Mt Arthur Coal

proposed

Mt Arthur
UNDERGROUND PROJECT

Volume 1

Main Text & Appendices 1-3

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Umwelt
Environmental Consultants

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Environmental Assessment
Proposed Mt Arthur Underground Project

Prepared by

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on behalf of

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Executive Summary

Background

Mt Arthur Coal, a wholly owned subsidiary of BHP Billiton Hunter Valley Energy Coal, proposes to establish an underground coal mine at the existing Mt Arthur Coal site, south of Muswellbrook in the Upper Hunter Valley region of NSW.

The proposed underground mine will be located within the existing Bayswater No. 3 and exploration adit mining leases (MLs) and adjacent Exploration Licence (EL) area, held since 1996. Most of the land within the project area is owned by Mt Arthur Coal and consists of low intensity grazing or mining land. There are no privately owned residences, buildings or significant improvements within the project area and much of the land has been cleared of vegetation by past farming and mining practices.

The Mt Arthur Underground Project (the Underground Project) is classed as a 'Major Project' and requires approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The project application is required to be accompanied by this Environmental Assessment (EA) report. The NSW Minister for Planning is the consent authority for the project.

Proposed Project

The Underground Project is seeking approval for an initial 21 years of underground longwall mining in five coal seams. The project will have an annual run-of-mine (ROM) production rate of approximately 8 million tonnes per annum (Mtpa). This is in addition to the total approved and proposed ROM production from the Mt Arthur Coal complex, being the combined operations of the Mount Arthur North mine (DA 144-05-2000), the Bayswater No. 2 and Bayswater No. 3 mines (DA 210/93) and the South Pit Extension Project, of 20 Mtpa ROM coal. The coal reserves will be accessed through existing or approved open cut pits and will maximise use of the existing Mt Arthur Coal infrastructure including the coal handling and preparation plant (CHPP) and rail loading facility.

The key new surface infrastructure components of the project comprise:

- pit-top facilities including office, workshop, store and bathhouse;
- a ROM coal clearance system including conveyors, ROM stockpiling and a coal sizing facility;
- an extension of the existing Mt Arthur Coal site access road to provide internal access to Underground Project facilities;
- construction and upgrade of site services including power lines, water system, a water extraction point on the Hunter River and associated clean water pipeline;
- an upgrade of the existing CHPP including a new plant module, coal stockpiles and associated handling systems;
- an upgrade of the existing rail facility including extension of an existing passing lane on the Antiene rail spur should additional train movement capacity be required; and
- mining infrastructure including ventilation, borehole, gas drainage and dewatering facilities.

Construction of the main surface facilities is expected to be undertaken over a period of approximately two years.

Access to the Underground Project will be via the existing Mt Arthur Coal access road from Thomas Mitchell Drive and product coal will be transported to export or domestic markets via the existing rail facility or conveyor.

Justification for the Project

This EA provides a detailed assessment of the potential environmental and social impacts associated with the proposed Underground Project and details the significant economic, environmental and social benefits of the project. This includes a detailed assessment of the project under the principles of Ecologically Sustainable Development (ESD) as required by the EP&A Act. The EA concludes that the project is consistent with the principles of ESD.

The key benefits of the project include the significant economic benefit to the state and region associated with job creation, capital expenditure, ongoing operational expenditure, employee expenditure and contributions to community enhancement programs. Establishment of an underground mine at the Mt Arthur Coal operations area, which is already utilised for open cut mining, is an effective use of resources and minimises environment and community impacts as:

- the majority of land is owned by Mt Arthur Coal;
- the Mt Arthur Coal operations is surrounded by an extensive area of buffer land;
- the project maximises use of existing infrastructure;
- the majority of proposed infrastructure will be located within existing open cut mining areas;
- the majority of surface disturbance will occur on Mt Arthur Coal land;
- the main Underground Project surface facilities are distant from key residential areas and are shielded by topography;
- the integration of the existing open cut and proposed Underground Project water management systems will provide a number of synergies, maximising water efficiency; and
- the Underground Project builds on existing conservation management in buffer lands.

During the construction phase, the project will employ a peak workforce of approximately 470 people and will have an initial capital cost of approximately $300 million. During operation, the project will employ a peak workforce of approximately 300 people and will have a total operational expenditure of approximately $3 billion over the life of the project. Some of the key economic contributions of the project are outlined in **Table 1**.

Table 1 - Summary of Predicted Key Project Economic Contributions

		Direct Project-Related Economic Contribution		Multiplied Flow-on Economic Contribution from the Project[#]
Area of Economic Contribution	**Source of Economic Contribution**	**Average Annual Economic Contribution* (A$M)**	**Total Economic Contribution over Life of Project (A$M)**	**Total Economic Contribution over Life of Project (A$M)**
Muswellbrook	Employee expenditure	8	176	273
	Operating expenditure (excluding labour)	12	277	341
Hunter Region	Employee expenditure	20	456	781
	Operating expenditure (excluding labour)	76	1,757	2,533
NSW	Employee expenditure	20	456	1,017
	Operating expenditure (excluding labour)	81	1,862	3,356
NSW Government	Royalties on coal		415	
	Payroll tax		37	
Commonwealth Government	Employee personal income tax and Medicare payment		156	
	Company tax		450	
NSW Gross Domestic Product (GDP)	Contribution to NSW GDP		2,318	4,374

NB: * Averaged over the project's construction and operational phases.
[#] Multiplied economic contributions include both the initial direct contribution and flow-on /indirect benefits.

Consultation

Consultation with the community and government agencies was a key component of the EA process. The consultation program commenced early in the project planning phase to assist in appropriately defining the scope of the EA and to enable the project to be responsive to community concerns.

The consultation program consisted of two key phases. The initial phase aimed to inform stakeholders and the community of the proposed project, sought feedback as to stakeholder and community issues regarding the project and defined the project assessment plan. The second phase of consultation was carried out following completion of the EA process and aimed to inform stakeholders and the community in more detail of the project and how it will impact on the community and environment.

A range of mechanisms were used to engage the community and other stakeholders, and to seek feedback on this information. Community consultation mechanisms included individual meetings with surrounding landholders, private property plans (PPPs) prepared for landholders within the EL, project information sheets, community newsletters, presentations

to stakeholder and community groups, a community information session and a number of briefings to Mt Arthur Coal's two Community Consultative Committees.

Agency consultation included project briefings with all key government agencies at various stages of the project to discuss key issues and proposed management measures. Mt Arthur Coal has also consulted with other stakeholders including the Aboriginal community, Australian Rail Track Corporation (ARTC), TransGrid, neighbouring mining operations, Mt Arthur Coal employees and local service providers.

Key Environmental and Community Issues

This EA has comprehensively addressed the potential environmental and community impacts associated with the Underground Project. The EA has considered the impact of Underground Project and, where relevant, Mt Arthur Coal operations as a whole. A range of management and mitigation measures are proposed to minimise the environmental and social impacts of the project. An overview of the outcomes of the detailed assessments of the key issues is provided below.

Subsidence

A subsidence assessment has been undertaken to predict levels of subsidence associated with the Underground Project and to assess the potential impacts of subsidence on surface infrastructure and the environment.

The assessment defines the area affected by subsidence from the project. This area generally extends above and immediately adjacent to the underground mine footprint. The majority of the subsidence affectation area consists of vacant grazing land owned by Mt Arthur Coal. There are no privately owned houses or building structures within the subsidence affectation area and subsidence will not affect the Hunter River or Saddlers Creek. Public infrastructure within the subsidence affectation area includes a 330/500kV transmission line, Edderton Road and associated drainage, power and telecommunications infrastructure. Subsidence management measures will be put in place to prevent adverse impacts on these services and Edderton Road will be progressively repaired as subsidence occurs.

In some locations above the underground mining area, subsidence will result in cracking of the ground surface and localised changes to surface water drainage. These impacts will be repaired by infilling, cultivation or deep ripping followed by revegetation as required, with changes to surface water drainage restored by earthworks, as required.

Detailed subsidence management plans (SMPs) will be prepared for each stage of the project, specifying the monitoring requirements and subsidence management measures to be implemented for each mining area.

Water Resources

The potential impact of the project on water quality and quantity within surrounding catchments and groundwater has been assessed in detailed groundwater and surface water assessments. The project has been designed to avoid adversely impacting on the Hunter River and Saddlers Creek and no mining will occur beneath these watercourses.

Underground mining will result in the drawdown of the water table above and adjacent to the mining area. This drawdown will not extend beneath the Hunter River alluvial zone and will not impact significantly on the Saddlers Creek alluvial zone. Groundwater bores owned by one private landowner will be affected by the drawdown of the water table. Mt Arthur Coal is

currently in discussions with this landowner regarding the management of impacts associated with the Underground Project. No change in regional groundwater quality is predicted as a result of the project.

The water management system of the Underground Project has been designed to integrate with the existing Mt Arthur Coal water management system. Runoff from infrastructure areas associated with the project will be collected and recycled on site.

Subsidence is predicted to impact on some ephemeral drainage lines above the proposed mining area. These drainage lines are generally degraded and lacking riparian vegetation due to past agricultural practices, and only flow after significant rainfall events. Subsidence will result in surface cracking within some of these drainage lines and some changes in drainage patterns. These impacts will be rectified by subsidence remediation works progressively as mining occurs. Given the existing degraded condition of these drainage lines, the predicted subsidence impacts can be repaired without having a significant impact on drainage patterns, land use or ecological values.

The Underground Project will result in an increase in water use early in the project's life, however, modelling indicates that Mt Arthur Coal currently has sufficient water sources to cater for this and will not require any additional Hunter River water access licences for the project. Demand for water will reduce as the project progresses due to increasing groundwater inflows into the mine workings. The integration of the water management systems with the existing open cut operation also results in a number of synergies that reduce potential demand for external water and provide greater flexibility for water recycling and management at Mt Arthur Coal.

Mt Arthur Coal is committed to managing operations to conserve water and will continue to maximise on-site water storage and water recycling, re-use mine water, utilise treated effluent and industrial water from external suppliers where available.

Noise

Noise was a concern to a number of local residents and a detailed study was undertaken to assess the potential impacts of noise from the project on surrounding residential locations. Noise minimisation has been considered as a key component of the design of the Underground Project, including the location of surface infrastructure within open cut pits, where possible.

This noise assessment found that the Underground Project will make minimal contribution to existing operational noise levels and that operational noise will be within the assumed noise acquisition criteria (which are consistent with the Mount Arthur North (MAN) development consent) at all surrounding residential locations.

Commitments by Mt Arthur Coal to manage train movement noise impacts on the Antiene area will result in significant reductions in train noise from that currently experienced. These controls will be applied to all future train movements from Mt Arthur Coal. With these proposed controls in place, rail noise is predicted to significantly exceed the Project Specific Noise Criteria at one private residence in the east Antiene area. This impact will occur for less than 10 per cent of the night time period during worst case meteorological conditions.

Air Quality

Potential dust impacts were a key issue raised by the community during consultation and a detailed air quality assessment has been undertaken.

Modelling of predicted dust emissions from the Underground Project shows that the project will result in minimal contribution to local dust levels and will readily comply with all relevant dust goals and criteria set by the Department of Environment and Climate Change (DECC).

A range of dust controls will be implemented consistent with existing operations, including dust controls on coal handling equipment, spray systems for suppressing dust from coal stockpiles and ongoing dust monitoring and reporting of results.

A detailed greenhouse gas emissions assessment has also been undertaken to consider emissions from the project itself and from the end use of the coal produced by the project. The assessment has found that the greenhouse gas emissions produced by the project are significantly less than the Australian underground coal mining industry average.

BHP Billiton has recently released a Climate Change Policy which commits to reducing energy use across its operations by 13 per cent and greenhouse gas emissions by 6 per cent by 2012. The Policy also commits to contributing $300 million to greenhouse gas emission reduction research and projects (internal and external) by 2012. Building on this commitment, a number of controls are proposed as part of the project to limit greenhouse gas emissions including the development and implementation of internal energy and greenhouse gas management plans and, where feasible, to implement control measures for methane gas.

Ecology

A comprehensive ecological survey and assessment was undertaken to assess the impact of the Underground Project on native flora and fauna. Much of the project area has been previously cleared for grazing or mining, however, some areas of woodland remain. The survey recorded eight threatened fauna species within the woodland areas including five bats, two woodland birds and one glider. Also recorded was one threatened grass species, two endangered flora populations and one Endangered Ecological Community.

The project will require minimal clearing of vegetation, as surface infrastructure will be largely located within existing open cut mining areas. Subsidence is not predicted to have a direct adverse impact on flora and fauna, however, subsidence remediation works such as cultivation and earthworks may impact on ecological values. Disturbance in woodland areas will be minimal, with the bulk of predicted subsidence remediation works occurring in grassland habitats.

The ecological assessment concludes that the project will not have a significant impact on threatened species, populations or communities or their habitats due to the small area of clearing and disturbance required within woodland areas.

A range of management measures will be put in place to further reduce potential impacts on ecological values and Mt Arthur Coal proposes to conserve 295 hectares of ecologically significant land along Saddlers Creek in perpetuity, providing a significant ecological conservation outcome.

Aboriginal and Non-Aboriginal Heritage

A comprehensive Aboriginal archaeological and cultural heritage assessment was undertaken in conjunction with 19 registered Aboriginal stakeholder groups to identify and assess the nature and significance of the Aboriginal cultural heritage within the project area.

A total of 77 Aboriginal heritage sites were identified within the study area, including one scarred tree, 46 artefact scatters and 30 isolated finds (single artefacts). Twenty-nine of

these sites are predicted to be disturbed for construction of surface infrastructure or subsidence remediation activities. The artefacts at these sites will be salvaged in consultation with the Aboriginal community while the remaining sites will be left undisturbed.

To offset the disturbance of these sites, Mt Arthur Coal proposes a number of strategies, including establishing the Saddlers Creek conservation area to protect approximately 295 hectares of land of high significance along Saddlers Creek in perpetuity; establishing a keeping place to store artefacts from the Mt Arthur Coal site to be staffed 50 days per year by trained Aboriginal representatives; management of the salvage program to provide ongoing employment opportunities for Aboriginal representatives; and establishing a Management Committee comprised of representatives from Aboriginal stakeholder groups to assist with the ongoing management of sites within the project area.

A historic heritage study was undertaken to identify and assess European heritage within the project area. Eight sites of local heritage significance were identified within the project area, all on Mt Arthur Coal owned land. Several of these sites will be impacted by subsidence and the sites will be recorded in detail prior to impact.

Visual Amenity

The Underground Project has limited potential for visual impacts due to the nature of underground mining. In addition, the project design minimises visual impacts with placement of major surface infrastructure within open cut pits. The key surface infrastructure proposed as part of the project will not be visible outside the project area. A small number of residences in elevated locations along Roxburgh Road and the Golden Highway will potentially have distant views (approximately 10 kilometres distant) of surface infrastructure, however, tree planting and screening bunds are proposed to shield or filter these views.

Traffic and Transport

A detailed traffic assessment has been conducted to assess both the direct traffic impacts of the proposal and the projected cumulative traffic impacts associated with the Underground Project and other major approved or proposed mining operations.

The assessment found that although the project will result in an increase in local traffic volumes during construction and operation, increases in traffic volume are not predicted to significantly impact on existing traffic conditions and no road upgrade works are required.

The ARTC has advised that sufficient rail capacity will be available to accommodate the predicted volume of rail traffic generated by the project.

Socio-economic

The Underground Project will result in an influx of employees and their families to the local area and region. An assessment of the potential impact on the key service areas of health, accommodation and education has identified that the health sector was the over-riding area of concern for residents and community groups in terms of community need. The health sector was also the only sector found to be currently at or beyond capacity in terms of service provision. Therefore the Underground Project is likely to place further pressure on a sector that is currently at or exceeding capacity.

Other sectors such as education and housing have been assessed as able to absorb any population impacts associated with the project's construction and operational workforce and associated family members.

TABLE OF CONTENTS

1.0 Introduction 1.1

1.1 Mine History and Existing Operations 1.1

1.2 Overview of the Project 1.2

1.3 Overview of the Existing Environment 1.4

1.3.1 Project Area and Surrounding Land Use 1.4

1.3.2 Property Description and Land Ownership 1.5

1.3.3 Overview of Environmental Features 1.5

1.3.4 Existing Mt Arthur Coal Environmental Management System 1.6

1.4 Overview of the Planning and Approval Process 1.7

1.5 Project Team 1.8

1.6 Environmental Assessment Structure 1.8

2.0 Stakeholder Consultation 2.1

2.1 Authority Consultation 2.1

2.2 Other Stakeholder Consultation 2.2

2.2.1 Community Consultation 2.2

2.2.2 Aboriginal Community Consultation 2.4

2.2.3 Service Provider Consultation 2.5

2.3 Identification of Key Issues 2.5

2.3.1 Key Community Issues 2.5

2.3.2 Agency Requirements 2.5

3.0 Description of the Underground Project 3.1

3.1 Need for the Underground Project 3.2

3.2 Project Alternatives Considered 3.2

3.3 Interaction with Existing Development Consents & Approvals 3.3

3.4 Exploration History and Resource Description 3.5

3.4.1 Geological Setting 3.6

3.4.2 Coal Resources 3.7

3.5 Construction Phase 3.7

3.6 Concept Mine Plan 3.8

3.6.1 Woodlands Hill Seam Concept Mine Plan 3.9

3.6.2 Glen Munro Seam Concept Mine Plan 3.10

3.6.3 Arrowfield, Bowfield and Piercefield Seams Concept Mine Plans 3.10

3.6.4 Mining Surface Infrastructure 3.11

3.6.5 Coal Production 3.11
3.7 Mine Infrastructure 3.12
3.7.1 Pit-Top Facilities 3.12
3.7.2 ROM Coal Handling System 3.12
3.7.3 Existing MAN CHPP Upgrade 3.13
3.7.4 Product Coal Transportation 3.14
3.7.5 Site Access and Road Works 3.15
3.7.6 Site Services and Associated Infrastructure 3.15
3.7.7 Water Services 3.16
3.8 Workforce and Hours of Operation 3.16
3.9 Use of Existing Facilities 3.17
3.10 Decommissioning and Closure 3.17

4.0 Planning Context 4.1
4.1 Commonwealth Legislation 4.1
4.1.1 Environmental Protection and Biodiversity Conservation Act 1999 ..... 4.1
4.1.2 Native Title Act 1993 ..... 4.1
4.2 New South Wales Legislation 4.2
4.2.1 Environmental Planning and Assessment Act 1979 ..... 4.2
4.2.2 Mining Act 1992 ..... 4.4
4.2.3 Coal Mine Health and Safety Act 2002 ..... 4.4
4.2.4 Mine Subsidence Compensation Act 1961 ..... 4.5
4.2.5 Protection of the Environment Operations Act 1997 ..... 4.5
4.2.6 Water Management Act 2000 ..... 4.5
4.2.7 Water Act 1912 ..... 4.5
4.2.8 Environmentally Hazardous Chemicals Act 1985 ..... 4.5
4.2.9 Roads Act 1993 ..... 4.6
4.2.10 Crown Lands Act 1989 ..... 4.6
4.2.11 Radiation Control Act 1990 ..... 4.6
4.3 State Environmental Planning Policies 4.7
4.3.1 State Environmental Planning Policy (Major Projects) 2005 ..... 4.7
4.3.2 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 ..... 4.7
4.3.3 State Environmental Planning Policy 33 ..... 4.7
4.3.4 State Environmental Planning Policy 44 ..... 4.8
4.3.5 State Environmental Planning Policy 55 ..... 4.8

5.0 Environmental Assessment 5.1
5.1 Environmental Risk Analysis 5.1

5.2 Subsidence 5.2
5.2.1 Subsidence Prediction Methodology 5.4
5.2.2 Subsidence Predictions 5.4
5.2.3 Subsidence Impact Assessment 5.5
5.2.4 Subsidence Monitoring and Management 5.13
5.3 Ecology 5.14
5.3.1 Regional Ecological Context 5.14
5.3.2 Flora 5.15
5.3.3 Existing Fauna 5.17
5.3.4 Ecological Impact Assessment 5.17
5.3.5 Management and Monitoring 5.21
5.4 Heritage 5.23
5.4.1 Aboriginal Cultural Heritage 5.23
5.4.2 Historic Heritage 5.30
5.5 Soil and Water Resources 5.34
5.5.1 Soils 5.34
5.5.2 Surface Water Assessment 5.34
5.5.3 Groundwater 5.45
5.6 Noise 5.49
5.6.1 Existing Acoustic Environment 5.49
5.6.2 Assessment Criteria 5.49
5.6.3 Noise Modelling 5.52
5.6.4 Noise Impact Assessment 5.53
5.6.5 Cumulative Noise Impact Assessment 5.59
5.6.6 Noise Management and Mitigation 5.60
5.7 Air Quality 5.61
5.7.1 Air Quality Criteria 5.61
5.7.2 Existing Air Quality Environment 5.62
5.7.3 Assessment Methodology 5.63
5.7.4 Air Quality Impact Assessment 5.63
5.7.5 Air Quality Management 5.66
5.7.6 Spontaneous Combustion 5.66
5.8 Greenhouse Gas Emissions Assessment 5.67
5.8.1 Methodology 5.67
5.8.2 Energy Consumption 5.69
5.8.3 Greenhouse Gas Emissions 5.69
5.8.4 Greenhouse Gas Management 5.71
5.9 Visual Impact 5.73
5.9.1 Existing Visual Amenity 5.73

5.9.2 Visibility of the Project 5.74
5.9.3 Viewing Points and Assessment Methodology 5.74
5.9.4 Visual Impacts 5.75
5.9.5 Proposed Visual Controls 5.79
5.10 Land Resources, Decommissioning and Rehabilitation 5.79
5.10.1 Land Capability 5.79
5.10.2 Decommissioning Strategy 5.80
5.10.3 Mt Arthur Coal Rehabilitation and Habitat Management Strategy 5.83
5.11 Traffic and Transport 5.86
5.11.1 Existing Traffic Conditions 5.86
5.11.2 Construction Traffic Impacts 5.87
5.11.3 Operational Traffic Impacts 5.87
5.11.4 Traffic Management 5.89
5.11.5 Rail Infrastructure 5.90
5.12 Socio-economic Assessment 5.91
5.12.1 Methodology 5.91
5.12.2 Community Issues 5.92
5.12.3 Community Needs 5.92
5.12.4 Population Impact Projections 5.93
5.12.5 Economic Assessment 5.94
5.12.6 Cumulative Impacts 5.96
5.12.7 Management and Ongoing Community Involvement 5.96

6.0 Draft Statement of Commitments 6.1
6.1 Compliance with the EA 6.1
6.2 Life of Operation, Production, Concept Mine Plan and Rail Haulage 6.1
6.3 Subsidence 6.2
6.4 Ecology 6.3
6.5 Heritage 6.4
6.6 Water Resources 6.5
6.7 Noise 6.7
6.8 Air Quality 6.9
6.9 Greenhouse Gas Emissions 6.10
6.10 Visual 6.11
6.11 Decommissioning and Rehabilitation 6.11
6.12 Traffic and Transport 6.12
6.13 Community 6.12

6.14 Environmental Management, Monitoring, Auditing and Reporting 6.12

7.0 Conclusion and Justification for the Project 7.1

7.1 Environmental Impacts 7.1

7.2 Suitability of the Site 7.3

7.3 Benefits of the Project 7.4

7.4 Ecologically Sustainable Development 7.6

7.4.1 The Precautionary Principle 7.6

7.4.2 Intergenerational Equity 7.7

7.4.3 Conservation of Biological Diversity 7.8

7.4.4 Valuation and Pricing of Resources 7.8

7.5 Conclusion 7.9

8.0 References 8.1

9.0 Abbreviations and Glossary 9.1

9.1 Abbreviations 9.1

9.2 Glossary 9.3

FIGURES

1.1 Locality Plan 1.1

1.2 Mt Arthur Coal Operations and Project Application Area 1.1

1.3 Overview of Proposed Underground Project 1.2

1.4 Land Use 1.4

1.5 Land Ownership 1.5

1.6 Topography 1.5

2.1 Community Issues Raised During Consultation 2.5

3.1 Stratigraphic Column 3.5

3.2 Geological Structure 3.6

3.3 Woodlands Hill Seam Concept Mine Plan 3.9

3.4 Glen Munro Seam Concept Mine Plan 3.10

3.5 Arrowfield, Bowfield and Piercefield Seams Concept Mine Plans 3.10

3.6 MAN CHPP and ROM Upgrade.....3.13

3.7 Antiene Rail Spur Upgrade.....3.15

4.1 Land Zoning 4.3

5.1 Typical Subsidence Profile 5.2

5.2 Predicted Cumulative Subsidence – Woodlands Hill Seam.....5.4

5.3 Predicted Cumulative Subsidence – Glen Munro Seam.....5.4

5.4 Predicted Cumulative Subsidence – Arrowfield Seam.....5.4

5.5 Predicted Cumulative Subsidence – Bowfield Seam.....5.4

5.6 Predicted Cumulative Subsidence – Piercefield Seam.....5.4

5.7 Predicted Total Subsidence – Year 21 .....5.4

5.8 Potential Subsidence Remediation Areas 5.6

5.9 Ecological Survey Area, Threatened Species, Vegetation Communities and Potential Subsidence Remediation Areas 5.14

5.10 Existing Mt Arthur Coal Rehabilitation and Landscape Strategy 5.14

5.11 Archaeological Site Distribution, Archaeological Significance and Potential Surface Impact Area.....5.24

5.12 Cultural Heritage Management Areas 5.26

5.13 Historical Heritage Sites and Subsidence Affectation Area.....5.31

5.14 Soil Landscapes.....5.34

5.15 Catchments, Surface Water Monitoring Locations and Mine Water Management System 5.35

5.16 Potential Subsidence Remediation Areas and Surface Water Drainage System.....5.38

5.17 Hierarchy of Water Sources.....5.40

5.18 Pre-Mining Groundwater Environment 5.45

5.19 Groundwater Drawdown in the Piercefield Seam at the end of Underground Mining.....5.46

5.20 Groundwater Drawdown in the Shallow Regolith Zone at the end of Underground Mining 5.46

5.21 Noise Monitoring and Assessment Locations 5.54

5.22 Dust Monitoring and Assessment Locations 5.62

5.23 Regional Air Quality Monitoring Results 5.62

5.24 Comparison of MAN EIS (Year 10) Air Quality Modelling Results with Proposed Combined Mt Arthur Coal Operations 5.65

5.25 Visual Assessment Locations 5.74

5.26 Areas Visible from Roxburgh Road (Location 18) 5.75

5.27 Visual Transect Assessment – Roxburgh Road (Location 18) 5.76

5.28 Areas Visible from Denman Road West (Location 13).....5.76

5.29 Visual Transect Assessment – South of Golden Highway and Denman Road West (Locations 2 & 13) 5.76

5.30 Areas Visible from South of Golden Highway (Location 2).....5.76

5.31 Areas Visible from South Muswellbrook (Location 22) 5.77

5.32 Areas Visible from Racecourse (Location 20).....5.77

5.33 Land Capability 5.79

5.34 Conceptual Final Landform.....5.83

5.35 Revised Mt Arthur Coal Rehabilitation and Landscape Strategy incorporating the Underground Project.....5.84

5.36 Road Reserves Proposed to be Closed 5.90

APPENDICES

1 EA Form, Project Team and Schedule of Lands

2 Authority Correspondence

3 Socio-economic Impact Assessment

4 Environmental Risk Analysis

5 Subsidence Assessment

6 Ecological Assessment

7 Aboriginal Archaeological Assessment

8 Historical Heritage Assessment

9 Surface Water Assessment

10 Groundwater Management Study

11 Noise Assessment

12 Air Quality Assessment

13 Greenhouse Gas Assessment

14 Traffic and Transport Assessment

1.0 Introduction

Mt Arthur Coal Pty Ltd (Mt Arthur Coal), a wholly owned subsidiary of BHP Billiton Hunter Valley Energy Coal, operates the Mt Arthur Coal open cut coal mine south of Muswellbrook in the upper Hunter Valley of NSW (refer to **Figure 1.1**). Mt Arthur Coal's existing operation consists of three mining areas, the Bayswater No. 2 mining area (extraction complete), the Bayswater No. 3 mining area (including an exploration adit) and the Mount Arthur North (MAN) mining area and associated coal handling and loading facilities (refer to **Figure 1.2**). Mt Arthur Coal proposes to develop an underground coal mine in the Bayswater No. 3 and exploration adit MLs and the adjacent Exploration Licence (EL) 5965 held since 1996. This project is known as the Mt Arthur Underground Project (the Underground Project).

The proposed Underground Project will target five coal seams within the Whittingham Coal Measures and will aim to extract approximately 160 million tonnes (Mt) over the first 21 years of mining. Sufficient resources have been identified for in excess of 50 years of underground mining. The mining areas will be accessed through existing and approved open cut pits at Bayswater No. 3 and the project will utilise much of Mt Arthur Coal's existing infrastructure, including the coal handling and preparation plant (CHPP) and rail loading facility.

The Underground Project is classed as a 'Major Project' under Part 3A of the Environment Protection and Assessment Act (EP&A Act) (refer to **Section 4.2.1**), requiring the preparation of an Environmental Assessment (EA) report. The NSW Minister for Planning will be the consent authority for the project.

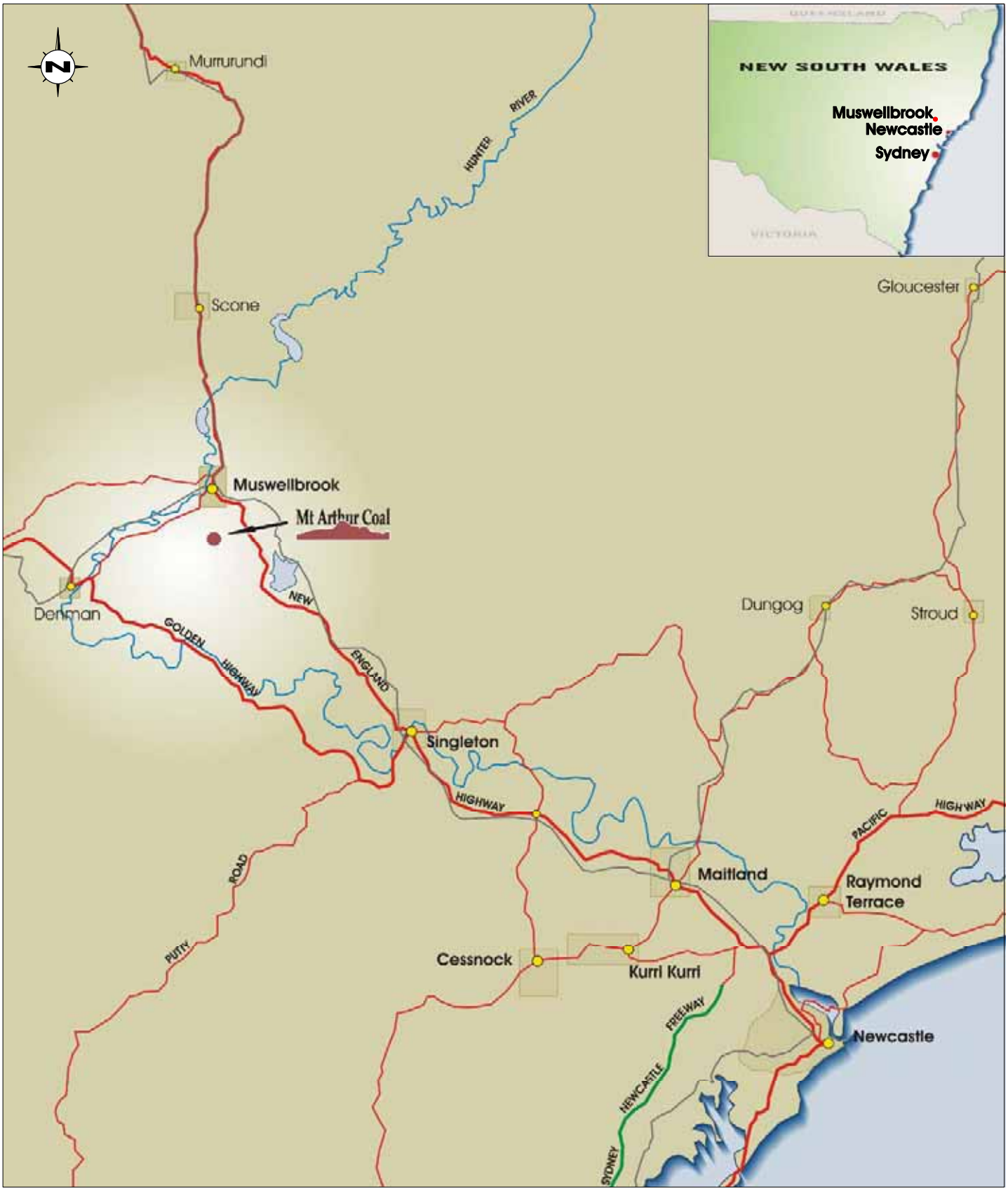
A Major Projects Application for the project was lodged with the Department of Planning (DoP) in March 2006. The Project Application Area (project area) is shown on **Figure 1.2**. The schedule of lands within the project area is contained in **Appendix 1**.

This EA has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Mt Arthur Coal in accordance with the Director-General's Requirements (DGRs) for the project issued by DoP (refer to **Section 2.3.2**). This EA includes a description of the project, a discussion of the planning and environmental context, a detailed environmental impact assessment, identifies the required management and mitigation measures, and contains a statement of commitments to be implemented as part of the project.

1.1 Mine History and Existing Operations

Mt Arthur Coal's history traces back to the late 1950s with the operation of an underground mine until 1964. Open-cut mining began at Bayswater No. 2 in 1966, within the Greta Coal Measures. Coal production slowly increased until September 1994 when approval was obtained (DA 210/93) for a significant expansion of the operation into the Bayswater No. 3 Mining Lease (ML) 1358, mining the Whittingham Coal Measures. The development consent for Bayswater No. 3 approved mining up to 3.8 Mtpa of saleable coal (equivalent of approximately 5 Mtpa ROM coal).

Mining began at Bayswater No. 3 in 1995, serviced by the existing coal processing and industrial facilities located at Bayswater No. 2. Coal extraction was completed in Bayswater No. 2 in late 1998. To support the expanded operation and to remove coal transport from public roads, approval was obtained in November 2000 for the construction and operation of a rail loading facility and spur line. Commissioned in late 2001, the rail facility provided an immediate reduction in heavy traffic volumes along Thomas Mitchell Drive and the New England Highway, improving the safety and amenity of these areas.



Base Source: NSW Road Directory

FIGURE 1.1

Locality Plan

Base Source: Mt Arthur Coal, 2006

Legend

- Mining and Exploration Lease Boundary
- Project Application Boundary

FIGURE 1.2

Mt Arthur Coal Operations and Project Application Area

In May 2001, the Mount Arthur North (MAN) Project, located adjacent to the Bayswater operations, was granted development consent by the Minister for Planning (DA 144-05-2000). MAN was approved to produce 15 Mtpa of run-of-mine (ROM) coal. Construction of the MAN Project commenced in late 2001 and coal mining began in 2002.

Since the integration of the Bayswater and MAN mining operations to form Mt Arthur Coal in 2002, mining has been focused within the MAN area, with limited mining also occurring in the Bayswater No. 3 area. Coal preparation, handling and loading is undertaken within the centralised MAN CHPP located within the MAN ML (ML1487) and loaded onto trains for export via the Bayswater rail facility or stockpiled and transported by conveyor to nearby Bayswater Power Station, operated by Macquarie Generation.

In February 2006, as part of the planning and exploration work associated with the proposed Underground Project, Mt Arthur Coal sought approval from the DoP for the construction and operation of an exploration adit within the Woodlands Hill Seam. The aim of the adit was to provide further information about the potential underground coal mining resource to assist in detailed mine and infrastructure planning for the proposed Underground Project. In September 2006, the Minister for Planning approved the exploration adit under Part 3A of the EP&A Act. Mining of the adit commenced in mid 2007 and will continue for approximately two years.

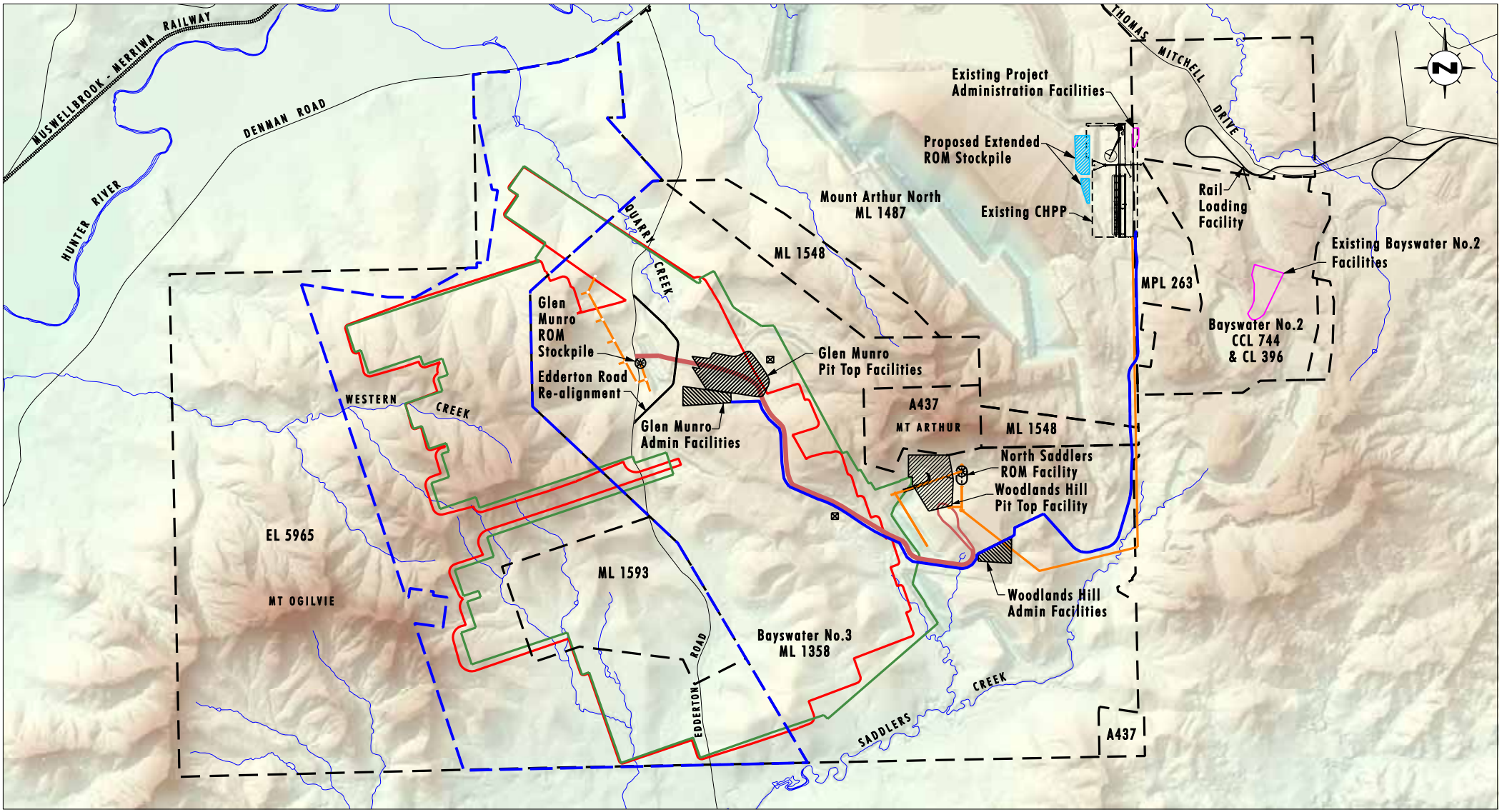
In March 2006, Mt Arthur Coal submitted an application to DoP under Part 3A of the EP&A Act to extend the currently approved MAN South Pit further south into the Bayswater No. 3 ML. This proposed extension of the open cut mining area is known as the South Pit Extension Project. If approved, the project will result in the recovery of an additional 25 million tonnes of coal over the 21 year approval life, however, it will not increase Mt Arthur Coal's currently approved annual production limits. The South Pit Extension Project EA was submitted to DoP for public exhibition in June 2007 and is currently being assessed.

Mt Arthur Coal has a firm commitment to minimising the impact of its operations on the local environment and community, and has a comprehensive Environmental Management System (EMS) in place to assist it in reaching this goal. The EMS is certified against ISO 14001, the international standard for EMS. This certification requires regular surveillance audits and a full recertification audit undertaken by external auditors every three years. The most recent recertification audit was undertaken in May 2006. Mt Arthur Coal was successful in maintaining certification. The EMS includes an EMS, detailed environmental management plans and operational procedures to assist in managing the operations environmental impacts and continual improvement programs. A key action within the EMS is to disseminate responsibilities for environmental management to all persons working on site. Through implementation of the EMS, Mt Arthur Coal strives for best practice in environmental management and to be an effective and valued member of the local community.

The EMS and a number of the environmental management plans are required by DoP conditions contained within existing development consents which govern Mt Arthur Coal's operations. These documents are regularly reviewed and provided to DoP and other Government agencies, as required, for authorisation.

1.2 Overview of the Project

The Underground Project involves longwall mining in five coal seams over a 21 year period. The proposed underground mining area and proposed ML over the existing EL area are shown on **Figure 1.3**. The project will have an annual production rate of approximately 8 Mtpa of ROM coal.



Source: Mt Arthur Coal, 2006

0 1 2 3km
1:70 000

Legend

- Mining and Exploration Lease Boundaries
- Subsidence Affectation Area
- Proposed Underground Mining Area
- Proposed Mining Lease Boundary
- Mine Access Road
- Haul Road
- Surface Conveyor
- Major Shaft Complex

FIGURE 1.3

Overview of Proposed Underground Project

File Name (A4): R21_V1/2051_250.dgn

Mt Arthur Coal will access the coal reserves through existing and approved open cut pits and will maximise the use of existing Mt Arthur Coal infrastructure including the CHPP and rail facility. Some upgrade works to these facilities will be required to provide sufficient capacity. The key additional surface infrastructure required as part of the project will include:

- pit-top facilities including offices, workshop, fuel/oil storage areas, stores compound and bathhouse;
- a ROM coal clearance system including conveyors, ROM stockpiling and a coal sizing facility;
- an extension of the sealed Mt Arthur Coal site access road to provide internal access to Underground Project facilities;
- construction and upgrade of site services including powerlines, potable water, mine water and groundwater pipelines, a water extraction point on the Hunter River and associated clean water pipeline;
- an upgrade of the existing CHPP including a new plant module, coal stockpiles and associated handling systems;
- an upgrade of the existing rail facility including extension of an existing passing lane on the Antiene rail spur if additional train movement capacity is required; and
- various mining surface infrastructure including ventilation and borehole facilities, gas drainage infrastructure and dewatering facilities.

Further details of the proposed project are included in **Section 3.0**, with the key components that comprise the underground project shown on **Figure 1.3**.

As described in **Section 1.3.1**, the dominant land uses within and surrounding the project area are mining and grazing. The majority of land within the project area is owned by Mt Arthur Coal, with mining to occur under three private land ownerships. All major surface infrastructure will be located on lands owned by Mt Arthur Coal.

The ground surface above the underground mining operations will be subject to varying degrees of mine subsidence. The extent of the ground surface area likely to be affected by subsidence is referred to as the subsidence affectation area (refer to **Figure 1.3**).

A detailed subsidence assessment undertaken for the project (refer to **Section 5.2**) identifies that subsidence is not predicted to impact on any privately owned residences or significant private infrastructure. The project will have a subsidence impact on the Mt Piper-Bayswater 330/500 kV power line which is owned and operated by TransGrid (a NSW corporate entity under the *State Owned Corporations Act 1989*) as well as on some local powerlines and Edderton Road. The project has been designed to avoid subsidence impacts on Saddler's Creek and the Hunter River and its associated alluvial zone.

Substantial further coal resources will remain within the project area beyond the initial 21 year approval sought as part of this project. Mt Arthur Coal intends to seek approval to continue the underground operation as it approaches the end of the initial 21 year period. Sufficient resources exist in the project area for in excess of 50 years of underground mining.

1.3 Overview of the Existing Environment

1.3.1 Project Area and Surrounding Land Use

The proposed underground mining area is located approximately 10 kilometres south of Muswellbrook in the upper Hunter Valley of NSW. The Project Application Area (refer to **Figure 1.2**) includes the proposed underground mining area in the existing Bayswater No. 3 and exploration adit MLs and adjacent EL, all areas in which surface infrastructure are proposed to be located, the existing CHPP and rail facility, open cut mining areas that may be used for reject and tailings disposal for the life of the Underground Project and the Antiene rail spur to its connection with the main northern railway. The proposed ML boundary is shown on **Figure 1.3**.

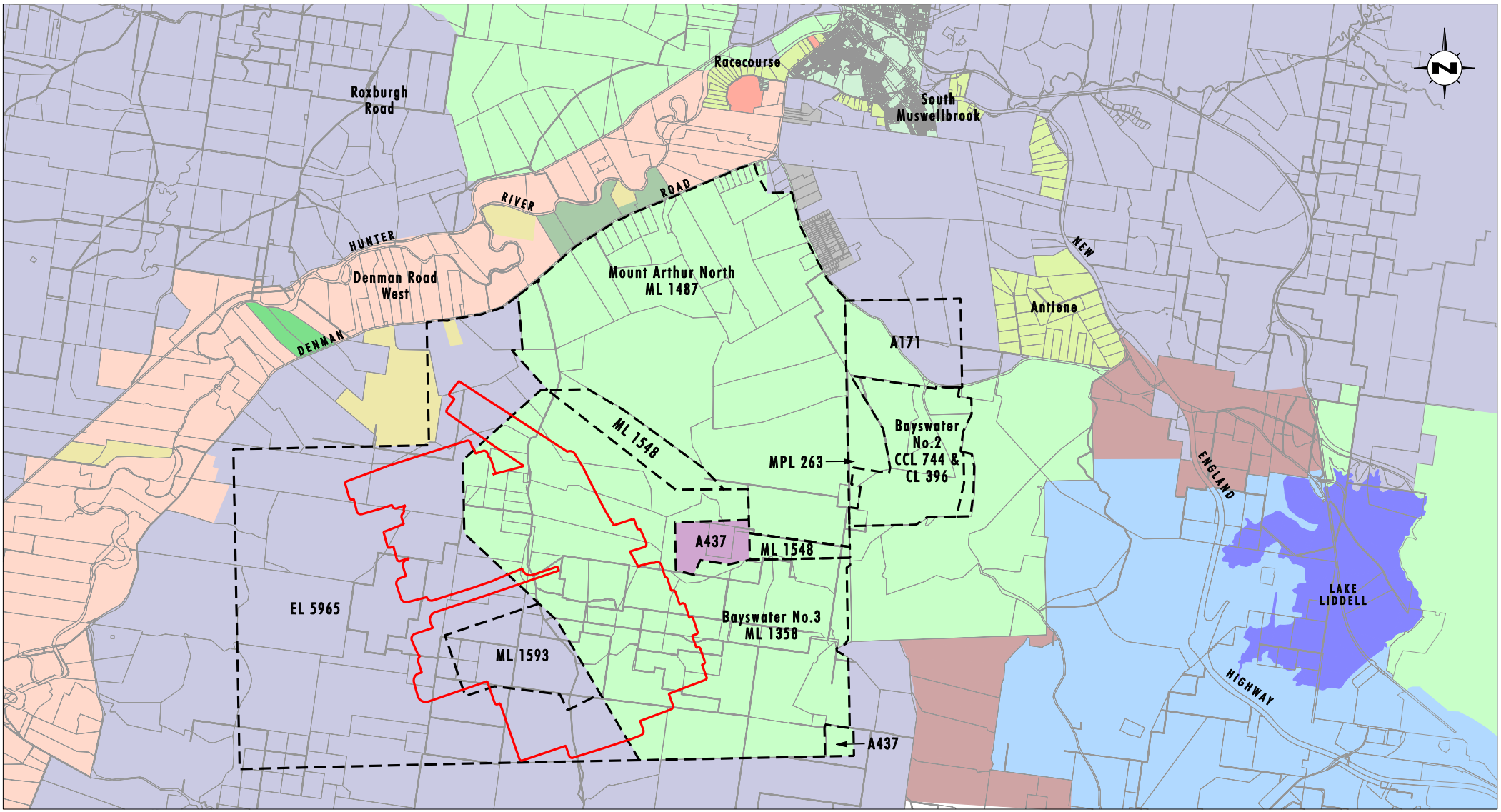
The Hunter Valley has had a long history of rural land use and as such the majority of the region consists of cleared land used for a variety of agricultural pursuits, predominantly grazing (refer to **Figure 1.4**). More intensive agricultural land uses occur on fertile lands, such as the Hunter River alluvial zone, including horse studs, dairying, viticulture, olives and intensive cropping for stock feed. Other key land uses in the region are mining and power generation, tourism, residential and smaller areas of industrial land use.

The dominant land uses within and adjacent to the project area are mining and grazing (refer to **Figure 1.4**). Much of the underground mining area and the majority of surface infrastructure will be located within existing open cut MLs held by Mt Arthur Coal, with the land outside the MLs primarily subject to grazing activity (including land owned by Mt Arthur Coal). The steeper slopes of Mt Ogilvie consist of remnant vegetation which is subject to low intensity periodic grazing. Interactions of the Underground Project with agricultural land use are discussed in **Section 5.2**.

To the north and north-east of the EL, the more productive lands along the Hunter River are used for irrigated pasture/fodder crops, with areas also used for horse studs and dairies. A number of vineyards and olive groves also exist in this area, including Rosemount's Roxburgh Vineyard which is adjacent to the northern boundary of the EL.

As shown on **Figure 1.4**, there are several residential and rural residential areas within the vicinity of the project area including:

- the Antiene rural residential area to the north-east (which is located more than 8.5 kilometres from the nearest item of major new Underground Project infrastructure);
- South Muswellbrook to the north (which is located more than 10 kilometres from the nearest item of major new Underground Project infrastructure);
- the Racecourse rural residential/residential area to the north (which is located more than 6.5 kilometres from the nearest item of major new Underground Project infrastructure);
- Denman Road west rural residential area to the north and north-west (which is located more than 3.5 kilometres from the nearest item of major new Underground Project infrastructure); and
- Roxburgh Road rural area to the north-west (which is located more than 8 kilometres from the nearest item of major new Underground Project infrastructure).



Base Source: LEP 2004, LPI 2004

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Horse Stud
- Vineyard
- Olive Plantation
- Rural Residential
- Racecourse / Greyhound Track
- Urban
- Area of intensive / Irrigated Agriculture
- Non-intensive Agricultural Use (Grazing)
- Power Station Owned Land Used Primarily for Grazing
- Power Station Buffer
- Mount Arthur
- Mining
- Industrial

FIGURE 1.4

Land Use

File Name (A4): R21_V1/2051_253.dgn

1.3.2 Property Description and Land Ownership

The Project Application Area is shown in **Figure 1.2** and incorporates Mt Arthur Coal's existing MLs, the eastern portion of EL 5965 and the Antiene rail spur to the point where it joins the Main Northern Rail Line. Mt Arthur Coal owns the majority of land within its existing MLs, excluding small areas of Crown land and road reserves (refer to **Figure 1.5**).

Land ownership within the project area and surrounds is shown on **Figure 1.5**. Mt Arthur Coal owns the majority of land within the project area, including all land within ML 1358 and ML 1593, with the exception of Crown and Council land (in the form of a Travelling Stock Reserve (TSR) and road reserves), and also owns the eastern portion of EL 5965. There are nine private landholders within the western portion of the EL, with a small area of land also owned by Anglo Coal. As shown on **Figure 1.5**, much of the land surrounding the project area is owned by mining companies and Macquarie Generation.

All land within the subsidence affectation area is owned by Mt Arthur Coal, with the exception of three private land ownerships along the western edge of the subsidence affection area. A TSR (Crown land), Crown and Council road reserves and a Council road also occur within the subsidence affectation area.

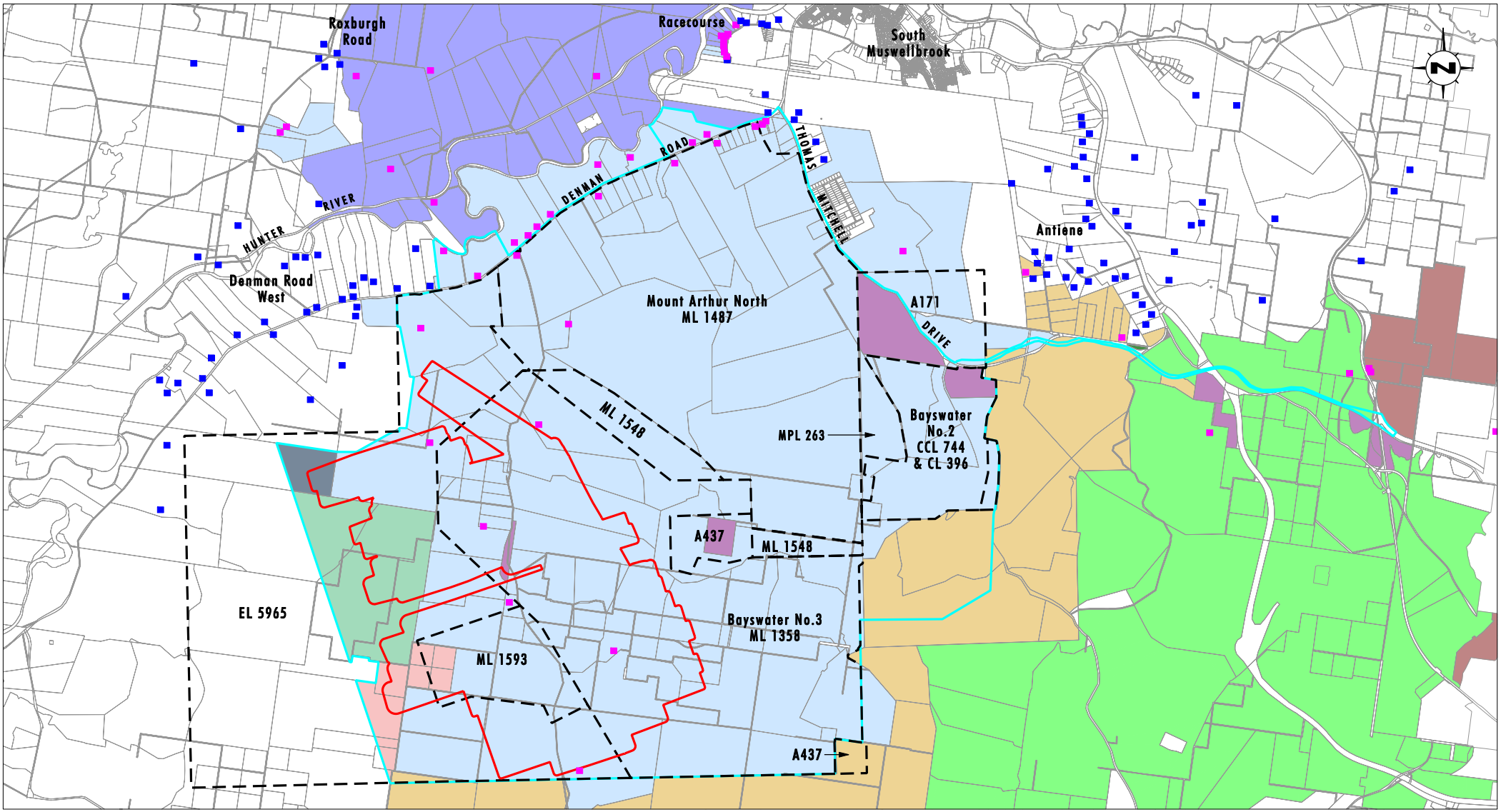
Each of the nine private landholders within the EL have been consulted regarding the Underground Project and have been provided with Private Property Plans (PPPs) specific to their property (refer to **Section 2.2.1**). Three of these landholders are located within the proposed ML boundary. These plans outline the work undertaken on each property to date and the future works proposed (e.g. exploration drilling, ecological and archaeological survey findings, subsidence predictions, surface and groundwater investigations, future surveys, etc.) and discuss the potential interaction of each property with the concept mine plan. These plans have been updated throughout the EA process to provide the EL landholders with detailed information about potential interactions of the Underground Project with their property. Mt Arthur Coal is currently undertaking discussions with all three affected private landholders regarding future surface access and ML arrangements.

1.3.3 Overview of Environmental Features

The topography of Mt Arthur Coal's existing operational area is dominated by Mt Arthur (482 metres), which is located approximately in the middle of the existing operations, and Mt Ogilvie (468 metres) which occurs in the western half of the EL (refer to **Figure 1.6**). The northern half of the EL slopes from the alluvial flats of the Hunter River at an elevation of approximately 120 metres to Mt Ogilvie with gently undulating slopes becoming progressively steeper in the vicinity of Mt Ogilvie. In the southern half of the EL the land slopes from the floodplain associated with Saddlers Creek at an elevation of approximately 120 metres north to Mt Ogilvie with gently undulating slopes that once again become progressively steeper as they approach Mt Ogilvie.

The steep slopes of Mt Arthur and Mt Ogilvie are located outside the subsidence affectation area, however there are two main areas of steep slopes located within the north and west of the subsidence affectation area. These slopes typically have grades between 1 in 3 and 1 in 2, with some isolated areas having slopes up to 1 in 1.5.

A ridge extends from the middle of the eastern boundary of the EL, near Edderton Road, approximately south-west to join Mt Ogilvie (refer to **Figure 1.6**). The ridge acts as the major drainage divide in the EL area, with all land to the north draining to the Hunter River either via Quarry Creek or other north/north-west flowing tributaries, while land to the south of the ridge drains to the Hunter River via Saddlers Creek.



Base Source: LPI, 2004

0 1 2.5 5km
1:100 000

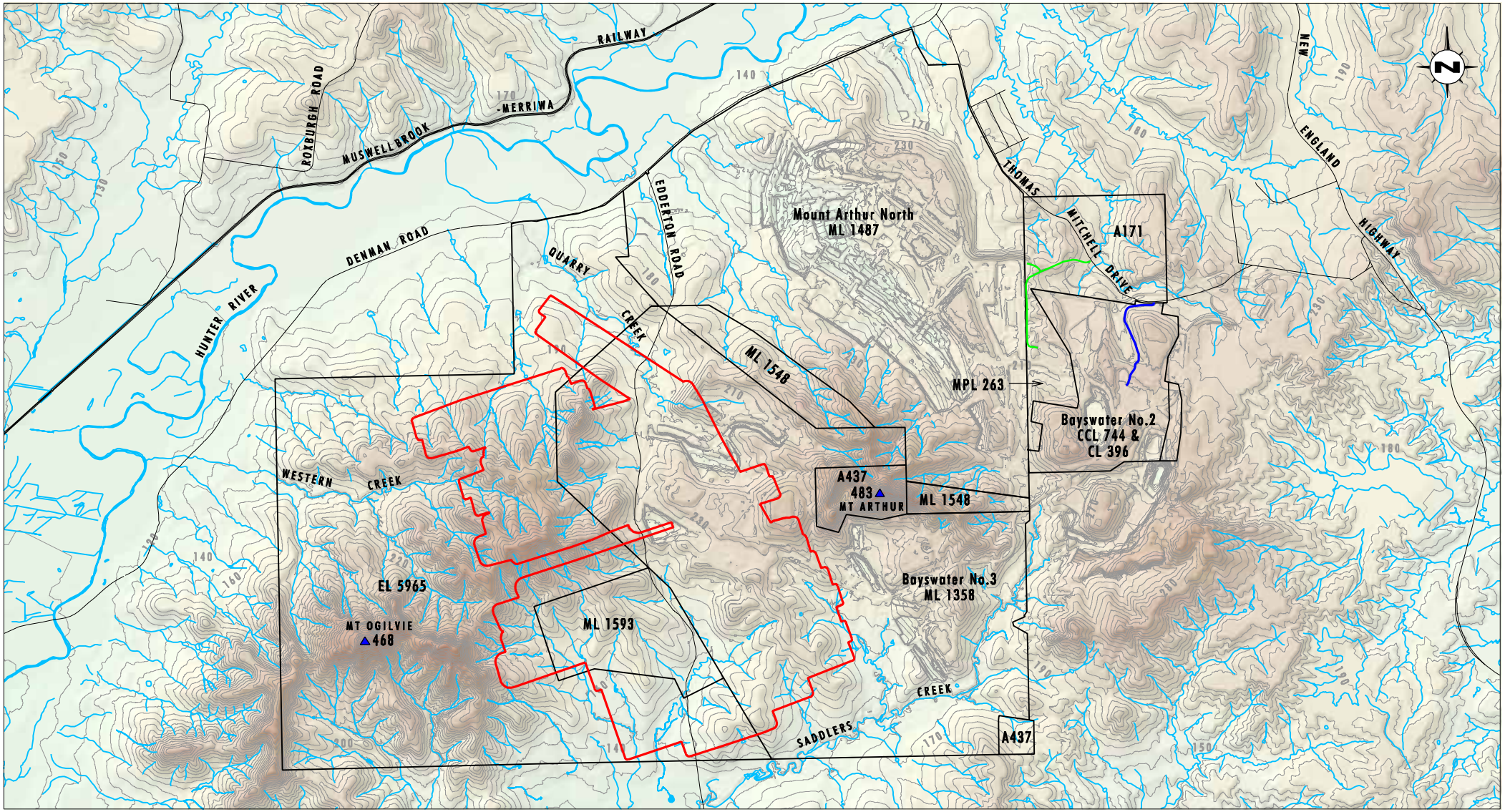
Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Project Application Boundary
- Mt Arthur Coal
- Macquarie Generation
- Bengalla
- Anglo-Drayton Coal
- Liddell
- Crown Land
- Private Land
- Private Landholder 1
- Private Landholder 2
- Private Landholder 3
- Privately Owned Residence
- Mine / Power Generation Owned Residence

FIGURE 1.5

Land Ownership

File Name (A4): R21_V1/2051_251.dgn



Base Source: LPI, 2004 & Mt Arthur Coal, 2006

0 1 2 4km
1:90 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Mt Arthur Coal Access Road
- Contour Line
- Drainage Line
- Bayswater Access Road

Note: Contour Interval 10m

File Name (A4): R21_V1/2051_254.dgn

FIGURE 1.6

Topography

A number of ephemeral watercourses drain the project area, including Quarry Creek in the north and tributaries to Saddlers Creek in the south. All of these watercourses drain to the Hunter River to the north-west and west of the site, with the exception of Saddlers Creek, which drains to the Hunter River in the south. No permanently flowing watercourses exist within the project area, however, Saddlers Creek has permanent pools.

The soils within the project area generally have moderate to high susceptibility to erosion and poor fertility. More fertile soils are found to the north of the EL associated with vineyards and the alluvial flats of the Hunter River and also limited areas of land associated with Saddlers Creek in the south-east of the project area. These more fertile soils typically have low to moderate erosion hazards.

The majority of the land within the project area has been previously cleared for agricultural land uses. Significant areas of remnant vegetation exist around Mt Arthur and Mt Ogilvie, with riparian vegetation remaining along Saddlers Creek and other scattered pockets of remnant vegetation occurring across the project area (refer to **Figure 1.2**).

1.3.4 Existing Mt Arthur Coal Environmental Management System

Mt Arthur Coal has a comprehensive EMS in place for the existing open cut mining operations. As discussed in **Section 1.1**, the EMS has been certified to ISO 14001 since 2003 and is the subject of regular certification surveillance audits and a full recertification audit every three years. The EMS includes a number of environmental management plans that have been prepared to assist in the management of key environmental issues. Many of these plans have been prepared in accordance with conditions contained in one of Mt Arthur Coal's three main development consents and have therefore been prepared in consultation with relevant government agencies and approved for implementation, typically by DoP.

Given the close relationship between the existing open cut operations and the proposed Underground Project, in particular the common use of coal processing and transportation equipment, implementation of an integrated management system will be the most effective way of managing site operations. The Project will therefore be managed in accordance with Mt Arthur Coal's existing EMS, however, changes will be required to address issues specific to the Underground Project.

The EMS contains EMS procedures which provide directions for the successful implementation of the EMS, including aspects such as monitoring, external communication, environmental risk assessment and training. Operational procedures are also developed to appropriately manage areas of residual risk, with all relevant site personnel trained in relation to these procedures. Where appropriate, existing EMS and operating procedures will be implemented as part of the Underground Project with additional procedures developed specifically for the underground operations as required.

The successful implementation of the current Mt Arthur Coal EMS has resulted in a high level of environmental performance by the existing operations including compliance with Mt Arthur Coal's detailed development consent conditions. This high level of compliance has been confirmed by statutory compliance audits undertaken in accordance with conditions included in Mt Arthur Coal's development consents and reported externally to DoP.

The key management plans for the Mt Arthur Coal operations that will assist in the management of mining operations undertaken in the Underground Project area include the:

- Environmental Management Strategy – provides an overview of the environmental management system and strategies for the existing open cut mining area;

- Dust Management Plan - outlines the dust and weather monitoring to be undertaken and specifies the dust controls to be implemented;
- Noise Management Plan – defines noise mitigation and monitoring measures, and specifies noise controls;
- Water Management Plan – outlines design criteria and specifies controls to be implemented;
- Spontaneous Combustion Management Plan – identifies controls and monitoring requirements;
- Bushfire, Land Management and Waste Management Plans;
- Flora and Fauna Management Plan – discusses management and enhancement of remnant vegetation and habitat areas within and surrounding existing mining areas; and
- Community Involvement Management Plan – details Mt Arthur Coal's approach to community involvement and engagement.

The majority of these management plans have been approved for implementation by DoP and assist Mt Arthur Coal in successfully managing the impacts of its existing operations. Details of how these plans will be applied to the Underground Project, including required revisions or updates, are discussed in the relevant sections of the EA section of this report (refer to **Section 5.0**).

1.4 Overview of the Planning and Approval Process

This section contains an overview of the planning context for the Underground Project and the process followed during the preparation of the EA. A detailed discussion of the planning context for the Underground Project is included in **Section 4.0**.

The Underground Project requires approval under Part 3A of the EP&A Act as it is of a class of development listed in Schedule 1 of the State Environmental Planning Policy (SEPP) (Major Projects) 2005. The Minister for Planning will therefore be the consent authority for the Underground Project.

If project approval is granted under Part 3A of the EP&A Act, various approvals, licenses and permits will be required prior to the commencement of certain activities associated with the Underground Project. These include:

- a ML under the *Mining Act 1992* (which will include requirements to prepare Mining Operations Plans (MOPs) and SMPs);
- approval under s15 of the *Mine Subsidence Compensation Act 1961* for the construction of surface infrastructure within a mine subsidence district;
- approval under the *Coal Mine Health and Safety Act 2002* for secondary extraction and establishment of emplacement areas;
- an Environment Protection Licence (EPL) under the *Protection of the Environment Operations Act 1997* (PoEO Act);
- approval under s138 of the *Roads Act 1993* to undertake works within a road reserve;

- approval under the *Crown Lands Act 1989* for works within Crown road reserves or the Travelling Stock Route, where they have not been closed or relocated prior works commencing; and

- approval under Part 5 of the *Water Act 1912* for the extraction of groundwater.

1.5 Project Team

Umwelt prepared this EA on behalf of Mt Arthur Coal. A number of organisations undertook specialist studies as part of the EA process, including:

- Wilkinson Murray Pty Limited - Noise Assessment;

- Holmes Air Sciences - Air Quality Assessment;

- Mackie Environmental Research Pty Ltd - Groundwater Assessment;

- Mine Subsidence Engineering Consultants (MSEC) - Subsidence Assessment;

- Coakes Consulting - Socio-economic Assessment;

- Transport and Urban Planning - Traffic Assessment;

- SEE Sustainability Consulting - Greenhouse Gas and Energy Consumption Assessment; and

- Weir Phillips - Architectural input to Historic Heritage Assessment.

The assessments of surface water, ecology, archaeology and historic heritage were completed by Umwelt's in-house specialists. Further details of the Project Team are provided in **Appendix 1**.

1.6 Environmental Assessment Structure

The purpose of this EA is to enable consideration of the implications of proceeding with the Underground Project. The EA has been prepared in accordance with the EP&A Act and the Environmental Planning and Assessment Regulation 2000 (refer to EA Statement of Authorship in **Appendix 1**). An overview of the layout of this EA is provided below:

The Executive Summary provides a brief overview of the Underground Project and the major outcomes of the EA.

Section 1.0 introduces the Underground Project, outlines the project background and existing operations, provides a summary of the key project details, outlines the Project team involved in producing the EA and the structure of the EA.

Section 2.0 contains a description of the stakeholder consultation program and the environmental and community issues identified as part of this process for detailed assessment in the EA.

Section 3.0 contains a detailed description of the proposed project.

Section 4.0 describes the planning context and environmental context for the Underground Project, including the applicability of Commonwealth and State legislation.

Section 5.0 contains a description of the existing environment and a comprehensive analysis and assessment of the key EA issues relevant to the Underground Project, including the project specific and cumulative impacts.

Section 6.0 details the draft Statement of Commitments proposed to be adopted throughout the life of the Underground Project in order to mitigate impacts.

Section 7.0 contains a conclusion as required by the DGRs.

Section 8.0 contains a list of references referred to in the EA.

2.0 Stakeholder Consultation

Consultation with relevant stakeholders including affected landholders, the surrounding community, community groups, government authorities, service providers, Aboriginal groups and other relevant stakeholders commenced during the early project planning phases in 2005 and continued through the project. The key aims of the consultation process were to inform stakeholders about the Underground Project and identify any issues of concern or interest to be investigated and addressed, as appropriate. The consultation process built on the communication mechanisms in place for the existing Mt Arthur Coal operations, maximising the ability to effectively communicate with key stakeholders regarding the Underground Project.

The details of the authority consultation program are outlined in **Section 2.1**, with details of consultation with the community and other stakeholder groups outlined in **Section 2.2**. An outline of the key issues identified during the consultation process is included in **Section 2.3**.

2.1 Authority Consultation

The authority consultation process for the project commenced with initial briefing meetings with DoP, Muswellbrook Shire Council (MSC) and the Department of Primary Industries (DPI). Discussions were also held during the initial phases of the project with the Department of Environment and Conservation (DEC) (now Department of Environment and Climate Change (DECC)) regarding the Aboriginal archaeology assessment, the Department of Lands (DoL) regarding Crown Road reserves in the project area and the Department of Natural Resources (DNR) (now Department of Water and Energy (DWE)) regarding water resource issues.

Consultation with DPI regarding the potential underground mining resource had been ongoing since Mt Arthur Coal was granted the EL in 1996. DPI has also been regularly consulted regarding the concept mine plans with a Conceptual Mine Plan meeting held on 22 November 2005. Periodic updates have been provided to DPI since this time regarding resource definition and mine planning progress. Several project update meetings were also held with DoP to keep them informed of project status and to discuss assessment issues as required.

The formal EA process consultation commenced with the preparation of a Preliminary EA (Umwelt, 2006) for the project. The Preliminary EA was prepared and distributed to DoP and other key agencies (as directed by DoP) in early 2006. A Planning Focus Meeting was convened by DoP to discuss the project and key assessment issues, and was held on 28 February 2006. The Planning Focus Meeting was attended by the following authorities:

- DoP;
- MSC;
- DEC;
- DNR;
- DPI; and
- TransGrid.

The Project Application for the Underground Project was lodged with DoP on 16 March 2006. DoP subsequently provided the DGRs for the project on 26 April 2006, confirming that the project requires approval under Part 3A of the EP&A Act. Modified DGRs were issued by DoP on 25 January 2007 to include further clarification of the scope of the required greenhouse gas assessment. A checklist of the DGRs is included in **Section 2.3**, along with an indication of where these requirements are addressed within the EA. A copy of the DGRs is included in **Appendix 2**.

During the completion of the environmental impact assessment phase of the project and preparation of the EA a number of meetings were held with the relevant government agencies to discuss key issues, impact assessment findings and proposed management and mitigation measures. This included meetings with DoP, MSC (including a presentation to the Council Environment Committee), DPI, DWE, DECC and TransGrid. Discussions were also held with the Roads and Traffic Authority (RTA) regarding the traffic assessment and ARTC regarding the rail network.

2.2 Other Stakeholder Consultation

2.2.1 Community Consultation

A comprehensive socio-economic impact assessment (SIA) has been undertaken for the Underground Project by Coakes Consulting. An integral part of the SIA process is consultation with the local community and stakeholder groups to ensure that the communities views and issues of concern are identified, and that the social and economic impacts associated with the project are documented and addressed in this EA document.

The consultation program was commenced early in the project planning phase in order to appropriately inform the scope of the EA and to enable the project to be responsive to community concerns.

The consultation program consisted of two key phases, with the initial phase aimed at informing stakeholders and the community of the proposed project, seeking feedback as to stakeholder and community issues surrounding the project and defining the project assessment plan (refer to **Section 2.2.1.1**). A second phase of consultation was carried out following completion of the EA process and aimed to inform stakeholders and the community in more detail of the project, how it will impact on the community and environment (refer to **Section 2.2.1.2**) and feedback on the strategies proposed to address these impacts. Consultation is, and will continue to be, an ongoing component of Mt Arthur Coal's operations.

2.2.1.1 Initial Consultation Phase

The initial phase of community consultation was commenced in late 2005. A range of communication mechanisms were used to provide the community and stakeholders with information regarding the project and provide an opportunity to comment on and/or ask questions about the project. The key mechanisms used during the initial stakeholder consultation phase are outlined in **Table 2.1**.

Table 2.1 - Stakeholder Consultation Methods - Initial Consultation Phase

Stakeholder Group	Mechanism	No. of Participants
Residents/Landholders/ Tenants	Personal interviews with residents/landholders and tenants located in proximity to the Mt Arthur Coal operation in the following areas (refer to **Figure 1.4**): • the EL • Antiene Estate • Denman Road • East of the New England Highway • Golden Highway • Racecourse Area • Roxburgh Road • South Muswellbrook	67
Service Providers: • Accommodation • Education • Health • Justice • Tourism • Youth • Community Services • Local Government	Personal and telephone interviews with service providers across the following local government areas (LGAs): • Muswellbrook • Singleton • Scone (Upper Hunter Shire)	48
Community Groups	Presentations on the project to community groups within the Muswellbrook LGA	6
Community Consultative Committee	Project presentations to Community Consultation Committee (CCC) members (Mt Arthur Coal has two current CCCs) and regular updates on the project through monthly meeting forums	Monthly
Employees	• Surveys of existing Mt Arthur Coal employees to develop mine employee profile and to update residential and expenditure patterns • Presentations regarding project to Mt Arthur Coal workforce and internal newsletters.	51 4
	Total Number of Participants	**172**

To assist in the consultation process, Mt Arthur Coal developed a series of project information sheets which were distributed to local residents and community stakeholders. Information and updates regarding the project were also included in the Mt Arthur Coal Community Matters newsletter which is delivered to all households in the Muswellbrook LGA.

The first and second project information sheets were distributed as part of the initial phase of community consultation. The first provided details of the Underground Project proposal, consultation process and planning process, while the second provided community feedback on the issues raised during interviews with stakeholders and the community. The third project information sheet was distributed as part of the second phase of community consultation (refer to **Section 2.2.1.2**) and provided an update on the project design and an overview of the EA findings. Copies of the project information sheets are provided in **Appendix 3**.

All private landholders within the EL were provided with an additional level of information regarding the project in the form of an individual PPP. The PPPs provided landholders with specific information regarding the project as it relates to their property. They included details of the proposed project, the results of detailed studies, potential impacts on their property and proposed management and mitigation measures. A baseline PPP was provided to all landholders within the EL as part of the initial phase of community consultation. These baseline PPPs were updated in the second round of consultation with further details of the project and the key findings of the EA as they relate to each property.

A DVD explaining the project, including animation explaining how the underground mining process is undertaken, was also prepared and used as part of the consultation phase.

2.2.1.2 Impact Assessment Findings Consultation Phase

A second round of community consultation was commenced in July 2007, towards the end of the EA process. This phase of consultation aimed to provide stakeholders and the community with more detail about the project, inform them how it will interact with the community and environment and provide stakeholders the opportunity to provide feedback on the proposed strategies to address any identified impacts.

The key mechanisms used in the second phase of consultation were:

- personal meetings were offered to residents, landholders and tenants in proximity to the Mt Arthur Coal operation;
- presentations were offered to local community groups;
- a presentation and site tour was undertaken with the community consultative committees;
- a third project information sheet was distributed to local residents and community stakeholders providing further detail of the project and EA assessment findings;
- the Community Matters newsletter was distributed to all residents within the Muswellbrook LGA providing a project update and summary of the EA assessment findings;
- approximately 170 surrounding residents were invited to attend a resident information evening held at Mt Arthur Coal on 19 July 2007. The information session provided details of the project design and an overview of the EA findings. Also presented at the information day was a DVD providing details of the project and describing the underground longwall mining process. Key project personnel and representatives of the environmental and social impact assessment teams were available at the open day to discuss any questions or issues; and
- local service providers, including MSC and local education, health and temporary accommodation providers, were invited to attend a session on 24 July 2007, which presented the outcomes of the SIA, including population impact predictions and the outcomes of the service needs assessment, and sought feedback from the service providers regarding these outcomes.

2.2.2 Aboriginal Community Consultation

Nineteen Aboriginal stakeholder groups who registered an interest in the project or who were previously known to have an interest in the project area were consulted regarding the Aboriginal archaeology assessment completed for the project. This consultation was

undertaken on a number of occasions during the assessment process in accordance with relevant guidelines and is discussed further in **Section 5.4.1**.

2.2.3 Service Provider Consultation

A number of service providers who have infrastructure within the project area, or who may provide services for the project, have been consulted by Mt Arthur Coal during the project design and EA phases. The key service providers include the ARTC who manage the rail network that will be used to deliver coal from the project to market, and TransGrid who own a 330/500 kV powerline that crosses above the proposed underground mining area. Extensive consultation has been undertaken by Mt Arthur Coal with these two service providers so that any project design or management issues could be identified and addressed. Further details of interactions with the rail network and management of impacts on the 330/500 kV powerline are included in **Sections 3.7.4** and **5.2**, respectively.

Other service providers consulted during the EA process include Telstra and Energy Australia.

2.3 Identification of Key Issues

2.3.1 Key Community Issues

The key issues raised by the community and other stakeholders during the initial phase of the consultation program which commenced in late 2005, are outlined in **Figure 2.1**. The issues raised focus on the perceived benefits and environmental impacts of the project and are discussed in further detail in the SIA in **Appendix 3**.

When considering the potential environmental impacts associated with the Underground Project, the key issues of concern raised during the consultation process were dust, cumulative impacts, blasting noise and vibration, operational noise, groundwater, loss of natural amenity and to a lesser extent increased rail movements, surface water, subsidence, traffic and visual amenity.

Issues raised throughout the consultation program were closely associated with the geographic location of respondents. The proximity to local infrastructure (e.g. railway line), the co-location of particular industry sectors (e.g. irrigators) and the natural geography of the land (e.g. elevated locations overlooking the project area) were significant factors underlying issues associated with the project. Visual and dust impacts were perceived by many respondents as less critical given the underground nature of the Underground Project, however dust was still the most commonly raised issue of concern.

When asked about potential benefits associated with the Underground Project over two-thirds of those consulted raised the benefit of the project to the local economy, opportunities for further employment, and the potential attraction of new business to the area.

The potential impacts of the project and proposed management and mitigation measures are discussed in **Section 5.0**.

2.3.2 Agency Requirements

The DGRs for the EA report are contained in **Table 2.2**, which also notes the relevant section of the EA that addresses each requirement. A full copy of the DGRs is included in **Appendix 2**.

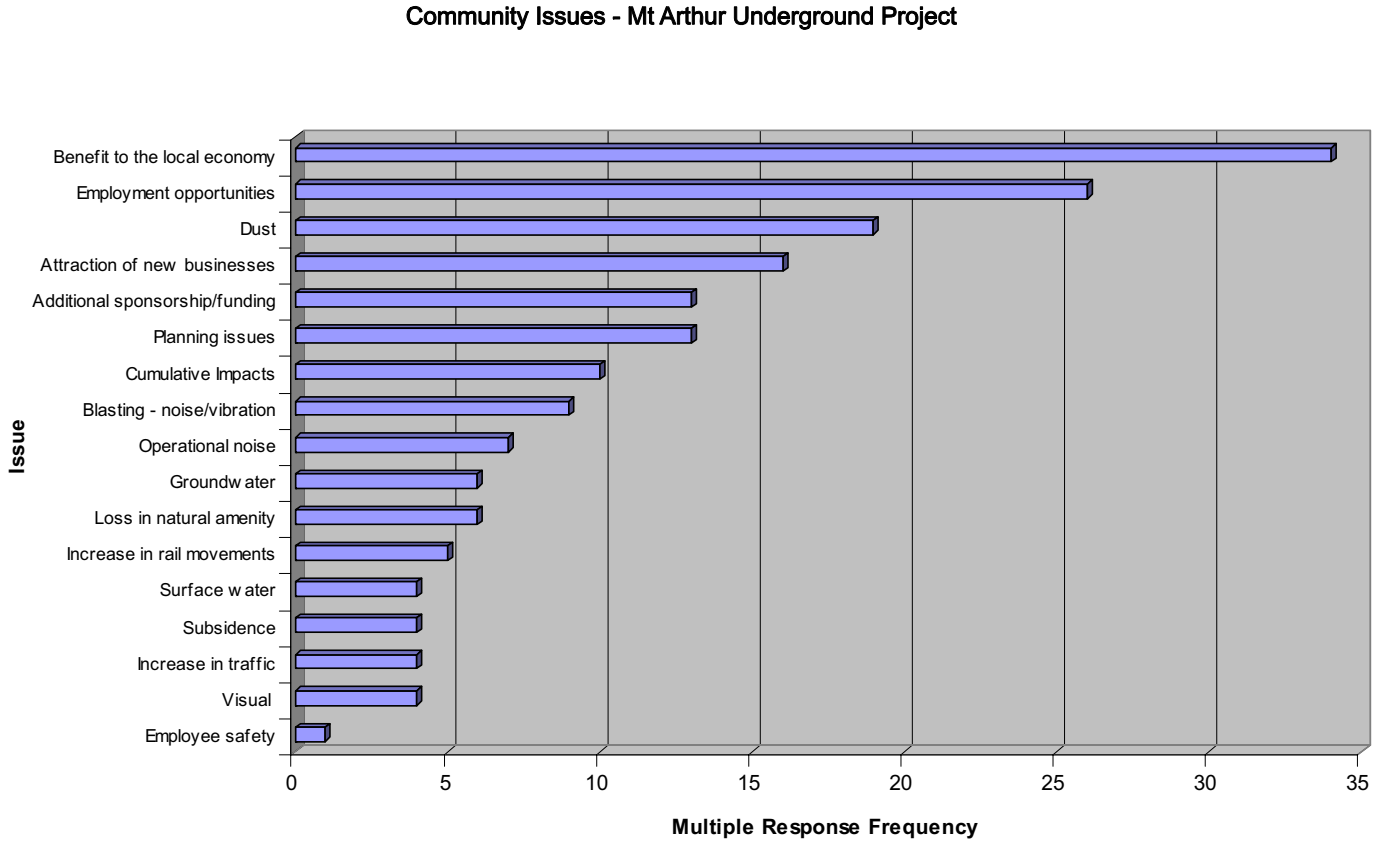


FIGURE 2.1

Community Issues Raised during Consultation

Source: Sheridan Coakes Consultancy Pty Ltd, 2007

Table 2.2 - Director-General's Requirements Checklist

Requirement	Relevant Section
General Requirements	
The EA must include:	
• an executive summary;	Executive Summary
• a detailed description of the project including the: - need for the project; - alternatives considered; and - various components and stages of the project;	**Section 3.0**
• consideration of any relevant statutory provisions;	**Section 4.0**
• an environmental risk analysis of the project which takes into consideration the issues raised during consultation;	**Section 5.1**
• a detailed assessment of the key issues specified below, which includes: - description of the existing environment; - an assessment of the potential impacts of the project, including the potential cumulative that may arise from the combined operation of the mine, together with existing Mt Arthur operations including the Bayswater No.2, the proposed Mt Arthur North South Pit Extension, and the neighbouring Drayton Coal Mine and Saddlers Creek Proposal; - a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage, and/or monitor the impacts of the project;	**Section 5.0** (refer also to Note 1 below table).
• a draft Statement of Commitments, outlining environmental management, mitigation, and monitoring measures;	**Section 6.0**
• a conclusion justifying the project, taking into consideration the environmental impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest;	**Section 7.0**
• a signed statement from the author of the EA certifying that the information contained in the report is neither false nor misleading.	**Appendix 1**
Key Issues:	
• **Subsidence** – including impacts on surface and groundwater resources, cultural sites, areas of public access, and surface infrastructure including roads, utilities, buildings and other structures;	**Section 5.2**
• **Noise** – including construction, operation, and on-site and off-site road and rail noise impacts, including impacts adjacent to the Antiene rail spur;	**Section 5.6**
• **Air Quality** – including consideration of impacts in the vicinity of the Antiene rural residential area;	**Section 5.7**
• **Greenhouse Gases –** a greenhouse gas assessment (including a quantitative analysis of greenhouse gas emissions associated with the combustion of product coal, and a qualitative assessment of the impacts on the environment);	**Section 5.8**
• **Heritage** – both Aboriginal and non-Aboriginal, including conservation outcomes for significant heritage items and areas in the mine affectation zone;	**Section 5.4**

Table 2.2 - Director-General's Requirements Checklist (cont)

Requirement	Relevant Section
General Requirements	
The EA must include:	
• **Flora and Fauna** – including impacts on critical habitats, threatened species, populations, ecological communities and native vegetation. An offset strategy should be included to compensate for the loss of existing (or previously approved) conservation areas, and to ensure that there is no net loss of flora and fauna values in the area in the medium to long term;	**Section 5.3**
• **Surface and Groundwater** – including detailed modelling of potential surface and groundwater impacts, a site water balance, and a salinity budget. A surface and groundwater contingency strategy must be included as part of the mitigation measures for the project which details the measures proposed to protect the supply of water to landowners and the environment in the region;	**Section 5.5**
• **Rehabilitation, Final Landform and Final Void Management** – including a justification of the proposed final land use for the site in relation to strategic land use objectives and the synoptic landscape plan for the Upper Hunter Valley area; a detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape; and the measures which would be put in place for the long term management of the site (including biodiversity offset areas) following cessation of mining;	**Section 5.10**
• **Blasting and Vibration**;	**Section 5.6**
• **Visual**;	**Section 5.9**
• **Traffic and Transport**; and	**Section 5.11**
• **Social and Economic**.	**Section 5.12**
References:	
The EA should take into account appropriate State government technical and policy guidelines. While not exhaustive, guidelines which may be relevant to the project are included in the attached list.	**Section 5.0**
Consultation:	
During the preparation of the EA, you must consult with the relevant local and State government authorities, service providers, community groups, affected landowners and affected Commonwealth government authorities. In particular you must consult with: • Department of Environment and Conservation; • DNR; • DPI; • MSC; • ARTC; and • NSW RTA.	**Section 2.0**

Note 1: It is assumed that the reference to Bayswater No. 2 should refer to Bayswater No. 2 and 3. No details were available regarding the Saddlers Creek Proposal mentioned in the Director General's Requirements at the time of preparation of this EA and the proposal has not been approved. This proposal could not therefore be considered in the assessment of cumulative impacts. This EA has considered the potential cumulative impacts associated with the operations mentioned in the DGRs including the proposed South Pit Extension Project which is currently being assessed by DoP.

3.0 Description of the Underground Project

The conceptual design of the Underground Project has evolved throughout the EA process in light of ongoing exploration and mine planning, due to detailed analysis of environmental constraints and opportunities, and in consideration of stakeholder consultation outcomes. A description of the conceptual features that comprise the Underground Project is included in this section and **Table 3.1** provides a summary of the key project details.

Table 3.1 - Key Project Information

Project	Underground coal mine, extracting and processing approximately 8 Mtpa of run of mine (ROM) coal. Construction and operation of surface facilities associated with underground mining operations, including coal handling and processing infrastructure. Use of existing Mt Arthur Coal infrastructure including rail transportation facilities.
Proponent	Hunter Valley Energy Coal Pty Ltd (Mt Arthur Coal).
Project Life	Approval is sought for a 21 year project life (from the date of commencement of longwall mining).
Mining	Underground coal mining.
Coal Washing	Construction and operation of new ROM coal handling facilities plus use and upgrade of the existing MAN CHPP including a new plant module, stockpiling and associated handling systems.
Employment	During the construction phase it is anticipated that there will be a peak workforce of approximately 470 personnel with a peak operational workforce of approximately 300 personnel post construction.
Construction	Construction of the coal handling facilities, pit-top facilities, mine access infrastructure and other underground mining facilities is expected to be undertaken over a main construction period of approximately two years. Ancillary facilities to be constructed as required.
Hours of Operation	The mine will operate 24 hours per day, seven days per week. The majority of construction activities will be undertaken during daylight hours, seven days per week.
Product Coal Transport	Export product coal will be loaded onto trains at the existing Bayswater rail loading facility and transported to markets via the Bayswater Rail Loop, Antiene Rail Spur and then the Main Northern Railway. The Underground Project will result in an increase in the annual tonnage of coal transported on the Bayswater Rail loop and Antiene Rail Spur from Mt Arthur Coal from 13 Mtpa (approved) to 19 Mtpa. Rail movements along the Bayswater Rail Loop are also predicted to increase from the currently approved maximum of 18 movements per day from Mt Arthur Coal to a maximum of 24 movements per day at full production. Coal may also be supplied to export or domestic markets via rail or conveyor.
Mine Access	The main mine access will be via the existing Mt Arthur Coal access road from Thomas Mitchell Drive. Some construction phase traffic will utilise the existing Bayswater access road.

The Project Application area (project area) boundary is shown on **Figure 1.2**.

3.1 Need for the Underground Project

The project is focussed on timely recovery of a state significant resource in a manner that minimises environmental and social impact and maximises the use of resources and existing infrastructure. The need for the project is represented in the potential lost/missed opportunities of not proceeding with the project.

Proceeding with the project will result in the environmental, economic and social benefits discussed in **Sections 5.0** and **7.0** of this EA. Some of the specific benefits are outlined below.

- The following economic benefits are expected from the project:
    - during the construction phase, the project is anticipated to contribute approximately $300 million in direct capital expenditure and create direct employment for approximately 470 people;
    - in the operational phase, it is estimated that the project will contribute approximately $1757 million in operating expenditure (excluding labour) to the Hunter Region economy over the life of the project. The project will create direct employment for approximately 300 people and annual employee household expenditure is estimated at approximately $20 million, with approximately $8 million of this predicted to be spent in Muswellbrook;
    - it is estimated that the project will create indirect employment for approximately 900 people in the region and 600 people elsewhere in NSW during the construction and operational phases; and
    - contribution to GDP of $2.3 billion over the life of the project;
- the project will provide an opportunity to secure long term protection of significant Aboriginal archaeological sites and flora and fauna within the proposed Saddlers Creek conservation area;
- the project will provide development contributions towards improved and additional local community facilities; and
- a major coal resource will be developed and there will be the benefit of a major underground coal mine with long term reserves which can continue to build business in the NSW coal industry providing significant economic benefits to the State and region.

Further details regarding justification for the project are provided in **Section 7.0**.

3.2 Project Alternatives Considered

Mt Arthur Coal has undertaken detailed concept and pre-feasibility studies into the proposed Underground Project in accordance with the BHP Billiton capital investment process. This process requires all potentially viable options to be assessed, with the overall aim of the process being to ensure that the project is viable and that the selected option achieves the best practical safety, environmental, social and economic outcomes. As part of this process, numerous alternate mine and infrastructure plans were considered, with some of the key alternatives considered including:

- the target coal seams and mining footprint areas. These aspects of the project evolved throughout the project planning phase in consideration of geological data, mine safety and environmental considerations (e.g. surface features such as the Hunter River, Mt Arthur, Mt Ogilvie and Saddlers Creek);

- mining method for each seam (including mining equipment, mine layout and sequence of mining). Various mining techniques were investigated including additional open cut mining and nil subsidence mining techniques, with mine layouts and sequence adjusted to minimise surface subsidence impacts and ensure maximum mine safety;

- production rate and mine scale options. This included consideration of the number of mining units and mining areas operating at any one time and associated flow-on implications for coal handling and transportation. A two longwall mine was considered, however, due to current market drivers it was decided to progress with a one longwall mine plan;

- mine entry options including consideration of further open cut works to facilitate mine entry and various locations for drifts and shafts;

- options for location of surface facilities. These were typically related to the various mine entry options investigated but also included modifying the path of road and conveyors and other such infrastructure to minimise impacts on identified high value surface features such as Saddlers Creek, vegetated areas, archaeological sites etc. This included relocating the proposed overland conveyor to the CHPP and Underground Project access road to reduce impacts on Saddlers Creek;

- ROM coal transportation options including assessing truck versus conveyor haulage;

- CHPP options including consideration of a new facility versus capacity upgrade of the existing CHPP;

- product coal transportation options including consideration of an Underground Project specific coal loading facility; and

- various options for environmental management controls and offsets.

The project as proposed in this EA has evolved from consideration of all of the above options and it is considered that it provides the best balance of safety, economic, environmental and social outcomes.

3.3 Interaction with Existing Development Consents & Approvals

Mt Arthur Coal currently has several development consents and project approvals that permit coal mining and associated operations. These include:

- the development consent for the Bayswater No. 3 mine (granted on 12 September 1994 by the Minister for Planning). The consent allows for open cut mining in the Bayswater No. 2 and 3 mining areas and for ongoing use of the Bayswater No. 2 CHPP and other facilities. The consent was granted for a period of 21 years and lapses in 2015;

- the development consent for the Bayswater Rail Loading Facility granted by the Minister for Planning in November 2000. The consent allows for construction and operation of a rail loading facility and spur line to transport product coal from Mt Arthur Coal to markets

by rail. The rail facility was commissioned in November 2001. Approval was granted for use of the facility for a period of 25 years;

- the development consent for the MAN project granted by the Minister for Planning in May 2001. MAN was approved to produce up to 15 Mtpa of ROM coal for a period of 21 years and also allowed for construction and operation of a new CHPP (approved to process up to 20 Mtpa), workshop, office and other associated facilities to service the entire Mt Arthur Coal complex; and

- the project approval for an exploration adit within the Woodland Hill coal seam granted by the Minister for Planning in September 2006. The approval was granted for a period of five years from the commencement of mining in the adit, with total coal production from the adit limited to 450,000 tonnes.

Mt Arthur Coal is also currently seeking approval for the South Pit Extension project which involves an extension of the approved MAN south pit further south into the Bayswater No. 3 ML. The project application is currently being assessed by DoP.

The Underground Project will interact with each of the above development consents and approvals and, if approval is granted, will have an approval period that extends beyond all of Mt Arthur Coal's other development approvals. As detailed in the following sections of this EA, the Underground Project will be integrated with the existing operations and therefore approval is sought as part of this project for ongoing use of elements of the existing approved operations, including the existing CHPP, rail loading facility, workshops, administration and stores facilities, services and infrastructure such as roads, water management structures, and environmental management and monitoring equipment, plus the upgrades and extensions to existing elements contemplated in this report. The key interactions with each of the development consents/approvals discussed above are detailed below, with further specific details discussed throughout the EA. The key interactions of the Underground Project with Mt Arthur Coal's existing consents and approvals include:

- Bayswater No. 3 development consent – the Underground Project will utilise voids established by open cut mining works under the Bayswater No. 3 consent to gain access into the underground coal resource. These voids will be maintained for the life of the Underground Project and decommissioned as part of the Underground Project when they are no longer required for access. The Underground Project will also utilise the water management system infrastructure and other services and facilities approved under the Bayswater No. 3 consent (including infrastructure in the Bayswater No. 2 area). These facilities will be decommissioned at the completion of underground mining or earlier if no longer required (refer to **Section 5.10.2**). The planned open cut works within the Bayswater No. 3 ML will be performed under the existing Bayswater No. 3 development consent;

- Bayswater Rail Facility development consent – the Underground Project will utilise the approved Bayswater Rail Facility and seeks approval to undertake some minor upgrades to increase capacity. Approval is sought to use the rail facility for the life of the Underground Project (which will extend beyond the current approved life of the rail facility) and approval is also sought to increase both the tonnage of coal exported from site via the facility and the maximum permissible daily train movements (refer to **Section 3.7.4**). If the Underground Project is approved, Mt Arthur Coal will discuss the potential to relinquish this consent with DoP;

- MAN development consent – the Underground Project will utilise the facilities established under the MAN consent, including the CHPP, offices, workshop, stores, water management infrastructure and other services and facilities, for the life of the

Underground Project. This will involve continued use of these facilities beyond the currently approved life of the MAN open cut. Some upgrades and extensions are proposed to the CHPP and associated facilities to provide for the increased production associated with the Underground Project. The MAN mining area may also be used for the disposal of reject and tailings for the life of the project (refer to **Section 3.7.3**); and

- Exploration Adit project approval – the Underground Project will utilise the exploration adit as the initial access point into the underground coal resource (i.e. it will become a gate road for longwall mining in the Woodlands Hill seam). Approval is sought for the use of the surface facilities (including coal handling facilities, workshop, office etc.) established for the exploration adit for the initial phases of underground mining as part of the Underground Project (i.e. development mining prior to the commencement of longwall mining) whilst the Underground Project pit top facilities and coal handling system are being constructed.

Further details of the above aspects of the proposed Underground Project are discussed in the remainder of **Section 3.0** of this EA.

3.4 Exploration History and Resource Description

The Underground Project area is located within the Hunter Coalfield in the northern Sydney basin. The coal seams within the project area are Upper Permian in age and are contained within the Wollombi and Whittingham Coal Measures.

The Wollombi Coal Measures are restricted to isolated portions of the project area and are not considered to be economical. The Whittingham Coal Measures cover a maximum thickness greater than 600 metres in the project area, containing 19 coal seam groups of which eight are considered to be potential underground mining targets. A stratigraphic column, with the target seams highlighted is included as **Figure 3.1**, and **Table 3.2** provides a summary of seam thickness and depth.

Table 3.2 - Details of Whittingham Coal Measure Seams within Project Area that have Potential for Underground Mining

	Seam Thickness (m)		Seam Depth (m)		Interburden to Underlying Seam (m)
Seam Name	**Range**	**Average**	**Range**	**Average**	**Average**
Glen Munro	0.2–5.6	2.7	7–128	53	34
Woodlands Hill	0.2–7.5	3.6	6–226	96	66
Arrowfield	0.1–3.7	2.3	30–258	139	20
Bowfield	0.4–4.7	2.5	48–273	155	117
Piercefield	0.4–5.4	2.3	169–419	291	26
Vaux	0.5–4.5	2.4	305–435	318	37
Bayswater	0.5-4.8	2.8	252-455	357	84
Edinglassie	3.0-4.8	3.9	326-542	446	-

Extensive exploration work has been undertaken in the project area, with exploration programs completed periodically since 1949. The objectives and targets of these programs varied greatly from targeting shallow open cut coal to undertaking deeper regional drilling. However, the original exploration programs generally focused on defining open cut resources/reserves.

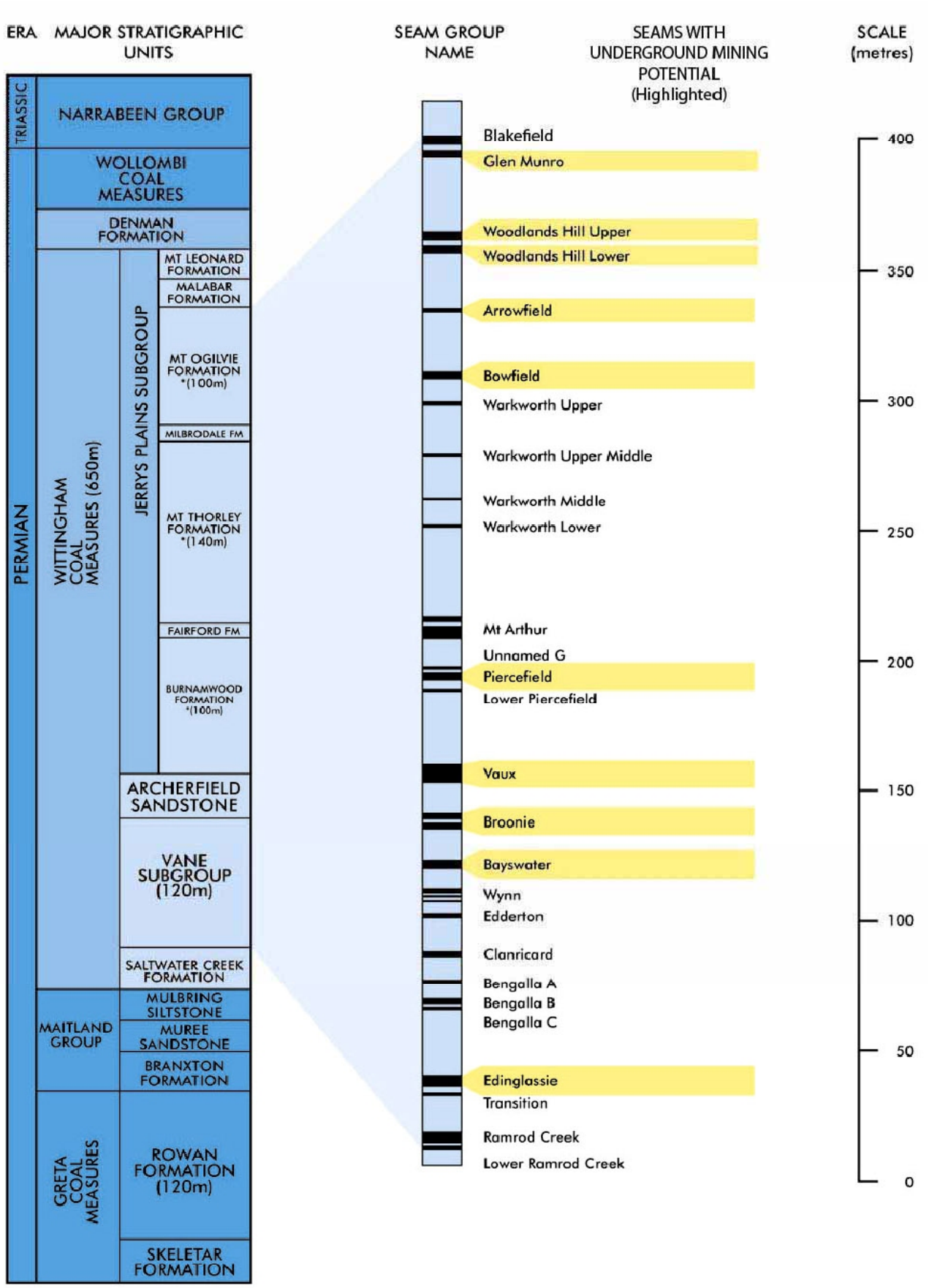


FIGURE 3.1

Stratigraphic Column

Source: Mt Arthur Coal

Comprehensive exploration for potential underground resources commenced in 2001 when Mt Arthur Coal began exploration associated with an underground mine concept study which was completed in late 2004. Exploration drilling has been ongoing since this time to define the underground mining resource and identify geological structures or management issues to be considered in mine planning.

3.4.1 Geological Setting

3.4.1.1 Geological Structure

The project area is primarily located west of Mt Arthur Coal's existing open cut operations and is separated from potential open cut resources by a zone of steeply dipping bedding known as the Monocline, which strikes north-north-west (refer to **Figure 3.2**). Dips across the Monocline generally range from 10-15 degrees. Within the project area, the general geological structure is centred around the Calool Syncline - a broad, flat and southerly plunging local syncline. Bedding generally dips south-west, south or south-east, at dips of 1-4 degrees, depending on location in relation to the Calool Syncline.

A number of other significant structures are found within the project area (refer to **Figure 3.2**) and have the potential to constrain and limit coal extraction by underground methods:

- **Faults**: The project area is transected by a series of large east-west striking normal faults with displacements of up to 130 metres. These faults are hinge faults with zero displacement at extremities and a maximum displacement near the middle of the fault. The faults generally dip at relatively shallow angles ranging from 50-75 degrees and are generally 'tight' with most of the displacement taken up over a relatively short distance and with drag folding of strata occurring close to the faults.

  The Mt Ogilvie fault system located within the western half of the EL is a major fault system which forms a barrier to mining. This system forms the western boundary of the potential underground mining area for this project.

- **Igneous Intrusions**: The project area contains a range of igneous intrusions, including sub-vertical dykes and sills. The intrusions are mostly doleritic in composition and vary significantly in character and degree of alteration. Most intrusions are relatively altered and moderately soft.

The location and nature of these and other geological structures has been considered in the development of the concept mine plans for each seam.

3.4.1.2 Geochemistry

Spontaneous Combustion Potential

Spontaneous combustion propensity testing has been completed for representative boreholes within the project area. This preliminary testing has indicated that the target resource has a high inherent propensity for spontaneous combustion that is somewhat moderated by the relatively high moisture content. These results are considered typical of Hunter Valley coals. Further bulk sample testing for spontaneous combustion propensity will be undertaken as part of the approved exploration adit into the Woodlands Hill seam planned to commence in 2007.

Management of spontaneous combustion will be a key safety issue for this project, as for all underground coal mining operations, and effective controls will be put in place to limit the potential for spontaneous combustion and to provide for the timely and effective

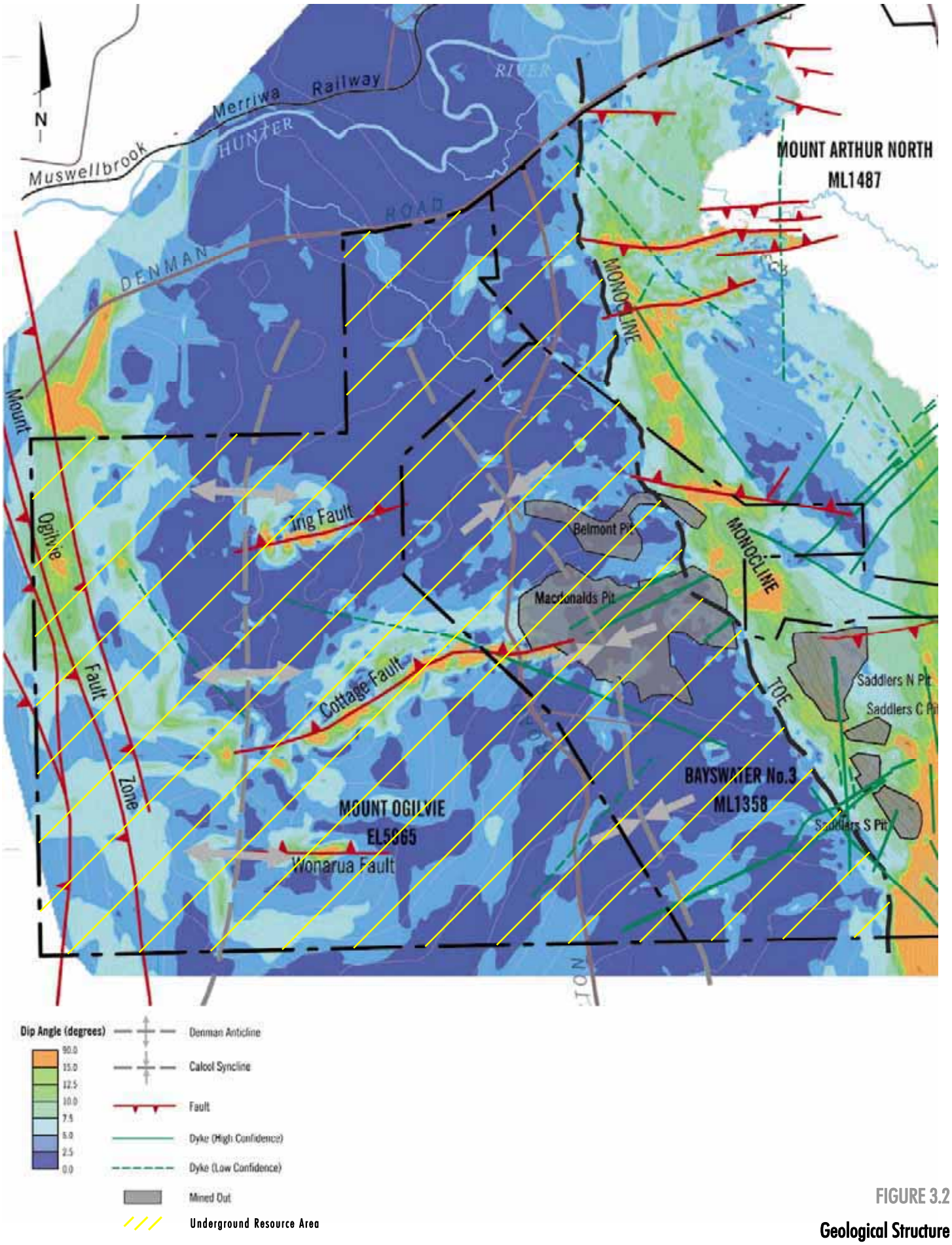


FIGURE 3.2

Geological Structure

Source: Mt Arthur Coal

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management of any events that do occur (refer to **Section 5.7.6**). A comprehensive spontaneous combustion management plan will be implemented as part of this project, and will include measures to reduce the spontaneous combustion risk on both the surface and for underground operations, such as the use of water sprays, prudent stockpile management, proper ventilation management and inertisation of the goaf.

Acid Mine Drainage Potential

Testing of acid mine drainage risk has been undertaken in the Underground Project area. This testing has indicated that the risk of acid mine drainage occurring with the potential to impact on the local environment is minimal. Further testing of acid generating potential will be undertaken as part of the approved exploration adit into the Woodlands Hill seam.

Gas Content

From an environmental management perspective, seam gas content impacts primarily relate to greenhouse gas emissions. A detailed greenhouse gas emissions assessment has been completed as part of the EA and is discussed in **Section 5.8**.

3.4.2 Coal Resources

The coal resource in the project area will continue to be refined throughout the project life based on ongoing exploration drilling work and geological modelling. The current estimate of coal resources in the project area (including coal within EL5965 and ML1358) has been provided to DPI by Mt Arthur Coal.

3.5 Construction Phase

The Underground Project aims to maximise use of Mt Arthur Coal's existing infrastructure, including the existing MAN CHPP and the rail facility. Additional infrastructure will be required as part of the project with the key infrastructure to be constructed prior the commencement of longwall mining. Construction activities will, however, occur periodically over the life of the project due to the multiple underground access points to be used and the need for mining surface facilities to be relocated as underground mining progresses.

The key construction activities will include:

- construction of the Underground Project access road as an extension of the existing Mt Arthur Coal access road;
- construction of the North Saddlers ROM facility and overland conveyor to the MAN CHPP;
- upgrade of the existing CHPP and ROM facility including a new plant module, coal stockpiles and associated handling systems;
- upgrade of the Antiene rail spur (replacement of sleepers etc.) and increasing the length of an existing passing loop if required to cater for additional train movements;
- construction of pit-top facilities such as the Underground Project offices, workshop, bathhouse, deployment, store and other facilities;
- set-up of underground mining access, conveyors and access points;

- construction of mining surface facilities including ventilation facilities, gas drainage boreholes, dewatering boreholes and other similar facilities; and

- installation of services such as powerlines, water pipelines, dams and other water management structures.

The initial construction period prior to longwall mining commencing is expected to last approximately two years. During this time, underground mining operations will be undertaken to establish roadways in preparation for the commencement of longwall mining. Coal generated during underground roadway establishment will be brought to the surface and handled by the infrastructure established for the exploration adit until the North Saddlers ROM facility becomes operational. This will include use of a front-end-loader to load coal from an in-pit ROM coal stockpile into trucks for haulage to the MAN CHPP.

Site access during the construction phase will be via the existing Mt Arthur Coal access road and Bayswater access road, using internal mine roads to reach construction sites. Occasional access will also be required from other public roads such as Edderton road, Denman Road, Thomas Mitchell Drive and Hebden Road for construction of specific local infrastructure. Where such construction access is required, appropriate temporary construction traffic controls will be put in place in consultation with the relevant roads authority as discussed in **Section 5.11**.

Construction project offices and other construction workforce facilities (e.g. parking, workshop and amenities) will be established at the site of the existing Mt Arthur Coal project offices and the Bayswater No. 2 infrastructure area (refer to **Figure 1.3**).

3.6 Concept Mine Plan

The project will involve longwall mining operations in five coal seams over the initial 21 year approval life, primarily producing thermal coal aimed at the export market but with opportunities to supply various quality coals into the domestic and export markets. As discussed above, further coal resources will remain within the project area after this initial 21 years of mining and Mt Arthur Coal intend to continue mining beyond this period should future approvals be granted. The five target seams for the initial 21 year period are the:

- Woodlands Hill seam;

- Glen Munro seam;

- Arrowfield seam;

- Bowfield seam; and

- Piercefield seam.

The concept mine plans for each of these seams are discussed in **Sections 3.6.1** to **3.6.3**. Mining will be completed using one longwall mining unit with a number of continuous mining units (typically four) being required to provide sufficient gate road development in advance of longwall mining.

The concept mine plans which form the basis of the assessment in this EA have been designed in consideration of current mining techniques and technologies and are based on the current understanding of the local geology. Mining operations are, however, dynamic and the specific mine plan layout and mining sequence that form the concept mine plan may

be subject to changes due to technological advances, operational needs or as further geological data is gathered. Approval is therefore sought for the general mining footprint and extent of associated activities discussed in this section, with any changes to the concept mine plan to be addressed as part of the DPI's Subsidence Management Plan and Mining Operations Plan processes, as discussed below.

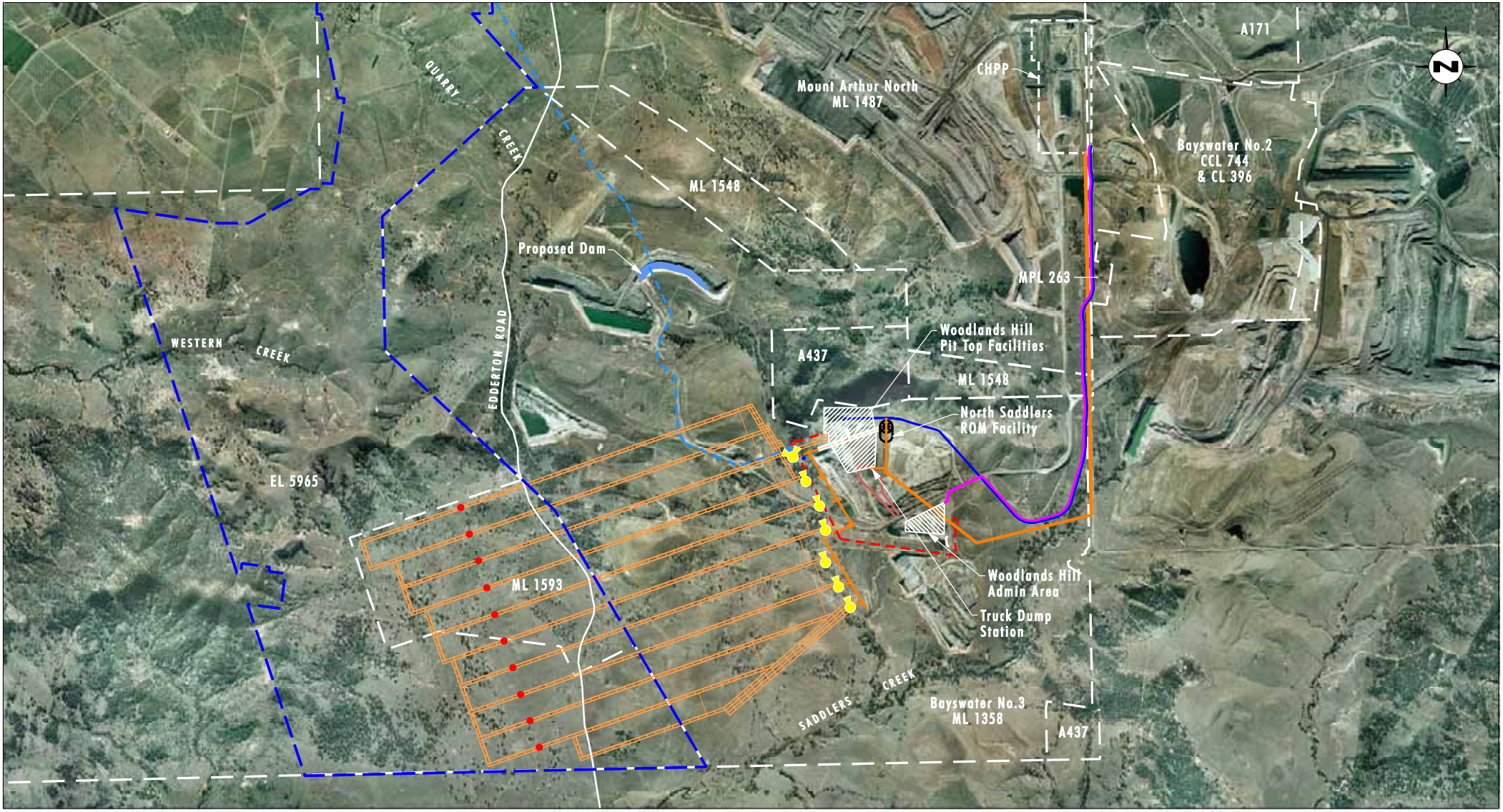
The concept mine plan is based on a longwall panel extraction width (face width) of 275 metres. This face width is considered to be readily achievable using current longwall mining technology and has therefore been used as the basis for the design of the concept mine plan. Improvements in mining technology are currently resulting in increases in face width with some mining operations using face widths of up to 400 metres. A face width of 275 metres as used in the concept mine plan achieves the critical width for subsidence in the project area (i.e. the width at which maximum vertical subsidence occurs) and is considered to represent the worst case face width in terms of subsidence impacts for impact assessment purposes. Increasing the panel width from 275 metres up to a width of 400 metres will not increase the magnitude of subsidence impacts, but may change the location of peak subsidence impact. It is also possible that in some cases a reduced face width may be used due to the presence of geological structures. Approval is therefore sought for extraction of longwall panels for a face width of up to 400 metres.

Prior to underground mining proceeding, a Subsidence Management Plan (SMP) will be required for each set of longwall panels to discuss detailed mine plans and management of mining impacts. Should any changes to the concept mine plans discussed in this EA be required during the approval life (including changes in longwall panel face width), these changes will be discussed with relevant government agencies and submitted to the DPI for approval as part of the SMP process.

3.6.1 Woodlands Hill Seam Concept Mine Plan

Mining will start in the Woodlands Hill seam which will be accessed via the Saddlers Pit in the Bayswater No.3 mining area. The concept mine plan for the Woodlands Hill seam and the associated surface infrastructure is shown on **Figure 3.3**. Although the Woodlands Hill seam lies below the Glen Munro seam in stratigraphic order (refer to **Figure 3.1**), it can be mined first as the Glen Munro seam does not have a viable mine plan above the Woodlands Hill seam in this area due to seam splitting or other geological constraints.

The majority of the Woodlands Hill mining operation will be a 'punch longwall' operation meaning that the gate roads (mine access tunnels) for longwall blocks will have access directly into the coal seam from the Saddlers Pit highwall. The first two longwall panels cannot be directly accessed from the highwall and will be accessed conventionally from a set of main headings driven from the Saddlers Pit highwall. Each longwall panel will be mined up-dip (uphill) from its western end back towards the Saddlers Pit entry. As indicated on **Figure 3.3**, ventilation fans will be located at the Saddlers Pit end of the longwall panels with downcast ventilation shafts also potentially required near the western end of the panels to provide adequate ventilation. Approximately four ventilation fans may be operated concurrently. Ventilation shaft locations shown on **Figure 3.3** are indicative only and may change subject to further investigations. This will be managed in accordance with appropriate approvals from DPI post project approval and by the management controls outlined in **Section 5.0** of this EA. The ventilation shaft sites may also be used for service boreholes to provide power, communications, compressed air and other materials to the underground workings. Other small borehole facilities such as dewatering boreholes and gas drainage boreholes will also be required above the longwall panels as mining progresses, with access tracks, powerlines and other services associated with these facilities.



Source: Mt Arthur Coal, 2006

Legend

- Mining and Exploration Lease Boundary
- Proposed Mining Lease Boundary
- Woodlands Hill Seam Concept Mine Layout
- Mine Access Road
- Surface Conveyor
- Haul Road
- Potable Water
- Clean Water Supply
- Power Supply
- Ventilation Fan Indicative Location
- Downcast Shaft Indicative Location

FIGURE 3.3

Woodlands Hill Seam Concept Mine Plan

File Name (A4): R21_V1/2051_262.dgn

Coal from the longwall equipment will be brought to the surface via an underground conveyor system which will surface in the Saddlers Pit and deliver coal to the North Saddlers ROM facility (refer to **Section 3.7.2**). After passing through the North Saddlers ROM facility, ROM coal will be delivered via conveyor to the existing MAN CHPP.

3.6.2 Glen Munro Seam Concept Mine Plan

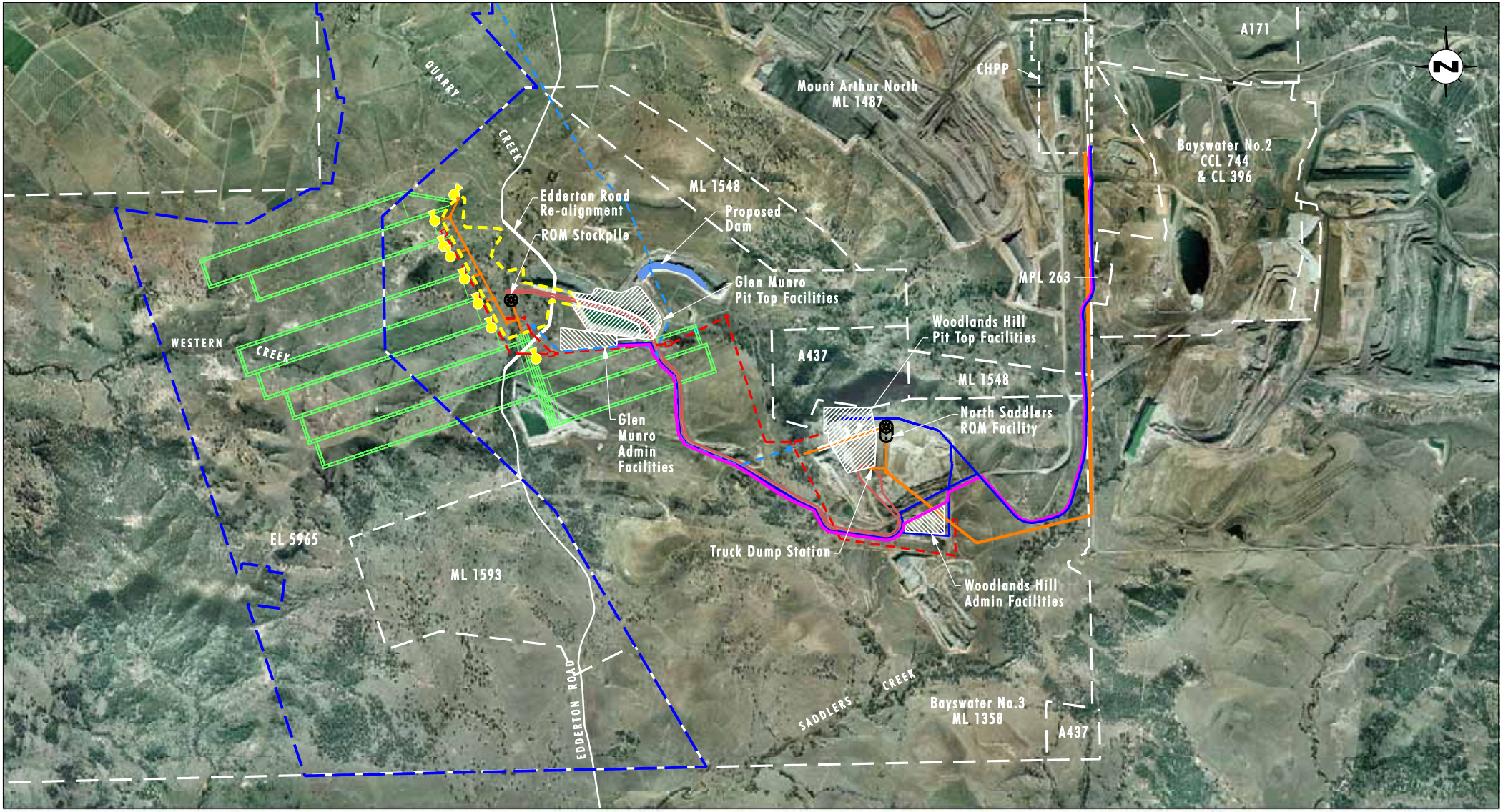
Following the extraction of the Woodlands Hill seam, the longwall equipment will move into the Glen Munro seam. Development mining for the establishment of roadways in the Glen Munro seam will be undertaken concurrently with longwall mining in the Woodlands Hill seam. The Glen Munro seam will be accessed via the Belmont Pit in the Bayswater No. 3 mining area, with further open cut mining works required in this pit prior to underground mining occurring. These works will be undertaken in accordance with the existing development consent for the Bayswater No. 3 mining area. The current conceptual mine plan for the Glen Munro seam is shown on **Figure 3.4**. The Glen Munro mining operation will be a punch longwall operation and will be operated in a similar manner as the Woodlands Hill seam (refer to **Section 3.6.1**). Ventilation fan and boreholes facilities, and associated services, will also be required for this seam, with approximately four ventilation fan likely to be operated concurrently. Ventilation shaft locations shown on **Figure 3.4** are indicative only and may change subject to further investigations. This will be managed as part of the SMP process post project approval and by the management controls outlined in **Section 5.0** of this EA. Other small borehole facilities such as dewatering boreholes and gas drainage boreholes will also be required above the longwall panels as mining progresses, with access tracks, powerlines and other services associated with these facilities.

Mined coal will be brought to the surface in the Belmont Pit via underground conveyor and delivered to an in-pit ROM coal stockpile. Coal will be reclaimed from the stockpile by front-end-loader and delivered to the North Saddlers ROM facility via trucks on internal haul roads. From the North Saddlers ROM facility ROM coal will the transferred by conveyor to the MAN CHPP.

3.6.3 Arrowfield, Bowfield and Piercefield Seams Concept Mine Plans

The Arrowfield, Bowfield and Piercefield seams are deeper than the Woodlands Hill and Glen Munro seams and cannot be accessed directly from open cut mining pits. A drift (tunnel) will therefore be established from the base of the North Saddlers pit to provide access into these seams. The drift will consist of several separate tunnels and will firstly provide access to the Arrowfield seam prior to being extended for access into the lower Bowfield and Piercefield seams. The concept mine plans for these three seams are shown on **Figure 3.5**. The concept mine plan shown for the Piercefield seam finishes after 21 years of mining, however further coal will remain in this seam and in lower seams in the project area at this time. Mt Arthur Coal plans on continuing underground mining after this time, subject to future approvals.

As access to these seams will be via a drift, larger ventilation fan and service borehole facilities will be required to provide adequate ventilation and materials for use in mining operations. Approximately four ventilation fans may be operated concurrently during mining operations including a specific fan for the ventilation of the drift, a major fan complex containing two fans and fans at the western end of the longwall panels. The major fan complex may also house other boreholes and associated facilities such as compressors, substations, water pumps, gas drainage infrastructure (including flares), emulsion tanks and materials boreholes. The major fan complex locations shown on **Figure 3.5** are indicative only and may change subject to further investigations. This will be managed as part of the SMP process post project approval and by the management controls outlined in **Section 5.0**



Source: Mt Arthur Coal, 2006

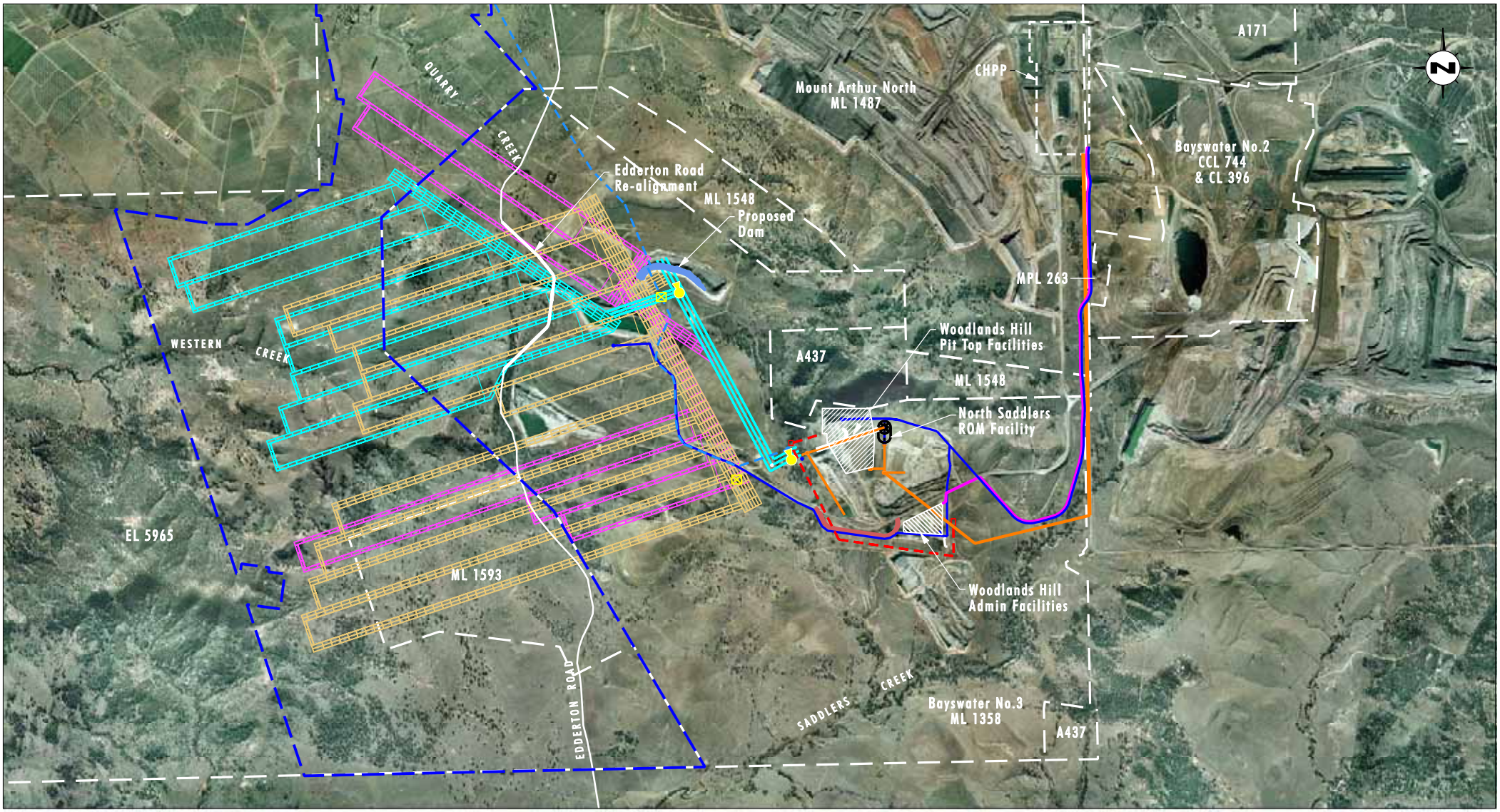
Legend

- Mining and Exploration Lease Boundary
- Proposed Mining Lease Boundary
- Glen Munro Seam Concept Mine Layout
- Mine Access Road
- Surface Conveyor
- Haul Road
- Potable Water
- Clean Water Supply
- Power Supply
- Approved Open Cut
- Ventilation Fan Indicative Location

FIGURE 3.4

Glen Munro Seam Concept Mine Plan

File Name (A4): R21_V1/2051_263.dgn



Source: Mt Arthur Coal, 2006

Legend

- Mining and Exploration Lease Boundary
- Proposed Mining Lease Boundary
- Arrowfield Seam Concept Mine Layout
- Bowfield Seam Concept Mine Layout
- Piercefield Seam Concept Mine Layout
- Mine Access Road
- Surface Conveyor
- Haul Road
- Potable Water
- Clean Water Supply
- Power Supply
- Ventilation Fan Indicative Location
- Shaft Complex Indicative Location

FIGURE 3.5

Arrowfield, Bowfield and Piercefield Seams Concept Mine Plans

of this EA. Small borehole facilities for gas drainage, dewatering and other similar activities will be located above the longwall panels, as required.

Coal will be brought to the surface via the drift and delivered by conveyor to the North Saddlers ROM facility and then to the MAN CHPP.

3.6.4 Mining Surface Infrastructure

A range of ancillary mining infrastructure will be required above the underground mining area including ventilation fan facilities, downcast ventilation shafts, access tracks, service boreholes (power etc.), gas drainage and flaring facilities including pipe networks, dewatering boreholes and associated piping and other similar infrastructure. The conceptual plans for these facilities were discussed in **Section 3.6.1** to **3.6.3** above with conceptual localities for some facilities shown on **Figures 3.2** to **3.5**. As the locations in which these facilities are required will vary as mining progresses, there will be ongoing drilling, relocation of equipment and construction operations associated with these facilities for the life of the project.

The exact location and number of these facilities will be determined as the project progresses, depending on mining operation needs, geological conditions and other mining and environmental variables. The final locations will be determined as part of the detailed mine planning process for each set of panels and will be included in the MOP and SMP provided to DPI prior to mining commencing. The facilities will be located in consideration of environmental factors such as ecological values, Aboriginal sites, surface drainage and potential amenity impacts.

3.6.4.1 Gas Drainage

Mt Arthur Coal is committed to ensuring safe underground working conditions and minimising greenhouse gas emissions, and will use gas drainage infrastructure to drain gas from some target coal seams prior to mining. It is anticipated that this will include both underground and surface based drainage systems. Collected gas will also be drained from goaf (mining void) areas as required. Where methane concentrations allow, drainage gas will either be flared or utilised in small scale power generation on or off site (where practical) to minimise greenhouse gas emissions. The feasibility of energy production from collected gas will be the subject of ongoing investigations once mining operations commence. Flares will be designed to provide efficient combustion of gas whilst ensuring relevant safety requirements are met and minimising the potential for environmental impact (e.g. visual impacts, bushfire hazard). These gas collection and utilisation systems will require installation of surface fans, a network of pipelines, pressurisation units and associated access tracks. The surface equipment will be relocatable and will be moved as required over the life of the project to maximise gas capture.

3.6.5 Coal Production

The current 21 year concept mine plan will result in extraction of approximately 160 Mt of coal at a production rate of approximately 8 Mtpa. The annual production rate is expected to typically vary between 6 and 8 Mtpa depending on the seam, mining conditions and the timing of longwall panel changeovers. This is in addition to the production of the existing approved and proposed Mt Arthur Coal open cut mine complex.

3.7 Mine Infrastructure

The project has been designed to maximise use of existing Mt Arthur Coal infrastructure including the existing MAN CHPP and rail facility. Some upgrade works to these existing facilities will be required as described below, with new project specific infrastructure also required. The conceptual infrastructure layouts associated with each mine plan are shown on **Figures 3.3** to **3.5**.

3.7.1 Pit-Top Facilities

The pit-top facilities required for the operation of the Underground Project will include office, workshop, store and bathhouse facilities. These facilities will be constructed in the locations shown on **Figures 3.3** to **3.5**, which are primarily previously mined areas. Use may also be made of the current Mt Arthur Coal Project offices located near the MAN CHPP to provide office and deployment facilities.

Pit-top facilities will be established in the Saddlers Pit area for mining in the Woodlands Hill seam, with some facilities subsequently relocated to Belmont pit during mining of the Glen Munro seam. Once the drift is established in North Saddlers pit to provide access to the lower coal seams, all pit-top facilities will be relocated permanently to Saddlers Pit.

The pit-top facilities will have stores of fuel, oils, chemicals and potentially other dangerous goods associated with the workshop and stores facilities. These materials, along with any waste materials, will be stored in areas constructed in accordance with relevant Australian Standards and DECC guidelines. Drainage from pit-top facilities will be appropriately managed to contain run-off and treated (e.g. hydrocarbon management systems) prior to re-use on-site within the mine water management system.

3.7.2 ROM Coal Handling System

The ROM coal handling system proposed for each mine plan was discussed briefly above in **Sections 3.6.1** to **3.6.3** and is shown on **Figures 3.3** to **3.5**. Coal from the Woodlands Hill mining operation will be delivered by a conveyor system to the North Saddlers ROM Facility. The ROM facility will be located on previously mined land in the North Saddlers Pit area, as shown on **Figure 3.3**. The ROM Facility will receive and size coal from the underground mining operations and will have a ROM stockpile with a capacity of approximately 500,000 tonnes. Coal from adjacent open cut workings may also be delivered to the ROM Facility which will have a truck dump station for receiving ROM coal.

Coal will be reclaimed from the ROM Facility stockpile and passed through a sizing plant with sized coal delivered to the existing Mt Arthur Coal CHPP by overland conveyor (refer to **Figure 3.3**).

Dust suppression equipment will be installed throughout the ROM coal handling system to control emissions. The overland conveyor and transfer points will also be designed to control noise and dust emission.

During the Glen Munro mining operation, coal will be delivered from underground via a conveyor system onto an in-pit ROM coal stockpile. Coal from nearby open cut operations may also be delivered to the Glen Munro ROM stockpile. Coal reclaimed from this stockpile will be transferred by truck (240 tonne dump truck or similar) as currently used by Mt Arthur Coal for coal haulage, or road-type trucks e.g. B-doubles) to the North Saddlers ROM facility, prior to being reclaimed, sized and delivered by the overland conveyor to the MAN CHPP.

Coal mined from the Arrowfield, Bowfield and Piercefield seams, will be delivered by conveyor from the drift directly onto the North Saddlers ROM Facility stockpile prior to being reclaimed, sized and delivered by overland conveyor to the MAN CHPP.

3.7.3 Existing MAN CHPP Upgrade

ROM coal from the underground operations will be delivered by conveyor to the existing MAN CHPP. The existing CHPP has approval to process 20 Mtpa of ROM coal. ROM coal produced by the Underground Project will be handled by the MAN CHPP in addition to existing and proposed open cut production. Coal handled by the CHPP will be washed or bypassed directly to product.

ROM coal delivered by overland conveyor from the Underground Project will either be fed directly into the coal processing plant for processing or loaded out onto a new raw coal stockpile of approximately 300,000 tonne capacity (refer to **Figure 3.6**).

In order to accommodate the coal flow from the Underground Project, a re-organisation and expansion of stockpiling at the open cut ROM facility is required. It is proposed to extend the existing 100,000 tonne emergency ROM stockpile to create a single permanent stockpile area with a capacity of approximately 650,000 tonnes (refer to **Figure 3.6**). Coal from the stockpile will be loaded into the ROM feed hoppers using a truck and front end loader and will require occasional shaping using a dozer. The stockpile will be equipped with perimeter water sprays or equivalent permanent means of dust control.

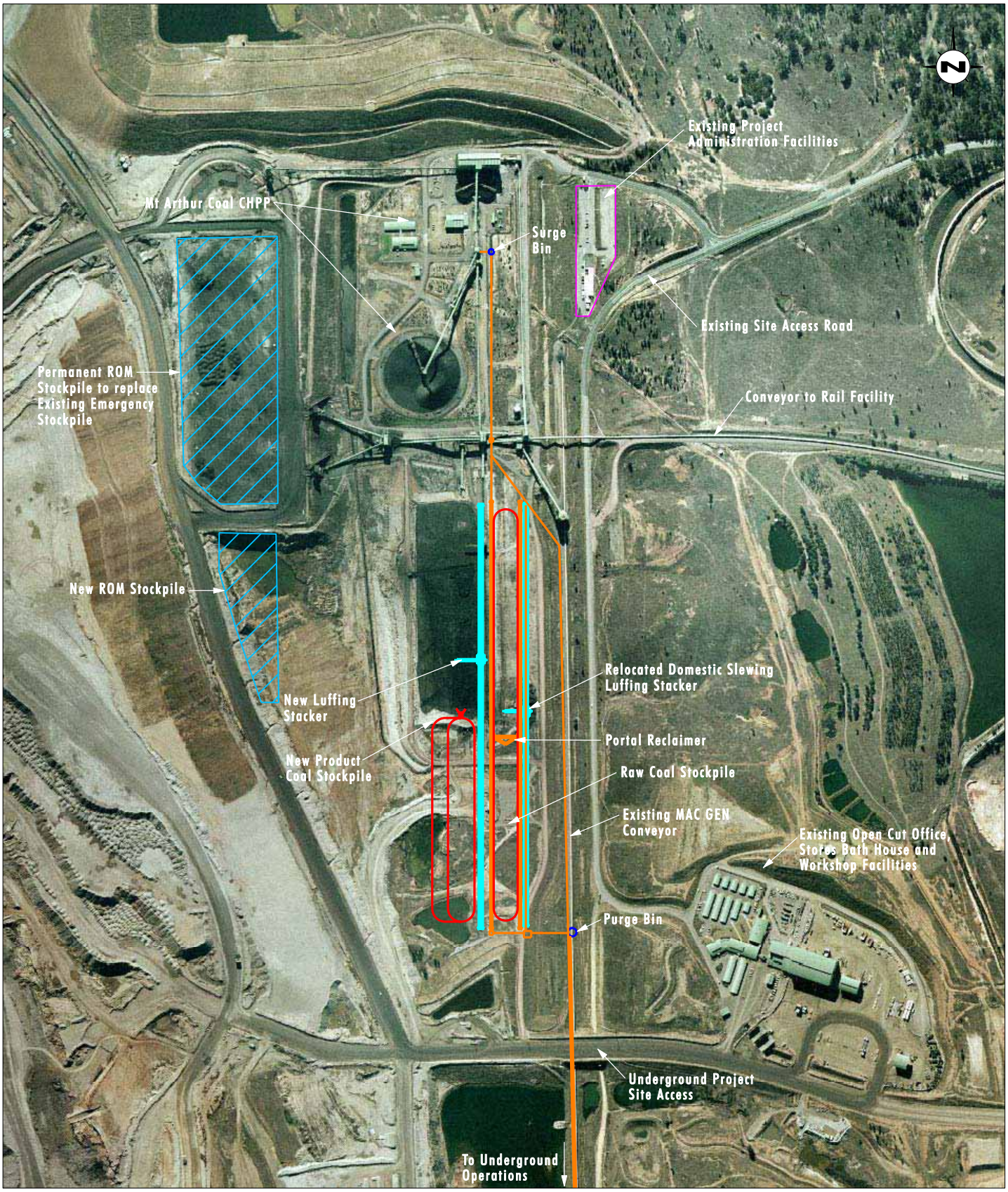
The MAN coal processing plant is comprised of three washing modules. To provide sufficient capacity to process the coal from the combined open cut and underground operations, the modules will be upgraded and an additional module added to cater for the anticipated production.

After processing, product coal from the CHPP will be transferred by conveyor to either a product coal stockpile adjacent to the raw coal stockpile (refer to **Figure 3.6**) or directly to the export coal stockpile at the rail loading facility. The existing product coal stockpile will be extended to achieve a capacity of approximately 440,000 tonnes. The capacity of the overland conveyor to the rail loading facility and the rail facility stockpile stacker will be increased either by duplication or upgrading, to provide increased coal handling capacity. No other changes to the rail facility are required.

3.7.3.1 Tailings and Coarse Reject Handling

In the MAN Project Environmental Impact Statement (EIS) (URS, 2000), a range of options for rejects and tailings disposal were canvassed. The EIS noted that the preferred option for the disposal of tailings was eventually mechanical dewatering and disposal of tailings and coarse rejects in the pit overburden emplacement after the West Pit void at Bayswater No. 2 was filled with washery reject during the initial years of mining. The key drivers in this assessment were limitation of space, efficiency of water use, economic feasibility and effective rehabilitation.

It is proposed that tailings and reject from all coal produced by Mt Arthur Coal (including coal from MAN, Bayswater No. 3, the proposed South Pit Extension and the Underground Project) will be disposed of within existing voids and overburden emplacement areas in the Bayswater No. 2, Bayswater No. 3, MAN and, if agreement is reached, in the planned Drayton West Pit sub-lease or partial-lease transfer area. This may include co-disposal of coarse reject and tailings in the same emplacement areas or the use of separate emplacement areas depending on the final emplacement strategy agreed in consultation with



Source: Mt Arthur Coal

0 100 250 500m
1:10 000

Legend

- New Conveyors
- New Stockpile
- New Stacker
- New Bins

FIGURE 3.6

MAN CHPP and ROM Upgrade

DPI. Reject may also be disposed of in overburden emplacement areas in accordance with the MAN development consent.

This tailings and reject disposal strategy provides adequate disposal capacity for all tailings and reject produced from coal extracted as part of the Underground Project. As all coal from the Underground Project will be handled by the MAN CHPP, the methods for handling of tailings and reject and disposal locations will be the same as all other coal produced by Mt Arthur Coal. This strategy involves all tailings and reject disposal being emplaced within open cut voids or overburden emplacement areas, with no non-mining areas required for emplacement areas.

Mt Arthur Coal is currently investigating dewatering options for tailings as discussed in the MAN EIS. The aim of the tailings dewatering investigations is to increase the tailings solids component resulting in increased water recovery, improved geotechnical stability of the final landform and greater flexibility for long-term emplacement activities. Should these investigations identify that tailings dewatering is viable, it will be implemented during the life of the Underground Project.

Tailings emplacement strategies implemented during the life of the project will require consultation with, and approval from, DPI prior to activities commencing. These approvals will detail the specific operational design and management measures to be implemented, including environmental management measures.

3.7.4 Product Coal Transportation

Coal from the Underground Project will be transported from the site to markets via Mt Arthur Coal's existing rail facility. The existing rail loading facility will not require any major upgrade works, with only minor changes to conveyor and stacker capacities required. Coal may also be delivered to Mt Arthur Coal's domestic clients via an existing overland conveyor.

The development consent for the Bayswater Rail Facility limits coal loading and transportation from Mt Arthur Coal to 13 Mtpa, with a maximum of 18 train movements per day (note: each train entering or exiting the Bayswater Rail Facility is counted as a single train movement. That is, one train load of coal results in two train movements). The Underground Project seeks to increase Mt Arthur Coal's total coal production and therefore an increase in the amount of coal permitted to be transported from the site by train is required. Approval is sought as part of this project to transport 19 Mtpa of Mt Arthur Coal's production from the site by rail and to use the Bayswater Rail Facility, rail spur and Antiene Rail Spur for the life of the Underground Project. This represents an increase of 6 Mtpa above the levels approved by the Bayswater Rail Facility development consent (DA-105-04-00). The potential impacts associated with this increase in product coal transportation are assessed as part of this EA, with the findings provided in **Section 5.0**. Should approval be granted for the Underground Project, the environmental management controls (including monitoring and regular reporting of train movements) currently in place for the Bayswater Rail Facility will be integrated with the Mt Arthur Coal operations management plans and programs (refer to **Section 6.0**).

The Bayswater Rail Facility consent also limits the maximum number of train movements on the Bayswater Rail Loop from Mt Arthur Coal to 18 movements per day, with a total limit of 30 train movements per day on the Antiene Rail Spur from all operations (i.e. Mt Arthur Coal and Drayton). Due to the proposed increase in total production from Mt Arthur Coal, there will be an increase in the number of train movements per year through the rail facility and along the Antiene rail spur. When both underground and open cut operations are operating at full capacity, there will be a maximum of 24 train movements per day from Mt Arthur Coal. This represents an increase of 6 movements above the levels approved by the Bayswater

Rail Facility development consent. Rail loading is anticipated to occur on approximately 320 days per year and will result in an average of approximately 16.5 train movements per day from Mt Arthur Coal.

Although no major upgrades are required to the rail facility for the Underground Project, approval is sought to extend an existing passing lane on the Antiene rail spur by approximately 600 metres to provide additional train movement capacity should it be required. The extended passing lane would be located to the east of the New England Highway near the intersection of the Antiene spur with the Main Northern Railway (refer to **Figure 3.7**). The passing lane extension would be constructed within the existing rail corridor.

3.7.5 Site Access and Road Works

Vehicular access to the Underground Project will be via the existing Mt Arthur Coal site access road off Thomas Mitchell Drive. During the construction phase, some traffic will enter via the existing Bayswater access road. An additional section of internal access road will be constructed to connect the existing Mt Arthur Coal site access road to the Underground Project facilities. The location of this access road is shown on **Figure 3.3**. The original design of the access road included a crossing of Saddlers Creek, however, the design was revised to avoid the need for a creek crossing due to the archaeological and ecological values of Saddlers Creek.

As indicated on **Figure 3.4**, a section of Edderton Road will be re-aligned prior to the commencement of mining in the Glen Munro seam due to approved open cut mining in the Belmont Pit. These works are approved as part of the Bayswater No. 3 project, with the final design to be undertaken in consultation with MSC. This road re-alignment includes a grade separated crossing of a mine haul road. The current design for the re-alignment includes the haul road passing under Edderton Road, ensuring there are no height restrictions for traffic on Edderton road. Sections of Edderton Road will also require upgrade works due to subsidence impacts throughout the life of the project. These works will be primarily pavement repair and minor upgrade works. Temporary road diversions may be used along the edge of Edderton Road to facilitate traffic management during periods of road works.

Residents in the Antiene area east of the New England Highway have previously raised the issue of trains blocking the Antiene Road level crossing as being a key issue for their local area. Mt Arthur Coal has recognised that the extension of the passing lane on the Antiene spur and the increase in train movements resulting from this project, have the potential to increase the frequency of trains blocking the crossing. There are a number of organisations that are relevant to this issue including Anglo Coal (the owners of the Antiene Rail Spur), MSC (roads authority for Antiene Road), Macquarie Generation (operators of an adjacent rail unloading facility) and Mt Arthur Coal as a user of the Antiene spur. Mt Arthur Coal is committed to working with the other stakeholders to resolve the current access situation for the residences in the Antiene area east of the New England Highway and has commenced discussions with MSC regarding possible solutions (e.g. a grade separated crossing).

3.7.6 Site Services and Associated Infrastructure

Site services required for the Underground Project will include:

- powerlines;
- potable water pipelines;
- communications lines; and

Base Source: Mt Arthur Coal, 2006

Legend

- Mining and Exploration Lease Boundary
- Passing Loop Extension

FIGURE 3.7

Antiene Rail Spur Upgrade

- minor access roads and other such minor infrastructure within the project MLs (including a future ML over the existing EL area).

The conceptual locations of the major site services are shown on **Figures 3.3** to **3.5** with locations for other required services to be determined based on mining operation needs as the project progresses. Some site services will be relocated as mining progresses to meet the changing needs of the mining operation.

3.7.7 Water Services

Water usage requirements, water sources and general water management requirements (including water management controls) are detailed in **Section 5.5**, with the discussions below limited to infrastructure associated with water supply and use.

To provide safe mining conditions, dewatering boreholes will be established to extract water from the target coal seams prior to mining and also from goaf areas following mining. Pipelines will transfer this water into dams within the minewater management system for re-use on site. An in-pit dewatering system will also be used resulting in water being returned to the surface via pipelines within the underground workings.

A water extraction point will be established on the Hunter River on Mt Arthur Coal owned land to the north of Denman Road. The extraction point will make use of Mt Arthur Coal's existing allocations to extract water from the Hunter River Regulated Water Source and will provide clean water to the operations as required. The water will be transferred by pipeline to a clean water storage dam to be established in the northern end of the existing Belmont Pit in the Bayswater No. 3 ML or an equivalent new storage within vicinity of this location (refer to **Figure 3.5**). This system will also have the capacity to pump water from the river during high flow events in accordance with the provision of the Water Sharing Plan for the Hunter Regulated River Water Source (DNR, 2004) The final location and design of the extraction point will be determined in consultation with DWE.

In addition to the new water extraction point discussed above, Mt Arthur Coal may also upgrade the existing Hunter River extraction point established as part of the MAN project. This upgrade could include increasing the pump capacity at this location to provide increased extraction flexibility. Any upgrades would be undertaken in consultation with DWE.

Sewage from each of the amenity areas will be treated by on-site package sewage treatment facilities with the resulting effluent reclaimed and used as production water or, for smaller systems, disposed of via irrigation systems.

3.8 Workforce and Hours of Operation

The workforce during construction is expected to peak at approximately 470 personnel. Typical construction hours of operation will be 7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturday. Works may also be undertaken outside these hours provided that they are managed such that Mt Arthur Coal's total noise emissions remain within the operational noise limits discussed in **Section 5.6**.

During operations, the project will employ approximately 300 people at full production. Mining operations and ancillary activities are planned to be undertaken 24 hours per day, seven days per week.

3.9 Use of Existing Facilities

As discussed in **Section 3.7**, the Underground Project has been designed to maximise use of existing Mt Arthur Coal facilities. An initial approval period of 21 years (from the date of commencement of longwall mining) is sought for the Underground Project with the potential for ongoing mining operations after this time subject to subsequent approvals. This initial approval period will extend beyond the life of Mt Arthur Coal's current approvals and approval is sought as part of this project for ongoing use of the existing Mt Arthur Coal facilities for the life of the Underground Project. This includes ongoing use of the:

- MAN CHPP and associated conveyors and mobile equipment;
- Bayswater rail loading facility, rail spur and the Antiene rail spur;
- MAN office complex, workshop, store, bathhouse and other associated facilities;
- MAN project office complex associated with the MAN CHPP;
- exploration adit and associated surface facilities;
- existing water management infrastructure including dams, pumps, pipeline, the existing extraction point on the Hunter River; and
- services, access roads and environmental management infrastructure.

3.10 Decommissioning and Closure

In accordance with best practice and BHP Billiton's requirements for all new projects, a Conceptual Closure and Decommissioning Plan has been prepared for the Underground Project. The Plan has been prepared in consideration of relevant government policy and in accordance with BHP Billiton's Closure Standard which requires that it must identify, mitigate, where possible, and manage environment and community risks associated with closure. The aim of the BHP Billiton process is to ensure that decommissioning and closure are considered at all phases of a project, including as part of the investment decision process.

The objectives of the closure planning process included:

- limiting or mitigating adverse environmental and socio-economic impacts associated with closure;
- planning to avoid long term liabilities;
- to provide for the safety of employees and the public during and following the closure of the project; and
- achieving sustainable land-use conditions as agreed with relevant authorities and the community.

The closure planning process covered the following key aspects:

- identification of closure requirements including corporate and regulatory requirements as well as relevant industry codes of practice;

- a description of the existing environment and potential environmental impacts of the project as they relate to closure;
- planning for mine closure including identification and management of potential fatal flaws, closure risks, key closure issues and development of closure criteria;
- a stakeholder consultation strategy including identification of key stakeholders and their needs and requirements;
- a detailed decommissioning and rehabilitation plan detailing the actions required to be implemented to close each component of the operation, including ongoing care and maintenance requirements; and
- a close out procedure to be implemented on the completion of closure activities.

A key aspect of the closure planning process included the development of closure criteria, with closure works planned to achieve these criteria. The closure criteria takes into account corporate requirements, legislative and government policy requirements, existing operations and commitments and likely stakeholder views and requirements including the views of the local community. The closure criteria will be reviewed and revised throughout the project life. The conceptual closure criteria developed at this stage of the project include:

- all mine entries and boreholes will be sealed (but provided with suitable apparatus to allow appropriate ongoing gas management and utilisation, as required) to prevent future access and remove potential safety risks;
- all subsidence affected areas will be rehabilitated to a safe and stable state consistent with their pre-mining land capability;
- all surface infrastructure which does not have a potential future use associated with the post mining land use will be removed, unless such removal has a greater environmental impact then rehabilitating the area with the *in situ* infrastructure;
- all surface infrastructure areas will be deep ripped (as required) to remove hard stand or compacted areas, returned to a stable landform and will be rehabilitated using pasture and/or native woodland species depending on their pre-disturbance groundcover. Pasture species used in rehabilitation will include native grasses wherever possible;
- tailings and reject emplacement areas will be capped and reshaped and be free draining;
- all post mining drainage lines will be stable (consistent with or better than their pre-mining condition) and will be rehabilitated using endemic species;
- the overall post mining land capability of the project area will be consistent with the overall pre-mining land capability of the project area, except with increased areas of native vegetation provided to enhance the ecological value of the project area; and
- the potential for post-mining economically productive land uses (in addition to grazing activity) will be investigated and implemented as part of the closure process where possible.

Closure and decommissioning works will be undertaken progressively over the life of the project as each phase of the mine plan is completed, ensuring that much of the closure works required will be completed prior to the end of the initial 21 year approval period.

The conceptual closure planning process undertaken for the project concluded that Mt Arthur Coal will be able to effectively close the Underground Project ensuring compliance with the BHP Billiton Charter, other BHP Billiton requirements, legislative and government policy requirements and stakeholder expectations.

As discussed in **Section 3.6**, further coal resources will remain within the project area following the initial 21 year approval period sought and Mt Arthur Coal intend to seek subsequent approvals to continue mining operations. Should mining not continue beyond the initial 21 year period, all required closure works will be completed following the completion of mining in the twenty first year of the project. It is envisaged that the majority of closure and decommissioning works would be completed within two years of completion of mining. Closure monitoring and maintenance works would continue after this two year period. Further discussion of closure and rehabilitation is included in **Section 5.10**.

4.0 Planning Context

The following section contains details of the relevant Commonwealth and State planning provisions and a discussion of the application of these planning provisions to the project.

4.1 Commonwealth Legislation

4.1.1 Environmental Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval of the Commonwealth Minister for the Environment and Water Resources is required for any action that may have a significant impact on matters of national environmental significance. These matters are:

- World heritage properties;
- National Heritage Places;
- Ramsar wetlands;
- cetaceans, migratory species, threatened species, critical habitats or ecological communities listed in the EPBC Act;
- Commonwealth land, marine areas or reserves; and
- nuclear actions.

The provisions of this legislation relevant to the Underground Project relate to potential impacts on migratory species, threatened species, or ecological communities listed under the EPBC Act. One EPBC Act threatened flora species was recorded within the project area and another listed flora species was considered to potentially occur in the project area. Two EPBC listed migratory species were recorded within the project area and a further 23 species listed under the schedules of the JAMBA/CAMBA and Bonn agreements as marine or migratory species were also recorded.

An assessment of the impact of the project on these threatened and migratory species was undertaken and it was concluded that the Underground Project will not have a significant impact on listed threatened species and communities or migratory species as listed under the Schedules of the EPBC Act (refer to **Section 5.3**). On this basis, approval under the EPBC Act is not required for the project.

None of the other listed triggers for assessment under the EPBC Act are relevant to the Underground Project.

4.1.2 Native Title Act 1993

The *Native Title Act 1993* is administered by the National Native Title Tribunal. The Tribunal is responsible for maintaining a register of native title claimants and bodies to whom native title rights have been granted. These native title holders and claimants must be consulted prior to the granting of a ML over land to which the native title claim or right applies. The Act prescribes that native title can be extinguished under certain circumstances, including the granting of freehold land.

No native title claims are known to exist over land within the project area.

4.2 New South Wales Legislation

4.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act defines the approval process for proposed developments in NSW. The objectives of the Act relevant to the project are:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(iv) ESD, and

(b) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

It is considered that the project meets these objectives as it relates to planning for the safe and economic recovery of the State's coal resource whilst effectively managing impacts on the environment and community. Consistent with the above objectives relating to community participation, a community consultation program was undertaken as part of the EA process to provide opportunities for community involvement, with further opportunities to be provided by the public exhibition of the EA, facilitated by DoP. This builds on Mt Arthur Coal's existing community involvement program for its current operations.

Major Projects

The Underground Project requires approval under Part 3A of the EP&A Act as it is of a class of development listed in Schedule 1 of the *SEPP (Major Projects) 2005*. The listing in Schedule 1 of the SEPP that applies to this project is:

5 Mining

(1) Development for the purpose of mining that:

(a) is coal or mineral sands mining.

As the Underground Project will be approved under Part 3A of the EP&A Act, the Minister for Planning will be the consent authority for the Project. The Director-General of DoP provided the requirements for the EA as discussed in **Section 2.1**.

Application of Environmental Planning Instruments

The Project is located wholly within the area to which the Muswellbrook Local Environmental Plan 1985 (Muswellbrook LEP) and Hunter Regional Environmental Plan 1989 (Hunter REP) apply.

However, section 75R of the EP&A Act provides that environmental planning instruments, other than SEPPs, do not apply to Major Projects assessed under Part 3A of the Act, other than as detailed below.

Permissibility

The Muswellbrook LEP is relevant to the permissibility of the Underground Project. Under section 75J(3) of the EP&A Act, the Minister may be precluded from granting approval for a project under Part 3A where an environmental planning instrument prohibits development. Regulation 8O, however, provides that the Minister's power to approve Part 3A applications cannot be precluded where another environmental planning instrument permits the development.

As shown on **Figure 4.1**, the land affected by the Underground Project is located primarily within land zoned 1(a) (Rural 'A' Zone) under the Muswellbrook LEP, with a small portion of the site in the north of the project area zoned 7(L1) (Environment Protection General (Alluvial Areas)). Mining is a permissible land use within zone 1(a), however, it is prohibited within zone 7(L1).

The SEPP (Mining, Petroleum Production and Extractive Industries) 2007 makes underground mining permissible with consent on all land. Accordingly, the Minister is not precluded, under section 75J of the EP&A Act, from being able to grant approval to the Underground Project.

Approvals and Legislation That Do Not Apply

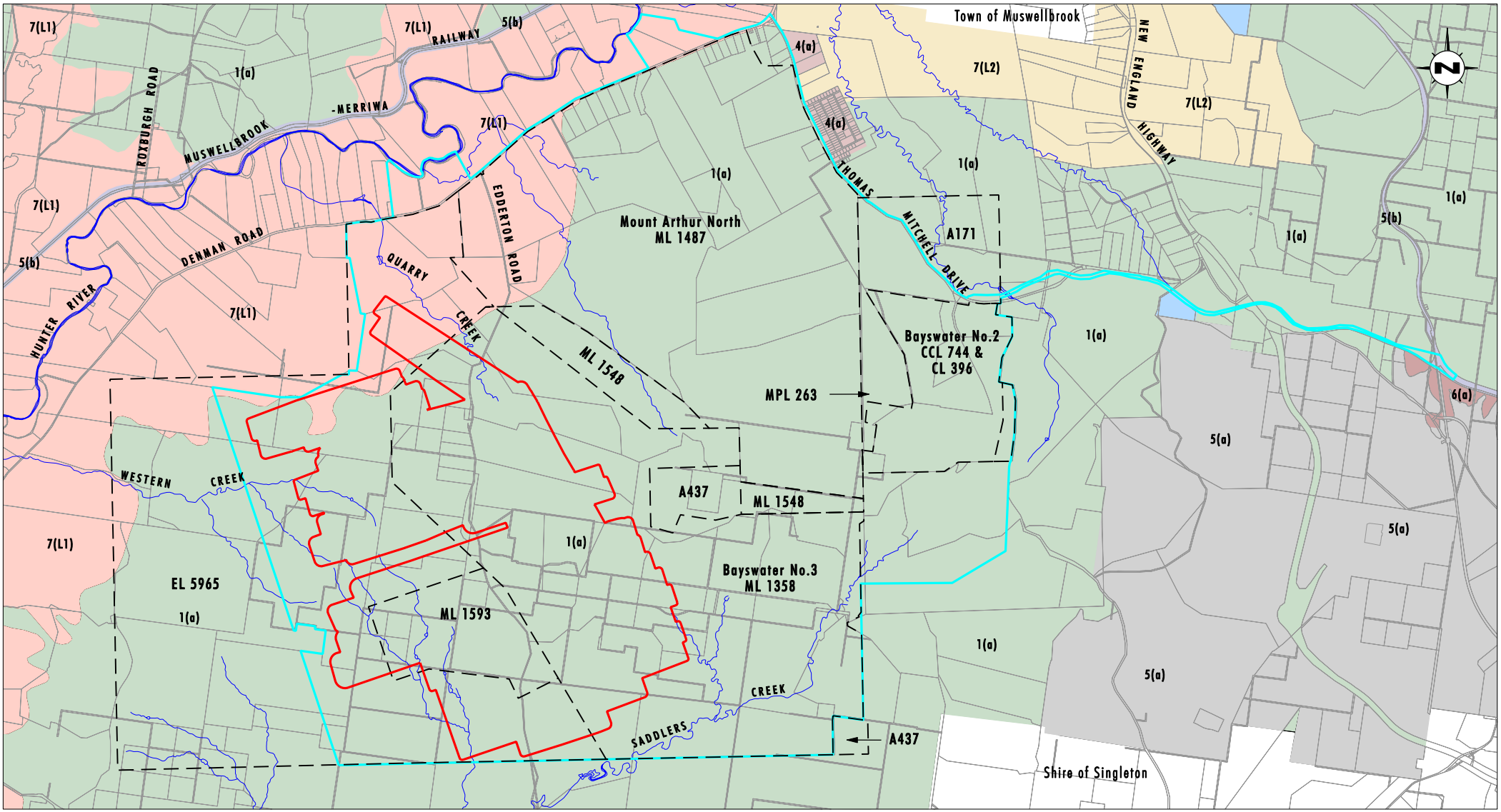
Under s75U of the EP&A Act if the Underground Project is granted project approval under Part 3A of the EP&A Act, the following approvals, which may otherwise have been relevant, will not be required to carry out the Underground Project (refer to **Table 4.1**).

Table 4.1 - Approvals and Legislation That Do Not Apply

Act	Approval
Fisheries Management Act 1994	Permit for works or structures within a waterway.
Heritage Act 1977	Disturbance to an item listed on State Heritage Register or Interim Heritage Order; Excavation permit.
National Parks & Wildlife Act 1974	s87 preliminary research permit; s90 consent to destroy relics.
Water Management Act 2000	Water use approval, water management work approval or activity approval.
Threatened Species Conservation Act 1995	Licence to harm or pick threatened species, populations or ecological communities or habitat.

Approvals and Legislation to be Applied Consistently

If the Underground Project is granted project approval under Part 3A of the EP&A Act, the following approvals, which will be required for the Project, must not be refused by the relevant approval authority and must be substantially consistent with the terms of the Project approval (refer to **Table 4.2**).



Source: Muswellbrook LEP, 1985

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Project Application Boundary
- Subject to Re-zoning
- Zone 1(a) - Rural 'A'
- Zone 4(a) - General Industrial
- Zone 5(a) - Special Uses 'A' (Schools, Hospitals etc)
- Zone 5(b) - Special Uses 'B' (Railways)
- Zone 6(a) - Existing Recreation
- Zone 7(L1) - Environmental Protection General (Alluvial Area)
- Zone 7(L2) - Environmental Protection General (Urban Buffer)

FIGURE 4.1

Land Zoning

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Table 4.2 - Approvals Legislation to be Applied Consistently

Act	Approval	Authority
Mine Subsidence Compensation Act 1961	Development within Mine Subsidence District	Mine Subsidence Board (MSB)
Mining Act 1992	Mining Lease	DPI
PoEO 1999	Environmental Protection Licence	DECC
Roads Act 1993	Permit to impact on a public road	Local roads – MSC

4.2.2 Mining Act 1992

The *Mining Act 1992* is administered by DPI on behalf of the Minister for Mineral Resources and, amongst other legislative instruments, places controls on methods of exploration and mining, the disposal of mining waste, land rehabilitation, and environmental management activities.

A ML granted under the *Mining Act 1992* entitles the leaseholder to mine coal from a deposit. Mt Arthur Coal currently holds mining leases (ML 1358 and ML 1593) over part of the project area with the remainder of the project area subject to an Exploration Licence (EL 5965) (refer to **Figure 1.2**). Should approval be granted for the proposed Underground Project, application will be made to DPI for a ML over the portion of the project area that is currently part of the EL (refer to **Figure 1.3**) and to vary the current ML to permit underground mining. Within the proposed ML area, Mt Arthur Coal intends to seek a ML with surface rights over Mt Arthur Coal owned land and privately owned land where appropriate agreement can be reached with the private landholders. Alternatively a subsurface lease will be sought with appropriate access arrangements agreed between Mt Arthur Coal and private landholders.

The portion of EL 5965 not proposed to be converted to a ML (refer to **Figure 1.2**) is proposed to remain in place for the duration of the EL.

A Mining Operations Plan (MOP) and a Subsidence Management Plan (SMP) will also be prepared and submitted to DPI for approval, in accordance with the conditions of the ML, prior to the commencement of mining.

4.2.3 Coal Mine Health and Safety Act 2002

The *Coal Mine Health and Safety Act 2002* recently replaced the *Coal Mines Regulation Act 1982.* The principal aim of the *Coal Mine Health and Safety Act 2002* is to secure the objectives of the *Occupational Health and Safety Act 2000* in relation to coal operations. It does this by imposing certain specific safety requirements on coal mines. This includes the requirement to comply with minimum barriers for underground mining workings and the requirement to obtain consent from the Minister for Mineral Resources for the establishment of emplacement areas.

Clause 88 of the Coal Mine Health and Safety Regulation 2006 imposes the same requirement to obtain approval for secondary workings as that which existed previously in s138 of the *Coal Mines Regulation Act 1982*. Approval is required under s100 of the Act for establishment of reject emplacement areas.

4.2.4 Mine Subsidence Compensation Act 1961

Under the *Mine Subsidence Compensation Act 1961*, the approval of the Mine Subsidence Board (MSB) is required for the erection or alteration of improvements within a mine subsidence district. The project area is located within the Muswellbrook Mine Subsidence District and approval under s15 of the Act will be required for the construction of a range of surface infrastructure.

4.2.5 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (PoEO Act) is administered by DECC. The Act establishes the procedures for issuing of licences for environmental protection including waste, air, water and noise pollution control. The owner or occupier of a premise that is engaged in scheduled activities is required to hold an EPL and comply at all times with the conditions of that licence. The project will require an EPL because coal mining is a scheduled activity listed in Schedule 1 of the PoEO Act.

Mt Arthur Coal currently holds two EPLs, one for the Bayswater No. 2 and 3 mining areas (EPL 113) and one for the MAN mining area (EPL 11457). Mt Arthur Coal will seek to modify the existing Bayswater EPL to include underground mining and associated surface facilities, and to accommodate increased rail capacity associated with the Underground Project. The MAN EPL will be modified to allow for the increased tonnages through the CHPP.

4.2.6 Water Management Act 2000

The Underground Project involves the extraction of water from the Hunter River which is subject to the Water Sharing Plan for the Hunter Regulated River Water Source 2004. The licensing provisions of the *Water Management Act 2000* are therefore relevant, except where exemptions apply under Part 3A of the EP&A Act.

The Project will not require approval under sections 89, 90 or 91 of the Water Management Act due to the operation of section 75U of the EP&A Act, as described in **Section 4.2.1**.

Mt Arthur Coal has an existing allocation allowing extraction of water from the Hunter River water source. Should a further allocation be required, it will be obtained through purchase of an existing allocation.

4.2.7 Water Act 1912

A water sharing plan under the *Water Management Act 2000* has not been developed for the water resources within the Underground Project area, therefore the licensing provisions of the *Water Act 1912* still apply. The *Water Act 1912* is administered by DWE. Under the Act, a permit and/or licence must be obtained to extract surface (Part 2 of the Act) or groundwater (Part 5 of the Act).

An approval under Part 5 of the Act will be required for the project to intercept and extract groundwater from mine workings and for the proposed groundwater monitoring bores.

4.2.8 Environmentally Hazardous Chemicals Act 1985

DECC is granted power under the *Environmentally Hazardous Chemicals Act 1985* to assess and control certain chemicals by making a Chemical Control Order (CCO). A CCO can prohibit specified activities or require them to be licensed, prohibit activities that don't comply with the conditions of the order or permit an activity unconditionally. None of the chemicals

or chemical wastes listed under the Act will be required or produced as a result of the project. Approval will not therefore be required under this Act.

4.2.9 Roads Act 1993

The *Roads Act 1993* is administered by the NSW RTA, local Council or the DoL. The RTA has jurisdiction over major roads, local Council over minor roads and the DoL over road reserves or Crown roads.

Under Section 138, Part 9, Division 3 of the Act, a person must not:

(a) erect a structure or carry out a work in, or over a public road, or
(b) dig up or disturb the surface of a public road, or
(c) remove or interfere with a structure, work or tree on a public road, or
(d) pump water into a public road from any land adjoining the road, or
(e) connect a road (whether public or private) to a classified road,

otherwise than with the consent of the appropriate roads authority.

The Underground Project will impact on a Council road (Edderton Road) and road reserves and Crown road reserves. Subsidence remediation works will be necessary along sections of Edderton Road and approval for these works will be required from MSC under s138 of the Act. Further detail of the subsidence impact on Edderton Road and the required remediation works is provided in **Section 5.2**.

Works may also be necessary within Crown and Council road reserves including those located within the subsidence affectation area (refer to **Section 4.2.1**). Where appropriate, application will be made to close Crown and Council road reserves which will be impacted by the Underground Project. Where closure is not possible or appropriate, approval will be sought to undertake works within road reserves, as required, under s138.

4.2.10 Crown Lands Act 1989

The *Crown Lands Act 1989* provides for the administration and management of Crown land in the eastern and central divisions of the State. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the *Crown Lands (Continued Tenures) Act 1989*. The approval of the DoL will be required for any works within Crown road reserves, should they not be closed prior to these works commencing, as discussed above. Approval will also be required for works within the TSR located on Edderton Road, unless the TSR is relocated prior to these works in accordance with the approval provided as part of the Bayswater No. 3 project. This relocation has not occurred to date as open cut mining in the Bayswater No. 3 ML has not yet progressed to the point at which it interacts with the TSR. Mt Arthur Coal has consulted with the NSW Lands Office during the preparation of this EA regarding the closure of the remaining Crown roads in this area.

4.2.11 Radiation Control Act 1990

The *Radiation Control Act 1990* is administered by DECC and provides for the regulation and control of radiation apparatus. Density gauges, which are used in the coal preparation and handling process, are defined as a sealed source device and therefore any new density gauges will require registration and licensing under the Act.

4.3 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) are environmental planning instruments created by the State government. The SEPPs that are potentially relevant to the project have been discussed below:

4.3.1 State Environmental Planning Policy (Major Projects) 2005

The SEPP (Major Projects) 2005 identifies development to which the development assessment and approval process under Part 3A of the EP&A Act apply. As discussed in **Section 4.2.1**, the project is listed under Schedule 1 of the SEPP and will therefore be assessed under Part 3A of the EP&A Act.

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

The SEPP (Mining, Petroleum Production and Extractive Industries) 2007 (Minerals SEPP) was gazetted in February 2007. The Minerals SEPP repeals SEPP 37 - Continued Mines and Extractive Industries and SEPP 45 - Permissibility of Mining. The SEPP also removed mining developments from Schedule 1 of SEPP 11- Traffic Generating Development, meaning that SEPP 11 no longer applies to mining projects.

The new SEPP aims to:

a) provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State; and

b) facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources; and

c) establish appropriate planning controls to encourage ESD through the EA, and sustainable management, of development of mineral, petroleum and extractive material resources.

With regards to mining, the Minerals SEPP outlines where various minerals activities are permissible both with and without development consent. The Minerals SEPP also defines mining developments that are prohibited, exempt or complying developments. These provisions do not affect the requirement for approval under Part 3A of the EP&A Act for the current project.

4.3.3 State Environmental Planning Policy 33

SEPP No. 33 – Hazardous and Offensive Development requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry.

Previous investigations have identified that Mt Arthur Coal's existing operations are not classed as hazardous or offensive development. Given that the proposed Underground Project is essentially a continuation of existing land use and will not result in significant changes to the existing infrastructure and hazardous materials storage areas, it is not considered hazardous or offensive. A detailed hazard assessment is therefore unnecessary.

4.3.4 State Environmental Planning Policy 44

SEPP No. 44 – Koala Habitat Protection applies to the extent that in LGAs listed in the SEPP a Council is restricted from granting development consent for proposals on land identified as core koala habitat without the preparation of a plan of management. Muswellbrook LGA is listed in Schedule 1 of the SEPP and therefore the SEPP is relevant to this project. A koala habitat assessment was completed as part of the ecological assessment for this project and no core kola habitat was identified within the project area (refer to **Section 5.3**). Therefore a koala plan of management is not required for the project.

4.3.5 State Environmental Planning Policy 55

SEPP No. 55 – Remediation of Land aims to provide a state wide planning approach to the remediation of contaminated land and to reduce the risk of harm to human health and the environment by consideration of contaminated land as part of the planning process. Under the SEPP, a consent authority must not consent to the carrying out of development on land unless it has considered potential contamination issues.

No potential contamination issues have been identified within the Underground Project area. Land use within the project area is dominated by non-intensive agricultural grazing with existing mining activities occurring to the east. Mining activities have been undertaken in accordance with strict environmental controls to prevent land and water contamination.

The Project will be designed to prevent contamination and the storage and handling of chemicals will be undertaken in accordance with Australian Standards and DECC guidelines. A closure and decommissioning strategy, including a contaminated land management strategy will be developed for the decommissioning and closure of the Underground Project in consultation with DPI. This management strategy will incorporate the investigation and remediation of any contaminated land and will be included in MOPs submitted to DPI for approval should this project be approved.

5.0 Environmental Assessment

5.1 Environmental Risk Analysis

To assist in identifying the key environmental and community issues that required detailed assessment as part of this EA, a preliminary environmental risk analysis was undertaken as part of the Preliminary EA (Umwelt, 2006). The risk analysis undertook a technical assessment of potential risks to the environment and community associated with the project. The risk analysis was completed using the BHP Billiton risk assessment process, with the risk matrix, consequence table and likelihood table used for the assessment included in **Appendix 4**. The methodology for the risk analysis followed the general principles outlined in Australian Standard AS/NZS 4360:2004 Risk Management. Consistent with the BHP Billiton quantitative risk assessment matrix, environmental risks were categorised as low, medium, high or extreme. As shown in **Appendix 4**, prior to the detailed EA work being undertaken, the majority of activities were rated as low or medium level risks, with few high risks and no extreme risks identified. The activities that were identified in the preliminary environmental risk analysis as high risks (note: this is the initial risk rating prior to detailed assessment with no project specific controls in place) were:

- disturbance of Aboriginal objects or places as a result of construction works, surface drilling, subsidence and subsidence remediation works and establishment of ventilation fans and borehole facilities;
- disturbance of sites of European heritage significance due to subsidence and subsidence remediation works;
- loss of flora and fauna values due to subsidence and subsidence remediation works;
- alteration of natural overland drainage flow and surface water capture due to subsidence and subsidence remediation works;
- alteration of existing topography and potential for land slips on steeper slopes near Mt Ogilvie due to subsidence and subsidence remediation works; and
- degradation of noise amenity due to coal handling and transport.

The Preliminary EA which included the preliminary risk analysis was provided to DoP along with the Project Application for consideration in issuing the DGRs for the project. The Preliminary EA was also provided to other relevant government agencies with whom DoP consulted regarding the DGRs. The DGRs identified the key EA issues for the project as:

- subsidence;
- noise;
- air quality, including greenhouse gas emissions;
- heritage;
- flora and fauna;
- surface and groundwater;
- rehabilitation, final landform and final void management;

- blasting and vibration;
- visual;
- traffic and transport; and
- social and economic.

Following the completion of the detailed assessment of these key issues which is documented in this EA, the preliminary risk analysis was reviewed to determine the residual risk associated with the Underground Project, taking into consideration implementation of the management practices outlined in **Sections 3.0**, **5.0** and **6.0**. The residual risk ratings are documented in **Appendix 4** and were found to generally be lower than the raw risk identified in the preliminary risk analysis. The residual risk rating for the majority of risks was found to be low or moderate. The activities which remain the most significant risks for the project following implementation of management measures outlined in this assessment were:

- disturbance of Aboriginal places or objects as a result of construction works, subsidence and subsidence remediation works; and
- degradation of noise amenity due to product coal transport.

It is considered that the risk associated with the above activities is able to be effectively managed as part of the project and details of the offset and management measures proposed for these risks is provided in **Sections 5.4** and **5.6**.

5.2 Subsidence

Underground longwall mining involves the removal of coal from a series of panels (extraction areas) laid out within a coal seam. As the coal in each longwall panel is removed, the roof behind the mine workings is allowed to collapse causing the overlying rock to fracture and settle. This settlement progresses up through the overlying strata resulting in subsidence of the ground surface immediately above and surrounding the longwall panels. A diagrammatic representation of a typical subsidence profile is shown in **Figure 5.1**.

The term subsidence generally refers to the range of ground movements which result from mining operations. These movements are described by the following parameters:

- **subsidence** refers to the vertical and horizontal displacement of the ground;
- **tilt** is the change in the slope of the ground as a result of differential subsidence;
- **curvature** refers to the rate of change of tilt; and
- **strain** is the change in horizontal distance between two points on the ground. Tensile strains occur when the distance between two points increases and compressive strains occur when the distance between two points decreases.

The ground surface area predicted to be affected by subsidence due to mining of the proposed longwall panels within the Underground Project area and based on the conceptual mine plan, is referred to as the subsidence affectation area (refer to **Figure 1.3**). The subsidence affectation area for the Underground Project has been defined by the following parameters:

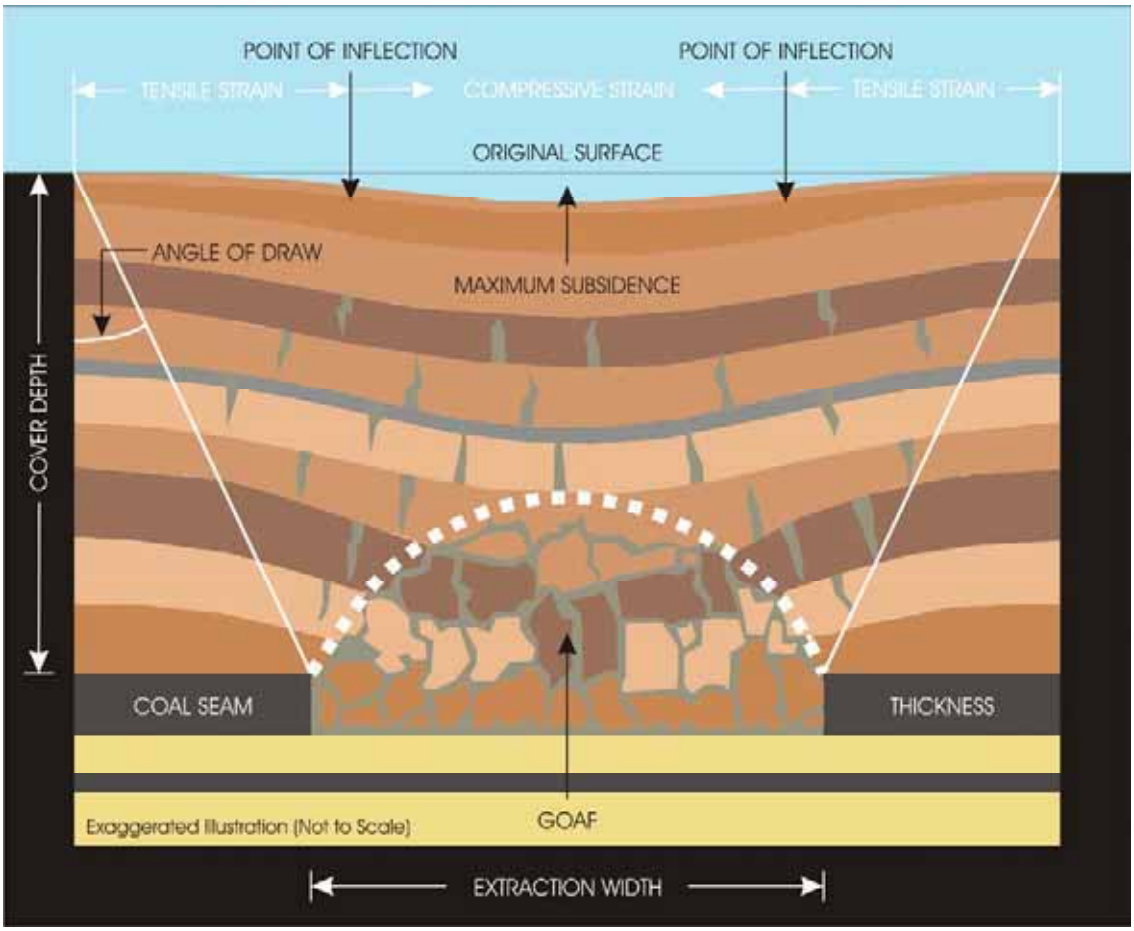


FIGURE 5.1

Typical Subsidence Profile

Source: Adapted from Mine Subsidence Board, 2007

- the area bounded by the 26.5 degree angle of draw (i.e. the angle of the line connecting the edge of underground workings and the limit of subsidence at the surface) (refer to **Figure 5.1**); and

- the predicted vertical limit of measurable subsidence, taken as the 20 millimetre subsidence contour.

The extent of subsidence depends on a number of factors including the width and height of the coal seam removed in a given longwall panel, the characteristics of the overlying rock strata and the depth of cover above mining operations. The vertical extent of subsidence is generally less than the thickness of coal removed due to the voids that are left within the collapsed strata. The maximum achievable subsidence in the Hunter Coalfields is typically 60 to 65 per cent of the extracted seam thickness.

The depth of cover above mining operations within the project area differs between seams and longwall panels and ranges from 20 metres to approximately 435 metres. **Table 5.1** provides a summary of the depth of cover and proposed extraction heights for longwalls within each seam.

Table 5.1 - Depth of Cover and Proposed Extraction Heights for Proposed Longwalls within Each Seam

Seam	Depth of Cover (m)	Proposed Extraction Height (m)
Woodlands Hill Seam	70 – 175	2.0 – 3.6
Glen Munro Seam	20 – 225	1.8 – 3.8
Arrowfield Seam	95 – 310	2.2 – 3.0
Bowfield Seam	50 – 220	2.2 – 3.6
Piercefield Seam	210 – 435	2.0 – 3.0

Low depth of cover areas exist over parts of the two northern most panels in the Glen Munro seam (refer to **Figure 3.4**). These areas present two specific risks; environmental impacts due to the extent of subsidence and a post extraction spontaneous combustion risk due to interconnective cracking and the associated ingress of air and moisture into the mine workings. These two panels will not be mined until after the completion of longwall mining in the Woodlands Hill seam. This will mean that extensive site specific subsidence monitoring data is available, allowing the potential extent of impacts in these low depth of cover areas to be better quantified. The impact assessment details provided in this EA have assumed extensive surface disturbance as a result of subsidence in these low depth of cover areas and have not identified any significant constraints to impacts in these areas. It is also considered that appropriate management controls can be put in place as part of the project to manage spontaneous combustion risk. Prior to any mining associated with these panels, a detailed SMP process will be completed in consultation with and for the approval of DPI to further assess the impacts of mining in these low depth of cover areas.

Mine Subsidence Engineering Consultants Pty Ltd (MSEC) was engaged to undertake a subsidence prediction and impact assessment for the Underground Project. A copy of the report is contained in **Appendix 5**. The initial draft of the MSEC report was subject to an independent peer review to provide an additional level of rigor to the assessment. The predictions and impact assessment have been undertaken based on the conceptual mine plan for the project (refer to **Section 3.6**). As mining progresses, there will be ongoing refinement of the predictive model as a result of subsidence monitoring and comparison with predictions. The mine layout may also change as the project progresses resulting in

changes to subsidence predictions. Any changes to the mine layout and subsidence predictions will be assessed as part of the DPI's SMP process.

5.2.1 Subsidence Prediction Methodology

Subsidence predictions for the project were made using the Incremental Profile Method developed by MSEC. The method is an empirical model based on a large database of observed monitoring data from previously extracted longwalls within the Southern, Newcastle, Hunter and Western Coalfields of NSW.

The Incremental Profile Method uses the database of observed subsidence profiles, proposed longwall geometries and local surface and seam information to make subsidence predictions. The method is designed to predict maximum subsidence and therefore results in a conservative estimate of actual subsidence impacts.

The standard Hunter Coalfields profiles from the database were used to predict subsidence parameters for each of the longwalls within the Woodlands Hill, Glen Munro, Arrowfield, Bowfield and Piercefield Seams. Multi-seam subsidence interactions were used in the predictions for longwalls which are located beneath previously extracted longwalls.

The subsidence predictions for the project are discussed in **Section 5.2.2**.

5.2.2 Subsidence Predictions

Detailed subsidence predictions have been completed for each seam to be mined as part of the project, and for the project as a whole. Cumulative subsidence predictions for each seam are shown on **Figures 5.2** to **5.6**. Total subsidence predictions at the completion of the conceptual 21 year mine plan are shown on **Figure 5.7**. A summary of the maximum predicted cumulative and total subsidence at the completion of mining in each seam is provided in **Table 5.2**.

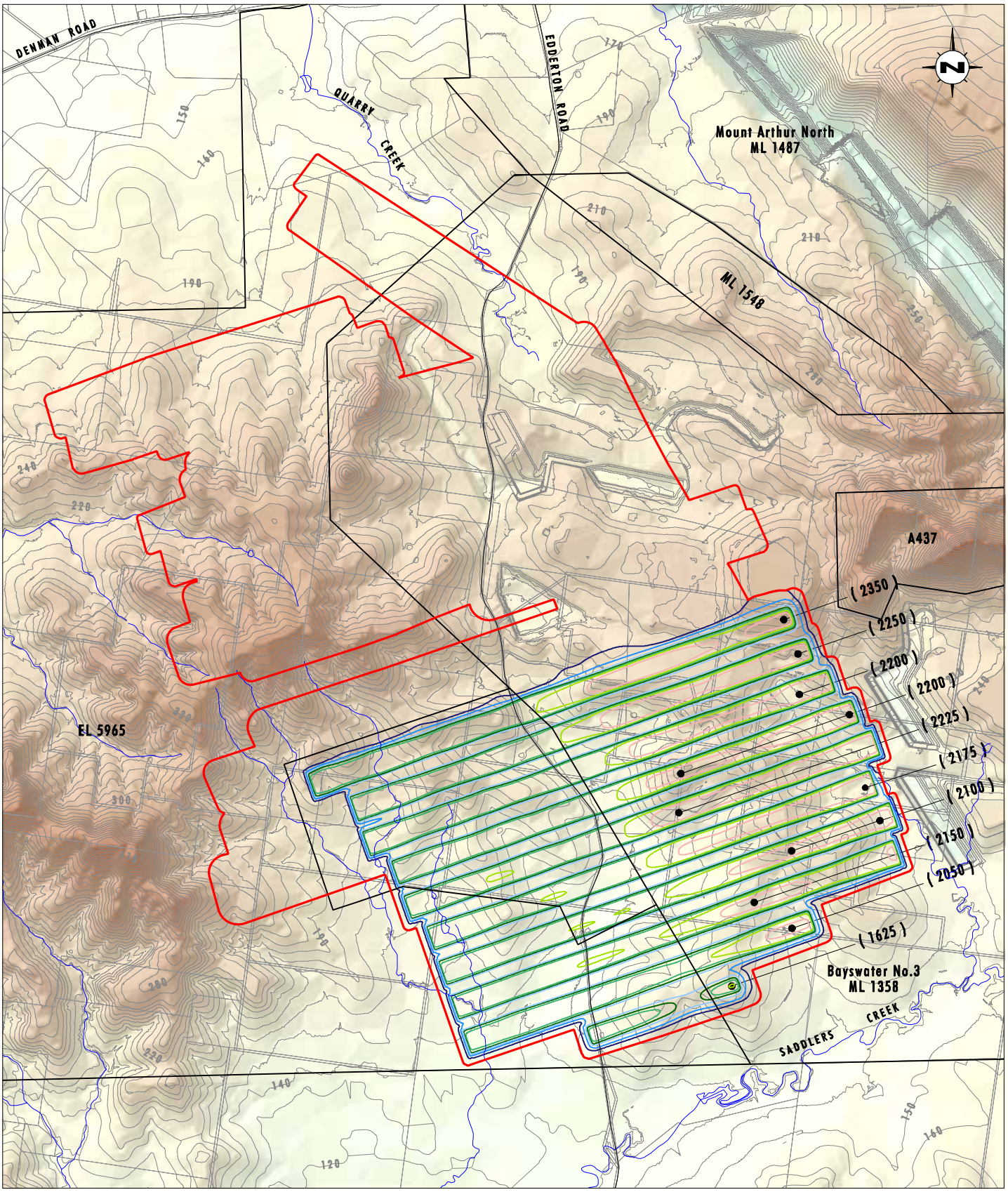
Table 5.2 - Maximum Predicted Cumulative and Total Subsidence Due to the Extraction of Longwalls

Longwall Series	Maximum Cumulative* Subsidence due to Extraction of the Series of Longwalls within the Seam (mm)	Maximum Total** Subsidence at the Completion of the Series of Longwalls within Each Seam (mm)
Woodlands Hill seam	2350	2350
Glen Munro seam	2875	2875
Arrowfield seam	2150	4125
Bowfield seam	2275	4125
Piercefield seam	2025	5600

* Cumulative subsidence refers to the accumulated subsidence, tilts, curvatures and strains which occur due to the extraction of a series of longwalls within a single seam.

** Total subsidence refers to the accumulated subsidence, tilts, curvatures and strains which occur after the extraction of a series of longwalls within current and preceding seams.

As shown in **Table 5.2**, the maximum cumulative subsidence predicted to result from mining in any one seam (i.e. due to a single subsidence event) ranges from approximately 2100 millimetres to 2900 millimetres, with the greatest cumulative subsidence predicted to occur due to mining of the Glen Munro seam. Total subsidence represents the combined subsidence impact over the life of the Underground Project where longwalls are located



Source: MSEC, 2007
Base Source: LPI, 2004 & Mt Arthur Coal, 2006

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- 20mm Subsidence Contour
- 100mm Subsidence Contour
- 400mm Subsidence Contour
- 800mm Subsidence Contour
- 1200mm Subsidence Contour
- 1600mm Subsidence Contour
- 2000mm Subsidence Contour

Contour Interval 10m

Note:
The value of the Subsidence Contours, from the outside to the inside of the panels, is 20mm, 100mm, 400mm, 800mm and so forth, in 400mm increments. The maximum subsidence over each longwall is shown in brackets - ie. (2600)

FIGURE 5.2

Predicted Cumulative Subsidence - Woodlands Hill Seam

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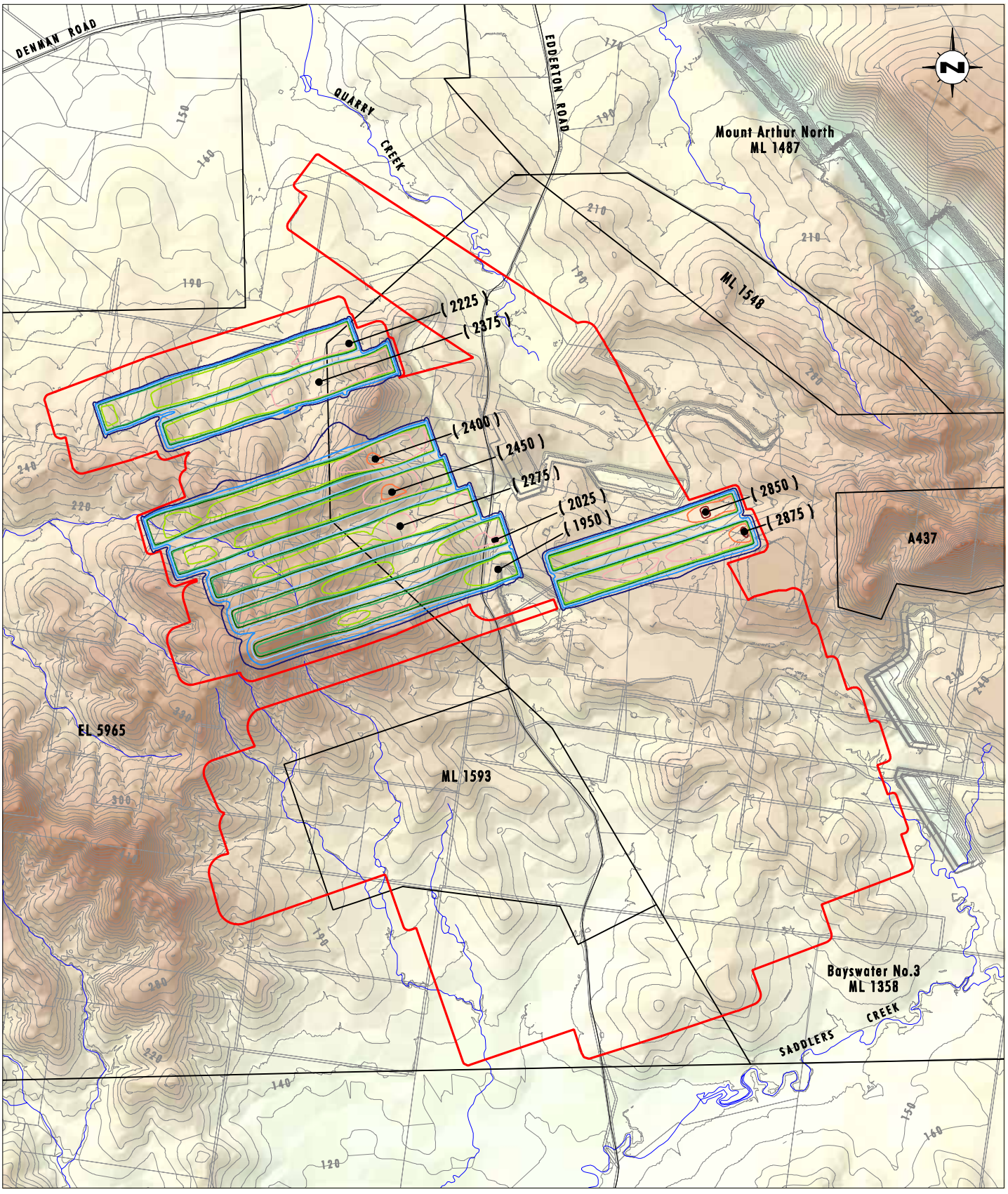


Source: MSEC, 2007
Base Source: LPI, 2004 & Mt Arthur Coal, 2006

0 0.5 1 2km
1:45 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- 20mm Subsidence Contour
- 100mm Subsidence Contour
- 400mm Subsidence Contour
- 800mm Subsidence Contour
- 1200mm Subsidence Contour
- 1600mm Subsidence Contour
- 2000mm Subsidence Contour
- 2400mm Subsidence Contour
- 2800mm Subsidence Contour

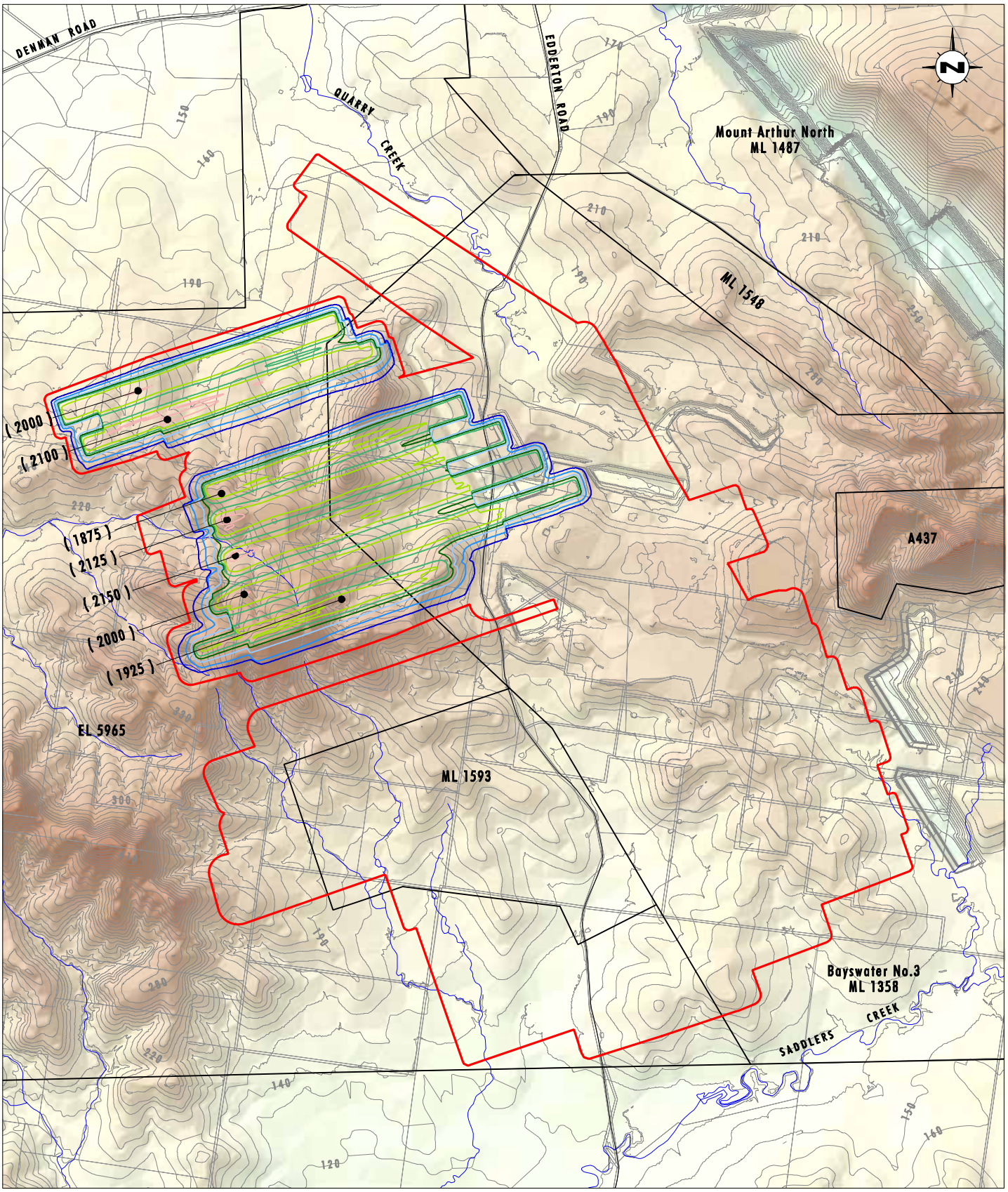
Contour Interval 10m

Note:
The value of the Subsidence Contours, from the outside to the inside of the panels, is 20mm, 100mm, 400mm, 800mm and so forth, in 400mm increments. The maximum subsidence over each longwall is shown in brackets - ie. (2600)

FIGURE 5.3

Predicted Cumulative Subsidence - Glen Munro Seam

File Name (A4): R21_V1/2051_268.dgn



Source: MSEC, 2007
Base Source: LPI, 2004 & Mt Arthur Coal, 2006

0 0.5 1 2km
1:45 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- 20mm Subsidence Contour
- 100mm Subsidence Contour
- 400mm Subsidence Contour
- 800mm Subsidence Contour
- 1200mm Subsidence Contour
- 1600mm Subsidence Contour
- 2000mm Subsidence Contour

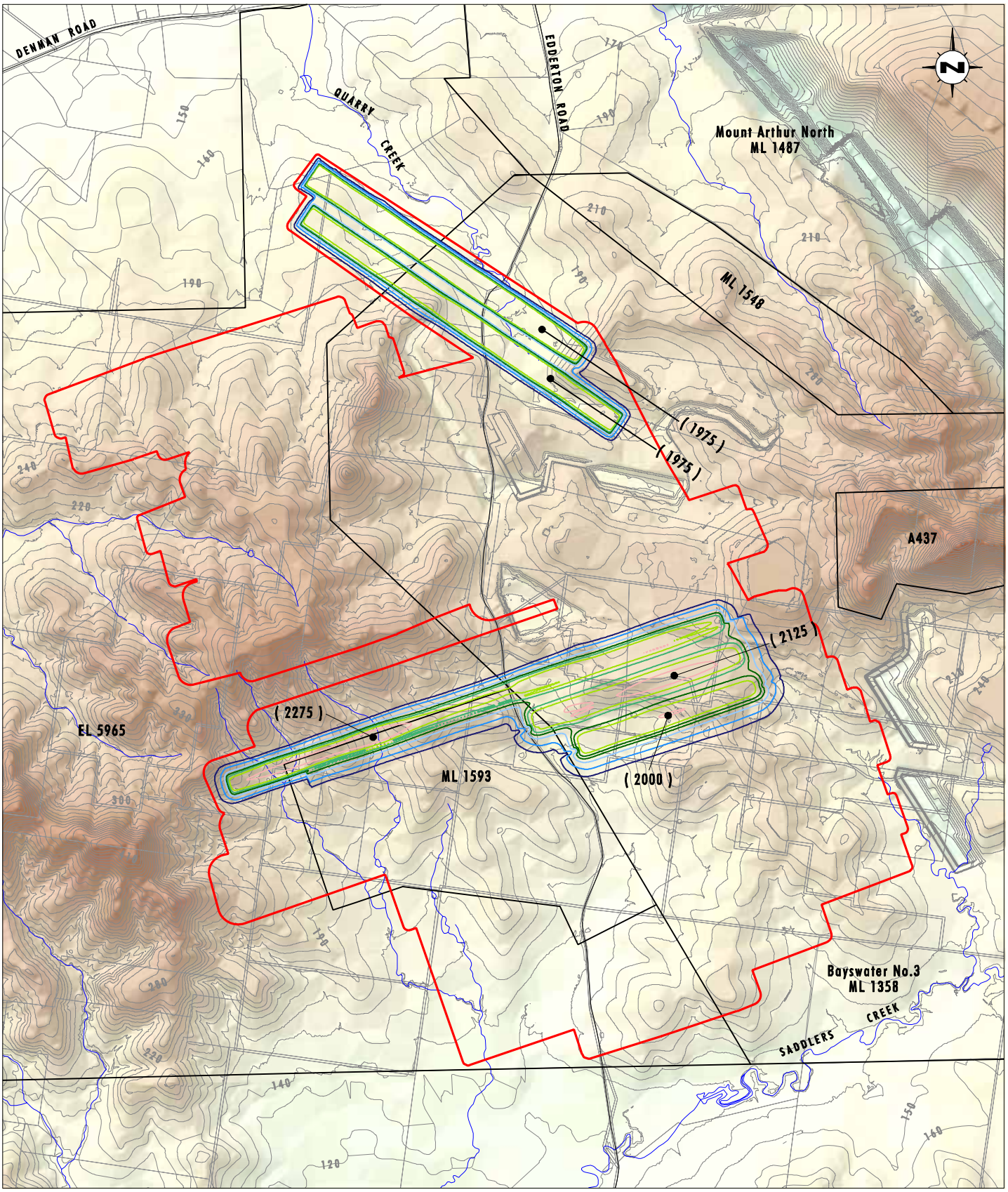
Contour Interval 10m

Note:
The value of the Subsidence Contours, from the outside to the inside of the panels, is 20mm, 100mm, 400mm, 800mm and so forth, in 400mm increments. The maximum subsidence over each longwall is shown in brackets - ie. (2600)

FIGURE 5.4

Predicted Cumulative Subsidence - Arrowfield Seam

File Name (A4): R21_V1/2051_269.dgn



Source: MSEC, 2007
Base Source: LPI, 2004 & Mt Arthur Coal, 2006

0 0.5 1 2km
1:45 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- 20mm Subsidence Contour
- 100mm Subsidence Contour
- 400mm Subsidence Contour
- 800mm Subsidence Contour
- 1200mm Subsidence Contour
- 1600mm Subsidence Contour
- 2000mm Subsidence Contour

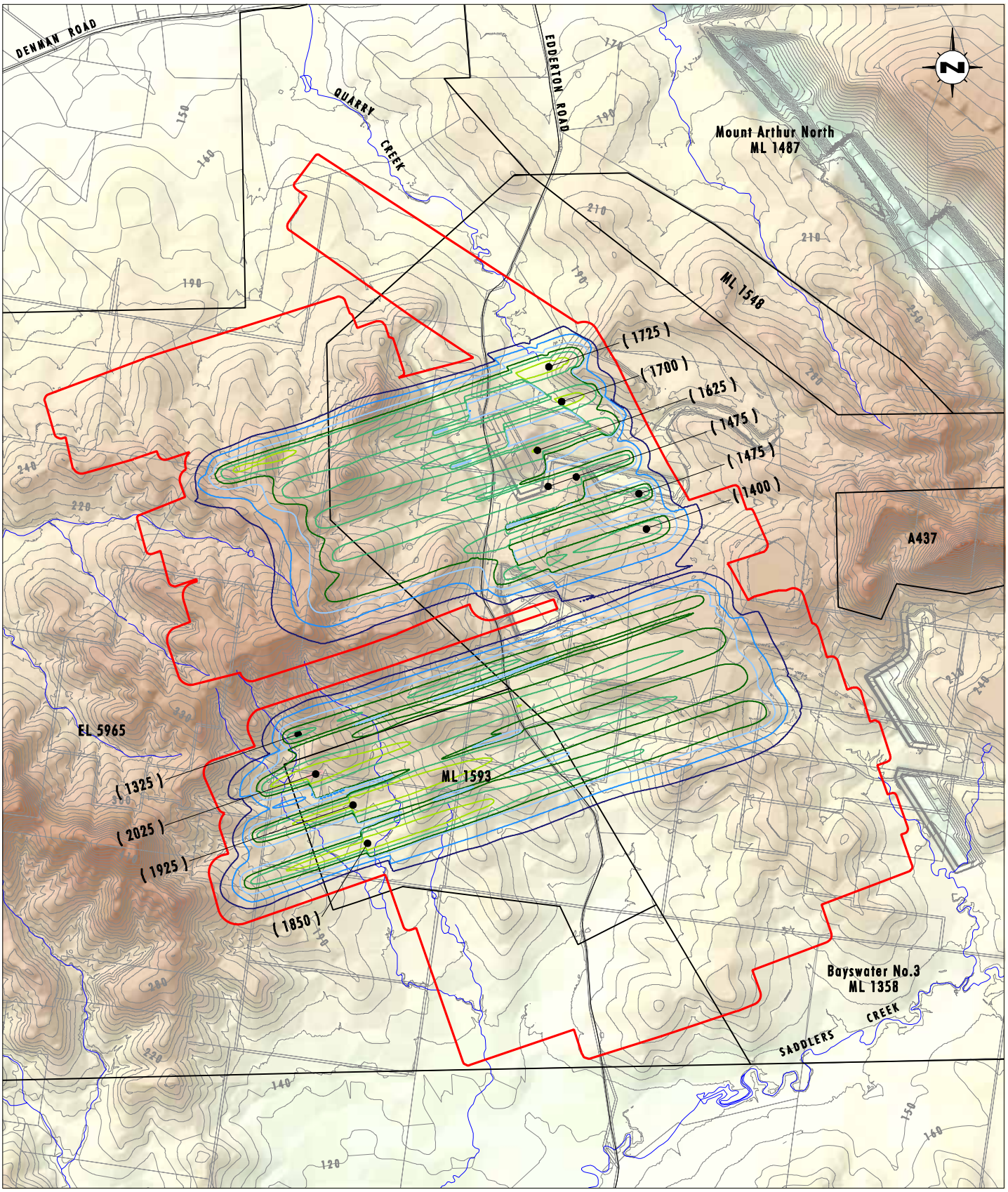
Contour Interval 10m

Note:
The value of the Subsidence Contours, from the outside to the inside of the panels, is 20mm, 100mm, 400mm, 800mm and so forth, in 400mm increments. The maximum subsidence over each longwall is shown in brackets - ie. (2600)

FIGURE 5.5

Predicted Cumulative Subsidence - Bowfield Seam

File Name (A4): R21_V1/2051_270.dgn



Source: MSEC, 2007
Base Source: LPI, 2004 & Mt Arthur Coal, 2006

0 0.5 1 2km
1:45 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- 20mm Subsidence Contour
- 100mm Subsidence Contour
- 400mm Subsidence Contour
- 800mm Subsidence Contour
- 1200mm Subsidence Contour
- 1600mm Subsidence Contour
- 2000mm Subsidence Contour

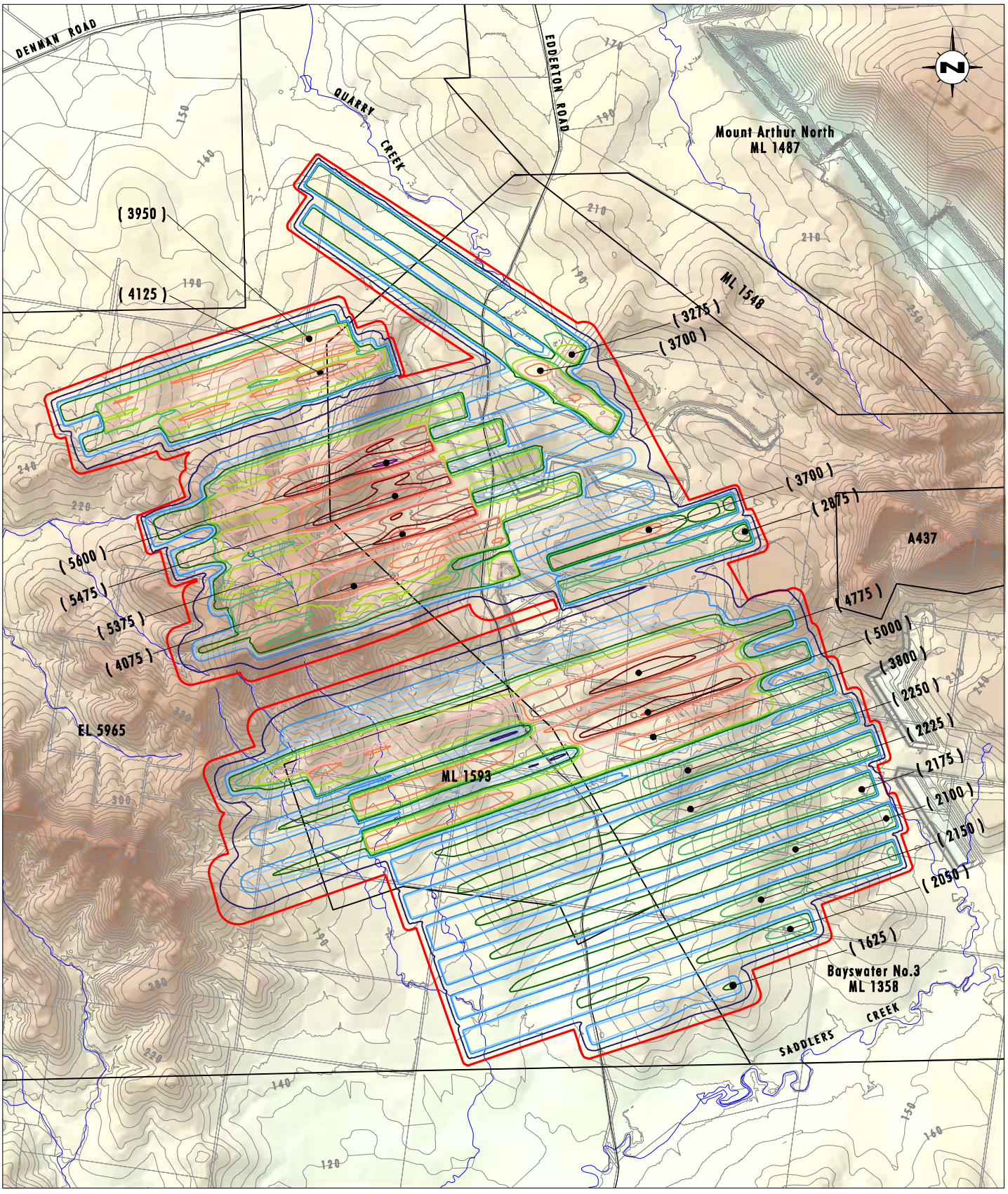
Contour Interval 10m

Note:
The value of the Subsidence Contours, from the outside to the inside of the panels, is 20mm, 100mm, 400mm, 800mm and so forth, in 400mm increments. The maximum subsidence over each longwall is shown in brackets - ie. (2600)

FIGURE 5.6

Predicted Cumulative Subsidence - Piercefield Seam

File Name (A4): R21_V1/2051_271.dgn



Source: MSEC, 2007
Base Source: LPI, 2004 & Mt Arthur Coal, 2006

0 0.5 1 2km
1:45 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- 20mm Subsidence Contour
- 500mm Subsidence Contour
- 1000mm Subsidence Contour
- 1500mm Subsidence Contour
- 2000mm Subsidence Contour
- 2500mm Subsidence Contour
- 3000mm Subsidence Contour
- 3500mm Subsidence Contour
- 4000mm Subsidence Contour
- 4500mm Subsidence Contour
- 5000mm Subsidence Contour
- 5500mm Subsidence Contour

Contour Interval 10m

Note:
The value of the Subsidence Contours, from the outside to the inside of the panels, is 20mm, 500mm, 1000mm and so forth, in 500mm increments. The maximum subsidence over each longwall is shown in brackets - ie. (5600)

FIGURE 5.7

Predicted Total Subsidence - Year 21

File Name (A4): R21_V1/2051_272.dgn

beneath one another. The maximum total subsidence predicted to occur as a result of the project is approximately 5600 millimetres (refer to **Figure 5.7**).

It is important to note that total subsidence resulting from a multi seam project such as this will occur in a series of discrete phases over the life of the project, and will be interspersed with extended periods of stabilisation. Following the completion of mining within each seam, there will be a period a remediation and stabilisation of the land surface while mining progresses elsewhere within the project area. Mining may then return to a seam beneath a previously subsided area, resulting in a second phase of subsidence impact. The period of stabilisation between subsidence events will vary, however, it will generally be at least two years.

5.2.3 Subsidence Impact Assessment

Subsidence impact assessment involves using the subsidence predictions to forecast the level of impact on natural and man-made surface features within the project area and beyond. A comprehensive review of all natural features and items of surface infrastructure potentially impacted by the project has been completed and detailed subsidence predictions and impact assessment provided for each item (refer to **Appendix 5**).

The following sections provide a description of the physical impacts of subsidence on the land and surface features. Further details of the impact of subsidence on particular environmental aspects are provided in the following sections:

- groundwater resources – **Section 5.5.3**;
- surface drainage systems – **Section 5.5.2**;
- flora and fauna – **Section 5.3**;
- Aboriginal heritage sites – **Section 5.4.1**; and
- historic heritage sites – **Section 5.4.2**.

5.2.3.1 Land Surface Impacts

Surface Profile

A typical subsidence profile, such as that shown on **Figure 5.1**, generally develops a relatively smooth surface. However, irregularities may arise in the profile where major geological features (e.g. faults) exist in proximity to the longwalls or in shallow mining situations where the collapse zone above the extracted seam extends to the surface.

In the project area, it is considered that the collapse zone may extend to the surface in areas where the depth of cover is less than 100 metres. Some longwalls within the Woodlands Hill, Glen Munro and Bowfield seams have minimum depths of cover less than 100 metres. It is therefore possible that the subsidence profile in these locations could become irregular, resulting in bumps and steps at the surface. Where the depth of cover is less than 50 metres, the subsidence profile is likely to become very irregular, potentially resulting in shearing of the strata around the longwall panel edges. Areas where the depth of cover is less than 50 metres are limited to longwalls in the Glen Munro Seam.

The surface features at greatest risk of being impacted by an irregular subsidence profile are those which occur continuously over the longwalls, such as Quarry Creek, Edderton Road and underground copper telecommunications cabling adjacent to Edderton Road. As

irregular profiles develop, they can be detected using subsidence or visual monitoring, allowing early detection and implementation of management strategies.

Surface Cracking

As subsidence occurs, surface cracks generally appear in the tensile zones around the edges of longwall panels. These cracks are usually parallel to the edges and ends of the longwall panels. Surface cracking can also occur at shallow depths of cover (<100 metres) in any location above the extracted longwall panel. The width of these cracks typically increases as the depth of cover decreases.

Longwalls within the Woodlands Hill, Glen Munro and Bowfield seams have minimum depths of cover less than 100 metres. These longwalls are therefore at greatest risk of surface cracking. Crack widths will typically be in the order of 200 millimetres and could vary in width to approximately 500 millimetres over a limited extent. In areas with a depth of cover of less than 50 metres, shearing (block failure) may occur at the surface and result in extensive surface disturbance.

Steep Slope Impacts

The land within the subsidence affectation area is undulating to hilly, with the steepest slopes associated with Mt Ogilvie to the west and Mt Arthur to the east. Mining will not occur beneath Mt Ogilvie or Mt Arthur, however, two areas of natural steep slopes have been identified within the north and west of the subsidence affectation area.

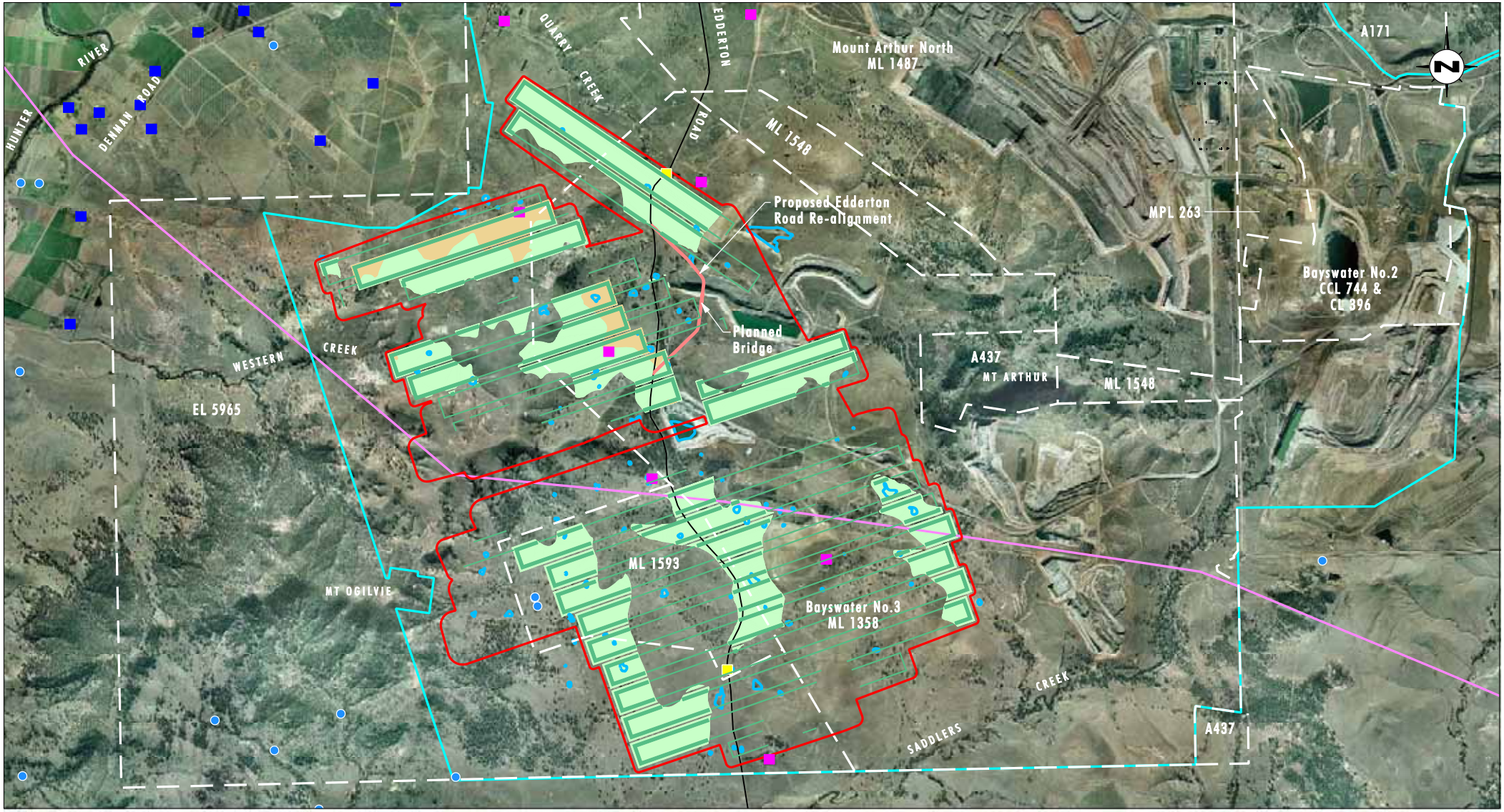
Predictions indicate that there is the possibility of soil slumping occurring on the steepest slopes of the northern hills where depth of cover is shallowest, and to a lesser extent on the steepest slopes of the western hills. It is unlikely, however, that mine subsidence will result in any large scale slope failure. Cracks of a greater width may be more prevalent at the tops of steep slopes where soil slumping can occur. Cracking may also develop further down the steep slopes as a result of tensile strains.

Combined Surface Impact Zone

The combined predicted surface impact zone which will potentially be impacted by irregular subsidence profiles and/or surface cracking is shown on **Figure 5.8**. The predicted surface impact zone covers an area of approximately 820 hectares and defines the area within which it may be necessary to undertake subsidence remediation works. While it is highly unlikely that surface impacts will occur across the entire zone, this area has been used in subsequent impact assessments to define the extent of potential significant surface cracking impacts and subsidence remediation requirements.

5.2.3.2 Management of Land Surface Impacts

Remediation of surface cracking and irregular subsidence profiles will generally be required in areas where the depth of cover above mine workings is less than 100 metres and in some tensile zones. These areas are shown on **Figure 5.8** as potential subsidence remediation areas and tensile cracking zones. In areas where the depth of cover above mine workings is between 50 and 100 metres, it is expected that subsidence remediation techniques will consist of general cultivation activities, such tilling and deep ripping, or infilling of cracks with soil. In areas where the depth of cover above mine workings is less than 50 metres, or mining occurs below steep slopes, it is expected that more extensive earthworks may be required, such as regrading and recompacting of soil. Earthworks may also be required in some ephemeral drainage lines to restore flow paths (refer to **Section 5.5.2.5**). Assisted



Base Source: Mt Arthur Coal 2006

Legend

- Mining and Exploration Lease Boundary
- Project Application Boundary
- Subsidence Affectation Area
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Tensile Cracking Zone
- 330/500kV Transmission Line
- Groundwater Bore Location
- Farm Dam
- Bridge Location
- Privately Owned Residence
- Mine / Power Generation Owned Residence

FIGURE 5.8

Potential Subsidence Remediation Areas

File Name (A4): R21_V1/2051_273.dgn

revegetation will be carried out as required, where natural regeneration does not occur satisfactorily.

Mt Arthur Coal will utilise a variety of rehabilitation techniques to repair the impacts of subsidence. Remediation techniques will vary depending on the extent of surface cracking or landform changes. These techniques will aim to minimise the impact on the surface whilst achieving an acceptable level of rehabilitation from a land user safety, mine safety and environmental perspective.

In areas where smaller scale cracking is predicted to occur (50-100 metres depth of cover), cultivation activities will generally consist of one, or a combination, of the following methods:

- infilling of cracks with soil and/or bentonite to seal cracks visible at the surface;
- tilling the ground surface using small agricultural equipment to blend fill material and restore the soil profile; and/or
- where necessary, using small machinery, such as a small excavator, bobcat or grader, to restore the surface profile.

In areas where more substantial cracking or changes in landform are predicted to occur, more extensive earthworks may be required, such as dozing and deep ripping prior to the final surface treatment. Earthworks may also be required in some ephemeral drainage lines to restore flow paths, however, the equipment and techniques appropriate for each site will as assessed on a case by case basis to minimise the level of disturbance required.

Where subsidence remediation is required within sensitive areas such as adjacent to Aboriginal sites or significant ecological areas, hand methods can be used to repair any cracking and restore the soil profile.

Mt Arthur Coal is committed to effective and timely rehabilitation of surface cracking, whilst minimising impact on the natural environment (e.g. ecological values), cultural values and land use. Trials of various subsidence cracking remediation techniques will therefore be undertaken as part of the project in consultation with DPI to identify the most effective methods to use in local conditions. This will include trialling of different mechanical techniques, addition of ameliorants (e.g. gypsum) and use of organic matter. Details of the trials to be undertaken will be outlined in the SMPs prepared for the project.

The ground surface across the project area will be visually inspected during and following longwall extraction so that significant cracking or irregularities in the subsidence profile can be identified and remediated where required.

5.2.3.3 Drainage System Impacts

The Hunter River is located north of Denman Road, a minimum of two kilometres from the closest longwall panels. The limit of alluvials associated with the Hunter River is also located north of Denman Road. As shown on **Figure 5.8**, the Hunter River and associated alluvials are located well outside the predicted subsidence affectation area and therefore, will not be subject to any systematic subsidence impacts as a result of the project.

Saddlers Creek is a tributary of the Hunter River located in the south of the project area (refer to **Figure 5.8**). The creek flows in a south-westerly direction and is a minimum of 575 metres south of the closest longwall panel. Saddlers Creek is located outside the subsidence affectation area and therefore will not be subject to any systematic subsidence impacts as a result of the Underground Project. It is possible however, that Saddlers Creek

may be subject to minor far field valley related movements as a result of the project. Valley related movements are a natural phenomenon which can be accelerated by mine subsidence, resulting in upsidence within the base of the valley, closure of valley sides and strains within and adjacent to the valley. The predicted valley related movements at Saddlers Creek are very small (<5 millimetres) and are not expected to have any significant impact on the Creek. The mining activities which may influence Saddlers Creek will occur at the very end of the extraction period within the Woodlands Hill seam. These will occur at least six to seven years after the commencement of longwall mining in the Woodlands Hill seam and so a large amount of site specific subsidence monitoring data will be available to calibrate the predicted values against. The actual measured subsidence behaviour will be used as the basis for assessing and, if necessary, putting in place appropriate management of any minor subsidence impact on Saddlers Creek.

Quarry Creek is an ephemeral creek which crosses the northern edge of the subsidence affectation area and drains generally in a north-westerly direction to the Hunter River (refer to **Figure 5.8**). An 800 metre section of the upper reaches of Quarry Creek will be undermined by two longwall panels in the Bowfield seam and one longwall panel in the Piercefield seam. This section of Quarry Creek will therefore be subject to systematic subsidence impacts.

The predicted impacts of subsidence within Quarry Creek include additional ponding and cracking within the creek bed and the potential for connectivity of cracking between the surface and mine workings (refer to **Section 5.5.2**). The issue of connectivity is most likely to arise in areas where the depth of cover is such that the collapse zone potentially extends to the surface (that is, where depth of cover is less than 100 metres). It is possible in these circumstances that, without rectification works, surface water could drain from this ephemeral creek into mine workings. As discussed in **Section 5.2.3.4** below, stream remediation works will be undertaken within the affected section of Quarry Creek to manage these impacts.

Numerous additional natural drainage lines exist across the subsidence affectation area and will be subject to subsidence impacts to varying degrees, these impacts are discussed in **Section 5.5.2**.

5.2.3.4 Management of Drainage System Impacts

The Hunter River and Saddlers Creek are located outside the subsidence affectation area and are not predicted to be subject to any systematic subsidence impacts as a result of the Underground Project. Quarry Creek will, however, be subject to subsidence impacts including additional ponding and cracking of the creek bed. Given the alluvial nature of the creek bed, the extent of additional ponding and cracking is expected to decrease with time and sufficient flow of water within the creek. In addition, if cracking of the creek bed becomes hydraulically connected to mine workings, it will be necessary to undertake remedial works within the creek to seal any fracturing and dilation of the underlying strata by methods such as grouting.

A similar situation exists for the remaining ephemeral drainage lines within the subsidence affectation area, with the extent of additional ponding and cracking expected to decrease with time and sufficient flow of water within the creek due to the nature of the creek bed/bank substrate. However, remedial work will be undertaken within drainage lines to repair out of bank ponding and changes to flow path, and to repair any significant or interconnective cracking. Further information regarding the location and extent of drainage system remedial works is provided in **Section 5.5.2**.

5.2.3.5 Rural Land Improvements

Houses

There are 10 houses located within, or in close proximity to the subsidence affectation area (refer to **Figure 5.8**). All are owned by Mt Arthur Coal and the majority are unoccupied. Many of the unoccupied houses are in a dilapidated state and are not habitable (some are standing ruins).

Predictions of subsidence, tilt and strain have been made for each structure both during and at the completion of mining in each seam to determine appropriate management measures for these structures. Each structure has been categorised based on the degree of structural damage likely to result from subsidence, principally tilt and strain.

Of the 10 houses, seven are expected to be significantly affected by mining, requiring extensive repair work or complete rebuilding to be returned to a safe and serviceable condition. Of these, two are located within the path of the Bayswater No. 3 open cut mining area and will be removed under the current approval prior to being undermined. The remaining five houses will be assessed by a structural engineer before and after mining to determine the extent of any preventive or remedial works required. It may also be necessary for some structures that are currently in a potentially unsafe state, to be demolished or fenced off prior to being undermined. Structures not demolished or relocated prior to undermining will be further assessed by a structural engineer post mining to assess their structural condition and make recommendations regarding remedial or demolition works, as appropriate. The remaining three houses, including Edderton Homestead, are expected to experience negligible impacts as a result of mining and are unlikely to require any remedial works. Further information regarding the heritage value of these houses is provided in **Section 5.4.2**.

Rural Building Structures

There are 39 rural building structures located within, or in close proximity to the subsidence affectation area, consisting of farm sheds, garages and other non-residential structures. All are owned by Mt Arthur Coal and the majority are no longer used. More than half the structures are expected to be significantly affected by mining, requiring extensive repair work or complete rebuilding to be returned to a safe and serviceable condition. All rural building structures will be inspected by a structural engineer prior to undermining and where appropriate, preventive measures will be provided. Some structures may be demolished or fenced off prior to being undermined. Structures not demolished or relocated prior to undermining will be further assessed by a structural engineer post mining to assess their structural condition and make recommendations regarding remedial or demolition works as appropriate.

Farm Dams

There are 90 farm dams located within the subsidence affectation area, nine of which are privately owned, the remainder are owned by Mt Arthur Coal (refer to **Figure 5.8**). The dams are typically earthen dams constructed of cohesive soils with reasonably high clay content, capable of withstanding tensile ground strains up to 3 mm/m. Approximately 68 dams, including four privately owned, are predicted to experience strains of greater than 3 mm/m and may be subject to some cracking or leakage of water from the dam walls. High tilts can also reduce the storage capacity of dams and cause them to temporarily overflow. It is not predicted however that there will be any significant loss of water from dams or that there will be any dam failure as a result of the project.

Regular monitoring of the potentially affected dams will occur during mining to identify any impacts on the safety or serviceability of these dams. Some remedial earthworks may be required to seal cracks or reshape spillways and embankments to maintain current drainage paths. In the event that a private farm dam suffers a significant loss of water as a result of mine subsidence, an alternative water supply would be provided by Mt Arthur Coal and the MSB would repair the farm dam at the completion of mining. Mt Arthur Coal will continue to consult with landholders regarding potential impacts and remedial works.

Fences

Fences within the subsidence affectation area may be affected by tilting of fence posts and changes of tension in the fence wires. It is likely that some fences will require repairing as mining occurs. Repairs generally involve re-tensioning the fencing wire, straightening fence posts or if necessary, replacing some sections of fencing.

Bores

There are 11 registered water bores located within the subsidence affectation area, three are privately owned and the remainder are owned by Mt Arthur Coal. It is likely that differential displacement of horizons within the strata at the bore locations will result in blockage or reduced capacities of these bores. Should the capacity of any utilised private bore be reduced to unacceptable levels as a result of subsidence, Mt Arthur Coal will provide an alternative supply of water until such time as the MSB repairs, extends or re-establishes the bore. Mt Arthur Coal will continue to consult with relevant landholders regarding potential impacts to bores.

5.2.3.6 Public Infrastructure & Utilities

Edderton Road

The only formed public road within the subsidence affectation area is Edderton Road which crosses the project area in a north-south direction. Longwall panels in all five seams to be mined occur beneath Edderton Road, with the road generally oriented perpendicular to the longwalls. A diversion of a section of Edderton Road has previously been approved as part of the Bayswater No. 3 project and will be constructed in consultation with MSC across the Belmont open cut pit prior to mining in the Glen Munro seam, as shown on **Figure 5.8**. There are two small bridges on Edderton Road within the subsidence affectation area and a third bridge will be constructed along the Edderton Road diversion spanning the Belmont Pit.

Predictions of subsidence, tilt and strain have been made along Edderton Road and the planned diversion both during mining and at the completion of each series of longwalls. A summary of the maximum predicted values of total subsidence, tilt and strain on Edderton Road is provided in **Table 5.3**.

Table 5.3 - Maximum Predicted Total Subsidence Parameters along the Alignment of Edderton Road and Planned Diversion Following Extraction

	Maximum Predicted Total Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)	Maximum Predicted Tensile Strain (mm/m)	Maximum Predicted Compressive Strain (mm/m)
Edderton Road	4290	67	>25	>25
Edderton Diversion	3850	72	>25	>25

The predicted tilts along Edderton Road and the planned diversion will potentially result in small changes to surface water drainage along the road where the existing grade is relatively flat. It is likely, however, that the road will remain free draining and that any additional ponding will be very small and localised. Road works will be undertaken to rectify any drainage issues.

The maximum predicted ground strains of both Edderton Road and diversion are likely to result in cracking and rippling of the road surface. A series of cracks across the road surface, parallel to the proposed longwalls, of approximately 30 millimetres width are likely to occur after each longwall passes beneath the road. Cracks along the road surface, perpendicular to the proposed longwalls, are also likely to occur as the extraction face of each longwall passes beneath the road. These cracks are expected to partially close once the extraction face passes beyond the road.

The depth of cover in some areas along Edderton Road and the planned diversion is less than 100 metres and therefore it is possible that the subsidence profiles in these areas may become irregular resulting in bumps or small steps in the road surface. Road works will be undertaken as required to repair cracking.

The two existing bridges along Edderton Road are not predicted to be significantly impacted by changes in tilt, however, the maximum predicted tensile strains may result in a small gap occurring between the road pavement and the bridge structure at the abutments. The maximum predicted horizontal movement at the abutments is approximately 30 millimetres at each end of the northern bridge and 50 millimetres at each end of the southern bridge. It is also possible that cracking of the road surface may occur on the southern bridge. The predicted subsidence impacts are unlikely to be of sufficient magnitude to overstress the bridge structure.

Predictions of subsidence, tilt and strain have been made for the proposed bridge across Belmont Pit and the bridge will be designed to tolerate the maximum predicted subsidence movements along and across the bridge.

Subsidence impacts to road surfaces and associated drainage systems will be repaired as mining proceeds using standard road maintenance techniques. Each longwall will affect a length of road of approximately 300 to 500 metres, and repairs at any time will be limited to the affected section of road. Temporary diversions around subsidence impacted areas will be established as required (with temporary diversions put in place prior to undermining) and a Traffic Management Plan for the road works prepared in consultation with MSC. The Traffic Management Plan is expected to include a reduced speed limit for the affected section of road along with signage warning of impacts from mine subsidence.

Utilities

A 330/500 kV transmission line, owned by TransGrid, crosses the project area directly above the proposed longwalls in an east-west direction (refer to **Figure 5.8**). The transmission line is currently operating at 330 kV but is planned to be upgraded to 500 kV capacity by the end of 2008. The stability of transmission towers can be impacted by the tilts and ground strains associated with subsidence, while the cables can be impacted by changes in bay length resulting from differential subsidence and tilt of adjacent towers.

Predictions of subsidence parameters have been made at each transmission tower and the maximum change in bay length calculated to determine the potential impact on the transmission line. Preventive measures will be required to some of the transmission towers to provide stability to the tower bases, allow proper management of the tensions in the aerial

conductors and earth wires, and to allow proper management of the separations between adjacent aerial wires and the ground.

Mt Arthur Coal has undertaken detailed consultation with TransGrid, DPI and the MSB regarding subsidence impacts on this transmission line as part of the project design phase. The outcomes of the discussions on the technical aspects of subsidence remediation for the towers are, in summary:

- cruciform bases are TransGrid's preferred method of stabilising the tower bases and are a proven means of achieving proper management of tower bases subjected to strain. The cruciform base design is a function of tower base geometry. The design methodology is well understood and TransGrid has indicated that it has a high level of confidence in achieving an appropriate design;

- cable tensions have been previously managed using sheaves. An appropriate sheave arrangement will be designed for the transmission line whereby an array of smaller diameter sheaves arranged in a curved profile will replace the normal single large diameter sheave. This design will be developed and tested by TransGrid prior to implementation; and

- the key issue will be the management of aerial tensions around Tower 29 which is a tension tower. Mt Arthur Coal has revised the mine plan so that this tower is located above a chain pillar in the Woodlands Hill seam and will therefore be subject to minimum subsidence from mining in this seam. The tower will be further undermined in the Bowfield and Piercefield seams, however approximately 15 years of subsidence monitoring data and five years of site-specific multi-seam subsidence data will be available prior to commencement of multi-seam mining below the tension tower. This will allow for greater accuracy in predicting subsidence impacts on the tension tower and enable suitable engineering solutions to be implemented. TransGrid has indicated that it considers that an engineering solution is available to manage impacts on this tower.

Mt Arthur Coal will prepare a management plan in consultation with TransGrid, for the protection of the 330/500 kV transmission line to allow it to remain in a safe and serviceable condition throughout the mining period. The plan will be submitted to DPI for approval prior to undermining of the transmission line.

Low voltage powerlines also cross the project area following the alignment of Edderton Road. It is likely that preventive measures will be required for some of the powerlines, including cable sheaves and guy ropes, to allow for tilts of greater than 20 mm/m at the power poles. Monitoring of the powerlines will be required to ensure the cables are maintained in a safe and serviceable condition at all times. Mt Arthur Coal will develop management strategies, in consultation with Energy Australia, for the protection of the powerlines throughout the mining period.

Underground copper telephone cables cross the project area following the alignment of Edderton Road. It is likely that the cables will be adversely impacted by subsidence from some longwall panels. Depending on the current condition of the cables, preventive measures may be required including relocation of the cables to conduits and the installation of additional lengths of cable. Monitoring of the copper cables will be required to ensure they are maintained in a safe and serviceable condition at all times. Mt Arthur Coal will develop management strategies, in consultation with Telstra, for the protection of the underground copper cables throughout the mining period so that they are maintained in a serviceable condition.

Utilities located within the subsidence affectation area, including low voltage powerlines and underground telephone cabling, will be installed with preventive measures as required so that they remain in a safe and serviceable condition throughout the mining period. Specific details of works to be undertaken above each series of longwall panels will be detailed in the relevant SMP.

5.2.4 Subsidence Monitoring and Management

The range of typical subsidence management and remediation measures likely to be implemented for surface features across the site have been summarised in **Table 5.4**.

Table 5.4 - Summary of Subsidence Management and Remediation Measures

Feature/Location	Typical Management and Remediation Options
Hunter River	• No predicted impact
Saddlers Creek	• No predicted impact
Quarry Creek and other drainage lines	• Earthworks to repair grade and increased ponding • Seal significant cracking
Tensile cracking zone and <100 metre depth of cover zone	• Cultivation, seal significant cracking, soil remediation and/or revegetation as required
<50 metre depth of cover zone	• Earthworks, soil remediation and revegetation as required
Steep slopes	• Earthworks, soil remediation and revegetation as required
Roads, culverts and bridges	• Repair using standard maintenance techniques • Traffic management in consultation with MSC
330kV/500kV transmission line	• Reinforcement or re-engineering of tower bases • Engineering measures to allow inter-tower cable movements, with specific measures engineered for Tower 29
Low voltage power lines	• Management strategy developed in consultation with Energy Australia
Underground services	• Management strategy developed in consultation with infrastructure owner
Buildings	• Structural inspection to assess best option, including demolition, relocation, prevention of access or repair (note: all Mt Arthur Coal owned)
Farm dams	• Repair leaking dams as required
Fences	• Repair impacted fences as required
Bores	• Repair or replace impacted bores as required

The following subsidence monitoring procedures will be implemented as part of the Underground Project, and will be further refined in consultation with DPI as mining progresses:

- subsidence monitoring lines to be located as determined as part of the SMP process;
- visual assessment of all natural features and items of surface infrastructure before, during and following mining to detect subsidence impacts such as surface cracking, irregularities in the subsidence profile, erosion, damage to structures, changes in drainage patterns or loss of water from drainage structures;

- assessment of all building structures by a structural engineer before and after mining; and
- verification and revision of subsidence predictions as mining progresses.

There will be ongoing refinement and calibration of the subsidence predictive model throughout the project life as a result of subsidence monitoring and comparison with predictions. As the coal resource is extracted, refinement and verification of the model will be incorporated into the SMP for each set of longwalls, providing a more accurate basis for the assessment and management of subsidence impacts as the project progresses.

5.3 Ecology

A comprehensive ecological survey and assessment was undertaken for the Underground Project by Umwelt. Fieldwork was undertaken in April and December 2005 across a survey area of approximately 3800 hectares (refer to **Figure 5.9**). The survey area included all areas potentially impacted by the Underground Project that had not been previously disturbed by open cut mining or associated activities and that were not covered by current mining approvals. The survey area also included an approximately 9 kilometre length of Saddlers Creek planned for long term conservation. This survey work builds on previous surveys undertaken across Mt Arthur Coal's operational area for past ecological assessments and as part of the annual ecological monitoring program. The survey completed specifically for this project included a plot based vegetation survey and a fauna survey including mammal trapping, bird searches, diurnal reptile and amphibian searches, spotlighting transects, nocturnal reptile and amphibian searches, Anabat II echolocation recording transects, fixed all night Anabat II echolocation recording, harp traps and habitat assessment.

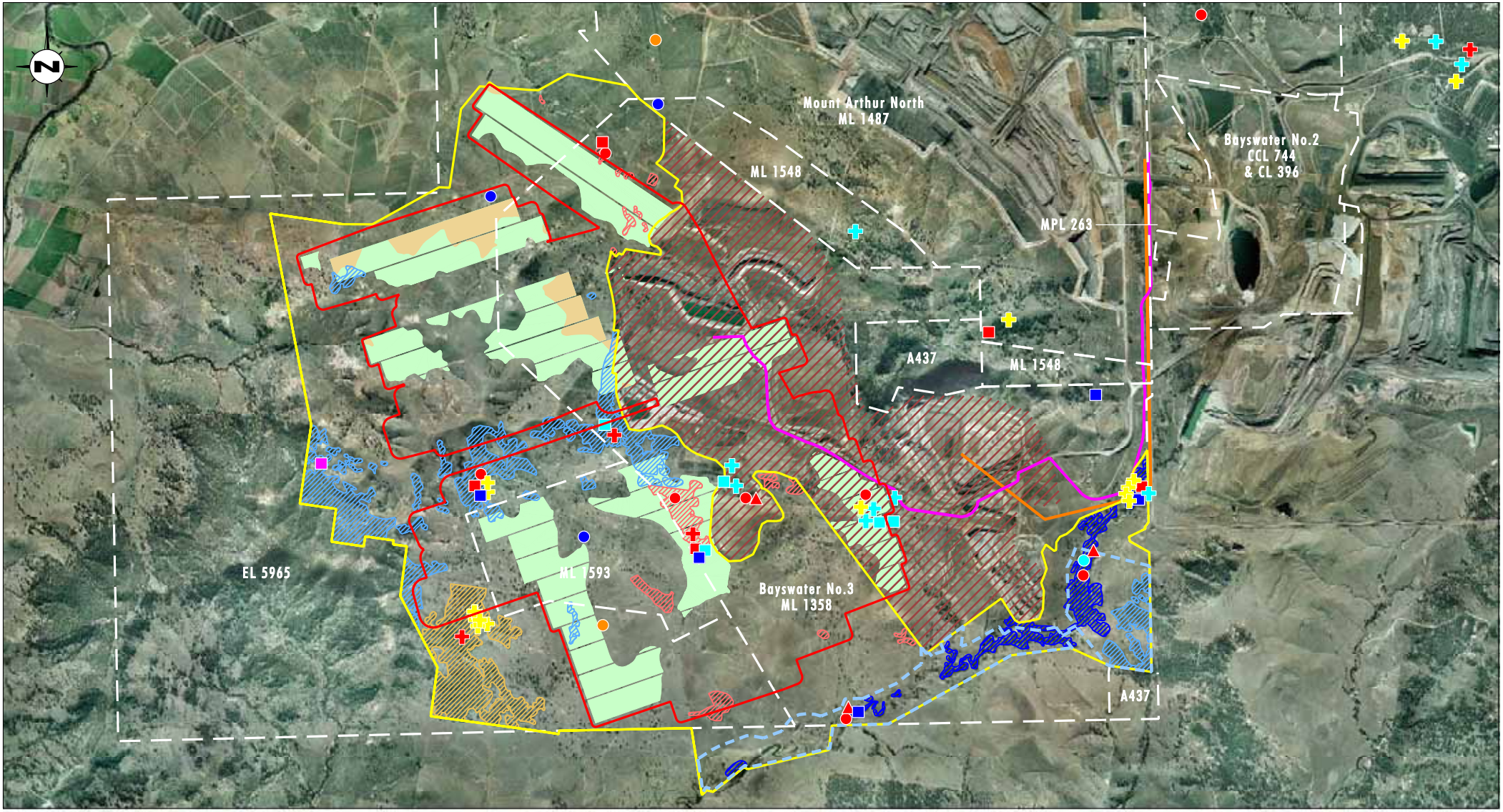
The complete ecological assessment is included in **Appendix 6**, with a summary of the main findings outlined below.

5.3.1 Regional Ecological Context

The upper Hunter Valley has been largely cleared of native vegetation, primarily for agricultural and other land uses including urban development and mining. The valley floodplain areas have been subject to the most intensive agricultural use. Due to these land use patterns, conserved areas of native vegetation are generally located on the edge of the valley and connectivity to and from these conservation reserves is patchy due to the variety of land tenures and long history of land modification. In terms of the main valley floor area, formally protected areas constitute about 1.9 per cent (Peake, 2006).

The project area contains a number of scattered vegetated fragments that would function broadly as 'stepping-stone' corridors for highly mobile fauna species able to travel across large areas of open country. Although a lack of formal movement corridors within the project area reduces the habitat potential of a number of these fragments, they remain significant on local and regional scales. Approximately 100 hectares of vegetation on Mt Arthur, immediately east of the subsidence affectation area (refer to **Figure 5.10**), is planned to be protected under a voluntary conservation agreement (VCA) between Mt Arthur Coal and the NSW Minister for Climate Change, the Environment and Water. This vegetation represents a significant area of protected flora and fauna habitat in the locality.

There is a tenuous vegetated corridor linkage from Mt Arthur through the riparian habitats associated with Saddlers Creek and adjacent woodland areas to Mt Ogilvie to the south-west. The corridor between Mt Arthur and Mt Ogilvie has been identified in the Synoptic



Base Source: Mt Arthur Coal, 2006

Legend

- Mining and Exploration Lease Boundary
- Survey Area
- Subsidence Affectation Area
- Bayswater No.3 Mining Area
- Mine Access Road
- Surface Conveyor

- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Proposed Saddlers Creek Conservation Area
- Central Hunter Box-Ironbark Woodland
- Central Hunter Bullook Regeneration
- Hunter Floodplain Redgum Woodland
- Narrabeen Footslopes Slaty Box Woodland

- Hunter Valley Weeping Myall Woodland EEC
- */Acacia pendula* (Endangered Population)
- *Bothriochloa biloba*
- *Cymbidium canaliculatum* (Endangered Population)
- grey-crowned babbler
- grey-crowned babbler nest

- squirrel glider
- speckled warbler
- eastern bentwing-bat
- eastern cave bat
- greater broad-nosed bat
- eastern freetail-bat
- yellow-bellied sheathtail-bat
- large-footed myotis

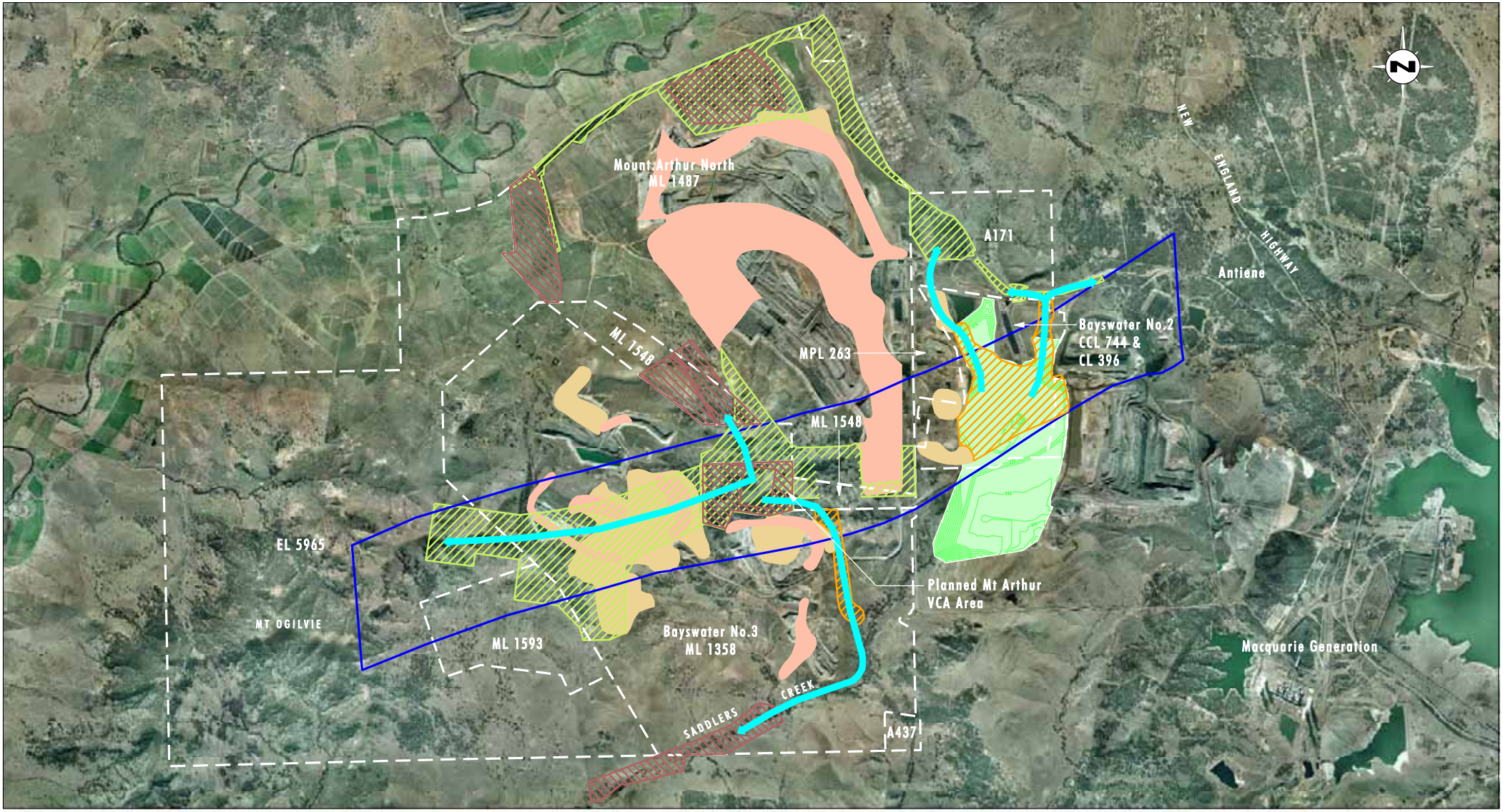
Note: Areas within the survey area not otherwise delineated constitute derived grassland (or aquatic vegetation if fringing dams)

0 1 2 3km
1:65 000

FIGURE 5.9

Ecological Survey Area, Threatened Species, Vegetation Communities and Potential Subsidence Remediation Area

File Name (A4): R21_V1/2051_257.dgn



Base Source: Mt Arthur Coal, 2006

0 1 2 4km
1:90 000

Legend

- Mining and Exploration Lease Boundary
- Rehabilitated Area
- Existing and Previously Proposed Rehabilitation Areas - Native Trees
- Regional Habitat Links (Synoptic Plan, NSW DMR 1999)
- Heritage Management and Conservation Areas
- Existing Habitat Management/Improvement Zones
- Proposed Vegetated Areas - South Pit Extension Project (currently subject to assessment by DoP)
- Local Corridors

FIGURE 5.10

Existing Mt Arthur Coal Rehabilitation and Landscape Strategy

File Name (A4): R21_V1/2051_301.dgn

Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley (DMR, 1999) as a regional habitat linkage (refer to **Figure 5.10**). A highly fragmented, but significant corridor follows north-east from Mt Arthur, though spotted gum (*Corymbia maculata*) dominated woodland in the Antiene area to vegetated land to the east of the New England Highway. Potential may exist for fauna movement through this corridor from the project area however, approved and proposed mining operations, Thomas Mitchell Drive and the New England highway constitute a barrier to movement for some species in this direction. The existing Mt Arthur Coal rehabilitation and landscape strategy (including revegetated areas proposed as part of the South Pit Extension Project) which illustrates the planning for long term ecological habitat connectivity through the Mt Arthur Coal operational areas is shown on **Figure 5.10**.

Areas of remnant vegetation also occur to the east of the project area within the Macquarie Generation buffer zones. These habitats are not well linked via vegetation corridors to habitats within the project area.

5.3.2 Flora

5.3.2.1 Vegetation of the Project Area

The flora survey found that the floristic diversity of the project area is moderate, with the overall diversity of plant species recorded likely to be affected by the history of clearing for agricultural activity. Despite the disturbed nature of the vegetation of the project area, some areas of woodland remain and the floristic diversity is generally considered to be representative of similar disturbed woodlands and grasslands occurring widely across the Hunter Valley.

A total of 220 flora species were recorded during survey work in the project area, with seven vegetation communities recorded. Derived grassland was the most extensive community, comprising approximately 87 per cent of the surveyed area, with scattered woodland communities comprising approximately 13 per cent and riparian and aquatic communities comprising less than 1 per cent. The vegetation communities recorded have been named in accordance with the vegetation communities mapped by Peake (2006) as part of the Hunter Remnant Vegetation Project. The location and extent of these communities is depicted on **Figure 5.9** and include:

- Derived Grassland (approximately 3275 hectares), occurring over the majority of the survey area;
- Hunter Valley Weeping Myall Woodland (less than 1 hectare). This community is listed as an Endangered Ecological Community under the Schedules of the *Threatened Species Conservation Act* (TSC Act);
- Central Hunter Bulloak Forest Regeneration (approximately 55 hectares);
- Central Hunter Box – Ironbark Woodland (approximately 245 hectares);
- Hunter Floodplain Red Gum Woodland Complex (approximately 75 hectares) – a mixed variant of this vegetation complex was recorded along Saddlers Creek, the majority of which is proposed for conservation (refer to **Section 5.3.5.1**);
- Narrabeen Footslopes Slaty Box Woodland (approximately 115 hectares); and

- aquatic vegetation - small areas (less than 1 hectare) were recorded fringing some of the dams that occur within the survey area and along parts of Saddlers Creek in highly altered habitats (which are ephemeral in the case of drainage lines).

5.3.2.2 Threatened Species and Endangered Populations

One Commonwealth listed threatened species was identified in the survey area during survey work. The grass species *Bothriochloa biloba,* listed as vulnerable on the EPBC Act, was identified at two sites within the survey area, as shown on **Figure 5.9**. The species is also known to occur adjacent to Edderton Road to the north of the survey area. This species was previously listed on the TSC Act, however, it was recently removed as further information became available regarding the status of the species.

Diuris tricolor, listed as vulnerable on both the TSC Act and EPBC Act, is known to occur within the Mt Arthur Coal operations area near Thomas Mitchell Drive to the east, however it was not recorded in any of the ecological surveys completed within, or near the survey area.

Two species forming part of Endangered Populations listed under the TSC Act were identified during survey work. *Cymbidium caniculatum* (a mistletoe) is listed as an Endangered Population within the Hunter Catchment. A single specimen of this species was recorded in a tree in close proximity to Saddlers Creek outside the proposed disturbance area and within the proposed Saddlers Creek conservation area (refer to **Figure 5.9**). The population of *C. canaliculatum* in the Hunter Catchment is at the south-eastern limit of the geographic range for this species (Peake 2005).

Acacia pendula (a tree) is listed as an Endangered Population in the Hunter Catchment and also as the Hunter Valley Weeping Myall Woodland Endangered Ecological Community (EEC) under the TSC Act. The species was recorded in the south-west of the subsidence affectation area and is also known to occur to the north of the subsidence affectation area along Edderton Road (refer to **Figure 5.9**). A disjunct population of *Acacia pendula* occurs in the Hunter Valley at the eastern edge of the distributional limit of the species. The Hunter population is known to occur naturally as far east as Warkworth and extends north-west to Muswellbrook and to the west of Muswellbrook at Wybong.

A further two species that are listed or proposed Endangered Populations are known to have been previously recorded within the wider Mt Arthur Coal operations area; river red gum (*Eucalyptus camaldulensis*) and *Diuris tricolor.* Neither of these species were recorded in the survey area for the Underground Project.

5.3.2.3 Endangered Ecological Communities (EEC)

An assessment of the EECs listed under the Schedules of the TSC Act and EPBC Act identified four with the potential to occur within the project area; White - Box Yellow - Box Blakely's Red Gum Woodland, Hunter Lowland Redgum Forest, Hunter Valley Weeping Myall Woodland of the Sydney Bioregion and Weeping Myall – Coobah - Scrub Wilga Shrubland of the Hunter Valley.

The presence of weeping myall (*Acacia pendula*) within the project area dictates the presence of the Hunter Valley Weeping Myall Woodland EEC, as listed under the TSC Act. A small area of this EEC is therefore present within the south-west of the subsidence affectation area (refer to **Figure 5.9**), and to the north of the subsidence affectation area adjacent to Edderton Road.

Detailed statistical assessment of the floristic data collected through systematic sampling showed that the vegetation communities present within the project area did not conform with

any of the remaining three EECs (refer to **Appendix 6**). Therefore, the White - Box Yellow - Box Blakely's Red Gum Woodland EEC, Hunter Lowland Redgum Forest EEC and Weeping Myall – Coobah - Scrub Wilga Shrubland of the Hunter Valley EEC will not be impacted by the proposed Underground Project.

5.3.3 Existing Fauna

A total of 97 fauna species were recorded in the survey area, including eight species listed as vulnerable on the TSC Act and 25 species listed as migratory on the EPBC Act. The threatened fauna species recorded were:

- speckled warbler (*Pyrrholaemus saggitata*);
- grey-crowned babbler (*Pomatostomus temporalis temporalis*);
- squirrel glider (*Petaurus norfolcensis*);
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- large-footed myotis (*Myotis adversus*);
- greater broad-nosed bat (*Scoteanax rueppellii*);
- eastern freetail-bat (*Mormopterus nofolkensis*); and
- eastern cave bat (*Vespadelus troughtoni*).

Threatened fauna species were restricted to areas of remnant woodland/forest vegetation within the survey area, with no records obtained from the grassland habitats (refer to **Figure 5.9)**. The survey area is also considered to provide potential habitat for a number of other threatened species known to occur in the region, including three species previously recorded on Mt Arthur Coal land; the hooded robin (*Melanodryas cucullata cucullata*), diamond firetail (*Stagonopleura guttata*), yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*), and two species tentatively recorded on Mt Arthur Coal land; the parma wallaby (*Macropus parma*) and turquoise parrot (*Neophema pulchella*). Further discussion regarding these species is included in **Appendix 6**.

There are no Endangered Fauna Populations listed for the region, and none occur or are expected to occur within the project area. There are also no areas of declared critical habitat within the project area.

5.3.4 Ecological Impact Assessment

Subsidence itself does not typically directly adversely impact on ecological values, however subsidence can lead to surface cracking and changes to surface drainage that may impact on ecological values. The subsidence impacts associated with the project are not predicted to result in significant tree failure or death. The majority of ecological impacts associated with the Underground Project will arise from potential subsidence cracking, subsidence remediation works to repair areas of cracking or to rectify changes to drainage lines and from clearing for the construction of surface infrastructure. The surface water drainage assessment completed for the project has not identified any significant changes to overland flow paths that could result in significant ecological impacts (refer to **Section 5.5.2.5**).

Subsidence remediation works may be required in areas impacted by surface cracking or changes to surface drainage. These works will generally fall into one of two categories,

general cultivation activities such as tilling, deep ripping and filling of smaller surface cracks with soil, or more extensive earthworks such as regrading of the soil profile and may include earthworks within drainage lines (refer to **Section 5.5.2**).

Mt Arthur Coal will utilise a variety of rehabilitation techniques to repair the impacts of subsidence. Remediation techniques will vary depending on the extent of surface cracking or landform changes. These techniques will aim to minimise the impact on the surface whilst achieving an acceptable level of rehabilitation from a land user safety, mine safety and environmental perspective. In areas where smaller scale cracking is predicted to occur (50-100 metres depth of cover), cultivation activities will generally consist of one, or a combination, of the following methods:

- infilling of cracks with soil and/or bentonite to seal cracks visible at the surface;
- tilling the ground surface using small agricultural equipment to blend fill material and restore the soil profile; and/or
- where necessary, using small machinery, such as a small excavator, bobcat or grader, to restore the surface profile.

In areas where more substantial cracking or changes in landform are predicted to occur, more extensive earthworks may be required, such as dozing and deep ripping prior to the final surface treatment. Earthworks may also be required in some ephemeral drainage lines to restore flow paths, however, the equipment and techniques appropriate for each site will as assessed on a case by case basis to minimise the level of disturbance required.

This subsidence remediation work does not result in total clearing of vegetation, with only the areas affected by cracking requiring disturbance. The impacts of remediation works are primarily limited to ground vegetation layers, with minimal impact on the shrub layers. Subsidence remediation works do not typically require clearing of any canopy vegetation and no large scale clearing works are proposed as part of the project, with only small scale clearing required for the construction of surface infrastructure. As discussed in **Section 5.3.4.1** below, specific subsidence remediation techniques will be used to minimise impacts on woodland/forest vegetation.

5.3.4.1 Flora Impact Assessment

Subsidence Impacts

As discussed in **Section 5.2**, an area of approximately 820 hectares has been identified as a potential surface disturbance zone within which subsidence remediation works may need to be undertaken. Of this 820 hectares, approximately 140 hectares has been previously assessed and approved for open cut mining impacts as part of the Bayswater No. 3 consent, leaving a total surface disturbance area of approximately 680 hectares assessed as part of this ecological survey and assessment. Total ground disturbance will not occur in this area, with subsidence remediation works only required where significant cracking occurs. This total area has been used for impact assessment purposes to provide a conservative assessment. Approximately 93 per cent of the predicted surface disturbance zone falls within the Derived Grassland vegetation community (refer to **Figure 5.9**), and has the potential to affect up to approximately 630 hectares, or 19 per cent of the extent of this community within the survey area. The highly modified state of this vegetation community, and its limited fauna habitat value, means that the predicted subsidence remediation works in this area are not likely to cause a negative impact on biodiversity values in the project area.

Approximately 7 per cent of the predicted surface disturbance zone will occur within woodland vegetation communities (refer to **Figure 5.9**). This consists of approximately 24 hectares of Central Hunter Bulloak Forest Regeneration and approximately 24 hectares of Central Hunter Box – Ironbark Woodland. These predicted impact areas represent 44 per cent and 10 per cent of the extent of these vegetation communities within the survey area, respectively. Where remediation works are required within woodland areas, the clearing of vegetation will be minimised by using small machinery which requires less room to manoeuvre. As disturbance will only occur where it is necessary to repair areas of cracking, clearing of canopy vegetation is unlikely to be required and the majority of vegetation will remain largely undisturbed. In particularly sensitive areas of vegetation (such as the stand of *Acacia pendula* in the south of the project area), hand methods can be used to repair any cracking and restore the soil profile.

The predicted impact of subsidence remediation work is not expected to result in a significant loss of floristic diversity in the survey area, project area or the region.

Surface Infrastructure Impacts

The majority of surface infrastructure required for the Underground Project will be located within areas that have been disturbed by past mining operations or that are currently approved for disturbance by open cut mining. This includes the main surface facilities for each target coal seam and the North Saddlers ROM facility.

The proposed overland conveyor and associated services corridor will cross Saddlers Creek, as well as a minor upper tributary of Saddlers Creek in the east of the project area (refer to **Figure 5.9**), requiring the removal of 0.16 hectares of Hunter Floodplain Red Gum Woodland Complex (less than 1 per cent of the occurrence of this community within the survey area).

The proposed access road and associated services corridor will cross a minor upper tributary of Saddlers Creek in the east of the project area, however the path of the road was redesigned so as to not impact on Saddlers Creek itself. The access road will require the removal of approximately 0.5 hectares of the Hunter Floodplain Red Gum Woodland Complex vegetation community, representing approximately 0.7 per cent of the extent of this community within the survey area. Any tree clearing required as part of the project will be undertaken in accordance with existing Mt Arthur Coal clearing procedures.

The precise location of other minor infrastructure such as ventilation fans and borehole facilities will not be known until detailed mine planning has been completed and will be refined as further information on mining conditions has been obtained as part of mining operations. However, these facilities will be located within previously disturbed or derived grassland areas wherever possible with the aim of avoiding areas of known ecological significance, including woodland areas. Due to the small disturbance area associated with these facilities (typically less than 0.5 hectares for borehole facilities) and the extensive ecological survey conducted within the project area, it is considered that these surface infrastructure requirements can be constructed without significant impact on vegetation communities and fauna habitats. An ecological inspection process will be implemented for the final location of ventilation fan and borehole facilities as discussed in **Section 5.3.5**.

The ecological assessment has found that the project will not result in a significant change or loss of floristic diversity in the project area, Mt Arthur Coal operations area or region. The impact of the project on floristic diversity is not expected to be significant due to the small amount of native vegetation to be affected, the amount of unaffected vegetation within the project area and the floristic similarity of the vegetation of the project area to the wider region.

Impact on Threatened Flora Species, Populations and EECs

One Commonwealth listed threatened flora species (*Bothriochloa biloba*), two endangered flora populations (*Cymbidium caniculatum* and *Acacia pendula*) and one EEC (Hunter Valley Weeping Myall Woodland) were recorded in the survey area. *Bothriochloa biloba* was found to occur at two sites within the subsidence affectation area, both of which may be impacted by subsidence remediation work or the construction of minor surface infrastructure associated with the project. *Acacia pendula* and associated Hunter Valley Weeping Myall Woodland EEC was also recorded at one location within the subsidence affectation area, however the site is outside the potential subsidence remediation impact zone and is therefore unlikely to be impacted by such works. A single specimen of *Cymbidium caniculatum* was found to occur in the vicinity of Saddlers Creek in a location which will not be impacted by subsidence, subsidence remediation works or surface infrastructure.

A detailed assessment of significance was completed for each of the threatened species, Endangered Populations and EECs recorded, or considered likely to occur in the project area (refer to **Appendix 6**). The assessment of significance concludes that the Underground Project will not have a significant impact on threatened species, Endangered Populations, EECs or their habitats recorded within the survey area or that have the potential to occur within the survey area. In reaching this conclusion the assessments of significance identified that the project will, in most circumstances, avoid threatened species, Endangered Populations and EECs. Where potential impacts do occur, they will occur within a small proportion of the potential habitat for the species within the project area and are unlikely to result in the extinction of a local population of the species.

5.3.4.2 Fauna Impact Assessment

Subsidence Impacts

It is unlikely that subsidence impacts associated with the Underground Project will result in a significant loss or deterioration of fauna habitat within the project area. Subsidence remediation works are predicted to affect a portion of the woodland and grassland habitats within the project area, however the potential disturbance area is relatively small, representing only 10 per cent of woodland and 19 per cent of grassland habitat within the project area (refer to **Figure 5.9**). Subsidence remediation impacts will also be temporary in nature, will not result in the total disturbance of affected habitat and will require minimal disturbance of canopy vegetation. Subsidence remediation works are not predicted to alter the structural and floristic integrity of the vegetation communities within the project area and will therefore not significantly affect fauna habitats.

Subsidence remediation works may be required within minor drainage lines within the predicted subsidence impact area. These works may be required to repair subsidence cracking, changes in flow path or out of bank ponding (refer to **Section 5.5.2**). As these drainage lines are highly ephemeral, significantly altered and lacking substantial areas of aquatic or riparian habitat, potential works within these areas are not likely to significantly impact on the availability or functioning of aquatic or riparian habitats.

Surface Infrastructure Impacts

The impact on fauna habitat from the construction of surface facilities is also predicted to be minor, with the main impact arising from the construction of a conveyor across Saddlers Creek, resulting in the loss of less than one hectare of the Hunter Floodplain Red Gum Woodland Complex.

Pit top facilities will be located within existing or approved open cut pits and upgrades to the existing CHPP and rail facility will occur within existing disturbed areas. Other minor surface infrastructure, including ventilation fans, ventilation shafts, borehole facilities and site services, will disturb small areas of habitat and will be located, wherever possible, within disturbed areas or areas of derived grassland.

Impact on Threatened Flora Species, Populations and EECs

Eight threatened fauna species were recorded in the survey area, with a number of others considered to potentially occur considering habitat profiling and the known ranges of these species. A detailed assessment of significance was completed for each of the threatened species recorded, or considered likely to occur in the project area (refer to **Appendix 6**). The assessment of significance concludes that the Underground Project will not have a significant impact on threatened species or their habitats recorded within the project area or that have the potential to occur within the project area. This is largely due to the fact that the project will require only minor clearing of vegetation and the bulk of impacts will be in areas of derived grassland habitat rather than woodland.

An assessment of significance was also undertaken for the 25 migratory species listed under the EPBC Act recorded in the project area in accordance with the EPBC Act (refer to **Appendix 6**). The assessment determined that the project will not have a significant impact on any listed migratory or marine species due to the small area of habitat to be impacted and as it is unlikely that the project area forms an area of important habitat for these species.

5.3.5 Management and Monitoring

Mt Arthur Coal has a range of ecological management and monitoring strategies in place for the existing operations, including ecological management and monitoring plans. Monitoring and management strategies currently implemented include revegetation works to establish native vegetation communities, management of remnant vegetation, pre-clearing surveys, fauna habitat creation and ecological monitoring including monitoring of fauna, remnant vegetation and revegetation areas. Mt Arthur Coal proposes to build on these existing programs to assist in management and mitigation of the ecological impacts associated with the Underground Project.

The proposed management and mitigation measures to be implemented as part of the project are outlined in detail in **Appendix 6**, and in summary include:

- use of small earthmoving machinery for the remediation of surface cracking within woodland and forest vegetation. This will reduce the amount of vegetation disturbed and reduce the potential to require clearing of small tree, shrub and other vegetation layers;

- use of hand methods rather than machinery if remediation of surface cracking is required within the vicinity of the weeping myall (*Acacia pendula*) Endangered Population and EEC;

- development of a management strategy for the weeping myall Endangered Population and EEC to provide for its management and conservation during the life of the mining operation. This strategy may be included as a component of the Mt Arthur Coal site ecological management plan;

- assisted regeneration of vegetation communities affected by subsidence remediation, where natural regeneration is unsuccessful;

- location of minor surface infrastructure within previously disturbed areas or areas of Derived Grassland wherever possible. Where the disturbance of native vegetation is unavoidable, a due diligence procedure will be followed so that where feasible, areas containing significant ecological features such as known threatened species habitat, or hollow bearing trees will be avoided. Details of the due diligence procedure are provided in **Appendix 6**;

- implementation of a pre-clearance survey and clearing procedure for all tree clearing works associated with the project. This strategy will be used to minimise the potential impact of clearing activities on fauna species, particularly threatened fauna species and allow salvage of suitable habitat structures;

- replacement of arboreal habitat, should the removal of any hollow bearing trees be required, through the relocation of salvaged tree hollows and erection of nest boxes in surrounding remnant vegetation;

- the majority of Saddlers Creek on Mt Arthur Coal land will be fenced off to protect the riparian corridor and encourage natural regeneration. Cattle grazing will be excluded from this area and watering points established outside the riparian zone. This area will be conserved in perpetuity. The conservation of this area is proposed primarily to protect its archaeological values, however, it will also conserve and be managed for its significant ecological values. Further details regarding the proposed Saddlers Creek conservation area and other ecological offsets proposed are provided in **Section 5.3.5.1**; and

- modification of the existing Mt Arthur Coal ecological monitoring program to include monitoring of revegetated areas, monitoring of vegetation condition within subsidence affected areas, monitoring of the weeping myall (*Acacia pendula*) stand and fauna monitoring in the Underground Project.

5.3.5.1 Ecological Offsets

As part of the Underground Project, Mt Arthur Coal propose to extend and conserve in perpetuity the previously planned conservation area along the Saddlers Creek (refer to **Figure 5.10**). The Saddlers Creek conservation area has been proposed primarily to offset impacts on Aboriginal cultural heritage values (refer to **Section 5.4.1**), however, it will also provide the opportunity to conserve significant ecological features, and to offset the ecological impacts of the project.

The proposed Saddlers Creek conservation area is approximately 295 hectares in size and runs along the southern boundary of the project area (refer to **Figure 5.9**). The vegetation of the Conservation Area is dominated by Hunter Floodplain Red Gum Woodland Complex (approximately 53 hectares) and Derived Grassland (approximately 213 hectares), and includes small areas of Aquatic Vegetation along Saddlers Creek.

The proposed Saddlers Creek conservation area is of ecological significance for the following key reasons:

- a number of threatened species have been recorded within riparian vegetation along Saddlers Creek, including the eastern cave bat, grey-crowned babbler, the squirrel glider, eastern freetail-bat, large-footed myotis, and eastern bentwing-bat, and a number of others are considered likely to occur;

- a number of regionally significant species have also been recorded from this area, including the southern forest bat (*Vespadelus regulus*) and inland forest bat (*Scotorepens rueppellii*);

- the vegetation along Saddlers Creek provides habitat for hollow-dependent species, with a number of hollow-bearing trees being identified during surveys;

- the tiger orchid (*Cymbidium canaliculatum*) Endangered Population was recorded within the Conservation Area. This is currently the only known record of this Endangered Population from the Mt Arthur Coal operations area;

- the Saddlers Creek conservation area serves to protect part of an important riparian corridor that contributes greatly to the biodiversity values of the immediate area, as well as to the greater Mt Arthur Coal holdings. This corridor allows movement through the project area, and provides connectivity through the landscape in a north-east – south-west direction; and

- the Hunter Floodplain Red Gum Woodland Complex vegetation community is a regionally significant vegetation community.

The combined value of the significant ecological features of the Saddlers Creek conservation area identifies it as an ideal area for the offsetting of the ecological impacts of the Underground Project. The Conservation Area contains approximately 53 hectares (approximately 71 per cent) of the Hunter Floodplain Red Gum Woodland Complex within the Survey Area, easily offsetting the loss of 0.66 hectares of this vegetation community for the construction of the access road and overland conveyor.

The conservation of the high biodiversity values of the 53 hectares of Hunter Floodplain Red Gum Woodland Complex also more than adequately offset any loss of biodiversity resulting from the potential impact from subsidence remediation works within 35 hectares of woodland vegetation.

The following recommendations apply to the ecological management of the Saddlers Creek conservation area and will be incorporated into a management plan to be prepared for the area:

- the proposed Saddlers Creek conservation area will be managed and conserved in perpetuity by Mt Arthur Coal;

- the proposed Conservation Area will be fenced and sign-posted to avoid any inadvertent damage from mining activities;

- all stock will be removed from the area to allow for natural regeneration;

- fire, weed and feral animal management will occur within the Conservation Area, as required; and

- ecological monitoring will occur in the area, as required, to assess the effectiveness of management controls.

5.4 Heritage

5.4.1 Aboriginal Cultural Heritage

A comprehensive Aboriginal archaeological assessment was undertaken for the Underground Project by Umwelt in consultation with the 19 registered Aboriginal stakeholder

groups for the project. The detailed assessment report is included as **Appendix 7**, with a summary included in this section.

The Aboriginal archaeological assessment and consultation program was undertaken in accordance with the draft Part 3A assessment guideline Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation, July 2005 and DECC's Interim Community Consultation Requirements for Applicants 2004. The registered Aboriginal community stakeholders were involved in all facets of the assessment including a presentation and open forum discussion for the development of the survey strategy and determination of a conservation offset strategy, participation in field survey, site identification and recording, provision of information regarding cultural heritage values and review and comment on the draft report, including another open forum discussion.

The draft Aboriginal archaeological assessment report was provided to the registered stakeholders for comment in December 2006. At this time, a detailed presentation was made to the Aboriginal stakeholders and DECC on the results of the survey, the significance assessment including any Aboriginal community comments provided during fieldwork, the impact assessment findings, proposed management measures and the proposed offset package. The meeting included a site inspection and feedback from the stakeholders regarding cultural heritage values. As an outcome of this meeting and the subsequent written and verbal comments provided by the registered Aboriginal stakeholders, the offset package for the project was revised.

The revised offset package (as outlined in this EA) was presented to the Aboriginal stakeholders at a meeting held on 17 July 2007. The Aboriginal stakeholders subsequently provided comments on the revised offset package and 12 of the 14 comments provided agreed with the revised strategy and advised that the stakeholders considered it appropriate from an Aboriginal cultural heritage perspective.

5.4.1.1 Survey Methodology

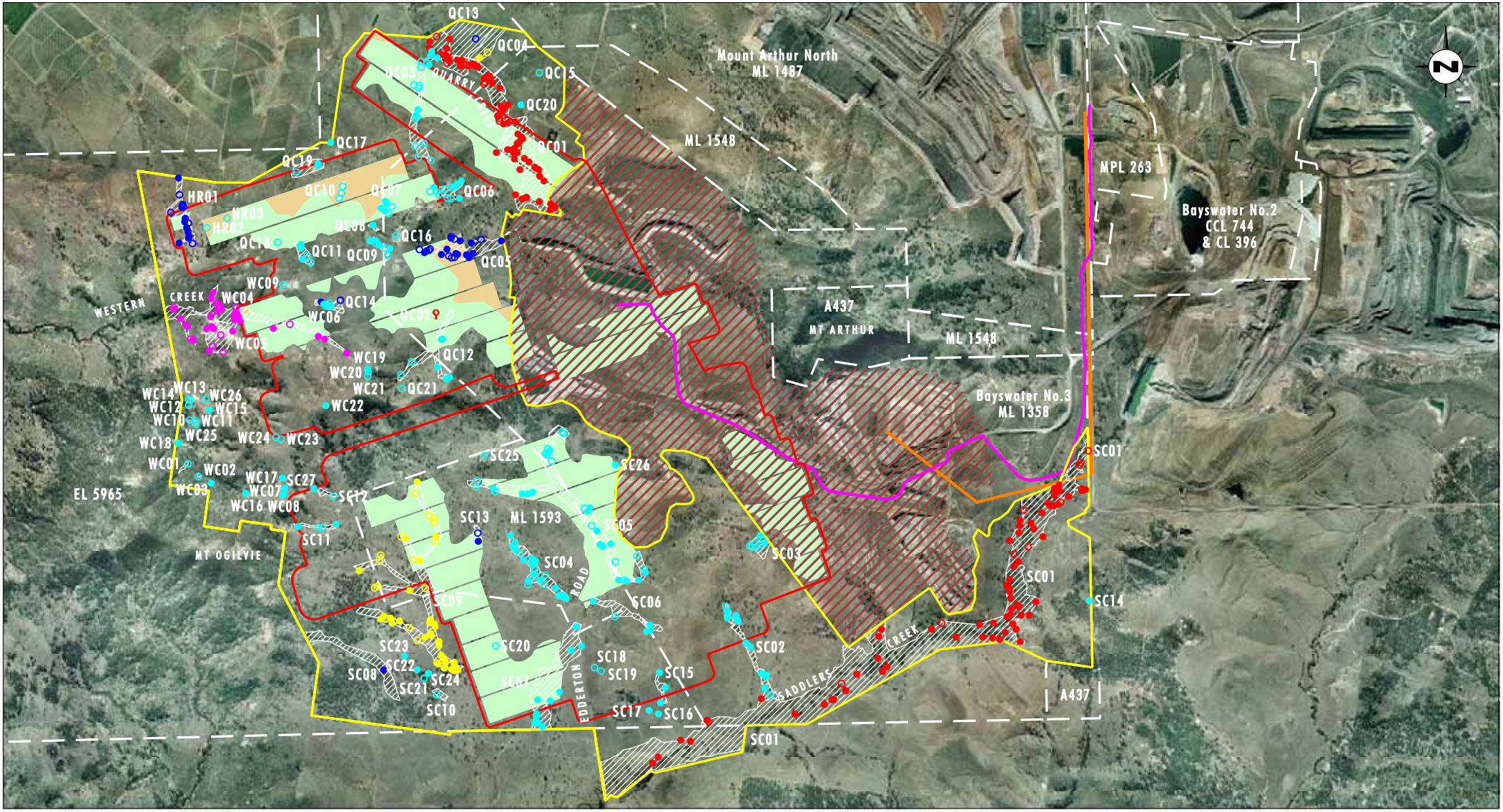
The assessment covered a survey area of approximately 3800 hectares as shown on **Figure 5.11**. Fieldwork was undertaken over a period of 23 days from January to May 2006 by a team of two archaeologists accompanied by six representatives from Aboriginal stakeholder groups. The survey covered all areas of proposed disturbance and areas within the subsidence affectation area that were outside areas previously salvaged and subject to detailed subsurface investigations as part of the currently approved Bayswater No. 3 open cut mining area.

The survey strategy for the project was designed to be consistent with that used for the proposed South Pit Extension and MAN Project to make the results of all surveys comparable. The survey area was traversed on foot by the team and sites were recorded using a comparable system of archaeological terrain units and environmental and cultural contexts. Areas in which artefacts were located were recorded as site loci.

5.4.1.2 Survey Results

A total of 77 sites were identified within the survey area, including one scarred tree, 46 artefact scatters and 30 isolated finds. A total of 509 site loci (artefact exposures) were recorded within these 77 sites. The most complex assemblages of artefacts were found in association with higher order watercourses, with areas of Saddlers Creek, Quarry Creek and Western Creek (refer to **Figure 5.11**) showing repeated and consistent evidence of Aboriginal occupation over long periods of time.

The sites recorded within the survey area are shown on **Figure 5.11**.



Base Source: Mt Arthur Coal, 2006

0 1 2 3km

1:60 000

Legend

- Mining and Exploration Lease Boundary
- Survey Area
- Bayswater No.3 Mining Area
- Subsidence Affectation Area
- Mine Access Road
- Surface Conveyor
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Archaeological Site Boundary
- Artefact Scatter
- Isolated Find
- Scarred Tree

Site Significance

- Low Significance
- Low to Moderate Significance
- Moderate Significance
- Moderate to High Significance
- High Significance

FIGURE 5.11

Archaeological Site Distribution, Archaeological Significance and Potential Surface Impact Area

File Name (A4): R21_V1/2051_287.dgn

5.4.1.3 Significance Assessment

The assessment of significance of Aboriginal sites has two defined components: cultural significance, which is determined by the Aboriginal community, and archaeological/scientific significance, which is determine by an archaeologist based on the ability of the site to contribute to the scientific understanding of Aboriginal culture. These two components are not interrelated, with sites potentially having different cultural and scientific values.

Aboriginal Cultural Significance

Aboriginal cultural significance can only be assessed by the relevant Aboriginal community groups. Any comments made by the Aboriginal community members participating in the field survey regarding cultural significance were recorded. Further comments were received from twelve of the Aboriginal stakeholder groups as part of their comments on the draft assessment report. A specific tour of the project area and proposed offset areas was also provided for Aboriginal elders unable to participate in the fieldwork, with comments made during this tour regarding cultural significance recorded.

The Aboriginal stakeholder groups comments state that all sites identified during the survey were of high cultural significance. However, some groups commented that sites QC01, QC02 and SC01 (refer to **Figure 5.11**) were of great importance to the Aboriginal stakeholder groups (these have been noted in the assessment report as of very high significance).

Mrs Barbara Foot provided further specific information regarding locations that she perceived to be of cultural significance in addition to the archaeological sites recorded during the survey. These locations were recorded and assessed as areas of Aboriginal cultural significance and not as archaeological sites. The locations identified by Mrs Foot were not recorded as archaeological sites as they did not have recognisable features that would warrant their recording as archaeological sites.

Archaeological/Scientific Significance

The archaeological or scientific significance of Aboriginal sites was assessed according to their potential to contribute to furthering the archaeological/scientific understanding of Aboriginal culture. Three sites within the survey area were assessed as having high archaeological significance, these being SC01 located along Saddlers Creek, QC01 located along Quarry Creek and the scarred tree, QC02. Two sites were assessed as having moderate to high archaeological significance (WC04 and WC05 located along Western Creek), three sites as moderate significance, four sites as low to moderate significance and 65 sites as having low archaeological significance. The significance of sites across the survey area is shown on **Figure 5.11**.

5.4.1.4 Impacts

The proposed Underground Project has the potential to impact on Aboriginal sites in three key ways:

- direct surface impacts associated with construction of mine infrastructure;
- impacts due to surface cracking associated with mine subsidence; and
- direct surface impacts associated with subsidence remediation works, including remediation works within drainage lines.

For the purpose of this assessment, it has been assumed that all Aboriginal sites and values identified within the areas of proposed direct impact by infrastructure will be damaged or destroyed (refer to **Figure 5.11**). Impacts from subsidence are not predicted to impact on scarred trees and are unlikely to cause damage to artefact scatters or isolated finds, however, subsidence remediation works could disturb, damage or destroy artefacts, depending on the type and extent of remediation required. **Figure 5.11** shows the extent of potential subsidence remediation works within the project area. Total ground disturbance will not occur within this area, with subsidence remediation works only required where significant cracking occurs. This total area has been used for impact assessment purposes to provide a conservative assessment.

Surface infrastructure will impact on site SC01 where the proposed overland conveyor crosses Saddlers Creek in the north-eastern section of the survey area (refer to **Figure 5.11**). Four site loci and a small section of potential archaeological deposit (PAD) will be damaged or destroyed as a result of conveyor construction. The remainder of site SC01 will be unaffected by the project and is proposed for conservation (refer to **Section 5.4.1.8**).

The location of minor surface infrastructure will be determined as mining progresses and wherever possible, will be located so as to avoid sites, site loci and PAD, especially those assessed as having moderate to high or high Aboriginal cultural heritage and archaeological significance. Management protocols have been developed to guide the siting and construction of these facilities (refer to **Section 5.4.1.6**).

Subsidence remediation will potentially impact on 28 of the 77 sites identified within the survey area. This includes partial impacts within two areas assessed as having high archaeological significance (QC01 and QC02), and one area assessed as having moderate to high archaeological significance (WC04). Remediation work in the area of QC01 and WC04 has the potential to impact on multiple site loci and areas of PAD within an area assessed as having high or moderate to high Aboriginal and archaeological significance.

The scarred tree, QC02 recorded as an archaeological site and the second scarred tree identified by an Aboriginal stakeholder are also located within areas considered likely to require subsidence remediation work. However, it is unlikely that surface cracking will impact on the viability of the trees. Any subsidence remediation work required in the vicinity of these trees will be managed to avoid impacts on the trees. The scarred trees are not predicted to be impacted by changes to surface drainage or groundwater resulting from underground mining.

5.4.1.5 History of Cultural Heritage Conservation by Mt Arthur Coal

The Bayswater No. 3 development consent required that Mt Arthur Coal assess the need for a conservation zone to reserve an example of undisturbed archaeology. The granting of this consent and the subsequent Section 90 consent process under the *National Parks and Wildlife Act 1974* also resulted in extensive salvage and subsurface investigation in the Bayswater No. 3 area over a period of many months with the Aboriginal community. As an outcome of the Bayswater research project, Mt Arthur Coal investigated opportunities for conservation in consultation with DECC and the Aboriginal community. This process was ongoing for a number of years and identified three potential conservation areas located in the vicinity of Saddlers Creek, Quarry Creek and Mt Arthur (refer to **Figure 5.12**). The establishment of a Voluntary Conservation Area (VCA) at Mt Arthur was subsequently required by the MAN development consent.

A draft Plan of Management was prepared for the conservation areas under consideration at Bayswater No. 3 which identified the statutory context governing the management of the areas, described the physical character of the archaeological landscape, reviewed the

Base Source: Mt Arthur Coal, 2006

Legend

- Mining and Exploration Lease Boundary
- Proposed Mt Arthur Conservation Area
- Previously Proposed Quarry Creek Conservation Area
- Previously Proposed Saddlers Creek Conservation Area
- Proposed Saddlers Creek Conservation Area
- MAN Heritage Management Zones

FIGURE 5.12

Cultural Heritage Management Areas

File Name (A4): R21_V1/2051_288.dgn

findings of previous archaeological studies, provided an assessment of the cultural heritage significance of the areas and established a comprehensive management strategy to protect archaeological and cultural heritage values. The Plan acknowledged the existence of underground coal reserves within the conservation areas and foreshadowed potential future underground mining, noting that aspects such as subsidence management, mine ventilation and relocation of infrastructure would be required albeit subject to careful assessment and management.

Shortly prior to the finalisation of the draft Plan of Management, changes to DECC policy meant that underground mining and exploration work were no longer considered compatible with conservation areas, and as such, the finalisation of the conservation areas was put on hold while the viability of the Underground Project was assessed.

Exploration work has since confirmed substantial underground resources within the project area which means that the section of Quarry Creek and the additional landform units north of Saddlers Creek previously considered for conservation are no longer suitable as a VCA. The remainder of the Saddlers Creek conservation area, incorporating the creek corridor (refer to **Figure 5.12**), has been considered as part of the offset strategy for the Underground Project (refer to **Section 5.4.1.9**).

In addition to the archaeological works undertaken as part of Bayswater No. 3 mining operations, there was extensive archaeological work completed and cultural heritage offsets established as part of the MAN Project. These works and offsets included:

- extensive salvage and subsurface investigation undertaken over a number of months, providing extensive information regarding the archaeological values of the Mt Arthur area;

- a commitment for Mt Arthur to be protected under a VCA to conserve archaeological values in perpetuity (100 hectares). Establishment of the Mt Arthur VCA is a requirement of the MAN development consent and will be finalised in consultation with DECC;

- establishing three heritage management zones established at MAN of representative landform areas (approximately 400 hectares);

- donation of land for a keeping place to the local Aboriginal community;

- provision of funds to the local Aboriginal community for production of a DVD regarding cultural heritage;

- creation of an Aboriginal Employment Working Group to assist in Aboriginal employment both at Mt Arthur Coal an in other industries;

- training of Aboriginal people in relation to land management works (e.g. fencing, tree planting, seed collection, weed control etc.). These training opportunities have been provided as part of both the Bayswater and MAN projects; and

- subsequent employment of Aboriginal people for land management works leading to other industry employment.

As demonstrated above, extensive archaeological salvage and investigations have been undertaken at the Mt Arthur Coal site, providing extensive information about the Aboriginal archaeological values of the Mt Arthur area. Mt Arthur Coal has also committed to extensive cultural heritage offsets as part of previous projects, achieving significant conservation outcomes.

Mt Arthur Coal is committed to progressing the proposed establishment of the Mt Arthur conservation area and presenting a draft Conservation Agreement and associated Aboriginal Cultural Heritage Management Plan to DECC and Aboriginal stakeholder groups for consideration in accordance with the MAN development consent.

5.4.1.6 Management Strategy

A range of management options were considered when developing an appropriate management strategy for the Underground Project. These include:

- site conservation;
- site destruction with salvage and subsurface investigation;
- site destruction with salvage; and
- site destruction without salvage.

Site conservation is the preferred management option for all sites, site loci and their associated PAD located outside the predicted surface impact zone (refer to **Figure 5.11**). These sites will be managed *in situ* under an Aboriginal Cultural Heritage Management Plan (ACHMP) for the duration of the project, except where impacts are required for minor surface infrastructure (refer to **Section 5.4.1.7**).

In addition to the sites conserved *in situ*, Mt Arthur Coal propose to set aside the majority of site SC01 for conservation within the Saddlers Creek conservation area (shown on **Figure 5.11**) to offset the loss of cultural heritage values elsewhere within the project area. Site SC01 was assessed as having high archaeological and cultural heritage significance, with this area also having significant ecological values. The land within the proposed conservation area is proposed to be conserved in perpetuity and the area managed under an ACHMP. Further details of the Saddlers Creek conservation area which will conserve an area of approximately 295 hectares is provided in **Section 5.4.1.9**. This conservation area, in conjunction with the Mt Arthur Conservation Area (approximately 100 hectares) under the existing MAN Consent (refer to **Figure 5.12**) will act to conserve a representative sample of Aboriginal sites, site types and archaeological terrain units for the project area.

Conservation of the remaining sites, site loci and PAD within the surface impact area is not predicted to be feasible due to predicted subsidence related impacts, however, their destruction will be offset by the setting aside of the proposed Saddlers Creek conservation area. In addition to these conservation outcomes, appropriate salvage of the site/site loci to be impacted is essential.

Surface collection and targeted subsurface investigation has been recommended for sites within the surface impact zone which have been identified as having the potential to retain a degree of integrity and/or complex sub-surface assemblages. The sites recommended for salvage and subsurface investigation include areas of Quarry Creek (QC01), Saddlers Creek tributary (SC09) and Western Creek (WC04) in areas potentially impacted by subsidence remediation and for Saddlers Creek (SC01) within the proposed conveyor corridor (refer to **Figure 5.11**).

Surface collection is recommended for all remaining sites within the surface impact zone (refer to **Figure 5.11**). Subsurface investigation has not been recommended for sites that are located in areas of high disturbance that thus retain no integrity and which are assessed as having no or low potential for complex subsurface assemblages.

The impact assessment for the project has been undertaken on the worst case subsidence remediation impact zone. Mt Arthur Coal has committed to undertaking surface collection and salvage on a per longwall panel basis, so that ongoing subsidence monitoring and predictions may potentially allow the predicted subsidence remediation impact zone to be refined to a smaller area. This may allow more sites to be managed *in situ*, with reduced numbers of sites requiring salvage and will also provide ongoing employment opportunities associated with salvage works for Aboriginal representatives over the life of the project.

Site destruction without salvage is not seen as an appropriate management option for any of the sites within the surface impact area and has therefore not been recommended for any sites within the project area.

Mt Arthur Coal has committed to the establishment of a Management Committee including at least five representatives of the Aboriginal stakeholder groups to provide ongoing management of sites within the project area.

5.4.1.7 Management of Minor Surface Infrastructure

Wherever possible, minor surface infrastructure will avoid known sites, especially those assessed as having moderate to high or high Aboriginal cultural heritage and archaeological significance. The ACHMP will provide a management protocol if a known site cannot be avoided by minor infrastructure, or if the minor infrastructure impacts on a previously unknown site. This will include inspections of infrastructure locations. The management of these sites will be based on their Aboriginal cultural heritage and archaeological significance and Mt Arthur Coal, in consultation with the Management Committee, will undertake the site salvage in a manner appropriate to its significance assessment.

5.4.1.8 Aboriginal Cultural Heritage Management Plan

An ACHMP will be developed in consultation with DECC and Aboriginal stakeholder groups to facilitate ongoing management of the sites, timing and methodology for the salvage of sites, the preparation of a management strategy for sites in the proposed Saddlers Creek conservation area and the establishment of a Management Committee in relation to ongoing management of sites within the project area.

5.4.1.9 Offset Strategy

To offset the impacts of the proposed Underground Project on Aboriginal cultural heritage, Mt Arthur Coal has made the following commitments:

- to set aside the proposed Saddlers Creek conservation area to be conserved in perpetuity, comprising a total area of approximately 295 hectares (refer to **Figure 5.12**);

- to manage the proposed Saddlers Creek conservation area under an Aboriginal Cultural Heritage Management Plan. The management procedures and protocols for this area will be stringent in relation to any activity that has the potential to cause ground surface disturbance;

- to provide safe access to the proposed Saddlers Creek conservation area. Visitors to the proposed Saddlers Creek conservation area will be supervised by an inducted member of the Management Committee or their representative and escorted by a Mt Arthur Coal employee as required; and

- to review applications to undertake non-destructive research within the proposed Saddlers Creek conservation area which will be considered by the Management Committee and approved based on their merit.

The Saddlers Creek conservation area will be fenced and sign-posted to avoid any inadvertent damage from mining activities. All stock will be removed from the fenced area to allow natural revegetation of eroded areas and avoid trampling of the artefact loci.

The proposed Saddlers Creek conservation area is an area where the express intention is that the surface will not be disturbed, however, its creation does not preclude forms of underground mining, for example, first workings, from occurring beneath it that are designed to not impact on the surface, subject to approval of any such future proposal.

From an archaeological perspective the setting aside of the proposed Saddlers Creek conservation area is considered an adequate offset for the loss of the sites/values within the project impact area but it may not fully offset the loss of the section of Quarry Creek previously considered for conservation. In consideration of this, and in light of the comments made by Aboriginal stakeholder groups, it is proposed that Mt Arthur Coal provide the following as part of the overall offset strategy for the project:

- Mt Arthur Coal will fund and construct a Keeping Place within the Proposed Saddlers Creek conservation area as part of the Aboriginal cultural heritage offset strategy. The Keeping Place will have a storage room for artefacts and a display centre for teaching/educational purposes. This Keeping Place will provide for storage of all artefacts salvaged at Mt Arthur Coal and will be staffed for approximately 50 days per year for the life of the project by appropriately trained Aboriginal community representatives. The Keeping Place also will be available for use as an educational facility;

- Mt Arthur Coal will fund the training of five representatives from the registered stakeholder groups to undertake 'Collections Training' at the Australian Museum (or similar training) for staffing of the proposed Keeping Place;

- Mt Arthur Coal will construct within or near to the existing fenced section of Quarry Creek west of Edderton Road, a facility suitable for use by the Aboriginal community when using the area for teaching purposes until such time as the area is impacted by subsidence in approximately year 13 of the project;

- provide training for one member of each of the registered Aboriginal stakeholder groups for the project in relation to site recording and artefact recording and basic analysis. The training package will be devised so that it enables these representatives to train other members of their respective groups and the broader Aboriginal community; and

- prior to mining of each longwall panel, Mt Arthur Coal will salvage all Aboriginal archaeological sites to be impacted by surface infrastructure or subsidence remediation works in accordance with the methods outlined in **Appendix 7**.

The above offset strategy for the Underground Project was discussed with the Aboriginal stakeholder groups for the project at a meeting on 17 July 2007. Twelve of the fourteen Aboriginal stakeholders that provided comments endorsed the proposed offset strategy.

5.4.2 Historic Heritage

A comprehensive historic heritage assessment was undertaken for the Underground Project by Umwelt in association with Weir Phillips. The assessment was undertaken in accordance

with the NSW Heritage Manual and NSW Heritage Office guidelines for Archaeological Assessments. The assessment included review of background information from previous research and assessments undertaken for approved open cut mining activities, register searches of statutory and non-statutory databases, surveys of the sections of the project area potentially impacted by the Underground Project, and consultation with MSC, the Muswellbrook Local and Family History Society and local residents.

The historic heritage assessment report is included as **Appendix 8**, with a summary provided in this section.

5.4.2.1 Historical Context

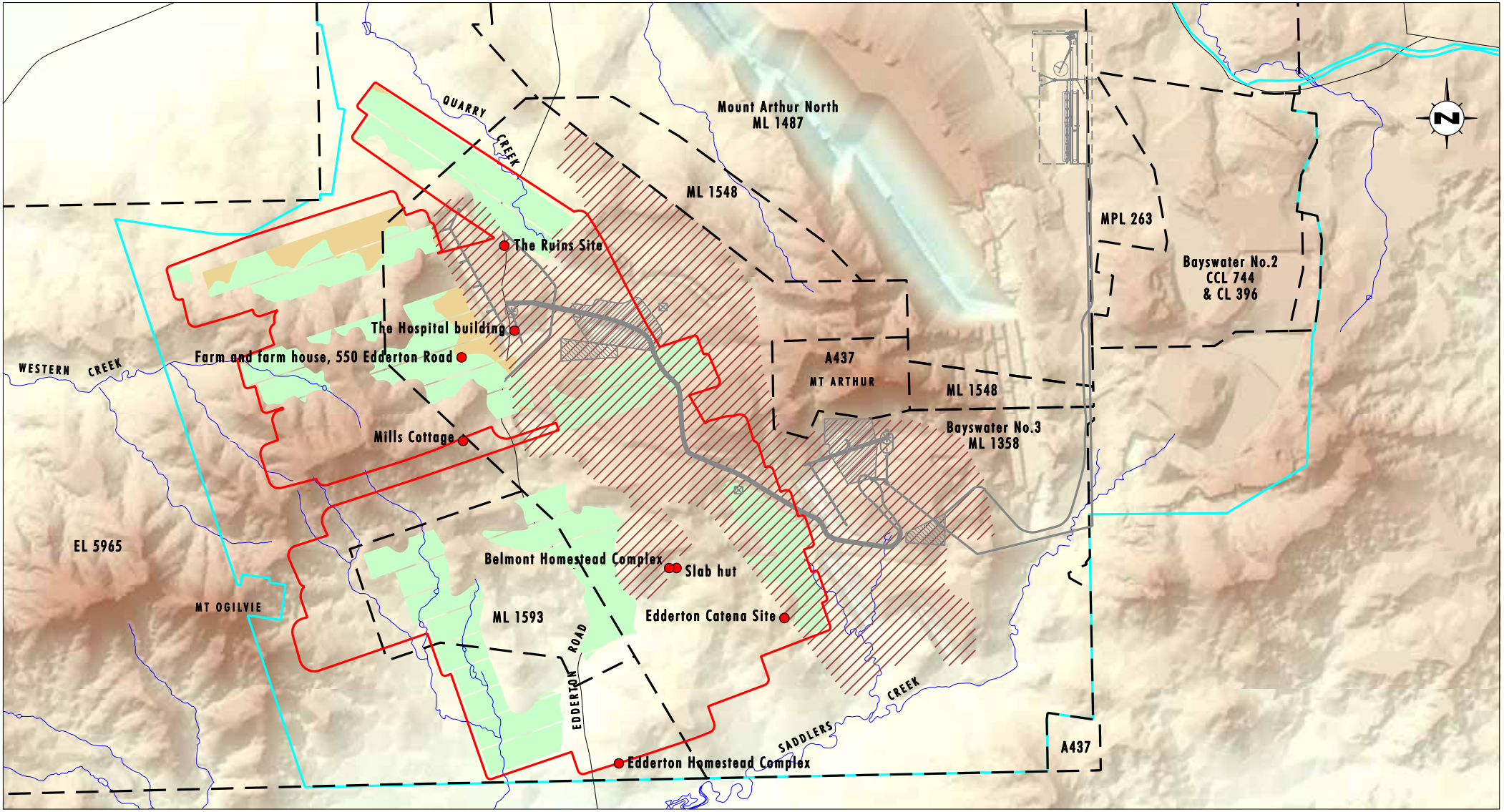
European settlement within the Hunter Region has had a long history dating from 1801 with the establishment of a convict settlement to mine and ship coal. Settlement growth during the nineteenth century was based on coal mining, timber-getting and agriculture. Coal was first mined in the Upper Hunter in the 1860s (Rappoport 2006), and was commercially exploited in the region from the 1890s.

Land within and surrounding the project area was taken up by freeholders from the 1820's onwards and established primarily as grazing land. The majority of the project area falls within original land grants made to Francis and George Forbes in the north and to George Bowman in the south. George Bowman's Arrowfield estate was granted in 1824. Smaller portions of land were available for selection after the subdivision of land by the Robertsons Land Act in 1861. This included the subdivision of Arrowfield estate, incorporating the area of Saddlers Creek. There were a relatively large number of conditional purchase settlers in the Saddlers Creek area between the 1860s and 1900 (Rappoport 2006). Further details of the settlement history of the project area and relationships to recorded structures (refer to **Section 5.4.2.2**) are included in **Appendix 8**.

5.4.2.2 Survey Results

A search of the Australian Heritage Database (Commonwealth Department of Environment and Water Resources), the State Heritage Register and State Heritage Inventory (NSW Heritage Council), and the Register of the National Trust (NSW) did not identify any listed heritage sites located within sections of the project area potentially impacted by the project. Rous Lench and Edinglassie homesteads, located off Denman Road on Mt Arthur Coal owned land are listed on the State Heritage Register, however, these sites are not within the project area and the Underground Project will have no negative impact on these sites.

The survey identified eight historic sites of local significance within the project area. These sites are associated with the pastoral history of the project area from the late nineteenth century to present day and consist of two homestead complexes, various farmhouse and cottage buildings, a relocated hospital building and the remains of pastoral infrastructure. A brief description of the sites and their condition and integrity (assessed as per Heritage Office guidelines) is included in **Table 5.5**. The location of all eight sites within the project area is shown in **Figure 5.13**.



Source: Mt Arthur Coal, 2006

0 1 2 3km
1:60 000

Legend

- Mining and Exploration Lease Boundaries
- Project Application Boundary
- Subsidence Affectation Area
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Existing and Approved Bayswater No.3 Mining Area
- Historic Heritage Site

FIGURE 5.13

Historical Heritage Sites and Subsidence Affectation Area

File Name (A4): R21_V1/2051_289.dgn

Table 5.5 - Heritage Sites - Local Significance

Site	Description	Condition	Integrity
The Hospital Building	Site comprises a standing structure of timber frame clad in corrugated iron. The building comprises six rooms and may have been constructed by or in the style of WL Vernon, Government Architect. Thought to be the former isolation ward of the former Brentwood Hospital in Muswellbrook.	Substantially intact	Intact*
The Ruins Site	Site includes burnt remains of a slab hut and elements of associated pastoral infrastructure, including yards. The site is also notable for a substantial scatter of bottles, glass, ceramic and domestic refuse.	Ruin	None
Mills Cottage Precinct	Site is a typical late 19th to early 20th century two room cottage with rear skillion extension in two stages and a corrugated iron roof.	Substantially intact	Minor modification
Farm and Farm house, 550 Edderton Road	The farm house is a weatherboard cottage of early 20th century design with corrugated iron gable roof and chimneys removed. The house is surrounded by a shed, water tank, set of children's swings and enclosed by fencing and associated yards.	Substantially intact	Minor modification
Belmont Homestead Precinct	The homestead is an early 20th century cottage of timber frame with asbestos cement sheet cladding and corrugated iron roof. The homestead is surrounded by ancillary buildings of varied age, including a garage, meat house and tack room. More distant from the homestead are shearers' quarters and a shearing shed. The shearing shed is a large shed of timber and corrugated iron, the interior is substantially intact and showing a variety of typical details. The shearing quarters are of asbestos construction and have been completely destroyed by bushfire apart from brick chimney and fireplaces.	Intact	Minor Modification
Slab hut near Belmont homestead	A slab building relocated from its former position near Edderton Road and re-erected with corrugated metal roofing and a brick chimney.	Intact	Minor Modification
Edderton Homestead Precinct	A substantial building of single storey, timber framed with weatherboard cladding and corrugated iron roof, the house was built prior to 1915 and remains in a curtilage that is enhanced by surviving outbuildings and garden.	Intact	Intact
"Edderton Catena Heritage" site	Previously reported to consist of an arrangement of sandstone slabs and scattered evidence of pastoral settlement. Survey identified only ceramic, bottles and cross blades on site near a collapsed post and rail fence.	Archaeological Site	None

*The Hospital Building has been relocated from its original context, however none of the fabric of the building has been modified which affects its integrity or condition.

5.4.2.3 Significance Assessment

All sites identified were considered to be of local significance and no sites were assessed as having State significance.

The Hospital Building was considered to have high local significance due to its association with the former Brentwood Hospital in Muswellbrook and the possibility that it was designed by Walter Liberty Vernon, Government Architect. The building is thought be the former isolation ward and was relocated from the Brentwood Hospital site in 1972, a site which is now listed on the NSW State Heritage Register and of State heritage significance. Having been relocated, the building is no longer in context and has lost a degree of significance, however, the building remains substantially intact and is still considered of high local significance. This building is within the approved open cut mining footprint of the Bayswater No. 3 project and is proposed to be relocated prior to open cut mining proceeding as part of that consent.

The Edderton Homestead complex and Belmont Homestead complex, including the nearby slab hut, were assessed as having moderate local significance, while the remaining sites were assessed as having low local significance. All other structures within the project area associated with the historical agricultural land uses were considered to have no heritage significance.

5.4.2.4 Impact Assessment

Historic heritage sites located within the subsidence affectation area (refer to **Figure 5.13**) will potentially be subject to a range of subsidence related impacts including changes in floor level, cracking of walls, pulling apart of cladding and joints, distortion of window and door frames, service pipe disruption and visible deformation of roof and walls. No structures are predicted to collapse as a result of subsidence, however, it is possible that some sites may be rendered unsafe as a result of subsidence impacts.

The majority of Edderton Homestead complex, including the homestead building, is not predicted to be impacted by subsidence and will not be damaged by the project. Some of the outbuildings will be impacted by subsidence. The Belmont Homestead complex is located within the subsidence affectation area and will experience impacts such as those described above, except where preventive measures are undertaken as discussed in **Section 5.4.2.5**.

The Hospital Building is located in the path of approved open cut mine workings approved as part of the Bayswater No. 3 consent and will need to be relocated to avoid destruction. The remaining heritage sites listed in **Table 5.5** are also predicted to be impacted by subsidence.

5.4.2.5 Management Strategy

The Hospital Building will be relocated prior to impact from approved open cut mining activities following preparation of a management plan to identify an appropriate alternative location and opportunities for adaptive re-use, if available. The management plan will guide the ongoing management of the structure and include full archival recording undertaken to the standard of local heritage significance.

All other heritage sites listed in **Table 5.5** likely to be impacted by the project will undergo full archival recording to standards of local heritage significance prior to impact from mining operations. Sites will also be inspected by a qualified engineer to assess their structural condition prior to mining. Following undermining, sites will again be inspected by a qualified engineer to determine their structural condition and recommend remedial works, as appropriate. Sites which are found to be structurally sound will be left *in situ*, while sites found to be unsafe may be demolished.

Subsidence impact mitigation measures are proposed for the Belmont Homestead building and nearby slab hut to minimise damage caused by subsidence and, where necessary,

remedial works will be undertaken to repair damage associated with subsidence. Mitigating measures are not required for Edderton Homestead as this building will not be impacted by subsidence. The existing draft Conservation Management Plans prepared on behalf of Mt Arthur Coal for both Belmont Homestead complex, including the slab hut, and Edderton Homestead complex will be finalised prior to mining impact on these sites, to guide ongoing management of these sites.

5.5 Soil and Water Resources

5.5.1 Soils

The soil types occurring within the project area are mapped on the Singleton 1:250,000 Soil Landscapes Map Sheet (digital mapping provided by DNR, 2005) and described in Kovac and Lawrie (1991). Soil landscapes present in the project area are shown on **Figure 5.14** and include the Liddell, Bayswater, Brays Hill, Ogilvie, Dartbrook and Hunter soil landscapes. These soil landscapes consist of a range of soil types including various clays, sands and duplex soils.

The Liddell Soil Landscape is dominant across the project area and central portion of the subsidence affectation area, occurring over undulating terrain. The Bayswater landscape occurs in the northern and southern portions of the subsidence affectation area in association with drainage lines. The Brays Hill Soil Landscape is found over undulating hills in the southern portion of the subsidence affectation area.

The Ogilvie Soil Landscape is present in two locations to the east and west of the subsidence affectation area, associated with the steep slopes and escarpments of Mt Ogilvie and Mt Arthur. The Dartbrook landscape occurs to the north and west of the subsidence affectation area over undulating rises and low hills, and the Hunter landscape occurs on the floodplains of the Hunter River and tributaries to the north of the subsidence affectation area.

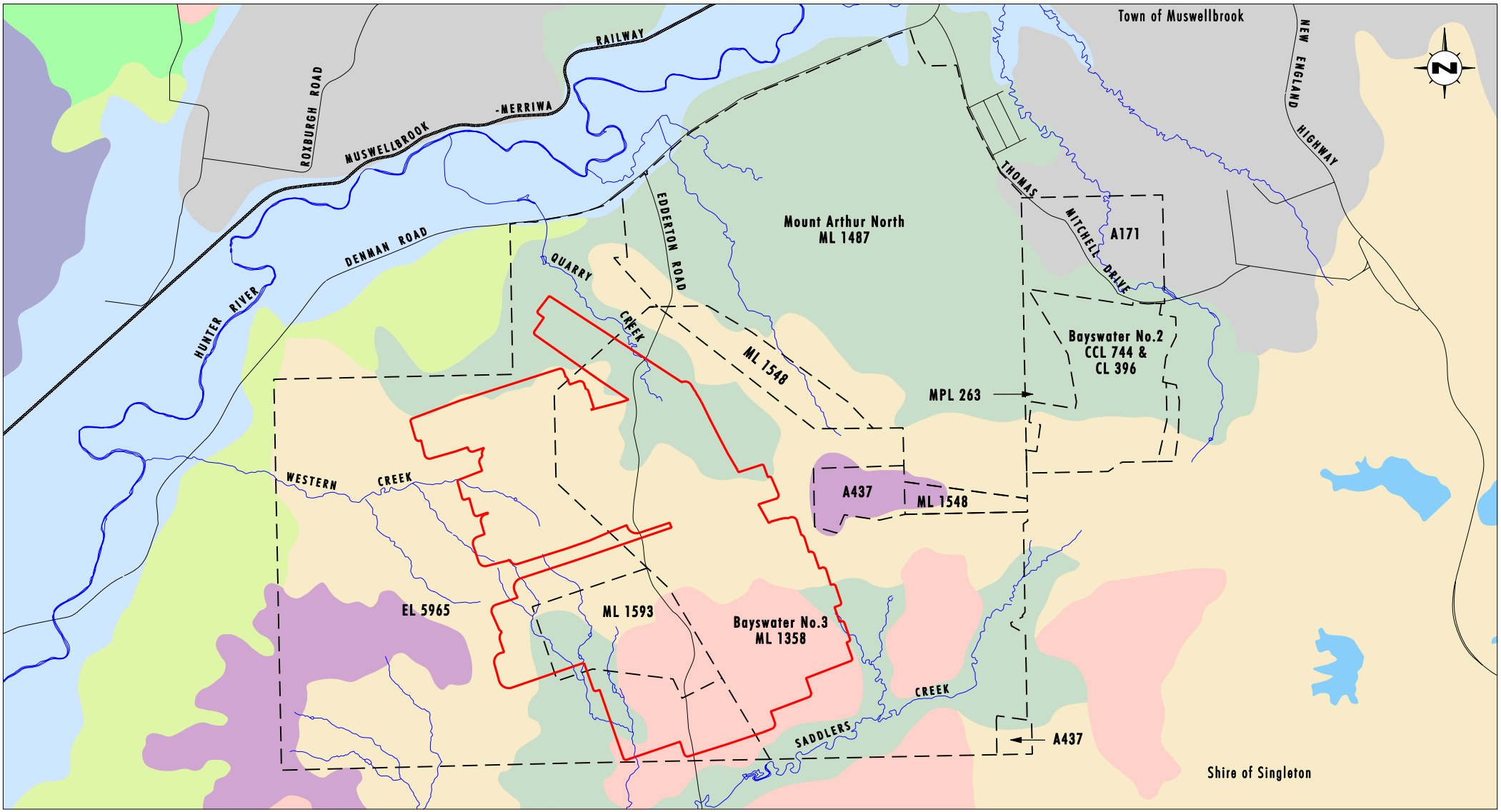
The soil landscapes which occur within the subsidence affectation area are the Liddell, Bayswater and Brays Hill landscapes. The fertility of each of these soils is low, except for the Brays Hill landscape which is generally (Kovac and Lawrie, 1991). This low fertility will need to be addressed during rehabilitation works through the use of soil ameliorants.

Erosion hazards across the soil landscapes within the subsidence affectation area are typically moderate to high, although some soil types have low erosion hazards (e.g. the majority of the Brays Hill landscape has low to moderate erodibility). The erosion potential of the various soil types within the areas to be impacted as part of the Underground Project has been considered in the assessment of surface water impacts and design of appropriate surface water management measures (refer to **Section 5.5.2**). Appropriate sediment and erosion control measures will be developed as part of detailed construction and management plans for the project and are discussed further in **Section 5.5.2.3**.

5.5.2 Surface Water Assessment

A detailed Surface Water Assessment has been completed for the Underground Project to assess the potential impact on surface water quality and quantity and is included in **Appendix 9**. A summary of the key findings is included below.

The DGRs for the project require detailed modelling of surface water impacts, a site water balance and a salinity budget be undertaken, and that a surface water contingency strategy



Source: DIPNR, 2005

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area

Soil Landscapes

- Sandy Hollow
- Castle Rock
- Dartbrook
- Brays Hill
- Hunter
- Roxburgh
- Bayswater
- Ogilvie
- Liddell
- Water

FIGURE 5.14

Soil Landscapes

File Name (A4): R21_V1/2051_255.dgn

be prepared, which details the measures proposed to protect the supply of water to landowners and the environment in the region.

The key features of the project that have the potential to impact on surface water management include:

- construction of Underground Project surface infrastructure (noting that the major infrastructure will be located in existing open cut mining areas);
- subsidence of the landform resulting in changes to the surface profile and surface cracking, and the subsequent remediation works completed so that the landform and drainage lines remain free draining; and
- changes to the existing mine water management system and water balance.

The impacts of these aspects of the project are discussed further in the following sections.

5.5.2.1 Existing Catchment

The subsidence affectation area is located within the catchments of Quarry, Western, Southern, Saddlers and South-East Creeks (refer to **Figure 5.15**). Quarry Creek, Western Creek and Saddlers Creek are tributaries of the Hunter River, while Southern and South-East Creeks are tributaries of Saddlers Creek.

The creeks within the subsidence affectation area are all ephemeral systems with flows only occurring during storm events or after prolonged periods of rain. Quarry, Western and Southern Creeks are in generally poor condition with erosion of the creek bed and banks and the majority of riparian vegetation being cleared. Saddlers Creek has significant areas of riparian vegetation present, however, there are significant erosion scarps along sections of the main creek banks. South-East Creek is generally in good condition with signs of only minor erosion in the upper and lower reaches.

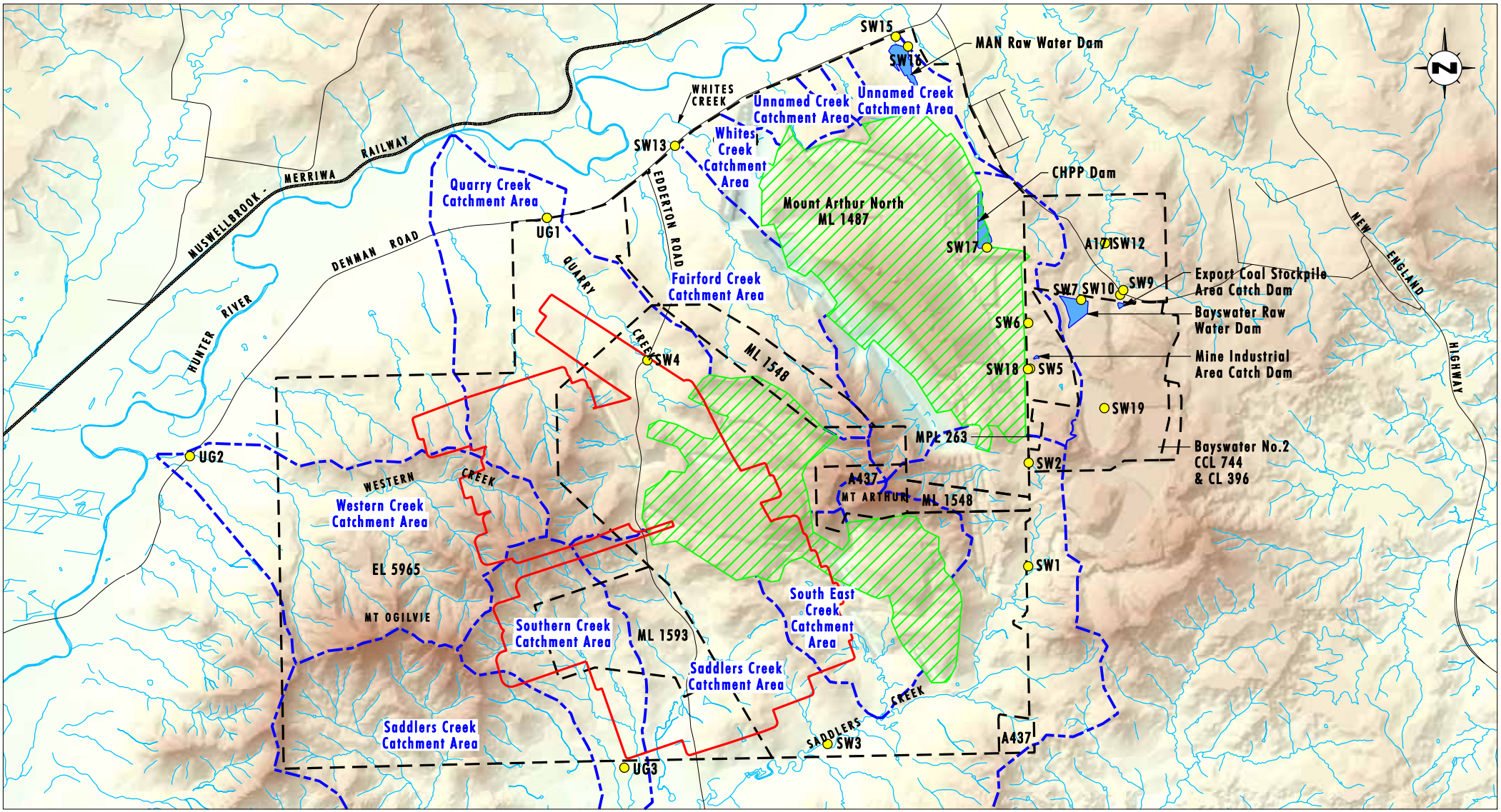
The subsidence affectation area includes approximately 39 per cent of the Quarry Creek catchment, 11 per cent of the Western Creek catchment, 56 per cent of the Southern Creek catchment, 35 per cent of the South-East Creek catchment and 10 per cent of the total Saddlers Creek catchment (refer to **Figure 5.15**).

5.5.2.2 Water Quality Monitoring

A surface water quality monitoring program has been undertaken at Mt Arthur Coal since 1995, with the program extended in 2005 to provide further baseline data for the Underground Project. Surface water quality has been monitored at 17 locations, including sites to the north, west and south of Mt Arthur Coal (refer to **Figure 5.15**) and within the mine water management system. The sites are monitored for a range of parameters including pH, electrical conductivity, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), nutrients, major ions and oil and grease.

In Quarry Creek the pH ranges from 7.6 to 9.1, and electrical conductivity ranges from 490 µS/cm to 14,630 µS/cm. When runoff occurs in the catchment area the electrical conductivity averages 8720 µS/cm in the creek.

Typically the pH in Saddlers Creek ranges from 6.7 to 8.7, with electrical conductivity ranging from 760 µS/cm to 17,000 µS/cm. When runoff occurs in the catchment area the electrical conductivity averages 5680 µS/cm in the creek.



Source: Mt Arthur Coal 2006, LPI NSW
Base Source: Mt Arthur Coal, 2006

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Catchment Boundary
- Open Cut Mining Area
- Surface Water Monitoring Locations
- Drainage Lines

FIGURE 5.15

Catchments, Surface Water Monitoring Locations and Mine Water Management System

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The results of water quality monitoring are detailed in **Appendix 9**, and indicate that water quality within the natural catchment areas of the project area exceeds the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values for pH and electrical conductivity. It is therefore considered appropriate that baseline water quality data be used as impact assessment criteria for the project rather than ANZECC trigger values.

5.5.2.3 Surface Water Management System

Existing Surface Water Management System

The existing Mt Arthur Coal water management system shown on **Figure 5.15**, captures runoff from the mining disturbance footprint including open cut mining pits, overburden emplacement areas, haul road routes and infrastructure areas. The current catchment area of the water management system is approximately 1860 hectares. This catchment area will change as approved mining activities progress, and will increase to a maximum of approximately 3100 hectares. The water captured within the mine water management system is re-used on site for dust suppression, coal processing and other mining purposes.

A series of diversion and catch drains have been constructed around the perimeter of existing open cut mining areas and emplacement areas. These drains minimise the inflow of clean water runoff from undisturbed catchment areas into the pits and prevent discharge of dirty water from the pits into surrounding creeks and drainage lines.

Runoff from active mining areas is collected in catch drains and directed through sediment dams to remove suspended sediment prior to re-use on site. Runoff from overburden emplacement areas is also collected in catch drains and directed through sediment dams prior to re-use or discharge from site.

Runoff from mine infrastructure areas is directed through diversion drains and collected in catch dams and retained for re-use in the mine water management system.

In the event that mine water needs to be discharged from the site, Mt Arthur Coal holds a licence under the Hunter River Salinity Trading Scheme (HRSTS) to discharge water to the Hunter River. This licence has not been used to date with any excess water stored on site in dams or inactive open cut mining areas for latter use during dry periods.

Underground Project Surface Water Management System

The Underground Project will utilise Saddlers and Belmont open cut pits to access target coal seams. Surface water controls within and surrounding these pits established in accordance with the existing approvals for the Bayswater No. 3 mining area will be maintained for the life of the Underground Project. To prevent surface water runoff entering the underground workings, a series of diversion drains, catch drains and sumps will be installed to safely handle runoff from a 100 year Average Recurrence Interval (ARI) storm event. Water collected in these sumps will be pumped to a central storage dam in each pit prior to re-use. Water returned from the underground workings will also be collected in the sumps.

The key water management controls for Underground Project infrastructure includes:

- the Belmont Water Dam to be constructed within part of Belmont Pit or a suitable nearby area and the storage is to be fully contained within mine-affected lands owned and managed by Mt Arthur Coal. The dam will have a capacity of approximately 180 ML, however, this may need to be varied depending on the needs of the water management system and will be used to store clean water pumped from the Hunter River. The dam is

located within the mine water management system and will have no impact on surrounding catchment areas;

- the Saddlers Pit mine water dam with a storage capacity of approximately 180 ML or as required to meet the requirements with the existing operation for peak storage demand;

- the proposed CHPP upgrade with existing controls around the CHPP providing sufficient capacity to capture and treat runoff prior to re-use on site;

- an overland conveyor from the North Saddlers ROM Facility to the CHPP. The conveyor will cross Saddlers Creek in two locations and will be designed so as to not adversely influence flood levels, flows or velocities downstream. The conveyor will be designed to minimise impacts on Saddlers Creek and surrounding drainage lines. A catch tray (or similar) will be installed on the underside of the conveyor where it passes over the creek to minimise the potential for coal spillage entering the creek. A sump will be constructed near the creek to recover spillage from the conveyor system;

- controls for the pit-top facilities including all facilities will be located within the mine water management system catchment areas and runoff from roofs and surrounds will be re-used on site. Pollution control systems will be implemented as required downstream of key facilities to manage water quality within the mine water management system (e.g. hydrocarbon management systems); and

- appropriate water management controls for ancillary surface mining infrastructure including ventilation fans, service and dewatering boreholes, sealed and unsealed access roads, pumps and drainage works and services designed in accordance with the criteria discussed in **Section 5.5.2.3** below.

5.5.2.4 Sediment and Erosion Control

The Underground Project will result in short term surface disturbance associated with the construction of infrastructure and subsidence remediation works. These works have the potential to increase sediment generation and export sediment off site. To mitigate this potential impact, erosion and sediment control measures will be implemented as part of detailed construction plans and management plans for surface infrastructure works, including major infrastructure, haul roads and services, and for all subsidence remediation works.

The sediment and erosion control measures implemented during the construction phase and detailed in site management plans will be established to a standard consistent with Managing Urban Stormwater: Soils and Construction (NSW Landcom 2004) (the Blue Book) and Guidelines for Establishing Drainage Lines on Rehabilitated Minesites (Draft) (DLWC, 1999).

The erosion and sediment control measures proposed to be adopted to control the quality of runoff from the site include:

- construction and regular maintenance of catch drains, silt fences and sediment dams to minimise sediment generation and contain sediment downslope of disturbed areas;

- clearly identifying, delineating and minimising areas required to be disturbed and ensuring that disturbance is limited to those areas. Clearing vegetation only as required to achieve the works and minimising machinery disturbance outside of these areas;

- applying gypsum, where required, to reduce the dispersibility of the subsoils that will be disturbed and to minimise the potential for tunnel erosion and surface rilling of disturbed

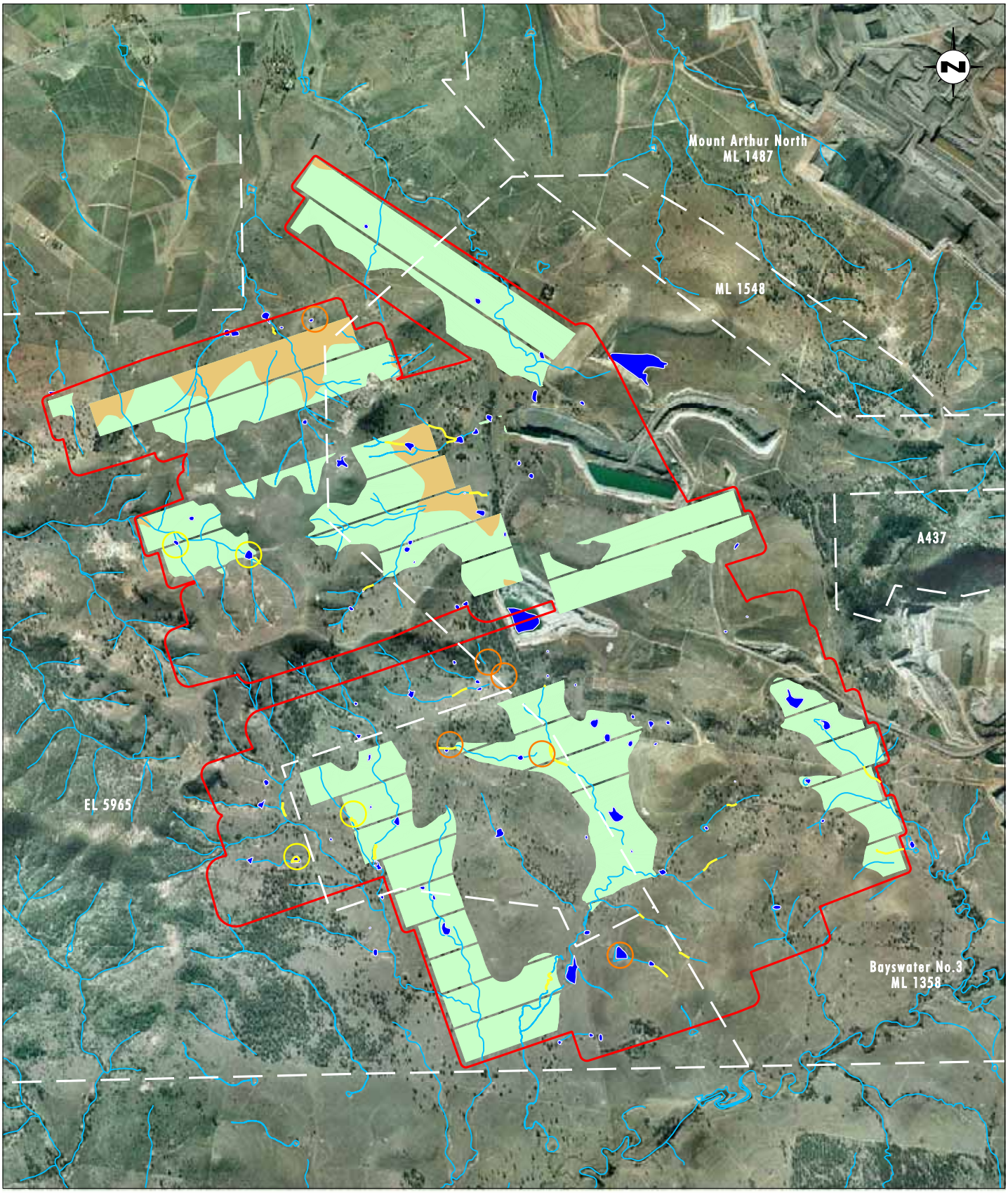
or reshaped areas. The application rate to be determined by localised soil testing as required;

- ensuring that where possible all drainage and sediment and erosion control works are designed and constructed to be free draining to minimise the potential for ponding, infiltration and tunnel erosion;
- establishing a stable vegetative cover on all areas as soon as possible and regularly maintaining these areas;
- construction of drains upslope of areas to be disturbed to convey clean runoff away from most disturbed areas;
- diversion of surface and road runoff away from disturbed areas where possible;
- constructing access road and earthworks cut and fill batters at slopes (of 1V:3H or less, where possible) to maximise long term stability;
- limiting the number of roads and tracks established;
- reshaping, topsoiling and vegetating road and cut and fill batters as soon as practical;
- rehabilitating disturbed areas as soon as possible;
- where significant subsidence remediation work is required, progressively stripping and stockpiling topsoil where possible, for later use following remediation earthworks;
- where necessary, placing sediment fences around the downslope batter of all topsoil stockpiles; and
- revegetate stockpiles that are to remain undisturbed for periods of greater than six months.

5.5.2.5 Subsidence Impacts and Management

Subsidence of the landform due to underground longwall mining has the potential to impact on surface water drainage and drainage management structures such as dams, road and culverts. Analysis of subsidence predictions for the Underground Project (refer to **Section 5.2**) indicates that there will be no significant change to existing catchment boundaries as a result of subsidence. However, where subsidence is predicted beneath existing drainage lines, there is the potential for increased in-channel and out-of-channel ponding during runoff events. In areas where the depth of cover is less than 100 metres (refer to **Figure 5.16**), there is the potential for irregular subsidence profiles and interconnected cracking between the surface and mine workings. This risk is greatest in areas with less than 50 metres depth of cover (refer to **Figure 5.16**). Where adverse drainage impacts occur, subsidence remediation and drainage works will be required to restore drainage flows, rectify any increased out-of-channel ponding and close cracks at the surface. The drainage lines predicted to be subject to subsidence impacts are all ephemeral and flow only after significant rainfall events. The affected drainage lines are primarily first and second order drainage lines with only a small number of third order drainage lines affected (refer to **Appendix 9**).

Subsidence will also affect Edderton Road and its associated drainage infrastructure and a number of farm dams, the majority of which are on Mt Arthur Coal owned land. Subsidence



Source: Mt Arthur Coal, 2006 and MSEC 2007

0 0.5 1 2km
1:45 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Mt Arthur Coal Owned Farm Dams Potentially Requiring Spillway Works
- Privately Owned Farm Dams Potentially Requiring Spillway Works
- Areas with Potential Changes to Drainage
- Dam

FIGURE 5.16

Potential Subsidence Remediation Areas and Surface Water Drainage System

remediation works will be required to maintain road drainage and to reshape some dam spillways and embankments where subsidence impacts occur.

In order to manage the effect of subsidence and drainage line remediation works on surface water systems, detailed drainage line monitoring and remediation protocols will be developed as part of the SMP process and in consultation with DWE. These protocols will be revised as mining progresses and site specific subsidence monitoring data and experience is obtained and will include:

- monitoring of subsidence impacts on drainage lines;
- an increased monitoring frequency for drainage lines in areas with lower depths of cover (e.g. less than 100 metres depth of cover);
- a program to complete drainage remediation works in a timely manner post subsidence to limit the potential for surface water capture;
- details of the design of drainage line remediation works such that the rehabilitated drainage lines maintain a similar channel form and sinuosity to the pre-mining environment, to ensure that the overall erosive power of the creek system is consistent with that existing pre-mining;
- management of surface water runoff post subsidence until the completion of any required remediation work and effective rehabilitation;
- sediment and erosion controls and construction of sediment dams/controls downstream of disturbed areas as required to collect sediment;
- potential use of temporary dams upstream of predicted subsidence impact areas to control flows until remediation works can be completed;
- a review of the potential to undertake proactive measures such as installing liners or geo-fabrics in drainage lines prior to subsidence to minimise its impact on flow;
- treatment of soils with gypsum, if required, to reduce dispersibility;
- revegetation (including planting of native tree species) and maintenance of disturbed areas following the completion of any required reshaping works and fencing of the riparian zone to protect the drainage line and enhance ecological function; and
- preparation of guidelines for the remediation of potential worst case (i.e. shearing) subsidence failure in areas with depth of cover less than 50 metres (refer to **Figure 5.16**), incorporating additional contingency measures such as increased monitoring frequency in at-risk areas, ensuring availability of earthworks equipment to allow timely remediation and regular review of the effectiveness of drainage controls.

5.5.2.6 Water Balance

Existing Water Balance

The primary sources of water supply to Mt Arthur Coal are catchment inflows to open cut mining areas, groundwater make and water sourced from external supplies. Current external supply sources include:

- treated effluent from MSC, with an available supply expected to be on average 750 ML/year, depending on meteorological conditions and potentially up to 900 ML/year;

- recycled water from neighbouring industrial sources, with supply in previous years ranging from 50 to 615 ML/year, depending on meteorological conditions;

- Mt Arthur Coal's Water Access Licences (WALs) for the Hunter Regulated River Water Source, which as at January 2007, consisted of 3107 unit shares of regulated river (general security) and 342 unit share of regulated river (high security) access licences. Mt Arthur Coal is also currently finalising acquisition of additional WALs totalling 950 general security shares to meet demand for the existing operation.

  The amount of water that can be extracted from the Hunter Regulated River Water Source using these licences varies depending on the Available Water Determinations set by the NSW Government. At full supply levels, 1 ML of water can be extracted for each unit share. At minimal supply levels in all but the worst case drought years an allocation of 75 per cent of high security and 0 per cent of general security can be expected. During uncontrolled flows, up to 100 per cent of both high and general security can be accessed. For Mt Arthur Coal's current WALs, and depending on frequency of uncontrolled flow events, this equates to a total controlled and uncontrolled water supply in periods of minimum allocation of approximately 3450 ML/year (or 4400 ML/year including the 950 general security shares currently being acquired); and

- potable water from MSC as required.

Mt Arthur Coal has a defined hierarchy of water use, and aim to use water sourced on site in preference to importing water from external sources (refer to **Figure 5.17**). This on-site water includes catchment runoff, groundwater inflows, recycled water and water stored on site in pits and dams. If water is required to be imported to site to meet operational requirements treated effluent from MSC and recycled industrial water (e.g. from Drayton Mine) are the preferred sources (refer to **Figure 5.17**). If excess water is available from these sources it may be used to maintain site water storage levels. If additional water is required on site, water is extracted from the Hunter Regulated River Water Source utilising Water Access Licences (WALs).

Current water demands for the Mt Arthur Coal operations include:

- CHPP water demand of 174 Litres per tonne ROM open cut coal;

- haul road dust suppression, with the level of demand depending on climatic conditions and use of dust suppressants;

- stockpile dust suppression and plant washdown water; and

- potable water demand.

Losses also occur due to evaporation from dam surfaces which vary with climatic conditions.

Modelling of the existing Mt Arthur Coal (including the proposed South Pit Extension Project) mine water balance was undertaken for a range of meteorological conditions including dry (10^{th} percentile), average and wet (90^{th} percentile) rainfall years. The results, assuming no external water supply, indicate that the existing site water balance at peak net water demand may consist of a water deficit of approximately 3235 ML/ year for the worst case rainfall year on record and 2660 ML/year in a dry rainfall year. Mt Arthur Coal has trialled the use of alternate water-saving dust suppressants in recent years with success in significantly

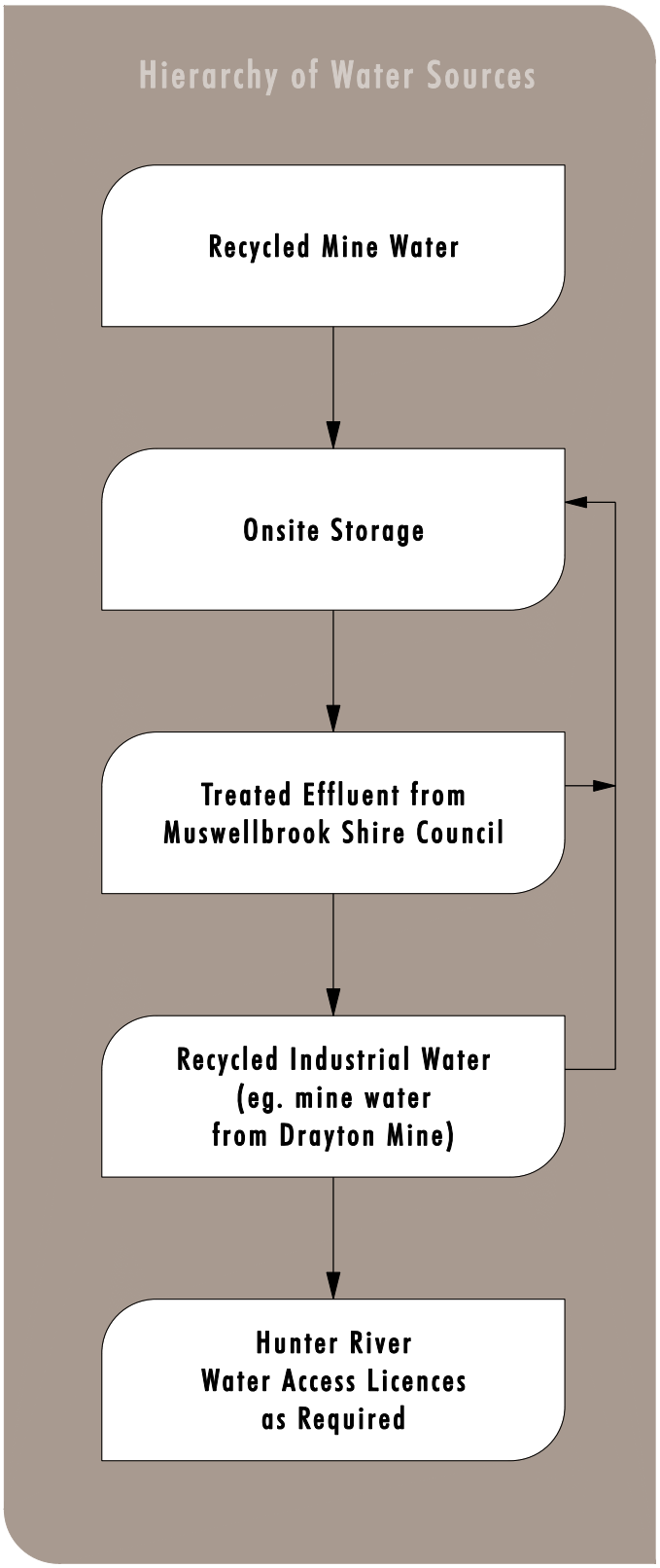


FIGURE 5.17

Hierarchy of Water Sources

reducing water consumption. With the use of dust suppressants in dry periods, this deficit can be reduced by up to 760 ML/year. In a wet year, the site may experience a surplus of up to approximately 1920 ML/year.

When taking into account the use of water stored on site during periods of higher rainfall, the use of haul road dust suppressants and the currently available external supply sources, it is predicted that the existing Mt Arthur Coal operation, including the proposed South Pit Extension, has access to sufficient water to meet the predicted water deficits.

Mt Arthur Coal is also currently investigating access to a range of new external non-potable (e.g. industrial or effluent) water supplies. If these investigations prove successful, then this would enhance the site's ability to successfully manage operations during extreme dry weather conditions whilst also reducing the reliance on external water supplies in these times.

Underground Project Water Balance

The Underground Project has the potential to impact on the existing Mt Arthur Coal water balance by:

- increased water supply through groundwater inflows into the underground workings;
- increased CHPP water demand due to increased coal production;
- water demand for underground mining equipment and underground project surface facilities; and
- increased potable water demand for the increased workforce.

The Underground Project will not result in significant changes to the catchment area of the mine water management system. As part of the project, new water storage dams will be built on site within the Belmont Pit and Saddlers Pit mining areas, with a combined storage capacity of approximately 360 ML and a surface area of approximately 17 hectares. This will increase the evaporative area of site water storages from approximately 35 hectares to approximately 52 hectares.

Groundwater supplies to Mt Arthur Coal will increase as a result of the project, with inflows to the underground workings (or from pre-draining via dewatering boreholes) predicted to varying between 355 ML/year and 2057 ML/year (refer to **Section 5.5.3**).

Water demands will increase as a result of the Underground Project, and will include the following water sinks:

- CHPP demand of 115 L/t ROM underground coal;
- underground development water of up to approximately 82 ML/year;
- underground longwall water of up to approximately 437 ML/year, with up to approximately 100 ML/year recovered for re-use on site;
- underground conveyor water of up to approximately 140 ML/year;
- underground surface facilities and general water of up to approximately 22 ML/year; and
- potable water demand increase by approximately 7 ML/year.

The water required for underground mining equipment must meet specific quality standards to ensure the equipment operates effectively. This will require water of suitable quality being handled separately to other mine water and may require water treatment measures to be implemented.

Modelling of the revised mine water balance, incorporating the Underground Project, was undertaken for a range of meteorological conditions including dry, average and wet rainfall years. The results, assuming no external water supplies, indicate that the site water balance may consist of a water deficit of approximately 3542 ML/year for the worst case rainfall year on record and 2920 ML/year for a dry rainfall year. This deficit can be reduced by up to 760 ML/year by use of haul road dust suppressants. In a wet year, the site is predicted to experience a surplus of up to approximately 2620 ML/year.

The predicted maximum water deficit is in the order of approximately 350 ML/year higher than that predicted for the existing open cut operation alone and is primarily due to increased coal production.

When taking into account water stored on site during periods of higher rainfall, the use of haul road dust suppressants and the currently available external supply sources, it is considered that the Mt Arthur Coal operation, including the proposed South Pit Extension and Underground Projects, can access sufficient water to meet the predicted worst case dry year water deficit. As discussed above, Mt Arthur Coal is also currently investigating a range of additional potential external supply sources from industrial sources and effluent re-use. Based on the modelling undertaken, however, the project will not require any further WALs for the Hunter Regulated River Water Source. Further contingency measures relating to management of Mt Arthur Coal's overall water balance are discussed in **Section 5.5.2.8**.

Salinity Budget

The currently approved Mt Arthur Coal complex is predicted to potentially require discharges of mine water from the site during wet rainfall years towards the end of the approved mine life. Discharges are only likely to be required if consecutive wet years occurred and when available storage volumes had been used, and have not been required by Mt Arthur Coal to date. Any discharges required would be in accordance with the HRSTS.

An analysis of the salt balance for existing and proposed operations indicates that the Underground Project will continue to result in a significantly lower salt export from the site compared to the estimated pre-mining catchment area salt export. The mining operation actually acts as a salt sink and captures salt that, if the mine was not present, would have run off from natural catchment areas to the Hunter River.

Modelling of the water balance within the final open cut voids for Belmont Pit and Saddlers Pit (refer to **Section 5.10**) indicate that the voids will reach equilibrium well below the maximum void storage volume and water will not spill from these voids into the surrounding environment. These voids will therefore continue to act as a salt sink post mining.

5.5.2.7 Cumulative Impacts

Potential cumulative surface water impacts associated with the Underground Project relate to:

- demand for water from the Hunter Regulated River Water Source;

- surface disturbance associated with construction and subsidence remediation works potentially resulting in increased sediment generation and deposition in surrounding catchments;

- subsidence potentially resulting in increased ponding and reduced runoff within the subsidence affectation area and a resultant reduction in runoff to surrounding catchments; and

- potential changes in salt balance.

The water required to meet the operational and dust suppression requirements of the combined Mt Arthur Coal operations, including the Underground Project, will continue to be sourced from catchment inflows, groundwater make and external supplies, including MSC effluent, neighbouring industries, the Hunter River and Muswellbrook Shire potable water supply. Extractions from the Hunter River will be in accordance with WALs and Water Sharing Plan for the Hunter Regulated River Water Source. The NSW government manages extraction from the Hunter River under the Water Sharing Plan to ensure that environmental flows maintained and therefore extractions undertaken in accordance with this plan are not predicted to result in adverse cumulative impacts. Based on current predictions, no new WALs will be required to accommodate the Underground Project.

Subsidence impacts are not predicted to result in significant changes to catchment boundaries and appropriate subsidence remediation work will be undertaken to prevent significant changes in ponding and prevent capture of surface runoff due to surface cracking. Sediment and erosion control measures are proposed to prevent significant impact on downstream water quality due to subsidence impacts and associated remediation works. Sediment and erosion control measures will also be implemented for all project infrastructure.

Discharges of mine water from the site, if required, will continue to be managed under the HRSTS and the net salt load exported from the site will remain significantly lower than the surrounding natural catchment areas.

On this basis it is considered that the project will not result in adverse cumulative impacts on water use, flows or qualities in the surrounding areas.

5.5.2.8 Surface Water Monitoring

Mt Arthur Coal's surface water monitoring network has been extended to incorporate monitoring for the Underground Project, and now includes 17 sites (refer to **Figure 5.15**). The surface water monitoring and reporting program will continue during the construction and operational phases of the project and once operational, water storage dams and major sediment dams will also be monitored.

All monitoring results will be reported in the Mt Arthur Coal Annual Environmental Management Report (AEMR) and will be used to review the effectiveness of the Mt Arthur Coal water management system on an ongoing basis. Water usage, external sourcing, rainfall on site, dam volumes and discharges from the site will also continued be monitored for the entire operation to enable management of the water system. Details of the Mt Arthur Coal operations water balance will also be reported annually in the AEMR.

5.5.2.9 Contingency Measures

An annual analysis of surface water monitoring data will be undertaken and will include time series analysis to identify any trends or changes in surface water quality. Should any

negative trends in water quality be identified, an investigation will be implemented to determine if the trend is a result of Mt Arthur Coal's operations. Where required, management strategies will be implemented to address the identified issues. The monitoring results and trend analysis will be reported to DWE and DoP as part of the AEMR.

Surface water management structures will be designed in accordance with the Blue Book (Landcom, 2004) and Guidelines for Establishing Drainage Lines on Rehabilitated Minesites (Draft) (DLWC, 1999) or subsequent revisions. Ongoing inspections will be undertaken of water management structures to ensure that they are operating effectively and have sufficient capacity to meet water management objectives. Should any deficiencies in the water management system be identified through these inspections, rectification works will be undertaken to resolve identified issues.

Water Balance Contingency Measures

The Mt Arthur Coal complex will range from being a net water user to being a net water maker over the Underground Project life. As a consequence, there is considerable flexibility in managing the volume of water that is stored on site and that is imported to the site. There is also reasonable flexibility in where water is sourced providing a wide range of contingency measures that can be implemented. These include varying the rate that water is drawn from external supplies and, if necessary, purchasing additional water access licences and/or seeking new sources of industrial water or recycled effluent.

In addition, Mt Arthur Coal acknowledges that sustained periods of water deficit during consecutive dry years may require modifications to mining operations to reduce water demands on site during these periods. These modifications may include:

- reduction of haul road lengths;
- increased application of alternate haul road dust suppressants;
- reduction of storage dam surface areas or evaporation from dam surfaces;
- concentration of mining operations to underground operations during sustained dry periods as underground mining requires less water per tonne of ROM coal than open cut mining;
- delays in the commencement of underground mining to minimise overall water demand; and/or
- changes to volume of coal processed.

In addition to the contingency measures listed above Mt Arthur Coal acknowledges the need for high quality water to be used in the underground mining machinery. It is intended to utilise high quality water from MSC treated effluent for this purpose. If high quality water is not available from MSC treated effluent or under Mt Arthur Coal's WALs, Mt Arthur Coal will utilise water from the Hunter River and/or establish a water treatment plant on site that will be capable of treating and producing the required volume of water. Prior to establishing such a plant, discussions will be held with DWE and DECC and all necessary licences will be obtained.

There are also several contingency options available regarding water quality treatment for the re-use or discharge of water during extended wet periods. If additional treatment of water is required there is sufficient area able to be allocated on site to increase the treatment time/treatment area of site runoff. In addition, flocculation could be used to assist in settling

clay particles prior to re-use or discharge of water. It is proposed that the site may manage excess water by increasing storage capacity on a temporary basis, including cooperatively working with neighbouring mining and industrial landowners, or by discharges from the mine water management system in accordance with the HRSTS.

5.5.3 Groundwater

A comprehensive assessment of groundwater impacts associated with the Underground Project has been undertaken by Mackie Environmental Research. The full assessment report is included in **Appendix 10**, with a summary provided below.

5.5.3.1 Existing Groundwater Environment

Three broadly defined groundwater aquifer systems occur within the vicinity of the project area; the coal measures where coal seams are more permeable than surrounding rock types, the regolith (soils and weathered rock) which is just below the surface and which acts as a water store during periods of extended rainfall, and the alluvial lands associated with the Hunter River, Saddlers Creek and subsidiary drainages.

The coal measure aquifers are mostly confined aquifers which are sustained by rainfall percolation from the shallow regolith. Rainfall recharge percolates downwards from the regolith at a reducing rate as increasing confinement and reducing permeability impedes flow. This vertical flow regime is predominantly fracture flow, where pathways depend upon fracture and joint connectivity within the rock strata.

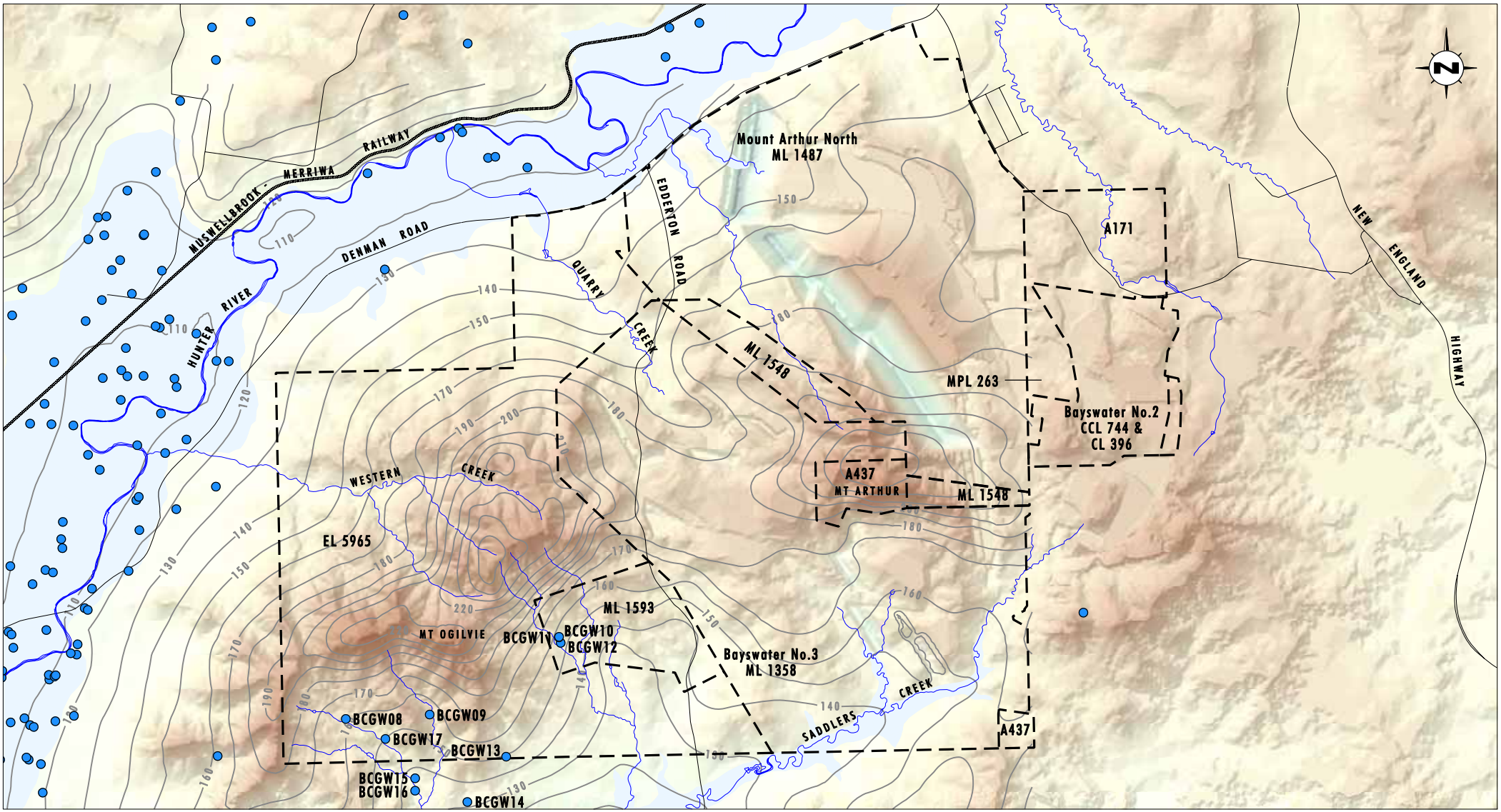
The Hunter River to the north of the project area and Saddlers Creek to the south, act as drainage sinks, with the associated alluvial lands made up of unconsolidated silts, sand and fine gravels acting as shallow unconfined aquifers (refer to **Figure 5.18**). Useful groundwater supplies (from wells and bores) are sourced from areas of the Hunter River alluvial aquifer to the north and west of the project area. Groundwater is not extracted from the Saddlers Creek alluvial zone within the vicinity of the project area.

The groundwater surface within the project area and surrounds is a reflection of surface topography, with a groundwater mound beneath the topographically elevated areas of Mt Arthur, Mt Ogilvie and the major ridgeline connecting these two areas (refer to **Figure 5.18**). The hydraulic gradient falls towards the Hunter River to the north of the project area and Saddlers Creek to the south (refer to **Figure 5.18**).

The groundwater quality within the project area is consistent with regional groundwater qualities. In general, groundwater quality within the alluvial lands and coal measures is brackish to saline, while water quality within the regolith is variable from fresh to saline. Most groundwater within the project area has limited beneficial use when compared to Australian and ANZECC guidelines, with the exception of some less saline groundwaters with potential for use in stock watering.

5.5.3.2 Groundwater Users

There are a number of privately owned bores within the vicinity of the project area which are subject to varying degrees of condition and use. The locations of these bores are shown on **Figure 5.18**. The highest density of privately owned bores is located more than three kilometres west of the underground mine footprint in the alluvial lands of the Hunter River. Bores beyond the alluvial lands draw groundwater from the regolith and underlying coal measures, three such privately owned bores are located within the underground mine footprint.



Base Source: Mt Arthur Coal, 2006
Source: Mackie Environmental Research, 2007

Legend

- Mining and Exploration Lease Boundary
- Hunter River / Saddlers Creek Alluvial Aquifer
- Pre-mining Piezo Surface Contours
- Groundwater Bores (excluding bores owned by Mt Arthur Coal)

FIGURE 5.18

Pre-Mining Groundwater Environment

5.5.3.3 Groundwater Impact Assessment

A computer based mathematical model was developed in order to understand the likely groundwater impacts of the Underground Project. The model covered an area of 400 km^2 and was carefully designed to represent the Hunter River, Saddlers Creek, other regional drainages, the alluvial aquifers and coal measures, open cut operations and underground mining in all seams. Model simulations were completed for all mining operations over the 21 year conceptual mine plan and for groundwater recovery over a period of 100 years following cessation of mining.

The key groundwater impact assessment findings are summarised below.

Mine Water Seepage

Total mine water seepage into the active underground mining operation is predicted to steadily increase over the period of mining from an initial rate below approximately 0.5 ML/day during entry and development in the Woodlands Hill Seam, to a rate of approximately 6 ML/day on completion of mining in the Piercefield Seam at the end of the 21 year mining approval sought as part of this project.

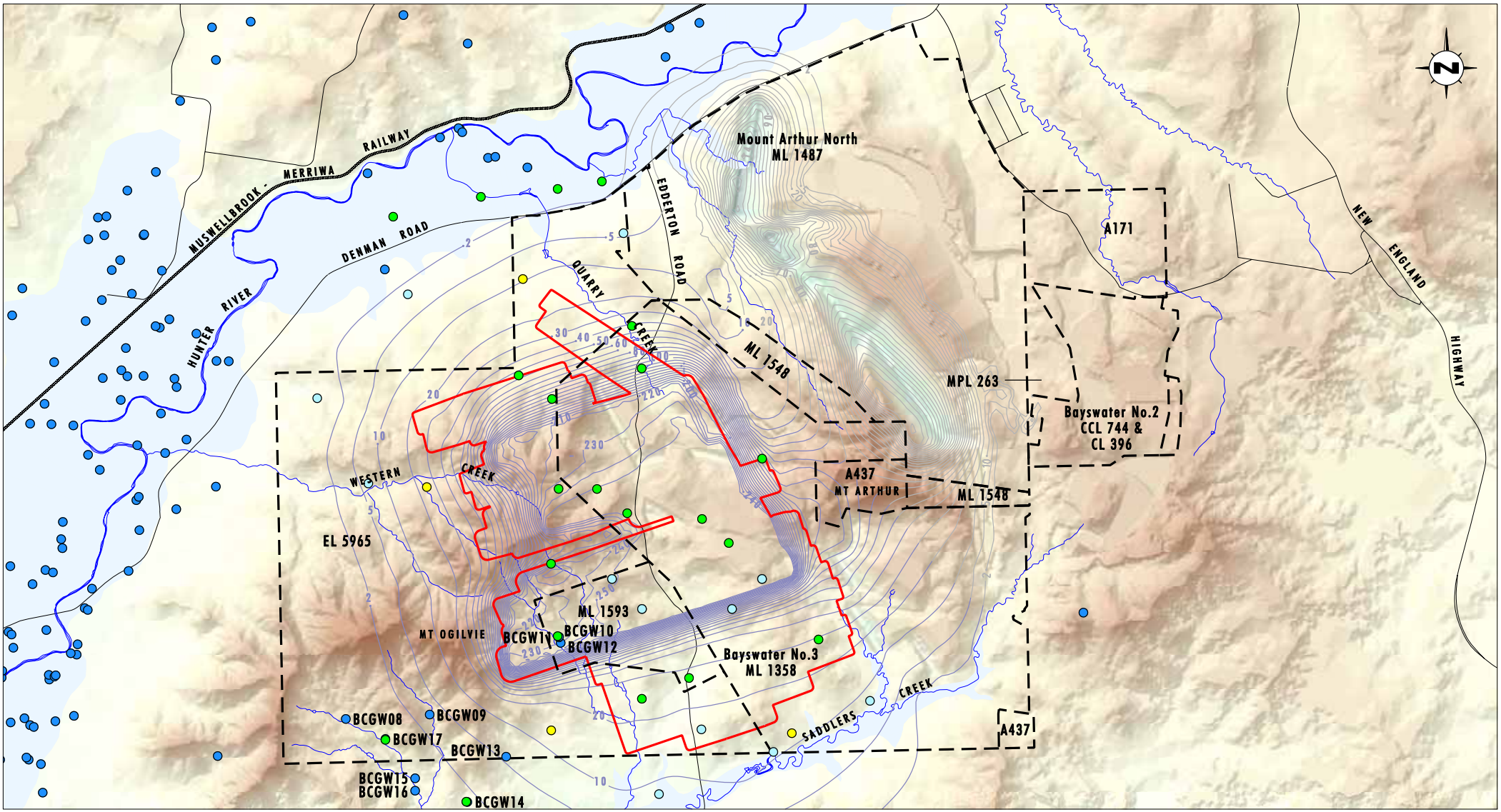
Change in Regional Aquifer Pressures

The project will extract coal from below the prevailing regional water table and will therefore result in depressurisation of the coal seam being mined and the strata above and below mined seams.

At the completion of mining in the Piercefield Seam, the predicted pressure loss extends beyond the mine panel footprint up to a distance of three to four kilometres in most directions. **Figure 5.19** shows the regional drawdown of the water table at the completion of mining at the depth of the Piercefield Seam. At this depth, the northern limit of the depressurisation extends to the edge of, but not below, the Hunter River alluvium, while the southern limit of depressurisation extends beneath Saddlers Creek. Depressurisation beneath Saddlers Creek is, however, at a depth of more than 300 metres and is therefore unlikely to impact upon pressure and flow distributions within shallower strata or the Saddlers Creek alluvial aquifer.

In contrast, **Figure 5.20** shows the maximum predicted drawdown of the water table within the shallow unconfined regolith at the completion of mining. Depressurisation within this zone has the potential to impact on shallow existing groundwater bores and surface drainage systems, therefore **Figure 5.20** provides a useful reference for impact assessment purposes. As shown on **Figure 5.20**, the regional extent of pressure losses in the shallow regolith is generally restricted to within the underground mine footprint, where loss of the water table is predicted via vertically downwards drainage induced by subsidence cracking. Water table losses of the order of five to 20 metres are predicted over the southern part of the mine panel footprint, while losses of approximately 40 to 50 metres are predicted over the northern part of the footprint, where there is predicted to be reasonably direct connection with the Glen Munro seam workings.

Pressure losses within the regolith will encroach on the outer edge of the Saddlers Creek alluvium where it extends to the north along a tributary. This tributary is approved to be impacted by open cut mining as part of the Bayswater No. 3 project. The area of impact on this tributary will be minimal, with predicted head losses in the order of two metres or less. Impacts within this zone may be minimised by undertaking a program of shallow crack repair. Beyond the subsidence affectation area, the shallow water table or zone of unsaturated flow



Base Source: Mt Arthur Coal, 2006
Source: Mackie Environmental Research, 2007

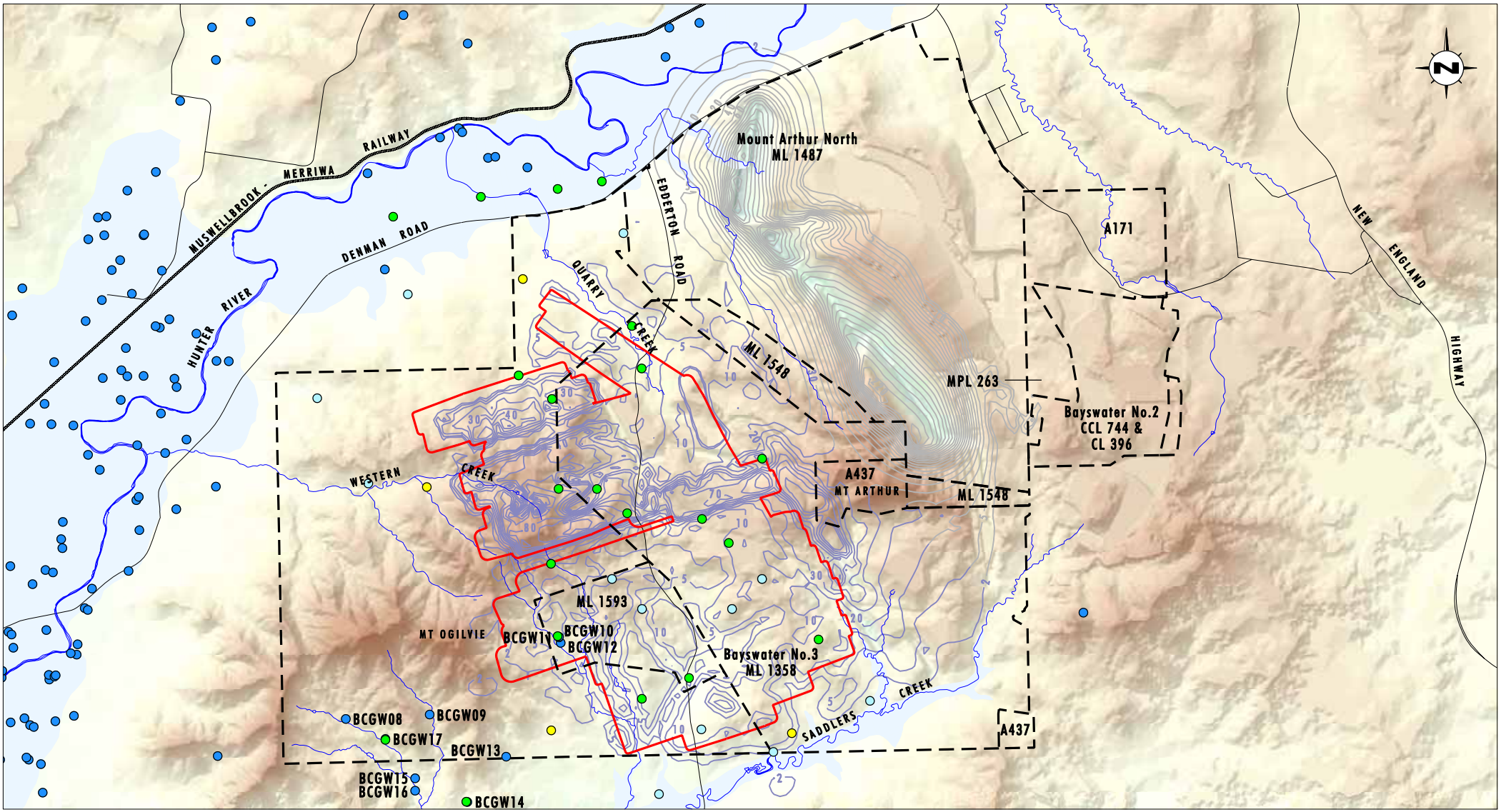
Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Hunter River / Saddlers Creek Alluvial Aquifer
- Head Loss in metres (Underground Mine)
- Head Loss in metres (Open Cut Mine)
- Groundwater Bores (excluding bores owned by Mt Arthur Coal)
- Proposed Dual Standpipe Piezometer
- Proposed Multilevel Vibrating wire Piezometer
- Existing Underground Project Monitoring Location

FIGURE 5.19

Groundwater Drawdown in the Piercefield Seam at the end of Underground Mining

File Name (A4): R21_V1/2051_291.dgn



Base Source: Mt Arthur Coal, 2006
Source: Mackie Environmental Research, 2007

0 1 2 4km
1:90 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Hunter River / Saddlers Creek Alluvial Aquifer
- Head Loss in metres (Underground Mine)
- Head Loss in metres (Open Cut Mine)
- Groundwater Bores (excluding bores owned by Mt Arthur Coal)
- Proposed Dual Standpipe Piezometer
- Proposed Multilevel Vibrating wire Piezometer
- Existing Underground Project Monitoring Location

FIGURE 5.20

Groundwater Drawdown in the Shallow Regolith Zone at the end of Underground Mining

File Name (A4): R21_V1/2051_292.dgn

is predicted to be maintained essentially through long term rainfall recharge to, and storage within, the regolith.

Impacts on Alluvial Lands

Depressurisation does not extend beneath the Hunter River alluvium and therefore the Hunter River alluvial zone will not be impacted by the Underground Project.

Vertical leakage between the Saddlers Creek alluvium and the underlying coal measures may, however, be affected. Analysis of fluxes indicates a pre-mining net upward seepage from the coal measures to the Saddlers Creek alluvium in the vicinity of the project area in the order of 0.34 ML/day, or 0.1 L/day/square metre. At the cessation of mining, the net upward flux would continue at a reduced rate of 0.26 ML/day. No large scale reversal to downward leakage is indicated, hence the alluvial lands associated with Saddlers Creek are expected to continue to receive saline seepage from the coal measures and to remain relatively unimpacted by the proposed mining.

Change in Groundwater Quality

There is no change in regional groundwater quality predicted as a result of the Underground Project.

Loss of Groundwater Yield at Existing Bore Locations

The location of existing private bores in the project area and surrounds is shown on **Figure 5.18**. Those bores located within the Hunter River alluvial lands will not be affected by the project. Bores considered to be vulnerable to loss of groundwater yield as a result of the project are located within, and to the west of the mine panel footprint, with five privately owned bores (owned by the same landholder) predicted to be impacted. **Table 5.6** summarises the potential losses experienced by the five privately owned bores considered to be vulnerable. As shown in **Table 5.6**, only one of those bores is currently used.

Table 5.6 - Privately Owned Bores Considered to be Vulnerable to Loss of Groundwater Yield

Identifier	Owner	Status	Depth (m)	Potential Head Loss (m)
BCGW09	Private Landholder 2	Dry	36	4
BCGW13	Private Landholder 2	Dry	-	5
BCGW10	Private Landholder 2	Not equipped – not currently used	-	>30
BCGW11	Private Landholder 2	Used for dam	41	>30
BCGW12	Private Landholder 2	Poor supply – not currently used	43	>30

Three of the privately owned bores are located above the underground mine footprint, only one of which (BCGW11) is currently in use (refer to **Figure 5.19**). It is predicted that this bore will experience maximum head loss of greater than 30 metres and suffer from blockages and reduced capacity due to subsidence impacts at this location. It is expected that post mining, this bore will no longer be usable and a replacement supply will be required.

Mt Arthur Coal has consulted with the owner of the five bores predicted to be impacted by the project. This has included providing the owner with a PPP outlining the impact of the project on their bores. Mt Arthur Coal has committed to providing an alternative water

supply, as required, to replace the supply from any impacted bores. As discussed in **Section 5.2.4**, the private bores will be monitored during mining to allow impacts to be identified.

Rising Aquifer Pressure Post Mining

Modelling indicates that it will take more than 50 years for groundwater levels and pressures within the depressurised area to substantially rebound and approach equilibrium. However, full recovery may not be achieved due to large voids associated with the MAN open cut operations to the north-east likely to act as evaporative sinks in the very long term. As discussed in the EIS (URS, 2000) prepared for the approved MAN mining areas, these sinks will retain a depressed water level relative to pre mining conditions and are likely to influence strata pressures within the Underground Project area.

5.5.3.4 Groundwater Monitoring and Management

The existing Mt Arthur Coal groundwater monitoring network has been established to identify depressurisation of the shallow coal measures, potential indirect impacts on alluvial aquifer systems associated with the Hunter River and changes to groundwater hydrochemistry induced by regional depressurisation. An additional 17 monitoring bores will therefore be established to monitor the impacts of the Underground Project on the coal measures and shallow strata near and beneath the Hunter River, Saddlers Creek and other surface drainages (refer to **Figures 5.19** and **5.20**).

All existing and proposed bores will be monitored quarterly for water level with selected bores being monitored daily for water level via auto recorders. All existing and proposed bores will be monitored quarterly for pH and electrical conductivity and selected bores will be monitored six-monthly for total dissolved solids and speciation of samples. Volumetric monitoring of water pumped into and out of the underground workings will also be undertaken.

Impacts on existing private groundwater bores will be determined by monitoring. In the event that any utilised privately owned bore is significantly affected, an alternative water supply will be provided by Mt Arthur Coal and the bore repaired or re-established at a suitable location, or an alternative supply provided.

Further detail regarding the proposed monitoring program, including the location of existing and proposed monitoring bores, is provided in **Appendix 10**.

5.5.3.5 Groundwater Contingency Strategy

An annual analysis of groundwater monitoring data will be undertaken and will include a comparison to modelled groundwater impact predictions. The monitoring results and comparison findings will be reported to DWE and DoP as part of the AEMR.

Contingency measures for any identified negative impacts beyond those predicted may include replacement of water supply or relinquishment of groundwater or surface water allocations as an offset to monitored leakage from the alluvial aquifers in excess of predictions.

5.6 Noise

A comprehensive noise assessment was completed for the project by Wilkinson Murray Pty Limited. A summary of the key findings of the assessment is included below, with the full assessment report included in **Appendix 11**.

5.6.1 Existing Acoustic Environment

Mt Arthur Coal has an extensive noise monitoring system in place, including real-time directional noise monitoring and periodic noise monitoring undertaken on a quarterly basis. The status of compliance with noise limits is reported externally to the community and relevant government agencies as part of the Mt Arthur Coal AEMR.

This monitoring has confirmed that the existing acoustic environment surrounding the MAN and Bayswater No 3 mining areas is affected by a range of mining and non-mining activities. These include mine truck haulage, overburden handling and dumping, mine dozer activities, coal handling and rail transport, public road traffic, construction noise, residential area noise, agricultural activities and natural sources such as birds and insects.

In 2006, periodic noise monitoring found that noise from the operation exceeded the relevant noise limits on two occasions (once at Yammanie and once at South Muswellbrook). The exceedances were in the order of 1 decibel and were recorded under adverse weather conditions during winter nights. These results follow no noise limit exceedances in 2005 and two noise limit exceedances in 2004 (Mt Arthur Coal, 2007). Mt Arthur Coal manages exceedances in accordance with the requirements of the MAN Noise Management Plan to minimise the potential for recurrences.

Directional noise monitoring results from 2006 also identified that Mt Arthur Coal is generally complying with relevant maximum noise limits, however, some levels were recorded above noise limits, mostly during winter night-time periods. Response measures were taken following each event to minimise the potential for recurrences consistent with the MAN Noise Management Plan. The recorded exceedances did not continue over consecutive nights, suggesting that response measures taken following each event were successful in restoring noise levels to below the criteria. Mt Arthur Coal's noise limits are set on a 10 per cent exceedance basis and therefore periodic elevated noise levels do not necessarily result in exceedances of the MAN development consent acquisition criteria.

5.6.2 Assessment Criteria

5.6.2.1 Operational Noise

An ambient noise survey was carried out during the preparation of the MAN EIS during 1999 at several residences that are representative of the residential locations surrounding Mt Arthur Coal. Subsequent to this survey, a Rating Background Level (RBL) value was determined for each location, following discussion with DECC regarding the exclusion of data under the NSW Industrial Noise Policy (INP) (Environment Protection Authority, 2000). It is considered appropriate to use these assessed RBLs when setting criteria for the Underground Project, as any new ambient noise measurement data would likely be affected by mining noise from approved Mt Arthur Coal operations. The monitoring locations assessed for the MAN project are the same potentially sensitive receiver locations as for the Underground Project. The project specific intrusive criteria derived from the assessed RBLs are presented in **Table 5.7** below along with the relevant amenity criteria. These criteria also correspond to the intrusive and amenity noise criteria in the MAN development consent.

Table 5.7 - Intrusive and Amenity Assessment Criteria

Location	Assessed RBL (Day/Evening/Night)*	Intrusive Noise Criteria (Day/Evening/Night)* $L_{Aeq,15min}$	Amenity Noise Criteria (Day/Evening/Night)* $L_{Aeq,period}$
Antiene Estate	32 / 35 / 33 dBA	**37** / **40** / **38** dBA	50 / 45 / 40 dBA
Skellatar Stock Route Thomas Mitchell Drive Denman Road	34 /33 / 32 dBA	**39** / **38** / **37** dBA	50 / 45 / 40 dBA
Racecourse Road	32 / 31 / 30 dBA	**37** / **36** / **35** dBA	50 / 45 / 40 dBA
Denman Road West Roxburgh Vineyard Roxburgh Road	32 / 31 / 30 dBA	**37** / **36** / **35** dBA	50 / 45 / 40 dBA
South Muswellbrook	30 / 30 / 30 dBA	**35** / **35** / **35** dBA	50 / 45 / 40 dBA

* Day period is 7.00 am – 6.00 pm; Evening is 6.00 pm – 10.00 pm; Night is 10.00 pm – 7.00 am

The project-specific noise criteria for the project, as defined by the INP, are the more stringent of the intrusive and amenity criteria. Therefore, the project-specific noise criteria for the Underground Project are the intrusive criteria at all locations, shown in bold in the above table.

Since the completion of the MAN EIS, several new potentially affected residential receivers have been identified in the eastern portion of the Antiene estate near the New England Highway. A noise logger was placed at a representative location within the east Antiene estate between 13 April and 26 April 2006 in order to determine an RBL for this location in accordance with the INP. The assessed RBL and assessment criteria are set out in **Table 5.8**.

Table 5.8 - Intrusive and Amenity Assessment Criteria - East Antiene

Location	Assessed RBL (Day/Evening/Night)*	Intrusive Noise Criteria (Day/Evening/Night)* $L_{Aeq,15min}$	Amenity Noise Criteria (Day/Evening/Night)* $L_{Aeq,period}$
East Antiene	36 / 35 / 34 dBA	**41** / **40** / **39** dBA	50 / 45 / 40 dBA

* Day period is 7.00 am – 6.00 pm; Evening is 6.00 pm – 10.00 pm; Night is 10.00 pm – 7.00 am

The project-specific noise criteria adopted for east Antiene are therefore the intrusive noise criteria, shown in bold above.

In those cases where the INP project-specific assessment criteria are exceeded, it does not automatically follow that all people exposed to the noise would find the noise noticeable or unacceptable. In subjective terms, exceedances of the criteria can be generally described as follows:

- negligible noise level increase (less than 1 dBA) (not noticeable by all people);
- marginal noise level increase (between 1 dBA and 2 dBA) (not noticeable by most people);

- moderate noise level increase (between 3 dBA and 5 dBA) (not noticeable by some people and may be noticeable by others); and

- appreciable noise level increase (greater than 5 dBA) (noticeable by most people).

It should be noted that the INP does not set mandatory limits, but requires operations to seek to achieve the criteria. Where INP criteria cannot be achieved by applying feasible and reasonable measures, there is scope to apply alternative criteria.

Recent mining project approvals have required that any landholders with a residence or greater than 25 per cent of vacant land that is predicted to experience exceedance of the INP criteria by more than 5 dBA, are offered the opportunity to sell their properties to the mining company. This is consistent with the MAN development consent which imposes acquisition criteria for noise from the MAN mining area. Based on these precedents, the assumed project specific acquisition criteria are therefore outlined in **Table 5.9**.

Table 5.9 - Project Specific Noise Criteria and Assumed Acquisition Criteria

Location	Project Specific Noise Criteria (Day/Evening/Night)*	Assumed Acquisition Criteria (Day/Evening/Night)*
Antiene Estate	37 / 40 / 38 dBA	42 / 45 / 43 dBA
Skellatar Stock Route Thomas Mitchell Drive Denman Road	39 / 38 / 37 dBA	44 / 43 / 42 dBA
Racecourse Road	37 / 36 / 35 dBA	42 / 43 / 40 dBA
Denman Road West Roxburgh Vineyard Roxburgh Road	37 / 36 / 35 dBA	42 / 41 / 40 dBA
South Muswellbrook	35 / 35 / 35 dBA	40 / 40 / 40 dBA
East Antiene	41 / 40 / 39 dBA	46 / 45 / 44 dBA

* Day period is 7.00 am – 6.00 pm; Evening is 6.00 pm – 10.00 pm; Night is 10.00 pm – 7.00 am

5.6.2.2 Sleep Disturbance

DECC has not developed a specific criteria to address sleep disturbance. However, in a noise guide for local government, DECC identify that sleep may be disturbed if the $L_{A1,60\ seconds}$ or L_{Amax} noise level exceeds the L_{A90} background noise level by more than 15 dBA when measured outside the bedroom window. Further guidance on the potential for 'awakening reactions' is provided in DECC's Environmental Criteria for Road Traffic Noise (EPA, 1999), which states that internal maximum noise levels below 50-55 dBA are unlikely to cause awakening reactions.

5.6.2.3 Road Traffic Noise

The criteria for the assessment of noise from traffic on public roads are set out in DECC's Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999). To apply these criteria, the classification of the road needs to be determined. The following classifications apply to the roads surrounding the project area; Denman Road east of Thomas Mitchell Drive and Thomas Mitchell Drive itself would be considered 'collector' roads. Denman Road west of Thomas Mitchell Drive would be classified as a 'local' road. The New England Highway

would be considered a 'freeway or arterial road'. The relevant criteria for the roads surrounding the project area are outlined in **Table 5.10**.

Table 5.10 - Road Traffic Noise Criteria

Type of Development	Noise Level Criterion		Where Criteria are already Exceeded
	Daytime*	Night Time*	
Land use developments with potential to create additional traffic on collector roads	$L_{Aeq, 1hr}$ 60 dBA	$L_{Aeq, 1hr}$ 55 dBA	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dB. Where feasible & reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies…
Land use developments with potential to create additional traffic on local roads	$L_{Aeq, 1hr}$ 55 dBA	$L_{Aeq, 1hr}$ 50 dBA	
Land use developments with potential to create additional traffic on existing freeways / arterials	$L_{Aeq, 15hr}$ 60 dBA	$L_{Aeq, 9hr}$ 55 dBA	

* Daytime 7.00 am – 10.00 pm; Night Time is 10.00 pm – 7.00 am

There are no private residences along Edderton Road which are adjacent to the road and therefore it has not been included in the assessment.

5.6.2.4 Rail Noise on Main Northern Line

DECC's Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects (DECC, 2007) sets trigger levels at which an assessment of rail noise impacts would need to be undertaken for rail infrastructure projects. The trigger levels address both an increase in rail noise due to a project and absolute rail noise levels at receiver locations. An increase in both rail noise and the absolute level of rail noise must be met to initiate an assessment of rail noise impacts. The trigger levels are set out in **Table 5.11**.

Table 5.11 - Rail Traffic Noise Trigger Levels for Residential Land Uses

Type of Development	Noise Trigger Levels (dBA)		
	Daytime*	Night Time*	Comment
Redevelopment of existing rail line	Development increases existing rail noise levels and resulting rail noise levels exceed:		These numbers represent external levels of noise that trigger the need for an assessment of the potential noise impacts from a rail infrastructure project. An 'increase' in existing rail noise levels is taken to be an increase of 2dBA or more in L_{Aeq} in any hour or an increase of 3dBA or more in L_{Amax}
	65 $L_{Aeq, 15hr}$	60 $L_{Aeq, 9hr}$	
	85 L_{Amax}	85 L_{Amax}	

* Daytime 7.00 am – 10.00 pm; Night Time is 10.00 pm – 7.00 am

5.6.3 Noise Modelling

5.6.3.1 Noise Modelling Methodology

Noise levels for the project have been calculated using the ENM prediction model. The model included noise generated from the Underground Project alone and noise generated from combined Mt Arthur Coal operations, including the proposed Underground Project

activities, proposed South Pit Extension and the approved MAN operations that would be undertaken concurrently with these proposed operations. Noise levels were predicted for three representative worst case operational scenarios, namely worst case winter nights in years 5, 10 and 15 of the Underground Project. These scenarios correlate with periods of maximum mining activity and represent the three main operating scenarios; punch longwall operations from both Saddlers and West Belmont pits, and operations using drift access. The modelled scenarios correspond approximately to MAN years 10, 15 and 21 respectively and South Pit Extension years 5, 10 and 15 respectively. All calculations were performed under adverse meteorological conditions. Key noise controls included in the modelling are discussed in **Section 5.6.4**.

5.6.3.2 Calibration of Noise Model

Noise levels surrounding the MAN mining area have been continuously monitored by four permanent BarnOwl directional noise monitoring units since mining operations began at MAN in 2002. Mt Arthur Coal also produce annual predictions of noise levels arising from the MAN operation to assist in minimising noise impacts as part of annual mine planning (typically focussing on worst case winter periods). These predictions are subsequently compared with actual noise level measurements taken by the BarnOwl monitors. These comparisons have shown that the noise models developed for the MAN operation are over-predicting noise impacts associated with the operation, particularly under the worst case scenarios that involve complex temperature inversion conditions.

Given this trend of noise models over predicting noise impacts for the MAN operation, a model calibration exercise was undertaken. The calibration exercise found that temperature inversion values used in modelling were causing the over predictions, with modelling of a range of different temperature inversion strengths identifying that an inversion strength of 4 ºC per 100 metres when modelling night time operations resulted in well correlated predictions of noise with actual measured noise impacts. This temperature inversion value has therefore been used in the assessment completed for the Underground Project. It should be noted that the use of this value provides a more conservative approach to that outlined in the INP, which recommends applying a temperature inversion strength of 3 ºC per 100 metres.

5.6.4 Noise Impact Assessment

Noise management has been a key focus for Mt Arthur Coal's existing open cut operations and potential noise impacts associated with the Underground Project were a key consideration in project design. The key potential operational noise impacts associated with the Underground Project were identified as the coal handling chain (ROM facilities, CHPP, rail facility etc.) and the location of surface facilities (e.g. pit top facilities, ventilation fans etc.). Preliminary noise modelling was undertaken as part of the design process to identify potential noise impacts associated with various options, with the proposed project design an outcome of this process. Key measures implemented as part of the design to reduce potential noise impacts include:

- location of the North Saddlers ROM Facility in an existing mining area shielded from residential locations by Mt Arthur;
- location of the majority of pit top facilities within existing mining voids or in areas with topographic shielding to residential locations;
- maximising use of existing equipment as opposed to construction of separate facilities;

- use of overland conveyors as opposed to haul trucks for delivery of coal from the North Saddlers ROM facility to the existing CHPP;
- use of enclosures on CHPP equipment;
- use of covers on top of overland conveyors;
- managing sound power levels of mobile equipment through either procurement of 'quiet' equipment or noise attenuation; and
- considering potential for noise impacts during the placement and alignment of ventilation shafts.

These controls and project design approaches have assisted in reducing the potential noise impacts of the Underground Project on surrounding residential locations.

5.6.4.1 Operational Noise Impacts

Underground Project Alone

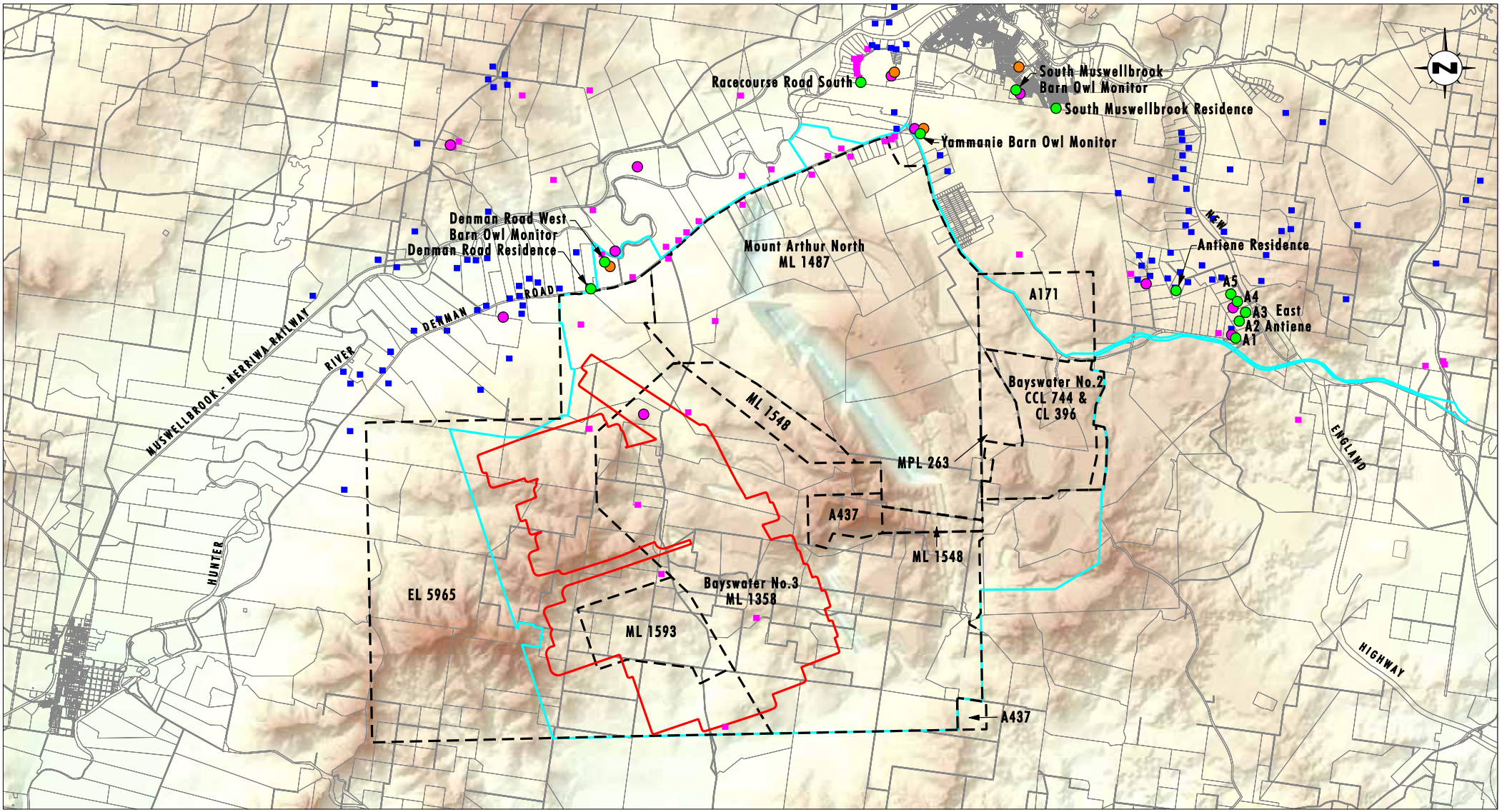
The worst case predicted noise levels for the Underground Project, including operation of the CHPP and rail facility and noise from trains travelling along the Antiene Rail Spur, are shown in **Table 5.12**. The predictions are made for the representative sensitive receiver locations shown on **Figure 5.21** and assessed against night time criteria as these are the most stringent. Noise contours for each of the modelled scenarios are provided in **Appendix 11**.

Table 5.12 - Predicted Worst Case Noise Levels from Underground Project Operations during Winter Night Period

Assessment Location	Project Year 5 ($L_{Aeq,15mins}$)	Project Year 10 ($L_{Aeq,15mins}$)	Project Year 15 ($L_{Aeq,15mins}$)	Project - Specific Noise Criteria ($L_{Aeq,15mins}$)	Assumed Project-Specific Acquisition Criteria ($L_{Aeq,15mins}$)
Yammanie BarnOwl Monitor	30	30	30		**42**
Sth Mus. Residence	33	33	33	**35**	**40**
Sth Mus. BarnOwl Monitor*	31	31	31	**-**	**-**
Antiene Residence	**41**	**41**	**41**	**38**	**43**
Racecourse Rd Sth	29	29	29	**35**	**40**
Denman Rd BarnOwl Monitor*	30	29	28	**-**	**-**
Denman Rd Residence	26	28	24	**35**	**40**

* Assessment location is not a private residential location. Denman Rd BarnOwl Monitor site is owned by Mt Arthur Coal with the Sth Mus. BarnOwl Monitor site owned by MSC.

Table 5.12 shows that noise levels from the Underground Project are within the project-specific noise criteria at all locations for all modelled scenarios with the exception of Antiene, where a marginal exceedance of 3 dBA is predicted. This exceedance is the result of rail passbys, with train movements for all of Mt Arthur Coal's approved and proposed operations included in the model. It is noted that there is expected to be six movements per night, with



Source: Mt Arthur Coal, 2006
Base Source: LPI 2004, Mt Arthur Coal, 2006

0 2.0 4.0 6km
1:110 000

Legend

- Mining and Exploration Lease Boundary
- Project Application Boundary
- Subsidence Affectation Area
- Real-time Monitoring Site
- Periodic Noise Monitoring Location
- Noise Assessment Location
- Privately Owned Residence
- Mine / Power Generation Owned Residence

FIGURE 5.21

Noise Monitoring and Assessment Locations

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each train taking less than 5 minutes to pass residences under typical operating conditions. This equates to an impact at residences for less than 10 per cent of the night-time period. At all other times, when no train passbys occur, the predicted noise levels will comply with the project-specific noise goals for the project. Noise levels from the Underground Project are predicted to be within the assumed project-specific acquisition criteria at all times.

Combined Mt Arthur Coal Operations

To assess the total noise impacts from the approved and proposed Mt Arthur Coal operations, the combined noise from the proposed Underground Project, the proposed South Pit Extension project and the approved MAN operations that will occur concurrently, were modelled for years 5, 10 and 15 of the Underground Project. The worst case predicted noise levels for the combined operations are shown in **Table 5.13**. For comparative purposes, the worst case noise levels predicted to occur for the approved MAN operations alone (based on the MAN EIS) are also shown. Noise contours for each of the modelled scenarios are provided in **Appendix 11**.

Table 5.13 - Predicted Worst Case Noise Levels from Combined Mt Arthur Coal Operations during Winter Night Period

Assessment Location	Combined Year 5 ($L_{Aeq,15mins}$)	Combined Year 10 ($L_{Aeq,15mins}$)	Combined Year 15 ($L_{Aeq,15mins}$)	Project-Specific Noise Criteria ($L_{Aeq,15mins}$)	Assumed Project-Specific Acquisition Criteria ($L_{Aeq,15mins}$)	Worst Case MAN EIS[2]
Yammanie BarnOwl Monitor	**40**	38	**40**	**37**	**42**	**39**
Sth Mus. Residence	**38**	**37**	**37**	**35**	**40**	33
Sth Mus. BarnOwl Monitor*	37	37	37	-	-	35
Antiene Residence	**42**	**42**	**42**	**38**	**43**	38
Racecourse Rd Sth	**39**	**38**	**39**	**35**	**40**	**41**
Denman Rd BarnOwl Monitor*	39	39	39	-	-	39
Denman Rd Residence	35	**37**	**37**	**35**	**40**	37

* Assessment location is not a private residential location. Denman Rd BarnOwl Monitor site is owned by Mt Arthur Coal with the Sth Mus. BarnOwl Monitor site owned by MSC.
[2] Derived from noise contours contained in the MAN EIS (URS, 2000).

Table 5.13 shows that the assumed acquisition limits for the project (and the acquisition limits for the approved MAN operations) will be met at all locations.

Table 5.13 also shows that combined noise levels from all Mt Arthur Coal operations will exceed the night time project-specific noise goals at all locations under worst case conditions at some point during the 21 year life of the project. These are predicted to be:

- a marginal exceedance of up to 2 dBA at Denman Road residence west of the project area. The worst case predicted noise level for the combined operations is the same as predicted for the approved MAN operations;

- a moderate exceedance of up to 3 dBA at South Muswellbrook (residences);

- a moderate exceedance of up to 3 dBA at Yammanie. The worst case predicted noise level for the combined operations of 40 dBA is 1 dBA more than the maximum of 39 dBA predicted for the approved MAN operations;

- a moderate exceedance of up to 4 dBA at Racecourse Road. The worst case predicted noise level for the combined operations of 39 dBA is 2 dBA less than the maximum of 41 dBA predicted for the approved MAN operations. It should also be noted that the majority of potentially noise affected residences along Racecourse Road are now owned by mining companies (refer to **Figure 1.5**); and

- a moderate exceedance of up to 4 dBA at Antiene. It should be noted that this impact will only occur during train passbys, which will occur less than 10 per cent of the night time period.

Noise levels at all locations except Antiene, are driven by approved MAN open cut operations. The incremental contribution of the Underground Project to the total noise impact from Mt Arthur Coal's approved and proposed open cut operations (including proposed South Pit Extension and approved MAN operations that will occur concurrently) is predicted to be minimal at the locations where exceedances of the project-specific noise criteria will occur. The incremental impact attributable to the Underground Project (including all CHPP infrastructure, rail infrastructure and rail movements in the Underground Project noise) in worst case winter night time conditions and in the worst case year is predicted to be:

- 1.8 dBA at South Muswellbrook which is considered marginal;

- 0.6 dBA at Denman Road residence west of the project area which is considered negligible;

- 0.6 dBA at Racecourse Road which is considered negligible; and

- 0.8 dBA at Yammanie which is considered negligible.

As shown above, the incremental impact of the Underground Project on surrounding residential receiver locations will be marginal at South Muswellbrook and negligible at all other locations.

Noise levels at Antiene are driven by rail noise from existing and proposed operations. Rail movement noise is predicted to occur for less than 10 per cent of the night-time period under worst case operating conditions. The predicted exceedance of the project-specific noise goals will therefore only occur for less than 10 per cent of the night-time period.

Mt Arthur Coal has developed and implemented an extensive noise management program for existing operations and is committed to implementing all reasonable and feasible noise management measures to control noise emissions from their operations (refer to **Section 5.6.6**).

Rail Movement Noise Impacts on East Antiene

In addition to the impacts on Antiene discussed above as part of the operational noise impact assessment, impacts due to train noise are predicted on residents in the east Antiene area. This area is not affected by mining noise from Mt Arthur Coal and will therefore only receive noise impacts from train movements on the Antiene Rail Spur. There is expected to be a maximum of 24 train movements per day from Mt Arthur Coal's combined operations once

the Underground Project is operational, an increase of six from currently approved levels. Worst case operations would involve up to six train movements occurring during the night time period (10.00 pm to 7.00 am). With each train typically taking less than five minutes to pass by residences, this would result in noise impacts for less than 10 per cent of the night time period on the nights when trains are running. It is for this worst case operating scenario that the assessment of train noise impacts on the east Antiene area has been completed.

Noise impacts due to rail passbys were calculated from measured noise levels of the existing trains and wagons used by Mt Arthur Coal travelling at 20 kph. While this is representative of a typical operating scenario, and while Mt Arthur Coal currently utilise new low noise rail technology, future advances in low noise rail or other technology may allow for variations to the operating conditions while maintaining or reducing rail noise impacts in east Antiene.

The assessment was undertaken for the five closest residences to the Antiene Rail Spur in the east Antiene area (refer to **Figure 5.21**). The worst case predicted noise levels for the east Antiene area are included in **Table 5.14**.

Table 5.14 - Predicted Worst Case Noise Levels from Train Movements on East Antiene

Assessment Location	Predicted Noise Level ($L_{Aeq,15mins}$)	Project-Specific Noise Criteria Night ($L_{Aeq,15mins}$)	Assumed Project-Specific Acquisition Criteria Night ($L_{Aeq,15mins}$)
East Antiene Location A1	**48**	**39**	**44**
East Antiene Location A2	43	**39**	**44**
East Antiene Location A3	39	**39**	**44**
East Antiene Location A4	39	**39**	**44**
East Antiene Location A5	38	**39**	**44**

As shown in **Table 5.14**, during worst case operations which occur for less than 10 per cent of the winter night-time period, there will be a moderate exeedance of the project-specific noise goals at east Antiene Location A2 and an appreciable exceedance at east Antiene Location A1. Mt Arthur Coal has engaged with this landholder regarding potential noise impacts from the project.

Sleep Disturbance

As the noise modelling indicates that the project-specific noise criteria will be exceeded during worst case night time periods, it is appropriate to undertake an assessment of the potential for Underground Project operations to disturb sleep.

There are two aspects of the Underground Project that require assessment for sleep disturbance potential, operational noise and noise from train movements. As the proposed Underground Project is located further from residences than MAN operations and the noise sources are similar, it follows that maximum operational noise levels would not be greater than those calculated in the MAN EIS (URS, 2000). The assessment of sleep disturbance potential undertaken for the MAN EIS (URS, 2000) found that the sleep disturbance criterion would be met in all operating scenarios.

In regards to noise from train movements, an assessment of the sleep disturbance potential has been undertaken for six residential receiver locations in Antiene and east Antiene. The results indicate that external maximum noise levels at east Antiene Locations A1 and A2 will

exceed the sleep disturbance goal, however, further assessment in accordance with DECC's ECRTN indicates that internal maximum noise levels will be within the range of levels that are unlikely to cause awakening reactions.

5.6.4.2 Traffic Noise Impacts

Construction Phase

Increases in traffic noise are predicted along Thomas Mitchell Drive and Denman Road during both the morning (6.00 am - 7.00 am) and evening (6.00 pm - 7.00 pm) peak construction traffic periods. The predicted increases in traffic noise levels on both Thomas Mitchell Drive and Denman Road are predicted to be less than 2 dBA and therefore comply with the relevant DECC criteria.

Operational Phase

The maximum traffic generation during the operational phase will occur at the three main shift change times, which are likely to be 8.00 am, 4.00 pm and midnight (these times have been adopted for assessment purposes). Increases in traffic noise are predicted along Thomas Mitchell Drive and Denman Road at each of the shift change times, with the exception of Denman Road west of Thomas Mitchell Drive, where there is no increase predicted during the 8.00 am or 4.00 pm shift change. The increase in traffic noise levels during the 8.00 am and 4.00 pm shift changes are predicted to comply with DECC criteria at all locations.

During the midnight shift change, as there are very low vehicle numbers on the road at this time, the increase in traffic noise required further detailed investigation to determine whether DECC criteria would be met at houses along Thomas Mitchell Drive south of Denman Road and on Denman Road east of Thomas Mitchell Drive. This further investigation calculated the distance from the road that traffic noise impacts would occur and found that DECC criteria would not be exceeded at any residence along Thomas Mitchell Drive or Denman Road.

Cumulative Traffic Noise Impacts

An assessment of cumulative traffic volumes associated with the approved Mt Pleasant and Anvil Hill mines identified the potential for a cumulative traffic noise impact on Thomas Mitchell Drive and Denman Road during the morning shift change for the Underground Project. The calculated cumulative increase in traffic noise at this time complies with the relevant DECC criteria at both roads.

5.6.4.3 Rail Noise Impacts on Main Northern Line

The Underground Project seeks to increase the maximum daily rail movements from Mt Arthur Coal from the currently approved 18 movements per day to 24 movements per day. The potential noise impact of these additional six movements per day has been assessed and the predicted increase in noise levels is less than the 2dBA required to trigger further noise assessment of rail noise impacts under DECC's Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects. The project will also not result in an increase in maximum noise levels on the Main Northern Line.

5.6.4.4 Construction Noise Impacts

The main noise generating construction activities associated with the Underground Project include the construction of additional stockpile areas at the existing CHPP, construction of a

new ROM Facility in Saddlers pit and construction of pit top facilities. Given that the sound power levels of construction plant at these locations would be no greater than that of plant currently active or proposed in these locations, and that construction would take place during daytime periods, the impacts from construction activities at both locations would be no greater than impacts that have already been assessed for operations.

5.6.4.5 Blasting and Vibration Impacts

No significant blasts are proposed as part of the Underground Project, with the only blasts being very small, isolated blasts to assist with underground mining operations. There are not predicted to be any blasting or vibration impacts at residential locations as a result of the Underground Project.

5.6.5 Cumulative Noise Impact Assessment

The DGRs for the project require an assessment of potential cumulative noise impacts to take into account noise generated from relevant existing and approved development within the local area. Apart from Mt Arthur Coal operations assessed in previous sections, the two main existing or approved developments within the vicinity of the project area are Bengalla mine to the north and Drayton mine to the east.

5.6.5.1 Assessment Criteria

To limit continuing increases in noise levels, DECC has established criteria for the maximum ambient noise level from all industrial sources within an area. These noise criteria are referred to as amenity criteria. The amenity criteria for the project are listed in **Tables 5.6**, **5.7** and **5.8**.

The amenity criteria applicable to cumulative noise impacts from all industrial operations during the night time period is 40 dBA for all residential locations. As no residence surrounding Mt Arthur Coal's operations would be exposed to noise from more than two existing industrial operations (i.e. Mt Arthur Coal and another industrial operation such as Bengalla or Drayton mine), the adopted amenity criterion for Mt Arthur Coal operations would be 37 dBA. This represents 50 per cent of the adopted criteria of 40 dBA.

5.6.5.2 Cumulative Noise Impacts

The critical period for assessing compliance with amenity goals is during night time periods. Compliance with the cumulative amenity criteria during the night time is measured as an equivalent continuous noise level over a nine hour period (i.e. a $L_{Aeq,9\ hr}$) between 10.00 pm and 7.00 am.

The predicted $L_{Aeq,9\ hr}$ noise levels for the combined Mt Arthur Coal operations are included in **Table 5.15**. As shown in **Table 5.15** the $L_{Aeq,9\ hr}$ noise levels are not predicted to exceed 37 dBA at any residence over the life of the project. Therefore, the noise modelling results demonstrate that the combined Mt Arthur Coal operations will not result in exceedances of cumulative noise goals.

Table 5.15 - Predicted Worst Case Amenity Noise Levels from Combined Mt Arthur Coal Operations during Winter Night Period

Assessment Location	Combined Noise Level Mt Arthur Coal Operations ($L_{Aeq,9\ hr}$)	Adopted Cumulative Amenity Criteria Night ($L_{Aeq,9\ hr}$)
Yammanie BarnOwl Monitor	36	**37**
Sth Mus. Residence	33	**37**
Sth Mus. BarnOwl Monitor*	33	**-**
Antiene Residence	36	**37**
Racecourse Rd Sth	35	**37**
Denman Rd BarnOwl Monitor*	35	**-**
Denman Rd Residence	33	**37**

* Assessment location is not a private residential location. Denman Rd BarnOwl Monitor site is owned by Mt Arthur Coal with the Sth Mus. BarnOwl Monitor site owned by MSC.

Train movement noise impacts on residences in East Antiene have also been assessed against the adopted cumulative amenity criteria for the project (note that there are no discernable operational noise impacts from Mt Arthur Coal on residences in East Antiene). The assessment has found that train movement noise in the night time period will comply with the adopted cumulative amenity criteria at all residences except for East Antiene Location A1, where an exceedance of 4 dBA is predicted.

5.6.6 Noise Management and Mitigation

Mt Arthur Coal has an extensive noise management program in place for its existing operations and has applied many examples of best practice to manage the noise impacts. This approach to noise management will be implemented as part of the Underground Project.

As discussed in **Section 5.6.4.1**, noise modelling indicates that a number of residential locations in Antiene and east Antiene may experience noise levels from train movements in excess of the relevant project-specific noise criteria. One property (Location A1) is predicted to be significantly impacted by noise from train movements, i.e. the project-specific noise criteria are predicted to be exceeded by greater than 5 dBA. Mt Arthur Coal has engaged with this landholder regarding potential rail noise impacts. The Underground Project is predicted to comply with the project specific noise criteria at all other locations.

To minimise the impact of train movement noise in the east Antiene area, Mt Arthur Coal commit to manage rail noise impacts to meet the assumed project-specific acquisition criteria at all locations (except Location A1) for the 15 minute night-time periods when Mt Arthur Coal trains are passing on the line. This may be achieved through implementation of a range of controls, including use of low noise rail or other technology, and/or through operational controls such as train speed. This will not only reduce noise impacts associated with the Underground Project but will also reduce the impacts of noise from Mt Arthur Coal's existing train movements by approximately 4 dBA, resulting in a significantly reduced noise impact of each train passby event. Mt Arthur Coal will continue to review opportunities to use improved noise management technology as part of ongoing improvement in rail noise management. Train noise levels will be a factor in Mt Arthur Coal's assessment of new contracts for rail transportation of Mt Arthur coal on the Antiene spur line.

Mt Arthur Coal will also aim to limit potential operational noise impacts associated with the combined underground and open cut operations through continued application of appropriate noise management measures. Key measures currently being successfully implemented at Mt Arthur Coal and that will be applied to future operations include:

- planning controls, such as locating infrastructure or consideration of seasonal influences on noise impacts, to avoid or otherwise minimise noise impacts to sensitive receivers;
- operational controls such as the placement of mobile plant and equipment and the use of real-time noise monitoring with text message alerts to supervisors to assist operational and environmental staff in proactive management of noise impacts;
- engineering controls including noise attenuation, where feasible, on mobile and stationary equipment that is potentially generating significant noise. Equipment attenuation will be used as required to achieve off-site noise levels in combination with other planning and operational controls; and
- real-time directional noise monitoring equipment to provide high quality data, assess compliance and assist with minimising impacts.

Mt Arthur Coal has an extensive noise monitoring system in place, including real-time directional and targeted noise monitoring. This system will continue to provide adequate coverage to manage and assess compliance of Underground Project operational noise with project specific noise goals. The monitoring system will be subject to ongoing reviews over the life of the project, with any changes undertaken in consultation with DECC and DoP. In order to assess the compliance of rail passby noise with the assumed project-specific acquisition goals, Mt Arthur Coal will undertake annual noise monitoring in east Antiene for a period of three years. The monitoring program will be reviewed at the end of the three year period to determine if there is a need for ongoing monitoring.

5.7 Air Quality

A comprehensive air quality assessment was completed for the project by Holmes Air Sciences in accordance with relevant DECC guidelines. A summary of the key findings of the assessment is provided below, with the full assessment report included in **Appendix 12**.

5.7.1 Air Quality Criteria

The following section summarises the current air quality assessment criteria specified by DECC for assessing impacts from mining activities. These criteria relate to dust deposition and dust concentration.

Dust concentration refers to airborne dust and is measured in micrograms per cubic metre (µg/m³). Relevant criteria for dust concentration are defined in terms of two classes; total suspended particulate (TSP) and PM_{10}. TSP relates to all suspended particles which are up to 50 micrometres (µm) in size. Particle sizes larger than 50 µm are measured in dust deposition levels. PM_{10} refers to particulate matter with a diameter less than 10 µm. TSP measurements include PM_{10} particles.

Goals for dust concentration are referred to as long term (annual average) and short term (24 hour maximum) goals. The air quality goals (excluding 24 hour PM_{10} which is project specific) relate to the total dust burden in the air and not just the dust from the project.

Therefore, some consideration of background levels needs to be made when using these goals to assess impacts (refer to **Section 5.7.4**).

Relevant goals for TSP and PM_{10} are outlined in **Table 5.16**.

Table 5.16 - DECC Assessment Criteria for Particulate Matter Concentrations

Pollutant	Standard/Goal	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 $\mu g/m^3$	Annual mean	National Health & Medical Research Council
Particulate matter <10 μm (PM_{10})	50 $\mu g/m^3$	24-hour maximum	DECC
	30 $\mu g/m^3$	Annual mean	DECC long-term reporting goal
	50 $\mu g/m^3$	(24-hour average, 5 exceedances permitted per year)	National Environment Protection Council

Dust deposition levels refer to the quantity of dust particles that settle out of the air as measured in grams per square metre per month (g/m²/month) at a particular location. DECC expresses dust deposition criteria in terms of an acceptable increase in dust deposition over the existing background deposition levels as shown in **Table 5.17**.

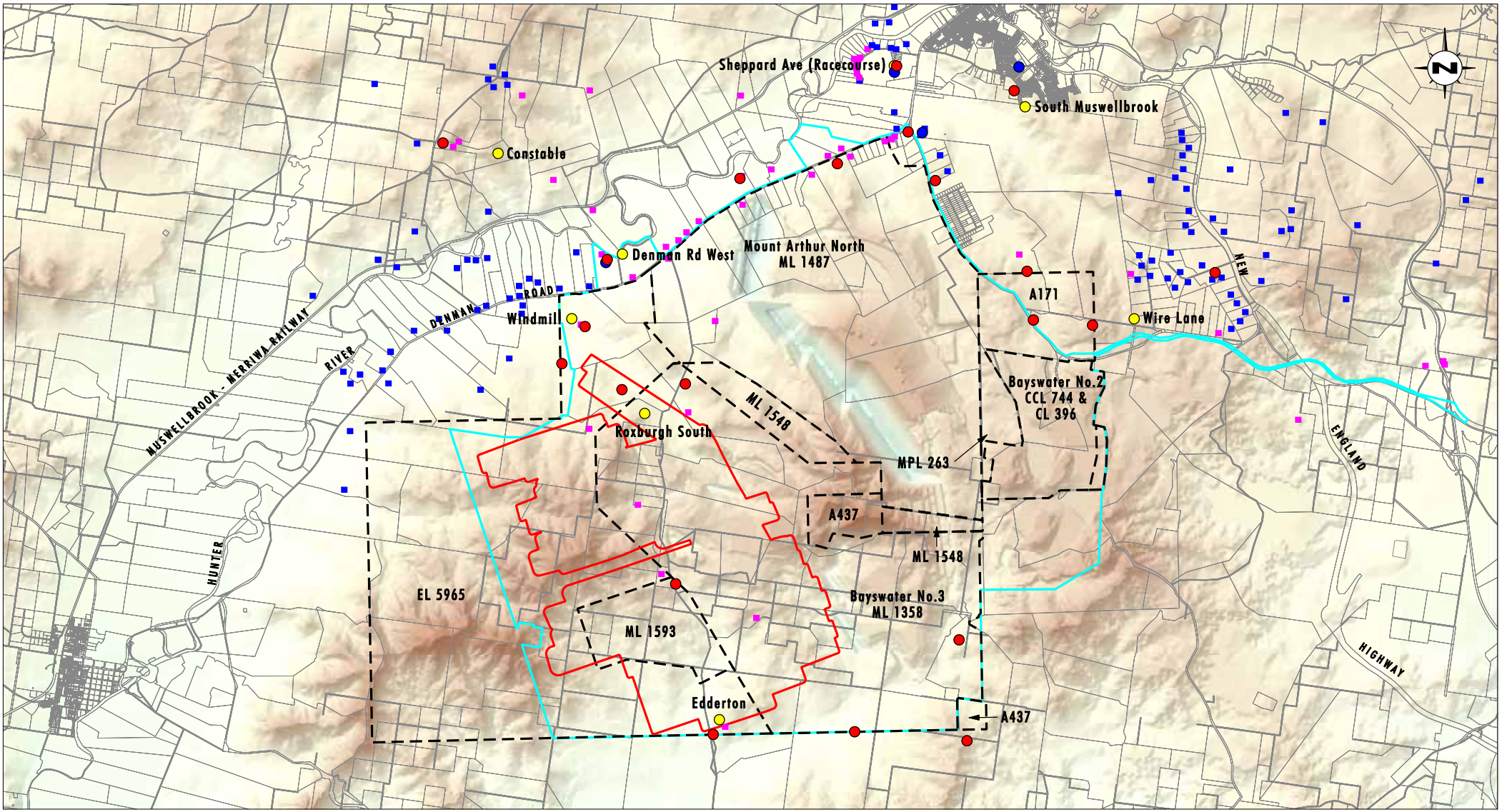
Table 5.17 - DECC Criteria for Dust Deposition

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

5.7.2 Existing Air Quality Environment

Mt Arthur Coal has an extensive dust monitoring network in place that measures both dust deposition and airborne dust concentration (PM_{10}). The current monitoring network consists of eight high volume air samplers, measuring PM_{10} on a six day cycle, four real-time samplers measuring PM_{10} and 21 dust deposition gauges (refer to **Figure 5.22**). The results of historical PM_{10} and dust deposition monitoring are provided in **Figure 5.23**. A summary of recent monitoring results is provided below.

In 2004, 2005 and 2006 the annual average PM_{10} concentrations were below the current DECC assessment criterion of 30 $\mu g/m^3$ at all monitoring locations. The highest level was recorded at the South Muswellbrook site in 2004 with 28.2 $\mu g/m^3$. The analysis of dust monitoring results (refer to **Appendix 12**) found that average PM_{10} concentrations in 2005 were lower than the 2004 records at all sites except Denman Road West where a minor increase (17.9 to 18.9 $\mu g/m^3$) was reported. Results in 2006 rose slightly at four of the eight monitoring locations when compared to 2005, however they remained below 2004 concentrations at all sites except Edderton which is on Mt Arthur Coal land and is not nearby to any private residential receivers (refer to **Figure 5.22**). Annual average TSP concentrations were also below DECC assessment criterion of 90 $\mu g/m^3$ at all monitoring locations in 2004, 2005 and 2006.



Source: Mt Arthur Coal, 2006
Base Source: LPI 2004, Mt Arthur, 2006

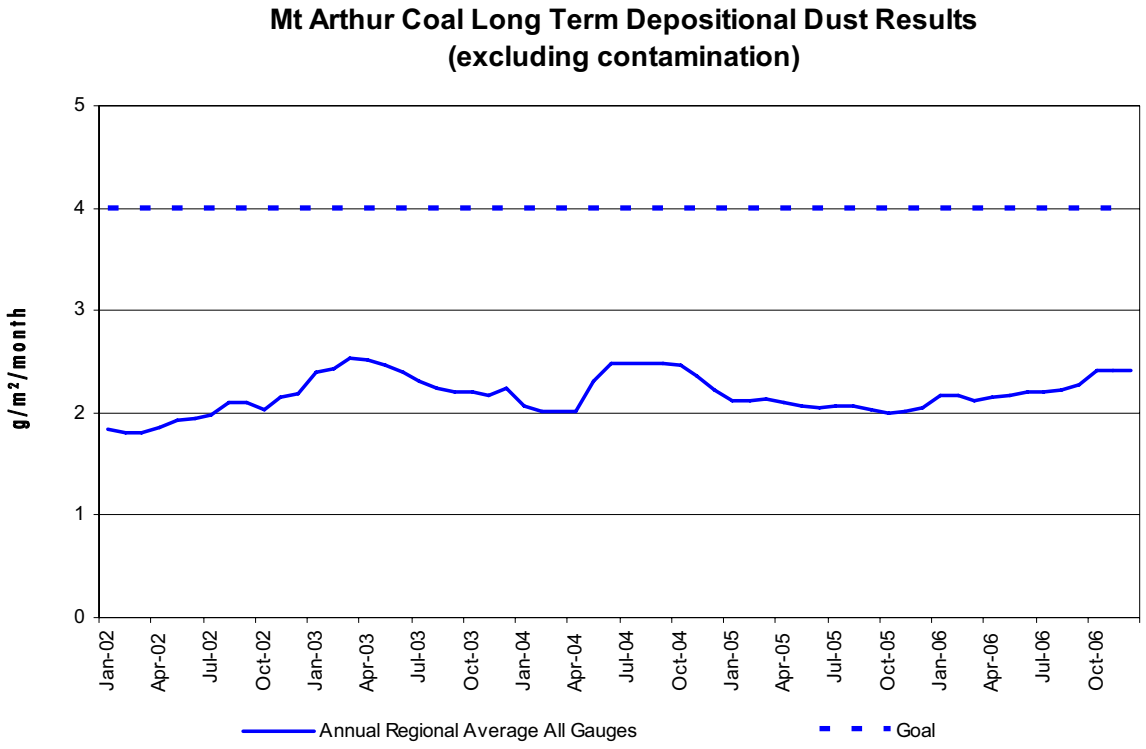
Legend

- Mining and Exploration Lease Boundary
- Project Application Boundary
- Subsidence Affectation Area
- PM10 Dust Monitoring Location
- Depositional Dust Monitoring Location
- Real-time Dust Monitoring Site
- Privately Owned Residence
- Mine / Power Generation Owned Residence

FIGURE 5.22

Dust Monitoring and Assessment Locations

File Name (A4): R21_V1/2051_303.dgn



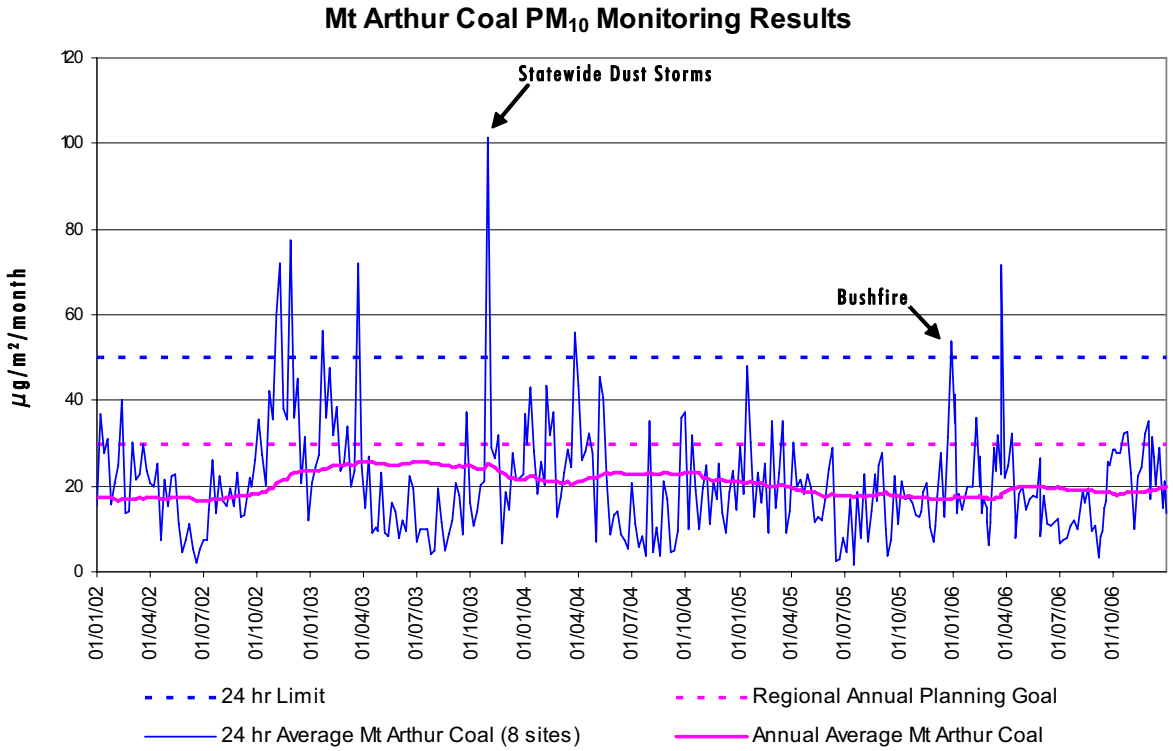


FIGURE 5.23

Regional Air Quality Monitoring Results

Source: Mt Arthur Coal, 2007

File Name (A4): R21_V1/2051_351.dgn

Results from several of the monitoring sites have recorded maximum 24-hour average concentrations above the current DECC goal of 50 $\mu g/m^3$, however, these elevated results have been rare (in the order of one or two events per year) and are generally due to widespread dust events, such as regional dust storms and bushfires.

The 2004, 2005 and 2006 dust deposition data also suggests that dust deposition in the area has declined slightly over this period. Dust deposition measurements generally reflect the influence of activities occurring very close to the monitoring site and are also particularly susceptible to contamination by bird droppings, insects and other localised issues. Thus, the average from all sites has been calculated to provide an indication of annual average fallout levels in the project area. The measured average annual dust deposition levels across all monitoring sites was 3.1 g/m^2/month in 2004, 2.6 g/m^2/month in 2005 and 2.6 g/m^2/month in 2006.

5.7.3 Assessment Methodology

The Air Quality Impact Assessment (**Appendix 12**) is based on procedures outlined in the 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (DEC, 2005). The assessment uses a modified version of the computer-based dispersion model, US EPA ISCST3, to predict off-site dust concentration and dust deposition levels, due to the existing and proposed mining operations. The dispersion modelling takes account of local meteorology, terrain information and uses dust emission factors to predict air quality impacts for each stage of the project.

The assessment has considered three representative underground mining scenarios throughout the 21 year life of the project, to ensure that the range and extent of proposed activities are considered. The three mining scenarios are as follows:

- Year 5, Woodlands Hill seam;
- Year 10, Glen Munro seam; and
- Year 15, Arrowfield seam.

These three underground mining scenarios coincide approximately with MAN open cut operations for Year 10, 15 and 21 respectively, and the proposed South Pit Extension operations (currently being assessed by DoP) for Year 5, 10 and 15 respectively.

The assessment examines the impacts of the Underground Project alone, and also considers the cumulative impact of Mt Arthur Coal's approved and proposed operations and surrounding mining operations.

5.7.4 Air Quality Impact Assessment

5.7.4.1 Project Specific Emissions

The results of predictive air quality modelling have identified that the project will meet the relevant air quality criteria at all residential receiver locations and at all vacant private land. The dust contributions from the Underground Project are small due to the relatively small number of dust sources associated with underground mining operations and the dust controls included in the project design. In summary, the predicted impacts include:

- maximum 24-hour average PM_{10} concentrations are predicted to be of the order of 5 $\mu g/m^3$ at the nearest privately owned residences. This is significantly less than DECC criteria of 50 $\mu g/m^3$;

- maximum annual average dust deposition at the nearest privately owned residence is in the order of 0.2 g/m^2/month or less, significantly less than DECC criteria of 2 g/m^2/month;

- annual average PM_{10} concentrations of up to 1 $\mu g/m^3$ are predicted at the nearest privately owned residences, significantly less than DECC criteria of 30 $\mu g/m^3$; and

- annual average TSP concentrations up to <2 μg/m3 are predicted at the nearest privately owned residences, significantly less than DECC criteria of 90 $\mu g/m^3$.

In general, dust concentrations and deposition rates are higher during the Glen Munro mining scenario (year 10), reflecting the increase in dust emissions associated with transporting ROM coal by truck from the West Belmont Pit to the North Saddlers ROM facility.

To provide an assessment of the incremental impact of the predicted dust emissions from the Underground Project on total local dust levels, the calculated dust levels for each mining scenario were added to the measured background dust levels for the local area. These background levels include dust contributions from existing Mt Arthur Coal and other mining operations. The calculations were completed for each of Mt Arthur Coal's high volume sampler monitoring locations which provide representative coverage of the surrounding nearest residential receiver locations (refer to **Figure 5.22**). The results of this assessment are provided in **Table 5.18**.

Table 5.18 - Predicted Worst Case Air Quality Impacts

Location	Highest Measured Existing Level 2004 – 2006	Predicted Impact Project Year 5	Predicted Impact Project Year 10	Predicted Impact Project Year 15	Predicted Worst Case Dust Level (incl. Background)	Criteria
Annual Average PM_{10} concentration ($\mu g/m^3$)						
Roxburgh Road (Constable)[#]	19	0.1	0.3	0.1	19.3	30
Denman Rd West[#]	19	0.1	0.3	0.1	19.3	30
South Muswellbrook	28	<0.05	0.1	<0.05	28.1	30
Racecourse (Sheppard Ave)	28	<0.05	0.1	<0.05	28.1	30
Windmill[#]	19	0.2	0.7	0.2	19.7	30
Edderton[*#]	16	0.5	1.2	0.4	17.2	30
Roxburgh South[*#]	17	0.3	2.7	0.3	19.7	30
Antiene (Wire Lane)	23	0.3	0.4	0.3	23.4	30

Table 5.18 - Predicted Worst Case Air Quality Impacts (cont)

Location	Highest Measured Existing Level 2004 – 2006	Predicted Impact Project Year 5	Predicted Impact Project Year 10	Predicted Impact Project Year 15	Predicted Worst Case Dust Level (incl. Background)	Criteria
Annual Average TSP concentrations (μg/m^3)						
Roxburgh Road (Constable)[#]	47	0.1	0.3	0.1	47.3	90
Denman Rd West[#]	47	0.2	0.4	0.2	47.4	90
South Muswellbrook	71	<0.05	0.1	<0.05	71.1	90
Racecourse (Sheppard Ave)	69	<0.05	0.1	<0.05	69.1	90
Windmill[#]	47	0.2	0.9	0.2	47.9	90
Edderton*[#]	40	0.5	1.3	0.5	41.3	90
Roxburgh South*[#]	43	0.3	3.7	0.4	46.7	90
Antiene (Wire Lane)	58	0.3	0.5	0.3	58.5	90

[#] Located on Mt Arthur Coal land

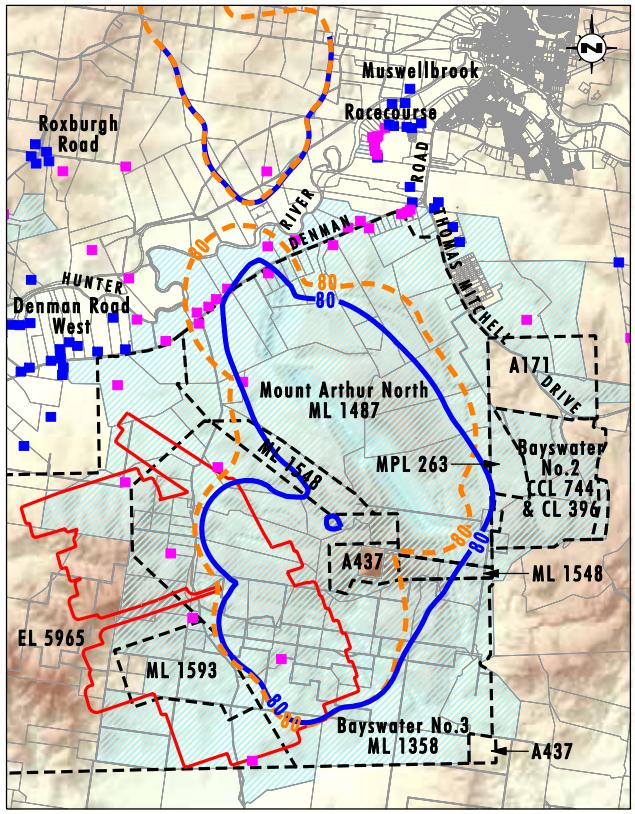
* The Edderton and Roxburgh South assessment locations are on Mt Arthur Coal land and are not considered representative of surrounding private residential receiver locations. They have been included to provide additional coverage for assessment purposes.

As shown in **Table 5.18**, the annual average PM_{10} and TSP concentrations are predicted to comply with the 30 and 90 μg/m^3 criteria respectively at all locations when background levels are included in the assessment. Annual average dust deposition is also predicted to comply with the relevant cumulative goal of 4 g/m^2/month at all monitoring locations when the impact of the project is combined with existing dust levels, with the highest annual average of all locations predicted to be 3.1 g/m^2/month.

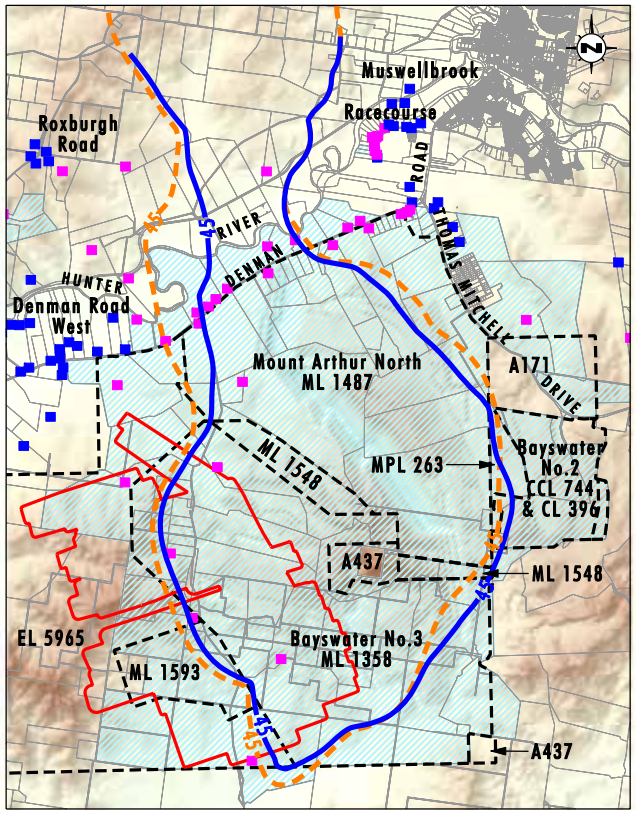
In summary, the results of dispersion modelling suggest that the incremental increase to off site dust concentrations and deposition levels due to activities associated with the project would be small and are not expected to cause air quality goals to be exceeded at sensitive receptor locations.

5.7.4.2 Comparison with MAN EIS

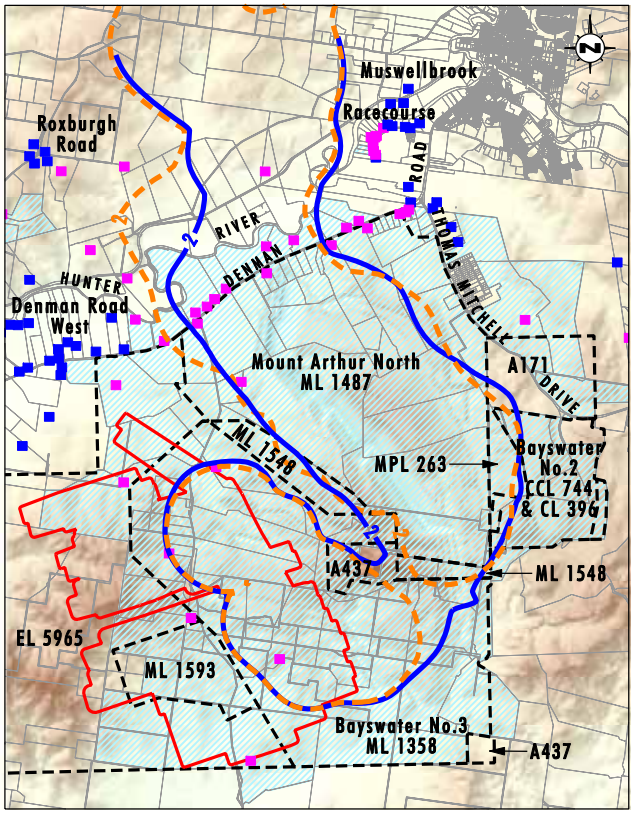
Another objective of the air quality assessment was to compare the impacts of the combined MAN, South Pit Extension and Underground Project operations with impacts presented in the MAN EIS (URS, 2000). The extent of impacts predicted in the MAN EIS compared with impacts predicted for the combined approved and proposed future Mt Arthur Coal operations (including the Underground Project, South Pit Extension and concurrent MAN operations) for Year 5 of underground operations, are shown on **Figure 5.24**. The assessment shows that the annual average PM_{10} impact zone for the combined operations is very similar to the impact zone defined in the MAN EIS for the MAN operations, with marginally lower dust levels to the north-west near to private residences along the Hunter River (refer to **Figure 5.24**). Areas to the south which have a slightly increased impact footprint are contained on Mt Arthur Coal land and do not affect any privately owned land. Annual average TSP and dust deposition levels exhibit a similar trend to annual average PM_{10} with slight decreases to the north-west and slight increases to the south on mine owned land



Annual Average TSP - 80 $\mu g/m^3$



Annual Average PM_{10} - 45 $\mu g/m^3$



Annual Average Dust Deposition - $g/m^2/month$

Base Source: LPI, 2004
Source: Holmes Air Sciences 2007

0 2.0 4.0 8km
1:165 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Mt Arthur Coal Owned Land
- Privately Owned Residence
- Mine / Power Generation Owned Residence
- MAN EIS Impact Zone
- Combined Operations Impact Zone (MAN, South Pit Extension and Underground Project)

File Name (A4): R21_V1/2051_348.dgn

FIGURE 5.24

Comparison of MAN EIS (Year 10) Air Quality Modelling Results with Proposed Combined Mt Arthur Coal Operations

(refer to **Figure 5.24**). This assessment therefore shows that overall, the Underground Project when combined with the existing approved Mt Arthur Coal operations and proposed South Pit Extension, will result in minimal changes to the dust impacts predicted for the approved MAN operations.

5.7.5 Air Quality Management

Measures to minimise potential dust emissions from the operation have been included in the project design including:

- enclosures on top of overland conveyors;
- spray systems for permanent coal stockpiles;
- progressive site rehabilitation and revegetation; and
- haul road dust suppression.

The project design has also sought to minimise the total disturbance footprint and to minimise the area of untreated hardstand areas that may generate dust.

In addition to these project specific controls, Mt Arthur Coal also has existing management measures that will be applied to the Underground Project including:

- real-time and periodic monitoring including strong wind speed alerts;
- operational dust controls (including both proactive and reactive controls) which are implemented by operational personnel as part of normal business operations; and
- operational procedures for management of short term dust episodes that occur due to climatic conditions.

5.7.6 Spontaneous Combustion

Spontaneous combustion has the potential to result in air quality and odour impacts where it is not effectively managed. To determine the potential risk of spontaneous combustion occurring in the project area, spontaneous combustion propensity testing has been completed for representative boreholes. This preliminary testing has indicated that the target resource has a high inherent propensity for spontaneous combustion, a result which is typical of Hunter Valley coals.

Management of spontaneous combustion during mining operations will be a key safety issue for this project, as for all underground coal mining operations, and effective controls will be put in place to limit the potential for incidences of spontaneous combustion and to allow timely and effective management of any events that do occur. These controls will include effective management of the mine ventilation system including placement of seals to restrict flow of air to goaf areas and nitrogen inertisation (or equivalent), a process which assists to speed up the time taken for the mining goaf to become inert after mining (which will occur naturally).

On the surface, management of spontaneous combustion potential associated with underground mining operations primarily relates to coal stockpile areas. Mt Arthur Coal has extensive management measures in place for existing coal stockpile areas which will be implemented for the Underground Project. With these controls in place, the potential for

incidences of spontaneous combustion that will result in odour impacts is predicted to be minimal.

5.8 Greenhouse Gas Emissions Assessment

A Greenhouse Gas and Energy Assessment has been completed for the Underground Project and is included as **Appendix 13**. The assessment provides an estimate of the direct and indirect greenhouse gas (GHG) emissions for the project and provides a summary of the GHG management measures for the project.

5.8.1 Methodology

The energy and GHG emissions assessment was completed with regard to the following policies for undertaking a GHG emissions assessment as part of the preparation of an EA:

- the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol 2004 (GHG Protocol);
- the Australian Greenhouse Office (AGO) AGO Factors and Methods Workbook December 2006 (Workbook) (AGO Workbook); and
- the draft NSW Energy and Greenhouse Guidelines for Environmental Impact Assessment, Sustainable Energy Development Authority and Planning NSW, 2002 (EIA Guidelines).

The GHG Protocol establishes an international standard for accounting and reporting of GHG emissions by entities. Under the GHG Protocol the establishment of operational boundaries involves identifying emissions associated with an entity's operations, categorising them as direct or indirect emissions, and identifying the scope of accounting and reporting for indirect emissions.

Three 'Scopes' of emissions (Scope 1, Scope 2, and Scope 3) are defined for GHG accounting and reporting purposes. These scopes are briefly outlined below.

Scope 1 emissions refer to direct emissions associated with a development. Direct GHG emissions are defined as those emissions that occur from sources that are owned or controlled by the entity. Direct GHG emissions are those emissions that are principally the result of the following types of activities undertaken by an entity:

- generation of electricity, heat, or steam. These emissions result from combustion of fuels in stationary sources;
- physical or chemical processing. Most of these emissions result from manufacture or processing of chemicals and materials;
- transportation of materials, products, waste, and employees. These emissions result from the combustion of fuels in entity owned/controlled mobile combustion sources; and
- fugitive emissions. These emissions result from intentional or unintentional releases, e.g. methane emissions from coal mines and venting.

Scope 2 emissions are a category of indirect emissions that account for GHG emissions from the generation of purchased electricity consumed by the entity.

Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity. Scope 2 emissions physically occur at the facility where electricity is generated. Entities report the emissions from the generation of purchased electricity that is consumed in its owned or controlled equipment or operations as Scope 2.

Under the GHG Protocol, Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are defined as those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity. Some examples of Scope 3 activities provided in the GHG Protocol are extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services.

To harmonise the international reporting of GHG emissions, the AGO Workbook and the EIA Guidelines have adopted the emissions categories outlined in the GHG Protocol. In this context both the AGO workbook and EIA guidelines provide that the scope of emissions that are reported by an entity include both direct (Scope 1) and indirect emissions from a project (Scope 2 and Scope 3 emissions).

In addition, the EIA guidelines define reporting boundaries for a particular project. These boundaries are not physical but are related to the extent to which emissions are associated with 'upstream' and 'downstream' components of a project and its products. The EIA guidelines consider 'upstream' components to include essential inputs to a project including materials, plant and equipment, whilst 'downstream' include outputs of the project including the use of products or waste or the implications in terms of induced use of products, infrastructure or services.

The current policy framework has historically regarded the assessment and reporting of Scope 3 emissions to be optional and only to be included along with Scope 1 and Scope 2 emissions where an organisation believes that Scope 3 emissions are a significant component of the total emissions inventory. In addition the EIA guidelines specify that the application of 'upstream' and 'downstream' project boundaries should be considered on a case by case basis.

Recent interpretations of the application of GHG assessment to the EIA process have indicated that where a project has a direct link to the contribution of GHG emissions beyond its immediate boundaries, these emissions need to be included in the GHG assessment.

To date the NSW government has not developed policy to further define the application of the assessment of indirect GHG emissions on a project basis. In this context, it is considered that the project will result in the generation of indirect GHG emissions mainly through diesel usage for rail and ship transport of product coal, electricity used for conveyors to transport product coal and the combustion of product coal. As such an assessment of Scope 3 GHG emissions has been included as part of this assessment.

The key Scope 1, 2 and 3 emission considered by the GHG and energy assessment for the Underground Project are:

- direct emissions of CO_2 from the combustion of diesel (Scope 1);
- direct emissions of methane from the exposed coal seams (Scope 1);
- direct emissions of CO_2 from spontaneous combustion and slow coal oxidation (Scope 1);
- indirect emissions of CO_2 from the consumption of electricity (Scope 2);

- indirect emissions of CO_2 from the combustion of diesel for coal transport beyond the project boundary (Scope 3); and

- indirect emissions of CO_2 from the end use of coal produced by the project, for example, from combustion in overseas power generation and steel production plants (Scope 3).

The assessment for the Underground Project was undertaken over the 21-year life of the project. A calculation of the energy consumption and GHG emissions were undertaken for indicative years throughout the project life, average annual production and the project as a whole.

5.8.2 Energy Consumption

5.8.2.1 Scope 1 and 2 Energy Consumption

The project's estimated average annual Scope 1 and 2 energy usage is dominated by electricity consumption making up 81 per cent of total energy use, with the remaining 19 per cent consisting of on-site diesel usage. The average annual electricity consumption for the project is estimated at 289,418 GJ and on-site diesel consumption is estimated at 68,070 GJ. The energy index for the mining operation is 0.075 GJ of energy used per tonne of saleable coal, significantly less than the Australian underground coal mining industry average of 0.22 GJ per tonne (AGSO, 2000). This result has been achieved as modern energy efficient and productive equipment will be used for the Underground Project. The energy required for the processing of coal from the Underground Project is also incremental energy on top of that required for processing of open cut coal from the approved operations.

5.8.2.2 Scope 3 Energy Usage

Scope 3 energy consumption is dominated by marine diesel used to transport coal to overseas markets accounting for 69.3 per cent of the total energy used by the project. Diesel used to transport the coal to port by train accounts for 13 per cent of the total energy used by the project.

A comparison of Scope 3 energy consumption figures with AGSO industry averages is not possible, as the AGSO study excludes Scope 3 diesel use for product transport. This also means that a direct comparison of the combined Scope 1, 2 and 3 energy consumption of the project with Australian coal mining industry averages is not possible.

5.8.3 Greenhouse Gas Emissions

5.8.3.1 On-site Greenhouse Gas Emissions

The assessment of site related GHG emissions includes the assessment of Scope 1, 2 and 3 emissions. The assessment of Scope 3 emissions from coal transport and product coal combustion has been considered separately and these results are presented in **Sections 5.8.3.2** and **5.8.3.3**.

Scope 1 emissions assessed include the combustion of diesel on site, slow oxidation, spontaneous combustion and methane releases on site. Scope 2 emissions include the electricity consumed on site and Scope 3 emissions include upstream emissions from diesel and electricity usage on site.

The scope 1, 2 and 3 annual average GHG emissions from on-site activities are dominated by methane emissions at approximately 53.8 per cent or 123,531 TCO_2-e. Emissions from energy use include electricity at 37.4 per cent or 85,941 TCO_2-e per annum and diesel at

2.3 per cent or 5,290 TCO_2-e per annum. Emissions from spontaneous combustion comprise 6.3 per cent or 14,359 TCO_2-e per annum and emissions from slow oxidation comprise 0.3 per cent or 598 TCO_2-e per annum to make up the remainder of the inventory.

The average annual greenhouse emissions from on-site activities are estimated at 229,720 TCO_2-e, representing in total approximately 0.041 per cent of the Australian annual GHG emission rate (AGSO, 2000).

The greenhouse index for the project, based on on-site activities, is 0.048 TCO_2-e per tonne of saleable coal. This is significantly less than the Australian underground coal mining industry average of 0.213 TCO_2-e per tonne of saleable coal (AGSO, 2000). By way of comparison the index for mines in the Hunter and Newcastle coalfields (open cut and underground) ranges from approximately 0.02 to 0.58 TCO_2-e per tonne of saleable coal (AGSO, 2000). This result has been achieved as modern energy efficient and productive equipment will be used for the Underground Project and seam gas contents in the Underground Project area are not as high as in some other coal deposits.

5.8.3.2 Emissions from the Offsite Transport of Product Coal

The annual Scope 3 emissions from the diesel fuel consumed by rail transport of the product coal are estimated at 18,360 TCO_2-e per annum. The Scope 3 emissions from diesel fuel consumed by sea transport of the product coal to the export destination are estimated at 97,269 TCO_2-e per annum. This represents in total, approximately 0.02 per cent of the Australian annual GHG emission rate.

A comparison of Scope 3 GHG emissions with AGSO industry averages is not possible, as the AGSO study excludes Scope 3 diesel use for product transport. This also means that a direct comparison of the combined Scope 1, 2 and 3 GHG emissions of the project with Australian coal mining industry averages is not possible.

5.8.3.3 Emissions from Coal Combustion

The annual average greenhouse emissions from combustion of the coal produced by the project (assuming that all product coal is burnt) are estimated to be approximately 12,986,776 TCO_2-e. This is equivalent to 0.031 per cent of annual global GHG emissions, based on total annual global emissions in 2000 of approximately 42,000,000,000 TCO_2-e (Stern, 2006).

It should be acknowledged that there are a range of practical implications of the assessment of indirect GHG emissions, particularly in relation to the issue of double counting of emissions and the assumptions underlying the assessment of indirect emissions. The GHG Protocol specifically acknowledges the importance of the avoidance of double counting of GHG emissions and, for instance, at an international scale, double counting needs to be avoided when compiling national inventories under the Kyoto Protocol. The limitations of the assessment of Scope 3 GHG emissions in relation to double counting of emissions should be taken into account in the interpretation of this assessment.

Moreover the interpretation of Scope 3 GHG assessments needs to acknowledge the limitations imposed by the largely speculative assumptions upon which the assessment is based. For instance, this assessment assumes the management of indirect GHG emissions resulting from the project will be managed by relevant international, domestic and project specific regulations of each of the potential end users.

5.8.3.4 Qualitative Assessment of Impacts

The DGRs for the project issued by DoP require a quantitative assessment of GHG emissions (see preceding sections) and a qualitative assessments of the impacts of these emissions. This qualitative assessment is included below.

It is generally accepted in the scientific community that the release of emissions of carbon dioxide and other GHGs from human activities including industrial processes, fossil fuel combustion and changes in land use, such as deforestation, are contributing to global warming (Pew Centre on Global Warming, 2007). It is predicted that a continuation of historical trends of GHG emissions will result in additional warming over the 21st century, with Australia's annual average temperatures projected to increase 0.4 to 2 °C above 1990 levels by the year 2030, and 1 to 6 °C by 2070 (CSIRO, 2006)

The preceding sections included calculations of the GHG emissions associated with the Underground Project, including an assessment of the emissions resulting from the end use of product coal. As there are no accepted methods for undertaking an assessment of the impacts that these emissions may have on the global climate, a comparative analysis of project related emissions to global emissions has been undertaken. Total emission from the Underground Project are estimated to be 0.032 per cent of annual global GHG emissions, based on total annual global emissions in 2000 of approximately 42,000,000,000 TCO_2-e (Stern, 2006). Ignoring the significant issue of double counting of Scope 3 emissions resulting from the project (refer to **Section 5.8.1**), it is therefore possible to assume that the project will contribute to up to 0.032 per cent of the extent of global climate change resulting from anthropogenic activities. Given that there is significant conjecture regarding the potential extent of impacts resulting from global warming, quantifying this effect is not practical. However, it should also be noted that the coal produced by the Underground Project will be meeting market demand and that should the project not proceed, this demand will be met from other sources. These sources may have poorer quality coal or less energy efficient operations (such as occur in older mining operations or some other countries) and may result in increased GHG emissions per unit of energy.

From an impact assessment perspective, given the very small contribution that the project will make to global climate change and the fact that should the project not proceed the demand for coal will be met from other sources, it is reasonable to conclude that there will be no measurable environmental effects resulting from the emission of GHGs from the project. However, it is recognised that global warming is the result of the cumulative effect of many such small contributions.

5.8.4 Greenhouse Gas Management

BHP Billiton has recently released a revised Climate Change Policy which outlines its approach to the issue of climate change and details emission reduction targets to be met by operations. The policy acknowledges that climate change is a major challenge and that accelerated action is required to stabilise greenhouse gas concentrations in the atmosphere at levels guided by the research of the United Nations Intergovernmental Panel on Climate Change.

The policy outlines four key action areas for BHP Billiton:

- understanding emissions from the full life cycle of BHP Billiton products;
- improving the management of energy and greenhouse gas emissions across BHP Billiton;

- committing US$300 million over five years to support low emissions technology development, internal energy excellence projects and encourage emissions abatement by BHP Billiton employees and local communities; and

- using BHP Billiton technical capacity and experience to assist governments and other stakeholders on the design of effective and equitable climate change policies including market–based mechanisms such as emissions trading.

Under the revised policy, BHP Billiton has committed to a number of key mechanisms to improve management of energy and greenhouse gas emissions from production. These key mechanisms include:

- a group target for energy and greenhouse gas emissions intensity reduction of 13 and 6 per cent respectively over the period of 2006 - 2012;

- the BHP Billiton business excellence systems, which promote and share leading practice and innovation in energy and operational efficiency to deliver savings in emissions and costs;

- site based plans and targets, whereby each site (including the Underground Project) is required to have a greenhouse gas and energy management plan, including targets that are incorporated into their business plans with associated monitoring and reporting;

- requiring that carbon pricing sensitivity analysis be undertaken in capital decisions on assets of US$100 million or more or for projects that emit greater than 100,000 tonnes of CO_2 equivalent per annum; and

- BHP Billiton will continue to pursue external projects and other opportunities that deliver tangible reductions in greenhouse gas emissions and generate credits.

As part of its commitment to energy management and consistent with BHP Billiton requirements, Mt Arthur Coal will develop and maintain internal energy management plans with specific targets for its operations, including the Underground Project. Mt Arthur Coal will also develop and maintain an internal greenhouse gas management plan consistent with internal corporate requirements.

For the Underground Project, the primary measures that may assist in the reduction of greenhouse gas emissions will be:

- energy efficiency measures, focusing on increased energy efficiency for mine plant and equipment; and

- opportunities for methane capture and combustion through flaring or energy production. Where gas purity reliably allows, methane emissions from the mine (including the gas drainage system, goaf drainage system and mine ventilation system), will either be flared or utilised in small scale power generation where practical and feasible.

Where suitable gas concentrations exist and where Mt Arthur Coal can obtain the rights to extract and utilise coal seam gas, pre-draining of coal seam gas is the preferred method of managing methane emissions from underground mining areas. Pre-drained coal seam gas has the greatest potential for utilisation and preference will be given to technologies which utilise methane for power generation, with flaring being the fall back position if utilisation is not achievable.

Where pre-draining is not suitable, Mt Arthur Coal will investigate whether an efficient means of collecting methane from the mine ventilation system is available.

There are a number of existing and emerging options for methane capture and utilisation from coal seam gas. These include options currently being used or investigated by BHP Billiton at various sites. Potential options that will be considered for this project will include:

- flaring;
- purification to pipeline quality gas via Pressure Swing Adsorption (PSA);
- gas engines;
- gas turbines;
- Hybrid Coal Gas Turbine System (HCGTS);
- Megtec Vocsidizer; and
- lean burn gas turbine.

5.9 Visual Impact

5.9.1 Existing Visual Amenity

The visual character of the upper Hunter Valley is diverse, with a range of landforms, vegetative cover patterns and land uses resulting in considerable variations in scenic quality. The valley floor has been largely cleared of vegetation and is utilised for a range of agricultural, residential, industrial and mining activities, while the slopes bordering the valley remain largely vegetated and undeveloped.

The dominant land uses within and adjacent to the project area are mining and grazing. Local grazing land is considered to provide views of moderate scenic quality with the vegetated steeper slopes of Mt Arthur and Mt Ogilvie providing areas of higher scenic quality. Mining operations within and adjacent to the project area reduce the overall visual quality of the area, however over time, the completion of rehabilitation of the more prominent overburden emplacement areas will provide screening of mining operations, improving the scenic amenity from the majority of viewing locations. To the north and north-east of the project area, the Hunter River alluvial zone, which is used for intensive agriculture, provides areas of moderate to high scenic quality.

Views of Mt Arthur Coal's existing open cut mining operations are possible to varying degrees from a number of surrounding residential locations including South Muswellbrook, the racecourse area, Denman Road to the west and north of the project area and elevated residences along Roxburgh Road approximately 10 kilometres to the north-west. Views of mining operations are also available from local transport corridors including Thomas Mitchell Drive, Edderton Road and Roxburgh Road. As part of its approved open cut mining operations, Mt Arthur Coal is currently completing construction of a visual bund to screen views of mining operations from South Muswellbrook. Stage one of this bund, which provides screening for the majority of operations, is complete, however, the bund will continue to be increased in height as mining operations in the MAN area progress.

Night-time Scenic Quality

The night-time scenic quality of Muswellbrook and surrounding areas is not that of a typical rural town as a result of 24 hour mining operations and other industries in the local area. Management measures to reduce lighting emissions are used by local mining operations and direct night lighting impacts on residential locations can be managed through mine planning and careful placement of lighting plant. However, a night-time glow occurs around each of the mining operations, detracting from the local night time scenic quality.

5.9.2 Visibility of the Project

Elements of the project that will be potentially visible from public viewing locations are limited to surface infrastructure and land impacted by subsidence remediation. The major surface facilities associated with the project include the North Saddlers ROM facility, pit top facilities (at both Saddlers Pit and West Belmont Pit), overland conveyors, haul and access roads and additional stockpiling and infrastructure associated with the existing CHPP. Minor surface facilities that may also be visible include ventilation fans, downcast ventilation shafts, borehole facilities and site services.

The majority of the major surface infrastructure associated with the Underground Project will be shielded by topography, including placement in open cut pits and shielding from overburden emplacement areas, however, portions of the North Saddlers ROM Facility, pit top facilities, and the Glen Munro mining operation haul road will potentially be visible from public viewing locations. The minor surface facilities such as ventilation facilities and boreholes will typically be fenced areas with small sheds and are considered to be consistent with surrounding rural infrastructure and are not visually intrusive.

Subsidence remediation areas, although visible, are not considered to be visually intrusive as they consist of localised earthworks which are consistent with agricultural cultivation and other similar land management practices. The visibility of these works is, however, discussed as part of the visual assessment.

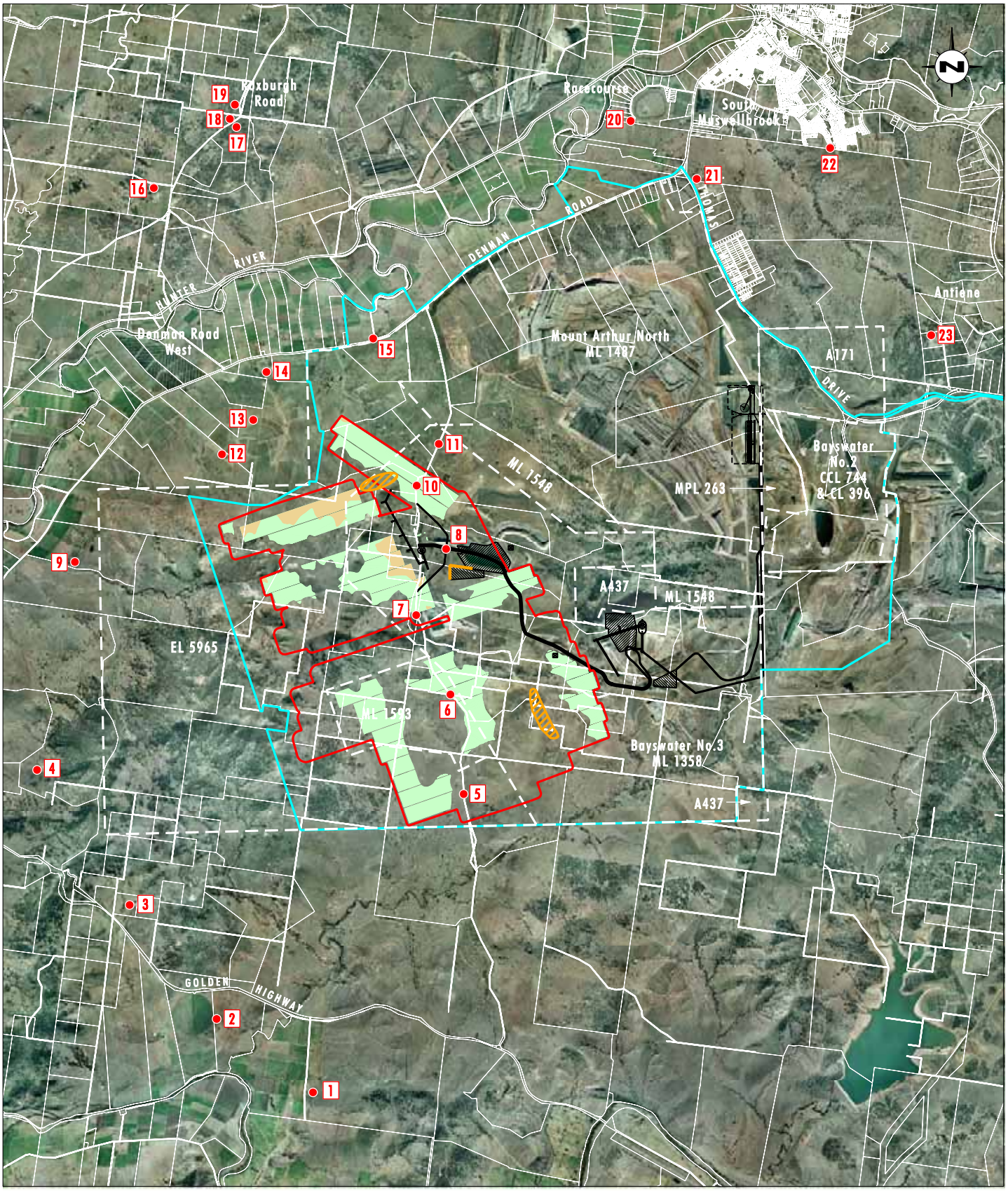
The project may impact on the night landscape through the use of lighting for infrastructure areas including pit-top facilities and lights associated with mobile plant.

5.9.3 Viewing Points and Assessment Methodology

There will be limited potential for visual impact associated with the project given that it involves underground mining, the location of the majority of major surface infrastructure within existing or approved open cut pits and the use of existing coal handling and preparation facilities that have existing visual controls.

An initial visual assessment was undertaken for the Underground Project to identify surrounding locations from which views of project-related surface facilities or predicted subsidence remediation areas may be possible. A radial topographic analysis technique was used as part of this assessment to identify areas potential visible from a particular viewing location, based on ground topography alone (i.e. no allowance was included for screening vegetation). The assessment was undertaken from 23 residential and public viewing locations (e.g. public roads) surrounding the project area (refer to **Figure 5.25**).

The initial assessment found that based on topography alone, parts of the Glen Munro pit top facilities and haul road were potentially visible from elevated residences at Roxburgh Road and from locations along Edderton Road. The North Saddlers ROM facility was potentially visible from a residence south of the Golden Highway and from locations along the Golden Highway. Areas of subsidence remediation works on elevated land above the underground



Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Project Application Boundary
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Proposed Visual Bund
- Proposed Tree Planting
- Viewing Location

FIGURE 5.25

Visual Assessment Locations

File Name (A4): R21_V1/2051_293.dgn

mining area were potentially visible from residences at Racecourse Road, South Muswellbrook, Roxburgh Road, Denman Road west and south of the Golden Highway, and also from vehicles travelling on Denman Road, Edderton Road and the Golden Highway.

A representative viewing location was selected for each of the areas predicted to have potential for views of the Underground Project and a further detailed visual assessment completed using transect analysis. Detailed transect analyses were undertaken for residential locations at Roxburgh Road, Denman Road West and south of the Golden Highway. The transects completed were:

- from Roxburgh Road residence (location 18) through the West Belmont pit to the Glen Munro pit-top facilities;
- from Roxburgh Road residence (location 18) through the West Belmont pit to the Glen Munro pit-top facilities;
- from Roxburgh Vineyard at Denman Road west (location 13) through West Belmont pit to the Glen Munro pit-top facilities; and
- from the residence south of the Golden Highway (location 2) through the Saddlers pit to the North Saddlers ROM facility.

Further findings of the visual assessment are detailed in the following sections.

5.9.4 Visual Impacts

As discussed above, views of major surface infrastructure will be limited to distant views (approximately 10 kilometres from potentially visible project infrastructure) of pit-top facilities and the North Saddlers ROM facility from a residence south of Golden Highway and elevated residences along Roxburgh Road. There will also be views of the Glen Munro pit-top facilities when travelling along Edderton Road.

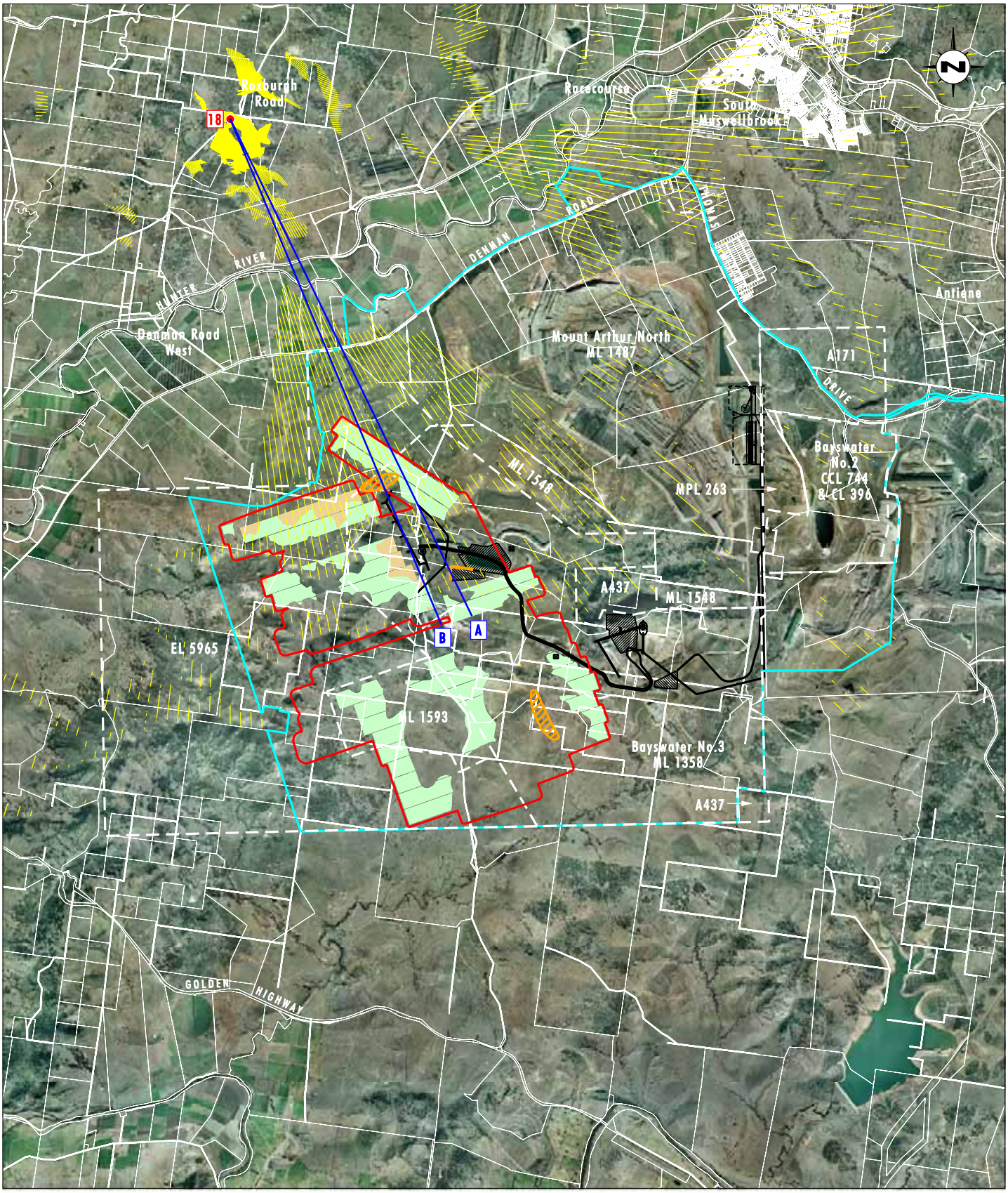
Subsidence remediation areas will be visible from a number of residential and public road locations surrounding the project area. Subsidence remediation work will consist of deep ripping, regrading and some minor earthworks, all activities which are consistent with surrounding agricultural land management practices. Therefore the visual impact of subsidence remediation works is considered to be minimal given the surrounding rural environment and temporary nature of the impact.

The minor surface facilities required above the underground mining area such as ventilation facilities and boreholes will typically be small fenced areas with small sheds and other minor infrastructure and are considered to be consistent with surrounding rural infrastructure. Theses facilities are therefore considered unlikely to be visually intrusive and will not adversely affect existing visual amenity.

The findings of the visual impact assessment and detailed transect analysis are discussed below for each viewing area separately.

Roxburgh Road

Elevated residences on Roxburgh Road to the north of the project area will have distant views of subsidence remediation areas and will potentially have views of the Glen Munro pit-top facilities and haul road (refer to **Figure 5.26**). These residences are located on an elevated ridgeline more than six kilometres from the closest point of the subsidence affectation area and more than nine kilometres from major surface infrastructure. From their



Base Source: Mt Arthur Coal, 2006

0 1 2.5 5km
1:100 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Project Application Boundary
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Terrain Visible from Viewing Location 18
- Proposed Visual Bund
- Proposed Tree Planting
- Cross Section Location
- Viewing Location

FIGURE 5.26

Areas Visible from Roxburgh Road (Location 18)

File Name (A4): R21_V1/2051_296.dgn

elevated position, these residences currently have views of the MAN mining area with management strategies implemented to minimise visual impacts in accordance with the MAN development consent. These residences also have views of surrounding rural, residential and industrial land uses, and in some cases, of Bengalla Mine. **Figure 5.26** also shows that these residents will not be able to see the North Saddlers ROM Facility and pit-top facilities in the Saddlers Pit area.

Detailed transect analysis shows that, in the absence of any visual controls, it is possible that Roxburgh Road residents may have views of buildings associated with the Glen Munro pit-top facilities (refer to **Figure 5.27**). These buildings are expected to be up to approximately eight metres high and will be clad with suitable natural tones to blend in as much as possible with the surrounding environment. Views of further infrastructure within the pit, including the proposed ROM coal stockpile, will be shielded by the northern edge of the pit. To screen views of the Glen Munro pit-top facilities, it is proposed that an approximately 10 metre high bund be constructed along the northern and western edge of the pit top facility area (refer to **Figures 5.26** and **5.27**). The bund wall will be planted with trees to provide an additional screen (approximately 15 metres) which will filter views of the buildings from residences along Roxburgh Road. This bund will be constructed and planted with suitable tree species early in the project life and prior to the construction of the Glen Munro pit-top facilities.

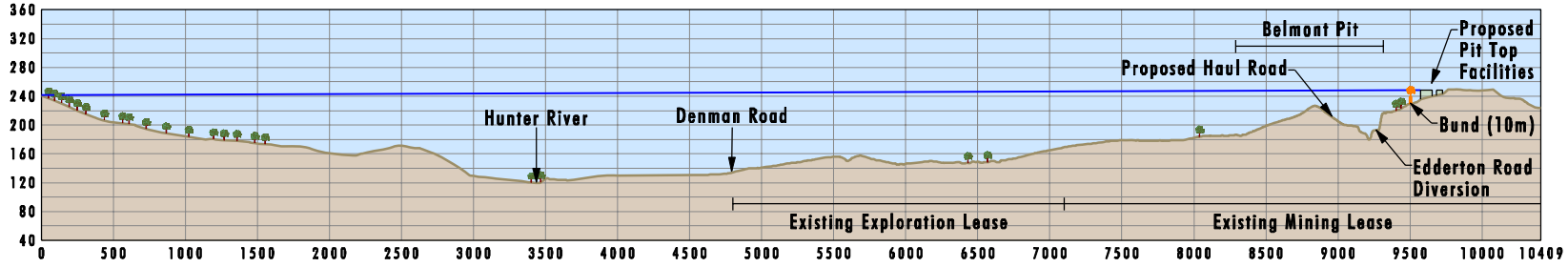
Views of subsidence remediation areas will be limited to the northern section of the subsidence affectation area and are considered to be consistent with views of surrounding agricultural land management practices. Given the existing views from Roxburgh Road, the distance from the project area and the proposed screening of Glen Munro infrastructure, the project is not considered likely to significantly change the existing visual character of the Roxburgh Road area.

Denman Road West

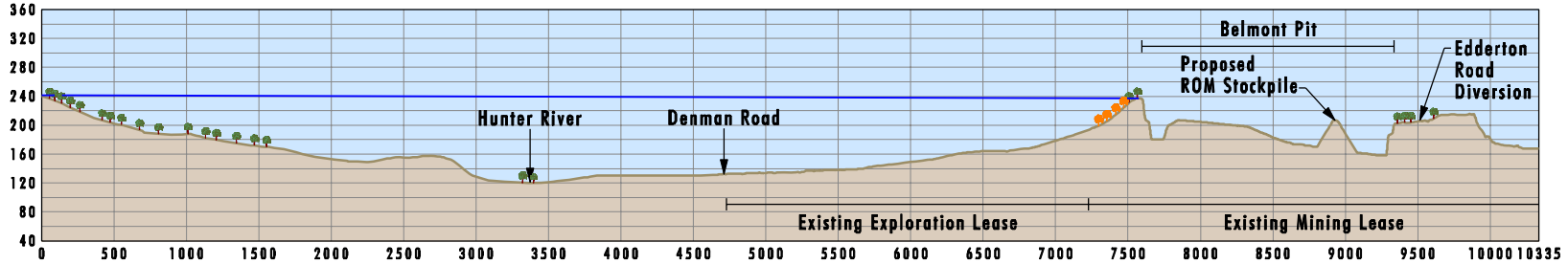
As shown on **Figures 5.28** and **5.29**, none of the major project infrastructure will be visible from Denman Road or adjacent residences, including Roxburgh Vineyard, due to intervening topography. Views of subsidence remediation areas will, however, be possible from sections of Denman Road and a limited number of residences in the vicinity (refer to **Figure 5.28**). The representative (potentially worst affected residential location) visual assessment for this area was undertaken from Roxburgh Vineyard from which views will be limited to the northern section of the subsidence affectation area (refer to **Figure 5.28**). A tree screen is proposed to limit potential views of the edge of West Belmont Pit (refer to **Figure 5.28**). Roxburgh Vineyard and road users currently have views of overburden emplacement areas at Mt Arthur Coal and Bengalla mine and views of surrounding rural and residential land uses. In the context of these existing views, the short-term localised impact of subsidence remediation works and the consistency of these works with surrounding agricultural practices, the project is not considered likely to significantly change the existing visual character of the area.

South of Golden Highway

Views of subsidence remediation areas are possible from the Golden Highway and a small number of residences to the south of the Golden Highway (refer to **Figure 5.30**). It is also possible that, in the absence of any screening vegetation, road users and the residence at location 2 (refer to **Figure 5.29**) may have limited views of the North Saddlers ROM facility and pit-top facilities in Saddlers pit, a distance of more than 10 kilometres away. Views of further infrastructure within the pit and other major Underground Project infrastructure will be shielded by intervening topography. In order to filter views of the ROM facility and pit-top facilities, Mt Arthur Coal propose to plant a screen of trees on a rise between the Golden Highway and the ROM facility (refer to **Figure 5.30** and **Section 5.9.5**).



Cross-Section 18A



Cross-Section 18B

0 200 400 500m
Vertical Scale 1:10 000

0 1 2 2.5km
Horizontal Scale 1:50 000

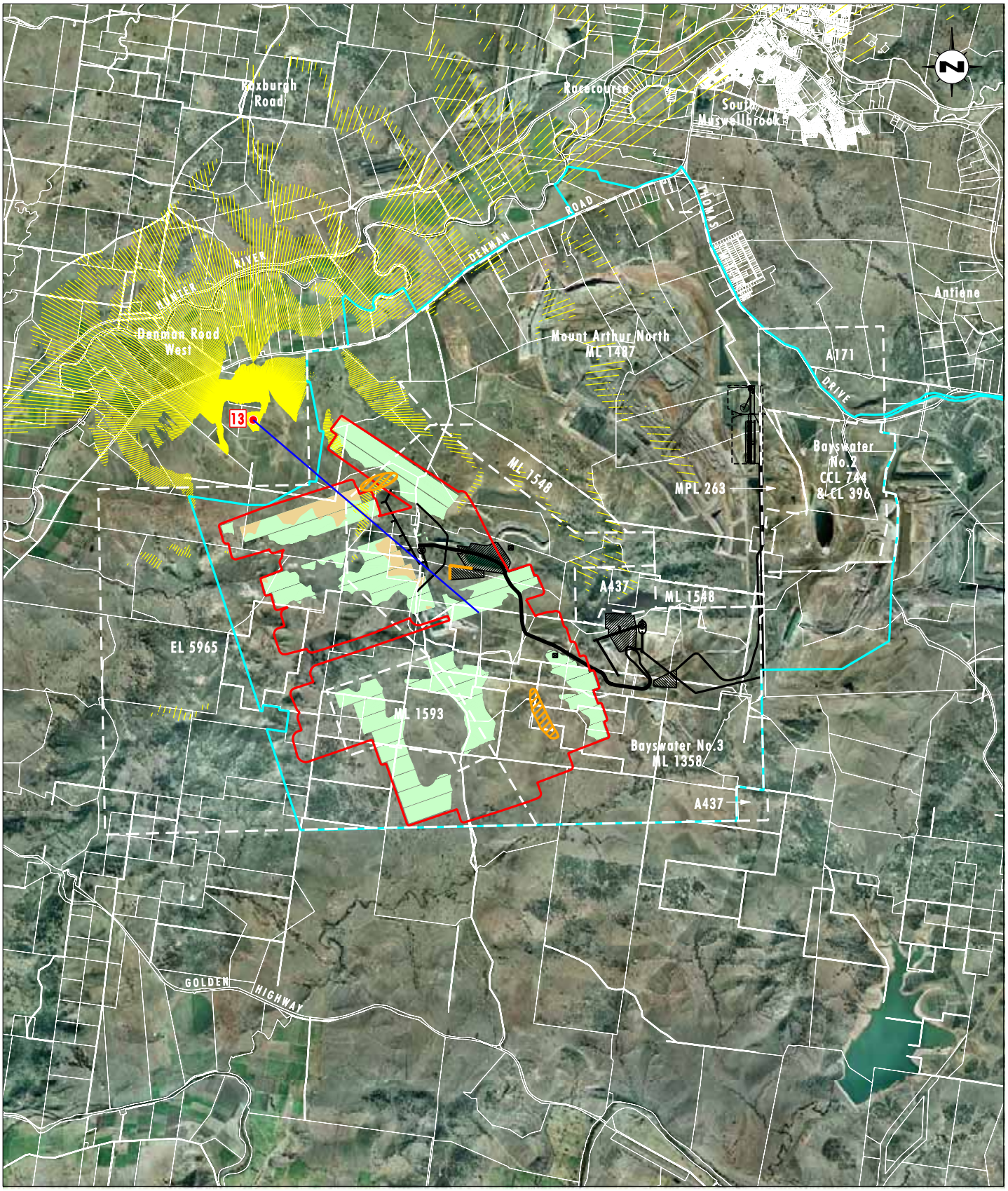
Legend

- Viewline
- Existing Trees
- Proposed Tree Planting

Note: See Figure 5.25 for cross section locations

FIGURE 5.27

Visual Transect Assessment - Roxburgh Road (Location 18)



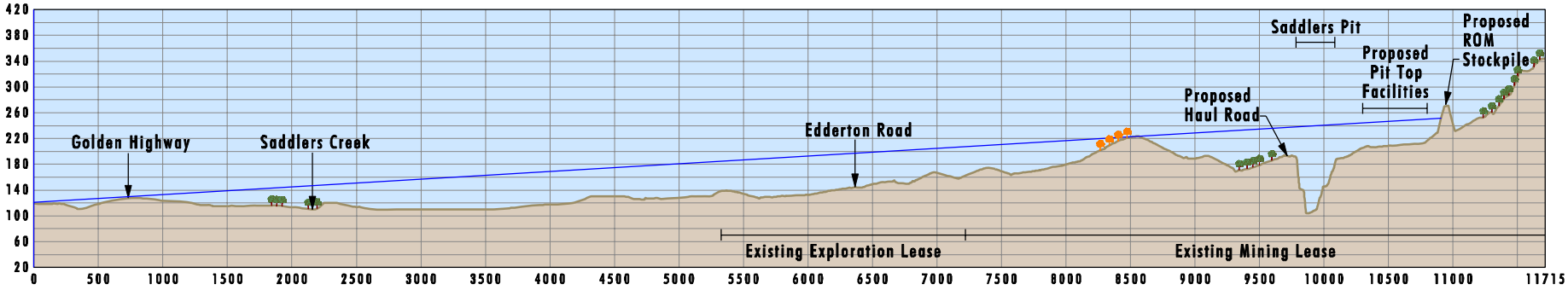
Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Project Application Boundary
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Terrain Visible from Viewing Location 13
- Proposed Visual Bund
- Proposed Tree Planting
- Cross Section Location
- Viewing Location

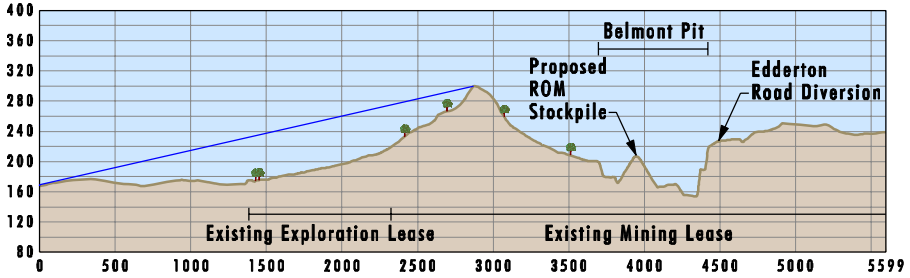
FIGURE 5.28

Areas Visible from Denman Road West (Location 13)

File Name (A4): R21_V1/2051_295.dgn



Cross-Section 2



Cross-Section 13

0 200 400 500m
Vertical Scale 1:10 000

0 1 2 2.5km
Horizontal Scale 1:50 000

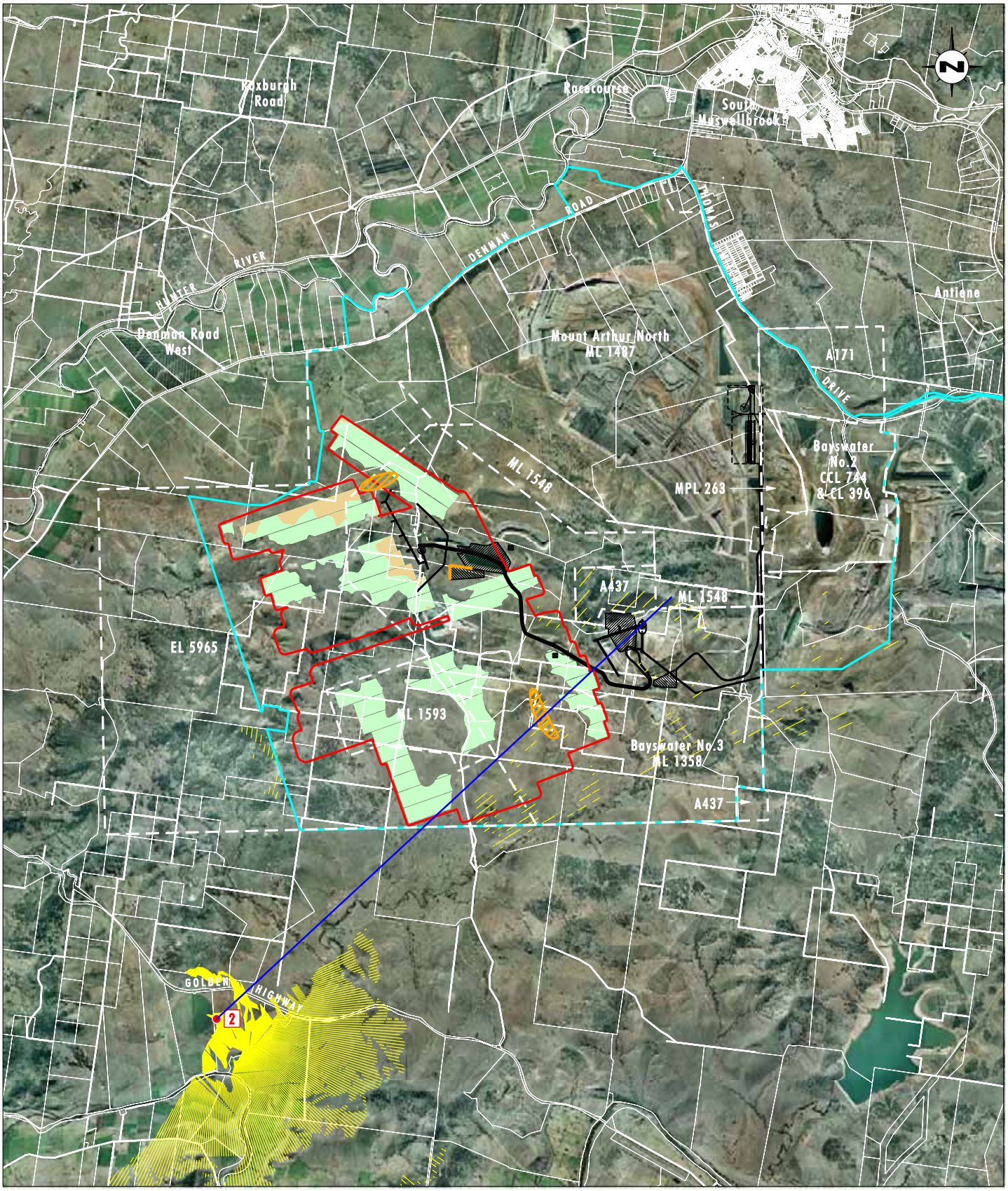
Legend

- Viewline
- Existing Trees
- Proposed Tree Planting

Note: See Figure 5.25 for cross section locations

FIGURE 5.29

Visual Transect Assessment - South of Golden Highway and Denman Road West (Locations 2 & 13)



Base Source: Mt Arthur Coal, 2006

0 1 2.5 5km
1:100 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Project Application Boundary
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Terrain Visible from Viewing Location 2
- Proposed Visual Bund
- Proposed Tree Planting
- Cross Section Location
- Viewing Location

FIGURE 5.30

Areas Visible from South of Golden Highway (Location 2)

Views of subsidence remediation areas will be limited to the southern section of the subsidence affectation area, with the visual impacts considered to be consistent with surrounding agricultural land uses. Given the distance from the project area and the proposed screening of project infrastructure in the vicinity of Saddlers pit, the project is not considered likely to significantly change the existing visual character of the Golden Highway area.

Edderton Road

Edderton Road passes through the middle of the project area and will therefore provide prominent views of subsidence remediation areas, Glen Munro pit-top facilities and the associated haul road. The road itself will also be subject subsidence impact and will require repair works. The Edderton Road diversion will cross Belmont Pit and, without controls, would potentially provide direct views of the Glen Munro facilities. Bunding and tree planting is proposed along the northern and western edges of Glen Munro pit-top facilities area which will largely screen the facilities from vehicles travelling south along Edderton Road, while topography will largely screen the view of pit top facilities from vehicles travelling north along Edderton Road. The proposed bunding will also act to shield traffic from direct lighting impacts associated with pit top facilities.

As discussed in **Section 5.11**, the final design of the Edderton Road diversion approved as part of the Bayswater No. 3 Project will be completed in consultation with MSC. This design will consider controls required to screen views of Underground Project infrastructure associated with the Glen Munro mining operation. A key focus will be to minimise potential lighting impacts on traffic travelling along Edderton Road. Potential controls may include bunding adjacent to the road to prevent direct views and lighting impacts.

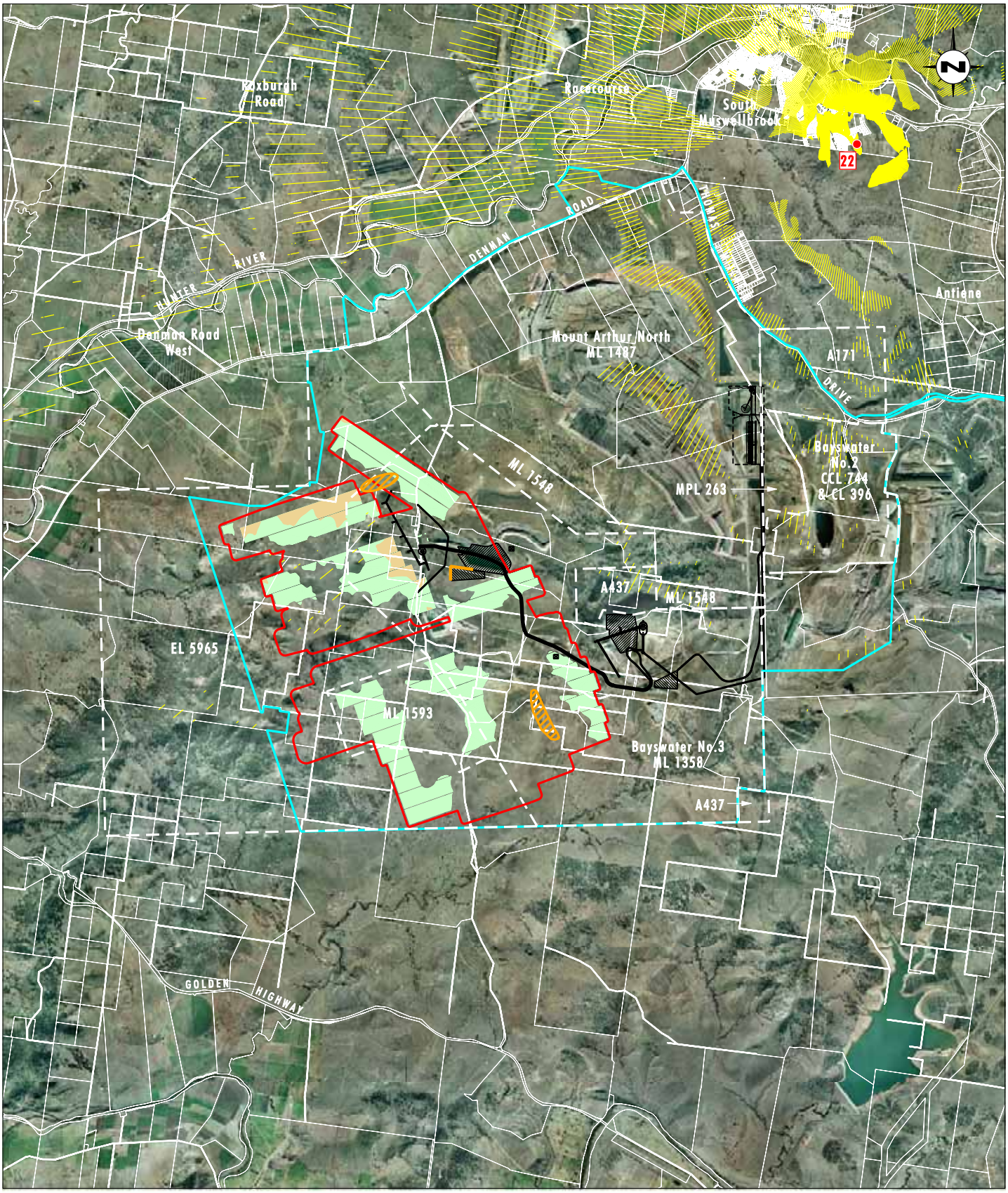
Given the existing views of open cut mining operations from Edderton Road and the consistency of subsidence remediation works with existing rural land management practices, the visual impact of the project on road users is not considered to be significant.

South Muswellbrook

As shown on **Figure 5.31**, none of the major project infrastructure will be visible from South Muswellbrook due to intervening topography. Distant views of small areas of subsidence remediation areas will, however, be possible from some locations within South Muswellbrook (refer to **Figure 5.31**). Views will be limited to the northern section of the subsidence affectation area and will be at a distance of more than 11 kilometres from residences at South Muswellbrook. At this distance the minor ground disturbing works will not be visually intrusive and the visual impacts will be minimal. The major surface infrastructure associated with the project will not be visible from South Muswellbrook due to intervening topography and existing emplacement areas in the MAN mining area. Residences with south and west facing views at South Muswellbrook currently have views of existing overburden emplacement areas at Mt Arthur Coal and Bengalla mines and of surrounding rural and industrial land uses. In the context of these existing views, the distance between the residences and subsidence remediation areas and the consistency of these works with surrounding agricultural land uses, the project is not considered likely to significantly change the existing visual character of the South Muswellbrook area.

Racecourse Road

As shown on **Figure 5.32**, none of the major project infrastructure will be visible from Racecourse Road or adjacent residences due to intervening topography. Distant views of subsidence remediation areas will, however, be possible from residences in the vicinity of the racecourse (refer to **Figure 5.32**), the majority of which are currently owned by mining



Base Source: Mt Arthur Coal, 2006

0 1 2.5 5km
1:100 000

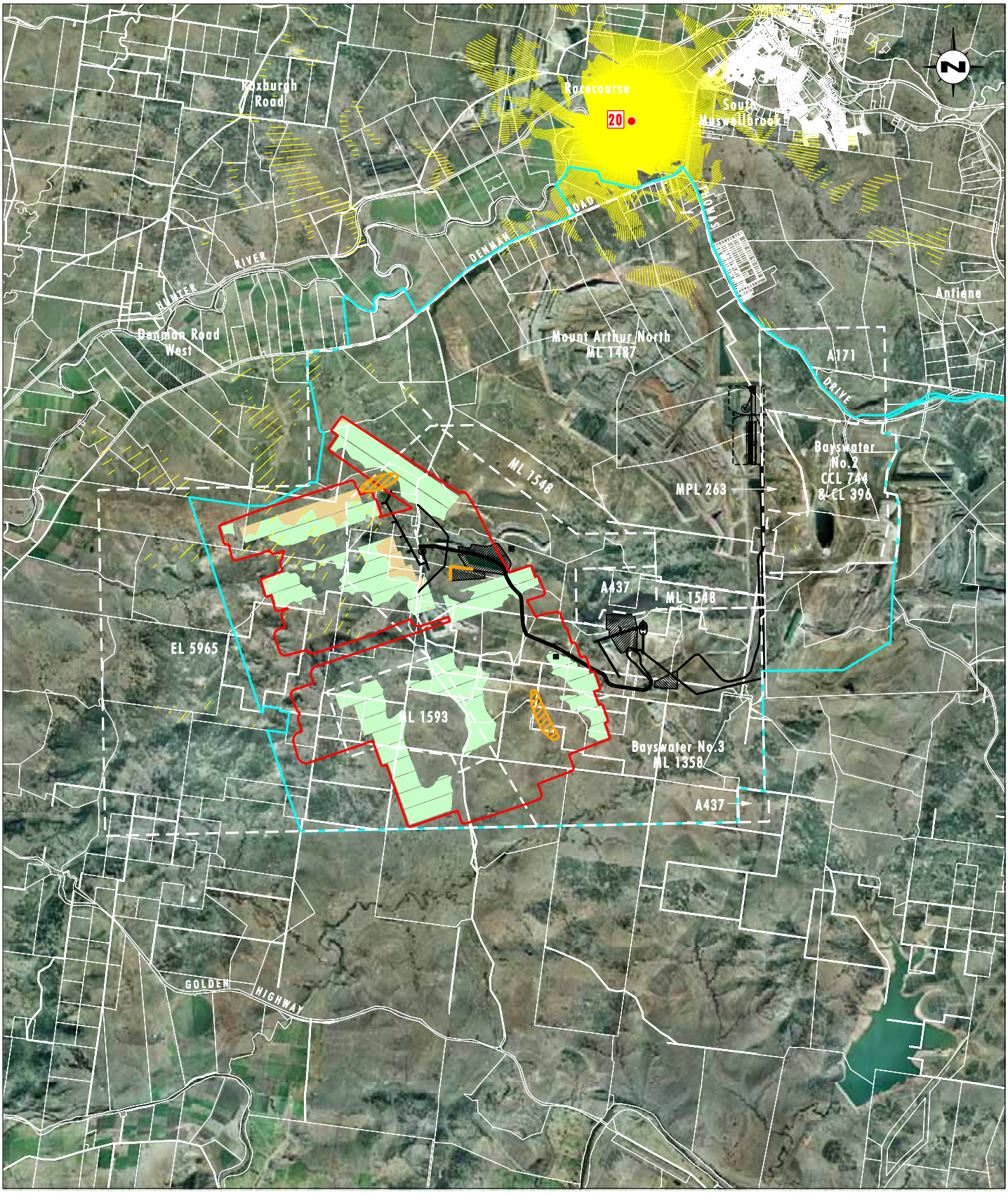
Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Project Application Boundary
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Terrain Visible from Viewing Location 22
- Proposed Visual Bund
- Proposed Tree Planting
- Viewing Location

FIGURE 5.31

Areas Visible from South Muswellbrook (Location 22)

File Name (A4): R21_V1/2051_298.dgn



Base Source: Mt Arthur Coal, 2006

0 1 2.5 5km
1:100 000

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Project Application Boundary
- Potential Subsidence Remediation Area - Cultivation
- Potential Subsidence Remediation Area - Earthworks
- Terrain Visible from Viewing Location 20
- Proposed Visual Bund
- Proposed Tree Planting
- Viewing Location

FIGURE 5.32

Areas Visible from Racecourse (Location 20)

File Name (A4): R21_V1/2051_297.dgn

companies. Views will be limited to the northern section of the subsidence affectation area and will be at a distance of more than nine kilometres. At this distance the minor ground disturbing works will not be visually intrusive and the visual impacts will be minimal. The major surface infrastructure associated with the project will not be visible from the racecourse area due to intervening topography and the location of the main facilities within open cut pits. Residences with south and west facing views currently have views of existing overburden emplacement areas at Mt Arthur Coal and Bengalla mines and of surrounding rural and residential land uses. In the context of these existing views, the distance between the residences and subsidence remediation areas, and the consistency of these works with surrounding agricultural practices, the project is not considered likely to significantly change the existing visual character of the racecourse area.

Other Locations

Views of the project will not be possible from residential locations to the south-west or west of the project area due to the shielding provided by Mt Ogilvie. Residents in the Antiene area and along Thomas Mitchell Drive are also shielded from views of the project by intervening topography or existing overburden emplacement areas.

Night Lighting

Potential night lighting impacts associated with the project will be centred around the North Saddlers ROM facility, the Saddlers and Glen Munro pit-top facilities, and lighting from mobile plant travelling along haul roads. Potential impacts associated with the existing coal handling and transport facilities have been assessed as part of previous projects and appropriate management measures implemented. Subsidence remediation works will only occur during day time hours and therefore will not result in any night lighting impacts.

The North Saddlers ROM facility and Saddlers pit-top facilities will not be visible from the majority of residential locations, with only one residence over 10 kilometres to the south-west having potential views of this area. Lighting controls will be implemented at the Saddlers ROM and pit-top facilities, with lights directed away from this residence and Edderton Road, and louvers or shields used on fixed lighting as required. With these controls in place, the potential for lighting impacts will be minimal.

The Glen Munro pit-top facilities will potentially be visible from a limited number of residences on Roxburgh Road, however, bunding and tree screening is proposed to shield these views. With the proposed bund and tree screens in place, along with careful lighting design as discussed above, and considering the significant distance to these residences (over 9 kilometres), the potential for lighting impacts will be minimal. These controls will also assist in minimising the potential for lighting impacts on vehicles on Edderton Road.

Mt Arthur Coal currently has comprehensive lighting controls in place for mobile equipment and lighting plant which will be implemented as appropriate for the Underground Project. This includes procedures for the placement of lighting plant and use of louvers and shields on lights as required to reduce fugitive lighting emissions.

In the context of the controls discussed above and considering the relatively small footprint of the surface facilities associated with the project, the project is considered unlikely to significantly adversely impact the existing night-time scenic amenity.

5.9.5 Proposed Visual Controls

Mt Arthur Coal propose to implement a range of visual controls to screen or filter views of project infrastructure from residential and public road locations. These include:

- construction of a 10 metre high bund around the northern and western edge of the Glen Munro pit-top facilities with tree plantings on bund wall to provide further shielding (refer to **Figure 5.25**);
- tree planting around the northern edge of Belmont pit to filter views of the edge of the open cut mining area (refer to **Figure 5.25**);
- tree planting on a rise to the south-west of the North Saddlers ROM facility to filter distant views of ROM facility from the South-west (refer to **Figure 5.25**);
- all lighting to be located and directed so as to not directly impact on residential or road locations. Lighting will be designed to minimise excessive night glow; and
- all buildings potentially visible to the public to be coloured in suitable natural tones.

Specific visual controls are not required for subsidence remediation areas as these activities will have only a localised temporary impact which is considered to be consistent with the surrounding agricultural land management practices. Subsidence remediation activities are therefore considered to have minimal impact on the visual quality of the surrounding environment.

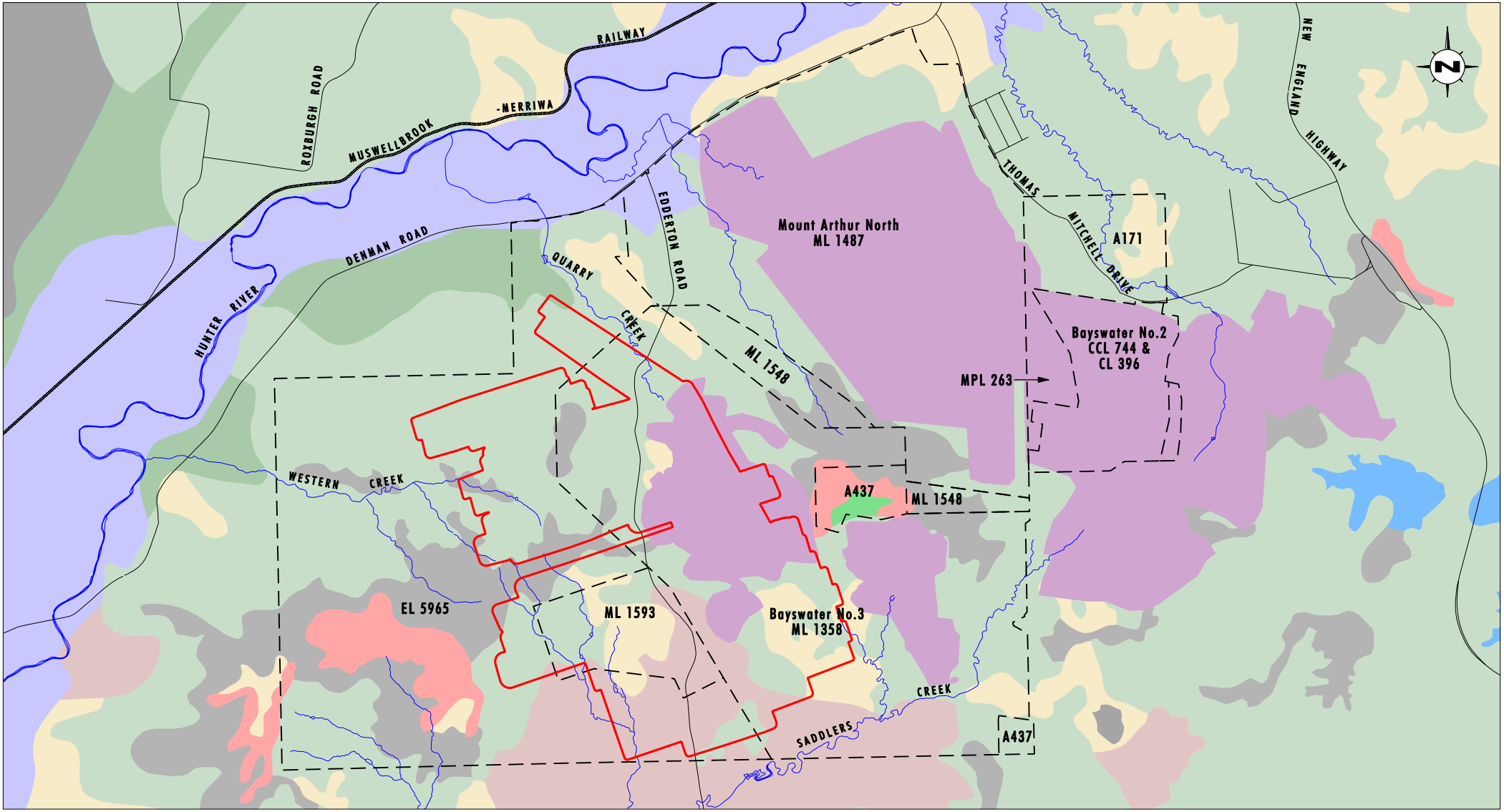
5.10 Land Resources, Decommissioning and Rehabilitation

5.10.1 Land Capability

Land capability is the ability of the land to maintain its productive potential under a specified use, without degradation. Climate, soils, geology, geomorphology, soil erosion, site and soil drainage characteristics and current land use data are all considered in determining land capability (Emery, 1986). Eight classes of Rural Land Capability were defined by the then Soil Conservation Service for mapping rural lands (refer to **Table 5.19**). Mapping of the Muswellbrook 1:100,000 map sheet was provided in digital format by the then Department of Infrastructure Planning and Natural Resources in early 2004. Land Capability in the project area is shown on **Figure 5.33**.

Table 5.19 – Rural Land Capability Classes

General Capability	Land Capability Classes	Interpretations and Implications
Suitable for regular cultivation	I	Suitable for a wide variety of uses. Where soils are fertile, has the highest potential for agriculture. Includes 'prime agricultural land'.
	II	Usually gently sloping land suitable for a wide variety of agricultural uses. Includes "prime agricultural land".
	III	Sloping land suitable for cropping on a rotational basis. Soil erosion problems are often severe. Generally fair to good agricultural land.



Source: DIPNR, 2004

Legend

- Mining and Exploration Lease Boundary
- Subsidence Affectation Area
- Class I
- Class II
- Class III
- Class IV
- Class V
- Class VI
- Class VII
- Class VIII
- Urban Area
- Mining and Quarrying Areas

FIGURE 5.33

Land Capability

File Name (A4): R21_V1/2051_256.dgn

Table 5.19 – Rural Land Capability Classes (cont)

General Capability	Land Capability Classes	Interpretations and Implications
Suitable for grazing and occasional cultivation	IV	Land not suitable for cultivation on a regular basis owing to limitations of slope gradient, soil erosion, shallowness or rockiness, climate, or a combination of these factors. Comprises the better classes of grazing land.
	V	Land not suitable for cultivation on a regular basis owing to considerable limitations of slope gradient, soil erosion, shallowness or rockiness, climate, or a combination of these factors. Soil erosion problems are often severe. Production is generally lower than for grazing lands in Class IV.
Suitable for grazing but not for cultivation	VI	Productivity will vary due to soil depth and fertility. Comprises the less productive grazing lands.
Land best protected by green timber	VII	Generally comprises areas of steep slopes, shallow soils and/or rock outcrop.
Unsuitable for agricultural or pastoral uses	VIII	Cliffs, lakes or swamps and other lands unsuitable for agricultural and pastoral production.
Mining and quarrying areas	M	

Excluding previously mined areas, land within the subsidence affectation area contains four land capability classes, these being Class III, IV, V and VI. The subsidence affectation area is dominated by Class V land, this being land suitable for grazing and occasional cultivation. This class of land is present on the lower sloping areas within the northern, western and southern extents of the subsidence affectation area. There is also a significant area of Class III land within the southern portion of the subsidence affectation area. Class III land is suitable for rotational cropping.

The Underground Project has the potential to impact on land capability through ground disturbance associated with construction of mining infrastructure and through subsidence remediation works. The main surface infrastructure will be located in existing and approved open cut mining areas and will therefore not impact on land capability, with the remaining minor surface infrastructure involving disturbance of only small areas which will have only minor impact on overall land capability. Subsidence remediation works are also considered unlikely to significantly impact on land capability as they are short-term impacts that are consistent with typical agricultural impacts such as cultivation.

Following subsidence impact, the land within the predicted subsidence affectation area will remain viable for its current use of low intensity grazing. It is likely that grazing will be excluded from portions of the project area as mining occurs beneath areas of predicted surface cracking. Following any required remediation of surface cracking, grazing may be re-instated. It is therefore predicted that there will be only localised short-term impacts on productive agricultural land use within the project area.

5.10.2 Decommissioning Strategy

As part of the mine planning process for the Underground Project, Mt Arthur Coal have prepared a conceptual closure and decommissioning plan. This plan is required as part of the BHP Billiton capital investment process to ensure that prior to project commencement,

appropriate closure and decommissioning strategies have been identified and to demonstrate that the project can be appropriately decommissioned in accordance with relevant BHP Billiton and government requirements, industry guidelines and community expectations. The BHP Billiton process also ensures appropriate accruals for decommissioning costs throughout the project life. The detailed closure planning process undertaken as part of the project design has found that the Underground Project can be effectively closed and decommissioned to meet these aims.

Decommissioning of the underground mining operations and minor surface facilities associated with the Underground Project will occur progressively throughout the life of the project as mining progresses to each new extraction area. This will include progressive decommissioning of mine entries, ventilation fans, ventilation shafts, borehole facilities and associated surface facilities.

A detailed decommissioning plan will be prepared for each mining stage as part of the MOP process and provided to DPI for approval prior to the commencement of decommissioning works. These decommissioning plans will be designed to meet the rehabilitation criteria discussed in **Section 5.10.3**. The decommissioning process will involve the following key tasks:

- salvage and removal of mine equipment and machinery from the mine;
- sealing of all mine openings and boreholes in accordance with DPI guidelines;
- removal of services such as power, water, sewer;
- final rehabilitation of all areas affected by subsidence;
- removal of any excess carbonaceous material;
- demolition and removal of all surface infrastructure;
- implementation of a site investigation process in accordance with relevant guidelines, to identify any contamination present and, where required, to remediate these areas;
- stabilisation and closure of highwalls used for access into underground mining areas;
- rehabilitation of disturbed areas following removal of surface infrastructure; and
- ongoing monitoring and management of rehabilitated areas.

Decommissioning of major surface facilities including the North Saddlers ROM facility, Saddlers pit-top facilities, access road, water management structures and closure of Saddlers Pit will occur at the cessation of underground mining at the Mt Arthur Coal site. The decommissioning of the Glen Munro facilities area and West Belmont Pit will occur after the completion of mining in the Glen Munro seam. Further details regarding the rehabilitation of open cut voids used for accessing underground mining areas are included in **Section 5.10.2.2**.

As discussed in **Section 1.2**, substantial further coal resources will remain within the project area beyond the proposed 21 year mining period and Mt Arthur Coal intend to seek approval to continue underground mining beyond the life of the Underground Project. Should approval for ongoing mining be approved, the facilities constructed for this project would continue to be used. Should, however, approval for continued underground operations at the site not be

granted, decommissioning will occur following the completion of the 21 year concept mine plan.

5.10.2.1 Decommissioning of MAN Infrastructure

The Underground Project will use existing Mt Arthur Coal infrastructure, including the MAN CHPP and rail facility. The approval period sought for the Underground Project continues beyond the currently approved life of the open cut mining operations. At the completion of mining as part of the Underground Project, should the MAN infrastructure no longer be required for ongoing mining (either open cut or underground), it will be decommissioned. The decommissioning of these facilities will be carried out consistent with the approved rehabilitation concept plan for the MAN project and be detailed in the final MOP submitted to DPI for the project. Decommissioning of these facilities will include removal of all infrastructure and remediation of the land to a grazing land use or as otherwise determined in consultation with DPI as part of the detailed decommissioning planning process.

5.10.2.2 Conceptual Final Landform

The Underground Project will utilise two open cut pits approved as part of the Bayswater No. 3 project to access the underground mining areas. Saddlers Pit will be utilised throughout the 21 year mine plan for mining in the Woodlands Hill, Arrowfield, Bowfield and Piercefield seams, while the West Belmont Pit will provide access to the Glen Munro seam. Once mining in the Glen Munro seam is complete, the West Belmont Pit will no longer be required and will be decommissioned. Saddlers Pit is planned to be used for underground access beyond the initial 21 year mining period, should future mining approvals be granted. The conceptual final landform discussed below assumes that both of these mining pits are decommissioned at the end of the initial 21 year mining period and is consistent with the conceptual final void arrangements approved as part of the Bayswater No. 3 project.

The final void strategy for the Bayswater No. 3 mining area was outlined in the Bayswater No. 3 EIS (Resource Planning, 1993). At the end of the 20 year mine plan outlined in the EIS, there were planned to be four active void areas; Saddlers Pit, Belmont Pit, West Belmont Pit and Calool Pit. The conceptual final landform outlined in the EIS involved partially backfilling the Calool Pit and had three final voids; West Belmont Pit, Belmont Pit and Saddlers Pit. The overall final void concept approved as part of the Bayswater No. 3 project has not been changed by the Underground Project, however, open cut mining in Saddlers and West Belmont Pits will no longer cover the same extent as previously planned. Coal in some of the areas previously planned for open cut mining will now be extracted by underground mining methods, reducing the overall extent of open cut mining and therefore modifying the final void concept for the West Belmont and Saddlers Pits. The timing of closure of these final voids will also be delayed from the previously planned timing due to their ongoing use for underground access.

The main objectives for the closure and ongoing management of the West Belmont and Saddlers Pit final voids are:

- to minimise the area of disturbance and maximise the area of land restored to its former land capability;
- to provide a landform which is stable and able to be maintained in the long term; and
- to ensure there is no risk to public safety.

In line with these objectives, it is proposed that the following treatments will be applied to the final voids:

- any exposed coal seams within the highwall will be effectively covered and the highwall benched and/or battered back to an angle of repose considered geotechnically stable;
- a safety berm and fence will be constructed at the top of the highwall to provide for public safety;
- low walls will be reshaped to less than 18°, suitably revegetated and made stable for the long term; and
- any carbonaceous material remaining in the pit floor will be suitably capped and the capping material revegetated.

The revised conceptual final landforms for West Belmont and Saddlers Pits and related disturbance corridors following the completion of underground mining and based on the above criteria are shown on **Figure 5.34**. The rehabilitation of the remaining open cut mining areas in the Bayswater No. 3 ML will be undertaken in accordance with the Bayswater No. 3 development consent and in consultation with DPI. Any subsidence impacts on these areas due to underground mining will be undertaken as required as part of the Underground Project.

To guide the decommissioning process for these open cut pits following the completion of underground mining, Mt Arthur Coal will prepare final void management plans for West Belmont Pit and Saddlers Pit at least five years prior to their planned closure. These plans will be prepared in consultation with DPI and will address:

- options for future use of final voids;
- likely groundwater inflows and the potential effects on local and regional groundwater;
- details of the strategy for the long-term management of final voids; and
- management of the catchment for the final void.

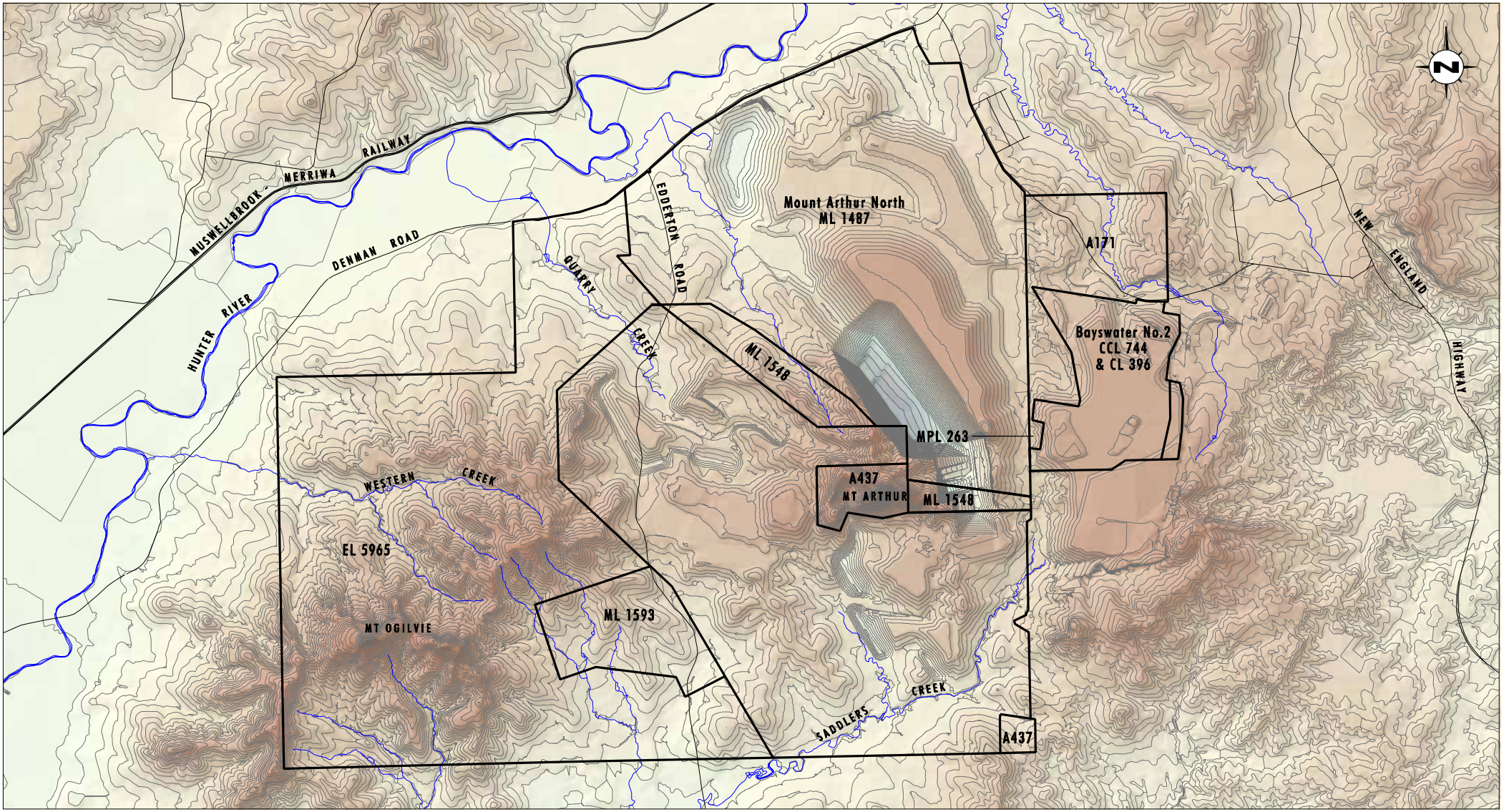
The plans will be incorporated into the MOPs submitted to DPI as part of the closure process.

5.10.3 Mt Arthur Coal Rehabilitation and Habitat Management Strategy

The Underground Project will involve minimal surface disturbance for construction of mining infrastructure, with the majority of infrastructure located in previously mined areas. The project will also involve surface disturbance due to subsidence cracking and associated remediation works. These areas are readily rehabilitated as subsidence cracking and remediation works are short-term impacts and do not typically involve widespread impacts to topsoil structure and fertility. It is therefore considered that the rehabilitation works associated with the Underground Project can be readily achieved by Mt Arthur Coal which has extensive local experience in rehabilitation of disturbed mining areas.

The existing rehabilitation strategy for the Mt Arthur Coal complex has a number of key objectives which will be applied to the Underground Project including:

- rehabilitation of mined land to achieve a land capability that is comparable with the pre-mining land capability;



Source: Mt Arthur Coal, LPI NSW

Legend

— Mining and Exploration Lease Boundary

FIGURE 5.34

Conceptual Final Landform

- allowing for productive post mining land uses;
- rehabilitation is to be completed progressively during the mine life;
- providing increased areas of native vegetation and fauna habitat;
- providing improved linkages between existing remnant vegetation areas; and
- achieving consistency with the DPI Synoptic Landscape Plan (NSW DMR, 1999).

The post mining land use for the Mt Arthur Coal complex, including the Underground Project area, will be a mixture of grazing land, commercial forestry, habitat areas and archaeological and ecological conservation areas.

One of the key aims of Mt Arthur Coal's rehabilitation strategy is to achieve its rehabilitation objectives in an integrated fashion across its entire operational area. A complex-wide rehabilitation and habitat management strategy has therefore been developed to achieve an integrated and effective rehabilitation outcome. The strategy integrates and builds on Mt Arthur Coal's previous commitments regarding final land use, maintaining and enhancing habitat values and achieving conservation outcomes. **Figure 5.10** shows the existing rehabilitation and landscape strategy (including commitments made as part of the Mt Arthur Coal South Pit Extension Project which is currently being assessed by DoP) which includes conservation areas, habitat management areas, vegetated corridors and existing and planned rehabilitated areas. **Figure 5.10** also shows the regional habitat linkage relevant to Mt Arthur Coal's operational area from the DPI's Synoptic Landscape Plan (NSW DMR, 1999).

The existing rehabilitation and habitat management strategy has been revised in light of the proposed Underground Project and is shown on **Figure 5.35**. The key additions to the strategy are:

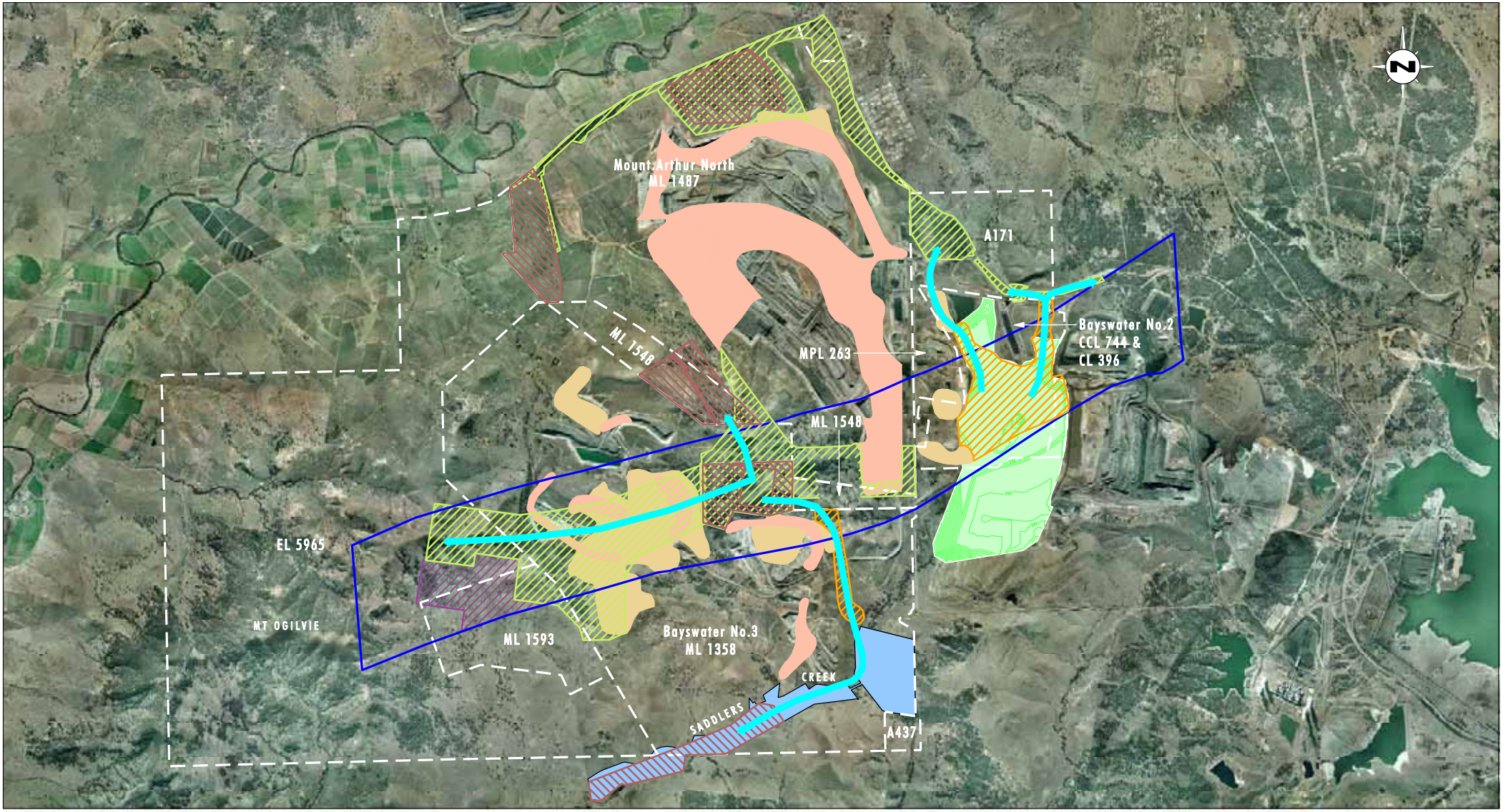
- an approximately 295 hectare conservation area along Saddlers Creek (proposed to conserve archaeological and ecological values, refer to **Sections 5.3** and **5.4.1**); and
- approximately 154 hectares of land to the west of Edderton Road owned by Mt Arthur Coal that is within the DPI's mapped regional habitat linkage (Synoptic Landscape Plan, NSW DMR, 1999) which will be managed to enhance its ecological corridor values. The management of this area to be outlined in a revised ecological management plan to be prepared for the Mt Arthur Coal complex.

The complex wide rehabilitation and habitat management strategy will be regularly reviewed and revised as part of the ongoing rehabilitation planning process at Mt Arthur Coal, with details of the implementation of the strategy included in the operations various MOPs submitted to DPI for approval. Progress in implementing the strategy will be reported in Mt Arthur Coal's AEMR.

5.10.3.1 Rehabilitation Techniques and Criteria

To ensure consistency of rehabilitation practice across the Mt Arthur Coal complex, the following broad rehabilitation criteria that apply to the existing open cut areas are of relevance to the Underground Project:

- revegetation will be conducted following the reshaping, topsoiling and deep-ripping of disturbed areas. Native species endemic to the local area will be used wherever possible;



Base Source: Mt Arthur Coal, 2006

0 1 2 4km
1:90 000

Legend

- Mining and Exploration Lease Boundary
- Rehabilitated Area
- Existing and Previously Proposed Rehabilitation Areas - Native Trees
- Regional Habitat Links (Synoptic Plan, NSW DMR 1999)
- Heritage Management and Conservation Areas
- Existing Habitat Management/Improvement Zones
- Proposed Vegetated Corridors - South Pit Extension Project
- Proposed Saddlers Creek Conservation Area
- Area Proposed to be Managed to Enhance Ecological Corridor Function
- Local Corridors

FIGURE 5.35

Revised Mt Arthur Coal Rehabilitation and Landscape Strategy incorporating the Underground Project

File Name (A4): R21_V1/2051_302.dgn

- the overall aim of the rehabilitation program is to return the post-mining landscape to its pre-mining overall level of land capability. Additionally, it is proposed to increase the average percentage of forest to improve the habitat value and to provide shade and shelter for stock;

- generally the flatter longer slopes of the reshaped areas will be sown to pasture while the steeper sections and those which adjoin treed areas and watercourses will be planted or sown to grasses, trees and shrubs. Small clumps of trees will also be sown or planted within pasture areas to provide stock shelter and windbreaks. Initial pasture and cover crop sowings will temporarily stabilise steep slopes prior to tree plantings and sowings; and

- native grass species typical of the local area will be used in pastoral grassland establishment. Improved pastures and occasional forage crops will also be considered on areas of Class IV land.

Building on the above existing criteria for the existing Mt Arthur Coal operations, the rehabilitation criteria for the Underground Project will incorporate the following:

- all subsidence affected areas will be rehabilitated to a safe and stable state consistent with their pre-mining land capability, however the landform will not be identical. This rehabilitation may involve the use of earth moving equipment to repair subsidence cracking, drainage works, the erection of erosion control devices, addition of organic material and/or soil ameliorants and re-seeding of the area;

- all surface infrastructure which does not have a potential future use associated with the post mining land use will be removed, unless such removal has a greater environmental impact then rehabilitating the area with the *in situ* infrastructure;

- all surface infrastructure areas will be deep ripped (as required) to remove hard stand or compacted areas, returned to a stable landform and will be rehabilitated using pasture and/or native woodland species depending on their pre-disturbance groundcover. Pasture species used in rehabilitation will include native grasses wherever possible;

- tailings and reject emplacement areas (refer to **Section 3.7.3.1**) will be sufficiently capped and reshaped to be free draining;

- all post mining drainage lines will be stable (consistent with or better than their pre-mining condition) and will be rehabilitated using endemic species;

- revegetation following subsidence remediation works or decommissioning of access tracks and remote sites across the project area will aim to compliment existing vegetation types;

- the overall post mining land capability of the project area will be consistent with the overall pre-mining land capability of the project area, except with increased areas of native vegetation provided to enhance the ecological value of the project area; and

- the potential for post-mining economically productive land uses (in addition to grazing activity) will be investigated and implemented as part of the closure process where possible.

Rehabilitated areas will be monitored on a regular basis to ensure that the above rehabilitation criteria are met. Rehabilitation monitoring will include regular inspections of rehabilitated areas to assess soil conditions and erosion, drainage and sediment control

structures, runoff water quality, revegetation germination rates, plant health and weed infestation. Maintenance works will be undertaken as required to resolve issues identified by monitoring. Rehabilitation monitoring results will be used to assist in the continual improvement and refinement of rehabilitation techniques used at Mt Arthur Coal.

5.11 Traffic and Transport

An assessment of the traffic impacts associated with the Underground Project was undertaken by Transport and Urban Planning. The full assessment report is included in **Appendix 14**, with a summary provided below.

5.11.1 Existing Traffic Conditions

The existing road network surrounding and servicing the project area is shown on **Figure 1.6** and a brief description of the relevant roads is provided below. Traffic volume data for the local road system has been determined by traffic counts undertaken as part of the traffic assessment in September 2006 and February 2007. RTA data has been sourced fro traffic volumes on the New England Highway.

5.11.1.1 New England Highway

The New England Highway is a State Highway under the control of the RTA. The Highway is a main north/south link that passes through Muswellbrook and carries local, regional and interstate traffic. Outside the urban area, the road is a high standard rural highway with a posted speed limit of 100 km/h. The Annual Average Daily Traffic volume (AADT) recorded by the RTA in 2004 south of the highway's intersection with Denman Road in Muswellbrook, is 16,253 vehicles per day (vpd).

5.11.1.2 Denman Road

Denman Road is an RTA funded road which extends east from Denman and connects with the New England Highway in Muswellbrook. Denman Road primarily consists of a two lane 'rural highway' that provides the main connection between the township of Denman and Muswellbrook. The AADT for Denman Road east of the intersection with Thomas Mitchell Drive is 5321 vpd. Traffic volumes using Denman Road west of Thomas Mitchell Drive are lower, with an AADT of 3398 vpd.

5.11.1.3 Thomas Mitchell Drive

Thomas Mitchell Drive is a local road linking the New England Highway and Denman Road, providing access to Mt Arthur Coal, Anglo Coal's Drayton mine and the Muswellbrook Industrial Estate. The road also acts as a bypass of the Muswellbrook township for vehicles travelling between Denman Road and the New England Highway. The road is generally two lanes and has a speed limit of 100 km/h in the rural sections and 80 km/h past the industrial estate. The AADT for Thomas Mitchell Drive immediately south of the Denman Road intersection is 3495 vpd. Traffic volumes using Thomas Mitchell Drive west of the New England Highway are lower, with an AADT of 1947 vpd.

5.11.1.4 Edderton Road

Edderton Road is a local road which connects Denman Road and the Golden Highway near Jerrys Plains. The road generally provides access to adjoining rural properties and has a

speed limit of 100 km/h adjacent to the project area. Typical AADT volumes for Edderton Road are 565 vpd.

5.11.1.5 Mt Arthur Coal Access Road

The Mt Arthur Coal Access Road is a sealed private road that provides access to the Mt Arthur Coal site from Thomas Mitchell Drive. The road is generally two lanes and the speed limit is predominantly 70 km/h, reducing to 20 km/h adjacent to the Mt Arthur Coal administration complex.

5.11.1.6 Bayswater Access Road

The Bayswater Access Road is a sealed private road that was constructed to replace the previous access point to the Bayswater Mine (now part of Mt Arthur Coal). The road provides access to facilities located near the Rail Loading Facility and to some heavy vehicles accessing the Mt Arthur Coal site. The road is generally two lanes wide and constructed to a good standard with satisfactory traffic management and a 40 km/h speed limit.

5.11.1.7 Traffic Contribution of Existing Operations

Peak traffic generation from the existing Mt Arthur Coal operations occur between 6.00 am and 7.00 am and 6.00 pm and 7.00 pm, coinciding with shift time changes. The site generates a total of approximately 251 vehicles per hour (vph) during the morning peak period and approximately 153 vph during the afternoon peak period.

5.11.2 Construction Traffic Impacts

The initial construction phase of the Underground Project is expected to last approximately two years, with the construction workforce peaking in the second year. The maximum daily traffic generation during the construction phase is estimated to be approximately 420 vehicle trips into and out of the mine site per day, approximately 20 of which will be heavy vehicle deliveries. Construction traffic will access the site via either the Mt Arthur Coal Access Road or the Bayswater Access Road.

Construction traffic is expected to peak between 6.00 am and 7.00 am and 6.00 pm and 7.00 pm weekdays, with approximately 268 vehicle movements between these times. Heavy vehicle deliveries are expected to generally occur between 7.00 am and 6.00 pm and will therefore not coincide with peak periods.

Traffic modelling undertaken to assess the impact of construction vehicles on the existing road network indicates that the four principle intersections along Thomas Mitchell Drive (i.e. intersections with the New England highway, Mt Arthur Coal Access Road, Bayswater Access Road and Denman Road) that will be subject to increased traffic volumes as a result of the project, will continue to operate at a satisfactory level, with minimal increases in delays of 1 to 2 seconds per vehicle. The existing road network has sufficient capacity to cater for the expected construction phase traffic volumes and no road upgrades will be required.

5.11.3 Operational Traffic Impacts

At maximum production levels, the Underground Project is expected to generate the following approximate traffic volumes:

- 488 employee related light vehicle movements per day, based on an 85 per cent driver ratio;

- 36 visitor related light vehicle movements per day; and

- 120 delivery/maintenance vehicle movements per day, 60 of which are estimated to be heavy vehicles.

The Mt Arthur Coal Access Road will be the primary access used during the operational phase. Peak traffic volumes will occur around the likely main Underground Project shift changes at 8.00 am and 4.00 pm. These shift times do not coincide with existing shift changes and associated peak traffic flows. Maximum traffic generation associated with the project (based on likely shift change times adopted for assessment purposes) will occur between 7.15 am and 8.15 am and 3.15 pm and 4.15 pm, with approximately 184 vehicle movements predicted during these times.

It is expected that approximately 63 per cent of these vehicles will travel north along Thomas Mitchell Drive while 37 per cent will travel south along Thomas Mitchell Drive. The increase in daily traffic volumes on the local road network is predicted to be as follows:

- 32 vpd on Denman Road west of Thomas Mitchell Drive, representing an increase of 0.8 per cent on the weekday average volume of 3828 vpd;

- 300 vpd on Denman Road east of Thomas Mitchell Drive, representing an increase of 4.8 per cent on the weekday average volume of 6254 vpd;

- 322 vpd on Thomas Mitchell Drive south of Denman Road, representing an increase of 7.5 per cent on the weekday average volume of 4414 vpd;

- 312 vpd on Thomas Mitchell Drive west of New England Highway, representing an increase of 12.8 per cent on the weekday average volume of 2430 vpd; and

- 312 vpd on the New England Highway at the intersection with Thomas Mitchell Drive, representing an increase of approximately 3 per cent of AADT of 10,269 vpd.

There is predicted to be minimal change to traffic volumes on Edderton Road as a result of the project.

Predicted peak traffic flows were modelled to assess the impact of the project on the existing road network. The modelling confirmed that the additional traffic associated with the project will not have a significant impact on the performance of the three principle intersections along Thomas Mitchell Drive that will be subject to increased traffic volumes as a result of the project, and conditions at these intersections are expected to remain satisfactory. The existing road network has sufficient capacity to cater for the predicted operational phase traffic volumes and no road upgrades will be required.

5.11.3.1 Cumulative Traffic Impacts

An assessment of the cumulative traffic volume impacts associated with the Underground Project and other major approved or proposed mining operations was undertaken as part of the traffic assessment (refer to **Appendix 14**). The assessment found that the peak traffic generation times for the Mt Pleasant and Anvil Hill mines (approved but not commenced) may in part overlap with the morning peak period of the Underground Project. This will result in increased traffic volumes on the local road network, in particular at the Denman Road/Thomas Mitchell Drive intersection. Modelling of the cumulative impacts of these three projects found that the combined traffic volumes will not have a significant impact on the three principle intersections along Thomas Mitchell Drive that will be subject to increased

traffic volumes as a result of the project during the morning peak and all intersections will continue to operate at a satisfactory level of service.

5.11.4 Traffic Management

5.11.4.1 Edderton Road

A section of Edderton Road approximately 6.5 kilometres in length will be subject to subsidence impacts over the life of the project. The resulting road and pavement damage will require repair using standard road maintenance techniques. Impacts will be restricted to sections of road approximately 300 to 500 metres in length at any one time and repairs will be carried out progressively as impacts occur. Temporary road diversions within the road corridor will be established to cater for traffic whilst the road is being subsided.

To manage this process and mitigate any adverse impacts, Mt Arthur Coal will prepare a traffic management and road maintenance plan for Edderton Road in consultation with MSC. The plan will address planning, notification, monitoring and repair works, including any temporary road diversions, and will also consider measures to maintain fauna passages as part of road reconstruction. An approval under Section 138 of the *Roads Act 1993* from MSC will be necessary to undertake the required works.

In the event of any temporary road closures of sections of Edderton Road for repairs, access to local properties will be maintained via temporary diversions onto unsealed roads. If necessary, and in rare circumstances, other through traffic using Edderton Road could be diverted via the Golden Highway and Denman Road. Edderton Road currently carries a total of 632 vpd and between 15 to 62 vph. The temporary diversion of this volume of traffic to the Golden Highway and Denman Road, if it occurs, is not expected to have any adverse impact on these roads.

A section of Edderton Road will be re-aligned prior to the commencement of mining in the Glen Munro seam due to approved open cut mining in the Belmont Pit. These works are approved as part of the Bayswater No. 3 project, with the final design to be undertaken in consultation with MSC. This road re-alignment includes a grade separated crossing of a mine haul road. The current design for the re-alignment includes the haul road passing under Edderton Road, ensuring there are no height restrictions for traffic on Edderton road.

5.11.4.2 Antiene Railway Station Road

Hebden Road, located to the west of the New England Highway, runs parallel to the Antiene Rail Spur, which connects Mt Arthur Coal and adjacent Drayton mine to the Main Northern Rail Line. The road is unsealed and provides access to Antiene Railway Station Road which crosses the Antiene rail spur at a level crossing near where it joins the Main Northern Rail Line. Trains travelling on the spur periodically block this level crossing while waiting for signalling to join the main line, restricting access for a small number of residents located to the north of the Antiene Rail Spur.

The Underground Project will increase the maximum number of train movements by Mt Arthur Coal from the currently approved 18 per day to 24 per day. In addition, up to 12 train movements per day are generated from Anglo Coal's Drayton mine. Mt Arthur Coal has recognised that the increase in train movements on the spur has the potential to increase the frequency of trains blocking the crossing. There are a number of organisations that are relevant to the management of this issue including Anglo Coal (the owners of the Antiene Rail Spur), MSC (the roads authority for Hebden and Antiene Railway Station Roads), Macquarie Generation (operators of an adjacent rail unloading facility which is currently under construction), the ARTC and Mt Arthur Coal as a user of the Antiene spur.

Mt Arthur Coal is committed to resolving the current access situation for the residences in the Antiene area east of the New England Highway in partnership with the other relevant stakeholders and has commenced discussions with MSC regarding possible solutions. One option that will be considered is a grade separated crossing.

5.11.4.3 Road Reserves

A number of Crown and Council road reserves located within the project area are likely to be affected by subsidence, subsidence remediation works or the construction of surface infrastructure. Where appropriate, Mt Arthur Coal will seek to close Crown and Council road reserves likely to be impacted by the project. Mt Arthur Coal will discuss proposed road closures with any relevant surrounding landholders prior to applying for the roads to be closed and will ensure legal access is retained to private property. Reserves proposed for closure are shown on **Figure 5.36**. Approval will be sought for the closure of these road reserves through the relevant roads authority, that is, the DoL for Crown road reserves and MSC for Council road reserves.

5.11.4.4 Construction of Minor Surface Infrastructure

The construction of minor surface infrastructure such as borehole facilities, ventilation fans and downcast shafts west of Edderton Road may require construction vehicles to periodically access sites from Edderton Road. To manage this process and mitigate any adverse impacts, Mt Arthur Coal will included relevant construction traffic management controls in the traffic management plan to be prepared for Edderton Road (refer to **Section 5.11.4.1**).

5.11.5 Rail Infrastructure

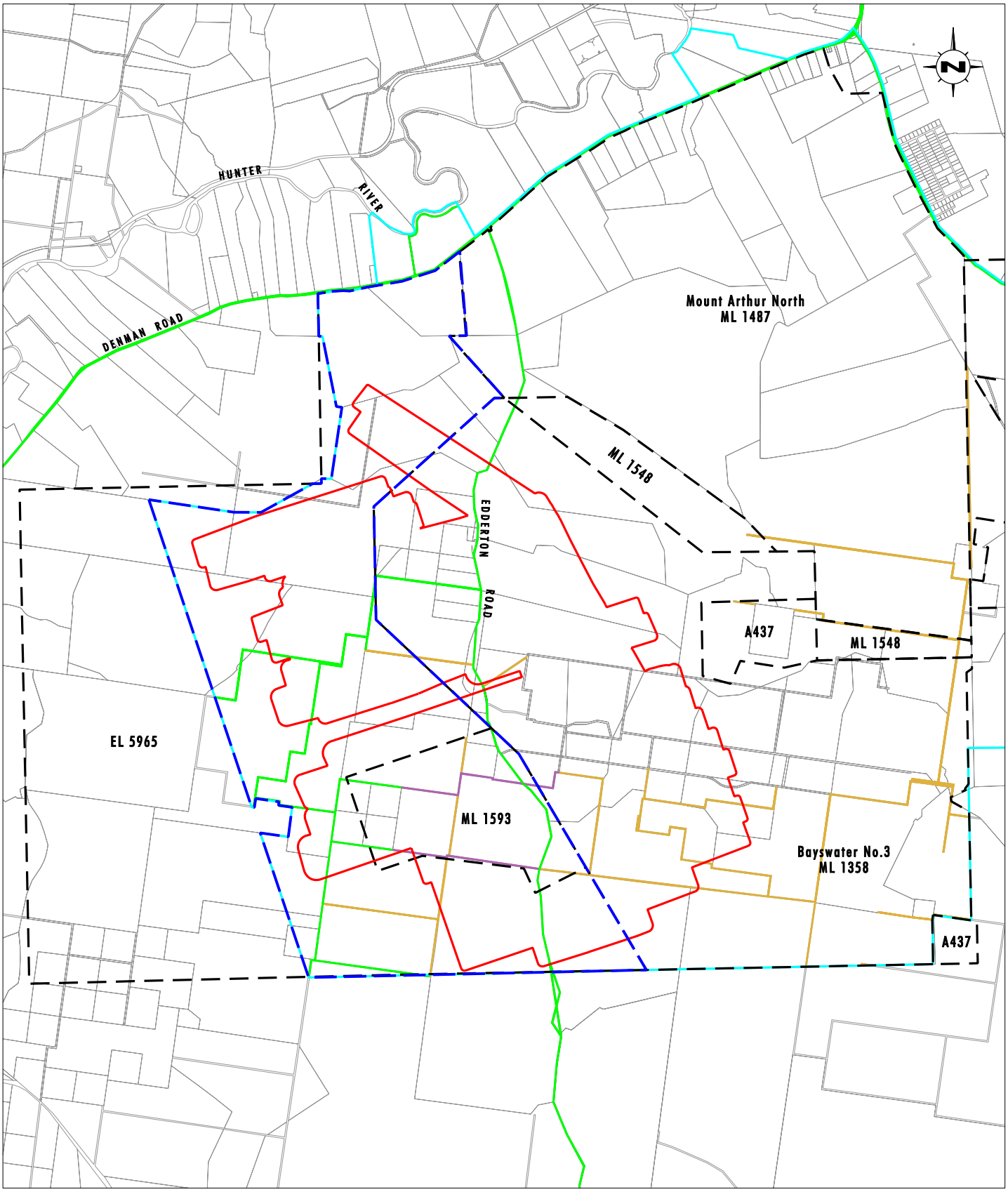
Coal from the Underground Project will be transported from the site to markets via the Antiene rail spur and Main Northern Rail Line. Once the Underground Project is at full capacity, there will be a maximum of 24 train movements per day from Mt Arthur Coal along this line. Mt Arthur Coal currently has approval for a maximum of 18 train movements per day.

Mt Arthur Coal has consulted with ARTC in regard to the capacity of the Main Northern Rail Line to accommodate the additional tonnages of coal produced by the Underground Project. As discussed below, ARTC has a strategy in place to provide additional capacity for coal haulage along the Main Northern Rail Line. ARTC has confirmed that it has reviewed the current strategy for rail corridor capacity and has determined that there will be sufficient capacity to accommodate the train movements that will be generated by the project (refer to **Appendix 2**).

The present capacity (prior to the recent completion of the Sandgate Grade Separation Project) of the Main Northern Line system into the Port of Newcastle is approximately 85 Mtpa, with industry forecasts indicating a projected increase in demand to approximately 145 Mtpa by 2011 (ARTC 2006). ARTC (2006) has developed the 2006-2011 Hunter Valley Coal Chain Improvement Strategy, which specifies a number of specific strategies to enhance the capacity, safety and reliability of the rail system to meet projected demand.

Based on published briefings, the following points can be made in relation to the ARTC's improvement strategy for the Main Northern Railway:

- ARTC released an updated version of its 'Hunter Valley Capacity Improvement Strategy' in April 2006 for comment and consultation with industry, including key changes:
    - an updated timeframe with plans extending out to 2011;



Base Source: LPI 2004, Department of Lands (road status)

0 1 2 3km
1:70 000

Legend

- Exploration and Mining Lease Boundary
- Proposed Mining Lease Boundary
- Project Application Boundary
- Subsidence Affectation Area
- Road Reserves within Project Area to be Retained (Crown and Council Reserves)
- Crown Road Reserves within Project Area Proposed to be Closed
- Council Road Reserves within Project Area Proposed to be Closed

FIGURE 5.36

Road Reserves Proposed to be Closed

File Name (A4): R21_V1/2051_300.dgn

- fully revised volumes forecasts, with export volumes reaching 145 Mtpa; and
- the total projected cost of capacity enhancements is $375 million over five years.

Specific strategies include works to address junction conflicts and increased congestion along the rail system south of Whittingham, which will improve train movements and ultimately increase the capacity of the rail network in the short to medium term. The ARTC has recently completed the Sandgate Grade Separation Project, which will allow the removal of conflicts between coal trains and other rail users and has increased the current coal capacity of the Hunter Valley Rail line to approximately 115 Mtpa (ARTC 2006).

5.12 Socio-economic Assessment

A comprehensive Socio-Economic Assessment for the project has been completed by Coakes Consulting and is included in **Appendix 3**. A summary of the key findings of this assessment is provided in this section.

5.12.1 Methodology

Socio-economic assessment predicts and assesses the likely consequences of a proposed action in both social and economic terms. While economic assessment emphasises the monetary effects of an action or proposal, socio-economic assessment is concerned with assessing benefits and costs in non-monetary terms. This involves understanding impacts from the perspectives of those involved in a personal, community, social or cultural sense. Social and economic assessment processes work together to provide a complete picture of impacts and their meaning.

The SIA process has a number of phases, including:

- assessment and evaluation of issues, which includes profiling to understand the community, and scoping to identify stakeholder issues;
- prediction of the likely effects of the project;
- mitigation, that is, working with the community to develop appropriate strategies to address the issues raised; and
- monitoring and management of the issues throughout the life of the project.

The process employed for the Underground Project utilised a range of consultative and assessment mechanisms appropriate to the various stakeholder groups and assessment phases, as discussed in **Section 2.0**. Key mechanisms utilised in the initial consultation phase included personal interviews, telephone interviews, presentations, newsletters, information sheets, surveys and baseline property plans and the process involved a range of stakeholders including local residents/landholders/tenants, government agencies and political representatives, special interest groups, service providers and functional groups, and the wider community in general.

A second phase of consultation was carried out following completion of the EA process and aimed to provide an overview of the key outputs of the environmental and social impact studies undertaken and obtain any stakeholder/community feedback on the strategies proposed to address the issues raised (refer to **Section 2.0**). Key mechanisms utilised in the second consultation phase included personal meetings with landholders and provision of updated PPPs to EL landholders; presentations to Mt Arthur Coal's community consultative

committees; a resident information evening and stakeholder feedback sessions; presentations to community groups, MSC and government agencies; an information session with service providers and a community newsletter and project information sheet distributed to the local community. All stakeholders involved in the initial consultation phase were invited to participate in the second phase, along with any additional stakeholders identified through the EA process.

5.12.2 Community Issues

As part of the initial phase of the community consultation program, stakeholders with an interest in the Underground Project, including residents, landholders, tenants, service providers, community groups, community consultative committee members and employees were asked to identify the key issues and perceived impacts associated with the project.

As discussed in **Section 2.3**, the benefits to the local economy and employment opportunities associated with the project were the issues most frequently identified by stakeholders. Increases in dust levels, concerns about the planning process and the potential for cumulative impacts with other mines were the most frequently identified concerns. Other issues raised included blasting noise and vibration, noise from the proposed mining operation, impacts of subsidence and the potential loss of the area's natural features. In general, visual and dust impacts relating to the project were perceived by many as less critical given the underground nature of the project.

Issues raised throughout the consultation program were closely associated with the geographic location of respondents. For example, landholders in the Antiene area were more likely to raise issues associated with noise and property values, whereas on Denman Road issues of water, dust, visual amenity and traffic impacts were frequently cited. Cumulative impacts of mining, general visual amenity and dust were noted as key issues in the Racecourse area, South Muswellbrook and at Roxburgh Road.

The second phase of community consultation focused on presenting the findings of the EA and informing stakeholders about the project in more detail. Questions raised during the second phase of consultation primarily focused on the technical aspects of the proposed mining operations such as the concept mine plans and staging, and on the company's existing open-cut operations, with minimal concern expressed regarding environmental and social impacts associated with the Underground Project. Issues related to the environment were primarily focused on dust, noise and visual amenity associated with the existing operations.

5.12.3 Community Needs

Stakeholders were asked to comment on community services and facilities and identify perceived needs in relation to services and facilities. In general, residents were satisfied with each of the community sectors, with the exception of health. The majority of respondents saw a need for improved health related services and housing and accommodation facilities should the project proceed. The key health issues highlighted by the community include:

- access to specialist medial services and general practitioners;
- lack of services for the aged and those with disabilities, particularly in relation to respite care; and
- rural isolation and effects on children and the elderly.

Despite a general level of satisfaction with existing services, other sectors cited as requiring improvement include education facilities, employment opportunities and general service level enhancement. The key issues highlighted by the community include:

- skills shortages in the labour market with fewer residents continuing education past Year 10;
- educational opportunities and transition from high school to work;
- unskilled young people dropping out of work and society;
- infrastructure and service provision enhancement for the young, ages and people with disabilities;
- need to create a sense of belonging and overcome social isolation, particularly among the young and elderly; and
- need for out-of-hours services and youth entertainment facilities.

It is clear from the consultation that health services and facilities are of greatest concern to the Muswellbrook community.

5.12.4 Population Impact Projections

5.12.4.1 Construction Phase

The workforce during the construction phase is estimated to peak at approximately 470 workers (of which approximately 170 will be employed in the early phases of mining operations and the balance will be construction workers). Due to the specialised nature of construction, it is assumed that approximately 20 per cent of construction contractors will be sourced from within and around the Muswellbrook LGA, while the remaining 80 per cent will be sourced from outside the region. It is also assumed that due to the temporary nature of construction, these workers will not be accompanied by their families and will stay in temporary accommodation for the construction period.

The major population impact associated with the construction phase is therefore expected to be demand for temporary accommodation. A review of temporary accommodation facilities has been undertaken to determine whether sufficient accommodation will be available within the area to accommodate the construction workforce. This review identified that there are high occupancy rates in the Muswellbrook LGA and that affordable residential and rental housing stock is also currently a problem within the LGA. However, the assessment also found through discussions with service providers and MSC, that there are currently a number of initiatives underway that would provide substantial suitable housing for the construction workforce. Based on the occupancy rates of existing facilities and the planned expansion of a number of accommodation facilities, there is expected to be sufficient temporary accommodation available to house the construction workforce.

5.12.4.2 Operational Phase

The operational workforce associated with the project is estimated to peak at approximately 300 workers. Whilst Mt Arthur Coal will be encouraging local employment, because of local skills shortages it is assumed that approximately 20 per cent (60) of these workers will be sourced locally and the remaining 80 per cent (240) will be sourced from outside the region, of which, all are expected to relocate to the area with their families. Based on the current Mt Arthur Coal workforce residential locations, the population increase is anticipated to be

greatest within the Muswellbrook LGA with approximately 103 employees expected to relocate to the Muswellbrook and Denman areas. This will yield a family population of approximately 361 additional residents. A further 62 employees are expected to relocate to Singleton and 31 to Scone, resulting in additional family populations of approximately 218 and 109 respectively.

The Socio-Economic Assessment has reviewed the impact of the projected population changes on existing service capacity within Muswellbrook and surrounds. This process has identified education, health and housing/accommodation as key sectors which have the potential to be impacted.

A review of pre-school, primary, secondary and tertiary education facilities within the Muswellbrook, Singleton and Scone regions has identified that there is sufficient capacity at each of these levels to absorb the predicted changes in population impacts associated with the project.

A review of health services within the Muswellbrook, Denman, Singleton and Scone regions has identified that hospital facilities are at or exceeding capacity and that doctor-patient ratios are significantly worse than recommended. It is therefore evident that the population influx associated with the Underground Project is likely to place further pressure on existing health services. Given that the average age of potential employees is approximately 41 years, pressure on hospital services may be less of an issue than additional strain on General Practitioners and/or other allied health professionals.

A review of the housing sector has recognised that availability and affordability of residential and rental housing stock is an issue in the Muswellbrook area. However, a number of current initiatives have been identified which will contribute to the resolution of this issue, including recent multi-lot subdivision approvals and applications for subdivision submitted to councils within the region. It is expected that these initiatives will improve housing availability and affordability.

The population impact assessment has therefore identified that Muswellbrook and surrounding areas are likely to be able to absorb the predicted population impacts arising from the construction and operational phases of the Underground Project across the education and housing sectors. However, health services may find it more difficult to cope with the additional population associated with the project.

5.12.5 Economic Assessment

The key benefits of the Underground Project include the significant economic benefit to the state and region associated with job creation, capital expenditure, ongoing operational expenditure, employee expenditure and contributions to community enhancement programs.

To determine the economic contribution of the project at the local level, survey analysis has been used to develop a profile of residential and business expenditure patterns of Mt Arthur Coal and its employees. Further analysis has also been undertaken to assess the flow-on effects on income, investment and employment of the proposed project on the local, regional, state and national economy.

During the construction phase, the project will employ a peak workforce of approximately 470 people and will have an initial capital cost of approximately $300 million. During operation, the project will employ a peak workforce of approximately 300 people and will have a total operational expenditure of approximately $3 billion over the life of the project. When taking into account both the direct and indirect employment generated by the

Underground Project, it is estimated that the project will create 913 jobs in the Hunter Region during the construction phase and 546 jobs during operation.

Some of the key economic contributions of the project are outlined in **Table 5.20**.

Table 5.20 - Summary of Predicted Key Project Economic Contributions

		Direct Project-Related Economic Contribution		Multiplied Flow-on Economic Contribution from Project[#]
Area of Economic Contribution	**Source of Economic Contribution**	**Average Annual Economic Contribution[*] (A$M)**	**Total Economic Contribution over Life of Project (A$M)**	**Total Economic Contribution over Life of Project (A$M)**
Muswellbrook	Employee expenditure	8	176	273
	Operating expenditure (excluding labour)	12	277	341
Hunter Region	Employee expenditure	20	456	781
	Operating expenditure (excluding labour)	76	1,757	2,533
NSW	Employee expenditure	20	456	1,017
	Operating expenditure (excluding labour)	81	1,862	3,356
NSW Government	Royalties on coal		415	
	Payroll tax		37	
Commonwealth Government	Employee personal income tax and Medicare payment		156	
	Company tax		450	
GDP	Contribution to GDP		2,318	4,374

NB: * Averaged over the project's construction and operational phases.
[#] Multiplied economic contributions include both the initial direct contribution and flow-on /indirect benefits.

As indicated in **Table 5.20**, the Underground Project will provide significant economic benefits to Muswellbrook, with the average annual direct economic contribution predicted to be approximately $20 million due to employee and operating expenditure (approximately $453 million over the life of the project). The majority of employee household expenditure is predicted to be spent in Muswellbrook, Singleton and Scone, with the greatest benefit associated with employee household expenditure therefore experienced in the townships closest to the project.

The Underground Project will also result in significant economic benefits to the Hunter Region, contributing an average of approximately $96 million in direct economic benefit due to employee and operating expenditure (approximately $2213 million over the life of the project).

In addition to the substantial economic contributions due to employee and operating expenditure, the project will contribute approximately $452 million to the state government through royalties on coal and state taxes, and approximately $606 million to the commonwealth government in taxes.

5.12.6 Cumulative Impacts

The Socio-Economic Assessment has identified another two key projects in the Muswellbrook vicinity with the potential to increase pressure on community infrastructure, services and housing. These are the Anvil Hill project, which was recently approved and the Mount Pleasant project, which is also approved but is yet to commence construction.

Based on currently available information, it is considered likely that the construction of the Anvil Hill project would be completed prior to the commencement of the Underground Project and therefore the construction phases of these projects are not anticipated to coincide. However, there is a degree of uncertainty surrounding the timing for the Mt Pleasant project, and as such a cumulative assessment has been undertaken assuming that the construction phases of these projects coincide. The assessment concludes that the accommodation requirements of the temporary workforce will be adequately absorbed, provided additional planned accommodation capacity (based on discussions with accommodation service providers) is developed within the project timeframes. Additional permanent housing likely to be developed within the region will also assist in absorbing the impact of the temporary construction workforce.

An assessment of the cumulative impacts of the operational phases of all three projects has also been undertaken and concluded that these projects have the potential to contribute to cumulative social impacts, in particular in the areas employee residential accommodation and health service provision. The Shire of Muswellbrook has sufficient land available for residential development to cater for the potential worst case employee and family population impacts associated with the three projects, however there is the potential for additional strain on health services which are currently at or exceeding capacity.

The Mt Arthur Coal South Pit Extension project, for which a Project Application was lodged in 2006, will not result in any significant changes to current employment levels at Mt Arthur Coal and is therefore not expected to result in cumulative population impacts.

By contrast, the Dartbrook underground coal mine located between Muswellbrook and Aberdeen recently completed a phased closure plan. The loss of the Dartbrook employee population from the region, or its absorption within other projects such as the Underground Project, Anvil Hill project or Mt Pleasant project, has the potential to reduce cumulative impacts on community service providers and housing availability. However, there is insufficient certainty regarding the timing of proposed projects to assess their capacity to provide employment for a substantial number of ex-Dartbrook employees. Consistent with the approach to employment for the existing open cut operations, Mt Arthur Coal will target local employment for the Underground Project as far as practical.

5.12.7 Management and Ongoing Community Involvement

In response to the perceived and predicted impacts identified by the SIA, a range of mitigation and ongoing monitoring measures have been identified to address the predicted social impacts and issues raised by the community in relation to the project.

The environmental issues raised by the community as part of the consultation program, have been subject to specific specialist assessment as part of this EA. Management and monitoring measures relating to these environmental issues have been outlined in the relevant sections of this EA (refer to **Section 5.0** and **6.0**).

5.12.7.1 Ongoing Community Involvement

Positive feedback was received regarding Mt Arthur Coal's existing community engagement processes during the community consultation program for the Underground Project. Mt Arthur Coal has a proactive approach to community relations and has a dedicated community relations position at the operation. As part of the operation's ongoing community relations program, regular contact is undertaken with close neighbours and information is provided in response to questions or issues raised. There is also ongoing consultation with the broader community through involvement with community groups and the regular distribution of Mt Arthur Coal's Community Matters Newsletter throughout the Muswellbrook LGA. These existing programs will be continued in relation to the Underground project.

5.12.7.2 Managing Construction Impacts

The key potential impact associated with the construction period is related to temporary accommodation. Whilst these impacts have been assessed as acceptable, Mt Arthur Coal will continue to provide MSC, service providers and the broader community with information regarding the status of the project and the implications of the build up of the construction workforce, through the company's existing consultation mechanisms.

5.12.7.3 Enhancing the Benefits of the Project

Mt Arthur Coal has a solid record of encouraging and facilitating local employment and local sourcing of goods and services. This is demonstrated by the high proportion of locally sourced workers, goods and services within existing operations. This approach will be applied to the Underground Project should it be approved.

Mt Arthur Coal has an existing Community Plan in place that documents the operation's approach to community development opportunities, including community partnerships, sponsorships and other programs. This plan will be reviewed to effectively target community contributions to meet the needs of the local community. The key areas for consideration identified through the assessment process are health, community services and education and training.

Education and training has been identified as a key issue in the community. Mt Arthur Coal is committed to continued support for training and skills development initiatives in the local community. Mt Arthur Coal will expand the company's existing traineeship program to accommodate the needs of the Underground Project.

Mt Arthur Coal recognises that the project is likely to impact on local services and facilities, particularly health and accommodation sectors. The company will be making a development contribution pursuant to section 94 of the EP&A Act for the enhancement of services and/or facilities in the local community.

6.0 Draft Statement of Commitments

The DGRs for the Underground Project require that the EA includes a Statement of Commitments which details the measures proposed by Mt Arthur Coal for environmental mitigation, management and monitoring of the proposed Underground Project.

If approval is granted under Part 3A of the EP&A Act for the proposed Underground Project, Mt Arthur Coal will commit to the following controls.

6.1 Compliance with the EA

6.1.1 To carry out the development for the Underground Project generally in accordance with the Project Application and this EA report.

6.2 Life of Operation, Production, Concept Mine Plan and Rail Haulage

Project Life

6.2.1 The project approval life will be 21 years from the commencement of longwall mining. Closure and rehabilitation activities may continue beyond this 21 year period and will be undertaken in accordance with an approved Mining Operations Plan.

Production Limits

6.2.2 The Underground Project will produce approximately 8 Mtpa ROM coal. This will be in addition to the approved annual coal production from the combined Mt Arthur Coal open cut mine complex.

Hours of Operation

6.2.3 Mining and associated activities for the Underground Project may be undertaken 24 hours a day, seven days a week.

Refinement of Mine Plan

6.2.4 Any material changes to the concept mine plan outlined in this EA report will be detailed and assessed as part of SMPs and MOPs prepared by Mt Arthur Coal.

6.2.5 The locations of minor surface infrastructure required to implement the project will be detailed and assessed as part of MOPs prepared by Mt Arthur Coal.

Rail Haulage

6.2.6 The peak number of train movements from Mt Arthur Coal will be limited to a maximum of 24 movements per day, except in the event that Drayton Mine does not utilise all of its approved train movements, whereby Mt Arthur Coal may take up the spare capacity.

6.2.7 Coal transported along the Bayswater Rail Loop from Mt Arthur Coal will be limited to 19 Mtpa.

6.2.8 No product coal will be transported from site by road transport except in an emergency situation and as approved by the Director General.

6.2.9 Annual average and maximum daily train movements and tonnages will be reported annually in the Annual Environmental Management Report (refer to commitment 6.14.1).

6.3 Subsidence

6.3.1 Mt Arthur Coal will manage the impacts of mining subsidence as required by the conditions of the ML and other DPI conditions.

6.3.2 Where a potential subsidence impact is identified on private property, Mt Arthur Coal will prepare an updated PPP for each of the potentially affected private landholders. These plans will clearly outline impacts of mining on the property and the management and remediation measures to be implemented.

6.3.3 Subsidence management measures to be implemented as part of the project will include:

- visual monitoring of the land surface and drainage lines within the subsidence affectation area pre and post subsidence to identify remediation requirements, if any;
- detailed subsidence monitoring in accordance with Department of Primary Industry requirements, and utilise this data to regularly update the subsidence predictions for the site;
- remediation and rehabilitation of subsidence impacts will be carried out, where required, as soon as practicable following subsidence using methods specified in SMPs;
- building structures located within the subsidence affectation area will be inspected by a structural engineer prior to and after undermining and appropriate management measures implemented;
- informing all relevant service providers of the potential impacts of mining subsidence on services;
- farm dams within the subsidence affectation area will be monitored during and following undermining to ensure they remain in a safe and serviceable condition. Remediation works will be undertaken as required;
- in the event of any significant loss of water from a privately owned farm dam, Mt Arthur Coal will provide an alternate source of water, as required, until the dam is repaired; and
- all privately owned bores within the subsidence affectation area will be monitored during and following undermining. If the capacity of any utilised private bore is reduced to unacceptable level as a result of subsidence, Mt Arthur Coal will provide an alternative supply of water until such time as the MSB re-establishes or replaces the bore.

6.3.4 Mt Arthur Coal will, prior to undermining of Edderton Road, prepare and implement a Traffic Management Plan to manage subsidence impacts on Edderton Road in consultation with MSC and DPI and to the satisfaction of the Director General.

6.3.5 Mt Arthur Coal will prepare a management plan in consultation with TransGrid, for the protection of the 330/500 kV transmission line to allow it to remain in a safe and serviceable condition throughout the mining period. The plan will be submitted to the DPI for approval prior to undermining of the transmission line.

6.4 Ecology

6.4.1 Mt Arthur Coal will, within six months of the commencement of operations submit to the Director General for approval, a revised Mt Arthur Coal complex Ecological Management Plan which integrates management of ecological issues associated with the Underground Project with the remainder of Mt Arthur Coal operations. This will include:

- measures to minimise the impact of subsidence remediation works on ecological values such as use small earthmoving machinery to carry out subsidence remediation works within woodland/forest areas and use of hand remediation methods for any works within the vicinity of the known weeping myall (*Acacia pendula*) Endangered Population and EEC;
- measures to assist regeneration of vegetation communities affected by subsidence remediation where satisfactory natural regeneration does not occur;
- a due diligence process for the location of minor surface infrastructure to be implemented when they cannot be located wholly within previously cleared areas;
- use of existing clearing procedures;
- continued implementation of existing measures for the replacement of arboreal habitat, should the removal of any hollow bearing trees be required; and
- expansion of the existing Mt Arthur Coal ecological monitoring program to include monitoring of vegetation condition within subsidence affected areas, rehabilitation works, the weeping myall (*Acacia pendula*) stand and monitoring of fauna in the Underground Project area.

6.4.2 Mt Arthur Coal will develop a management strategy for the weeping myall (*Acacia pendula*) Endangered Population and EEC located in the Underground Project area (this may be included as part of the above Ecological Management Plan).

6.4.3 Mt Arthur Coal will establish and manage the proposed Saddlers Creek conservation area (refer to **Figure 5.12**) to protect and enhance its ecological values in perpetuity, to the satisfaction of the Director General.

6.5 Heritage

Aboriginal Heritage

6.5.1 Prior to any impact on Aboriginal sites, Mt Arthur Coal will submit to the Director General of the DoP, an Aboriginal Cultural Heritage Management Plan (ACHMP), to be developed for the project in consultation with DECC and Aboriginal stakeholder groups. The ACHMP will:

- facilitate ongoing management of Aboriginal sites;
- outline the timing and methodology for the salvage of sites;
- detail the management strategy for the Saddlers Creek conservation area; and
- include the establishment of a Management Committee to review and advise in relation to ongoing management of sites within the project area.

6.5.2 Aboriginal site loci within the subsidence remediation impact zone (shown on **Figure 5.11** or as refined in the SMP process) will be salvaged by surface collection on a per longwall panel basis prior to the commencement of mining in each longwall panel. Salvage works will be undertaken in accordance with the methods outlined in **Appendix 7** of the EA.

6.5.3 Targeted sub-surface investigation will be carried out within areas of Quarry Creek (QC01), Saddlers Creek tributary (SC09) and Western Creek (WC04) in areas within the subsidence remediation impact zone (shown on **Figure 5.11** or as refined in the SMP process) and for Saddlers Creek (SC01) within the proposed conveyor corridor (refer to **Figure 5.11**). The sub-surface investigations will be undertaken in accordance with the methods outlined in **Appendix 7** of the EA.

6.5.4 Aboriginal sites (or part thereof) located outside the subsidence remediation impact zone (shown on **Figure 5.11** or as refined in the SMP process) and not required to be impacted for establishment of mining, will be conserved *in situ* and managed under the ACHMP for the duration of the project.

6.5.5 A report containing the findings of the salvage program and subsequent artefact analysis will be completed for the series of longwall panels in each target coal seam. The report will be prepared within two years of the completion of salvage works and two copies provided to DECC. Copies will be made available to Aboriginal community groups that participated in the consultation program for the project.

6.5.6 Mt Arthur Coal commit to the following Aboriginal cultural heritage offsets:

- to set aside the proposed Saddlers Creek conservation area to be conserved in perpetuity for its Aboriginal cultural heritage values (refer to **Figure 5.12**). The proposed conservation area will be managed under an ACHMP prepared in consultation with DECC and the registered Aboriginal stakeholder groups;
- to fund and construct a Keeping Place within the Proposed Saddlers Creek conservation area, during the period of this project. The Keeping Place will store artefacts salvaged as part of the project and will be staffed an average of 50 days per year by appropriately trained Aboriginal community representatives, or as otherwise agreed with Mt Arthur Coal;

- to fund the training of five representatives from the registered Aboriginal stakeholder groups to undertake "Collections Training" at the Australian Museum (or similar training) for staffing of the proposed Keeping Place, during the period of this project;

- to establish within or near to the existing fenced section of Quarry Creek west of Edderton Road, a facility suitable for use by the Aboriginal community when using the area for teaching purposes until such time as the area is impacted by subsidence;

- to offer training for one member of each of the registered Aboriginal stakeholder groups for the project in relation to site recording and artefact recording and basic analysis; and

- to establish a Management Committee including at least five representatives of the Aboriginal stakeholder groups to guide the ongoing management of sites within the project area for the duration of this project.

6.5.7 If any human skeletal material is uncovered during ground disturbing works, all works will cease and the NSW Police Department, DECC and Aboriginal stakeholder groups will be notified. These stakeholder groups will then be consulted in relation to the development of appropriate mitigation measures.

Historic Heritage

6.5.8 The draft Conservation Management Plans for Belmont Homestead complex and Edderton Homestead complex will be finalised prior to any underground mining impact in consultation with the Muswellbrook Local and Family History Society and MSC.

6.5.9 The Hospital Building will be relocated prior to impact from approved open cut mining activities following preparation of a management plan to identify an appropriate alternative location and opportunities for adaptive re-use, if available. The management plan will guide the ongoing management of the structure and include full archival recording undertaken to the standard of local heritage significance.

6.5.10 Mt Arthur Coal will carry out archival recording of all heritage sites listed in **Table 5.5** and located within the subsidence affectation area, to the standards of local heritage significance prior to underground mining impact.

6.6 Water Resources

Surface Water

6.6.1 Mt Arthur Coal will review and extend its current water balance and related water management system for the complex to seek to minimise external clean water demand. The water balance and performance of the related management system with respect to external clean water demand will be subject to an annual review and the key outcomes will be reported in the Annual Environmental Management Report.

6.6.2 The overland conveyor crossing of Saddlers Creek will have a catch tray system (or similar) on the underside of the conveyor where it passes over the creek to minimise the potential for coal spillage entering the creek.

6.6.3 Drainage from pit-top facilities and high traffic hardstand areas, including workshops, will be appropriately managed to contain and treat run-off prior to re-use on-site within the mine water management system.

6.6.4 Erosion and sediment control measures will be designed and implemented for construction of surface infrastructure to a standard consistent with Managing Urban Stormwater: Soils and Construction (NSW Landcom 2004) (the Blue Book) and Guidelines for Establishing Drainage Lines on Rehabilitated Minesites (Draft) (DLWC, 1999).

6.6.5 Subsidence impacts on drainage lines will be effectively remediated such that there is no significant impact on downstream water users and environmental flows. Drainage line monitoring and remediation protocols will be developed as part of the SMP process, and in consultation with DWE, to guide the management of subsidence impacts and drainage line remediation works on surface water systems. The drainage line monitoring and remediation protocols will include:

- detailed monitoring protocols;
- a program to complete drainage remediation works in a timely manner post subsidence to limit the potential for surface water capture;
- details of the design of drainage line remediation works such that the rehabilitated drainage lines maintain a similar channel form and sinuosity to the pre-mining environment, to ensure that the overall erosive power of the creek system is consistent with that existing pre-mining;
- assessment of the viability and benefits of applying proactive measures such as the installation of liners or geo-fabrics in drainage lines prior to subsidence; and
- following the completion of any required reshaping works, remediated drainage lines will be revegetated and the riparian zone fenced to protect the drainage line and enhance ecological function.

6.6.6 The existing surface water monitoring program will be continued as part of the Underground Project, or as otherwise agreed by the Director General in consultation with the DWE.

6.6.7 Surface water monitoring results will be reported annually in the Annual Environmental Management Report.

6.6.8 The final design of the proposed Hunter River pump station will be determined in consultation with the DWE.

Groundwater

6.6.9 A groundwater monitoring program will be implemented for the project as outlined in **Appendix 10**, or as otherwise agreed by the Director General in consultation with the DWE.

6.6.10 The results of groundwater monitoring and a comparison of measured and predicted impacts will be reported annually in the Annual Environmental Management Report (refer to commitment 6.14.1).

6.6.11 Impacts on privately owned bores will be assessed by monitoring and in the event that any utilised privately owned bore is significantly affected, an alternative water supply will be provided by Mt Arthur Coal until such time as the bore is re-established or replaced.

Monitoring Review

6.6.12 Additional groundwater monitoring locations will be established to monitor the impacts of the Underground Project on groundwater aquifers as outlined in **Appendix 10**, or as otherwise agreed by the Director General in consultation with the DWE.

6.6.13 An annual analysis of surface and groundwater monitoring data will be undertaken and will include:

- identification of any changes or long term trends in surface water quality. Should any adverse trends be identified, an investigation will be implemented to determine if the trend is a result of the Underground Project operations and if so, will identify management strategies to be implemented to address the identified issues; and
- a comparison to modelled groundwater impact predictions.

The monitoring results and analysis findings will be reported in the Annual Environmental Management Report.

6.7 Noise

6.7.1 Unless otherwise agreed with the landowner, Mt Arthur Coal will manage operations associated with the Underground Project (the project alone), including noise from underground operations, coal processing and rail loadout, such that the noise emissions from the project comply with the noise criteria included in **Table 6.1** at privately owned land. All reasonable and feasible noise management measures will be implemented as part of the project with the aim of meeting the intrusive noise criteria.

Table 6.1 - Project Specific Noise Levels and Assumed Acquisition Criteria

Location	Project Specific Noise Levels (Day/Evening/Night[1]) $L_{Aeq,15min}$	Assumed Acquisition Criteria (Day/Evening/Night[1]) $L_{Aeq,15min}$
Antiene Estate[2]	37 / 40 / 38 dBA	greater than 42 / 45 / 43 dBA
East Antiene	41 / 40 / 39 dBA	greater than 46 / 45 / 44 dBA
Skellatar Stock Route[2] Thomas Mitchell Drive[2] Denman Road[2]	39 / 38 / 37 dBA	greater than 44 / 43 / 42 dBA
Racecourse Road[2]	37 / 36 / 35 dBA	greater than 42 / 43 / 40 dBA
Denman Road West[2] Roxburgh Vineyard [2] Roxburgh Road[2]	37 / 36 / 35 dBA	greater than 42 / 41 / 40 dBA
South Muswellbrook [2] (incl. the South Muswellbrook Development Area)	35 / 35 / 35 dBA	greater than 40 / 40 / 40 dBA

Notes: 1) Day period is 7.00 am – 6.00 pm; Evening is 6.00 pm – 10.00 pm; Night is 10.00 pm – 7.00 am.
2) Locations as identified in Schedule B of the MAN development consent

a. $L_{Aeq,15min}$ is the value of $L_{Aeq,15min}$ which shall not be exceeded for more than 10 per cent of the monitoring periods detailed in the noise monitoring program for continuous noise monitoring (refer Condition 6.4.3(a)(i)) or for independent noise investigations (refer Condition 6.4.3(a)(v)), as representative of any season (i.e. December to February, March to May, June to August, or September to November) and would include the locality specific range of weather conditions occurring at the time of monitoring.

b. All measured or predicted noise levels to be rounded to the nearest decibel.

6.7.2 Underground Project operations will be managed with the aim of achieving the predicted noise levels in **Section 5.6** of the EA report.

6.7.3 Unless otherwise agreed with the owner, Mt Arthur Coal will manage its total operations such that the total noise impacts of the combined Underground Project, South Pit Extension project and MAN mining operations, including noise from coal processing and rail loadout, to comply with the assumed noise acquisition criteria for the Underground Project detailed in **Table 6.2** (note: these criteria are consistent with the noise acquisition criteria in the MAN development consent).

Table 6.2 - Assumed Noise Acquisition Criteria

Location	Intrusive Noise Acquisition Criteria (Day/Evening/Night[1]) $L_{Aeq,15min}$	Cumulative Amenity Acquisition Criteria (Day/Evening/Night[1]) $L_{Aeq,period}$
Antiene Estate[2]	greater than 42 / 45 / 43 dBA	greater than 53 / 48 / 43 dBA
East Antiene	greater than 46 / 45 / 44 dBA	greater than 53 / 48 / 43 dBA
Skellatar Stock Route[2] Thomas Mitchell Drive[2] Denman Road[2]	greater than 44 / 43 / 42 dBA	greater than 58 / 48 / 43 dBA
Racecourse Road[2]	greater than 42 / 43 / 40 dBA	greater than 53 / 48 / 43 dBA
Denman Road West[2] Roxburgh Vineyard[2] Roxburgh Road[2]	greater than 42 / 41 / 40 dBA	greater than 53 / 48 / 43 dBA
South Muswellbrook [2] (incl. the South Muswellbrook Development Area)	greater than 40 / 40 / 40 dBA	greater than 53 / 48 / 43 dBA

Notes: 1) Day period is 7.00 am – 6.00 pm; Evening is 6.00 pm – 10.00 pm; Night is 10.00 pm – 7.00 am.
2) Locations as identified in Schedule B of the MAN development consent

a. $L_{Aeq,15min}$ is the value of $L_{Aeq,15min}$ which shall not be exceeded for more than 10 per cent of the monitoring periods detailed in the noise monitoring program for continuous noise monitoring (refer Condition 6.4.3(a)(i)) or for independent noise investigations (refer Condition 6.4.3(a)(v)), as representative of any season (i.e. December to February, March to May, June to August, or September to November) and would include the locality specific range of weather conditions occurring at the time of monitoring.

b. LAeq,period is the long-term LAeq noise level over the relevant day, evening or night period, as detailed in the noise monitoring program for continuous noise monitoring (refer Condition 6.4.3(a)(i)) or for independent noise investigations (refer Condition 6.4.3(a)(v)). These periods

would be representative of any season (i.e. December to February, March to May, June to August, or September to November) and would include the locality specific range of weather conditions occurring at the time of monitoring.

c. All measured or predicted noise levels to be rounded to the nearest decibel.

6.7.4 Mt Arthur Coal will manage train movement noise impacts from Mt Arthur Coal trains travelling on the Bayswater Rail Loop and Antiene Rail Spur to meet the assumed noise acquisition criteria (refer to **Table 6.2**) at all private residences (except East Antiene Location A1, refer to **Section 5.6**) when Mt Arthur Coal trains are travelling on the Bayswater Rail Loop and Antiene Rail Spur. Details of the measures implemented to manage train noise will be discussed in the AEMR.

6.7.5 Mt Arthur Coal will implement reasonable and feasible noise mitigation strategies in an effort to minimise noise impacts at sensitive receivers.

6.7.6 Mt Arthur Coal will review and revise their existing noise management plan in relation to noise management associated with Underground Project operations.

6.7.7 Mt Arthur Coal will maintain the existing noise monitoring network (or as otherwise agreed with DECC), including real-time directional noise monitoring in accordance with the MAN development consent. In order to assess the compliance of rail passby noise with the criteria in **Table 6.2**, Mt Arthur Coal will undertake annual noise monitoring in east Antiene for a period of three years. Monitoring will be undertaken during winter night time periods and will monitor a minimum of 10 train movements. The monitoring program will be reviewed at the end of the three year period. Noise monitoring findings relating to the Underground Project will be reported annually in the Annual Environmental Management Report (refer to commitment 6.14.1).

6.8 Air Quality

6.8.1 Mt Arthur Coal will manage operations associated with the Underground Project such that, unless a specific agreement is reached with the landholder in regard to air quality impacts, the air quality criteria outlined in **Tables 6.3**, **6.4** and **6.5** will be met at any privately owned residence (or, in relation to privately owned vacant land, will not impact on more than 25 per cent of that land).

Table 6.3 - Long Term Dust Concentration Criteria

Pollutant	Averaging Period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m^3
Particulate matter <10 µm (PM_{10})	Annual	30 µg/m^3

Note: Should monitoring identify that the above limits are not met an investigation will be undertaken to identify if Mt Arthur Coal is a major contributor to dust levels at this location with further action subject to the findings from this investigation and as agreed with DoP.

Table 6.4 - Short Term Dust Concentration Criteria

Pollutant	Averaging Period	Criterion	Percentile[a]	Basis
Particulate matter < 10 µm (PM_{10})	24 hour	150 µg/m^3	99[b]	Total[c]
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3	98.6	Increment[d]

a Based on the number of block 24 hour averages in an annual period.
b Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by DoP in consultation with DECC.
c Background PM_{10} concentrations due to all other sources plus the incremental increase in PM_{10} concentrations due to the Underground Project alone.
d Incremental increase in PM_{10} concentrations due to the Underground Project alone.

Table 6.5 - Dust Deposition Criteria

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, 1991, AS 3580.10.1-1991: Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method.

6.8.2 Mt Arthur Coal will revise their existing operational dust management plan in relation to dust management associated with Underground Project operations.

6.8.3 Mt Arthur Coal will maintain their existing dust monitoring network (or as otherwise agreed with DECC), that includes high volume air samplers measuring PM_{10} on a six day cycle, real-time samplers measuring PM_{10} and dust deposition gauges. Dust monitoring findings relating to the Underground Project will be reported annually in the Annual Environmental Management Report (refer to commitment 6.14.1).

6.9 Greenhouse Gas Emissions

6.9.1 Mt Arthur Coal will develop and maintain an internal energy management plan with monitoring and reporting elements and specific targets and a greenhouse gas management plan for the Underground Project, in accordance with BHP Billiton requirements.

6.9.2 Mt Arthur Coal will investigate opportunities for reduction of greenhouse gas emissions from the project. This will include ongoing review of emissions monitoring and management technology.

6.9.3 Where gas purity reliably allows, methane emissions from the mine will either be flared or utilised in power generation where practical and feasible.

6.10 Visual

6.10.1 Mt Arthur Coal will implement the following visual controls to screen or filter views of project infrastructure from residential and public road locations (refer to **Figure 5.25**):

- construction of a 10 metre high bund around the northern and western edge of the Glen Munro pit-top facilities with tree plantings on the bund wall;
- tree planting around the northern edge of Belmont pit to filter views of the edge of the open cut mining area;
- tree planting on a rise to the south-west of the North Saddlers ROM facility to filter distant views of the ROM facility from the south-west;
- all lighting to be located and directed so as to not directly impact on residential or road locations. Lighting will be designed to minimise excessive night glow in a manner consistent with AS 4282 Control of the Obtrusive Effects of Outdoor Lighting; and
- all buildings potentially visible to the public to be coloured in suitable natural tones.

6.11 Decommissioning and Rehabilitation

6.11.1 A decommissioning plan will be prepared for each mining stage as part of the MOP process and submitted to the DPI for approval approximately five years prior to the commencement of decommissioning works (Note: this excludes progressive closure of underground mining facilities such as shafts which will be closed as part of ongoing mining activities will be outlined in the relevant MOP and undertaken in accordance with the requirements of the DPI).

6.11.2 Tailings emplacement strategies implemented during the life of the project will be implemented in consultation with, and following approval from, the DPI.

6.11.3 Mt Arthur Coal will prepare final void management plans for West Belmont Pit and Saddlers Pit at least five years prior to their planned closure. The plans will be incorporated into the Mining Operations Plan submitted to the DPI as part of the closure process.

6.11.4 The existing rehabilitation and habitat management strategy for the Mt Arthur Coal complex will be revised to include:

- an approximately 295 hectare conservation area along Saddlers Creek (proposed to conserve archaeological and ecological values) (refer to **Figure 5.35**); and
- approximately 150 hectares of land to the west of Edderton Road owned by Mt Arthur Coal that is within the Department of Primary Industry's mapped regional habitat linkage (Synoptic Landscape Plan, NSW DMR, 1999) which will be managed to enhance its ecological corridor values (refer to **Figure 5.35**).

6.11.5 The complex wide rehabilitation and habitat management strategy will be regularly reviewed and revised as part of the ongoing rehabilitation planning process at Mt Arthur Coal, with details of the implementation of the strategy included in the

operations various MOPs submitted to the DPI for approval. Progress in implementing the strategy will be reported annually in the Annual Environmental Management Report.

6.12 Traffic and Transport

6.12.1 As described in commitment 6.3.4, Mt Arthur Coal will, prior to undermining of Edderton Road, prepare a Traffic Management Plan to manage subsidence impacts on Edderton Road in consultation with MSC, the MSB and DPI, and to the satisfaction of the Director General. This Traffic Management Plan will also include measures for the management of construction access from Edderton Road for minor surface infrastructure (e.g. ventilation facilities).

6.12.2 Mt Arthur Coal will liaise with Anglo Coal, MSC, Macquarie Generation and the ARTC to address legal and appropriate access for properties along Antiene Railway Station Road.

6.13 Community

6.13.1 Mt Arthur Coal will work with the MSC and DoP to create an appropriate Community Consultative Committee for the Underground Project. Mt Arthur Coal will provide the Community Consultative Committee with regular information regarding the environmental management performance of the Underground Project and any relevant matters regarding community relations.

6.13.2 Mt Arthur Coal will make a development contribution pursuant to section 94 of the EP&A Act for the enhancement of services and/or facilities in the local community.

6.14 Environmental Management, Monitoring, Auditing and Reporting

Annual Environmental Management Report

6.14.1 Mt Arthur Coal will prepare an Annual Environmental Management Report for the Underground Project. This Annual Environmental Management Report may be integrated into a whole-of-site Mt Arthur Coal Annual Environmental Management Report.

Waste Management

6.14.2 No waste will be disposed of on site except for inert wastes permissible under the EPL obtained for the Underground Project with all other waste disposed of at appropriately licensed waste management facilities located offsite.

Update of Environmental Management Plans

6.14.3 Within 12 months of commencing underground longwall mining operations, Mt Arthur Coal will incorporate relevant aspects of the environmental management of the Underground Project and rail facility in the Mt Arthur Coal complex environmental management plans. This work will be undertaken in consultation with the relevant Government authorities, as agreed with the Director-General.

Independent Environmental Audit

6.14.4 Three years after commencement of Underground Project mining operations, and every three years thereafter, Mt Arthur Coal will commission and pay the full cost of an Independent Environmental Audit of the project in consultation with the Director-General of DoP. A copy of the audit report will be provided to the Director-General of DoP and DPI, DECC, MSC, DWE and members of the Community Consultative Committee for the Underground Project. This audit may be combined with other independent environmental audits required by Mt Arthur Coal's development consents/Project Approvals as agreed by the Director-General of DoP.

7.0 Conclusion and Justification for the Project

The DGRs seek a conclusion justifying the project, taking into consideration the environmental impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest. These elements are addressed in this section.

7.1 Environmental Impacts

The potential environmental impacts of the project have been identified through a process involving:

- assessment of the site characteristics (existing environment);
- consultation with government agencies;
- consultation with surrounding local landowners, the local community, the Aboriginal community and other stakeholders;
- environmental risk analysis; and
- expert technical assessment.

The key issues identified, including those specified in the DGRs, were the subject of comprehensive technical assessments to assess the potential impacts of the project on the existing environment. The results of these assessments are detailed in **Section 5.0** and the appendices to this EA.

Whilst there are many complex aspects which must be read in their entirety to fully understand these assessments, **Table 7.1** provides a broad overview of the key outcomes of the environmental and social impact assessment.

Table 7.1 - Overview of Environmental and Social Impacts

Environmental/Social Issue	Overview of Key Outcomes (After proposed Management and Mitigation)
Subsidence	• Subsidence will not affect any major privately owned infrastructure such as houses or farm buildings. • The majority of subsidence impacts will occur on Mt Arthur Coal owned land, with subsidence impacting three private landholdings. Mt Arthur Coal is seeking to reach appropriate agreements with these landholders. • Subsidence will affect some public infrastructure including a 330/500kV transmission line, Edderton Road and associated utilities. Appropriate management controls will be implemented to manage impacts on services. • Comprehensive SMPs will be prepared prior to each stage of mining, in consultation with relevant stakeholders. • Subsidence remediation will be carried out progressively as subsidence occurs.

Table 7.1 - Overview of Environmental and Social Impacts (cont)

Environmental/Social Issue	Overview of Key Outcomes (After proposed Management and Mitigation)
Ecology	• Minimal vegetation clearing required. • The project will not have a significant impact on listed threatened species, populations and EECs. • Saddlers Creek conservation area proposed to conserve important habitat area in perpetuity.
Historic Heritage	• Historic heritage items to be impacted by the project are of local significance. Controls are proposed to manage these impacts.
Aboriginal Archaeology	• Sites potentially affected by the project will be salvaged and the artefacts stored in a Keeping Place to be established on site and staffed by trained Aboriginal community representatives. • Saddlers Creek conservation area proposed to protect sites of high significance in perpetuity (295 hectares). • The remaining Aboriginal sites will be appropriately managed in accordance with an Aboriginal Heritage Management Plan and guided by a management committee that has five Aboriginal representatives.
Surface and Groundwater	• The project will not mine beneath the Hunter River or Saddlers Creek. • Groundwater drawdown will not extend beneath the Hunter River alluvial zone and will not impact significantly on the Saddlers Creek alluvial zone. • Groundwater drawdown will impact on bores owned by one private landholder. Mt Arthur Coal is in discussions with this landholder regarding these impacts. • Minor changes to the existing mine water management system will contain runoff from mining and infrastructure areas. • Subsidence impacts to surface water drainage systems will be remediated as required. • Modelling indicates Mt Arthur Coal has sufficient water sources to cater for the project, without the need for additional Hunter River water access licences.
Noise	• The Underground Project will make minimal contribution to existing operational noise levels from the Mt Arthur Coal complex. • Commitments by Mt Arthur Coal to manage train movement noise impacts on the Antiene area will result in substantial reductions in train noise from that currently experienced. • With these proposed controls in place, rail noise is predicted to significantly exceed the Project Specific Noise Criteria at one private residence in the east Antiene area. This impact will occur for less than 10% of the night time period during worst case meteorological conditions.
Air Quality	• The project will make minimal contribution to local dust levels and is predicted to readily comply with all relevant criteria.

Table 7.1 - Overview of Environmental and Social Impacts (cont)

Environmental/Social Issue	Overview of Key Outcomes (After proposed Management and Mitigation)
Greenhouse Gas Emissions	• Direct and indirect greenhouse gas emissions will be significantly less than the Australian underground coal mining industry average. • Controls to be set out in an energy management plan and greenhouse gas management plan will aim to further reduce energy use and greenhouse gas emissions. • Mt Arthur Coal has committed that where practical and feasible and where gas purity reliably allows, flaring or small scale power generation will be used to reduce greenhouse gas emissions due to methane emissions from the mine.
Visual Amenity	• Major surface infrastructure will largely be located within open cut pits and will not be visible outside the project area. Screening is proposed where key infrastructure will potentially be visible. • Visual impact of subsidence remediation work will be minimal.
Traffic and Transport	• The project will utilise existing mine access roads. • Coal will be transported by rail using the existing rail facility. • Traffic generated by the project is not predicted to significantly impact on existing traffic conditions. • Edderton Road will require progressive repair and maintenance as a result of subsidence impacts.
Socio Economic	• The Underground Project will create approximately 470 jobs during construction and 300 jobs during operation. • The socio economic benefits of the project are discussed in **Section 7.3**.

The impacts of the project have been kept to a minimum through:

- obtaining a detailed understanding of the issues and impacts by scientific evaluation;
- close consideration of environmental and community factors as part of an iterative design process to avoid or minimise impacts;
- development of proactive and appropriate strategies to avoid, minimise and mitigate or manage; and
- a thorough Statement of Commitments (refer to **Section 6.0**).

7.2 Suitability of the Site

The proposed Underground Project is located within and adjacent to existing Mt Arthur Coal MLs, amongst an active mining area in the Upper Hunter Valley. The project area is located adjacent to land utilised for mining and power generation activities and associated buffer areas.

The project will utilise and build on existing mining infrastructure at the Mt Arthur Coal site, including the CHPP and rail loading facility, and will locate much of the major surface infrastructure within existing or approved open cut pits, thus limiting the disturbance footprint of the project. The local topography, including Mt Arthur, also assists in shielding areas

proposed for the major surface facilities from the residential areas of Muswellbrook and surrounds.

The land within the project area consists primarily of low intensity grazing or mining land, and has been largely cleared of vegetation as a result of past farming and mining practices. Some areas of woodland remain within the project area, however, no significant clearing will be required. The topographic variation across the project area results in a low likelihood of topographic changes associated with subsidence being visually detected, with only minor ephemeral drainage lines occurring within the predicted subsidence affectation area. The Hunter River and Saddlers Creek are both well outside the predicted subsidence affectation area.

Most of the land within the project area is owned by Mt Arthur Coal, with only three private landholders located within the western portion of the proposed ML boundary. No major privately owned surface infrastructure will be affected by subsidence from the project, with no privately owned houses or farm buildings located within the subsidence affectation area.

Significant public infrastructure potentially affected by the project includes a 330/500kV transmission line and Edderton Road. A comprehensive management plan will be prepared for the transmission line in consultation with TransGrid to prevent any adverse impacts associated with subsidence. A management plan will also be prepared for Edderton Road in consultation with MSC, with ongoing repair and maintenance undertaken to rectify subsidence impacts.

A detailed analysis of potential on-site and off-site impacts associated with the project is provided in **Section 5.0** and an overview of environmental impacts in **Section 7.1**. This analysis demonstrates that there are no major constraints to use of the site to accommodate the proposed Underground Project.

7.3 Benefits of the Project

The key benefits of the project include the economic benefit to the state and region associated with job creation, capital expenditure and ongoing expenditure on materials and equipment, contributions to community enhancement programs and the benefits associated with improved environmental management at the existing Mt Arthur Coal site.

An economic assessment (refer to **Appendix 3**) has been prepared to quantify the predicted economic benefits of the project at a local, regional and state level. The revenue, expenditure and employment associated with the construction and operation of the proposed Underground Project will stimulate economic activity for the local and regional economy. There are benefits from both the construction phase and operational phase.

The key benefits of the project include the significant economic benefit to the state and region associated with job creation, capital expenditure, ongoing operational expenditure, employee expenditure and contributions to community enhancement programs. The project will also have a number of environmental and social benefits.

During the construction phase, the project will employ a peak construction workforce of approximately 470 people and will have an initial capital cost of approximately $300 million. During operation, the project will employ a peak workforce of approximately 300 people and will have a total operational expenditure of approximately $3 billion over the life of the project. Some of the key economic contributions of the project are outlined in **Table 7.2**.

Table 7.2 - Summary of Predicted Key Project Economic Contributions

		Direct Project-Related Expenditure		Multiplied Flow-on Expenditure from Project #
Area of Spend	**Source of Spend**	**Average Annual Spend * (A$M)**	**Total Spend over Life of Project (A$M)**	**Total Spend over Life of Project (A$M)**
Muswellbrook	Employee expenditure	8	176	273
	Operating expenditure (excluding labour)	12	277	341
Hunter Region	Employee expenditure	20	456	781
	Operating expenditure (excluding labour)	76	1,757	2,533
NSW	Employee expenditure	20	456	1,017
	Operating expenditure (excluding labour)	81	1,862	3,356
NSW Government	Royalties on coal		415	
	Payroll tax		37	
Commonwealth Government	Employee personal income tax and Medicare payment		156	
	Company tax		450	
NSW GDP	Contribution to NSW GDP		2,318	4,374

NB: * Averaged over the project's construction and operational phases.
multiplied economic contributions include both the initial direct contribution and flow-on /indirect benefits.

Other benefits associated with the project include the section 94 development contributions the Underground Project will make towards improved community facilities within the local area, and the value of the conservation offsets and environmental management measures proposed, many of which will result in improved environmental outcomes for the existing operations. For example:

- the project will establish a 295 hectare conservation area within Saddlers Creek to secure protection in perpetuity of the Aboriginal archaeological and cultural heritage values, and ecological values of the area;

- a Management Committee will be established to guide management of all Aboriginal sites within the project area and a Keeping Place will be established on site to store Aboriginal artefacts salvaged at Mt Arthur Coal;

- the integration of the water management systems for the existing open cut and proposed underground operation results in a number of synergies that reduce potential demand for external water and provides greater flexibility for water recycling and management at Mt Arthur Coal; and

- Measures proposed to manage rail noise impacts in the Antiene area will result in a reduction of existing and future rail noise impacts from all Mt Arthur Coal operations.

7.4 Ecologically Sustainable Development

The EP&A Act aims to encourage ESD within NSW. As outlined in **Section 4.0,** the proposed Underground Project requires approval from the Minister under Part 3A of the EP&A Act. As such, the Minister needs to be satisfied that the project is consistent with the principles of ESD. This section provides an assessment of the project in relation to the principles of ESD.

To justify the proposed project with regard to the ESD principles, the benefits of the project in an environmental and socio-economic context should outweigh any negative impacts. The ESD principles encompass the following:

- the precautionary principle;
- inter-generational equity;
- conservation of biological diversity; and
- Valuation and pricing of resources.

Essentially, ESD requires that current and future generations should live in an environment that is of the same or improved quality than the one that is inherited.

7.4.1 The Precautionary Principle

The EP&A Regulation defines the precautionary principle as:

> Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
>
> In the application of the precautionary principle, public and private decisions should be guided by:
>
> (i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
> (ii) an assessment of the risk-weighted consequences of various options.

In order to achieve a level of scientific certainty in relation to potential impacts associated with the project, this EA has undertaken an extensive evaluation of all the key components of the project. Detailed assessment of all key issues and necessary management procedures has been conducted and is comprehensively documented in this EA.

The assessment process has involved a detailed study of the existing environment (refer to **Section 5.0**), and the use of engineering and scientific modelling to assess and determine potential impacts as a result of the project. To this end, there has been careful evaluation to avoid, where possible, irreversible damage to the environment.

The decision making process for the design, impact assessment and development of management processes has been transparent in the following respects:

1. Government authorities, landholders potentially affected by the project, the local community, the Aboriginal community and other stakeholders were consulted during EA preparation (refer to **Section 2.0**). This enabled comment and discussion regarding potential environmental impacts and proposed environmental management procedures.

The community was initially consulted through a range of mechanisms including interviews, presentations, surveys and distribution of community newsletters and a project information sheet which provided project details and an opportunity for the community to provide feedback on the project. A second project information sheet provided feedback on the issues raise by the community. Baseline PPPs were prepared for residents within the EL area to provide a sound basis on which to undertake the subsequent property specific impact assessment.

A second phase of consultation was carried out following completion of the EA process and included a Community Information Session to which the local community and other relevant stakeholders were invited, personal meetings, presentations and the distribution of community newsletters and a third project information sheet which summarised the outcomes of the EA. PPPs for residents within the EL were revised and updated with the EA findings as they related to each property. Briefings were also provided to the existing Bayswater and MAN Community Consultative Committees. Specific meetings were also held with key government agencies to address specific environmental issues.

2. The Mt Arthur Coal complex has designed and implemented a comprehensive Environmental Management System (EMS), and related environmental management programs, that seek to implement best practice management. The Underground Project will incorporate the practices implemented and demonstrated to be effective at the Mt Arthur Coal complex and the existing EMS will be revised to incorporate the additional controls outlined in this EA.

3. The EA has been undertaken on the basis of the best available scientific information about the project area. Where uncertainty in the data used in the assessment has been identified, a conservative worst-case analysis has been undertaken and contingency measures have been identified to manage that uncertainty. A validation program has also been proposed to measure predicted against actual impacts of the project (refer to **Section 6.0**), so that contingency measures, if required, can be implemented in a timely and pro-active manner.

4. An auditing and review process is an integral component of the existing EMS at Mt Arthur Coal, providing for verification of project performance by independent auditors and relevant government agencies. The Underground Project will implement an auditing and verification processes consistent with that currently undertaken at Mt Arthur Coal.

7.4.2 Intergenerational Equity

The EP&A Regulation defines intergenerational equity as:

> Intergenerational equity namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

Intergenerational equity refers to equality between generations. It requires that the needs and requirements of today's generations do not compromise the needs and requirements of future generations in terms of health, bio-diversity and productivity.

The objectives of the Underground Project are to provide access to further coal resources in a manner that achieves the best practical safety, environmental, social and economic outcomes, maximises the use of existing and approved infrastructure and minimises surface disturbance and associated environmental impacts. The environmental management measures discussed in **Section 6.0** have been developed to minimise the impact on the environment to the greatest extent reasonably possible.

The management of environmental issues as outlined in the EA will maintain the health, diversity and productivity of the environment for future generations. The Underground Project will also make a significant contribution to maintaining services in the community through the direct and flow on effects of employee and operational expenditure and through Section 94 development contributions.

7.4.3 Conservation of Biological Diversity

The conservation of biological diversity refers to the maintenance of species richness, ecosystem diversity and health and the links and processes between them. All environmental components, ecosystems and habitat values potentially affected by the project are described in the EA. Potential impacts are also outlined and measures to ameliorate any negative impact are outlined in the statement of commitments (refer to **Section 6.0**).

The Underground Project maximises the use of existing disturbed areas for surface infrastructure and will require minimal clearing of vegetation. The detailed ecological assessment has concluded that the project will not have a significant impact on threatened species, populations or communities or their habitat. The underground mining methods proposed by the project will result in substantially reduced impacts on biological diversity than would be the case for open cut mining. Notwithstanding the minimal impact of the Underground Project on biodiversity values, Mt Arthur Coal has committed conserve in perpetuity approximately 295 hectares of land along Saddlers Creek and to manage approximately 150 hectares of land to the west of Edderton Road to enhance its ecological corridor values, providing a significant biodiversity conservation outcome as part of the project.

7.4.4 Valuation and Pricing of Resources

The goal of improved valuation of natural capital has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment. The principle of improved valuation and pricing refers to the need to determine proper values of services provided by the natural environment. The objective is to apply economic terms and values to the elements of the natural environment. This is a difficult task largely due to the intangible comparisons that need to be drawn in order to apply the values.

The project optimises the valuation and pricing of the coal resources with minimal impact by:

- optimising available use of the existing coal processing and transportation facilities to wash coal and to transport product coal to existing markets;
- integration with approved Mt Arthur Coal coal handling and processing infrastructure rather than duplicating facilities which would result in increased consumption of energy and impacts associated with the construction of the duplicated facilities; and
- maximising the efficient extraction of the coal resource and avoiding the isolation and sterilisation of coal through effective mine planning and location of site infrastructure.

Project feasibility considerations have included the costs of integration of effective management measures to minimise potential environmental and social impacts.

7.5 Conclusion

The DGRs seek a conclusion justifying the project, including whether or not the project is in the public interest. The Minister for Planning will determine whether or not the project is in the public interest, however, the project is consistent with relevant objectives of the EP&A Act. On considering the balance of environment and community impacts, it is considered that it would be reasonable for the Minister to conclude that the State, regional and local benefits of the project outweigh the impacts.

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9.0 Abbreviations and Glossary

9.1 Abbreviations

AADT	Annual average daily traffic volume
AEMR	Annual Environmental Management Report
AGO	Australian Greenhouse Office
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
ARTC	Australian Rail Track Corporation
CCC	Community Consultative Committee
CCO	Chemical Control Order
CHPP	Coal Preparation Plant
dB	Decibel
dBA	A-weighted decibel
DECC	Department of Environment and Climate Change
DGRs	Director General's Requirements
DNR	Department of Natural Resources
DoP	Department of Planning
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EA	Environmental Assessment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EL	Exploration Licence
EMS	Environmental Management System
EPA	Environment Protection Authority of NSW (former, now DECC)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)

EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPL	Environment Protection Licence
GDP	Gross Domestic Product
GHG	Greenhouse gas
ha	hectares
HRSTS	Hunter River Salinity Trading Scheme
HVAS	high volume air sampler
INP	NSW Industrial Noise Policy
kV	Kilovolt (1000 volts)
LEP	Local Environmental Plan
LGA	Local Government Area
m	metres
MAN	Mount Arthur North
ML	Mining Lease
MLA	Mining Lease Application
MOP	Mining Operations Plan
MSB	Mine Subsidence Board
MSC	Muswellbrook Shire Council
MSEC	Mine Subsidence Engineering Consultants
Mt	million tonnes
Mtpa	million tonnes per annum
PAD	Potential Archaeological Deposit
PM_{10}	Particulate matter less than 10 micro metres in diameter
PoEO Act	*Protection of the Environment Operations Act 1997*
PPP	Private Property Plan
RBL	Rating Background Level
REP	Regional Environmental Plan

ROM	Run of mine
RTA	Roads and Traffic Authority
SEPP	State Environmental Planning Policy
SIA	Socio-economic impact assessment
SMP	Subsidence Management Plan
TDS	Total Dissolved Solids
t/hr	Tonnes per hour
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
TSR	Travelling stock reserve
TSS	Total Suspended Solids
TSP	Total suspended particulate matter, usually in the size range of zero to 50 micrometres
Umwelt	Umwelt (Australia) Pty Limited
VCA	Voluntary Conservation Agreement
WAL	Water Access Licence
yr	Year

9.2 Glossary

Alluvium:	Sediment deposited by a flowing stream, e.g., clay, silt, sand, etc.
Amenities:	Lunch room, showers, toilets.
Amenity:	An agreeable feature, facility or service which makes for a comfortable and pleasant life.
Aquifer:	A water-bearing rock formation.
Arboreal:	Adapted for living and moving around in trees.
Archaeological:	Pertaining to the study of culture and description of its remains.
Attenuation:	The reduction in magnitude of some variable in a transmission system, for example, the reduction of noise with distance as it travels through air.

Average Recurrence Interval (ARI):	The statistically calculated interval likely to be exceeded once in a given period of time. A term used in hydrology, also known as return period.
Background Noise:	Existing noise in the absence of the sound under investigation and all other extraneous sounds.
Catchment Area:	The area from which a river or stream receives its water.
Coal Resources:	All of the potentially useable coal in a defined area, based on geological data at certain points and extrapolations from these points.
Conservation:	The management of natural resources in a way that will preserve them for the benefit of both present and future generations.
Cumulative Subsidence:	The accumulated subsidence, tilts, curvatures and strains which occur due to the extraction of all longwalls within a single seam.
dB (Decibel):	A unit for expressing the relative intensity of sounds on a logarithmic scale from zero (for average least perceptible sound) to about 130 (for the average pain level).
dBA:	A modified decibel scale which is weighted to take account of the frequency response of the normal human ear.
Dip:	The direction in which rock strata is inclined.
Drift:	A tunnel used to access coal resources.
Ecology:	The science dealing with the relationships between organisms and their environment.
Ecosystem:	Organisms of a community together with its non-living components through which energy and matter flow.
Effluent:	The liquid waste of sewage and industrial processes.
Electrical Conductivity:	The measure of electrical conduction through water or a soil-water suspension generally measured in millisiemens per centimetre or microsiemens per centimetre. An approximate measure of soil or water salinity.
Environmental Planning and Assessment Act 1979:	NSW Government Act to provide for the orderly development of land in NSW.
Environment Protection and Biodiversity Conservation Act 1999:	Commonwealth legislation that regulates development proposals that have an actual or potential impact on matters of national environmental significance.

Fault: A fracture or fracture zone along which there has been displacement of the sides relative to one another. Displacement can be vertical and/or horizontal.

Fauna: All vertebrate animal life of a given time and place.

Floodplain: Large flat area of land adjacent to a stream which is inundated during times of high flow.

Flora: All vascular plant life of a given time and place.

Geology: Science relating to the earth, the rocks of which it is composed and the changes it undergoes.

Geomorphic Processes: Processes involved in the formation of the earth's surface features.

Geotechnical: Relates to the form, arrangement and structure of geology.

Groundwater: Sub-surface water which is within the saturated zone and can supply wells and springs. The upper surface of this saturated zone is called the water table.

Habitat: The environment in which a plant or animal lives; often described in terms of geography and climate.

***In situ*:** In its original place.

kV (Kilo Volt): One thousand volts.

L_{A1} Noise Level: The noise level exceeded for one per cent of the time. It is used in assessment of sleep disturbance.

L_{A90} Noise Level: The noise level, measured in dB(A), exceeded for 90 per cent of the time, which is approximately the average of the minimum noise levels. The L_{90} level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes.

L_{Aeq} Noise Level: The equivalent continuous noise level, measured in dB(A), during a measurement period.

L_{AMax} Noise Level: The maximum noise energy, measured in dB(A), during a measurement period.

Land Capability: The ability of a parcel of land to be used in a sustainable manner (that is without permanent damage) for a given land use.

Landform: Sections of the earth's surface which have a definable appearance (e.g. cliff, valley, mountain range, plain, etc).

Longwall Mining Techniques: A panel of coal is removed by shearing machinery, which travels back and forth across the coal face. The area immediately in front of the coal face is supported by a series of hydraulic roof supports providing working space.

Mean:	The average value of a particular set of numbers.
Megalitre (ML):	One million litres.
Mitigate:	To lessen in force, intensity or harshness. To moderate in severity.
Native:	Belonging to the natural flora or fauna in a region.
Overburden Emplacement:	An area for placing overburden or waste rock, removed from above and between the coal seams.
Particulates:	Fine solid particles which remain individually dispersed in gases.
pH:	Scale used to express acidity and alkalinity. Values range from 0-14 with seven representing neutrality. Numbers from seven to zero represent increasing acidity whilst seven to fourteen represent increasing alkalinity.
Piezometer:	A small diameter bore lined with a slotted tube used for determining the standing water level of groundwaters.
Protection of the Environment Operations Act 1997:	NSW legislation administered by DECC that regulates discharges to land, air and water.
Rating Background Level (RBL):	A period (day, evening or night) background noise level determined in accordance with chapter 3 of the NSW Industrial Noise Policy (EPA, 2000).
Rehabilitation:	The process of restoring to a condition of usefulness. In regard to quarrying, relates to restoration of land from a degraded or quarried condition to a stable and vegetated landform.
Revegetation:	The process of re-establishing vegetation cover.
Run of mine (ROM):	Bulk material extracted from a mine, before it is processed in any way.
Salinity:	A measure of the concentration of dissolved solids in water.
Seam:	An identifiable discrete coal unit.
Socio-economic:	Combination of social and economic factors.
Sound Power Level:	The total sound energy radiated per unit time measured as 10 times a logarithmic scale, the reference power being 12 picowatts.
Spontaneous Combustion:	Spontaneous ignition of some or all of a combustible material.
Subsidence:	The vertical movement of a point on the surface of the ground as it settles above an extracted panel.

Subsidence affectation area:	The ground surface area affected by subsidence, defined by: • the area bounded by the 26.5 degree angle of draw (i.e. the angle of the line connecting the edge of underground workings and the limit of subsidence at the surface); and • the predicted vertical limit of measurable subsidence, taken as the 20 mm subsidence contour.
Surface Infrastructure:	Any man made object, facility or structure on the surface of the land.
Tailings:	Fine residual waste material separated in the coal preparation process.
Thermal Coal:	Includes medium to high ash, low sulphur coals used for domestic power generation and medium to low ash energy coals which are exported.
Topography:	Description of all the physical features of an area of land and their relative positions, either in words or by way of a map.
Total Dissolved Solids (TDS):	A measure of salinity expressed in milligrams per litre (mg/L).
Total Subsidence:	The accumulated subsidence, tilts, curvatures and strains which occur after the extraction of all longwalls within the current and preceding seams.
Total Suspended Particulates (TSP):	A measure of the total amount of un-dissolved matter in a volume of water or air usually expressed in milligrams per litre (mg/L) (for water) or micrograms per cubic metre ($\mu g/m^3$) for air.
Woodland:	Land covered by trees that do not form a closed canopy.