EMGA

ABBEY GREEN PROJECT ALTERATIONS

Statement of Environmental Effects

Prepared for Coal & Allied (Rio Tinto Coal Australia) - January 2010

COAL & ALLIED

Managed by Rio Tinto Coal Australia

Mount Thorley Operations, Abbey Green Project Alterations – Section 96 (2) Modification of Development Consent

STATEMENT OF ENVIRONMENTAL EFFECTS

for

Coal & Allied Industries Limited

by

Environmental Management Group Australia

ACN 136 396 524

JANUARY 2010

Approval Signatures

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EXECUTIVE SUMMARY

Mount Thorley Operations (MTO) is seeking approval to modify the Development Consent DA 34/95, under Section 96 (2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

MTO is an existing open cut coal mine, located approximately 18 kilometres south west of Singleton, in the Hunter Valley region of New South Wales (NSW). The mine is located within Coal Lease 219. MTO is operated by Coal & Allied, as part of the broader integrated Mount Thorley Warkworth (MTW) mining operations. Rio Tinto Coal Australia provides management services to Coal & Allied.

The proposed modification relates to the Abbey Green North (AGN) and Abbey Green South (AGS) Pits of MTO. It will enable:

- extension of the approved AGN Pit by approximately 75 hectares (ha) to the west;
- realignment of a coal haul road to accommodate the extended AGN Pit and the continued trucking of coal to the existing Mount Thorley coal preparation plant;
- relocation of minor items of infrastructure and services from within the AGN Pit extension area, to suitable locations outside the footprint of the extended pit, but within the confines of the approved mine site; and
- temporary storage of mine water in the AGN Pit void and the adjacent AGS Pit void.

The proposed AGN Pit extension will enable the extraction of approximately 5 million tonnes of additional run of mine coal from the Mount Arthur, Warkworth and Bowfield seams, which are already approved for extraction.

As previously approved, the final AGN Pit void will be used for the transfer of mine and decanted water between the operating areas of MTW, and then used for the placement of tailings from MTW Operations. No changes to the currently approved Development Consent boundary or mining lease areas, mining extraction rates, mining methods, mining equipment, employment, processing, mine services, product transport, operating hours or environmental management systems are proposed. The only change to AGS Pit will be the ability to temporarily store water in the pit void.

The proposed AGN Pit extension area has been highly disturbed by past land uses, including mining and agriculture. It is characterised by rehabilitated overburden dumps, mining infrastructure and disturbed grasslands which have previously been cleared of most native overstorey vegetation and used for grazing. All proposed changes are within the footprint of currently consented disturbance areas.

An air quality impact assessment undertaken by PAEHolmes found that the potential impacts of the proposed modification will be minimal, and similar to those previously assessed and approved as part of the Environmental Resources Management Australia (2002) *Statement of Environmental Effects* (the '2002 SEE') for MTO, which originally proposed the AGN and AGS Pits. Air pollutant levels are predicted to be well within Department of Environment, Climate Change and Water air quality criteria at all sensitive receivers.

An acoustic assessment undertaken by Environmental Management Group Australia Pty Limited found that there will be zero to marginal change to potential noise impacts, as a result of the proposed modification, from those previously assessed and approved as part of the 2002 SEE.

A review of water impacts undertaken by JP Environmental found that potential surface water impacts of the proposed modification will be similar to those assessed and approved as part of the 2002 SEE. Uncontrolled leakage of stored mine water from the AGN or AGS Pits is unlikely. A small, temporary loss of runoff to the Hunter River will occur, associated with the extended AGN pit area. However, this will be more than offset by a planned reduction in draw from the Hunter River for MTW Operations, resulting from the increased availability of recycled water for use in mining activities. Approximately 144ha of the Loders Creek catchment will be temporarily diverted into the Doctors Creek catchment. This will restore part of the original pre-mining catchment for Doctors Creek. The original catchments will be fully restored once rehabilitation of AGN Pit is complete.

Water balance modelling of the proposed modified mining operation found that existing and proposed site water management systems will be able to successfully manage mine water. Temporary water storage in the AGN and AGS Pit voids will provide MTO, and the broader MTW Operations, with an improved flexibility and ability to manage its water balance, and reduce the risk to continuation of the approved mining operations at other MTW mining areas posed by in-pit water.

Potential groundwater impacts from the proposed modification will be similar to those assessed and approved as part of the 2002 SEE. No impacts to alluvial aquifers or groundwater users are predicted to occur. There is minimal potential for impact on groundwater quality. Some stored water in the AGN and AGS Pits could potentially

leak through fractures, however, this will not adversely impact water quality of the deep aquifers surrounding the pits, as the salinity of stored water will be lower than that of the receiving groundwater. Temporary water storage in the AGN and AGS Pits will increase the hydraulic head at aquifers immediately surrounding the pits, which will influence groundwater flow lines, however, these flow lines will continue to be to the west, as currently occurs. There will be a marginal increase in groundwater inflows to the AGN Pit due to the larger pit area, however, these inflows will be negligible and can be incorporated into the existing mine water management system.

No cultural heritage sites exist within the proposed AGN Pit extension area and none will be impacted by the proposed modification.

Site vegetation is restricted to scattered trees and a mixture of native and introduced grassland species, including a number of weeds which are treated under a weed control program. The remnant vegetation that will be impacted by the proposed AGN Pit extension is within the approved disturbance footprint defined in the 2002 SEE, and is approved for clearing under DA 34/95. The proposed AGN Pit extension area is considered to have low to very low conservation value and is unlikely to provide any valuable fauna habitat, particularly for threatened species. No threatened or migratory species, threatened populations or endangered ecological communities occur or have the potential to occur within the modification area. No ecological impacts additional to those previously assessed and approved are anticipated to occur as a result of the proposed modification.

Coal & Allied's existing approved environmental management and monitoring plans and procedures are considered adequate for the proposed operations at AGN and AGS Pits. These will be updated as required to reflect changes to operations resulting from the proposed modification.

The proposed modification will improve the productivity of the mining operation, improve the site water management system in the short term, and provide MTO with a larger capacity tailings facility for the long term management of tailings.

Approval for consent modification is sought under Section 96 (2) of the EP&A Act.

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ACRONYMS

Abbreviation	Description
2002 SEE	ERM (2002) Mount Thorley Operations and Warkworth Mining Limited Section 96 (2) Modification of Development Consent Statement of Environmental Effects.
AGN	Abbey Green North
AGS	Abbey Green South
AMBS	Australian Museum Business Services
Coal & Allied	Coal & Allied Industries Limited
CL	Coal Lease
DA	Development Application
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
DECCW	NSW Department of Environment, Climate Change and Water
DoP	NSW Department of Planning
EIS	Environmental Impact Statement
EMGA	Environmental Management Group Australia Pty Limited
EMS	Environmental Management System
ENM	Environmental Noise Model
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPL	Environmental Protection Licence
ERM	Environmental Resources Management Australia
$g/m^2/m$	grams per square metre per month
ha	hectare
HRSTS	Hunter River Salinity Trading Scheme
INP	Industrial Noise Policy
ISCMOD	modified version of the US EPA ISCST3 model
km	kilometre
m/s	metres per second
MIC	maximum instantaneous charge
ML	Megalitre
MTCPP	Mount Thorley Coal Preparation Plant
MTO	Mount Thorley Operations
MTW	Mount Thorley Warkworth
NERDDC	National Energy Research, Development and Demonstration Council
OPSIM	Coal & Allied's site water balance model
PM_{10}	particulate matter of 10 microns in diameter or smaller
ROM	run of mine
SEE	Statement of Environmental Effects

Abbreviation	Description
SPCC	State Pollution Control Commission
TSP	total suspended particulates
µg/m³	micrograms per cubic metre
µS/cm	microsiemens per centimetre
US EPA	United States Environmental Protection Agency

1 INTRODUCTION

1.1 Background

Mount Thorley Operations (MTO) is an existing open cut coal mine, located approximately 18 kilometres (km) south west of Singleton, in the Hunter Valley region of New South Wales (NSW). A locality plan is provided as Figure 1.1. The mine is located within Coal Lease (CL) 219. MTO is operated by Coal & Allied Industries Limited (Coal & Allied), as part of the broader integrated Mount Thorley Warkworth (MTW) mining operations. Rio Tinto Coal Australia provides management services to Coal & Allied.

Coal & Allied is proposing to modify the MTO Development Consent (DA 34/95) to allow for the extension of the approved Abbey Green North (AGN) Pit by approximately 75 hectares (ha) to the west. Mining will extend into the already approved Mount Arthur, Warkworth and Bowfield seams and extract approximately 5 million tonnes of run of mine (ROM) coal over the life of the project. Extension of the AGN Pit will require the realignment of a section of haul road and the relocation of some minor items of infrastructure and services. The AGN Pit void and the adjacent Abbey Green South (AGS) Pit void will be temporarily used to store mine water. Temporary water storage in the pit void is the only change proposed to AGS. As approved in 2002, the final AGN Pit void will be used for the transfer of mine and decanted water between MTO and the adjacent Warkworth Mine, and the placement of tailings from MTW.

The proposed development, as detailed in this Statement of Environmental Effects (SEE), will be substantially the same as the approved development in terms of the nature of the works proposed and the potential environmental impacts.

Environmental Management Group Australia Pty Limited (EMGA) has been engaged by Coal & Allied to prepare the SEE for the proposed modification. This document constitutes the requisite SEE.

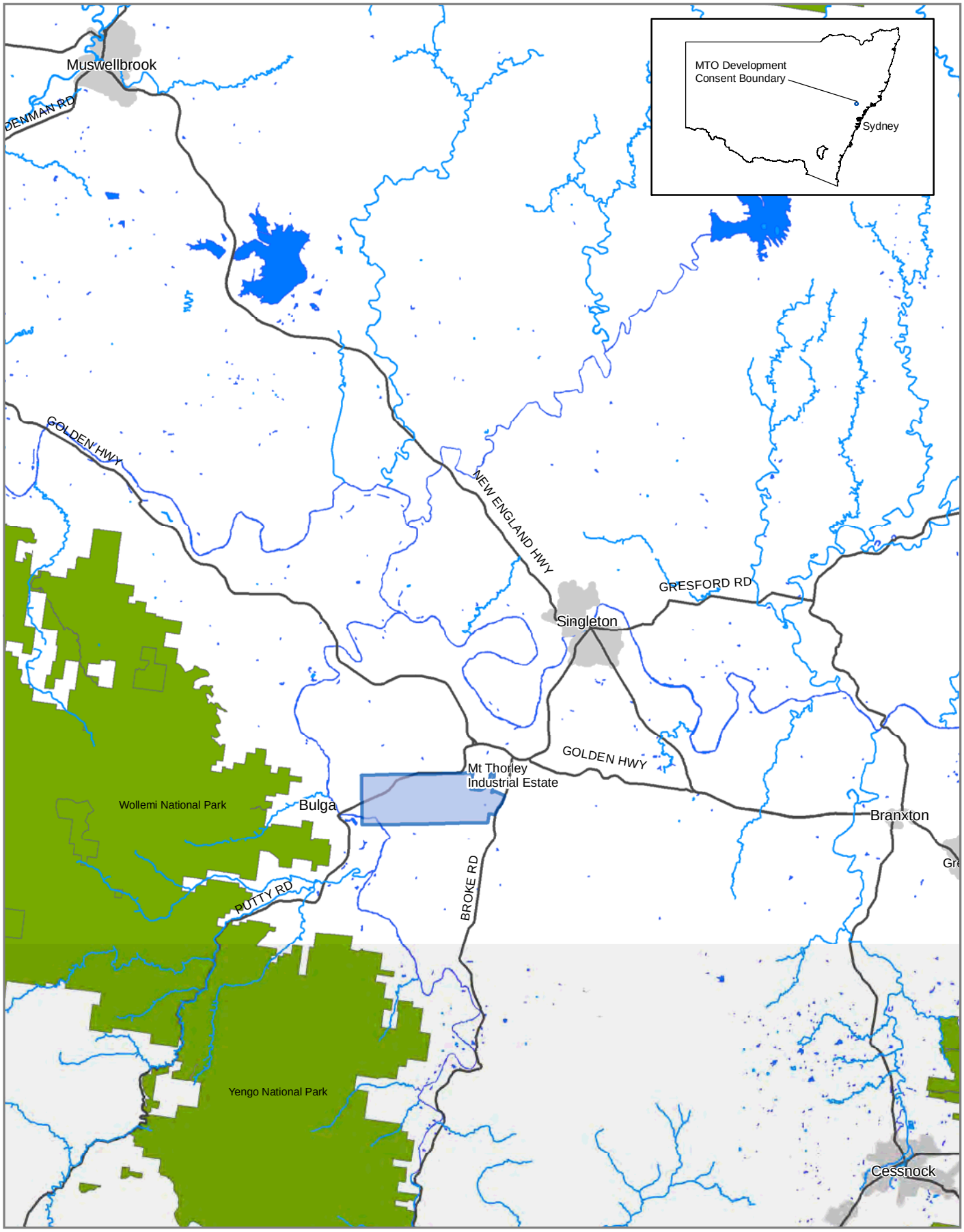
1.1.1 History of MTO

Operations at MTO commenced in 1981. Since this time, MTO has been producing coal for export and domestic markets by open cut mining.

After a business restructuring of mining company R.W. Miller, Coal & Allied became the owner of MTO, and the managers of the mine, in 1989. While maintaining separate ownership, MTO and the adjacent Warkworth Mine are operated by the Coal & Allied

group (with management services provided by Rio Tinto Coal Australia) as a single integrated mine. The integrated operations are known as MTW.

MTW operates under two separate Development Consents, namely, DA 34/95 for MTO, and DA 300-9-2002-i for Warkworth Mine. An aerial photograph of MTW, showing the Development Consent boundaries, is presented as Figure 1.2. The proposed modification applies to land covered by the MTO Development Consent.



September 8, 2009

C:\GIS\EMGA\Hunter valley\Fig 1.1

Metres
0 1,900 3,800 7,600 11,400

Waterway
Road
MTO Development Consent Boundary
Built up area
NPWS Estate

Figure 1.1
Regional Setting of MTO

Abbey Green Project Alterations SEE

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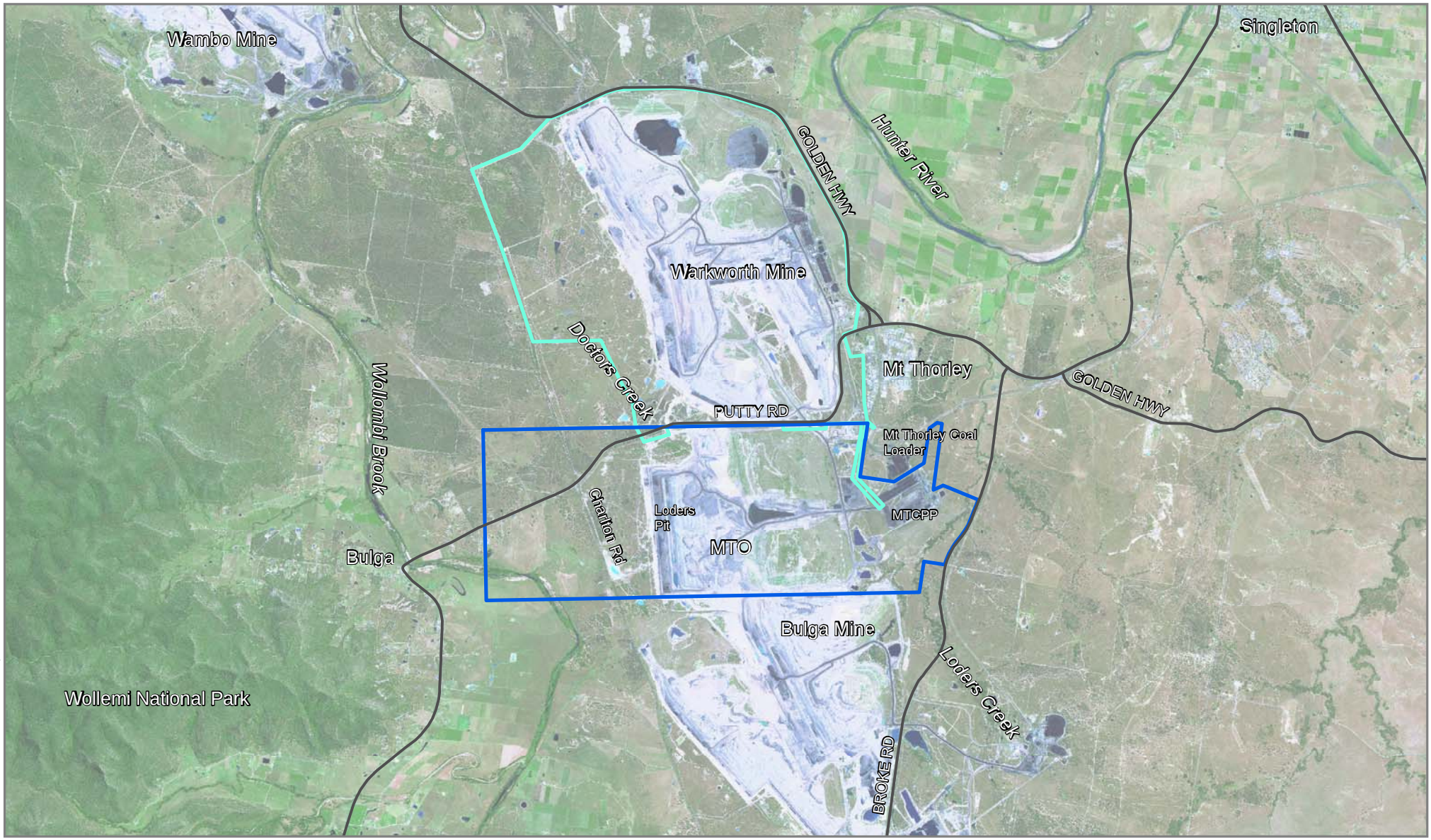

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Kilometres
0 0.5 1 2 3

MTO Development Consent Boundary
Warkworth Mine Development Consent Boundary

Figure 1.2

Aerial Photograph of MTO and the Surrounding Area

Abbey Green Project Alterations SEE

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1.1.2 History of Approvals

Development Consent for mining at MTO was first granted by the Minister for Planning and Environment on 5 March 1981. This consent allowed the production of 1.1 million tonnes per annum of ROM coal, by open cut mining. On 12 January 1983, another Development Consent was granted by the Minister, allowing for an increase in ROM coal production from 1.1 to 1.7 million tonnes per annum.

The 1983 Development Consent was subsequently modified twice:

- a modification approved by the Minister on 17 January 1984 to increase the tonnage of ROM coal produced from 1.7 to 2.5 million tonnes per annum; and
- a modification approved by Singleton Shire Council on 24 April 1993 to extend the mining area by approximately 50ha.

On 22 June 1996, Development Consent was granted by the Minister for Urban Affairs and Planning under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to extend the mine to the west, to Charlton Road (DA 34/95). This consent allowed for the mining of up to eight million tonnes per annum of ROM coal. DA 34/95 has been modified on four occasions, as detailed below.

In 2001, approval was granted to modify DA 34/95 to allow haulage of ROM coal between MTO and Warkworth Mine.

In 2002, the Minister for Planning granted approval to modify DA 34/95 enabling:

- establishment of two new boxcut pits (AGN and AGS Pits), to ultimately be used for the storage of reject;
- placement of overburden east of and adjacent to the AGN and AGS boxcuts;
- an increase in the throughput at the Mount Thorley coal preparation plant (MTCPP) from eight million tonnes per annum of ROM coal to ten million tonnes per annum of ROM coal over the life of MTO;
- disposal of reject from Warkworth Mine at MTO and the transfer of mine and decanted water between Warkworth Mine and MTO; and
- an increase in the capacity of Dam 9S from 288 to 500 Megalitres (ML).

In 2004, the Minister for Infrastructure, Planning and Natural Resources approved a further modification to the DA 34/95 to allow for:

- erection of a new reject bin and corresponding rejects conveyor adjacent to the MTCPP, for direct loading of rejects to the MTW truck fleet;
- installation of ROM truck dump dust hoods (ROM sheds) over the existing ROM bins located at the western end of the MTCPP; and
- mining of the existing haul road between the approved AGN and AGS boxcut pits, resulting in one pit rather than two separate pits.

In May 2009, DA 34/95 was further modified to allow for an extension to Dam 9S, increasing its storage capacity from 500ML to 2,000ML, so that it consolidates and replaces three existing approved dams with a single mine water dam.

A copy of the current Development Consent, DA 34/95, as modified, is included as Appendix A.

1.2 Purpose of the SEE

The purpose of this SEE is to assess the potential impacts resulting from the proposed modification and support a Section 96(2) application to the Department of Planning (DoP), under the EP&A Act, to modify the MTO Development Consent DA 34/95.

2 PROPOSED MODIFICATION

2.1 Modification Area

As described in Section 1.1, the proposed modification applies to land at MTO, which is located within CL219. MTO is within the local government area of Singleton, in the Hunter Valley region of NSW.

The proposed modification, including the AGN Pit extension, is shown in Figures 2.1 and 2.2. The area has been disturbed by previous mining and agricultural activities and is currently characterised by rehabilitated overburden dumps, mining infrastructure and disturbed grasslands which have been cleared of most native overstorey vegetation and previously used for grazing.

The region surrounding MTO is dominated by coal mining, industrial development and agriculture. Warkworth Mine and the Mount Thorley Industrial Estate are to the north, Bulga Mine is to the south, the Mount Thorley Coal Loader and rail siding are to the east, and Bulga village and Wollemi National Park are to the west of the proposed modification area (see Figure 1.2).

2.2 The Proposal

Coal & Allied proposes to extend the approved AGN Pit by approximately 75ha to the west, enabling the mining of a now economically viable coal resource that previously was not proposed to be mined. The extension is largely located within previously mined land and is proposed to access the Mount Arthur, Warkworth and Bowfield seams. These seams are already approved to be mined (DA 34/95 Mod I, approved 12 September 2002). Over the life of the project, approximately 37 million bank cubic metres of overburden will be removed from the fully extended pit area, to enable the extraction of approximately 5 million tonnes of ROM coal. Figures 2.1 and 2.2 show the proposed pit extension area and locations of associated mine infrastructure, respectively.

As previously approved, extracted coal will be hauled to the MTCPP, to the south east, for processing and rail load out. To allow for the extended pit footprint and enable continued coal haulage, the haul road will be realigned. The location of the proposed realignment is shown on Figure 2.2.

Overburden from the extended pit will be transported along the haul roads shown on Figure 2.2. It will be transferred to, or used in the construction of:

- the realigned haul road;
- the AGN rim embankment areas;
- the east and west embankments of the existing MTO Operations Dam; and
- possibly, the MTO north dump.

The proposed AGN Pit extension will involve the relocation of some minor items of infrastructure and services from the extension area, to suitable locations outside the footprint of the extended pit, but within the confines of the approved mine site. These comprise:

- water and tailing pipes and pumps;
- truck water fill points;
- lighting plants;
- light vehicle wash bay;
- underground services;
- tyre storage area; and
- trade waste infrastructure.

It should also be noted that there will be some minor modifications to MTO's water management structures to accommodate proposed mining operations. This will include decommissioning of two existing dams, Dams 2S and 3S, within the area where the haul road will be realigned. These dams have already been approved for decommissioning as part of the 2002 modification to DA 34/95. To replace the function of these dams, an existing water control dam, Dam 1S, will be enlarged, and two small sediment dams, Dams 16S and 17S, will be constructed (see Figure 2.2). Modifications to the water management structures will not change the way in which MTO's water supply and pollution control system operates.

When inactive, the AGN and AGS Pit voids will be temporarily used for storage of mine water. Once mining of the AGN Pit is complete, and in accordance with the already approved arrangement, the final AGN Pit void will be used for the transfer of mine and

decanted water between MTO and Warkworth Mine. When required, it will then be dewatered and used for the placement of tailings from MTW Operations, as is currently approved. Rehabilitation will be undertaken in accordance with the Mining Operations Plan.

The main features of the approved operations at MTO will not be affected by the proposed modification. There will be no change to the approved Development Consent boundary or mining lease areas, mining extraction rates, mining methods, mining equipment, employment, processing or mine services, product transport, operating hours or environmental management systems. The proposed modification will improve the productivity of the mining operation. The proposed use of the pit voids for temporary water storage and then for tailings emplacement will improve MTO's flexibility and ability to manage its water balance in the short term and its ability to manage tailings in the long term.

As described in Chapter 3, the potential environmental impacts predicted for the proposed modification essentially remain unchanged compared to those for the currently approved activities.

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Metres
0 50 100 200 300

Approved AGN Pit (indicative)
Proposed AGN Extension
MTO Development Consent Boundary

Figure 2.1

Proposed AGN Extension Area – Limit of Disturbance

Abbey Green Project Alterations SEE

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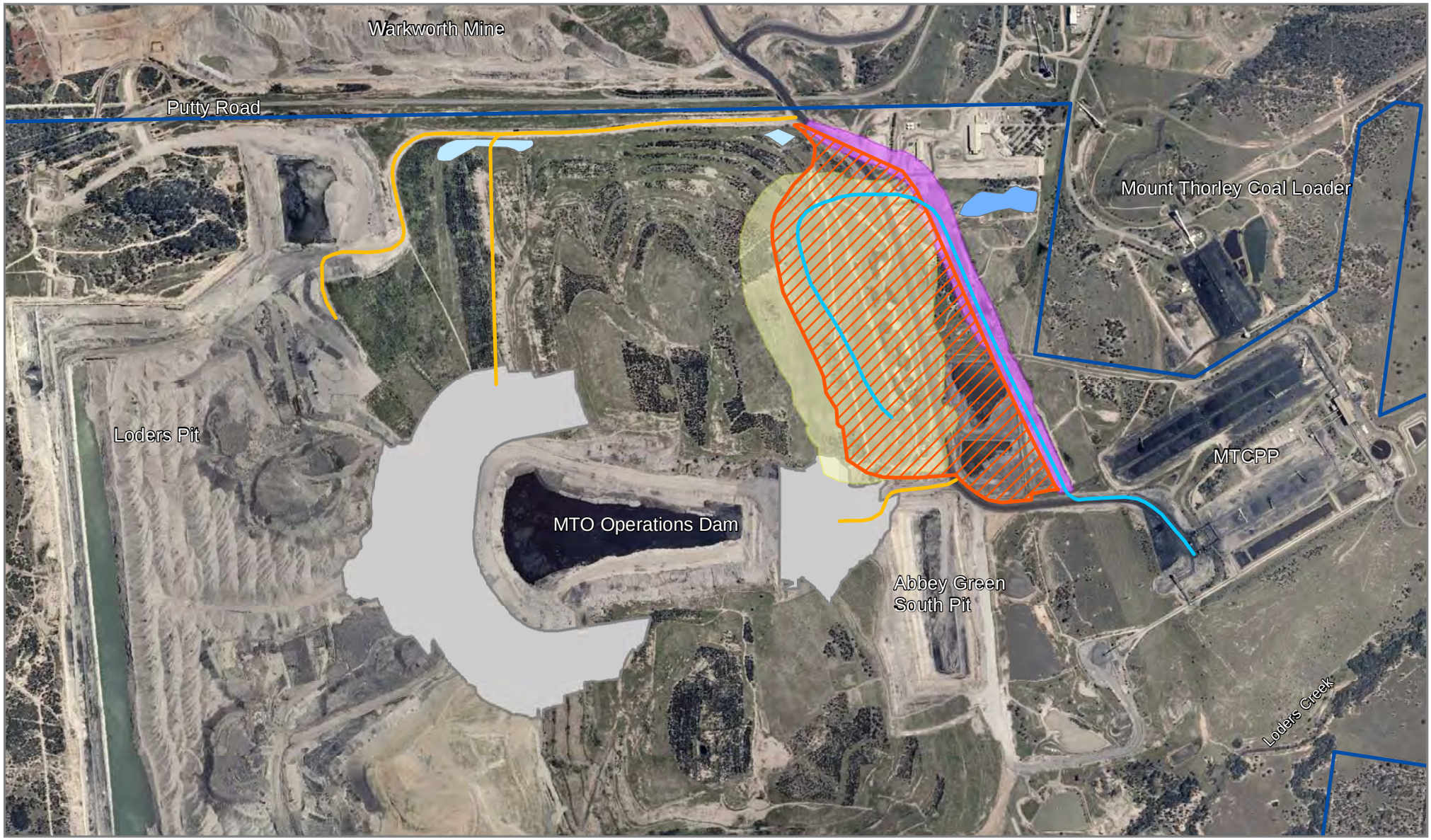

C:\GIS\EMGA\Abbey Green North SEE Fig 2-2 November 11, 2009

Kilometres
0 0.1 0.2 0.4 0.6

- Indicative coal truck haul route
- Indicative overburden truck haul route
- Enlarged process water dam
- Proposed sediment control dam
- Indicative overburden emplacement
- Proposed rim embankment and location of new section of haul road
- Proposed AGN tailings storage facility - preliminary design
- Proposed AGN pit disturbance area
- MTO Development Consent Boundary

Figure 2.2

Indicative Locations of Associated Infrastructure

Abbey Green Project Alterations SEE

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2.3 Section 96 (2) Justification

Section 96 of EP&A Act provides for the modification of existing consents made under the Act. Section 96 (2) states, in part:

> *A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:*
>
> *(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and .....*

It is contended that the proposal which is the subject of this SEE (see Chapter 2 for proposal details) is substantially the same development as the development for which consent was originally granted, namely DA 34/95. The reasons for this contention are as follows.

- The AGN Pit extension will be located within the currently approved Development Consent boundary, on land previously disturbed, mined and/or rehabilitated.
- As demonstrated in Chapter 3, there will be minimal change to MTO's approved potential air quality, noise, vibration, water quality, heritage or ecology impacts as a result of the proposed modification.
- There will be no changes to the currently approved Development Consent boundary and mining lease areas, mining extraction rates, mining methods, mining equipment, employment, processing, mine services, product transport, operating hours or environmental management systems.

Accordingly, it is proposed to use the Section 96 (2) approval process. The Minister for Planning is the consent authority in respect of the proposed modification to DA 34/95. This SEE will accompany the application to the Minister seeking the proposed modification.

2.4 Conditions required to be Modified

It is proposed to modify Condition 1 of the MTO Development Consent (DA 34/95), to include reference to this SEE.

Condition 1 of DA 34/95 is as follows:

"Condition 1 is a general condition stating that development is to be carried out generally in accordance with the:

a) EIS dated 10 August 1995 prepared by ERM Mitchell McCotter Pty Limited;

b) SEE dated June 2001 prepared by Environmental Management Resources Australia Pty Ltd;

c) SEE dated January 2002 prepared by Environmental Management Resources Australia Pty Ltd;

d) Additional Noise Assessment contained in CNA letter dated 7 February and 5 April 2002;

e) Aboriginal Cultural Heritage Report dated February 2002 prepared by Victor Perry;

f) SEE dated July 2004, prepared by Environmental Management Resources Australia Pty Ltd;

g) CNA letter to the Department dated 30 August 2004; and

h) Statement of Environmental Effects titled Mount Thorley Operations Pty Limited Extension to Mine Water Dam 9S, dated February 2009, prepared by Coal & Allied.

Reference to this SEE is required to be inserted into Condition 1 as i):

i) Mount Thorley Warkworth, Abbey Green Project Alterations SEE dated January 2009, prepared by Environmental Management Group Australia Pty Limited.

3 ENVIRONMENTAL ASSESSMENT AND MANAGEMENT

3.1 Introduction

A preliminary risk assessment workshop identified air quality, noise and vibration, surface water, groundwater, heritage and ecology as the key environmental aspects for the proposed modification. The following sections provide assessment of the potential impacts of the proposed modification in respect of these environmental aspects. Mitigation measures and management actions, including the application of existing Coal & Allied environmental management plans and procedures, are provided where appropriate to negate and/or minimise potential impacts.

The previous Environmental Impact Statement (EIS) and SEEs for MTO, referenced in Section 2.4, describe in detail the existing environment of MTO and surrounding areas.

3.2 Air Quality

Particulate matter emissions from open cut mining activities have the potential to cause health and nuisance effects if not actively managed. PAEHolmes (formerly Holmes Air Sciences) were engaged by Coal & Allied to assess the potential air quality impacts of the proposed modification. The assessment report constitutes Appendix B and a summary is provided herein.

3.2.1 Existing Environment

Scattered rural residences are located to the west and north east of AGN which could potentially be subject to particulate matter emissions from the proposed AGN operations. Existing air quality at these locations is influenced by emissions from surrounding local mines. MTO air monitoring results from April 1995 to December 2008 are summarised in the PAEHolmes (2009) report (see Appendix B) and provide an indication of existing air quality surrounding AGN. The results indicate that:

- annual average total suspended particulate (TSP) concentrations have been in the range 21 – 62 micrograms per cubic metre (µg/m³);
- annual average concentrations of particulate matter of 10 microns in diameter or smaller (PM_{10}) have been in the range 9 – 41 µg/m³; and

- residential areas could accept a further 2 g/m²/month dust deposition without a significant deterioration in air quality.

3.2.2 Impact Assessment

a) Methodology

The air quality impact assessment was undertaken by PAEHolmes in accordance with the Department of Environment, Climate Change and Water (formerly Department of Environment and Climate Change) (2005) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.

Particulate matter emissions from the extended AGN operation were calculated using methodologies developed by the SPCC (1983), US EPA (1985) and NERDDC (1988). Emission rates were calculated for two scenarios, representative of the two worst case operating conditions for AGN, in terms of particulate matter emissions. Scenario 1 is for year three of operations, when the highest rate of overburden transfer is expected to occur. Scenario 2 is for year four of operations, when the highest rate of coal transfer is predicted to occur. The estimated TSP emissions are provided in the PAEHolmes (2009) report in Appendix B. They do not differ significantly from those calculated by Holmes Air Sciences (2002) for the original AGN proposal.

Air dispersion modelling of AGN emissions was undertaken using a modified version of the US EPA ISCST3 model (ISCMOD). The model was used to predict ground level concentrations of particulate matter (TSP and PM_{10}) and dust deposition rates likely to be experienced at sensitive receivers due to emissions from AGN. Modelling took into account prevailing meteorological conditions (which can affect dust generation and dispersion), local terrain, and dust controls which form part of the AGN project design (e.g. water suppression).

Modelling of cumulative emissions was also undertaken to predict the total particulate matter concentrations and dust deposition rates likely to be experienced at sensitive receivers. Estimates of emissions from surrounding mining operations (i.e. Warkworth Mine, Bulga Mine and other operations within MTO), sourced from the EISs for these mines, and background air pollutant levels from other sources, were used in this cumulative assessment, as well as the predicted emissions from AGN.

b) Predicted Impacts from AGN Emissions Only

The modelling results for AGN emissions only are presented in Table 3.1 for the nearest sensitive receivers. This table provides a comparison of the results against the

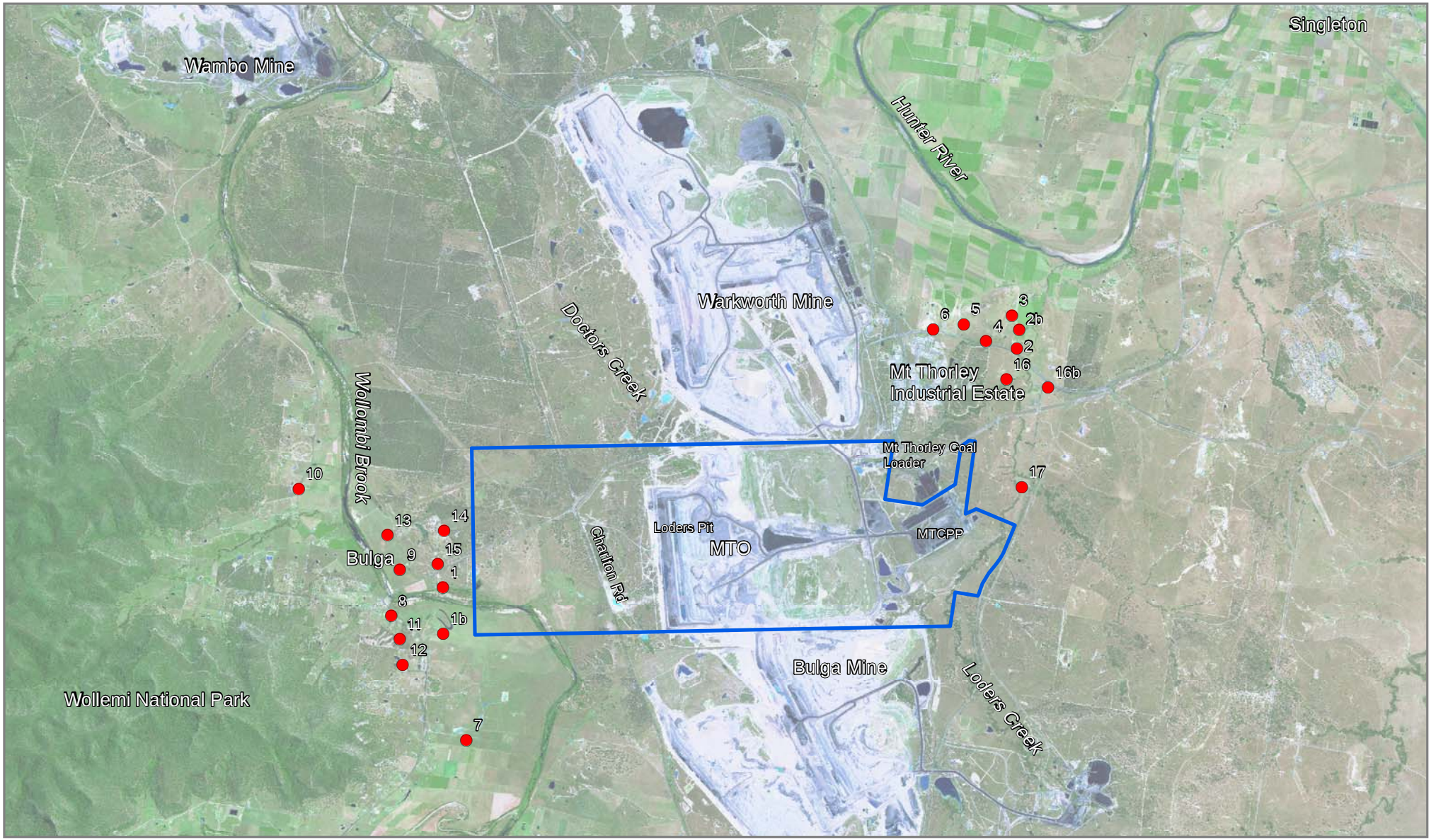
Department of Environment, Climate Change and Water (DECCW) air quality criteria and the assessment results from the ERM (2002) SEE. The results are presented in the form of dispersion contours in the PAEHolmes (2009) report (see Appendix B). The locations of the receivers assessed are shown on Figure 3.1.

Table 3.1 shows that the air modelling results from the current assessment are similar to, albeit marginally lower than, those predicted in the Holmes Air Sciences (2002) assessment for the original AGN proposal. Residences to the north east (Assessment Locations 3, 4, 5, 6, 16, 16b and 17) will be the most affected by emissions from AGN. However, the predicted TSP and PM_{10} concentrations and dust deposition rates are well below the DECCW air quality criteria at all assessment locations, when considering emissions from AGN in isolation.

Table 3.1 - Predicted annual average and maximum ground level pollutant concentrations solely due to emissions from AGN

Assessment Location		Scenario 1				Scenario 2			
		Annual Average				Annual Average			
ID	Description	Dust g/m²/m	TSP µg/m³	PM_{10} µg/m³	Max. 24 hr PM_{10} µg/m³	Dust g/m²/m	TSP µg/m³	PM_{10} µg/m³	Max. 24 hr PM_{10} µg/m³
NSW DECCW Criteria		**2**	**90[1]**	**30[1]**	**50**	**2**	**90[1]**	**30[1]**	**50**
Maximum predictions from 2002 Assessment		**0.2**	**4**	**3**	**NA**	**0.2**	**4**	**3**	**NA**
1	Mine owned	0.016	0.28	0.26	4.0	0.015	0.25	0.22	3.4
1b	Mine owned	0.011	0.24	0.22	2.8	0.010	0.21	0.19	2.5
2	Private residence	0.034	0.91	0.82	9.5	0.031	0.79	0.7	8.2
2b	Private residence	0.032	0.86	0.78	9.6	0.029	0.75	0.67	8.3
3	Private residence	0.034	1.00	0.93	11.5	0.031	0.87	0.8	9.8
4	Private residence	0.042	1.09	0.98	11.6	0.039	0.95	0.85	10.0
5	Private residence	0.072	1.57	1.41	11.8	0.066	1.38	1.23	9.7
6	Private residence	**0.095**	**1.84**	**1.63**	10.8	**0.087**	**1.62**	**1.42**	9.7
7	Mine owned	0.005	0.22	0.21	4.7	0.004	0.19	0.18	4.1
8	Bulga Community Centre	0.011	0.22	0.20	3.0	0.010	0.19	0.17	2.6
9	Private residence	0.017	0.27	0.25	4.0	0.016	0.24	0.21	3.4
10	Private residence	0.017	0.23	0.21	3.6	0.016	0.2	0.18	3.1
11	The State of NSW	0.010	0.22	0.2	2.7	0.009	0.19	0.18	2.4
12	The State of NSW	0.008	0.21	0.19	2.5	0.007	0.18	0.17	2.1
13	Private residence	0.021	0.29	0.26	3.9	0.019	0.25	0.23	3.3
14	Mine owned	0.027	0.35	0.31	4.5	0.025	0.3	0.27	3.9
15	Private residence	0.020	0.31	0.27	4.4	0.018	0.26	0.24	3.7
16	Private residence	0.042	1.18	1.07	11.5	0.038	1.02	0.92	9.1
16b	Private residence	0.029	0.84	0.75	12.2	0.026	0.72	0.64	9.8
17	Private residence	0.075	1.62	1.39	**12.5**	0.068	1.4	1.18	**10.7**

1. Background levels need to be considered when applying DECCW criteria.
2. The highest predicted levels of each pollutant are shown in bold.



C:\GIS\EMGA\Abbey Green North SEE F3-1 September 8, 2009

0 0.5 1 2 3 Kilometres

Assessment Location

MTO Development Consent Boundary

Figure 3.1

Air and Noise Assessment Locations

Abbey Green Project Alterations SEE

COAL & ALLIED

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EMGA

c) *Predicted Cumulative Impacts*

The predicted particulate matter concentrations and deposition rates at sensitive receivers, due to cumulative emissions from AGN, surrounding mining operations (Warkworth Mine, Bulga Mine and other operations within MTO), and background levels from other sources, are provided in Table 3.2.

Table 3.2 - Predicted cumulative annual average ground level pollutant concentrations

Assessment Location		Scenario 1			Scenario 2		
ID	**Description**	**TSP µg/m³**	**PM_{10} µg/m³**	**Dust g/m²/m**	**TSP µg/m³**	**PM_{10} µg/m³**	**Dust g/m²/m**
	NSW DECCW Criteria:	**90**	**30**	**4**	**90**	**30**	**4**
	Maximum predictions from 2002 Assessment:	**37-38**	**28-29**	**<2**	**37-38**	**28-29**	**<2**
1	Mine owned	37.9	12.1	2.48	37.9	12.1	2.48
1b	Mine owned	36.7	11.0	2.33	36.6	11.0	2.33
2	Private residence	40.7	15.0	2.33	40.6	14.9	2.33
2b	Private residence	40.2	14.5	2.30	40.0	14.4	2.30
3	Private residence	40.7	15.0	2.31	40.6	14.9	2.31
4	Private residence	41.8	16.0	2.38	41.7	15.9	2.38
5	Private residence	45.2	19.0	2.55	45.0	18.9	2.54
6	Private residence	**47.1**	**20.7**	**2.69**	**46.9**	**20.5**	**2.68**
7	Mine owned	35.0	9.6	2.19	34.9	9.5	2.19
8	Bulga Community Centre	35.5	10.0	2.29	35.4	9.9	2.29
9	Private residence	37.3	11.6	2.45	37.3	11.6	2.45
10	Private residence	35.4	9.9	2.33	35.4	9.9	2.33
11	The State of NSW	35.8	10.3	2.28	35.8	10.3	2.28
12	The State of NSW	35.5	10.0	2.24	35.4	10.0	2.24
13	Private residence	37.7	11.9	2.52	37.7	11.9	2.51
14	Mine owned	39.9	13.8	2.71	39.9	13.7	2.70
15	Private residence	38.6	12.7	2.55	38.5	12.6	2.55
16	Private residence	42.0	16.2	2.42	41.8	16.0	2.42
16b	Private residence	39.7	14.1	2.30	39.5	13.9	2.30
17	Private residence	42.2	16.2	2.54	42.0	16.0	2.53

1. The highest predicted levels of each pollutant are shown in bold.
2. Background levels included in the current assessment are TSP of 30µg/m³, PM_{10} of 5µg/m³ and dust deposition rate of 2g/m²/month.

The data in Table 3.2 shows that at the worst affected receivers, TSP concentrations and dust deposition rates are predicted to higher than predicted in the Holmes Air Sciences (2002) assessment, and PM_{10} concentrations are predicted to be lower.

Given that the contribution from the modified AGN operation is predicted to be smaller than previously calculated (see Table 3.1), it can be concluded that any increases from the 2002 predictions are due to operations at surrounding mines. The predicted cumulative TSP and PM_{10} concentrations and dust deposition rates are well below the DECCW air quality criteria at all sensitive receivers assessed. In addition, the predicted levels of air pollutants are comparable to existing levels in the area, as determined from air monitoring conducted by Coal & Allied (see Section 3.2.1).

Air emissions from operations at AGN are predicted to be minor in comparison with emissions from surrounding mining operations.

3.2.3 Management and Monitoring

Detailed air quality management and monitoring plans and procedures currently govern the management of air quality across MTO. These will continue to be implemented during operations at the AGN Pit extension area. Table 3.3 provides examples of dust control procedures.

Table 3.3 - AGN dust control procedures

Source	Control Procedures
Wind Blown Dust	
Areas disturbed by mining	Only the minimum area necessary for mining will be disturbed. Completed overburden emplacement areas will be reshaped, topsoiled and rehabilitated as soon as practicable after the completion of overburden tipping.
Coal handling areas	Coal handling areas will be maintained in a moist condition, using water carts, to minimise wind blown and traffic generated dust.
Coal product stockpiles	Water sprays will be maintained on product stockpiles and used to reduce the risk of airborne dust.
Mining Generated Dust	
Road dust	All roads and trafficked areas will be watered using water carts to minimise the generation of dust.
	All haul roads will have edges clearly defined with marker posts or equivalent to control their locations, especially when crossing large overburden emplacement areas.
	Obsolete roads will be ripped and revegetated.
Minor roads	Development of minor roads will be limited and the locations of these will be clearly defined.
	Minor roads used regularly for access etc will be watered.
	Obsolete roads will be ripped and revegetated.

Source	Control Procedures
Topsoil stripping	Access tracks used by topsoil stripping scrapers during their loading and unloading cycle will be watered.
Topsoil stockpiling	Long term stockpiles, not used for over six months, will be revegetated.
Drilling	Dust aprons will be lowered during drilling.
	Drills will be equipped with dust extraction cyclones, or water injection systems.
	Water injection or dust suppression sprays will be used when high levels of dust are being generated.
Blasting	Adequate stemming will be used at all times. Blasting will be undertaken when wind speeds are below 5m/s and not in the direction of residents.
Raw coal bins	Automatic sprays, or other dust control mechanisms, will be used when tipping raw coal that generates excessive dust quantities.
Coal preparation plant	All spillage of material will be cleaned up to prevent dust. Water sprays are/will be fitted at all transfer points.

The existing approved air monitoring network, which forms part of the Coal & Allied Environmental Management System (EMS), is considered adequate to monitor the performance of the proposed modification.

3.2.4 Conclusions

The PAEHolmes (2009) air quality impact assessment results for the proposed modification indicate that particulate matter concentrations at sensitive receivers due to emissions from AGN will be lower than those predicted in the Holmes Air Sciences (2002) assessment for the original AGN proposal. The predicted particulate matter concentrations and dust deposition levels at all sensitive receivers are well within the DECCW air quality criteria, which are designed to protect against health and nuisance effects of dust. Therefore, the proposed modification is predicted to be of minimal air quality impact. Furthermore, the potential air quality impacts of operations at AGN are expected to be minor in comparison with those of surrounding mining operations. Coal & Allied's existing approved air quality management and monitoring plans and procedures are considered adequate for the proposed modification.

3.3 Noise and Vibration

Noise generated by open cut mining can affect the amenity of surrounding residents, particularly during sleeping hours, if not actively managed. Coal & Allied engaged EMGA to prepare an acoustic assessment for the proposed modification. The assessment report constitutes Appendix C and a summary is provided following.

3.3.1 Existing Environment

Scattered rural residences to the west and north east could experience noise from AGN. The existing noise environment at these locations is characterised by natural sounds and industrial noise from the Mount Thorley Industrial Estate, transportation and mines.

Noise monitoring conducted throughout 2008 found that existing operations at MTO are generally inaudible at surrounding residences. At the closest assessment location to AGN, noise levels from MTO were measured to range from 34 decibels (dB(A)) to 48dB(A).

3.3.2 Impact Assessment

a) Methodology

To assess potential noise impacts of the proposed AGN Pit extension, noise modelling was undertaken using the *Environmental Noise Model* (ENM) noise prediction software. The major noise generating plant, equipment and activities for the entire MTO, inclusive of AGN, were included in the model, incorporating the modified mine plan. Conservative modelling assumptions were used and are provided in the report in Appendix C, along with the equipment inventory adopted. Noise levels were predicted for 20 assessment locations, representative of the closest sensitive receivers (see Figure 3.1).

In accordance with the requirements of DECCW's *Industrial Noise Policy* (INP), noise modelling was conducted for calm weather conditions (i.e. no wind or temperature gradient) and a range of other weather conditions which could enhance noise propagation i.e. 'INP weather conditions'. The INP weather conditions assessed were source-to-receiver winds with speeds of 3m/s or below which are a feature of the local area i.e. occur for at least 30 per cent of the time in any assessment period (day, evening or night) in any season.

b) *Operational Noise – Calm Weather*

The noise modelling results for calm weather are presented in Table 3.4. This table provides a comparison of the results against the permissible limits for MTO noise (DA 34/95, Consent Conditions 9 and 16) and the previously assessed results from the ERM (2002) SEE and the ERM (2004) SEE.

Table 3.4 - Predicted calm weather noise levels, dB(A)

Assessment Location		Current Study	2002 Study	2004 Study (incl. Reject Bin)	Consent Limits[1]	Consent Acquisition Limits[1]
ID	Description					
1	Mine owned	28	27	27	NA	NA
1b	Mine owned	26	-	-	NA	NA
2	Private residence	27	27	29	37	40
2b	Private residence	26	-	-	37	40
3	Private residence	28	25	27	39	40
4	Private residence	28	24	26	39	40
5	Private residence	30	29	26	41	42
6	Private residence	35	32	34	43	44
7	Mine owned	26	26	27	NA	NA
8	Bulga Community Centre	26	26	27	65[2]	NA
9	Private residence	25	24	24	39	40
10	Private residence	20	21	22	35	40
11	The State of NSW	27	27	28	65[2]	NA
12	The State of NSW	27	27	28	65[2]	NA
13	Private residence	24	24	24	NA	40
14	Mine owned	25	25	25	NA	NA
15	Private residence	26	25	25	39	40
16	Private residence	30	-	32	40	40
16b	Private residence	28	-	-	NA	40
17	Private residence	25	-	27	NA	40

1. The consent limits apply under prevailing weather conditions of wind speeds up to 3m/s at 10m above ground and temperature inversions of up to 3 degrees per 100m elevation.

2. This is the DECCW's INP amenity criteria for commercial receivers.

The data in Table 3.4 show that under calm weather conditions, predicted noise levels from MTO (inclusive of the proposed modification) comply with the current consent limits at all assessment locations. At the majority of assessment locations, noise levels differ by 2dB or less from those predicted previously. Given that a change in noise of 2dB is generally imperceptible to the human ear, the change is considered to be negligible. Four private residences to the north east (assessment locations 3 to 6) are predicted to experience a marginal increase in noise levels (up to 4dB) from those

previously predicted, though noise levels at these locations will still be well below consent limits.

c) *Operational Noise - Prevailing Weather Conditions*

The predicted noise levels from MTO (inclusive of the proposed modification) under INP weather conditions are provided in Table 3.5. The results are also presented in the form of noise contours in the EMGA (2009) report (see Appendix C).

In general terms, noise levels at assessment locations to the east and north east of MTO will be affected by AGN plant (mostly trucks and other mobile plant on haul roads), and assessment locations to the west of MTO will be influenced by plant operating at Loders Pit (not plant operating within the AGN Pit).

Table 3.5 - Predicted adverse weather noise levels, dB(A)

Assessment Location		Current Study	2002 Study	2004 Study (inc. Reject Bin)	Consent Limits[1]	Consent Acquisition Limits[1]
ID	Description					
1	Mine owned	39	36	36	NA	NA
1b	Mine owned	39	-	-	NA	NA
2	Private residence	44	42	44	37	40
2b	Private residence	43	-	-	37	40
3	Private residence	44	41	43	39	40
4	Private residence	43	42	44	39	40
5	Private residence	46	44	39	41	42
6	Private residence	47	45	46	43	44
7	Mine owned	36	NA	NA	NA	NA
8	Bulga Community Centre	37	35	35	65[2]	NA
9	Private residence	38	37	37	39	40
10	Private residence	33	32	33	35	40
11	The State of NSW	38	36	36	65[2]	NA
12	The State of NSW	38	36	36	65[2]	NA
13	Private residence	37	36	36	NA	40
14	Mine owned	38	37	37	NA	NA
15	Private residence	39	37	38	39	40
16	Private residence	46	45	47	40	40
16b	Private residence	46	-	-	NA	40
17	Private residence	43	45	43	NA	40

1. The consent limits apply under prevailing weather conditions of wind speeds up to 3m/s at 10m above ground and temperature inversions of up to 3 degrees per 100m elevation.

2. This is the DECCW's INP amenity criteria for commercial receivers.

The data in Table 3.5 show that noise levels at sensitive receivers resulting from the proposed modified operation differ only marginally from those previously predicted to occur. Differences are generally imperceptible at ±2dB, though marginally higher increases of 3dB are predicted at locations 1 and 3. The other atypical increase is that between the current study and the 2004 results for assessment location 5. This may be due to the slight shift in the assessment location adopted for the current study, combined with the position of sources being more in line with assessed wind directions. The consent limits are predicted to be exceeded at the same locations identified in previous studies.

It should be noted that the predicted noise levels are conservative due to factors including the conservative assumptions used, such as the unlikely assumption that all plant and equipment will operate simultaneously, and the fact that the ENM typically over predicts noise under adverse weather conditions.

d) Blasting Noise and Vibration

The blasting design for the proposed AGN Pit extension will be similar to that previously approved for AGN. Therefore, no significant change in noise and vibration levels from blasting is anticipated at the assessment locations.

MTO's existing blast management procedures will be used to control the blast design at AGN and ensure compliance with the MTO consent limits for airblast overpressure and ground vibration (DA 34/95, Consent Condition 11). This includes the use of appropriate charge masses, monitoring of all blasts, and blasting during meteorological conditions that will minimise the potential for impacts on neighbours. Recommended maximum instantaneous charge (MIC) masses are presented in the EMGA (2009) report in Appendix C.

e) Other Noise Emissions

Construction activities for the proposed modification will be confined to daytime periods and associated noise levels at assessment locations will be less than those predicted to result from mining activities.

3.3.3 Management and Monitoring

Coal & Allied has detailed plans and procedures in place for blasting and noise management, monitoring and assessment, which currently govern noise and vibration management across MTO. They will be updated as required to reflect changes to MTO resulting from the proposed modification. These plans and procedures will be

implemented during operations at the AGN Pit extension area to ensure that acceptable noise limits are maintained and to assess the performance of the mining operations against the Development Consent noise limits. They include requirements for:

- training in noise control procedures;
- purchase, maintenance, testing and operation of plant and equipment;
- timing of activities and equipment operations;
- management of community complaints.
- blasting overpressure and vibration limits;
- blast design, including MIC;
- blasting restrictions due to weather conditions; and
- noise and blast monitoring.

3.3.4 Conclusions

The EMGA (2009) acoustic assessment of the proposed modified operation has shown that there will be zero to marginal change to potential noise impacts at sensitive receivers from those previously approved under the 2002 and 2004 modifications to DA 34/95. Locations where consented noise limits were previously predicted to be exceeded under INP weather conditions are still predicted to experience exceedences under these weather conditions. Noise levels are predicted to be well below the consented limits at all assessed locations under calm weather conditions. Coal & Allied's existing approved noise and blasting management and monitoring plans and procedures are considered suitable for the proposed modification.

3.4 Surface Water

Mining operations have the potential to impact water resources if not proactively managed. Coal & Allied engaged JP Environmental to prepare a review of water impacts for the proposed modification, addressing both surface water and groundwater. A copy of the assessment report constitutes Appendix D and aspects relating to surface water are discussed in this section. Groundwater is addressed in Section 3.5.

3.4.1 Existing Environment

a) Surrounding Waterways

MTO lies across the Salt Pan Creek, Doctors Creek and Loders Creek catchments. These creeks are all ephemeral tributaries of the Hunter River. Wollombi Brook flows through the south western portion of CL219 (see Figure 1.2). Wollombi Brook is also a tributary of the Hunter River.

b) Site Water Management

MTO water requirements are met by:

- water harvested from the site, e.g. surface runoff and seepage from coal seams, spoil and tailings emplacements;
- water pumped from the Hunter River under the Mount Thorley Joint Venture Water Supply Scheme; and
- Singleton's potable water supply (for potable requirements only).

The water management system for MTO is described in the JP Environmental (2009) report in Appendix D. The system includes a series of interconnected dams that are used for storage and water quality control. The key elements are set out below.

- Diversion of runoff from undisturbed areas, away from mining areas, and into local watercourses.
- Diversion of runoff from newly rehabilitated areas and areas being cleared, to on site sedimentation dams for treatment. Overflows from these dams discharge to local watercourses. The water can also be used to supplement the mine's water supply.
- Collection of contaminated runoff from the mine's operational areas in water quality control dams, where entrained sediments are settled out. These dams are the main water storage facilities for MTO. Contained water is re-used on

site or released to the Hunter River under the Hunter River Salinity Trading Scheme (HRSTS) and the site Environmental Protection Licence (EPL).

- Collection of pit runoff within in-pit sumps, with pump out to Dam 9S (the central water quality control dam) as required.

Mine water is stored in inactive mining voids, if required, to meet operational requirements when out of pit storages are full. This water is relocated to alternative voids or dams as required.

A number of changes to the site water management system have been approved under the 2002 and 2009 modifications to DA 34/95. This includes the recent approval to increase the capacity of Dam 9S from 500ML to 2,000ML.

3.4.2 Impact Assessment

The proposed use of the AGN Pit void for water storage when transferring mine and decanted water between MTO and Warkworth Mine (currently approved), and the use of the AGN and AGS Pit voids for temporary mine water storage, will be beneficial for the mine water management system. It will provide an improved flexibility and ability to manage the water balance and, by providing additional storage for dewaterings from active pits, will reduce the risk posed by pit water to the continuation of the approved mining operations at other MTW mining areas. In addition, these aspects of the proposed modification will increase the availability of recycled water for use in mining activities, and potentially reduce draw from the Hunter River and the requirement for discharge of saline mine water to the Hunter River.

Stored water levels in the AGN and AGS Pit voids will be maintained below the level of the natural, undisturbed ground surface at all times. Accordingly, uncontrolled leakage of the stored high salinity mine water (predicted electrical conductivity of 6,000 to 8,000µS/cm), to the surrounding environment, is unlikely to occur.

The proposed pit extension will result in the temporary loss of 75ha of the Hunter River catchment, which equates to an average loss of 120ML per annum of runoff to the Hunter River. This temporary loss will be compensated by a reduction in draw from the Hunter River, due to the planned increased capacity of Dam 9S, temporary mine water storage in the AGN and AGS Pit voids, and increased use of recycled water from the operational synergies between MTO and Warkworth Mine. The catchment temporarily subsumed by the AGN Pit extension will be restored after mining is completed and the AGN tailings facility is decommissioned and rehabilitated.

The larger AGN Pit area will generate more in-pit water which requires management (calculated to be no more than 50ML per annum on average). Groundwater inflow to the AGN Pit is expected to be very low. The marginal increase in pit inflow volumes will have minimal impact on operation of the mine water management system. It will easily be accommodated in the additional storage proposed in the AGS Pit and within the enlarged Dam 9S (recently approved to be enlarged to provide an additional 1,500ML of storage capacity).

As outlined in Section 2.2, there will be some minor modifications to MTO's water management structures to accommodate proposed mining operations. This will include decommissioning of two existing dams, Dams 2S and 3S, within the area where the haul road will be realigned. These dams have already been approved for decommissioning as part of the 2002 modification to DA 34/95. To replace the function of these dams, an existing water control dam, Dam 1S, will be enlarged, and two small sediment dams, Dams 16S and 17S, will be constructed at the outlet of the northern emplacement rehabilitation (see Figure 2.2 and Figure 2 in Appendix D). Modifications to the water management structures will not change the way in which MTO's water supply and pollution control system operates.

Coal & Allied's computer based site water balance model (OPSIM model) was used to assess potential impacts of the proposed modification on the site water management system. The modelling results for a mine plan, inclusive of the proposed modification, showed that both the existing and proposed future mine water management systems could successfully handle water generated over the life of the mining operations. However, during prolonged wet weather, seam workability within the pit could be impaired by rising in-pit water levels, unless excess water is discharged off site (as occurs currently).

Once mining of the AGN Pit is complete and the void has been dewatered, it will be used for the placement of tailings from MTO and the adjacent Warkworth Mine, as is currently approved. To avoid placing undue pressure on the MTO water management system during tailings emplacement in these voids, decanted tailings water will be directed back to Warkworth Mine if Dam 9S is approaching full service levels and MTO does not require the water for operations.

Proposed landform changes from extension of the AGN Pit will lead to the temporary diversion of approximately 144ha of the Loders Creek catchment into the Doctors Creek catchment. This will not result in any nett loss of runoff to the Hunter River and approximately 75ha of this area is part of the original pre-mining Doctors Creek

catchment. As described previously, the original catchments will be restored once rehabilitation has been completed.

3.4.3 Management and Monitoring

Surface water volume and quality monitoring will continue to be undertaken for MTO in accordance with the MTO Water Management Plan and the MTW Water Monitoring Manual, and as required by the site EPL. These documents will be updated as required to reflect the proposed modifications to the water management system described in Section 3.4.2. Updates will include systematic controls to monitor water levels and containment in the AGN and AGS Pit voids, to ensure water levels are maintained below the level of the undisturbed natural ground surface.

There will be no change to the way in which the MTO water supply and pollution control system operates as a result of the proposed modification. Runoff will continue to be intercepted and treated as necessary prior to being allowed to flow off site. Catchment management techniques will minimise the amount of water intercepted by the larger AGN Pit footprint. All runoff considered unsuitable for discharge will be incorporated into the mine water system.

New sediment dams and water management structures will be designed by a qualified professional engineer or environmental professional, in accordance with current regulatory requirements.

Existing surface water infrastructure is either licensed or does not require licensing. Since the proposed modification does not involve harvesting of runoff or conveyance of runoff between catchments beyond that already approved or beyond restoration of the original pre-mining catchments, licensing under the *Water Act 1912* is not likely to be required.

3.4.4 Conclusions

Potential surface water impacts from the proposed modification will be minimal and similar in nature to those assessed and approved as part of the 2002 modification to DA 34/95.

The increased AGN Pit footprint will cause a small, temporary loss of runoff to the Hunter River from the additional 75ha area of catchment to be subsumed. However, this will potentially be offset by a reduction in draw from the Hunter River. Approximately 144ha of the Loders Creek catchment will be temporarily diverted to Doctors Creek. This will restore part of the original pre-mining Doctors Creek

catchment and will not result in any nett change in runoff to the Hunter River. The original catchments will be fully restored once rehabilitation of AGN is complete.

Additional pit inflow resulting from the proposed extension to the AGN Pit area will be minimal. Modelling undertaken with the MTO site water balance model indicates that existing and proposed water management systems will be able to successfully handle mine water for the life of the project.

Temporary water storage in the AGN and AGS Pit voids will provide an improved flexibility and ability to manage the site water balance, and reduce the risk to continuation of the approved mining operations at other MTW mining areas posed by storage of in-pit water. There is not likely to be any uncontrolled leakage of stored mine water from the AGN or AGS Pits. MTO's existing surface water management and monitoring systems are suitable for continued application across MTO, inclusive of AGN and AGS. They will be updated where necessary to reflect the modified operation.

3.5 Groundwater

Mining operations have the potential to impact groundwater resources if not proactively managed. Coal & Allied engaged JP Environmental (and sub consultant, Groundsearch Australia), to prepare a review of potential water impacts for the proposed modification, including potential groundwater impacts. A copy of the assessment report constitutes Appendix D and aspects relating to groundwater are discussed in this section.

3.5.1 Existing Environment

a) Groundwater Setting

There are three main sources of groundwater in the Hunter Valley:

- unconsolidated alluvial aquifers, representing the sediments of the Hunter River and its tributaries;
- porous Jurassic age sandstone and shale rocks; and
- fractured hard rock.

Groundwater surrounding AGN and AGS is present in deep, unconfined aquifers which are expected to behave hydraulically as an unconfined, fractured rock aquifer. Fluid movement throughout the area is predominantly via the secondary permeability features such as fractures and weathered zones. The current MTO workings (Loders Pit) are separated stratigraphically from the AGS Pit and the AGN Pit and proposed extension area.

Further afield, along nearby watercourses and minor palaeochannels, there are shallow, unconsolidated, unconfined aquifers within the alluvial deposits. These aquifers are recharged by rainfall and runoff, which migrates through the porous materials present. They are not in connection with the AGN or AGS Pits.

Regional flow gradients and hence, flow lines, appear to approximate the prevailing topography and strata dip directions. The shape of the piezometric surface in the vicinity of AGN also indicates that depressurisation of the fractured rock aquifer has occurred due to the surrounding mining operations. This affects groundwater gradients and hence, flow lines. In the vicinity of the AGN and AGS Pits, groundwater flow is expected to be in a westerly direction, consistent with the strata dip direction.

b) Groundwater Quality

Monitoring data from piezometers at and around AGN and AGS indicate that the deep groundwater is not suitable for potable uses and could be corrosive, being acidic and saline, with relatively high levels of sodium and chloride. This is consistent with regional observations of groundwater quality. Local groundwater users extract water from the higher quality, upper alluvial systems.

c) Groundwater Users

Groundwater in the deep, Permian age strata where mining will take place, is of low yield and poor quality. Accordingly, there are no registered water extraction bores into the Permian aquifers. The nearest registered groundwater extraction bores are in the Hunter River alluvial sediments, the closest of which is approximately six kilometres from AGN.

3.5.2 Impact Assessment

Potential groundwater impacts arising from the proposed modification will be largely unchanged from the currently approved operation. Alluvial aquifers and water supply bores, including those at the current extraction zone around the Hunter River, are not expected to be impacted due to the following:

- groundwater around the AGN and AGS Pits is contained within the stratigraphically lower Permian strata;
- storage of water in the AGN and AGS Pit voids will not recharge aquifers to a level where the piezometric surface changes direction from the current down dip direction;
- lack of recorded groundwater discharge points in proximity to the Hunter River alluvial bores; and
- high lateral permeability and storage capacity of the alluvial aquifers.

The deep aquifers may be affected differentially by blasting operations, which could result in increasing secondary permeability with time. Leakage from the pit voids through open fractures is possible. Leakage through the residual rock between AGN and AGS may also occur. However, mine water proposed to be stored in the AGN and AGS Pit voids has lower salinity levels than the existing native groundwater, and the modification is expected to have minimal impact on groundwater quality.

As outlined in Section 3.5.1, AGS and AGN and the proposed extension area are stratigraphically separated from the current MTO workings at Loders Pit. Therefore, as

observed by Groundsearch (2002), no groundwater movement is expected between the AGN and AGS Pit voids/ tailings facilities and Loders Pit. Likewise, there is no evidence to suggest groundwater ingress from the existing MTO Tailings Facility (labelled as 'MTO Operations Dam' on Figures 2.1 and 2.2) to the AGN and AGS seams.

The AGN Pit extension final pit floor area is only 15 to 20 per cent larger than that approved in 2002. The strike length is unchanged and the floor extension is to the west and down dip. Therefore, the extended pit will not influence groundwater flow lines. Temporary storage of water above the existing piezometric levels within the AGN and AGS Pit voids will increase the hydraulic head at each of the aquifers at the pits. This will influence the direction and rate of groundwater flow lines. However, groundwater flow lines are expected to follow the downward dip direction of the existing strata, in a similar manner to the existing flow lines. Migration of water leaking from the eastern low walls will be restricted by the easterly increase in the strata dip. Accordingly, groundwater will continue to migrate towards the west.

There will be a marginal increase in groundwater seepage due to the increased AGN Pit area. However, as predicted in the Groundsearch (2002) report, overall inflow volumes are expected to remain negligible. As currently approved, groundwater seepage into the pit will be incorporated into the mine water system, for re-use on site. Groundwater inflows will be poor quality. However, this is not expected to pose a significant management issue as inflows will be very small and will be diluted with other water in the surface water management system.

3.5.3 Management and Monitoring

Groundwater management and monitoring will continue to be undertaken in accordance with the MTO Water Management Plan. This plan will be updated as required to reflect any changes to the water management system which form part of the proposed modification.

Groundwater quality and levels in the AGN sub-region will be monitored by three new open hole piezometers (ABGOH13, ABGOH14 and ABGOH15) and one existing piezometer (GW9708). This network will adequately capture any departures from expected trends that may be caused by the storage of water in the AGN and AGS Pit voids. If additional monitoring is found to be necessary to ascertain the influence of temporary water storage within the AGN and AGS Pits, additional piezometers can be installed, for example located between the two voids, adjacent to the end and low walls.

This would be required more for stability assessment than for monitoring environmental impacts.

The locations of existing and proposed piezometers are identified in the JP Environmental (2009) report in Appendix D. New piezometers will be added to licence 20BL168821. Separate borehole licences will be sought or maintained for any additional future observation piezometers.

The proposed modification, including temporary storage of saline water within the AGN and AGS Pit voids, does not trigger a requirement to modify the current excavation licence 20BL170011. Licensing relating to groundwater seepage to the mine pit may be required under Part 5 of the *Water Act 1912*, if pumped water has a beneficial use.

3.5.4 Conclusions

Potential groundwater impacts from the proposed modification will be minimal, and will be similar to those assessed and approved in the 2002 modification to DA 34/95. Groundwater impacts from proposed operations at AGN are predicted to be equivalent to those experienced at the adjacent AGS mining area.

No impacts to alluvial aquifers or groundwater users are predicted to occur and the potential for impacts on groundwater quality will be minimal. Some stored water in the AGN and AGS Pits could leak through fractures. However, this will not adversely impact water quality of the deep aquifers surrounding the pits, as stored water will be lower in salinity than the receiving groundwater. Temporary water storage in the AGN and AGS Pits will increase the hydraulic head at aquifers immediately surrounding the pits, which will influence groundwater flow lines. However, these will continue to be toward the west as currently occurs.

A marginal increase in groundwater inflows into the AGN Pit is predicted due to the larger pit area. These inflows however will be negligible and can be managed through the existing mine water management system. The existing MTO groundwater management and monitoring plans and procedures will be suitable for the proposed modified development.

3.6 Heritage

3.6.1 Aboriginal Cultural Heritage

a) Existing Environment

The traditional owners of land in the Singleton region are the Wonnarua Tribal People. Several archaeological investigations have been undertaken within the local area and across MTO. These investigations identified a number of Aboriginal sites, located along or adjacent to creek lines, predominantly comprising open camp sites with stone artefacts.

An archaeological survey conducted in 2001 by Australian Museum Business Services (AMBS) for the original Abbey Green proposal covered the proposed modification area. This survey identified seven previously unrecorded Aboriginal sites (five open camp sites and two isolated artefacts) within, or in close proximity to, the proposed AGN Pit extension area, along with three areas of potential archaeological deposit and two sites which had previously been recorded. These sites were assessed to be of low to medium significance. They were salvaged in 2004, in accordance with the conditions of a Section 90 consent to destroy certificate (permit number 1795) obtained from the DECCW. The salvage results are detailed in the ERM (2004) *Aboriginal Cultural Salvage at Abbey Green* report.

Based on the outcomes of previous archaeological assessments conducted at MTO, and subsequent salvage works undertaken, it can be concluded that Aboriginal cultural heritage sites no longer exist within the modification area.

b) Impact Assessment

There are no Aboriginal cultural heritage sites within the modification area. Accordingly, no Aboriginal cultural heritage sites will be impacted by the proposed modification.

c) Management and Monitoring

No management or monitoring measures are warranted with regards to Aboriginal cultural heritage.

d) Conclusions

There are no cultural heritage sites within the modification area. Accordingly, Aboriginal cultural heritage will not be impacted by the proposed modification and no management or monitoring measures are warranted.

3.6.2 Non-indigenous Heritage

a) Existing Environment

Searches of Federal, State and Local Government heritage databases and lists undertaken for this SEE did not identify any items or places of non-indigenous heritage significance in the vicinity of the proposed modification area. The databases and lists searched were the Australian Heritage Places Inventory, National Heritage List, Australian Heritage Database, NSW State Heritage Register, Roads and Traffic Authority Section 170 Register, *Hunter Regional Environmental Plan 1989 (Heritage)* and Schedule 3 of the *Singleton Local Environment Plan 1996*.

b) Impact Assessment

Given that no items or places of non-indigenous heritage significance have been recorded within or adjacent to the modification area, non-indigenous heritage will not be impacted by the proposed modification.

c) Management and Monitoring

No non-indigenous heritage management or monitoring measures are warranted.

d) Conclusions

No items or places of non-indigenous heritage significance have been identified in the vicinity of the modification area. Therefore, non-indigenous heritage will not be impacted by the proposed modification and no management or monitoring measures are warranted.

3.7 Ecology

3.7.1 Existing Environment

A number of flora and fauna surveys have been conducted at MTO. Methodologies and outcomes of previous flora and fauna assessments are detailed in the EIS and SEEs previously prepared for the site (referenced in Section 2.4).

In summary, the proposed modification area is highly disturbed and modified due to past land uses, including mining and agriculture. It is characterised by overburden dumps rehabilitated with pasture and tree shelter belts, mining infrastructure and disturbed grasslands which have previously been cleared of most native overstorey vegetation and used for grazing (see Figure 1.2). No old growth trees remain within the modification area and there is little or no understorey. Remnant vegetation within the AGN Pit extension area is restricted to scattered trees, predominantly comprising regrowth Bulloak (*Allocasuarina leuhmannii*), and a mixture of native and introduced grassland species, including a number of weeds which are the subject of a weed control program. Remnant vegetation to be impacted by the AGN Pit extension is within the disturbance footprint defined in the ERM (2002) SEE, and is approved for clearing under DA 34/95.

The proposed footprint of the extended AGN Pit will also impact on rehabilitated overburden dumps consisting of exotic grasses which were planted for future grazing land uses. Some areas within these exotic grasslands have been planted with native trees for cattle shelter (< 5 hectares approximately). The native tree cattle shelters consist of a mixture of *Acacia salicina* (coobah wattle), *Eucalyptus cladocalyx* (sugar gum) and *Corymbia maculata* (spotted gum). Understorey is limited to exotic grasses. The rehabilitated cattle shelters are less than 20 years old and contain no habitat hollows.

The rehabilitated tree shelters provide limited wildlife corridors, and the connectivity to remaining native vegetation is scant. The tree shelters provide limited value as stepping-stones and/or refugia for highly mobile species throughout the study area.

The predominantly clear rehabilitated areas provide limited resources for fauna with very few foraging, nesting or breeding opportunities. Common birds including Richard's Pipit *Anthus novaeseelandiae*, Common Starling *Sturnus vulgaris* (introduced) and Australian Magpie *Gymnorhina tibicen* have been seen in the area. Other common bird species possibly use these shelter belts opportunistically. Small mammals, such as the introduced House Mouse *Mus musculus*), and common reptiles, such as snakes and

skinks, may occur within the grassy rehabilitation. The exotic rehabilitated pasture is considered to be in poor condition in terms of fauna habitat.

3.7.2 Impact Assessment

The majority of the impacted area of the proposal is either currently approved to be cleared or is represented by cleared disturbed grazing land or previously rehabilitated land. Of the rehabilitated land less than five hectares of tree shelters planted during previous rehabilitation are within the impacted area. These shelter belts are considered to be in a poor condition in terms of fauna habitat and are also fragmented and isolated from surrounding wildlife corridors.

In 2002 ERM considered the currently approved modification area to have low to very low conservation value and was unlikely to provide any valuable fauna habitat, particularly for threatened species. Areas proposed to be impacted by the current proposal have similar low conservation value and are also unlikely to provide valuable fauna habitat, particularly for threatened species. No threatened or migratory species, threatened populations or endangered ecological communities have been recorded in the area and the poor quality habitat value limits the potential for threatened species to occur within the modification area.

Given that the remnant native vegetation within in the modification area has previously been approved for clearing and the remaining modification area has little ecological value, no significant ecological impacts additional to those previously assessed and approved are anticipated to occur as a result of the proposed modification.

3.7.3 Management and Monitoring

Coal & Allied's standard flora and fauna management procedures and rehabilitation procedures will be implemented during the works.

3.7.4 Conclusions

Site vegetation is restricted to scattered trees and a mixture of native and introduced grassland species, including a number of weeds which are treated under a weed control program. The remnant vegetation that will be impacted by the proposed AGN Pit extension is within the approved disturbance footprint defined in the 2002 SEE, and is approved for clearing under DA 34/95. The rehabilitated tree shelters proposed to be cleared by the AGN Pit extension area are considered to have low to very low conservation value and are unlikely to provide any valuable fauna habitat, particularly

for threatened species. No threatened or migratory species, threatened populations or endangered ecological communities occur or have the potential to occur within the modification area. No ecological impacts additional to those previously assessed and approved are anticipated to occur as a result of the proposed modification.

4 PROJECT JUSTIFICATION AND CONCLUSION

The proposed modification, incorporating extension of the AGN Pit, realignment of the haul road and relocation of some infrastructure and services, will improve the productivity of the mining operation and provide MTO with a larger capacity tailings facility for the long term management of tailings from MTW Operations. Temporary storage of mine water within the AGN and AGS Pit voids will improve MTO's flexibility and ability to manage its water balance. The interim and final void from the extension of the AGN Pit will provide MTW with a facility to decant water from the tailings and allow the transfer of water around the site, thereby improving operational synergies and water recycling between MTO and Warkworth Mine.

The proposed modification will not result in any potential impacts to environmental aspects, including air quality, noise, vibration, water, heritage or ecology, which differ significantly from those previously assessed and approved under DA 34/95 and its subsequent modifications.

The proposed modified development is substantially the same as that approved in terms of the nature of the proposed works and the potential environmental impacts. Accordingly, it meets the threshold requirements for assessment and approval under Section 96(2) of the EP&A Act.

5 REFERENCES

DECCW (2000) **NSW Industrial Noise Policy** Environment Protection Authority, Sydney.

DECCW (2005) **Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales** DECCW, Sydney.

ERM (2002) **Mount Thorley Operations and Warkworth Mining Limited Section 96 (2) Modification of Development Consent Statement of Environmental Effects**. Prepared for Coal and Allied, January 2002.

ERM (2004) **Section 96(1A) Modification of Development Consent – Mount Thorley Operations Statement of Environmental Effects**. Prepared for Coal and Operations Pty Ltd, July 2004.

ERM (2004) **Aboriginal Cultural Salvage at Abbey Green, Mount Thorley Mine**. Prepared for RTCA, September 2004.

Groundsearch (2002) **Abbey Green Project Groundwater Impact Potential**. Prepared for C&A Technical Services, January 2002.

Holmes Air Sciences (2002) **Air Quality Impact Assessment, Abbey Green Project**. Prepared for ERM, January 2002.

NERDDC (1988) **Air Pollution from Surface Coal Mining: Volume 2 Emission factors and model refinement,** National Energy Research and Demonstration Council, Project 921.

SPCC (1983) **Air Pollution from Coal Mining and Related Developments**, State Pollution Control Commission of NSW, Sydney.

US EPA (1985) **Compilation of Air Pollutant Emission Factors** *AP-42 Fourth Edition* United States Environmental Protection Agency, North Carolina.

Appendix A

MTO Development Consent DA 34/95

N91/00310/Z04

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

DETERMINATION OF DEVELOPMENT APPLICATION PURSUANT TO SECTION 91

I, the Minister for Urban Affairs and Planning, pursuant to Section 91 of the Environmental Planning and Assessment Act, 1979 ("the Act") and clause 8 of State Environmental Planning Policy No. 34 - Major Employment Generating Industrial Development, determine the development application ("the application") referred to in Schedule 1 by granting consent to the application subject to the conditions set out in Schedule 2.

The reasons for the imposition of the conditions are set out in Schedule 2. The reason for the imposition of conditions generally is to minimise any adverse effects from the development, consistent with the objectives of the Act.

Craig Knowles
Minister for Urban Affairs and Planning

Sydney, 22 June 1996 File No. N91/00310/004

Schedule 1

Application made by: R W Miller and Company Pty Ltd ("the Applicant").

To: The Minister for Urban Affairs and Planning ("the Minister").

In respect of: Land within Coal Lease 219.

For the following: Construction and operation of surface coal mine extensions ("the Development").

Development Application: DA34/95 lodged with Department of Urban Affairs and Planning on 21 September, 1995 accompanied by an Environmental Impact Statement ("EIS") prepared by ERM Mitchell McCotter Pty Ltd dated August 1995.

1) To ascertain the date upon which the consent becomes effective, refer to section 93 of the Act.
2) To ascertain the date upon which the consent is liable to lapse, refer to section 99 of the Act.
3) Section 97 of the Act confers on an applicant who is dissatisfied with the determination of a consent authority a right of appeal to the Land and Environment Court exercisable within 12 months after receipt of notice.

SCHEDULE 2

Red Type represents September 2001 Modification
Blue Type represents September 2002 Modification
Teal Type represents October 2004 Modification
Brown Type represents April 2009 Modification

General

1. The Applicant shall carry out the development generally in accordance with the:
   (a) Environmental Impact Statement titled *Extension of Mining at Mount Thorley Operations*, dated August 1995, and prepared by ERM Mitchell McCotter Pty Ltd;
   (b) Statement of Environmental Effects titled *Haul Road Between Warkworth Mine & Mount Thorley Operations*, dated June 2001, and prepared by Environmental Management Resources Australia Pty Ltd;
   (c) Statement of Environmental Effects titled *Mount Thorley Operations and Warkworth Mining Ltd Section 96(2) Modification of Development Consent*, dated January 2002, prepared by Environmental Management Resources Australia Pty Ltd;
   (d) The additional noise assessment contained in the letter and fax from Coal & Allied to the Department, dated 7 February 2002 and 5 April 2002 respectively;
   (e) The *Aboriginal Cultural Heritage Assessment for Abbey Green*, dated February 2002, and prepared by Victor Perry of the Upper Hunter Wonnarua Council Inc.;
   (f) Modification application MOD 63-7-2004-i and the accompanying document *Statement of Environmental Effects*, *Section 96 (1A) Modification of Development Consent – Mount Thorley Operations*, dated July 2004, and prepared by Environmental Resources Management Australia Pty Ltd;
   (g) The letter from Coal & Allied to the Department, dated 30 August 2004, titled *Variation to Section 96 Application to Modify Development Consent 34/95 – Mount Thorley Operations*;
   (h) Statement of Environmental Effects titled *Mount Thorley Operations Pty Limited Extension to Mine Water Dam 9S*, dated February 2009, prepared by Coal and Allied; and
   (i) conditions of this consent.

1A. If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of this consent shall prevail to the extent of any inconsistency.

1B. The Applicant shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:

a) Any reports, plans or correspondence that are submitted in accordance with this consent; and
b) The implementation of any actions or measures contained in these reports, plans or correspondence.

1C. The Applicant shall prepare revisions of any strategies, plans or programs required under this consent if directed to do so by the Director-General. Such revisions shall be prepared to the satisfaction of, and within a timeframe approved by, the Director-General.

Duration

2. Approval in respect of coal mining is limited to a period of 21 years from the date of this consent.

Statutory Requirements

3. The Applicant shall ensure that all statutory requirements including but not restricted to those set down by the Local Government Act, 1993, Clean Air Act, 1961, Clean Water Act, 1970, Noise Control Act, 1975, Protection of the Environment Administration Act, 1991, and all other relevant legislation, Regulations, Australian Standards, Codes, Guidelines and Notices, Conditions, Directions, Notices and Requirements of the Department of Environment and Climate Change ("DECC"), Department of Primary Industries ("DPI"), Department of Planning ("the Department") and Roads and Traffic Authority ("RTA"), are fully met.

4. Deleted.

Flood Lighting

5. The Applicant shall screen or direct all on-site flood lighting and vehicular lights away from residences and roads, to the satisfaction of the Council.

Reasons: *to protect the amenity of nearby residents from night lighting and to promote road safety*

Fire Protection

6. The Applicant shall maintain the existing fire protection works on site. This shall include one (1) fully equipped fire fighting unit on standby and annual hazard reduction works with particular attention to boundaries of adjoining land holdings.

Land Management and Erosion and Sediment Control

7. The Applicant shall:

(i) Prepare an erosion and sediment control plan to cover the proposed mine extension site and revise this plan to incorporate the haul road from the Warkworth mine to the Mount Thorley Operations, to meet the requirements of the The Department; and

(ii) Prepare and implement a Soil and Water management Plan for the works proposed in the Statement of Environmental Effects titled Mount Thorley Operations and Warkworth Mining Pty Ltd Section 96(2) Modifications of Development Consent. This Plan must:

a. Be prepared in accordance with the Department of Housing's Managing Urban Stormwater: Soils and Construction Manual;

b. Identify the activities that cause soil erosion or result in the discharge of sediments and/or other pollutants from the site;

c. Describe in detail what actions and measures would be implemented to minimise soil erosion and the discharge of sediments and/ or other pollutants from the site;

d. Describe how the effectiveness of these measures would be monitored during these works, clearly indicating who would conduct the monitoring, how often this monitoring would be conducted, how the results of this monitoring would be recorded; and if any non-compliance is detected; and

e. Describe which procedures would be implemented to ensure compliance.

The Applicant shall not carry out any of these works before the Director General has approved this Plan

Reasons: *To protect the existing amenity of the immediate or wider area adjacent to the mine.*

Roads, Levee, and Traffic Route Lighting

8. (i) Prior to the relocation of the existing Putty Road, the Applicant shall carry out the following:

a) investigate and allow for potential soil slippage and settlement in the design and construction of the road deviation, especially if it is to be sited on mine spoil;

b) provide Type B intersection treatments at the deviated Putty Road intersections with Charlton Road and Wallaby Scrub Road, reconstruct Charlton Road and Wallaby Scrub Road such that these roads intersect with the deviated Putty Road at an angle consistent with AUSTROADS guidelines, and provide dedicated free flow slip lanes for north bound Putty Road traffic into Wallaby Scrub Road, and for south bound Putty Road traffic into Charlton Road. Geometric designs are to be in accordance with

Section 5 of AUSTROADS "Guide to Traffic Engineering Practice", Part 5 - Intersections at Grade;

c) construct the deviation to at least the RTA's and AUSTROADS road pavement and construction standards, and dedicate to Council a deviation of the Putty Road, to the north of and between Mount Thorley and Warkworth Mine coal lease (as shown in Fig 11.1 of the EIS), to RTA and Council's requirements, and in accordance with the general design requirements contained in the EIS;

d) monitor the road pavement to determine settlement, rideability, surface cracking and collapse, and provide monitoring records to Council at frequencies and in a format to be agreed with Council engineers prior to the completion of construction;

e) maintain the Mount Thorley Operations section of the deviated Putty Road for a period of 10 years and carry out maintenance promptly and in accordance with maintenance standards and requirements of the Council and the RTA, to be agreed with Council engineers prior to the completion of construction;

f) ensure as little obstruction as possible is caused to the public during the traffic deviation associated with the reconstruction of the Putty Road.

(ii) The Applicant shall:

a) construct the levee bank at an adequate distance from the Charlton Road formation such that road drainage is not impeded;

b) reconstruct the drainage lines on the eastern side of Charlton Road in the vicinity of the levee to ensure that surface water from the road formation and from the levee is drained successfully from the area under heavy storm conditions, and does not pool;

c) ensure that the levee is well maintained such that wash-outs from the toe and western bank of the levee do not impede road drainage paths and do not wash onto the Charlton Road. Any such damage is to be rectified as soon as possible to ensure safety on the public road.

(iii) The Applicant shall meet fifty percent of Council's capital contribution for the provision of Traffic Route Lighting along the Putty Road in the vicinity of the Jerry's Plains Road intersection, to the SAA Traffic Route Lighting Standard. The Applicant shall also pay to Council a capitalised contribution for ongoing running expenses based on a five year capitalisation to be advised by Energy Australia. The intersections and routes to be lit are to be agreed with Council.

(iv) The Applicant shall:

a) construct/ upgrade the haul road between Warkworth Mine and the Mount Thorley Operations as described in the SEE dated June 2001, at the site

location illustrated in Figure 1 of the SEE and generally in accordance with the design drawings attached in Appendix D to the SEE;

b) prior to the commencement of construction, install adequate screening between the Putty Road and the haul road. This screening is to be located and designed specifically to eliminate any safety issues and visual conflicts between vehicles on the haul road and users of the Putty Road. The screening is to be located outside the Main Road 503 road reserve and be designed, constructed and maintained to the satisfaction of the Council and RTA;

c) ensure that adequate access to easements is maintained and that relevant easement owners have been consulted prior to construction/ upgrading of the haul road.

Noise Levels

9. The Applicant shall ensure that noise from the mine's operations do not exceed the limits in the following table for wind speeds less than or equal to 3 m/s at 10 metres height above ground level and temperature inversions up to 3°C/100m at the nominated residences:

Residence	**$L_{Aeq(15min)}$, dB(A)**
Kime	43
P & C Russell	41
Renaud; Townsend; C Russell; Isaac; Upward	39
Slade	38
B & C Russell	37
Wambo; Bulga	35

Note:

(1) For the purpose of the noise criteria for this condition, 5dB(A) must be added to the measured level if the noise is substantially tonal or impulsive in nature. Where two or more of these characteristics are present the maximum addition to the measured noise level is limited to 10dB(A).

(2) For the purpose of noise measurement, the L_{Aeq} noise level must be measured or computed over the required period using "FAST" response on the sound level meter.

(3) Noise from the site is to be measured or computed at the most affected point on the residential boundary or within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary to determine compliance with this condition.

However, if the Applicant has a written negotiated noise agreement with any landowner of a residence nominated in the table above, and a copy of this agreement has been forwarded to the Department and the DECC, then the Applicant may exceed the noise limits at that residence in accordance with the negotiated noise agreement.

Reasons: *To protect the acoustic amenity of residents adjacent to the mine.*

Noise Monitoring and Management

10. Within 6 months of the date of the modification, the Applicant shall prepare and implement a detailed Noise Monitoring Program for the Development, to the satisfaction of the Director General.

10A The Applicant shall:

a) investigate ways to reduce the noise generated by the development;

b) implement best practice noise mitigation measures at the development; and

c) report on these investigations and the implementation of any new noise mitigation measures at the development in the Annual Environmental Management Plan Report,

to the satisfaction of the Director General.

Blasting

11. The Applicant shall:

(i) ensure that air blast overpressure and vibration monitoring and control is generally carried out in accordance with the recommendations of Australian Standard AS-2187-1993 or its latest version, and to the satisfaction of the DECC;

(ii) not blast within 500m of the Putty, Charlton or Wallaby Scrub Roads while the affected road(s) is/are open for traffic;

(iii) in the circumstance that both Warkworth Mining Limited and Mt. Thorley Operations will be mining within 500m of the Putty Road at the same time, blasting schedules shall be jointly prepared to minimise road closures and disturbance to road users;

(iv) prepare a Road Closure Management Plan in accordance with the general requirements of the Roads and Traffic Authority, to the satisfaction of Council;

(v) design all blasts based on the results of monitored blasts designed to minimise air blast overpressure and ground vibration using the Nonel or equivalent system such that any one (1) blast has less than a five per cent (5%) probability of exceeding an air blast overpressure of 115dBL and vibration with a peak particle velocity of 5mm/sec at the closest residence not owned by the applicant outside the mining lease;

(vi) determine appropriate weather data by taking measurements as soon as practicable prior to blasting and from the data shall predict whether air blast overpressure levels outside the project area are likely to be increased above the levels expected under neutral meteorological conditions. The data shall be recorded by the Applicant as part of its monitoring data;

(vii) not blast if the predictions in sub-clause (v) herein indicate that air blast overpressure levels are likely to be exceeded at residences not owned by a mining company, particularly when light winds are blowing towards Bulga village. An assessment of the suitability of weather conditions will be made by the Drill and Blast Supervisor, and Engineer in consultation with the Environmental Co-ordinator. If agreement cannot be reached the final decision will be made by the Manager-Mining. Critical parameters are wind speeds less than 1.0m/s from the north-east to east sector.;

(viii) monitor all blasts and record the overpressure and peak particle velocity at locations to be agreed by DECC and the DPI;

(ix) upon written request of the owner of any property located within two (2) kilometres of the boundaries of the proposed pits, the Applicant shall arrange at its own costs, for the inspection by a technically qualified person agreed to by both parties, to record the material condition of any structure on such property. The Applicant shall supply a copy of any inspection report, certified by the person who undertook the inspection, to the relevant property owner within fourteen (14) days of receipt of same and shall negotiate necessary remedial measures;

Reasons: *to protect the amenity of residences, to limit inconvenience to users of Putty, Charlton and Wallaby Scrub Roads and to provide for monitoring of air blast overpressure and vibration.*

Air Quality

12. The Applicant shall:

(i) utilise a wind direction, velocity monitoring and recording station at a non protected location adjacent to the area to be mined or as directed by DECC.

(ii) use the data collected by the wind monitoring and recording station referred to in sub-clause (i) above to determine when and how the mine operation is to be modified to minimise the potential for dust emissions exceeding the relevant DECC dust amenity criteria.

(iii) install and maintain dust deposition gauges as specified by the DECC and in each calendar month shall determine the dust deposition rate in gm/m^2/month. The $4gm/m^2$/month (insoluble solids) isopleth for dust deposition shall be plotted in the Annual Environmental Management Plan Report (Condition 18);

(iv) continue meteorological monitoring as well as the monitoring of dust deposition rates and concentrations of total suspended particulates for the life of the mine subject to sub-clause (i);

(v) have high volume samplers located in positions approved by the DECC. Samplings are to be undertaken on a 24hr 6-days per week cycle with

averaging periods (annual means) as well as monitoring equipment/ procedures to follow AS2724.3 and AS3508.9.6;

(vi) provide to the Director-General of Planning ("the Director-General") DECC, DPI, and the Council results and analysis of air quality monitoring on an agreed basis;

(vii) adjust mining operations at any time when driver visibility or traffic safety on the Putty, Charlton and Wallaby Scrub Roads is adversely affected, in accordance with the requirements of Council.

(viii) During the works proposed in the Statement of Environmental Effects titled *Mount Thorley Operations and Warkworth Mining Ltd Section 96(2) Modification of Development Consent*, the Applicant shall conduct air quality monitoring at the Kime residence in accordance with the following table:

Pollutant	**Units of Measure**	**Frequency**	**Sampling Method**
Particulate Matter – PM_{10}	$\mu g/m^3$	1 day in 6 or continuous	AM-18# or AS3580.9.8-2001

#NSW DEC, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in NSW

(ix) Within 6 months of the date of this modification, the Applicant shall prepare and implement a detailed Air Quality Monitoring Program for the development, to the satisfaction of the Director General.

12A The Applicant shall prepare and implement procedures to minimise air quality impacts from the development on any privately owned land, to the satisfaction of the Director-General.

Dust Suppression

13. The Applicant shall:

(i) maintain sufficient equipment with the capacity to apply water to all unsealed trafficked areas at the rate of at least one litre per square metre per hour or apply an equally effective dust suppressant;

(ii) ensure the prompt rehabilitation of all disturbed areas to minimise generation of wind erosion dust, in accordance with the requirements of DPI;

(iii) the surface of the coal stockpiles shall be kept sufficiently damp or otherwise treated to minimise windblown dust;

(iv) ensure construction/ upgrade and use of the haul road from Warkworth Mine to the Mount Thorley Operations is carried out in a manner that will minimise the potential for dust emissions to exceed the relevant DECC dust amenity criteria.

Reasons: *To protect air quality to the mine and to provide for monitoring of dust deposition and concentration.*

Water Management

14A. The Applicant shall submit a site water management plan to the Department, DWE and DECC for consideration and approval. The plan shall address the following matters:

(i) the quality and quantity of discharge from the site;

(ii) storm water diversion within the site;

(iii) the quality of water in Salt Pan Creek or other drainage paths from the mine such that waters shall not be reduced in water quality by any discharge from the mine site other than under DECC Licence Conditions;

(iv) identify the date and duration of discharges under the Hunter River Salinity Trading Scheme (as per Scheme Rulebook);

(v) the Applicant shall comply with the requirements of DWE in relation to a monitoring program in respect of surface water at the mine boundary at Salt Pan Creek, Loders creek and Wollombi Brook, and groundwater accessions to the final void.

14B. Before carrying out any of the works proposed in the Statement of Environmental Effects titled *Mount Thorley Operations and Warkworth Mining Ltd Section 96(2) Modification of Development Consent*, the Applicant shall revise the mine's site water management plan in consultation with the Department of Land & Water Conservation.

14C. Before increasing the capacity of Dam 9 above 288ML, the Applicant shall refer the plans for the proposed expansion to the Dams Safety Committee for review and classification.

14D. The Applicant shall obtain approval for the design of the proposed Dam 9S expansion from the Dams Safety Committee prior to commencement of construction activities.

Reason: *To protect water quality and to provide for water management measures at the site.*

Replacement Water Supply

15. The Applicant shall liaise with those landowners who obtain water from Salt Pan Creek to provide a bore and pump for their usage.

Reason: *To provide land owners with a replacement water supply.*

Acquisition of Land

16A In this condition "land" means the whole of a lot in a current plan registered at the Land Titles Office as at the date of this consent.

16B The noise acquisition criteria for the mine's operations for wind speeds equal to or less than 3m/s at 10 metres height above ground level and temperature inversions up to 3°C/100m are as follows:

Residence	**$L_{Aeq(15min)}$, dB(A)**
Kime	44
P & C Russell	42
S Hedley; J Hedley; Renaud; Townsend; C Russell; Isaac; B & C Russell; Upward; Slade; Wambo; Feeney; Bulga	40

Note:

(1) For the purpose of the noise criteria for this condition, 5dB(A) must be added to the measured level if the noise is substantially tonal or impulsive in nature. Where two or more of these characteristics are present the maximum addition to the measured noise level is limited to 10dB(A).

(2) For the purpose of noise measurement, the L_{Aeq} noise level must be measured or computed over the required period using "FAST" response on the sound level meter.

(3) Noise from the site is to be measured or computed at the most affected point on the residential boundary or within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary to determine compliance with this condition.

16C If a landowner considers the mine's operations to be exceeding the noise criteria in Condition 9 and/or the relevant DECC annual average amenity criteria for dust deposition rate and total suspended particulate matter at his/her residence, then he/she may ask for independent noise and/or dust monitoring of the mine's operations at his/her residence.

Within one month of receiving any such request in writing, the Applicant must arrange for, and bear the full cost of, independent noise and/or dust monitoring at the relevant residence by a qualified person, whose appointment has been approved by the Director-General.

This person must report to the Director-General, Applicant, and landowner on a quarterly basis.

If the mine's operations comply with the noise criteria in Condition 9 and/or the relevant DECC annual average amenity criteria for dust deposition rate and total suspended particulate matter at the relevant residence for 2 consecutive noise/dust monitoring periods, then the Applicant may discontinue the independent monitoring with the approval of the Director-General. If the Director-General approves the discontinuation of independent monitoring, and

the relevant landowner subsequently requests additional monitoring, then the Applicant shall only arrange for this monitoring if the Director-General approves the landowner's request.

If the mine's operations exceed the noise criteria in Condition 9 and/or the relevant DECC annual average amenity criteria for dust deposition rate and total suspended particulate matter at the relevant residence, then the Applicant shall carry out actions and measures, in consultation with the landowner, to ensure that the mine's operations comply with the relevant criteria.

Article I. If the mine's operations exceed the noise criteria in Condition 16B and/or the relevant DECC amenity criteria for dust at the relevant residence for 2 consecutive noise/dust monitoring periods, the landowner may ask the Applicant to purchase the land on which the relevant residence is located. Within 6 months of receiving any such request in writing, the Applicant shall negotiate and purchase the land in accordance with Conditions 16D and 16E.

Note: This condition does not apply to a landowner that holds an Authority under the Mining Act 1992.

16D In respect of a request to purchase land arising under sub-clause 16B or 16C, the Applicant shall pay the owner the acquisition price which shall take into account and provide payment for:

(a) a sum not less than the current market value of the owner's interest in the land used for its existing use at the date of this consent whosoever is the occupier and all improvements thereon at this date as if the land was unaffected by the Mt Thorley Coal Mine and the development proposal.

(b) the owner's reasonable compensation for disturbance allowance and relocation costs within the Local Government Area of Singleton.

(c) the owner's reasonable costs for obtaining legal advice and expert witnesses for the purposes of determining the acquisition price of the land and the terms upon which it is to be acquired.

16E In the event that the Applicant and any owner referred to in any part of Condition 16 cannot agree within the time limit upon the acquisition price of the land and/or the terms upon which it is to be acquired, then:

(a) either party may refer the matter to the Director General who shall request the President for the time being of the Australian Institute of Valuers and Land Economists to appoint a qualified independent valuer, suitably qualified in compensation issues, who shall determine, after consideration of any submissions from the land owner and the Applicant, the acquisition price.

(b) in the event that the independent valuer requires guidance on any contentious legal, planning or other issues, the independent valuer shall refer the matter to the Director General, if satisfied that there is need for a

qualified panel, shall arrange for the constitution of the panel. The panel shall consist of:

1) the appointed independent valuer,
2) the Director General, or her nominee, and/or
3) the President of the Law Society of NSW or his nominee.

The qualified panel shall on the advice of the valuer determine the issue referred to it and advise the valuer.

16F. The Applicant shall bear the costs of any valuation or survey assessment requested by the Director General in accordance with any part of Condition 16.

16G. Upon receipt of a valuation, the Applicant shall offer to acquire the relevant land at a price not less than the said valuation. Should the Applicant's offer to acquire not be accepted by the owner within six (6) months of the date of such offer, the Applicant's obligations to such owner and in respect of that property pursuant to Condition 16 shall cease.

Reasons: *To provide for acquisition of affected land.*

Environmental Officer

17. The Applicant shall employ an Environmental Officer whose qualifications are acceptable to the DPI who shall report to the General Manager. The General Manager is responsible for ensuring that all environmental safeguards proposed for the development and as required by this consent and other statutory approvals, are enforced and monitored from the commencement of construction of the expansion to the mine.

Annual Environmental Management Plan Report

18. The Applicant will continue to:

(i) prepare and submit to DPI an Annual Environmental Management Plan Report according to Document 80860302 GU-1 issued by DPI, 17 January, 1994. The report shall generally include:

(a) short, medium and long-term mining plans;

(b) rehabilitation report in respect of open cut operations;

(c) a review of the effectiveness of environmental management of the subject area in terms of DECC, the Department and DPI requirements which enables ready comparison with the Environmental Impact Statement's predictions, diagrams and tables;

(d) a review of performance in terms of the conditions of development consent;

(e) results of environmental monitoring in respect of air, water and noise pollution;

(f) a listing of any variations obtained to approvals applicable to the subject area during the previous year;

(g) the outcome of the water budget for the year, the quantity of clean water used from water storages. Details of the waste disposal of any contaminated water on site or into water courses;

(h) set out environmental management targets for the next year.

(ii) consult with the Director General during report preparation concerning any additional requirements.

(iii) ensure that copies of the Annual Environmental Management Plan report are submitted to the Director General, the Department, DPI, DECC, the Council and the Community Consultative Committee (Condition 20)

(iv) ensure that the first report is completed and submitted within twelve (12) months of this consent, at a date to be determined in consultation with DPI and thereafter.

Complaints

19. The Applicant shall establish within six (6) months a protocol complying with the reasonable requirements of the DPI for the response by the Applicant to complaints with respect to the operation of the Mount Thorley Operations Coal Mine and refer to complaints received and the action taken to satisfy those complaints in the Annual Environmental Management Plan Report (Condition 18).

Reasons: *To provide for environmental monitoring and performance reporting.*

Community Consultative Committee

20. The Applicant shall:

(i) participate and co-operate in the establishment by the Council of a Community Consultative Committee including representatives of Council, the proponent, three (3) government agencies (The Department, DECC, DPI), and four (4) community representatives to monitor compliance with conditions of this consent during the term of the development.

The Committee, initially chaired by the Council, shall be convened twice a year or as required at the request of any representative to discuss compliance matters.

(ii) The Applicant shall at its own expense:

(a) nominate two representatives to attend all meetings of the Committee;

(b) provide to the Committee copies of the latest Environmental Management Plan Report, referred to in Condition 18;

(c) promptly provide to the Committee such other information as the Chairman of the Committee may reasonably request concerning the environmental performance of the development;

(d) provide access for site inspections by the Committee;

(e) take and distribute minutes of Committee Meetings and provide meeting facilities for the Committee.

Reasons: *To allow the community to participate in environmental monitoring and performance review.*

Financial Contributions

21. The Applicant shall pay to the Council a financial contribution pursuant to Section 94 of the Environmental Planning and Assessment Act 1979, the amount of:

(i) $10,000 toward the cost of a landscape plan for mine affected lands; and

(ii) $20,000 toward the cost of the Wollombi Brook Total Catchment Management Study.

The Applicant shall pay the contribution to Council within three (3) months of acting upon this consent.

Dispute Resolution

22. In the event that the Applicant and the Council or a Government body other than the Department, cannot agree on the specification or requirements applicable under this consent, the matter shall be referred by either party to the Director General or if not resolved, to the Minister, whose determination of the disagreement shall be final and binding on the parties.

Reasons: *To provide for dispute resolution in respect to conditions of consent.*

Independent Environmental Audit

23. At 5, 10, 15 years after commencement of mining, pursuant to this consent and any additional periods as the Director General may direct, the Applicant shall conduct an environmental audit of the mining and infrastructure areas of the

development and submit a report to the Director General who shall provide a copy to the Council.

The audit shall be carried out at the Applicant's expense and be conducted by a duly qualified independent person or team approved by the Director General in consultation with the Council and Community Consultative Committee (Condition 20).

The Director General may, after considering any submission made by Council and the Community Consultative Committee on the report, notify the Applicant of the Director General's reasonable requirements with regard to any recommendations in the report. The Applicant shall comply with those reasonable requirements within such time as the Director General may reasonably require.

Reason: *To provide for periodic independent environmental audits.*

Rehabilitation

24. The Applicant shall progressively rehabilitate the site to the satisfaction of the DPI and the Director-General.

Landscape Management Plan

24A. The Applicant shall prepare and implement a detailed Landscape Management Plan for the development to the satisfaction of the DPI and Director-General. This plan must:
- (a) be prepared in consultation with DECC, DWE and Singleton Shire Council by suitably qualified expert/s whose appointment/s have been approved by the Director-General;
- (b) include a:
  - Rehabilitation Management Plan;
  - Final Void Management Plan;
  - Mine Closure Plan; and
- (c) subject to condition 24C, be submitted to the Director-General for approval by 31 May 2010.

Rehabilitation Management Plan

24B. The Rehabilitation Management Plan must include:
- (a) the objectives for rehabilitation of the site;
- (b) a description of the short, medium, and long term measures that would be implemented to rehabilitate the site and the remnant vegetation and habitat on the site;
- (c) detailed performance and completion criteria for the rehabilitation of the site;
- (d) a detailed description of how the performance of the rehabilitation of the mine would be monitored over time to achieve the stated objectives;
- (e) a detailed description of what measures and procedures would be implemented over the next 3 years to rehabilitate the site;

(f) a description of the potential risks to successful rehabilitation and/or revegetation, and a description of the contingency measures that would be implemented to mitigate these risks; and
(g) details of who is responsible for monitoring, reviewing, and implementing the plan.

Final Void Management

24C. The Final Void Management Plan must:
(a) be submitted to the Director-General for approval at least 5 years prior to the completion of mining in the vicinity of the proposed void(s);
(b) incorporate design criteria and specifications for the final void based on verified groundwater modelling predictions and a re-assessment of post-mining groundwater equilibration;
(c) assess the potential interactions between creeks on the site and the final void; and
(d) describe what actions and measures would be implemented to:
- minimise any potential adverse impacts associated with the final void; and
- manage and monitor the potential impacts of the final void.

Mine Closure Plan

24D. The Mine Closure Plan must:
(a) define the objectives and criteria for mine closure;
(b) investigate options for the future use of the site, including the final void;
(c) investigate ways to minimise the adverse socio-economic effects associated with mine closure, including reduction in local employment levels;
(d) describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and
(e) describe how the performance of these measures would be monitored over time.

25. The Applicant shall prepare and implement an Archaeological and Cultural Management Plan for the works proposed in the Statement of Environmental Effects titled *Mount Thorley Operations and Warkworth Mining Ltd Section 96(2) Modification of Development Consent*. This plan must:

(i) Be prepared in consultation with the Upper Hunter Wonnaura Council Inc and DECC;

(ii) Identify the archaeological sites that would be destroyed during the proposed works;

(iii) Describe what actions and measures would be implemented to salvage archaeological material from these sites;

(iv) Identify the sites that would be protected and preserved on the site;

(v) Identify the proposed works that could affect these sites;

(vi) Describe in detail what actions and measures would be implemented to protect and preserve these sites;

(vii) Describe how the effectiveness of these actions and measures would be monitored during the proposed works; and

(viii) Describe what procedures would be implemented if any archaeological material is discovered during the proposed works.

The Applicant shall not carry out any of the works proposed in the Statement of Environmental Effects titled *Mount Thorley Operations and Warkworth Mining Ltd Section 96(2) Modification of Development Consent* before this plan has been approved by the Director-General.

Note: Under Section 90 of the National Parks & Wildlife Act 1974, the Applicant requires consent to knowingly destroy, deface or knowingly cause or permit the destruction or defacement of or damage to a relic or Aboriginal place.

Notes:

1. **This approval does not relieve the Applicant of the obligation to obtain any other approval under the Local Government Act, 1993 as amended, the Ordinance made thereunder including approval of building plans, or any other Act.**

2. **Any acceptable levels relating to noise, dust deposition rates, air blast overpressure and vibration etc, contained in this consent are maximum levels. Other agencies, such as the DECC for example, may grant approvals/licences for certain aspects of the development, which may include consideration of matters such as noise levels etc.**

   These regulatory processes generally occur after development consent is granted. Some licences (such as Pollution Control Licences) are renewable annually. These approvals/licences may require emission levels that are more stringent than those contained in this consent. This may occur where an agency receives additional information indicating that the emission levels approved in the development consent, are not sufficiently stringent to protect social and/or natural environmental quality.

Appendix B

Air Quality Impact Assessment: Abbey Green North Project, prepared by PAEHolmes, 2009

REPORT

AIR QUALITY IMPACT ASSESSMENT: ABBEY GREEN NORTH PROJECT

Rio Tinto Coal Australia

Job No: 3271

11 September 2009

A PEL Company

PROJECT TITLE:	Air Quality Impact Assessment: Abbey Green North Project
JOB NUMBER:	3271
PREPARED FOR:	Trudie MacDonell Rio Tinto Coal Australia
PREPARED BY:	Kelsey Bawden
APPROVED FOR RELEASE BY:	Aleks Todoroski
DISCLAIMER & COPYRIGHT:	

DOCUMENT CONTROL

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1 INTRODUCTION

This report has been prepared by PAEHolmes for Rio Tinto Coal Australia. It provides an assessment of the air quality impacts of the proposed Abbey Green North Pit Expansion (referred to hereafter as AGN) in the upper Hunter Valley, NSW.

1.1 Background

The proposed modification to the existing Mount Thorley Operations (MTO) Development Consent (DA 34/95) will allow for the extension of the approved AGN Pit by approximately 75 hectares (ha) to the west. Mining will extend into the already approved Mount Arthur, Warkworth and Bowfield seams and extract approximately 5 million tonnes of run of mine (ROM) coal over the life of the project. Extension of the AGN Pit will require the realignment of a section of haul road and the relocation of some minor items of infrastructure and services.

The AGN Pit void and the adjacent Abbey Green South (AGS) Pit void will be temporarily used to store mine water. Temporary water storage in the pit void is the only change proposed to AGS, and accordingly, AGS is not addressed further in this air quality assessment. As approved in 2002, the final AGN Pit void will be used for the transfer of mine and decanted water between MTO and the adjacent Warkworth Mine, and the placement of tailings from Mount Thorley Warkworth (MTW).

2 AIR QUALITY CRITERIA

The New South Wales Department of Environment, Climate Change and Water (NSW DECCW) specifies air quality assessment criteria relevant for assessing impacts from mining in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DEC, 2005). The assessment criteria are summarised in Table 2.1.

These criteria are consistent with the National Environment Protection Measures for Ambient Air Quality (Air NEPM). However, the NSW DECCW's criteria include averaging periods which are not included in the Air NEPM and references to other non-NEPM measures of air quality, namely total suspended particulate matter (TSP) and the insoluble component of deposited dust.

Table 2.1: NSW Impact Assessment Criteria for Pollutants

Pollutant	Averaging period	Impact Assessment Criteria	
Particulate matter with an aerodynamic diameter of less than 10 µm (PM_{10})	24 hours	50 µg/m³ [a]	
	Annual	30 µg/m³	
Sulfur dioxide (SO_2)	10 minutes	712 µg/m³	
	1 hour	570 µg/m³	
	1 day	228 µg/m³	
	Annual	60 µg/m³	
Nitrogen dioxide (NO_2)	1 hour	246 µg/m³	
	Annual	62 µg/m³	
Carbon monoxide (CO)	15 minutes	100 mg/m³	
	1 hour	30 mg/m³	
	8 hours	10 mg/m³	
Total suspended particulate (TSP)	Annual	90 mg/m³	
		Maximum increase in deposited dust	Maximum allowable dust deposition
Deposited dust [b]	Annual	2 g/m²/month [a]	4 g/m²/month

[a] Non-cumulative for purposes of impact assessment

[b] Taken as the total insoluble component of deposited material

The sulfur content of Australian diesel is too low and mining equipment is too widely dispersed over mine sites to cause sulfur dioxide goals to be exceeded even in mines that use large quantities of diesel. For this reason no detailed study is required to demonstrate that impacts due to SO_2 emissions are acceptable.

Similarly, NO_x and CO emissions from the Project activities are too small and too widely dispersed to require a detailed modelling assessment.

Thus the focus of the study is on the potential effects of particulate matter emissions. Particulate matter has the capacity to affect health and to cause nuisance effects.

3 EXISTING AIR QUALITY

Air quality standards and goals refer to pollutant levels that include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals (see Section 2), it is necessary to have information or estimates on existing dust concentration and deposition levels in the area in which the Project is likely to contribute to these levels. A monitoring program operates at MTO to measure 24 hour concentrations of TSP every sixth day. TSP monitoring locations are shown in Figure 3.1, marked as MTO-TSP1 and MTO-TSP2/Bulga.

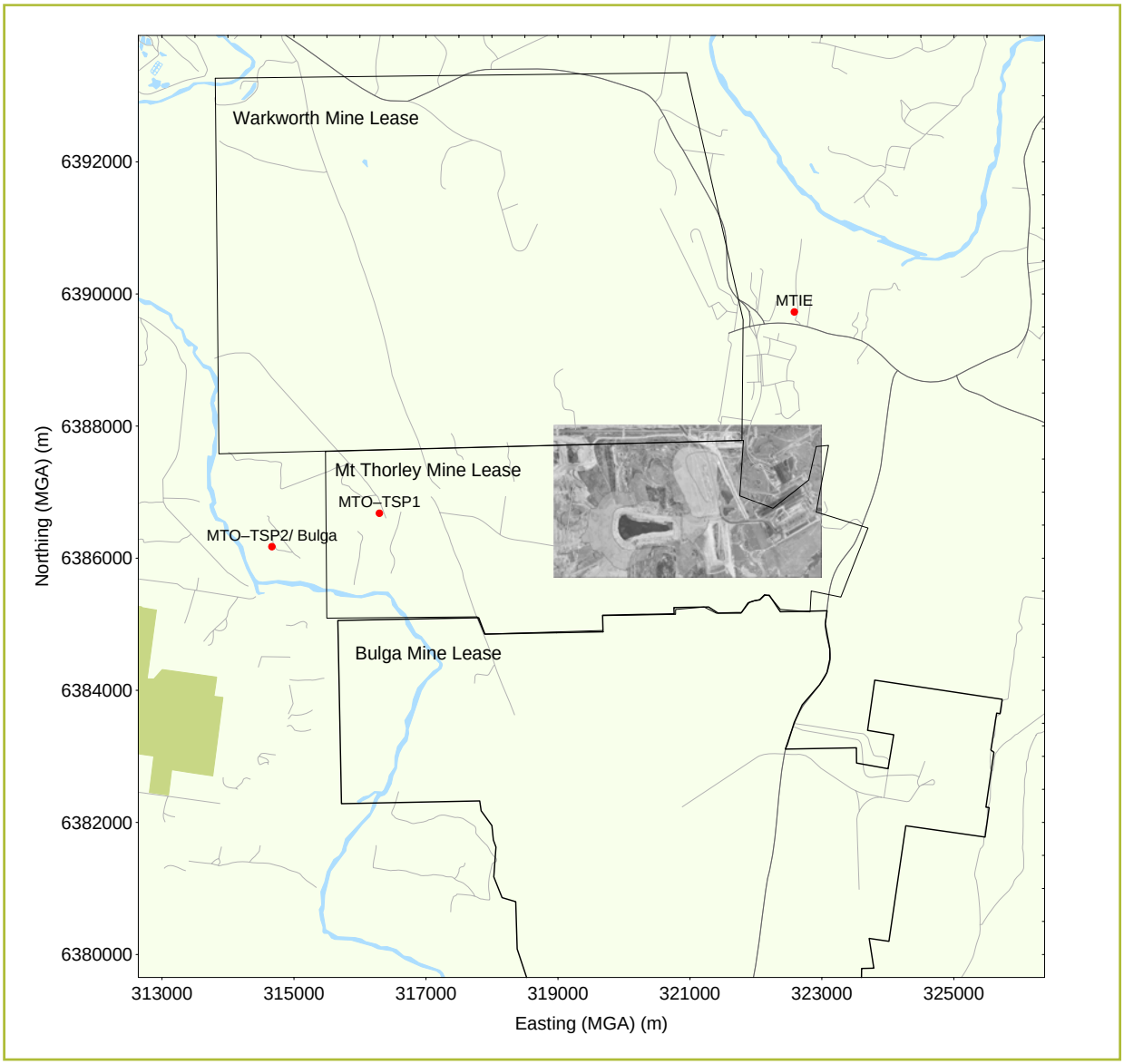

Figure 3.1: Monitoring Locations Surrounding AGN

Between April 1995 and December 2008 the annual average TSP concentrations have been in the range 21 – 62 µg/m³. While these concentrations indicate that mining

emissions have a measurable effect on TSP concentrations, the concentrations are well below the NSW DECCW guideline of 90 µg/m³. Annual average TSP results are summarised in Table 3.1.

Table 3.1: Annual Average Monitored TSP Concentrations

Year	Annual Average TSP Concentration (µg/m³)	
	MTO TSP1	MTO TSP2
1995	ND	33
1996	ND	21
1998	ND	24
1999	ND	32
2000	ND	38
2001	38	37
2002	62	50
2003	58	45
2004	46	36
2005	40	35
2006	47	46
2007	41	38
2008	38	42

[a] ND; No Data

PM_{10} monitoring locations are shown in Figure 3.1, marked as MTO-TSP1, MTO-TSP2/Bulga and MTIE. Between April 1995 and December 2008 the annual average PM_{10} concentrations have been in the range 9 – 41 µg/m³. Annual average PM_{10} results are summarised in Table 3.2.

Monitoring data for deposition in the region indicate that residential areas could accept a further 2 g/m²/month without a significant deterioration in air quality (Holmes Air Sciences, 2002).

Table 3.2: Annual Average Monitored PM_{10} Concentrations

Year	Annual Average PM_{10} Concentration (µg/m³)				
	Bulga TEOM	Bulga GRIMM	MTIE GRIMM	MTIE PM10	MTO PM10
1995	ND	ND	ND	ND	23
1996	ND	ND	ND	ND	13
1998	ND	ND	ND	ND	12
1999	ND	ND	ND	ND	14
2000	ND	ND	ND	ND	18
2001	ND	ND	ND	ND	16
2002	ND	ND	ND	ND	20
2003	ND	ND	ND	ND	18
2004	ND	ND	ND	ND	15
2005	ND	ND	ND	41	16
2006	ND	ND	ND	35	19
2007	9	24	17	27	17
2008	ND	ND	14	27	15

4 CLIMATE AND METEOROLOGY

This section summarises climatic and meteorological information relevant to the study site.

4.1 Wind Speed and Direction

Meteorological data, consisting of wind speed, wind direction, the standard deviation of wind direction (sigma-theta) and temperature are required as inputs to the dispersion modelling. Data are available for a number of different sites including a meteorological station operated as part of the MTO environmental monitoring program. These data are representative of the area being assessed and data covering the twelve month period, 1 January 2008 to 31 December 2008, have been used for the current study. A total of 8,664 hours of data were available for the study. This corresponds to 98.6% of the data potentially available for the year.

A wind rose diagram for the site, derived from the Mt Thorley meteorological station, is shown in Figure 4.1.

The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points – N, NNE, NE, etc. The bar at the top of each wind rose diagram represents winds blowing from the north (i.e., northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the colours of the bar sections correspond to wind speed categories. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

Figure 4.1 shows that in the average summer month, winds are generally light and are predominantly from the south-southeast to east-southeast. Autumn winds are predominantly from the south-southeast and are lighter. Average winter winds are predominantly from the north-northwest, and average spring winds are predominantly from the north-northwest and the south-east quadrant.

The estimated mean wind speed for the year at the site is 3.2 m/s. Wind speeds greater than 5.4 metres per second occur for 13% of the time.

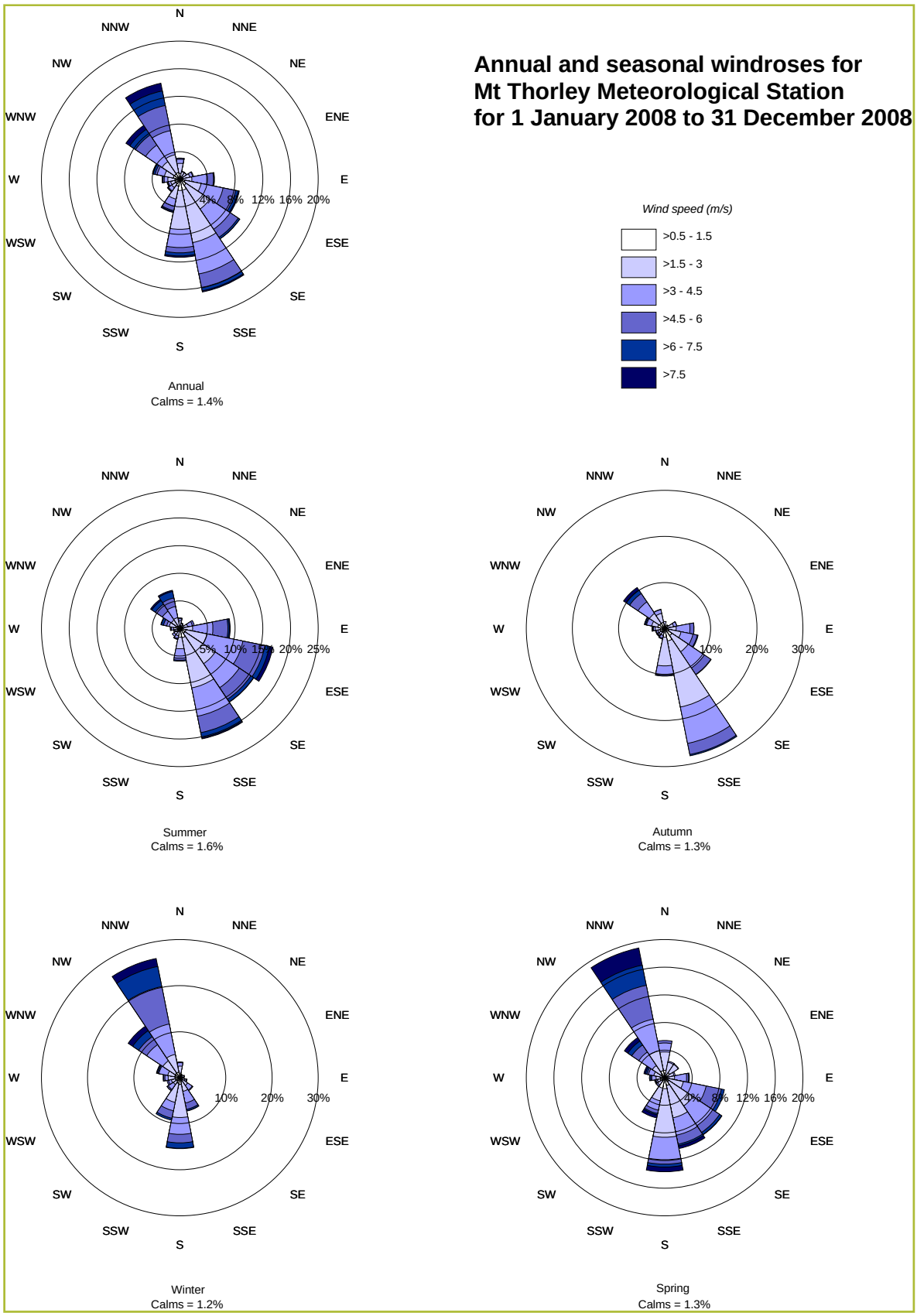

Figure 4.1: Annual and seasonal windroses for Mount Thorley meteorological station

4.2 Stability Class

The stability class, which is a measure of the level of turbulence in the atmosphere near the ground, is an important aspect of plume dispersion. Turbulence acts to dilute or diffuse a plume by increasing the cross-sectional area of the plume due to random motions. As turbulence increases, the rate of plume dilution or diffusion increases. Weak turbulence limits diffusion and is a critical factor in causing high plume concentrations downwind of a source.

The most well-known stability classification is the Pasquill-Gifford scheme, which denotes stability classes from A to F. Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution. At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, such as commonly occur under clear skies at night and in the early morning. Under these conditions plumes can remain relatively undiluted for considerable distances downwind. Intermediate stability classes grade from moderately unstable (B), through neutral (D) to slightly stable (E). Whilst classes A and F are closely associated with clear skies, class D is linked to windy and/or cloudy weather, and short periods around sunset and sunrise when surface heating or cooling is small.

The frequency distribution of stability classes in the meteorological dataset for the MTO site is presented in Figure 4.2. The 1-year dataset contains approximately 20% of hours with either E or F class.

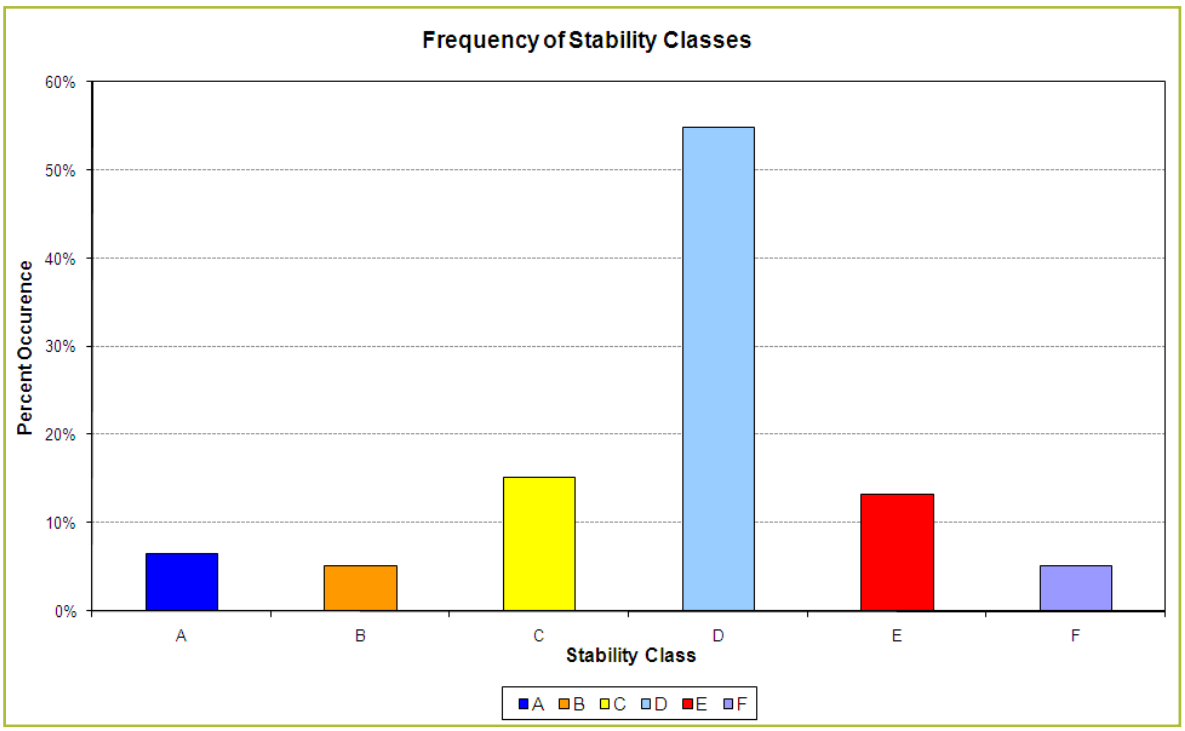

Figure 4.2: Frequency of Stability Classes in Trap Gully Data Set

4.3 Temperature and Humidity

The annual mean of daily maximum temperatures is 24.8°C, with an annual mean of daily minimum temperatures of 11.1°C. January is generally the warmest month, with mean temperatures of 22°C at 9 AM and 29°C at 3 PM. July experiences the coldest mean temperatures of 9.1°C at 9 AM and 16.8°C at 3 PM.

The mean relative humidity is 78% at 9.00 AM (recorded over 11 years) and 50% at 3.00 PM (recorded over 11 years). Humidity levels peak during winter and are at their lowest in spring.

4.4 Rainfall and Cloud Cover

The average annual rainfall is 645 mm, with an average of 70 days with rain greater than 1 mm per year. Highest falls occur during summer, with an average of 88 mm per month. Lowest falls occur in August, with a mean of 28 mm.

Mean daily evaporation records for the Bureau of Meteorology (BoM) Cessnock (Nukaba) station show that the mean daily evaporation rate is 3.3 mm. It is worth noting that the average annual potential evaporation rate is significantly higher (i.e. around 2 times) than the long-term average annual rainfall (see Table 4.1).

Climate averages sourced from the Bureau of Meteorology are presented in Table 4.1.

Table 4.1: Long Term Climate Data for Singleton (Bureau of Meteorology, 2009)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Air Temperature													
Highest maximum (°C) [a]	43.6	40	41	34.7	28.2	25.4	26	30.4	33	39	43	41.4	43.6
Mean daily maximum (°C) [a]	30.6	29.6	27.7	25.4	21.1	18.3	18	20.1	23.1	26	27.6	29.7	24.8
Mean daily minimum (°C) [a]	17.3	17.2	15.2	11.1	8.6	5.6	4.8	5	8	10.7	13.5	15.9	11.1
Lowest minimum (°C) [a]	9.6	9.6	7.5	2.5	0.4	-2	-3.9	-4.2	0.4	2.5	5	8.1	-4.2
Relative Humidity													
Mean 9 AM relative humidity (%) [a]	76	83	84	82	85	84	83	76	71	66	69	73	78
Mean 3 PM relative humidity (%) [a]	49	52	54	51	60	57	54	44	43	43	46	47	50
Rainfall													
Mean monthly rainfall (mm) [a]	70.2	107.6	75.1	38.3	37.8	31.7	38.8	27.6	44.1	32.8	59.2	86.6	645.4
Mean number of days of rain≥1 mm [a]	7.4	7.5	7.3	3.9	5.5	4.6	4.7	4.2	5.8	5	7.6	6.8	70.3
Maximum monthly rainfall (mm) [a]	119.7	302	235.9	107.5	121.1	91	104.6	117.1	102.4	56.6	128.1	164.3	810.9
Lowest monthly rainfall (mm) [a]	26.6	26	2.2	0	3	8.6	2.5	0	2.2	2.9	0.6	27.4	484.6
Maximum daily rainfall (mm) [a]	40	94.4	62.9	47	31	54.4	43.4	40	32	29.1	33.5	60	94.4
Mean daily evaporation (mm) [b]	5.7	5	3.9	2.9	1.9	1.5	1.8	2.5	3.6	4.4	5.1	5.8	3.7
Wind													
Mean 9 AM wind speed (km/h) [a]	4.4	3.9	4	4.3	5.5	7	6.6	7.3	8.8	7.8	6.6	5	5.9
Mean 3 PM wind speed (km/h) [a]	9.4	9.3	10.4	8.3	8.8	10.5	10.3	14.1	14	13.3	12.4	11	11
Cloud Cover													
Mean number of clear days [a]	6.5	3.9	5	6.4	5.8	7	8.1	9.2	10.1	7.2	4.7	6.3	80.2
Mean number of cloudy days [a]	10.9	10.2	9.3	6.4	8.4	8.5	9	5.2	5.5	7.4	9.7	9.9	100.4

Downloaded 16 April 2009 from http://www.bom.gov.au/climate/averages/tables/cw_061371_All.shtml and http://www.bom.gov.au/climate/averages/tables/cw_061242_All.shtml

[a] Singleton Water Board station

[b] Cessnock (Nulkaba) station

5 APPROACH TO ASSESSMENT

5.1 Model Used

In August 2005, NSW DECCW published the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DEC, 2005) for the assessment of air pollution sources using dispersion models. The approved methods specify how assessments based on the use of air dispersion models should be undertaken. The approved methods contain guidelines for the following aspects of air impact assessment:

- the methodology for the preparation of meteorological data to be used in dispersion models;
- the methodology recommended for emission estimation;and
- relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the proposal.

The approaches recommended by the guidelines have been followed as closely as possible in this assessment.

The model used in this assessment was a modified version of the US EPA ISCST3 model (ISCMOD). ISCST3 is fully described in the user manual and the accompanying technical description (US EPA, 1995a). The ISCST3 model has a tendency to overestimate short-term (24-hour) PM_{10} concentrations (Holmes Air Sciences, 2002a and 2006a). To overcome this difficulty, ISCST3 has been modified to create ISCMOD. ISCMOD is identical to ISCST3 except that the horizontal plume spreading dispersion curves have been modified to adopt the recommendations of the American Meteorological Society's (AMS) expert panel on dispersion curves (Hanna, 1977) and the suggestions made by Arya (1999). The suggested changes were recommended because, as the AMS panel notes, the original horizontal dispersion curves relate to an averaging time of three minutes and they recommend that these be adjusted to the one hour curves required by ISCST3. The change involves increasing the horizontal plume widths by a factor of 1.82 $(60 \text{ minutes} / 3 \text{ minute})^{0.2}$. The modifications improve the performance of the model in predicting 24-hour concentrations and make almost no difference to the annual average predictions.

A similar adjustment has been applied to account for the local surface roughness being different at the sites compared with the site where the original curves were developed. The sites have been taken to have a surface roughness of 0.3 metres compared with 0.03 metres for the original curves. The adjustment leads to an increase in the horizontal and vertical curves by a factor of 1.6 $((0.3 \text{ m}/ 0.03 \text{ m})^{0.2})$.

The modelling has been based on the use of three particle-size categories (0 to 2.5 µm - referred to as $PM_{2.5}$ or fine particles (FP), 2.5 to 10µm - referred to as coarse matter (CM or $PM_{2.5\text{-}10}$) and 10 to 30 µm - referred to as ($PM_{10\text{-}30}$ or Rest). Emission rates of TSP have been calculated using emission factors developed both within NSW and by the USEPA (see Section 6 and Appendix A).

The particle size distribution was derived from measurements published by the former SPCC (SPCC, 1986) and is presented in Table 5.1.

Table 5.1: Particle Size Distribution

Particle Size Range	Percentage of TSP
$PM_{2.5}$ (FP)	4.7%
$PM_{2.5-10}$ (CM)	34.4%
PM_{10-30} (Rest)	60.9%

[a] Source: SPCC (1986)

Modelling was performed using three ISC source groups, with each group corresponding to a particle size category. Each source in the group was assumed to emit at the full TSP emission rate and to deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mean of the limits of the particle size range. The exception was the $PM_{2.5}$ group, which was assumed to have a particle size of 1 µm. The predicted concentration in the three plot output files for each group were then combined according to the particle size distribution presented in Table 5.1.

The ISC model also has the capacity to take into account dust emissions that vary in time, or with meteorological conditions. This has proved particularly useful for simulating emissions on mining operations where wind speed is an important factor in determining the rate at which dust is generated.

5.2 Emission Source Representation

Estimates of emissions for each source were developed on an hourly time step taking into account the activities that would take place at that location. Thus, for each source, for each hour, an emission rate was determined which depends upon the level of activity and the wind speed. It is important to do this in the ISC model to ensure that long-term average emission rates are not combined with worst-case dispersion conditions which are associated with light winds. Light winds at a mine site would correspond with periods of low dust generation because wind erosion and other wind dependent emissions rates will be low. Light winds also correspond with periods of poor dispersion. If these measures are not taken into account, the model has the potential to significantly overstate impacts.

Operations were represented by a series of volume sources located according to the location of activities for the modelled scenarios (as shown on Figure 6.1). These correspond to operations as they are envisaged to occur in year three and year four of operations.

5.3 Scenarios Modelled

Two modelling scenarios were assessed in the air quality assessment corresponding to year three and year four of operations. These years were selected as they correspond to the greatest amount of activity. Year three corresponds to the greatest amount of overburden and year four to the greatest amount of coal production. Therefore, dust

emissions and predicted impacts are expected to be greatest during year three and four of operations and the results presented in this assessment are considered conservative.

The quantities of coal and overburden transferred in years three and four of operations are provided in Table 5.2.

Table 5.2: Modelling Scenarios Included in the Assessment

Scenario	Year 3	Year 4
Overburden transferred (bcm/year)	10,000,000	7,000,000
Coal transferred (tonnes/year)	2,500,000	3,000,000

Dust concentrations and deposition rates have been predicted in the vicinity of the Project for the both scenarios. The local terrain has been taken into consideration in the modelling.

All associated activities have been modelled for 24 hours per day. Section 6 provides details of dust emissions and allocation of sources for each activity.

5.4 Sensitive Receptors

Identified sensitive receptors surrounding the Project are provided in Table 5.3 and shown in Figure 5.1.

Table 5.3: Identified Sensitive Receptors Surrounding AGN

ID	Description	Easting (MGA) (m)	Northing (MGA) (m)
1	Mine owned	315107	6385821
1b	Mine owned	315112.6	6385141
2	Private residence	323638.8	6389392
2b	Private residence	323686.4	6389643
3	Private residence	323566.6	6389843
4	Private residence	323383.3	6389510
5	Private residence	322844.8	6389675
6	Private residence	322606.4	6389635
7	Mine owned	315461.2	6383583
8	Bulga Community Centre	314366.4	6385397
9	Private residence	314684.5	6386104
10	Private residence	312969.8	6387265
11	The State of NSW	314742.3	6385070
12	The State of NSW	314788.4	6384664
13	Private residence	314556	6386576
14	Mine owned	315108	6386652
15	Private residence	315020.1	6386175
16	Private residence	323447.8	6388933
16b	Private residence	324064.3	6388769
17	Private residence	323668.4	6387314

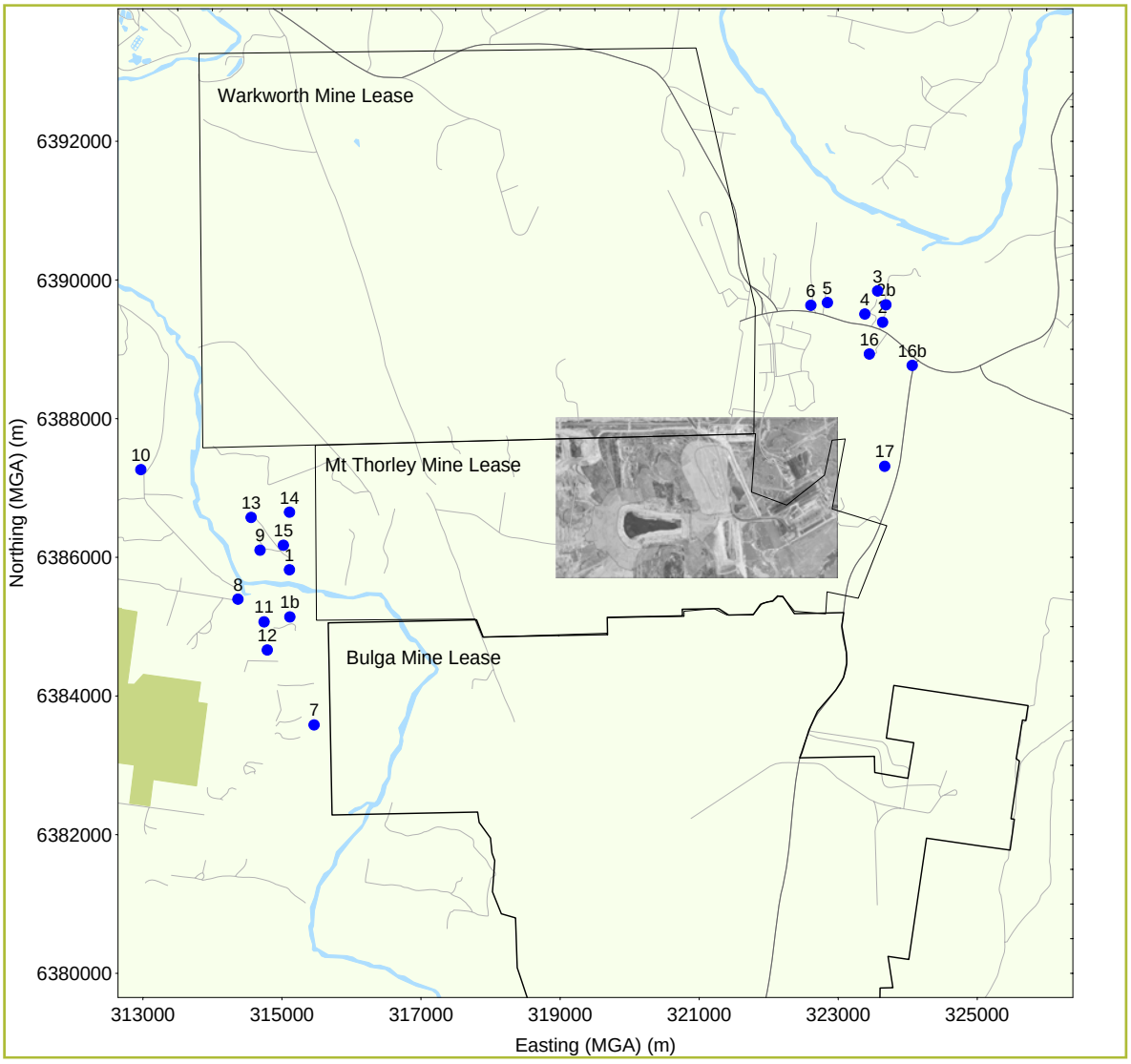

Figure 5.1: Sensitive Receptors Surrounding AGN

Predicted concentrations of TSP and PM_{10} and dust deposition rates are presented in Section 7 for these identified receptors.

6 ESTIMATED EMISSIONS

6.1 Preamble

The model requires the estimates of particulate matter emission rates for each activity associated with the mining operation. The operations include:

- drilling overburden;
- blasting overburden;
- shaping and other bulldozer work on overburden;
- loading overburden to trucks;
- hauling overburden to waste dumps;
- unloading overburden at waste dumps;
- dozers working on coal;
- loading coal to trucks;
- hauling coal to dump hopper or ROM stockpile;
- unloading coal to dump hopper of ROM stockpile;
- loading coal to stockpiles;
- re-handling coal at the ROM hopper;
- loading coal to trains; and
- graders on roads.

In addition, there will be dust emissions due to wind erosion from exposed working areas (including pits and dumps) and also from stockpiles.

Emissions from all these sources have been estimated using methodologies outlined in the US (USEPA, 1985) and in Australia (NERDDC, 1988; SPCC, 1983).

6.2 Controls

The controls that are available for the mine can be summarised in three broad categories:

- engineering controls;
- planning controls to increase the separation distance between dust sources on the mine and sensitive areas; and
- operational controls which vary mining activities when adverse meteorological conditions occur.

Broadly these three types of controls include the following activities and measures.

Potential engineering controls involve measures such as shielding conveyors, selection of appropriate stockpile stacking and reclaim systems, maintaining dust loadings on

trafficked areas at low levels by watering and using agglomerating agents, and installation of sprinkler systems on coal handling areas.

Potential planning controls include the maintenance of adequate buffer distances between dust sources and receptors and progressive rehabilitation of mined areas to minimise the area susceptible to wind erosion. They may also involve the acquisition of impacted properties or limiting the extent of mining.

Potential operational controls involve limiting dust-generating activities when wind speeds, or more significantly, wind directions would take dust from its source to a sensitive area. Watering of roads and stockpiles with water trucks can be considered in this category of controls.

The dust control measures that will be incorporated into the AGN project and which have been taken into account in the modelling are listed below:

- dust controls to be fitted to all drill rigs;
- watering of all trafficked areas, active work areas, coal handling areas, and other areas susceptible to wind erosion;
- minimising exposed land susceptible to wind erosion;
- progressive rehabilitation of areas disturbed by mining activities; and
- water sprays on stockpiles.

Allowance for these control measures has been incorporated into the current model runs. The model assumes 75% control on haul roads due to dust suppression watering.

6.3 Estimated Emissions for AGN

A summary of estimated TSP emissions from the AGN project are provided in Table 6.1. Details on the methodology used to estimate dust emissions are provided in Appendix A.

Table 6.1: Summary of Estimated TSP Emissions from AGN

Emission Source	TSP Emission Rate (kg/year) Scenario 1 (Year 3)	Scenario 2 (Year 4)
Drilling overburden	5,900	5,900
Blasting overburden	31,300	31,300
Dozers on overburden dumps	54,500	54,500
Dozers on overburden assisting excavators	55,400	55,400
Loading overburden to trucks	50,500	35,400
Hauling overburden to waste dump	720,000	504,000
Unloading overburden to waste dump	50,500	35,400
Dozers working on coal	5,690	5,690
Loading coal to trucks	169,000	203,000
Hauling coal to the MTCPP	78,900	94,700
Unloading coal to hopper	25,000	30,000
Re-handle coal at the ROM hopper	2,500	3,000
Loading coal to stockpiles	1,130	1,360
Loading coal to trains	791	949
Wind erosion - waste emplacement 1	258,000	258,000
Wind erosion - waste emplacement 2	63,900	63,900
Wind erosion - pit	278,000	278,000
Wind erosion - ROM stockpile	2,580	3,100
Wind erosion - Product stockpile	875	1,050
Grading roads	1,120	1,120
Total(TSP Emission)	**1,860,000**	**1,670,000**
ROM Coal Produced (t/year)	2,500,000	3,000,000
TSP/ROM (kg/t)	0.742	0.555

[a] All estimated values are displayed to 3 significant figures.

MTCPP – Mount Thorley Coal Preparation Plant

6.4 Estimated Emissions from Other Local Mines

The assessment of cumulative impacts has assumed that the dust emissions from other local mines will be the same as estimated in the Environmental Impact Statements for these mines for the years that may closely correspond to the stages being modelled for the AGN project.

The location of each of the surrounding mines is shown in Figure 6.1. In the cumulative modelling work, each neighbouring mine has been treated as four volume sources located at the estimated points of major emissions.

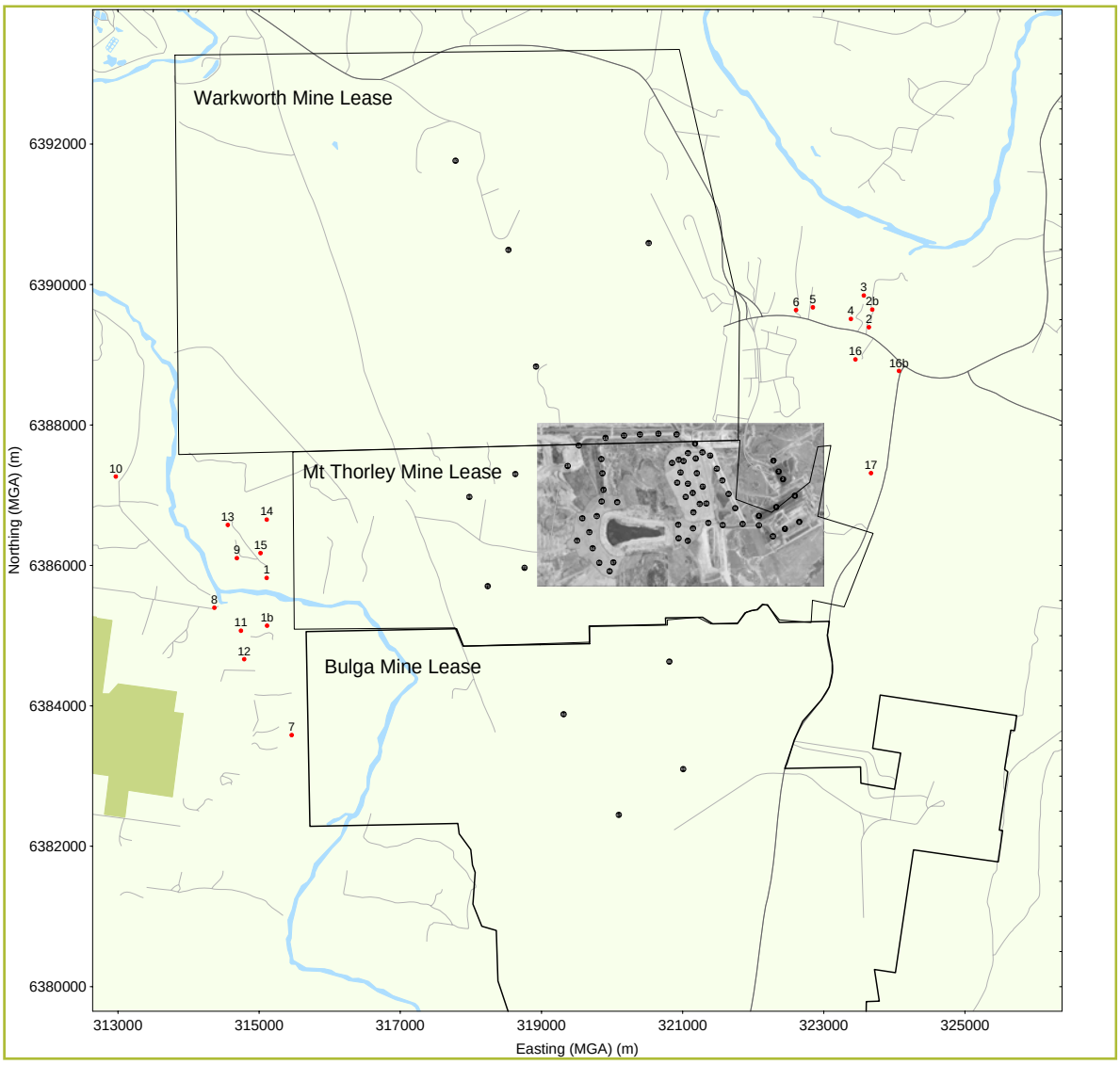

Figure 6.1: Location of Emission Sources and Surrounding Mines

Sources have been considered in three classes: wind erosion sources where emissions vary with the hourly average wind speed according to the cube of the wind speed, and loading and unloading operations where emissions vary as wind speed raised to the power of 1.3. All other sources have been assumed to have emissions independent of wind speed.

For the neighbouring mines, the proportions of emissions in each of these categories have been assumed to be (Holmes Air Sciences, 2000):

- 73.2% for emissions independent of wind speed;
- 13.5% for emissions that depend on wind speed (such as loading and unloading); and
- 13.3% for wind erosion sources.

Estimated dust emissions for the surrounding mines are provided in Table 6.2

Table 6.2: Estimated Dust Emissions from Surrounding Mines

Mine	Emission Source	Estimated TSP Emission (kg/year)
Warkworth [a]	Wind insensitive	6,774,660
	Wind sensitive	1,249,425
	Wind erosion	1,230,915
	Total	**9,255,000**
Bulga [b]	Wind insensitive	3,294,000
	Wind sensitive	607,500
	Wind erosion	598,500
	Total	**4,500,000**
Mt. Thorley [c]	Wind insensitive	6,545,983
	Wind sensitive	1,207,251
	Wind erosion	1,189,366
	Total	**8,942,600**

[a] Table 5, Air Quality Impact Assessment: Extension of Mining Warkworth Coal Mine

[b] Table 6, Air Quality Impact Assessment: Extension of Mining Warkworth Coal Mine

[c] Table 4, Air Quality Impact Assessment, Abbey Green Project (emissions are for MTO with the exception of operations from Abbey Green)

7 MODELLING RESULTS

Predicted ground level concentrations (GLCs) of TSP and PM_{10} and dust deposition rates at sensitive receptors are presented in this section. Ground level concentration plots are presented in Appendix B.

Predicted GLCs at sensitive receptors due to emissions from AGN only are presented in Section 7.1.

Predicted cumulative impacts due to emissions from AGN and surrounding mines are presented in Section 7.2.

7.1 Predicted Impacts from AGN Only

7.1.1 Predicted Maximum 24 Hour PM_{10} Concentrations

Predicted maximum 24 hour concentrations at sensitive receptors are provided in Table 7.1.

Table 7.1: Predicted Maximum 24 Hour PM_{10} Concentrations due to AGN Operations

Receptor ID	Receptor Description	Maximum PM_{10} Concentration (µg/m³)	
		Scenario 1	Scenario 2
1	Mine owned	4.0	3.4
1b	Mine owned	2.8	2.5
2	Private residence	9.5	8.2
2b	Private residence	9.6	8.3
3	Private residence	11.5	9.8
4	Private residence	11.6	10.0
5	Private residence	11.8	9.7
6	Private residence	10.8	9.7
7	Mine owned	4.7	4.1
8	Bulga Community Centre	3.0	2.6
9	Private residence	4.0	3.4
10	Private residence	3.6	3.1
11	The State of NSW	2.7	2.4
12	The State of NSW	2.5	2.1
13	Private residence	3.9	3.3
14	Mine owned	4.5	3.9
15	Private residence	4.4	3.7
16	Private residence	11.5	9.1
16b	Private residence	12.2	9.8
17	Private residence	12.5	10.7
	NSW DECCW Criterion:	**50**	

7.1.2 Predicted Annual Average Concentrations

Predicted annual average concentrations and deposition rates at sensitive receptors due to emissions from AGN are provided in Table 7.2.

Table 7.2: Predicted Annual Average Concentrations due to AGN

Receptor ID	Receptor Description	Scenario 1			Scenario 2		
		TSP (µg/m³)	PM_{10} (µg/m³)	Dust (g/m²/m)	TSP (µg/m³)	PM_{10} (µg/m³)	Dust (g/m²/d)
1	Mine owned	0.28	0.26	0.016	0.25	0.22	0.015
1b	Mine owned	0.24	0.22	0.011	0.21	0.19	0.010
2	Private residence	0.91	0.82	0.034	0.79	0.7	0.031
2b	Private residence	0.86	0.78	0.032	0.75	0.67	0.029
3	Private residence	1.00	0.93	0.034	0.87	0.8	0.031
4	Private residence	1.09	0.98	0.042	0.95	0.85	0.039
5	Private residence	1.57	1.41	0.072	1.38	1.23	0.066
6	Private residence	1.84	1.63	0.095	1.62	1.42	0.087
7	Mine owned	0.22	0.21	0.005	0.19	0.18	0.004
8	Bulga Community Centre	0.22	0.20	0.011	0.19	0.17	0.010
9	Private residence	0.27	0.25	0.017	0.24	0.21	0.016
10	Private residence	0.23	0.21	0.017	0.2	0.18	0.016
11	The State of NSW	0.22	0.2	0.010	0.19	0.18	0.009
12	The State of NSW	0.21	0.19	0.008	0.18	0.17	0.007
13	Private residence	0.29	0.26	0.021	0.25	0.23	0.019
14	Mine owned	0.35	0.31	0.027	0.3	0.27	0.025
15	Private residence	0.31	0.27	0.020	0.26	0.24	0.018
16	Private residence	1.18	1.07	0.042	1.02	0.92	0.038
16b	Private residence	0.84	0.75	0.029	0.72	0.64	0.026
17	Private residence	1.62	1.39	0.075	1.4	1.18	0.068
	NSW DECCW Criteria:	**90[a]**	**30[a]**	**2**	**90[a]**	**30[a]**	**2**

[a] NSW DECCW criteria are to be considered with background levels

7.2 Predicted Impacts from AGN and Surrounding Mines

Predicted annual average concentrations and deposition rates at sensitive receptors due to emissions from AGN and surrounding mines are provided in Table 7.3.

Table 7.3: Predicted Annual Average Concentrations due to AGN and Surrounding Mine Operation [a]

Receptor ID	Receptor Description	Scenario 1			Scenario 2		
		TSP (µg/m³)	PM_{10} (µg/m³)	Dust (g/m²/m)	TSP (µg/m³)	PM_{10} (µg/m³)	Dust (g/m²/m)
1	Mine owned	37.9	12.1	2.48	37.9	12.1	2.48
1b	Mine owned	36.7	11.0	2.33	36.6	11.0	2.33
2	Private residence	40.7	15.0	2.33	40.6	14.9	2.33
2b	Private residence	40.2	14.5	2.30	40.0	14.4	2.30
3	Private residence	40.7	15.0	2.31	40.6	14.9	2.31
4	Private residence	41.8	16.0	2.38	41.7	15.9	2.38
5	Private residence	45.2	19.0	2.55	45.0	18.9	2.54
6	Private residence	47.1	20.7	2.69	46.9	20.5	2.68
7	Mine owned	35.0	9.6	2.19	34.9	9.5	2.19
8	Bulga Community Centre	35.5	10.0	2.29	35.4	9.9	2.29
9	Private residence	37.3	11.6	2.45	37.3	11.6	2.45
10	Private residence	35.4	9.9	2.33	35.4	9.9	2.33
11	The State of NSW	35.8	10.3	2.28	35.8	10.3	2.28
12	The State of NSW	35.5	10.0	2.24	35.4	10.0	2.24
13	Private residence	37.7	11.9	2.52	37.7	11.9	2.51
14	Mine owned	39.9	13.8	2.71	39.9	13.7	2.70
15	Private residence	38.6	12.7	2.55	38.5	12.6	2.55
16	Private residence	42.0	16.2	2.42	41.8	16.0	2.42
16b	Private residence	39.7	14.1	2.30	39.5	13.9	2.30
17	Private residence	42.2	16.2	2.54	42.0	16.0	2.53
	NSW DECCW Criteria:	**90**	**30**	**4**	**90**	**30**	**4**

[a] Includes background levels as follows:

TSP background: 30 µg/m³

PM_{10} background: 5 µg/m³

Dust deposition background: 2 g/m²/month

8 ASSESSMENT OF IMPACTS DUE TO DUST EMISSION

8.1 Preamble

This section provides an interpretation of the predicted contours of dust concentration and deposition levels. Simulations were performed for two mining scenarios corresponding to the year of highest overburden transfer (year 3, scenario 1) and the year of highest coal transfer (year 4, scenario 2). Firstly, contours and predicted GLCs have been presented for AGN in isolation and then contours and GLCs have been presented showing predictions taking into account of emissions from all surrounding mines.

For each of the cases considered, isopleth plots have been produced showing the following:

- the predicted annual average PM_{10} concentration;
- the predicted annual average TSP concentration; and
- the predicted annual average dust deposition rate.

Also, the maximum predicted 24 hour concentration has been presented for operations from AGN only at sensitive receptors.

The air quality criteria used for assessing which properties are likely to experience air quality impacts are:

- 50 µg/m^3 for 24-hour average PM_{10} for the Project considered alone;
- 30 µg/m^3 for annual average PM_{10} due to the Project and other sources;
- 90 µg/m^3 for annual average TSP concentrations due to the Project alone and other sources;
- 2 g/m^2/month for annual average deposition (insoluble solids) due to the Project considered alone; and
- 4 g/m^2/month for annual average predicted cumulative deposition (insoluble solids) due to the Project and other source levels.

Following practice established in recent conditions of development consent, with the exception of the 2 g/m^2/month goal and the 24-hour PM_{10} criterion, the assessment criteria are interpreted to be cumulative assessment criteria.

8.2 Analysis of Impacts

8.2.1 Predicted Maximum 24 Hour PM_{10}

Predicted maximum 24 hour PM_{10} concentrations at sensitive receptors due to emissions from AGN are presented in Table 7.1. The modelling results show that residences 3, 4, 5, 6, 16, 16b and 17 are the most affected by emissions from AGN alone. These residences are predicted to experience a maximum 24 hour

concentration of less than 13 µg/m³. This is well below the NSW DECCW's incremental goal of 50 µg/m³.

8.2.2 Predicted Annual Average TSP

Predicted annual average TSP concentrations due to emissions from AGN are presented in Table 7.2 and Figure B11.1. The modelling results show that residence 6 is the most affected by emissions from AGN alone. Residence 6 is predicted to experience an annual average TSP concentration of approximately 2 µg/m³ due to emissions from AGN. This is a small fraction of the NSW DECCW air quality criteria of 90 µg/m³.

Predicted cumulative annual average TSP concentrations are presented in Table 7.3 and Figure B11.4. The modelling results include emissions from AGN, Warkworth, MTO and Bulga and a background level of 30 µg/m³ to account for sources not included in the modelling.

The results show that residence 6 is most affected by emissions from mining operations in the surrounding area, with a predicted annual average TSP concentration of approximately 47 µg/m³. This is well below the NSW DECCW air quality criteria of 90 µg/m³.

Historical monitoring data from the region indicates that typical annual average TSP concentrations are below 50 µg/m³. It is also noted that the monitoring data is impacted from emissions from the surrounding mines. Therefore, the modelling results indicate that the annual average TSP concentrations are expected to be below the NSW DECCW air quality criteria when considering background concentrations.

8.2.3 Predicted Annual Average PM_{10}

Predicted annual average PM_{10} concentrations due to emissions from AGN are presented in Table 7.2 and Figure B11.2. The modelling results show that residence 6 is the most affected by emissions from AGN alone. Residence 6 is predicted to experience an annual average PM_{10} concentration of approximately 1.6 µg/m³ due to emissions from AGN. This is a small fraction of the NSW DECCW air quality criteria of 30 µg/m³.

Predicted cumulative annual average PM_{10} concentrations are presented in Table 7.3 and Figure B11.5. The modelling results include emissions from AGN, Warkworth, MTO and Bulga and a background level of 5 µg/m³ to account for sources not included in the modelling.

The modelling results show that residence 6 is most affected by emissions from mining operations in the surrounding area, with predicted annual average PM_{10} concentrations of approximately 21 µg/m³.

This is below the NSW DECCW air quality criteria of 30 µg/m³ and is comparable to levels monitored in the area.

8.2.4 Predicted Annual Average Dust Deposition (Insoluble Solids)

Predicted annual average dust deposition due to emissions from AGN are presented in Table 7.2 and Figure B11.3. The modelling results show that residence 6 is the most affected by emissions from AGN alone. Residence 6 is predicted to experience an annual average dust deposition rate of less than 0.1 g/m²/month due to emissions from AGN. This is a small fraction of the NSW DECCW air quality criteria of 2 g/m²/month.

Predicted annual average dust deposition rates due to emissions from AGN, Warkworth, MTO and Bulga are presented in Table 7.3 and Figure B11.6. The modelling results show that dust deposition rates at sensitive receptors are expected to be below the NSW DECCW air quality criterion of 4 g/m²/month. All sensitive receptors are predicted to experience dust deposition rates of less than 3 g/m²/month when including a background dust deposition value of 2 g/m²/month.

8.3 Comparison with Previous Assessments

Comparisons between this assessment and the previous air quality assessment performed for the Abbey Green mining operation are presented in this section.

8.3.1 Estimated emissions

Analysis of estimated emissions between this assessment and the previous assessment shows that there is no significant difference between the total TSP emissions for each operation. The total estimated emissions for both assessments is approximately 1,800,000 +/- 100,000 kg per annum.

8.3.2 Modelling Methodology

The modelling methodology in this assessment was essentially the same as that employed in 2002 (the air quality assessment performed to support the development of the Abbey Green Open Cut coalmine) with the following differences:

- a different meteorological data set was used in each assessment; and
- ISCMOD has improved initial dispersion algorithms. This is expected influence predictions of the maximum 24 hour PM_{10} concentration. It is noted that the previous assessment was conducted prior to the introduction of 24 hour impact criteria for PM_{10} emissions in NSW.

8.3.3 Modelling Results

A comparison between modelling results between the assessment performed in 2002 and this assessment is presented in Table 8.1.

Table 8.1: Comparison of Modelling Results

Mining operations	Pollutant	Averaging period	Maximum Predicted Impact at Sensitive Residence	
			2002 Assessment	2009 Assessment
Abbey Green operations only	PM_{10}	24 hour maximum	NA	13 µg/m³
		Annual	3 µg/m³	1.6 µg/m³
	TSP	Annual	4 µg/m³	2 µg/m³
	Dust deposition	Annual	0.2 g/m²/month	0.1 g/m²/month
Abbey Green and surrounding mines	PM_{10}	Annual	28 – 29 µg/m³	20.7 µg/m³
	TSP	Annual	37 – 38 µg/m³	47.1 µg/m³
	Dust deposition	Annual	< 2 g/m²/month	2.69 g/m²/month

[a] NA: Not applicable

Relative to 2002, lower impacts are predicted at the worst affected location in 2009 for the project alone. Predicted impacts due to operations at AGN are expected to be minor in comparison to impacts from surrounding mining operations.

Relative to 2002, total cumulative levels predicted in 2009 reduce for annual PM_{10}, but increase for TSP and deposited dust. The total cumulative levels are unlikely to be greatly influenced by the project.

Overall predicted impacts are below all applicable criteria for the project in isolation and for total cumulative impacts.

9 MONITORING AND MITIGATION MEASURES

The modelling results are based on the assumption that dust control measures will be applied to operations for the AGN project, similar to those historically applied at Abbey Green South and at MTO and elsewhere in the Hunter Valley. Detailed air quality management procedures currently govern the management of air quality across MTO. These procedures are part of Coal & Allied's procedures for blasting, air quality monitoring and assessment and dust management.

It is appropriate to ensure that dust emissions are kept to the minimum practicable level, and thus ensuring that cumulative impacts with other mining projects are kept within acceptable levels. This section outlines procedures proposed for the management and control of dust emissions.

Proposed dust management and control procedures

The following procedures are proposed for the management of dust emissions from AGN. The aim of these procedures is to minimise the emissions of uncontrolled dust. Dust can be generated from two primary sources, these being:

- wind blown dust from exposed areas; and
- dust generated by mining activities.

Different sources of wind blown dust and recommended control procedures are listed in Table 9.1. Different sources of mining generated dust and recommended control procedures are listed in Table 9.2.

Table 9.1: Control Procedures for Wind Blown Dust

Source	Control Procedures
Areas disturbed by mining	Disturb only the minimum area necessary for mining. Reshape, topsoil and rehabilitate completed overburden emplacement areas as soon as practicable after the completion of overburden tipping.
Coal handling areas	Maintain coal-handling areas in a moist condition using water carts to minimise wind blown and traffic generated dust.
Coal product stockpiles	Maintain water sprays on product stockpiles and use sprays to reduce the risk of airbourne dust.

Table 9.2: Control Procedures for Mining Generate Dust

Source	Control Procedures
Road dust	All roads and trafficked areas will be watered using water carts to minimise the generation of dust.
	All haul roads will have edges clearly defined with marker posts or equivalent to control their locations, especially when crossing large overburden emplacement areas.
	Obsolete roads will be ripped and re-vegetated.
Minor roads	Development of minor roads will be limited and the locations of these will be clearly defined.
	Minor roads used regularly for access etc will be watered.
	Obsolete roads will be ripped and re-vegetated.
Topsoil stripping	Access tracks used by topsoil stripping scrapers during their loading and unloading cycle will be watered.
Topsoil stockpiling	Long term stockpiles, not used for over 6 months will be re-vegetated.
Drilling	Dust aprons will be lowered during drilling
	Drills will be equipped with dust extraction cyclones, or water injection systems.
	Water injection or dust suppression sprays will be used when high levels of dust are being generated.
Blasting	Adequate stemming will be used at all times and blasting when wind speeds are below 5 m/s and not in the direction of residents.
Raw coal bins	Automatic sprays, or other dust control mechanisms will be used when tipping raw coal that generates excessive dust quantities.
Coal preparation plant	All spillage of material will be cleaned up to prevent dust. Water sprays are/will be fitted at all transfer points.

It is envisaged that the existing approved monitoring network program as a part of the Coal & Allied Environmental Management System, (EMS) will be adequate to monitor the performance of the AGN project.

10 CONCLUSIONS

This air quality assessment has examined the expected air quality impacts due to operation of the proposed AGN project. Potential air quality impacts examined are those due to emissions of various classes of particulate matter (TSP, PM_{10} and deposition of insoluble solids). The analysis covers two stages of the proposed project, corresponding to maximum overburden and coal transfer rates. These scenarios were modelled to provide results from worst case conditions.

The assessment of impacts expected to arise through emissions of particulate matter have focussed on assessing compliance with NSW DECCW criteria for the maximum predicted 24-hour average PM_{10} concentration, annual average concentrations of PM_{10} and TSP and annual average dust (insoluble solids) deposition rates. The assessment takes into account all mining operations expected to be active during the life of the mine and include a background allowance for all other sources that cannot be accounted for directly in the model.

Comparisons between this assessment and the previous air quality assessment performed for the Abbey Green mining operation were performed as part of the assessment. Similar impacts are predicted at surrounding residences in both assessments. Predicted impacts due to operations at AGN are expected to be minor in comparison to impacts from surrounding mining operations. As such, it is envisaged that the existing approved monitoring network program as a part of the Coal & Allied Environmental Management System, (EMS) will be adequate to monitor the performance of the AGN project.

11 REFERENCES

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APPENDIX A

Estimation of Emissions

A.1 ESTIMATION OF EMISSIONS

A.1.1 Operations on Overburden

A.1.1.1 Drilling Overburden

Analysis of data obtained from RTCA showed that the maximum number of holes drilled in a year for the Abbey Green project between 2004 and 2008 was found to be 6,700. Therefore, it was conservatively assumed that that the maximum number of holes drilled in overburden in an annual period would be 10,000. Emissions of TSP were estimated using the emission factor for drilling of 0.59 kg per hole (USEPA, 1985). Therefore, emissions of TSP from drilling overburden are estimated to be 5,900 kg per year.3

A.1.1.2 Blasting Overburden

Emissions from blasting overburden were estimated using the following emission factor equation from USEPA (1985):

$$EF_{TSP} = 0.00022 \times A^{1.5}$$

where:

EF_{TSP}	=	Emission factor for TSP from blasting	(kg/blast)
A	=	Area to be blasted	(m²)

Analysis of data provided by RTCA shows that the area of a typical blast is 24,855 m². The estimated emission from a typical blast is 862 kg. Analysis of data provided by RTCA indicates that the typical number of blasts per year is 36. Therefore, emissions of TSP from blasting overburden are estimated to be 31,300 kilograms per year.

A.1.1.3 Dozers on Overburden Dumps

It was assumed that 3,258 dozer hours will be devoted to working on overburden dumps. Emissions were estimated using the following emission factor equation from USEPA (1985):

$$EF_{TSP} = 2.6 \times \frac{s^{1.2}}{M^{1.3}}$$

where:

EF_{TSP}	=	Emission factor for TSP from dozers	(kg/hour)
s	=	Silt content of material bulldozed	(%)
M	=	Moisture content of material bulldozed	(%)

Taking the moisture content to be 2% and the silt content of overburden to be 10% based on recent measurements performed in the Hunter Valley, the emission factor is

estimated to be 16.7 kg per hour. Therefore, the total TSP emission from dozers working on overburden dumps is estimated to be 54,515 kg per year.

A.1.1.4 Dozers on Overburden assisting Excavators

It was assumed that 3,308 dozer hours will be devoted to assisting the excavator handling overburden. The USEPA emission factor equation used to estimate emissions is provided in Section A.1.1.3 and is estimated to be 16.7 kg per hour. Therefore, the total TSP emission from dozers on overburden assisting excavators is 55,240 kg per year.

A.1.1.5 Loading Overburden to Trucks

Loading overburden to trucks will generate emissions of TSP. The rate of emission is dependent on the wind speed and the moisture content of the overburden. Emissions were estimated using the following emission factor equation from USEPA (1985):

$$EF_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$$

where:

EF_{TSP}	=	Emission factor for TSP from loading overburden to trucks	(kg/tonne)
k	=	Particulate size specific factor for batch loading operations (k_{TSP} = 0.74)	(kg/tonne)
U	=	Wind speed	(m/s)
M	=	Moisture content of material loaded	(%)

The annual average value of $(U/2.2)^{1.3}$ is 1.78 for the Mount Thorley meteorological data set (using 2008 data). Assuming a moisture content of 2%, the estimated emission factor for loading overburden to trucks is 0.0021 kg per tonne.

In year three of operations, 10,000,000 bcm of overburden is estimated to be loaded into trucks and transported to the dump areas. This corresponds to the maximum rate of overburden movement in the life of AGN. Assuming a density of 2.4 t/m³, this is equivalent to approximately 24,000,000 tonnes per year. Therefore, estimated emissions from loading overburden to trucks in year three of operations is 50,510 kg per year.

In year four of operations, 7,500,000 bcm of overburden is estimated to be loaded into trucks and transported to the dump areas. This year of operation corresponds to the maximum rate of ROM coal movement in the life of AGN. Assuming a density of 2.4 t/m³, this is equivalent to approximately 16,800,000 tonnes per year. Therefore,

estimated emissions from loading overburden to trucks in year four of operations is 35,360 kg per year.

A.1.1.6 Hauling Overburden to Waste Dump

Trucks are estimated to generate approximately 1 kg of TSP per kilometre travelled by haul trucks after the application of water to haul roads to control dust emissions. The capacity of haul trucks used at AGN is 240 tonnes. Furthermore, the estimated distance from the pit to the waste dumps is approximately 3.6 kilometres or 7.2 kilometres for a return trip. Therefore, the estimated emission from hauling overburden to the waste dumps is as follows:

- Year Three operations:
- 24,000,000 [t/year] x 1/240 [trip/t] x 7.2 [km/trip] x 1 [kg TSP/km] = 720,000 [kg TSP/year]
- Year Four Operations
- 16,800,000 [t/year] x 1/240 [trip/t] x 7.2 [km/trip] x 1 [kg TSP/km] = 504.000 [kg TSP/year]

A.1.1.7 Unloading Overburden to Waste Dump

Unloading overburden to the waste dumps leads to emissions of particulate matter. Emissions were estimated using the emission factor equation for batch unloading operations provided in USEPA (1985) and presented in Section A.1.1.5. The estimated emission factor for unloading overburden to waste dumps is 0.0021 kg per tonne.

In year three of operations, 10,000,000 bcm of overburden is estimated to be loaded into trucks and transported to the dump areas. This corresponds to the maximum rate of overburden movement in the life of AGN. Assuming a density of 2.4 t/m^3, this is equivalent to approximately 24,000,000 tonnes per year. Therefore, estimated emissions from loading overburden to trucks in year three of operations is 50,510 kg per year.

In year four of operations, 7,500,000 bcm of overburden is estimated to be loaded into trucks and transported to the dump areas. This year of operation corresponds to the maximum rate of ROM coal movement in the life of AGN. Assuming a density of 2.4 t/m^3, this is equivalent to approximately 16,800,000 tonnes per year. Therefore, estimated emissions from loading overburden to trucks in year four of operations is 35,360 kg per year.

A.1.2 Operations on Coal

A.1.2.1 Drilling Coal

There will be no drilling of coal for AGN.

A.1.2.2 Blasting Coal

There will be no blasting of coal for AGN.

A.1.2.3 Dozers working on Coal

It was assumed that 3,258 dozer hours will be devoted to working on coal. Emissions were estimated using the following emission factor equation from USEPA (1985):

$$EF_{TSP} = 35.6 \times \frac{s^{1.2}}{M^{1.4}}$$

where:

EF_{TSP}	=	Emission factor for TSP from dozers	(kg/hour)
s	=	Silt content of material bulldozed	(%)
M	=	Moisture content of material bulldozed	(%)

Taking the moisture content to be 6% and the silt content of coal to be 5% based on recent measurements performed in the Hunter Valley, the emission factor is estimated to be 1.7 kg per hour. Therefore, the total TSP emission from dozers working on coal is estimated to be 5,690 kg per year.

A.1.2.4 Loading Coal to Trucks

Loading coal to trucks leads to emissions of particulate matter. Emissions were estimated using the following emission factor equation provided in USEPA (1985):

$$EF_{TSP} = \frac{0.58}{M^{1.2}}$$

where:

EF_{TSP}	=	Emission factor for TSP from dozers	(kg/tonne)
M	=	Moisture content of coal	(%)

Using a moisture content of 6%, the estimated emission factor for loading coal to trucks is 0.068 kg per tonne.

In year three of operations, 2,500,000 tonnes of ROM coal is estimated to be loaded into trucks. Therefore, estimated emissions from loading coal to trucks in year three of operations is 168,900 kg per year.

In year four of operations, 3,000,000 tonnes of ROM coal is estimated to be loaded into trucks. Therefore, estimated emissions from loading coal to trucks in year four of operations is 202,700 kg per year.

A.1.2.5 Hauling Coal to CPP

Trucks are estimated to generate approximately 1 kg of TSP per kilometre travelled by haul trucks after the application of water to haul roads to control dust emissions. The capacity of coal haul trucks used at AGN is 190 tonnes. Furthermore, the estimated distance from the pit to the ROM stockpiles is approximately 3 kilometres or 6

kilometres for a return trip. Therefore, the estimated emission from hauling coal to the ROM stockpiles is as follows:

- Year Three operations:
- 2,500,000 [t/year] x 1/190 [trip/t] x 6 [km/trip] x 1 [kg TSP/km] = 78,950 [kg TSP/year]
- Year Four Operations
- 3,000,000 [t/year] x 1/190 [trip/t] x 6 [km/trip] x 1 [kg TSP/km] = 94,740 [kg TSP/year]

A.1.2.6 Unloading Coal to Hopper

Emissions from trucks unloading ROM coal to the dump hopper were estimated using the emission factor of 0.01 kg/tonne sourced from Environment Australia (2001). Therefore, estimated emissions during year three of operations is 25,000 kg/year and estimated emissions during year four operations is 30,000 kg/year.

A.1.2.7 Re-handle Coal at the ROM Hopper

Emissions from the rehandling of coal at the ROM hopper will also lead to emissions of particulate matter. Emissions were estimated using the emission factor of 0.01 kg/tonne sourced from Environment Australia (2001). Activity data was estimated by allowing for 10% of ROM coal to be dumped to the temporary stockpile and reloaded to the hopper. Therefore, estimated emissions from the re-handle of coal at the ROM Hopper are as follows:

- Year Three operations:
- 2,500,000 [t/year] x 0.1 x 0.01 [kg TSP/t] = 2,500 [kg TSP/year]
- Year Four Operations
- 3,000,000 [t/year] x 0.1 x 0.01 [kg TSP/t] = 3,000 [kg TSP/year]

A.1.2.8 Loading Coal to Stockpiles

Loading coal to stockpiles will generate emissions of TSP. The rate of emission is dependent on the wind speed and the moisture content of the coal. Emissions were estimated using the following emission factor equation from USEPA (1985):

$$EF_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$$

where:

EF_{TSP} = Emission factor for TSP from loading overburden to trucks (kg/tonne)

k	=	Particulate size specific factor for batch loading operations (k_{TSP} = 0.74)	(kg/tonne)
U	=	Wind speed	(m/s)
M	=	Moisture content of material loaded	(%)

The annual average value of $(U/2.2)^{1.3}$ is 1.78 for the Mount Thorley meteorological data set (using 2008 data). Assuming a moisture content of 6%, the estimated emission factor for loading coal to stockpiles is 0.00045 kg per tonne.

Therefore, the estimated emission from loading coal to stockpiles is as follows:

- Year Three operations:
- 2,500,000 [t/year] x 0.00045 [kg TSP/t] = 1,130 [kg TSP/year]
- Year Four Operations
- 3,000,000 [t/year] x 0.00045 [kg TSP/t] = 1,360 [kg TSP/year]

A.1.2.9 Loading Coal to Trains

Emissions from loading coal to trains were estimated using the emission factor equation presented in Section A.1.2.8. Estimated emissions of TSP from train loading are as follows:

- Year Three operations:
- 1,750,000 [t/year] x 0.00045 [kg TSP/t] = 790 [kg TSP/year]
- Year Four Operations
- 2,100,000 [t/year] x 0.00045 [kg TSP/t] = 950 [kg TSP/year]

A.1.3 Miscellaneous Activities

A.1.3.1 Graders on Roads

Emissions from graders were estimated using the following emission factor equation provided in USEPA (1985):

$$EF_{TSP} = 0.0034 \times S^{2.5}$$

where:

EF_{TSP}	=	Emission factor for TSP from graders	(kg/km)
M	=	Speed of grader	(km/hour)

Using an average speed of 8 km per hour, the estimated emission factor for graders on roads is 0.62 kg per tonne. Assuming 5 km of grader travel per day over 365 days per year, the distance travelled annually by the grader will be 1,825 km per year. Therefore, emissions of TSP from graders are estimated to be 1,120 kg per year.

A.1.4 Wind Erosion

The emission factor equation for wind erosion is provided below:

$$EF_{TSP} = 1.9 \times \left(\frac{s}{1.5}\right) \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right)$$

where:

EF_{TSP}	=	Emission factor for TSP from wind erosion	(kg/ha/day)
s	=	Silt content of exposed material	(%)
p	=	Number of rain days per year	(days/year)
f	=	Frequency of the time that wind speed is greater than 5.4 m/s	(%)

The long term average number of rain days for this location is 75 (Bureau of Meteorology average of records for Singleton Army, Singleton Waterboard, Cessnock airport and Cessnock stations. From the meteorological data file used in the modelling the percentage of winds above 5.4% is 12.8%. For a silt content of 10% (i.e. waste emplacement dams), the emission factor is 13.3 kg per ha per day. For a silt content of 5% (i.e. coal stockpiles), the emission factor is 6.7 kg per ha per day.

A.1.4.1 Wind Erosion from Exposed Working Areas

There will be an estimated 57 hectares of exposed land associated with the Abbey Green North pit and 66 hectares associated with the waste emplacement areas. There will be two waste emplacement areas with exposed areas of approximately 53 hectares and 13 hectares each. Therefore, the annual TSP emissions from wind erosion is as follows:

AGN Pit **=** 57 [ha] x 13.3 [kg TSP/ha/d] x 365

= 277,550 [kg TSP/y][a]

Waste emplacement area 1 **=** 53 [ha] x 13.3 [kg TSP/ha/d] x 365

= 258,240 [kg TSP/y]

Waste emplacement area 2 **=** 13 [ha] x 13.3 [kg TSP/ha/d] x 365

= 63,950 [kg TSP/y]

[a] The results of the emission estimation calculation are slightly different to calculated values based on displayed variables due to rounding of variables displayed in this report.

A.1.4.2 Wind Erosion from ROM Stockpiles

The ROM stockpile at the Mount Thorley Coal Loader is estimated to occupy 11.9 hectares. Therefore, the annual TSP emissions from the ROM stockpile are as follows:

ROM Stockpile **=** 11.9 [ha] x 6.7 [kg TSP/ha/d] x 365 = 29,000 [kg TSP/y]

However, the emissions from the ROM stockpile are attributed to operations from Abbey Green North, Warkworth mine and Mount Thorley mine. Therefore, to estimate the emissions from the ROM stockpile attributable to AGN the wind erosion emissions have been scaled according to the throughput from AGN in comparison to the total throughput to the Mount Thorley Coal Loader. The total throughput for the ROM stockpiles for the Mount Thorley Coal Loader is estimated be to 28 Mt ROM per annum.

Therefore emissions from the ROM stockpile attributable to AGN are as follows:

- Year Three operations:
- 2,500,000 [t/year]/28,000,000 [t/year] x 29,000 [kg TSP/y] = 2,600 [kg TSP/year]
- Year Four Operations
- 3,000,000 [t/year] /28,000,000 [t/year] x 29,000 [kg TSP/y] = 3,100 [kg TSP/year]

A.1.4.3 Wind Erosion from Product Stockpiles

The product stockpile at the Mount Thorley Coal Loader is estimated to occupy 4 hectares. Therefore, the annual TSP emissions from the ROM stockpile are as follows:

Product Stockpile **=** 4.0 [ha] x 6.7 [kg TSP/ha/d] x 365 = 9,800 [kg TSP/y]

However, the emissions from the product stockpile are attributed to operations from Abbey Green North, Warkworth mine and Mount Thorley mine. Therefore, to estimate the emissions from the product stockpile attributable to AGN the wind erosion emissions have been scaled according to the throughput from AGN in comparison to the total throughput to the Mount Thorley Coal Loader. The total throughput for the Mount Thorley Coal Loader is estimated to be 28 Mt ROM per annum.

Therefore emissions from the product stockpile attributable to AGN are as follows:

- Year Three operations:
- 2,500,000 [t/year]/28,000,000 [t/year] x 9,800 [kg TSP/y] = 875 [kg TSP/year]
- Year Four Operations
- 3,000,000 [t/year]/28,000,000 [t/year] x 9,800 [kg TSP/y] = 1,050 [kg TSP/year]

A.2 SUMMARY OF EMISSIONS

A summary of estimated TSP emissions from the AGN project are provided in Table A11.1. Details on the methodology used to estimate dust emissions are provided in Appendix A.

Table A11.1: Summary of Estimated TSP Emissions from AGN

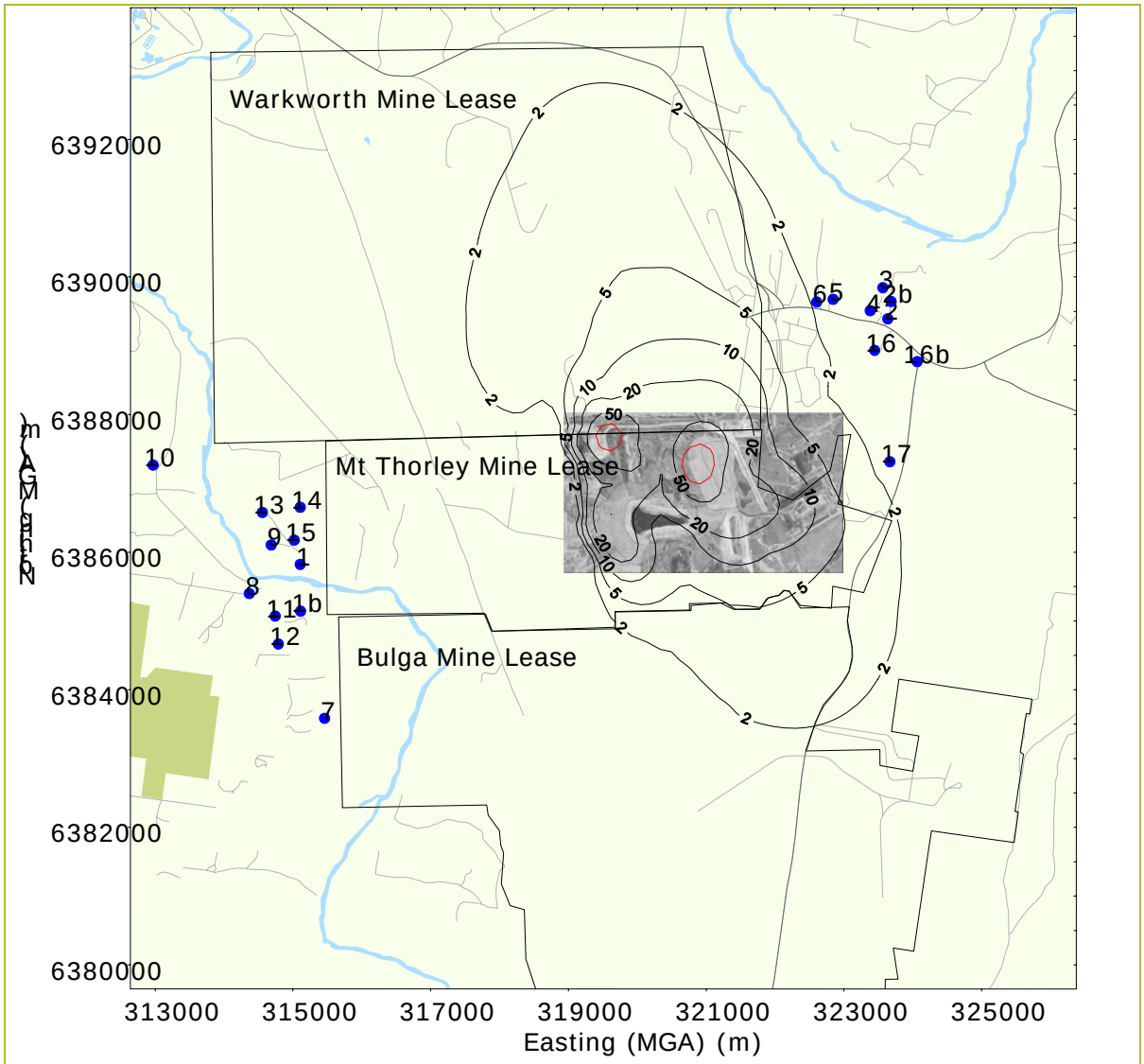
Emission Source	TSP Emission Rate (kg/year)	
	Scenario 1 (Year 3)	**Scenario 2 (Year 4)**
Drilling overburden	5,900	5,900
Blasting overburden	31,300	31,300
Dozers on overburden dumps	54,500	54,500
Dozers on overburden assisting excavators	55,400	55,400
Loading overburden to trucks	50,500	35,400
Hauling overburden to waste dump	720,000	504,000
Unloading overburden to waste dump	50,500	35,400
Dozers working on coal	5,690	5,690
Loading coal to trucks	169,000	203,000
Hauling coal to the MTCPP	78,900	94,700
Unloading coal to hopper	25,000	30,000
Re-handle coal at the ROM hopper	2,500	3,000
Loading coal to stockpiles	1,130	1,360
Loading coal to trains	791	949
Wind erosion - waste emplacement 1	258,000	258,000
Wind erosion - waste emplacement 2	63,900	63,900
Wind erosion - pit	278,000	278,000
Wind erosion - ROM stockpile	2,580	3,100
Wind erosion - Product stockpile	875	1,050
Grading roads	1,120	1,120
Total(TSP Emission)	**1,860,000**	**1,670,000**
ROM Coal Produced (t/year)	2,500,000	3,000,000
TSP/ROM (kg/t)	0.742	0.555

[a] All estimated values are displayed to 3 significant figures.

APPENDIX B

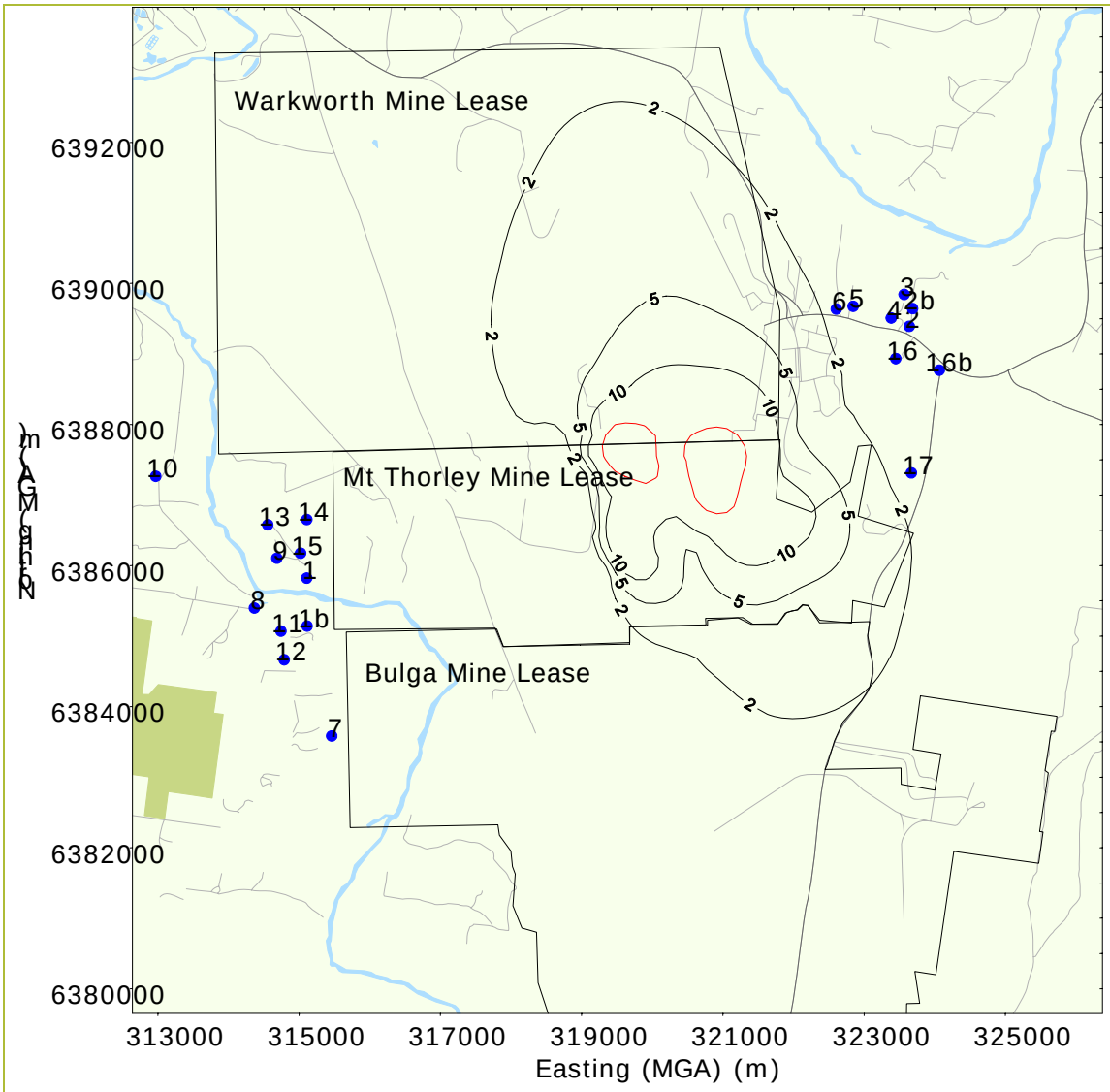
Model Results

B.1 SCENARIO 1 – ABBEY GREEN NORTH IMPACTS



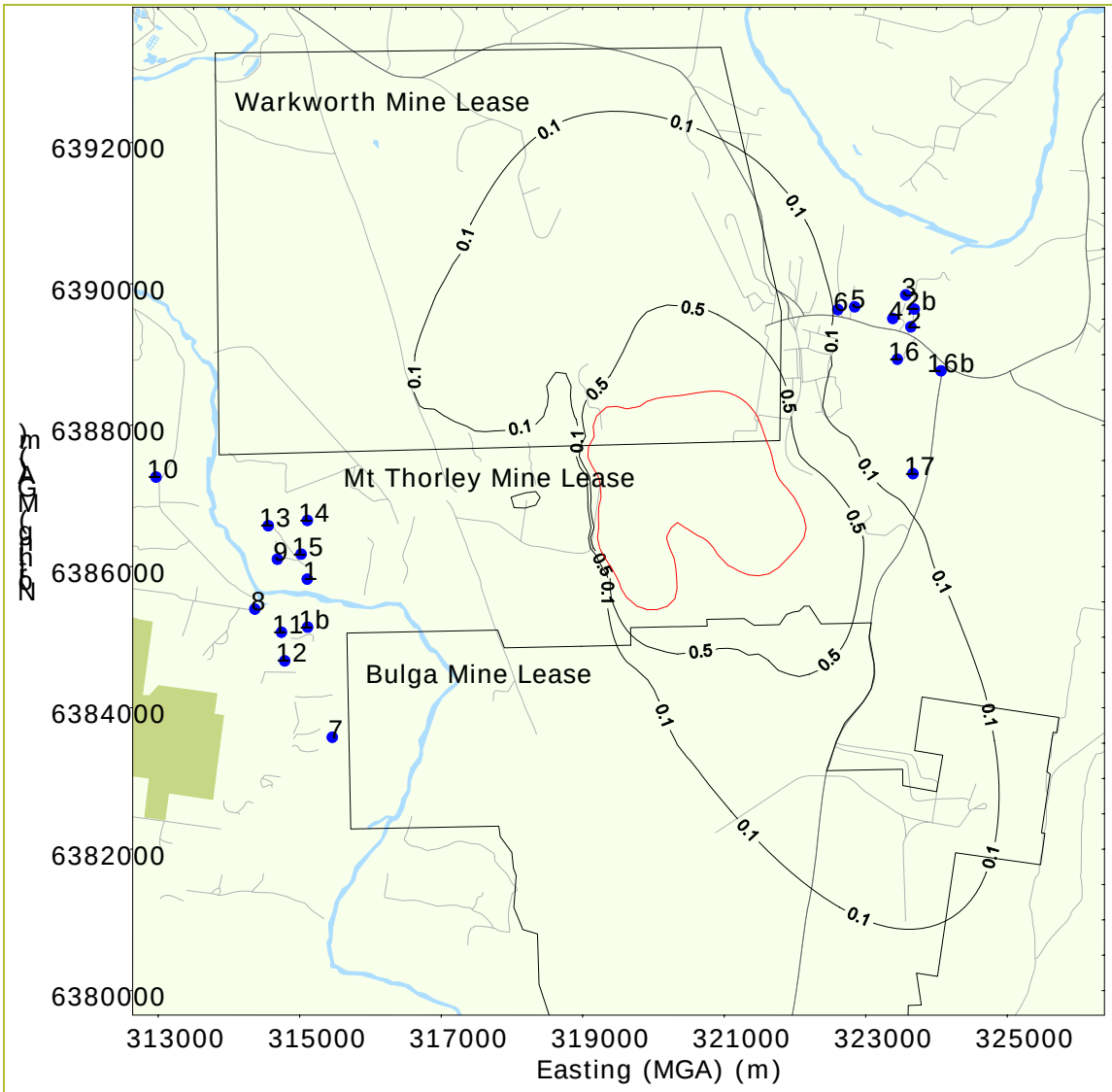
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Abbey Green North, Hunter Valley, NSW	Scenario 1 (Emissions from AGN only)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	µg/m³	90 µg/m³ (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

Figure B11.1: Scenario 1: Predicted Annual Average TSP Concentrations due to Emissions from AGN only



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Abbey Green North, Hunter Valley, NSW	Scenario 1 (Emissions from AGN only)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	µg/m³	30 µg/m³ (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

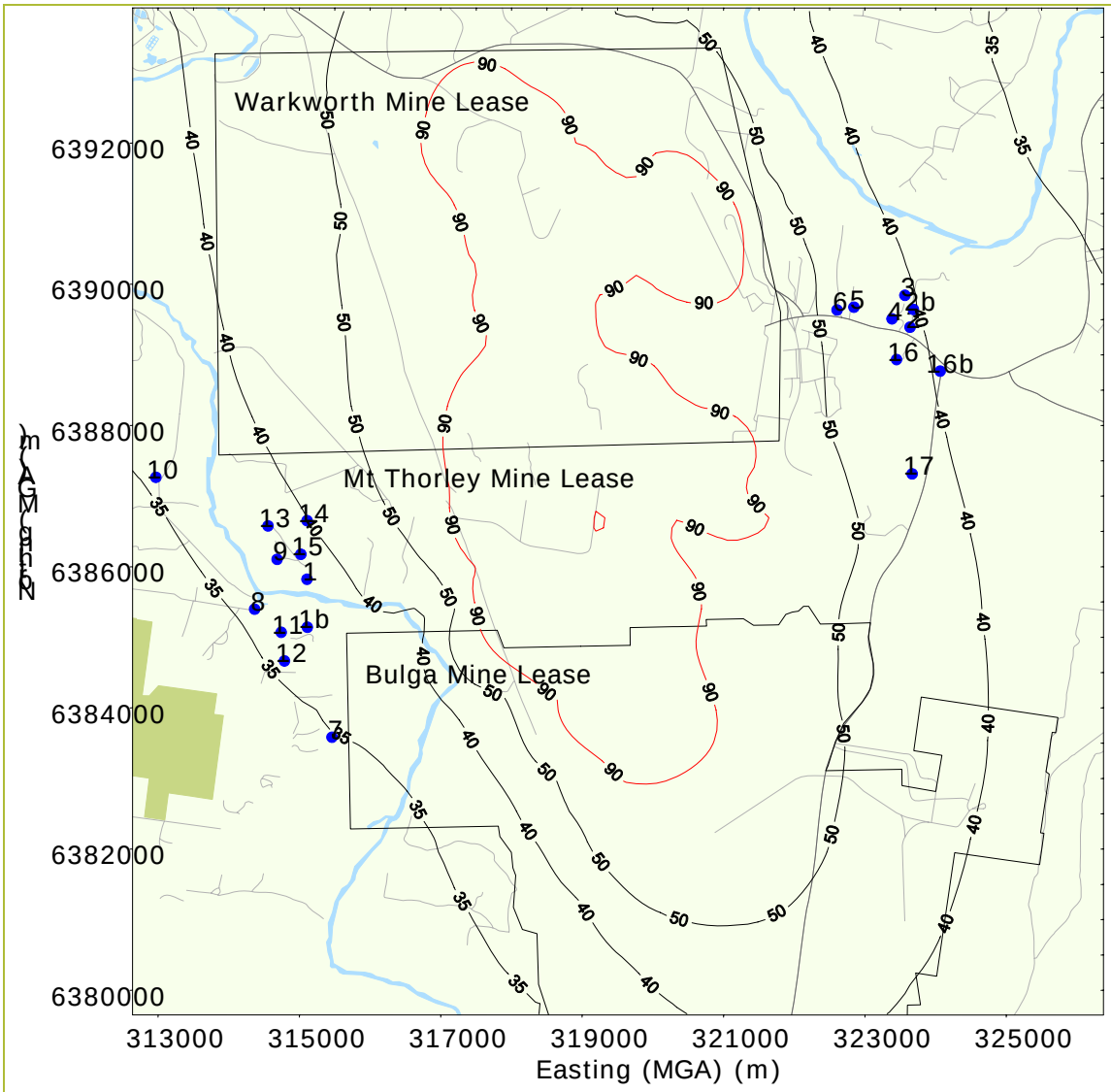
Figure B11.2: Scenario 1: Predicted Annual Average PM_{10} Concentrations due to Emissions from AGN only



Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Abbey Green North, Hunter Valley, NSW	Scenario 1 (Emissions from AGN only)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	g/m²/month	2 g/m²/month(shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

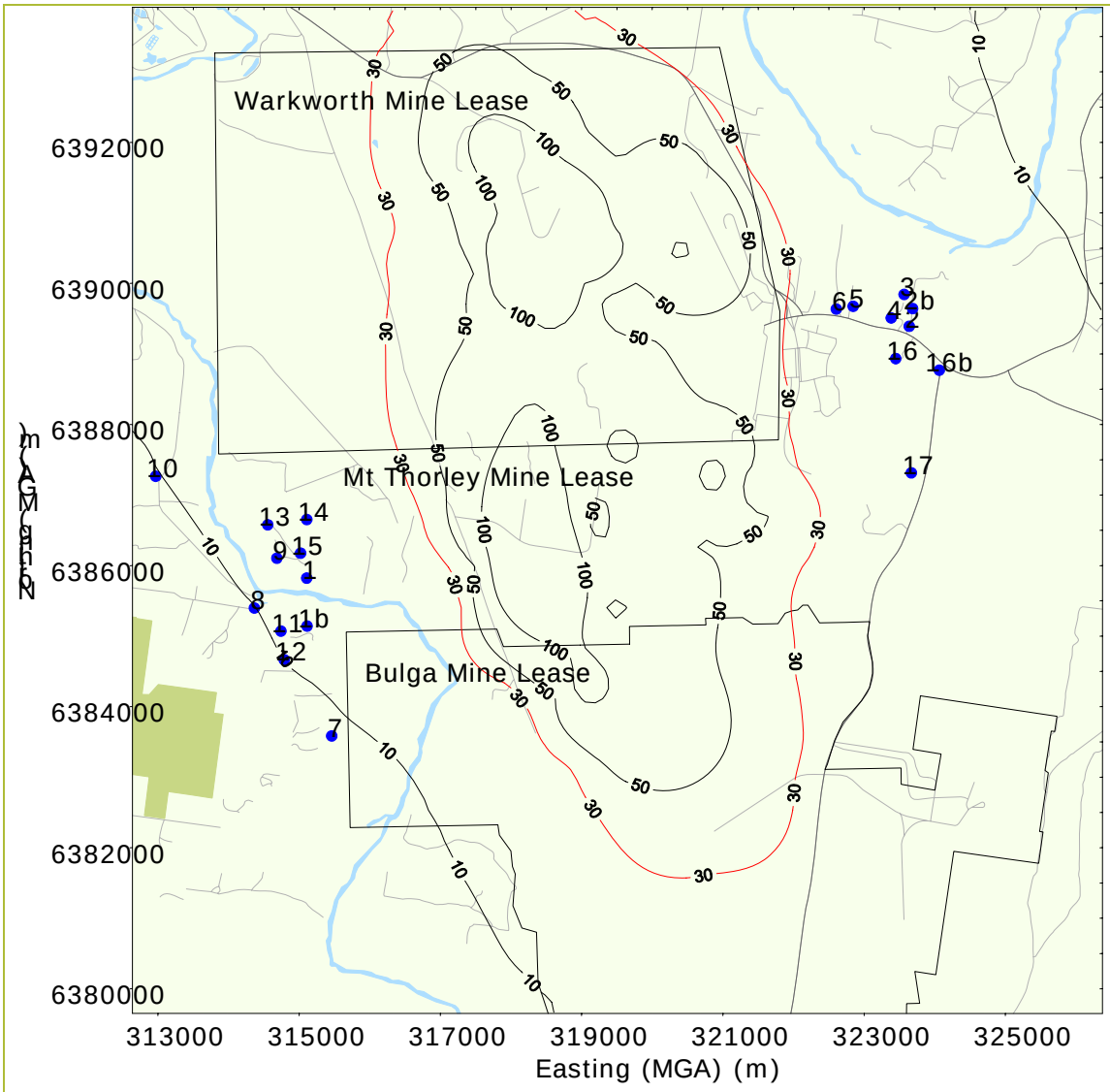
Figure B11.3: Scenario 1: Predicted Annual Average Dust Deposition Rates due to Emissions from AGN only

B.2 SCENARIO 1 – CUMULATIVE IMPACTS



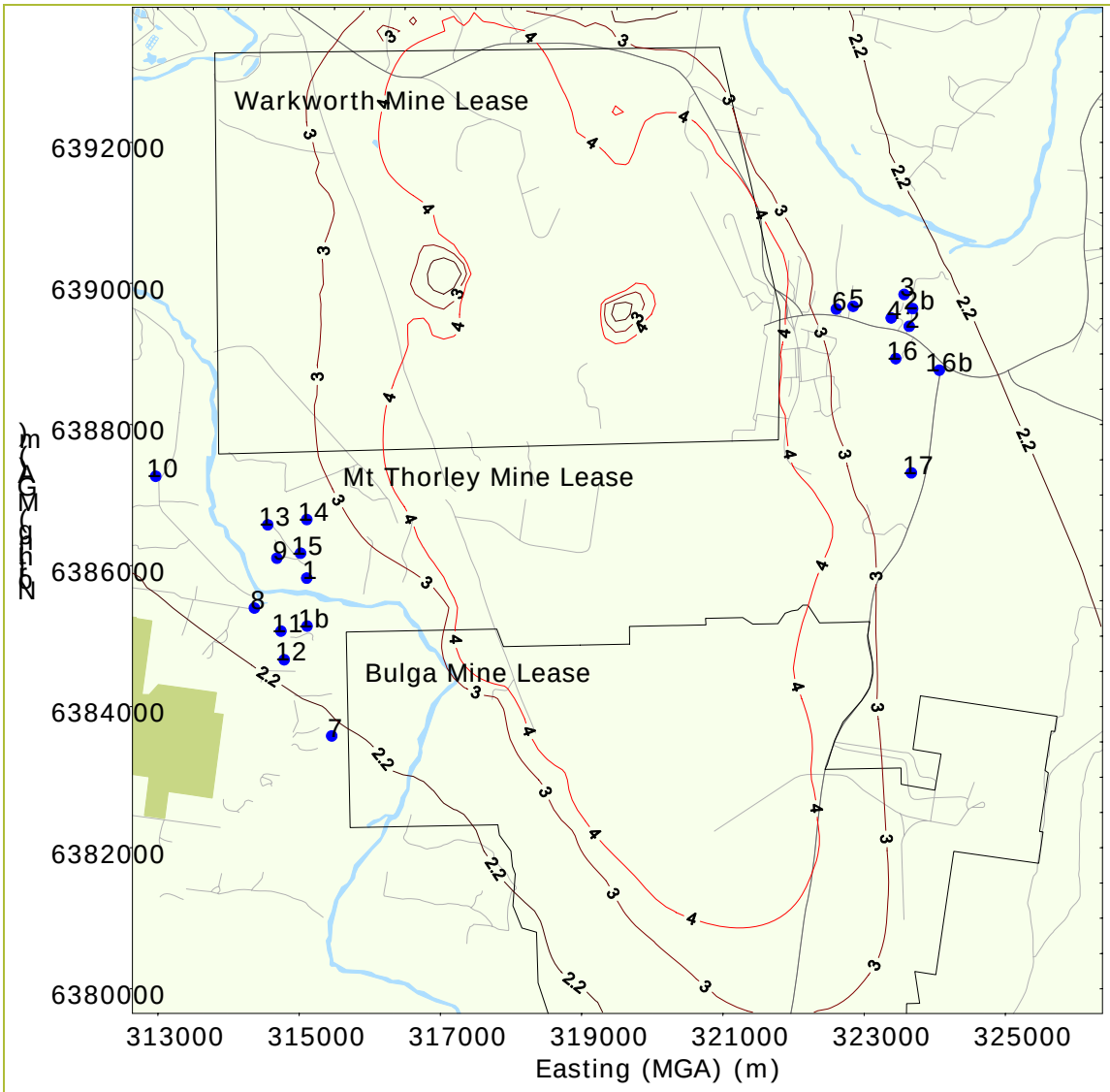
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Abbey Green North, Hunter Valley, NSW	Scenario 1 (Emissions from AGN and surrounding mines) including background (30 µg/m³)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	µg/m³	90 µg/m³ (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

Figure B11.4: Scenario 1: Predicted Annual Average TSP Concentrations due to Emissions from AGN and Surrounding Mines



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Abbey Green North, Hunter Valley, NSW	Scenario 1 (Emissions from AGN and surrounding mines) including background (5 µg/m³)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	µg/m³	30 µg/m³ (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

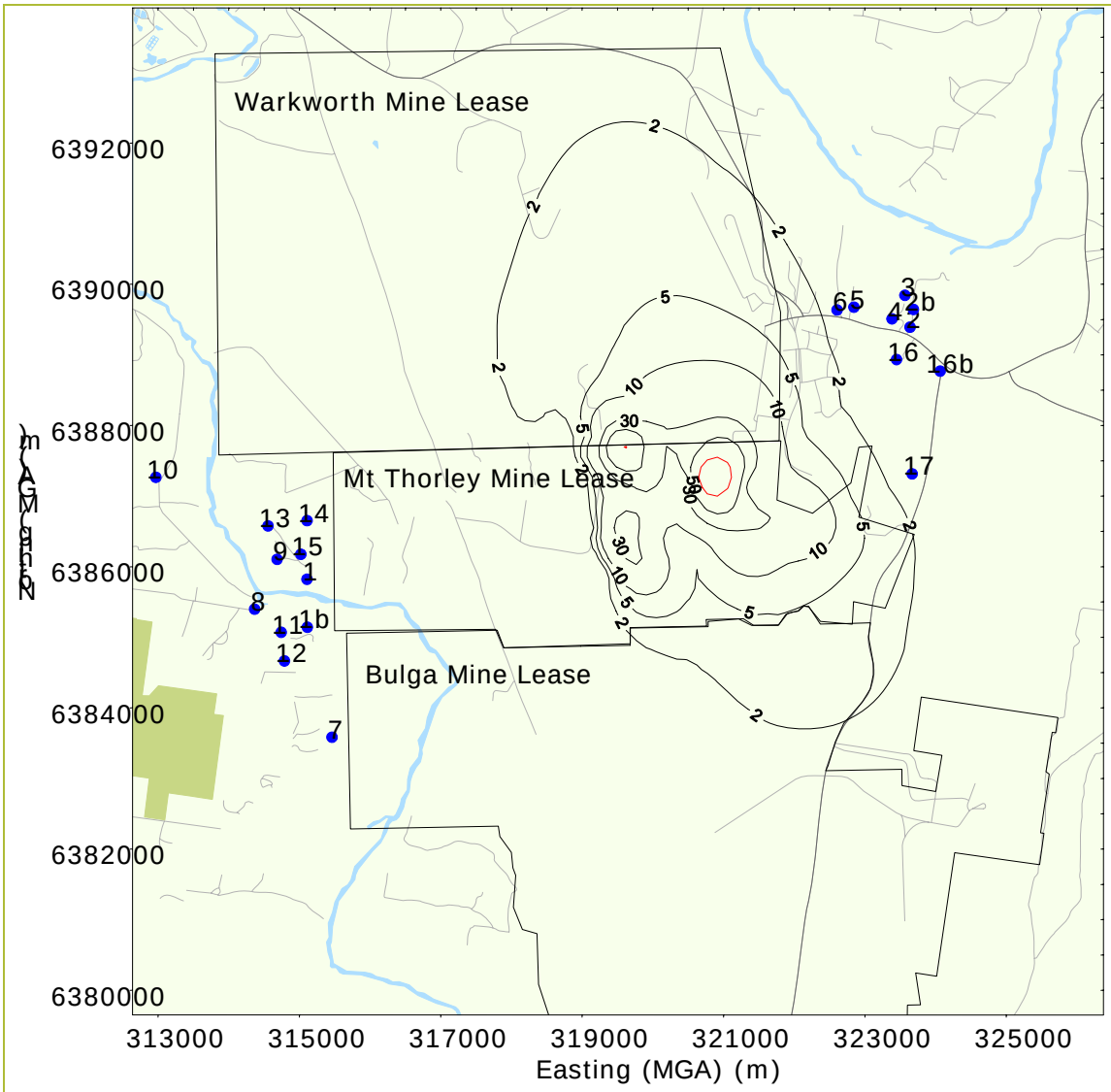
Figure B11.5: Scenario 1: Predicted Annual Average PM_{10} Concentrations due to Emissions from AGN and Surrounding Mines



Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Abbey Green North, Hunter Valley, NSW	Scenario 1 (Emissions from AGN and Surrounding Mines) including background 2 g/m²/month	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	g/m²/month	4 g/m²/month (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

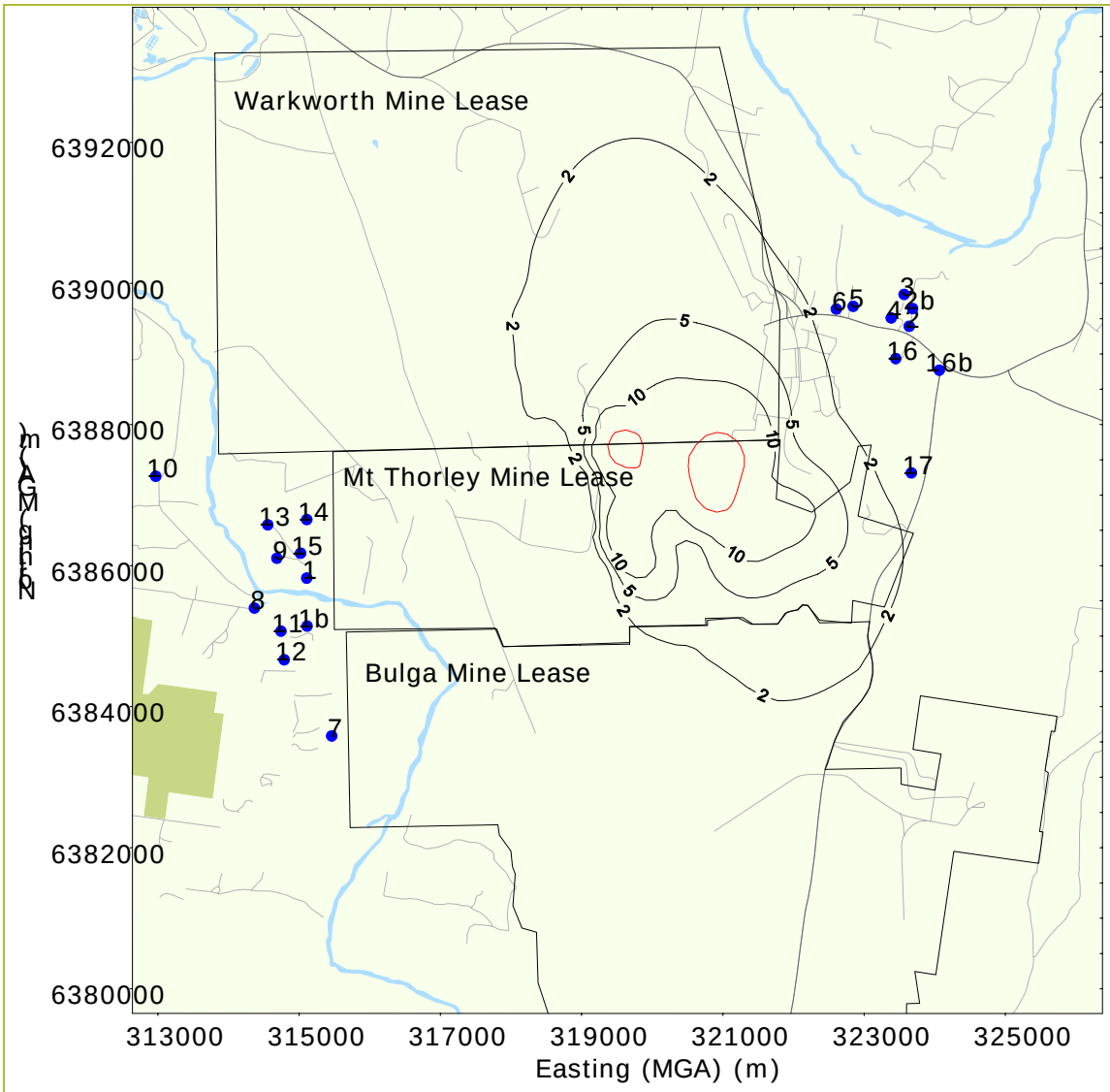
Figure B11.6: Scenario 1: Predicted Annual Average Dust Deposition Rates due to Emissions from AGN and Surrounding Mines

B.3 SCENARIO 2 – ABBEY GREEN NORTH IMPACTS



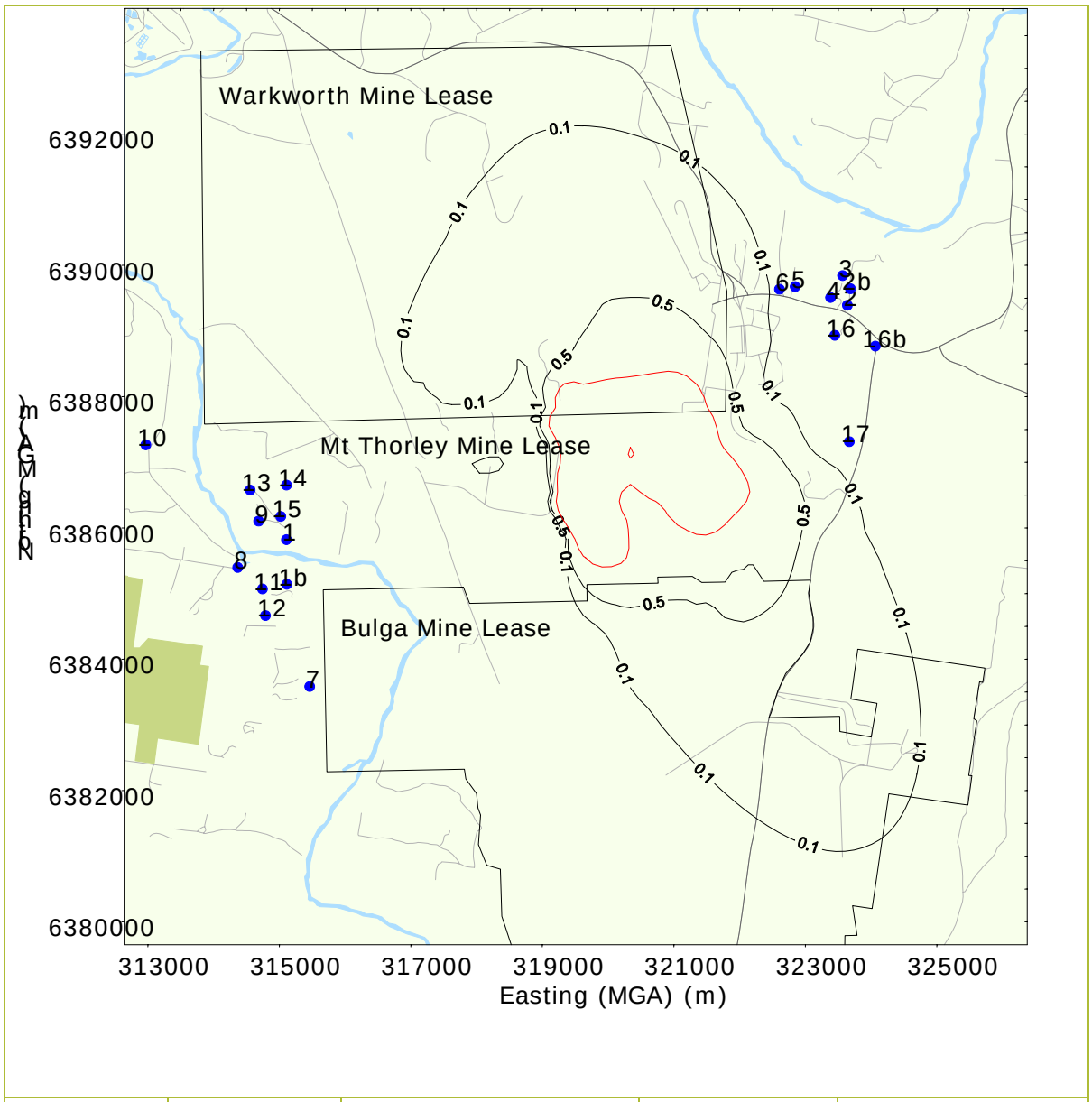
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Abbey Green North, Hunter Valley, NSW	Scenario 2 (Emissions from AGN only)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	µg/m³	90 µg/m³ (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

Figure B11.7: Scenario 2: Predicted Annual Average TSP Concentrations due to Emissions from AGN only



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Abbey Green North, Hunter Valley, NSW	Scenario 2 (Emissions from AGN only)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	µg/m³	30 µg/m³ (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

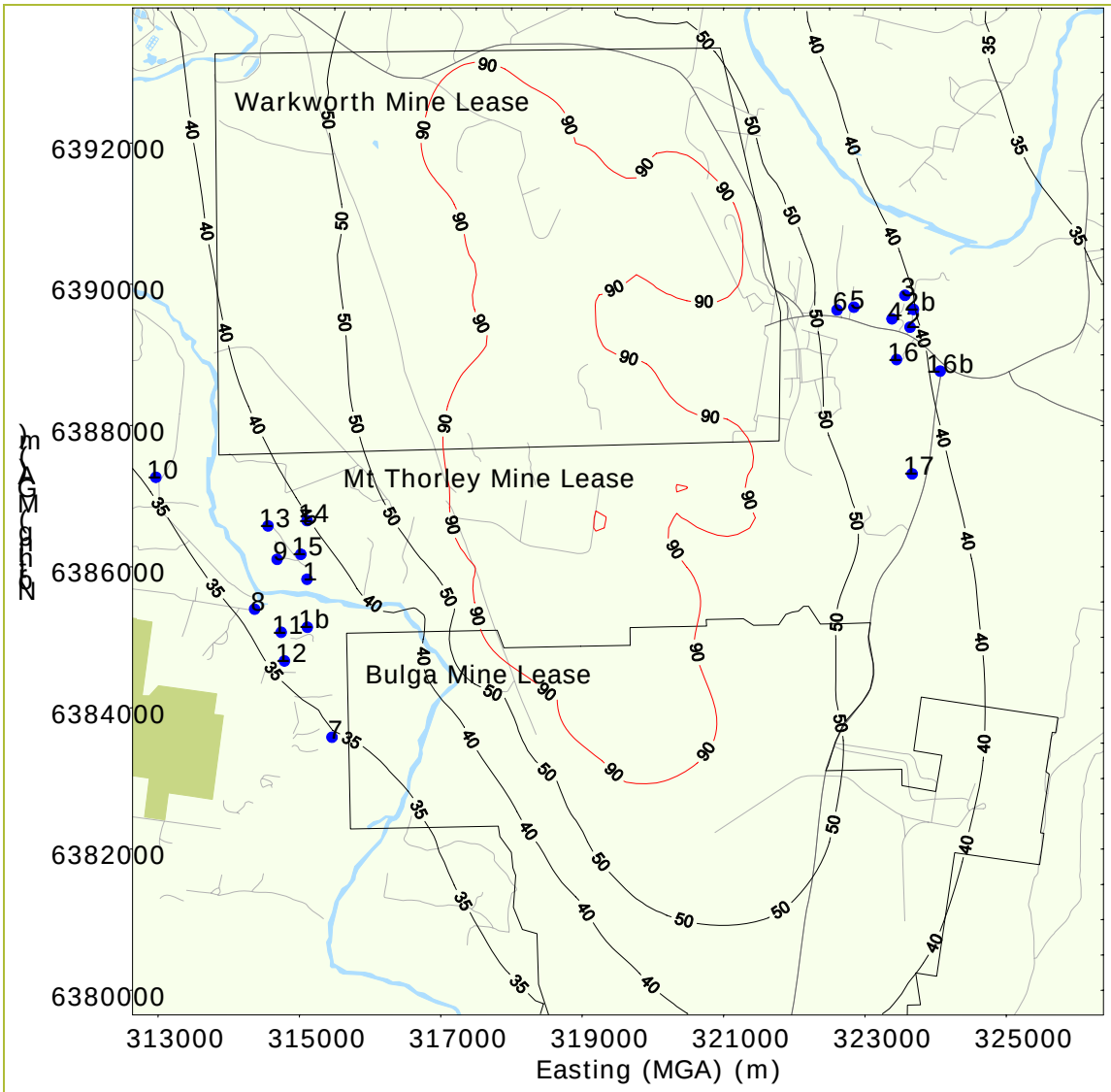
Figure B11.8: Scenario 2: Predicted Annual Average PM_{10} Concentrations due to Emissions from AGN only



Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Abbey Green North, Hunter Valley, NSW	Scenario 2 (Emissions from AGN only)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	g/m²/month	2 g/m²/month (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

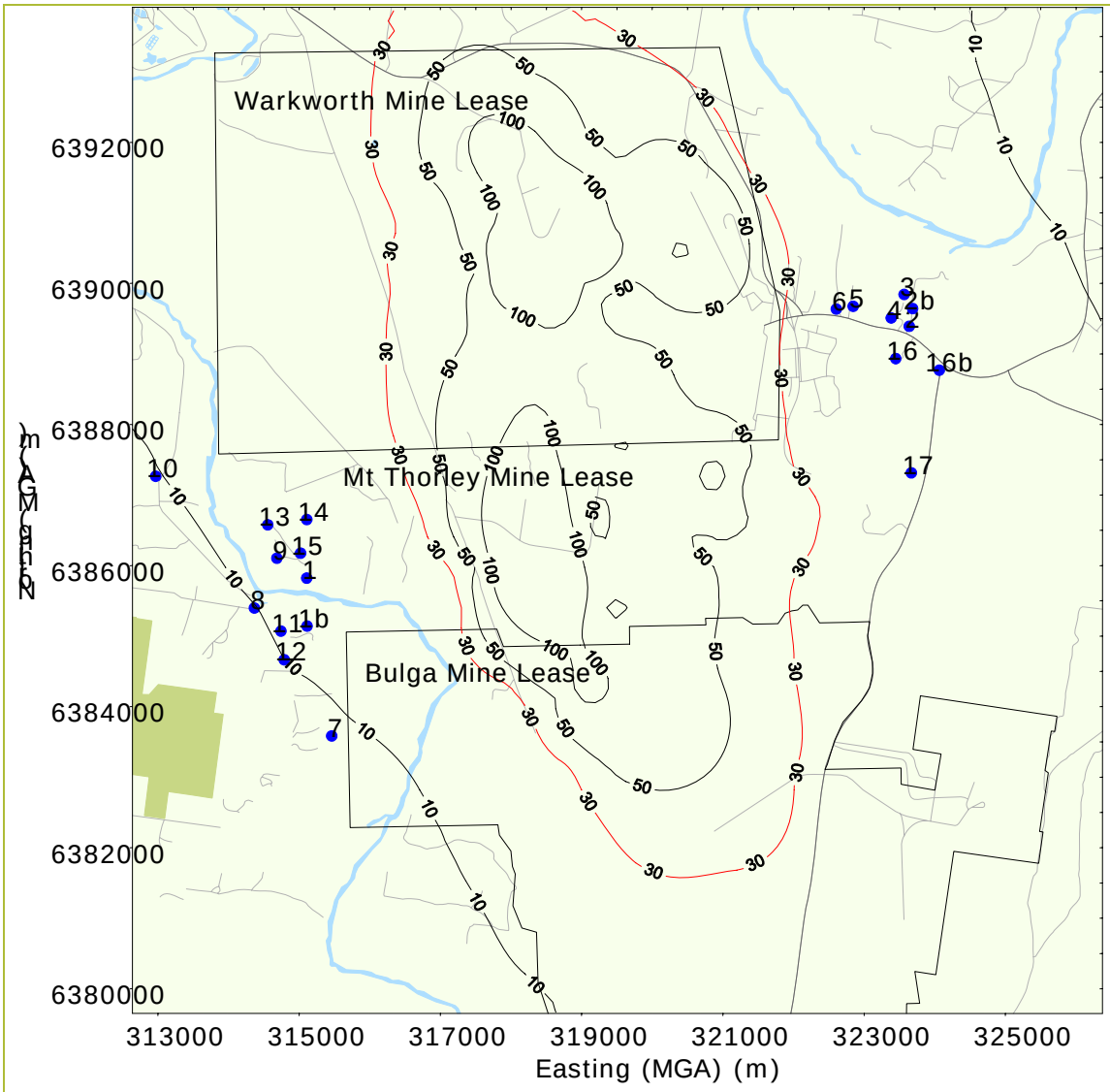
Figure B11.9: Scenario 2: Predicted Annual Average Dust Deposition Rates due to Emissions from AGN only

B.4 SCENARIO 2 – CUMULATIVE IMPACTS



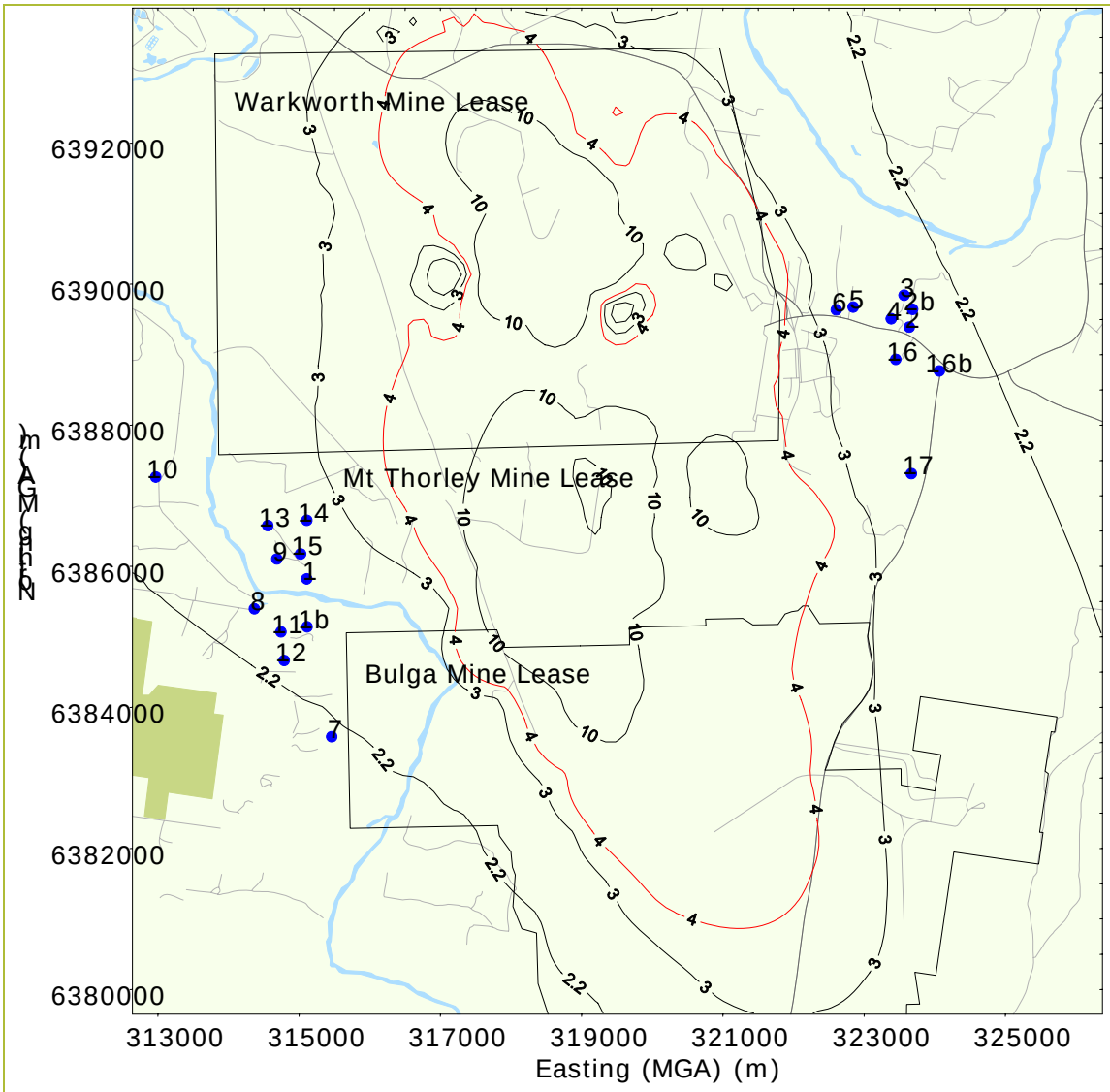
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Abbey Green North, Hunter Valley, NSW	Scenario 2 (Emissions from AGN and surrounding mines) including background (30 µg/m³)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	µg/m³	90 µg/m³ (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

Figure B11.10: Scenario 2: Predicted Annual Average TSP Concentrations due to Emissions from AGN and Surrounding Mines



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Abbey Green North, Hunter Valley, NSW	Scenario 2 (Emissions from AGN and surrounding mines) including background (5 µg/m³)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	µg/m³	30 µg/m³ (shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

Figure B11.11: Scenario 2: Predicted Annual Average PM_{10} Concentrations due to Emissions from AGN and Surrounding Mines



Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Abbey Green North, Hunter Valley, NSW	Scenario 2 (Emissions from AGN and Surrounding Mines) including background (2 g/m²/month)	Average	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	g/m²/month	4 g/m²/month(shown as red line)	2008 Mount Thorley Monitoring Data	K Bawden

Figure B11.12: Scenario 2: Predicted Annual Average Dust Deposition Rates due to Emissions from AGN and Surrounding Mines

APPENDIX C

Joint Wind Speed, Wind Direction and Stability Class Tables for Mt Thorley

PASQUILL STABILITY CLASS 'A'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000802	0.003896	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004698
NE	0.001490	0.003896	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005386
ENE	0.001719	0.004240	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005959
E	0.001260	0.004354	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005615
ESE	0.000917	0.005386	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006302
SE	0.002292	0.003438	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005729
SSE	0.002406	0.002865	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005271
S	0.001948	0.001948	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003896
SSW	0.001604	0.001260	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002865
SW	0.001031	0.001031	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002063
WSW	0.001260	0.001031	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002292
W	0.001260	0.001031	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002292
WNW	0.001031	0.001260	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002292
NW	0.000573	0.001719	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002292
NNW	0.000802	0.001604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002406
N	0.002063	0.002521	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004583
CALM									0.001948
TOTAL	0.022459	0.041480	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.065887

MEAN WIND SPEED (m/s) = 1.71
NUMBER OF OBSERVATIONS = 575

PASQUILL STABILITY CLASS 'B'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000344	0.001604	0.000115	0.000000	0.000000	0.000000	0.000000	0.000000	0.002063
NE	0.000115	0.000802	0.000229	0.000000	0.000000	0.000000	0.000000	0.000000	0.001146
ENE	0.000458	0.000802	0.001604	0.000000	0.000000	0.000000	0.000000	0.000000	0.002865
E	0.000115	0.002177	0.003438	0.000000	0.000000	0.000000	0.000000	0.000000	0.005729
ESE	0.000458	0.002750	0.002521	0.000000	0.000000	0.000000	0.000000	0.000000	0.005729
SE	0.000458	0.003667	0.000917	0.000000	0.000000	0.000000	0.000000	0.000000	0.005042
SSE	0.000802	0.002406	0.000573	0.000000	0.000000	0.000000	0.000000	0.000000	0.003781
S	0.001031	0.000458	0.000688	0.000000	0.000000	0.000000	0.000000	0.000000	0.002177
SSW	0.000344	0.000573	0.000688	0.000000	0.000000	0.000000	0.000000	0.000000	0.001604
SW	0.000344	0.000000	0.000573	0.000000	0.000000	0.000000	0.000000	0.000000	0.000917
WSW	0.000229	0.000229	0.000573	0.000000	0.000000	0.000000	0.000000	0.000000	0.001031
W	0.000458	0.000458	0.000458	0.000000	0.000000	0.000000	0.000000	0.000000	0.001375
WNW	0.000688	0.000802	0.001146	0.000000	0.000000	0.000000	0.000000	0.000000	0.002635
NW	0.000917	0.001490	0.001833	0.000000	0.000000	0.000000	0.000000	0.000000	0.004240
NNW	0.000688	0.003094	0.002521	0.000000	0.000000	0.000000	0.000000	0.000000	0.006302
N	0.000573	0.002177	0.001031	0.000000	0.000000	0.000000	0.000000	0.000000	0.003781
CALM									0.000802
TOTAL	0.008021	0.023490	0.018907	0.000000	0.000000	0.000000	0.000000	0.000000	0.051220

MEAN WIND SPEED (m/s) = 2.51
NUMBER OF OBSERVATIONS = 447

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000229	0.001031	0.000344	0.000000	0.000000	0.000000	0.000000	0.000000	0.001604
NE	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
ENE	0.000229	0.000802	0.001146	0.000458	0.000000	0.000000	0.000000	0.000000	0.002635
E	0.000229	0.001604	0.006302	0.005500	0.000000	0.000000	0.000000	0.000000	0.013636
ESE	0.000917	0.003094	0.008365	0.006990	0.000000	0.000000	0.000000	0.000000	0.019365
SE	0.000917	0.003781	0.008136	0.005615	0.000000	0.000000	0.000000	0.000000	0.018448
SSE	0.001375	0.007563	0.010198	0.006188	0.000000	0.000000	0.000000	0.000000	0.025324
S	0.001031	0.003094	0.003438	0.002063	0.000000	0.000000	0.000000	0.000000	0.009625
SSW	0.000917	0.000573	0.001604	0.000344	0.000000	0.000000	0.000000	0.000000	0.003438
SW	0.000458	0.000688	0.000917	0.000458	0.000000	0.000000	0.000000	0.000000	0.002521
WSW	0.000458	0.000229	0.000917	0.000229	0.000000	0.000000	0.000000	0.000000	0.001833
W	0.000229	0.000458	0.000802	0.000802	0.000000	0.000000	0.000000	0.000000	0.002292
WNW	0.000344	0.000917	0.002177	0.002292	0.000000	0.000000	0.000000	0.000000	0.005729
NW	0.001031	0.001833	0.005959	0.006990	0.000000	0.000000	0.000000	0.000000	0.015813
NNW	0.001146	0.004927	0.008594	0.009511	0.000000	0.000000	0.000000	0.000000	0.024178
N	0.001031	0.001948	0.001948	0.000458	0.000000	0.000000	0.000000	0.000000	0.005386
CALM									0.000229
TOTAL	0.010542	0.032543	0.060846	0.047897	0.000000	0.000000	0.000000	0.000000	0.152057

MEAN WIND SPEED (m/s) = 3.71
NUMBER OF OBSERVATIONS = 1327

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000115	0.000917	0.000344	0.000000	0.000000	0.000000	0.000000	0.000000	0.001375
NE	0.000344	0.000458	0.000115	0.000000	0.000000	0.000000	0.000000	0.000000	0.000917
ENE	0.000229	0.002063	0.001719	0.000458	0.000000	0.000000	0.000000	0.000000	0.004469
E	0.000917	0.002979	0.010427	0.003896	0.000917	0.000115	0.000000	0.000000	0.019251
ESE	0.001948	0.010771	0.022230	0.011573	0.004011	0.001719	0.000115	0.000000	0.052366
SE	0.003094	0.022917	0.025095	0.008021	0.002750	0.000229	0.000000	0.000000	0.062106
SSE	0.004583	0.046751	0.035522	0.015011	0.004354	0.001031	0.000229	0.000000	0.107483
S	0.004813	0.032084	0.018334	0.005386	0.004698	0.002063	0.000229	0.000000	0.067606
SSW	0.003323	0.007906	0.006875	0.005042	0.001604	0.001031	0.000115	0.000000	0.025897
SW	0.001490	0.002750	0.003552	0.000573	0.000229	0.000229	0.000000	0.000000	0.008823
WSW	0.000802	0.002406	0.001948	0.001260	0.000229	0.000229	0.000000	0.000115	0.006990
W	0.000573	0.003094	0.003896	0.000802	0.001031	0.000229	0.000000	0.000000	0.009625
WNW	0.002521	0.005615	0.005042	0.000573	0.002979	0.001260	0.000115	0.000000	0.018105
NW	0.003094	0.009854	0.013865	0.008594	0.009167	0.004011	0.002063	0.000688	0.051335
NNW	0.003323	0.012032	0.021772	0.028647	0.022230	0.007792	0.003094	0.000458	0.099347
N	0.001604	0.004240	0.002750	0.000802	0.000115	0.000115	0.000000	0.000000	0.009625
CALM									0.002292
TOTAL	0.032772	0.166839	0.173485	0.090638	0.054314	0.020053	0.005959	0.001260	0.547611

MEAN WIND SPEED (m/s) = 3.89
NUMBER OF OBSERVATIONS = 4779

PASQUILL STABILITY CLASS 'E'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000802	0.000344	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001146
NE	0.000344	0.001031	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001375
ENE	0.000458	0.001719	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002177
E	0.000802	0.000573	0.000115	0.000000	0.000000	0.000000	0.000000	0.000000	0.001490
ESE	0.001604	0.001604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003208
SE	0.002177	0.004354	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006531
SSE	0.004927	0.017646	0.001375	0.000000	0.000000	0.000000	0.000000	0.000000	0.023949
S	0.004011	0.017073	0.003552	0.000344	0.000000	0.000000	0.000000	0.000000	0.024980
SSW	0.002177	0.008479	0.001833	0.000917	0.000000	0.000000	0.000000	0.000000	0.013407
SW	0.001719	0.001260	0.000458	0.000000	0.000000	0.000000	0.000000	0.000000	0.003438
WSW	0.001948	0.000917	0.000344	0.000000	0.000000	0.000000	0.000000	0.000000	0.003208
W	0.002177	0.003208	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005386
WNW	0.002521	0.003323	0.002177	0.000000	0.000000	0.000000	0.000000	0.000000	0.008021
NW	0.001719	0.004354	0.005500	0.000573	0.000000	0.000000	0.000000	0.000000	0.012146
NNW	0.002750	0.004354	0.004583	0.000344	0.000000	0.000000	0.000000	0.000000	0.012032
N	0.002292	0.003323	0.000573	0.000000	0.000000	0.000000	0.000000	0.000000	0.006188
CALM									0.003552
TOTAL	0.032428	0.073565	0.020511	0.002177	0.000000	0.000000	0.000000	0.000000	0.132233

MEAN WIND SPEED (m/s) = 2.12
NUMBER OF OBSERVATIONS = 1154

PASQUILL STABILITY CLASS 'F'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.001031	0.000573	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001604
NE	0.001719	0.000802	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002521
ENE	0.001146	0.000573	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001719
E	0.001031	0.000573	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001604
ESE	0.001146	0.000802	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001948
SE	0.001146	0.001604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002750
SSE	0.001948	0.001031	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002979
S	0.002865	0.001604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004469
SSW	0.002292	0.000917	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003208
SW	0.002292	0.001490	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003781
WSW	0.002635	0.001260	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003896
W	0.002979	0.001604	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004583
WNW	0.002635	0.001490	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004125
NW	0.001948	0.001260	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003208
NNW	0.001490	0.000802	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002292
N	0.000917	0.000573	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001490
CALM									0.004813
TOTAL	0.029220	0.016959	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.050991

MEAN WIND SPEED (m/s) = 1.26
NUMBER OF OBSERVATIONS = 445

ALL PASQUILL STABILITY CLASSES

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.003323	0.008365	0.000802	0.000000	0.000000	0.000000	0.000000	0.000000	0.012490
NE	0.004011	0.006990	0.000344	0.000000	0.000000	0.000000	0.000000	0.000000	0.011344
ENE	0.004240	0.010198	0.004469	0.000917	0.000000	0.000000	0.000000	0.000000	0.019824
E	0.004354	0.012261	0.020282	0.009396	0.000917	0.000115	0.000000	0.000000	0.047324
ESE	0.006990	0.024407	0.033116	0.018563	0.004011	0.001719	0.000115	0.000000	0.088919
SE	0.010084	0.039762	0.034147	0.013636	0.002750	0.000229	0.000000	0.000000	0.100607
SSE	0.016042	0.078263	0.047668	0.021199	0.004354	0.001031	0.000229	0.000000	0.168787
S	0.015698	0.056262	0.026011	0.007792	0.004698	0.002063	0.000229	0.000000	0.112754
SSW	0.010657	0.019709	0.011000	0.006302	0.001604	0.001031	0.000115	0.000000	0.050418
SW	0.007334	0.007219	0.005500	0.001031	0.000229	0.000229	0.000000	0.000000	0.021542
WSW	0.007334	0.006073	0.003781	0.001490	0.000229	0.000229	0.000000	0.000115	0.019251
W	0.007677	0.009854	0.005156	0.001604	0.001031	0.000229	0.000000	0.000000	0.025553
WNW	0.009740	0.013407	0.010542	0.002865	0.002979	0.001260	0.000115	0.000000	0.040908
NW	0.009282	0.020511	0.027157	0.016157	0.009167	0.004011	0.002063	0.000688	0.089034
NNW	0.010198	0.026813	0.037470	0.038501	0.022230	0.007792	0.003094	0.000458	0.146557
N	0.008479	0.014782	0.006302	0.001260	0.000115	0.000115	0.000000	0.000000	0.031053
CALM									0.013636
TOTAL	0.135442	0.354876	0.273748	0.140713	0.054314	0.020053	0.005959	0.001260	1.000000

MEAN WIND SPEED (m/s) = 3.28
NUMBER OF OBSERVATIONS = 8727

FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 6.6%
B : 5.1%
C : 15.2%
D : 54.8%
E : 13.2%
F : 5.1%

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STABILITY CLASS BY HOUR OF DAY
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Hour   A    B    C    D    E    F
  01 0000 0000 0000 0235 0097 0031
  02 0000 0000 0000 0227 0099 0037
  03 0000 0000 0000 0226 0099 0038
  04 0000 0000 0000 0241 0089 0033
  05 0000 0000 0000 0218 0106 0039
  06 0012 0005 0012 0224 0081 0029
  07 0017 0017 0063 0210 0047 0009
  08 0035 0041 0093 0193 0001 0000
  09 0052 0039 0119 0153 0000 0000
  10 0062 0048 0133 0120 0000 0000
  11 0077 0048 0125 0113 0000 0000
  12 0073 0051 0137 0104 0000 0000
  13 0068 0055 0131 0111 0000 0000
  14 0068 0045 0139 0113 0000 0000
  15 0058 0041 0147 0119 0000 0000
  16 0040 0036 0132 0143 0012 0001
  17 0013 0021 0096 0188 0032 0014
  18 0000 0000 0000 0295 0052 0017
  19 0000 0000 0000 0288 0056 0020
  20 0000 0000 0000 0282 0054 0028
  21 0000 0000 0000 0258 0074 0032
  22 0000 0000 0000 0244 0083 0037
  23 0000 0000 0000 0244 0077 0042
  24 0000 0000 0000 0230 0095 0038

--------------------------------
STABILITY CLASS BY MIXING HEIGHT
--------------------------------
Mixing height    A    B    C    D    E    F
    <=500 m    0066 0062 0161 0824 1105 0423
   <=1000 m    0216 0154 0507 1602 0013 0001
   <=1500 m    0293 0231 0659 1659 0036 0021
   <=2000 m    0000 0000 0000 0477 0000 0000
   <=3000 m    0000 0000 0000 0210 0000 0000
    >3000 m    0000 0000 0000 0007 0000 0000

----------------------------
MIXING HEIGHT BY HOUR OF DAY
----------------------------
       0000  0100  0200  0400  0800  1600  Greater
        to    to    to    to    to    to   than
Hour   0100  0200  0400  0800  1600  3200  3200
  01   0035  0077  0022  0050  0131  0047  0001
  02   0036  0075  0039  0049  0128  0035  0001
  03   0037  0080  0029  0048  0126  0043  0000
  04   0036  0066  0033  0066  0123  0039  0000
  05   0115  0057  0030  0045  0087  0029  0000
  06   0072  0110  0097  0016  0043  0025  0000
  07   0106  0056  0123  0072  0003  0003  0000
  08   0000  0055  0127  0181  0000  0000  0000
  09   0000  0000  0088  0196  0079  0000  0000
  10   0000  0000  0000  0223  0140  0000  0000
  11   0000  0000  0000  0139  0224  0000  0000
  12   0000  0000  0000  0091  0274  0000  0000
  13   0000  0000  0000  0000  0365  0000  0000
  14   0000  0000  0000  0000  0365  0000  0000
  15   0000  0000  0000  0000  0365  0000  0000
  16   0000  0000  0000  0000  0364  0000  0000
  17   0004  0005  0008  0007  0331  0009  0000
  18   0005  0024  0012  0022  0277  0024  0000
  19   0013  0049  0018  0025  0186  0073  0000
  20   0024  0044  0017  0046  0177  0056  0000
  21   0028  0062  0024  0052  0148  0050  0000
  22   0035  0067  0024  0056  0135  0047  0000
```

23	0034	0068	0025	0061	0131	0044	0000
24	0033	0076	0028	0051	0130	0044	0001

Appendix C

Abbey Green North Extension Project Acoustic Assessment, prepared by Environmental Management Group Australia, 2009

EMGA

Environmental Management Group Australia

Mount Thorley Operations Modification - Abbey Green North Extension Project Acoustic Assessment

Prepared for Coal & Allied (Rio Tinto Coal Australia) - September 2009

Report No. J09005RP1 Final

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances.

Approved by:	Najah Ishac
Position:	Director - Acoustic Services
Signed:	
Date:	*11 September, 2009*

Environmental Management Group Australia

Level 4, Suite 78, 330 Wattle Street

Pyrmont NSW 2007

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Executive Summary

This report was prepared for Rio Tinto Coal Australia - Coal & Allied to assess environmental noise and vibration associated with proposed extended mining operations within the Abbey Green North (AGN) area.

The proposed modification to the existing Mount Thorley Operations (MTO) Development Consent (DA 34/95) will allow for the extension of the approved Abbey Green North (AGN) Pit by approximately 75 hectares to the west. Mining will extend into the already approved Mount Arthur, Warkworth and Bowfield seams and extract approximately 5 million tonnes of run-of-mine (ROM) coal over the life of the project.

This report has been prepared as supporting documentation to the Statement of Environmental Effects (SEE). The assessment herein is provided to demonstrate compliance with the consent conditions on noise and vibration. Due consideration is given to the NSW Department of Environment, Climate Change and Water (DECCW) *Industrial Noise Policy, ANZECC Blasting Guidelines* and other relevant standards as appropriate.

This study incorporates all of MTO and the assessment includes modelling of all major mining equipment at representative operational locations.

The noise modelling has shown that under calm weather conditions all private residential properties experience noise levels below the operational noise development consent limits as specified in DA 34/95.

Similarly, the current study indicates zero to only marginal changes in noise from that predicted previously for adverse weather conditions. The current study also shows that operational and acquisition limits are exceeded at the same locations identified in previous studies.

Coal & Allied's environmental management plans and procedures, which include ongoing noise monitoring, will be used to assess the performance of the mining operations against the consent noise limits.

Blast design will incorporate control on the maximum instantaneous charge (MIC) as described in this study and implementation of Coal & Allied's environmental management plans and procedures will ensure that acceptable limits are maintained. This will include monitoring of all MTO blasts.

1 Introduction

This report was prepared for Rio Tinto Coal Australia - Coal & Allied to assess environmental noise and vibration associated with proposed mining operations within the Abbey Green North (AGN) area. The AGN area is part of the Mount Thorley Operations (MTO), which is situated west of Singleton, NSW.

The proposed modification to the existing MTO Development Consent (DA 34/95) will allow for the extension of the approved AGN Pit by approximately 75 hectares (ha) to the west. Mining will extend into the already approved Mount Arthur, Warkworth and Bowfield seams and extract approximately 5 million tonnes of run of mine (ROM) coal over the life of the project. Extension of the AGN Pit will require the realignment of a section of haul road and the relocation of some minor items of infrastructure and services.

The AGN Pit void and the adjacent Abbey Green South (AGS) Pit void will be temporarily used to store mine water. Temporary water storage in the pit void is the only change proposed to AGS, and accordingly, AGS is not addressed further in this acoustic assessment. As approved in 2002, the final AGN Pit void will be used for the transfer of mine and decanted water between MTO and the adjacent Warkworth Mine, and the placement of tailings from Mount Thorley Warkworth (MTW). The proposal's infrastructure details are shown graphically in *Figure 1.1*.

The proposed AGN mining method is generally the same as that previously approved. The larger footprint is created through areas further west of the currently approved plan and hence further from the closest private properties to the east. The associated noise impacts are therefore expected to remain relatively unchanged as compared to the approved operations.

The expected AGN mine life is three to five years and will involve a truck and shovel campaign. This assessment includes MTO Loders pit operations, the main pit at MTO expected to occur concurrently with AGN activities. Importantly, mining in the Abbey Green South pit has been completed in April 2009, before AGN commences.

Previous studies in 1995, 2002 and 2004 provide useful reference material, however all information relevant to the current study is included herein.

This report has been prepared as supporting documentation to the Statement of Environmental Effects (SEE). The assessment is provided to demonstrate compliance with the consent conditions on noise and vibration. Due consideration is given to the NSW Department of Environment, Climate Change and Water (DECCW) *Industrial Noise Policy, ANZECC Blasting Guidelines* and other relevant standards as appropriate.

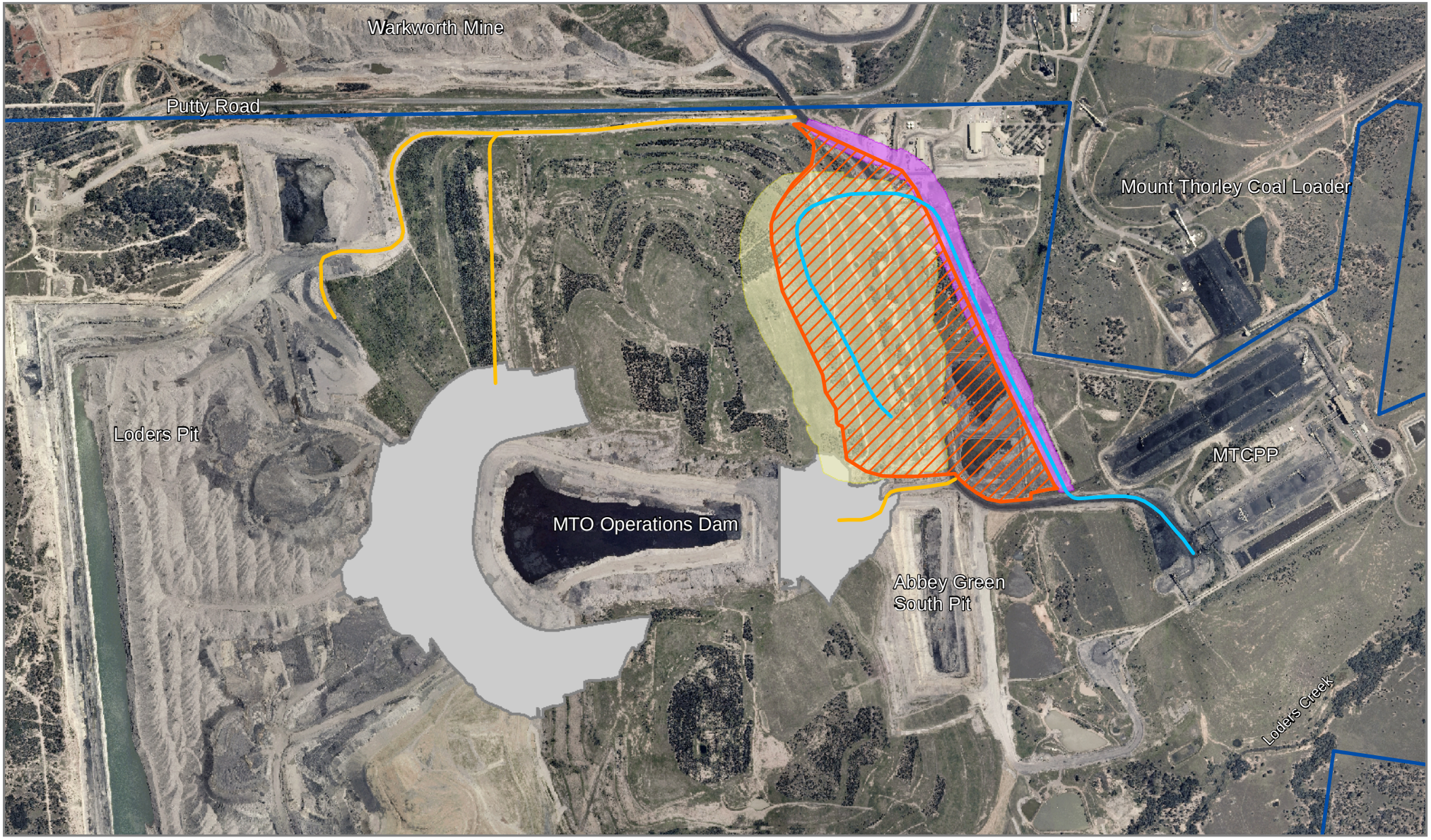
1.1 Glossary

Table 1.1 provides a glossary of noise related and other terms used in this assessment.

Table 1.1 GLOSSARY

Term	Definition
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{90} statistical noise levels
AGN	Abbey Green North
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(LinPeak)	The peak sound pressure level (not RMS) expressed as decibels with no frequency weighting
DECCW	Department of Environment, Climate Change and Water NSW (formerly Department of Environment and Climate Change)
INP	Industrial Noise Policy.
L_1	The noise level exceeded for 1% of a measurement period.
L_{10}	A noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise levels.
L_{90}	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
L_{eq}	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
L_{max}	The maximum root mean squared (RMS) sound pressure level received at the microphone during a measuring interval.
MIC_{8ms}	Maximum Instantaneous Charge (with a minimum 8 milli-sec delay).
MTO	Mount Thorley Operations
Peak Particle Velocity (ppv)	The maximum velocity of a particle of the transmission medium, used in assessment of vibration.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
RMS	Root Mean Square which is a measure of the mean displacement (velocity or acceleration) of a vibrating particle.
SEE	Statement of Environmental Effects
SI	Still isothermal (SI) refers to calm weather conditions (defined as no wind and standard temperature gradients).
sigma-theta (σ_θ)	The standard deviation of horizontal wind fluctuation.

Sound power level	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment.
Temperature inversion	A positive temperature gradient. A meteorological condition where atmospheric temperature increases with altitude to some height.



C:\GIS\EMGA\Abbey Green North SEE Fig 2-2 September 8, 2009

Kilometers
0 0.1 0.2 0.4 0.6

- Indicative coal truck haul route
- Indicative overburden truck haul route
- Indicative overburden emplacement
- Proposed rim embankment and location of new section of haul road
- Proposed AGN tailings storage facility - preliminary design
- Proposed AGN pit disturbance area
- MTO Development Consent Boundary

Figure 1.1

Indicative Locations of Associated Infrastructure

Abbey Green Project Alterations SEE

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EMGA

2 Existing Environment

2.1 Representative Assessment Locations

The previous studies identified and listed up to seventeen assessment locations, for detailed noise modelling purposes. Since those studies the ownership of some of these locations has changed. The current (as of February 2009) ownership details are shown in *Table 2.1*. The ownership changes of note are those for locations 1, 7 and 14, now being mine owned. Additional assessment locations 1b, 2b and 16b have been included for the current study.

Table 2.1 REPRESENTATIVE ASSESSMENT LOCATIONS

Location	2002 SEE Owner	Feb09 Owner	MGA56 Coordinates		Direction from AGN
			Easting	Northing	
1[1]	Slade	Miller Pohang Coal Company Pty Ltd (MTO)	315107	6385821	W
1b	NA	Miller Pohang Coal Company Pty Ltd (MTO)	315113	6385141	W
2	B and C Russell	B and C Russell	323639	6389392	NE
2b	NA	K and S Issac	323686	6389643	NE
3	K Issac	K Issac and Sharon Isaac	323567	6389843	NE
4	C Russell	Dorothy Clare Russell	323383	6389510	NE
5	P and C Russell	Paul Henry Russell	322845	6389675	NNE
6	V Kime	Carol Anne Dyson	322606	6389635	NNE
7[1]	J Feeney	Saxonvale Coal Pty Limited & Nippon Steel Australia Pty Limited	315461	6383583	SW
8	Bulga	Bulga Community Centre Incorporated	314366	6385397	WSW
9	Renaud	Andre Marc Renaud & Noela Mary Renaud	314685	6386104	W
10	Wambo	George David Lianos & Honor Claire Lianos	312970	6387265	W
11	Police	The State of NSW	314742	6385070	WSW
12	NPWS	The State of NSW	314788	6384664	WSW
13	Hexon Sands	John Charles Mulally & Peter Edwin McMaugh & Garrett John Burke	314556	6386576	W
14[1]	W Townsend	Miller Pohang Coal Company Pty Ltd (Coal & Allied)	315108	6386652	W
15	Upward	Kane Mobberley & Jodie Helen Mobberley (Upward owns coal title)	315020	6386175	W
16	S Hedley	I Hedley	323448	6388933	NE
16b	NA	I Hedley	324064	6388769	NE
17	J Hedley	I Hedley	323668	6387314	E

Notes: 1. MTO Owned.

2.2 Acoustic Climate

The areas of the selected noise assessment locations are generally rural residential and include natural sounds. For locations to the east through to the north of AGN, existing industrial noise from the Mount Thorley Industrial Estate, transportation and neighbouring mines influence their acoustic amenity.

To gain a better appreciation of the existing level of noise at assessment locations, the 2008 attended monitoring data reports commissioned by Coal & Allied were reviewed. It was found that the existing MTO were generally inaudible at most of the selected monitoring locations. At one location, 154 Broke Road, which corresponds to the current study's assessment location 17 (I Hedley), MTO noise levels were able to be directly measured. This information is summarised in *Table 2.1*. The data presented was recorded during the night period (2200 to 0700) under weather conditions that varied from calm (zero wind and temperature gradients) to adverse (source to receiver wind and or temperature inversions). It is considered that the reported range of noise levels, ie 34dB(A) to 48dB(A), is mostly attributable to the varied weather conditions.

Table 2.2 2008 ATTENDED MONITORING DATA SUMMARY – 154 BROKE RD/ASSESSMENT LOCATION 17

Measured Noise Level, dB(A)			Comments
Total L_{90}	**Total L_{eq}**	**MTO Specific L_{eq}**	
39	41	41	15/5/08
43	45	44	28/5/08
39	41	40	13/6/08
46	48	48	27/6/08
37	41	40	16/7/08; CPP = 37dB(A)
42	44	42	29/7/08
40	42	41	3/9/08
36	68	34	9/9/08
39	41	40	16/9/08
42	51	42	26/9/08
37	67	34	24/10/08
45	47	42	16/12/08
43	45	35	30/12/08

Notes: 1.Source is Global Acoustics Reports: 08012_R01, 08063_R01, 080132_R01, 08224_R01, 08147_R01. This data was not verified by EMGA.

2.3 Prevailing weather conditions

The efficiency of noise propagation over long distances can be significantly affected by the weather conditions. Of most interest are source to receptor winds and the presence of temperature inversions as both these conditions can enhance received noise levels. To account for these phenomena, the DECCW in its Industrial Noise Policy (INP), specify weather analysis procedures to determine the prevalent weather conditions that enhance noise propagation. This is to determine whether they can be described as a feature of the area. The INP states "*Wind is considered to be a feature where source-to-receiver wind speeds (at 10-m height) of 3m/s or below occur for 30 per cent of the time or more in any assessment period (day, evening, night) in any season. This differs from the procedure used with temperature inversions, in that the 30-per-cent occurrence applies to all seasons and each assessment period – and not just the winter season and night assessment period*."

For noise modelling consistency with previous studies and to facilitate a direct comparison of results, the current study has adopted the meteorological weather conditions reported in the 2002 Statement of Environmental Effects (SEE) noise study. These were derived on the interpretation of the intent of the DECCW's INP at that time. The modelled weather conditions include:

- calm condition of zero wind speed and zero temperature gradient;
- wind speed of 1m/s at 70 degrees from north;
- wind speed of 1m/s at 80 degrees from north;
- wind speed of 1.5m/s at 90 degrees from north; and
- wind speed of 2m/s at 215 degrees from north.

The selected wind directions are those that exceed the INP's 30% occurrence threshold and are consistent with the direction of assessment locations from AGN.

The conditions above generally apply to the night time period only, whereas typical daytime conditions that are assessable under the INP are calm.

3 Noise Impact Assessment

3.1 Consent Limits

The current MTO development consent was last modified in 2004. The consent's Conditions 9 and 16 provide operational noise and acquisition limits respectively. *Table 3.1* lists the limits for the current study's nominated assessment locations, based on the intent of the consent limits.

Table 3.1 NOISE LIMITS BASED ON MTO CONSENT

Assessment Location	Operational Noise Limits	Acquisition Noise Limits
1	NA	NA
1b	NA	NA
2	37	40
2b	37	40
3	39	40
4	39	40
5	41	42
6	43	44
7	NA	NA
8	65[2]	NA
9	39	40
10	35	40
11	65[2]	NA
12	65[2]	NA
13	NA	40
14	NA	NA
15	39	40
16	40	40
16b	NA	40
17	NA	40

Notes: 1. These limits are to apply under prevailing weather conditions of wind speeds up to 3m/s at 10m above ground and temperature inversions of up to 3 degrees per 100m elevation.

2. This is the DECCW's Industrial Noise Policy (INP) amenity criteria for commercial receivers.

3. NA indicates limits do not exist in the consent conditions specific to this receiver. This could be because this property has an agreement with or is otherwise owned by Coal & Allied or other mines.

Similarly, MTO's consent Condition 11 provides limits for blast noise and vibration. These are consistent with the commonly adopted ANZECC Guidelines and dictate that blast noise overpressure is not to exceed 115dBL and blast ground vibration is not to exceed 5mm/s for more than 5% of all blasts. This applies at the closest private residence not owned by the mine outside the mining lease.

3.2 Operational Noise Modelling

The Environmental Noise Model (ENM) noise prediction software was used for modelling purposes. ENM takes into account distance, ground effects, atmospheric absorption and topographic detail. ENM is a DECCW accepted noise prediction model as it gives consistently reliable predictions of environmental noise. Initial calculations were performed with no wind or temperature gradients, which are termed calm weather conditions. Assumed night air temperature and relative humidity were 10 °C and 80% respectively. Noise levels during other conditions are discussed in *Section 2.3*.

The model incorporates three-dimensional digitised ground contours for the surrounding land and the new mine plan for AGN. Contours of the mine were superimposed on surrounding base topography. Equipment was placed at various locations and heights, representing potential operating conditions that could result in the greatest noise impacts for the life of AGN.

The noise model predicts LAeq noise levels, based on equipment sound power levels. For noise modelling consistency with previous studies and to facilitate a direct comparison of results, the current study has adopted the sound power levels reported in the 2002 SEE noise study. The results assume that all plant and equipment operate simultaneously. In practice, such an operating scenario would be unlikely to occur. The results are therefore considered conservative.

i. Noise Model Equipment Inventory

The current study adopted the inventory used for the night scenario in the 2002 SEE MTO main pit plant and supplemented this with plant proposed for AGN. The reject bin introduced in the 2004 study is also included here. Also of note, day and night time plant varies only in respect of lighting plant. *Table 3.2* lists the likely equipment inventory.

Table 3.2 MODELLED PLANT INVENTORY

Item	Description	Quantity
AGN		
Dozer	CATD10 or D11	3
Dozer - Rubber-Tyred	690	1
Drill	Reedrill SK-SS	1
Excavator3600	Hitachi EX3600	1
Excavator5500	Hitachi EX5500	1
Grader	CAT16G	2
Haul Truck – Coal	Komatsu 730E	6
Haul Truck - Waste	Komatsu 830E	10
Water Truck	CAT785	1
Lighting Plant	-	2
MTO Main		
2800 Shovel	PH2800	2
5700 Shovel	PH5700	2
Dozer	CATD10 or D11	11
Drill	Drillteck	6
Front-end-loader	L1400 or CAT994	2
Fuel/Lube Truck	CAT777	2
Grader	CAT16G	6
Haul Truck	CAT777 or Komatsu 730E	4
Haul Truck	Komatsu 830E	10
Rubber Tyred Dozer	CAT834	2
Water Truck	CAT777	4
Lighting Plant	-	10
Pump	-	6
Coal Preparation Plant	-	1
Reject Bin	-	1

3.3 Operational Noise Level Predictions

i. Calm Weather Conditions

Table 3.3 summarises calm weather noise modelling results for the current and two previous studies for comparison. The noise levels under calm weather typify the noise received at locations surrounding the mine during the day in the absence of adverse INP assessable weather conditions.

The predicted noise levels under calm weather conditions are below the site's current consent limits during calm weather conditions at all private residences. The current study indicates zero to only marginal changes in noise from that predicted previously. These changes are generally imperceptible at ±2dB, with two locations demonstrating marginally higher increases for the current study of 3dB, and a further two locations demonstrating a 4dB increase.

Table 3.3 PREDICTED CALM WEATHER NOISE LEVELS

Assessment Location	Current Study	2002 Study	2004 Study (inc. Reject Bin)	Consent Limits	Consent Acquisition Limits
1	28	27	27	NA	NA
1b	26	-	-	NA	NA
2	27	27	29	37	40
2b	26	-	-	37	40
3	28	25	27	39	40
4	28	24	26	39	40
5	30	29	26	41	42
6	35	32	34	43	44
7	26	26	27	NA	NA
8	26	26	27	65[2]	NA
9	25	24	24	39	40
10	20	21	22	35	40
11	27	27	28	65[2]	NA
12	27	27	28	65[2]	NA
13	24	24	24	NA	40
14	25	25	25	NA	NA
15	26	25	25	39	40
16	30	-	32	40	40
16b	28	-	-	NA	40
17	25	-	27	NA	40

Notes: 1.These limits are to apply under prevailing weather conditions of wind speeds up to 3m/s at 10m above ground and temperature inversions of up to 3 degrees per 100m elevation.

2. This is the DECCW's INP amenity criteria for commercial receivers.

ii. Prevailing Weather Conditions

Received sound levels increase when the wind blows from source to receiver or under temperature inversion conditions and decrease when the wind blows from receiver to source or under temperature lapse conditions.

There is a premise that if the criterion is met under calm conditions, higher noise under strong winds (>3m/s) is generally acceptable. This is because the ambient noise at receptors also increases during such weather conditions and mine noise is masked (for example, by wind induced vegetation noise). However, at wind speeds below 3 m/s and under temperature inversions, noise levels are assessable under the DECCW's INP. These conditions are referred to as *INP weather conditions,* as mentioned previously.

It is well documented that the adopted modelling software ENM is typically conservative when used to predict noise under adverse weather conditions. Previous site validation studies at other Hunter Valley Coal & Allied sites indicate that ENM typically over predicts noise levels by 2 to 3dB on average. This was not applied to results herein since a site specific validation study was not undertaken, but should be considered when reviewing the predicted noise levels.

The predicted levels under INP weather conditions are provided in *Table 3.4*. The results are also presented in the form of noise contours in *Figure 3.1.* These contours represent the outer envelope of noise levels assuming all assessable weather conditions occurred concurrently for the current AGN mine plan. It is therefore an artificial representation of actual noise levels since winds of differing speeds and directions cannot exist at one point in time.

The current study indicates zero to only marginal changes in noise from that predicted previously. These changes are generally imperceptible at ±2dB, with marginally higher increases of 3dB at locations 1 and 3. The other atypical increase is that between the current study and the 2004 results for location 5.

The predictions in *Table 3.4* show that the night time operational and acquisition limits are exceeded at the same locations identified in previous studies.

In general terms, noise levels at assessment locations to the east and north east of the site are affected by AGN plant (mostly trucks and other mobile plant on haul roads). The assessment locations to the west of MTO are influenced by plant operating as part of the main pit and not AGN plant.

Another useful analysis to undertake is the comparison of modelled and monitored noise levels. To that end, the monitoring data for 2008 in *Table 2.2* for location 17 shows that under calm weather conditions at night the contribution (alone) from MTO is generally around 40dB(A) ±2dB, mostly attributed to the coal preparation plant (at 37dB(A)). For adverse weather this increases to 48dB(A) at this location. The predicted noise levels for this location is up to 45dB(A) under adverse weather, which is reasonably consistent with the monitoring data (noting that

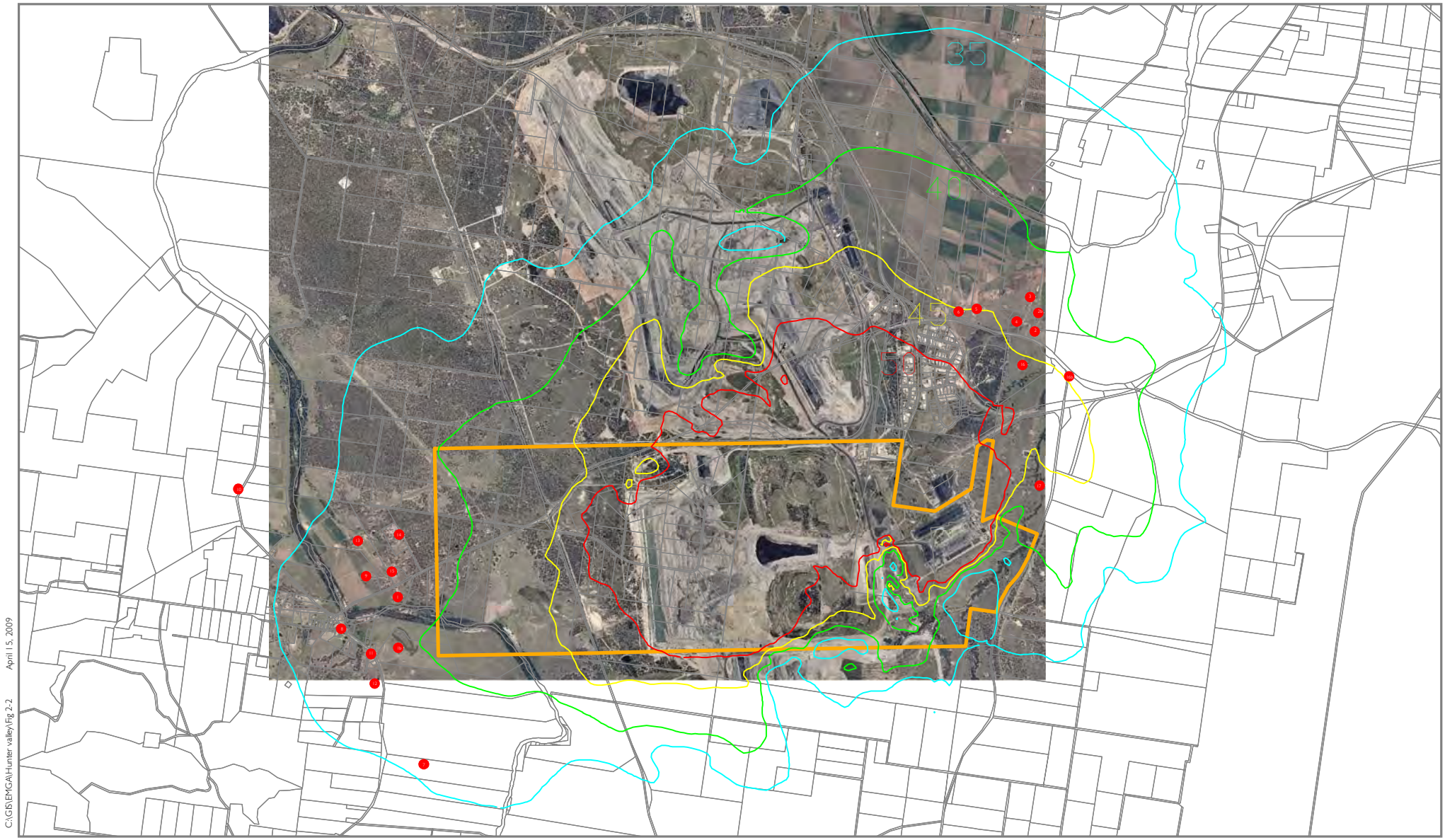
modelled and monitored weather conditions are different). Nonetheless it provides some surety and confidence in the modelling results.

Table 3.4 PREDICTED ADVERSE WEATHER NOISE LEVELS

Assessment Location	Current Study	2002 Study	2004 Study (inc. Reject Bin)	Consent Limits	Consent Acquisition Limits
1	39	36	36	NA	NA
1b	39	-	-	NA	NA
2	44	42	44	37	40
2b	43	-	-	37	40
3	44	41	43	39	40
4	43	42	44	39	40
5	46	44	39	41	42
6	47	45	46	43	44
7	36	NA	NA	NA	NA
8	37	35	35	65[2]	NA
9	38	37	37	39	40
10	33	32	33	35	40
11	38	36	36	65[2]	NA
12	38	36	36	65[2]	NA
13	37	36	36	NA	40
14	38	37	37	NA	NA
15	39	37	38	39	40
16	46	45	47	40	40
16b	46	-	-	NA	40
17	43	45	43	NA	40

Notes: 1.These limits are to apply under prevailing weather conditions of wind speeds up to 3m/s at 10m above ground and temperature inversions of up to 3 degrees per 100m elevation.

2. This is the DECCW's INP amenity criteria for commercial receivers.



Kilometres
0 0.35 0.7 1.4 2.1

Receiver location
MTO Development Consent Boundary
Cadastre

Figure 3.1

Combined All Weather Outer Envelope Noise Levels, Leq,15min dB(A)

Abbey Green North SEE

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3.4 Blasting Noise and Vibration

The blasting design for the AGN Expansion mine plan will be similar to that of the previously approved AGN plan. Hence no significant change in received noise and vibration levels is anticipated for assessment locations. The consent noise and vibration limits for blasting will be achieved by controlling blast design, primarily through the maximum instantaneous charge mass and by monitoring.

The blast design is actively managed by the operation, and hence corresponding airblast overpressure and ground vibration are minimised. MTO's existing blast management procedures will be used to ensure appropriate charge masses are used for blasting. Such MIC masses are presented in *Table 3.5*. These were derived from 95% formulae in Blastronics Pty Limited publication for monitoring data collected at similar mines in the area.

Table 3.5 RECOMMENDED BLAST CHARGE MASSES

Blast to Receptor Distance, m	MIC_{8ms} to Satisfy ANZECC 95% Overpressure Limit of 115 dB(Lin), kg	MIC_{8ms} to Satisfy ANZECC 95% Ground Vibration Limit of 5 mm/s (ppv), kg
1,500	163	745
2,000	386	1,324
2,500	753	2,069
3,000	1,302	2,980
4,000	3,088	5,299
5,000	6,031	8,279
6,000	10,422	11,922

Notes: 1. These results are derived from equations contained in the Drill and Blast Study, Mount Pleasant prepared by Blastronics Pty Limited for CNA in September 1994.

2. In general, blast overpressure considerations limit MIC.

The highest MIC that is recommended to be used is 386 kg when the proximity of a noise sensitive receptor is less than 2 km.

The distance from the eastern most extremities of the proposed AGN pit, and therefore probable blast location, is approximately 2200 metres from assessment location 17. The MIC masses for blasts within this area will be managed to minimise impacts on the residence.

Blasting will occur between the hours of 7.00 am to 6.00 pm. This will provide the mine with flexibility to blast during meteorological conditions that will result in the least impact on its neighbours. Typically, blasting operations will be conducted more than once a day. All blasts will be monitored for overpressure noise and ground vibration at several locations.

It is recommended that when a temperature inversion is known to exist, blasting is avoided if practical. This does not apply where the effects of blasting are not perceived at noise sensitive locations. In addition to the above criteria, general best practice procedures can be used to effectively minimise noise impacts (see *Section 4*).

3.5 Other Noise Emissions

Construction activities for the proposal will include relocation of some minor items of infrastructure and services and the construction of a new section of haul road. Such works will be confined to daytime periods and associated noise levels at assessment locations will not be greater than that which is predicted for mining activities.

4 Noise Management and Monitoring

Detailed noise management procedures currently govern the management of noise across MTO. These procedures are part of Coal & Allied's procedures for blasting, noise monitoring and assessment.

These procedures will continue to be implemented and will be upgraded to reflect changes to MTO resulting from the proposal.

For noise, these procedures include requirements for:

- training in noise control procedures;
- maintenance and testing for plant and equipment;
- equipment operation;
- timing of activities and equipment operations;
- equipment purchase requirements; and
- management of community complaints.

For blasting, these procedures include requirements for:

- overpressure and vibration limits;
- timing of blasts;
- blast design including MIC; and
- restrictions due to weather conditions.

Monitoring will include attended as well as unattended noise monitoring in specified locations and operating conditions. Similarly, all blasts within the site will be monitored.

5 Conclusion

This study considers the potential noise impacts of the proposal, which incorporates all of MTO as described in *Section 1*. The acoustic assessment includes modelling of all major mining equipment at representative operational locations.

The noise modelling has shown that under calm weather conditions all private residential properties experience noise levels below the operational noise development consent limits. The current study indicates zero to only marginal changes in noise from that predicted previously. These changes are generally imperceptible at ±2dB, with two locations demonstrating marginally higher increases for the current study of 3dB, and a further two locations demonstrating a 4dB increase.

Similarly, the current study indicates zero to only marginal changes in noise from that predicted previously for adverse weather conditions. These changes are generally imperceptible at ±2dB, with marginally higher increases of 3dB at locations 1 and 3. The current study also shows that operational and acquisition development consent limits are exceeded at the same locations identified in previous studies. It is also note worthy that noise predictions are conservative due to the unlikely assumption of concurrent operation of all listed plant and the modelling software's algorithms that estimate the influence of adverse weather on noise propagation.

Coal & Allied's environmental management plans and procedures, which include ongoing noise monitoring, will be used to assess the performance of the mining operations against the development consent noise limits.

Blast design will incorporate control on the MIC as described in this study and implementation of Coal & Allied's environmental plans and procedures will ensure that acceptable limits are maintained. This will include monitoring of all MTO blasts.

In conclusion there will be a zero to marginal change to noise impacts on assessment locations compared to the previously approved noise impacts from the 2002 and 2004 assessments. Hence the noise impact of the AGN Expansion is of minimal environmental impact.

Appendix A

Noise Model Source Locations

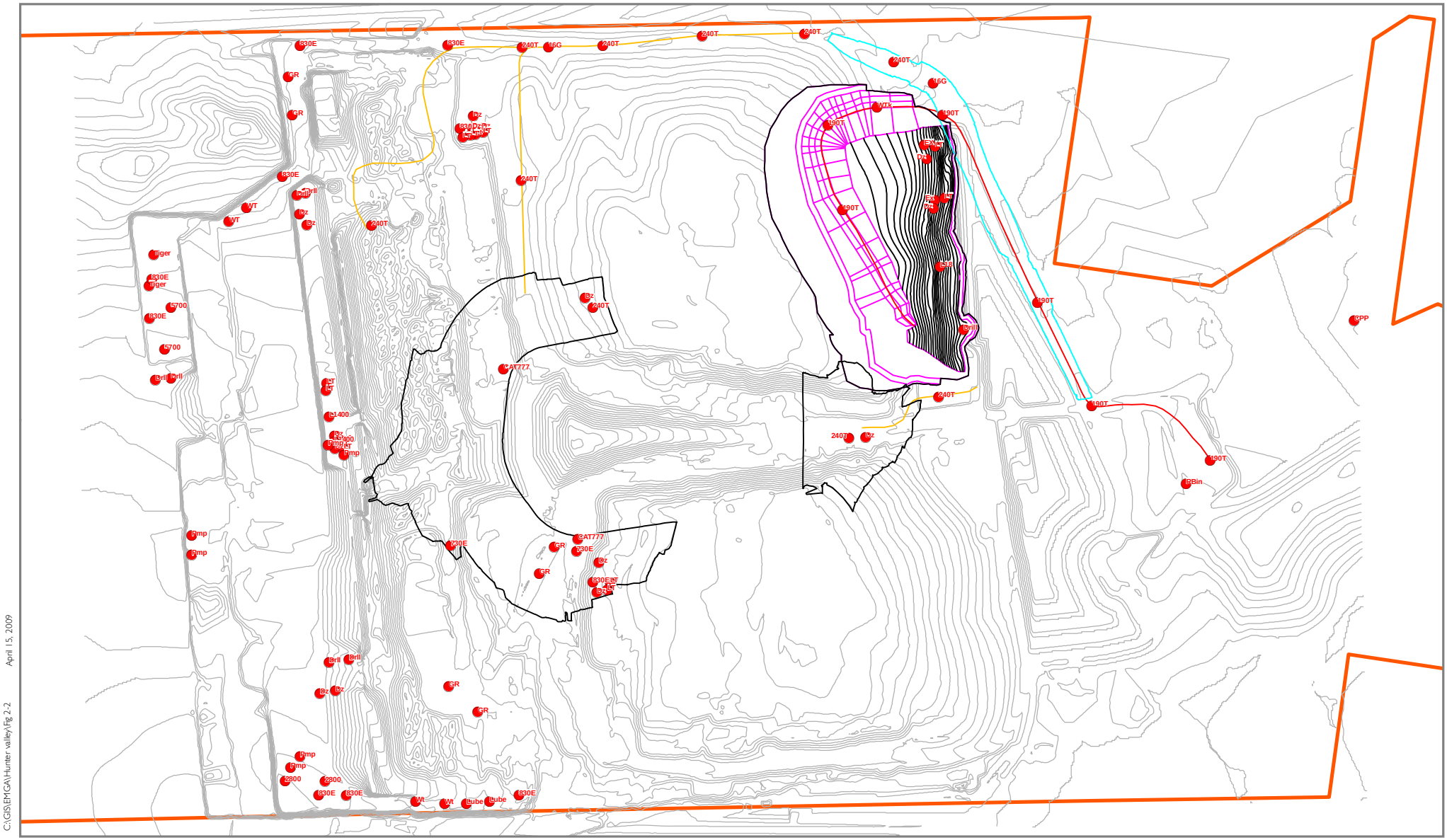

Figure A.1

Noise Model Source Locations

Abbey Green North SEE

COAL & ALLIED
Managed by Rio Tinto Coal Australia

EMGA

EMGA

Environmental Management
Group Australia

Appendix D

Review of Water Impacts from Modifications to Abbey Green North Pit, prepared by JP Environmental, 2009

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Modification to the Existing Mount Thorley Operation (MTO) Development Consent (DA 34/95)

Review of Water Impacts from Modifications to Abbey Green North Pit

13th May 2009
Revision 1

Table of Contents

1 Introduction

The proposed modification to the existing Mount Thorley Operation (MTO) Development Consent (DA 34/95) will allow for the enlargement of the approved Abbey Green North (AGN) Pit by approximately 75 hectares to the west. Mining will extend into the already approved Mount Arthur, Warkworth and Bowfield seams and extract approximately 5 million tonnes of run-of-mine (ROM) coal over the life of the project. The proposal will require the relocation of some minor items of infrastructure and services and the construction of a new section of haul road. As previously approved in 2002, the final void will continue to be used for the placement of reject material from Mount Thorley Warkworth (MTW) Operations and will be used for the return transfer of mine and decanted water between MTO and Warkworth Mining Limited (WML) during operations.

This review of the water impact assessment described in the *Mount Thorley Operations and Warkworth Mining Limited Section 96(2) Modification of Development Consents Statement of Environmental Effects January 2002* (2002 Abbey Green SEE) has been prepared by JP Environmental to identify and mitigate water impacts that may arise from the proposed modification to DA 34/95.

2 Surface Water

2.1 Regional Setting

MTO lies partially within the catchments of Salt Pan Creek, Doctors Creek and Loders Creek. MTO occupies approximately two thirds of the catchment of Salt Pan Creek, a tributary of Wollombi Brook. Wollombi Brook is a tributary of the Hunter River. The southern side of the Doctors Creek catchment falls within MTO, comprising about 9% of the original undisturbed catchment. MTO lies in the north-west corner of the Loders Creek catchment, occupying about 10% of the catchment. Loders Creek and Doctors Creek join together about 450 metres before entering the Hunter River.

The catchment for Salt Pan Creek is relatively steep and the stream is ephemeral. Wollombi Brook also experiences only intermittent flows. Generally, two freshes, or significant flow periods, are expected each year, with base flows between

these events. At times, Wollombi Brook dries to a series of apparently non-continuous ponds.

Loders Creek only flows intermittently, a few times per year after rain. The majority of the time, Loders Creek is only a trickle. Doctors Creek is ephemeral.

The mining operations are protected from backwater flooding from Wollombi Brook into the Salt Pan Creek catchment by a levee across Salt Pan Creek on the eastern side of Charlton Road.

2.2 Hunter River Salinity Trading Scheme

The Hunter River Salinity Trading Scheme (HRSTS) operates under the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002.*

Under this Scheme, credit holders are permitted to discharge saline water to the Hunter River on a managed basis. The aim is to maintain river salinity levels below 600 electrical conductivity units (EC) at Denman and 900 EC at Singleton.

This is achieved through:

- Discharge scheduling that allows discharge only at times when the river flow and salinity level are such that salt can be discharged without breaching the salinity targets; and
- Sharing the allowable discharge according to licensed discharger's holdings of tradeable salinity credits.

The discharge schedule prohibits discharges during low flow periods. Discharges are regulated in proportion to credit holdings during high flow periods and unlimited discharges are permitted during flood flow periods, subject to tributary protection limits and the overarching requirement to remain below 600 EC at Denman and 900 EC at Singleton.

A total of 1,000 credits are available for allocation through the scheme. Consequently, a holding of one credit entitles the owner to discharge 0.1 per cent of the total allowable discharge for the period.

The classification of low, high and flood flow periods is presented in Table 1:

Table 1: Flow Discharge Categories for Each Sector of the Hunter River

Sector	Low flow range	High flow range	Flood flow range
Upper	Less than 1,000 ML per day	1,000 ML per day to 4,000 ML per day (inclusive)	Exceeds 4,000 ML per day
Middle	Less than 1,800 ML per day	1,800 ML per day to 6,000 ML per day (inclusive)	Exceeds 6,000 ML per day
Lower	Less than 2,000 ML per day	2,000 ML per day to 10,000 ML per day (inclusive)	Exceeds 10,000 ML per day

Source: Protection of The Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002

MTO and WML are located in the lower sector of the Hunter River. MTO holds an allocation of 24 credits. MTO operates a discharge point under EPL 1976 at Dam 9S. WML holds an allocation of 64 credits. WML operates a discharge point under EPL 1376 at Dam 9S. Credits are traded on an as needs basis between WML and MTO.

If discharge of further excess water to the Hunter River system is required by either site, under the scheme, credits may be obtained on a day to day basis though trade between licensed users, or, for long term use, through public auction.

2.3 Mine Water Management System

2.3.1 Water Supply

Principal water requirements are:

- Make-up water for the coal preparation plant (CPP);
- Dust suppression on mining roads, coal conveyors and stockpile areas;
- Machinery washing;
- Fire fighting; and
- Potable supplies for bathing and other domestic uses.

Water requirements for the mine and the CPP are normally met from two sources:

- The Mount Thorley Joint Venture Water Supply Scheme (MTJV) i.e. Hunter River; and
- Water of elevated salinity (mine water) harvested from mining operations.

Under most weather conditions, MTO experiences a water deficit. Additional water is then sourced from the Hunter River under the MTJV. This scheme is a cooperative venture between Singleton Shire Council and several local mining ventures whereby each mine pays for the water on a 'user pays' basis. At MTO, potable water supplies are sourced from the Singleton Shire Council potable supply. All other site water demands are preferentially supplied by mine water harvested from the mining operations. Any shortfall is made up from the MTJV when there is inadequate mine water available.

2.3.2 Water Management

All contaminated water is managed on-site or released under the HRSTS. To achieve this, the existing water management system consists of a series of interconnected dams that are used for storage and water quality control. The dams can be categorised into two types:

- Sedimentation dams; and
- Operational water quality control dams.

In addition to these dams, excess surface water within the mine working areas is directed to in-pit drainage sumps. These sumps generally have a capacity between five and ten megalitres (ML). Water from the in-pit sumps is pumped to the water control dams as required.

Importantly, appropriate catchment management techniques are applied to all areas of the mining lease. These include the minimisation and the timely reinstatement and rehabilitation of disturbed surfaces. Runoff from undisturbed areas is diverted away from mining areas and discharged to local watercourses.

2.3.3 Sedimentation Dams

Runoff from reshaped and newly rehabilitated areas and areas being cleared in advance of mining operations is directed to sedimentation dams. The capacity of these dams is determined by the volume of runoff from a 1 in 10 year storm of 1 hour duration.

The main sedimentation dams are 3S, 8S, 10S, 11S and 12S.

These dams are maintained at a minimum of 75 per cent of their design capacity by periodic removal of accumulated sediment.

After treatment in the sedimentation dams, overflows discharge to local watercourses. Water from the sedimentation dams may be used to supplement the mine's water supply.

2.3.4 Operational Water Quality Control Dams

The MTO Development Consent was recently modified (7th May 2009) by the Dam 9S Extension Statement of Environmental Effects. The extension of Dam 9S is such that it subsumes three existing dams (Dams 6S, 7S and 8S) with a mine water dam with a capacity of 2,000 ML. Construction of Dam 9S extension is expected to commence in June 2009 and take approximately 3 months to complete.

The water quality control dams (Dams 1S, 2S, 9S, 14S and 15S) are the main water storage facilities for the mine. They receive contaminated surface water runoff from the mine's operational areas and water pumped from the open-cut pit sumps. Water can be stored in the open cut pit sumps and pumped between the water quality control dams and to the CPP storage dam as required.

Rainfall runoff and wash-down water from the vehicle washing and workshop areas are passed through a grit and oil separation system before discharging to the water control dams.

Dam 9S acts as a central mine water collection point and settling pond. Dam 9S can receive water from the in-pit sumps, tailings dams and from WML. Dam 9S pumps water directly to the CPP raw water tank and to the CPP raw water dam (Dam 14S), as well as acting as a mine water discharge facility under the HRSTS. Dam 14S can also receive make-up water from the MTJV as needed.

Dam 15S at the CPP receives runoff from the coal stockpiles and wash down from the CPP, settling any entrained sediment before the water is re-used in the CPP. Dam 15S is operated in the near empty condition to minimise the risk of overflows from extreme rainfall events.

2.3.5 In-Pit Sumps

Pit runoff is mostly derived from stripped areas, benches, pit floor and ramp areas. Spoil piles and groundwater seepage will also contribute to water levels in pit sumps. To maintain water levels amenable to the workability of the pits, water is pumped from the sumps to the salinity control Dam 9S.

2.4 Water Balance Model

Until 2006, site water balance models for MTO and WML were prepared and reported by Mackie Environmental Research (MER) to simulate the operation of the proposed mine water management system under a range of climatic conditions. Since 2007, Coal & Allied has owned and operated the OPSIM water balance model, provided by Water Solutions Pty Ltd. Both of these models are computer based predictive models, calibrated against site data. The models are very similar in operation and have the same data requirements. The benefit gained by adopting the OPSIM model is that it is able to be operated by site personnel, and can thus be continuously updated and calibrated as water management data is collected.

The main aspects of the OPSIM model are summarised below.

The model compares water demands against the volume of water generated within the mine's catchments. Water deficits may be made up from WML or the MTJV. Generally, water surpluses are stored in the open-cut pit until required.

The main water demands are described above. Water is also lost through evaporation from the surface of water storage facilities, and some is permanently held in tailings. The water demands are largely met by water generated within the mine catchment.

Water is generated within the mine catchment by seepage from coal seams, spoil and tailings emplacements; and surface runoff. Based on the results of geological investigations and the historical experience of the mine's operations, the volume of groundwater ingress is considered to be less than 0.1 ML/day.

The model conducts a daily simulation of the mine water system using local rainfall records for 120 years from 1 January 1889. Figure 1 shows the

catchment plan of the mine site that has been developed for estimating rainfall runoff.

Runoff from each of the catchments is calculated on a daily basis and distributed around the mine site according to the water management system described above. Daily water demands (including evaporation and losses to tailings) are then applied to the water storage facilities and a water balance calculated.

The OPSIM water balance model has been regularly updated and calibrated since 2007 as new data becomes available. The model has been used to assist in the design and to assess the impacts of the proposed water management system.

Two operating scenarios have been modelled:

- Zero discharge of surplus water off site; and
- Discharge of mine water under the HRSTS.

Under the first scenario, water is no longer pumped from the pit once the site water management system reaches its capacity. Consequently, mining operations may be impaired as water levels rise in the pit.

The second scenario assumes sufficient salinity credits are obtained to allow discharge of excess water to the Hunter River system at flow rates up to the Environmental Protection Licence (EPL) limit of 100 ML/day (current, subject to change under the EPL).

The results of the mine water balance model indicate that the proposed changes to the water management system due to enlarging AGN could be successfully incorporated under either scenario. However, the ongoing HRSTS discharge strategy provides an improved risk profile against impairment to mining from water in pit.

2.5 Proposed Changes to the Water Management System

There will be no changes to the operation of the mine's water supply system as a result of the AGN Expansion. However, while the mine water pollution control system will continue to operate in the same manner, modifications to the water storage facilities will be required by the extension of disturbance to the north and west of the AGN footprint as shown on Figure 2, and described here.

As the AGN Expansion is mined, overburden will be placed around the existing MTO Operations Tailings Dam (also known as the Centre Ramp Tailings Dam), enabling the capacity of this tailings disposal facility to be increased within the approved RLs. Mining in the Abbey Green South pit has been completed and it will also operate as a tailings disposal facility, as described in the 2002 Abbey Green SEE.

Water control Dam 2S will be decommissioned before constructing the proposed haul road. Dam 2S prevents mildly saline runoff from the industrial area flowing off site, as required by the HRSTS. This function will now be taken over by Dam 1S, which will be enlarged to provide the required buffer storage to make way for the AGN expansion.

Sediment control dam, Dam 3S, will be decommissioned before mining, as described in the original 2002 Abbey Green SEE. However, extending the Abbey Green North footprint to the north cuts the drainage line from the rehabilitated MTO northern emplacement catchment that flows to Loders Creek. The northern emplacement will be diverted northwards into Doctors Creek, which rejoins Loders Creek nearer to the Hunter River. A new sediment control dam, Dam 16S, will be constructed at the outlet of the northern emplacement rehabilitation to maintain sediment controls for this area, replacing the function of Dam 3S.

As described in the Dam 9S Extension SEE 2009, Dams 6S, 7S and 8S will be subsumed by the enlarged Dam 9S facility. Subject to constraints that may arise from the detailed design of the Dam 9S Extension, the clean water catchment that was diverted off site via Dam 7S will either be diverted to sediment dam, Dam 11S, to flow off site, or the current drain and dam system will be shifted upslope. The small area of disturbed catchment that drained to sediment dam, Dam 8S, will be diverted to Dam 11S. When the capacity of the Dam 9S facility is increased to 2,000 ML, overall mine water storage capacity at MTO will be increased by about 1,900 ML, far outweighing any increased mine water make from the 75 ha increase in the proposed Abbey Green North footprint.

The enlarged Dam 9S facility assumes the role of central storage dam that is currently assigned to Dam 6S, as shown in the schematic of the proposed water management system (Figure 3). If required, sumps of the proposed Abbey Green North Pit will be pumped directly to Dam 9S.

Once mining is complete, the Abbey Green North void will be used for the placement of tailings from MTO CPP and the adjacent WML CPP, as is currently approved. To avoid placing undue pressure on the MTO water management system, decanted tailings water will be directed back to WML if Dam 9S is approaching full service levels and MTO does not require the water to supplement process and mine water supplies.

2.6 Potential Impacts

Groundwater inflows into the proposed Abbey Green Pits are expected to remain low and flows generated in the proposed workings would be diverted to the mine water management system. The increased groundwater flows are negligible (Groundsearch 2009) and will not impact the operation of the mine water management system.

The temporary loss of 75 ha of catchment due to the larger mining footprint will result in, on average, about 120 ML per annum less runoff to the Hunter River.

Inside the mining footprint, increased soil storage and evaporation and losses to spoil storage on the unshaped spoils should result in a lower water yield than from an equivalent rehabilitated surface. The likely additional mine water yield from the increased mining disturbance should be no more than 50 ML per annum on average. Consequently, the impact on the mine water system from the enlargement of Abbey Green North is considered minimal.

Some 144 ha of the MTO northern emplacement rehabilitated catchments will be diverted from the Loders Creek catchment into the Doctors Creek catchment. There will be no nett loss of runoff to the Hunter River due to this change due to the Abbey Green North Expansion. About 75 ha of this area is part of the original Doctors Creek catchment.

Water balance modelling of the existing and the proposed water management systems has been undertaken by Coal & Allied personnel. The modelling has demonstrated that both the existing and proposed mine water management systems are capable of handling contaminated water generated by rainfall runoff and groundwater inflows over the life of the mining operations. During prolonged wet weather, seam workability within the pits may be impaired unless the mine utilises the HRSTS to discharge excess water.

The MTO Operations and Abbey Green South Tailings facilities will accept tailings from both WML and MTO and will help realise the approved operational synergies between the two mines. The ongoing bi-directional water movements between MTO and WML for use in mine activities will assist in the management of water at both operations by providing a mechanism to supplement water supply requirements. The transfer of mine water between the two mines will increase the availability of recycled water, reducing the need to draw from the Hunter River and potentially reduce the requirement for discharge from site under the HRSTS.

2.7 Water Management System Monitoring and Development

Surface water monitoring will continue to be undertaken generally in accordance with MTO Water Management Plan and the MTW Water Monitoring Manual. This includes:

- Recording water received under the MTJV;
- Recording daily rainfall at the mine site;
- Monitoring water quality in Dams 9S and 15S for use in the CPP; and
- Water quality monitoring at the authorised discharge point to Loders Creek, as required under the site Environment Protection Licence.

Operation and improvement of the water management system is driven by the MTO Water Management Plan, which identifies and prioritises improvements to the water management system.

The MTW Water Monitoring Manual and the MTO Water Management Plan will be updated to reflect changes to the water management system due to the AGN Expansion. Both plans are reviewed annually and updated as required to capture changes to the water management system.

2.8 Mitigation of Potential Impacts

Where practical, runoff from undisturbed and rehabilitated areas will be captured, diverted, settled in dams and allowed to overflow offsite.

Appropriate catchment management techniques will be applied to all areas of the development to minimise the amount of water intercepted by the larger pit footprint. Runoff from undisturbed and rehabilitated areas will be diverted away

from mining operations, treated for sediment where required and allowed to overflow to local water courses. Sediment laden runoff from disturbed areas will be treated via collection in sedimentation basins, before being allowed to flow off site. All runoff considered not suitable for discharge will be incorporated into the mine water system.

Temporary runoff loss from the enlarged Abbey Green North footprint will be compensated by a measurable decrease in the long term draw from the Hunter River (current average 784 ML per annum). Reduced draw from the Hunter River is expected from improved water recycling efficiencies from the operational synergies in the tailing system, and larger reserves of recycled water held in Dam 9S. The catchment contained by the Abbey Green North footprint will be restored after mining is completed and the Abbey Green North Tailings Facility is decommissioned and rehabilitated. The restored catchment will drain to the Loders Creek catchment.

All new sediment dams and water management systems will be designed by a qualified professional engineer or environmental professional in accordance with current regulatory requirements.

2.9 Conclusions: Surface Water

The Abbey Green North surface water impacts are similar to those approved in the 2002 modification to the Mount Thorley Operation Development Consent (DA 34/95).

The increase in mining footprint of 75 ha will cause a temporary loss of runoff from the additional 75ha of catchment subsumed by Abbey Green North. The lost runoff will be more than compensated for by reduced draw from the Hunter River resource due to improved water re-use on site.

The proposal will result in a transfer of about 144 ha of catchment from Loders Creek to Doctors Creek, but there will be no nett loss of runoff to the Hunter River.

As a result of the AGN expansion there will be minimal change to the impact on surface water from that assessed in 2002.

3 Groundwater

An update on the groundwater assessment described in the *Mount Thorley Operations and Warkworth Mining Limited Section 96(2) Modification of Development Consents Statement of Environmental Effects January 2002* (2002 Abbey Green SEE) has been undertaken by Groundsearch Australia and incorporated into this report. The potential impact of the Abbey Green North (AGN) Expansion on the natural groundwater regime and current groundwater users is described here.

3.1 Regional Hydrogeology

There are three main sources of groundwater in the Hunter Valley:

- Unconsolidated alluvial aquifers representing the sediments of the Hunter River and its tributaries,
- Porous Jurassic age sandstone and shale rocks, and
- Fractured hard rock.

The alluvial aquifers generally yield water with low salinity levels. This water is largely used for irrigation, town water, stock and domestic supplies. Groundwater discharges from the sedimentary rocks of the Hunter Coalfield, which were deposited under marine conditions, are considered to be responsible for the high natural salinity levels in the Hunter River.

3.2 MTO Sub-region (Abbey Green) Groundwater Setting

The MTO lease area comprises alluvium overlying westerly-dipping, interbedded, sedimentary rocks. The sedimentary rocks include sandstones, siltstones, mudstones shales and coal seams of the Singleton and Maitland Groups. The western boundary is delineated by depth of cover. The Wollombi Brook, the sub-region's major watercourse, flows through the extreme south west portion of the coal lease.

The proposed AGN Expansion will mine coal from the Warkworth, Bowfield and Mount Arthur coal seams, associated with the Late Permian Age. These seams form part of the Foybrook Formation, a subgroup of the Singleton Supergroup. The Glen Munro, Woodlands Hill and Wambo coal seams that are currently being mined at Mount Thorley are higher in the stratigraphic sequence than the AGN target seams.

The eastern coal-bearing boundary is delineated by the Mt Thorley Monocline which is the dominant, northerly-trending structural feature. The strata dip steeply (~75°) near the axis of the monocline and contain tensional tectonic features that act as potential groundwater recharge zones.

Geotechnical and down-hole geophysical studies in the Abbey Green mining area indicate that the strata dip steeply to the west (~60° at the subcrop adjacent to the Mt Thorley Monocline) and then flatten out to ~40° over a relatively short distance. There is evidence of reverse faulting in the box cut and also on the Mount Thorley Coal Loader (MTCL) site.

There are many tectonic features – principally joints – which indicate potentially high permeability vertical and horizontal hydraulic interconnection zones in the coal seam roof and floor zones. Therefore, the aquifers in the Abbey Green area are considered to be unconfined and are expected to behave hydraulically as an unconfined, fractured rock aquifer.

The movement of fluids throughout the Mt Thorley area strata is predominantly via the secondary permeability features that include:

- Open tectonic joints, associated with tensional folding;
- Shear zones associated with faulting;
- Bedding plane separations;
- Coal cleat; and
- A permeable zone of weathering/subcrop.

The surface water percolates downwards through the weathered zones and migrates through porous materials or through a complex system of fractures. It eventually establishes regional flow gradients that appear to approximate the prevailing topography and rock strata dips. Mining induced aquifer depressurisation also affects groundwater gradients and hence, flow lines.

The aquifers will be affected differentially by blasting operations, which might result in increasing secondary permeability with time.

The groundwater flow lines are expected to be in a westerly direction consistent with the strata dip direction towards the current Loders Pit void.

3.3 Potential Impacts

3.3.1 MTO Sub-region Ephemeral Alluvial Aquifers

These unconsolidated, unconfined aquifers include alluvial deposits along ephemeral streams and within minor palaeochannels. These alluviums tend to be silt and clay materials in minor drainage channels. The shallow aquifer systems are recharged by rainfall, runoff from mining activities and seepage from surface water storage dams. They are restricted laterally and the flow lines are generally controlled by the prevailing topography.

These aquifers are not expected to be influenced by the AGN Expansion and are consistent with the 2002 Abbey Green SEE.

3.3.2 MTO Sub-region Wollombi Brook Alluvial Aquifer

This is a Quaternary age, unconfined, poorly cemented unit comprising irregularly distributed palaeochannels and point bar deposits comprising sill and fine to medium grained, quartz-rich sand. The interconnected pore spaces between grains act as the primary permeability mechanism for water migration both laterally and vertically. It is contained within the floodplain of the Wollombi Brook. The base of the aquifer is irregular and results from the deposition of sediments onto an uneven palaeotopographic surface.

These aquifers are not expected to be influenced by the AGN Expansion and are consistent with the 2002 Abbey Green SEE.

3.3.3 Groundwater Quality

Groundwater data collected at Abbey Green is presented in Table 2. The location of piezometers ABGOH07 and ABGOH 12, adjacent to Abbey Green, are shown in Figure 4. As observed previously in the 2002 Abbey Green SEE, the water is not potable and could be corrosive to some metals due to the low pH; and relatively high levels of sodium and chloride, which predominate. However, the very small inflows of groundwater into Abbey Green would be buffered by mixing with the very much larger volumes of higher alkalinity water in the surface water management system (pH 8 to 9).

As observed previously in the 2002 Abbey Green SEE, the groundwater quality is consistent with regional data collected by environmental approval studies carried

out for previous approvals at MTO and for adjacent mining operations. It is expected that the AGN Expansion will have minimal impact on groundwater quality.

3.3.4 MTO Sub-regional Groundwater Gradients

As observed previously in the 2002 Abbey Green SEE, the shape of the piezometric surface indicates depressurisation of the fractured rock aquifer due to mining operations at Warkworth (north), MTO (west) and Bulga (south). Groundwater infiltration from the eventual AGN Tailings Facility is expected to be controlled predominantly by the prevailing piezometric regime. Effectively the groundwater will migrate towards the west.

The AGN Expansion coal seams are expected to be the major aquifers with significant secondary permeability resulting from tectonic fracturing features such as open joints.

The current MTO workings (Loders Pit) are separated stratigraphically from the AGN Expansion. As observed previously in the 2002 Abbey Green SEE, there is not expected ·to be any groundwater make from the AGN Tailings Facility to Loders Pit. There is no ·evidence to date to suggest a groundwater ingress through the current pit floor to the AGN Expansion seams from the existing MTO Operations Tailings Facility that is situated in the spoil material between Abbey Green and Loders Pit.

The AGN Expansion final pit floor area is only 15 - 20% larger than previously approved in 2002. The strike length is unchanged and the floor enlargement is to the west and down dip. Groundwater recharge is from local sources only and water make is expected to be marginally higher than for the originally approved operation.

3.3.5 Predicted Impact on Existing Groundwater Users

As observed previously in the 2002 Abbey Green SEE, the nearest registered water bores extract groundwater from Hunter River alluvial sediments. These bores are situated on the other side of the Hunter River to the AGN Expansion. The nearest bore is approximately six kilometres away and it is difficult to envisage a groundwater model that would enable AGN to affect the quality or quantity of the alluvial aquifers in that extraction area given that the:

- Indicative groundwater flow directions are generally towards Warkworth, MTO and Bulga open cuts, but are contained within the stratigraphically lower Permian strata.
- Lack of recorded groundwater discharge points in proximity to the Hunter River alluvial bores.
- High lateral permeability and storage capacity of the alluvial aquifer.

There are no registered water extraction bores into the Permian aquifers due to low yield and poor water quality.

There are no impacts on water supply bores expected to be caused by the AGN Expansion.

3.4 Mitigation of Potential Impacts

Most impacts arising from the AGN expansion are unchanged from the originally approved operation.

There will be a marginal increase in groundwater seepage from the increased area of the excavation; however expected volumes under the 2002 approval were expected to be negligible. This expectation of minimal seepage has held true for the recently completed Abbey Green South

All groundwater seepage collected in the AGN Expansion will be incorporated into the mine water system in accordance with the Water Management Plan for Mount Thorley Warkworth. The normal management options are either re-use on site or disposal of in accordance with the HRSTS.

3.5 Ground Water Monitoring and Development

Ground water monitoring will continue to be undertaken generally in accordance with the current approved version of the MTO Water Management Plan.

Operation and improvement of the water management system (including groundwater) is driven by the Water Management Plan, which identifies and prioritises improvements to the water management system.

The MTW Water Monitoring Manual and the MTO Water Management Plan will be updated to reflect changes to the water management system due to the AGN Expansion. Both plans are reviewed annually and updated as required to capture changes to the water management system.

Current and proposed piezometers are shown on Figure 4. Open hole piezometers ABGOH13 and ABGOH14 are proposed to replace the function of ABGOH07 and ABGOH12 and monitor water quality and level up dip of the mining operation. Piezometers GW9708 (existing) and ABGOH15 (proposed) will be used to collect water level data and quality in the AGN sub-region.

It is very difficult to measure ground water seepage into an open cut coal mine from near vertical rock faces for several reasons. It is not safe to work against a highwall, and it is prohibited under the Coal & Allied Safety System. Rainfall onto, and evaporation off the rock face; and mixing of ponded groundwater and rainfall runoff reduce the accuracy of seepage calculations to little better than order of magnitude estimates. A programme to measure groundwater ingress is not proposed due to the difficulties outlined above. Seepage estimates will be made based on regular inspections and inference from pumping rates.

3.6 Conclusions: Groundwater

The AGN Expansion groundwater and geological settings are considered to be similar to those encountered in the Abbey Green South mining area. Groundwater impacts in the AGN Expansion are predicted to be no different from those experienced at Abbey Green South. That is, there will be only small volumes of groundwater generated and the quality is expected to be consistent with local and regional data.

Groundwater data from two piezometers located up dip from the early mining stages of AGN expansion are generally consistent with regional data.

Available groundwater data does not indicate that the AGN Expansion will impact negatively on the MTW groundwater regime; and groundwater quality and flow directions should be consistent with those existing in the adjoining Abbey Green South mining area.

As a result of the AGN expansion there will be minimal change to the impact on groundwater from that assessed in 2002.

4 Water Licence Requirements

Licensing of certain aspects of the mining operations with the Department of Water and Energy is normally required under Part 2 and Part 5 of the Water Act 1912, and the Water Management Act 2000.

4.1 Part 2 (Water Act) Licensing — Surface Water Facilities

Current infrastructure relating to management of surface water runoff, erosion and sedimentation controls is either licensed or does not require licensing. Since future operations do not provide for harvesting of runoff or conveyance of runoff between catchments beyond that already approved, licensing is not likely to be required. However, depending on the ultimate destination of water currently draining to Dam7S, a licence application may be required.

4.2 Part 5 (Water Act) Licensing — Groundwater Seepage

Licensing relating to groundwater seepage to the mine pit may be required under Part 5 of the Water Act 1912 if pumped water has a beneficial use. The proposed AGN Extension does not trigger a requirement to modify the current excavation licence 20BL170011.

Proposed open hole piezometers ABGOH13, ABGOH14 and ABGOH15 will need to be added to licence 20BL168821. Separate borehole licenses will need to be sought or maintained for any additional future observation piezometers.

5 References

1. *Coal & Allied Mt Thorley Operations Water Management Update; Mackie Environmental Research. July 2000*
2. *Abbey Green Project Groundwater Impact Potential; Groundsearch Australia Pty Ltd. January 2002*
3. *Mount Thorley Operations and Warkworth Mining Limited Section 96(2) Modification of Development Consents Statement of Environmental Effects; Environmental Resources Management Australia. January 2002*
4. *MTW – OPSIM Water Management Initial Investigations. Water Solutions Pty Ltd. June 2007*
5. *Abbey Green North Project Groundwater Impact Potential - Groundwater Quality for JP Environmental Pty Ltd; Groundsearch Australia Pty Limited. 20 April 2009*

Table 2: Abbey Green Groundwater Monitoring

Piezometer	Date	SWL mAHD	pH	EC µS/cm	TDS mg/L	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Sodium mg/L	Chloride mg/L	Carbonate mg/L	Sulphate mg/L	Nitrate mg/L
ABGOH07	Dec 2001	61.02	-	-	-	-	-	-	-	-	-	-	-
ABGOH07	Mar 2002	-	4.4	8360	5450	75	200	88	1280	2470	<1	687	6.7
ABGOH07	Dec 2003	59.92	5.7	10900	-	-	-	-	-	-	-	-	-
ABGOH07	Dec 2004	59.60	5.6	9700	-	-	-	-	-	-	-	-	-
ABGOH12	Dec 2001	58.99	-	-	-	-	-	-	-	-	-	-	-
ABGOH12	Mar 2002	-	4.5	6870	4160	7.1	119	58	1120	1880	<1	366	4.4
ABGOH12	Dec 2003	56.89	6.3	6300	-	-	-	-	-	-	-	-	-
ABGOH12	Dec 2004	57.39	6.6	7300	-	-	-	-	-	-	-	-	-

Plan of: Existing MTO Dams and Catchments

Location:	MTO	Projection:	MGA Zone 56	Date:	090417	Project:	Abbey Green SEE
LGA:	Singleton	Contour	N/A	Plan By:	HE	Layout:	A4
		Source:	N/A	Version:	01	Our Ref:	N/A

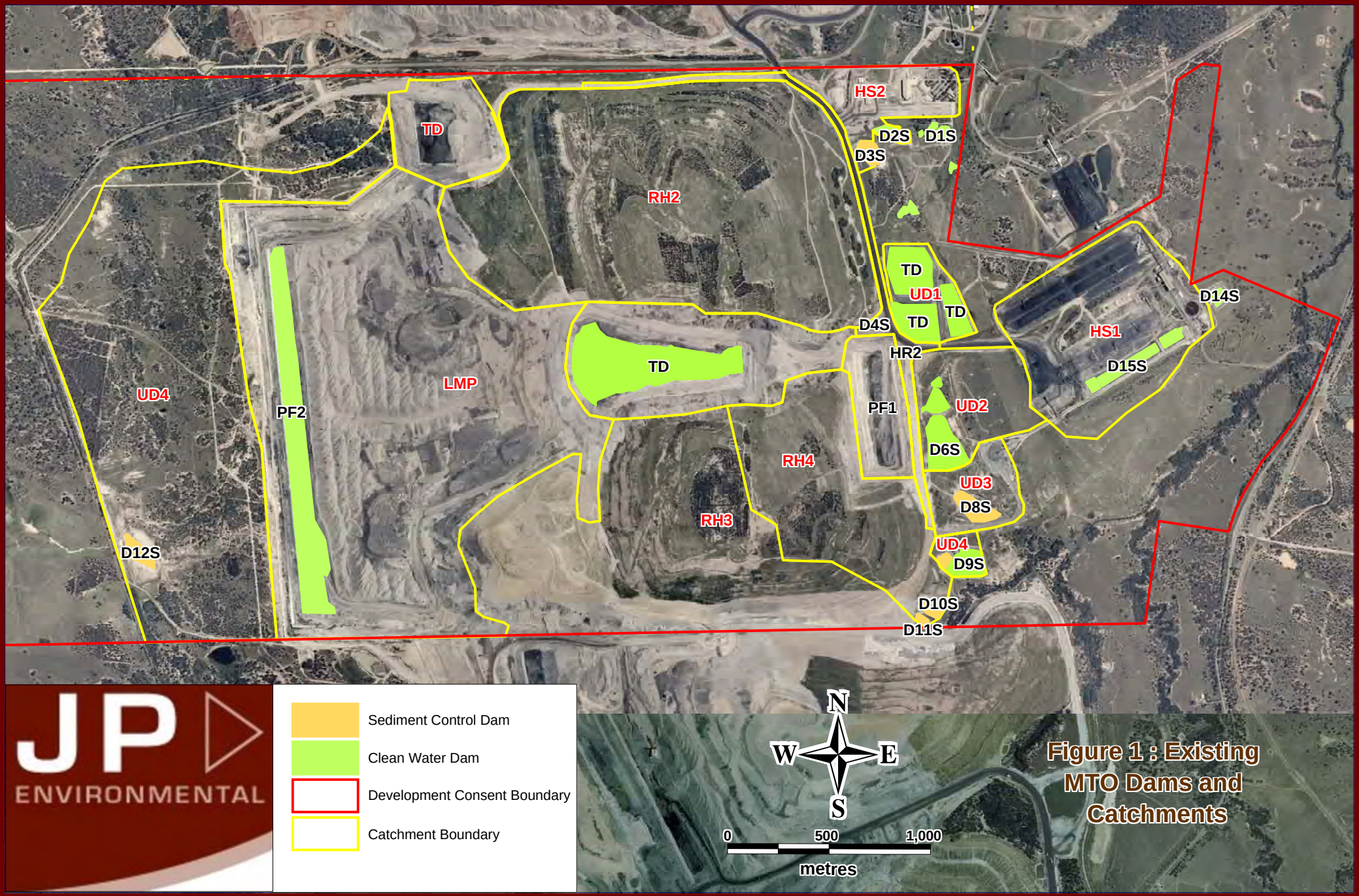

Figure 1 : Existing MTO Dams and Catchments

Coal & Allied

Plan of: Water Management Structures for Abbey Green North Proposal

Location:	MTO	Projection:	MGA Zone 56	Date:	090417	Project:	Abbey Green SEE
LGA:	Singleton	Contour	N/A	Plan By:	HE	Layout:	A4
		Source:	N/A	Version:	01	Our Ref:	N/A

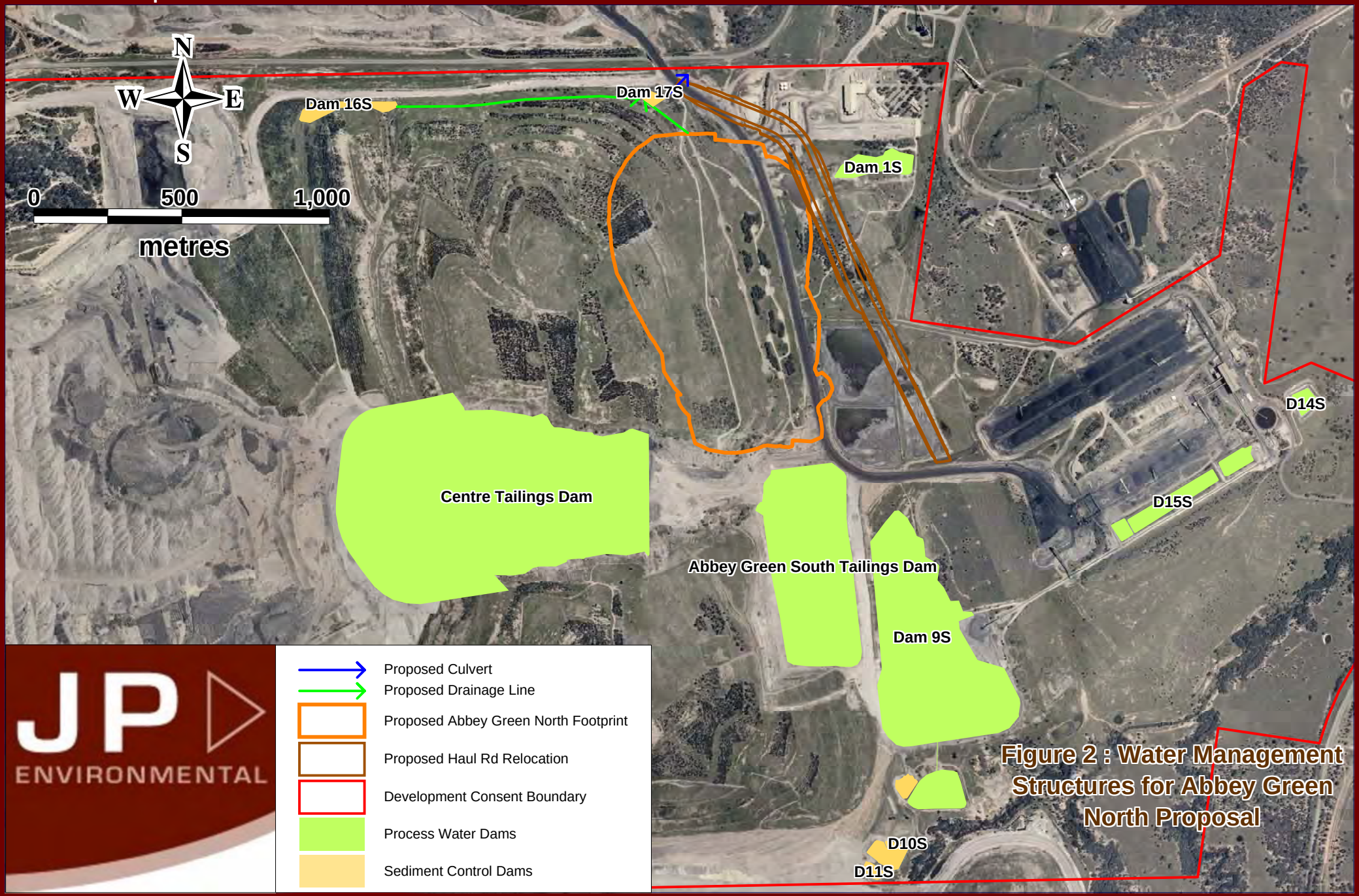

Figure 2 : Water Management Structures for Abbey Green North Proposal

Coal & Allied

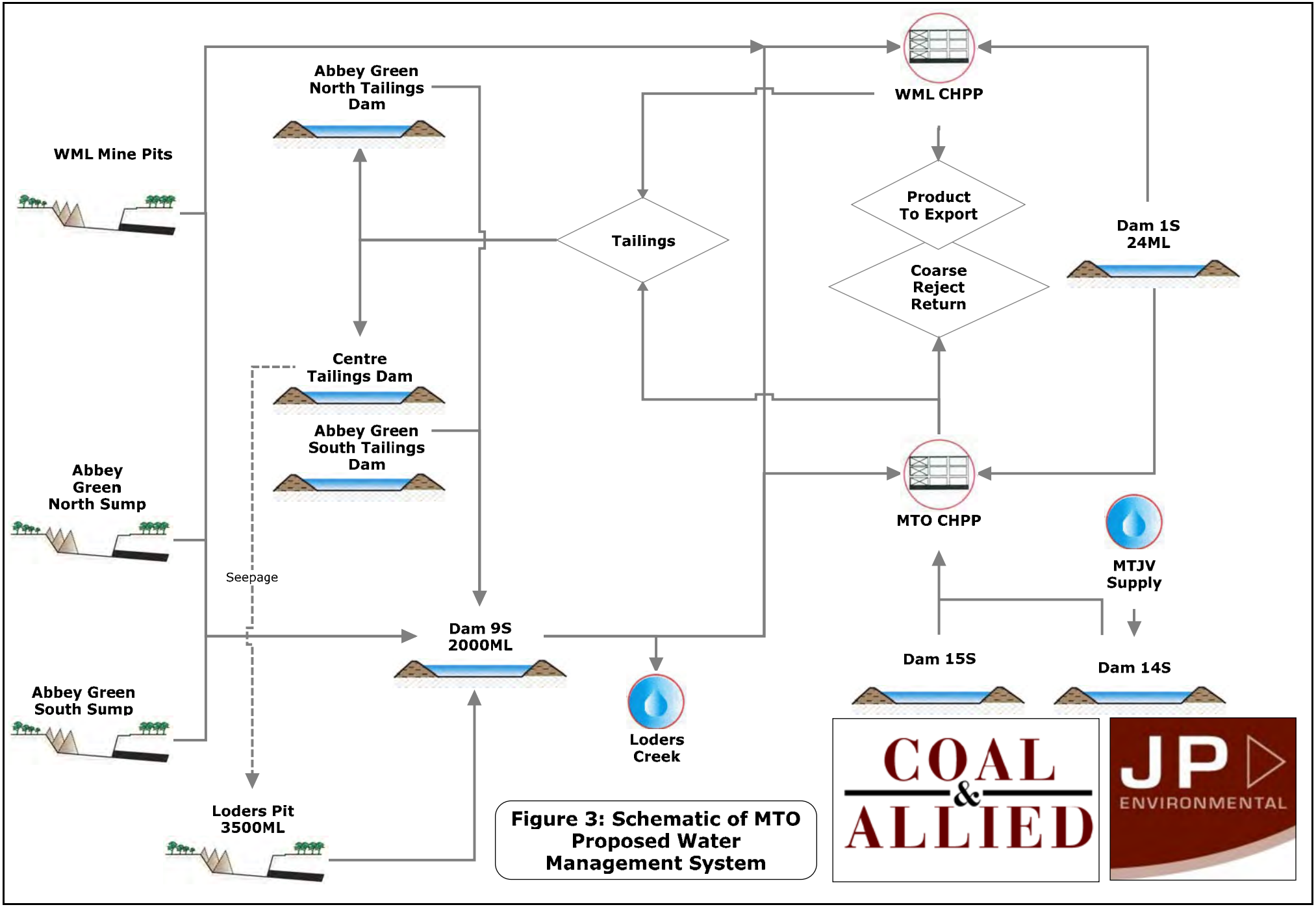

Figure 3: Schematic of MTO Proposed Water Management System

Plan of: Existing and Proposed AGN Piezometers

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LGA:	Singleton	Contour	N/A	Plan By:	HE	Layout:	A4
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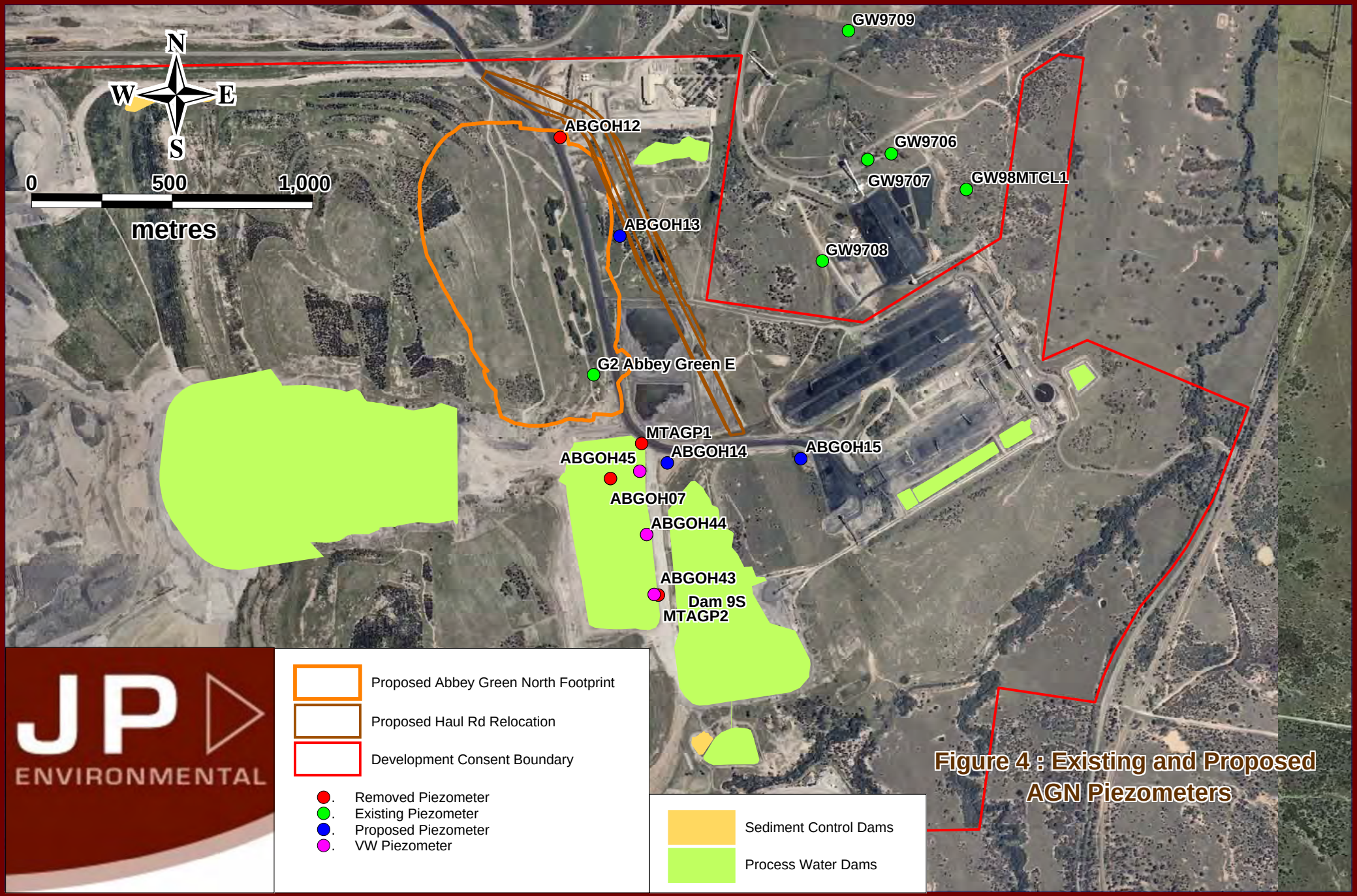

Figure 4 : Existing and Proposed AGN Piezometers

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Modification to the Existing Mount Thorley Operation (MTO) Development Consent (DA 34/95)

Addendum:
Review of Water Impacts from Modifications to Abbey Green North Pit

18th August 2009

Modification to the Existing Mount Thorley Operation (MTO) Development Consent (DA 34/95)

Addendum:
Review of Water Impacts from Modifications to Abbey Green North Pit

Prepared by:

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On behalf of:
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Table of Contents

1 Introduction

The proposed modification to the existing Mount Thorley Operation (MTO) Development Consent (DA 34/95) will allow for the enlargement of the approved Abbey Green North (AGN) Pit by approximately 75 hectares to the west. Mining will extend into the already approved Mount Arthur, Warkworth and Bowfield seams and extract approximately 5 million tonnes of run-of-mine (ROM) coal over the life of the project. The proposal will require the relocation of some minor items of infrastructure and services and the construction of a new section of haul road. As previously approved in 2002, the final void will continue to be used for the placement of reject material from Mount Thorley Warkworth (MTW) Operations and will be used for the return transfer of mine and decanted water between MTO and Warkworth Mining Limited (WML) during operations.

A review of the water impact was assessed in *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009) was prepared by JP Environmental to identify and mitigate water impacts that may arise from the proposed modification to DA 34/95. Subsequent to this review, it has become necessary to store water in the Abbey Green South (AGS) and AGN voids on an as required basis.

This document is an addendum to *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009) prepared to address any impacts from storing water in AGN and AGS.

2 Surface Water

2.1 Mine Water Management System

The mine water management system has been described previously in *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009). Some of that description is re-stated here for clarity.

2.1.1 Water Supply

Principal water requirements are:

- Make-up water for the coal preparation plant (CPP);
- Dust suppression on mining roads, coal conveyors and stockpile areas;

- Machinery washing;
- Fire fighting; and
- Potable supplies for bathing and other domestic uses.

Water requirements for the mine and the CPP are normally met from two sources:

- The Mount Thorley Joint Venture Water Supply Scheme (MTJV) i.e. Hunter River; and
- Water of elevated salinity (mine water) harvested from mining operations.

Under most weather conditions, MTO experiences a water deficit. Additional water is then sourced from the Hunter River under the MTJV. This scheme is a cooperative venture between Singleton Shire Council (SCC) and several local mining ventures whereby each mine pays for the water on a 'user pays' basis. At MTO, potable water supplies are sourced from the SCC potable supply. All other site water demands are preferentially supplied by mine water harvested from the mining operations. Any shortfall is made up from the MTJV when there is inadequate mine water available.

2.1.2 Water Management

All contaminated water is managed on-site or released under the Hunter River Salinity Trading Scheme (HRSTS). To achieve this, the existing water management system consists of a series of interconnected dams that are used for storage and water quality control. The dams can be categorised into two types:

- Sedimentation dams; and
- Operational water quality control dams.

In addition to these dams, excess surface water within the mine working areas is directed to in-pit drainage sumps. These sumps generally have a capacity between five and ten megalitres (ML). Water from the in-pit sumps is pumped to the water control dams as required.

Mine water is stored in inactive mining voids on an as needs basis to meet operational requirements when out-of-pit storages are full. When a mining void is re-activated, the water is relocated to alternate voids or dams so that mining operations may commence.

Importantly, appropriate catchment management techniques are applied to all areas of the mining lease. These include the minimisation and the timely reinstatement and rehabilitation of disturbed surfaces. Runoff from undisturbed areas is diverted away from mining areas and discharged to local watercourses.

2.2 Water Balance Model

The operation and history of water balance models at MTO has been described previously in *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009).

The proposal to temporarily store water in the AGN and AGS voids before the voids are utilised for tailings placement will provide a more water storage capacity than the Dam 9S Extension which is yet to be constructed. In the short term this will improve the risk profile against impairment to mining caused by water in pit.

2.3 Proposed Changes to the Water Management System

There will be no changes to the operation of the mine's water supply system as a result of the AGN Expansion as previously described in *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009).

While the mine water pollution control system will continue to operate in the same manner, modifications to the water storage facilities will be required by the extension of disturbance to the north and west of the AGN footprint as shown on Figure 2 from *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009).

The enlarged Dam 9S facility assumes the role of central storage dam as shown in the schematic of the proposed water management system in Figure 3 from *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009). If required, sumps of the proposed AGN Pit will be pumped directly to Dam 9S.

Subject to geotechnical stability assessments, the AGS Void may be used to store mine water whilst mining occurs in AGN Pit. Once mining is complete, AGN and AGS voids will be utilised to store mine water until the enlarged Dam 9S facility is available for water storage.

Mine water storage elevations in the voids will be maintained below original natural surface level at all times.

Once AGN and AGS are dewatered, the voids will be used for the placement of tailings from MTO CPP and the adjacent WML CPP, as is currently approved. To avoid placing undue pressure on the MTO water management system, decanted tailings water will be directed back to WML if Dam 9S is approaching full service levels and MTO does not require the water to supplement process and mine water supplies.

2.4 Potential Impacts

Potential impacts from the operation of the mine water management system have been described previously in *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009) .

Water balance modelling of the existing and the proposed water management systems has been undertaken by Coal & Allied personnel. The modelling has demonstrated that both the existing and proposed mine water management systems are capable of handling contaminated water generated by rainfall runoff and groundwater inflows over the life of the mining operations. During prolonged wet weather, seam workability within the pits may be impaired unless the mine utilises the HRSTS to discharge excess water. Temporarily storing mine water in the AGN and AGS voids will improve this risk profile.

There is a potential impact if saline water escapes from the AGN and AGS voids. If water levels in the voids rise higher than the level of undisturbed natural ground there is a probability that uncontrolled leakage could occur.

2.5 Water Management System Monitoring and Development

Surface water monitoring will continue to be undertaken generally in accordance with MTO Water Management Plan and the MTW Water Monitoring Manual. This includes:

- Recording water received under the MTJV;
- Recording daily rainfall at the mine site;
- Monitoring water quality in Dams 9S and 15S for use in the CPP; and

- Water quality monitoring at the authorised discharge point to Loders Creek, as required under the site Environment Protection Licence.

Operation and improvement of the water management system is driven by the MTO Water Management Plan, which identifies and prioritises improvements to the water management system.

The MTW Water Monitoring Manual and the MTO Water Management Plan will be updated to reflect changes to the water management system due to the AGN Expansion. Both plans are reviewed annually and updated as required to capture changes to the water management system.

2.6 Mitigation of Potential Impacts

The mitigation of potential impacts has been described previously in *Review of Water Impacts from Modifications to Abbey Green North Pit,* (JP Environmental, May 2009).

Provided water levels are maintained below the level of undisturbed natural ground there is little probability that uncontrolled leakage could occur. Systematic controls will be put in place to monitor water levels and containment in these voids via changes to the MTW Water Monitoring Manual and the MTO Water Management Plan.

3 Groundwater

The potential impact of the storage of water in the AAGN and AGS voids on the natural groundwater regime and current groundwater users is described here.

3.1 MTO Sub-region (Abbey Green) Groundwater Setting

The MTO lease area comprises alluvium overlying westerly-dipping, interbedded, sedimentary rocks. The sedimentary rocks include sandstones, siltstones, mudstones shales and coal seams of the Singleton and Maitland Groups. The western boundary is delineated by depth of cover. The Wollombi Brook, the sub-region's major watercourse, flows through the extreme south west portion of the coal lease.

AGS and the proposed AGN Expansion target coal from the Warkworth, Bowfield and Mount Arthur coal seams, associated with the Late Permian Age. These

seams form part of the Foybrook Formation, a subgroup of the Singleton Supergroup. The Glen Munro, Woodlands Hill and Wambo coal seams that are currently being mined at Mount Thorley are higher in the stratigraphical sequence than the AGN target seams.

The eastern coal-bearing boundary is delineated by the Mt Thorley Monocline which is the dominant, northerly-trending structural feature. The strata dip steeply (~75°) near the axis of the monocline and contain tensional tectonic features that act as potential groundwater recharge zones.

Geotechnical and down-hole geophysical studies in the Abbey Green mining area indicate that the strata dip steeply to the west (~60° at the subcrop adjacent to the Mt Thorley Monocline) and then flatten out to ~40° over a relatively short distance. There is evidence of reverse faulting in the box cut and also on the Mount Thorley Coal Loader (MTCL) site.

There are many tectonic features – principally joints – which indicate potentially high permeability vertical and horizontal hydraulic interconnection zones in the coal seam roof and floor zones. Therefore, the aquifers in the Abbey Green area are considered to be unconfined and are expected to behave hydraulically as an unconfined, fractured rock aquifer.

The movement of fluids throughout the Mt Thorley area strata is predominantly via the secondary permeability features that include:

- Open tectonic joints, associated with tensional folding;
- Shear zones associated with faulting;
- Bedding plane separations;
- Coal cleat; and
- A permeable zone of weathering/subcrop.

The surface water percolates downwards through the weathered zones and migrates through porous materials or through a complex system of fractures. It eventually establishes regional flow gradients that appear to approximate the prevailing topography and rock strata dips. Mining induced aquifer depressurisation also affects groundwater gradients and hence, flow lines.

The aquifers will be affected differentially by blasting operations, which might result in increasing secondary permeability with time.

The groundwater flow lines are expected to be in a westerly direction consistent with the strata dip direction towards the current Loders Pit void.

3.2 Temporary Storage of Saline Water within Abbey Green North and South Voids

MTW is assessing the temporary storage of saline water (6,000 to 8,000EC) in the final voids created by coal mining operations at its AGN and AGS operations.

The final voids will be used for the placement of reject material from mining operations and the return transfer of mine and decant water between MTO and Warkworth Mining Limited (WML).

3.3 Potential Impacts

3.3.1 Groundwater Quality

As observed previously in the *Mount Thorley Operations and Warkworth Mining Limited Section 96(2) Modification of Development Consents Statement of Environmental Effects* (ERM, January 2002) (2002 Abbey Green SEE), the groundwater quality is consistent with regional data collected by environmental approval studies carried out for previous approvals at MTO and for adjacent mining operations. It is expected that the storage of water in the AGN and AGS voids will have minimal impact on groundwater quality.

3.3.2 MTO Sub-regional Groundwater Gradients

As described previously in the *Mount Thorley Operations and Warkworth Mining Limited Section 96(2) Modification of Development Consents Statement of Environmental Effects* (ERM, January 2002), the shape of the piezometric surface indicates depressurisation of the fractured rock aquifer due to mining operations at Warkworth (north), MTO (west) and Bulga (south). Groundwater infiltration from the eventual AGN Tailings Facility is expected to be controlled predominantly by the prevailing piezometric regime. Effectively the groundwater will migrate towards the west.

The AGN Expansion and AGS coal seams are expected to be the major aquifers with significant secondary permeability resulting from tectonic fracturing features such as open joints.

The current MTO workings (Loders Pit) are separated stratigraphically from the AGN Expansion and AGS. As observed previously in the 2002 Abbey Green SEE, there is not expected to be any groundwater make from the AGN and AGS voids to Loders Pit. There is no evidence to date to suggest groundwater ingress through the current pit floor to the AGN and AGS seams from the existing MTO Operations Tailings Facility that is situated in the spoil material between Abbey Green and Loders Pit.

3.3.3 Implications for Temporary Water Storage

The temporary storage of water above the existing piezometric levels within the AGN and AGS pit final voids will increase the hydraulic head at each aquifer. This will influence the direction and rate of groundwater flowlines.

Leakage from the voids through open fractures caused by blasting or natural tectonic joints is possible. Leakage through the proposed barrier wall between AGN and AGS may also occur.

Groundwater flowlines influenced by the temporary water storage are expected to follow the downward dip direction of the existing strata, in a similar manner to the pre-storage flowlines. Migration of water leaking from the eastern low walls will be restricted by the easterly increase in the strata dip.

The stability of the saturated upper strata of the voids needs to be addressed as a major wall failure might result in water becoming displaced over the top of the voids.

3.3.4 Predicted Impact on Existing Groundwater Users

As observed previously in the 2002 Abbey Green SEE, the nearest registered water bores extract groundwater from Hunter River alluvial sediments. These bores are situated on the other side of the Hunter River to the AGN Expansion. The nearest bore is approximately six kilometres away and it is difficult to envisage a groundwater model that would enable AGN to affect the quality or quantity of the alluvial aquifers in that extraction area given that the:

- Indicative groundwater flow directions are generally towards Warkworth, MTO and Bulga open cuts, but are contained within the stratigraphically lower Permian strata.
- The storage of water in the AGN and AGS voids will not recharge aquifers to a level where the piezometric surface changes direction from the current down dip direction.
- Lack of recorded groundwater discharge points in proximity to the Hunter River alluvial bores.
- High lateral permeability and storage capacity of the alluvial aquifer.

There are no registered water extraction bores into the Permian aquifers due to low yield and poor water quality.

There are no impacts on water supply bores expected to be caused by the storage of water in the AGN and AGS voids.

3.4 Mitigation of Potential Impacts

Impacts arising from the storage of water in the AGN and AGS voids are unchanged from the currently approved operation.

3.5 Groundwater Monitoring and Development

Groundwater monitoring will continue to be undertaken generally in accordance with the current approved version of the MTO Water Management Plan.

Open hole piezometer installation is not practical down dip direction from the voids due to the large quantity of dumped, unconsolidated and geomechanically-variable material that overlies the coal measures.

Current and proposed piezometers are shown on Figure 4 from *Review of Water Impacts from Modifications to Abbey Green North Pit* (JP Environmental, May 2009). Open hole piezometers ABGOH13 and ABGOH14 are proposed to replace the function of ABGOH07 and ABGOH12 and monitor water quality and level up dip of the mining operation. Piezometers GW9708 (existing) and ABGOH15 (proposed) will be used to collect water level data and quality in the AGN sub-region. This network will adequately capture any departures from expected trends that may be caused by the storage of water in AGN and AGS.

The influence of water temporarily stored with AGN and AGS on the groundwater piezometric surface levels and flowlines may require additional monitoring. The groundwater monitoring regime will be adjusted if additional monitoring as found to be necessary. Additional piezometers could be installed in the barrier between the two voids, adjacent to the end and low walls however this would be required more for stability assessment rather than for monitoring environmental impacts.

3.6 Conclusions: Groundwater

The temporary storage of saline water within the AGN and AGS final voids above the existing piezometric surface level will increase the hydraulic head. Groundwater flowlines influenced by the temporary water storage are expected to follow the downward dip direction of the existing strata, in a similar manner to the pre-storage flowlines.

Water quality of the planned stored water has lower salinity levels than that of existing native groundwater.

Impacts arising from the storage of water in the AGN and AGS voids are unchanged from the currently approved operation.

4 Water Licence Requirements

Licensing of certain aspects of the mining operations with the Department of Water and Energy is normally required under Part 2 and Part 5 of the Water Act 1912, and the Water Management Act 2000.

4.1 Part 2 (Water Act) Licensing — Surface Water Facilities

The temporary storage of saline water within the AGN and AGS final voids will not require licensing under Part 2 of the *Water Act 1912*.

4.2 Part 5 (Water Act) Licensing — Groundwater Seepage

The temporary storage of saline water within the AGN and AGS final voids does not trigger a requirement to modify the current excavation licence 20BL170011.

Separate borehole licenses will need to be sought or maintained for any additional future observation piezometers.

5 References

1. *Coal & Allied Mt Thorley Operations Water Management Update; Mackie Environmental Research. July 2000*
2. *Abbey Green Project Groundwater Impact Potential; Groundsearch Australia Pty Ltd. January 2002*
3. *Mount Thorley Operations and Warkworth Mining Limited Section 96(2) Modification of Development Consents Statement of Environmental Effects; Environmental Resources Management Australia. January 2002*
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5. *Abbey Green North Project Groundwater Impact Potential - Groundwater Quality for JP Environmental Pty Ltd; Groundsearch Australia Pty Limited. 20 April 2009*
6. *Abbey Green Project Temporary Water Storage Considerations Report For JP Environmental Pty Ltd; Groundsearch Australia Pty Limited. 20 April 2009*

Plan of: Water Management Structures for Abbey Green North Proposal

Location:	MTO	Projection:	MGA Zone 56	Date:	090417	Project:	Abbey Green SEE
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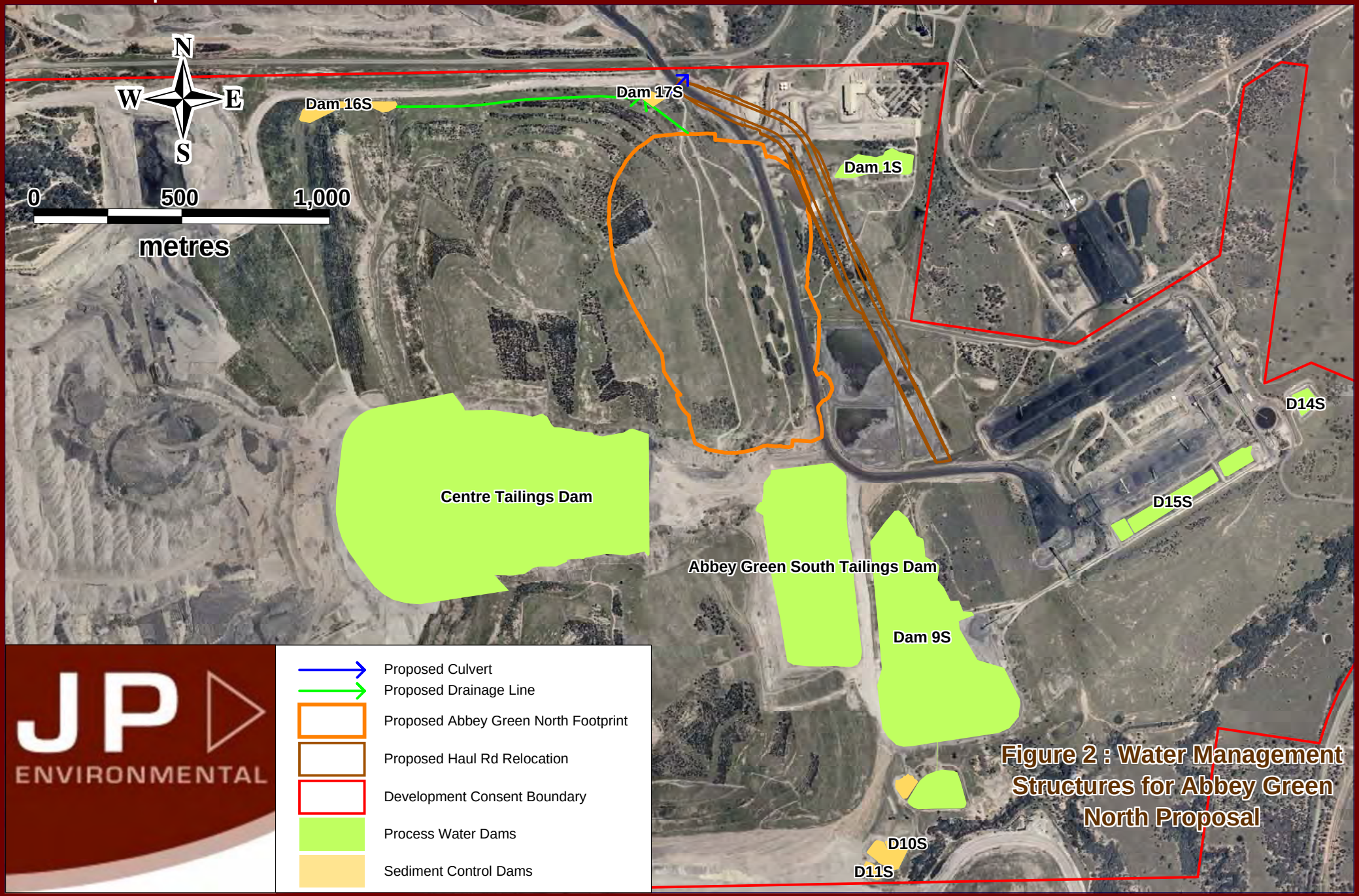

Figure 2 : Water Management Structures for Abbey Green North Proposal

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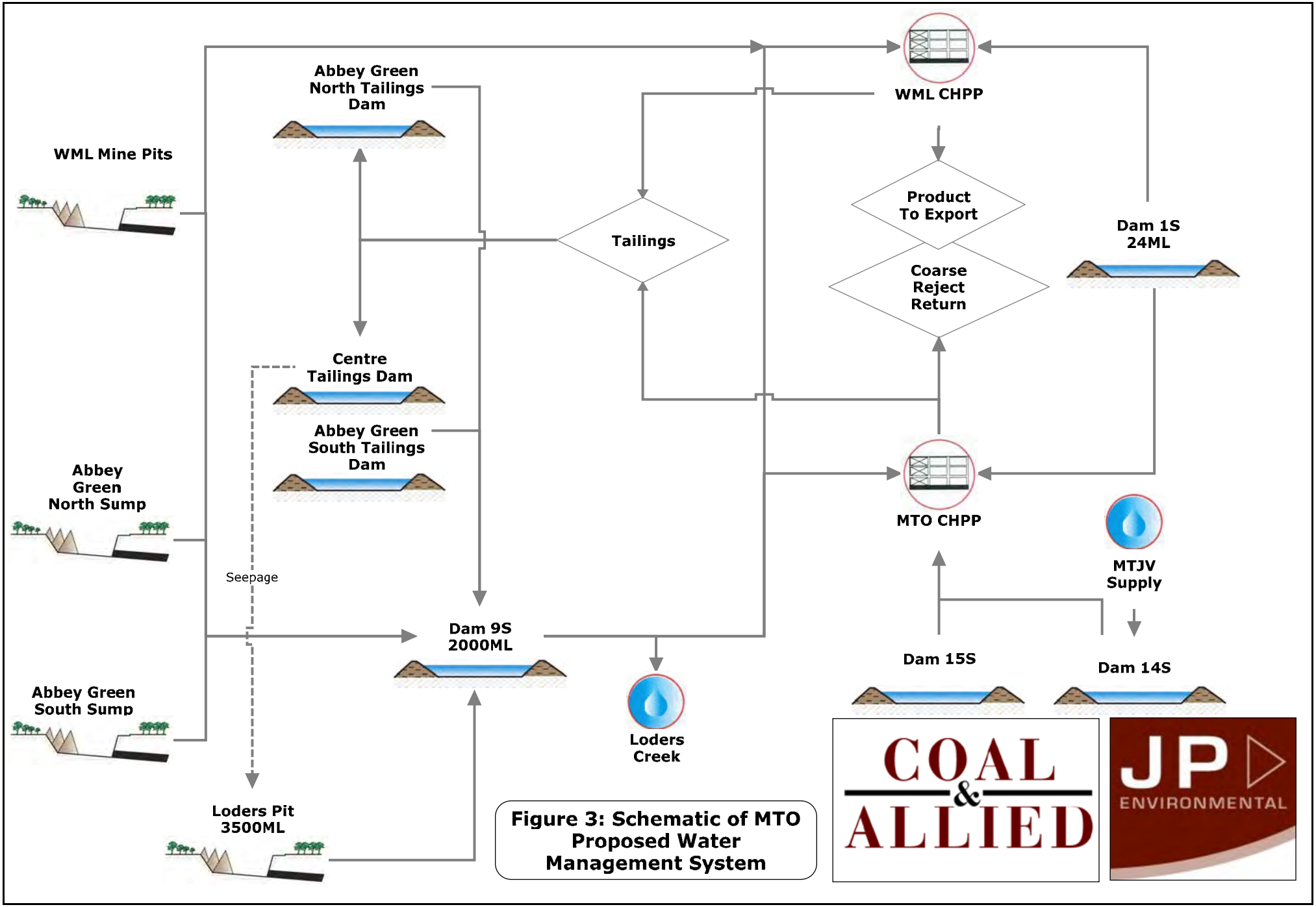

Figure 3: Schematic of MTO Proposed Water Management System

Plan of: Existing and Proposed AGN Piezometers

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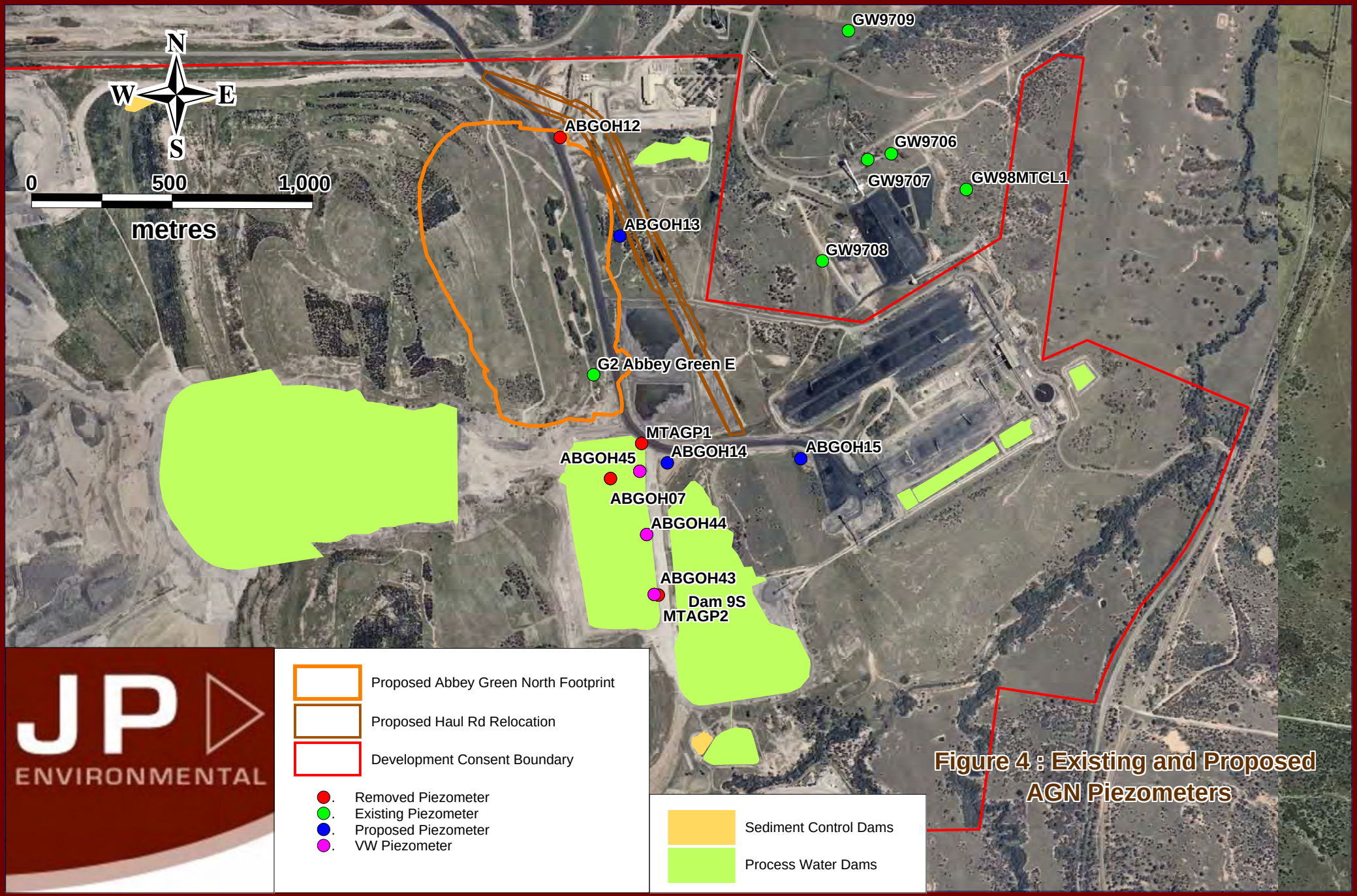

Figure 4 : Existing and Proposed AGN Piezometers

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