DEVELOPMENT CONSENT MODIFICATION DA 309-11-2001 (MOD 4)

Prepared

for

Ashton Coal Operations Pty Limited

by

Wells Environmental Services

July 2009

Preparation and submission of Environmental Assessment report prepared under Part 3A of the Environmental Planning and Assessment Act 1979

EA Report prepared by:	
Name:	Alan Wells
Qualifications:	BA; CPP; T&CP (Ord4), FAICD.
Address:	Wells Environmental Services Level 1, 3/95 High Street, East Maitland, NSW. 2323.
Major Projects Application:	DA 309-11-2001 MOD4.
Applicant's name:	Peter Barton Ashton Coal Operations Pty Limited. ABN 22 078 556 500.
Applicant's address:	Glennies Creek Road, Camberwell. NSW. 2330.
Land to be developed:	Refer to Schedule 1 of DA 309-11-2001 dated 11 October 2002 contained in Table 1.1.
Proposed development:	Modification of DA 309-11-2001 to authorise the development and mining of an additional longwall panel (Longwall/Miniwall Panel No. 9), increase production of the Ashton underground mine by 250,000 tonnes per annum of run of mine coal and deletion of Condition No's 3.18, 3.24, 3.25, 3.26 3.27 and 3.28 from Schedule 2 of the development consent of the Ashton Coal Project.
Environmental Assessment:	☑ An Environmental Assessment Report is attached which addresses those matters contained in the Director-General Requirements dated 31 August, 2008 pursuant to Section 75W of the Environmental Planning and Assessments Act, 1979.
Certification	Alan Wells of Wells Environmental Services, certifies that the Environmental Assessment for the proposed modifications to DA 309-11-2001 of the Ashton Coal Project contains relevant information that is neither false nor misleading.
Signature:	
Name:	Alan Wells
Date:	24 July, 2009.

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1 INTRODUCTION

Ashton Coal Operations Limited (ACOL) has commissioned Wells Environmental Services (WES) to prepare an Environmental Assessment (EA) report to support a proposed modification of the existing Ashton Coal Project (ACP) near the village of Camberwell in the Singleton local government area of New South Wales. The location of the ACP is shown by **Figure 1**.

The proposed modification involves:

- Authorising the development and mining of an additional longwall/miniwall panel;
- Increasing overall production of coal from the ACP underground mine by an additional 250,000 tonnes per annum of run of mine (ROM) coal;
- Deleting Conditions 3.18, 3.24, 3.25, 3.26, 3.27 and 3.28 of Schedule 2 of the existing development consent.

1.1 The Proponent

The proponent for the project is ACOL a wholly owned subsidiary of Felix Resources Limited (FRL), a publicly listed company on the Australian Stock Exchange and the operator of the ACP. The ACP is owned by the Ashton Joint Venture.

The Ashton Joint Venture is currently comprised of the following participants:

- Felix Resources Limited (60%);
- International Marine Corporation Group (30%); and
- ICRA Ashton (10%).

FRL is an Australian resources company developing, operating and investing in resource-related projects with a primary focus on coal. FRL's key assets are the Ashton coal mine and Moolarben coal mining project in New South Wales and the Yarrabee and Minerva coal mines and Athena and Harrybrandt exploration projects in Queensland. The Ultra-Clean Coal (UCC) technology and associated patents are also owned by FRL.

FRL has grown strongly since 2003 through expansion, new developments and acquisitions. Based on anticipated coal sales from its existing and proposed mining operations, whilst being conscious of its environmental responsibilities, FRL has entered into an agreement with the Australian Greenhouse Office with respect to greenhouse gas emissions.

The agreement reflects the contents of the Greenhouse Challenge Plus Programme Framework, whereby FRL undertakes to put in place appropriate, practical and cost effective actions to reduce its own greenhouse gas emissions and to encourage its staff and other external stakeholders to implement similar measures.

FRL is also contributing to the Coal 21 Fund which is a recently formed voluntary fund established by the coal industry to invest in various clean coal demonstrations.

1.2 Project Background

Initial investigations within the area began in late 1969, after the original proponents (Durham Holdings) acquired the mineral rights to the Ashton Property. In 1969 and 1970, thirty four (34) fully cored holes were drilled within the Ashton area. This work formed part of a larger exploration

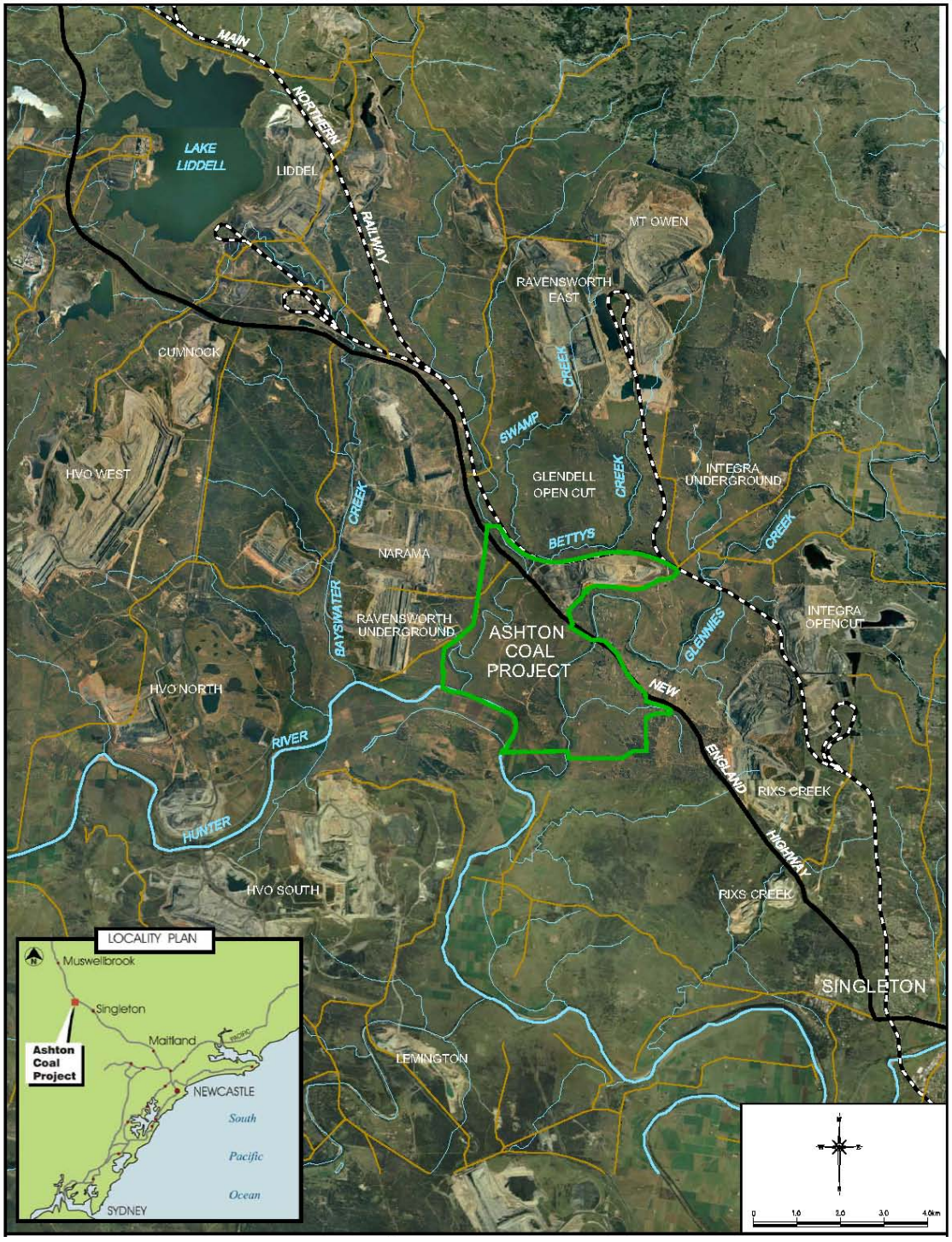

Figure 1: Location of the ACP.

program that was serviced and managed by the Joint Coal Board (JCB) for Durham Holdings Ltd, a subsidiary of consolidated Gold Fields Australia Ltd and Dalgety Australia Ltd.

In September 1999, the Minister for Mineral Resources transferred to White Mining Limited (WML) all rights, title and interests in Exploration Licence (EL) 4918, the Ashton area. EL 4918 covers an area of 370ha. During the period February 2000 to June 2001, WML implemented a program of in-fill drilling comprising 22 boreholes to augment the work conducted by Durham Holdings. These investigations, in conjunction with the earlier exploration, confirmed the potential of the ACP. In May 2001, an additional EL 5860 was granted to WML. EL 5860 is located east of and adjacent to EL 4918 and covers an area of 272ha.

In November 2001, WML lodged a Development Application (DA 309-11-2001) for the ACP with the Department of Planning. The ACP was granted development consent by the Minister for Planning on 11 October 2002.

To date, DA 309-11-2001 has been modified on three (3) separate occasions these being:

- DA 309-11-2001 modification (Mod 1) dated 15 October 2003 allows the Environment Protection Authority (EPA) to specify noise criteria in table 5;
- DA 309-11-2001 modification (Mod 2) dated 27 January 2005 permits a 10 metre (m) increase in the height in Eastern Emplacement Area; and
- DA 309-11-2001 modification (Mod 3) dated 29 February 2007 allows for the construction and operation of tailings pipelines between the mine and the former Ravensworth Mine.

In April 2005 FRL acquired WML, and therefore the ACP.

ACOL submitted correspondence to the Department of Planning (DoP) in May 2008 advising of the proposed modification to DA 309-11-2001 (MOD 4). On 31 July 2008 the DoP issued the Director-General's Environmental Assessment Requirements for the proposed modification.

The assessment of environmental impacts associated with the Section 75W modification of DA 309-11-2001 (MOD 4) will be undertaken by the NSW DoP in accordance with the requirements of the Environmental Planning and Assessment (EP&A) Act, 1979 and the Environmental Planning and Assessment Regulations (EP&AR) 2000.

This Environmental Assessment (EA) report provides an assessment of the potential impacts associated with the proposed modifications. The document has been prepared to address relevant issues and requirements raised by government agencies, statutory authorities and the community. The EA report also identifies and describes the need for the project, environmental safeguards and measures to mitigate potential impacts with respect to key issues, together with the proponent's Statement of Commitments and justification for the modification.

1.3 Project Objectives

The principal objectives of the Section 75W modification are:

- To maximise resource extraction from the existing coal resource;
- Offset coal lost from maintaining required aquaclude above approved longwall/miniwall panels, and ensure the ACP remains economically viable;
- Continue ACP operations to recover valuable coal resources for the benefit of the workforce and the community;
- Mine the resource by environmentally acceptable and presently approved mining methods;
- Mine the resource while ensuring the protection of the Bowmans Creek aquifers and stream; and
- Mine the resource within the existing approved environmental goals.

1.4 Location and Land Description

The ACP is situated 14 kilometres (km) north west of Singleton in the Hunter Valley of NSW as indicated in Figure 1. The village of Camberwell is located approximately 600metres (m) to the south east of the existing Ashton open cut mine and 1,500m east of the mine surface facilities.

The Main Northern Railway line forms the northern boundary of the site. The New England Highway is located to the south of the open cut and mine surface facilities. Glennies Creek Road is located along the south eastern boundary of the existing open cut operations. The existing Ashton underground mine is located north of the Hunter River, south of the New England Highway and west of Glennies Creek.

No mining will occur on lands other than those that currently apply to DA 309-11-2001. Some title descriptions of lands within the original consent have changed since the grant of the approval. **Table 1.1** details the land description shown within DA 309-11-2001, and the current land description in 2009.

Table 1.1: Lands Described in DA 309-11-2001 (2009).

Consent Land Description	Current Land Description	Location and ACP Component	Owner
Lot 101 DP 635131.	Unchanged.	North of New England Highway currently used for the ACP coal handling and preparation plant facilities, open cut mine and underground access.	Ashton Coal Operations Pty Limited.
Part Lot 11 DP 261916.	Unchanged.	North of New England Highway, west of Bowmans Creek, current agricultural land use. Above main gate road.	Glendell Tenements Pty Limited.
Lot 3 DP 195598.	Unchanged.	Eastern end of open cut mine, now under rehabilitation.	Glendell Tenements Pty Limited.
Pt Lot 70 DP 752499.	Pt 70 DP 1107703.	Southern end of underground area, underground mining and agricultural landuse.	Alistair Stuart Bowman.
Lot 701 DP 828294.	Lot 3 DP 1114623.	South of New England Highway, underground mining and agricultural land use.	Ashton Coal Operations Pty Limited.
Lot 1 DP 745486.	Unchanged.	North of New England Highway, open cut mining and facilities.	Glendell Tenements Pty Limited.
Pt Lot 1243 DP 1007536.	Lot 2 DP 1089848.	South of New England Highway north western area of underground mine.	Macquarie Generation.
Lot 1 DP 195598.	Unchanged.	Eastern end of open cut mine, now under rehabilitation.	Glendell Tenements Pty Limited.
Lot 59 DP 752499.	Unchanged.	Western end of open cut mine	Glendell Tenements Pty Limited.
Crown land including Crown Roads adjoining Lot 1 DP 745486.	Lot 1 DP1048686.	North of New England Highway, open cut mining.	Glendell Tenements Pty Limited.
Lot 128 DP 752499 (Reserve No.89555).	Unchanged.	North of New England Highway within open cut mine.	Ashton Coal Operations Pty Limited
Travelling Stock Reserve No. 66768.	Lot 1 DP 1056200.	North of New England Highway within open cut mine. (Former TSR)	Ashton Coal Operations Pty Limited
Part Camberwell Temporary Common.	Lot 2 DP 1056200.	North of New England Highway within open cut mine. (Former Temporary Common)	Ashton Coal Operations Pty Limited

Consent Land Description	Current Land Description	Location and ACP Component	Owner
Main Northern Railway corridor.	Unchanged.	Railway.	Australian Rail Track Corporation and NSW Railway.
Glennies Creek Road reserve	Unchanged	Road.	Singleton Council.
New England Highway road reserve.	Unchanged	Road.	Roads and Traffic Authority.

A small strip of land immediately west of the approved ACP is located within the sphere of subsidence of proposed Longwall/Miniwall Panel No. 9. These lands are not included within DA 309-11-2001, and are shown within **Table 1.2**, below. These lands are predominantly associated with adjoining mining operations including rehabilitation of former open cut operations.

The proposed extraction area is generally located east of the lands identified in Table 1.2

Figure 2 shows the layout of the ACP and key features of the locality.

Table 1.2: Description of lands west of ACP.

Consent Land Description	Owner
Road Reserve between Lot 3 DP 1114623 and Lot 165 DP 2328	Singleton Council
Lot 167 DP 2328	Renison Limited_Ravensworth Operations Pty Limited
Lot 166 DP 2328	Renison Limited_Ravensworth Operations Pty Limited
Lot 165 DP 2328	Renison Limited_Ravensworth Operations Pty Limited
Lot 164 DP 2328	Renison Limited_Ravensworth Operations Pty Limited
Lot 167 DP 2328	Renison Limited_Ravensworth Operations Pty Limited
Lot 31 DP 585169	WG Bowman, GR Elder, & IH Bowman
Lot 1 DP 823148	Renison Limited_Ravensworth Operations Pty Limited

1.5 Structure of the Environmental Assessment Report

The EA report has been prepared to assist the consent authority and the public in understanding the project, its impacts and safeguards and to identify the proponent's commitments. The EA report is presented in 1 volume. Volume 1 contains a description of the project, as approved and the proposed modifications, a description of the statutory planning framework, an overview of community and stakeholder consultation, identification and analysis of environmental interactions and management safeguards. Volume 1 also contains the proponent's Statement of Commitments, project justification and conclusion, together with a list of references and glossary of terms used within the EA report. Volume 1 contains the specialist studies. The specialist studies provide a detailed technical analysis of key issues identified and associated with the project.

The specialist studies for the development and mining of an additional longwall/miniwall panel have relied upon their investigations and modelling reported in a document titled the *Ashton Coal Underground for Longwall and Miniwall Panels 5 to 9*. The report is a Subsidence Management Plan (SMP) prepared by Maunsell Australia Pty Ltd to support ACOL's application to the Department of Primary Industries for mining by longwall methodology for Longwall/Miniwall Panels 5 to 9. The SMP was approved on 2 July 2009, the approval excluded the area of Longwall/Miniwall Panel No 9 as development consent is required and as such is the subject of this document.

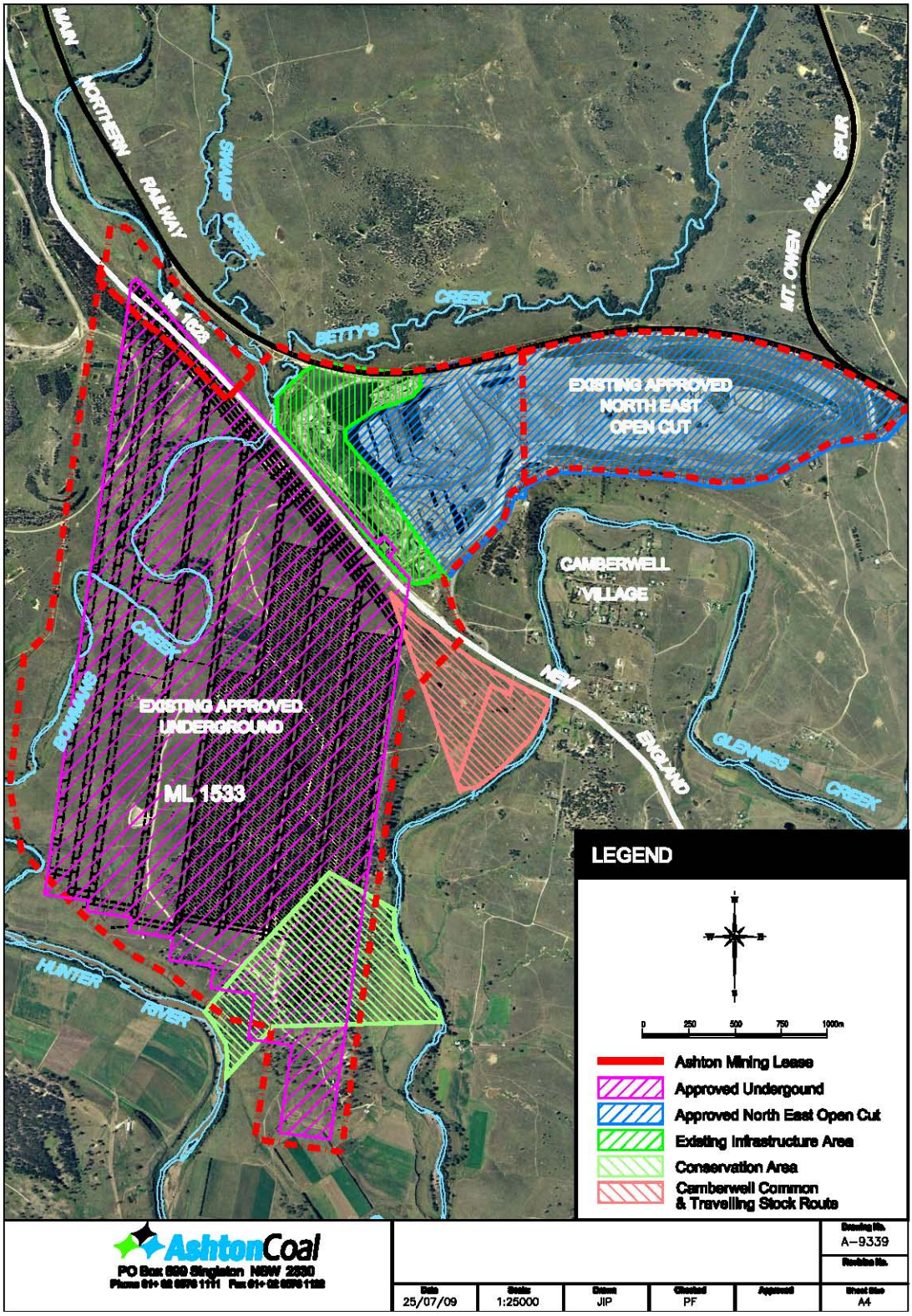

Figure 2: Layout of ACP

1.6 How to Read the Environmental Assessment Report

Anyone seeking to obtain information about the proposed modification and its impact upon the environment can do so at two levels.

Firstly, for those who want a general understanding of the project and its impacts, a reading of main text should be sufficient.

Secondly, those seeking an in depth understanding of the modification or a particular issue associated with the proposed modification should read the main text together with the respective specialist report(s) which are included as appendices.

1.7 Study Team

This EA report was prepared in association with and assisted by the management of ACOL and specialist consultants shown in **Table 1.3**

Table 1.3: Specialist consultants involved in the preparation of the ACP EA.

Project Role	Consultant
Project management and EA report writing, assessment of impacts and safeguards.	Wells Environmental Services Pty Ltd.
Subsidence.	SCT Operations Pty Limited.
Water.	Aquaterra Pty Limited.
Aboriginal Heritage.	Insite Heritage Pty Ltd.
Aquatic Ecology.	Marine Pollution Research
Flora and Fauna.	Environmental Resource Management Australia
Air Quality.	Holmes Air Sciences.
Acoustics.	Spectrum Acoustics.

2 PROJECT APPROVAL FRAMEWORK

This section details the relevant New South Wales legislation that applies to the proposed modification.

2.1 Approval Authority

The ACP was granted development consent under Part 4 of the EP&A Act 1979 as designated, state significant, integrated development in 2002 by the Minister for Planning.

ACOL is seeking approval from the Minister of Planning to modify DA 309-11-2001 under Part 3A, Section 75W of the EP&A Act, 1979.

Had the ACP been approved after the commencement of Part 3A of the EP&A Act 1979, the ACP would have been a project to which Part 3A applies because it is development for the purposes of coal mining (Schedule 1, Group 2 of the *State Environmental Planning Policy (Major Projects) 2005*).

Consequently the ACP is "*A development consent in force immediately before the commencement of Part 3A"* of the EP&A Act 1979 "…*that would be a project to which Part 3A of the [EPA] Act applies but for the operation of clause 6(2) (a) of State Environmental Policy (Major Projects) 2005".*

As such the ACP consent meets the prerequisite in Clause 8(J)8 of the EP&AR 2000 entitling the Minister to "…*approve of the development consent [ACP Consent] being treated as an approval for the purposes of Section 75W of the [EPA] Act".*

On 21 May 2008, ACOL wrote to the Director – General of the DoP, to:

- Notify their intention to lodge an application to modify DA 309-11-2001;
- Request that the modification be assessed under Section 75(W) of the EP&A Act 1979, along with supporting justification; and
- Request Director-General Requirements (DGR's) to be issued for the purpose of compiling the EA report.

On 31 July 2008, the Executive Director, Major Projects Assessments as delegate for the Director – General of the DoP responded to ACOL's request and provided DGR's (refer to **Appendix 1**) under Part 3A, Section 75W of the EP&A Act 1979.

2.2 Development Particulars

Table 2.1 below details the key aspects of the original development consent.

Table 2.1: Development particulars for the approved ACP.

Item	Development Particulars
Name and Address of Applicant.	Ashton Coal Operations Pty Limited. Glennies Creek Road, Camberwell, NSW. 2330. Mailing Address: PO Box 699, Singleton NSW 2330. Contact: Peter Barton.

Item	Development Particulars
Major Project Reference Number.	DA 309-11-2001 (MOD 4).
Development Consent Date.	11 October 2002.
Description of Project to be carried out under the Project Approval.	Development of an open cut coal mine, an underground coal mine and construction and operation of associated surface facilities.
Address and formal particulars of title on which the Project is to be carried out on.	Refer to Table 1.1 above.

2.3 Proposed Modifications

ACOL seeks a modification to the existing development consent pursuant to the provisions of Part 3A Section 75W of the EP&A Act, 1979 as amended. Section 75W (2) states that:

> *"The proponent may request the Minster to modify the Minister's approval for a project. The minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this part."*

The ACP with the proposed modifications, will continue to operate in the same manner and by the same mining methods and processes as it has been operating. The ACP will continue to operate in accordance with its various approvals, permits and licences.

2.4 Modify Condition 1.2, Schedule 2 - Additional Longwall Panel

ACOL is seeking to establish and mine an additional coal resource. The area and resource will be referred to in the EA report as Longwall/Miniwall Panel No. 9. The resource will provide replacement coal for the coal left insitu by not mining those parts of the approved longwalls to support the surface in the location of Bowmans Creek in order to maintain the aquaclude required by Condition 3.9 of Schedule 2 of DA 309-11-2001.

The coal to be recovered from the proposed Longwall/Miniwall Panel No. 9 is required to ensure the continued economic viability of the ACP. This EA provides a description of mining and impact assessment in Sections 5 and 6 for the proposed additional extraction area.

It is requested that Condition 1.2 of Schedule 2 of DA 309-11-2001 be modified through the addition of subclause "*ab) Document titled Development Consent Modification DA 309-11-2001 (MOD 4), prepared by Wells Environmental Services"*.

2.5 Modify Condition 2.7, Schedule 2 – Increase ROM Coal Production

DA 309-11-2001 approved the extraction of coal at a rate of up to 5.2 million tonnes per annum (Mtpa) of ROM coal. The original EIS did not seek approval for a ROM coal extraction limit, rather an approval for the production of 1.7 Mtpa of product coal from the open cut mine and a further 2.4 Mtpa from the underground mine, totalling 4.1 Mtpa of product coal.

Modelling for air quality in the original ACP EIS was based on 2.95 Mtpa of ROM coal from the underground mine and 2.5 Mtpa of ROM coal from the open cut mine, making a total of 5.45 Mtpa of ROM coal. The noise modelling undertaken in the original ACP Environmental Impact Statement (EIS) was for all mining fleet, plant and equipment to mine the same production levels reported in the air quality assessment. ACOL is seeking to increase annual production of ROM coal by 250,000 tonnes to 3.2 Mtpa of ROM coal from the ACP underground mine.

The 250,000 tpa production increase will be achieved due by ACP workforce operational efficiencies and increased product coal yield.

It is requested that Condition 2.7 of Schedule 2 of the consent be modified to read *"Annual production of coal from the ACP shall not exceed 5.45Mtpa of ROM coal".*

2.6 Deletion of Specific Conditions of Consent

ACOL seeks the deletion of Conditions No's 3.18, 3.24, 3.25, 3.26, 3.27 and 3.28 contained in Schedule 2 of the approval. Since the granting of the consent an inter governmental agency (Subsidence Management Plan (SMP) Interagency Committee) panel with an associated charter has been established. The SMP Interagency Committee assesses and determines SMP's for underground mining.

The information required by Condition No's 3.18, 3.24, 3.25, 3.26, 3.27 and 3.28 is also required to be supplied by the proponent within any SMP to support underground mining and to be assessed and determined by the SMP Interagency Committee.

ACOL seeks relief from the above conditions (by their deletion) as the requirements are duplicated within the SMP process.

3 STAKEHOLDER AND COMMUNITY CONSULTATION

3.1 Introduction

The DGRs require that relevant government authorities, service providers, community groups and affected landowners be consulted during the preparation of the EA report.

This section outlines the consultation that has been undertaken in the course of preparing the EA for the modification, including consultation for the Ashton Coal SMP for Longwall and Miniwall Panels 5 to 9.

3.2 Consultation Methodology

3.2.1 Landowners

The following landowners were identified as being directly or indirectly affected by the impacts of subsidence:

- Macquarie Generation – direct subsidence impacts to landholdings;
- Ravensworth Operations Pty Ltd – subsidence impacts to surface improvements and Ravensworth underground mine including access via Brunkers Lane which is being used (informally) as an alternative access to portions of Property No.153;
- Private Landowner (Property No. 130) – no direct subsidence impacts from the proposed development of Longwall/Miniwall Panel No. 9, however ongoing alterations and repairs to property access road as a result of underground mining (LW1-4); and
- Glendell Tenements – subsidence impacts to landholdings.

Singleton Council and the Roads and Traffic Authority (RTA) are responsible for remnants of the former Brunkers Lane and the New England Highway respectively. Consultation with these agencies is discussed in Section 3.2.4.

Notification letters and individual meetings were used to consult with landowners and utility service providers having land and infrastructure interests in the vicinity of the Ashton underground mine. A summary of consultations is provided in **Table 3.1**.

Table 3.1: Summary of consultation with landowners and utility service providers.

Stakeholder	Date Consulted	Description
Macquarie Generation.	30 June 2008	Notification letter.
Ravensworth Operations Pty Ltd.	30 June 2008	Notification letter.
Private Landowner (Property No. 130).	20 June 2008	Notification Letter..
Ravensworth Operations Pty Ltd.	3 July 2008	Meeting.
Energy Australia.	8 July 2008	Meeting.
Ravensworth Operations Pty Ltd.	11 July 2008	Email response.
Glendell Tenements.	21 July 2008	Notification Letter.
Macquarie Generation.	26 August 2008	Meeting.

3.2.2 Local Community and General Public

Community consultation was undertaken via a range of methods in order to ensure both local residents and the broader community were provided an opportunity to comment on the modifications. Consultation was undertaken with the following groups:

- ACOL Community Consultative Committee (CCC);
- Local indigenous community;
- Camberwell residents and residents of nearby rural properties; and
- General public.

The consultation methodology was developed to ensure that all of the above groups were given notice of ACOL's intention to prepare a SMP and proposal to mine the additional coal reserves associated with proposed Longwall/ Miniwall Panel No. 9. It also outlined opportunities to obtain further information on the proposal and make comment. A summary of community consultation is provided in **Table 3.2.**

Table 3.2: Community consultation summary.

Date	Description
17 June 2008	ACOL CCC Presentation outlining the proposed mine plan (including the additional Longwall /Miniwall Panel No. 9) to the CCC.
27 June 2008	Public Notice - Newspaper Advertisements placed within the Public Notices section of the Sydney Morning Herald and Singleton Argus advising that ACOL was preparing a Subsidence Management Plan and inviting the public to an information day to be held at the Singleton Library on 7th July, 2008.
June 2008	ACOL Community Newsletter No. 28 Posted on Ashton Coal's website and mailed to regular distribution list including residents of Camberwell Village and lands in the immediate vicinity of the ACP.
23 June 2008 26 June 2008 15 July 2008	Correspondence to local Aboriginal groups: • Ungooroo Aboriginal Corporation • Wattaka Wonnarua C.C. Service • Wonnarua Local Aboriginal Land Council • Wonnarua Aboriginal Custodians • Junburra Consulting • Yarrawalk Enterprises [*letter returned – undeliverable*] • Aboriginal Native Title Heritage Consultants [*letter returned – undeliverable*] • Lower Wonnarua Tribal Council • Aboriginal Native Title Elders Consultants • Biami Pty Ltd • Wonnarua Nation Aboriginal Corporation
1 July 2008	Public Notice - Newspaper Advertisements placed within the Public Notices section of the Singleton Argus advising that ACOL was preparing a Subsidence Management Plan and inviting the public to an information day to be held at the Singleton Library on 7th July, 2008
7 July 2008	Public Information Day Held at Singleton Library and previously advertised in the Sydney Morning Herald, Singleton Argus (two separate days), via the community newsletter, and in various correspondence listed above.
2 December 2008	ACOL CCC ACOL CCC advised that Subsidence Management Plan for Longwall Panels 5 to 9 had been submitted to DPI and that a variation to the original development would be sought for Longwall Panel 9.

3.2.3 Public Utilities

The location of public utilities in the area is well known to ACOL management. The location and type of services (underground and above ground) was reconfirmed using Dial-Before-You-Dig, and notification letters forwarded to Energy Australia, Telstra and PowerTel.

3.2.4 Government Agencies

Government agencies identified as requiring consultation as part of the SMP and EA processes include:

- Department of Planning;
- Department of Primary Industries (DPI)
- Department for the Environment and Climate Change (DECC);
- Department of Water and Energy (DWE);
- Mine Subsidence Board (MSB);
- Dam Safety Committee (DSC);
- Roads and Traffic Authority; and
- Singleton Council.

Consultation with these agencies was undertaken via the following:

- **Aquaclude Committee Meeting** - This meeting aimed to consider the mine plan together with results of monitoring of subsidence and groundwater investigations. The Aquaclude Committee, comprised representatives of the DPI, DoP, DWE, ACOL, Aquaterra, SCT Operations, and Maunsell.
- **SMP Interagency Committee** - ACOL presented the proposed mine plan to the SMP Interagency Committee which included representatives of the MSB, the DPI, DWE, DECC and DoP.
- **Notification Letters -** Letters to agencies not contacted during either of the above committee meetings were sent to notify them of the upcoming preparation of the SMP and requesting any input or comment.

A summary of the consultation undertaken with relevant government agencies is provided in **Table 3.3**

Table 3.3: Summary of consultation with relevant government agencies.

Stakeholder	Date Consulted	Description
Department of Primary Industries (Minerals).	21 May 2008.	Aquaclude Committee Meeting.
	4 June 2008.	SMP Interagency Committee.
	30 June 2008.	Meeting with Subsidence Executive Officer.
	15 July 2008.	Meeting with Principal Subsidence Engineer.
Department of Primary Industries (Fisheries).	4 June 2008.	SMP Interagency Committee.
	23 June 2008.	Notification Letter.
Department of Primary Industries (Agriculture).	23 June 2008.	Notification Letter.
Department of Planning.	21 May 2008.	Aquaclude Committee Meeting.
	4 June 2008.	SMP Interagency Committee
	23 June 2008	Letter regarding clarification of conditions of consent.
	4 June 2008	SMP Interagency Committee.
Department of Environment and Climate Change.	21 May 2008	Aquaclude Committee Meeting.
Department of Water and Energy.	4 June 2008	SMP Interagency Committee.

Stakeholder	Date Consulted	Description
	15 July 2008	Meeting with DWE Senior Hydrogeologists.
	4 June 2008	SMP Interagency Committee.
Mine Subsidence Board.	4 June 2008	SMP Interagency Committee.
	19 June 2008	Notification Letter.
Dam Safety Committee.	19 June 2008	Notification Letter.
	19 June 2008	Notification Letter.
Roads and Traffic Authority.	19 June 2008 28 August 2008	Notification Letter. Meeting.
Singleton Council.	17 June 2008 19 June 2008	ACOL CCC. Notification Letter.

On 31 July 2008, the DoP issued the DGR's. **Table 3.4** provides a summary of the DGRs, along with where these have been addressed within this EA report. A copy of the DGRs is contained in Appendix 1.

Table 3.4: Summary of Director-Generals Requirements

Specific Issues to be Addressed	Reference in EA Report
A summary of the existing and approved mining operations/facilities on site.	Section 4.
A detailed description of the proposal.	Section 5.
A detailed assessment of the key issues specified below, which includes:	
• A description of the existing environment.	Sections 5 and 6.
• An assessment of the potential impacts of the proposal, including any potential cumulative impacts, taking into consideration any relevant policies, guidelines, plans and statutory provisions.	Section 6 and Appendices 2A, 2B, 3A, 3B, 4, 5, 6, 7 and 8.
• A description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate, remediate, monitor and/or offset the potential impacts of the proposed modification.	Sections 6 and 7.
A general assessment of any other potential impacts of the proposal.	Section 6.
A statement of commitments outlining all proposed environmental management and monitoring measures.	Section 7.
A conclusion justifying the proposal on economic, social and environmental grounds, taking into consideration whether it is consistent with the objects of the *EP&A Act 1979.*	Section 8.
A signed statement from the author of the Environmental Assessment, verifying that the information contained within the document is neither false nor misleading.	Before Table of Contents.
Subsidence – including, • Accurate predictions of the potential subsidence effects of the modified mine plan; and • An assessment of the potential impacts of these subsidence effects on the natural and built environment, and particularly on Bowmans Creek.	Section 6 and Appendices 2A, 2B, 3A, 3B, 4 and 5.
Soil and Water – including a revised water balance.	Section 6 and Appendices 2A and 3A.
Aboriginal Heritage.	Section 6 and Appendix 6.
Flora and Fauna.	Section 6 and Appendix 5.
Air Quality and Noise – demonstrate that the mine as modified would comply with the air quality and noise limits in the existing development consent.	Section 6 and Appendices 7 and 8.
References The Environmental Assessment should take into account relevant State Government policies, guidelines and plans.	Section 9.

Specific Issues to be Addressed	Reference in EA Report
Consultation During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups or affected landowners. In particular you should consult with the: • Department of Environment and Climate Change; • Department of Water and Energy; and • Department of Primary Industries. The consultation process and the issues raised must be described in the Environmental Assessment.	Section 3.

3.3 Summary of Consultation Outcomes

The formal responses and direct feedback received by ACOL from representatives of the stakeholders consulted are summarised in **Table 3.5.**

Table 3.5: Summary of consultation outcomes.

Date	Respondent / Organisation	Type of Response / Consultation	Key Issues	Comment
3 July 2008	Registrar of Aboriginal Owners.	Letter.	No Registered Aboriginal Owners within the subject land.	
3 July 2008	Messrs A Wright, N Slate and M Turner, Ravensworth Underground Mine	Meeting.	Explanation of subsidence from Longwall/Miniwall No. 9. Ravensworth representatives identified potential development of power lines besides Brunker Lane, and existing mine infrastructure that needed to be considered.	Addressed in EA SMP reports and accompanying specialist subsidence assessment prepared by SCT.
6 July, 2008	Ms V McBride and Mr P Osterman, Ravensworth Underground Mine,	Meeting.	ACOL to supply copies of subsidence and groundwater assessment reports including 100 year and water flow through the 40 m barrier and abutment loading between the two operations.	Copies provided.
7 July 2008	Mr Barry French On behalf of Yarrawalk (Biami)	Personal Communication Public Information Day.	Requested copy of management plan once it has been prepared.	Copy of the draft archaeology management plan will be forwarded to all interested Aboriginal groups once prepared.
8 July 2008	Mr Noel Downs / Wannaruah Local Aboriginal Land Council (WLALC).	Letter.	WLALC do not and will not agree to the disturbance or destruction of any Aboriginal Cultural sites within the Conservation offset area, of the conservation area itself.	This area will not be impacted by Longwall/Miniwall Panel No. 9. Impacts to the Conservation Area were previously considered in the SMP for LW 1-4 and the WLALC consulted. No impacts to Aboriginal sites have occurred in the conservation zone as a result of underground mining in LW 1 or 2.
30 June 2008	Mr Garry Moore, MSB.	Letter.	Requirements for information to be included in the SMP.	SMP includes the requested information.
15 July 2008	Principle Subsidence Engineer, Mr Gang Li	Meeting.	Pillar stability and hydraulic connections – Principal Subsidence Engineer concerns on	Addressed in SMP.

Date	Respondent / Organisation	Type of Response / Consultation	Key Issues	Comment
	DPI-MR.		mine design and need to understand lithology and potential for different strata to propagate features. DPI-MR noted need for contingency planning in event of unexpected mine inflows and that this should be submitted as a management plan with the SMP to demonstrate preparedness.	
26 August 2008	Mr Robert Cullen, Macquarie Generation.	Meeting.	Proposed construction of a spoil dam adjacent to Longwall/ Miniwall Panel No. 9. Dam will be prescribed under the *Dam Safety Act 1979*. Undermining of site access road.	ACOL will consult with DSC in accordance with prescribed dam requirements prior to mining within this proposed notification area. Notification will be provided to Macquarie Generation and Ravensworth prior to undermining road. ACOL already has general maintenance responsibility of this road. Road is to be maintained to provide access to the Macquarie Generation Void 4 access gate.
			Access to site – locked gate. Induction requirements.	ACOL will ensure any staff or contractors under its responsibility will be inducted prior to entering Macquarie Generation site to undertake works for ACOL.
			Spontaneous combustion in spoil piles.	Not a major risk for ACOL as dump is initial out-of-pit spoil and unlikely to contain coal. Issue to be addressed in the ACP Spontaneous Combustion Management Plan.
			Reporting.	Macquarie Generation to be included in weekly report that is being generated.

4 THE ASHTON COAL PROJECT

The ACP consists of an open cut and underground coal mine, as well as a coal preparation plant and associated surface infrastructure and operates in accordance with DA 309-11-2001 and associated conditions in conjunction with a suite of approved management plans, permits and licences.

4.1 Summary of existing operation

A summary of the existing ACP operations approved by Development Consent (DA) 309-11-2001-i as amended is provided in **Table 4.1**. The general layout of the existing ACP is shown by Figure 2.

Table 4.1: Summary of the approved ACP operations and their status.

Aspect	Approved Operations	Existing Status of Operations	Modification Required
Project Life	ACP approved in October 2002 for 21 years from grant of Mining Lease.	ML 1529 covers the eastern end of the existing ACP north east open cut NEOC which was granted 10 September 2003, and expires 11 November 2012. ML 1533, covers the coal handling and preparation plant and underground area and was granted 26 February 2003 and expires 25 February 2024. ML1623 covers the north-western corner of the underground area and was granted 30 October 2008 and expires 30 October 2029.	No
Mine Production	Production from open cut and a descending underground coal mine. Annual production of coal from the ACP not to exceed 5.2Mtpa of ROM coal.	ACOL is currently extracting coal at a rate of approximately 5.16Mtpa of ROM coal.	Yes
Open Cut	Two pits – Arties Pit and Barrett Pit (forming the NEOC).	Expected to be completed by October 2010.	No
	Total output of open cut 12Mtpa of product coal over 7 year period.	Anticipated as per approval.	No
	Extraction of approximately 1.7 Mtpa of product coal. Equating to approximately 2.5Mtpa ROM coal as used in the air quality modelling.	In the 2006-2007 operating year 1.36Mt of product coal was generated from 2.22Mt of ROM coal.	No
	Construction of environmental bunds.	Completed as per original ACP EIS and under vegetation.	No
	Construction of the Eastern Emplacement Area (north of the New England Highway) to RL125m (modified in January 2005 by MOD 2 to permit construction up to a height of RL135m).	Completed as per EIS and modification.	No
	Construction of Western Emplacement (south of the highway) to RL 105m.	Effectively became redundant following approval of MOD 2.	No
	Use of highwall mining at appropriate times.	No highwall mining has occurred to date.	No
	Final void filled with reject material.	As per approval (see surface facilities).	No

Aspect	Approved Operations	Existing Status of Operations	Modification Required
	Rehabilitation to combination of woodland and pastures.	Consistent with approval,	No
Underground	EIS estimated 18 year life for the ACP underground mine.	Commenced mining in December 2005. The ACP Underground Mine would be estimated to be completed by 2023 (assumes maximum production rates).	No
	Entry via highwall of the Arties Pit on the north side of the New England Highway with main headings aligned beneath the New England Highway.	Development of the underground entries and infrastructure commenced in December 2005, with the extraction of the first panel commencing following the SMP approval in March 2007.	No
	Extraction equating to approximately 2.95Mtpa of ROM coal as used in the air quality modelling of the original Ashton EIS.	ACOL is currently extracting coal at a rate nearing the approved limit from the underground mine.	Yes
	Approval for underground mining 24 hours per day 7 days per week.	The underground mine currently operates 15 hours per day, 5 days per week	No
	Diversion of Bowmans Creek proposed within EIS to minimise impacts to alluvials. Diversion excluded from the consent with conditional approval of undermining of alluvials pending studies showing minimal impact.	Studies undertaken, determined that mining design could be modified through alteration of panel width to reduce potential of connective cracking and protection of Bowmans Creek flows and associated alluvials. SMP approved on 2 July 2009 documents these studies.	No
	Six panels approximately 250m wide proposed within EIS, later replaced by 7 panels (LW1 to LW7) approximately 210m wide, conditional on no impacts to Bowmans Creek alluvium.	The SMP for Longwall (LW) Panels 1 to 4 in the Pikes Gully Seam was approved on 8 March 2007. Longwall 1 and 2 are complete, Longwall 3 commenced in September 2008 with development of Longwall 4 underway. SMP prepared and approved on 2 July 2009 for the remaining panels. The mine design now consists of longwall panels and miniwall panels, ranging from 60 to 216m wide starting at Longwall 5 through to Miniwall 8. Longwall/Miniwall Panel No. 9 is the subject of this modification and is located west of Miniwall 8.	No
	Descending multi seam operation targeting Pikes Gully, Upper Liddell, Upper Lower Liddell and Lower Barrett Seams.	Currently working the Pikes Gully Seam.	No
Coal handling, preparation, and processing	Train loading and CHPP operation 24 hours per day, 7 days per week.	Currently operated 24 hours per day, 5 days per week.	No
	Construction and operation of pit top facilities for coal preparation, stockpiling and train loading.	Constructed as per EIS and approved modifications.	No
	Coarse and fine rejects to be disposed of within final void.	Final void will continue to be filled with reject, however MOD 3 dated February 2007 provided for the disposal of fine reject within voids of the “old” Ravensworth Open Cut.	No
Water Demand and supply	Water supply from site run-off, underground mine dewatering, excess mine water from neighbouring mines, potable water collected	Water is currently sourced as approved, with a water sharing agreement with the Glennies Creek Coal Mine and from	No

Aspect	Approved Operations	Existing Status of Operations	Modification Required
	from roof tops, and imported water when required.	licenced water allocations on Bowmans Creek, Glennies Creek and the Hunter River.	
Support facilities and utilities	Administration, car parking, stores and bathhouse facilities.	Constructed as per EIS.	No
	Power and water supply infrastructure.	Consistent with approval.	No
Mine Access	Glennies Creek Road.	As per approval.	No
Operating Hours	Open cut operations 7am to 10pm Monday to Saturday and 8am to 10pm on Sunday.	Operating as approved.	No
	Blasting 9am to 5pm Monday to Saturday.	Operating as approved.	No
	Underground operations 24 hours per day, 7 days per week.	Operating as approved.	No
	Coal handling and preparation facilities 24 hours per day 7 days per week.	Operating as approved.	No
Employment		Currently employ 386 personnel and contractors, made up from: • 160 in open cut • 180 in underground • 27 in CHPP • 19 management and support staff.	No

4.2 Environmental Management and Monitoring Regime

As required by the original development consent DA 309-11-2001, ACOL have established a comprehensive environmental management and environmental monitoring regime which has been approved by relevant government agencies and implemented throughout the construction and operation of the ACP. All approved management plans are available on the Ashton Coal website (http://www.ashtoncoal.com.au/Documents.aspx?cat=Environmental+Plans). These management plans contain comprehensive environmental reporting procedures incorporating principles of operating the ACP in an efficient and environmentally responsible manner.

ACOL has established the following suite of management plans:

- Environmental Management Strategy;
- Air Quality Management Plan;
- Noise Management Plan;
- Blasting and Vibration Management Plan;
- Erosion and Sediment Control Management Plan;
- Site Water Management Plan
- Groundwater Management Plan;
- Aboriginal Heritage Management Plan;
- Archaeology and Cultural Heritage Management Plan;
- Flora and Fauna Management Plan;
- Weed Management Plan;
- Landscape and Revegetation Management Plan;

- Land Management Plan;
- Soil Stripping Management Plan;
- Final Void Management Plan;
- Rail and Road Closure Management Plan;
- Lighting Management Plan;
- Spontaneous Combustion Management Plan;
- Bushfire Management Plan;
- Waste Management Plan; and
- Subsidence Management Plan

5 DESCRIPTION OF PROPOSED UNDERGROUND MINING

5.1 Underground Mine Design

The original ACP EIS proposed the mining of coal reserves by descending longwall extraction methodology targeting the Pikes Gully, Upper Liddell, Upper Lower Liddell and Lower Barrett coal seams. The original design of the ACP underground mine included a 1.5 km diversion of Bowmans Creek to flow parallel with the western boundary of ML 1533.

The proponent amended the design of the project by removing underground mining at shallow depths of cover below Bowmans Creek alluvium and the proposed diversion of Bowmans Creek. Following the amendments to the design of the project DA 309-11-2001 was conditionally approved on 11 October, 2002. The approval specified that underground mining of the coal seams could occur beneath Bowmans Creek and its associated alluvium provided no connective cracking or direct hydraulic connection to the workings occurred.

Based on extensive drilling, subsidence and groundwater investigations involving detailed modelling and consultation with government authorities, ACOL redesigned its underground mine layout having consideration to data based on actual underground mining derived from Longwall Panels 1 and 2. The underground mine layout includes features such as miniwalls, larger chain pillars and barriers of in-situ coal. The incorporation of miniwalls in the mine plan and leaving some of the coal seam aims to maintain a substantially intact barrier of overburden between the caving zone, the goaf and the base of the Bowmans Creek alluvium.

These features significantly reduce the risk of adversely impacting on Bowmans Creek and associated alluvial and groundwater resources by connective cracking. Subsidence, with associated cracking in key areas, will be minimised to lessen the risk of adverse impacts on groundwaters, water flows and water quality within Bowmans Creek in the original ACP EIS.

The area proposed for underground mining is located south of the New England Highway and immediately east of the western boundary of ML 1533. The extraction area is rectangular in shape and is orientated in a north-south direction similar to other approved longwall panels for the ACP. The area and associated coal reserves coincides with that part of the site which was proposed to contain the realigned Bowmans Creek.

ACOL propose to develop and mine the extraction area for the full thickness of the Pikes Gully Seam, utilising longwall mining methodology to recover an additional 1.25 mt of ROM coal. The southern portion of the extraction area will have a reduced extraction width or “miniwall”. The reduced extraction width or miniwall will maximise environmental protection to Bowmans Creek and associated alluvium. The area will be ACOL’s most western extraction area. The extraction area is shown by **Photographs 1 and 2.**

The design and layout of Longwall/Miniwall Panel No. 9 maximises the efficient extraction of the coal resource contained in the Pikes Gully Seam without compromising the integrity of the natural and built environs or adjoining underground mining operations located west of the ML 1533 boundary. Importantly, the coal can be mined with minimal impact or cost with respect to existing operations, manning levels and infrastructure associated with the ACP.

The land is largely owned by ACOL and Macquarie Generation and is predominantly used for livestock grazing and providing access by a private road from the New England Highway for activities associated with adjoining power generation and mining.

The Pikes Gully Seam overburden comprises sandstone and minor siltstone units. These sandstone units are categorised as being moderate to strong in terms of their structural integrity and are largely

Photograph 1: View of northern portion of extraction area.

Photograph 2: View of southern portion of extraction area.

self supporting (Maunsell 2008). The existing underground workings have proven to be highly stable during both development and extraction to date.

The miniwall panel will have a width of approximately 90 metres and extend in a northerly direction away from the Hunter River for approximately 1500m and will pass beneath Bowmans Creek. The longwall panel will commence approximately 50m north of Bowmans Creek extending in a northerly direction for approximately 1300m before finishing about 160m south of the New England Highway. The longwall panel will have a width of about 140m.

The area proposed for additional longwall mining is shown by **Figure 3**.

5.1.1 Development of Headings and Gate Roads

Entry to the ACP underground mine will continue to be via the Arties Pit highwall located immediately north of the New England Highway. Access to the mine workings will be provided by the main headings which lie beneath and run parallel to the New England Highway, while gate roads between sets of parallel headings divide the coal into mineable panel sections.

The main headings and gate roads for Longwall/Miniwall Panel No. 9 will be developed using a continuous miner. This machine contains a rotating drum fitted with numerous cutting picks that mechanically cut the coal to form an access tunnel. The excavated coal will be delivered directly to the shuttle cars from the rear of the continuous miner then transferred to a conveyor system. The

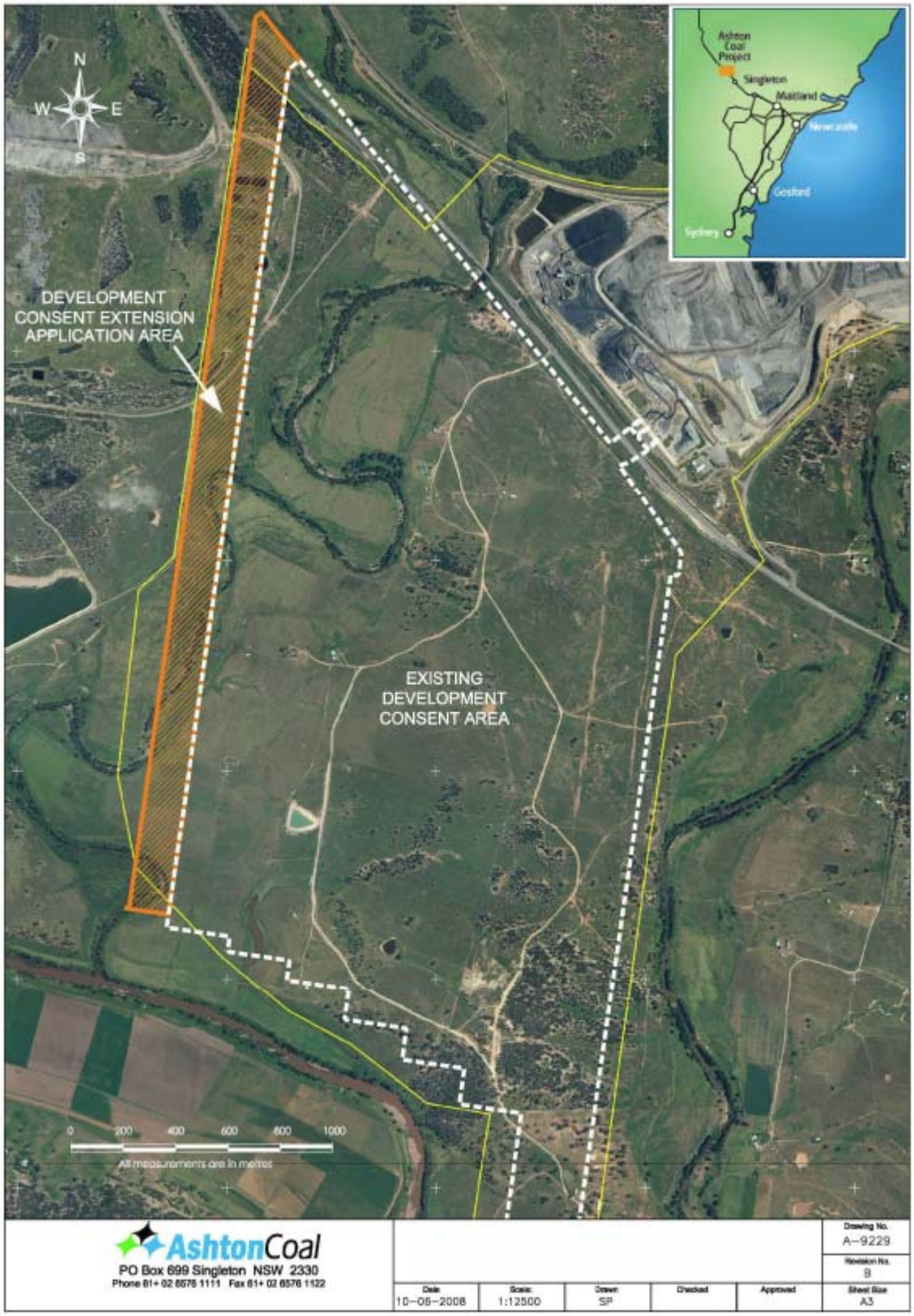

Figure 3: Area proposed for additional longwall mining

ROM coal is then transported along the conveyor system to the surface facilities for processing, stockpiling and dispatch by rail to the Port of Newcastle.

5.1.2 Longwall Mining and Subsidence

The underground coal will be mined using conventional longwall methods (see **Figure 4**). Longwall mining is performed in a nearly continuous operation using an integrated mining and roof support system. Each longwall panel is mined in linear slices by a shearer moving backwards and forwards across the coal face. The cut coal falls onto a chain conveyor that transports the coal to one end of the working face. It is then transferred to a belt conveyor established along the gate road and main heading for transport to the surface.

Large, self-advancing hydraulic "shields" support the roof immediately adjacent to the face. As the cut advances the roof support line also advances. The unsupported roof above the mined panel is then allowed to collapse behind the advancing face and longwall miner. The collapsed roof area behind the working face is termed the 'goaf zone'.

Mining will commence at the southern end of Longwall/Miniwall Panel No. 9 and will retreat to the north. Once Longwall/Miniwall Panel No. 9 is completed the longwall will then be relocated to the next approved coal extraction area (Upper Liddell Seam) to recommence the operations.

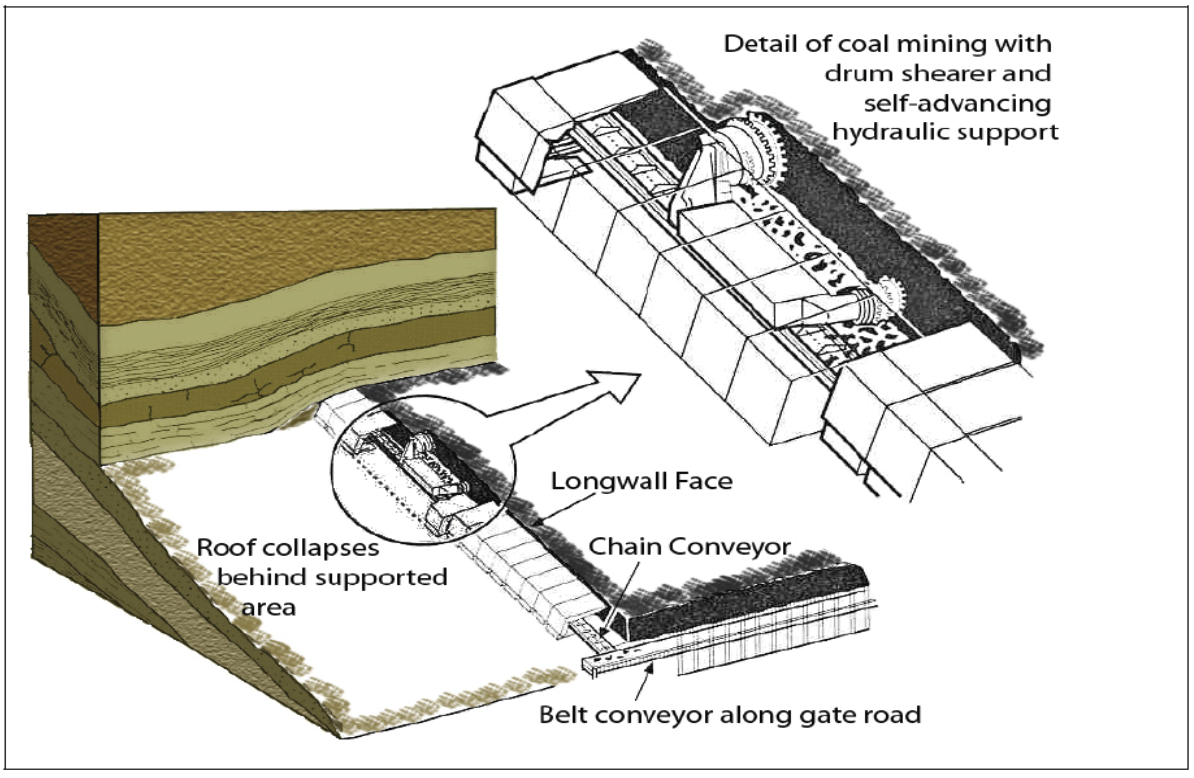

Figure 4: Schematic diagram of longwall mining operation.

5.1.3 Ventilation and as Management

The existing fresh and exhaust air networks will be extended to Longwall/Miniwall Panel No. 9 to provide fresh air in areas where mine personnel and contractors will be working.

Methane gas yield from Longwall/Miniwall Panel No. 9 will be low and will not support capture or co-generation.

5.1.4 Water Management

The existing ACP underground dewatering infrastructure network will be extended to cater for any ground water inflow associated with the mining of Longwall/Miniwall Panel No. 9. Extracted groundwaters will be managed in accordance with the approved Groundwater Management Plan.

The existing ACP underground mine operations produce a net surplus of water. Clean water is required to operate the longwall. This water is collected within the ACP together with seepage or inflow from groundwaters and is conveyed to the Arties Pit sump or the process water dam.

ACOL engaged Worley Parsons Pty Ltd to metre flow rates into and out of the ACP underground mine. The metering was for a period of approximately 18 months and enabled the determination of water make and demand levels The ACP underground mine currently provides the operations with a net surplus averaging about 0.4 mega litres per day (ML/day).

The surplus will increase as the existing ACP mine extracts the western longwall panels – but at rates marginally below the original ACP EIS. Groundwater modelling predicts inflow rates of about 1.45 to 1.55 mega litres per day for the extraction of Longwall/Miniwall Panel No. 9 these levels are very similar to those predicted for the recently approved Miniwall Panel No. 8.

The extraction of groundwaters associated with the mining of Longwall/Miniwall Panel No. 9 will require licencing under the Water Act 1912 and or the Water Management Act 2000.

The mining of Longwall/Miniwall Panel No 9 and the increase in annual ROM underground production will result in minor changes to the existing site water balance. The ACP has sufficient licenced water capacity to process the additional production.

5.1.5 Mining Fleet, Equipment and Coal Handling Facilities

The existing ACP underground mine fleet, equipment and associated surface based coal handling facilities will be used for mining Longwall/Miniwall Panel No. 9. No capital investment or upgrades are required by ACOL to cater for the additional 250,000 tpa increase of ROM coal production or coal obtained from Longwall/Miniwall Panel No. 9.

5.1.6 Underground Workforce and Working Hours

The excising ACP underground mine workforce and contractors will be employed to develop and mine Longwall/Miniwall Panel No. 9.

Since the commencement of the ACP the workforce has gained considerable experience and knowledge of site conditions. The experience and knowledge gained has resulted in improved operational efficiencies whereby an additional 250,000 tpa of ROM underground coal production can be achieved from the underground operations.

There will be no increase in employment levels at the ACP as a consequence of the modifications.

ACOL does not seek to change the approved ACP underground mine operational hours as a consequence of proceeding with the mining of Longwall/Miniwall Panel No. 9.

5.1.7 Reject Disposal

The mining of coal reserves contained in Longwall/Miniwall Panel No. 9 will generate approximately 400,000 tonnes of coarse reject and tailings.

The reject and tailings will be conveyed and emplaced either within the approved ‘old’ Ravensworth Mine void or the north east open cut final void for disposal. There is sufficient void capacity to cater for the quantity of reject material generated from mining the Longwall/Miniwall Panel No. 9 coal resources.

6 EXISTING ENVIRONMENT KEY ISSUES AND INTERACTIONS

This section of the EA report provides a description of the existing environment associated with the ACP together with an analysis of impacts (including cumulative impacts) and mitigation measures associated with the key issues contained in the DGR's for the proposed modifications.

The key issues identified within the DGR's are subsidence, soil and water, Aboriginal heritage, air quality, noise, flora and fauna.

6.1 Existing Environment

The original ACP EIS adequately addressed the climate of the area. A brief summary of the area's climate is provided below.

Rainfall and Evaporation - Seasonal changes are a factor in the distribution of annual rainfall, with a greater proportion of rainfall occurring during the summer months. Over the remaining seasons, the rainfall is spread more evenly with minimum totals generally being recorded in winter. The wettest median (i.e. where 50% of records are higher and 50% of records are lower) monthly rainfall occurs in January where 65.1mm occurs over an average of 6.5 days, while the driest median monthly rainfall occurs in May with only 28.7mm of rain falling over 4.9 days. The median rainfall is 644.2mm.

The mean monthly evaporation rate for the period 1970 to 1979 was 154 mm with monthly variations between 78 mm in May and 245 mm in January.

Much of the year is characterised by a water deficit.

Temperature and Humidity - Summers are often characterised by extremely hot conditions with the highest temperatures exceeding 45 degrees Celsius (ºC). The average temperature during summer ranges from a maximum of more than 31ºC, to a minimum of 16ºC. During winter temperatures have been recorded below -4 ºC with the average temperature ranging from just over 4ºC to more than 18ºC. Frosts occur regularly during May to August, where on average more than 27 days per year record temperatures below 2ºC (temperatures less than 2ºC measured at 1.2m typically equate to a ground surface temperature of 0ºC, BOM 2008).

Winds - Summer winds are predominantly from the south-southeast, while during winter winds are generally confined to the north-northwest and northwest. The pattern in autumn and spring are a combination of these with winds from both the north-northwest and south-southwest, with approximately equal frequency.

6.2 Subsidence

ACOL commissioned SCT Operations Pty Ltd (SCT) to undertake subsidence assessments of the proposed Longwall/Miniwall Panel No. 9. Copies of the reports are contained in **Appendix 2A and 2B**. The reports provide a general description of the area including mining geometry, subsidence assessments and prediction of impacts upon both natural and man-made features including the Narama Dam together with recommendations to monitor and manage subsidence impacts.

6.2.1 Mining Geometry

The underground mine layout to extract coal from the Pikes Gully Seam has been designed specifically to limit the subsidence impact on Bowmans Creek and the associated alluvium by

reducing the panel width directly below the creek and alluvium features. The width of the extraction area is also restricted by its proximity to the lease boundary (immediately west) and adjoining approved ACP underground longwall panels situated to the east and Ravensworth underground mine to the west.

The Pikes Gully Seam dips to the south west at a grade of about 1 in 10. The overburden depth ranges from 140m at the northern (New England Highway) end of Longwall Panel No. 9 to 190m above Miniwall Panel No. 9 (as a result of seam dip).

Miniwall Panel No. 9 is designed to limit subsidence impacts on Bowmans Creek. The maximum panel width to overburden depth directly below Bowmans Creek and associated alluvium is designed to be 0.6:1. The panel width to depth is designed so that maximum subsidence is less than 10% of the seam thickness extracted.

6.2.2 Natural Features and Surface Improvements

The natural features and surface improvements have been identified for the area of Longwall/Miniwall Panel No. 9 and are shown by **Figure 5.** The main natural features of the area are the Hunter River, Bowmans Creek and associated alluvial flats. The northern portion of Longwall Panel No. 9 has been disturbed by past mining activities and has been rehabilitated.

Surface improvements include the New England Highway, Powertel optic fibre cable, 132kV, 66kV and local area electricity lines and poles, Telstra underground copper wire cable, Bowmans Creek flow gauging station, Brunkers Lane (private road), Macquarie Generation access road, Macquarie Generation sedimentation ponds, underground polyethylene water pipeline extending from the Narama Dam to Mt Owen coal mine.

The toe of the Narama Dam is 270m from the nearest goaf edge of Miniwall Panel No 9. A Dam Safety Committee Notification zone for the Narama Dam extends over part of the area in which Longwall/Miniwall Panel No. 9 will be located. A second water storage dam (Ravensworth Void 5 flyash dam) is planned to be constructed west of the north-western corner of Longwall Panel No. 9 and before mining occurs.

As reported within the Ashton Coal Underground Subsidence Management Plan for Longwall and Miniwall Panels 5 to 9 prepared by Maunsell 2008,

> *"The Pikes Gully Seam overburden comprises sandstone and minor siltstone units. These sandstone units are categorised as being moderate to strong in terms of their structural competency (with associated UCS values of generally >60MPa) and are largely self-supporting on drivage. The underground workings have proven to be typically highly stable both development and extraction to-date"*

6.2.3 Subsidence Estimates

SCT provide subsidence predictions for extracting the Pikes Gully Seam from Longwall/Miniwall Panel No. 9. The subsidence predictions at the ACP underground mine are based on empirical experience in NSW for similar panel width, overburden depths and previous monitoring over Ashton's Longwall Panel No's 1, 2 and 3.

SCT advise that subsidence monitoring at the Ashton underground mine is most relevant to subsidence behaviour over full width panels, however centreline subsidence lines located over the start of Longwall Panel No's 1, 2 and 3 provide an indication of the bridging characteristics of the overburden strata for narrow width longwall panels. As the longwall face moves away from the starting rib, the effective width of the void increases. The subsidence characteristics for a range of panel widths can then be measured, albeit a dynamic subsidence profile.

Profiles of subsidence prepared by SCT for Longwall/Miniwall Panel No. 9 are based on the subsidence profiles measured over Longwall Panel No's 1 and 2 with allowance for difference in overburden depth (refer to Figure 5) and panel geometrics. The SCT estimates of strains and tilts are

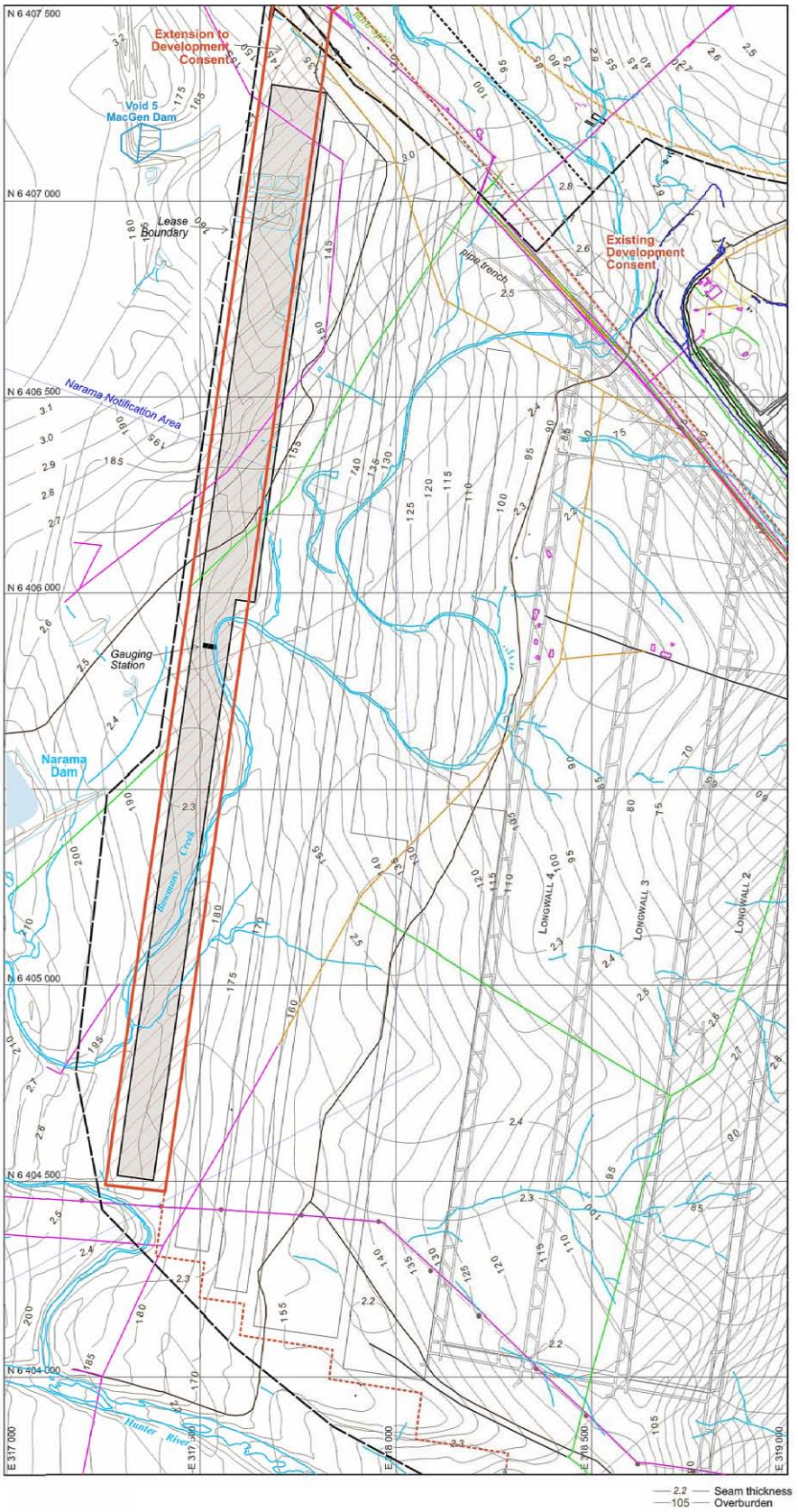

Figure 5: **Location of surface infrastructure and overburden depth and seam thickness isopachs.**

based on guidelines developed in the Western Coalfields and the results of previous monitoring over Longwall Panel No's 1 and 2.

6.2.3.1 Miniwall Panel No. 9

Miniwall Panel No. 9 is located in the southern portion of the extraction area is overlain by Bowmans Creek and is remote from previous panels. SCT conclude that subsidence will be almost entirely a result of sag subsidence. **Table 6.1** below provides a summary of Miniwall Panel No. 9 subsidence predictions based on mining geometry and overburden depth.

Table 6.1: Summary of Miniwall Panel No. 9 – subsidence predictions.

Site	Panel Width (m)	Overburden Depth (m)	W/D (max)	Maximum Subsidence (mm)	Maximum Tensile Strain (mm/m)	Maximum Compressive Strain (mm/m)	Maximum Tilt (mm/m)
Miniwall 9	93	160-190	0.5-0.6	200	3.2	4.2	11

SCT with respect to subsidence for Miniwall Panel No. 9 conclude that horizontal movements of up to 200 mm are considered possible but are likely to be generally less than 50 mm. Surface cracking is unlikely to be perceptible given the alluvial nature of most of the surface area above Miniwall Panel No. 9.

6.2.3.2 Longwall Panel No. 9

Longwall Panel No. 9 is located in the northern portion of the extraction area and its width is constrained by the mine lease boundary to the west and approved ACP underground longwall mine panels to the east.

For the purposes of impact assessment SCT conclude maximum subsidence over Longwall Panel No. 9 is 50% of seam thickness but recognising that the actual maximum ground subsidence is likely to be in the range 0.5-1.0m based on previous monitoring.

Table 6.2 below provides a summary of Longwall Panel No. 9 subsidence predictions based on mining geometry and overburden depth.

Table 6.2: Summary of Longwall Panel No. 9 – subsidence predictions.

Site	Panel Width (m)	Overburden Depth (m)	W/D (max)	Maximum Subsidence (mm)	Maximum Tensile Strain (mm/m)	Maximum Compressive Strain (mm/m)	Maximum Tilt (mm/m)
Longwall 9	141	141-180	0.8-1.0	1200	15	20	50

SCT predict surface cracking of up to about 200 mm in the vicinity of the northern end longwall No. 9 near the out of pit spoil placement. Largest cracks typically occur along the crest of sloping ground. As previously noted, much of the northern portion of Longwall Panel No. 9 is part of an out-of pit spoil dump and this has been taken into consideration by SCT in their subsidence calculations.

6.2.4 Subsidence Impacts

SCT have provided an assessment of impacts on the area's natural features and surface improvements which are summarised below, whilst **Figure 6** shows final predicted subsidence contours.

Bowmans Creek and associated alluvial flats – The mine layout has been designed specifically to control the hydraulic interaction between the surface water in Bowmans Creek and adjacent alluvium and the underground mine.

The proposed mine layout is expected to cause vertical subsidence along Bowmans Creek of up to approximately 200mm. The sections of the creek channel subject to the peak subsidence are likely to be only 5-10m long with subsidence decreasing back to less than 50 mm over the panel edges.

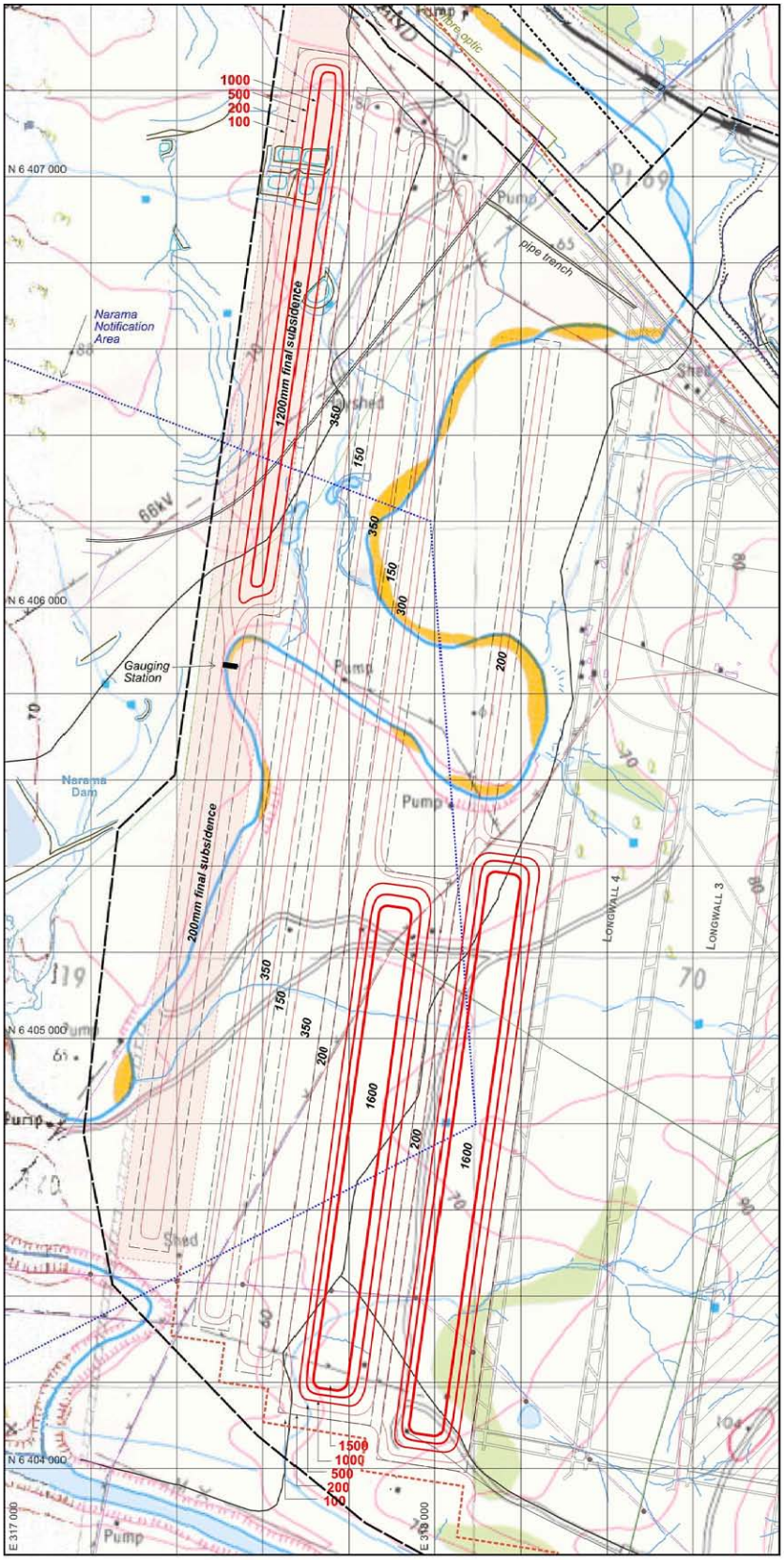

Figure 6: Final predicted subsidence contours

While there is some potential for localised ponding within the creek channel, the level of ponding is considered unlikely to be outside the variability that is currently evident within the channel or that which occurs naturally during flood scouring.

Local tilting of the surface may cause the stream channel to move sideways within the creek bed, but for the low tilt levels expected and the short distances over which tilting is occurring, the changes are expected to be within the natural variation that is evident naturally in the creek.

Hunter River – The Hunter River is located approxiamtely 500m outside the extraction area, consistent with the 200m offset from the Hunter alluvium specified in the existing Development Consent. It is considered that there is no potential for subsidence to impact on the Hunter River itself.

New England Highway – The southern edge of the road reserve is located some 100m from the northern end of Longwall 9. Mine roadways pass directly under the highway at a depth of greater than 130m.

Vertical subsidence is expected to be less than 20mm at a distance of less than 20m from the goaf corner and horizontal subsidence movements are expected to be imperceptible beyond about 40m from the goaf corner. No impacts on the New England Highway are expected.

Powertel fibre optic cable – The Powertel fibre optic cable is approximately 170m from the corner of Longwall 9 at its closest point in an area where the overburden depth is approximately 140m, so the cable is protected by an angle of draw of greater than $45^{o.}$ It is not expected to be impacted by mining subsidence from Longwall 9.

132kV and 66kV electricity lines - Two electricity lines (one 132kV and one 66kV) supported on single poles are located along the southern side of the New England Highway. Both lines cross the highway near the intersection with Brunkers Lane. The poles are supported with multiple stays in this area. This geometry and the low level of subsidence are expected to be sufficient to provide a high level of protection to these lines.

Local area electricity line – A local area electricity line crosses Longwall 9 twice within the Macquarie Generation land. This line is supported on single pole structures. Single pole structures are typically capable of accommodating subsidence movements.

Tilts of up to 50mm/m are considered possible so horizontal movements at conductor level of up to approximately 300mm are expected at an elevation of 6m. Suspension of individual conductors in sheaves may be necessary to protect the cross-arms from becoming overloaded.

Telstra underground cable - The line is currently unused so some checking and possible remediation may be necessary if it is damaged by mining subsidence.

Bowmans Creek flow gauging station – The gauging house is expected to subside approximately 200mm. The section of channel where the weir is located will also subside by a similar amount. There will be a transient effect when mining is proceeding directly under the site.

Tilting of the weir and possible structural cracking of the concrete may occur. Remedial works may be required to bring the weir back into operation.

The radio communication link used for regional data transfer from this station is not expected to be impacted by mining subsidence.

Brunkers Lane (private road) - The tar sealed section of Brunkers Lane (private road) is expected to subside up to 1.2m above Longwall 9 (between the gate to Macquarie Generation and the gate to Ravensworth) with horizontal strains of up to 20mm/m and maximum tilts of 50mm/m across the road and 25mm/m in a direction along the road).

These levels of vertical subsidence, strains and tilts are expected to cause perceptible cracking and buckling of the pavement surface starting soon after Longwall 9 mines under the road continuing until it is approximately 100m past.

This road is used periodically. ACOL will ensure the private road is restricted upon cessation of mining and is trafficable on an “as required basis”.

Macquarie Generation access road – The alternative access to Macquarie Generation land continues from Brunkers Lane as a gravel road. Subsidence movements are expected to cause perceptible cracking and grade changes on this road. Remediation in the form of regrading and filing of cracks as required will be an effective control measure.

Macquarie Generation sedimentation ponds – The four clay lined sedimentation ponds and a fifth downstream dam located over Longwall 9 at an overburden depth of approximately 150m are expected to experience the full range of subsidence movements.

Mining subsidence movements are expected to cause temporary and permanent tensile cracking in the ponds with up to about 1.0m of differential settlement across the two western ponds and the downstream dam. The two eastern ponds are likely to experience mainly transitory subsidence and some resealing of cracks may also be necessary. SCT recommend that the dams are pumped down during the few weeks of mining under them as a precaution against cracks that may allow uncontrolled discharge and possible erosion of the dam wall.

Polyethylene water pipes – The polyethylene water pipes located in open trenches or laying on the surface are not expected to be impacted by mining subsidence.

The buried polyeythyleme pipe that crosses over Longwall 9 and back is expected to experience the full range of subsidence movements.

SCT recommended exposing the buried pipeline so that shear cannot be generated between the soil and the pipe or bypassing sections across the surface with a temporary pipe and reconnecting back to the buried pipe once it is confirmed that the buried section remains serviceable. However this measure is considered likely to be unnecessary.

Narama Dam – The Narama Dam is an earth dam located west of Miniwall 9. Subsidence movement at Narama Dam is expected to be imperceptible. SCT recommend that the existing network of survey pegs around Narama Dam is monitored at the completion of each of the approaching miniwall panels including Miniwall 9 to confirm the low levels of movement expected.

Proposed Water Storage Dam (Ravensworth Void 5 flyash dam) – The nearest toe of the proposed dam wall is approximately 260m from the nearest goaf edge of Longwall 9. The average overburden depth is approximately 160m, so the dam is protected by an angle of draw of 26.5^{O} plus 180m. No subsidence impacts would be expected with a barrier of this size.

Ashton Infrastructure - Ashton owned infrastructure located within the area is limited and comprises some fences, a farm access track and tailings pipelines.

Some temporary electric fencing may be necessary to control livestock during the period that fences are potentially impacted by mining. The fences may need to retensioned at the completion of mining.

6.2.5 Subsidence Monitoring

SCT has recommended a detailed program of subsidence monitoring associated with the mining of Longwall/Miniwall Panel No. 9 which are summarised below:

- A program of subsidence monitoring is recommended to confirm that the subsidence behaviour is developing as expected.
- A cross-line with pegs spaced at 5m centres and measured in three dimensions is recommended across the middle of Miniwall 9 as an extension of the cross-line across all the southern panels. A second line across the middle of Longwall 9 is also recommended as an extension of the cross-line across all the northern panels.
- Three dimensional monitoring of pegs is considered appropriate for monitoring over the longwall panels where the strain levels are expected to be generally higher. Peg to peg strain measurement would be appropriate above the miniwalls where low magnitude strains are anticipated. It is recommended to survey the lines for each panel once the longwall has mined at least 150m past.
- Monitoring of individual items of infrastructure is recommended on an as required basis.

6.3 Groundwater

In 2001, HLA Envirosciences was engaged to undertake a Groundwater Hydrology and Impact Assessment and is reported in the original ACP EIS. Aquaterra Pty Limited (Aquaterrra) has been engaged to review this report and to undertake an assessment of the impacts of the proposed Longwall/Miniwall Panel No. 9 on groundwater and upon the neighbouring Ravensworth underground mine. Copies of the assessments are contained in **Appendix 3A and Appendix 3B**. The Aquaterra reports provide a description of the existing hydrogeological regime, groundwater modelling and assessment of impact associated with mining the extraction area.

6.3.1 Review of Existing Studies and Data

Aquaterra conducted a review of the previous groundwater assessment following the mining of ACP Longwal Panel No's 1 and 2. The key findings reported by Aquaterra are:

- The Bowmans Creek alluvium forms a shallow aquifer unit within the Bowmans Creek floodplain that is hydraulically distinct from both the underlying Permian coal measures and the Hunter River alluvium.
- The Bowmans Creek alluvium contributes some baseflow to Bowmans Creek, although the contribution from the planned mining area is very small. Baseflow is also derived locally from the Permian.
- There is only limited hydraulic connection between the Bowmans Creek alluvium and shallow weathered Permian sediments, and virtually no connection with the Pikes Gully coal seam or the deeper seams planned for future mining. This is evidenced by distinctly different groundwater levels, differences in groundwater quality, and differing responses to recharge and mining activity.
- Despite the absence of direct hydraulic connection and the presence of an aquaclude between the Bowmans Creek alluvium and the Pikes Gully seam, there is potential for some leakage from the alluvium to the underground mine workings due to the intrinsic (albeit very low) permeability of the coal measures.
- The impact of subsidence on leakage from the Bowmans Creek alluvium will be controlled by the height of interconnected fracturing and the residual vertical permeability of the Permian above the subsidence-affected zone. Provided that a zone of unfractured rock remains between the base of the alluvium and the top of the zone of continuous interconnected fracturing, vertical leakage from the alluvium will be limited by the low vertical permeability within the unfractured barrier zone (or "aquaclude" as required by Consent Condition 3.9).
- Monitoring during mining of Longwall Panel 1 and Longwall Panel 2 has shown groundwater level impacts in the Pikes Gully Seam and in the deeper sections of the overlying coal measures. Reduced drawdowns occur at higher levels in the coal measures, but no impacts have been observed in the near-surface weathered Permian or in alluvium above the mine area. Cover depths in Longwall 1 ranged from 35m to 90m, and in Longwall 2 from 50m to 105m.
- Piezometers in the lower sections of the Pikes Gully seam overburden which initially showed drawdown response to subsidence above Longwall 1 or Longwall 2 have shown partial recovery after the initial mining impact. This suggests that some degree of self-healing of subsidence fractures is occurring.
- No drawdown impacts have been observed in the coal measures below the Pikes Gully Seam, even in the Arties Seam.

Figure 7 shows the proposed layout of Longwall/Miniwall Panel No. 9 and location of piezometres from which the baseline data was obtained.

6.3.2 Description of Hydrogeological and Surface Drainage Regimes

Within the ACP underground mine area alluvium occurs in association with the Hunter River and its tributaries of Glennies and Bowmans Creek. The Bowmans Creek alluvium indicated up to 15 metres of sandy silts, silts and silty clays with horizons of silty sands and gravels. The maximum recorded saturated thickness is 4.5m.

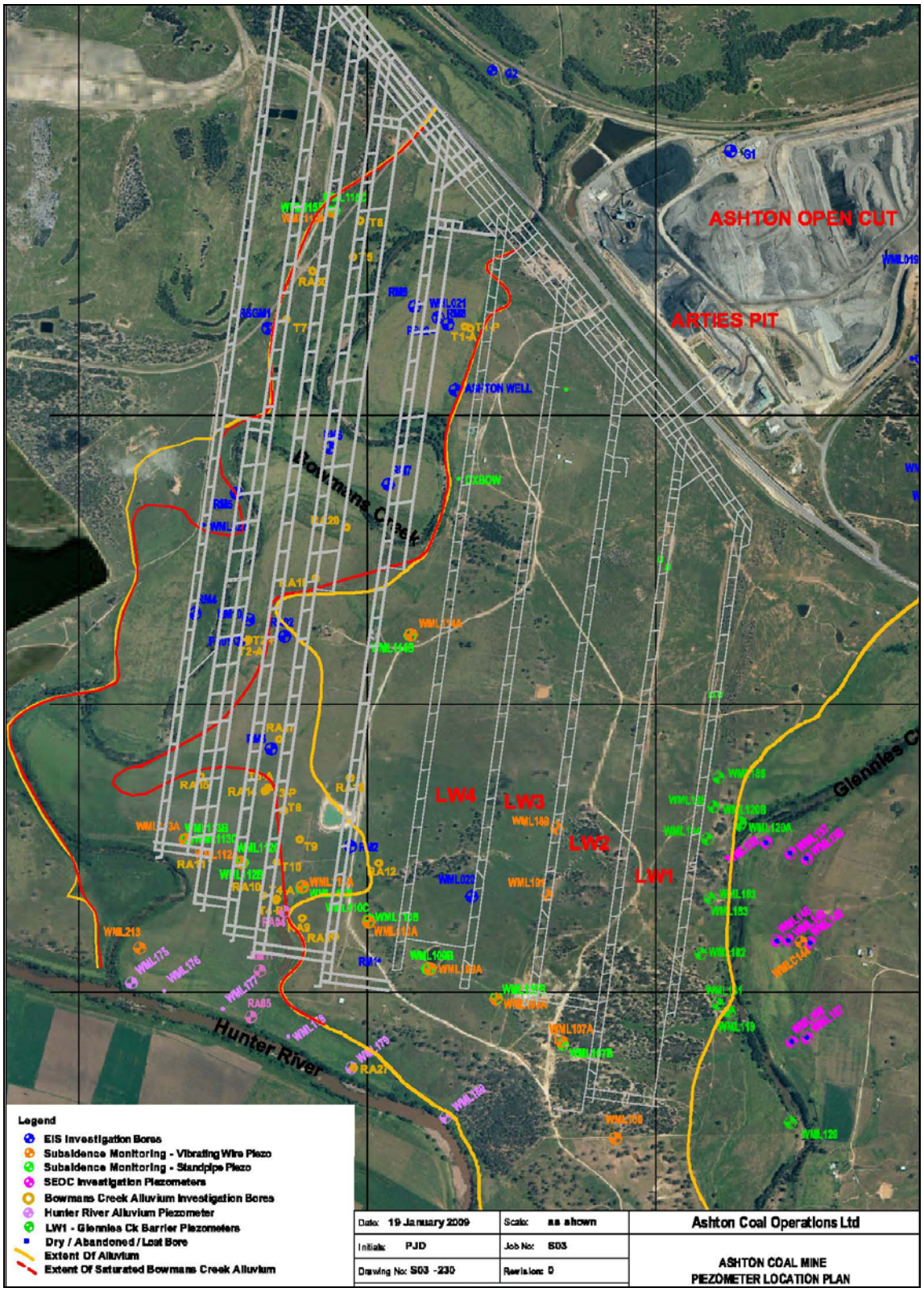

Figure 7: Longwall/Miniwall Panel No. 9 and location of piezometres.

6.3.2.1 Aquifers

Two distinct aquifer systems occur in the area which are described by Aquaterra as:

- *"A fractured rock aquifer system in the Permian coal measures, with flow occur predominantly in the coal seams;*
- *A shallow porous median regolith/alluvium aquifer system in the unconsolidated sediments of the alluvium associated with Bowmans Creek, Glennies Creek and the Hunter River, merging into colluviums and residual soils (extremely weather coal measures)".*

6.3.2.2 Hydraulic Parameters

Generally, the coal seams are more brittle and more densely fractured than the interburden strata and therefore have a relatively higher hydraulic conductivity, typically one to two orders of magnitude higher than the interburden material.

Vertical hydraulic conductivities are considered to be 2-3 or more orders of magnitude lower than the horizontal hydraulic conductivity in all units, based on the very strongly bedded nature of the strata and the role of bedding plane features in controlling groundwater flow. This applies especially to the interburden sediments which comprise interbedded siltstones, sandstones, claystones and shale, but also to the coal seams themselves (which frequently contain interbeds of siltstone/sandstone/ claystone).

6.3.2.3 Groundwater Levels

Groundwater levels in the upper part of the Permian coal measures tend to reflect the local topography, with higher groundwater levels in elevated areas and lower groundwater levels in topographic lows. However, groundwater levels at depth in the coal measures are more regionally-controlled, and are independent of the local topography.

Early monitoring data from Ashton indicates that prior to commencement of mining at Ashton, groundwater levels in the Pikes Gully seam were above the surface water levels in Bowmans Creek and Glennies Creek.

In the Bowmans Creek alluvium, groundwater levels show a gradient from north to south (ie upstream to downstream) but also converge about Bowmans Creek.

The shallow groundwater levels are generally similar to or slightly higher than in the immediately underlying weathered Permian coal measures. However, in unstressed (premining) conditions, the potentiometric surface in the deeper Permian coal measures is higher than the water table, and there is a tendency for increasing heads with depth (Aquaterra, 2008a).

6.3.2.4 Recharge

The alluvium and regolith aquifer systems are recharged by direct infiltration of rainfall and local runoff. The primary mode of recharge to the Permian coal seam aquifers is by direct infiltration where the various seams outcrop or subcrop beneath the alluvium or regolith layer. It is considered that recharge via downward leakage through overburden and interburden layers subject to head differences is a very minor or negligible component of recharge. However, where the overburden/interburden has been altered through subsidence fracturing, vertical leakage between seams is more significant.

Regional studies suggest approximately 0.5% to 1.0 % of the annual rainfall percolates to the coal measures groundwater system (HLA, 2001).

Recharge rates of 0.8% have been assigned to the Hunter River alluvium and 0.6% to the Glennies Creek and Bowmans Creek alluvium.

6.3.2.5 Discharge

Groundwater discharge from the Permian coal measures occurs through evapotranspiration and baseflow contributions to the creeks and rivers, including some discharge to the alluvium, and by groundwater abstraction/pumping.

Analysis of groundwater quality data (Aquaterra, 2008a) indicates that, while some baseflow to Bowmans Creek does occur within the ACP area, the contribution is very small and intermittent.

There is no existing groundwater abstraction from the coal measures in the study area, apart from the coal mine dewatering. ACP is currently extracting around 6 to 7 L/s of groundwater inflows from the underground operations (Longwall 1 to Longwall 3 panels and the development headings).

Alluvial groundwater is only sparingly used for stock and domestic purposes, and a small number of registered bores and wells have been identified from a search of the DWE groundwater database. No registered water supply bores are located within the Ashton mining lease area. The two nearest registered water supply bores are located in Camberwell Village (north-east of the underground mine), and on the south bank of the Hunter River, south-west of Ashton.

Alluvial groundwater in the Bowmans Creek valley discharges via evapotranspiration or baseflow discharge to Bowmans Creek, with a small component from the southern end of the valley possibly discharging directly to the Hunter River.

6.3.2.6 Surface Drainage

The ACP is located in an area of rolling hills with topography relief ranging from 60m Australian Height Datum (AHD) to 100m AHD. The area is drained by Glennies Creek and Bowmans Creek discharging to the Hunter River.

The flow in Bowmans Creek is perennial for most years but it has been known to go dry for short periods. The DWE gauging station (Foy Brook 210130) located on Bowmans Creek midway between New England Highway and the Hunter River reported a 50 percentile flow rate of 1.5 ML/d in the period 2003 to 2008, with zero flows on 4.3% of days. DWE gauging station Ravensworth 210042, located on Bowmans Creek 2km upstream from New England Highway, reported a 50 percentile flow rate of 2 ML/d from the period 1959 to 1999, with zero flows on 35% of days. Glennies Creek flows are about 100 ML/day or more for 50% of the time, with a minimum sustained flow of approximately 10 ML/day. Flows are regulated by the Glennies Creek Dam which is located upstream of the ACP.

6.3.3 Groundwater Modelling

Aquaterra undertook groundwater modelling to provide predictions of the impacts of underground mining on the local groundwater and surface water as part of the approved SMP for Longwall and Miniwall Panels 5 to 9. That report included the extraction area known as Longwall/Miniwall Panel No. 9. The current Aquaterra report contained in Appendix 3A focuses on the specific incremental impacts associated with Longwall/Miniwall Panel No. 9 within the Pikes Gully Seam.

Aquaterra used the MODFLOW numerical groundwater flow model with Version 3 of the SURFACT module to assist impact analysis.

The hydrogeological investigations (including modelling) were undertaken with reference to the DWE guideline for mining near stream/aquifer systems in the Hunter Valley (DNR, 2005), and the model was developed in accordance with the best practice guideline for groundwater flow modelling (MDBC, 2001).

The model simulations were undertaken to assess the impacts of mining the full width of the underground mine, ie Longwall 1 to Miniwall 9 and Longwall 9. For the purposes of this report, only the incremental impacts associated with the mining of Miniwall 9 and Longwall 9 are considered.

The model domain covers an area of around 132 km2 Model boundaries have been set to coincide with the locations of nearby current or former mines, including Ravensworth No. 2 pit, Ravensworth South mine, Narama mine, Lemington North open cut mine, Camberwell South pit, Camberwell North

pit, Glennies Creek Underground mine, and Ravensworth East pit, generally using specified head cells. The specific boundary conditions assumed in the model are described in detail in Aquaterra (2008c).

The hydrogeology has been represented in the model by 9 model layers, where coal seams and interburden are represented independently.

ACOL retained the services of Associate Professor Noel Merrick, a leading groundwater modelling expert, to provide an independent review of all stages of modelling and to provide input/advice to the modelling team.

In conclusion, the model prediction of mine inflows and drawdown effects discussed in Aquaterra (2008c) and in the following sections of the report can be regarded as an appropriately conservative prediction based on the available data, determined by adoption of a best practice modelling approach.

6.3.4 Ground and Surface Water Impacts

6.3.4.1 Mine Inflow Rates

The calibrated ACP Groundwater Model has been used for predictive transient modelling to assess the potential impact of progressive underground mining of the Pikes Gully seam on the groundwater and surface water resources. The modelling allowed assessment of potential changes to flow to/from surface water courses (Bowmans Creek and Hunter River), regional changes in groundwater levels during mining, and on the potential water ingress into the mine workings through vertical leakage from the overlying Bowmans Creek alluvium, during the mining of Longwall 1 to Longwall/Miniwall Panel No 9, in accordance with the proposed mine plan.

Figure 8 shows the model-predicted mine inflow rates over the calibration and prediction periods as compared to both the original Ashton EIS prediction and the measured underground mine inflow rates to date. The extraction of Miniwall 9 and Longwall 9 are scheduled for the period October 2011 to April 2012.

Aquaterra made the following observations:

- The inflow rates predicted by the model during the extraction of Miniwall 9 and Longwall 9 (1.45-1.55 ML/d) are not noticeably different from those predicted for the prior extraction of Miniwall 8 (1.43-1.53 ML/d).
- During mining of Miniwall 9 and Longwall 9, the predicted mine inflow rates are marginally below the EIS predicted inflow rates.

6.3.4.2 Creek Baseflow Impacts

Figure 21 of Appendix 3A shows the model predicted net baseflows during the mining period. Figures 22 to 24 of Appendix 3A show the predicted baseflow changes for Bowmans Creek, Glennies Creek and Hunter River respectively together with the modelled baseflow changes with the impacts predicted in the EIS, and the observed baseflow impacts for Glennies Creek to date.

Aquaterra made the following observations:

- Baseflow reductions in Glennies Creek and Hunter River during extraction of Miniwall 9 and Longwall 9 as predicted by the model are not noticeably different from those predicted during prior mining of Miniwall 8;
- Slightly greater baseflow reduction is predicted for Bowmans Creek during the mining of Miniwall 9 and Longwall 9 (1.1-1.2 L/s) compared with the prediction for the prior extraction of Miniwall 8 (0.7-1.1 L/s); and
- This baseflow reduction is substantially smaller than the EIS prediction of 4.3 L/s (0.37 ML/d) during longwall extraction of the westernmost panel in Pikes Gully Seam.

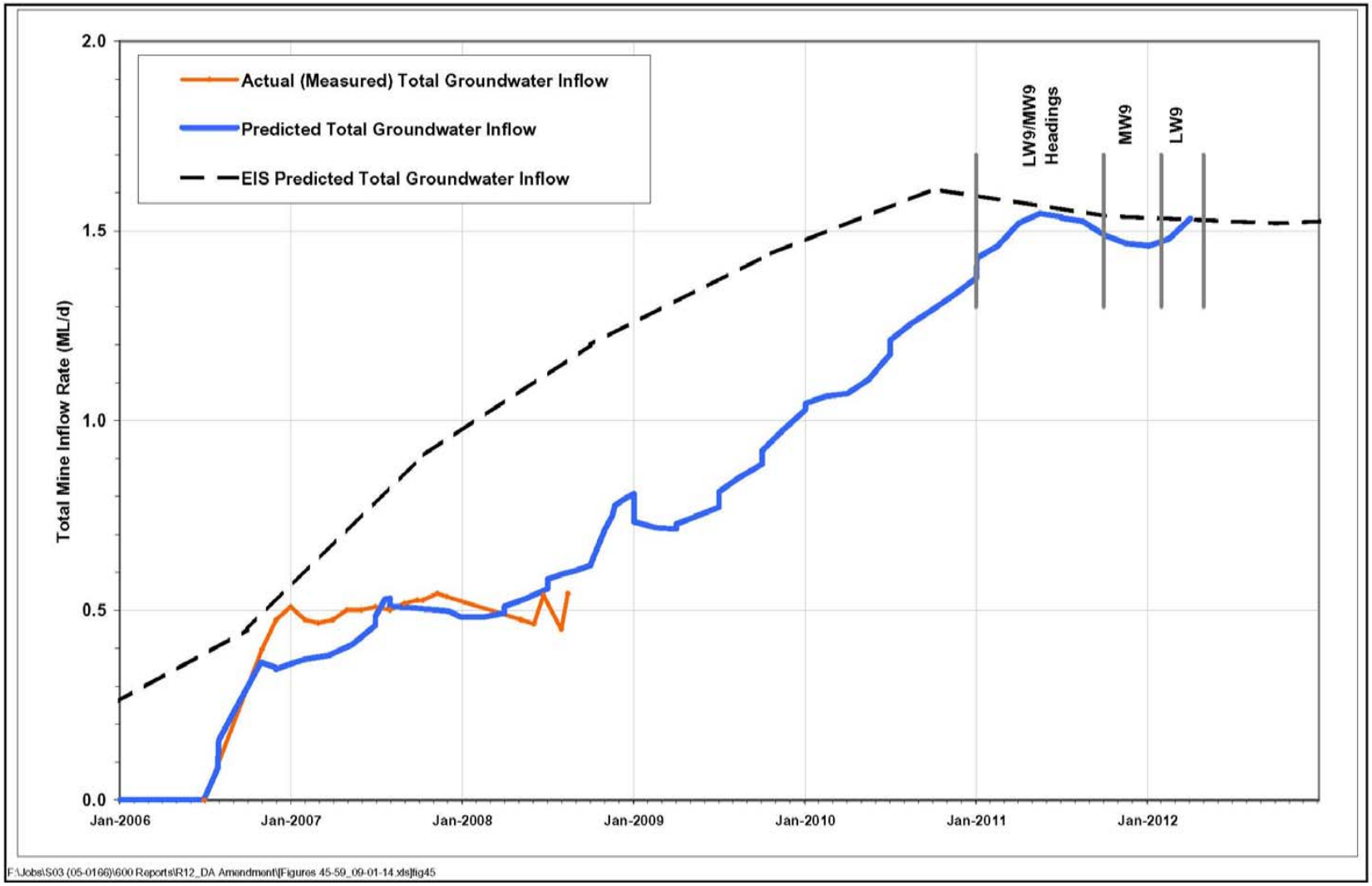

Figure 8: Model-predicted mine inflow rates

Wells Environmental Services

6.3.4.3 Groundwater Level Impacts

The modelled versus observed hydrographs over the prediction period are shown in Figures 25 to 33 in Appendix 3A. The hydrographs show the following:

- Substantial water level declines are predicted in the Pikes Gully Seam (model Layer 8), with the greatest declines at piezometers from the western parts of the mine area (WML213, WML115-144m and WML21), consistent with the dip to the south-west. By the time mining commences in Miniwall 9 and Longwall 9, the Pikes Gully Seam will have already been substantially dewatered across the underground mine area (see Figures 25 to 27 of Appendix 3A).
- Water levels are also predicted to have already declined significantly in model Layers 6 and 7, with no further significant decline during mining of Miniwall 9 and LW9 (Figure 28 of Appendix 3A).
- It is predicted that Layers 4 and 5 will be substantially dewatered within the longwall footprint, but only partially depressurized outside the mine footprint. No additional drawdown in the overburden layers is predicted to occur during the mining of Miniwall 9 and Longwall 9.
- Variable water level changes are predicted for Layers 2 and 3 (upper parts of the coal measures overburden). Responses will be greatest at sites above the full width (216m) panels, where the effects of subsidence fracturing are assumed in the model to extend up to Layer 3, with some resulting drawdown impact to occur in the overlying Layer 2 in such areas. Minimal drawdown response is predicted to occur in Layers 2 and 3 above the restricted width panels Miniwall 9 and Longwall 9 (93m and 141m respectively).
- Drawdowns are predicted to be limited in Layer 1 where it represents the Bowmans Creek alluvium. In the central and western parts of the floodplain, including the areas above Miniwall 9 and Longwall 9, drawdowns of less that 0.1m are predicted.
- Drawdown in the Hunter River alluvium which is 400m south of the inbye end of Miniwall 9 is predicted to be less than 0.1 m.

6.3.4.4 Bowmans Creek Alluvium and Aquifer Storage

One of the main objectives of the Longwall/Miniwall 5 to 9 impact assessment modelling (Aquaterra, 2008) was to determine the potential impact of the proposed mining on groundwater storage within the Bowmans Creek alluvium.

The change in saturated volume in the Bowmans Creek alluvium during mining approved by the SMP was calculated to be approximately 0.7m^3, or less than 12 % of the total pre-mining storage. Most of the reduction in saturated volume was predicted to occur on the eastern side of the Bowmans Creek floodplain. The predicted incremental reduction in alluvium saturation during the mining of Miniwall 9 and Longwall 9 was minimal.

Based on groundwater modeling Aquaterra conclude that:

- Groundwater inflow rates during mining of Miniwall 9 and Longwall 9 (1.45-1.55 ML/d) are not noticeably different from those predicted for the prior extraction of Miniwall 8 (1.43-1.53 ML/d). The predicted inflow rates are lower than those predicted in the original ACP EIS for the same stage of underground mining;
- Slightly greater baseflow reduction for Bowmans Creek during the mining of Miniwall 9 and LW9 (1.1-1.2 L/s) compared with the prediction for the prior extraction of Miniwall8 (0.7-1.1 L/s). This baseflow reduction is substantially smaller than the original ACP EIS prediction of 4.3 L/s (0.37 ML/d) for the same stage of underground mining; and
- Negligible additional groundwater level drawdowns during mining of Miniwall 9 and Longwall 9 compared with the prior mining of Miniwall 8. The Pikes Gully Seam is predicted to have been already substantially dewatered across the mine area prior to the commencement of extraction from Miniwall 9 and Longwall 9.

6.3.4.5 Impacts on Alluvium and Surface Water Quality

Because the extension has a minimal incremental reduction in Permian water levels, any slight impacts on surface water or alluvial water quality will tend to be positive, as flows from the more

saline Permian to the alluvium will tend to reduce. This will be the case both during operations and post mining, when the additional mining will result in slower rebound within the Permian.

6.3.4.6 Ravensworth Underground Mine Impacts

Aquaterra (Appendix 3B) considered the potential groundwater impacts of mining Longwall/Miniwall Panel No. 9 upon the neighbouring Ravensworth underground mine. The conclusions reached by Aquaterra following additional modelling of groundwater conditions in the area of mining by the Ravensworth underground mine was that both mines would be concurrently collecting water inflows, creating a mutual interference effect on each other and reducing the rate of inflow to each mine.

6.4 Surface Water

Bowmans and Glennies Creeks flow through the ACP area and are tributaries of the Hunter River. Glennies Creek meanders round the village of Camberwell, prior to its confluence with the Hunter River to the south. Bowmans Creek flows from the north west and underneath the New England Highway, then meanders south along the western boundary of the project area, prior to its confluence with the Hunter River.

6.4.1 Existing Surface Water

6.4.1.1 Bowmans Creek

The Bowmans Creek catchment area is approximately 265 square kilometres (km^2) and the head of the catchment is located in the Mount Royal Range to the north. From its headwaters, the creek meanders in a mostly southerly direction until it reaches its junction with the Hunter River immediately south-west of the ACP area.

The reach of Bowmans Creek between the New England Highway and its junction with the Hunter River is approximately 6km long. Approximately 5 kilometres of this reach is located within the ACP area. The floodplain associated with Bowmans Creek ranges in width from approximately 700 metres near the New England Highway to 1300 metres near the Hunter River. Floodplain elevations range from approximately 67m Australian Height Datum (AHD) to 61m AHD at these locations respectively.

Stream Flows

A stream gauging station is located on Bowmans Creek (Department of Water and Energy Station "Foy Brook", Station No. 210130). This station has been operating since 1993. Provisional stream gauging data for this station was obtained from the Department of Water and Energy website 'NSW Water Information'.

Review of the provisional data revealed some limitations for use in the estimation of hydrologic indices. These include:

- Relatively short timeframe over which data has been gathered;
- Only two significant flood events have been recorded in this period (August 1998 and June 2007) and recorded levels were likely to be strongly influenced by backwater flooding from the Hunter River (therefore overestimating discharge);
- Drought conditions - region was dominated by low rainfall conditions for a large percentage of the available data set; and
- Incomplete data set.

A flow duration curve was prepared based on the provisional data, noting that the above limitations have implications for the accuracy and error margins of the analysis. Due to these limitations the estimates for low flow indices (95^{th} percentile, 90^{th} percentile etc) are likely to be substantially lower than if a longer, more representative data set was available.

Based on this curve and the data set, the following characteristics of stream flow for Bowmans Creek can be inferred:

- Median flow (Q_{50}) of approximately 2.5 ML/day;
- Low flow – 95th Percentile (Q_{95}) of approximately 0.32 ML/day; and
- Longest recorded period of consecutive zero-flow days occurred in April-May 2007 (40 days).

Curve of the flow duration curve below the median flow (Q_{50}) represents low flow conditions. The flow duration curve below Q_{50} has a low slope and therefore suggests continuous discharge to the stream. The ratio of discharge which is equalled or exceeded 90% of the time (Q_{90}) and the median flow Q_{50} is commonly used to estimate the baseflow contribution. This ratio (Q_{90}/Q_{50}) for Bowmans Creek was estimated to be approximately 28%. However, this is likely to be a substantial overestimate due to the sustained drought conditions experienced during much of the stream gauging data period.

Due to the limitations discussed above, these indicators are a worst case and not truly representative of long-term hydrological conditions for Bowmans Creek. However, the data supports the conclusions that Bowmans Creek is:

- A perennial stream which ceases to flow only on a relatively infrequent basis; and
- Has some baseflow contribution from groundwater sources but that this contribution may cease during drought conditions.

The conclusion that baseflow provides a constant but relatively low contribution to surface flows in Bowmans Creek is further supported by the surface and ground water quality monitoring data (particularly salinity) discussed.

Water Quality

Water quality data for the original Ashton EIS was collected for Bowmans Creek, Glennies Creek and the Hunter River by HLA Envirosciences from July 1999. At the time of preparing the EIS, monitoring data indicated that the pH of the waters was generally alkaline (a pH above 7). The pH range for Bowmans Creek was 7.6 to 8.1, Glennies Creek was 7.1 to 8.1 and the Hunter River was 7.9 to 8.6.

Electrical conductivity (EC) is a measure of the total ions (dissolved salts) in the water. The EC range for Bowmans Creek was 250 to 2330, Glennies Creek was 242 to 712 and the Hunter River was 343 to 913.

Total Suspended Solids (TSS) is a measure of the total suspended load within an aqueous solution. The TSS range for Bowmans Creek was 2 to 438, Glennies Creek was 2 to 110 and the Hunter River was 3 to 158.

Total Dissolved Solids (TDS) is a measure of the concentration of dissolved solids within an aqueous solution. The TDS range for Bowmans Creek was 262 to 1750, Glennies Creek was 149 to 460 and the Hunter River was 340 to 556.

Since the grant of the Development Consent for the ACP, ACOL has been monitoring surface water quality in Bowmans Creek since at least 2004. The location of monitoring sites is shown in Water quality monitoring sites are located on both Bettys Creek and Bowmans Creek upstream of the New England Highway (SM1, SM2, SM3 and SM4A). Another three sites are located along Bowmans Creek between the highway bridge and the confluence with the Hunter River (SM4, SM5 and SM6). SM9 and SM10 are located on the Hunter River, upstream and downstream of the Bowmans Creek confluence respectively.

Marine Pollution Research (MPR) (2008) presents summary statistics for surface water quality at these monitoring locations for the period September 2004 to March 2008. This report is attached as **Appendix 4**.

The values presented by MPR (2008) are reproduced below in **Table 6.3** below and compared with upper and lower trigger values developed for the monitoring program based on the *Australian and*

New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000) for slightly to moderately disturbed ecosystems.

Table 6.3: Water quality summary statistics.

Site	SM1	SM2	SM3	SM4A	SM4	SM5	SM6	SM9	SM10
Alkalinity (mg/L CaCO3)									
Lower Trigger Level (20th percentile band)				360					
Upper Trigger Level (80th percentile band)				580					
N	3	3	38	12	42	42	42	42	42
Min	39	71	102	106	97	105	107	131	112
Max	283	303	383	344	1590	363	371	358	356
Mean	147	159	301	251	683	291	241	218	221
SE of Mean	72	72	10	22	64	8	10	8	9
Total Suspended Solids (TSS mg/L)									
Lower Trigger Level (20th percentile band)				-					
Upper Trigger Level (80th percentile band)				-					
N	3	3	38	12	42	42	42	42	42
Min	8	18	2	2	2	2	2	1	2
Max	504	98	160	103	278	31	36	204	160
Mean	175	48	23	24	49	11	15	26	26
SE of Mean	165	25	5	9	8	1	1	5	4
Acidity (pH)									
Lower Trigger Level (20th percentile band)				7.8					
Upper Trigger Level (80th percentile band)				8.0					
N	3	3	39	13	43	43	43	42	42
Min	7.2	6.6	6.9	7.5	7.4	6.9	6.9	7.8	7.9
Max	7.9	7.6	7.9	7.9	9.1	8.1	8.3	8.5	8.5
Mean	7.6	7.1	7.5	7.7	8.0	7.7	8.0	8.1	8.2
SE of Mean	0.20	0.29	0.04	0.04	0.06	0.03	0.04	0.02	0.02
Conductivity (µS/cm)									
Lower Trigger Level (20th percentile band)				2500					
Upper Trigger Level (80th percentile band)				3350					
N	3	4	39	12	43	43	42	42	42
Min	277	574	421	434	428	432	453	304	319
Max	1800	1950	1750	1980	14400	2040	1850	1270	1290
Mean	951	1032	1375	1263	4574	1486	1001	740	767
SE of Mean	448	313	46	139	590	48	53	32	33
Total Dissolved Solids (TDS mg/L)									
Lower Trigger Level (20th percentile band)				1380					
Upper Trigger Level (80th percentile band)				1950					
N	3	3	38	12	42	42	42	42	42
Min	578	586	294	300	286	296	308	236	255
Max	1190	1120	976	1130	8820	1160	1080	658	672
Mean	919	791	818	734	2833	870	539	385	401
SE of Mean	180	166	25	76	364	27	31	18	18

Based on above conductivity and TDS values (mean) presented above, water within Bowmans Creek is suitable for livestock (ANZECC 2000) and irrigation use of moderately sensitive crops (ANZECC 2000) with the occasional exception of conductivity at SM4. Water quality across most sites (with the exception of SM4) is generally consistent with the objectives for the protection of aquatic ecosystems.

Channel Morphology and Stability

The channel of Bowmans Creek is generally incised below the surrounding alluvial flats. The depth of channel incision generally increases as the stream progresses downstream. The sinuosity characteristics of the creek are typical of a meandering stream and the channel location has been relatively stable over the at least the past twenty years (Environmental Resources Management (ERM), 2006). The pool-riffle sequence along this length of stream is formed by gravel shoals and in-channel point bars. The bed of the channel is typically lined by cobbles of varying size with occasional outcrops of bedrock. Bowmans Creek is generally perennial, however ceased to flow during the recent drought and retained water in only the larger pools.

A pre-mining survey and geomorphology assessment was undertaken of Bowmans Creek in 2006 (ERM, 2006c) in accordance with the Development Consent. During 2007, heavy rains and flooding resulted in some changes to the creek banks and pool-riffle sequence. Therefore, ACOL engaged consultants to resurvey Bowmans Creek and prepare an updated pre-mining baseline assessment.

Drainage Lines and Gullies

Ephemeral drainage lines and gullies within the ACP area are relatively small and minor. The majority of these small tributaries contribute directly to Bowmans Creek and catchment extent is limited to both the east and west.

6.4.1.2 Hunter River

The Hunter River lies outside the ACP area to the south. The underground workings are approximately 260 metres from the Hunter River and 200m from Hunter River alluvium.

In this area, the Hunter River channel is deeply incised within the floodplain and reflects various anthropogenic influences (i.e. clearing, grazing and irrigation) with respect to its general overall physical and water quality characteristics.

6.4.2 Potential Surface Water Impacts

6.4.2.1 Bowmans Creek

Bowmans Creek is expected to experience maximum vertical subsidence of up to 200mm where it crosses Miniwall Panel No. 9. Sections of the stream that will be subject to this maximum level of subsidence are expected to only be 5 to 10 m in length (i.e. through the centre of the sag subsidence trough) with subsidence decreasing to only 150mm over the chain pillars.

Stream Flows

Small groundwater losses are predicted by Aquaterra (2008) to occur from the Bowmans Creek alluvium to the Permian coal measures as a result of depressurisation of the coal seam during longwall mining associated with both the ACP and Ravensworth underground mines. The loss from the alluvium is predicted to be no greater than 1L/s (equivalent to 0.0864ML/day).

Analysis of stream flow data noted that Bowmans Creek stream flow has the following statistics/characteristics:

- Median flow (Q_{50}) of approximately 2.5 ML/day; and
- Low flow (95^{th} Percentile or Q_{95}) of approximately 0.32 ML/day.

Therefore, were the 1L/s seepage from the Bowmans Creek alluvium to translate to a 1L/s loss from Bowmans Creek surface flow, seepage from the alluvium would equate to a potential 4% and 27%

reduction in surface flows for Q_{50} and Q_{90} respectively. These percentage losses are conservative in that:

- Predicted groundwater losses are considered to be conservative as they are based on worst case parameters for the proposed mine plan and include substantial contingency;
- Not all of the existing baseflow is likely to be sourced from the alluvium, some areas of Bowmans Creek appear to be hydraulically linked with coal seams which sub crop beneath the stream bed;
- Seepage from the alluvium will not necessarily translate to an equivalent loss in surface flow; and
- Estimates for Q_{50} and Q_{95} are strongly influenced by severe drought conditions. In particular, the long-term Q_{95} is likely to be greater than 0.32ML/day.

Therefore the actual percentage loss of environmental flows due to mining impacts will be actually somewhat less than 27% and this percentage loss presents a predicted upper limit. It is estimated that under average rainfall and stream flow conditions, loss of surface flows as a result of mining will be negligible, and flows would still exceed those observed during the bulk of the recent drought in the region.

If severe drought conditions are experienced again during the period of mining or prior to post-mining groundwater recovery, low flows may be reduced by a maximum of 27%. This would result in slightly longer periods of zero flow and the stream pools would become disconnected slightly more frequently. Pool persistence and duration under these conditions would depend on individual factors such as surface area to volume ratio of each pool, aspect, vegetative cover, and localised interactions with the saturated alluvium and Permian measures.

Water Quality

Because the extension has a minimal incremental reduction in Permian water levels, any slight impacts on surface water or alluvial water quality will tend to be positive, as flows from the more saline Permian to the alluvium will tend to reduce. This will be the case both during operations, and post mining, when the additional mining will result in slower rebound within the Permian.

Erosion of the land surface as a result of subsidence cracking, if not remediated, could contribute to suspended sediment and turbidity of surface waters. Monitoring and remediation of erosion and cracking is implemented across the ACP site in accordance with the Erosion and Sediment Control Plan and Land Management Plan. The risk of this impact is therefore considered relatively low.

There are mine water and tailings pipelines that lie within the catchment extents of Bowmans Creek. Strate Control Technology (SCT) (2008) note that there is potential for these pipes to become overstressed and break or leak. These pipelines are used for mine water, tailings and extraction from the Hunter River. However, the ability of any breaks or leaks in these pipes to cause water quality pollution in Bowmans Creek or the Hunter River is limited. The tailings line is contained within an earth bund, and the mine water return line is fitted with pressure-loss activated cut off switches on the pumps.

Channel Morphology and Stability

Strains of less than 3-4m/mm are expected in the floor of the creek channel, and local tilting of the surface may cause the stream to move sideways in the creek bed (i.e. scour banks or existing in-channel point bars). This low degree of subsidence may result in:

- Minor changes to creek channel morphology, including redistribution of alluvial material within the existing pool and riffle sequences;
- Low probability of any major channel changes to channel cross-section or location; and
- Potential for increased bank loosening and instability of existing steep erosion banks.

These changes also have potential implications for aquatic ecosystems.

Drainage Lines and Gullies

The drainage lines within the ACP area drain to Bowmans Creek and may experiences changes of

grade along their length as they travel through subsidence troughs/chain pillars. This may result in the initiation of erosion knick points or minor ponding. These impacts are not considered to have a high likelihood of occurring given the relatively low levels of subsidence across most of the ACP area and limited length / catchment area for the affected subcatchments.

6.4.2.2 Hunter River

The Hunter River is located approximately 500 m to the south and there is no potential for subsidence movements to occur at this location.

Therefore, potential impacts to the Hunter River are largely indirect and would occur as a result to water quality or flow impacts to Bowmans Creek. Any water quality impacts such as increases or decreases in salinity, stream flow, increased sediment transport or turbidity in Bowmans Creek would discharge to the Hunter River.

Subsidence-initiated erosion and overland flow to the Hunter River would also contribute to turbidity and suspended sediment transport in the river. There are currently no mine water pipelines or tailings lines that could contribute to unplanned discharge directly to the Hunter River if pipelines were broken by subsidence movements.

6.4.3 Surface Water Impact Mitigation and Management

The main recommended mitigation measure is that of miniwall mining used for that area which lies beneath Bowmans Creek as subsidence impacts can be minimised to an acceptable level whereby there are no significant impacts on the aquatic ecology, water availability or water quality of Bowmans Creek.

The primary mitigation measures initiated by ACOL include riparian rehabilitation works and stabilisation of Bowmans Creek and. In addition ACOL will continue to implement the approved River Red Gum management plan and exclude cattle from the creek line in close proximity to this vegetation community.

ACOL propose to amend the aquatic ecology monitoring regime for Bowmans Creek to incorporate the development of Longwall/Miniwall Panel No. 9 in consultation with regulatory agencies. The results of the modified monitoring regime are to be made available through the mines' environmental systems.

6.5 Site Water Balance

ACOL engaged Worley Parsons to prepare a site water balance for the ACP. **Table 6.4** below shows the ACP site water balance.

The development of proposed Longwall/Miniwall No. 9 and increase in the annual production of 0.25 mtpa of ROM coal from the underground mine will have minimal impacts upon the water balance.

Table 6.4: ACP Water Balance

Water Demands/Sources	Average Annual Flow (ML)	Average Daily Flow (ML/day)
Water Demands		
CPP (net Demand)	1123	3.1
Dust Suppression	474	1.3
Evaporation Loss	71	0.2
Total Demand	1668	4.6
Water Sources		

Water Demands/Sources	Average Annual Flow (ML)	Average Daily Flow (ML/day)
Flow from underground mine (Net)	147	0.4
Flow from Glennies Creek mine	438	1.2
Glennies Creek Extraction	224	0.6
Hunter River Extraction	267	0.7
Pump out from Barrett pit	224	0.6
Surface Runoff (Estimate)	402	1.1
Total Source	1702	4.6
Balance*	34	0.0

*Difference between storage levels at the first and last model time step. (Source Worley Parsons, 2009)

6.6 Flooding

The proposed panels and associated first workings lie beneath the floodplain of Bowmans Creek. Based on flood modelling by Patterson Britton (2001) overbank flood flows occur in even relatively small, frequent flood events. Mapping of the 1 in 5, 20 and 100 year Average Recurrence Interval (ARI) floods indicate that large areas of the floodplain is inundated in the 1 in 5 year floods. The majority of the floodplain is affected by the 1 in 20 year ARI flood within only a minor increase in extent associated within the 1 in 100 year ARI flood despite the increase in depth (due to topographical constraints.

Patterson Britton (2001) reported that during 1955, flood levels within the Hunter River are estimated to have reached approximately 64.2m AHD in the vicinity of the ACP area. This flood is generally considered to be equivalent to a 1 in 100 year ARI design flood. During this event, backwater flooding and catchment flows are predicted to have resulted in a flood level of 67.8m AHD at the New England Highway Bridge over Bowmans Creek.

6.6.1 Potential Flooding Impacts

Subsidence of the Bowmans Creek overbank areas is likely to increase flood depths in these areas during major flow events, particularly backwater flooding of the Hunter River. However, this moderate increase (no greater than the experienced subsidence) is unlikely to significantly increase the risk of flooding to surface infrastructure or the life/property of landowners and residents.

Aquaterra (Appendix 3B) have reported the potential for flooding of the Ashton workings during a protracted 100 year flood as “low”.

The design of the LW/MW 5-9 panels beneath the Bowmans Creek floodplain has been developed to prevent direct hydraulic connection between Bowmans Creek and/or the alluvium to the mine. Hence the potential for floodwaters to drain into the mine beneath the floodplain alluvium is low.

6.7 Ecology

6.7.1 Existing Ecology

A flora and fauna assessment for the extraction area was conducted by ERM (2009) and is included in **Appendix 5**. This report includes a description of existing site flora and fauna, known and potential threatened and protected species and potential impacts as a result of the proposed mining activities. Information from the ERM (2009) report is summarised below.

6.7.1.1 Natural Vegetation

The ACP area has been previously cleared for agricultural uses, including grazing and some improved pasture. Large areas of the site are therefore currently open grasslands and natural vegetation is limited to a narrow riparian corridor along the banks of Bowmans Creek. This vegetation corridor is not continuous and in some parts consists only of a single row of trees/shrubs on the creek bank with grasses/sedges within the creek channel. This corridor consists of up to three vegetation communities, being:

- Hunter Valley River Oak (*Casuarina cunninghamia)* Forest;
- River Red Gum (*Eucalyptus camaldulensis*) Woodland (located ouside the lease area); and
- Grassland.

Scattered trees recorded within the pasture areas include *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melliodora* (Yellow Box)*, and Eucalyptus mollucana* (Grey Box). Some exotic weed species occur and these are identified and managed under the ACOL Weed Management Plan.

Improved pasture occurs on the alluvial floodplain areas and various exotic herbaceous species typically used for pasture improvement are present, such as Rye Grass, Rhodes Grass, Paspalum, Lucerne, White Clover and Kikuyu.

River Oak Forest

Riparian vegetation is dominated by an over storey of River Oak (*Casuarina cunninghamia*) with a sparse to absent midstorey and moderate groundcover. Isolated occurrences of Pepper Tree (*Schinus areira*), Rough-barked Apple (*Angophora floribunda*), White Poplar (*Populus alba*) and Weeping Willow (*Salix babylonica*) have been recorded through this community.

ERM (2009) noted the following species in the shrub and groundcover layers:

- Shrub layer:
  - Scattered thickets of African Boxthorn (*Lycium ferrosum*); and
  - Occasional stand of Bamboo (*Arundo donax*).
- Groundcover:
  - Purpletop (*Verbena bonariensis*);
  - Common couch (*Cynodon dactylon*);
  - Narrow-leaved Cotton Bush (*Gomphocarpus fructicosus*); and
  - Cobblers Pegs (*Bidens pilosa*).

River Red Gum Woodland

This community lies outside and to the west of Longwall/Miniwall Panel No. 9 project area on the banks of Bowmans Creek as shown on **Figure 9.**

The canopy of this community is dominated by River Red Gum (*Eucalyptus camaldulensis*) with isolated occurrences of Narrow-leaved Ironbark (*E.crebra*) and Grey Box (*E.moluccana*) occurring into adjacent paddocks. Weeping Willow has been noted where this community transitions with the River Oak Woodland. River Red Gum forests provide habitat for fish and waterbirds. They possess deep sinker roots that grow down towards zones of higher water supply (CSIRO 2004).

The CSIRO (2004) notes that *E.camaldulensis* prefers deep moist subsoils and commonly grows on riverine sites and is most extensive on heavy clay soils along river banks and floodplains subject to frequent or periodic flooding. *E.camaldulensis* has a moderate salinity tolerance and obtains its water from three main sources: groundwater, rainfall, and river flooding and its high water use contributes to maintaining water tables at depth.

In lower lying areas, sedges and rushes dominated the groundcover (including *Juncus usitatus, Schoenus apogon,* and *Typha orientalis.*

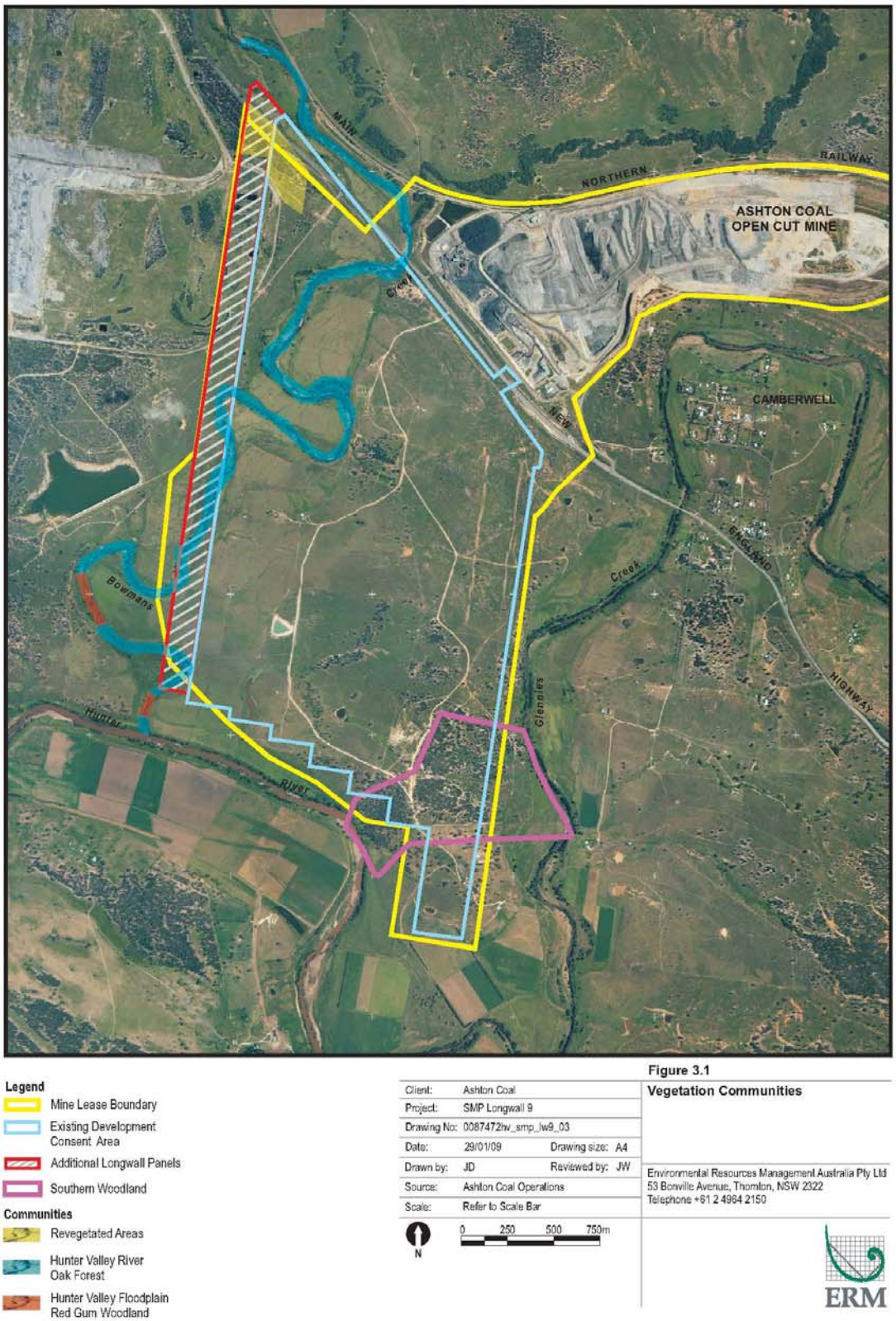

Figure 9: Native vegetation communities.

6.7.1.2 Aquatic Ecosystem

Aquatic ecosystem health of Bowmans Creek and Glennies Creek adjacent to the ACP has been subject to baseline assessments and pre-mining monitoring since 2001. A qualitative assessment for the preparation of the original ACP EIS (MPR, 2001) concluded that Bowmans Creek provides significant aquatic habitat and should be considered as a Class 1 stream under the Department of Primary Industries - Fisheries' classification scheme, which is defined as:

"Large, named, permanently flossing stream, creek or river. Threatened species habitat or area of declared "critical habitat" under the Threatened species provisions of the Act. Marine or freshwater aquatic vegetation is present. Known fish habitat and/or fish observed inhabiting the area. (NSW Fisheries 1999)".

In accordance with DA 309-11-2001, monitoring of Bowmans Creek is carried out biannually in spring and autumn and includes:

- Water quality sampling;
- Macroinvertebrate sampling;
- Fish sampling; and
- Riparian vegetation surveys.

Bowmans Creek shows various signs of anthropogenic disturbance including weed invasion, erosion, low dissolved oxygen, high salinity, low fish diversity and a macroinvertebrate community dominated by pollution tolerant species. The aquatic ecology monitoring of Bowmans Creek has adopted the Australian River Assessment System (AusRivAS) as developed by the Federal Government's National River Health Program in 1994. AusRivAS can be used to assess the biological health of rivers.

SIGNAL (Stream Invertebrate Grade Number Average Level) is a pollution tolerance index for stream macroinvertebrates and is a simple scoring system for quantifying the ecological health of streams. It is based on average sensitivity to disturbance of the aquatic macroinvertbrates present within a sample. Higher scores generally indicate healthier aquatic conditions as follows:

- SIGNAL Index > 6 = Healthy Unimpaired
- SIGNAL Index 5 – 6 = Mildly Impaired
- SIGNAL Index 4 – 5 = Moderately Impaired
- SIGNAL Index < 4 = Severely Impaired

Summary results of the macroinvertebrate surveys and SIGNAL scores are provided in **Table 6.5** for Bowmans Creek.

Table 6.5: Summary of aquatic sampling results, Bowmans Creek 2001 to 2008

Sampling Period	Total No.Taxa	SIGNAL Index Range	Native Fish Species	Introduced/Pest Fish Species
Sprint 2001 (MPR)[1, 5]	8	3.00 - 4.80.	-	Plague Minnow. Carp.
Spring 2005 (TEL)[2]	44	3.00 - 4.22.	Flathead Gudgeon (4). Longfinned Eel (22).	Plague Minnow (1000's). Carp (3).
Autumn 2006 (TEL)[3]	38	3.22 - 4.47.	Australian Smelt (77). Flathead Gudgeon (4). Empire Gudgeon (1). Striped Gudgeon (9). Bully Mullet (4). Australian Bass (2). Freshwater Catfish (4).	Plague Minnow (135). Carp (11).
Autumn 2007 (MPR)[4]	25	3.00 - 4.00.	Cox's Gudgeon (1). Gudgeon sp. (1).	Plague Minnow (2).

Sampling Period	Total No.Taxa	SIGNAL Index Range	Native Fish Species	Introduced/Pest Fish Species
Autumn 2008 (MPR)[5]	32	4.97 - 5.19.	Short-finned Eel. Long-finned Eel. Darling Hardyhead. Striped Gudgeon. Cox's Gudgeon. Empire Gudgeon. Flathead Gudgeon. Dwarf Flathead Gudgeon. Sea Mullet. Australian Bass. Freshwater Catfish. Australian Smelt.	Plague Minnow Carp.

References: 1 – MPR 2001; 2 – TEL 2006a; 3 – TEL 2006b; 4 – MPR 2007; and 5 – MPR 2008

As shown in Table 6.5, pre-mining monitoring of Bowmans Creek indicates that it currently ranges from a severely to moderately impaired ecosystem depending on the prevailing season and flow regime (Autumn 2007 was conducted in late June due to flood conditions). The SIGNAL Index scores for Bowmans Creek are within a similar range (if slightly lower) as concurrent monitoring undertaken for Glennies Creek and Rouchel Brook. These scores ranged from 3.47 to 4.71 also indicating that nearby aquatic systems are in a similar state of health.

6.7.1.3 Groundwater Dependant Ecosystems

Both the flora and fauna report (ERM) 2009 and aquatic ecology report (MPR) 2009 considered the occurrence of groundwater dependant ecosystems (GDE's) in the area associated with the proposed Longwall/Miniwall Panel No. 9. Potential GDE's were identified using the eight step rapid assessment (DLWC 2002) and it was concluded that there are no known or likely wetland, terrestrial or aquifer/cave GDE's in the study area. The assessment of riparian vegetation did not indicate any specific riparian plant communities which could be considered groundwater dependant.

6.7.1.4 Threatened Flora

No threatened fauna species have been previously recorded during the various ecological surveys of the ACP.

The Department of Environment and Climate Change database search by ERM (2008) identified one threatened flora species, *Digitaria porrecta* (Finger Panic Grass) within 10km of the Application Area. Habitat for three threatened flora species has been recorded in the DEWHA database within 10km of the Application area. These include *Diuris tricolor* (Pine Donkey Orchid), *Eucalyptus glaucina* (Slaty Red Gum) and *Thesium australe* (Austral Toadflax).

6.7.1.5 Threatened Fauna

Seven threatened fauna species have been identified as likely to occur with the site or its immediate surrounds including:

- Speckled Warbler (Pyrrholaemus sagittatus);
- Grey-crowned Babbler (Pomatostomus temporalis);
- Hooded Robin (Melanodryas cucullata cucullata);
- Grey-headed Flying Fox (Pteropus poliocephalus);
- Eastern Freetail-bat (Mormopterus norfolkensis);
- Eastern Bent-wing Bat (Miniopterus schreibersii oceansis); and
- Large-footed Myotis (Myotis adversus).

The above species have been recorded from surveys undertaken in Autumn 2005, Summer 2006, Autumn 2006, Spring 2006, Autumn 2007, Spring 2007 and Spring 2008.

6.7.1.6 Endangered Populations and Ecological Communities

A small area of River Red Gum Open Woodland occurs on Bowmans Creek outside the Application area. The River Red Gum population within the Hunter Valley is listed as an endangered population under the NSW *Threatened Species Conservation Act 1994*. The NSW Scientific Committee has also made a preliminary determination to list the 'Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Bioregions' as an Endangered Ecological Community.

The Hunter Valley is the only coastal catchment in which River Red Gum occurs in NSW and its distribution has been significantly reduced by changing land use and hydrological impacts to its habitat. There are currently only 19 known stands occupying approximately 100ha within the Hunter Valley, most of which is within private land and therefore not formally conserved (DECC, 2005).

The regeneration/reproduction of the species in the Hunter Valley are threatened by weed incursion, changing environmental flows and changed fire regime and grazing/cropping. Dieback has been associated with various causes including altered hydrologic regime (changes to the incidence and depth of flooding) or increasingly saline soils (due to the mobilisation of saline groundwater).

In addition to listed threatened vegetation communities, the Hunter Remnant Vegetation Project has described the Hunter Valley River Oak Forest as regionally significant as they predict that up to 98.9% of this community has been cleared and it is poorly represented in conservation areas.

6.7.2 Impacts to Ecology

Impacts to threatened and protected species were assessed by ERM (2009) (refer to Appendix 5). This assessment identified one endangered population (River Red Gum) and seven threatened fauna species (Grey headed Flying Fox, Eastern Bentwin Bat, Eastern Freetail bat, Large-footed Myotis, Speckled Warbler, Hooded Robin and Grey-crowned Babbler) potentially at risk from the proposal.

The assessment of impacts was carried out using the 7-part test under the EP&A Act and considered the potential effects of strain, tilt, surface cracking, ponding, water table changes, salinity, clearing (for remediation) and changes to flooding frequency/surface drainage on the threatened species and their habitat. The following key threatening processes were also considered:

- Alteration of habitat following subsidence due to longwall mining; and
- Alteration of natural flow regimes of rivers, streams, floodplains and wetlands.

It was concluded that the known threatened and protected species potentially affected by the proposal will not significantly impact any of these threatened species, nor will it significantly impact or alter their habitat resources on the site and surrounding lands (ERM, 2009).

6.7.2.1 Impacts to Natural Vegetation

In a general sense, subsidence can potentially disturb natural vegetation through the following mechanisms:

- Damage due to tilts or strains;
- Ponding around vegetation;
- Lowering/raising of the watertable;
- Clearing to enable subsidence remediation works (ripping of surface cracks or erosion control works); or
- Cumulative impact of the above.

Areas over Miniwall Panel No. 9 are unlikely to experience significant impacts as a result of subsidence due to the minor levels of subsidence resulting from the reduced width of extraction. Over Longwall Panel No. 9, subsidence is predicted to be greater, and therefore the risk of

subsidence impacts occurring increases. These areas will experience more surface cracking, tilt and so on. Assessment of impacts concluded that there will be no significant impacts on native vegetation as a result of the proposed modification.

6.7.2.2 Impact to Aquatic Ecology

A review of aquatic ecology monitoring requirements was conducted for the additional Longwall/Miniwall Panel No. 9 by MPR. A copy of this assessment is provided as Appendix 4.

Based on the subsidence predictions and other factors likely to influence the aquatic health of Bowmans Creek (channel morphology, groundwater / surface water interactions) MPR (2008) predict the following potential impacts of the development of miniwall mining beneath Bowmans Creek to aquatic ecosystems:

- Loss of minor baseflow contribution - however evidence presented by Aquaterra,2008 indicates that this contribution to overall stream flow in Bowmans Creek is relatively small;
- Potential improvement in water quality during low flow conditions; and
- Localised increases in bank instability and erosion with consequent increase in sedimentation and turbidity. However, overall impact is not expected to be significant given the scale of the present impact and planned riparian stabilisation works.

SCT (2008) note that whilst there is some potential for ponding within the creek channel, this level of ponding is unlikely to be outside the currently experienced variability within pool volumes, location and depth as a result of high and low flow periods. SCT also note that the local tilting that will be experienced is at low levels and will occur over only short time distances. Therefore, these changes are also expected to be within the natural variation range that is naturally occurring within the stream given its meandering nature.

Overall, MPR concluded that the impacts of mining on the existing aquatic biota and habitats within Bowmans Creek will be similar to those observed during the recent drought. This included a reduction in aquatic biota and habitat availability and a loss of connectivity between the Hunter River and upstream locations in Bowmans Creek (and Bettys Creek).

6.7.3 Ecological Impacts Mitigation and Management

Based on the predicted impacts, avoidances, mitigation measures and monitoring programs have been recommended with respect to site ecology which are discussed below.

6.7.3.1 Avoidance

The specialist longwall mining studies undertaken by SCT (2008) and Aquaterra (2008) estimate that subsidence over a full width longwall panel within the proposed mining area is estimated to reach 1.6 metres. Full width longwall mining beneath Bowmans Creek would have unacceptable impact upon:

- The aquatic ecology of Bowmans Creek;
- Fish passage (up and downstream) habitats;
- Potential fracturing of aquacludes, associated alluvium and drainage thereof possibly into the mine
- Lowering of sections of the creek resulting in deeper pools, destabilisation of stream banks by accelerated erosion and sedimentation;
- Cracking of rock bars with possible drainage; and
- Reduced water flows and water quality.

6.7.3.2 Mitigation, and Management

The main recommended mitigation measure is that of miniwall mining used for that area which lies beneath Bowmans creek as subsidence impacts can be minimised to an acceptable level whereby no significant impacts on the aquatic ecology, water availability or water quality of Bowmans Creek.

The primary mitigation measure initiated by ACOL include riparian rehabilitation works and stabilisation of Bowmans Creek and. In addition ACOL will continue to implement the approved River Red Gum management Land and exclude cattle from the creek line in close proximity to this vegetation community.

ACOL propose to amend the aquatic ecology monitoring regime for Bowmans Creek to incorporate the development of Longwall/Miniwall Panel No. 9 in consultation with regulatory agencies. The results of the modified monitoring regime are to be made available through the mines environmental systems.

6.8 Soils, Land Capability and Agricultural Suitability

6.8.1 Land Capability and Agricultural Suitability

Both pre-mining land capability and agricultural suitability was considered in the original ACP EIS (HLA, 2001). Rural Land Capability and Agricultural Suitability are two differing land classification systems developed by the Soil Conservation Service of NSW and Department of Agriculture respectively. Whilst similar in intent, the two systems are not comparable as the aims and approaches of the two classification systems (Cunningham *et al*, 1988) are different as explained below:

- Land Capability – delineates the various classes of rural land on the basis of the physical ability of the land to remain stable under particular rural land uses; and
- Agricultural Suitability uses land capability as a basis and then incorporates other factors such as infrastructure, geographic location and market factors to determine the lands productive potential.

Land capability has been used for the purpose of the subsidence impact assessment and management associated with the mining of Longwall/Miniwall Panel No. 9.

The capability of land can be affected if there are no protective measures from various forms of soil degradation such as erosion, loss of topsoil, water logging etc. The area associated with Longwall/Miniwall Panel No. 9 comprises land capability Classes II and V. These land classes are defined as:

Class II - Land capable of being regularly cultivated. Generally, gently sloping land suitable for a wide range of uses. Class II land has a high potential for production of crops on fertile soils similar to Class I but due to limitations, soil conservation practices such as strip cropping, conservation tillage and adequate crop rotations are required. Class II land generally follows the alluvial soils along the floodplain of Bowmans Creek and extends south to the Hunter River.

Class V - Land not capable of being regularly cultivated but suitable for grazing with occasional cultivation. Considerable limitations include slope gradient, soil erosion, shallowness or rockiness, climate or a combination of these factors. Structural soil conservation works such as absorption banks, diversion banks and contour ripping, together with practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for establishment or re-establishment of permanent pasture. Class V land is located over the central to northern portion of Longwall/Miniwall Panel No. 9 corresponding with lands rehabilitated from past mining activities.

6.8.2 Potential Impacts to Soils and Land Capability

Of the two classes of lands contained across Longwall/Miniwall Panel No. 9 only the Class II land is suitable for regular cultivation. Both Class II and Class V lands are suitable for grazing. The lands associated with Longwall/Miniwall Panel No. 9 are agisted for livestock grazing.

Land subsidence as a consequence of underground mining has the potential to affect the land capability through changes in grade, initiation of erosion and/or changes in drainage patterns. A potential secondary outcome is an accumulation of salt as a result of changes to drainage behaviour.

Cracking and increased subsurface permeability will increase the drainage of the soil profile and therefore reduce the amount of water available for pasture and cropping. Conversely, increased ponding and water logging of the floodplain areas (where Class II land predominantly exists) as a result of subsidence changes to the land surface, could result in soils becoming poorly drained and place limitations on the types of crops that could be used and/or limit pasture establishment and grazing.

Another potential impact of subsidence on land capability is increased salinity within the soil profile as a result of surface ponding. Ponding if allowed to remain over a period of time may lead to localised or short-term increases in the water table (due to water infiltration). The unconfined aquifer (alluvium) across the proposed mining varies in quality, however it is generally more saline than the adjacent rivers and creeks and in some areas can be classified as highly saline.

6.8.3 Soils Impact Mitigation and Management

Approximately half the surface area above Longwall/Miniwall Panel No. 9 is owned by ACOL with the remainder owned by Macquarie Generation. The latter half compromises Brunkers Lane (private road) and a rehabilitated out of pit overburden emplacement.

The geometry of the Longwall/Miniwall Panel No 9 will result in miniwall subsidence levels in the south of less than 200mm and according to SCT subsidence is unlikely to be perceptible. Subsidence levels in the north are expected to range to 1.2m. Subsidence in this area will be perceptible as cracking and grade changes on hard surfaces.

Regular visual monitoring of the area will enable the detection of surface cracking whilst mining is occurring. Some cracks are expected to close and heal naturally while others will be remediated by regrading and compacting the surface so as to provide a landform not susceptible to erosion, sedimentation or ponding.

6.8.4 Continuation of Agriculture

No changes to current land capability classes are anticipated to occur as a consequence of mining coal resources within Longwall/Miniwall Panel No. 9. Agriculture in the form of livestock grazing with occasional crop production in the southern portion of the site will continue Monitoring and repair (if necessary) of boundary fencing, internal paddock fences and associated gates will be undertaken on a regular basis to ensure the management, control and safety o livestock.

6.9 Aboriginal Archaeology

ACOL commissioned Insite Heritage Pty Ltd (Insite Heritage) to conduct an Aboriginal archaeological heritage assessment of proposed Longwall/Miniwall Panel No. 9 land area. A copy of the Aboriginal heritage assessment is contained in **Appendix 6.**

Community consultation with Aboriginal stakeholder groups and individuals was undertaken in accordance with the Department of Environment and Climate Change (DECC) guidelines: Interim Community Consultative Requirements for Applicants. Letters of notification of the project were sent to the DECC, NSW Native Titles Services, Office of the Registrar and Singleton Council.

Letters of invitation (to register an interest in the project) were sent to those stakeholders known to ACOL in accordance with their own register. Additional stakeholders identified by the above government agencies were also invited by letter to register an interest in the project.

Public notices advising of the project and inviting registrations from community groups and individual Aboriginal stakeholders were published in the public notices sections of the Singleton Argus and Sydney Morning Herald newspapers on 3rd and 10th October 2008.

A total of 21 groups/individuals registered an interest in the project. All registered groups were contacted by mail and invited to attend field work. The field work for Longwall/Miniwall Panel No. 9 was conducted in conjunction with fieldwork for the ACOL's south east open cut project.

6.9.1 Registered Aboriginal Heritage Sites

Insite Heritage conducted a search of the Aboriginal Heritage Information Management System (AHIMS) register for an area 30 square kilometres surrounding the area of Longwall/Miniwall Panel No. 9. The search identified 50 sites recorded in that area (refer to Appendix 6).

The review of the register and associated archaeological reports with respect to known sites in the area revealed a distinct pattern. Insite Heritage observed that previous archaeological investigations have shown that sites are more prevalent in areas in close proximity to water sources with the number and density of archaeological sites increasing with the permanence of the water resource.

6.9.2 Survey Results

Due to the number of registered stakeholders field work for Longwall/Miniwall Panel No. 9 was assigned on a roster basis of three days per group. The field work was undertaken in 1 day. Those registered groups who were not in attendance due to the roster system were taken over the study area on the following day.

A total of seventeen (17) stakeholder groups and individuals participated in the field survey conducted on 17 and 18 December 2008. The fieldwork team comprised of archaeologists (Besant, Wyatt and Carter) together with representatives from Culturally Aware, Ungooroo Aboriginal Corporation, Hunter Valley Cultural Consultants, Ungooroo Cultural and Community Services Inc, Giwiir Consultants, Wonnarua Nations Aboriginal Corporation, Wattaka Cultural Consultants Services, Upper Hunter Heritage Consultants, Lower Hunter Wonnarua Council Inc, Wanaruah Local Aboriginal Land Council, Cacatua Culture Consultants, Hunter Valley Cultural Surveying, Wonnarua Culture Heritage, Hunter Valley Aboriginal Corporation, Yarrawalk Enterprises, Aboriginal Native Title Consultants and Wonn 1 Contracting.

The area to be surveyed was divided into five landscape unit boundaries. The survey was conducted on foot. The five landscape units are shown by **Table 6.6** and by **Figure 10.**

Table 6.6: Survey details of landscape units.

Survey Unit	LWA1	LWA2	LWA3	LWA4	LWA5
Location	At southern end of study area flanking bed in creek and floodplain to the north.	Eastern edge of study area cuts into terrace.	Mid-section of study area west of Bowman's Creek.	West of Bowman's Creek toward Brunkers Lane.	Bowmans Creek margins.
Landform	Floodplain creek bank	Terrace	Floodplain creek bank	Ridge crest	Creek bank
Approx Area	9.3ha	1.3ha	12.1ha	11.5ha	.9ha
Surface Visibility (AV)	<1%	<1%	<2%	<5%	<1%
Arch. Visibility (AV)	20%	30%	30%	60%	60%
Effec. Coverage m^2	96	39	726	3540	54
Sites	0	1	0	6	

Survey Unit	LWA1	LWA2	LWA3	LWA4	LWA5
Notes	Very dense grass cover. Limited exposure along vehicular tracks. Cut in creek bank indicate alluvial deposit over 4 m deep.	Limited exposures on stock trail on edge of terrace above floodplain. Artefacts located.	Very dense grass cover. Limited exposure along vehicular tracks. Woodland of casuarinas and eucalypt along creek bank.	Limited exposures in heavy grass cover with a few stands of casuarinas with high exposure underneath. Artefacts located along vehicular track at the base of slop/creek flats margin.	Small areas of creek margin/bank exposed by sheet erosion and animal tracks.

The survey identified a total of twenty three (23) artefacts from seven (7) sites as shown by **Figure 11.**

6.9.3 Interpretation of Sites and Significance Assessment

This survey recorded 23 artefacts from 7 sites. This is consistent with Witter's (2002) identification of the Brunkers Lane site and his suggestion that the Bowmans Creek flats are likely to contain subsurface deposits. It is inferred from the evidence within the study and from other sources that:

- Members of the Wonnarua 'tribe' occupied the locality, with the first occupants probably arriving more than 13,000 years ago;The locality was suited to longer term occupation because of the presence of exploitable resources and its proximity to permanent water;
- The locality provided access to both aquatic (riverine and wetland) and terrestrial resources; and
- The stone material (indurated mudstone/tuff) was favoured for stone-working activities and these materials were obtained from local sources. There is high potential for subsurface deposits to occur within the study area, particularly along the terraces east of Bowman's Creek and along the creek margin.

The sites were considered to be of low significance (see **Table 6.7** below) but Insite Heritage noted that some potential sites and or artefacts may be located below the ground surface.

Table 6.7: Significance Assessment

Site Name	Site Type	Scientific Significance	Public Significance	Representative Significance
LWA2/1	Artefact scatter	Low	Low	Low
LWA4/1	Isolated find	Low	Low	Low
LWA4/2	Isolate find	Low	Low	Low
LWA4/3	Artefact Scatter	Low	Low	Low
LWA4/4	Isolated Artefact	Low	Low	Low
LWA5/1	Isolated Artefact	Low	Low	Low
LWA5/2	Isolated Artefact	Low	Low	Low

6.9.4 Aboriginal Archeology Impact Mitigation and Management

Insite Heritage made the following recommendations with respect to the identified sites and area as a whole, these being:

- The areas known to contain artefact scatters should be regularly monitored by the Aboriginal Community giving them the opportunity to record and relocate artefacts should subsidence appear to damage the site (s);
- The flood plain and terraces adjacent to Bowman's Creek have been previously identified as areas of archaeological sensitivity and should be regularly monitored by an archaeologist with regard to the effects of subsidence. Should subsidence that may damage sites be noted, further action can be taken to mitigate damage to the site;

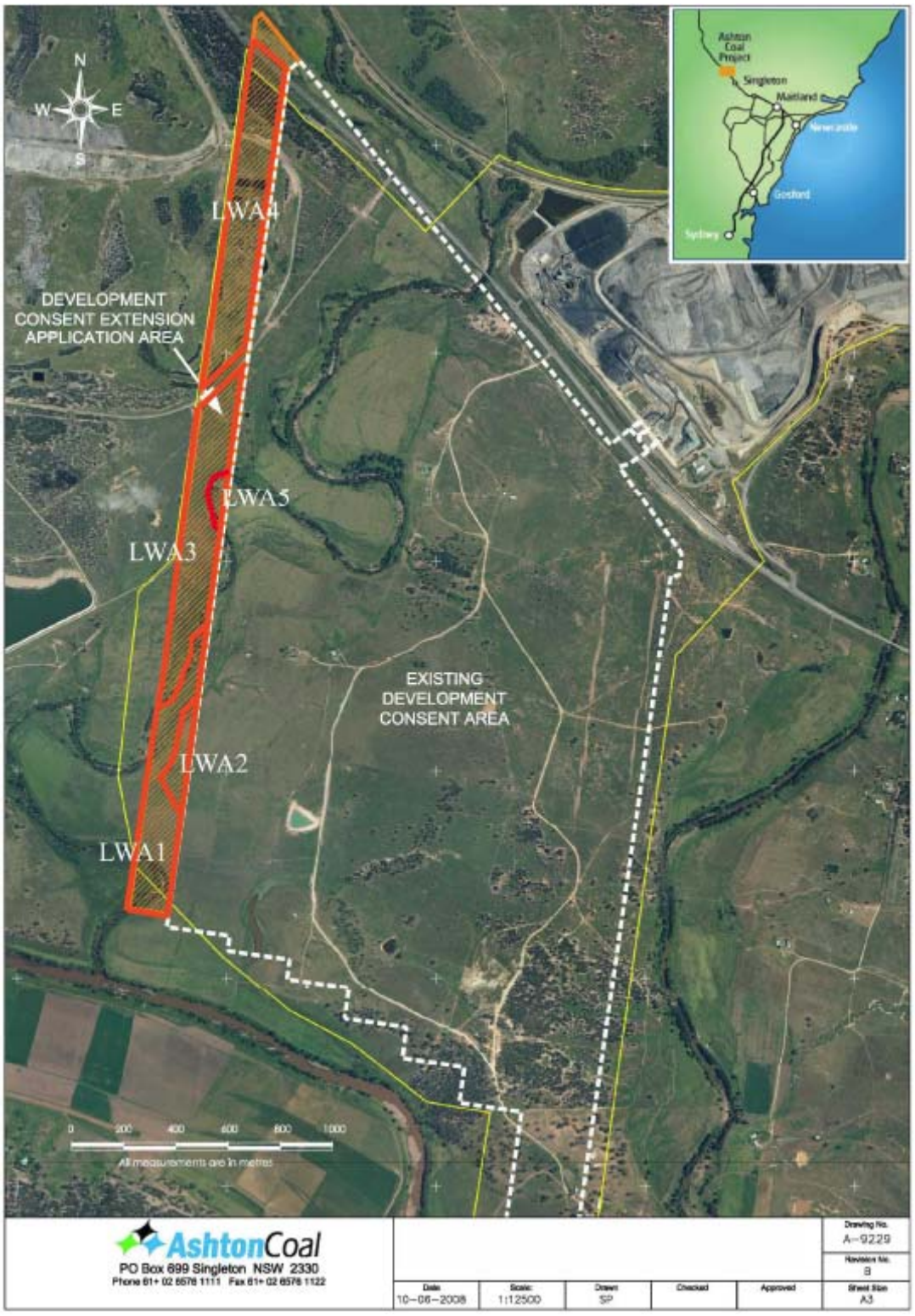

Figure 10: Archaeological landscape units.

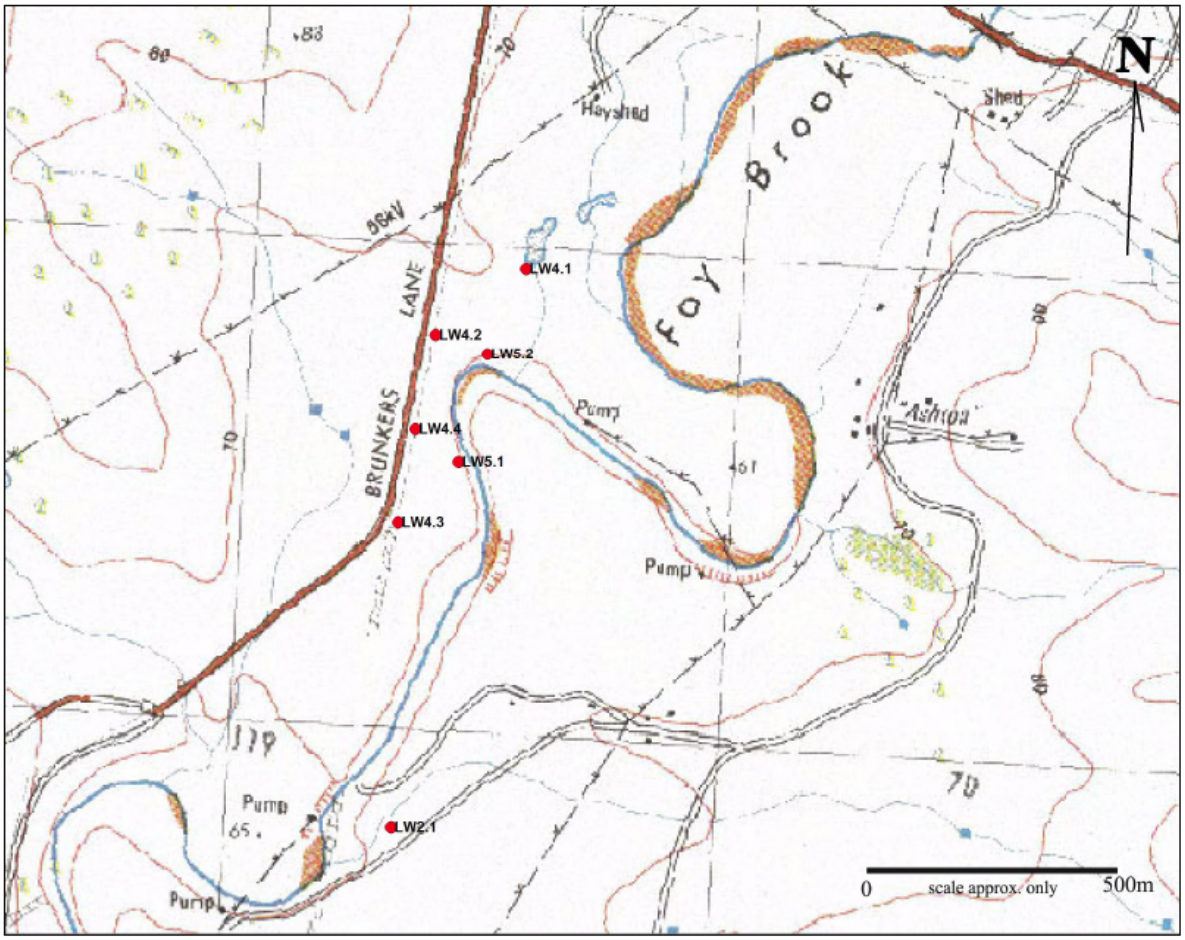

Figure 11: Location of identified sites.

- An approval will be required under Part 6 of the NPW Act 1974 prior to remediation works within the Bowmans Creek to Brunkers Lane area; and
- North of Brunkers Lane the area is considered disturbed by the Macquarie Generation emplacement area.

6.9.5 Review of Aboriginal Archaeological Report by Stakeholders

All the stakeholder groups and individuals who registered their interest in the project have been forwarded a copy of the report seeking their comment(s) on the findings and recommendations.

Some of the stakeholders have requested that their comments be treated as “confidential”. Copies of the stakeholders responses will be sent to the DoP and DECC under separate cover.

6.10 Air Quality

In 2001, Holmes Air Sciences undertook the original Air Quality Assessment for the ACP based on a production level of 5.45Mtpa of ROM coal. Holmes Air Sciences has been engaged to undertake an assessment of the proposed modification involving an increase in production by 0.25mtpa ROM coal associated with the ACP underground mine. The assessment is contained in **Appendix 7**

6.10.1 Existing Performance Against Air Quality Criteria

PAEHolmes examined recent ambient air quality and meteorological monitoring data for the area to assess existing conditions and the ACP's performance with environmental criteria.

As predicted in the original ACP EIS, the recent fourth year of mine operation has the greatest potential for dust impact. The winter period, with prevailing northwest winds also has potential to seasonally elevate dust impacts in Camberwell Village. Generally, this appears to be reflected in the monitoring data.

Overall, the recent results all show a downwards trend. This is consistent with a declining rate of open-cut activity, seasonal influences, rehabilitation of open-cut areas and the mine refining its management practice.

The criteria for annual average particulate matter less than 10 micron (annual average PM_{10}) and Total Suspended Particulate (TSP) in recent monitoring have been complied with, however the 24-hour average PM_{10} criteria apply to total ambient dust levels and are not met on all days. Four representative days on which the 24-hour average PM_{10} criteria are elevated were examined to determine the likely causes and contribution from the ACP.

The assessment determined that on some of these days the ACP appears to be a significant contributor to the elevated levels, however on some days it is unlikely that the mine is a significant contributor to the elevated levels. For example in windy conditions with wind from many directions, upwind and downwind sites can measure similar levels under steady weather conditions over the whole day.

In consideration of this and that the proposal to underground mine the extension area and increase production by 0.25 mtpa ROM coal from the ACP underground mine would have a small contribution to the total mine dust emissions. It appears the key factors for compliance to the 24-hour average criteria would be the prevailing background dust levels and how well the mine manages open-cut activities on a day-to-day basis.

6.10.2 Contribution from Underground Mining

An assessment based on the original modelling was undertaken to determine the relative dust emission contributions from the existing ACP open cut and underground mining operations, and the emissions resulting from the proposed modification.

The original environmental assessment determined that the underground operation delivered 54% of the (5.45 Mtpa) ROM coal produced at the mine. Presently the underground operation delivers 57% of the approved 5.2 Mtpa ROM coal. It is proposed to alter this to 59% of a total of 5.45Mtpa ROM coal.

Accordingly the underground operation would be responsible for 59% of the dust from all surface coal handling and associated activities, such as handling of rejects, ROM and product coal and also coal washing.

However, only 3.3% of the total Ashton mine dust emissions can be attributed to the underground activity and its associated surface activities.

6.10.3 Effect of Proposed Modification on Air Quality

It is understood that mining the proposed extension area and increasing annual production by 0.25 Mtpa ROM coal from the ACP underground mine would slightly increase the rate of activity/material handling at the surface but would not result in any changes to the general location of surface activities. The proposal would essentially extend the life of the approved underground operation and slightly increase the underground rate of production.

Essentially it can be concluded that there would not be any tangible change in dust impacts at receptors resulting as a consequence of underground mining the extension area or increasing annual production from the underground mine by 0.25 Mtpa of ROM coal.

6.11 Acoustic Environment

In 2001, HLA Envirosciences was engaged to undertake a Noise and Vibration assessment for the original ACP EIS. Spectrum Acoustics has been engaged to review the original report (HLA – Envirosciences 2001) and undertake an assessment of acoustical impacts of mining the proposed extension area and increasing production by 0.25 Mtpa of ROM coal from the ACP underground mine. This assessment is contained in **Appendix 8**.

6.11.1 Existing Noise Monitoring

ACOL currently have one real-time noise monitor (a Sentinex monitor) installed within Camberwell Village. The monitor has the functionality that allows some separation of mine noise from typical village sounds to help ACOL and consent authorities to identify machinery that may be contributing to high noise levels. The monitor also continuously records noise.

In addition to the real time monitor ACOL monitor potentially impacted residential receptors on a quarterly basis in accordance with the ACP conditions of consent. Typically this equates to five (5) regular attended monitoring sites that are monitored by Spectrum Acoustics.

6.11.2 Performance Against Acoustic Criteria

Attended noise monitoring from August 2007 to the time of compiling this EA, at five (5) noise monitoring locations have recorded only two (2) significant exceedences (greater than 2 dBA) of the ACP noise criteria. On both of these occasions the inversion strength was greater than 8^{O} per 100 metres. The ACP noise criteria are applicable for inversions up to 3^{O} per 100 metres.

In the last 2 years there has been no significant exceedences of noise criteria under the applicable inversion limit and actual noise monitoring results confirm compliance with the noise criteria

The proposed modification of mining the extension area and increasing production by 0.25 Mtpa of ROM coal from the ACP underground mine will not result in any tangible increase in noise levels above those currently generated.

6.11.3 Acoustical Impacts of the Modifications

The proposed modification of mining the extension area and increasing production by 0.25 Mtpa will not result in an increase in the mining equipment fleet originally modelled within the EIS. With no increase in equipment (and their corresponding noise source) no increase in predicted noise levels are anticipated as a result of the proposed modification, implying continued compliance with the noise criteria.

6.12 Blasting and Vibration

The proposed modification involves mining the extension area by longwall mining method and does not involve blasting activities. Therefore a blast and vibration assessment has not been undertaken for the proposed modification.

6.13 Social and Economic Environment

The proposed modifications detailed within the EA report will provide further job security for the 180 employees and contractors working at the ACP underground mine. In addition the different tiers of government will derive revenues from the various taxes and royalties associated with mining the coal resource. No adverse social or economic impacts are envisaged to occur from the proposed modifications.

6.14 Transport

The proposed modifications will not have an impact on road transport. The proposed modifications will not have an impact on rail transport transportation as the product coal limit remains consistent with that approved within DA 309-11-2001, therefore a rail transport assessment has not been undertaken. Rail transport will continue to be undertaken in accordance with the requirements of DA 309-11-2001.

6.15 Utility Services

Section 6.2 of the EA report provides a description and impact assessment of the proposed modification in relation to utility services.

6.16 Visual

The area containing and surrounding the ACP is characterised by undulating foothills and floodplains of the Hunter River, Bowmans Creek and Glennies Creek. The impact of mining in the area is clearly visible from the New England Highway when travelling between Singleton and Muswellbrook. The presence of coal mines is the dominant visual feature. The ACP is consistent with the surrounding landscape.

The proposed modification to DA 309-11-2001 will not involve the construction of any additional surface infrastructure. The proposed modification of mining Longwall/Miniwall Panel No. 9 will be impacted by subsidence. Visually the impact of subsidence will be minimal and imperceptible within the broader landscape setting.

7 DRAFT STATEMENT OF COMMITMENTS

ACOL will undertake the proposed modification and operate the ACP in a responsible manner to prevent and minimise harm to the environment.

The section of the EA report (refer **Table 7.1**) presents the proponents draft Statement of Commitments, environmental management and monitoring measures with associated timing to mitigate impacts that may be generated from the proposed modifications.

Table 7.1: ACOL Statement of Commitments

Item	Commitment and Environmental Management Mitigation Measures	Timing-implementation
Environmental Assessment General.	ACOL will comply with conditional requirements in all approvals, licences and permits.	Life of operations.
Subsidence.	Prepare a SMP over Longwall/Miniwall Panel No. 9 and obtain approval from the DPI. The SMP is to contain a program of subsidence monitoring to confirm that the subsidence behaviour is developing as expected. The SMP will contain contingencies as a precaution for unexpected subsidence.	Prior to Mining.
Groundwater and Surface Waters.	Water levels and quality of surface and groundwaters be monitored and reported in consultation with DWE, DPI-MR and DECC requirements. Contingency measures to be developed as required to manage any adverse impacts to surface and groundwaters in response to mining.	Prior to commencement of mining and life of operations.
Ecology and Aquatic Ecology.	Continue the implementation of the approved River Red Gum Management Plan. Monitor the subsidence impacts upon Bowmans Creek by: • Continuing and expanding the existing water quality monitoring program; and • Continue to implement the Bowmans Creek riparian rehabilitation works to achieve a “maintain or improve” outcome.	Prior to commencement of mining and for life of project.
Aboriginal Archaeology.	Identified Aboriginal archaeological sites LWA2/1, LWA4/1, LWA4/2, LWA4/3, LWA4/4, LWA5/1 and LWA5/2 be subject to surface collection and keeping in consultation with stakeholder groups and requirements of the National Parks and Wildlife Act 1974.	Prior to commencement of mining.
Soils.	Undertake regular visual monitoring of the area to detect surface cracking, erosion and ponding. Conduct regrading and surface compaction to provide a stable, non erosive landform.	Life of operations.

8 JUSTIFICATION AND CONCLUSION

In summary the proposed modifications to the existing ACP development consent involve:

- The establishment and mining of an additional coal resource;
- An annual increase in the ACP underground mine ROM coal production by 250,000 tonnes to 3.2Mtpa; and
- Deleting Condition No's 3.18, 3.24, 3.25, 3.26, 3.27 and 3.28 from Schedule 2 of the development approval.

ACOL have embarked upon a rigorous program of detailed environmental investigations consistent with its obligation under the existing development approval to prevent and minimise harm to the environment. The result of the specialist studies demonstrate that the proposed modifications are justified on environmental grounds.

The mining of Longwall/Mniwall Panel No. 9 will recover an additional 1.25Mt of ROM coal which would otherwise have been sterilized. The coal to be recovered would occur whilst the ACP longwall equipment and associated machinery and infrastructure is working in this section of the underground mine. ACOL want to take advantage of the economies of scale (saving in operating, production and delayed relocation costs of the longwall) that the opportunity presents. These coals will be the last recovered from the Pikes Gully Seam as the longwall and associated equipment will be relocated to work the Upper Liddel Seam.

The winning of this coal resource will provided a small increase in the life of the ACP underground mine by about 6 months which in turn provides further job security for the 180 employees and contractors working at the ACP underground. Additionally. The State and Federal governments will derive revenues from the various taxes and royalties from mining the resource.

The additional increase in annual ROM coal production was modelled (air and noise) in the original ACP EIS. The small increase in annual production from the ACP underground mine will have no tangible adverse environmental impacts. Existing air and acoustical conditions of consent are appropriate and should be maintained in their current form.

The increase in annual underground ROM coal production will be derived from efficiencies delivered by the existing underground mine workforce and improved recovery of product coals. In summary, the increase to annual production will improve the ACP's profitability and provide greater employment security to the ACP workforce. The increase in annual production levels will provide small but meaningful revenues to the public sector in the form of taxes and royalties derived from the additional production. The broader community and ACP workforce will derive positive economic and social benefits from the proposed modifications.

The proposed modifications sought by ACOL are justified on economic, social and environmental grounds. The modifications involve the proper management, development and conservation of natural resources including agricultural land, resources and water for the purpose of promoting the social and economic welfare of the community and a better environment. In addition the proposed modifications promotes the orderly and economic use of development of land, the protection of the environment and utility services which prevail in the area of the ACP.

The proposed modifications are consistent with the stated objects of the EP & A Act, 1979.

9 REFERENCES

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Worley Parsons (2009). Ashton Coal Operations Limited Surface Water Assessment.

10 ABBREVIATIONS

A

ACOL Ashton Coal Operations Pty Limited

ACP Ashton Coal Project

AHD Australian Height Datum

ANZECC Australian and New Zealand Environment and Conservation Council

ARI Average Recurrence Interval

AusRivAS Australian Rivers Assessment System

C

CCC Community Consultative Committee

CHPP Coal Handling and Preparation Plant

D

DA Development Application

dB decibel

dBA A weighted decibel

dBL Linear decibel

DGRs Director General's Requirements

E

EA Environmental Assessment

EC Electrical Conductivity

EIS Environmental Impact Statement

EL Exploration Licence

EP&A Act 1979 *Environmental Planning and Assessment Act* 1979 (NSW)

EP&A Regs,2000 *Environmental Planning and Assessment Regulation* 2000 (NSW)

F

FRL Felix Resources Limited

J

JCB Joint Coal Board

L

LW Longwall

M

Mtpa million tonnes per annum

P

PEA Preliminary Environmental Assessment

R

RASS Radio Acoustic Sonar System

ROM run-of-mine

RTA Roads and Traffic Authority

SIGNAL Stream Invertebrate Grade Number Average Level

SMIAR Subsidence Monitoring and Impact Assessment Report

SMP Subsidence Management Plan

SODAR Sonic Detection and Ranging

T

TDS Total Dissolved Solids

TSS Total Suspended Solids

V

VCA voluntary conservation area

W