million. NSW Government royalties increase from an assessed NPV of $159 million to $165 million representing an increase of $6 million. Taxes (NSW State and local government) fall from an assessed NPV of $5.2 million to $4.7 million representing a loss of $0.5 million. Overall economic benefit is an increase from an assessed NPV of $269.2 million for SSD5594 to $282.7 million for Modification 1, representing an increase of $13.5 million.	Increase economic contribution to the local and regional community and state taxes and royalties.		

4.2 Discussion Regarding Potential Social Impacts

The following tables (Tables 13 – 22) are 'populated' based on the findings of the assessment of potential social impacts. The tables allocate a score (determined by the extent of impact identified above) against the various items assessed in the SIA (refer Section 1 of the SIA). Where there is no or a positive impact no score is allocated, where there is an adverse impact a score of 1,, 2 or 3 is allocated depending on the degree of impact identified.

Table 13: Population Characteristics

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
The development will change the characteristics of the general population or persons who live or interact in or around any site in question.	Purchase property due to adverse social amenity impacts that cannot be mitigated.	No Impact Identified	0			
	Existing landholders relocate from the area due to mine operations and loss of social fabric, knowledge, networking and sense of community.	No Impact Identified	0			
	Increased in the number of tenancies across the area due to property in mine ownership. This results in different values to the area, land management practices and loss of social fabric, neighbouring etc.).	No Impact Identified	0			
	FI/FO or DI/DO workers coming to the area resulting in positive financial contribution to some sectors however do not contribute to the sense of community and create other impacts such as increased housing costs.	No Impact Identified	0			
Total Score			0			

Table 14: Disadvantage and Benefit

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
It is likely the development will disadvantage or benefit individuals or groups (including specific target/population groups).	Positive pay packet effect in the immediate local area to some / all sectors.	Positive Impact Identified	0			
	Positive pay packet effect however not in the immediate area, but on a broader regional level.	Not immediately identified	0			
	Increase in housing rental and housing purchase prices due to demand brought about by the project.	No Impact Identified	0			
	Increased number of housing investors taking advantage of accommodation demand for mine personnel.	No Impact Identified	0			
	Artificial increase in pricing for certain commodities / goods / housing.	No Impact Identified	0			
	Sterilisation of land for private development.	No Impact Identified	0			
	Reduced access to publicly accessible land.	No Impact Identified	0			
Total Score			0			

Table 15: Employment

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
Changes to employment opportunities	Direct and indirect employment created by the project.	Positive Impact Identified	0			
	Longevity / certainty of employment for existing employees and indirect employment.	Positive Impact Identified	0			
	Redistribution of employment patterns – i.e. mining attracting people due to higher wages whereas other sectors may not have this advantage.	No Impact Identified	0			
	Increased trade in other services (i.e. accommodation, retail) resulting in additional employment opportunities.	No Impact Identified	0			
Total Score			0			

Table 16: Housing

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
Impacts on existing housing stock will occur	Increase in demand from FI/FO or DI/DO workers.	No Impact Identified	0			
	Increased demand for tenancies.	No Impact Identified	0			
	Increased / inflated housing costs making housing unaffordable for a larger cohort of the community.	No Impact Identified	0			
	Decrease in the availability of and access to affordable housing stock.	No Impact Identified	0			
Total Score			0			

Table 17: Community Infrastructure

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
Additional utilisation of community infrastructure will occur (roads, community halls, child care facilities, sporting and recreation etc.)	New services and facilities required ancillary to the project due to population increase arising from the project.	No Impact Identified	0			
	Increase in employee traffic to and from the site.	Negligible adverse impact identified		1		
	Ongoing use of existing services by existing workforce.	Positive Impact Identified	0			
Total Score				1		

Table 18: Community Support Services

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
Additional support services will be required to meet the demands of any identified changes	New services and facilities required ancillary to the project due to population increase or decrease (in the case of mine closure).	No Impact Identified	0			
Total Score			0			

Table 19: Service Demand

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
Existing support services will be utilised to an extent where they are unable to meet the demand	Ongoing use of existing services however demand increased as a result of mine closure / increase in workforce.	No Impact Identified	0			
Total Score			0			

Table 20: Conflict

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
The proposal is likely to cause conflict within the community (i.e. is not supported, or there is conflict between supporters and non-supporters)	Visual impact caused by the location of infrastructure, lighting etc.	No Impact Identified	0			
	Change in environmental conditions (e.g. adverse noise and air quality impacts from the mines operations, changes to water quality and availability).	No Impact Identified	0			
	Transport noise caused by rail / trucks and employee movements.	Negligible impact may arise due to increased traffic however somewhat mitigated due to the main transport route being along the Castlereagh Highway.		1		
Total Score				1		

Table 21: Community Identity

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
An impact on community identity is likely	Caused by: Change in population structure (i.e. relocation of landholders due to property purchase).	No Impact Identified	0			
	Change in land characteristics that prevent use, development and / or access to certain areas.	No Impact Identified	0			
	Change to the social amenity due to noise, air quality, visual etc.	No Impact Identified	0			
Total Score			0			

Table 22: Cultural Identity

Effect	Causes	Comment	Score			
			No / positive impact	Low Impact	Medium Impact	High Impact
			0	1	2	3
An impact on cultural identity is likely	Loss of community / public access to certain areas.	No Impact Identified	0			
	Loss of or reduced access to sites of significance (indigenous and European)	No Impact Identified	0			
	Threat of a change in lifestyle for land holders.	No Impact Identified	0			
	New project proposed within an existing community	No Impact Identified	0			
Total Score			0			

5. CENTENNIAL'S RISK RANKING

5.1 Risk Ranking Overview

The identification of social impacts has been determined against the degree of impact identified in the various specialist consultant reports and effectiveness of controls in the bow-tie. The scores in Tables 13 to 22 are used to score the degree of change against a level of social impact / risk. This method allows the company to:

- explore whether the risk is acceptable or if strategies are required to reduce the social risk rating;
- benchmark the social impact as a basis for monitoring future change.

Based on scores in Tables 13 – 22 above the total score is 2. With reference to Table 23 a score of 2 indicates that the social risk of the proposed modification elements is insignificant. This means that the Project will result in:

- Negligible change to the community – i.e. meaning change is not outside of normal conditions.
- No change to the land use within Springvale Mine Extension Project Application Area (PAA) or across neighbouring areas.
- Economic benefits have positive effect on business / community via direct spending, employment.
- Complaints may be received requiring intervention.

Table 23: Social Risk Consequence Assessment

Score	Rating	Consequence Social and Economic Impact (SE)
81 - 102	Catastrophic	▪ Adverse change to the social amenity of an entire (defined) community outside of the PAA, which cannot be mitigated using conventional means, requiring purchase / compensation. ▪ Widespread change to the existing land use characteristic currently enjoyed by the community resulting in change to use, development, identity. ▪ Widespread changes to property value outside of the PAA due to adverse social amenity impacts. ▪ Adverse impact on non-mine related business due to mine operations.
61 – 80	Major	▪ Adverse change to amenity within the community requiring compensation / purchase of numerous properties. ▪ Mining operations change and / or limit the land use characteristics in some areas.

Score	Rating	Consequence Social and Economic Impact (SE)
		▪ There are adverse impacts on non-mine related businesses. ▪ There are changes in property values to some properties due to mine operations.
41 – 60	Moderate	▪ Change in amenity generating complaints but can be mitigated at source to meet compliance. ▪ Increased demand on social infrastructure as a result of mine operations (i.e. roads, facilities).
6 - 40	Minor	▪ Slight change in social amenity but all aspects of operations are within compliance. ▪ Complaints may be received requiring intervention.
0 - 5	Insignificant	▪ Negligible change to the community – i.e. meaning change is not outside of normal conditions. ▪ No change to the land use within PAA or across neighbouring areas. ▪ Economic benefits have positive effect on business / community via direct spending, employment. ▪ Complaints may be received requiring intervention.

6. CONCLUSION

This SIA has been undertaken to establish the level of change likely to arise from the modification to SSD 5594 that will allow for:

1. an increase in workforce from the approved 310 full time equivalent (FTE) to 450 FTE;
2. an increase in Run of Mine (ROM) coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa, with the transfer of coal off site continuing to occur using the overland conveyor system to the Springvale Coal Services Site and MPPS; and
3. an increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes (t) to 200,000 t and an accompanying extension in stockpile area footprint to the north of the existing footprint by approximately 20% or 0.3 ha.

The increase in production will be achieved through:

(i) the proposed increase in workforce;

(ii) the installation and operation of additional underground mining equipment; and

(iii) improved efficiencies associated with equipment utilisation and availability.

The SIA has undertaken a review of the specialist consultant reports (Air Quality and Greenhouse Gas Impact Assessment, Traffic Impact Assessment, Economic Impact Assessment) and found that the Project, as proposed will result in a negligible adverse social impact.

The economic contribution is found to be positive and is summarised as follows:

- The approved 310 FTE positions represents a NPV of $105 million for the period 2016 - 2028. The increased workforce of 450 FTE positions represents a revised NPV of $113 million therefore representing an increase in NPV of $8 million.
- NSW Government royalties increase from an assessed NPV of $159 million to $165 million representing an increase of $6 million.
- Taxes (NSW State and local government) fall from an assessed NPV of $5.2 million to $4.7 million representing a loss of $0.5 million.

Therefore the overall economic benefit is an increase from an assessed NPV (SSD 5594) of $269.2 million to $282.7 million, representing an increase of $13.5 million for the proposed modification.

7. REFERENCES

Aigis (2016), *Springvale Mine Extension Project Section 96(2) Modification SSD 5594: Economic Impact Assessment*, Aigis Group, March 2016.

Australian Bureau of Statistics, *2011 Census of Population and Housing*

ARC (2016), *Springvale Modification 1 Traffic Impact Assessment*, Anton Reisch Consulting Pty Ltd, March 2016.

RPS (2016a), *Springvale Mine Due Diligence Survey for Stockpile Expansion*, RPS East Australia Pty Limited, January 2016.

RPS (2016b), *Springvale Mine Aboriginal Heritage Due Diligence Survey for Coal Stockpile Expansion*, RPS East Australia Pty Limited, March 2016.

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Economic Impact Assessment

APPENDIX – F

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Springvale Mine Extension Project

Economic Impact Assessment

Section 96(2) Modification
State Significant Development 5594

July 2016

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EXECUTIVE SUMMARY

- This Economic Assessment forms part of the *Statement of Environmental Effects* (SEE) relating to an application by Springvale Coal Pty Limited (Springvale Coal), operator of Springvale Mine, to modify the State Significant Development (SSD) 5594 consent for the Springvale Mine Extension Project (the Project), which was granted on 21 September 2015.
- This economic assessment has been prepared to comply to the greatest practicable extent with DPE's *Guidelines for the economic assessment of mining and coal seam gas proposals* (December 2015).
- The proposed changes to the SSD-5594 consent under the Modification are;
  - an increase in the workforce from the approved 310 full time equivalent (FTE), including contractors, to 450 FTE, including contractors;
  - an increase in run-of-mine (ROM) coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa (Schedule 2 Condition 6 of SSD 5594);
  - an increase in the ROM coal stockpile capacity at the pit-top from the approved 85,000 tonnes to 200,000 tonnes.
- The focus of the assessment is to compare the relative outcomes of continuing the Project under its current approvals and under those proposed for the Modification.
- The cost-benefit analysis (CBA) conducted indicates a marginal improvement in the estimated economic outcomes for the Modification. The principle source of this benefit is an increase in estimated royalty revenue of approximately $6 million. Overall, the Modification is estimated to increase economic benefit by approximately $14 million. The increases are largely a product of the accelerated mining program assumed for modelling, and the resultant earlier realisation of returns.
- A modest increase in GHG emissions relating to increased movements of mobile plant required to manage the enlarged stockpile is the major environmental/biophysical effect that may result from the Modification;
- Local Effects Analysis (LEA) indicates that there are potentially increases in positive socioeconomic effects in the regional and local economies. Localised environmental/biophysical, public infrastructure and amenity effects are similar to those for the Project as proposed, and thus have little cumulative impact.
- The Modification returns positive net present value (NPV) and benefit-cost ratio (BCR) returns across a range of modelled possible economic outcomes. As a result, the Modification is supportable on the basis of its likely positive economic contribution.

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ABBREVIATIONS

ABS:	Australian Bureau of Statistics
BAU:	Business as Usual
BCR:	Benefit-Cost Ratio
CO_2-e:	Carbon dioxide equivalent
CBA:	Cost-Benefit Analysis
Cth:	Commonwealth (with reference to legislation)
DPE:	Department of Planning and Environment (NSW)
EIS:	Environmental Impact Statement
EPA:	Environment Protection Authority
EVRI:	Environmental Valuation Reference Inventory
FTE:	Full Time Equivalent (employment)
GDE:	Groundwater Dependent Ecosystem
GHG:	Greenhouse Gas/es
GVA:	Gross Value Added
I/O:	Input/Output
LCC:	Lithgow City Council
LEA:	Local Effects Analysis
LGA:	Local Government Area
Mtpa:	Million tonnes per annum
NPV:	Net Present Value
$PM_{2.5}$:	Fine air pollutant particles, less than 2.5 micrometres in diameter
PV:	Present value
ROM:	Run of Mine ('raw' coal)
SEARs:	Secretary's Environmental Assessment Requirements
SEE:	Statement of Environmental Effects
SLA:	Statistical Local Area
SMEP:	Springvale Colliery Mine Extension Project
SSD:	State Significant Development
tpa:	Tonnes per Annum
WPI:	Wage Price Index (ABS)

1. ECONOMIC ANALYSIS & IMPACT ASSESSMENT: PURPOSE AND APPROACH

This Economic Assessment (EA) forms part of the *Statement of Environmental Effects* (SEE) relating to an application by Springvale Coal Pty Limited (Springvale Coal), operator of Springvale Mine, to modify the State Significant Development (SSD) 5594 consent for the Springvale Mine Extension Project (the Project), which was granted on 21 September 2015. The approval was granted under Section 89E of the Environmental Planning and Assessment Act 1979 (EP&A Act). SSD 5594 allows Springvale Mine to carry out mining operations until 31 December 2028.

The Project is a controlled action (EPBC 2013/6881) under the Environment Protection and Biodiversity Act 1999 [Cth] (EPBC Act). The approval under the EPBC Act was granted on 15 October 2015 and has effect until 8 October 2035.

The Project is located to the west of the Blue Mountains in the Western Coalfields of NSW, approximately 10 km northwest of Lithgow.

Secretary's Environmental Assessment Requirements (SEARs) have not been issued for this modification (the Modification) application. The Department of Planning and Environment (DPE) has advised by correspondence of 21 June 2016 that the following assessments be submitted in relation to the Modification:

- Air quality and greenhouse gas assessment;
- Traffic impact assessment;
- Social impact assessment;
- Economic impact assessment;
- Water resources assessment;
- Ecology (due diligence) assessment;
- Cultural heritage (due diligence) assessment.

This economic assessment has been prepared to comply to the greatest practicable extent with DPE's *Guidelines for the economic assessment of mining and coal seam gas proposals* (December 2015), taking into account that;

- As a modification, this project relates to only some elements for assessment contemplated by the Guidelines, as noted above;
- The approval process for the 'parent' SSD-5594 Project was only completed recently. As a result, much of the material presented during 2015 in relation to that process remains valid;
- The supporting Technical Notes for the Guidelines had not been issued at the time of preparation of this assessment.

Consistent with the DPE guidelines, the approach to this assessment is to estimate the direct economic benefits and costs of the Modification, as they relate to the State, regional and local communities, employing:

- A Cost-Benefit Analysis (CBA) to assess the impacts of the Modification at State (NSW) level;
- A Local Effects Analysis (LEA) to assess the localised impacts, particularly those relating to certain environmental, social and economic outcomes that are concentrated in the local and/or regional community.

This report addresses these requirements by providing a 'triple bottom line' reporting focus on the social, economic and environmental outcomes of the Modification, based on both quantitative and qualitative assessments of effects, largely based on the approved SSD-5594 Project.

2. PROJECT BACKGROUND AND JUSTIFICATION

2.1 Applicant

Springvale Coal is the applicant for the proposed Modification, and the manager of the Project on behalf of a joint venture comprising Centennial Springvale Pty Ltd and Springvale SK Kores Pty Ltd.

2.2 Mine consents and related information

As disclosed in Section 1, the Modification is sought to the State Significant Development (SSD) 5594 consent, granted on 21 September 2015 by the Planning Assessment Commission of NSW, as delegate of the Minister of Planning under delegation from the Minister dated 14 September 2011.

Furthermore, the Project is a controlled action (EPBC 2013/6881) under the *Environment Protection and Biodiversity Act 1999* (EPBC Act). The approval under the EPBC Act was granted on 15 October 2015 and has effect until 8 October 2035.

2.3 Description of proposed Modification

The Modification application has been prepared and is submitted under Section 96(2) of the EP&A Act to seek changes to the consent SSD 5594 to allow for:

- an increase in the workforce from the approved 310 full time equivalent (FTE), including contractors, to 450 FTE, including contractors;
- an increase in run-of-mine (ROM) coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa (Schedule 2 Condition 6 of SSD 5594);
- an increase in the ROM coal stockpile capacity at the pit-top from the approved 85,000 tonnes to 200,000 tonnes.

The intent of the Modification is to address the consequences of the SSD-5594 Project consent being delayed by 8 weeks (including the federal assessment process) during 2015, which resulted in suspension of mining at Springvale. Springvale Coal is therefore seeking to increase production output to make up shortfalls in revenue. This will result in increased output for the remainder of the 2016 calendar year. To adequately ensure further production efficiencies have been assessed, Springvale Coal has elected to apply to increase its approved production limit to 5.5 Mtpa. The effect of this is that the current approved timeframe for mining does not change, terminating in 2028. In the event that efficiencies are gained and markets are available to accommodate possible efficiency gains, the life of the mine in terms of its production stage may be reduced. Rehabilitation and monitoring works will continue for the duration of the approved consent period, subsequent to the cessation of production.

3. PROJECT ECONOMIC ANALYSIS – COST BENEFIT ANALYSIS

3.1 Focus of analysis

The CBA component of this analysis presents the State-level implications of the Modification. The LEA addresses the environmental and social impacts, along with key

economic aspects of the project that are largely concentrated in the Lithgow City Council (LCC) Local Government Area (LGA) community[1].

3.2 Discussion of approach to CBA

As may be expected, Springvale Coal has conducted comprehensive internal financial modelling of the Project and this Modification. The analyses reported in this assessment are based on the Project economics determined by Springvale Coal and Centennial Coal through this rigorous process. As was submitted in relation to the assessment of the Project, the financial appraisal process and its outputs are highly commercially sensitive. Furthermore, the output of this modelling is of no consequence to consideration of third-party or externalised effects of the Modification. As such, Springvale Coal maintains that this material is unsuitable for presentation in a document which is intended for public exhibition. The publication of such information has the potential to jeopardise commercial negotiations and outcomes in which Springvale Coal and Centennial Coal may be involved in at the time of publication of this information, particularly in respect of sales to domestic customers, most notably electricity generators. Publication of this information may also impact on relevant Centennial customers. This information is excluded from this economic impact assessment on that basis, but can be made available to the relevant authorities as required.

The economic aspects assessed in this report are those that allow the community to consider the Modification in the context of social, economic and biophysical factors that are relevant to them, as required under the EP&A Act. This approach is consistent with the aims of the 2015 guidelines, which state in part that, 'as for many environmental impacts and some social impacts, the aim is to value them as they would be valued in money terms by the individuals who experience them' (DPE 2015:3). This is also an important consideration in the context of the distribution and assessment of effects discussed in Section 3.4.2.

The main economic effect of the Modification will be the potential for change in timing associated with the increase in the maximum annual production rate proposed, particularly over the remainder of calendar 2016. As noted in the project description (Section 2.3), the Modification entails an increase of one million tonnes in maximum annual production rate, with the intention of redressing the impacts of production lost during the SSD-5594 assessment process, during which Springvale Mine was required to stand down the workforce and suspend production for 8 weeks during 2015.

In order to achieve the increase in production capacity, additional employment will be required, increasing by 140 FTE positions. From the perspective of economic practice, the effects of the additional employment are considered as limited in the broader sense, due to the assumed availability of alternative work for these employees. However, from a more practical perspective, as the majority of additional employees are expected to be resident in the region, which is consistent with all other Centennial operations in the area, these employees disburse part of their incomes in the local economy, thus supporting further economic activity and supporting local jobs in other sectors. Subsequent estimation of the benefits of the Modification will assess the scale of this beneficial stimulus.

[1] For the purposes of estimation however, the relevant community is the ABS Statistical Local Area (Level 3) [SLA3] of Lithgow-Mudgee as required under the DPE guidelines (2015).

3.3 Discussion of alternatives to the Modification

The project alternatives are limited to continuation of the Project under its present consent conditions, and approval of the Modification. In the first instance, as disclosed in Section 2.3, the increase in annual production capacity will allow Springvale Coal to redress production losses experienced during the approval process. Over the life of the Project, the Modification permits additional flexibility to allow Springvale Coal to respond to market conditions and opportunities. This outcome is potentially beneficial to the State, as the ability to increase production and sales in favourable market conditions would result in increased royalty and tax returns to NSW and Commonwealth Treasuries. This potential benefit must be balanced against the possibility that accelerated production may result in exhaustion of the resource during a period of market strength. However, as this necessarily involves any marginal reduction being incurred at a later time, the size of any such reduction is notionally mitigated by the lower relative value of the later returns.

For the purposes of establishing the economic effects of the proposed Modification, the revised assumptions in terms of production schedules for calendar 2016 and subsequent years are compared with the Project as approved, in order to determine the relative impacts. Sensitivity testing is also presented, which represents a key element of the relative value of the Modification. These comparisons are undertaken in the following sections.

3.4 Project-related economic evaluation – Cost-Benefit Analysis (CBA)

The cost-benefit analysis (CBA) data presented in this section are present values (PV) and net present values (NPV), at an assumed discount rate of 7 per cent, except as otherwise noted[2].

3.4.1 Estimation of economic benefit

The analysis assumes the current Project as approved under SSD-5594 as the base case (alternatively, business as usual or 'BAU' scenario), which would result if the Modification was not to proceed.

The key economic benefits that would accrue to the local and State communities, as distinct from the proponent corporation, on approval of the Modification are:

- An acceleration in payment of royalties and taxes accruing to NSW. As noted previously, on the basis of the time value of these economic flows, their notional value is likely to be increased by earlier delivery;
- The availability of an additional 140 FTE positions (direct and contract employees) at Springvale Colliery, with similar flow-on effects to those noted above.

The latter potential outcome needs to be balanced against the effects of a possible associated reduction in the duration of the productive life of the mine, which would result in earlier cessation of employment at the mine. It is emphasised that as all 450 positions (310 approved and 140 proposed) are FTE, there may in fact be more individual workers who benefit from employment at the mine, as some positions may involve alternative work patterns (e.g. part-time; casual), thus possibly requiring more than one individual to fill them.

Employment effects are the source of significant direct and derived economic benefits and also have positive social and welfare benefits for the local communities in which these employees reside and spend a considerable proportion of their incomes. The extent to

[2] The economic appraisal principles employed herein are consistent with relevant parts of NSW Treasury/Planning NSW Cost Benefit Analysis for mining and coal seam gas proposals (2012) and NSW Treasury TPP07-6 Economic Appraisal Principles and Procedures Simplified.

which these impacts influence the local economy can be inferred through a comparison of Australian Bureau of Statistics (ABS) Census employment data (2011). Mining accounted for 11.6 percent of employment in the Lithgow (LCC) LGA, compared with 0.6 percent for NSW and 0.4 percent for Australia. Published LCC material recognises the relatively large contribution mining and its employees make to the local economy. Section 4 elaborates on the regional perspective on these contributions. As is discussed in detail in Appendix 3, an estimate of the 'labour surplus' effect of employment at Springvale Colliery was determined by assuming the escalated median industry wage (ABS, 2014) as a reservation wage, and adopting the difference between this and the Springvale Colliery average wage.

Table 1 summarises the valuation of these benefits. The assumptions on which these assessments are based are:

- For the purposes of business case modelling for the Modification, mining is assumed as ceasing in 2024, rather than 2028 as is provided for in the SSD-5594 Project consent. As discussed in Section 3.3, the Project consent remains in place until 31 December 2028, allowing scope for change in production planning as required;
- In order to ensure comparability, the data for the Project application SSD-5594 have been revalued at the current price assumptions adopted by Centennial Coal for internal project analyses. Therefore, the assessments differ from those presented in the most recent economic assessment material prepared for the Project (2015);
- Tax effects are excluded from the analysis due to changes in the approach to assessment of various forms of tax, with particular emphasis on the requirements of the DPE guidelines (2015). Explanatory material is provided at Appendix 2.
- The assumptions supporting the assessment of employee benefit are detailed in Appendix 3.

Table 1: Estimate of economic benefit – Springvale Project SSD-5594 Consent Modification (1)

Economic Benefit	Estimation assumptions	Approved	Modification	+/- Impact of Modification
Springvale Colliery sustained and additional employment (proportional benefit to local/regional community).	Operations employment[3]: 310 FTE positions 2016-2028 as assessed in SSD-5594 consent application (2015). Operations employment 450 FTE positions 2016-2024 as per Modification.	Assessed NPV ≈$105 million.	Assessed NPV ≈$113 million.	**+ ≈ $8 million**
NSW Government royalties	Assessed NPV ≈$159 million.		Assessed NPV ≈$165 million	**+ ≈ $6 million**
State taxes (land tax); Local Government rates	Refer to Appendix 2 for detailed explanation of tax estimation assumptions	Assessed NPV ≈ $5.2 million	Assessed NPV ≈ $4.7 million	**- ≈ ($0.5 million)**
Total economic benefit [4]		**≈ $269.2 million**	**≈ $282.7 million**	**+≈ $13.5 million**

[3] Includes contractors, as noted in Section 3.4.1.

[4] These totals are rounded to $269 million and $283 million (differential $14 million) for the subsequent analyses.

The comparison indicates that the Modification would result in a net increase in economic benefit of $13.5 million. The effects are related to the altered timing of production, and the additional employees required to achieve the accelerated production rate.

3.4.2 Estimation of economic costs

As noted in Section 1, SEARs have not been issued for this Modification to the Project. However, the key methodological approach to this assessment is a comparison between the Project, as approved, and the Modification to the Project, as proposed. As the effects of the Modification will largely involve changes to the timing of costs and benefits induced by the increase in production rate, and subsequent possible reduction in mine life, the economic assessment of environmental effects must also be adjusted. This being the case, the assessment addresses changes to the following effects which were quantified in the Project EIS (Golder Associates, 2014):

- Subsidence;
- Land resources;
- Water resources;
- Biodiversity;
- Heritage;
- Air quality;
- Greenhouse gases (GHG);
- Noise;
- Traffic and transport;
- Visual;
- Social and economic; and
- Rehabilitation.

In lieu of specific SEARs for the Modification, by correspondence of 21 June 2016, DPE has advised that in addition to the economic impact analysis subject of this report, the following specific issues are to be addressed, as a consequence of their being affected by the increased intensity of mining proposed, particularly over balance of calendar 2016, and also by the increased area of the pit-top stockpile.

- Air quality and greenhouse gas assessment;
- Traffic impact assessment;
- Social impact assessment[5].
- Water resources assessment
- Ecology (due diligence) assessment
- Cultural heritage (due diligence) assessment

The two physical changes of significance, which are the focus of these specific requirements, are the increase in coal stockpile area, and increases in traffic movements and effects relating to the additional employees and contractors at the mine.

The stockpile will remain entirely on existing disturbed area at the Springvale pit-top. The principal source of greater impact from this modification is the likelihood of more plant movements required for managing the larger stockpile.

Increased traffic movements have the potential to affect existing road capacity and contribute to GHG and air quality effects. Such impacts are ordinarily factored into the

[5] DPE also required the Economic Impact Assessment that is presented in this document.

respective specialist assessment for these effects, and are included in the valuations for those.

Generally, the detailed qualitative descriptions of these aspects of the Project, as presented in the consent application for SSD-5594, remain largely valid for this application. A copy of the specialist consultants' commentaries and recommendations on effects for SSD-5594 is included in Appendix 1 for reference. That table also details prospective controls and mitigation commitments proposed by Springvale Coal for addressing these impacts. It is noted that these are consistent with those presented in relation to the SSD-5594 Project consent.

Updated assessments for the specific matters identified by the Applicant and confirmed by DPE for this application are examined in Table 8. In order to estimate the relative change in net cost or benefit from the proposed Modification, it is appropriate to provide a monetised estimate of these impacts where practicable. This is achieved using a 'benefits transfer' method based on specialist assessments of magnitude of impacts, and relevant valuation methodologies, which are detailed in Table 3.

In relation to these valuations, four key points must be observed:

- 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 Modification* 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 present Modification relates only to possible changes to the intensity of presently-approved mining at Springvale Colliery. 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.
- The distribution of these impacts varies across communities. For example, some impacts such as those on traffic and air quality will be mainly apparent to residents in the immediate vicinity of operations. Potential impacts on greenhouse gas emissions on the other hand may notionally be more widely distributed.
- There remains an unquantified element of social impact. This may be described as the 'intrinsic value'[6] of certain impacts or effects, as attributed by individual stakeholders. This aspect can be highly individualised and subjective and consequently may not be accurately quantified, as the estimation techniques applied, although based on valid methodologies, may not align with individual stakeholders' values.

To allow the most valid comparison between the approved Project and the proposed Modification, a number of assumptions were adopted that essentially result in a 'hybrid' valuation based on parts of the Project assessment (particularly those where the impacts chiefly result from adjustments to Project timing/delivery) and based also on methods drawn from DPE guidelines material (including detailed methodological material from the 2015 draft version), which are applicable to the current assessment. These are preferred to other methods on the basis of the relevant DPE Technical Notes being unavailable at the

[6] James Marshall & Co. (2014), Springvale Mine Extension Project Social Impact Assessment, James Marshall & Co, March 2014.

time of preparation of this report. Tables 2 and 3 provide explanatory material on the methods and assumptions adopted. It should be noted that, once again, in the interest of permitting more valid comparison, all effects are quantitatively valued, as was the case with the Project assessment. It is noted that DPE draft guidelines material (2015) has indicated that some of these values are more amenable to qualitative evaluation, which is furnished in Table 8.

Table 2: Description of assessment methods and assumptions

Assessment timeframes	Modification modelling assumes mining operations over 2016-2024. Project assumed operations 2015-2028. Both cases assume a 10-year decommissioning, rehabilitation and relinquishment program, post-mining (i.e. 2025 to 2034 inclusive for the Modification and 2029 – 2038 inclusive for the Project).
Physical area for assessment	The relevant locality is the Lithgow-Mudgee SA3 (Refer to Figure 1). Based on 2011 ABS Census data; Assumed number of residents is 43,919 (formerly 20,160 for Lithgow LGA); households, 21,001 (formerly 7,787). More localised impacts are assessed on the basis 2.4 persons per receptor household (SA3). This was formerly assessed as 2.3 (Lithgow LGA).
Benefits transfer values	Adjusted to account for inflation (2015 to 2016). Assumes escalation at 2.5% (mid-point of RBA/Treasury target range)[7]
Greenhouse gas (GHG) emissions	Project EA assumed Scope 1 emissions only. Modification EA assumes Scope 1 & 2 emissions in operations stage, and Scope 1 emissions only in rehabilitation stage (Scope 2 emissions relate to purchased electricity use, which would largely cease at the end of mining).
Biodiversity	Recalculated to account for SA3 requirement
Subsidence[8]	Combined estimate with soil and land use, and natural heritage, as impacts are related, recalculated based on SA3 requirement
Soil & Land Use	Combined estimate with subsidence and natural heritage, as impacts are related, recalculated based on SA3 requirement
Water	Surface water (quantitative) impact recalculated to account for SA3 requirement. Not applicable to groundwater (qualitative) impact.
Heritage (natural)	Combined estimate with subsidence and soil and land use, as impacts are related, recalculated based on SA3 requirement.
Heritage (archaeological)	Adjusted for SA3 population
Air	Unit damage cost and $PM_{2.5}$ adopted as index pollutant, as preferred in DPE draft guidelines (October 2015) – Refer Table 3.
Noise	Recalculated to account for SA3 requirement, however no material change.
Visual	Assessment method consistent with Project consent
Traffic	Effects captured in other assessments (air, GHG, noise). No additional impacts, as effects are addressed by agreed undertakings for Project consent.

[7] Previous assessments have utilised a 3% escalation (inflation) rate, which is the upper bound of the target range. CPI (All Groups) for the December Quarter was 1.7%. The mid-point is assumed as being more representative of likely change over the assessment period. All values have been adjusted accordingly.

[8] In its independent review of the economic assessment for the Springvale Mine Extension Project (2015), the Centre for International Economics (CIE) suggested that subsidence, soil and land use, and natural heritage may not be appropriate for individual, additive valuation. A review of these effects concurs with that analysis. As a result, these three classes of effects (which are largely related to subsidence as the most likely impact) are assessed as a group under 'subsidence'.

Table 3: Valuation methods –biophysical and social/infrastructure impacts

Description	Methodology/Source of Valuation mechanism	Valuation measure/unit[9]	Comment on application
Noise	Day B, Bateman I & Lake I (2010): "Estimating the Demand for Peace and Quiet Using Property Market Data" - Hedonic pricing (impact on dwelling values). EVRI reference number: 06153-105312	$97 - $204/dBA per annum (upper bound assumed for estimation)	Valuation as per SSD-5594 Project. Post-mining impact assessed for 4 years, covering decommissioning and rehabilitation activity.
Subsidence, soil and water	Streever WJ, Callaghan-Perry M, Searles A, Stevens T & Svoboda P (1998): "Public Attitudes and Values for Wetland Conservation in New South Wales, Australia" – simulated market price/WTP. EVRI reference number 02309-0732	$172/household per annum	Valuation criteria as per SSD-5594 Project. Post-mining impact assessed for 8 years, covering decommissioning and rehabilitation and monitoring and maintenance stages.
Traffic and transport	Evaluation included under other impact assessments (i.e. air, GHG, noise)	Not applicable	Air quality, noise and GHG emissions considered in relevant evaluations. Traffic volume impacts remain within existing road network capacity.
Air	DPE (2015a:97) citing PAE Holmes (2013), Methodology for valuing the health impacts of changes in particle emissions – final report. Prepared for NSW Environment Protection Authority (EPA).	$29,000 per tonne/$PM_{2.5}$ unit damage cost	No exceedances anticipated as a result of Modification. Level assumed as unchanged from Project AQIA, increase in valuation due to changes in timing of impacts. Post-mining impact assessed for 4 years, covering decommissioning and rehabilitation activity.

[9] All values adjusted by 2.5 per cent per annum to allow for inflation, with the exception of the unit damage cost metric assumed for air quality and GHG emissions cost as described.

Description	Methodology/Source of Valuation mechanism	Valuation measure/unit[10]	Comment on application
Greenhouse gas (GHG)	Australian Energy Market Operator; National Electricity Forecasting Report, June 2016. Proxy emissions abatement cost estimate (2020)[11] http://www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report	$25 per tonne/$CO_2$-e	Assumes incremental Scope 1 costs as assessed (+ 4,479 t CO_2-e in any one year [SLR 2016:60, Table 37]). No increase in Scope 2. Scope 3 excluded as per DPE draft guidelines[12] (2015(a):58-59). Fixed cost assumed as a consequence of uncertainty regarding future pricing mechanism/s. Effects valued to full 10-year post mining program, to allow for long-term impacts.
Heritage	1. Allen Consulting Group (2005): "Valuing the Priceless: The Value of Heritage Protection in Australia" – choice modelling/WTP 2. Streever WJ, Callaghan-Perry M, Searles A, Stevens T & Svoboda P: "Public Attitudes and Values for Wetland Conservation in New South Wales, Australia" – simulated market price/WTP. EVRI Reference Number: 06153-105312	$7.62 per capita p.a. for each 1,000 places protected	1. Assumes Census 2011 population count (Lithgow-Mudgee SA3) of 43,919, and 34 Aboriginal heritage sites [RPS 2014a, p.2]. $0.26 per capita. No additional impacts anticipated for surface works associated with stockpile extension (RPS 2016). 2. Assumes conservation value of surface features (cliffs and pagodas) and associated ecological communities and features. Calculated with subsidence, soil & land use. Effects valued to full 10-year post mining program, to allow for long-term impacts.

[10] All values adjusted by three per cent per annum to allow for inflation, with the exception of the unit damage cost metric assumed for air quality.

[11] Measure adopted from DPE draft guidelines (2015). Approximates previously adopted measure of $25/ tonne/$CO_2$-e (The Garnaut Review (2011:72) http://www.garnautreview.org.au/update-2011/garnaut-review-2011/garnaut-review-2011.pdf, Australian Government Treasury modelling estimate of $24.60/ tonne/$CO_2$-e (core scenario) (http://carbonpricemodelling.treasury.gov.au/content/chart_table_data/chapter5.asp and social cost of carbon (escalated by average exchange rate) of $25.10/ tonne/$CO_2$-e; https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf .

[12] At the time of preparation of this assessment 'Technical Notes' supporting the DPE guidelines had not been published. The material from the consultation draft is adopted here, as it is the most recent guidance proffered by DPE on GHG assessment.

Description	Methodology/Source of Valuation mechanism	Valuation measure/unit[13]	Comment on application
Biodiversity	Land & Water Australia (2005): *Making Economic Valuation Work for Diversity Conservation:* Australian Government Department of Environment & Heritage. Jakobsson K. & Dragun A. (2001) The worth of a possum: valuing species with the contingent valuation method. *Environmental and Resource Economics* 19, 211-227: - simulated market price/ WTP	$212/household per annum (preservation of 700 species –flora & fauna - VIC)	Implied cost of $0.30 per species. Applied to 4 EECs, 3 threatened flora and 17 threatened fauna identified on or likely to occur in relevant areas of SMEP Project Area which may be affected [RPS 2014(c) pp.iv-v], total $7.27 per household p.a. 21,001 households (Lithgow Mudgee SA3).Effects valued to full 10-year post mining program, to allow for long-term impacts. No additional impacts anticipated for surface works associated with stockpile extension (RPS 2015)
Visual	Curtis I.A. (2004): "Valuing Ecosystem Goods and Services: A New Approach Using a Surrogate Market and the Combination of Multiple Criteria Analysis and a Delphi Panel to Assign Weights to Attributes – actual market pricing. EVRI reference number: 06 - 3 -1365.	$1,137 - $1,446/Ha per annum (upper bound assumed for estimation)	Valuation criteria as per SSD-5594 Project. Post-mining impact assessed for 4 years, covering decommissioning and rehabilitation activity.

[13] All values adjusted by three per cent per annum to allow for inflation, with the exception of the unit damage cost metric assumed for air quality.

3.4.3 Physical area applied for quantitative estimation of impacts

As is required by the 2015 guidelines, certain impacts assessed in the CBA are necessarily considered in the context of NSW. Furthermore, for the purposes of assessment, the guidelines require the adoption of the relevant ABS Statistical Area Level 3 (SA3) as the locality in which the Project is located. In this instance, the relevant SA3 is Lithgow-Mudgee, which is depicted in Figure 1. Figure 2 shows the Lithgow LGA.

Figure 1: Lithgow-Mudgee SA3

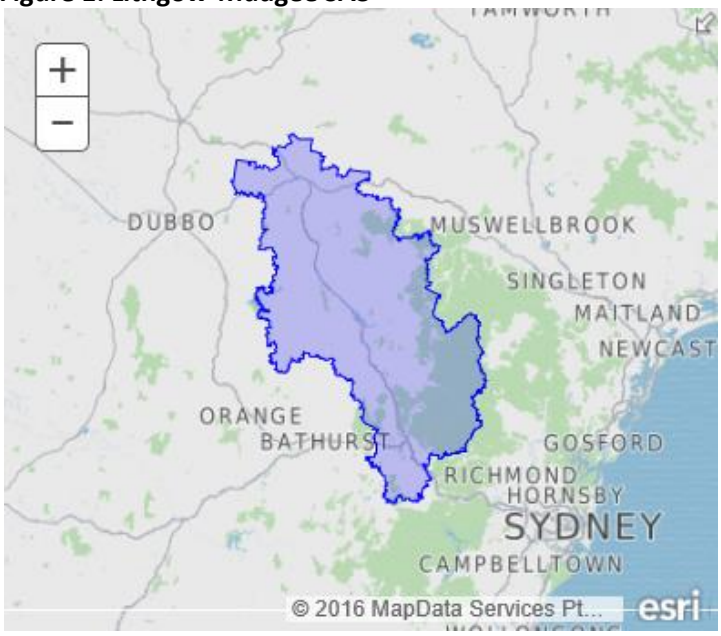

Figure 2: Lithgow LGA

Source: ABS Census Data 2016(b).

Figures 1 and 2 demonstrate that the effects likely to be generated by the Project and this Modification are likely to be of little practical relevance to a significant part of the SLA. The SLA3 has a land area of approximately 1.6 million hectares (Ha), and a population density of 2.8 persons/km^2 (2011 data; ABS 2016(d)). By comparison the population density of NSW at the same point was 9 persons/km^2. Lithgow LGA has a land area of approximately 451,000 Ha and a population density of 4.6 persons/km^2

The LEA guidelines (2015) also provide for the consideration of population groups in assessments, which are defined as '*for practical reasons of measurement and identification, the analysis should include local effects that accrue to those people ordinarily resident in the locality at the time of the proposal*' (2015:5). This definition indicates that certain impacts may be concentrated among much smaller population groups than, for example, the SLA3 or the LGA. For example, effects such as those on air quality are assessed as being limited to specific receptors such as certain residences in close proximity to operational sites as described in Table 3. These latter impacts remain part of the broader CBA, as they represent the affected part of the NSW community. The assessed impacts are detailed in Table 4.

Table 4: Comparison of Environmental effect assessments: Project with and without Modification

	SSD-5594 with Modification	**SSD-5594 as approved**	**Differential; Modification: Approved**
	PV @ 7%	**PV @ 7%**	**PV @ 7%**
GHG	$31,793,781	$37,774,740	($5,980,960)
Biodiversity	$1,893,059	$2,129,881	($236,822)
Subsidence; Soil & Land Use; Natural Heritage	$41,603,763	$47,709,488	($6,105,725)
Surface Water[14]	$41,603,763	$47,709,488	($6,105,725)
Heritage (Arch)	$141,585	$159,298	($17,712)
Air	$1,502,387	$1,141,866	$360,521
Noise	$1,052,799	$1,275,005	($222,206)
Visual	$157,321	$190,525	($33,204)
Traffic	-	-	-
Total PV	$119,748,458	$138,090,291	($18,341,833)
Total (rounded)	**$120 million**	**$138 million**	**- $18 million**

It is stated that a number of the estimates calculated may not be considered as meeting conventional assumptions of materiality. However, in the context that these estimates involve impacts on the various communities to which they are relevant, and may be subject of individuals' perceptions based on the intrinsic values described in the Social Impact Assessment for the Modification (Centennial Coal, 2016), they may be considered as material to those communities, and thus warrant inclusion in the assessment process. This approach is consistent with the DPE guidelines (2015), as previously noted.

The comparison of valuations reported in Table 4 recognises that there is a residual cost with respect to these impacts. This residual cost recognises that there is the risk of some impacts remaining despite avoidance, management and mitigation works and rehabilitation commitments. Furthermore, some effects such as air quality and noise are assumed as remaining to some extent during the decommissioning and rehabilitation process. In order

[14] Qualitative assessment of groundwater impacts (as indicated in DPE draft guidelines, October 2015) included in Table 8 of this report.

to allow for residual effects, the relevant impacts were calculated at full operational level for the post-mining periods described in Table 3.

3.4.4 Comparison of net economic benefit/cost

Table 5 compares the measures of net economic benefit of the Project, and the Modification, for the State and regional communities, based on the benefit and cost assessments detailed in Tables 3 and 4 for the two alternatives.

Table 5: Comparison of Project & Modification net benefit/cost

	SSD-5594 as approved	SSD-5594 with Modification	Differential (+/-), proposed to approved
Economic benefit (PV)	**$269 million**	**$283 million**	**$14 million**
Net economic cost (PV)	**$138 million**	**$120 million**	**($18 million)**
Net Present Value (NPV)	**$131 million**	**$163 million**	**$32 million**
Benefit-Cost Ratio (BCR)	**1.9**	**2.4**	**-**

The Modification will potentially result in an increase in net economic benefit of approximately $32 million when compared with the Project as approved. As has been previously stated, this is chiefly a function of the earlier realisation of Project effects, and the consequent valuation changes. Methodological changes (as detailed in Tables 2 and 3) also contribute to a higher BCR than was estimated for the Project.

As was the case with the assessment for the Project, the assumptions for the effects of the Modification are conservative. This is particularly relevant with respect to the valuation of environmental impacts, as the conservative approach equates to adopting upper-bound or 'worst-case' estimates based on the methods and data employed. Once again, this recognises the risk that effects may occur, but at unpredictable levels. In general terms however, it remains the case that the risk level would not materially increase as a result of the Modification.

3.5 Sensitivity analyses – alternative project options

Sensitivity analyses outcomes are presented in Tables 6 and 7. The testing is predicated on adjustments to interest rates and financial measures (such as royalties and costs). The nature of the Modification indicates that changes in project timing are also a potential cause of changes in project outcomes, which is in effect the data presented in these sensitivity tests. The Project SSD-5594 as approved represents the base case in these analyses.

Table 6: Sensitivity analysis – project options - adjusted discount rates (NPV)

Project option component	Discount Rate 4% $M	Discount Rate 7% $M	Discount Rate 10% $M
Approved Project net (unmitigated) environmental impact cost PV	179	138	110
Approved Project total State and community benefit PV	324	269	226
Approved Project NPV	145	131	116
Project with Proposed Modification net (unmitigated) environmental impact cost	149	**120**	99
Project with Proposed Modification total State and community benefit	324	**283**	249
Project with Modification NPV	175	**163**	150
Differential (NPV)	30	**32**	36

The NPV of the Project with the proposed Modification remains positive under these various discount rate assumptions. Furthermore, as discussed previously, the result is approximately $32 million more favourable in terms of the economic value of State returns and employee benefit. There may be any number of possible scenarios that vary from the forecast relativities between revenues and costs. The manipulation of the discount rate within NSW Treasury financial appraisal guidelines provides some indication of the range covered by such possible variances and the associated project risk.

A further means of testing the strength of the economic case for the proposal is to adjust certain economic performance assumptions. The test criteria are based on those prescribed in the DPE guidelines (2015:18), to the extent that these can be applied. In respect of the application of each of the recommended tests, the following comments are included to explain application:

- Royalties +/- 25%: - applied as suggested;
- Company income taxes +/- 50%: - company tax is not included in this assessment (refer Appendix 2);
- Environmental cost (high/low per workbooks): - workbooks had not been issued at the time of preparation of this assessment. High and low estimates from discount rate-based sensitivity testing were adopted as upper and lower bounds;
- Net public infrastructure cost +/- 25%: - no public infrastructure costs are associated with the proposed Modification.

It is noted that the guidelines also require that 'where practicable, sensitivity analysis should identify how much output prices would need to fall for a project to have a zero NPV and report on whether such a scenario is either likely or unlikely' (2015:18). Despite some limitations in practicality, a discussion of this requirement is included in Appendix 4. Based on the assumptions and limitations describe above, sensitivity testing outcomes are displayed in Table 7.

Table 7: Sensitivity analysis adjusted performance assumptions (NPV)[15]

Evaluation Element	Project as approved $M	Project with Modification $M
NPV as assessed	**131**	**163**
Royalties Δ 25%	170	204
Royalties - 25%	99	130
Environmental cost (maximum range)	89	134
Environmental cost (minimum range)	159	184

Sensitivity testing based on adjustments to discount rates and relevant performance indicators supports the conclusions in respect of the SSD-5594 Project. The changes to methodological assumptions for this Modification result in a lower yet still positive NPV and BCR. Furthermore, the present analyses demonstrate that the proposed Modification is likely to marginally increase the economic outcomes, particularly from the perspective of royalty returns to the State. Although this analysis examines a limited range of feasible outcomes from among a much broader range of potentialities, the social and economic outcomes are likely to be positive in most foreseeable eventualities.

4. LOCAL EFFECTS ANALYSIS (LEA)

4.1 Approach

As is the case with the CBA component of this assessment, the effects analysed in the LEA compared to the Project case are affected by the altered timeframe for delivery of the Project, with the methodological changes detailed in Table 2.

4.2 Regional context

Centennial's operations in the Lithgow and adjacent Mid-Western Regional Council LGAs are significant contributors to these regional economies, and those of contiguous LGAs, such as Bathurst and the Blue Mountains. For the purposes of analysis, the DPE guidelines require consideration of the impacts at the ABS SLA3 level. This was discussed in some detail in Section 3.4.3. It is noted however that some impacts require consideration at much more localised level. Such an approach was taken where appropriate, as detailed in Table 3.

4.3 Discussion of localised environmental impacts

Tables 4 and 5 compared the costs of the environmental impacts of the Project with those for the proposed Modification. The quantified assessments of these impacts form part of the overall CBA for the project. Importantly, however, many of these environmental impacts will principally affect the regional and/or local communities, as distinct from broader, less contiguous community groups, such as those resident in other parts of NSW. This is emphasised by the specific matters identified by DPE to be addressed in the SEE for this Modification; in particular, air quality and traffic impacts, along with social impacts, are likely to be focused on local and regional communities, warranting the particular attention

[15] At 7% discount rate.

afforded them. Recognition of these effects emphasises both financial and experienced materiality in dealing with these impacts, in order to appropriately address stakeholder interests. The specialist consultants' assessments of the specific environmental effects to be considered in relation to the current Modification are detailed in Table 8.

Table 8: Qualitative assessment of specific environmental & social/infrastructure effects

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Traffic **Consultant: ARC Traffic + Transport**	1. The Castlereagh Highway/ Springvale Access Road intersection will continue to operate at a good LoS[16] during each of the Springvale shift arrival and departure peak periods further to the Modification, with very moderate delays and significant available capacity. 2. The available capacity within the Pit-top staff car parks will continue to accommodate peak staff parking demands further to the Modification.	**Prospective controls/ mitigation Measures:** The assessment (ARC Traffic + Transport (2016) has determined that an upgrade of the intersection of Castlereagh Highway & Springvale Access Road to provide a CHR is currently required with reference to Condition 21 of the SSD 5594 approval, and further would be required with reference to GRD4A warrants. Springvale Coal has committed to the upgrade of the intersection.
Groundwater **Consultant: Jacobs Australia**	Negligible changes due to the Modification are predicted in respect of land use (Table 5.5), GDEs impacts, (Table 5.6), groundwater users (Table 5.7) and surface water/groundwater interaction (Table 5.8) (Jacobs 2016[a]:41-44).	Relevant provisions of SSD-5594 Water Management Plan and monitoring network detailed in Sections 6.2 and 6.3, Groundwater Assessment (Jacobs, 2016[a]:49-50).
Surface water **Consultant: Jacobs Australia**	Modelling presented in the Groundwater Assessment (Jacobs 2016[a] indicates the increase in mining rate does not lead to a significant difference in inflow to underground operations compared to that presented in the EIS (SSD-5594). Given that inflows to underground operations dominate the site water balance, there is accordingly no change to mine water discharge predicted to Sawyers Swamp Creek associated with the Modification (Jacobs 2016[b]:1) Impacts on surface water users (Coxs River and Wolgan River) negligible in respect of water flow, level and quality (Jacobs 2016[b]:39, Table 5.2).	Relevant provisions of SSD-5594 Water Management Plan and monitoring network detailed in Sections 6.2 and 6.3, Surface Water Assessment (Jacobs, 2016[b]:47).

[16] Levels of service

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Air **Consultant: SLR Consulting Australia**	No ambient background monitoring data for $PM_{2.5}$ are available in the local area or at nearest OEH monitoring sites. Therefore, a background $PM_{2.5}$ data set cannot be used within this assessment and comparison of the incremental concentrations to the criteria has been performed. The increase in 24-hour average and annual average $PM_{2.5}$ concentrations predicted as a result of the proposed MOD 1 operations are minor and are unlikely to cause any exceedances of the relevant NEPM criteria at any surrounding sensitive receptor locations.	**Mitigation Measures:** 1. Regular maintenance of plant and equipment to minimise fuel consumption. 2. Consideration of energy efficiency in plant and equipment selection/phase. 3. Switching to biodiesel fuel if considered feasible following investigation.
GHG **Consultant: SLR Consulting Australia**	The Modification is estimated to result in an increase in direct (Scope 1) GHG emissions of 4,479 t CO_2-e per annum, which represents an increase of 3.7% on current approved operations. It is noted that no net increase in coal seam methane generation is anticipated as a result of the proposed Project. Indirect (Scope 2) GHG emissions are not expected to change as a result of the Modification. Incremental direct (Scope 1) emissions from the Modification (4,479 tCO_2-e) are estimated as 0.0032% of NSW GHG emissions when compared to the latest available Scope 1 emissions data (2013) and 0.0008% of Australian GHG emissions.	**Mitigation measures:** Refer to Section 8.6, Air Quality and GHG Assessment (SLR 2016:62)

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Aboriginal heritage due diligence survey **Consultant:** **RPS Australia East Pty Ltd**	The Project Area was highly disturbed given its close proximity to active mine operations and the existing stockpile. Disturbance in the form of past tree clearance and further modification of the site with current operational activities was observed. The exposed clearings were targeted during the visual inspection, but no artefacts were observed. No artefacts were located in the survey unit, and the probability of Aboriginal sites located in situ is deemed highly improbable due to current land use practices in the area.	**Mitigation measures:** Refer to recommendations in Due Diligence survey report (p.5).
Biodiversity/ecology due diligence survey **Consultant:**	The site was found to be highly modified and devoid of any significant ecological attributes. A due diligence ecological survey of the area proposed for coal stockpile expansion at Springvale Colliery determined that no native vegetation communities were present, and no threatened flora or fauna species were identified. No important habitat features were identified. As a result, an impact assessment under either the TSC Act or EPBC Act is not considered necessary.	**Prospective controls/mitigation measures** The following recommendations have been outlined to limit potential impacts of the proposed clearing works upon surrounding ecological communities and associated flora and fauna species: • Areas of vegetation removal should be clearly demarcated to ensure clearing works are limited to areas within the site; • Appropriate sedimentation and erosion barriers should be installed along the interface between the site and surrounds to prevent indirect impacts to adjacent areas; and • Wash-down procedures should be employed for all equipment used during clearing operations to prevent the spread of weed species into surrounding vegetation.

4.4 Discussion of regional economic effects

A number of the economic impacts assessed in the CBA are also differentially distributed across local/regional and broader communities. The impacts of royalties and taxes are broadly distributed across the State, whereas the direct and indirect effects of wages earned by workers in a specific region may be more concentrated in that region. The following discussion provides evidence supporting a conclusion that the effects of the continuing operation of Springvale Colliery are significant in the regional context.

Information on the significant economic and social contribution of the mining sector to Lithgow and surrounding regions was presented in the economic assessment for SSD-5594. This was particularly evident in material contained in the LCC Economic Development Strategy (2010). Clearly, the current application largely preserves those beneficial impacts and to some extent may be expected to distribute them more broadly, as more employee households will benefit from the additional positions to be made available. However, it must be recognised that if the Modification did not proceed, employment would remain at the currently approved 310 FTE, for the longer life of mine period.

It is likely that some reasonable proportion of the additional employees will reside in the region. This would be consistent with current employees, the majority of whom reside in the Lithgow LGA (James Marshall & Co. 2013). Survey-based research found:

- Nearly 76% of employees live in the Lithgow Local Government Area and nearly 80% of these employees live in the major townships of Lithgow, Wallerawang and Portland.
- On average, each employee surveyed spends around 33 per cent of their weekly income with businesses located in their local community.

Further analysis of the survey data demonstrated that all employees were resident in NSW. This survey output provides some evidence on the extent of the 'pay packet effect' in relation to Springvale Colliery employees. These data indicate the importance of the mine's operations to the economy and the social fabric of the region.

With respect to the employment of contractors, analysis of Springvale Coal's internal data on contractor engagement indicates that on the basis of labour hours, 77% related to works carried out by locally based businesses, with local labour forces (Aigis Group 2016).

4.4.1 Community consultation

Due to the extent of its operations in the Lithgow Region, Centennial Coal has a continuing community engagement program in operation. This program entails consultation with the broader stakeholder community, which includes the company's workforce, the resident regional community, business networks and representative groups such as the business chamber, economic development committee and various levels of government. Focused consultation is also undertaken with individuals and households which may be specifically affected by Centennial operations. This permits continuous monitoring of operational effects, and community attitudes to those effects and operations more generally. With respect to the SSD-5594 Project, Centennial Coal undertook community consultations in 2012 in relation to a range of projects (Lidsdale Siding Upgrade Project, Western Coal Services Project, Springvale Colliery and Angus Place Colliery developments). Issues raised by the community in relation to the wider regional developments include:

- general visual impacts, particularly from open cut mining;
- intensification of mining activities; and

- the recognition of impacts from sources other than Centennial such as other mining operations and the two power stations[17].

Community information sessions to update on progress for the Angus Place and Springvale Mine Extension Projects and Lidsdale Siding Upgrade Project were undertaken in March 2013. Of particular interest was mining activity and its effects on the Newnes Plateau, in respect of which the following points were raised:

- Sensitive ecology;
- Structural geology of the Newnes Plateau;
- Maintaining the 'environmental architecture'.

These matters are addressed in the relevant specialist reports comprising parts of the Project EIS. They are also quantified in the relevant sections of this report. Specialist analysis of the differential effects of the Modification indicate that any material increase in the risk of such effects is unlikely.

The consultation process also resulted in the following observations:

- There is a strong connection to mining in areas such as Lithgow, Wallerawang and Portland however this connection is not shared across the entire LGA. There has been an increasing population in rural areas and the connections that many of these landholders have to the LGA are its natural assets.
- Despite the connection to power and mining, residents do not want to be adversely impacted upon by industry when they are not at work.
- Identified benefits arising from mining such as construction of additional infrastructure, maintenance of existing, and creation of additional jobs etc. do not always outweigh the impact on community amenity even if the industry (e.g. mine) operates within approved limits.

These findings remain relevant to the present Modification proposal, and emphasise an important issue. Notwithstanding attempts to quantify environmental and economic effects from the perspective of their impact on the relevant communities, there remains an 'intrinsic value' component[18]. This element of social value relates to individual value judgements on impacts. It is subjective and cannot be accurately quantified, but must be recognised as an aspect of social impact.

4.4.2 Social impacts

Springvale Coal has commissioned a detailed, systematic assessment of the likely social impacts of the Modification, which is presented in the Social Impact Assessment (Centennial Coal, 2016) supporting the SEE. This comprehensive assessment specifically addresses the effects of the Modification on the following aspects of social and socioeconomic factors in the local and regional community:

- Population;
- Economic effects;
- Employment;
- Housing;
- Community infrastructure;
- Community support services;
- Service demand;

[17] Wallerawang Power Station has subsequently ceased operating.
[18] James Marshall & Co. (2013)

- Conflict;
- Community identity; and
- Cultural identity.

The assessment in respect of each of these factors is that the Modification will have no additional impact, or a very minor impact if at all on available capacity of social infrastructure and services. Collectively, the assessment indicates a little additional socioeconomic impact on the local and regional communities as compared to the currently approved SSD-5594 Project.

4.5 Extended economic impacts

An estimate of the extended economic impacts associated with the parent Project, and by association the differential benefits of the Modification, can be derived using input-output (I/O) multipliers. The methodology is a commonly-used approach to providing an approximation of the economic effects of one industry's activities across the rest of the economy[19]. There are certain limitations to the application of I/O multipliers. These are also acknowledged by ABS[20]. The practical effect of these limitations is that the output of multiplier analysis can only be considered as *indicative* of outcomes that may result from economic stimuli.

The NSW Department of Trade, Investment, Regional Infrastructure and Services (Division of Resources and Energy) [21] identified output and employment multipliers for mining and related services. While acknowledging the aforementioned limitations on multiplier analysis, the application of the relevant NSW Government Department's declared multipliers adds validity to the analysis. The relevant multipliers are displayed in Table 9.

Table 9: Type 2A Multipliers – 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

The relatively large GVA multiplier in this instance demonstrates the importance of incomes generated by the relevant project. It should be noted that GVA comprises all components of income to labour, plus the gross operating surplus of the corporate entity. Due to the foreign ownership of Centennial, the latter will accrue beyond NSW; however, the former would be concentrated in the State and the immediate region.

As the stimulus to the economy is equivalent to the additional activity and output associated with both construction and operational phases of the project, the net benefit of the Modification would result in extended economic effects of approximately 2.1 to 4.4 times

[19] A detailed discussion on interpretation and limitations of multiplier analysis is included in ABS Cat No 5246.0; *Information Paper Australian National Accounts Introduction to Input-Output Multipliers*;
[20] For example, ABS Cat No 1301.0, *Year Book Australia, 2002*
[21] *The Contribution of Primary Industries to the NSW Economy, Key Data 2012*: <http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0010/427645/Contribution-of-primary-industries-key-data-2012.pdf >

the initial stimulus, dependent on the economic measure being considered. Employment of the magnitude of approximately 2.7 to 4 times the economic stimulus would result. These indirect positions represent employment supported in the broader economy as a result of the demand for additional goods and services related to the Modification.

An alternative assessment of likely multipliers from within Government (Treasury)[22] is that mining-related multiplier effects are likely to be in the range of 1.1 to 1.4 times the initial stimulus. However, economic modelling conducted for the neighbouring Mid-Western Regional Council (MWRC) LGA (2005) assessed multipliers for mining in that comparable regional economy as being in the range of 2.75 (output) to 4.41 (GVA) and an employment multiplier of 6.45 times. The MWRC multipliers may be considered as providing an indication of the importance of such a major industry as mining in a relatively small regional economy.

In any event, the application of these multipliers supports an assumption that there are positive extended benefits to be expected from the operation of Springvale Colliery. As has been established, should the Modification be approved, there would be a nominal marginal increase in these effects, chiefly as a consequence of production being brought forward, thus reducing the effects of discounting, particularly in respect of the larger components of economic benefit such as royalties.

4.6 Ecologically sustainable development reporting: quantitative and qualitative assessment of social, economic and environmental impacts

The legislation governing this proposed Modification requires consideration of the principles of ecologically sustainable development in the design and implementation of such a project (refer to Section 1). This report adopts a 'triple bottom line' approach to assessing and reporting these impacts. The approach is intended to provide an integrated assessment of the social, economic and environmental impacts of the Modification, with the interdependencies between each of these aspects taken into consideration. The output of this approach is included in Table 8. Equivalent information for the overall Project is included at Appendix 1 for reference.

4.7 Summary

From the operational perspective, the changes to economic outcomes at Springvale Colliery that the Modification would stimulate relate to changes in production schedule assumptions and the timing of realisation of economic benefits. The analysis in this economic assessment suggests that the Modification would potentially have a positive effect on the quantum of economic benefits accruing to NSW.

5. ADDITIONAL REQUIREMENTS

5.1 Cumulative impacts

There will be no additional cumulative impacts associated with the Modification. The risk of cumulative impacts remains the same as assessed for the SSD-5594 Project.

5.2 Intra-generational and intergenerational equity

The Project has direct implications for both intra-generational and intergenerational equity. With respect to the intra-generational benefits, those individuals and households benefitting

[22] Verbal advice provided by Treasury representatives January 2015.

from direct and indirect effects of Springvale Colliery's operations will continue to do so during the Project life. This benefit may be more broadly distributed across a greater number of households if the Modification is approved. The broader derived benefits are discussed in preceding sections.

There may be marginal impacts on the extent of intergenerational equity. The greater number of beneficiary households may be offset by the reduction in the duration of positive impacts occasioned by any reduction in mine life associated with the potential for accelerated extraction of the resource. However, these effects may offset each other to some extent.

The intra- and intergenerational impacts of the proposal in terms of environmental risks will be actively mitigated by Springvale Coal to the greatest practicable extent. As is identified in the assessment of these non-financial impacts, Springvale Coal continues to work on ongoing improvement of policies and procedures in order to ensure that management of impacts takes into account the most current, effective technologies and practices.

As is the case with the economic benefits of the Modification, changes in environmental and social impacts are likely to be a function of any change in the timing of the mining program. For example, an accelerated mining schedule may reduce mine life, possibly resulting in earlier cessation of operations-related impacts (e.g. noise, air quality, GHG). However, this may notionally be offset by the possibility of marginally increased effects during the more concentrated mining operations.

6. CONCLUSION

The Modification is proposed to initially address the impacts on Springvale Colliery of losses in production necessitated by the SSD-5594 Project approval process. It will also improve the operational flexibility and responsiveness of Springvale Coal to respond to market opportunities that may present themselves. This flexibility has potentially positive implications for the State, as the ability to increase production in favourable markets would result in increased royalty returns to NSW in particular. In overall terms, any marginal impact is likely to be positive, as it will entail earlier realisation of the net economic benefits.

In terms of social and economic impacts, any changes are also assessed as being marginal in scale, and as noted in Section 5.2, likely to be associated with changes in the mining program. The key social effect is the potential change in the distribution and duration of employment-related benefit consequent to the Modification.

The Project, SSD-5594 received its required approvals in September and October 2015, at which point the grant of consent recognises the positive contribution of the Project. Any effect of the Modification is likely to be a marginal increase in benefit of the Project, thus maintaining its suitability for approval.

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[23] In the interests of brevity, the extensive list of references in respect of specialist environmental assessments, valuation method sources, etc. Have been withheld from this report. These can be reviewed in the EIA prepared for the SSD5594 consent application (as referenced): https://majorprojects.affinitylive.com/public/5beaa425962ff192898e5f3381e84882/31.%20Springvale%20MEP_EIS%20Appendix%20O%20Economic%20Assessment.pdf

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Appendix 1: SSD-5594 Springvale Mine Extension Project Economic Impact Assessment – Summary Table

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Springvale Colliery supporting Infrastructure construction and commissioning **Consultant: Aigis Group**	The project will result in an overall positive economic contribution at a State, regional and also to the local community level.	Nil required. Local contractors tendering will have the opportunity to identify themselves as being locally based
Springvale Colliery extended operations **Consultant: Aigis Group**	The project will result in an overall positive economic contribution at a State, regional and also to the local community level.	Nil required
Subsidence **Consultant: MSEC**	Assessments indicate that the levels of impact on the natural and built features can be managed by the preparation and implementation of the appropriate management strategies.	**Prospective Controls:** 1. Mine plan designed to reduce likelihood of impacts on significant surface features (pagodas and cliffs and associated ecological environs and biodiversity). **Mitigation Measures:** Possible remediation activities: 1. Infilling of surface cracks with soil or other suitable materials. 2. Locally regrading and recompacting the surface. 3.Erosion protection, such as planting of additional vegetation.
Land use, soil & agriculture **Consultant: SLR Consulting Australia**	No biophysical strategic agricultural land is present within the Project Application Area; however, according to the site specific assessment Soil Type 3b (24 hectares) is potential BSAL. The post-disturbance Land and Soil Capability classes and Agricultural Suitability classes determined for the Project Application Area are the same as the pre-disturbance classes. Due to the nature of the Project, the only surface impacts likely to impact on the classification of land resources are primarily associated with subsidence. The impacts of the proposed Project on soil resources within the PAA are expected to be negligible.	**Prospective Controls:** Mine and infrastructure designed to minimise land and soil disturbance. **Mitigation Measures:** 1. Refer to Sections 5.1.3 and 5.1.4 of SMEP Soil and Land Capability Assessment. 2. Progressive rehabilitation of relevant sites.

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Water Resources **Consultant: RPS**	**1.Groundwater:** No detrimental impacts are anticipated on any other groundwater users in the area. No deterioration of quality of groundwater inflows have been observed due to current mining operations, and consequently none are predicted due to the proposed development. No detrimental impacts to groundwater quality are expected within the shallow groundwater aquifer or within swamps. **2. Surface water:** The proposed extension includes minor new and /or upgraded infrastructure, which construction and operation is not expected to impact on surface water across the region. Impacts on the surface water features at the Newnes Plateau are either localised and contained, or introduce little change to the current surface water environment, which is considered healthy and undisturbed. Increase of the discharge volumes of mine water make at LDP0001 will not have a considerable effect on existing flow regimes nor on water quality.	**Prospective Controls** **Groundwater:** Refer to SECTION 9.1, SMEP GROUNDWATER IMPACT ASSESSMENT **Surface water:** Refer to TABLE 9.1 SMEP - SURFACE WATER IMPACT ASSESSMENT **Mitigation Measures** **Groundwater**: Refer to SECTION 9.1, SMEP GROUNDWATER IMPACT ASSESSMENT **Surface water:** Refer to TABLE 9.1 SMEP - SURFACE WATER IMPACT ASSESSMENT

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Biodiversity **Consultant: RPS**	The project is unlikely to have a significant impact on threatened species or EECs as a result of proposed longwall mining. The Project will remove approximately 11.44 ha of woodland vegetation, which is potential habitat for a number of threatened fauna species. The location of the proposed clearing footprint incorporated significant avoidance measures, including the use of existing tracks and design modification to avoid threatened flora and EECs. Several mitigation measures will be employed to ameliorate those unavoidable impacts that would result from clearing.	**Prospective controls:** 1. Mine plan designed to reduce likelihood of impacts on significant surface features (swamps, pagodas and cliffs and associated ecological environs and biodiversity). Land clearing for works and infrastructure limited to 11.44 ha, ≈ 0.2% of the total project area[24]. Refer to Section 5.1, SMEP FLORA AND FAUNA ASSESSMENT REPORT **Mitigation Measures:** Refer to Section 5.1, SMEP FLORA AND FAUNA ASSESSMENT REPORT **Provision for remediation of swamps - $750K per swamp as required.** **Provision for restoration of swamps - $1 million per swamp as required.** **Biodiversity offset (refer to Appendix 2)**
Air **Consultant: SLR Consulting Australia**	The predicted results showed that the proposed SMEP is unlikely to cause any exceedances of the relevant ambient air quality criteria for TSP, PM10 and PM2.5 concentrations or dust deposition at any identified surrounding sensitive receptors when considering Project construction, operation and site rehabilitation.	**Prospective Controls:** Minimisation of exposed areas. Dust containment fixtures fitted to fixed plant and equipment (e.g. conveyors). **Mitigation Measures:** 1. Water spraying 2. Ceasing work during adverse weather conditions
GHG **Consultant: SLR Consulting Australia**	Total lifetime direct (Scope 1) emissions from the Project are estimated to be approximately 26,720 t CO_2-e in any one year. Comparison of Project emissions totals indicates that the SMEP is likely to represent approximately 0.02% of NSW GHG emissions when compared to the latest available emissions data (2010) Scope 1) and 0.005% of Australian GHG emissions (Scope 1).	**Prospective Controls:** 1. Cost effective measures to improve energy efficiency 2. Regular maintenance of plant and equipment to minimise fuel consumption 3. Consideration of energy efficiency in plant and equipment selection phase

[24] 5,811 Ha.

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Heritage **Consultant: RPS**	ARCHAEOLOGICAL 1. A search of the (AHIMS) identified a total of 49 registered sites within the boundary of the Project Application Area.14 were within the four study areas which encompassed proposed disturbance by both surface works and mining subsidence. 2. Of the 14 sites, it was considered that three were at potential risk of harm from mine subsidence and no sites will be affected by proposed surface works 3. Likelihood of significant impacts on site #45-1-0084 and site 45-1-2756 (duplicate 45-1-2757) is relatively low (MSEC 2013: 93-94. Site #45-1-0137 is predicted to experience very low level subsidence, which is highly unlikely to result in any harm to the shelter. NATURAL[25] 1. Whilst the cliffs and pagoda complexes could experience low levels of subsidence, they are not expected to experience any significant conventional tilts, curvatures or strains. These features are located along the valley sides and, therefore, are not expected to experience the valley related upsidence or compressive strains due to valley closure. 2. It is unlikely, therefore, that the cliffs and pagoda complexes would experience any adverse impacts resulting from the extraction of the proposed longwalls. 3.Whilst some cracking could occur in the swamps resulting from the extraction of the proposed longwalls, the previous experience of mining beneath swamps at Angus Place and Springvale and in the Southern Coalfield indicate that the likelihoods and extents of these impacts are small.	**Prospective Controls** 1. Refer to Section 9.3, Cultural Heritage Impact Assessment Lithgow Local Government Area 2. Mine plan designed to reduce likelihood of impacts on significant surface features (pagodas and cliffs and associated ecological environs). **Mitigation Measures** Refer to Section 9.3, Cultural Heritage Impact Assessment Lithgow Local Government Area Biodiversity offset (refer to Appendix 2)

[25] MSEC (2013)

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Noise **Consultant:** **SLR Consulting Australia**	Noise modelling has indicated that noise emissions associated with the SMEP are predicted to exceed the PSNLs by up to 4dBA during the night-time period under adverse meteorological conditions. Pit-top noise reduction strategies initiated, therefore no exceedances of project specific noise limits. Noise modelling has indicated that construction noise impacts associated with the proposed new infrastructure will be negligible at the nearest noise sensitive receivers. Traffic generated by the construction and operation of the SMEP is predicted to be within the NSW Road Noise Policy (RNP) criteria at all receiver locations. Vibration levels from the construction and operation of the SMEP is predicted to be negligible and significantly below levels of human perception at the nearest residential receivers.	**Prospective Controls:** Noise containment fixtures fitted to fixed plant and equipment (conveyors etc.) Train workers to use equipment in ways to minimise noise; ➢ operate the mobile plant in a quiet, efficient manner; ➢ switch off vehicles and plant equipment when not in use; ➢ keep plant and equipment well maintained including regular inspections and maintenance of equipment ➢ to ensure it is in good working order, and equipment not to be operated until it is maintained or repaired; and ➢ for equipment with enclosures, ensure door and seals are well maintained and kept closed.
Traffic and transport **Consultant: ARC Traffic + Transport**	With the application of consultant's recommendations, the Project is supportable from an access and traffic perspective. The Project will not alter the characteristics of the existing Pit-top traffic generation. No additional traffic would be generated by the Project to the local and sub-regional traffic network which provides access to the Pit-top via the intersection of Castlereagh Highway & Mine Access Road. The traffic generated by the construction and operation of the Newnes State Forest (NSF) Project Sites would not significantly impact the operation of the NSF road network or the NSF access intersections at Clarence and north Lithgow.	**Prospective Controls:** 1. Preparation and implementation of Construction and Operational Traffic Management Plans with FCNSW and LCC. 2. All heavy vehicle trips to/from NSF Project Sites be undertaken in daylight hours (6am to 6pm). 3. Regular maintenance of overland conveyor system such that the potential for contingency coal road transport to be required is minimal. 4. Agreement with FCNSW to limit new access tracks and adjacent infrastructure corridors to 5m + 5m **Mitigation Measures:** 1. Each infrastructure corridor to be remediated after installation (all supporting infrastructure installed underground). 2. The right turn treatment Castlereagh Highway to Mine Access Road be upgraded from the existing auxiliary right treatment to a channelised right treatment.

Impact	Environmental Assessment Commentary	Description of Environmental Controls & Mitigation Measures
Visual **Consultant: Golder Associates**	**Pit-top:** As the Project involves no changes at the pit-top, the views from identified receptors and any other fixed or transient viewpoints will remain unchanged. Residents will continue to see parts of the pit-top during day and night. However, there will be no additional visual impact to the existing operations. Following cessation of mining at Springvale, the pit-top will be dismantled and the site rehabilitated to a mixture of grassland and woodland interspersed with water management structures. Following rehabilitation, the view from the Springvale Lane receptors will revert back to a more natural view. **Newnes Plateau:** (Two new dewatering boreholes) are at the end of minor, terminating 4wd tracks and will be decommissioned on completion of mining, with the facilities dismantled and sites rehabilitated to native woodland. The long term visual effect following successful rehabilitation is negligible. Mine services borehole compound (clearing and installed plant) will be noticeable from Glowworm Tunnel Road. On cessation of mining, the mine services compound will be dismantled and rehabilitated to native woodland, providing a negligible long-term visual impact.	**Prospective Controls:** Project design: 1. Elevated conveyors at the pit-top have been clad in neutral coloured steel sheeting. 2. Lights at the pit-top have been designed and installed to minimise light spill and direct shining towards receptors. 3. Newnes Plateau pipelines and power lines will be buried and the clearing corridor promptly revegetated **Mitigation Measures:** 1. Pit-top rehabilitation plan provides for revegetation with native woodland and grasslands. 2. Newnes Plateau infrastructure will be progressively dismantled and rehabilitated to an appropriate land use as identified with the rehabilitation technical report.
Rehabilitation & decommissioning **Consultant: SLR Consulting Australia**	Rehabilitation activities will be undertaken both progressively and at the end of the mine life (LOM). Partial rehabilitation of the disturbed areas following construction of the proposed infrastructure on Newnes Plateau (Bores 9 & 10, dewatering facilities). LOM rehabilitation to include rehabilitation of all infrastructure areas and the pit-top and on Newnes Plateau.	**Prospective Controls:** Mining closure plan to be established and implemented - 5 years to + 10 years of mine closure **Mitigation Measures:** All rehabilitation activities are considered as part of mitigation commitments.

APPENDIX 2: TREATMENT OF ECONOMIC EFFECTS OF TAXATION COMPONENTS

As discussed in Section 3.4 and Table 1, a comparative assessment of the economic contribution of various Federal, State and Local government taxes, rates and charges is excluded from this analysis. The reasons for this approach essentially relate to changes in methodological assumptions, some of which are necessitated by clarifications provided in the DPE guidelines (December 2015). In essence, the guidelines in particular indicate that tax components be treated separately, whereas they were previously presented on the basis of a combined internal estimate. These are described below.

A2.1 Corporate taxes (Federal)

The DPE guidelines (2015) include provision for reporting of federally-levied corporate income taxes as a component of the economic benefit of projects[26], which has necessitated a review of method in terms of estimation of assessment of notional tax liability. Tax liability in respect of Centennial Springvale comprises part of tax assessment by Centennial Coal Pty Ltd at aggregate level for the entire company, and not on the basis of individual operations. Therefore, Centennial Springvale does not report corporate taxes as a stand-alone operation. Furthermore, given the extent of Centennial Coal's portfolio of operations and their varied performance in any given year, a proportional estimate of entire group tax liability cannot be validly attributed to individual operations. Even less so can a reliable assessment of taxes be made over the life of an individual project in the context of this volatility. As a result, corporate tax is not reported in this assessment. The necessary exclusion of this material will contribute to a conservative estimate of benefit, as ordinarily some component of tax paid by Centennial Coal would be returned to NSW.

A2.2 NSW State Government taxes and Local Government rates, local authority charges etc.

The treatment of State-levied taxes varies. The DPE guideline (2015) notes 'that a new mine will also pay other taxes, such as payroll tax and personal income tax. The majority of these taxes will have been generated without the project, as people would have been employed elsewhere'. As a consequence, payroll taxes, particularly those relating to the additional positions associated with the Modification, are interpreted as equating to new mining employment. As such they are excluded from the analysis.

NSW Government-levied land tax is included in the assessment. This is based on the 2015 tax assessment as a base year, with the average percentage increase in the fixed component of the premium threshold between 2009 and 2015 (4.1 percent) assumed as the escalation factor.

LCC land rates are included. These were escalated by the average rate peg set by IPART, for the three most recent years available (2014/15, 15/16 and 16/17). The resulting escalation factor was 2.2 percent. Local authority charges (such as water rates), which were previously included, have been excluded, as these are ordinarily levied on a user-pays basis. In the case of both land tax and land rates, liability is assumed as continuing until relinquishment (10 years post-mining).

[26] Calculated as a population-based proportional return to NSW

APPENDIX 3: DISCUSSION OF CBA ESTIMATION ASSUMPTIONS

A3.1: Mine operation stage sustained employment

Internal employee survey material on the residential status of Springvale Colliery is discussed in Section 4.2.1. This indicates that the workforce is largely resident in the immediate region. As a result, mobility in terms of alternative employment may be somewhat constrained, as transaction costs associated with relocation may be a barrier (e.g. Coulson and Fisher 2009). This being the case attempts to apply more generalised assumptions to a regional area in relation to which alternative employment is not geographically convenient are problematic and may not effectively capture the effects of these factors. Despite this, it is necessary to assess the extent to which employees of Springvale Colliery might find alternative employment if the consent is not approved and mining subsequently ceased. The approach taken is to adopt a 'reservation wage' and compare this to the assumed wage level for ongoing employment, producing an estimate of 'labour surplus'. The reservation wage is derived as:

$$RW = (1 – p)AW + pB$$

Where:
RW = reservation wage;
p = probability of a worker remaining unemployed and thus claiming unemployment (Newstart Allowance) benefit. The Australian Government JobSearch website was referenced to obtain information to inform an assumption on this probability. Findings for relevant occupations for the five-year period 2013 to 2018 are included in Table A3.

Table A3: Job outlook information

Occupation	Unemployment level (%)[27]	Employment growth	Job openings
Drillers, Miners & Shot Firers	average	declining	average
Mine Deputies[28]	above average	slight growth	average
Mining Engineers	average	relatively steady	low
Other Construction and Mining Labourers	above average	moderate growth	below average
Geologists & Geophysicists	average	declining	low
Production Managers	below average	relatively steady	above average

As the majority of the workforce at Springvale Colliery would fall into the first category (miners) this group is used as a basis for assessing probability of unemployment. As unemployment is assessed as average, the unemployment rate for NSW may be considered as reflecting the likelihood of a displaced employee being unable to find work. At January 2016, the unemployment rate for NSW was 6.0 percent[29]. Adopting this rate can be considered as conservative, as it does not allow for the constraints on employee mobility discussed above. It also does not recognise the inherently low labour mobility in the black coal industry reported by the Productivity Commission (1998), which found that voluntary

[27] At November 2013
[28] Included in the occupational group 'Other Building and Engineering Technicians
[29] Unadjusted

labour turnover rates were less than half the average for all industries, thus indicating scarcity of alternative employment positions.

AW = assumed alternate wage. In this instance the alternate wage is assumed as the median wage for the mining sector (2013) as determined by ABS (2014), which was $2,071 per week ($107,692 annualised). This was escalated by the Wage Price Index (ABS 2015), being 2.5 percent and 2.1 percent for 2014 and 2015 respectively[30]. The assumed wage was therefore $112,702.

B = Newstart Allowance. The benefit is assumed at partnered level, $472.60 per fortnight (each)[31] annualised ($24,575). Therefore, the reservation wage would be:

(0.94 x $112,702) + (0.06 x $24,575) ∴

$105,940 + $1,475 = **$107,415**

The assumed wage rate at the time of preparation of the economic impact assessment was the average wage at the mine, which was **$142,025**. As this estimate is based on 2013 data, it was escalated at an annual rate of three percent, consistent with Springvale Colliery's assumption of wages growth. Consequently, the difference, and the labour surplus value assumed for estimation of the employment effects in the Lithgow LGA is **$34,610**.

[30] Based on December Quarter data, December 2015 being the latest ABS version at the time of preparation.

[31] Australian Government Department of Human Services website (2016).

APPENDIX 4: DISCUSSION ON NET PRESENT VALUE ESTIMATION

As is noted in Section 3.5, the sensitivity analysis requirements of the DPE guidelines provide for; 'where practicable, sensitivity analysis should identify how much output prices would need to fall for a project to have a zero NPV and report on whether such a scenario is either likely or unlikely' (2015:18).

The nature of the Modification and the assessment methods adopted in this document introduce some practical limitations that may affect the determinative weight that might be placed on such analysis. As a consequence, the required analysis in respect of this application is provided as an annexure.

A4.1 Assumptions

The following assumptions (which also identify and/or address some of the limitations of the assessment), were adopted:

- Adjustments to the measures affected by output prices were limited to the assessment of royalty returns to the NSW government. As is described in Appendix 2, no assessment of corporate income taxes is included in the overall assessment, therefore no adjustment is required in this respect. Land taxes (NSW) and rates (LCC) would remain the same, so are also excluded. The benefit assessed for employment effects, relates to the estimation of regional economic benefit, and is also excluded on that basis.
- As a result of these exclusions, the approach is to approximate the discounted royalty returns to the assessed environmental costs presented in Table 5.
- Centennial Coal's internal pricing assumptions are adopted as the basis for estimating the required discount. It should be noted that these assumptions may differ from external assumptions, on the basis of the mix of domestic and international markets that the mine services.
- Where relevant a AUD/USD exchange rate of AUD$0.72 was adopted. This rate was current at the time of preparation.

A4.2 Adjustment to pricing assumptions

Centennial Coal's pricing assumptions may be characterised as being fixed-price assumptions for the operating years 2016 to 2020. Thereafter pricing in this assessment was escalated at 1.7 percent per year. The applied rate was based on most recently available CPI data at the time of preparation.

Testing resulted in discounting at a rate of 38.5 percent to achieve a zero NPV against estimated environmental costs. Table A4.1 compares the original and adjusted outcomes of this analysis.

In terms of the likelihood of such an outcome, World Bank (2016) price forecasts were used to calculate a comparative possible outcome[32], which is reported in Table A4.2.

[32] Prices are adjusted from 2021 to 2028 at CPI, as per pricing for Centennial and adjusted assumptions.

Table A4.1. Adjustments to price assumptions and resulting present values (AUD)

	PV Royalties	PV assessed costs	NPV
Price assumptions (EA)	$167,192,719	$118,888,019	**$48,304,700**
Price adjusted (-38.5%)	$118,734,637	$118,888,019	**($153,382)**

Table A4.2 World Bank pricing assumptions and resulting present value (AUD)

	PV Royalties	PV assessed costs	NPV
Price assumptions (WB)	$131,246,177	$118,888,019	**$12,358,157**

A4.3. Discussion

A reduction of 38.5 percent in Centennial's fixed pricing assumptions would be required to reduce the NPV for the Modification to zero in terms of the economic effects analysed in this assessment. Comparison with World Bank forecasts indicates that a reduction of this magnitude is not anticipated. This would indicate that the likelihood of the scale required to make the Modification not viable from the State's perspective is relatively low.

A further source of mitigation of this risk is that a proportion of Springvale Coal's output is committed to stable domestic contracts. This limits the company's exposure to market price variations to some extent.

A final source of mitigation of this risk is that, if the assessment of the economic outcomes of the Modification is considered more broadly, the proposal remains strongly positive

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Traffic Impact Assessment

APPENDIX – G

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Springvale Colliery

SSD 5594 Springvale Mine Extension Project

Modification 1 Proposal

Traffic Impact Assessment

April 2016

prepared for

Springvale Coal Pty Ltd

prepared by

ARC Traffic + Transport

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Contents

Executive Summary

Springvale Coal Pty Ltd (Springvale Coal) proposes a Modification to the current Springvale Colliery (Springvale) State Significant Development (SSD 5594) approval of September 2015 to allow for the extraction of up to 5.5 million tonnes per annum (mtpa) of coal from the existing operations at Springvale. Under the SSD 5594 approval, coal production at Springvale is currently limited to 4.5mtpa of Run of Mine (ROM) coal.

ARC Traffic + Transport has prepared a detailed Traffic Impact Assessment to examine the access, traffic and parking implications of the Modification. ARC has determined that: -

- Springvale Coal has committed to the upgrade of the intersection of Castlereagh Highway & Springvale Access Road in line within the requirements of Condition 21 of the (existing) SSD 5594 approval. Springvale Coal has commenced design planning for such, which would ultimately be finalised further to consultation with the RMS before implementation.

- The additional trip generation associated with the Modification is very minor, and would largely occur outside of peak traffic flow periods in Castlereagh Highway. Further to the Modification, the intersection of Castlereagh Highway & Springvale Access Road would continue to operate at a good level of service during all key peak periods through 2025, and the Castlereagh Highway would also continue to operate with significant spare capacity.

- The available capacity within the Pit Top staff car parks will continue to accommodate peak staff parking demands further to the Modification.

In summary, ARC has determined that the Modification would have no significant impact on the local or sub-regional traffic and transport environment.

Introduction

1.1 Project Overview

Springvale Coal Pty Ltd (Springvale Coal) proposes a Modification to the current Springvale Colliery (Springvale) State Significant Development (SSD 5594) approval of September 2015 to allow for the extraction of up to 5.5 million tonnes per annum (mtpa) of coal from the existing operations at Springvale. Under the SSD 5594 approval, coal production at Springvale is currently limited to 4.5mtpa of Run of Mine (ROM) coal.

The increase in production will primarily be achieved through the installation and operation of additional underground mining equipment (longwall equipment and continuous miners), increased workforce and the implementation of other operational practices to achieve greater utilization of that equipment; significantly, ROM coal will continue to be transferred by overland conveyor between Springvale pit top and the Springvale Coal Services Site (SCS Site), Mount Piper Power Station at Blackmans Flat and Lidsdale Siding Rail Facility at Wallerawang for the export market. The transfer of ROM coal from Springvale pit top to off-site locations is undertaken under the consent of the Western Coal Services Project (SSD 5579). The Modification also provides for: -

- An increase in full-time equivalent (FTE) employees to 450
- An increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes to 200,000 tonnes

Full details of the Modification are provided in the *Statement of Environmental Effects* prepared in support of the proposed modification (**Modification SEE**) which this assessment accompanies.

1.2 Assessment Criteria & Methodology

ARC Traffic + Transport (**ARC**) has been commissioned by Springvale Coal to prepare this Traffic Impact Assessment (**TIA**) to appropriately and independently assess the access, traffic and parking characteristics of the Modification. Specifically, the assessment examines the potential impacts arising from the additional vehicle trip generation of the Modification, and measures by which to mitigate any such impacts.

This methodology specifically responds to the Director General's Requirements (**DGRs**) previously detailed by the Department of Planning & Environment (DP&E) in regard to Springvale Mine Extension Project SSD 5594, which provided the following in regard to traffic and transport: -

Traffic & Transport – including:

- *an assessment of potential traffic impacts on the capacity, efficiency and safety of the road network; and*
- *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*

Reference is also made to Condition 21 of the SSD 5594 approval, which provides the following: -

Mine Access Road Intersection Upgrade

21. Unless the Secretary agrees otherwise, when peak two-way traffic volume on the Castlereagh Highway at its intersection with the Mine Access Road exceeds 400 vehicles per hour, the Applicant shall upgrade that intersection to include a Channelised Right Turn in accordance with Austroads standards, to the satisfaction of RMS.

This TIA references the traffic and transport guidelines and assessment requirements noted within the SSD 5594 DGRs, and more broadly as appropriate to the specific Modification characteristics. Key AustRoads references include: -

- Guide to Road Design Part 4A Unsignalised & Signalised Intersections (GRD4A)
- Rural Road Design Guide (RRDG)
- Guide to Traffic Engineering Practice Part 5 Intersections at Grade (GTEP5)

ARC has also consulted with the Roads & Maritime Services (RMS) in regard to accident data. ARC acknowledges the assistance provided by RMS officers in this regard.

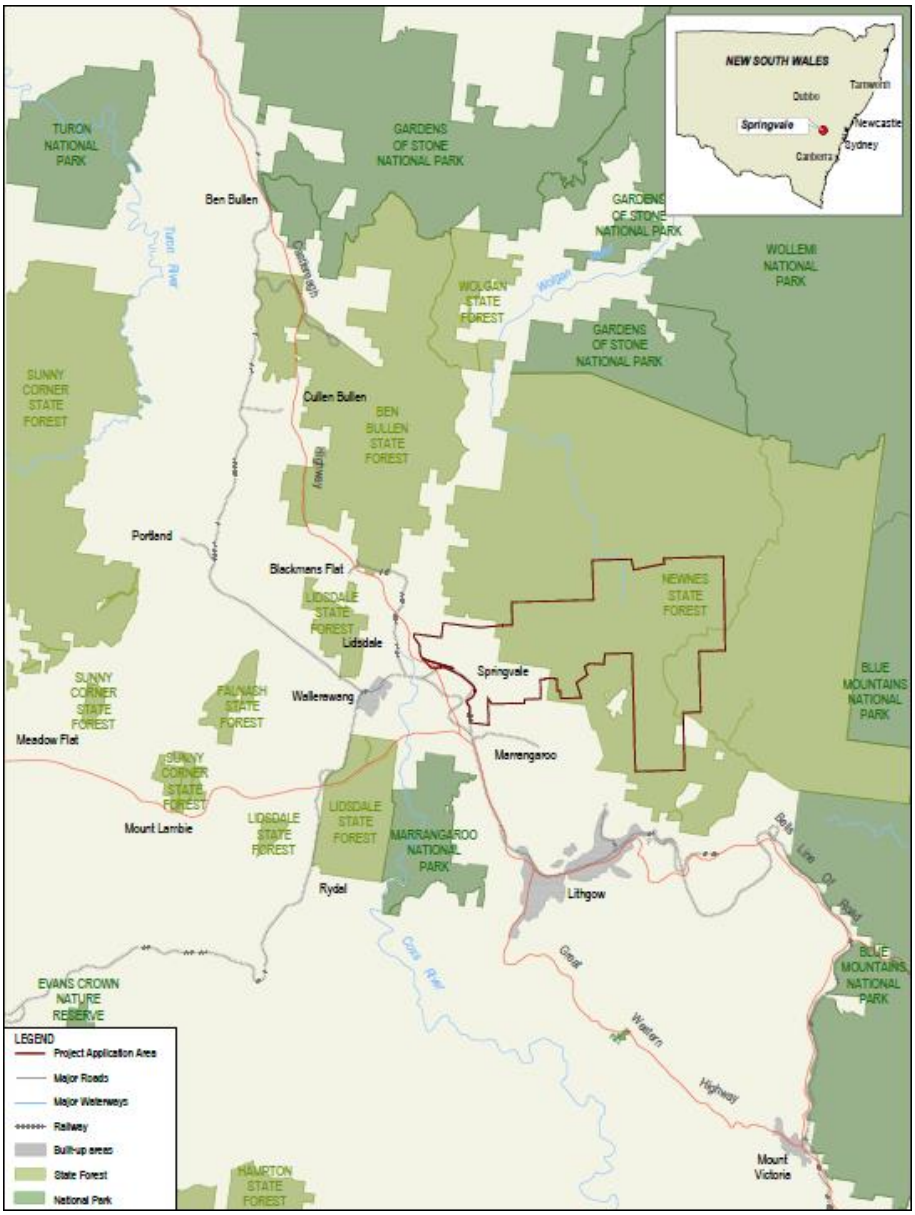
2 The Springvale Colliery

2.1 Location

Springvale is located north-west of Lithgow and east of Lidsdale, NSW. The Springvale Pit Top is located off the Castlereagh Highway east of the former Wallerawang Power Station (WPS).

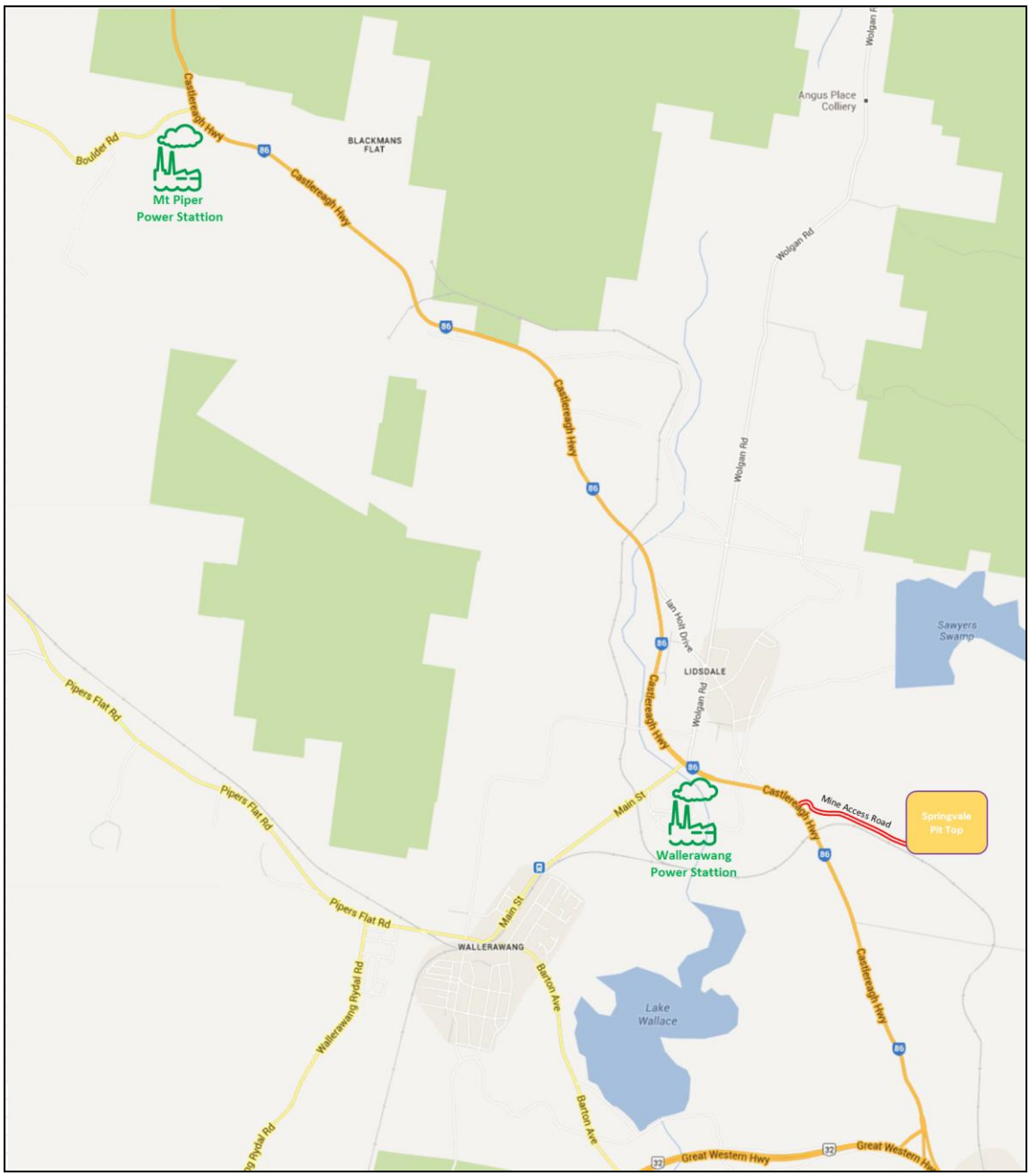
Springvale in its regional context is shown below in **Figure 2.1.1**, while **Figure 2.1.2** shows the road network providing for the Pit Top.

Figure 2.1.1 Springvale Colliery Location



Source: Springvale Coal

Figure 2.1.2 Springvale Access Road Network



Source: Google Maps

2.2 Existing Operations

2.2.1 Overview

Springvale is an underground coal mine producing high quality thermal coal. Domestically, Springvale supplies ROM coal to Mount Piper Power Station (MPPS), via the Western Coal Services Project (SSD 5579), and other local domestic markets using road haulage. Sized ROM coal is transferred to Springvale Coal Services Site (Western Coal Services Project) via a dedicated overland conveyor system, from where coal is supplied to MPPS, and Lidsdale Siding Rail Loading Facility for the export market.

Schedule 2, Condition 8 of the SSD 5594 approval provides for the contingency transport of up to 50,000tpa of coal via the public road network to local domestic market customers. The Modification would not affect this condition.

2.2.2 Annual Capacity

Further to the SSD 5594 approval, Springvale has a current extraction limit of 4.5mtpa of ROM coal.

2.2.3 Operational Shifts & Staff

Springvale operates 24 hours a day, 7 days a week, and employs 358 FTE staff, including up to 21 contract staff. Current shifts and staffing levels are shown below in **Table 2.2.3**.

Table 2.2.3 Springvale Shifts & Staff

Employees and numbers	Weekday Shift			Weekend Shift	
	Day	Afternoon	Night	Day	Night
	6:00am - 4:00pm	2:00pm - 12:00am	10:00pm - 8:00am	6:00am - 6:00pm	6:00pm - 6:00am
Mining	81	63	60	44	43
General Staff	39	2	2	2	1
Contractors	9	5	7	0	0
Total	**129**	**70**	**69**	**46**	**44**

Source: Springvale Coal

With reference to **Table 2.2.3**, general (administration) staff have varying start times between 5:00am and 8:00am, with finishing times between 3:00pm and 6:00pm; approximately 50% of general staff arrivals occur after 6:30am, which is significant in regard to the calculation of peak parking demand (see also **Section 2.5** below).

It is also important to note that mining staff arrive and depart over broad start/end times, i.e. not all staff will arrive in a short period immediately prior to a shift, nor depart in a short period after shift.

2.3 Pit Top Access

With reference to **Figure 2.1.2**, access to the Pit Top is provided via the Springvale Access Road, a two-way private access road which intersects with the Castlereagh Highway at Wallerawang. From the Castlereagh Highway, access is readily available to the sub-regional and regional road network.

2.4 Traffic Generation

2.4.1 Staff Trips

Based on our observations and a review of the traffic data in **Section 3** and **Appendix A**, it is apparent that almost the entire staff complement drives to the Pit Top via private vehicle, and that there is only a very minor level of car sharing. This is not surprising considering the nature (and hours) of the work; the location of Springvale; and the lack of other viable travel options.

Springvale mining shift arrival and departure peaks are off-set; for example, the traffic peak associated with arrivals for the Weekday Day Shift (prior to 6:00am) is over before the traffic peak associated with departures from the Weekday Night Shift commences (after 8:00am). The end of the Weekday Day Shift and start of the Weekday Afternoon Shift; and end of the Weekday Afternoon Shift and start of the Weekday Night Shift, are similarly off-set.

As discussed in **Section 2.2.3**, the Pit Top generates peak traffic flows over 1 – 2 hours periods prior to and following the shifts outlined in **Table 2.2.3**, though there are clearly identifiable peaks in the hour prior to and following each mining shift. Traffic flows during these broader arrival and departure periods generally mirror staff numbers (i.e. one car per staff member).

With reference to the detailed traffic data provided in **Section 3** and **Appendix A**, approximately 65% - 70% of staff trips are generated to/from the south (i.e. Lithgow) and 30% - 35% of staff trips are generated to/from the north.

2.4.2 Service Vehicle Trips

With reference to the detailed traffic data provided in **Section 3** and **Appendix A**, the Pit Top generates a moderate heavy vehicle demand – an average of some 150 heavy vehicle trips per day - including deliveries of equipment and light materials; maintenance vehicles; and occasionally machinery and the like. Approximately 70% of heavy vehicle trips to/from the south and 30% to/from the north.

Pit Top service vehicle trip generation is not expected to be affected by the Modification.

2.5 Parking

Parking which provides in full for the staff and heavy vehicle demands of the Pit Top is located on-site; Springvale generates no off-site parking demand.

The primary staff parking area is located in the south-eastern section of the Pit Top and provides 205 parking spaces, comprising 149 covered spaces and 56 uncovered spaces.

The current peak on-site demand is for up to approximately 180 parking spaces during the change-over period between the Night Shift and Day Shift (between approximately 6:00am and 6:30am); and up to approximately 199 spaces during the change-over period between the Day Shift and Afternoon Shift (between 2:00pm and 4:00pm). As such, the available car parking capacity remains in excess of peak demand at all times.

3 Road Network

The sub-regional road network which provides access for the Pit Top is shown in **Figure 2.1.2**, and described in detail in sections below.

3.1 Key Roads & Intersections

3.1.1 Castlereagh Highway

The Castlereagh Highway (State Highway 18, State Route 86) is a regional highway connecting the Great Western Highway at Marrangaroo to Mudgee and Gulgong and then further through north-west NSW. The Castlereagh Highway generally provides two traffic lanes and at-grade, and grade separated, intersections appropriate to the through and turning traffic demands in this part of the regional network.

The Castlereagh Highway has a posted speed limit of 80 km/h through the section of the local network that includes the intersections with Wolgan Road and Main Road west of Springvale Access Road, but otherwise is generally 100 km/h (with the transition located immediately west of Springvale Access Road). Vehicle speed surveys (provided in **Appendix A**) indicate Castlereagh Highway 85%ile speeds in excess of 100km/h through the intersection of Springvale Access Road.

3.1.2 Great Western Highway

The Great Western Highway (State Highway 5, National Route 32) is a regional highway which intersects with the Castlereagh Highway at Marrangaroo. The Great Western Highway links to the east to Lithgow, Katoomba and then through to the broader Sydney metropolitan area (M4); and to the west to Bathurst.

3.1.3 Springvale Access Road

Springvale Access Road operates as a private access road linking the Pit Top with the Castlereagh Highway. Springvale Access Road provides two wide traffic lanes and generates no flows other than those generated by the Pit Top operations. Springvale Access Road has a speed limit of 70km/h, east of the Castlereagh Highway, reducing to 40km/h on the immediate approach to the Pit Top, which includes the provision of speed humps.

3.1.4 Castlereagh Highway & Springvale Access Road

All access to the Pit Top is provided via the intersection of Castlereagh Highway & Springvale Access Road. This intersection is the only location where the concentration of existing Springvale trip generation, and the additional trip generation associated with the Modification, has potential for any significant impact.

With reference to GRD4A, the intersection provides an Auxiliary Right (AUR) treatment for arrivals from the south, where a short section of the Castlereagh Highway is widened to provide 2 lanes such that a through (north bound) vehicle can pass a vehicle turning right into Springvale Access Road. The left turn from the Castlereagh Highway to Springvale Access Road is provided as a Channelised Left (CHL) treatment with the turn lane protected by a wide tapered splitter island, and then a Give Way intersection at Springvale Access Road which provides priority to vehicles arriving via the right turn from Castlereagh Highway).

3.2 Traffic Surveys

In order to define traffic flows at the intersection of Castlereagh Highway & Springvale Access Road, ARC commissioned a series of traffic surveys in November 2015, including: -

- An automatic traffic counter (ATC) providing hourly counts over 7 days, as well as speed data, in Castlereagh Highway south of Springvale Access Road; and in Springvale Access Road east of Castlereagh Highway
- An intersection movement survey providing 15 minute counts over 24 hours of all through and turning movements at the intersection.

The surveys were completed by TRACSIS Traffic Surveys, and are provided in full (in electronic form) in **Appendix A**.

3.3 Daily Traffic Flows

3.3.1 Castlereagh Highway

A summary of the Castlereagh Highway ATC survey is provided in **Table 3.3.1** below, with the mining shift arrival periods highlighted.

Table 3.3.1 Castlereagh Highway ATC Summary

	Day of Week								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Ave	7 Day
Time	16-Nov	17-Nov	18-Nov	12-Nov	13-Nov	14-Nov	15-Nov	W'day	Ave
AM Peak	373	413	411	418	433	455	433		
PM Peak	469	497	478	476	550	414	482		
0:00	22	38	54	39	48	37	32	40	39
1:00	9	20	12	13	22	21	30	15	18
2:00	11	14	17	11	15	12	13	14	13
3:00	18	17	21	22	25	14	11	21	18
4:00	39	41	36	38	39	23	9	39	32
5:00	190	174	179	180	184	111	84	181	157
6:00	353	336	334	372	326	184	97	344	286
7:00	288	310	288	303	319	186	109	302	258
8:00	373	413	411	418	412	264	144	405	348
9:00	345	334	315	338	388	327	263	344	330
10:00	367	318	365	358	398	455	332	361	370
11:00	356	305	360	357	433	342	433	362	369
12:00	344	328	320	325	446	414	477	353	379
13:00	443	367	391	383	483	355	422	413	406
14:00	372	383	408	403	500	309	482	413	408
15:00	469	497	478	476	550	336	447	494	465
16:00	425	443	469	450	474	293	414	452	424
17:00	352	360	387	404	496	331	386	400	388
18:00	266	238	261	260	335	229	260	272	264
19:00	162	159	171	164	263	136	182	184	177
20:00	109	107	130	124	209	106	110	136	128
21:00	125	126	134	126	147	91	78	132	118
22:00	50	51	61	82	91	68	47	67	64
23:00	35	32	41	46	59	58	28	43	43
Total	5523	5411	5643	5692	6662	4702	4890	5786	5503

With reference to **Table 3.3.1** (and **Appendix A**) the Castlereagh Highway ATC reports an Average Daily Traffic (ADT) flow of 5,503 vehicles trips per day (vtpd) with a heavy vehicle percentage of 10%. The Average Weekday Traffic (AWT) flow is higher at 5,786 vtpd, with a heavy vehicle percentage of 12%. Friday 13th November 2015 reported the highest daily flow at 6,662 vtpd (and 10% heavy vehicles), some 1,000vtpd higher than other weekdays.

It is noted that these flows include Springvale arrival and departure flows to/from the south (i.e. Lithgow).

3.3.2 Springvale Access Road Traffic Flows

A summary of the Springvale Access Road ATC survey is provided in **Table 3.3.2** below.

Table 3.3.2 Springvale Access Road ATC Summary

	Day of Week								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Ave	7 Day
Time	16-Nov	17-Nov	18-Nov	12-Nov	13-Nov	14-Nov	15-Nov	W'day	Ave
AM Peak	107	99	100	97	105	72	72		
PM Peak	76	77	86	84	72	61	57		
0:00	0	26	32	30	24	1	0	22	16
1:00	0	10	6	0	6	1	0	4	3
2:00	1	0	1	0	1	1	1	1	1
3:00	2	0	1	0	2	0	1	1	1
4:00	11	13	13	12	11	0	0	12	9
5:00	107	99	100	97	105	72	72	102	93
6:00	41	28	31	26	21	16	8	29	24
7:00	23	39	34	41	44	12	6	36	28
8:00	21	48	65	38	38	7	2	42	31
9:00	19	24	38	14	32	4	3	25	19
10:00	23	24	29	23	20	6	2	24	18
11:00	23	22	25	19	44	2	1	27	19
12:00	30	25	29	25	33	5	0	28	21
13:00	76	77	86	84	46	3	1	74	53
14:00	42	49	57	48	42	1	0	48	34
15:00	48	45	45	47	15	3	0	40	29
16:00	47	51	67	40	9	5	4	43	32
17:00	12	9	7	8	72	61	57	22	32
18:00	2	3	8	4	19	17	11	7	9
19:00	8	4	5	2	5	16	11	5	7
20:00	7	11	5	6	5	0	1	7	5
21:00	61	67	66	52	0	0	12	49	37
22:00	6	3	3	10	2	0	0	5	3
23:00	19	12	16	16	0	0	0	13	9
Total	629	689	769	642	596	233	193	665	536

With reference to **Table 3.3.2** (and **Appendix A**) the Springvale Access Road ATC reports an ADT flow of 536 vtpd, with a heavy vehicle percentage of 21%. The AWT flow is higher at 665 vtpd, also with a heavy vehicle percentage of 21%. Wednesday 18th November reported the highest daily flow at 769 vtpd, with a heavy vehicle percentage of 25%.

These flows correlate well with the mining shift arrival and departure profiles as detailed in **Section 2.4**.

3.4 Peak Period Flows

The assessment of the intersection of Castlereagh Highway & Springvale Access Road is based on the Springvale mining shift arrival and departure periods, i.e. when turning movements to/from Springvale Access Road peak.

In this regard, the mining shift arrival peaks are specifically relevant to the assessment of intersection operations (Level of Service) and intersection design (warrants assessment); while the mining shift departure peaks are relevant to intersection operations only. Surveyed flows during these key peaks are provided below.

Figure 3.4.1 Castlereagh Highway & Springvale Access Road Shift Arrival Peaks

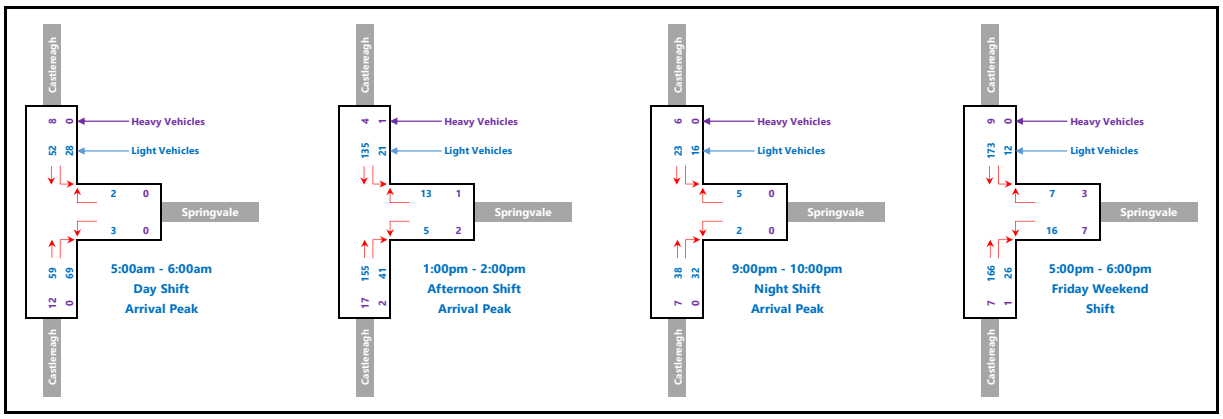
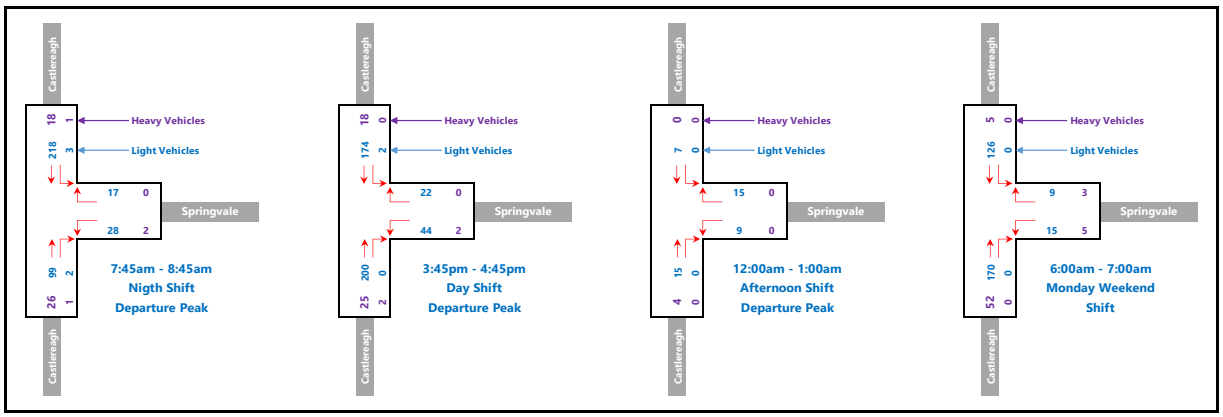


Figure 3.4.2 Castlereagh Highway & Springvale Access Road Shift Departure Peaks



3.5 Intersection Operations

3.5.1 SIDRA

SIDRA is an RMS approved micro-analytical traffic evaluation tool used to determine key performance measures of intersections operation. The key inputs in the SIDRA analysis include peak hour traffic flows and speed profiles; intersection geometry and control; and vehicle entry profiles (gap acceptance) appropriate to the intersection design. SIDRA then reports the following: -

- **Level of Service**

  Level of Service (LoS) is a basic performance indicator assigned to an intersection based on average delay; at priority controlled intersections, the reported LoS is based on the worst approach delay. The RMS LoS criteria, which have been used in the assessment, are provided below: -

Level of Service (RMS)	Control delay per vehicle in seconds (d) (including geometric delay)		
	Signals and Roundabouts	Rating	Stop and Give Way / Yield Signs
A	d < 14.5	Good	d < 14.5
B	14.5 < d < 28.5	Good with acceptable delay	14.5 < d < 28.5
C	28.5 < d < 42.5	Satisfactory	28.5 < d < 42.5
D	42.5 < d < 56.5	Near capacity	42.5 < d < 56.5
E	56.5 < d < 70.5	At capacity	56.5 < d < 70.5
F	70.5 < d	Over capacity	70.5 < d

- **Delay**

  Delay represents the difference between interrupted and uninterrupted travel times through an intersection, and is measured in seconds per vehicle in this assessment. Delays include queued vehicles accelerating and decelerating from/to the intersection stop, as well as general delays to all vehicles travelling through the intersection. With reference to the LoS criteria above, the average intersection delay for signals and roundabouts represents an average of delays to all vehicles on all approaches, while for priority intersections the average delay for the worst approach is used.

- **Degree of Saturation**

  Degree of Saturation (DoS) is defined as the ratio of demand (arrival) flow to capacity. DoS above 1.0 represent over-saturated conditions (demand flows exceed capacity) and degrees of saturation below 1.0 represent under-saturated conditions (demand flows are below capacity). The capacity of the movement with the highest DoS is reported.

3.5.2 Existing Intersection Performance

The intersection of Castlereagh Highway & Springvale Access Road has been assessed using the peak period flows shown in **Section 3.4** above. In addition, the SIDRA analysis reference the existing geometry, vehicles speeds and (priority) controls at the intersections. The results of the SIDRA modelling are provided below in **Table 3.5.2**.

Table 3.5.2 2015 Peak Period Intersection Operations

Intersection Castlereagh Highway & Springvale Access Road 2015 SIDRA Operations	Level of Service		Average Delay (s)		Degree of Saturation	
	Arrival Peak	Departure Peak	Arrival Peak	Departure Peak	Arrival Peak	Departure Peak
Weekday Day Shift	A	A	2.6	1.0	0.043	0.134
Weekday Afternoon Shift	A	A	1.4	1.2	0.099	0.130
Weekday Night Shift	A	A	2.7	3.2	0.027	0.019
Weekday Night Shift	A	A	1.2	0.7	0.102	0.138

With reference to **Table 3.5.2**, the intersection currently operates at a good LoS during each of the Springvale shift arrival and departure peak periods, with very moderate delays and significant available capacity.

It is noted that at the intersection of Castlereagh Highway & Springvale Access Road, through flows in the Castlereagh Highway are at times higher than during the shift arrival and departure peaks, but turning demands to/from Springvale Access Road during these period of high through flows are significantly lower. Sensitivity testing of these periods across the day reports similar LoS and capacity conditions as those reported in **Table 3.5.2**.

3.6 Castlereagh Highway & Springvale Access Road Design

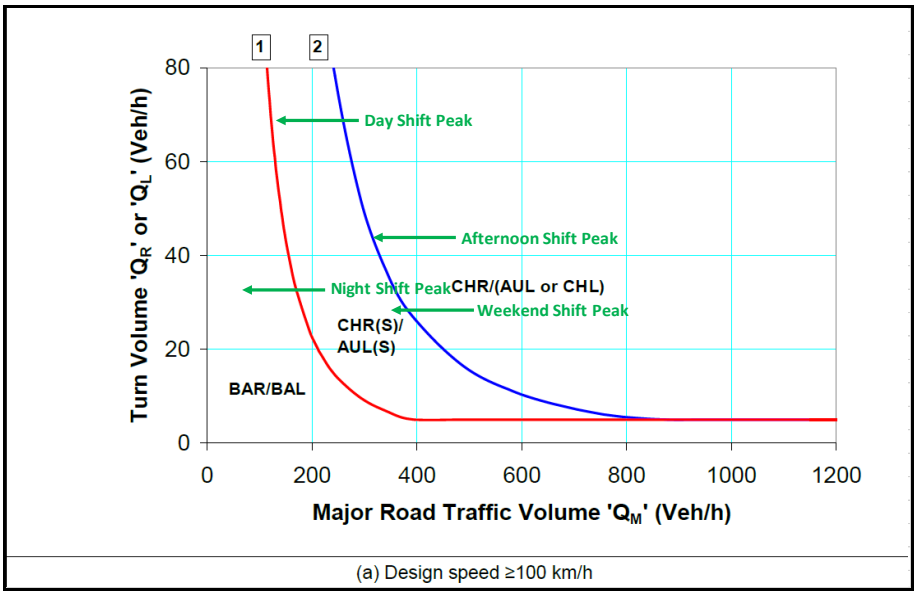
3.6.1 Existing Design

As discussed, the intersection provides an AUR treatment for arrivals from the south, and a CHL for arrivals from the north. With the CHL providing a high order auxiliary lane treatment, the assessment below focuses on the warrants for a right turn treatment, Castlereagh Highway to Springvale Access Road.

3.6.2 Design Warrants

Warrants for Basic Right (BAR), Channelised Right Short (CHR(S)) and Channelised Right (CHR) turn treatments are provided in Section 4.8 of GRD4A. Based on speeds at or above 100km/h (as surveyed in the Castlereagh Highway at Springvale Access Road – see **Appendix A**) and the peak flows reported in **Section 3.4**, ARC has reviewed warrants for the right turn treatment Castlereagh Highway to Springvale Access Road. The results of this warrants assessment are shown in **Figure 3.7.2**.

Figure 3.7.2 Existing Warrants, Castlereagh Highway & Springvale Access Road



(a) Design speed ≥100 km/h

Importantly, Condition 21 of the SSD 5594 requires that the intersection be upgraded to provide a CHR upon flows in the Castlereagh Highway exceeding 400vph. In our opinion, the intent of this Condition is for an upgrade to be required when the Castlereagh Highway through flows exceed 400vph in (any of) the Springvale arrival peak periods.

In this regard, while the intersection survey data reported in **Section 3.4** above indicates through flows remained below 400vph on the day of the intersection survey itself, a closer review of the broader ADT data for the Castlereagh Highway (**Appendix A**) indicates that on a number of days these through flows exceeded 400vph during the Weekday Afternoon Shift arrival period. Cross-referencing the Springvale Access Road ADT survey data for arrivals during this period, it is clear that the Weekday Afternoon Shift arrival period would on a number of days per week exhibit combined flows which would meet the Condition 21 requirements for an upgrade to a CHR, and moreover meet the GRD4A warrants for an upgrade (per **Figure 3.6.2** above).

As such, ARC has recommended that the intersection of the Castlereagh Highway & Springvale Access Road be upgraded to provide a CHR designed with reference to the Extended Design Domain (**EDD**) criteria detailed in Appendix A.5 of the GRD4A, the primary intent of which *is to enable an AUR turn treatment to be linemarked as a CHR turn treatment*. Springvale Coal has accepted this recommendation, and has engaged external engineering consultants to proceed with planning for the upgrade in accordance with RMS requirements.

3.7 Castlereagh Highway Capacity

While the capacity of urban and rural roads is generally determined by the capacity of intersections (as per **Section 3.5** above) roads can also be assessed with reference to their general traffic carrying capacity. Table 4.5 of the RTA Guide to Traffic Generating Developments (**RTA Guide**) reproduced below provides a basic means by which to assess LoS for two-way, two-lane rural roads such as the Castlereagh Highway.

Table 3.7 RTA Guide (Table 4.5) Peak Hour Flow on Two-Lane Rural Roads

Terrain	Level of Service	Percent of Heavy Vehicles			
		0	5	10	15
Level	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290
Rolling	B	500	420	360	310
	C	920	760	650	570
	D	1370	1140	970	700
	E	2420	2000	1720	1510
Mountainous	B	340	230	180	150
	C	600	410	320	260
	D	1050	680	500	400
	E	2160	1400	1040	820

The LoS reported in Table 4.5 of the RTA Guide is based on conditions which are generally represented in the Castlereagh Highway in the sub-region, including: -

- A 60/40 directional split of traffic during peak periods;
- Level terrain with good overtaking opportunities; and
- Wide traffic lanes with good side clearances.

With reference to the ATC traffic survey (**Appendix A**) the Castlereagh Highway immediately south-east of Springvale Access Road reports a peak weekday average flow of 494 vtph, including a heavy vehicle component of 9%, in the hour 3:00 pm – 4:00 pm.

While a review of individual peak hours across the week of ATC data shows a small number of hours with marginally higher flows (up to a maximum 550 vtph in the same hour on Friday 13th November 2015), it is reasonable to conclude that the Castlereagh Highway adjacent to Mine Access Road generally operates at a LoS "B", and has significant spare capacity within the RMS recommended operating performance standards (i.e. up to LoS "C" with reference to the RTA Guide).

3.8 Additional Sub-Regional Traffic

With reference to **Section 3.7** above, the identification of upgrade warrants being met for a CHR at the intersection of the Castlereagh Highway & Springvale Access Road – and moreover the commitment of Springvale to commence the upgrade – means that the intersection will effectively provide the 'highest' order rural intersection design. With reference to **Section 3.5**, the performance (Level of Service) of the intersection would be generally unaffected by the upgrade (i.e. average delays would be unchanged) and as reported these average delays are minimal.

There is no evidence to suggest any future significant traffic increases in the local network such as would increase average delays at the intersection, and as such significantly increase delays. Notwithstanding, ARC has completed a desktop review of sub-regional projects which could generate additional through traffic (in the Castlereagh Highway) during the period of operations provided for in the Modification so as to assess worst case intersection operations. Again, it is important to note that the identification of (potential) additional sub-regional traffic flows – through flows in the Castlereagh Highway at Springvale Access Road – would not alter the recommendation for a CHR upgrade.

3.8.1 Angus Place Colliery

Centennial operates the Angus Place Colliery (APC) is located in Wolgan Road north of Lidsdale, north-west of Springvale. In response to a downturn in international coal markets, Centennial commenced 'care and maintenance' operations at Angus Place in March 2015. A number of APC staff have since been redeployed to Springvale, but there is an expectation that APC will recommence mining operations in the future (pursuant to DP&E approvals).

At this time, APC trip generation in Castlereagh Highway is minimal, based on minimal care and maintenance staff requirements; these trips are captured by the recent traffic surveys. However, should APC recommence mining operations, additional APC staff trips would again be generated to the Castlereagh Highway, and indeed generated to the same peak shift arrival and departure periods as evidenced at Springvale.

Based on our previous work at APC and other available documentation, it is estimated that the APC could generate the following additional through trips in the Castlereagh Highway at Springvale Access Road further to mining operations recommencing: -

- An additional 70vph in the Weekday Day Shift arrival and departure peaks
- An additional 50vph in the Weekday Afternoon Shift arrival and departure peaks
- An additional 45vph in the Weekday Night Shift arrival and departure peaks
- An additional 30vph in the Weekend Day and Night Shift arrival and departure peaks

3.8.2 Average Annual Growth

As part of previous assessments in the sub-region, ARC has sourced information from the RMS for the permanent count station on the Castlereagh Highway at Lidsdale (Station 99.253). While a full data set is not publicly available, in 2010 the [then] RTA made available limited yearly data and a growth projection for the Lidsdale Count Station, which indicates a growth forecast of 1.7% per annum in the Castlereagh Highway adjacent to Springvale.

3.8.3 Sub-Regional Mining Projects

As part of previous assessments in the sub-regional, ARC sourced information from the DP&E in regard to sub-regional projects which had the potential to generate additional trips to the Castlereagh Highway through Wallerawang and past Springvale. A more recent review of these projects suggests that there is little potential for additional trip generation in the foreseeable future, with many previously proposed projects having been either refused or withdrawn.

3.9 Accident Data

The RMS has provided ARC with data in regard to accidents occurring in the road network adjacent to the Pit Top over the period 2010 - 2014. A crash plot indicating crash location and severity, and crash summary information, is provided in **Appendix B**.

Significantly, the intersection of Castlereagh Highway & Mine Access Road reports no crashes; in our opinion this is a function of the good design of the intersection – particularly with regard to sight distances - and the very moderate through and turning movements.

4 The Modification

4.1 Overview

Springvale Coal proposes a Modification to the SSD 5594 consent of September 2015 to allow for the extraction of up to 5.5mtpa of coal from the existing operations at Springvale.

The increase in production will primarily be achieved through the installation and operation of additional mining equipment, increased workforce and the implementation of other operational practices to achieve greater utilization of that equipment; significantly, coal will continue to be transferred by overland conveyor between Springvale and the Springvale Coal Services Site and subsequently to MPPS at Blackmans Flat and Lidsdale Siding Rail Facility at Wallerawang. The Modification also provides for: -

- An increase in full-time equivalent staff to 450
- An increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes to 200,000 tonnes

Full details of the Modification are provided in the Modification SEE which this assessment accompanies.

4.2 Access

Access to the Pit Top would be unaffected by the Modification, with all vehicles utilising the Springvale Access Road via the intersection with the Castlereagh Highway, and more broadly using the same sub-regional network as identified in **Section 3**.

4.3 Traffic Generation & Distribution

4.3.1 Staff Increases

The Modification will result in additional Pit Top trip generation associated with the increase in FTE staff, as shown in **Table 4.3.1** below.

Table 4.3.1 Modification Staff Increases

PROPOSED EMPLOYEES					
Employees and numbers	Weekday Shift			Weekend Shift	
	Day	Afternoon	Night	Day	Night
	6:00am - 4:00pm	2:00pm - 12:00am	10:00pm - 8:00am	6:00am - 6:00pm	6:00pm - 6:00am
Mining	81	65	65	86	86
General Staff	39	2	2	2	1
Contractors	9	5	7	0	0

Source: Springvale Coal

4.3.2 Trip Generation Increases

With reference to **Table 4.3.1**, the majority of the staff increases relate to high staff numbers for the weekend shifts, each of which would effectively double in (staff) size. Very minor increases are proposed for the afternoon (an additional 2 staff) and night (an additional 5 staff) shifts.

As discussed in **Section 2.4.1**, it is generally the case each shift staff member generates an individual arrival trip prior to the shift starting, and an individual departure trip after the shift has ended, and these trips are not specifically concentrated in a single arrival or departure hour. However, the traffic data reports some arrival periods (across the week) suggesting the potential for 100% of arrivals in the hour immediately preceding a shift start. As a worst case, this concentrated arrival pattern has been adopted (and also applied to the hour immediately following a shift end) to provide the following additional trip generation estimates: -

- An additional 2vph in the hour prior to and hour following the weekday afternoon shift
- An additional 5vph in the hour prior to and hour following the weekday night shift
- An additional 42vph in the hour prior to and hour following the weekend day shift
- An additional 43vph in the hour prior to and hour following the weekend night shift

4.3.3 Trip Assignment

The additional trips determined in **Section 3.3.2** above have been distributed to the intersection of Castlereagh Highway & Springvale Access Road with reference to the surveyed distribution of trips as shown in **Figure 3.4.1** and **Figure 3.4.2**. Additional through flows associated with potential sub-regional traffic flow increases (per **Section 3.8** above) through to a forecast year 2025 have also been included.

The resulting total flows at the intersection during each of the future shift arrival and departure periods are shown below in **Figure 4.3.3.1** and **Figure 4.3.3.2**.

Figure 4.3.3.1 2025 Castlereagh Highway & Springvale Access Road Shift Arrival Peaks

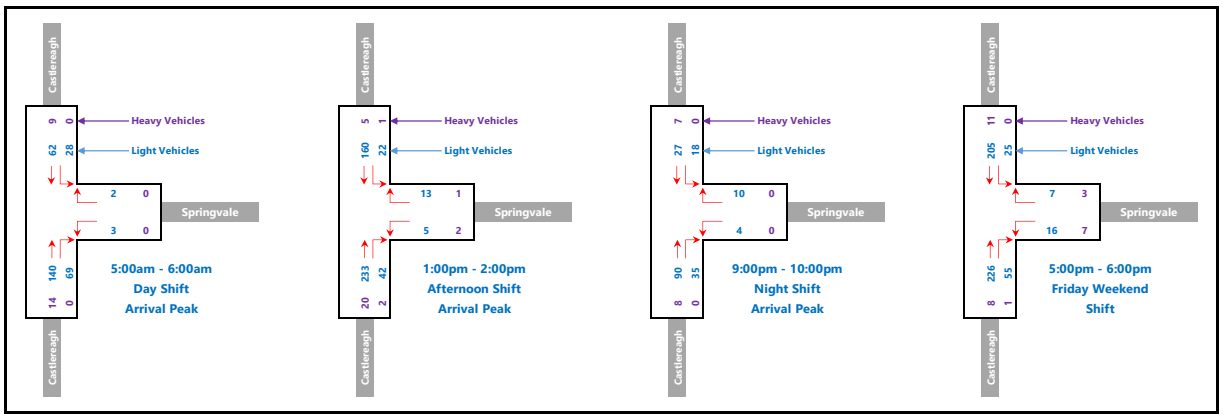
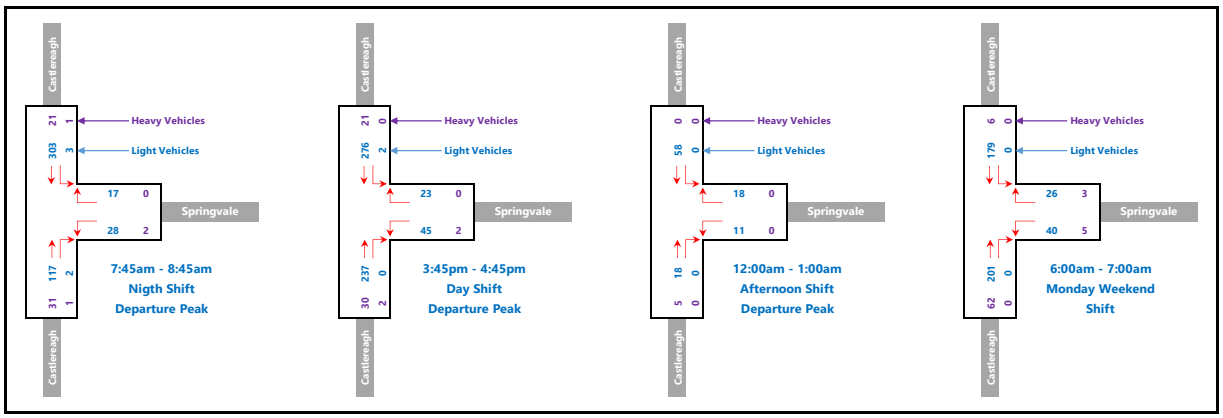


Figure 4.3.3.2 2025 Castlereagh Highway & Springvale Access Road Shift Departure Peaks



4.4 Future Road Network Performance

4.4.1 Future Intersection Performance

The intersection of Castlereagh Highway & Springvale Access Road has been reassessed using the 2025 peak period flows shown in **Section 4.3.3** above. The results of the SIDRA modelling are provided below in **Table 4.4.1**.

Table 4.4.1 2025 Peak Period Intersection Operations

Intersection Castlereagh Highway & Springvale Access Road 2025 SIDRA Operations	Level of Service		Average Delay (s)		Degree of Saturation	
	Arrival Peak	Departure Peak	Arrival Peak	Departure Peak	Arrival Peak	Departure Peak
Weekday Day Shift	A	A	1.9	0.9	0.088	0.183
Weekday Afternoon Shift	A	A	1.2	1.0	0.144	0.168
Weekday Night Shift	A	A	1.9	1.8	0.056	0.032
Weekend Night Shift	A	A	1.7	1.3	0.129	0.164

With reference to **Table 4.4.1**, the intersection will continue to operate at a good LoS during each of the Springvale shift arrival and departure peak periods further to the Modification, with very moderate delays and significant available capacity.

4.4.2 General Capacity Traffic Impacts

With reference to the intersection modelling outlined above, the Modification would have no significant impact on the operation of the key intersection of Castlereagh Highway & Springvale Access Road, which nonetheless will be upgraded to provide compliance with the Condition 21 of the SSD 5594.

More broadly, the additional traffic generation potential of the Modification can only be considered minor, and would have little impact on the operating capacity of the Castlereagh Highway. With regard to the current Level of Service B in the Castlereagh Highway (as reported in **Section 3.7**) the additional traffic flows would not result in a change of Level of Service and indeed significant growth capacity would still be available before a Level of Service C traffic flows were to be reached.

4.5 Parking

With reference to **Section 2.2.3** and **Table 4.3.1**, a future peak demand for up to 203 parking spaces will occur during the change-over period between the Weekend Night Shift and Weekday Day Shift (between approximately 5:00am and 6:30am), while demand during other weekday shift change-over periods would generally remain unchanged from current peak demand. As such, the available on-site parking would continue to provide for peak parking demands further to the Modification.

5 Conclusions

5.1 Intersection Castlereagh Highway & Springvale Access Road

Springvale Coal has committed to the upgrade of this intersection in line within the provisions of GRD4A to Condition 21 of the SSD 5594 approval, and has commenced design planning for such, which would ultimately be finalised further to consultation with the RMS before implementation.

5.2 General Traffic Impacts

The additional trip generation associated with the Modification is very minor, and would largely occur outside of peak traffic flow periods in Castlereagh Highway. Further to the Modification, the intersection of Castlereagh Highway & Springvale Access Road would continue to operate at a good level of service through all key peak periods through 2025, and the Castlereagh Highway would also continue to operate with significant spare capacity.

5.3 Pit Top Parking

The available capacity within the Pit Top staff car parks will continue to accommodate peak staff parking demands further to the Modification.

Springvale Colliery

SSD 5594 Modification 1 Proposal

Traffic Impact Assessment

Appendix A Traffic Surveys

Source All: ***TRACSIS Traffic Data Australia***

Anton Reisch Consulting Pty Ltd
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antonreisch@optusnet.com.au
ACN: 150 259 493

Table A1.1 Castlereagh Highway ADT Volume Summary

Job No	N2058
Client	ARC
Road	Castlereagh Hwy - 150m south of access Rd
Location	Lithgow
Site No.	1
Start Date	12-Nov-15
Description	Volume Summary
Direction	Combined

Average Weekday	5,786
7 Day Average	5,503

	Day of Week								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Ave	7 Day
Time	16-Nov	17-Nov	18-Nov	12-Nov	13-Nov	14-Nov	15-Nov	W'day	Ave
AM Peak	373	413	411	418	433	455	433		
PM Peak	469	497	478	476	550	414	482		
0:00	22	38	54	39	48	37	32	40	39
1:00	9	20	12	13	22	21	30	15	18
2:00	11	14	17	11	15	12	13	14	13
3:00	18	17	21	22	25	14	11	21	18
4:00	39	41	36	38	39	23	9	39	32
5:00	190	174	179	180	184	111	84	181	157
6:00	353	336	334	372	326	184	97	344	286
7:00	288	310	288	303	319	186	109	302	258
8:00	373	413	411	418	412	264	144	405	348
9:00	345	334	315	338	388	327	263	344	330
10:00	367	318	365	358	398	455	332	361	370
11:00	356	305	360	357	433	342	433	362	369
12:00	344	328	320	325	446	414	477	353	379
13:00	443	367	391	383	483	355	422	413	406
14:00	372	383	408	403	500	309	482	413	408
15:00	469	497	478	476	550	336	447	494	465
16:00	425	443	469	450	474	293	414	452	424
17:00	352	360	387	404	496	331	386	400	388
18:00	266	238	261	260	335	229	260	272	264
19:00	162	159	171	164	263	136	182	184	177
20:00	109	107	130	124	209	106	110	136	128
21:00	125	126	134	126	147	91	78	132	118
22:00	50	51	61	82	91	68	47	67	64
23:00	35	32	41	46	59	58	28	43	43
Total	5523	5411	5643	5692	6662	4702	4890	5786	5503

Table A1.2 Castlereagh Highway ADT Classification Summary

Road	Castlereagh Hwy - 150m south of access Rd
Location	Lithgow
Site No.	1
Start Date	12-Nov-15
Day	Weekday Ave.
Description	Class Summary

M'Cycle & P'Cycle	0%
Cars	87%
LGV	7%
OGV1 & PSV	1%
OGV2	4%

	NB						SB						Combined					
	M'Cycle & P'Cycle	Cars	LGV	OGV1 & PSV	OGV2	Total	M'Cycle & P'Cycle	Cars	LGV	OGV1 & PSV	OGV2	Total	M'Cycle & P'Cycle	Cars	LGV	OGV1 & PSV	OGV2	Total
0:00	0	13	1	0	3	17	0	21	1	0	1	23	0	34	2	0	4	40
1:00	0	5	0	0	4	9	0	5	1	0	0	6	0	10	1	0	4	15
2:00	0	3	0	0	5	9	0	3	1	0	1	5	0	6	1	0	6	14
3:00	0	5	1	0	5	12	0	6	0	0	3	9	0	12	1	0	8	21
4:00	0	14	2	1	4	20	0	16	0	0	2	18	0	29	3	1	6	39
5:00	0	97	15	1	7	119	0	53	3	1	5	62	0	150	18	1	12	181
6:00	1	177	29	2	8	217	1	117	4	1	6	127	2	294	33	2	14	344
7:00	0	101	21	3	7	133	0	153	10	2	5	169	1	254	31	5	12	302
8:00	0	114	18	3	6	141	0	243	12	4	6	264	0	357	30	6	12	405
9:00	1	125	14	4	6	149	2	168	9	5	11	195	3	293	23	9	17	344
10:00	1	130	14	6	7	158	2	177	11	4	9	203	3	307	26	10	16	361
11:00	1	147	16	3	9	176	0	164	8	3	10	186	2	311	24	7	19	362
12:00	1	153	15	2	5	176	1	154	9	3	9	177	2	307	23	6	15	353
13:00	2	196	21	4	6	229	1	160	12	3	8	184	3	357	33	7	14	413
14:00	1	163	14	3	5	186	1	203	12	3	8	227	2	366	26	6	13	413
15:00	1	199	15	3	8	225	3	244	11	2	9	269	3	443	26	5	17	494
16:00	0	191	20	1	8	220	2	213	8	1	8	232	2	404	28	2	16	452
17:00	1	202	13	1	5	221	1	164	7	0	7	179	2	365	20	1	11	400
18:00	1	136	9	0	6	152	2	108	5	0	5	120	3	245	13	0	11	272
19:00	0	89	6	0	5	101	0	76	2	0	5	82	0	165	8	0	10	184
20:00	0	75	6	0	3	85	0	46	1	0	4	50	0	121	7	1	7	136
21:00	0	77	8	0	3	89	0	37	1	0	5	43	0	114	9	1	8	132
22:00	0	34	3	0	2	39	0	25	0	0	2	28	0	59	4	1	4	67
23:00	1	17	1	0	2	21	0	19	1	0	2	22	1	36	2	0	3	43
Total	13	2463	264	37	127	2904	16	2575	127	35	130	2883	29	5038	391	72	257	5786

Table A2.1 Springvale Access Road ADT Volume Summary

Job No	N2058
Client	ARC
Road	Access Rd - 50m east of Castlereagh Hwy
Location	Lithgow
Site No.	2
Start Date	12-Nov-15
Description	Volume Summary
Direction	Combined

Average Weekday	665
7 Day Average	536

	Day of Week								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Ave	7 Day
Time	16-Nov	17-Nov	18-Nov	12-Nov	13-Nov	14-Nov	15-Nov	W'day	Ave
AM Peak	107	99	100	97	105	72	72		
PM Peak	76	77	86	84	72	61	57		
0:00	0	26	32	30	24	1	0	22	16
1:00	0	10	6	0	6	1	0	4	3
2:00	1	0	1	0	1	1	1	1	1
3:00	2	0	1	0	2	0	1	1	1
4:00	11	13	13	12	11	0	0	12	9
5:00	107	99	100	97	105	72	72	102	93
6:00	41	28	31	26	21	16	8	29	24
7:00	23	39	34	41	44	12	6	36	28
8:00	21	48	65	38	38	7	2	42	31
9:00	19	24	38	14	32	4	3	25	19
10:00	23	24	29	23	20	6	2	24	18
11:00	23	22	25	19	44	2	1	27	19
12:00	30	25	29	25	33	5	0	28	21
13:00	76	77	86	84	46	3	1	74	53
14:00	42	49	57	48	42	1	0	48	34
15:00	48	45	45	47	15	3	0	40	29
16:00	47	51	67	40	9	5	4	43	32
17:00	12	9	7	8	72	61	57	22	32
18:00	2	3	8	4	19	17	11	7	9
19:00	8	4	5	2	5	16	11	5	7
20:00	7	11	5	6	5	0	1	7	5
21:00	61	67	66	52	0	0	12	49	37
22:00	6	3	3	10	2	0	0	5	3
23:00	19	12	16	16	0	0	0	13	9
Total	629	689	769	642	596	233	193	665	536

Table A2.2 Springvale Access Road ADT Classification Summary

Road	Access Rd - 50m east of Castlereagh Hwy
Location	Lithgow
Site No.	2
Start Date	12-Nov-15
Day	Weekday Ave.
Description	Class Summary

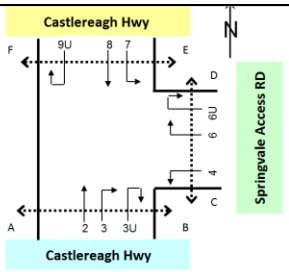
M'Cycle & P'Cycle	0%
Cars	78%
LGV	16%
OGV1 & PSV	3%
OGV2	2%

	EB						WB						Combined					
	M'Cycle & P'Cycle	Cars	LGV	OGV1 & PSV	OGV2	Total	M'Cycle & P'Cycle	Cars	LGV	OGV1 & PSV	OGV2	Total	M'Cycle & P'Cycle	Cars	LGV	OGV1 & PSV	OGV2	Total
0:00	0	0	0	0	0	0	0	15	8	0	0	22	0	15	8	0	0	22
1:00	0	0	0	0	0	0	0	3	1	0	0	4	0	3	1	0	0	4
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
3:00	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1
4:00	0	11	0	0	0	12	0	0	0	0	0	0	0	12	0	0	0	12
5:00	0	93	3	0	0	96	0	4	2	0	0	6	0	97	5	0	0	102
6:00	0	13	1	0	0	15	0	12	3	0	0	14	0	25	4	0	0	29
7:00	0	15	3	1	0	18	0	13	5	0	0	18	0	27	8	1	0	36
8:00	0	7	1	1	1	10	0	21	10	1	0	32	0	28	11	2	1	42
9:00	0	12	1	2	0	15	0	5	2	3	1	10	0	17	3	5	1	25
10:00	0	7	1	2	1	11	0	7	4	1	1	13	0	14	5	3	2	24
11:00	0	8	2	2	1	13	0	7	4	2	1	14	0	15	6	4	1	27
12:00	0	12	1	0	0	14	0	8	4	1	1	14	0	21	5	2	1	28
13:00	0	50	3	2	1	56	0	11	6	1	1	18	0	61	9	3	1	74
14:00	0	4	1	1	1	7	1	28	10	1	1	41	1	32	11	2	2	48
15:00	0	3	0	0	0	4	0	27	8	1	1	36	0	30	8	1	1	40
16:00	0	3	0	0	0	3	0	30	9	0	0	40	0	33	9	0	0	43
17:00	0	11	1	0	0	11	0	8	2	0	0	10	0	19	3	0	0	22
18:00	0	1	0	0	0	1	0	4	2	0	0	6	0	5	2	0	0	7
19:00	0	1	0	0	0	1	0	3	1	0	0	4	0	4	1	0	0	5
20:00	0	5	0	0	0	5	0	1	1	0	0	2	0	6	1	0	0	7
21:00	0	37	1	0	0	38	0	9	3	0	0	11	0	45	4	0	0	49
22:00	0	0	0	0	0	0	0	4	1	0	0	5	0	4	1	0	0	5
23:00	0	0	0	0	0	0	0	9	3	0	0	12	0	9	3	0	0	13
Total	0	293	21	11	6	331	1	228	87	11	6	334	1	521	108	23	12	665

Table A3.1 Castlereagh Highway & Springvale Access Road Volume Summary AM

Job No. : N2058
Client : ARC
Suburb : Lithgow ATC & IC
Location : Castlereagh Hwy / Springvale Access RD

Day/Date : Wed, 11th Nov 2015
Weather : Fine
Description : Classified Intersection Count
: Hourly Summary



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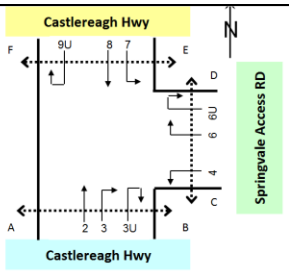
Approach	Castlereagh Hwy South								Springvale Access RD								Castlereagh Hwy North							
Direction	Direction 2 (Through)				Direction 3 (Right Turn)				Direction 4 (Left Turn)				Direction 6 (Right Turn)				Direction 7 (Left Turn)				Direction 8 (Through)			
Time Period	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total
0:00 to 1:00	15	4	0	19	0	0	0	0	9	0	0	9	15	0	0	15	0	0	0	0	7	0	0	7
0:15 to 1:15	13	1	0	14	0	0	0	0	5	0	0	5	6	0	0	6	0	0	0	0	7	0	0	7
0:30 to 1:30	9	0	0	9	0	0	0	0	5	0	0	5	7	0	0	7	0	0	0	0	6	2	0	8
0:45 to 1:45	7	0	0	7	0	0	0	0	4	0	0	4	5	0	0	5	0	0	0	0	5	2	0	7
1:00 to 2:00	3	6	0	9	0	0	0	0	1	0	0	1	2	0	0	2	0	0	0	0	5	2	0	7
1:15 to 2:15	1	7	0	8	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	4	3	0	7
1:30 to 2:30	2	12	0	14	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	2	0	3
1:45 to 2:45	3	12	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	4
2:00 to 3:00	2	10	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	6
2:15 to 3:15	2	10	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	5
2:30 to 3:30	2	6	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	6
2:45 to 3:45	4	8	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	0	7
3:00 to 4:00	6	4	0	10	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3	2	0	5
3:15 to 4:15	8	6	0	14	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	3	3	0	6
3:30 to 4:30	9	5	0	14	1	0	0	1	1	0	0	1	1	0	0	1	4	0	0	4	7	2	0	9
3:45 to 4:45	8	4	0	12	3	0	0	3	1	0	0	1	1	0	0	1	5	0	0	5	8	3	0	11
4:00 to 5:00	10	5	0	15	8	0	0	8	1	0	0	1	1	0	0	1	5	0	0	5	14	4	0	18
4:15 to 5:15	11	6	0	17	17	0	0	17	1	0	0	1	1	0	0	1	4	0	0	4	22	4	0	26
4:30 to 5:30	14	6	0	20	34	0	0	34	0	0	0	0	0	0	0	0	9	0	0	9	30	5	0	35
4:45 to 5:45	32	9	0	41	64	0	0	64	0	0	0	0	1	0	0	1	23	0	0	23	39	4	0	43
5:00 to 6:00	47	12	0	59	69	0	0	69	3	0	0	3	2	0	0	2	28	0	0	28	44	8	0	52
5:15 to 6:15	70	11	0	81	63	1	0	64	3	0	0	3	3	0	0	3	28	1	0	29	57	10	0	67
5:30 to 6:30	120	20	1	141	47	1	0	48	5	0	0	5	3	0	0	3	24	1	0	25	70	9	0	79
5:45 to 6:45	178	18	2	198	17	1	0	18	5	0	0	5	2	0	0	2	11	1	0	12	98	14	0	112
6:00 to 7:00	210	18	2	230	10	1	0	11	2	0	0	2	1	0	0	1	6	2	0	8	125	12	0	137
6:15 to 7:15	212	21	3	236	13	3	0	16	4	1	0	5	1	1	0	2	5	1	0	6	127	12	1	140
6:30 to 7:30	181	15	4	200	15	5	0	20	2	1	0	3	1	2	0	3	5	1	0	6	135	14	1	150
6:45 to 7:45	128	13	4	145	16	7	0	23	3	1	0	4	1	5	0	6	5	1	0	6	132	11	1	144
7:00 to 8:00	99	16	5	120	13	7	0	20	10	1	0	11	13	5	0	18	5	1	0	6	134	12	2	148
7:15 to 8:15	93	17	4	114	8	5	0	13	21	2	0	23	12	4	0	16	6	1	0	7	165	15	2	182
7:30 to 8:30	95	19	2	116	5	3	0	8	26	2	0	28	14	3	0	17	5	1	0	6	178	17	2	197
7:45 to 8:45	99	24	2	125	2	1	0	3	28	2	0	30	17	0	0	17	3	1	0	4	218	16	2	236
8:00 to 9:00	106	20	1	127	2	1	0	3	21	2	0	23	5	0	0	5	2	0	0	2	233	15	2	250
8:15 to 9:15	112	17	1	130	2	0	0	2	8	0	0	8	6	1	0	7	0	0	0	0	228	15	3	246
8:30 to 9:30	113	15	1	129	1	0	0	1	3	0	0	3	5	1	0	6	0	0	0	0	208	15	3	226
8:45 to 9:45	113	14	0	127	1	0	0	1	0	1	0	1	3	1	0	4	0	0	0	0	170	17	3	190
9:00 to 10:00	123	14	0	137	1	0	0	1	2	2	0	4	3	1	0	4	1	1	0	2	168	18	2	188
9:15 to 10:15	122	15	1	138	2	2	0	4	2	3	0	5	3	1	0	4	1	1	0	2	167	17	0	184
9:30 to 10:30	121	14	1	136	2	2	0	4	3	3	0	6	3	1	0	4	2	2	0	4	174	18	1	193
9:45 to 10:45	140	11	1	152	2	6	0	8	3	3	0	6	5	1	0	6	3	2	0	5	179	19	1	199
10:00 to 11:00	138	11	1	150	4	6	0	10	2	2	0	4	6	1	0	7	3	1	0	4	157	20	1	178
10:15 to 11:15	148	11	0	159	4	4	0	8	2	2	0	4	8	1	0	9	3	1	0	4	160	24	1	185
10:30 to 11:30	153	10	0	163	6	4	0	10	4	4	0	8	7	2	0	9	3	0	0	3	156	19	0	175
10:45 to 11:45	142	12	1	155	6	1	0	7	5	3	0	8	6	2	0	8	4	2	0	6	137	15	0	152
11:00 to 12:00	128	12	1	141	5	1	0	6	4	4	0	8	8	2	0	10	3	2	0	5	132	20	0	152
11:15 to 12:15	120	12	1	133	5	4	0	9	4	3	0	7	7	1	0	8	4	2	0	6	127	14	0	141
11:30 to 12:30	119	11	1	131	6	4	0	10	1	2	0	3	7	0	0	7	3	2	0	5	140	16	0	156
11:45 to 12:45	107	15	0	122	11	4	0	15	1	2	0	3	5	1	0	6	5	0	0	5	141	20	0	161

Table A3.2 Castlereagh Highway & Springvale Access Road Volume Summary PM

Job No. : N2058
Client : ARC
Suburb : Lithgow ATC & IC
Location : Castlereagh Hwy / Springvale Access RD

Day/Date : Wed, 11th Nov 2015
Weather : Fine
Description : Classified Intersection Count
: Hourly Summary



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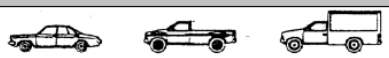
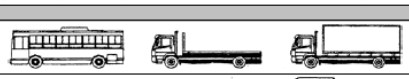
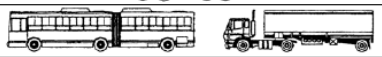
Traffic Data Australia

Approach	Castlereagh Hwy South								Springvale Access RD								Castlereagh Hwy North							
Direction	Direction 2 (Through)				Direction 3 (Right Turn)				Direction 4 (Left Turn)				Direction 6 (Right Turn)				Direction 7 (Left Turn)				Direction 8 (Through)			
Time Period	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total	Cars	Trucks	Buses	Total
12:00 to 13:00	113	15	0	128	14	4	0	18	1	2	0	3	4	3	0	7	8	0	0	8	151	15	0	166
12:15 to 13:15	120	16	0	136	22	1	0	23	3	3	0	6	5	3	0	8	8	1	0	9	136	13	0	149
12:30 to 13:30	133	19	0	152	30	1	0	31	5	3	0	8	6	3	0	9	16	1	0	17	124	13	0	137
12:45 to 13:45	144	16	0	160	44	1	0	45	5	3	0	8	8	2	0	10	21	1	0	22	140	9	0	149
13:00 to 14:00	155	16	1	172	41	2	0	43	5	2	0	7	13	1	0	14	21	1	0	22	135	4	0	139
13:15 to 14:15	164	10	1	175	31	2	0	33	12	2	0	14	15	1	0	16	22	0	0	22	140	5	0	145
13:30 to 14:30	174	9	1	184	20	2	0	22	15	2	0	17	17	1	0	18	15	1	0	16	148	13	0	161
13:45 to 14:45	180	8	2	190	1	1	0	2	17	2	0	19	18	1	0	19	7	1	0	8	156	18	0	174
14:00 to 15:00	181	7	1	189	0	2	0	2	19	2	0	21	14	0	0	14	7	1	0	8	173	22	0	195
14:15 to 15:15	180	12	1	193	0	2	0	2	16	5	0	21	11	0	0	11	7	2	0	9	180	26	0	206
14:30 to 15:30	168	12	1	181	1	2	0	3	13	4	0	17	10	0	0	10	7	1	0	8	205	18	0	223
14:45 to 15:45	180	9	0	189	1	2	0	3	15	6	0	21	7	0	0	7	7	1	0	8	205	14	0	219
15:00 to 16:00	201	10	0	211	1	0	0	1	34	6	0	40	16	0	0	16	4	1	0	5	195	14	0	209
15:15 to 16:15	209	12	1	222	1	2	0	3	43	2	0	45	20	0	0	20	2	0	0	2	212	13	0	225
15:30 to 16:30	206	17	1	224	0	2	0	2	46	4	0	50	21	0	0	21	3	0	0	3	188	15	2	205
15:45 to 16:45	202	24	1	227	0	2	0	2	44	2	0	46	22	0	0	22	2	0	0	2	174	16	2	192
16:00 to 17:00	185	23	1	209	0	2	0	2	24	5	0	29	10	1	0	11	2	0	0	2	172	14	2	188
16:15 to 17:15	168	19	0	187	1	0	0	1	10	6	0	16	4	1	0	5	2	0	0	2	163	11	2	176
16:30 to 17:30	178	12	0	190	1	0	0	1	7	5	0	12	1	1	0	2	0	0	0	0	169	11	0	180
16:45 to 17:45	169	6	0	175	1	0	0	1	6	5	0	11	0	1	0	1	0	0	0	0	178	9	0	187
17:00 to 18:00	166	6	1	173	2	0	0	2	8	2	0	10	1	0	0	1	0	0	0	0	173	9	0	182
17:15 to 18:15	169	4	1	174	1	0	0	1	8	1	0	9	1	0	0	1	0	0	0	0	140	10	0	150
17:30 to 18:30	159	6	1	166	1	0	0	1	7	0	0	7	1	0	0	1	0	0	0	0	125	9	0	134
17:45 to 18:45	147	5	1	153	1	0	0	1	5	0	0	5	1	0	0	1	0	0	0	0	101	9	1	111
18:00 to 19:00	128	5	0	133	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	102	11	1	114
18:15 to 19:15	106	7	0	113	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	108	8	1	117
18:30 to 19:30	77	7	0	84	0	0	0	0	3	0	0	3	3	0	0	3	1	0	0	1	100	6	1	107
18:45 to 19:45	61	9	0	70	2	0	0	2	3	0	0	3	4	0	0	4	1	0	0	1	104	7	0	111
19:00 to 20:00	57	9	0	66	2	0	0	2	3	0	0	3	5	0	0	5	2	0	0	2	81	6	0	87
19:15 to 20:15	56	7	0	63	2	0	0	2	2	0	0	2	5	0	0	5	2	0	0	2	69	7	0	76
19:30 to 20:30	58	6	0	64	3	0	0	3	1	0	0	1	2	0	0	2	1	0	0	1	57	8	0	65
19:45 to 20:45	54	5	0	59	3	0	0	3	1	0	0	1	1	0	0	1	1	0	0	1	47	7	0	54
20:00 to 21:00	52	3	0	55	7	0	0	7	0	0	0	0	0	0	0	0	1	0	0	1	52	9	0	61
20:15 to 21:15	52	3	0	55	11	0	0	11	0	0	0	0	0	0	0	0	1	0	0	1	45	9	0	54
20:30 to 21:30	50	4	0	54	14	0	0	14	0	0	0	0	0	0	0	0	2	0	0	2	39	8	0	47
20:45 to 21:45	47	5	0	52	31	0	0	31	0	0	0	0	0	0	0	0	14	0	0	14	36	8	0	44
21:00 to 22:00	38	7	0	45	32	0	0	32	2	0	0	2	5	0	0	5	16	0	0	16	23	6	0	29
21:15 to 22:15	26	7	0	33	28	0	0	28	3	0	0	3	5	0	0	5	16	0	0	16	21	7	0	28
21:30 to 22:30	26	5	0	31	25	0	0	25	4	0	0	4	5	0	0	5	15	0	0	15	24	8	0	32
21:45 to 22:45	24	3	0	27	7	0	0	7	6	0	0	6	5	0	0	5	3	0	0	3	22	7	0	29
22:00 to 23:00	21	1	0	22	2	0	0	2	4	0	0	4	0	0	0	0	0	0	0	0	25	5	0	30
22:15 to 23:15	21	1	0	22	2	0	0	2	4	0	0	4	1	0	0	1	0	0	0	0	25	3	0	28
22:30 to 23:30	15	1	0	16	1	0	0	1	3	0	0	3	1	0	0	1	0	0	0	0	19	2	0	21
22:45 to 23:45	16	2	0	18	0	0	0	0	9	0	0	9	2	0	0	2	0	0	0	0	10	2	0	12
23:00 to 0:00	14	3	0	17	0	0	0	0	21	0	0	21	3	0	0	3	0	0	0	0	8	1	0	9

Figure A4 AustRoads Vehicles Classification System

Level 1	Level 2		Level 3	AUSTROADS Classification		
Length (indicative)	Axles and Axle Groups		Vehicle Type			
Type	Axles	Groups	Typical Description	Class	Parameters	Typical Configuration
	LIGHT VEHICLES					
Short up to 5.5m		1 or 2	**Short** Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	1	d(1) ≤ 3.2m and axles = 2	
Medium 5.5m to 14.5m	3, 4 or 5	3	**Short - Towing** Trailer, Caravan, Boat, etc	2	groups = 3 d(1) ≥ 2.1m, d(1) ≤ 3.2m, d(2) ≥ 2.1m and axles = 3, 4 or 5	
	HEAVY VEHICLES					
	2	2	**Two Axle Truck or Bus**	3	d(1) > 3.2m and axles = 2	
	3	2	**Three Axle Truck or Bus**	4	axles = 3 and groups = 2	
	> 3	2	**Four Axle Truck**	5	axles > 3 and groups = 2	
Long 11.5m to 19.0m	3	3	**Three Axle Articulated** Three axle articulated vehicle, or Rigid vehicle and trailer	6	d(1) > 3.2m, axles = 3 and groups = 3	
	4	> 2	**Four Axle Articulated** Four axle articulated vehicle, or Rigid vehicle and trailer	7	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 4 and groups > 2	
	5	> 2	**Five Axle Articulated** Five axle articulated vehicle, or Rigid vehicle and trailer	8	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 5 and groups > 2	
	≥ 6	> 2	**Six Axle Articulated** Six axle articulated vehicle, or Rigid vehicle and trailer	9	axles = 6 and groups > 2 or axles > 6 and groups = 3	
Medium Combination 17.5m to 36.5m	> 6	4	**B Double** B Double, or Heavy truck and trailer	10	groups = 4 and axles > 6	
	> 6	5 or 6	**Double Road Train** Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	11	groups = 5 or 6 and axles > 6	
Large Combination Over 33.0m	> 6	> 6	**Triple Road Train** Triple road train, or Heavy truck and three trailers	12	groups > 6 and axles > 6	

Springvale Colliery

SSD 5594 Modification 1 Proposal

Traffic Impact Assessment

Appendix B RMS Crash Data

Figure B1 **RMS Crash Plot Castlereagh Highway**

Table B1 **RMS Summary Crash Report Castlereagh Highway**

Source All: ***RMS***

Anton Reisch Consulting Pty Ltd
19 Canoon Road Turramurra NSW 2074
Ph 02 9449 5161 Mob 0427 995160
antonreisch@optusnet.com.au
ACN: 150 259 493

Figure B1 RMS Crash Plot Castlereagh Highway

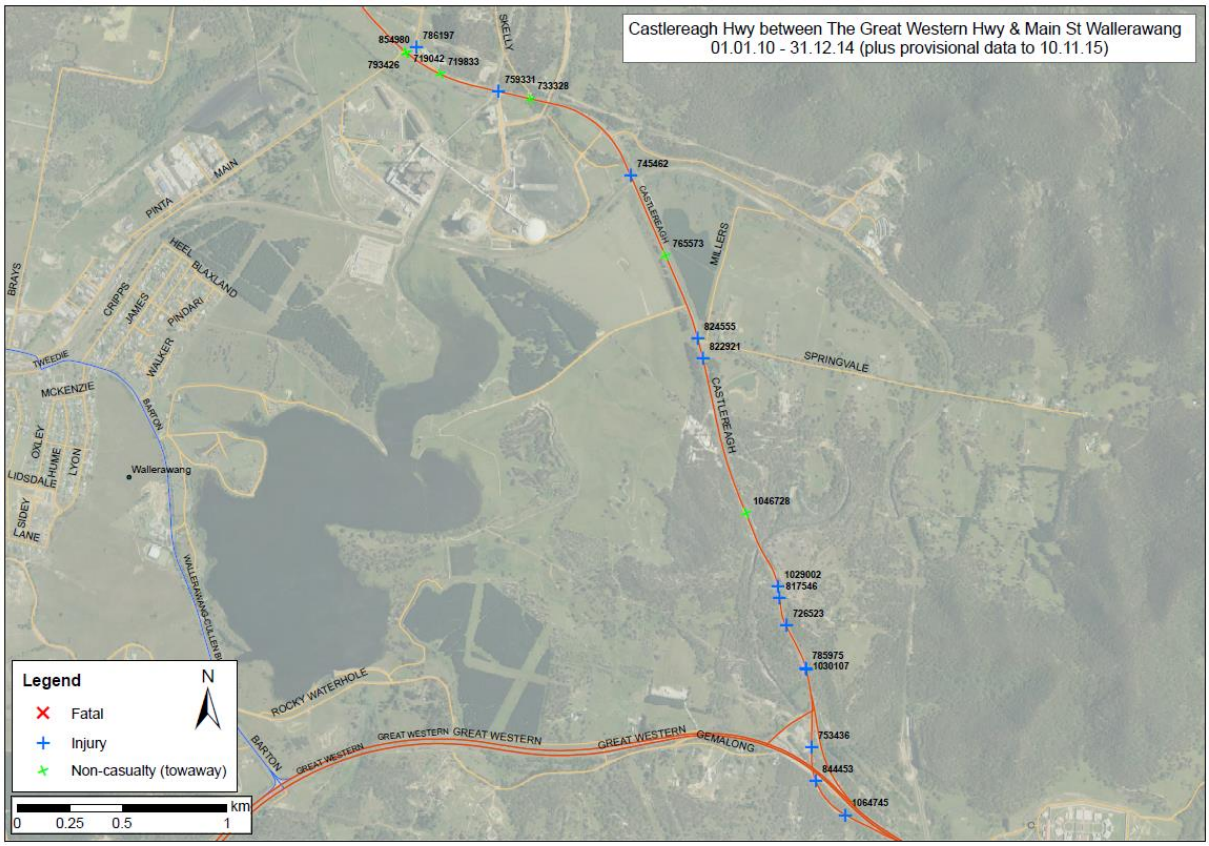


Table B1 RMS Summary Crash Report Castlereagh Highway

Summary Crash Report

Transport for NSW

# Crash Type		
Car Crash	17	85.0%
Light Truck Crash	7	35.0%
Rigid Truck Crash	1	5.0%
Articulated Truck Crash	1	5.0%
'Heavy Truck Crash	(2)	(10.0%)
Bus Crash	0	0.0%
"Heavy Vehicle Crash	(2)	(10.0%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	0	0.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	7	35.0%
Non intersection	13	65.0%

* Up to 10 metres from an intersection

Collision Type		
Single Vehicle	9	45.0%
Multi Vehicle	11	55.0%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	19	95.0%
Other Classified Road	0	0.0%
Unclassified Road	1	5.0%

Contributing Factors		
Speeding	3	15.0%
Fatigue	0	0.0%
Alcohol	1	5.0%

Weather		
Fine	14	70.0%
Rain	2	10.0%
Overcast	3	15.0%
Fog or mist	1	5.0%
Other	0	0.0%

Road Surface Condition		
Wet	2	10.0%
Dry	18	90.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	2	10.0%
Daylight	12	60.0%
Dusk	2	10.0%
Darkness	4	20.0%

Crash Movement		
Intersection, adjacent approaches	5	25.0%
Head-on (not overtaking)	1	5.0%
Opposing vehicles; turning	0	0.0%
U-turn	0	0.0%
Rear-end	3	15.0%
Lane change	1	5.0%
Parallel lanes; turning	1	5.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	1	5.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	5	25.0%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	3	15.0%
Out of control on curve	0	0.0%
Other crash type	0	0.0%

Speed Limit					
40 km/h or less	0	0.0%	80 km/h zone	7	35.0%
50 km/h zone	1	5.0%	90 km/h zone	0	0.0%
60 km/h zone	1	5.0%	100 km/h zone	11	55.0%
70 km/h zone	0	0.0%	110 km/h zone	0	0.0%

~ 07:30-09:30 or 14:30-17:00 on school days	~ 40km/h or less		~ School Travel Time Involvement		
	0	0.0%		3	15.0%

Day of the Week												
Monday	2	10.0%	Wednesday	3	15.0%	Friday	1	5.0%	Sunday	2	10.0%	WEEKEND	8	40.0%
Tuesday	2	10.0%	Thursday	4	20.0%	Saturday	6	30.0%	WEEKDAY	12	60.0%			

#Holiday Periods														
New Year	0	0.0%	Easter	0	0.0%	Queen's BD	0	0.0%	Christmas	0	0.0%	Easter SH	0	0.0%	Sept./Oct. SH	0	0.0%
Aust. Day	0	0.0%	Anzac Day	0	0.0%	Labour Day	0	0.0%	January SH	0	0.0%	June/July SH	4	20.0%	December SH	1	5.0%

CRASHES	20	
Fatal	0	0.0%
Serious inj.	5	25.0%
Moderate inj.	4	20.0%
Minor/Other inj.	1	5.0%
Uncategorised inj.	3	15.0%
Non-casualty	7	35.0%

Self Reported Crash	0	0%

Time Group		% of Day	
00:01 - 02:59	1	5.0%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	1	5.0%	4.2%
06:00 - 06:59	1	5.0%	4.2%
07:00 - 07:59	1	5.0%	4.2%
08:00 - 08:59	2	10.0%	4.2%
09:00 - 09:59	1	5.0%	4.2%
10:00 - 10:59	0	0.0%	4.2%
11:00 - 11:59	1	5.0%	4.2%
12:00 - 12:59	2	10.0%	4.2%
13:00 - 13:59	0	0.0%	4.2%
14:00 - 14:59	0	0.0%	4.2%
15:00 - 15:59	2	10.0%	4.2%
16:00 - 16:59	3	15.0%	4.2%
17:00 - 17:59	1	5.0%	4.2%
18:00 - 18:59	2	10.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	1	5.0%	8.3%
22:00 - 24:00	1	5.0%	8.3%

Street Lighting Off/Nil			% of Dark
4	of	4	in Dark 100.0%

CASUALTIES	24	
Killed	0	0.0%
Seriously inj.	8	33.3%
Moderately inj.	7	29.2%
Minor/Other inj.	1	4.2%
Uncategorised inj.	8	33.3%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes		Casualties
1	2015	5
3	2014	3
2	2013	1
5	2012	6
5	2011	5
4	2010	4

McLean Periods		% Week	
A	4	20.0%	17.9%
B	1	5.0%	7.1%
C	3	15.0%	17.9%
D	1	5.0%	3.5%
E	0	0.0%	3.6%
F	3	15.0%	10.7%
G	1	5.0%	7.1%
H	5	25.0%	7.1%
I	1	5.0%	12.5%
J	1	5.0%	10.7%

Crashid dataset HW18 from HW5 to Main St, Wallerawang from 01.01.10 to 31.12.14 (plus provisional to 10.11.15)

Note: Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.
Crash self reporting, including self reported injuries began in Oct 2014. Trends from 2014 are expected to vary from previous years. More unknowns are expected in self reported data.
Reporting years 2014 onwards contain uncategorised injury crashes.
Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Air Quality and Greenhouse Gas Impact Assessment

APPENDIX – H

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global environmental solutions

Springvale Mine

Modification 1 to State Significant Development 5594

Air Quality and Greenhouse Gas Impact Assessment

Report Number 630.11526-R1

7 April 2016

Springvale Coal Pty Limited
PO Box 198
Wallerawang NSW 2845

Version: Revision 0

Springvale Mine

Modification 1 to State Significant Development 5594

Air Quality and Greenhouse Gas Impact Assessment

PREPARED BY:

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
630.11526-R1	Revision 0	7 April 2016	F Rahaman	K Lawrence	K Lawrence

Executive Summary

SLR Consulting was commissioned by Springvale Coal Pty Ltd (Springvale Coal) to undertake an Air Quality and Greenhouse Gas Impact Assessment for a proposed modification to State Significant Development (SSD) 5594 (Springvale Mine Extension Project [SMEP]). Springvale Coal proposes to modify SSD 5594 to allow for:

- an increase in workforce from the approved 310 full time equivalent (FTE) to 450 FTE;
- an increase in ROM coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa, with the transfer continuing to occur using the overland conveyor system to the Springvale Coal Services Site; and
- an increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes (t) to 200,000 t and accompanying extension in stockpile area footprint to the north of the existing footprint by approximately 20%.

Potential dust emissions from the MOD 1 operation were estimated based on published emission factors and measured data from Angus Place Colliery's Ventilation Shaft. Dispersion modelling was performed for operation of the proposed MOD 1 to predict the future incremental and cumulative impacts on local air quality from the MOD 1 operation.

Ambient air quality monitoring data from the OEH-operated Bathurst monitoring station were used as background to assess the cumulative impact from MOD 1.

The predicted results showed that the proposed MOD 1 activities are unlikely to cause any exceedences of the relevant ambient air quality criteria for TSP, PM_{10} and $PM_{2.5}$ concentrations or dust deposition at any identified surrounding sensitive receptors.

The assessment also considered emissions of Greenhouse Gases (CH_4 and CO_2) from MOD 1 and includes estimates of direct and indirect GHG emissions. The results of these calculations were as follows:

- MOD 1 is estimated to result in an increase in direct (Scope 1) GHG emissions of 4,479 t CO_2-e per annum, which represents an increase of 15% on current approved operations.
- Indirect (Scope 2) GHG emissions are not expected to change as a result of MOD 1.
- Indirect (Scope 3) GHG emissions estimated to increase by 2,437,970 t CO_2-e per annum, an increase of approximately 22% on current approved operations. The increased emissions are due to the indirect emissions associated with combustion of the additional 1 Mtpa product coal by end users.
- Comparison of MOD 1 emissions with State and National GHG emission totals indicates that the MOD 1 is likely to represent approximately 0.0032% of NSW GHG emissions (Scope 1) when compared to the latest available emissions data (2013) (Scope 1) and 0.0008% of Australian National GHG emissions (Scope 1).

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1 INTRODUCTION

Springvale Coal Pty Limited (Springvale Coal) operates the Springvale Mine located 15 kilometres (km) northwest of Lithgow NSW. SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Springvale Coal to perform an Air Quality and Greenhouse Gas Impact Assessment for a proposed modification to State Significant Development (SSD) 5594 (Springvale Mine Extension Project [SMEP]) which was granted to Springvale Coal on 21 September 2015. The Air Quality and Greenhouse Gas Impact Assessment will be included in a Statement of Environmental Effects (SEE) to be submitted to support the modification (MOD 1 to SSD 5594, hereafter referred to as MOD 1).

Broadly, the objective of this assessment is to identify the potential impacts of air pollutant and greenhouse gas emissions associated with MOD 1, the cumulative impacts of the modification with existing and approved Springvale mining operations and the cumulative impacts of the modification with other activities/operations in the proximity of the mine.

This Air Quality and Greenhouse Gas Impact Assessment has been prepared in accordance with the Office of Environment and Heritage (OEH) document '*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*' (DEC, 2005), hereafter referred to as 'The Approved Methods'. This assessment involves the modelling of local meteorology and the dispersion of potential emissions from the Springvale pit top to predict the level of impact that may be experienced in the surrounding environment. The sections of this report where the requirements of the Approved Methods are met are as follows:

- Description of local topographic features and sensitive receptor locations (**Section 2.3**).
- Establishment of air quality assessment criteria (**Section 3**).
- Analysis of climate and dispersion meteorology for the region (**Section 6.2**).
- Description of existing air quality environment (**Section 5**).
- Compilation of a comprehensive emissions inventory for the existing and proposed activities (**Section 4**).
- Completion of atmospheric dispersion modelling and analysis of results (**Section 6** and **Section 7**).
- Preparation of an air quality impact assessment report comprising the above.

2 PROJECT DESCRIPTION

Springvale Mine (Springvale) is an underground coal mine producing high quality thermal coal which is supplied to local domestic markets and Western Coal Services Project (SSD 5579). Domestically, Springvale Coal supplies run of mine (ROM) Coal to Mount Piper Power Station (MPPS). Sized ROM coal is distributed to MPPS and Springvale Coal Services Site (Western Coal Services Project) via dedicated overland conveyors. Springvale is also approved to transport 50,000 tonnes per annum of ROM coal to local domestic market customers by road haulage from the pit top.

The main components of Springvale Mine's operations are an underground longwall mine and supporting surface infrastructure within the pit top area and in the Newnes State Forest. The pit top has an existing ROM coal stockpile area, a crushing and screening plant, water management structures, workshop facilities, car parking areas, administration offices and underground mine access. No coal beneficiation (washing) occurs at the pit top. The Newnes Plateau infrastructure comprises an upcast ventilation shaft, dewatering bore facilities and substations.

2.1 Project Objectives and Overview

Springvale Coal proposes to modify SSD 5594 to allow for:

- an increase in workforce from the approved 310 full time equivalent (FTE) to 450 FTE;
- an increase in ROM coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa, with the transfer of coal off site continuing to occur using the overland conveyor system to the Springvale Coal Services Site and MPPS;
- an increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes (t) to 200,000 t and an accompanying extension in stockpile area footprint to the north of the existing footprint by approximately 20% or 0.3 ha.

2.2 Project Elements with Potential for Air Quality Impacts

2.2.1 Springvale Mine Pit Top

Modifications proposed to the existing Springvale pit top include the extension of the footprint of the ROM stockpile and an increase in the rate of ROM coal being received at the stockpile and the crusher and screening plant. Given the proximity of the pit top operations to the sensitive receptor locations, a quantitative assessment of particulate emissions (Total Suspended Particulates (TSP), deposited dust, PM_{10} and $PM_{2.5}$) has been performed.

A temporary crusher may be in operation at the pit top during periods when the overland conveyor system for the transfer of ROM coal off site is not operational. In these cases (which has never occurred to date), up to 50,000 tonnes of coal would be crushed using a temporary crusher located on the ROM coal stockpile and loaded to trucks before being transported to local domestic market customers, including Springvale Coal Services Site by road. Given that coal crushing within this temporary plant would be at or lower than the rate crushed through the permanent crushing and screening plant, it is considered that emissions of particulate would not increase during these periods, and no specific quantitative assessment of these operations has been performed. Emissions and subsequent impacts resulting from this rare occurrence are considered to be encompassed in the modelling results for normal operations.

2.2.2 Ventilation Facilities

The Air Quality Impact Assessment (AQIA) performed as part of the SMEP assessment utilised a volumetric flow value of 221.1 m^3/s from the existing upcast ventilation shaft and used particulate emissions monitoring data collected at the nearby Angus Place Colliery to represent the likely emissions profile from upcast ventilation at Springvale.

As part of MOD 1, an additional continuous mining unit (CM) will be required to realise the increase in ROM coal production. Information provided by Springvale Coal mining engineers indicates that increased ventilation required to operate the CM unit would be 20 m^3/s. This increased ventilation rate has been quantitatively assessed within this modification AQIA with emissions of particulate matter represented by the Angus Place monitoring data. This is considered to be appropriate given that both mines access the Lithgow coal seam.

Emissions of carbon monoxide (CO) and odour from the ventilation shaft during operation were previously assessed as not having any significant off-site impacts and have not been considered further.

2.2.3 Site Rehabilitation

Following the finalisation of mining activities at Springvale, the site will be completely rehabilitated. Although emissions from all coal processing and ancillary operations will cease, during the rehabilitation phase emissions relating to infrastructure removal, land clearance, earth moving and shaping and topsoil spreading will occur.

A quantitative assessment of the potential air quality impacts associated with site rehabilitation was performed as part of the SMEP AQIA and was presented in that report. No increase in the level of rehabilitation is anticipated to be required as a result of MOD 1 and no additional assessment has been performed.

2.3 Local Topography and Sensitive Receivers

The topographical data used in the meteorological and dispersion modelling was sourced from the United States Geological Service's Shuttle Radar Topography Mission database that has recorded topography across Australia with a 3 arc second (~90 m) spacing. The topography of the local region surrounding Springvale is presented in **Figure 1**.

Springvale is located within a region of significant topographical variation as shown in **Figure 1**. The boundary of the Springvale Mine lies along the western edge of the Great Dividing Range and is situated at an altitude of between approximately 900 m to 1100 m AHD. It is bordered by the Wolgan Valley to the north and the Newnes Plateau to the east.

A number of residences are located in the area surrounding the Springvale pit top. A list of the nearest residences identified in the immediate vicinity of the Springvale pit top is presented in **Table 1** and **Figure 2**. Concentrations of particulate matter have been assessed at each of these receptors, for relevant averaging periods as discussed in **Section 3**.

Given that the upcast ventilation shaft is located in proximity to areas of recreational use, it is considered appropriate to estimate concentrations of particulate matter at these locations. It is noted that air quality impact assessment criteria as outlined in **Section 3** are also applicable to areas where a transient population of primarily recreational users may be located, and it is therefore considered appropriate to present predicted impacts at these locations. The locations of these receptors are presented in **Table 2** and **Figure 2**.

Figure 1 Topography of the Surrounding Area

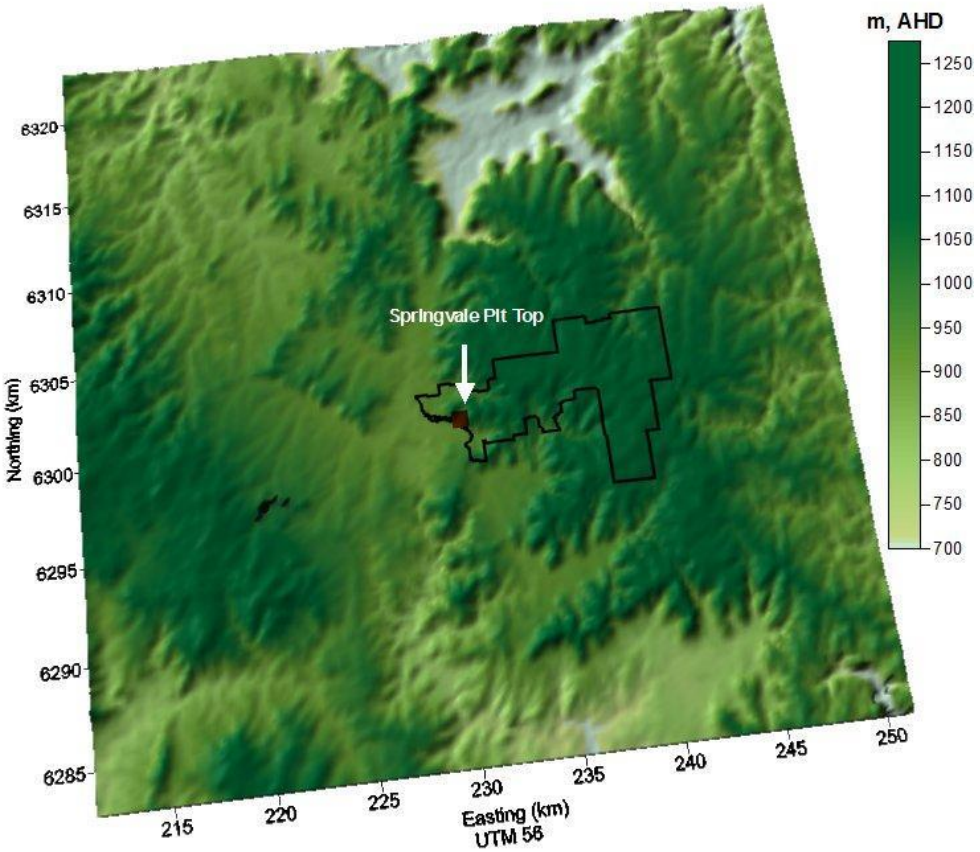


Table 1 Locations of Nearest Residential Receivers to Springvale Pit Top

Receptor	Easting (m)	Northing (m)	Zone	Elevation (m)
S1	230,230	6,299,725	56H	905
S2	230,456	6,299,541	56H	910
S3	228,775	6,301,089	56H	880
S4	231,589	6,299,387	56H	915
S5	232,009	6,299,182	56H	940
W1	227,484	6,301,148	56H	900
W2	227,420	6,300,654	56H	887
L1	229,078	6,302,626	56H	905
L2	229,028	6,301,777	56H	912

Figure 2 Sensitive Receptor Locations

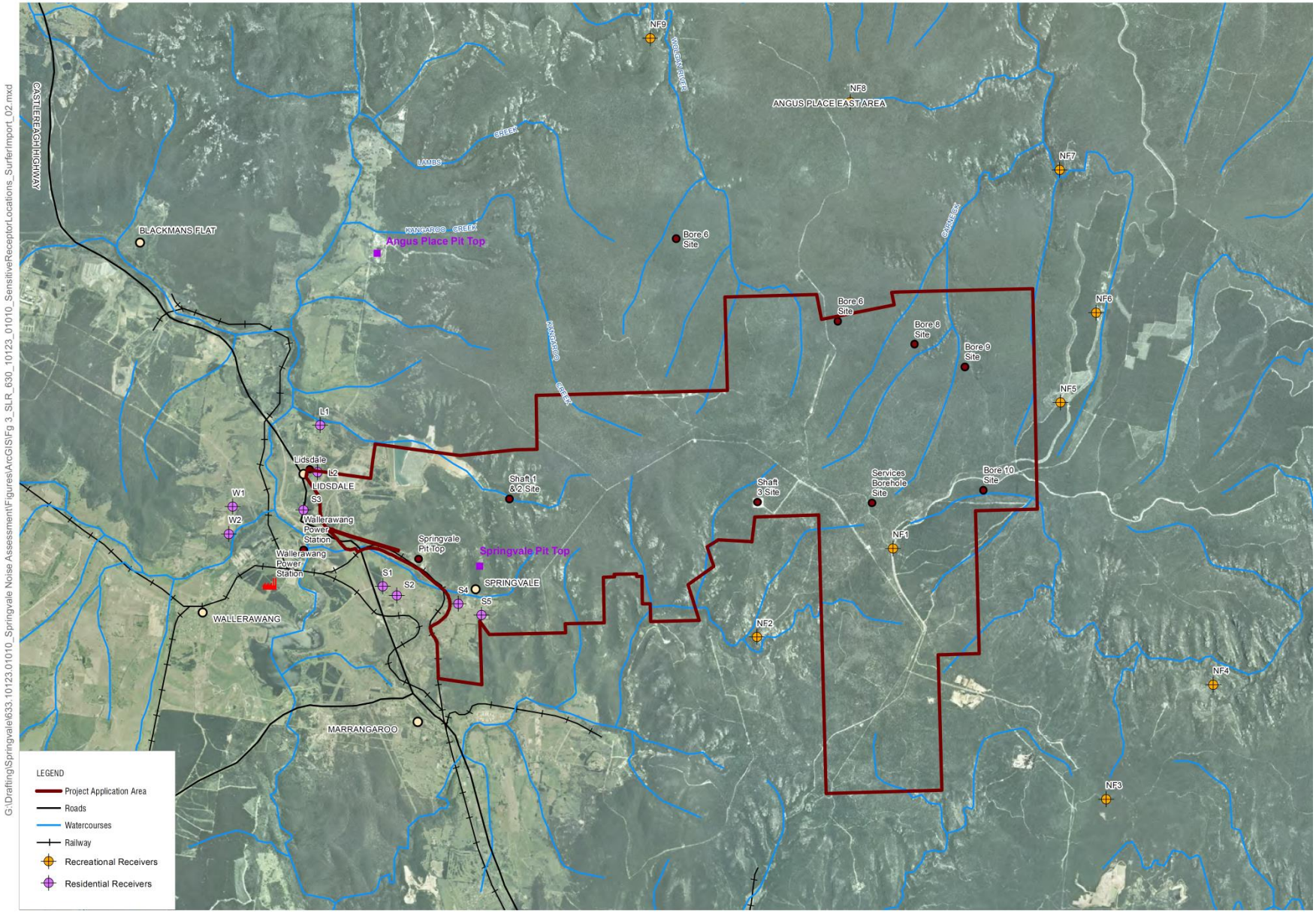


Table 2 Approximate Location of Nearest Sensitive Receivers on Newnes Plateau

Receptor	Easting (m)	Northing (m)	Zone	Elevation (m)
NF1	239,483	6,300,390	56H	1,165
NF2	237,015	6,298,782	56H	1,060
NF3	243,358	6,295,836	56H	1,160
NF4	245,304	6,297,921	56H	970
NF5	242,528	6,303,041	56H	1,080
NF6	243,182	6,304,671	56H	1,045
NF7	242,516	6,307,266	56H	925
NF8	238,709	6,308,496	56H	1110
NF9	235,079	6,309,656	56H	1030

3 AIR QUALITY CRITERIA

3.1 Air Pollutants Considered

Given the foregoing discussion relating to the current development consent and previously performed assessments, only emissions of particulate matter (TSP, deposited particulate, PM_{10} and $PM_{2.5}$) are considered within this assessment. It is not considered necessary to re-assess already approved infrastructure where no additional impacts are envisaged due to the proposed MOD 1.

3.2 Review of Air Quality Criteria

State air quality guidelines adopted by the NSW EPA are published in the Approved Methods (DEC, 2005).

The Approved Methods has been consulted during the preparation of this Air Quality and Greenhouse Gas Impact Assessment report. The Approved Methods lists the statutory methods that are to be used to model and assess emissions of air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the MOD 1 proposal. The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC, WHO and ANZECC). The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for the setting.

3.2.1 Suspended Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP). The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air (µg/m^3).

The TSP goal was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

Emissions of particulate matter less than 10 µm and 2.5 µm in diameter (referred to as PM_{10} and $PM_{2.5}$ respectively) are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $PM_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

The NSW EPA PM_{10} assessment goals set out in the Approved Methods are as follows:

- a 24-hour maximum of 50 µg/m^3.
- an annual average of 30 µg/m^3.

The Approved Methods do not set any assessment goals for $PM_{2.5}$. In December 2000, the National Environment Protection Council (NEPC) initiated a review to determine whether a national ambient air quality criterion for $PM_{2.5}$ was required in Australia, and the feasibility of developing such a criterion. The review found that:

- there are health effects associated with these fine particles;
- the health effects observed overseas are supported by Australian studies; and
- fine particle standards have been set in Canada and the USA, and an interim criterion is proposed for New Zealand.

The review concluded that there is sufficient community concern regarding $PM_{2.5}$ to consider it an entity separate from PM_{10}. As such, in July 2003, a variation to the Ambient Air Quality NEPM was made to extend its coverage to $PM_{2.5}$, setting the following Interim Advisory Reporting Standards for $PM_{2.5}$:

- a 24-hour average concentration of 25 µg/m^3; and
- an annual average concentration of 8 µg/m^3.

It is noted that the Advisory Reporting Standards relating to $PM_{2.5}$ particles are reporting guidelines only at the present time and not intended to represent air quality criteria.

The National Clean Air Agreement (NCAA) was endorsed by Commonwealth, state and territory Environment Ministers on 15 December 2015. Ministers agreed to strengthen national ambient air quality reporting standards for airborne fine particles as follows:

For PM_{10}:

- a 24-hour average concentration of 50 µg/m^3 (unchanged from the Approved Methods); and
- an annual average of 25 µg/m^3 (compared to a value of 30 µg/m^3 in the Approved Methods).

For $PM_{2.5}$:

- a 24-hour average concentration of 25 µg/m^3; and
- an annual average concentration of 8 µg/m^3.

The NCAA $PM_{2.5}$ standards are consistent with the NEPM goals, however the annual average PM_{10} standard is more stringent than the current NSW EPA assessment criterion. As the NCAA standards have not yet been adopted by NSW EPA, this assessment is based on the current PM_{10} assessment criteria set out in the Approved Methods.

3.2.2 Deposited Particulate

The preceding section is concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts need also to be considered, mainly in relation to deposited dust. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 grams per square metre per month (g/m^2/month).

Table 3 presents the impact assessment goals set out in the Approved Methods for dust deposition to avoid dust nuisance.

Table 3 EPA Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m^2/month	4 g/m^2/month

Source: Approved Methods, OEH 2005.

3.3 Summary of MOD 1 Air Quality Goals

The air quality goals adopted for this assessment, which confirm to current EPA and Federal air quality criteria, are summarised in **Table 4**.

Table 4 MOD 1 Air Quality Goals

Pollutant	Averaging Time	Goal
TSP	Annual	90 µg/m^3
PM_{10}	24 Hours	50 µg/m^3 (NSW EPA)
	Annual	30 µg/m^3 (NSW EPA)
$PM_{2.5}$	24 Hours	25 µg/m^3 (NEPM)
	Annual	8 µg/m^3 (NEPM)
Dust Deposition	Annual	Maximum Incremental (Project only) increase of 2 g/m^2/month Maximum Total of 4 g/m^2/month (Project and other sources)

Sources: Approved Methods (DEC 2005), NEPM (2003).

4 EMISSION ESTIMATION

4.1 Particulate Emission Sources

Activities associated with MOD 1 that are likely to generate dust emissions include:

- material handling (conveyor transfer points);
- dozers;
- crushing;
- wheel-generated dust;
- ventilation shaft emissions; and
- wind erosion.

4.2 Activity Data and Assumptions

The fugitive particulate emissions from MOD 1 operation were estimated based on emission estimation techniques listed in the NPI EET Manual for Mining, v 3.1 (DEH, 2012) and USEPA AP-42 emission factors. In the absence of any site-specific monitoring data, measured data from the nearby Angus Place Colliery ventilation shaft was used to estimate the potential particulate emissions from the upcast ventilation shaft at Springvale Colliery. Given that coal is extracted from the Lithgow seam at both Springvale and Angus Place Collieries, it is considered appropriate to use the same emissions data for the ventilation fan at Springvale Colliery.

A monitoring campaign was performed at the existing Angus Place Colliery vent shaft on 5 February 2013 and data relevant to this assessment is provided in **Table 5**.

Table 5 Emission Parameters – Upcast Ventilation Shaft

Parameter	Unit	Measured Value
Temperature	°C	25.4
Velocity	m/s	12.1
Volumetric Flow	Nm^3/s	221.06
Moisture	%	1.6
Oxygen	%	20.7
Total Solid Particulates	mg/Nm^3	0.6
PM_{10}	mg/Nm^3	<0.04
$PM_{2.5}$	mg/Nm^3	0.03

Note: A different method was used for $PM_{2.5}$ analysis than for PM_{10} and TSP analysis. The limit of reporting (LOR) for the $PM_{2.5}$ analysis method is lower than for the PM_{10} method. A value at the LOR for PM_{10} has been used in the assessment.

The activity data used in the emission estimation calculations are summarised in **Table 6**. For the purpose of developing the emission inventories, the following assumptions have also been applied:

- 6% silt content for coal in stockpile (SLR, 2012);
- 10% moisture content for coal in stockpile (SLR, 2012);
- heavy vehicle frequency on the on-site unsealed road is two trips per hour;
- ventilation rate at the upcast ventilation shaft will increase by 20%; and
- an increase in the ROM coal stockpile area footprint to the north of the existing footprint by approximately 20%;

Table 6 Summary of Activity Data used to Estimate Particulate Emissions - Operation

Parameter	Activity Data
Coal throughput	5.5 Mtpa
Dozer operation	24 hours per day
Average number of heavy vehicles on unsealed road	2 trips per hour
Potential wind erosion area	2.6 ha
Upcast ventilation fan rate	241.1 m^3/s

4.3 Emission Controls

Based on the information provided by Springvale Coal, the following emission control techniques employed on site have been incorporated into the emission estimation. No particular design measures can be incorporated into the Project to avoid impacts associated with particulate emissions. The measures detailed below are generally management measures.

4.3.1.1 Coal Conveying Transfer Points

There are four coal transfer points within the Springvale Colliery that have been considered within this assessment. These include:

- the conveyor exiting the drift;
- unloading from the conveyor onto the ROM stockpile;
- transfer of ROM coal from the conveyor into the screen/primary crusher; and
- transfer of crushed material onto the conveyor to Springvale Coal Services Site (Western Coal Services Project) and Mount Piper Power Station.

The transfer points are enclosed on three sides. It has been estimated that this will reduce the particulate emissions by 40% (Table 96, Katestone 2011).

The above controls will continue to be in operation throughout MOD 1.

4.3.1.2 Crushing

The crusher operation is enclosed. It has been estimated that this will reduce the particulate emissions by 70% (Table 4, DSEWPC 2012). These controls will continue to be in operation throughout MOD1.

4.3.1.3 Wind Erosion

Water sprays are used to suppress emissions of dust from coal stockpiles. It has been estimated that this will reduce the particulate emissions by 50% (Table 72, Katestone 2011). These controls will continue to be in operation throughout MOD 1.

4.4 Emission Estimation Techniques

The emission factors used for the estimation of TSP and PM_{10} emissions from the Springvale pit top are presented overleaf in **Table 7**.

The National Pollutant Inventory Manual for Mining, Version 3.1 (DSEWPC, 2012) and US EPA AP-42 Compilation of Emission Factors contain emission factors for TSP and PM_{10}. $PM_{2.5}$ emission factors are provided for some activities, however no $PM_{2.5}$ emission factors are provided for wind erosion within the NPI or US EPA AP-42. Some research has been conducted by the Midwest Research Institute (MRI) on behalf of the Western Regional Air Partnership (WRAP) with findings published within the document entitled *'Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors'* (MRI, 2006). This document provides a proposed $PM_{2.5}/PM_{10}$ ratio of 0.15 for wind erosion sources. This ratio was used within this assessment to calculate the emissions of $PM_{2.5}$ attributable to wind erosion at the Springvale pit top.

Table 7 Summary of Emission Factors Used to Estimate Emissions

Activity	Emission Factor Equation	Units	Source	Variables	Controls Applied
Dozers on coal	$EF_{TSP} = 35.6 \times \frac{(s)^{1.2}}{M^{1.4}}$ $EF_{PM_{10}} = 0.75 \times 8.44 \times \frac{(s)^{1.5}}{M^{1.4}}$ $EF_{PM2.5} = 0.022 \times 35.6 \times \frac{(s)^{1.2}}{M^{1.3}}$	kg/h/vehicle	AP42	M = moisture content (%) s = silt content (%)	No Control
Miscellaneous Transfer Points and Excavator	$EF = k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$	kg/t	AP42	k = 0.74 (TSP) k = 0.35 (PM_{10}) k = 0.053 ($PM_{2.5}$) U = mean wind speed (m/s) M = moisture content (%)	Enclosed on three sides– 40%
Primary Crusher	$EF_{TSP} = 0.01$ $EF_{PM10} = 0.004$ $EF_{PM2.5} = 0.0004$	kg/t	NPI EETM v3.1	Assumed $PM_{2.5}/PM_{10}$ ratio of 0.1	Enclosed – 70%
Wheel generated dust from unpaved roads (used by light duty vehicles)	$EF = \frac{0.4536}{1.6093} * k \times \left(\frac{s}{12}\right)^{a} \times \left(\frac{W}{3}\right)^{b}$	kg/VKT	NPI EETM v3.1	k = 4.9 (TSP) k = 1.5 (PM_{10}) k = 0.15 ($PM_{2.5}$) a = 0.7, b = 0.45 (TSP) a = 0.9, b = 0.45 (PM_{10}) S = mean wind speed (m/s) M = moisture content (%) s = silt content (%)	Level 2 Watering – 50% control for construction and rehabilitation. No control for operation
Wind Erosion	$EF_{TSP} = 0.4$ $EF_{PM10} = 0.2$ $EF_{PM2.5} = 0.03$	kg/ha/yr	NPI EETM v3.1	Assumed $PM_{2.5}/PM_{10}$ ratio of 0.15	Water Sprays – 50%

4.5 Emission Inventory

Based on the information presented above, a particulate emissions inventory has been compiled for the proposed MOD 1 and is presented in **Table 8**. Details of the emission calculations and emission factors used in estimating emissions are presented in **Appendix A**

Table 8 Emission Inventory for MOD 1 - Operation

Activity	Estimated Emissions (kg/annum)		
	TSP	PM_{10}	$PM_{2.5}$
Conveyor transfer points	3,662	1,732	262
Crushing	16,500	6,600	660
Dozers	134,195	32,444	2,952
Vehicle movements on unpaved roads	29,268	6,790	679
Wind erosion from exposed areas	4,608	2,304	346
Ventilation fan	4,561	304	228
Total Particulate Emissions	**192,794**	**49,870**	**5,127**

5 EXISTING AIR QUALITY ENVIRONMENT

The main focus of this report is the assessment of the potential impacts of the modification on the closest sensitive receptors to the pit top on Newnes Plateau. In this case, these sensitive receptors include nine residences, identified in **Section 2.3**. The purpose of assessing background air quality is to determine the concentrations of air pollutants currently experienced at these residences, with the predicted concentrations from the modification added to these background concentrations to identify the likely future air quality impacts. It is therefore important to gain an understanding of current background air quality at these residential locations.

The air quality in the region surrounding Springvale is influenced by emissions generated by a range of sources, originating from both within and outside of the local area. Specifically, air quality will be influenced by traffic-generated pollution (e.g. motorised recreational vehicles travelling in the Newnes State Forest), emissions from power stations and associated ash dams in the area, other coal mining operations, pollution transported into the area from more distant sources and pollution generated by the existing Springvale Mine itself.

To appropriately assess the *cumulative* impact of MOD 1, the incremental impact from the proposed operation needs to be added to a dataset which includes the influences of all other sources of particulate in the region, and is representative of the air quality likely to be experienced at sensitive receptor locations without the impact of the proposed operation.

As required by the Approved Methods, this background dataset is required to be contemporaneous with the meteorological data used within the assessment, and (for PM_{10}) include daily measurements. Given the limited availability of datasets in the area which meet both of these criteria, data from Bathurst has been selected for use within the assessment where appropriate, with justification for its use detailed below.

5.1 Suspended Particulate Matter

5.1.1 TSP and PM_{10}

On-site ambient TSP and PM_{10} monitoring has been performed at Springvale since December 2010. The ambient air quality monitoring program has been incorporated into a wider environmental monitoring campaign, and includes PM_{10} and TSP measurements using two co-located High Volume Air Samplers (HVAS, refer **Figure 3**). The monitoring is undertaken in accordance with AS3580.9.3:2003 and AS3580.9.6:2003 for TSP and PM_{10}, respectively.

The measured 24-hour average PM_{10} and TSP concentrations are presented graphically in **Figure 4**, while the annual average TSP and PM_{10} concentrations recorded during 2014 are summarised in **Table 9**. The ratio of mean TSP to PM_{10} measurements in 2014 is of the order of 2.2 to 1.

The monitoring data was measured on a 1-in-6-day cycle and therefore is not suitable for use in a contemporaneous cumulative impact analysis.

Figure 3 Location of the HVAS and Dust Deposition Gauges at Springvale Colliery

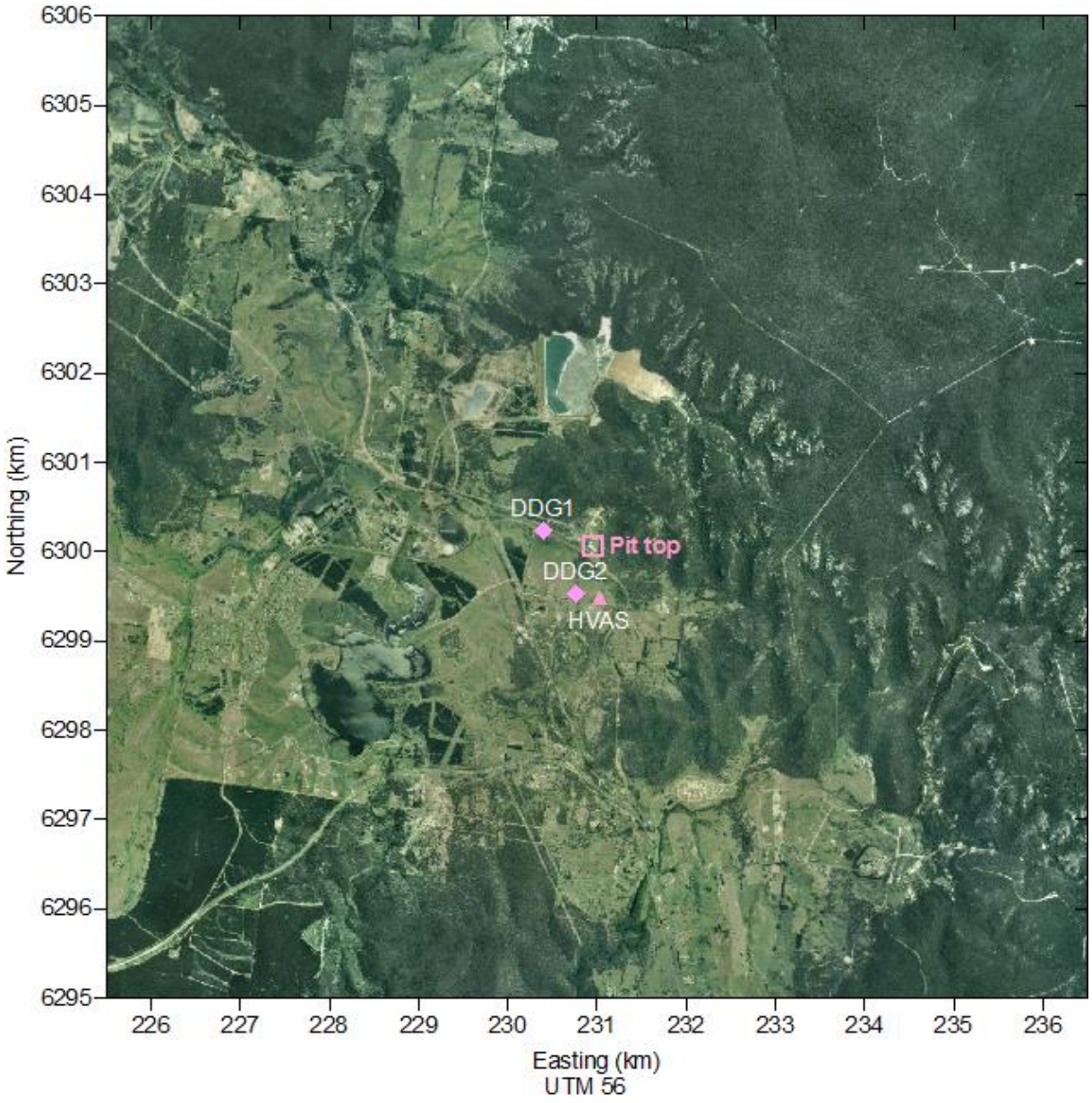


Figure 4 24-Hour Average TSP and PM_{10} Concentrations Measured by the Springvale HVAS

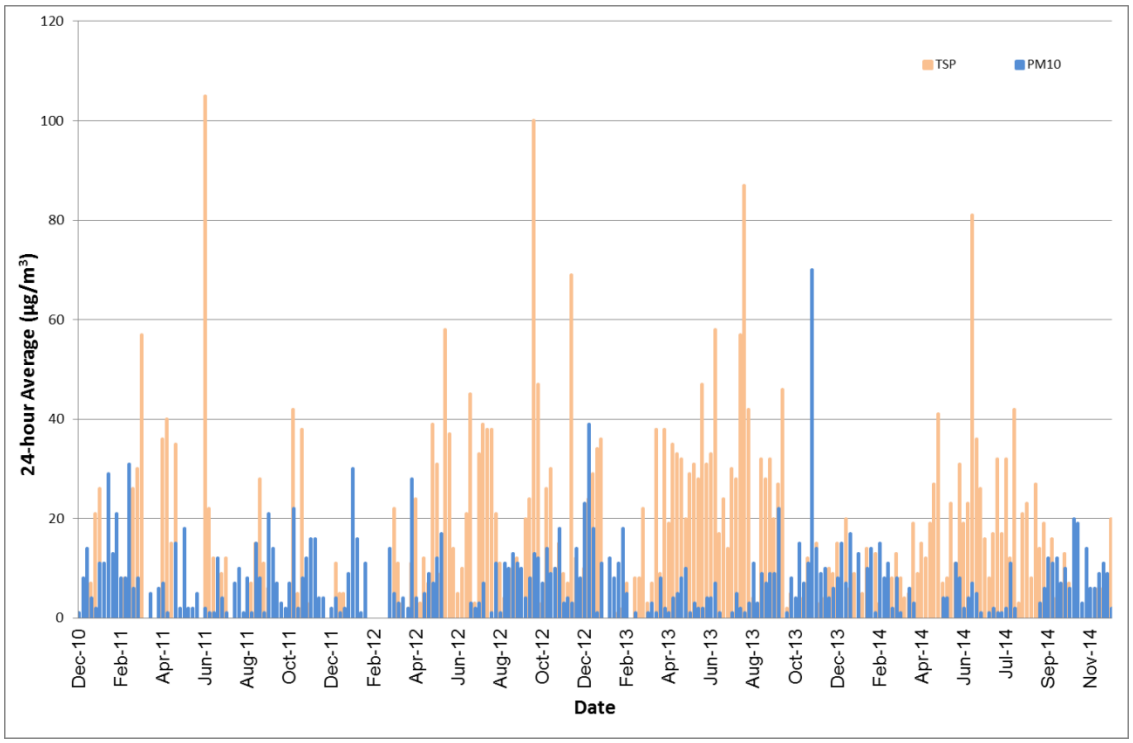


Table 9 Springvale HVAS 2014 Annual Average Particulate Concentrations

Particulate Size	2014 Annual Average (µg/m^3)
TSP	15.3
PM_{10}	7.0

The nearest OEH monitoring station measuring continuous PM_{10} concentrations is located in Bathurst, approximately 50 km northwest of the Springvale Mine. It is recognised that local dust-generating activities surrounding the Springvale pit top and Bathurst are significantly different. Mining, coal processing activities and Mount Piper Power Station are the key local potential suspended particulate sources in the area surrounding Springvale. Residential activities (such as lawn mowing, wood heaters) and vehicle emissions are the likely local sources of suspended particulate in the Bathurst area. Since the intensity and type of potential dust generating activities at Bathurst and the area surrounding Springvale are different, a further investigation was carried out to justify the use of ambient monitoring data recorded at OEH operated Bathurst monitoring site in this assessment.

Figure 5 and **Figure 6** present comparisons of the 24-hour average PM_{10} concentrations measured at Bathurst and Springvale HVAS. It is noted that the monitoring data at Springvale HVAS includes the contribution from the existing operations at Springvale.

It can be observed from **Figure 5** and **Figure 6** that measured data at Springvale Colliery is consistently lower than that measured at the Bathurst monitoring station. It is difficult to identify any trend between the two datasets but from examination of **Figure 7**, which shows a scatter plot of contemporaneous PM_{10} measurements in 2014 calendar year at Springvale and Bathurst, the Bathurst data can be seen to provide a conservative approximation of the background air quality experienced at the Springvale Colliery and surrounding receptors.

Based on the comparison shown in **Figure 5** and **Figure 7** , the use of continuous ambient monitoring data from Bathurst for 2014 is concluded to be a conservative and appropriate approach for the assessment of potential cumulative impacts for the Springvale Colliery.

Figure 5 Comparison of Measured 24-Hour Average PM_{10} Concentrations – All days (2010-2015)

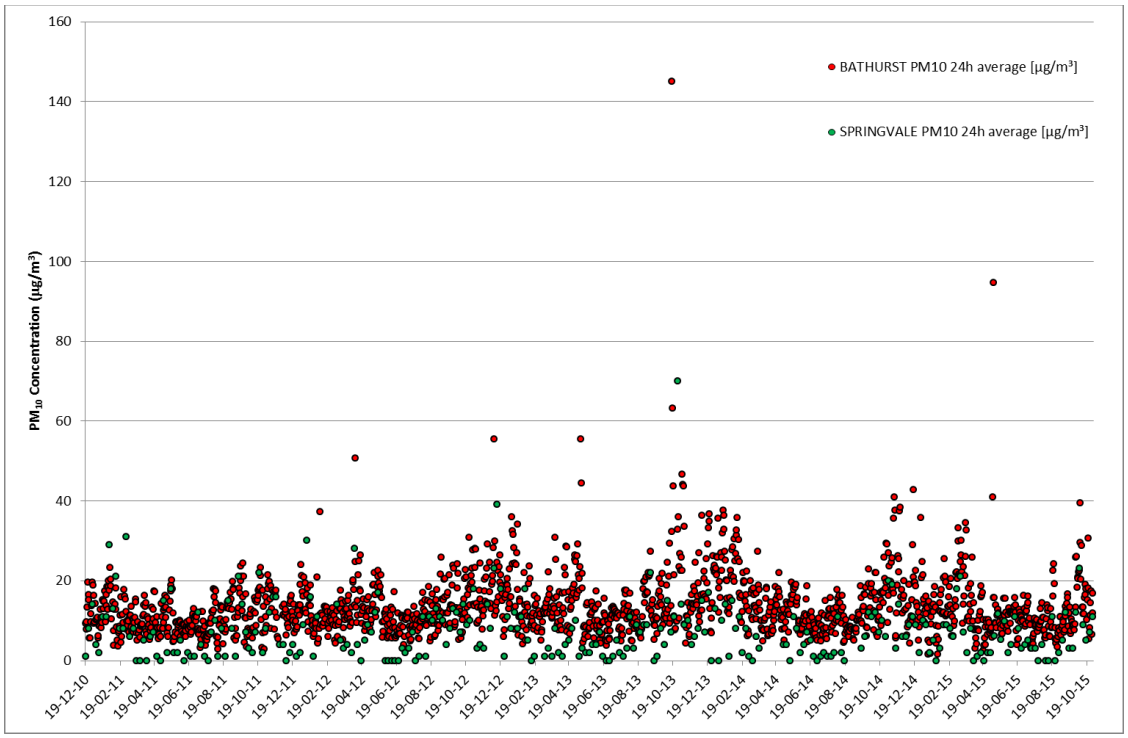


Figure 6 Comparison of Measured 24--Hour Average PM_{10} Concentrations – Springvale HVAS Sampling Days Only (2010-2015)

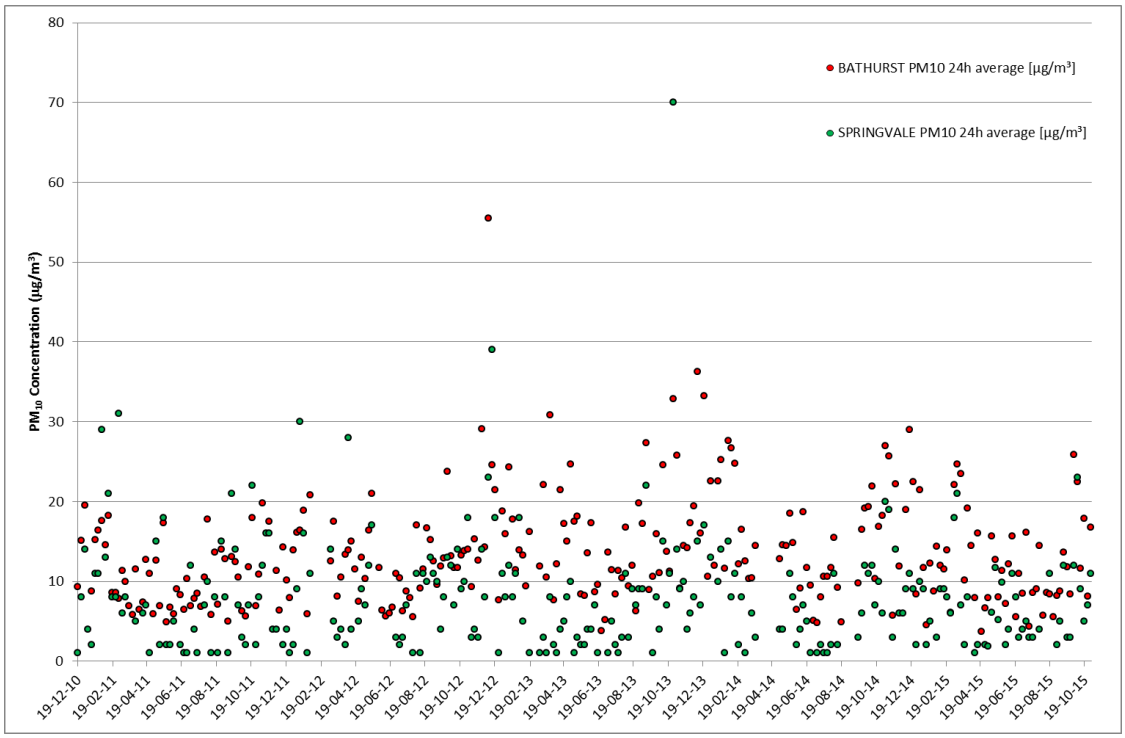
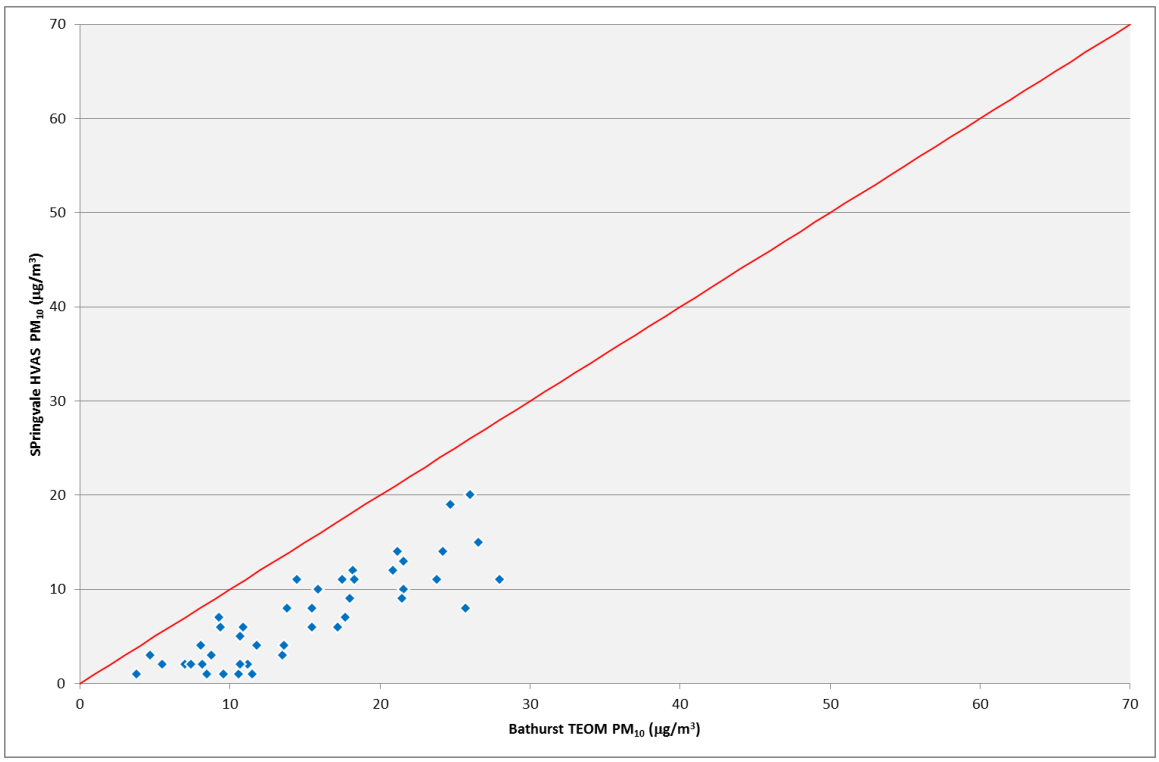


Figure 7 Bathurst PM_{10} versus Springvale PM_{10} data (2014)



Note: Red line denotes 1:1 relationship

5.1.2 $PM_{2.5}$

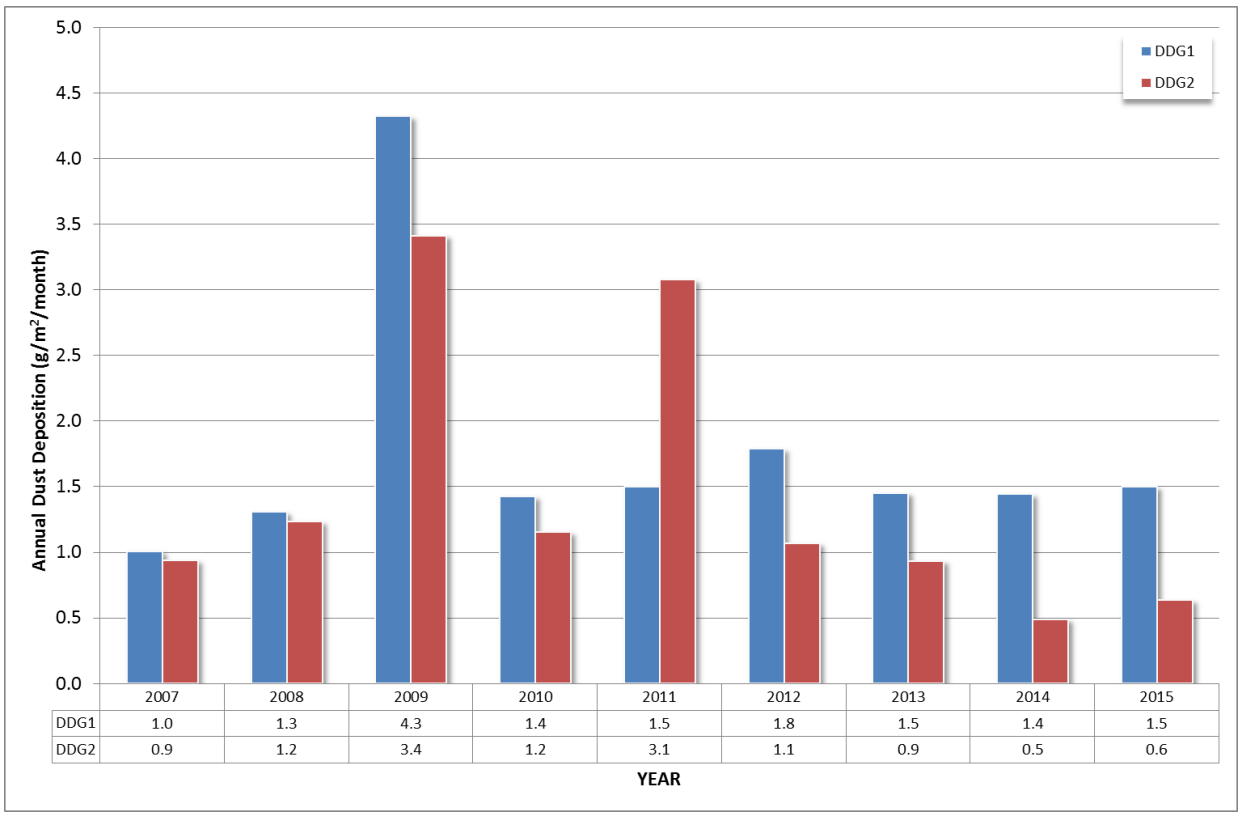
No ambient background monitoring data for $PM_{2.5}$ are available in the local area or at nearest OEH monitoring sites. Therefore a background $PM_{2.5}$ dataset cannot be used within this assessment and comparison of the incremental concentrations to the criteria has been performed.

5.2 Deposited Dust

Static dust monitoring commenced in January 2007 at two monitoring locations (DDG1 and DDG2) surrounding the Springvale pit top. The locations of the two dust deposition gauges are shown in **Figure 3**.

Monitoring results for dust deposition are presented in **Figure 8** for the years 2007 to 2015 (to November). All dust deposition results met the assessment criterion of 4 g/m^2/month with the exception of 2009. Monthly dust deposition results were shown to be elevated in September 2009 (between 10 g/m^2/month and 28 g/m^2/month) and October 2009 (between 7 g/m^2/month and 10 g/m^2/month) due to several dust storms experienced at the end of September 2009.

Figure 8 Monitoring Results for Dust Deposition – Springvale Mine



	2007	2008	2009	2010	2011	2012	2013	2014	2015
DDG1	1.0	1.3	4.3	1.4	1.5	1.8	1.5	1.4	1.5
DDG2	0.9	1.2	3.4	1.2	3.1	1.1	0.9	0.5	0.6

5.3 Assessment of Cumulative Impacts

A number of other industrial facilities located in the vicinity of Springvale Colliery may contribute to the cumulative impacts on the local airshed. The identified industrial facilities which are likely to have a cumulative impact on the local airshed are identified in **Table 10**.

Table 10 Identified Industrial Facilities in the Vicinity of the Springvale Mine

Industrial Facility	Location (Figure 9)
Springvale Pit Top	A
Springvale Coal Services Site, Blackmans Flat	B
Mount Piper Power Station (Mt Piper A)	C1
New Base Load Power Station (Mt Piper B)	C2
Western rail coal unloader	C3
Wallerawang Power Station (WPS) – *now decommissioned*	D
Angus Place Colliery	E
Lidsdale Siding Coal Loading Facility (LSCLF)	F
Pine Dale Coal Mine - *Under care and maintenance*	G
Clarence Colliery	Not Shown

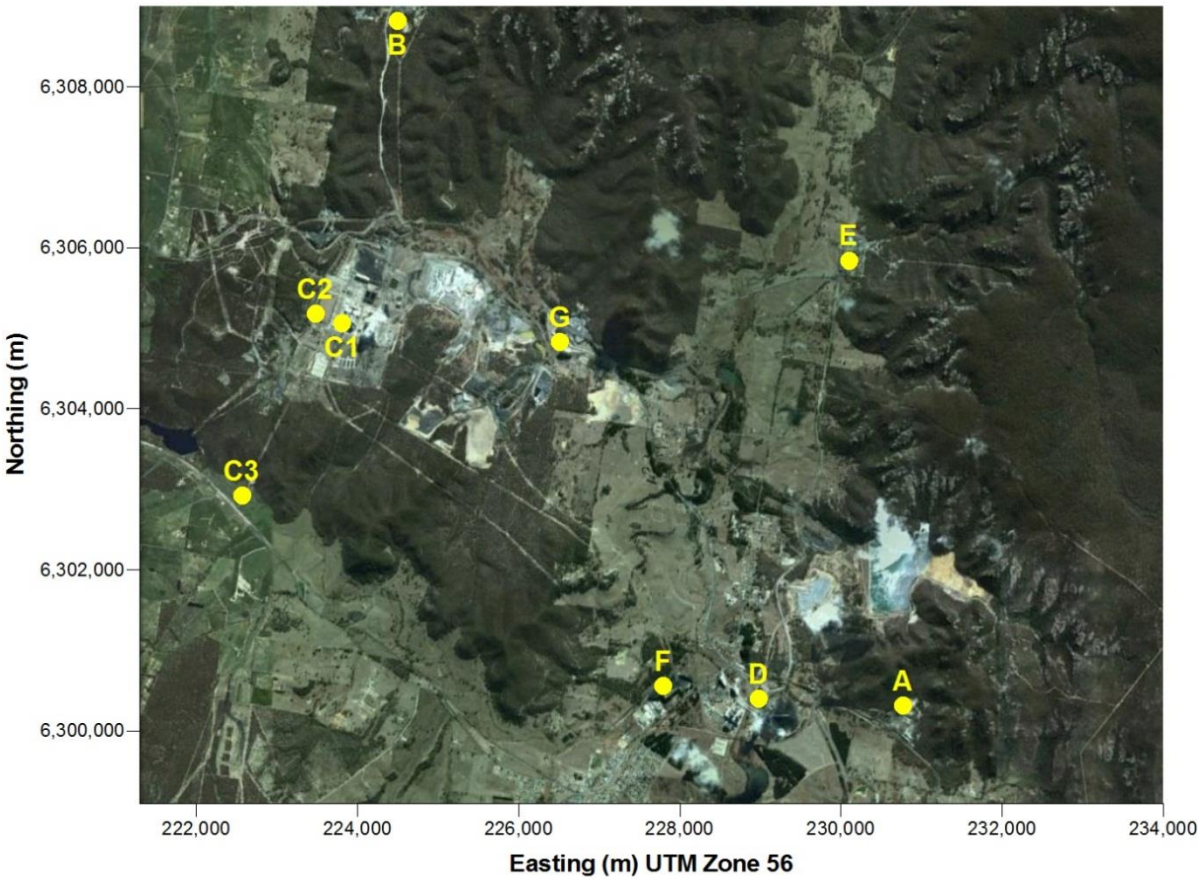
The location of the Springvale Pit Top with respect to the locations of other identified industrial facilities in its vicinity is shown in **Figure 9**.

It is noted that the Western rail coal unloader (C3) associated with Mount Piper Power Station was approved in June 2009 but construction is yet to start on this facility. Also included in this assessment is the Mount Piper Base Load power station which was approved in January 2010.

Given that the continuous particulate monitoring data obtained from the Bathurst OEH site is clearly shown in **Section 5.1** to be a conservative estimation of the actual particulate environment (as monitored) surrounding Springvale, it can be confidently considered that the following existing activities and projects located in the area surrounding the Springvale pit top are taken into account within this Air Quality and Greenhouse Gas Impact Assessment.

- Mount Piper Power Station (Mt Piper A), including associated infrastructure such as coal stockpiles and ash dams.
- Existing Angus Place Colliery (under care and maintenance.
- Current Lidsdale Siding Coal Loading Facility.
- Western Coal Services Project including Springvale Coal Services Site Operations, Mount Piper Haul Road, Wallerawang Haul Road and the overland conveyor system between Springvale pit top, Springvale Coal Services Site and Lidsdale Siding.
- Clarence Colliery.
- Fugitive emissions from exposed areas at the now decommissioned Wallerawang Power Station.
- Surrounding forestry activities and recreational activities (e.g. vehicles within the Newnes State Forest).

Figure 9 Location of Springvale Colliery and other Industrial Facilities



Given the conservatism in the adoption of the Bathurst particulate data it can also be considered that applications not approved, but advanced within the planning system may also be appropriately taken into account within the AQIA. Further discussion of each of the following projects is considered below:

- Mount Piper Power Station (Mt Piper B) approved in January 2010 and new rail coal unloader (new rail line of 5 km length and coal conveyor 4 km length) approved June 2009.
- Part 3A application for new ash placement areas at the existing Mount Piper Power Station.
- An approved (being constructed) new upcast ventilation shaft on Newnes Plateau for Angus Place Colliery.
- Lidsdale Siding Upgrade Project – a Centennial Coal project to improve rail loading facilities including a reclaim tunnel and train track extension, near Wallerawang.
- Pinedale Stage 2 Extension Project
- Centennial Western Coal Services Project – a Centennial Coal project for a new washery, a private haul road (linking, via a bridge, the existing Angus Place to Mount Piper private haul road with the Springvale Coal Services Site), and new reject emplacement areas.

5.3.1 Western Coal Services Project

Springvale Coal Services Site (part of Western Coal Services Project Application Area) is located to the immediate west of Springvale pit top and processes (beneficiates) and handles ROM coal from Springvale's operations. All processing operations within the Springvale Coal Services site are enclosed and it is not considered that cumulative impacts would occur between that operation and the Springvale pit top operations, especially given the 10.5 km separation distance between these two operations.

5.3.2 Mount Piper Power Station Western Coal Unloader

The Western Coal Unloader (WCU) associated with the Mt Piper Power Station gained Project Approval in June 2009. The WCU is designed to enable the supply of coal by rail to the Power Station from a number of mines, mainly to the north of the Power Station (SKM, 2007). The WCU will be located approximately 2 km to the south of the Mt Piper Power Station and approximately 9 km northwest of the Springvale pit top. The Environmental Assessment (SKM, 2007) for the WCU assessed the impact of particulate matter for the construction and operational scenarios.

It was concluded that during the operational scenario, maximum predicted 24-hour average incremental PM_{10} concentration at 'Receiver 1' was 9 $\mu g/m^3$ (SKM, 2007). The location of 'Receiver 1' is approximately 6 km from the Springvale Pit Top.

Given such low concentrations at these distances from the Springvale Pit Top, it is considered that the WCU will not have a cumulative impact on particulate concentrations associated with the Project. The WCU has therefore not been considered further within this report.

5.3.3 Angus Place Colliery

Angus Place Colliery is located approximately 6 km north of the Springvale Pit Top as shown in **Figure 9**. This site is currently under care and maintenance and given the relatively large distance between the sites, particulate impacts from the Angus Place Colliery at locations close to the Springvale pit top would be minimal. Therefore Angus Place Colliery has not been considered further within this report.

5.3.4 Lidsdale Siding Coal Loading Facility

A dispersion modelling exercise has been performed by SLR Consulting (SLR 2012c) and the impacts from the upgraded Project operations were assessed at ten identified sensitive receptors in the vicinity of the Lidsdale Siding Coal Loading Facility (LSCLF). The maximum incremental (Project only) 24-hour average PM_{10} concentrations (17.1 µg/m^3) were predicted to occur at a receptor which is approximately 4 km to the west of the Springvale Colliery.

Further investigation of the potential cumulative impacts from this Project on the receptors closest to the Springvale pit top (as outlined in the AQIA for Springvale Mine Extension Project (SLR 2014)) showed that the maximum predicted 24 hour average PM_{10} concentrations from the operation of the LSCLF were 0.5 µg/m^3 at Receptor S2 (refer **Figure 2**).

Considering the small incremental concentration resulting from the operation of the LSCLF at receptors surrounding the Springvale pit top, it is considered that the background data from Bathurst (refer **Section 5.4**) will appropriately include such impacts. The operation of the LSCLF is not considered further within this assessment.

5.3.5 Pine Dale Coal Mine Stage 2 Extension Project

The Pine Dale Coal Mine is located approximately 5 km northwest of the Springvale pit top operations. The Pine Dale Yarraboldy Extension has now been completed and the site is currently under care and maintenance. Planning for the Pine Dale Stage 2 Extension Project has been put on hold and no detailed air quality modelling has been made publicly available. For the purposes of this assessment, it has been assumed that impacts experienced at nearby receptors due to the Stage 2 Extension Project, should it proceed, may be similar to those experienced during the Yarraboldy Extension operations.

Dispersion modelling predictions of the Yarraboldy Extension Project indicated that predicted maximum incremental 24-hour average PM_{10} concentrations of between 2 µg/m^3 and 5 µg/m^3 at a receptor located approximately 6.5 km northeast of the Springvale Colliery pit top. Given the small predicted incremental impact from the Pine Dale Yarraboldy Extension, the proposed Stage 2 Extension Project has not been considered further within this report.

5.3.6 Clarence Colliery

Clarence Colliery is located approximately 13 km to the southeast of the Springvale pit top. Given the separation distance between the Clarence Colliery and the Springvale pit top, it is not considered that cumulative impacts would occur between the two operations.

5.3.7 Forestry and Recreation Activities

Forestry and recreation activities occur within the Newnes State Forest although in the immediate area surrounding the Project will be limited to unsealed road use by 4WD vehicles and occasional forestry vehicles. Given the likely infrequent nature of these activities, it is not considered that these will have cumulative effects with the MOD 1 operation.

5.4 Adopted Background for this Assessment

To provide an assessment of potential cumulative pollutant concentrations at surrounding sensitive receptors, measured long term (≥1 year) ambient air quality data are required. However, as stated in **Section 5**, no long term continuous ambient monitoring data are available in the vicinity of the Springvale pit top.

Following the analysis presented in **Section 5.1**, it has been established that the use of continuous PM_{10} monitoring data (2014) from the OEH operated monitoring site at Bathurst provides a conservative estimate of regional background levels and includes the impact of surrounding industries as discussed in **Section 5.2**.

The annual average background TSP concentration was estimated based on the annual average PM_{10} concentration at Bathurst and the TSP to PM_{10} ratio derived from Springvale HVAS data (presented in **Section 5.1**). An annual average background dust deposition rate was calculated based on the average of 2014 data measured at the five dust deposition gauges surrounding the Springvale Colliery. The adopted background data are presented in **Table 11**.

Table 11 Adopted Background Data

Pollutant	Averaging Period	Background Concentration (µg/m³)	Basis
PM_{10}	24-hours	Daily varying background	Monitoring data at Bathurst (2014)
	Annual	14.6	Monitoring data at Bathurst (2014)
TSP	Annual	32.1	TSP to PM_{10} ratio of 2.2
Dust Deposition	Annual	1.4 g/m^2/month	Average of dust deposition monitoring data in 2014

6 ATMOSPHERIC DISPERSION MODELLING

6.1 Model Selection

Emissions from the proposed operations have been modelled using the US EPA's CALPUFF (Version 6.267) modelling system. CALPUFF is a transport and dispersion model that ejects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further below. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain either hourly concentration or hourly deposition fluxes evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

6.2 Meteorological Modelling Methodology

To adequately characterise the dispersion meteorology of the Springvale pit top and surrounds, information is needed on the prevailing wind regime, ambient temperature, rainfall, relative humidity, mixing depth and atmospheric stability. The meteorology of the Springvale pit top was characterised based on a 3-dimensional prognostic meteorological dataset for the region surrounding the pit top.

6.2.1 WRF

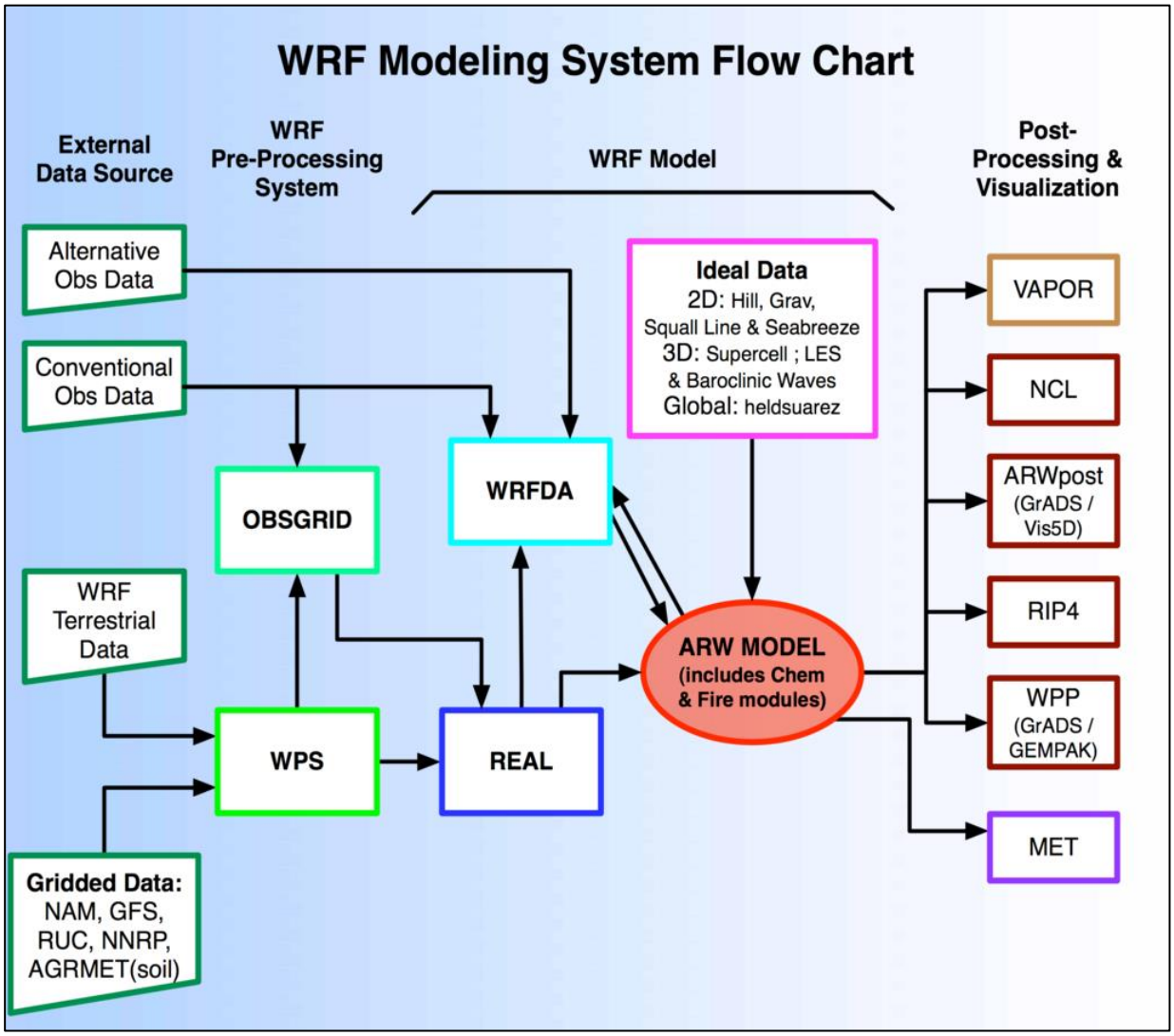
The Weather Research and Forecast (WRF) model is a next generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs. It features two dynamical cores; a data assimilation system and a software architecture facilitating parallel computation and system extensibility. The model serves a wide range of meteorological applications across scales from tens of meters to thousands of kilometres. A brief overview of the WRF modelling system is presented in **Figure 10**.

For this assessment, the WRF modelling system was used to produce the meteorological field required as an input to the CALMET meteorological model over the domains shown in **Figure 11**. Parameters used in the WRF model for this assessment are presented in **Table 12**. Modelling was performed for the 2014 calendar year.

Table 12 Meteorological Parameters used for this Study (WRF)

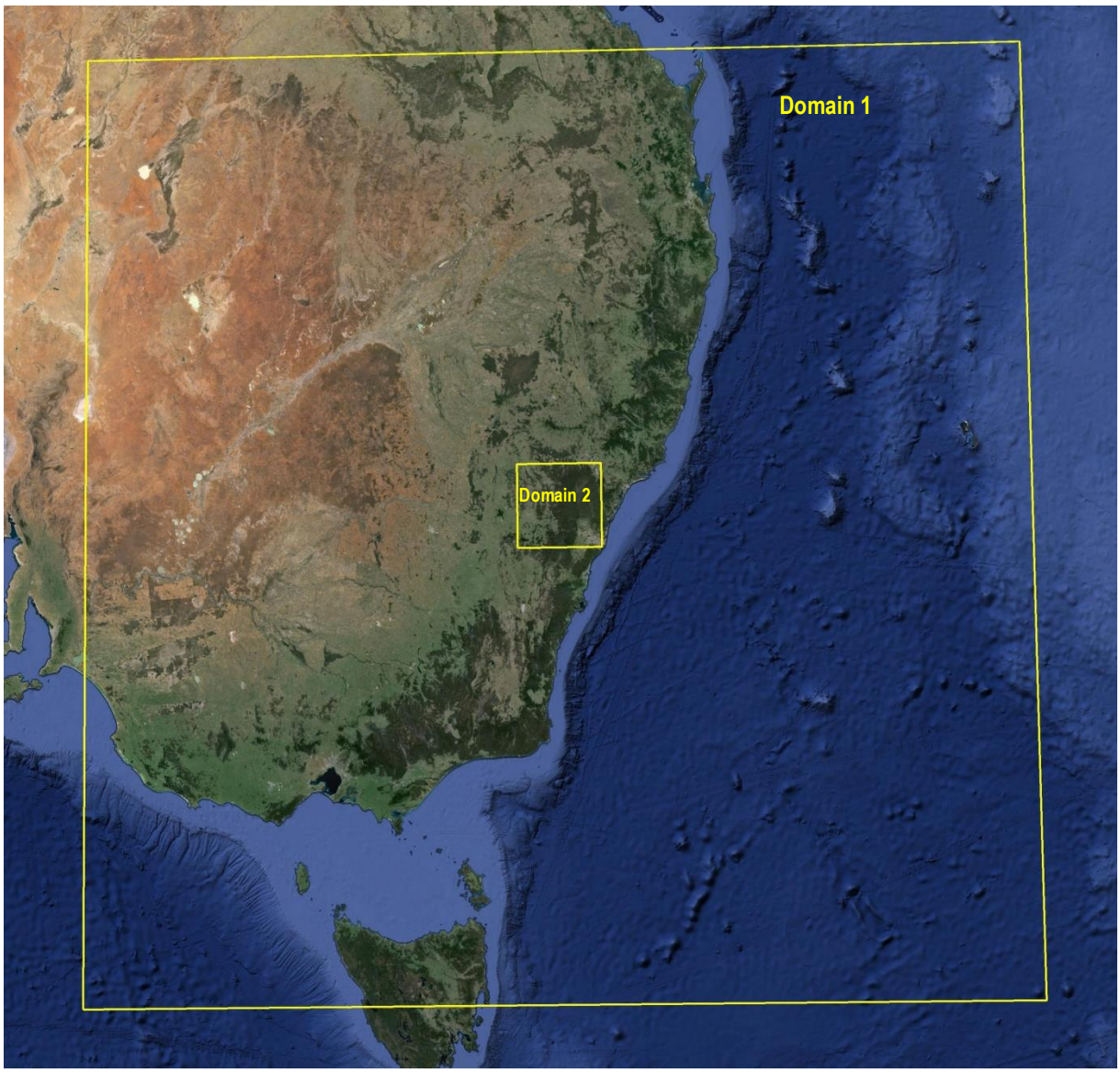
Parameter	Domain 1	Domain 2
Modelling domain	2,100 km × 2,100 km	190 km × 190 km
Grid resolution	30 km	10 km
Number of vertical levels	30	30

Figure 10 WRF Modelling System Flowchart



Source: http://www2.mmm.ucar.edu/wrf/users/model.html

Figure 11 WRF Modelling Domains



6.2.2 CALMET

CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects the influences of local topography and land uses.

CALMET modelling was conducted using the nested CALMET approach, where the final results from a coarse-grid run were used as the initial guess of a fine-grid run. This has the advantage that off-domain terrain features including slope flows, blocking effect can be allowed to take effect and the larger-scale wind flow provides a better start in the fine-grid run.

The outer domain was modelled with a resolution of 3 km. WRF-generated three dimensional meteorological data were used as the initial-guess wind field and local topography and landuse information were used to refine the wind field predetermined by the WRF data.

The output from the outer domain CALMET modelling was then used as the initial-guess field for the mid and inner domain CALMET modelling. A horizontal grid spacing of 1 km and 0.25 km were used in the mid and inner domain to adequately represent the important local terrain features and landuse. Fine scale local topography and land use information were used in the inner domain run to refine the wind field parameters predetermined by the coarse CALMET runs.

Table 13 details the parameters used in the meteorological modelling to drive the CALMET model.

Table 13 Meteorological Parameters used for this Study – CALMET (v 6.1)

Outer Domain	**Data**
Meteorological grid	60 km × 60 km
Meteorological grid resolution	3 km
Initial guess filed	3D output from WRF model
Mid Domain	
Meteorological grid	23 km × 28 km
Meteorological grid resolution	1 km
Initial guess field	3D output from outer domain modelling
Inner Domain	
Meteorological grid	19 km × 22 km
Meteorological grid resolution	0.2 km
Initial guess field	3D output from mid domain modelling

6.3 Meteorological Data Used in Modelling

6.3.1 Wind Speed and Direction

A summary of the annual wind behaviour predicted by CALMET for the Springvale pit top is presented as windroses in **Figure 12**. The frequency of wind speed variation is presented in **Figure 13**.

Figure 12 Wind Roses for the Springvale Pit Top, as Predicted by CALMET (2014)

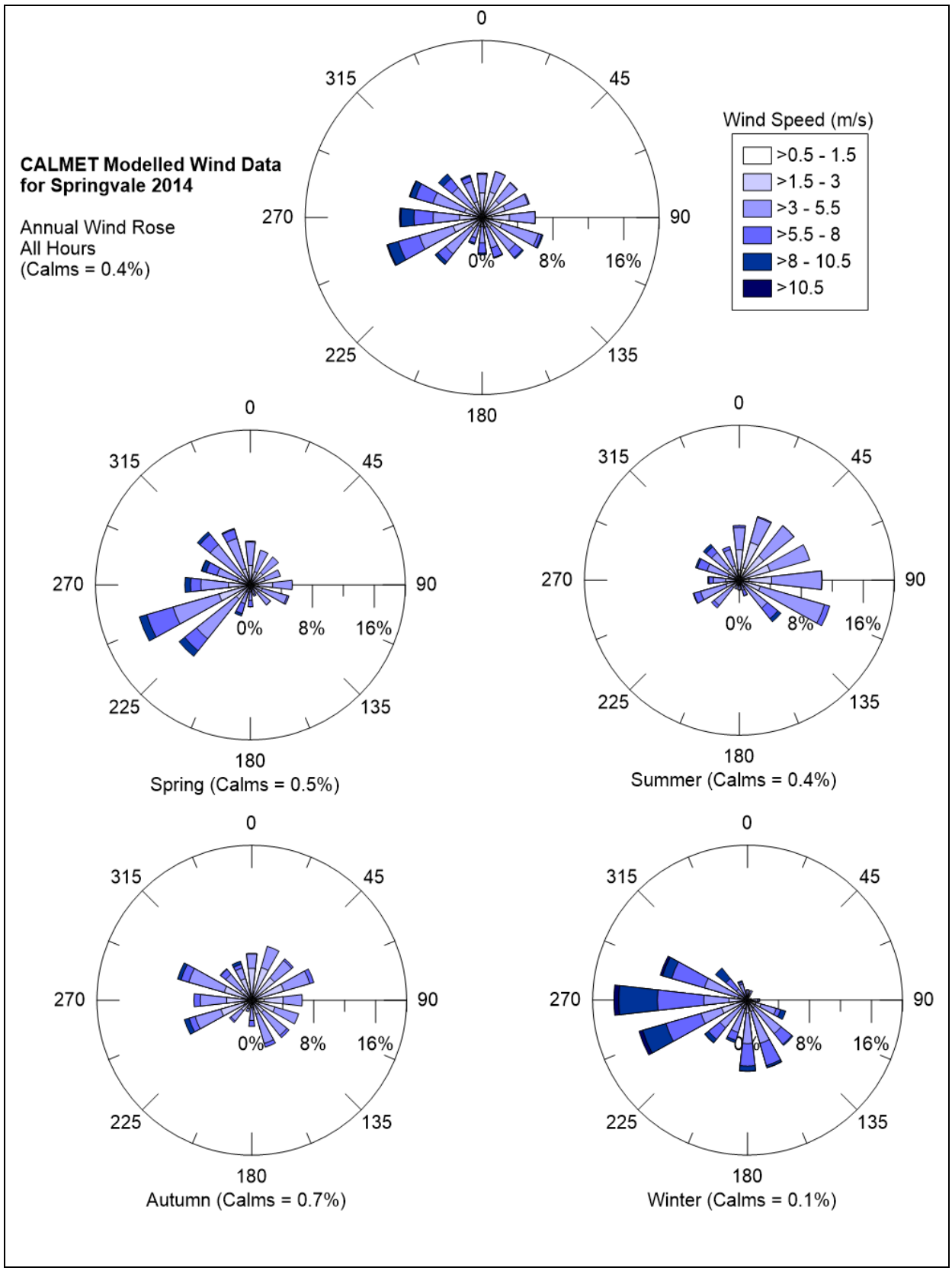


Figure 13 Wind Speed Distribution Predicted by CALMET for Springvale Pit Top (2014)

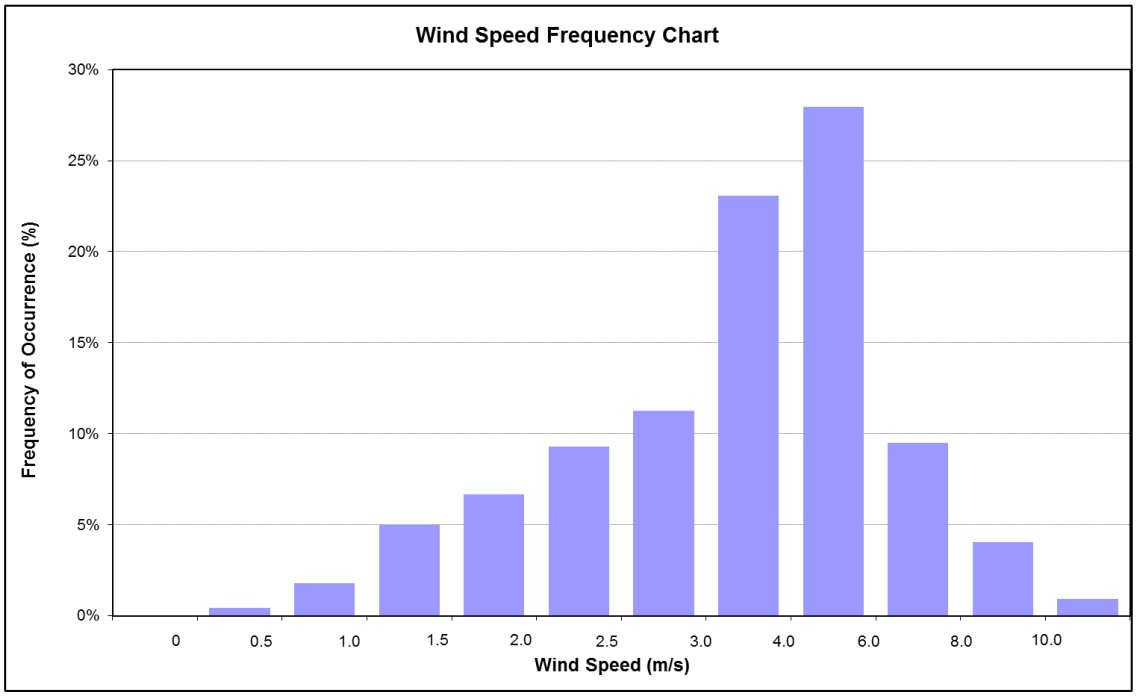


Figure 12 and **Figure 13** indicate that the site experienced predominantly light to moderate winds (between 1.5 m/s and 8 m/s), with the prevailing wind direction from western quadrant. Calm wind conditions (wind speed less than 0.5 m/s) were predicted to occur 0.4% of the year during 2014.

The seasonal wind roses indicate that:

- In spring, winds are light to moderate and experienced predominantly from west southwest quadrant with very few winds from the south southeast quadrant.
- In summer, light winds from northeast quadrant are predominant with very few winds from the southern quadrant.
- In autumn, winds are light to moderate and experienced almost evenly from all quadrants with the exception of the south southwest quadrant from which a low percentage of winds are experienced.
- In winter, winds are light to high and experienced predominantly from the western quadrant with very few winds from northeast quadrant.

6.3.2 Atmospheric Stability

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 categorize the degree of atmospheric stability as follows:

- A = Extremely unstable conditions
- B = Moderately unstable conditions
- C = Slightly unstable conditions
- D = Neutral conditions
- E = Slightly stable conditions
- F = Moderately stable conditions

The meteorological conditions defining each Pasquill stability class are shown in **Table 14**.

Table 14 Meteorological Conditions Defining Pasquill Stability Classes

Surface wind speed (m/s)	Daytime insolation			Night-time conditions	
	Strong	Moderate	Slight	Thin overcast or > 4/8 low cloud	<= 4/8 cloudiness
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

Notes:

Strong insolation corresponds to sunny midday in midsummer in England; slight insolation to similar conditions in midwinter.

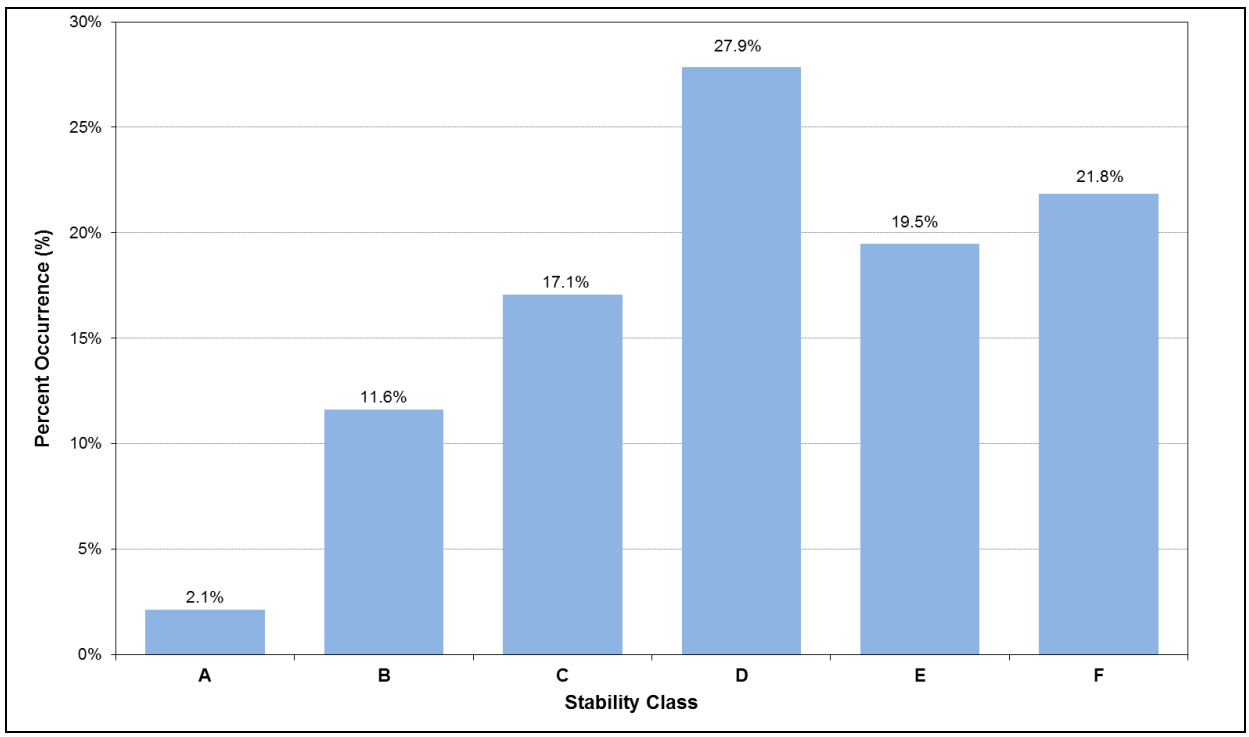
Night refers to the period from 1 hour before sunset to 1 hour after sunrise.

The neutral category D should also be used, regardless of wind speed, for overcast conditions during day or night and for any sky conditions during the hour preceding or following night as defined above.

Source: Pasquill, 1961

The frequency of each stability class predicted by CALMET, extracted at the site during the modelling period is presented in **Figure 14**. The results indicate a relatively even spread across stability classes C to F, with a slightly higher frequency of conditions typical to stability class D. Stability class D is indicative of neutral atmospheric conditions, with moderate winds and even mixing properties.

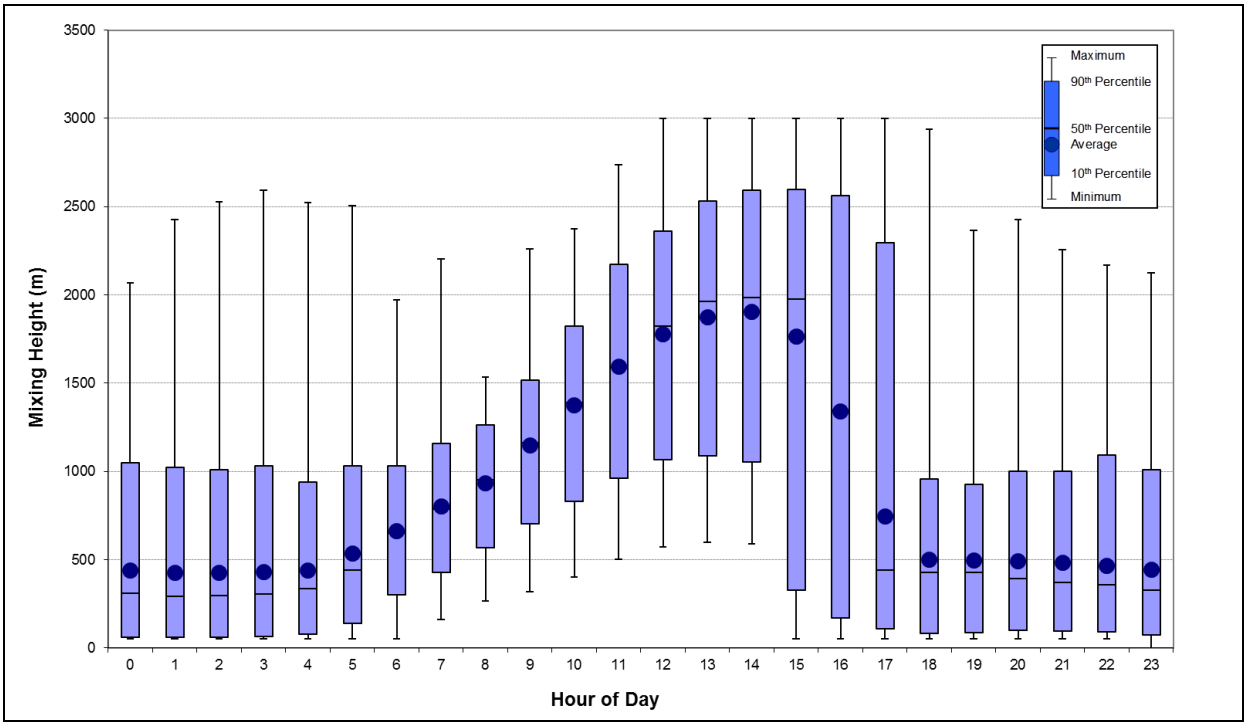
Figure 14 Stability Class Distribution Predicted by CALMET for the Springvale Pit Top (2014)



6.3.3 Mixing Heights

Diurnal variations in maximum and average mixing depths predicted by CALMET at the Springvale pit top during 2014 are illustrated in **Figure 15**. As would be expected, an increase in the mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of the convective mixing layer.

Figure 15 Mixing Heights Predicted by CALMET for the Springvale Pit Top (2014)



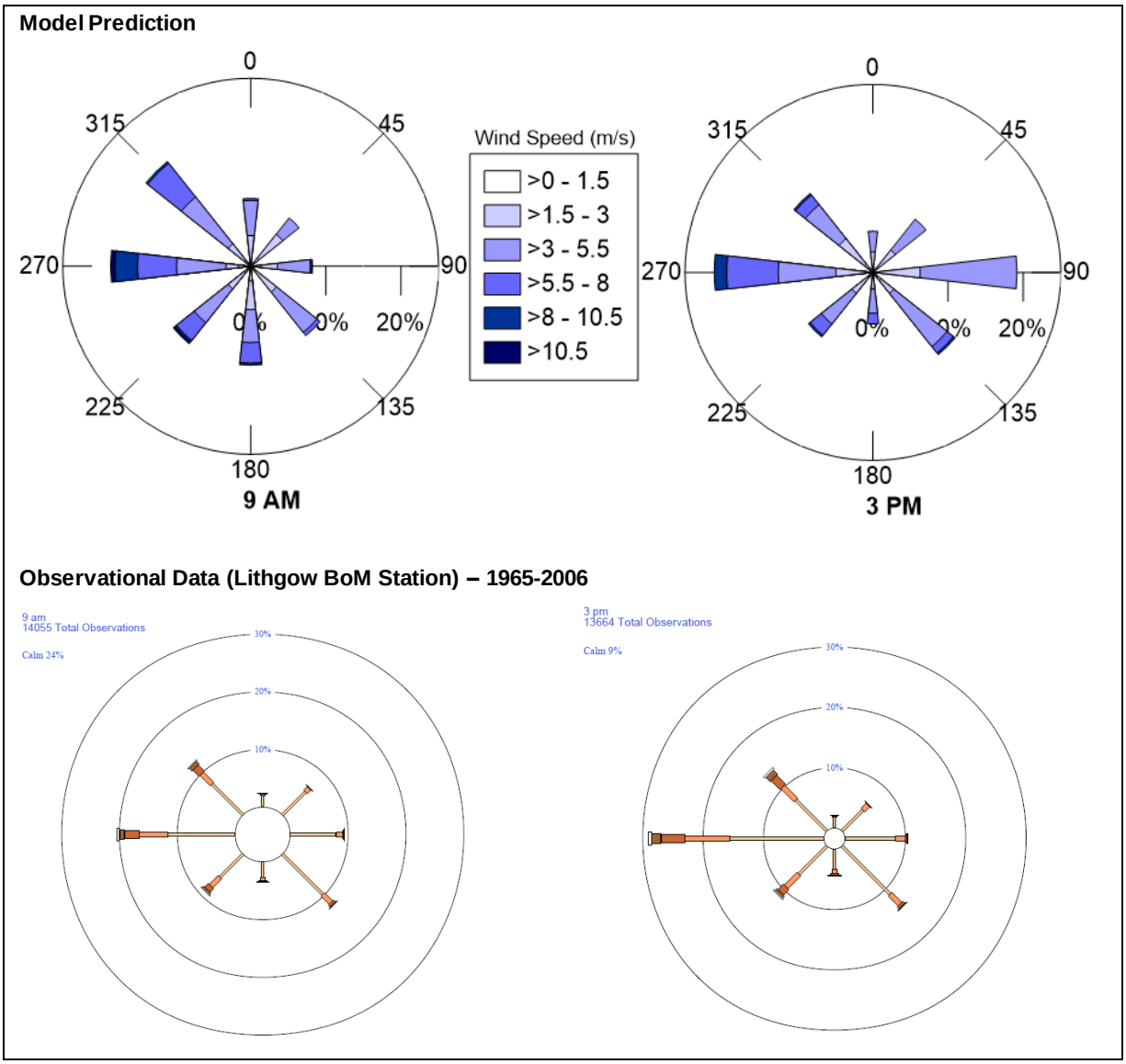
6.4 Modelling of Wind Erosion Emissions

An hourly-varying emission file was developed for the wind erosion sources from the total estimated annual emissions using a relationship between the cube of the hourly averaged wind speeds and sum of the hourly cubic wind speeds contained in the meteorological file. This cubic relationship provides a more realistic distribution of emissions with the peak emissions being modelled during high wind speed events and lower emissions being modelled during lower wind speed events.

6.5 Meteorological Data Validation

A comparison of predicted 9 AM and 3 PM wind data for 2014 calendar year (extracted at Lithgow Bureau of Meteorology site) and long term (1965-2006) average 9 AM and 3 PM wind data recorded at Bureau of Meteorology site (63224) located at Lithgow (Birdwood St) is shown in **Figure 16**. The comparison shows reasonably good agreement between the predicted and observed datasets.

Figure 16 Comparison of Predicted Meteorological Data with Long Term Average Observed Data



6.6 Meteorological Data Sensitivity Analysis

Meteorological data used in previous assessments performed by SLR for Springvale (e.g. SLR 2012, SLR 2014) were based on MM5 data generated by TRC for the 2006 – 2010 calendar years. No MM5 data for recent years were available at the time of modelling. Furthermore, the MM5 model is now obsolete and was replaced with the more advanced Weather Research and Forecast (WRF) model.

As presented in **Section 6.2**, the meteorological data used for this assessment was generated using a WRF model simulation for 2014. To assess the sensitivity of the predicted off-site particulate concentrations on the different meteorological data sets used in previous modelling studies and in this assessment, a sensitivity analysis has been performed using the emissions estimated for the Springvale Mine Extension Project. From this analysis is was concluded that the model predictions using the 2014 meteorological dataset (based on WRF) can be considered conservative

Further details of the sensitivity analysis, including a windrose comparison, are presented in **Appendix B**.

7 AIR DISPERSION MODELLING RESULTS

The ground level suspended particulate concentrations and deposition rates predicted by the modelling at the nearest sensitive receptors are presented and discussed below.

7.1 Dust Deposition

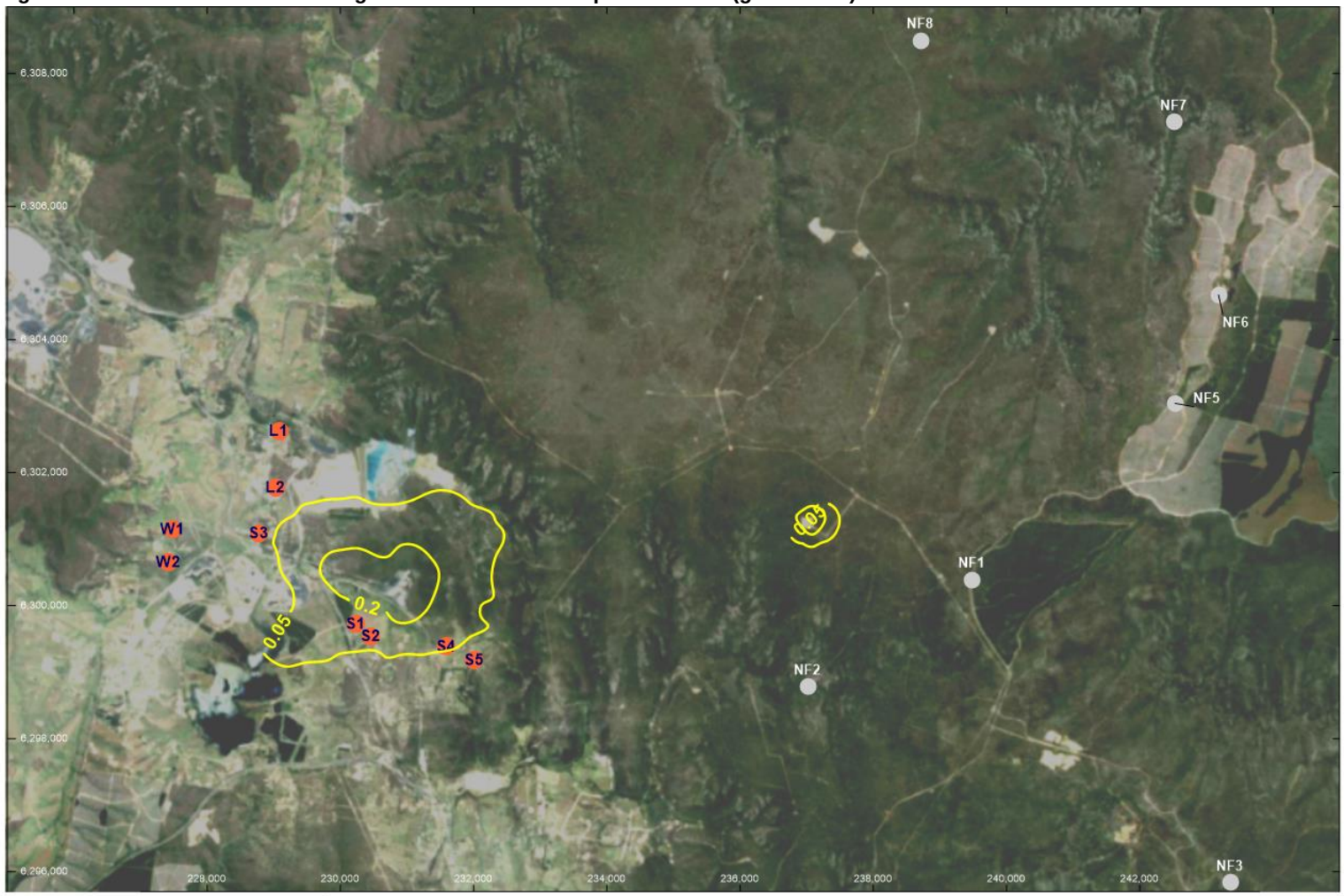
Table 15 shows the dust deposition rates predicted at the identified sensitive receptor locations due to the particulate emission rates estimated in **Section 4** for MOD 1. A contour plot of the predicted incremental increase in dust deposition rates is also presented in **Figure 17**.

Table 15 shows that the incremental and cumulative annual average dust deposition rates predicted at all nominated residences/properties/sensitive areas surrounding the Springvale pit top are well below the criteria of 2 g/m^2/month (incremental increase in dust deposition) and 4 g/m^2/month (cumulative dust deposition). The incremental increase predicted as a result of the proposed MOD 1 operations are negligible and would not result in a measureable increase above background levels.

Table 15 Predicted Annual Average Dust Deposition Rates

Receptor ID	Background (g/m²/month)	Annual Average Dust Deposition Rate (g/m²/month)	
		Increment	Cumulative
S1	1.4	0.2	1.6
S2	1.4	<0.1	<1.5
S3	1.4	<0.1	<1.5
S4	1.4	<0.1	<1.5
S5	1.4	<0.1	<1.5
W1	1.4	<0.1	<1.5
W2	1.4	<0.1	<1.5
L1	1.4	<0.1	<1.5
L2	1.4	<0.1	<1.5
NF1	1.4	<0.1	<1.5
NF2	1.4	<0.1	<1.5
NF3	1.4	<0.1	<1.5
NF4	1.4	<0.1	<1.5
NF5	1.4	<0.1	<1.5
NF6	1.4	<0.1	<1.5
NF7	1.4	<0.1	<1.5
NF8	1.4	<0.1	<1.5
NF9	1.4	<0.1	<1.5
EPA Criteria		**2.0**	**4.0**

Figure 17 Predicted Annual Average Incremental Dust Deposition Rate (g/m²/month)



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Pollutant	Dust Deposition	Averaging Period	Annual	Unit	g/m²/month

7.2 Suspended Particulate

7.2.1 TSP

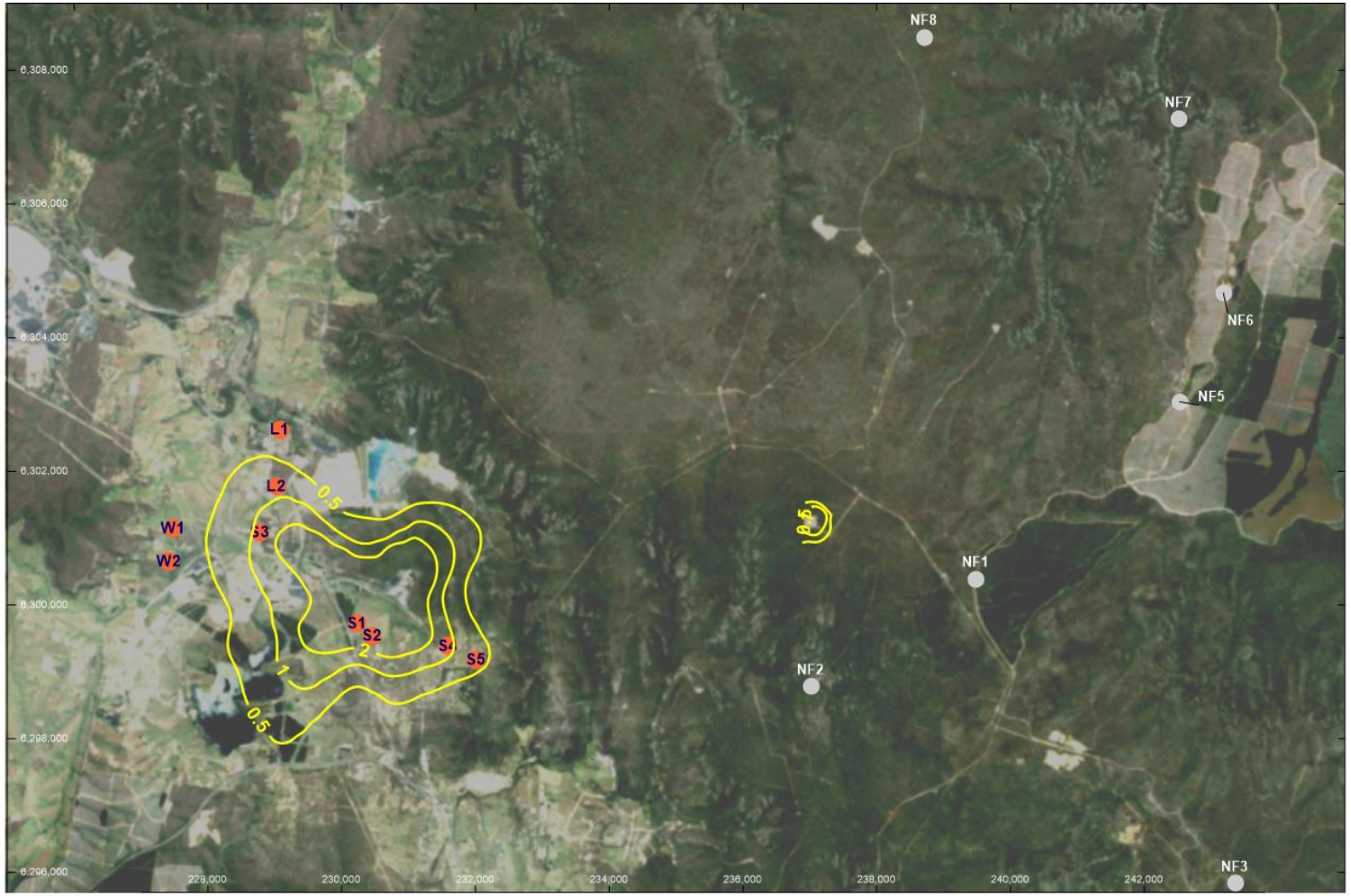
Table 16 presents the annual average TSP concentrations predicted by the dispersion modelling at each of the nominated residences/properties using the emission rates calculated in **Section 4**. The estimated background TSP concentration has been discussed in detail in **Section 5.1**. A contour plot of the predicted increase in TSP concentrations is presented in **Figure 18**.

Table 16 Predicted Annual Average TSP Concentrations

Receptor ID	Background (µg/m³)	Annual Average TSP Concentration (µg/m³)	
		Increment	Cumulative
S1	32.1	5.6	37.7
S2	32.1	4.1	36.2
S3	32.1	1.0	33.1
S4	32.1	1.2	33.3
S5	32.1	0.6	32.7
W1	32.1	0.3	32.4
W2	32.1	0.3	32.4
L1	32.1	0.3	32.4
L2	32.1	0.8	32.9
NF1	32.1	<0.1	<32.2
NF2	32.1	<0.1	<32.2
NF3	32.1	<0.1	<32.2
NF4	32.1	<0.1	<32.2
NF5	32.1	<0.1	<32.2
NF6	32.1	<0.1	<32.2
NF7	32.1	<0.1	<32.2
NF8	32.1	<0.1	<32.2
NF9	32.1	<0.1	<32.2
Criterion		**-**	**90**

The cumulative annual average TSP concentrations are predicted to be well below the criterion of 90 µg/m^3 at all nominated residences/properties/sensitive areas surrounding the Springvale pit top and recreational receptors on Newnes Plateau. The incremental increase predicted as a result of the MOD 1 operations are very low and are not predicted to give rise to a significant increase above existing background levels.

Figure 18 Predicted Annual Average Incremental TSP Concentration (µg/m³)



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7.2.2 PM_{10}

7.2.2.1 Annual Average PM_{10} Concentrations

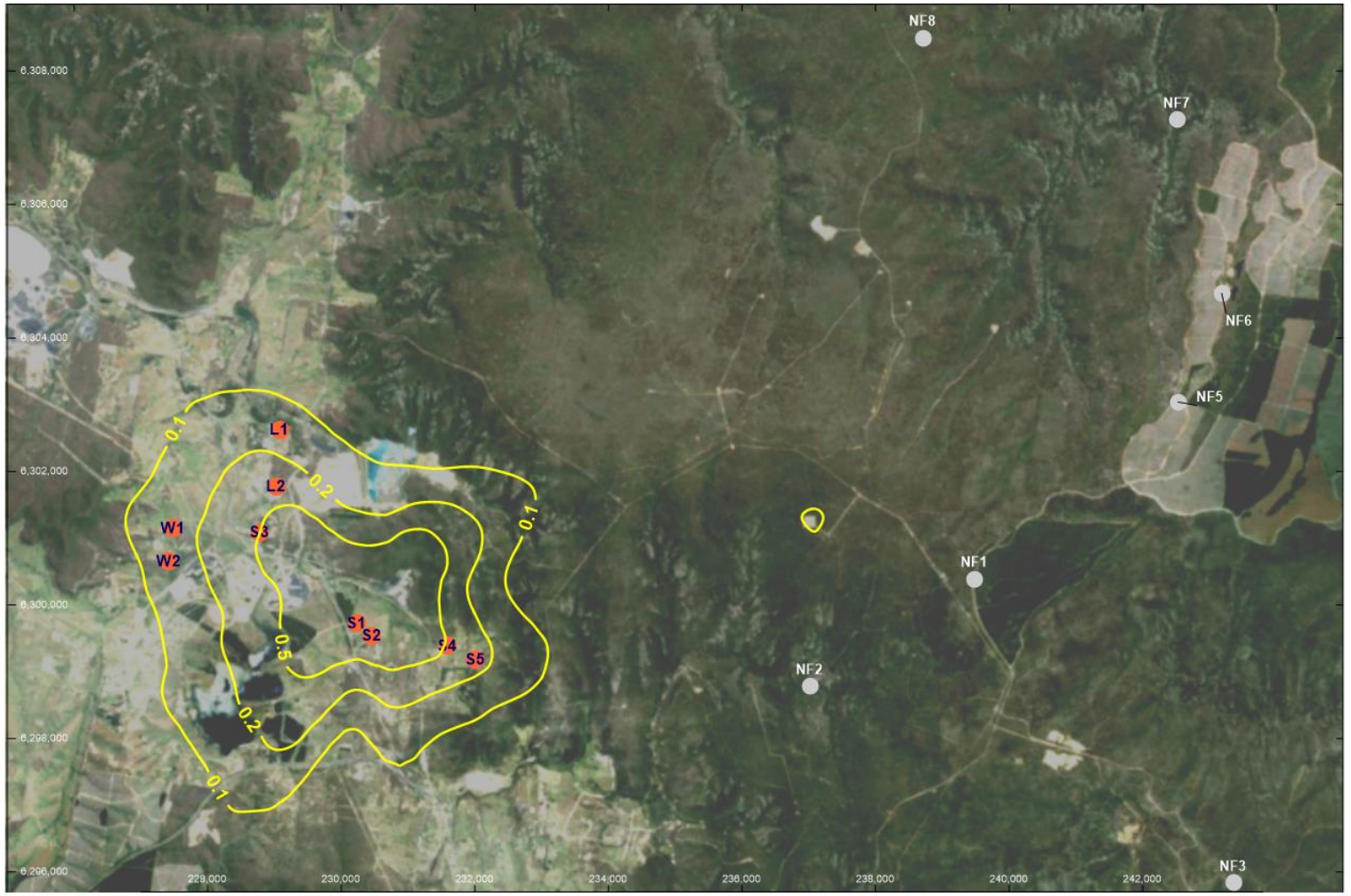
Table 17 presents the annual average PM_{10} concentrations predicted by the dispersion modelling at each of the nominated residences/properties/sensitive areas using the emission rates calculated in **Section 4**. The assumed background PM_{10} concentration has been discussed in detail in **Section 5.1**. A contour plot of the predicted increase in annual average PM_{10} concentrations is presented in **Figure 19**

Table 17 Predicted Annual Average PM_{10} Concentrations

Receptor ID	Background (µg/m³)	Annual Average PM_{10} Concentration (µg/m³)	
		Increment	Cumulative
S1	14.6	2.1	16.7
S2	14.6	1.5	16.1
S3	14.6	0.4	15.0
S4	14.6	0.5	15.1
S5	14.6	0.3	14.9
W1	14.6	0.2	14.8
W2	14.6	0.1	14.7
L1	14.6	0.1	14.7
L2	14.6	0.4	15.0
NF1	14.6	<0.1	<14.7
NF2	14.6	<0.1	<14.7
NF3	14.6	<0.1	<14.7
NF4	14.6	<0.1	<14.7
NF5	14.6	<0.1	<14.7
NF6	14.6	<0.1	<14.7
NF7	14.6	<0.1	<14.7
NF8	14.6	<0.1	<14.7
NF9	14.6	<0.1	<14.7
EPA Criterion		**-**	**30.0**

Annual average PM_{10} concentrations are predicted to be well below the NSW EPA criterion of 30 µg/m^3 at all nominated residences/properties/sensitive areas surrounding the Springvale pit top and recreational receptors on Newnes Plateau. The incremental increase predicted as a result of the MOD 1 operations are very low and are not predicted to give rise to a significant increase above existing levels.

Figure 19 Predicted Annual Average Incremental PM_{10} Concentration (µg/m³)



7.2.2.2 Maximum 24-Hour Average PM_{10} Concentrations

To assess the cumulative maximum 24-hour average PM_{10} concentrations at each of the identified sensitive receptors, the incremental impact predicted by the model for each hour of the year was added to the corresponding measured background concentration to provide cumulative 24-hour average PM_{10} concentrations.

Table 18 presents the maximum 24-hour average PM_{10} concentrations predicted by the dispersion modelling at each of the nominated residences/properties/sensitive areas using the emission rates calculated in **Section 4**. The results presented in **Table 18** show that the predicted cumulative 24-hour average PM_{10} concentrations are below the criterion of 50 µg/m³ and therefore the proposed MOD 1 operation is unlikely to cause any exceedences at any surrounding sensitive receptor locations. A contour plot of the predicted increase in maximum 24-hour average PM_{10} concentrations is presented in **Figure 20**

Following the Approved Methods, a contemporaneous analysis of the maximum predicted concentrations at the worst impacted receptor (S1) was performed and is presented in **Table 19**. This analysis showed that background concentrations are relatively low (<43% of the criterion) on days with highest predicted incremental contribution from MOD 1 operations.

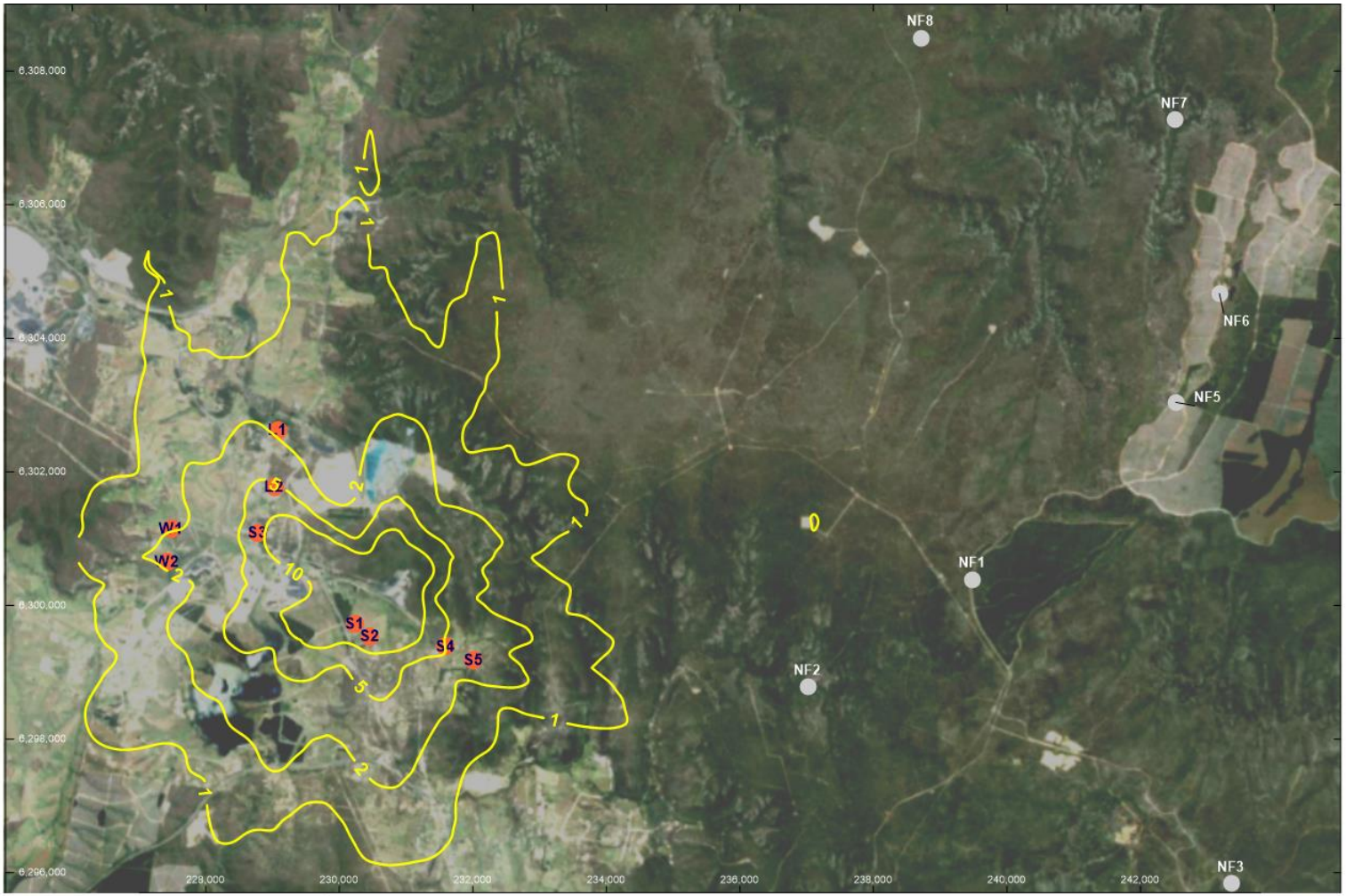
Table 18 Predicted Maximum 24 Hour Average PM_{10} Concentrations

Receptor ID	Maximum 24-Hour Average PM_{10} Concentration (µg/m³)	
	Increment	Cumulative
S1	21.2	45.1
S2	21.1	39.9
S3	5.8	39.4
S4	5.3	39.4
S5	3.5	39.4
W1	2.0	39.4
W2	2.2	39.4
L1	1.8	39.6
L2	5.4	39.5
NF1	0.3	39.4
NF2	0.3	39.4
NF3	0.2	39.4
NF4	0.1	39.4
NF5	0.1	39.4
NF6	0.1	39.4
NF7	0.1	39.4
NF8	0.1	39.4
NF9	0.1	39.5
EPA Criterion	**-**	**50**

Table 19 Summary of Contemporaneous Analysis – Receptor S1

Date	PM_{10} 24-Hour Average (µg/m³)			Date	PM_{10} 24-Hour Average (µg/m³)		
	Highest Background	Increment	Total		Background	Highest Increment	Total
25-03-2014	39.4	0.8	40.2	09-04-2014	7.9	21.2	29.1
26-03-2014	34.8	10.3	45.1	11-03-2014	10.5	19.8	30.3
01-10-2014	29.4	0.0	<29.5	07-02-2014	21.9	18.0	39.9
23-04-2014	28.1	0.0	<28.2	14-01-2014	14.5	15.9	30.4
06-01-2014	27.6	0.0	<27.7	13-02-2014	5.7	15.8	21.5

Figure 20 Predicted Maximum 24-Hour Average Incremental PM_{10} Concentration (µg/m³)



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Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

7.2.3 $PM_{2.5}$

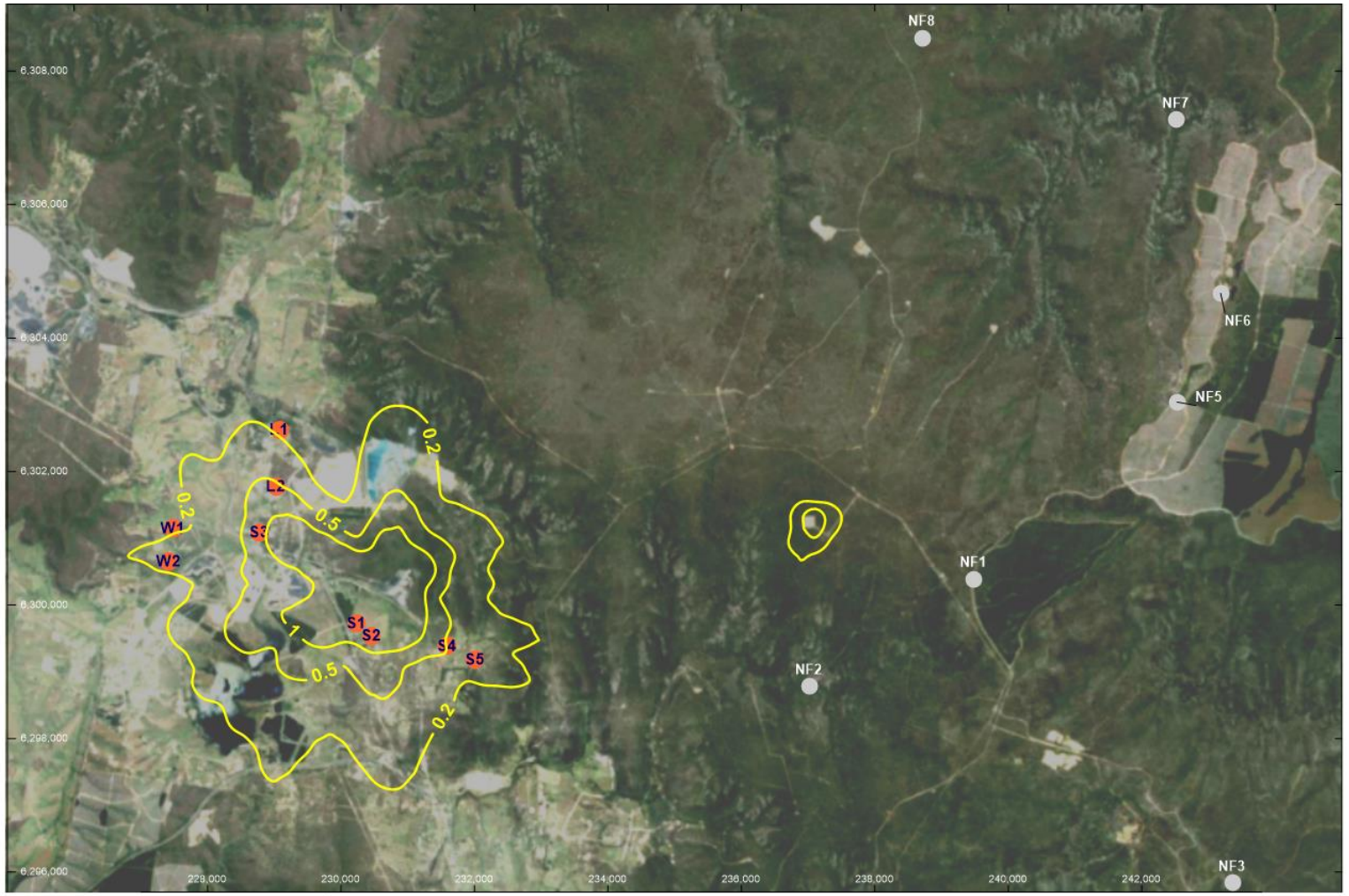
Table 20 presents the maximum 24-hour and annual average incremental $PM_{2.5}$ concentrations predicted by the dispersion modelling at each of the nominated residences/properties using the emission rates calculated in **Section 4**. As discussed in **Section 5.1**, no ambient background monitoring data for $PM_{2.5}$ are available in the local area or at the nearest OEH monitoring sites, hence the modelling results have been assessed by comparison of the incremental concentrations against the criteria.

Table 20 shows that the incremental increase in 24-hour average and annual average $PM_{2.5}$ concentrations predicted as a result of the proposed MOD 1 operations are minor and are unlikely to cause any exceedences at any surrounding sensitive receptor locations. Contour plots for predicted incremental maximum 24-hour average and annual average $PM_{2.5}$ concentrations are presented in **Figure 21** and **Figure 22**.

Table 20 Predicted 24-Hour and Annual Average $PM_{2.5}$ Concentrations

Receptor ID	Incremental $PM_{2.5}$ Concentration (µg/m³)	
	Maximum 24-Hour Average	Annual Average
S1	2.1	0.2
S2	2.1	0.2
S3	0.6	<0.1
S4	0.5	<0.1
S5	0.3	<0.1
W1	0.2	<0.1
W2	0.2	<0.1
L1	0.2	<0.1
L2	0.6	<0.1
NF1	<0.1	<0.1
NF2	<0.1	<0.1
NF3	<0.1	<0.1
NF4	<0.1	<0.1
NF5	<0.1	<0.1
NF6	<0.1	<0.1
NF7	<0.1	<0.1
NF8	<0.1	<0.1
NF9	<0.1	<0.1
NEPM Criteria	**25 (cumulative)**	**8 (cumulative)**

Figure 21 Predicted Maximum 24-Hour Average Incremental $PM_{2.5}$ Concentration (µg/m³)



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Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

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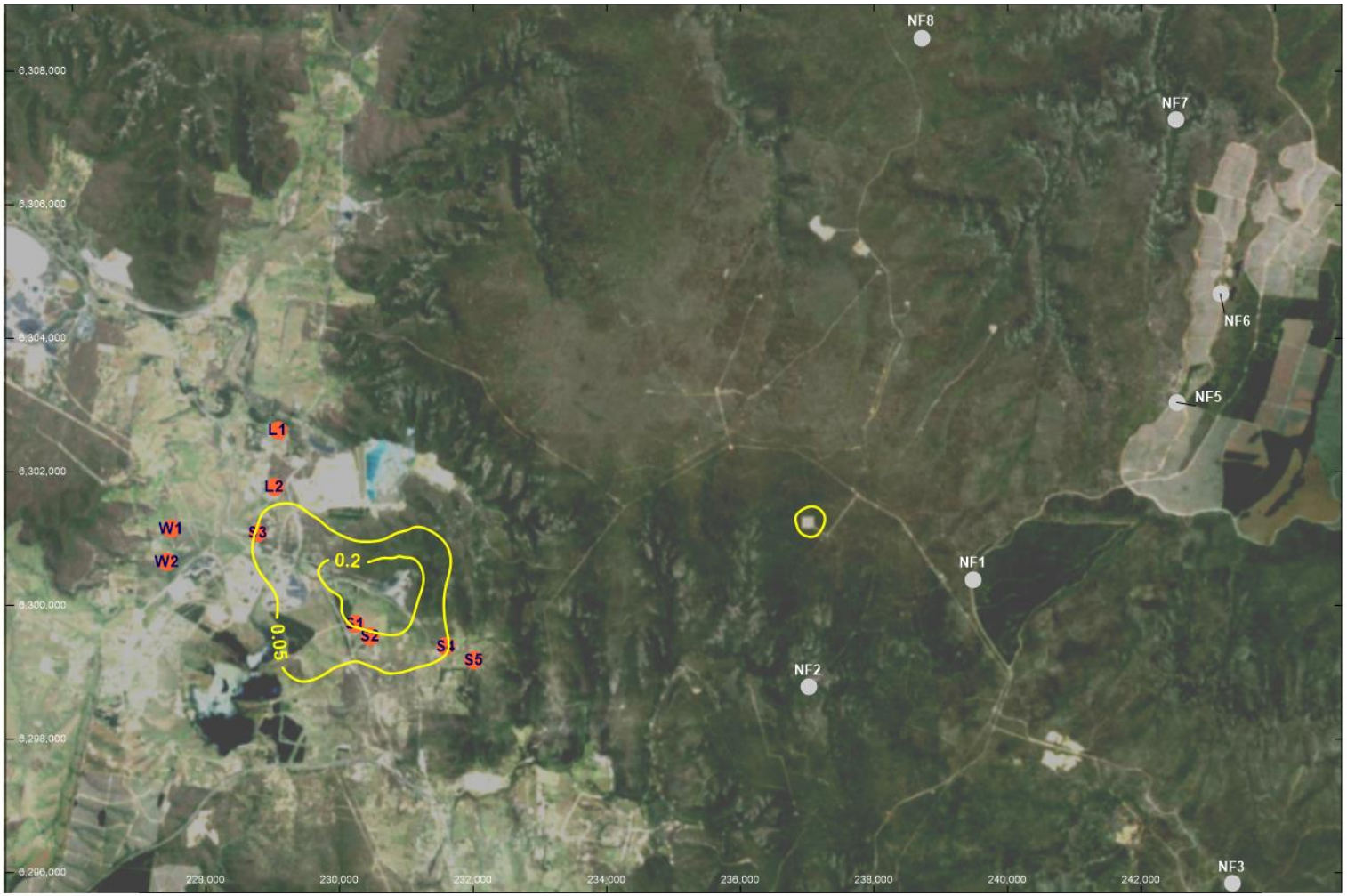
Figure 22 Predicted Annual Average Incremental $PM_{2.5}$ Concentration (µg/m³)



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Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

8 GREENHOUSE GAS ASSESSMENT

No Secretary's Environmental Assessment Requirements have been issued for MOD 1. The Director-General's Requirements issued on 06 November 2012 for the Springvale Mine Extension Project in relation to greenhouse gas (GHG) emissions were as follows:

- A quantitative assessment of potential Scope 1, 2 and 3 GHG emissions;
- A qualitative assessment of the potential impacts of these emissions on the environment; and,
- An assessment of reasonable and feasible measures to minimise GHG emissions and ensure energy efficiency.

The above requirements have again been assessed for MOD 1. This GHG assessment has been performed with reference to the Australian Department of Climate Change and Energy Efficiency (DCCEE) document "*National Greenhouse Accounts Factors*" (August, 2015), the NSW Department of Energy, Utilities and Sustainability (DEUS) document "*Guidelines for Energy Savings Action Plans*" (2005), the National Greenhouse and Energy Reporting Act 2007 (NGER Act), the Centennial Coal Greenhouse Gas Assessment Guidance Notes (Centennial Coal, 2010) and Climate Change Response Policy (Centennial Coal, 2012b).

Although this report is concerned with the installation and operation of MOD 1, data for all greenhouse gas generating activities are presented.

Activity data for the following have been obtained from Springvale Coal for the period 1 July 2014 to 30 June 2015:

- Total Run of Mine (ROM) Coal Production (tonnes [t]);
- Total Electricity Consumption (kilowatt-hours [kWh]);
- Total Diesel Consumption (litres [L]);
- Solid Waste to Landfill (t);
- Consumption of Liquid Petroleum Gas (LPG); and
- Consumption of oils and greases (consumed without combustion).

Data was made available for the period July 2014 to June 2015, being the most recent complete financial year of data which has been compiled to meet the requirements of the National Pollutant Inventory (NPI).

8.1 Activity Data

GHG inventories are presented for the following:

1. Baseline GHG emissions (Approved site operations including No. 3 Ventilation Shaft and Dewatering Bores 8, 9 and 10 – hereafter "Current Operations").
2. Baseline GHG emissions plus MOD 1 (hereafter "Proposed Operations").

8.1.1 Baseline Activity Data ("Current Operations")

The baseline against which the MOD 1 impacts are assessed is the currently approved ROM extraction and processing rate of 4.5 Mtpa. Activity data have been provided by Springvale Coal for the NPI reporting period of July 2014 to June 2015. The ROM coal extracted during this reporting period was 3.8 Mt. The baseline activity data has therefore been scaled (where appropriate) by a factor of 1.18 (4.5/3.8) to enable a comparison of approved versus proposed activities occurring as part of MOD 1.

8.1.2 Proposed Operations Activity Data

The changes to the Springvale Mine operations associated with MOD 1 that have the potential to increase GHG emissions from the site are:

- an increase in ROM coal production from the approved 4.5 Mtpa to 5.5 Mtpa; and
- an increase in workforce from the approved 310 FTE to 450 FTE.

To assess the impact of MOD 1, some scaling of activity data is required and assumptions are required to be made. These assumptions are outlined below:

- **Electricity consumption**: Electricity consumption at Springvale Colliery is associated with conveyors, boreholes pumps (existing) and current ventilation requirements, as well as bath house operations etc. It is assumed that these requirements will not change.
- **Diesel consumption**: Diesel consumption will be linked to production and it has therefore been assumed that diesel consumption will increase. To assess the impact of the approved 4.5 Mtpa extraction rate versus the proposed rate of 5.5 Mtpa, a scaling factor of 1.22 (5.5 Mtpa / 4.5 Mtpa) has been applied to both Springvale Coal and contractor diesel consumption data.
- **Ventilation requirements**: The increase in ROM coal production means that an additional continuous mining unit (CM) will be required. The increased ventilation required to operate the CM unit would be 20 m^3/s.
- **Solid waste**: The approved full time workforce is proposed to increase from the approved 310 FTE to 450 FTE and the quantity of solid waste generated has been assumed to increase proportionally. It is noted however that the site currently has 358 existing staff and this has also been factored into the calculations
- **Oil and grease**: Usage is assumed to remain constant
- **LPG**: Usage is assumed to remain constant.

8.1.3 Summary of Activity Data Used in the GHG Assessment

A summary of the activity data used in the GHG assessment to estimate emissions for the Current and Proposed Operations is provided in **Table 21**.

Table 21 Summary of Project Related Activity Data Relevant to GHG Emissions

Activity	Units	2014/2015 NPI Activity Data	Current Operations	Proposed Operations
Annual ROM production	Mtpa	3.8	4.5	5.5
Annual electricity consumption	kWh	116,662,837	116,662,837	116,662,837 [1]
Annual diesel consumption – Springvale Coal	litres	1,612,000	1,908,947 [2]	2,406,272 [3]
Annual diesel consumption - Contractor	litres	Not provided	697,452 [4]	852,441 [3]
Annual flowrate from mine ventilation shaft (airflow)	million m^3	4,792	4,792	5,426
Solid waste to landfill	t	773	669 [5]	971 [6]
Liquid Petroleum Gas (LPG)	kg	35,281	35,281	35,281
Petroleum based oils used	litres	183,000	183,000	183,000
Petroleum based greases used	litres	3,000	3,000	3,000

Note 1: Electricity consumption assumed to not change as a result of the increased ROM extraction rate.

Note 2: Scaling factor of 1.18 applied to 2014/15 diesel usage (2014/15 NPI Emission Inventory) to account for approved ROM production rate.

Note 3: Scaling factor of 1.45 applied to 2014/15 diesel usage (2014/15 NPI Emission Inventory) to account for proposed ROM production rate.

Note 4: Sourced from "*Springvale Coal Pty Ltd, Springvale Colliery SMEP, Air Quality and GHG Assessment (2014)"*

Note 5: Scaled down to account for 358 existing staff compared to approved 310 staff.

Note 6: Scaling factor of 1.45 applied to solid waste quantity based on proposed approved staffing increase.

8.2 Direct and Indirect Emissions (Emissions Scope)

National Greenhouse and Energy Reporting Regulations 2008 defines scope 1 and scope 2 emissions as:

Division 2.5 Meaning of *emissions*, production and consumption: section 10

2.23 Meaning of *emissions*, *production* and *consumption*

(1) ***Emissions*** of greenhouse gas, in relation to a facility, means the release of greenhouse gas into the atmosphere as a direct result of one of the following:

(a) an activity, or series of activities (including ancillary activities) that constitute the facility (***scope 1 emissions*)**;

(b) 1 or more activities that generate electricity, heating, cooling or steam that is consumed by the facility but that do not form part of the facility (***scope 2 emissions*)**.

(2) ***Production*** of energy, in relation to a facility, means 1 of the following:

(a) the extraction or capture of energy from natural sources for final consumption by or from the operation of the facility or for use other than in the operation of the facility;

(b) the manufacture of energy by the conversion of energy from 1 form to another form for final consumption by or from the operation of the facility or for use other than in the operation of the facility.

(3) ***Consumption*** of energy, in relation to a facility, means the use or disposal of energy from the operation of the facility including own-use and losses in extraction, production and transmission.

National Greenhouse and Energy Reporting Regulations does not include scope 3 emissions.

The National Greenhouse Accounts workbook (NGA) the methodology used for estimating scope 3 emissions in this assessment is defined as follows:

- Various emission factors can be used to calculate scope 3 emissions. For ease of use, this workbook reports specific 'scope 3' emission factors for organisations that:
  - *(a) burn fossil fuels: to estimate their indirect emissions attributable to the extraction, production and transport of those fuels; or*
  - *(b) consume purchased electricity: to estimate their indirect emissions from the extraction, production and transport of fuel burned at generation and the indirect emissions attributable to the electricity lost in delivery in the T&D network.*

It is noted that Springvale Coal has a restricted capacity to reduce their GHG emissions under Scope 3 at Springvale Colliery. Reductions in the emissions of GHG resulting from the extraction and transport of fossil fuels for use in electricity production or onsite diesel combustion are beyond the control of Springvale Coal but are reported here for completeness, as required by the Department of Planning and Environment.

8.3 Greenhouse Gas Calculation Methodology

8.3.1 Global Warming Potential

Quantification of potential Project emissions has been undertaken in relation to both carbon dioxide (CO_2) and other non-CO_2 greenhouse gas emissions.

For comparative purposes, non-CO_2 greenhouse gases are awarded a "CO_2-equivalence" (CO_2-e) based on their contribution to the enhancement of the greenhouse effect. The CO_2-e of a gas is calculated using an index called the Global Warming Potential (GWP). The GWPs for a variety of non-CO_2 greenhouse gases are contained within the Intergovernmental Panel on Climate Change's (IPCC) 2007 Fourth Assessment Report (AR4). These GWPs replace those used from the IPCC's Second Assessment Report (AR2) and were adopted for reporting from 2015 onwards at the United Nations Framework Convention on Climate Change meeting in November-December 2011 in Durban (South Africa.

The GWPs of relevance to this assessment are:

- methane (CH_4): GWP of 25 (25 times more effective as a greenhouse gas than CO_2); and
- nitrous oxide (N_2O): GWP of 298 (298 times more effective as a greenhouse gas than CO_2).

The short-lived gases such as carbon monoxide (CO), nitrogen dioxide (NO_2), and non-methane volatile organic compounds (NMVOCs) vary spatially and it is consequently difficult to quantify their global radiative forcing impacts. For this reason, GWP values are generally not attributed to these gases nor have they been considered further as part of this assessment.

The greenhouse gas emissions associated with MOD 1 have been assessed in terms of direct (Scope 1) emission potential, indirect (Scope 2) emission potential and significant upstream/downstream (Scope 3) emission potential.

8.3.2 Identification of Emission Sources

A summary of the potential Project GHG emission sources is provided in **Table 22**.

Table 22 Summary of Potential Project Greenhouse Gas Emissions

Project Component	Direct Emissions	Indirect Emissions	
	Scope 1	**Scope 2**	**Scope 3**
Fugitive Emissions	Emissions from the release of coal seam methane and carbon dioxide as a result of extraction activities.	N/A	N/A
Diesel	Emissions from the combustion of diesel at Springvale in both mobile and fixed plant and equipment)	N/A	Emissions associated with contractor diesel usage. Estimated emissions attributable to the extraction, production and transport of diesel consumed at Springvale.
Liquid petroleum gas	Emissions from the combustion of LPG at Springvale in mobile equipment	N/A	N/A
Use of Oils and Greases	Consumption (non-combustion) of oils and greases	N/A	N/A
Electricity	N/A	Emissions associated with the consumption of generated and purchased electricity at the mine.	Estimated emissions from the extraction, production and transport of fuel burned for the generation of electricity consumed at the mine and the electricity lost in delivery in the transmission and distribution network.
Solid Waste	N/A	N/A	Emissions associated with the disposal of solid waste to landfill
Coal Combustion	N/A	N/A	Emissions from the combustion of coal from Springvale.

N/A = Not applicable

8.3.3 Scope 1: Direct Emissions

Fugitive Emissions - Coal Seam Methane and Carbon Dioxide

The process of coal formation creates significant amounts of CH_4. Some of this CH_4 remains trapped in the coal until the pressure on the coal is reduced, which occurs during the coal mining process. The stored CH_4 is then released to the atmosphere.

Fugitive emissions from extraction of coal as defined by the National Greenhouse and Energy Reporting System (NGERS) were estimated for the 11-12 financial year using Method 4, subdivision 3.2.2.2 of the NGERS Measurement Determination 2008.

Based on information provided by Springvale Coal, the ventilation fan at the Springvale Colliery currently results in ventilation emissions of 4,792 Mm^3/yr at 0.11% CO_2 and 0.02% CH_4. With MOD 1, the increased production rate will require an increase in the ventilation rate of an additional 20.1 m^3/s (equivalent to 634 Mm^3/yr).

The gas densities of CO_2 and CH_4 have been taken to be 1.977 kg/Nm^3 and 0.680 kg/Nm^3, respectively. Temperature of the gas stream has been provided by Springvale Coal to be 290 K.

Scope 1 emissions calculated are as presented in **Table 23** for the current and proposed operations, using the above information on the temperature, gas volumes and composition of the ventilation gas stream.

Table 23 Calculated Scope 1 Fugitive Emissions from Ventilation

Source	Fugitive Emissions (tonnes CO_2-e)
Existing Ventilation Systems	25,167
Proposed Ventilation System	28,496

Diesel Usage

The primary fuel source for the vehicles operating at Springvale Colliery is diesel. Diesel consumption for all mobile and fixed equipment is estimated to be 2,606,399 L for the underground operation based the approved throughput of 4.5 Mtpa ROM. Vehicles and equipment owned by Springvale Coal are estimated to use 1,908,947 L of this, with 697,452 L estimated to be used by contractors. An additional 22,114 L of diesel is calculated to be consumed by the fan at the Ventilation Shaft No. 3 upgrade and a further 17,000 L by Dewatering Bores 8, 9 and 10.

As part of MOD 1, an additional 424,211 L per annum of diesel is expected to be required as a result of the proposed increase in the ROM production rate.

Scope 1 emissions from use of diesel fuel as defined by NGERS were estimated using Method 1, Division 2.4.2 section 2.41 of the NGERS Measurement Determination 2008. The energy content of diesel fuel was taken to be 38.6 GJ/kL with a Scope 1 emission factor of 70.2 kg CO_2-e/GJ (Table 3, DCCEE, August 2015).

Based on the above, the estimated Scope 1 emissions of CO_2-e from the combustion of diesel fuel are presented in **Table 24** for the baseline and proposed operations.

Table 24 Calculated Scope 1 Emissions from Diesel Combustion

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	Proposed Operations (5.5 Mtpa)
Diesel – Springvale Coal	5,173	6,322
Diesel - Contractor	1,890	2,310
Total	**7,063**	**8,632**

Liquid Petroleum Gas

LPG consumption is estimated at 35,281 kg per annum, which is not expected to change due to the proposed MOD 1 operations. Scope 1 emissions from use of LPG as defined by NGERS were estimated using Method 1, Division 2.4.2 section 2.41 of the NGERS Measurement Determination 2008. It has been assumed that 1 kg LPG is equal to 1.76 L and contains 25.3 GJ/kL with a Scope 1 emission factor of 51.53 kg CO_2-e/GJ (Table 2, DCCEE, August 2015).

Scope 1 emissions of CO_2-e from the consumption of LPG are presented in **Table 25**.

Table 25 Calculated Scope 1 Emissions from LPG Consumption

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	Proposed Operations (5.5 Mtpa)

LPG Consumption	81	81
Total	**81**	**81**

Oils and Greases

Oils and greases are used for lubrication of equipment and machinery. Oil and grease consumption are estimated as presented in **Table 21**. Scope 1 emissions from use of oils and greases as defined by NGERS were estimated using the method detailed in Section 2.68 part b (iii) of the NGERS Measurement Determination 2008. The energy content of oil and grease was taken to be 38.8 GJ/kL with Scope 1 emission factors of 13.9 kg CO_2-e/GJ for oils and 3.5 kg CO_2-e/GJ for greases (Table 3, DCCEE, August 2015).

Scope 1 emissions of CO_2-e from the use of oils and greases are presented in **Table 25**.

Table 26 Calculated Scope 1 Emissions from Oil and Grease Consumption

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	**Proposed Operations (5.5 Mtpa)**
Oil Consumption	99	99
Grease Consumption	0.3	0.3
Total	**99**	**99**

8.3.4 Scope 2: Indirect Emissions through the Consumption of Purchased Electricity

Scope 2 GHG emissions as defined by NGERS were estimated using Method 1, Chapter 7, section 7.2 of the NGERS Measurement Determination 2008.

State emission factors are used because electricity flows between states are significantly constrained by the capacity of the inter-state interconnectors and in some cases there are no interconnections.

Annual electricity consumption at the Springvale Colliery has been reported at 116,662,837 kWh (approximately 116,663 Megawatt-hours (MWh)) for the 2014/15 financial year. An additional 15,593 MWh/annum has been assumed for the operation of the upgraded Ventilation Shaft No. 3 and a further 11,217 MWh/annum attributable to the operation of Dewatering Bores 8, 9 and 10, resulting in a total baseline electricity consumption of 165,906 MWh/annum. It is not expected that this will increase due to MOD 1.

The Scope 2 emission factor for the consumption of purchased electricity in NSW is 0.84 kg of CO_2-equivalents per kilowatt hour [kg CO_2-e/kWh]) (Table 5(a), DCCEE, August 2015).

Scope 2 emissions of CO_2-e from the consumption of purchased electricity are presented in **Table 27**.

Table 27 Calculated Scope 2 Emissions from Electricity Consumption

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	**Proposed Operations (5.5 Mtpa)**
Electricity Consumption	97,996	97,996
Total	**97,996**	**97,996**

8.3.5 Scope 3: Other Indirect Emissions

As discussed previously, Scope 3 GHG emissions attributable to MOD 1 are reported for completeness. Springvale Coal has a restricted capacity to reduce their GHG emissions under Scope 3 at Springvale Colliery. Reductions in the emissions of GHG resulting from the extraction and transport of fossil fuels for use in electricity production or onsite diesel combustion are beyond the control of Centennial. Also beyond the control of Springvale Coal are the operations of coal consumers.

Combustion of Product Coal

Indirect emissions of GHG from the combustion of product coal are expected "downstream" due to the combustion of coal produced by Springvale. Up to 5.5 Mtpa of ROM coal may be produced by Springvale Colliery under MOD 1 and the following calculations assume that 100% of ROM coal produced is combusted to produce electricity.

The Scope 1 emission factor for bituminous coal published in Table 1 of the August 2015 version of the NGA Factors of 90.23 kg CO_2-e/GJ has been used within this assessment to estimate Scope 3 emissions from combustion of product coal by end customers. A coal energy content of 27 GJ/t for thermal (black coal) (Table 1 of the NGA Factors, August 2015) was also assumed.

Scope 3 emissions of CO_2-e from the combustion of saleable product coal are presented in **Table 28**.

Table 28 Calculated Scope 3 Emissions from Combustion of Product Coal

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	**Proposed Operations (5.5 Mtpa)**
Combustion of Product Coal	10,962,945	10,962,945
Total	**10,962,945**	**10,962,945**

Extraction, Production and Transport of Fuel Burned for the Generation of Electricity and Electricity Consumed in the Transmission and Distribution System

The NGA Factors provides Scope 3 emission factors for the consumption of purchased electricity by each state. State emission factors are used because electricity flows between states are significantly constrained by the capacity of the inter-state interconnectors and in some cases there are no interconnections.

The NSW Scope 3 emission factor of 0.13 kg CO_2-e/kWh (Table 41, DCCEE, August 2015) covers both the emissions from the extraction, production and transport of fuels used in the production of the purchased electricity (i.e. fugitive emissions and stationary and mobile fuel combustion emissions) and also the emissions associated with the electricity lost in transmission and distribution on route to the customer. In this report, Scope 2 and 3 emissions for the consumption of purchased electricity have been reported separately so that the share of the transport and distribution loss can be correctly attributed under Scope 3 emissions - Generation of Electricity Consumed in a transmission and distribution system.

Scope 3 emissions of CO_2-e from the consumption of purchased electricity are presented in **Table 29**.

Table 29 Calculated Scope 3 Emissions from Electricity Consumption

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	**Proposed Operations (5.5 Mtpa)**
Electricity Consumption	15,166	15,166
Total	**15,166**	**15,166**

Extraction, Production and Transport of Diesel Consumed at the Project

Scope 3 GHG emissions attributable to diesel used Springvale relate to its extraction, production and transport.

The annual emissions of CO_2 and other GHG from this source have been estimated using Table 38 of the NGA Factors, an emission rate of 3.6 kg CO_2-e/GJ (Table 39, DCCEE, August 2015) and an assumed energy content of diesel of 38.6 GJ/kL.

Scope 3 emissions of CO_2-e from the combustion of diesel fuel are presented in **Table 30**.

Table 30 Calculated Scope 3 Emissions from Diesel Combustion

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	**Proposed Operations (5.5 Mtpa)**
Diesel - Centennial	265	324
Diesel - Contractor	97	118
Total	**362**	**442**

Extraction, Production and Transport of Oils and Greases Consumed at the Project

Scope 3 GHG emissions attributable to oils and greases used at Springvale relate to its extraction, production and transport.

The annual emissions of CO_2 and other GHG from this source have been estimated using an emission rate of 3.6 kg CO_2-e/GJ and an assumed energy content of 38.8 GJ/kL.

Scope 3 emissions of CO_2-e from the use of oils and greases are presented in **Table 31**.

Table 31 Calculated Scope 3 Emissions from Oil and Grease Consumption

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	**Proposed Operations (5.5 Mtpa)**
Oil/Grease Consumption	26	26
Total	**26**	**26**

Waste Generation

Solid waste generated at the Springvale pit top and disposed of in landfill is estimated as presented in **Table 21**. It has been assumed that generation of waste will increase as a result of MOD 1 in proportion to the increase in employees.

Waste sent to landfill results in emissions of CH_4 as waste is degraded. Table 42 of the NGA Factors provides GHG emission factors based on broad waste streams (municipal solid waste, commercial and industrial waste and construction and demolition waste). To provide a worst case assessment of GHG emissions from waste sent to landfill, the emission rate for municipal solid waste (1.4 t CO_2-e / tonne waste) has been used within this assessment (table 43, DCCEE, August 2015).

Scope 3 emissions of CO_2-e from the disposal of solid waste are presented in **Table 32**.

Table 32 Calculated Scope 3 Emissions from Waste Disposal

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	**Proposed Operations (5.5 Mtpa)**
Waste Disposal	937	1,361
Total	**937**	**1,361**

Liquid Petroleum Gas

Scope 3 GHG emissions attributable to LPG used at the Project relate to its extraction, production and transport. It has been assumed that 1 kg LPG is equal to 1.76 L and contains 25.7 GJ/kL with a Scope 3 emission rate of 3.6 kg CO_2-e/GJ (Table 39, DCCEE, August 2015).

Scope 3 emissions of CO_2-e from the use of LPG are presented in **Table 33**.

Table 33 Calculated Emissions from LPG Consumption (tonnes) SCOPE 3

Source	Emissions (tonnes CO_2-e)	
	Current Operations (4.5 Mtpa)	**Proposed Operations (5.5 Mtpa)**
LPG Consumption	6	6
Total	**6**	**6**

Employees Commuting To and From Work

Fuel usage and associated GHG emissions attributable to company employees commuting to and from work can be reported under Scope 3 GHG emissions. Data has been provided by Springvale Coal on the assumed number of mine employees (358 for Current Operations (310 approved) and 450 for Proposed Operations). It has been assumed that each employee will travel to site on 320 days/year, giving 99,200 trips per year (one way) for Current Operations and 144,000 trips per year (one way) for Proposed Operations.

It is assumed that 50% of staff originate from Lithgow, approximately 13 km to the southeast of the Springvale pit top, with the remaining 50% of staff trips originating in Bathurst, approximately 56 km to the west of the Springvale pit top. Assuming that all employee-owned vehicles have a fuel efficiency of 10 L/100 km and operate on diesel as a *worst case assumption*, the total annual diesel consumption by employee owned vehicles would be 684.5 kL per annum for Current Operations and 993.6 kL for the Proposed Operations.

The annual emissions of CO_2 and other GHG from this source have been estimated using an emission rate of 70.2 kg CO_2-e/GJ (Table 3, DCCEE, August 2015), and an assumed energy content of diesel of 38.6 GJ/kL.

Scope 3 emissions of CO_2-e from the combustion of diesel fuel in employee vehicles are presented in **Table 34**.

Table 34 Calculated Scope 3 Emissions from Diesel Combustion in Employee Vehicles

Source	Emissions (tonnes CO_2-e)	
	Current Operations (310 FTE) [1]	**Proposed Operations (450 FTE)**
Employee Vehicles	1,855	2,692
Total	**1,855**	**2,692**

[1] 310 FTE Approved; currently there is a total of 358 staff on site.

Sources not Included

The following Scope 3 GHG emission sources were not included within the assessment:

- Employee business travel; and
- Outsourced activities.

8.4 Greenhouse Gas Calculation Results

8.4.1 Estimated Emissions

Calculated Scope 1, Scope 2 and Scope 3 emissions of greenhouse gas resulting from the emissions sources outlined are presented in **Table 35**.

Table 35 Summary of Scope 1, 2 and 3 GHG Emissions

Source	Current Approved Operations (tonnes CO_2-e/annum)	Proposed Operations (tonnes CO_2-e/annum)
Scope 1		
Fugitive emissions	25,167	28,496
Diesel combustion	5,173	6,322
LPG combustion	81	81
Oil and grease consumption	99	99
Total	***30,520***	***34,998***
Scope 2		
Electricity consumption	97,997	97,997
Total	***97,997***	***97,997***
Scope 3		
Product coal combustion	10,962,945	13,399,155
Extraction, production and transport of diesel	265	324
Diesel use by contractors (combustion & prod.)	1,987	2,428
Oil and grease extraction, production & transport	26	26
Electricity consumption	15,166	15,166
LPG extraction, production & transport	6	6
Waste Disposal	937	1,360
Employee Travel	1,855	2,692
Total	***10,983,187***	***13,421,157***

8.4.2 Impacts of MOD 1

MOD 1 is estimated to result in an increase in direct (Scope 1) GHG emissions of 4,479 t CO_2-e per annum, which represents an increase of 15% on current approved operations.

Indirect (Scope 2) GHG emissions are not expected to change as a result of MOD 1.

Indirect (Scope 3) GHG emissions are estimated to increase by 2,437,970 t CO_2-e per annum, an increase of approximately 22% on current approved operations. The increased emissions are due to the indirect emissions associated with combustion of the additional 1 Mtpa product coal by end users.

8.4.3 Comparison with National and State GHG Emissions

The estimated (net) annual emissions associated with the modified Project are presented in **Table 36**.

Table 36 Net Change in GHG Emissions Estimated to Result from MOD 1

Emission Scope	Estimated Emissions (t CO_2-e/annum)
1	4,479
2	0
3	2,437,970
TOTAL	***2,442,449***

Emissions of GHG in NSW were reported to be 141.8 Mt in 2013, 28% of the Australian total GHG emissions of 549.4 Mt in 2013 (http://ageis.climatechange.gov.au/). Comparison of the Scope 1 emissions attributable to MOD 1 with NSW and Australia emission totals is presented in **Table 37**. Scope 3 emissions are not included as the main contributor, combustion of product coal by end users, will not all occur within Australia.

Table 37 Comparison of Modified Project GHG Emissions with State and National Totals 2013

Emission Scope	Estimated Emissions (t CO_2-e/annum)	Percentage of NSW 2013 GHG Emission Total	Percentage of Australian 2013 GHG Emission Total
Scope 1	4,479	0.0032%	0.0008%

8.5 Potential Impacts of Greenhouse Gas Emissions on the Environment

Increased emissions of GHG are widely accepted to exert a warming influence on climate. Increasing concentrations of the long-lived GHGs (CO_2, CH_4, N_2O, halocarbons and SF_6 have led to a combined radiative forcing (RF) of +2.63 [±0.26] Watts per square metre (W m^{-2}). A 9% increase in this RF since the publication of the Third Assessment Report of the IPCC (IPCC, 2001) is the result of concentration changes since 1998 (IPCC, 2007). The IPCC state that it is very likely that there has been a substantial anthropogenic (man-made) contribution to surface temperature increases in every continent except Antarctica since the middle of the 20th Century, although difficulties exist in the attribution of temperature changes on smaller than continental scales and on timescales of less than 50 years.

Scientists at the 2005 conference, 'Avoiding Dangerous Climate Change: Symposium on Stabilisation of Greenhouse Gases' concluded that at the level of 550 parts per million (ppm) CO_2 concentration, a 2°C increase in global mean temperature above present levels would be experienced, and that stabilisation at a concentration of 400 ppm would be necessary to avoid a 2°C warming. IPCC reports (IPCC, 2007) have suggested that stabilising concentrations at 450 ppm by 2020 would only result in a 50% likelihood of limiting global warming to 2°C.

The linkages between emissions of CO_2 from an individual project, resulting global CO_2 concentrations and climate warming (as was required within the DGRs for the Springvale Mine Extension Project) is not possible due to a host of uncertainties and a lag in the climate system. However, action by National Governments aimed at reducing GHG emissions by sector and national totals will result in mitigation of climate change, and accurate quantification of GHG emissions will aid the ongoing assessment of climate impacts and will reduce the impact on global climate warming influenced by all countries.

8.6 Greenhouse Gas Mitigation Measures

Springvale Coal is currently implementing a number of measures to minimise to the greatest extent practicable GHG emissions from the Springvale Colliery. Relevant measures are described below:

- Maximising energy efficiency as a key consideration in the development of the mine plan. For example, significant savings of greenhouse gas emissions (through increased energy efficiency) are achieved by mine planning decisions.
- The mine has developed and implemented an Energy and Greenhouse Management System and monitors and reports energy usage at the mine. Key Performance Indicators including energy demand and GHG emissions per tonne of ROM coal produced are tracked.

Additional measures that Springvale Coal are striving to achieve include:

- Identification and implementation of cost effective measures to improve energy efficiency;
- Regular maintenance of plant and equipment to minimise fuel consumption; and
- Consideration of energy efficiency in plant and equipment selection/phase.

Centennial Coal is currently investigating at a corporate level the measures which may be taken to offset Scope 1 emissions from their operations. This work is ongoing, but measures may include (but not limited to) alignment with biodiversity offsets, purchase of greenpower and switching to biodiesel fuel if considered feasible. These measures are being investigated and all measures taken to offset GHG emissions associated with MOD 1 will be in alignment with the highest standards, such as the National Carbon Offset Standard.

No particular design measures can be incorporated into MOD 1 operations to avoid impacts associated with GHG emissions.

9 CONCLUSIONS

SLR Consulting was commissioned by Springvale Coal Pty Ltd (Springvale Coal) to undertake an Air Quality and Greenhouse Gas Impact Assessment for a proposed modification to State Significant Development (SSD) 5594 (Springvale Mine Extension Project [SMEP]). Springvale Coal proposes to modify SSD 5594 to allow for:

- an increase in workforce from the approved 310 full time equivalent (FTE) to 450 FTE;
- an increase in ROM coal production from the approved 4.5 million tonnes per annum (Mtpa) to 5.5 Mtpa, with the transfer continuing to occur using the overland conveyor system to the Springvale Coal Services Site; and
- an increase in the ROM coal stockpile at the pit top from the approved 85,000 tonnes (t) to 200,000 t and accompanying extension in stockpile area footprint to the north of the existing footprint by approximately 20%.

Potential dust emissions from the MOD 1 operation were estimated based on published emission factors and measured data from Angus Place Colliery's Ventilation Shaft. Dispersion modelling was performed for operation of the proposed MOD 1 to predict the future incremental and cumulative impacts on local air quality from the MOD 1 operation.

Ambient air quality monitoring data from the OEH-operated Bathurst monitoring station were used as background to assess the cumulative impact from MOD 1.

The predicted results showed that the proposed MOD 1 activities are unlikely to cause any exceedences of the relevant ambient air quality criteria for TSP, PM_{10} and $PM_{2.5}$ concentrations or dust deposition at any identified surrounding sensitive receptors.

The assessment also considered emissions of Greenhouse Gases (CH_4 and CO_2) from MOD 1 and includes estimates of direct and indirect GHG emissions. The results of these calculations were as follows:

- MOD 1 is estimated to result in an increase in direct (Scope 1) GHG emissions of 4,479 t CO_2-e per annum, which represents an increase of 15% on current approved operations.
- Indirect (Scope 2) GHG emissions are not expected to change as a result of MOD 1.
- Indirect (Scope 3) GHG emissions estimated to increase by 2,437,970 t CO_2-e per annum, an increase of approximately 22% on current approved operations. The increased emissions are due to the indirect emissions associated with combustion of the additional 1 Mtpa product coal by end users.
- Comparison of MOD 1 emissions with State and National GHG emission totals indicates that the MOD 1 is likely to represent approximately 0.0032% of NSW GHG emissions (Scope 1) when compared to the latest available emissions data (2013) (Scope 1) and 0.0008% of Australian National GHG emissions (Scope 1) for 2013.

10 REFERENCES

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Table A-1 Emission Estimation - Operation

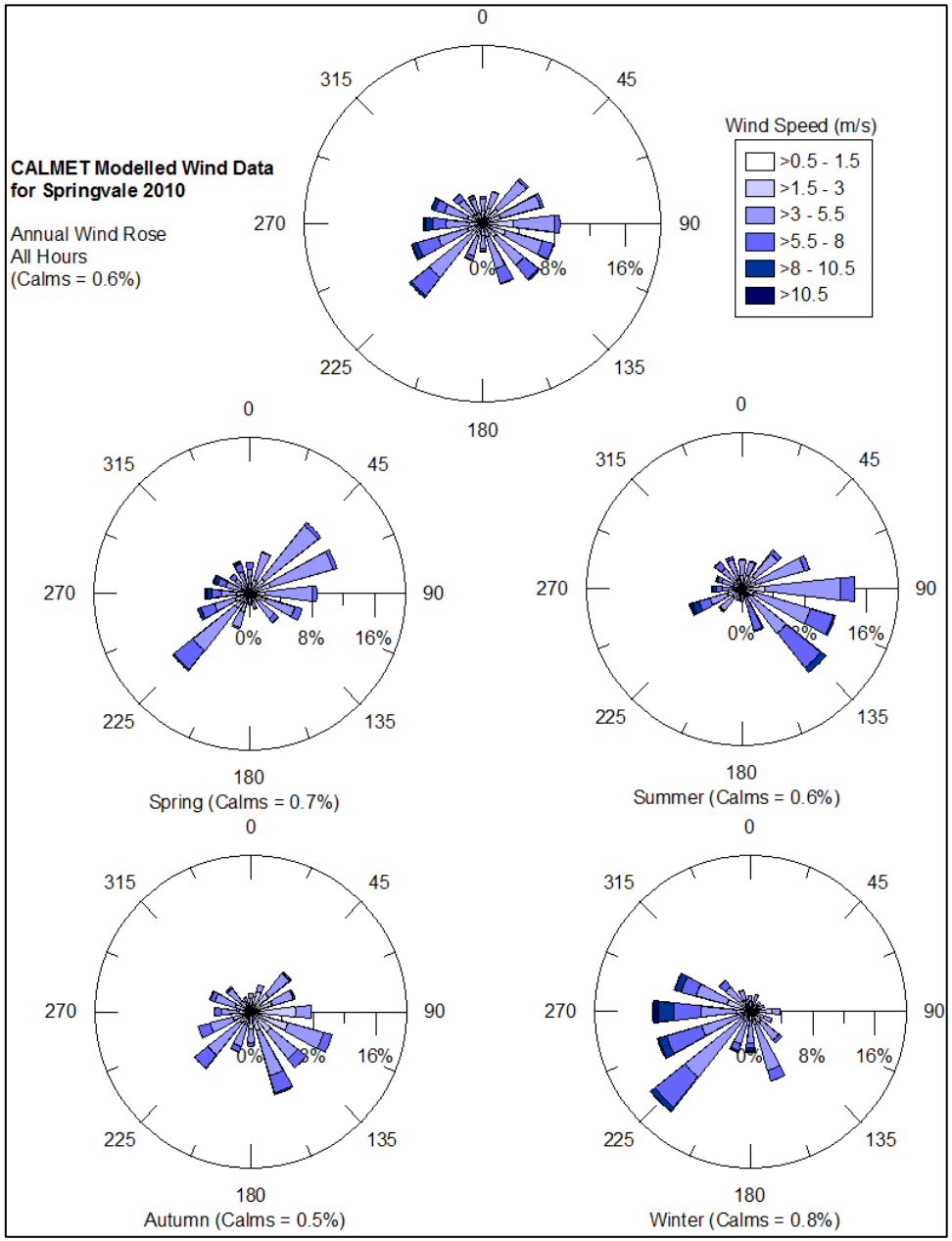
Activity	Intensity		Emission Factor				Variables		Ref
	Value	Units	TSP	PM_{10}	$PM_{2.5}$	Units	Parameter	Value	
Conveyor transfer points	22,000,000	tpa	0.0003	0.0001	0.00002	kg/t	Wind speed factor [1]	2.23	AP42
							Moisture content	10%	
							Control efficiency	40%	
Crushing	5,500,000	tpa	0.0100	0.0040	0.00040	kg/t	Control efficiency	70%	AP42
Dozers	8,760	hr/yr	15.3	3.7	0.34	kg/h	Silt content	6%	AP42
							Moisture content	10%	
Vehicle movement on unpaved roads	15,768	VKT/yr	1.856	0.431	0.04	kg/VKT	Silt content	3%	AP42
							Average gross mean vehicle weight	50 tonnes	
							Control efficiency	50%	
Wind erosion - Exposed areas	2.6	ha	0.40	0.20	0.03	kg/ha/hr	Hours per year	8,760 hours	NPI
							Control efficiency	50%	
Ventilation fan (Vertical)	241.1	m^3/s	0.60	0.04	0.03	mg/m^3			

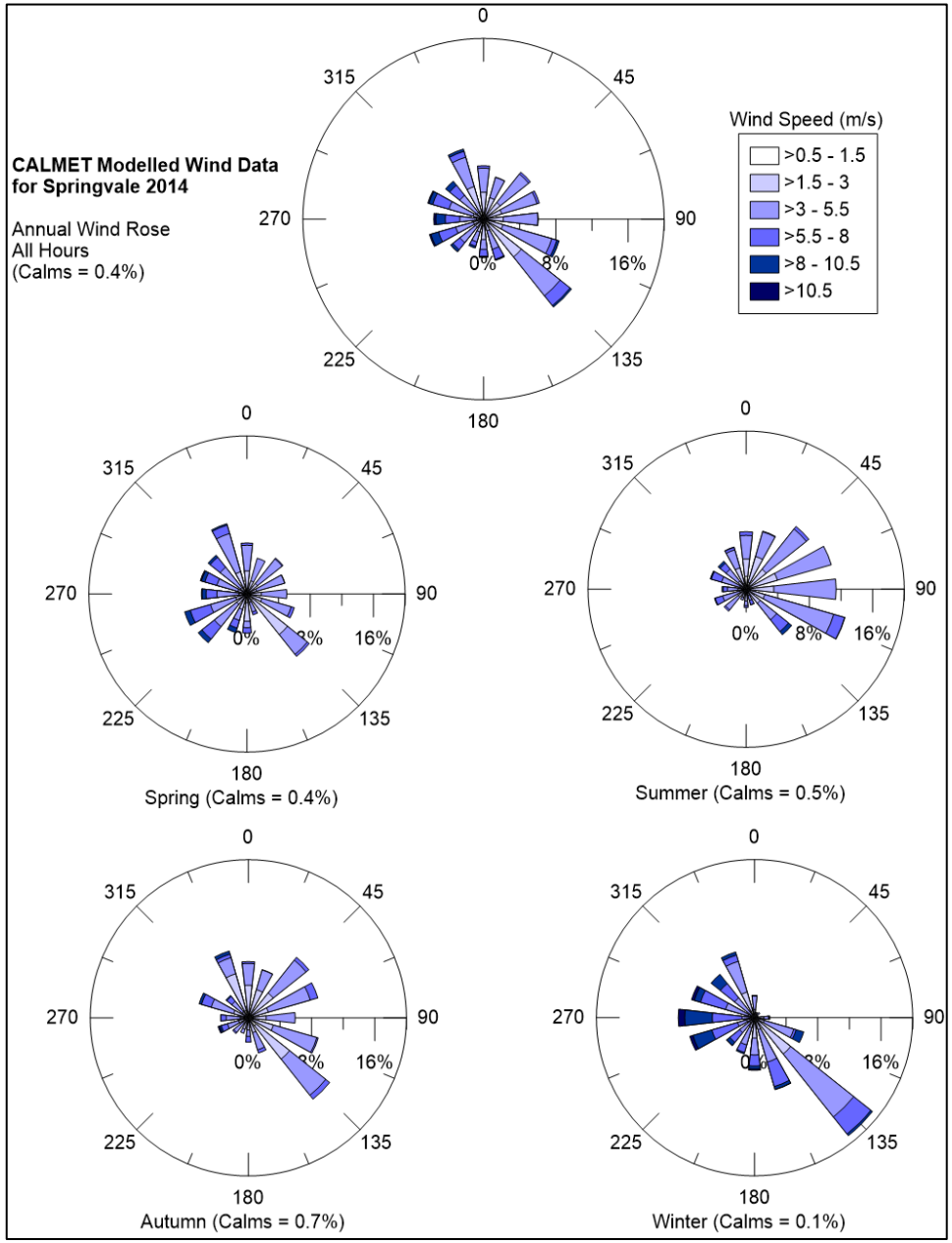
Note: Wind Speed Factor = average of $(\text{wind speed}/2.2)^{1.3}$

Windroses compiled from data extracted at the Springvale site from the 2010 and 2014 meteorological data sets are shown overleaf.

These windroses show a shift in the predominant wind directions predicted at the site for the two years modelled. In 2010 the winds were fairly well distributed across the compass but predominantly blew from the southwest and from the northeast to southeast. In 2014 the winds were gain well distributed but with a distinct predominance of southeasterly winds, especially during autumn and winter. The distribution of wind speeds and frequency of calm conditions was similar for the two years.

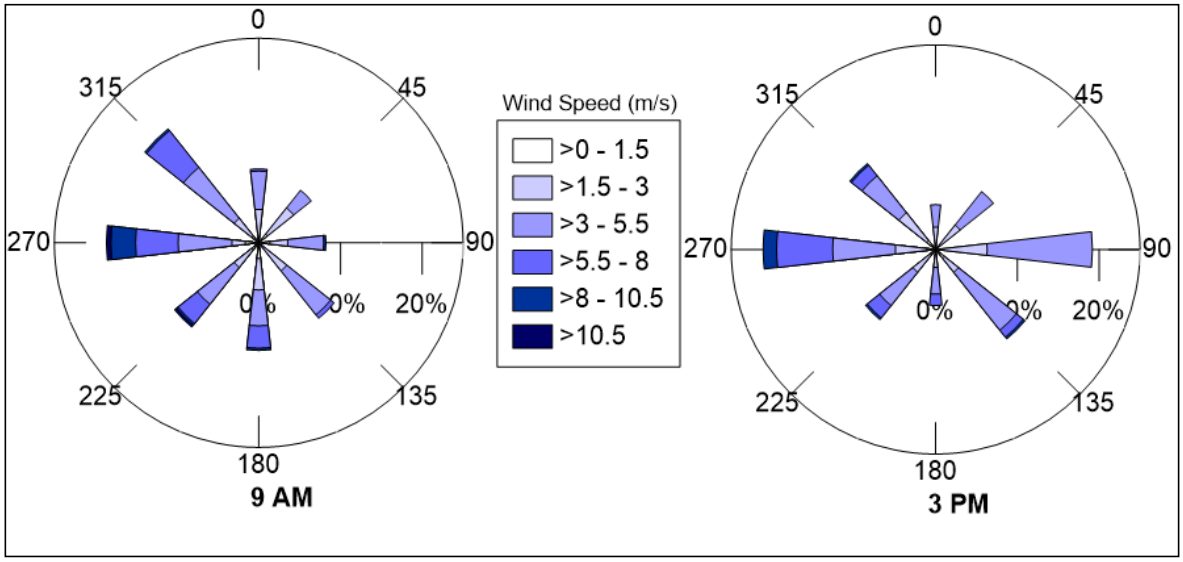
Inter-annual variations on wind patterns can be expected, however it is noted that the 2014 meteorological data shows a lower frequency of winds from the northwest quadrant, which appears to better reflect the topography surrounding the site and the sheltering effect of the elevated terrain to the north and west of the site. This may be reflective of the improved methodology (WRF) used to compile the 2014 dataset.


CALMET Modelled Wind Data for Springvale 2010
Annual Wind Rose
All Hours
(Calms = 0.6%)
Wind Speed (m/s)
>0.5 - 1.5
>1.5 - 3
>3 - 5.5
>5.5 - 8
>8 - 10.5
>10.5
0
45
90
135
180
225
270
315
0%
8%
16%
Spring (Calms = 0.7%)
Summer (Calms = 0.6%)
Autumn (Calms = 0.5%)
Winter (Calms = 0.8%)

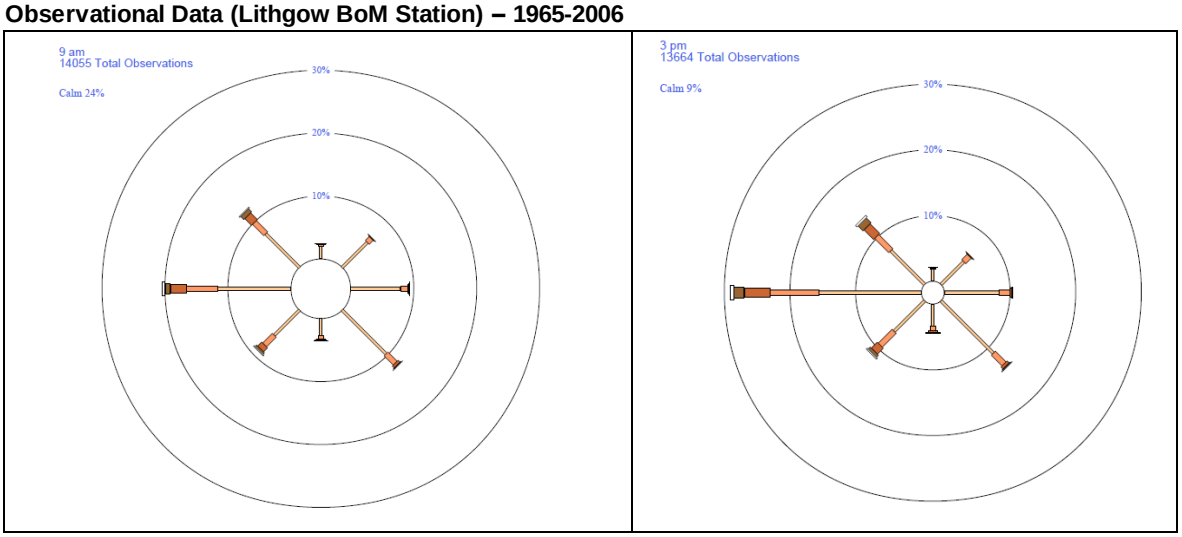

CALMET Modelled Wind Data for Springvale 2014
Annual Wind Rose
All Hours
(Calms = 0.4%)
Wind Speed (m/s)
>0.5 - 1.5
>1.5 - 3
>3 - 5.5
>5.5 - 8
>8 - 10.5
>10.5
0
45
90
135
180
225
270
315
0%
8%
16%
Spring (Calms = 0.4%)
Summer (Calms = 0.5%)
Autumn (Calms = 0.7%)
Winter (Calms = 0.1%)

A comparison of predicted 9 AM and 3 PM wind data for 2014 calendar year (extracted at Lithgow Bureau of Meteorology site) and long term (1965-2006) average 9 AM and 3 PM wind data recorded at Bureau of Meteorology site (63224) located at Lithgow (Birdwood St) is shown in the figure below. The comparison showed reasonably good agreement between the predicted and observed datasets.

Model Prediction - 2014



Observational Data (Lithgow BoM Station) – 1965-2006

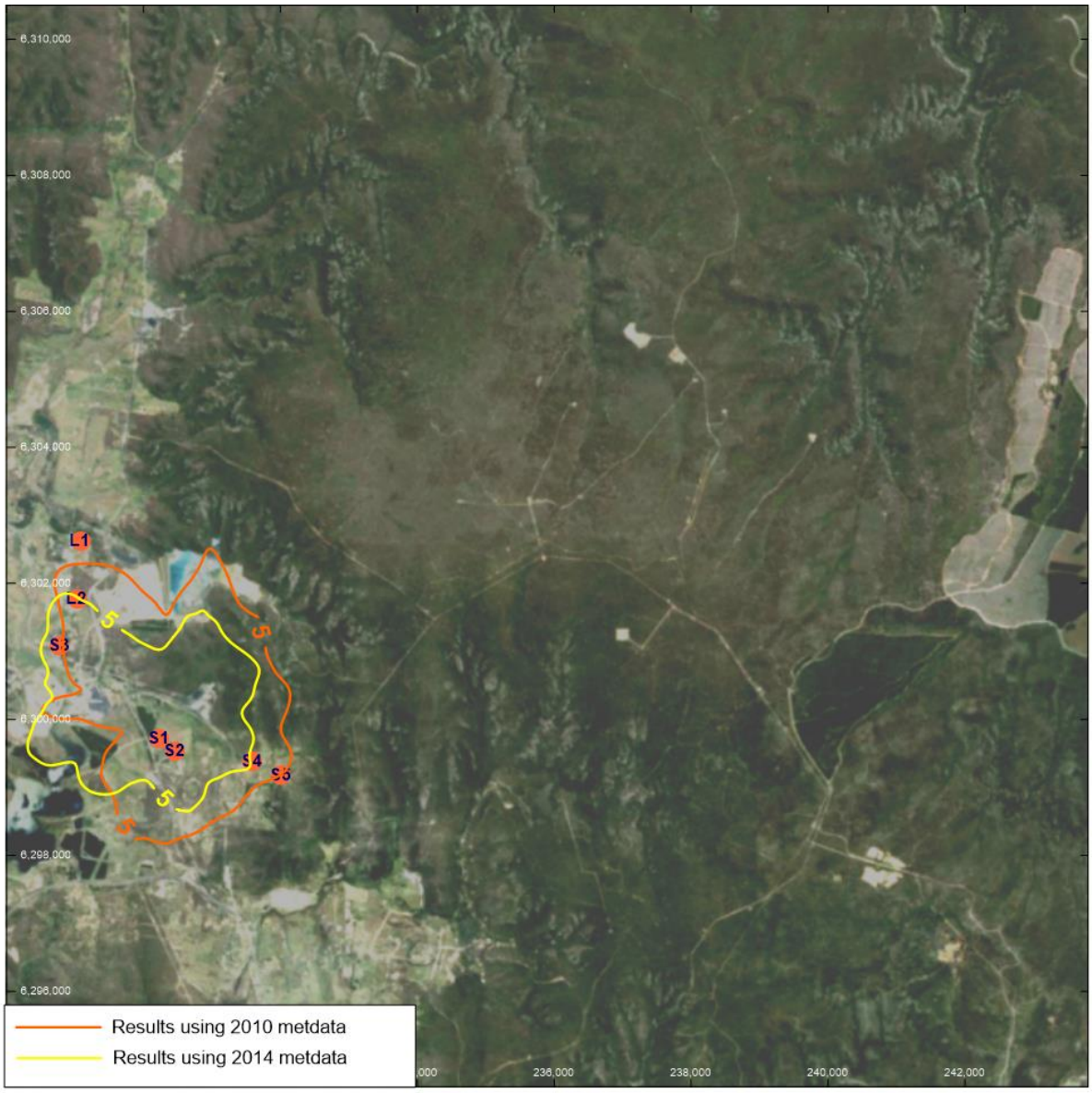


The maximum 24-hour PM_{10} concentrations predicted at the nearest sensitive receptors for the SMEP Operational Scenario using the two meteorological datasets are shown in the table below. The predictions that have increased when using the 2014 met data compared to the 2010 met data are shaded red in the table, the predictions that have decreased are shaded blue.

Receptor	Easting (m)	Northing (m)	24 Hour Average PM_{10} Concentration (µg/m³)			
			2010 Met Dataset		**2014 Met Dataset**	
			Increment	**Cumulative**	**Increment**	**Cumulative**
S1	230,230	6,299,725	14.4	43.3	24.6	45.1
S2	230,456	6,299,541	18.7	43.4	20.4	39.7
S3	228,775	6,301,089	4.0	43.3	6.3	39.4
S4	231,589	6,299,387	9.1	43.8	8.4	39.4
S5	232,009	6,299,182	4.9	43.6	5.3	39.4
W1	227,484	6,301,148	2.9	43.3	2.6	39.4
W2	227,420	6,300,654	2.9	43.3	2.5	39.4
L1	229,078	6,302,626	4.2	43.7	3.0	39.8
L2	229,028	6,301,777	7.5	43.6	11.0	39.6

The results show that the 2010 met data set generally results in only slight increases or decreases in the maximum cumulative 24-hour average PM_{10} concentrations predicted at the sensitive receptors. The most affected receptor is S1 which is predicted to increase the incremental 24-hour average PM_{10} concentration quite significantly. However because the background PM_{10} concentrations in 2014 were significantly lower than in 2010 which was affected by dust storms and bushfires, the cumulative PM_{10} concentration only increases by 1.8 µg/m^3. The cumulative impacts predicted at all other sensitive receptors are lower using the 2014 data compared to 2010.

The contour plot presented overleaf shows the changes in the distributions of the PM_{10} concentrations. This plot shows that the affected areas are similar. There is a slightly greater spread of PM_{10} to the west and east, but a slightly reduced spread to the south.



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Project Number:	630.11526
Dispersion Model:	CALPUFF
Modelling Period:	
Projection:	GDA 1994 MGA Zone 56
Date:	15/01/2016

Client Name

Springvale Mine
Air Quality Impact Assessment

Comparison of Results - 2010 and 2014 metdata

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³