

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Wongawilli Colliery
Nebo Area Project Approval (MP 09_161)

ANNUAL REVIEW/ANNUAL ENVIRONMENTAL MANAGEMENT REPORT
(1 JULY 2013 – 30 JUNE 2014)





Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

TITLE BLOCK

Name of Mine: Wongawilli Colliery
Title/Mining Leases: ML 1596, ML 1565 and CCL 766
MOP Commencement Date: March 2012
MOP Completion Date: September 2015
AEMR Commencement Date: 1 July 2013
AEMR Completion Date: 30 June 2014
Name of Leaseholder: Wongawilli Pty Limited
Name of Mine Operator: Wongawilli Pty Limited
Reporting Officer: Kamlesh Prajapati
Title: Group Environmental Coordinator

Signature:
Date: January 2014

Manager of Mining Engineering: Paul Coxhead

Signature:
Date: January 2014

GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	
AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
CCC	Community Consultative Committee
CCL	Consolidated Coal Lease
CRO	Community Relations Officer
CO ₂ -e	carbon dioxide equivalent
DP&E	NSW Department of Planning and Environment
DRE	NSW Department of Trade and Investment, Division of Resources and Energy
DSC	Dams Safety Committee
EA	Environmental Assessment
EPA	Environment Protection Agency
EEC	Endangered Ecological Community
EM	Environmental Manager
EO	Environmental Officer
EP&A Act	Environmental Planning and Assessment Act, 1979
EP&A Reg.	Environmental Planning and Assessment Regulation, 2000
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act, 1999
EPL	Environment Protection Licence
FY	Financial Year
IWMP	Integrated Wastewater Management Plan
LEP	Local Environment Plan
LGA	Local Government Area
LW	Longwall
km	kilometre
m	metre
mg/L	milligram per litre
ML	Mining Lease
ML/day	megalitre per day
MPL	Mining Purposes Lease
mm/m	millimetres per metre
Mtpa	Million tonnes per annum
NGER	National Greenhouse and Energy Reporting
NMP	Noise Management Plan
NRE	Gujarat NRE Coking Coal Ltd
NSW	New South Wales
OEH	Office of Environment and Heritage
PAC	Planning Assessment Commission
PCA	Private Certifying Authority
PKCT	Port Kembla Coal Terminal
PM ₁₀	particulate matter less than 10 microns in size
ROM	run-of-mine
SCA	Sydney Catchment Authority

SEPP	State Environmental Planning Policy
SMP	Subsidence Management Plan
TARP	Trigger Action Response Plan
TSC Act	Threatened Species Conservation Act, 1995
UEP	Underground Expansion Project
WCC	Wollongong City Council
WCL	Wollongong Coal Limited
%	percent
°	degree

Term	Definition
Alluvial	A general term for clay, silt, sand and gravel transported by water and deposited, on the bed of a flood plain, river or stream.
Baseline monitoring	Monitoring conducted over time to collect a body of information to define specific characteristics of an area (e.g. species occurrence or noise levels) prior to commencement of a specific activity.
Coking Coal	Self-coking coal with ash of less than 10% and volatile matter of 21-23%, excellent capacity for carrying 'soft' coking coals in a blend.
Continuous miner	A remote-controlled, tracked, electrically powered coal cutting and loading machine used to form mine roadways and extract coal pillars.
Conveyor	Fixed mechanical apparatus consisting of a continuous moving belt used to transport coal from one place to another.
Driveage	A horizontal or inclined heading or roadway in the process of construction. The road way will be used to access a new mining area within the lease.
Dyke	A sheet like vertical intrusion of igneous rock cutting across the strata of older rocks.
Ecosystem	An interacting system of animals, plants, other organisms and non-living parts of the environment.
Fault	Major fracture of the earth's crust caused by the relative movement of the rock masses on either side.
First Workings	Involves the development headings or roadways which will provide access to the coal resource. They are developed using continuous miners with integrated roof and rib bolting rigs. First workings leave the coal pillars intact and the overlying strata fully supported
Gate roads (maingates and tailgates)	An underground roadway (tunnel) that provides access to a working longwall for continuous mining.
Goaf (or goafing)	The space left following extraction of the coal seam where the roof material is allowed to collapse.
Greenhouse gases	Gases with potential to cause climate change (e.g. methane, carbon dioxide and non-methane volatile organic compounds). Usually expressed in terms of carbon dioxide equivalent.
Groundwater	All waters occurring below the land surface; the upper surface of the soils saturated by groundwater in any particular area is called the water table.
Habitat	The particular local environment occupied by an organism.
Infrastructure	The supporting installations and services that supply the needs of the Project.
Longwall	A secondary extraction method of mining coal that continuously removes the coal from the working face onto a series of conveyors that transfer the coal

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

	to the surface. As the coal is cut away (a 'shear'), both the longwall machine (known as a 'shearer') and the hydraulic roof supports advance forward ready for the next shear.
Permeability	The ability of a rock or soil to allow fluid to pass through it.
Pillar Extraction	A continuous miner system of mining whereby coal pillars are systematically extracted.
Pillar Run	A large scale progressive collapse of coal pillars in a short period of time.
Potable water	Water of quality suitable for human consumption.
Project Approval	Nebo Area Project Approval (MP 09_0161)
Rehabilitation	The restoration of a landscape and especially the vegetation following its disturbance.
Run-of-mine (ROM)	Raw coal that is stockpiled and/or prior to being processed through a coal preparation plant.
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points.
Subsidence	The deformation of the ground mass due to the mining activity, including both vertical and horizontal displacement, tilt, strain and curvature.
Terrestrial	Living or growing on the land.
Tilt	The difference in subsidence between two points divided by the horizontal distance between the points.
Upsidence	Relative upward movement, or uplift, created by the horizontal compression and buckling behaviour of the rock strata in the vicinity of a valley floor
Valley closure	A phenomenon whereby one or both sides of a valley move horizontally towards the valley centreline, due to changed stress conditions beneath the valley and its confining land masses

Table of Contents

TITLE BLOCK.....	2
GLOSSARY OF TERMS AND ABBREVIATIONS	3
1 INTRODUCTION	9
1.1 Background.....	9
1.2 Consents, Leases & Licences	16
1.3 Mine Contacts	18
1.4 Actions Required from Previous Annual Review / AEMR	18
1.5 Distribution	19
1.6 Document Content.....	20
2 Operations during reporting period	21
2.1 Exploration	21
2.2 Land Preparation.....	21
2.3 Construction	23
2.4 Mining.....	23
2.5 Mineral Processing	23
2.6 Waste Management.....	23
2.7 Ore & Product Stockpiles.....	24
2.8 Water Management	27
2.9 Hazardous Material Management	32
2.10 Other Infrastructure Management	33
3 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE.....	34
3.1 Air Pollution	34
3.2 Erosion & Sediment.....	36
3.3 Surface Water Pollution	38
3.4 Ground Water Pollution	40
3.5 Contaminated and/or Polluted Land	41
3.6 Threatened Flora	44
3.7 Threatened Fauna.....	45
3.8 Weeds	47
3.9 Blasting	47
3.10 Operational Noise	48
3.11 Visual and/or Stray Light.....	51
3.12 Aboriginal Heritage	51
3.13 Natural Heritage	52
3.14 Spontaneous Combustion.....	53
3.15 Bushfire	53
3.16 Mine Subsidence	56
3.17 Hydrocarbon Contamination.....	58
3.18 Methane Drainage & Ventilation.....	58
3.19 Public Safety.....	59
3.20 Other Issues & Risks	60
4 COMMUNITY RELATIONS	62
4.1 Complaints Procedure.....	62

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

4.2	Environmental Complaints & Non-Compliances	62
4.3	Community Consultation	79
4.4	Agency Consultation	80
5	REHABILITATION	81
5.1	Buildings	81
5.2	Rehabilitation of Disturbed Land	81
5.3	Other Infrastructure	81
5.4	Rehabilitation Trials & Research	81
5.5	Final Rehabilitation Plan	82
6	ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD	85
6.1	Activities Proposed	85
7	REFERENCES	86
8	CONTROL AND REVISION HISTORY	87

List of Tables

Table 1-1	Consents, Leases & Licences relevant to mining activities at Wongawilli Colliery ...	16
Table 1-2	Mine Contacts at Wongawilli Colliery	18
Table 1-3	Actions Required from Previous Reporting Period	18
Table 2-1	Wongawilli Colliery Annual ROM Coal Production During the Period	23
Table 2-2	Waste Streams designated at Wongawilli Colliery	24
Table 2-4	Wongawilli Colliery Stored Water	32
Table 3-1	Wongawilli Colliery Dust Monitoring Results	35
Table 3-2	Licence Discharge Point 2 (June 2014)	39
Table 3-3	Summary of Monitoring During Reporting Period	56
Table 3-4	Summary of Predicted and Observed Impacts from LW N2 on Surface Infrastructure	57
Table 4-1	Environmental Complaints Summary	62
Table 4-2	Non-Compliance Summary	63
Table 5-1	Rehabilitation Summary	82
Table 5-2	Maintenance Activities on Rehabilitated Land	83
Table 6-1	Activities Proposed during the next period	85

List of Figures

Figure 1	- Location of Wongawilli Colliery	11
Figure 2	- Typical Stratigraphic Section	12
Figure 3	- Wongawilli Colliery Assets and Leases	13
Figure 4	- Wongawilli Colliery Surface Facilities - Pit Top Area	14
Figure 5	- Wongawilli Colliery Surface Facilities - Stockpile Area	15
Figure 6	- Avondale Site	22
Figure 7	- Coal Haulage Route from Wongawilli Colliery to PKCT	26
Figure 8	- Wongawilli Colliery – Aquatic Ecology Monitoring	31
Figure 9	- Wongawilli Colliery - Water Monitoring	43



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Figure 10 - Wongawilli Colliery – Terrestrial Ecology Monitoring	50
Figure 11 - Wongawilli Colliery - Heritage Monitoring	55
Figure 12 - Wongawilli Colliery – Subsidence Predictions and Subsidence Monitoring	61

Appendices

Appendix A - WCL Environmental Policy	87
Appendix B - Environmental Protection Licence - 1087	89
Appendix C - LW N2 End of Panel Report	90
Appendix D - Wongawilli Colliery Register of Compliance	91
Appendix E - Drawings	99

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

1 INTRODUCTION

Wongawilli Coal Pty Ltd operates the Wongawilli Colliery in the Southern Coalfield of New South Wales. Wongawilli Coal Pty Ltd is a wholly owned subsidiary of Wollongong Coal Limited (WCL), formerly known as Gujarat NRE Coking Coal Limited (NRE). Wongawilli Colliery is located approximately 14 km south-west of Wollongong (see **Figure 1**), within the Wollongong and Wingecarribee Local Government Areas (LGAs).

The Wongawilli Colliery currently operates under a project approval granted by the Planning Assessment Commission (PAC) under delegation on 02 November 2011 (MP 09_0161). The project approval allows:

- continued use of the surface infrastructure at the Wongawilli pit top as currently operated;
- coal production at the historic level of up to 2 million tonnes per annum (mtpa);
- longwall mining in the Nebo area in the north east corner of the lease area;
- continued development and construction of the Western Driveage;
- continued transportation of run of mine coal from the Colliery to Port Kembla Coal Terminal (PKCT) by rail; and
- rehabilitation of the site.

Condition 3/Schedule 6 of the Project Approval conditions, requires Wongawilli Colliery to prepare an Annual Review report.

This Annual Review report /Annual Environmental Management Report (AEMR) is for the period 1 July 2013 to 30 June 2014. This period of reporting coincides and is consistent with the requirement agreed to previously with Department of Trade and Investment, Division of Resources and Energy (DRE). This report has been compiled, generally in accordance with, the NSW Department of Primary Industries - Mineral Resources (DPI-MR) *Guidelines to Mining, Rehabilitation and Environmental Management Process (2006)*.

1.1 Background

Wongawilli Colliery is an underground coal mine owned and operated by Wongawilli Coal Pty Ltd. The mine site is located approximately 14 km south-west of Wollongong on the Illawarra escarpment at West Dapto (Wongawilli village). The total lease area covered by Wongawilli Colliery is 147.67 square kilometres.

Mining was proposed in the Wongawilli area in 1906 and began in 1912. The Wongawilli Colliery was purchased by Hoskins in 1916 and the coal produced was washed and coked on site before being transported to the Lithgow Iron and Steel Plant. A blast furnace was commissioned by Hoskins at Port Kembla in 1927 and Australian Iron and Steel (AIS) was formed in 1928. Broken Hill Proprietary Company Ltd (BHP) acquired AIS in 1935. The Elouera Colliery was formed from the merger of the Wongawilli and Nebo Collieries in 1993. These

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

mines operated separately in adjoining reserves and mining had occurred in both the Bulli and Wongawilli seams. BHP became BHP Billiton Pty Ltd in 2000.

The Colliery was operated by BHP Billiton Illawarra Coal (BHPBIC) until June 2005 and contract miner Delta commenced mining in October 2005. NRE acquired the mining lease in December 2007 and the site was renamed NRE Wongawilli Colliery.

Historically, coal from the Colliery was transferred by rail to the Port Kembla Steelworks Coal Preparation Plant. Washed coal was used either in the steelworks or transferred to the Port Kembla Coal Terminal (PKCT) for shipping to both national and international markets. Coal wash reject from the washery was railed back to the Wongawilli emplacement area adjacent to the Wongawilli pit top. The emplacement area ceased its operations in November 2005 and has been rehabilitated. Run of mine (ROM) coal is now transported unprocessed, by rail to the PKCT.

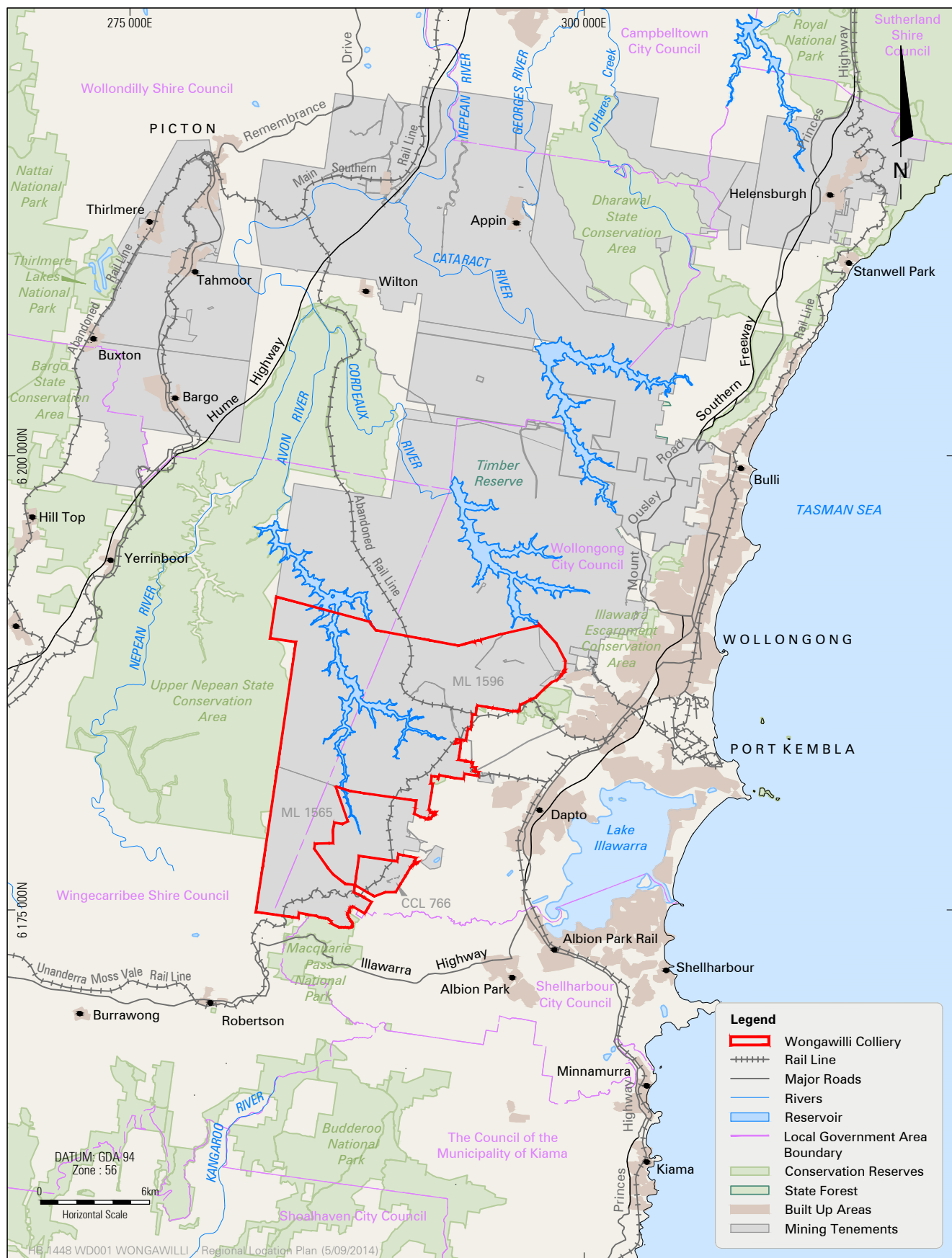
Mining of the Wongawilli seam (No. 3 seam) reserves in the area has been undertaken for more than 80 years. Prior to mining within the No. 3 seam, initial mining in the area was undertaken in the Bulli seam (No. 1 seam).

During the reporting period, Wongawilli Colliery undertook mining activities in the Wongawilli seam at a depth of cover over varying between 100 to 360 m. A typical stratigraphic section of the Illawarra Coal measures with indicative depths of cover is shown in **Figure 2**.

The economic working section of the coal seam is in the order of 3.5 to 4.0 metres thick in the present mining area. The mined seam thickness is primarily governed by localised variations between marker bands as well as changes in stress magnitudes and stone rolls. Approximately 76% of the coal mined in this seam section is recoverable. The Wongawilli seam, normally mined from the natural seam floor to one of the more prominent shale bands, is relatively high in ash content and low yielding.

The mine used one longwall miner and two continuous miners that are dedicated to longwall panel development. The Wongawilli Colliery site contains the main mine portal and caters for men, mining equipment, vehicle and machinery maintenance, mine supplies, administration, coal transport to the surface, and a 100,000 tonne capacity coal stockpiling facility and rail transportation facilities to transport coal to the PKCT.

There are currently two main transport entries into the mine, namely a roadway for rubber tyred vehicles and the other for rail mounted equipment. The rubber tyred vehicles are the primary transport system that services the mine. Coal is transported from the workings to the surface of the mine via an inclined conveyor approximately 2.5km in length.



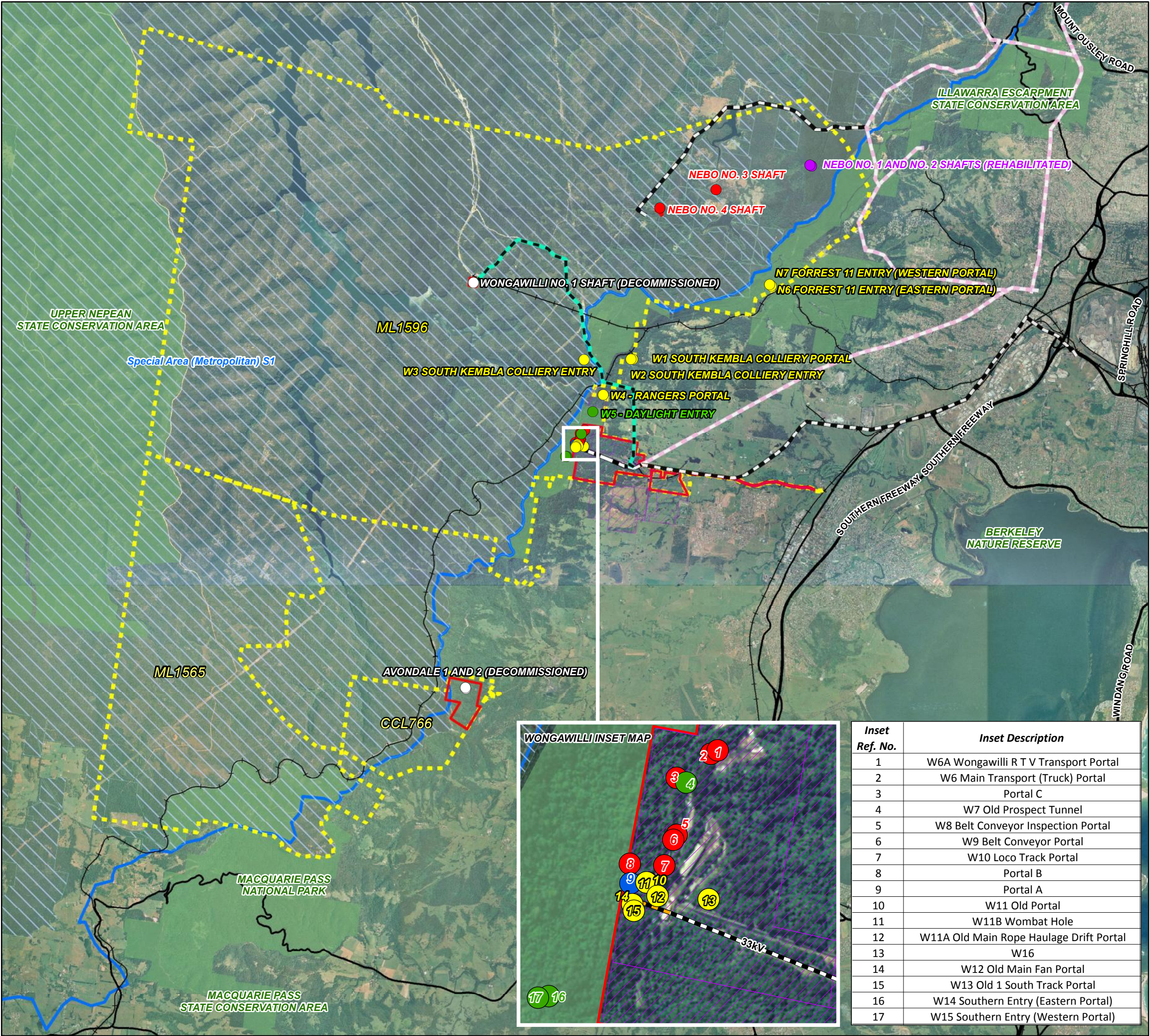
WONGAWILLI COLLIERY

Regional Locality

FIGURE 1

Figure 2 - Typical Stratigraphic Section

AGE	GROUP	SUB-GRP	CODE	FORMATION & MEMBERS	
TRIASSIC	WIANAMATTA GROUP		WMSH	BRINGELLY SHALE MINCHINBURY SANDSTONE ASHFIELD SHALE	
				MITTAGONG FORMATION	
			HBSS	HAWKS BURY SANDSTONE	
	NARRABEEN GROUP	GOSFORD	GRFM	NEWPORT FORMATION GARIE FORMATION	
			BACS	BALD HILL CLAYSTONE	
		CLIFTON	BGSS	BULGO SANDSTONE	
			SPCS	STANWELL PARK CLAYSTONE	
			SBSS	SCARBOROUGH SANDSTONE	
			WBCS	WOMBARRA CLAYSTONE	
			CCSS	COAL CLIFF SANDSTONE	
PERMIAN	ILLAWARRA COAL MEASURES	SYDNEY	BUSM	BULLI COAL	
			UNM1	LODDON SANDSTONE	
			BASM	BALGOWNIE COAL	
			LRSS	LAWRENCE SANDSTONE	
				BURRAGORANG CLAYSTONE	
			CHSM		CAPE HORN
			UNM2		UNNAMED MEMBER 2
				ECKERSLEY FORMATION	HARGRAVE COAL WORONORA COAL NOVICE SANDSTONE
			WW01-11	WONGAWILLI COAL	
			KBSS	KEMBLA SANDSTONE	
			ACSM	ALLANS CREEK FORMATION	AMERICAN CK. COAL
			APFM	DARKES FOREST SANDSTONE (APPIN FORMATION)	HUNTLEY CLAYST. AUSTIMER SANDST.
				BARGO CLAYSTONE	
			TGSM	TONGARRA COAL	
			WTFM	WILTON FORMATION	
				WOONONA COAL MEMBER	
				ERINS VALE FORMATION	
		CUMBERLAND		PHEASANTS NEST FORMATION	FIGTREE COAL UNANDERRA COAL BERKELEY LATITE MINNAMURRA LATITE CALDERWOOD LATITE FIVE ISLANDS LATITE
	SHOALHAVEN GROUP			BROUGHTON FORMATION BERRY SILTSTONE NOWRA SANDSTONE WANDRAWANDIAN SILTSTONE SNAPPER POINT FORMATION PEBBLEY BEACH FORMATION	
	TALATERANG			CLYDE COAL MEASURES	
UNDIFFERENTIATED PALAEOZOIC (DEVONIAN, SILURIAN & ORDOVICIAN)					
ROCKS OF THE BASIN BASEMENT					
Information Sourced From - "Geological Survey Report No. GS1998/277 - R.S. Moffitt"					



Wongawilli Colliery Assets and Leases

WONGAWILLI LEASE AREA

Asset Locations

- Currently Operational
- Decommissioned
- Proposed
- Rehabilitated
- Sealed by Natural Means
- To be Rehabilitated

Electricity Transmission Line 33kV

- Active (WCL Ownership)
- Inactive
- Transitional (BHPBIC Ownership)
- BHPBIC Owned
- Major Roads (LPI)
- WCL Owned Land
- NPWS Reserve (LPI)
- Surface Lease Extents
- SCA Freehold Land (SCA)
- Metropolitan Special Area (SCA)
- Wongawilli Colliery Lease Holdings

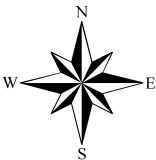
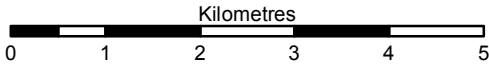


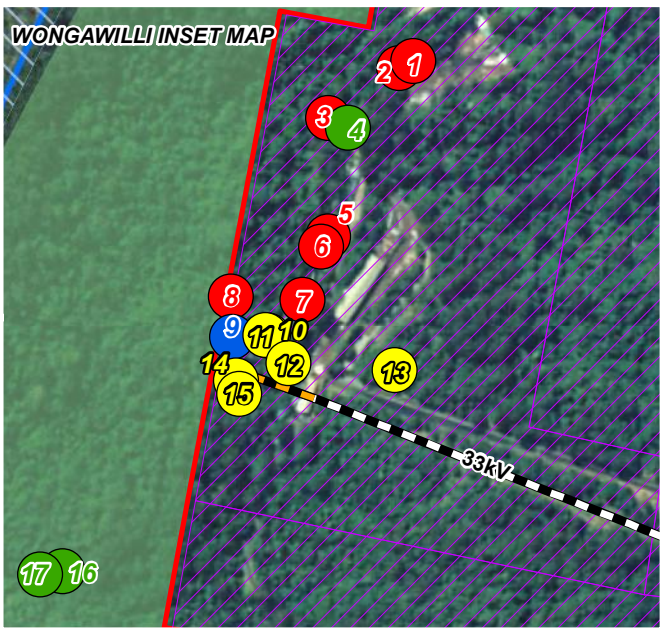
FIGURE 3

1:80,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2011-11-29
Coordinate System: GDA 1994 MGA Zone 56
Project: 111067-04
Map: G1001_SitePlan.mxd 09

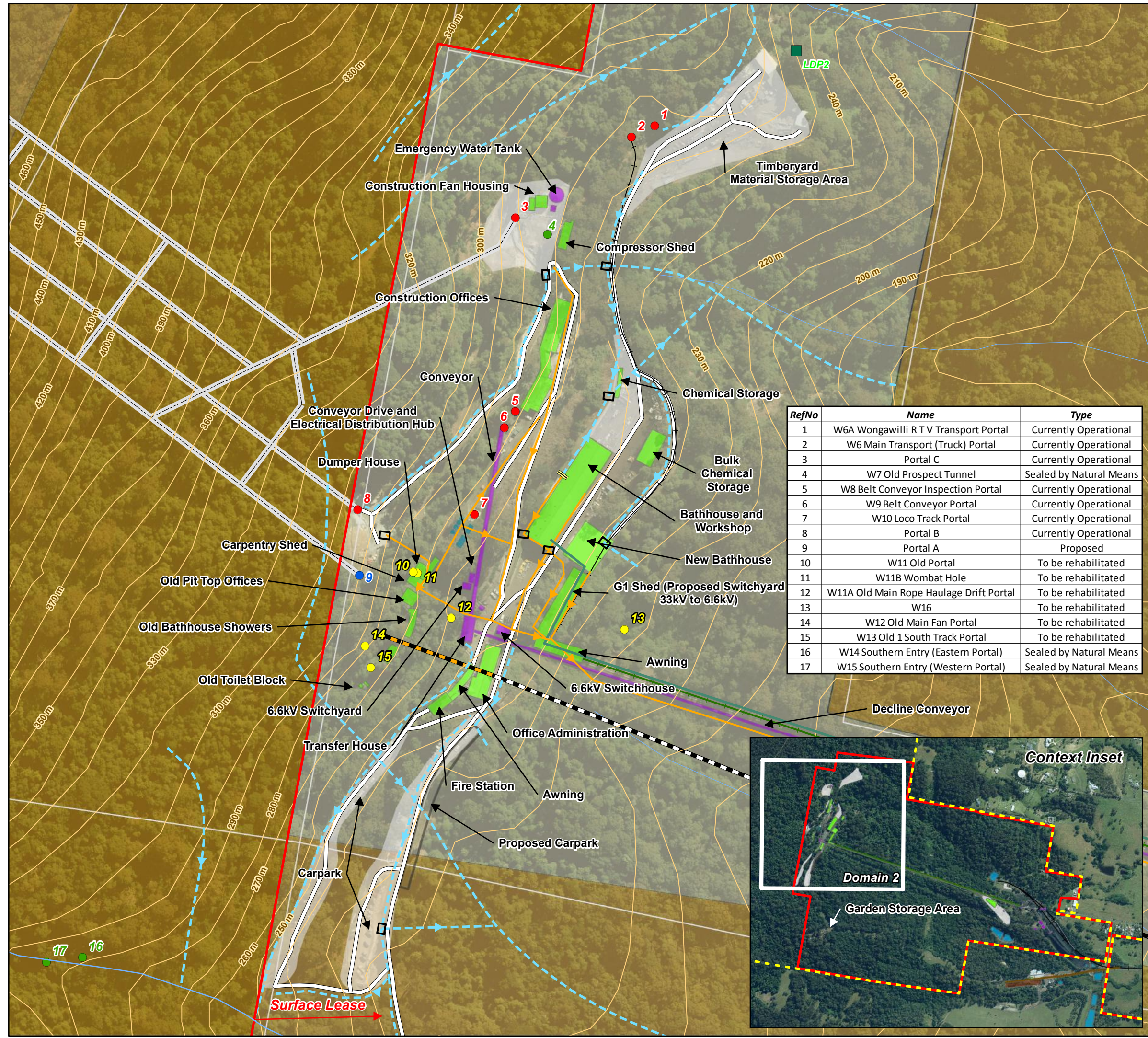
Aerial imagery supplied by NSW Land and Property Information



Inset Ref. No.	Inset Description
1	W6A Wongawilli R T V Transport Portal
2	W6 Main Transport (Truck) Portal
3	Portal C
4	W7 Old Prospect Tunnel
5	W8 Belt Conveyor Inspection Portal
6	W9 Belt Conveyor Portal
7	W10 Loco Track Portal
8	Portal B
9	Portal A
10	W11 Old Portal
11	W11B Wombat Hole
12	W11A Old Main Rope Haulage Drift Portal
13	W16
14	W12 Old Main Fan Portal
15	W13 Old 1 South Track Portal
16	W14 Southern Entry (Eastern Portal)
17	W15 Southern Entry (Western Portal)



Figure 4 - Pit Top Area
WONGAWILLI LEASE AREA



RefNo	Name	Type
1	W6A Wongawilli R T V Transport Portal	Currently Operational
2	W6 Main Transport (Truck) Portal	Currently Operational
3	Portal C	Currently Operational
4	W7 Old Prospect Tunnel	Sealed by Natural Means
5	W8 Belt Conveyor Inspection Portal	Currently Operational
6	W9 Belt Conveyor Portal	Currently Operational
7	W10 Loco Track Portal	Currently Operational
8	Portal B	Currently Operational
9	Portal A	Proposed
10	W11 Old Portal	To be rehabilitated
11	W11B Wombat Hole	To be rehabilitated
12	W11A Old Main Rope Haulage Drift Portal	To be rehabilitated
13	W16	To be rehabilitated
14	W12 Old Main Fan Portal	To be rehabilitated
15	W13 Old 1 South Track Portal	To be rehabilitated
16	W14 Southern Entry (Eastern Portal)	Sealed by Natural Means
17	W15 Southern Entry (Western Portal)	Sealed by Natural Means

- Surface Lease (Approx 141 ha)
- Licensed Discharge Points
- Drainage Channel Sump
- Portals and Tunnels**
 - Currently Operational
 - Proposed
 - Rehabilitated
 - Sealed by Natural Means
 - To be Rehabilitated
 - Under Construction
- Loco Track
- Conveyor
- Private Access Road
- Longwall Layout
- 10m Contours (LPI)
- Watercourses (LPI and WCL)
- Powerlines (Inactive)
- Electricity Transmission Line (WCL Owned)
- Drainage Channel Blockage
- WCL Wongawilli Colliery Lease Holdings
- Cadastre (LPI, 2009) *
- Drainage Channels**
 - Clean Water Drainage Channel
 - Dirty Water Drainage Channel
 - Grey Water Drainage Channel
- Surface Facilities**
 - Hardstand
 - Industrial Building
 - Miscellaneous Plant
 - Proposed Carpark (Indicative)
 - Water Tank/Facility
- Wollongong LEP 2009 & West Dapto 2010 (WCC) ***
 - E1 - National Parks and Nature Reserves
 - E2 - Environmental Conservation
 - RU1 - Primary Production

* Cadastre and zoning are from different sources and are not spatially aligned

N

W E S

1:2,500 Scale at A3

Metres

0 50 100 150

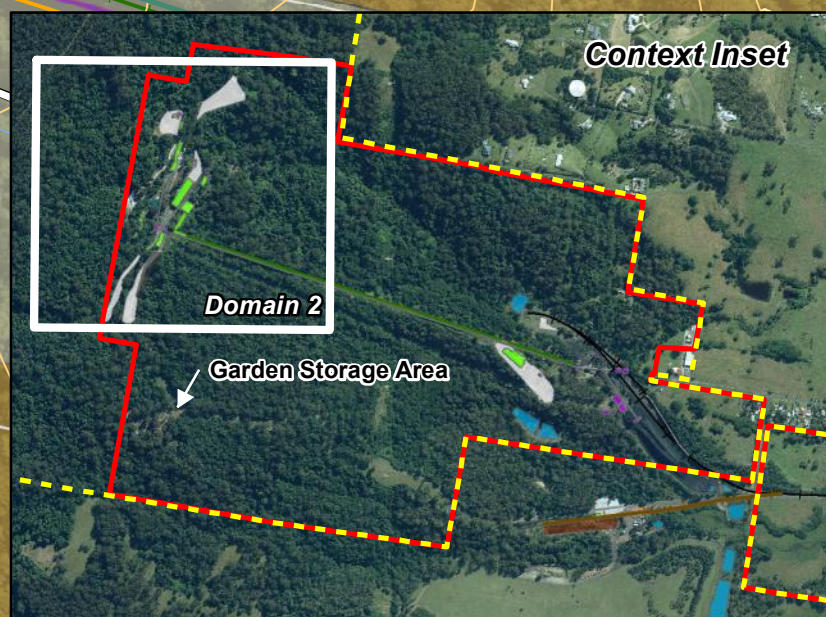
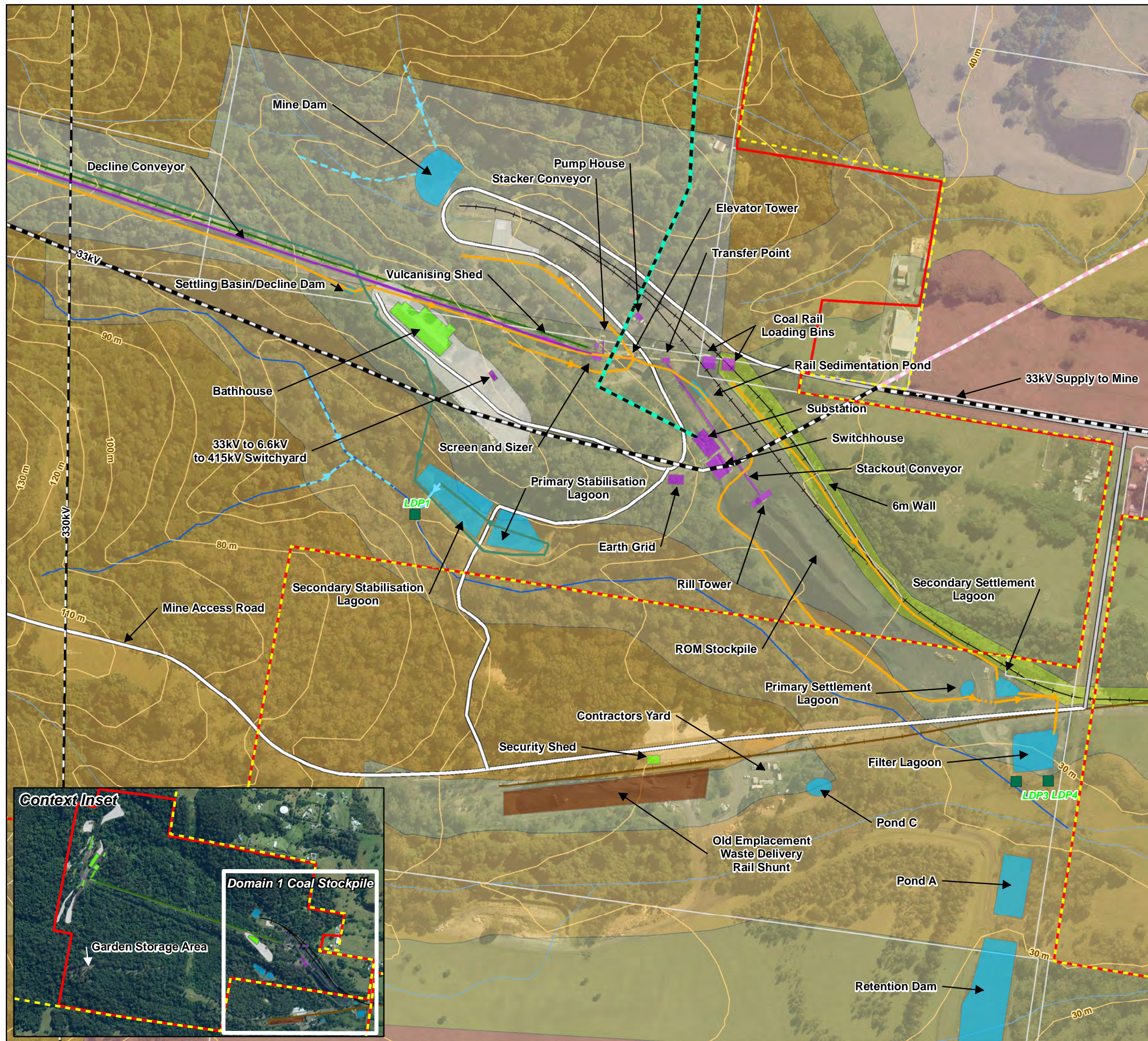




Figure 5 - Stockpile Area

WONGAWILLI LEASE AREA



- Surface Lease (Approx 141 ha)
- Licensed Discharge Points
- 10m Contours (LPI)
- Watercourses (LPI)
- Tributary to Robins Creek
- Shunt
- Conveyor
- Railway (LPI and WCL)
- Private Access Road
- Public Access Road/Fire Trail
- Cadastral (LPI, 2009)
- WCL Wongawilli Colliery Lease Holdings
- 330 kV Electricity Transmission Line (LPI)

Electricity Transmission Line 33kV

- Active (WCL Ownership)
- BHPBIC Owned
- Transitional

Drainage Channels

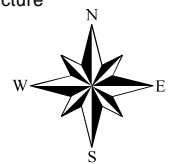
- Clean Water Drainage Channel
- Dirty Water Drainage Channel
- Grey Water Drainage Channel

Surface Facilities

- Emplacement
- Hardstand
- Industrial Building
- Miscellaneous Plant
- Water Collection and Treatment Ponds

Wollongong LEP 2009 & West Dapto 2010 (WCC)

- E2 Environmental Conservation
- E3 Environmental Management
- R2 Low Density Residential
- R5 Large Lot Residential
- RU1 Primary Production
- RU2 Rural Landscape
- SP2 Infrastructure



1:3,500 Scale at A3

Metres
0 50 100 150 200



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2011-11-29
Coordinate System: GDA 1994 MGA Zone 56
Project: 111067-04
Map: G1010_Domain1_CoalStockpile_Plan.mxd 06
Aerial imagery supplied by AAM 2011

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

1.2 Consents, Leases & Licences

During the reporting period, Wongawilli Colliery held approvals for a variety of activities. These approvals included mining leases and lease related approvals (MOP and SMP), complying development certificates, development consents, major project approvals, environmental protection licences and a variety of other approvals. These are outlined in **Table 1-1**. Additionally, a register of compliance is included in **Appendix D** as a guide.

Table 1-1 Consents, Leases & Licences relevant to mining activities at Wongawilli Colliery

Licence and/or Approval	Document Number	Issue Date	Expiry Date
Mining Lease (DRE)	ML 1596	03/02/2012	07/10/2029
Mining Lease (DRE)	ML 1565	02/08/06	09/10/15
Consolidated Coal Lease (DRE)	CCL 766	27/06/05	09/10/15
Mine Operations Plan - Interim (DRE)	MOP	01/03/2012	30/09/2015
Subsidence Management Plan (DRE)	SMP LW11,12,15,16,19 & 20 (Mod)	16/07/09	31/12/2017
Subsidence Management Plan (DRE)	Nebo Longwalls N1-N6	25/01/2013	31/01/2020
Project Approval – Nebo Area Project	MP 09_0161	02/11/11	31/12/15
Complying Development Certificate for 33kV power supply	CDC721/10	07/10/10	07/10/15
Complying Development Certificate for Temporary Stacker Conveyor (PCA)	CDC392/10	15/06/10	15/06/16
Complying Development Certificate for a ROM Coal Screening and Sizing Plant (PCA)	CDC272/09	26/02/10	NA
Project Approval for the Construction of a New Bath House and Office Extensions (DP&E)	MP 09_0030	24/02/10	NA
Environmental Protection Licence - WCL	EPL 1087	1 st October	02/11/2014

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Licence and/or Approval	Document Number	Issue Date	Expiry Date
Wongawilli Colliery (EPA)		(Anniversary Date)	(Review Date)
Environment Protection Licence WCL - Avondale Colliery (EPA)	EPL 12442	31 March (Anniversary Date)	31/03/2014
Radiation Control Licence/Registration (EPA)	RL35666	13/08/2011	13/08/2014
Radiation Control Licence/Registration (EPA)	RR8326	11/04/11	11/04/2013
Apparatus Licence (ACMA)	1149181	03/05/2012	03/05/2013
Apparatus Licence (ACMA)	1939618	02/05/2012	02/05/2013
Aboriginal Heritage Impact Permit	AHIP 1110772	28/01/10	28/01/15
Sydney Water Access Permit	ID1798	-	-
S138 Roads Act Approval (WCC)	Gate Across Jersey Farm Road	31/07/11	Revoked at Discretion
SCA Special Areas Access Mining Consent	D2009/03425	01/07/09	New Contract Being Developed
SCA Data License Agreement	1203	25/10/10	25/10/15
Surface Disturbance Notice (DRE)	06/3092	24/02/10	NA
Surface Disturbance Notice (DRE)	11/19 & 06/3052	05/01/11	NA
Part 5 Approval (SCA) – Wongawilli 1 Borehole Installation	D2009/04742	10/09/09	NA
Part 5 Approval (SCA)	D2009/05030	07/10/09	NA
Part 5 Approval (SCA) – Exploration Survey 1	D2009/06117	27/11/09	NA

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Licence and/or Approval	Document Number	Issue Date	Expiry Date
Part 5 Approval (SCA) – Exploration Survey 1, Additional Borehole Nebo 8A	D2010/00087	15/01/10	15/01/13
Part 5 Approval (SCA) – Swamp 24 and 46 Piezo Installation	D2010/00385	15/02/10	15/02/13
Part 5 Approval (SCA) – Exploration Survey 3	D2010/04572	23/12/10	23/12/13
Part 5 Approval (SCA) – Swamp 21A & 31 Piezo Installation	D2011/11456	09/05/11	09/05/14
Part 5 Approval (SCA) – Avon Water Quality monitoring	D2011/1059	09/05/11	At Completion of Monitoring
Part 5 Approval (SCA) – LW19 Subsidence Survey Line	D2011/13055	10/05/11	At Completion of LW19
Part 5 Approval (SCA) – Nebo Longwalls N1 to N6 Monitoring	D2013/18268	25/03/2013	31/03/2018
Water Licence	10BL602990	16/01/2013	16/01/2018

1.3 Mine Contacts

Table 1-2 Mine Contacts at Wongawilli Colliery

Contact	Position	Contact Details
Paul Coxhead	Manager of Mining Engineering	Ph: (02) 42629 338/ Mobile: 0425 383 596
Dave Clarkson	Group Environment Manager	Ph: (02) 4262 9301/ Mobile: 0458 059 564
Glen Hamilton	Mine Surveyor	Ph: (02) 4223 6898

1.4 Actions Required from Previous Annual Review / AEMR

Table 1-3 Actions Required from Previous Reporting Period

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Action Required	Section in Report
1. The 14 ha of rehabilitation referenced on the Rehabilitation Summary table and in Section 5.2 needs to be shown on an appropriate site plan. The current Figure 1.5 does not show any rehabilitation area at the Avondale site.	This will be addressed during next reporting period
2. Rehabilitation Plans need to clearly show, with appropriate labelling/legends; <ul style="list-style-type: none"> Landcover (cleared, forest, grass, other); and Rehabilitation status (undisturbed, previous rehabilitated, rehabilitated in AEMR period and to be rehabilitated in the next AEMR period). This needs to be consistent with Rehabilitation Summary Table. 	This will be addressed during next reporting period
3. The location of LDP7 needs to be shown and labelled on appropriate plan.	Figure 3
4. A much more detailed plan needs to be included for Avondale site.	Figure 6
5. The Rehabilitation Plans, or separate plans, needs to clearly differentiate clean and dirty water areas of the site, including catchment boundaries. Plans included in the 2012/2013 AEMR show the main drainage lines, not catchment areas and boundaries.	Figure 4 & Figure 5
6. Table should include disturbance areas associated with exploration sites.	Not Applicable during current reporting period because of no exploration program was undertaken during reporting period
7. It would also be preferable to include areas for individual sites (e.g. specify individual areas for the Wongawilli Site, Avondale site, shaft sites and exploration areas within the table).	This will be addressed during next reporting period

1.5 Distribution

This report has been prepared in consultation with, and copies will be distributed to:

- Department of Planning & Environment (DP&E);
- NSW Department of Trade and Investment, Division of Resources and Energy (DRE); and

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

- Other relevant agencies.

WCL will make this report publicly available on its website. A hard copy will also be kept at the Wongawilli Colliery, Jersey Farm Road, via Wongawilli Road, West Dapto, NSW 2530.

Any revisions undertaken will be the responsibility of WCL and any notifications will be sent accordingly. WCL will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on WCL's computer system, website, and hard copy at the Wongawilli Colliery, Jersey Farm Road, via Wongawilli Road, West Dapto, NSW 2530.

1.6 Document Content

This Annual Review report consists of the following sections:

- **Section 2** - describes the operations and undertakings during the reporting period;
- **Section 3** - provides an overview of the environmental performance of Wongawilli Colliery operations;
- **Section 4** - outlines the consultation associated with Wongawilli Colliery operations;
- **Section 5** - outlines the rehabilitation undertaken during the reporting period; and
- **Section 6** - provides an overview of the activities proposed during the next reporting period.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

2 OPERATIONS DURING REPORTING PERIOD

The Wongawilli Colliery currently operates under a project approval granted by the Planning Assessment Commission (PAC) under delegation on 02 November 2011 (MP 09_0161).

Attached in **Appendix A** is WCL's Environmental Policy which outline's the company's expectations of its employees with regard to sound environmental principles and the concept of sustainable development.

2.1 Exploration

No exploration program was undertaken during reporting period.

The exploration program currently being considered for the next reporting period includes:

- Drilling of one ground water monitoring borehole labelled GW03. The bore hole will be open holed to approximately 10m above the Bulli Seam and then fully cored to the base of the Tongarra Seam. The estimated total depth is about 370m with an eight (8) vibrating wire piezometers will be installed.
- Drilling of one exploration borehole labelled NWW21. The bore hole will be open holed to approximately 10m above the Bulli Seam and then fully cored to the base of the Tongarra Seam. The estimated total depth is about 370m with an eight (8) vibrating wire piezometers will be installed.

Approval has been received from SCA for these two boreholes.

2.2 Land Preparation

There were no new areas of land prepared for mining or mining related activities.

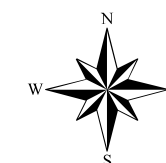


Figure 6

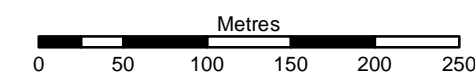
AVONDALE SITE

Legend

- Portal Entries
- ▭ Surface Lease (Approx 56.7 ha)
- ▭ WCL Wongawilli Colliery Lease Holdings
- 10m Contours (LPI)
- Access Roads
- Local Roads (LPI)
- Watercourses (LPI)
- Railway (LPI)
- ▭ Disturbance Areas
- ▭ Metropolitan Special Area (SCA)
- ▭ SCA Freehold Land (SCA)
- ▭ Cadastre (LPI, 2009)
- Previous Workings (Approx - ERM, EA)**
 - ▨ Tongarra Seam Workings
 - ▨ Wongawilli Seam Workings
- Wollongong LEP (2009)**
 - ▨ E2 - Environmental Conservation
 - ▨ E3 - Environmental Management
 - ▨ SP2R - Infrastructure (Road and Railway)



1:4,500 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2011-11-23
Coordinate System: GDA 1994 MGA Zone 56
Project: 111067-04
Map: G1012_Avondale_Plan.mxd 04

Aerial Imagery supplied by AAM 2011

2.3 Construction

During the reporting period no construction activities were undertaken.

2.4 Mining

Under the Approved Project, MP 09_0161, and subsequent SMP approval (No. 09/5341) for LWN1 to LWN6 in an area within ML 1596 known as Nebo Area, the mining undertaken during the reporting period is as follows:

- Development of LWN3 tailgate ; and
- Secondary extraction in LW N2 using longwall mining methods from 12 June 2013 to 26 February 2014. Mining of LW N2 was suspended due to a roof fall on the longwall miner.

The total run-of-mine (ROM) annual coal production for period ending June 2014, which includes development and secondary extraction, is outlined in **Table 2-1**.

Table 2-1 Wongawilli Colliery Annual ROM Coal Production During the Period

Year Ending	ROM Tonnes
June 2014	478,644

2.5 Mineral Processing

There was no coal preparation undertaken on site as all coal mined is exported as ROM.

2.6 Waste Management

Waste management is handled in most instances by licenced contractors. WCL Wongawilli has identified the need to better manage waste generated from site by investigating opportunities to integrate a Total Waste Management Plan. This is to ensure waste is tracked sufficiently and continues to be managed in accordance with regulatory requirements.

All rubbish from both the surface and underground operations is collected in large portable skips and removed regularly from site to a licensed waste disposal depot where opportunistic recycling of the appropriate materials are separated before other waste materials are disposed of to landfill. Licensed waste management contractors remove the general waste materials produced at Wongawilli Colliery site.

The use of waste management facilities is an expectation of all workers at the Colliery. General housekeeping for all areas of the Colliery is checked regularly during completion of the Environmental Sump Report inspection. Any housekeeping deficiencies are discussed

with the area supervisor and communication to the workforce completed using Toolbox Talks.

An oil/water separator unit is installed at the workshop wash-down bay. Oils and greases are stored in drums on bunded pallets and stored under cover.

Waste oil and oily water is collected from a waste oil tank and the oily water separator and, if necessary, site holding pits or sumps and removed from site by authorised oil recycling/disposal contractors.

No waste management activities occurred at the Avondale Colliery site during the reporting period.

Table 2-2 below provides the waste streams and approximate quantities generated at Wongawilli Colliery.

Table 2-2 Waste Streams designated at Wongawilli Colliery

Waste Stream	Volume/Weight	Treatment Facility
Timber	Nil	REMONDIS Australia Pty Ltd
Cardboard/Paper	0.48 tonnes	REMONDIS Australia Pty Ltd
Oily Water	5500 Litres	Transpacific Industries Group Ltd REMONDIS Australia Pty Ltd
Putrescible	197.25 tonnes	REMONDIS Australia Pty Ltd
Metal	Nil	Repro Pty Ltd
Sanitary Pan Waste	75000 Litres	REMONDIS Australia Pty Ltd Veolia Environmental Services

2.7 Ore & Product Stockpiles

Wongawilli Colliery has a single ROM coal stockpile area located at the base of the Illawarra escarpment. The site is approximately 300m long and 50m wide. The stockpile area occupies the southern-eastern section of the site and is bounded by an 8 metre high concrete noise barrier to the north, open pastureland to the south and east and to the west by the escarpment and the Wongawilli Colliery facilities. The stockpile area is shown on **Figure 5**.

ROM coal from the mine is transferred from the upper pit top on an overland conveyor belt down the decline corridor to the stockpile area. The decline conveyor delivers the coal to 2



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

x 2000 tonne rail loading bins, after passing through a screen and sizer facility that allows screening of coal to minus 50mm to meet the requirements for acceptance by PKCT.

When the coal bins are full, the incoming coal flow from the decline conveyor can be diverted on a stack-out conveyor to twin rill towers on the stockpile area, after passing through the screen and sizer facility. The rill towers provide a live temporary stockpile of 20,000 tonnes. If further on-ground coal storage is required the temporary stockpile can be extended using trucks and front-end loaders. The maximum holding capacity of the stockpile is 100,000 tonnes.

Coal stocks are managed on the stockpile with front-end loaders that build the pile and retrieve the coal for loading into rail wagons. The volume of stockpiled coal varies depending on mine production and the availability of trains to transport the product to the PKCT.

A private rail spur line from the Wongawilli Colliery stockpile area to the Illawarra Railway forms a transport link for coal supply to the PKCT. This transport route is shown in **Figure 7**.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Figure 7 - Coal Haulage Route from Wongawilli Colliery to PKCT



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

2.8 Water Management

The physical layout and detailed plans of the existing water management system at Wongawilli Colliery are shown in Drawing No's **WON-01-0605** and **WON-01-0606** included in **Appendix E**.

A Surface Water Management Plan was submitted to DP&E during the previous Annual Review reporting period. Revisions of this plan occurred during the current reporting period and were subsequently approved by DP&E. The Surface Water Management Plan was submitted to DRE as a MOP addendum by February 2014 to provide additional detail about site water management.

Water Supply and Use

There are three separate supplies of water for Wongawilli Colliery being potable water, raw water from the upper Cordeaux No.1 Reservoir, and groundwater. Potable water is supplied for office and bathhouse facilities.

Untreated fresh water direct from the upper Cordeaux No. 1 Reservoir also enters the mine via the No. 3 ventilation shaft. This supply is retained as a backup to the underground water supply for emergency fire fighting.

Wongawilli Colliery is generally considered a "wet" mine as it needs to be routinely de-watered. Ground water accumulates in the underground workings and is reticulated throughout the mine to provide water for mining operations (dust suppression) and for charging the fire fighting services. Extraction of LW19 resulted in restricted access to key storages of the underground reticulation system. Due to the restricted access to water underground, de-watering was stopped on 28th May 2011 to increase water availability underground.

The mine water is moderately alkaline and the dissolved solids content is predominantly in the form of sodium bicarbonate. This is characteristic of the groundwater quality seeping into the underground mines in the Illawarra. Wongawilli Colliery mine water quality is not expected to vary significantly because the water quality is primarily determined by the hydrogeology of the region rather than the activities of the mine.

Surface Water Management

A system of cut-off drains are established up-slope of the mine site facilities to capture stormwater run-off and divert it away from the operational areas of the mine site and into local watercourses. The clean water drains are generally open channels that are grassed or concrete lined. The system carries the water from the mine site to discharge through areas of bushland and via unnamed watercourse into tributaries of Robins Creek.

Dirty water drainage systems are provided on the mine site where the potential exists for run-off water to be contaminated by surface operations. Operations that normally contribute to contaminated water run-off include coal handling and stockpiling, rail loading, workshops,

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

store yard areas and associated operational roads etc. The drainage systems have been constructed to minimise erosional impacts. The control measures in place include grass or concrete lining of open drains and concrete sub-surface pipes and pits.

The dirty water drainage system at Wongawilli Colliery mine site includes a number of settling ponds and sumps to capture sediment and provide retention of dirty water to allow bioremediation. Each pond or sump is provided with access for the removal of silt by mobile equipment. The sumps are located toward the bottom of the decline corridor, at the foot of the transport decline east of the elevator building, adjacent to the coal storage bins and southeast of the ROM coal stockpile. Cleaning of these ponds and sumps is periodically undertaken to maintain the efficiency of the water treatment facilities.

Runoff from the conveyor decline flows down the slope in an open unlined channel and into a large settling and sediment retention basin located near the bottom of the decline. This water then flows into further settling basins located on the northern side of the stockpile area.

Dirty water runoff from the Stockpile area and the settling basin on the northern side of the stockpile enters two filter fabric lined gabion wall sediment ponds in series and a sand bed Filter Lagoon. 'Overflow' from the lagoon may enter Robins Creek according to licence conditions.

The levels of pH and TSS in the 'underflow' discharge have on occasion in the past exceeded EPA guidelines during heavy rain events. Due to these elevated levels, the underflow point is permanently closed and is not used. The underflow from the Filter Lagoon is an EPA Licensed Discharge. There have been no discharges during this reporting period as the underflow point has not been used.

Once the water level in this lagoon is greater than 30% it is transferred to adjacent ponds in the emplacement area where further treatment can occur, which may then be used for spray irrigation and/or dust suppression.

An estimate of the volume of clean and dirty water stored on site at the end of the reporting period is provided in **Table 2-4**.

Sewage Treatment / Disposal

Greywater from sinks and showers on the upper pit top is discharged to the Primary Stabilisation lagoon. Once full the Primary Stabilisation lagoon overflows into the Secondary Stabilisation Lagoon. Discharge from the Secondary Stabilisation Lagoons is via Licenced Discharge Point No. 1 (LDP1) which is established under EPL No. 1087. There was no flow through the discharge point during the reporting period.

Blackwater from toilets and urinals on the upper pit top is directed to two septic tanks which are regularly pumped out by licensed contractors. Toilet pans from the underground workings are collected routinely and removed from site by a licenced contractor for disposal

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

at an approved facility. The contractor's area toilet is managed by the current waste contractor.

An Integrated Wastewater Management Plan (IWMP) was required as part of MP 09-0030 for the construction of the new Bath House. An IWMP was completed and submitted to EPA and DP&E during October 2010 and was approved by DP&E in November 2012. A tank is temporarily used for the capture and storage of blackwater from the Bath Houses until actions from the IWMP can be implemented.

Due to encroaching residential development around the Colliery, the IWMP may need to be amended; as sewerage services will be located at close proximity to the Colliery within the next two years. Connecting to sewerage will provide a better solution for sewage disposal from the Colliery.

Groundwater Management

Groundwater is collected in pits/sumps underground and is recycled/transferred underground as much as possible. This water is primarily used for dust suppression at the operating coal face, transport roadways and conveyor systems.

Groundwater inflow to the mine creates issues for the coal face during mining and causes mine roadway deterioration. Added to this, are the problems arising from over wetted coal being transported by conveyor systems through the mine to the surface stockpile/coal bins.

The groundwater inflow to the mine is approximately 50 to 60 L/second during normal conditions with increases to approximately 120 L/second during prolonged periods of substantial regional rainfall. Mine de-watering occurs at an average rate of approximately 4.5 ML/day. Water demands underground at the completion of mining in LW19 resulted in the cessation of mine de-watering in May 2011. Between 19-30 June 2014 a total of 486kL of water was discharged from LDP2 to clear an underground transport road that had become temporarily blocked by water build-up

Groundwater that is discharged from the mine is pumped to the surface and flows into the Mine Dam via EPA Licensed Discharge Point No.2 (LDP2). The overflow discharges to natural watercourses. There was no discharge from LDP2 between 28 May 2011 and 19 June 2014. EPA Licence Discharge Point No.7 at Forest 11 (LDP7) is another point from which excess groundwater may be discharged. This however is only used in times of very high flow with no discharges occurring during this reporting period.

The water from the Mine Dam is used extensively for dust suppression in the Stockpile area.

Wongawilli Colliery has five licensed discharge points under Section 55 of the Protection of the Environment Operations Act 1997. They are:

- LDP1 – Secondary Stabilisation Lagoon (bathhouse water);
- LDP2 – Underground mine water discharge from Wongawilli Colliery;
- LDP3 – Underflow from stockpile sand Filter Lagoon;



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

LDP4 – Overflow from the stockpile sand Filter Lagoon; and
LDP7 – Underground mine water discharge at Forrest 11 portal (N6 and N7).

These points are marked on Drawing No's **WON-01-0605** and **WON-01-0606** included in **Appendix E**. The location of the Forest 11 portal (LDP7) is shown on **Figure 3**.

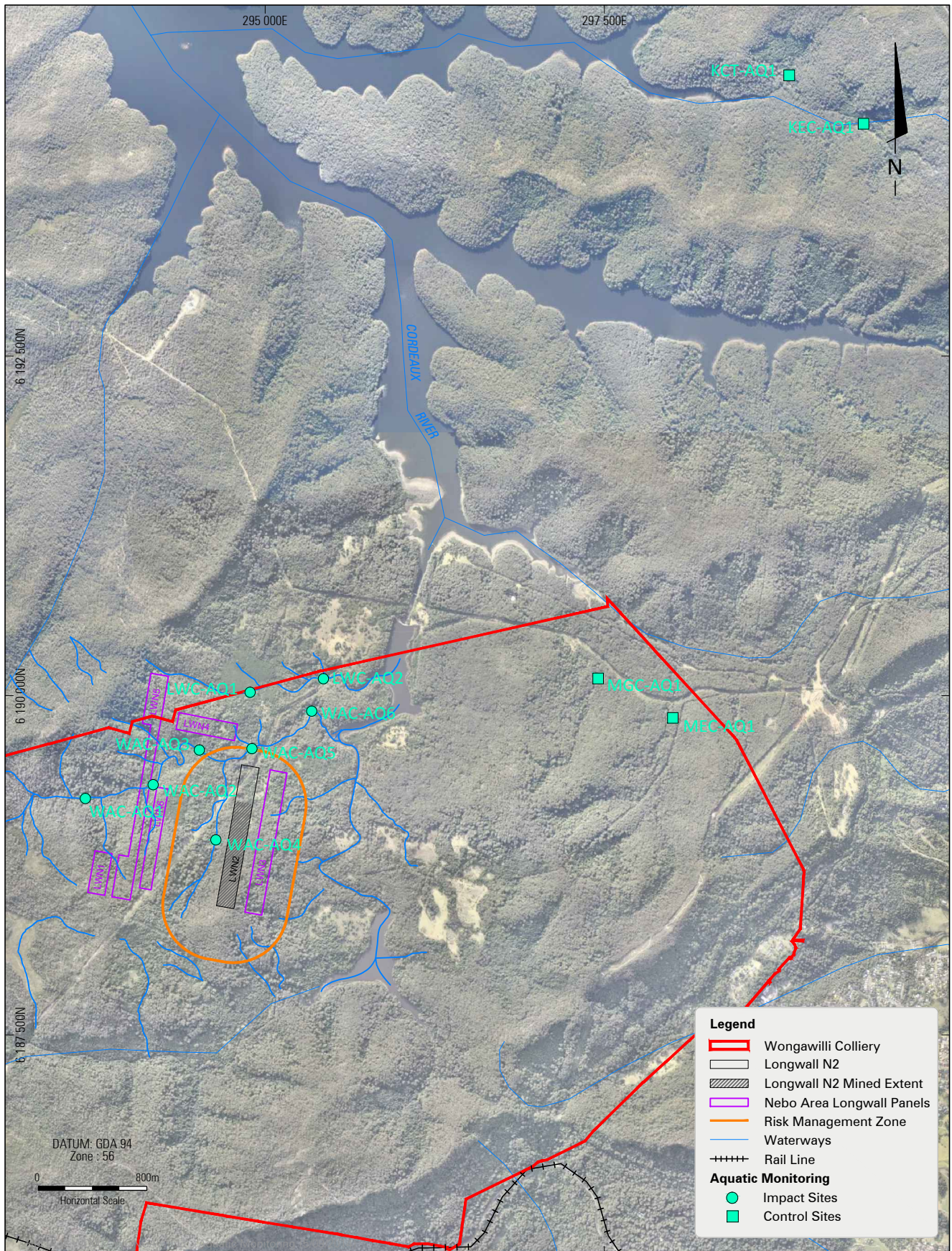


Table 2-3 Wongawilli Colliery Stored Water

	Volumes Held (ML)		
	Start of Reporting Period	At End of Reporting Period	Storage capacity
Secondary Sediment Pond	1.2	0.5	1.2
Filter Lagoon	2.0	2.0	5.8
Pond C	0.5	0.5	2.2
Retention Dam	29.2	29.2	29.2
Pond A	3.2	3.2	3.2
Mine Dam	3.1	3.1	3.1
Primary Stabilisation Lagoon	3.2	0	3.2
Secondary Stabilisation Lagoon	3.4	0	3.4

Note: Storages that make up a relatively small contribution to onsite stored water volumes of less than 1 ML have not been included. This includes the Decline Dam, Surcharge Dam, Rail Sedimentation Pond and Primary Sediment Pond.

2.9 Hazardous Material Management

Fuels

Diesel fuel is brought to site by fuel tankers. Wongawilli Colliery uses low emission fuels with sulphur content less than 0.02%. The fuel is stored on site in a 25,000 L tank. This tank is situated under a roof and is bunded adequately, with fire-fighting facilities in close proximity. Fuel is pumped from this main storage tank into smaller transportable containment vessels for use underground. Diesel fuel consumption during this reporting period was approximately 193,419 Litres. See **Figure 4** for location details of the bulk liquid chemical storages.

Substance/Chemicals

Wongawilli Colliery maintains a register of Material Safety Data Sheets (MSDS) for all chemicals used on site. The Safety and Training Department oversees the register system and hard copy MSDS's are kept in the Control Office. A database system known as 'Chem Watch' is used to provide the most current versions of documents and records are available for inspection on request.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Explosives

An explosives magazine is located at the Pit Top area of the Colliery. The explosive magazine utilises a sealed disused portal entrance and is used to safely store explosive products required for use underground. A Dangerous Goods Notification and an application for a License to Store Explosives have been submitted to WorkCover NSW.

Other

The dangerous goods kept at Wongawilli Colliery include compressed gases, flammable and combustible liquids, poisonous substances and corrosive substances, none of which exceed the acceptable holding limits.

2.10 Other Infrastructure Management

Coal Stockpile and Rail Corridor

Management of the coal stockpile facilities and the rail corridor includes vegetation, dust and water management. See **Figure 5** for the location of the stockpile and rail loading facilities and the rail line location.

During the reporting period Wongawilli Colliery used contractor Macmahon Holdings as the Rail Infrastructure Manager (RIM) as they possess the appropriate qualifications and expertise to assist in the management of the rail line in both the stockpile and rail corridor areas. A new contract was required for the RIM and MP Rail will be the new RIM during the next reporting period.

Bitz Excavations are employed to manage the stockpile and undertake the train loading from the stockpile area and rail bins.

Wongawilli Colliery is heavily involved in undertaking risk assessments and the provision of training and awareness of personnel responsible for stockpile operations. Areas addressed in training and awareness include water and dust management, transport management and slope stability management.

A successful trial involving the dosing of coal with a dust suppressant is continuing. A dosing unit is connected to the decline conveyor belt positioned at the entry to the new screener and sizer facility at the coal stockpile area. An ultrasonic sensor detects coal running on the belt and diluted dust suppressant is sprayed onto the coal using nozzles operated by compressed air. This system dramatically increases the volume of stockpiled coal exposed to dust suppressant, as opposed to a surface crust that forms when coal is treated post stockpiling. The trial commenced in February 2011 and continued during the review period.

3 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

3.1 Air Pollution

Environmental Management

Wongawilli Colliery Pit Top

The current air pollution management procedures have proven to be adequate.

Dust control measures applied to surface activities include:

- use of the stockpile and stacker conveyor water sprays system. This facility can be automatically activated according to preset wind speed and direction controls;
- minimising coal stockpile size by matching the shipping schedule to production as closely as reasonably possible;
- regular use of a road surface sweeper particularly around the pit top area;
- regular use of a water truck to wet down operational areas of the mine; and
- dosing of coal on conveyor with dust suppressant prior to stockpiling.

An Air Quality and Greenhouse Gas Management Plan was developed during the previous reporting period as a requirement of the MP 09_0161 approval. The Plan contains management plans, commitments and actions for the control of dust impacts from the Colliery. Revisions of this plan occurred during the current reporting period by the Colliery which was subsequently approved by DP&E.

During the previous reporting period, the Colliery was issued with a Pollution Reduction Program (PRP) from the EPA. PRP9: Coal Mine Particulate Matter Control Best Practice required the Colliery to investigate the most practicable means to reduce particle emissions. This determination and report was completed and submitted to the EPA during the previous reporting period. No feedback regarding the report has been received by the Colliery.

The report identified that the top four particulate generating activities at the Wongawilli Colliery are;

- Bulldozing coal on the stockpile;
- Material transfer of coal via conveyors;
- Loading trains from the coal stockpile; and
- Wind erosion on the coal stockpile.

Best practice control measures were identified for each of the top four particulate emission generating activities and the practicality of implementation assessed, along with a costing exercise undertaken.

At the Wongawilli Colliery there are best practice control measures in place for all of the top four particulate emission generating activities. All applicable best practice control measures

are utilised at the Colliery for the top two ranked activities. For the remaining two particulate emission generating activities, it was assessed that one additional best practice control measure may be applicable to the operation and an investigation into its use should occur.

Avondale Pit Top

The current air pollution management procedures have proven to be adequate.

There are no activities at the Avondale Pit Top to generate air pollution.

SMP and Catchment Lease Areas

The current air pollution management procedures have proven to be adequate.

The only activities in the catchment that could create dust are related to exploration drilling, Subsidence Management Plan (SMP) inspections and the operation of ventilation shafts. The impacts from these activities are:

- exhaust air from the ventilation shafts;
- particulate emissions from motor vehicles and other fuel powered machinery; and
- dust from drilling activities.

The REFs prepared for exploration boreholes make undertakings that all vehicles used in the catchment will meet the emission requirements for registered vehicles, vehicles and machinery would be shut off when not in use, and dust impacts would be minimised by wetting down tracks where appropriate.

Environmental Performance

Wongawilli Colliery Pit Top

Monitoring results for dust deposition, as shown in **Table 3-1**, indicate compliance with EPA's dust deposition requirements according to Environment Protection Licence (EPL) 1087 (**Appendix B**) and Annual Averaging Period criteria (4 g/m²/month) stated in MP 09_0161 approval Condition 11/Schedule 4. There were incremental increases in Insoluble Solids concentrations recorded for EPL Monitoring Points 9, 10, 11 and 13 during the reporting period. These incremental increases were mainly due to insects, dirt and polysaccharide slime which were confirmed during visual analysis of the deposited dust. The sampling period for dust is 30 ± 2 days and the first day starts at the beginning of the month. Analysis is conducted by ALS Laboratory Group in Newcastle.

Table 3-1 Wongawilli Colliery Dust Monitoring Results

EPL Monitoring Point	Analyte	Min (g/m ² /month)	Annualised Average (g/m ² /month)	Max (g/m ² /month)	Annualised Yearly Average (EPA Guideline, g/m ² /month)
9	Ash	0.1	1.0	8.4	4

EPL Monitoring Point	Analyte	Min (g/m ² /mont h)	Annualised Average (g/m ² /mont h)	Max (g/m ² /mont h)	Annualised Yearly Average (EPA Guideline, g/m ² /month)
10	Combustible Matter	0.1	0.5	1.6	4
	Insoluble Solids	0.2	1.4	10.0	
	Ash	0.1	0.4	0.8	
	Combustible Matter	0.3	1.0	5.2	
11	Insoluble Solids	0.4	1.3	6.0	4
	Ash	0.2	1.0	4.3	
	Combustible Matter	0.2	1.5	7.7	
	Insoluble Solids	0.4	2.5	12.	
12	Ash	0.1	0.6	1.5	4
	Combustible Matter	0.1	0.6	1.8	
	Insoluble Solids	0.1	1.2	3.3	
	Ash	0.2	0.5	1.0	
13	Combustible Matter	0.1	0.8	3.7	4
	Insoluble Solids	0.2	1.2	4.5	
	Ash	0.2	0.5	1.0	

Avondale Pit Top

There is no air pollution monitoring conducted at Avondale Pit Top

SMP and Catchment Lease Areas

There is no pollution monitoring conducted in the SMP or catchment. Activities were undertaken as outlined in the REF's.

3.2 Erosion & Sediment

Environmental Management

Wongawilli Colliery Pit Top

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

The current erosion and sediment management procedures have proven to be adequate.

Permanent erosion and sediment control measures involve the use of a number of settlement structures as outlined in **Section 2.8**. These include some smaller concrete lined sumps that are cleaned out as required with the frequency depending largely on rainfall runoff. There are three larger earthen dams in and to the north of the coal stockpile area. A front end loader is used to remove material from these dams following rain. The material removed from these dams is coal and is returned to the main stockpile area for drying and subsequent incorporation into the product for sale.

The outer section of the Timber Yard materials storage area embankment failed during the 2010-2011 reporting period. Options for the future use of this area are still being considered, with no remediation work completed to date. The boundary of the failed area and the materials storage area remains delineated.

The retaining wall located adjacent to the NW Mains Access Rd also failed during 2011 as a result of poor drainage and the growth of two large trees that have placed pressure against the wall. A detailed design was completed for the replacement of the existing failed retaining wall. As yet, no repair work has commenced. The retaining wall was regularly monitored during the reporting period to identify any further movement.

Avondale Pit Top

The current erosion and sediment management procedures have proven to be adequate.

A small sink hole has developed at the portal bench at the Avondale Pit Top. DRE required this to be filled to prevent it from becoming a public safety hazard. The sink hole has been filled.

SMP and Catchment Lease Areas

The current erosion and sediment management procedures have proven to be adequate. As part of SMP monitoring Wongawilli Colliery conducts regular inspections for impacts above active and completed longwall extraction areas that may have been affected by mine subsidence. Areas inspected that may experience soil erosion due to mine subsidence are generally restricted to rock outcrops, steep slopes and cliff lines, unpaved roads or tracks, creeks or streams and general soil cracking. These areas are checked fortnightly as part of the visual inspection monitoring program during the extraction of each longwall.

The exploration program REF's identified the following potential erosion and sediment risks:

- Disturbance to rock outcrops due to vehicle movements, access track clearance and borehole site preparation;
- Soil disturbance and compaction as a result of vehicle movements;
- Erosion and sedimentation and a result of vegetation clearance along borehole access tracks and borehole site preparation; and
- Alteration or disturbance of water courses due to access track crossings and associated vehicle movements.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

The following general sediment controls were implemented during the drilling activities in the past:

- Chose drill site to be as flat as possible;
- Minimised the disturbance footprint at drilling sites;
- Clean water run-off was diverted around the drill sites using bunds or catch-drains;
- Directing drilling process water to temporary two metre deep retention sumps;
- Use of filtration materials such as sediment fence to stop fine silt where necessary; and
- Within two weeks of completion of drilling the site was rehabilitated in accordance with SCA requirements.

Environmental Performance

Wongawilli Colliery Pit Top

The EPA license requires the water level in the Filter Lagoon to be maintained below 33% by dewatering (see **Section 2.8**). The system is regularly inspected and the water level reduced where necessary to comply with this requirement.

Avondale Pit Top

There are no disturbed areas and as such there have been no issues with erosion and sediment control at Avondale Pit Top.

SMP and Catchment Lease Areas

There has been no soil erosion incidents observed during the extraction of LWN2 in the reporting period.

3.3 Surface Water Pollution

Environmental Management

Wongawilli Colliery Pit Top

The current surface water pollution management procedures have proven to be adequate. Under EPL 1089 surface water is analysed at LDP1 and LDP3 only when treated water is being discharged. These sampling points are shown on Drawing No **WON-01-0606**. Due to the dry conditions and the management practices adopted for these areas, discharge has not occurred from LDP1 or LDP3 during this period. Some housekeeping measures here include twice weekly visual inspections of ponds, sumps, dams and dirty water transfer systems and monthly services of pumps.

Mine water discharge at LDP2 is monitored monthly when de-watering occurs. There was no discharge from LDP2 from period July 2013 to May 2014 due to use of water underground. The location of LDP2 is shown on Drawing No **WON-01-0605**.

Under EPL 1087, surface water is analysed at Licence Discharge Point (LDP) 2 following treatment and monitoring is required for pH, total suspended solids and Oil and Grease, which is summarised in **Table 3-2**.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Table 3-2 Licence Discharge Point 2 (June 2014)

Pollutant	Unit of Measure	Min
Oil and Grease	mg/L	<5
pH	pH	7.9
Total Suspended Solids	mg/L	76*

* Sample was not representative. The pump out line was not active since May 2011

A Surface Water Management Plan was developed during the previous reporting period as a requirement of the MP 09_0161 approval. The Plan contains management plans, commitments and actions for the control of surface water impacts from the Colliery. Revisions of this plan occurred during the reporting period by the Colliery which was subsequently approved by DP&E. The Surface Water Management Plan was submitted to DRE as a MOP addendum by February 2014 to provide additional detail about site water management.

Avondale Pit Top

The current surface water pollution management procedures have proven to be adequate.

There is one licenced discharge point, LDP1, identified in EPL 12442. There is no requirement in the licence to monitor this discharge point.

SMP and Catchment Lease Areas

The current surface water pollution management procedures have proven to be adequate.

Surface water quality monitoring is undertaken in the LW11-20 area to determine the impacts on surface water quality from previous mining. Surface water quality monitoring is also conducted in the current Nebo LW1-6 extraction area, along with baseline monitoring in the proposed future Wonga South extraction area. During the reporting period secondary extraction of LW N2 was undertaken from 12 June 2013 to 26 February 2014.

There were no creeks directly impacted by subsidence from the extraction of LW N2 during the reporting period. See **Figure 9** for information on watercourses in the Nebo extraction area.

During the extraction of LW N2 in the reporting period, surface water quality monitoring was undertaken for creeks in the extraction area as follows:

- Monthly field water quality and flow as well as 2-monthly laboratory water quality analysis for the duration of the longwall extraction;



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Environmental Performance

Wongawilli Colliery Pit Top

There has been no surface water pollution incidents observed at Wongawilli Colliery operational site during the reporting period.

Avondale Pit Top

There has been no surface water pollution incidents observed at Avondale Pit top during the reporting period.

Mining and/or Catchment Lease Areas

There has been no recorded negative impact on surface water quality during the extraction of LW N2 in the reporting period. See **Appendix C** for further details.

3.4 Ground Water Pollution

Environmental Management

Wongawilli Colliery Pit Top

The current ground water pollution management procedures have proven to be adequate.

An assessment of potential site contamination has been undertaken in the past at Wongawilli Colliery. Douglas Partners completed the assessment in 2005 and comprised 22 test pit sites at various locations at the Colliery. Results for ground water analysis showed that Organics, Pesticides and PCB levels were below detection limits levels. Lead and nickel concentrations were found to exceed GQC limits.

The report recommends further investigations and the development of a Remediation Action Plan prior to rehabilitation work at the end of mine life.

Avondale Pit Top

The current ground water pollution management procedures have proven to be adequate.

SMP and Catchment Lease Areas

The current ground water pollution management procedures have proven to be adequate.

Ground Water monitoring is undertaken in SMP and catchment lease areas of Wongawilli Colliery, as shown in **Figure 9**, on a regular basis and in accordance with SMP and EP approval requirements.

Environmental Performance

Wongawilli Colliery Pit Top

There has been no monitoring of groundwater impacts at Wongawilli Colliery operational site during the reporting period.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Avondale Pit Top

There has been no monitoring of groundwater impacts at Avondale Pit Top during the reporting period.

SMP and Catchment Lease Areas

Monitoring of groundwater within SMP area has identified no impacts as result of the extraction of LW N2 in the reporting period. See **Appendix C** for further details.

3.5 Contaminated and/or Polluted Land

Environmental Management

Wongawilli Colliery Pit Top

The current contaminated polluted land management procedures have proven to be adequate. An assessment of potential site contamination has been undertaken in the past at Wongawilli Colliery. Douglas Partners completed the assessment in 2005 and comprised 22 test pit sites at various locations at the Colliery.

Results for soil analysis showed that PAH, Pesticides and PCB levels were below HIL threshold levels and that no asbestos was detected. Arsenic, copper and zinc levels exceeded PIL guidelines but were under HIL threshold levels.

The report recommends further investigations and the development of a Remediation Action Plan prior to rehabilitation work at the end of mine life.

Avondale Pit Top

There are no potential contaminating substances stored at Avondale Pit Top.

SMP and Catchment Lease Areas

The only activities involving materials that could potentially contaminate land are:

- the transport to the No.4 Shaft site of minor quantities of:
 - diesel (200L) for the backup power generator should the electrical power supply cease working;
 - cleaning chemicals (20L) for cleaning of ventilation shaft buildings and machinery; and
 - herbicide (20L).
- diesel in vehicles accessing the ventilation shaft sites.

The diesel and cleaning chemicals are stored inside the ventilation shaft buildings. The herbicide is used to keep vegetation within the compound to a manageable level to reduce fire risk (**see Section 3.15**).

The only activities associated with the SMP areas involving materials that could potentially contaminate land are diesel fuel in vehicles accessing the SMP monitoring sites.



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

The exploration program REF's and ER identified the following potential contaminated polluted land risk:

- Pollution of soils and waterways as a result of oil and fuel spillages from vehicles and machines.

The following general sediment controls were implemented during the drilling activities:

- Provision of spill kits with sufficient capacity to capture any minor spills of diesel

Environmental Performance

Wongawilli Colliery Pit Top

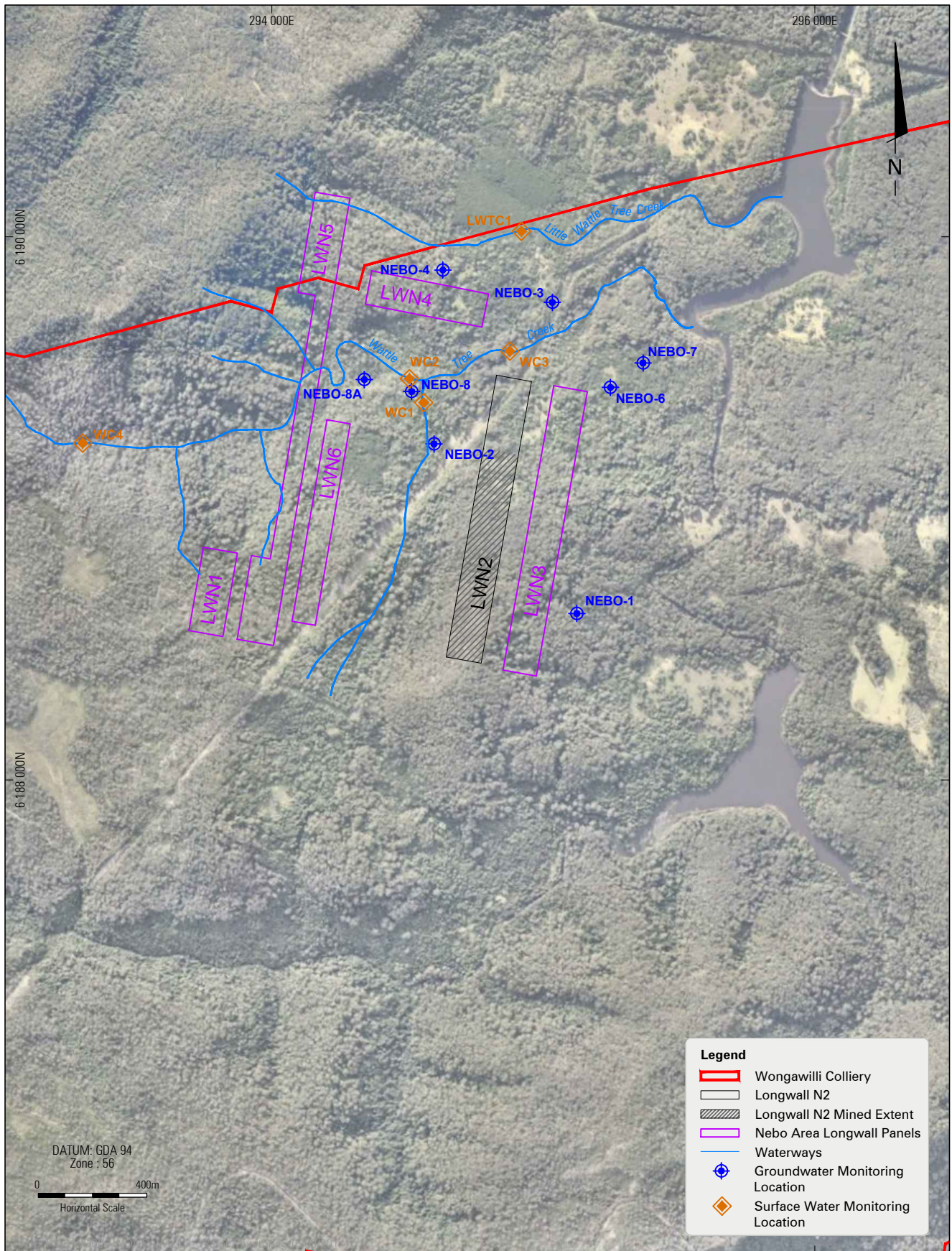
All potential contaminating substances are stored in bunded areas to prevent leakage or spills from contaminating soil.

Avondale Pit Top

There has been no activity at the Pit Top nor are there potentially contaminating substances stored at the site.

SMP and Catchment Lease Areas

No incidents of land pollution or contamination were reported during the reporting period.



WONGAWILLI COLLIERY

Water Monitoring

FIGURE 9

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

3.6 Threatened Flora

Environmental Management

Wongawilli Colliery Pit Top

The current threatened flora management procedures have proven to be adequate. Ongoing operations in historically disturbed areas of the pit top site have no potential effects on threatened aquatic or terrestrial vegetation as none have been identified close to these areas.

Over the entire history of its operation, the majority of the Wongawilli pit top area has been disturbed to some degree or another, resulting in large areas of native vegetation regrowth interspersed with introduced tree and weed species. For all construction activities that involved potential impacts on vegetation, an REF is undertaken. The outcome of the REF process is that no areas on site that contain endangered aquatic or terrestrial species or communities are disturbed in construction processes.

In accordance with conditions of its mining lease, and under advice from experienced vegetation management consultants and written advice from DRE, Wongawilli Colliery undertakes pit top vegetation management in following manner as required:

- Removal of dead, dying or dangerous trees;
- Removal of dangerous limbs from trees;
- Removal of regrowth trees that are beginning to pose a risk to machinery, buildings or other operational areas such as pipelines, dams, stockpiles etc;
- Removal of weeds and non-native groundcovers, bushes and trees;
- Removal of vegetation authorized as a result of an DRE Pt 5 assessment or other regulatory approval (e.g. DA, MOP, Pt 3A, Complying Development, Tree Preservation Order, Native Vegetation Act etc);
- Approved bushfire management clearing; and
- Removal of vegetation beneath powerlines in accordance with guidelines for safe distances.

A Biodiversity Management Plan was developed during the previous reporting period as required by the MP 09_0161 approval. The Plan contains management plans, commitments and actions for the management of flora at the Colliery. The Plan was submitted and approved by DP&E during the previous reporting period.

Avondale Pit Top

The current threatened flora management procedures have proven to be adequate. There has been no vegetation disturbance at the site.

SMP and Catchment Lease Areas

Vegetation clearing around the firebreaks at the shaft sites involves management of regrowth areas only and doesn't impact on threatened species. An REF for approval to

conduct ongoing vegetation management around Wongawilli Colliery infrastructure in the Catchment Lease Area remains in place with the SCA.

Areas potentially affected by mine subsidence associated with the extraction of LW15 and LW N2 were assessed for threatened flora in previous reporting periods and are being monitoring to determine if there are any impacts from subsidence. This work was established as part of the baseline studies needed for preparation of the SMPs for the extraction of the LW11-20 and Nebo N1-N6 longwalls. Continuing monitoring of these areas took place during the reporting period. The monitoring program involves monitoring at the sites in Nebo Area shown on **Figure 10**. The monitoring schedule for LW 11-20 and Nebo N1-N6 is as follows:

- Once prior to mining;
- 6-monthly monitoring of flora during mining;
- Aquatic ecology monitoring in accordance with surface water quality monitoring (see **Section 3.3**); and
- Annual monitoring of flora for 1 year once extraction has been completed.

The SMP approval for LW11-20 and Nebo N1-N6 also requires regular reporting to DRE (four monthly intervals during extraction), incident reporting as required, as well as an End of Panel report when each individual longwall is completed.

Environmental Performance

Wongawilli Colliery Pit Top

All construction and operational activities were assessed for impacts on threatened flora species and have been implemented in accordance with approvals. No impacts on threatened flora have occurred in the reporting period.

Avondale Pit Top

There has been no activity at the pit top and thus no impacts on threatened vegetation communities.

SMP and Catchment Lease Areas

There has been no impact to threatened flora species at the ventilation shaft sites.

There has been no observed impact on threatened flora during the extraction of LW N2 in the reporting period. See **Appendix C** for further details.

3.7 Threatened Fauna

Environmental Management

Wongawilli Colliery Pit Top

The current threatened fauna management procedures have proven to be adequate. Ongoing operations in historically disturbed areas of the site have no potential effects on threatened fauna habitat as none have been identified close to these areas.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Over the entire history of its operation, the majority of the Wongawilli pit top area has been disturbed to some degree or another. This has resulted in the degradation of key habitat for many native fauna species due to the large areas of poor habitat value native vegetation regrowth interspersed with high levels of introduced and weed species. For all the construction activities that involved potential impacts on habitat a full REF is undertaken and construction environment management plan developed.

During the review period, an ecological deer culling program ceased as a result of a NSW government restructure which prevented the NSW Games Council from continuing its assistance. The purpose of the program was to reduce the population of deer species at the Colliery. Areas of deer activity were assessed; with control sites in areas of Endangered Ecological Communities (EEC) established that will be monitored for the duration of the program to assess any improvement of EEC due to a reduction in deer population at the Colliery. WCL is currently investigating methods to re-establish a deer control program. This program will continue into the 2013-2014 review period.

A Biodiversity Management Plan was developed during the previous reporting period as required by the MP 09_0161. The Plan contains management plans, commitments and actions for the management of flora at the Colliery. The Plan was submitted and approved by DP&E during the previous reporting period.

Avondale Pit Top

The current threatened fauna management procedures have proven to be adequate. There has been no site activity and hence no impact on threatened fauna.

SMP and Catchment Lease Areas

The current threatened fauna management procedures have proven to be adequate.

There has been no activity that could impact threatened fauna species at the ventilation shaft sites.

Areas potentially affected by mine subsidence associated with the extraction of LW15 and LW N2 were assessed for threatened fauna in previous reporting periods and are being monitoring to determine if there are any impacts from subsidence. This work was established as part of the baseline studies needed for preparation of the SMPs for the extraction of the LW11-20 and Nebo N1-N6 longwalls. Continuing monitoring of these areas took place during the reporting period. The monitoring program is in place involving monitoring at the sites in Nebo Area shown on **Figure 8**. The monitoring schedule for LW 11-20 and Nebo N1-N6 is as follows:

- Once prior to mining;
- 6-monthly monitoring of fauna during mining;
- Aquatic fauna monitoring in accordance with surface water quality monitoring (see **Section 3.3**); and
- Annual monitoring of fauna for 1 year once extraction has been completed.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

The SMP approval for LW11-20 and Nebo N1-N6 also requires regular reporting to DRE (four monthly intervals during extraction), incident reporting as required, as well as an End of Panel report when each individual longwall is completed.

Environmental Performance

Wongawilli Colliery Pit Top

All activities have been assessed for fauna and habitat impacts and have been implemented in accordance with approvals.

SMP and Catchment Lease Areas

There were no observations of dead or injured fauna at the ventilation shaft sites.

There has been no observed impact on any habitat or threatened fauna during the extraction of LW N2 in the reporting period. See **Appendix C** for further details.

3.8 Weeds

Environmental Management

Wongawilli Colliery Pit Top

The current weed management procedures have proven to be adequate. The noxious weeds that have been identified at Wongawilli Colliery are Blackberry and Giant Parramatta Grass and they require periodic control.

Avondale Pit Top

No weed control activities occurred during the reporting period

SMP and Catchment Lease Areas

There are no weed related issues associated with SMP and catchment lease areas. The rehabilitation measures to restore disturbed sites are used to prevent weed establishment.

Regular weed management is undertaken at the shaft sites. This generally involves controlling vegetation around the compound and fence lines.

Environmental Performance

There was no inspection of weeds by the Illawarra District Noxious Weeds Authority or chemical spraying during the reporting period.

3.9 Blasting

No blasting activities have occurred on the surface at Wongawilli Colliery during the reporting period. Small scale blasting (known as Shot Firing) occurs underground infrequently or as the need arises. There have been no underground blasting activities undertaken during this reporting period.

3.10 Operational Noise

Environmental Management

The current noise management procedures have proven to be adequate.

Generally, management procedures for noise control include:

- A six metre high concrete wall that separates the nearest residences from the coal Stockpile Area. This wall was constructed some years ago and provides both a visual benefit as well as noise attenuation benefits;
- A three metre high, 250 metre long earth bund adjacent to the rail line to the east of Jersey Farm Road. This bund was constructed to provide noise attenuation for local residents from the Jersey Farm Road rail crossing.
- Hours of operation within the Stockpile Area in terms of heavy machinery loading trains is limited to 7am to 6pm Monday to Friday and 8am to 4pm Saturday and no loading on Sundays and Public Holidays;
- Front end loaders and dump trucks operating in the Stockpile Area have exhaust systems that meet manufacturer specifications;
- The tail gate of the dump truck operating in the Stockpile Area has a chain lift operation and this avoids tail gate banging during tipping;
- Construction hours limited to approved limits as set out in individual approvals; and
- Truck drivers are directed to drive slowly and have regard for Wongawilli residents' amenity.
- Regular maintenance of the decline overland conveyor system.

A Noise Management Plan was developed during the previous reporting period as required by the MP 09_0161. The Plan contains management plans, commitments and actions for the management of noise at the Colliery. The Plan was submitted for review to the DP&E during the reporting period. Feedback from DP&E has resulted in the requirement for a Noise Management Plan to be re-submitted for approval following the completion of the Noise Audit required by Condition 7/Schedule 4 of MP 09_0161. The Noise Audit has been completed and the Noise Management Plan will be revised and submitted for approval as a part of Annual Review process.

Avondale Pit Top

The current noise management procedures have proven to be adequate. There has been no noise generating activity at Avondale pit top during the reporting period.

SMP and Catchment Lease Areas

The current noise management procedures have proven to be adequate. Due to the absence of potentially affected receivers in the SMP and catchment areas, noise is not an issue.

Environmental Performance

Wongawilli Colliery Pit Top

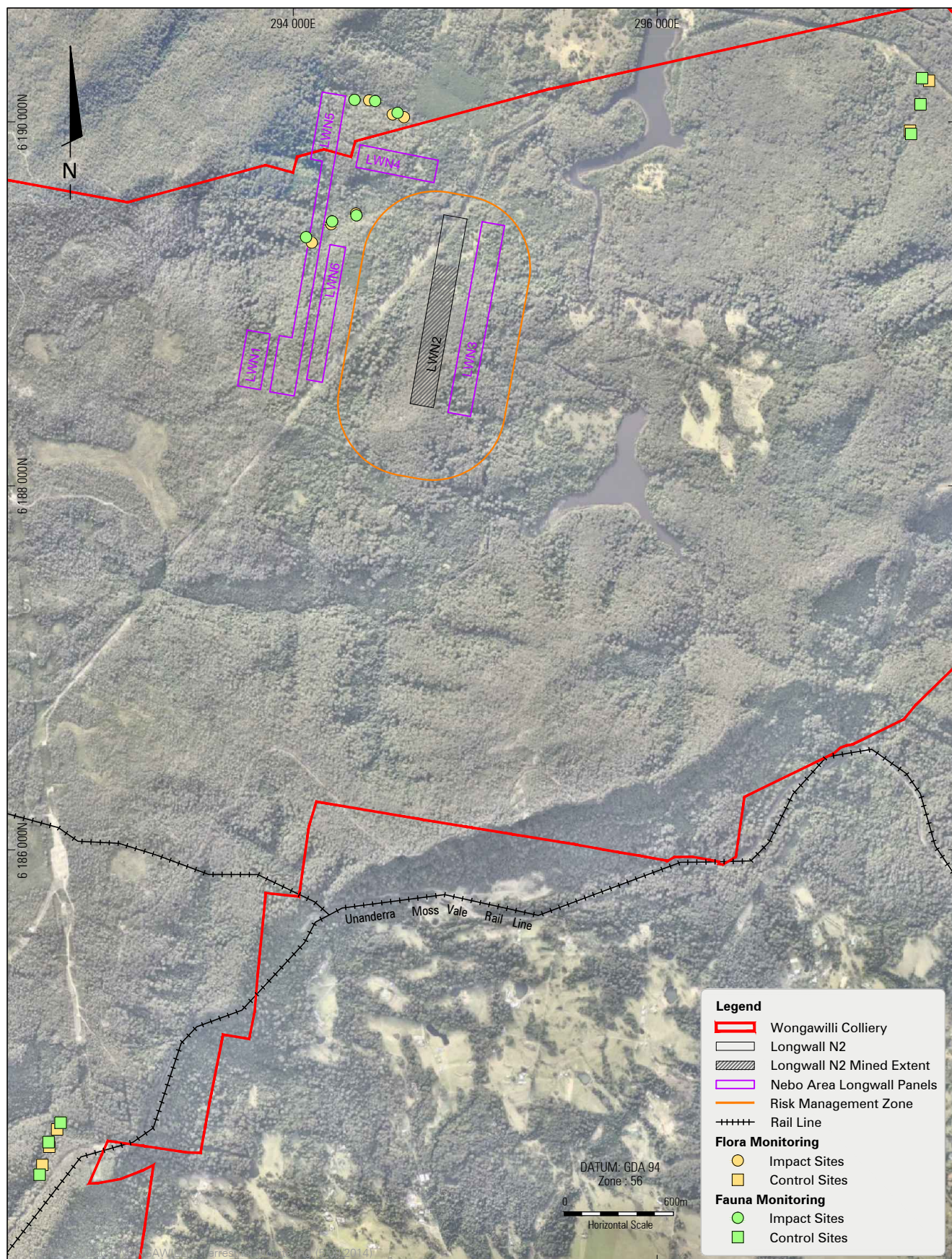


Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

There was one complaint from a local residents related to noise from the sounding of train horns at level crossings during the reporting period. The train driver was spoken to and the issue did not reoccur.

SMP and Catchment Lease Areas

Due to the absence of potentially affected receivers in the SMP and catchment areas, noise is not an issue.



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

3.11 Visual and/or Stray Light

Environmental Management

Wongawilli Colliery Pit Top

The current light management procedures have proven to be adequate. Light from Wongawilli Colliery is either directly or indirectly visible to the local community as well as to the regional community within the viewshed. The site is visible to a large area of the southern Wollongong and Shellharbour Local Government Areas due to its location on the escarpment. A lighting audit will be undertaken during the next reporting period.

Avondale Pit Top

The current light management procedures have proven to be adequate. There are no structures or lighting visible to the public at this site.

SMP and Catchment Lease Areas

The current light management procedures have proven to be adequate. The lights at the ventilation shaft are only turned on when required. There is no need to manage visual impact or stray light in the catchment areas.

Environmental Performance

Wongawilli Colliery Pit Top

There is no monitoring of stray light or visual impact. The community has not raised the issue of stray light from, or the visual impact of, the mine site facilities or mobile equipment as being a matter for concern.

Avondale Pit Top

There is no activity at the site and therefore no monitoring for stray light or visual impact.

SMP and Catchment Lease Areas

There are no sensitive receivers in catchment areas that would be impacted by stray light or visual impact.

3.12 Aboriginal Heritage

Environmental Management

Wongawilli Colliery Pit Top

The current Aboriginal heritage management procedures have proven to be adequate.

The Wongawilli Colliery pit top is listed in the Wollongong LEP 2009 and the Wollongong LEP (West Dapto) 2010 as having heritage significance, including Aboriginal heritage.

All construction activities undertaken at the site (see **Section 2.3**) are subjected to an REF process to determine if there is likely to be any impact on Aboriginal heritage.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

A Heritage Management Plan was developed for the Colliery during the previous reporting period. Revisions of the Plan occurred during the previous reporting period which were subsequently submitted to and approved by DP&E.

The Plan draws on the Heritage Constraints Report completed during the 2010-2011 reporting period. This plan identifies what impacts the listing on the Wollongong LEP 2009 and Wollongong LEP (West Dapto) 2010 will have on current and future activities at the Colliery and contains management plans for the management of heritage related aspects for these activities.

Avondale Pit Top

The current Aboriginal heritage management procedures have proven to be adequate. There has been no activity at the Avondale pit top in this reporting period.

SMP and Catchment Lease Areas

The current Aboriginal heritage management procedures have proven to be adequate.

Additionally, Aboriginal heritage monitoring is undertaken in mining and catchment lease areas of Nebo N1-N6, as shown in **Figure 11**, regularly in accordance with SMP and EP approval requirements.

Environmental Performance

Wongawilli Colliery Pit Top

Construction activities have been undertaken in accordance with conditions of approval with regard to management of potential disturbance to Aboriginal heritage.

Avondale Pit Top

There has been no activity at the Avondale pit top in this reporting period.

SMP and Catchment Lease Areas

There has been no subsidence impacts observed to the Aboriginal heritage site during the extraction of LW N2. See **Appendix C** for further details.

3.13 Natural Heritage

Environmental Management

Wongawilli Colliery Pit Top

The current natural heritage management procedures have proven to be adequate. There are no known items of natural heritage located on the site

Avondale Pit Top

The current natural heritage management procedures have proven to be adequate. There are no known items of natural heritage located on the site

SMP and Catchment Lease Areas



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

The current natural heritage management procedures have proven to be adequate. There are no known items of natural heritage located within the lease areas or current and proposed SMP extraction areas.

Environmental Performance

N/A

3.14 Spontaneous Combustion

The current spontaneous combustion management procedures for Wongawilli Colliery have proven to be adequate. No instances of spontaneous combustion have been recorded at Wongawilli Colliery or in the 90 years of mining the Wongawilli Seam in the NSW Southern Coalfields. No change in chemical properties of the coal in the proposed extraction area is recognised which would increase the risk of spontaneous combustion.

3.15 Bushfire

Environmental Management

Wongawilli Colliery Pit Top

The current bushfire management procedures have proven to be adequate. Ongoing clearing of undergrowth from around the general pit top operational areas and Stockpile Area has been undertaken during the reporting period to reduce the risk of bushfires affecting the operational areas of the mine surface. A fire fighting water main is also provided on the mine site, which is boosted by a pressure pump, to provide the means to manually fight any bushfire that may threaten the site. A firebreak is maintained along the pit top access road to ensure the emergency evacuation route remains safe. The site has personnel trained in fire fighting and has a large supply of readily available water and fire fighting equipment on site.

A Bushfire Management Plan was developed during the reporting period as required by MP 09_0161. The Bushfire Management Plan was submitted to DP&E for approval.

Avondale Pit Top

The current bushfire management procedures have proven to be adequate. There is no activity on the site that may cause bushfire risk.

SMP and Catchment Lease Areas

The current bushfire management procedures have proven to be adequate. A firebreak that has been cleared around the site perimeter fence line of the main ventilation shaft site provides an asset protection zone and catchment bushfire protection.

Environmental Performance

NRE Wongawilli Colliery Pit Top

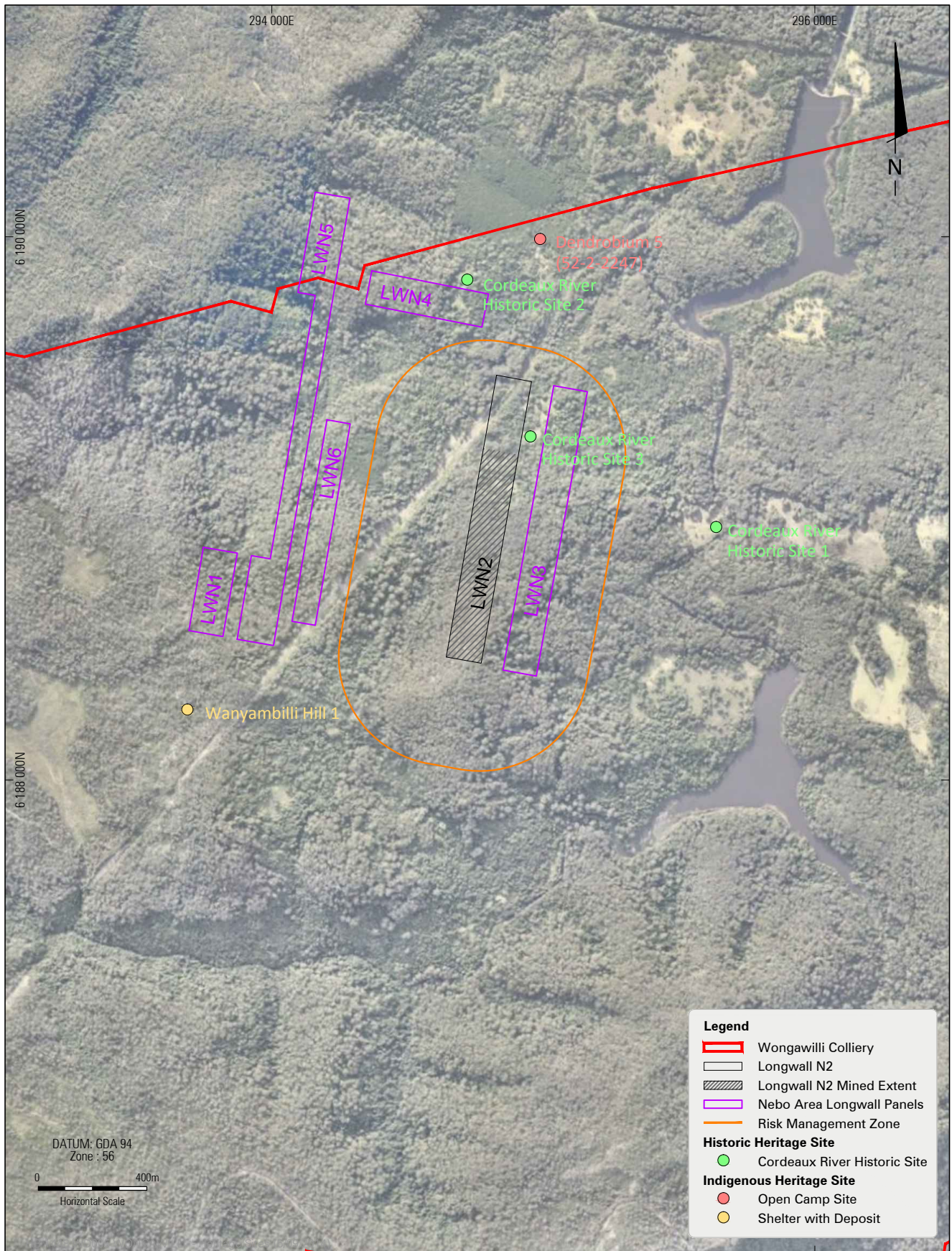
There has been no monitoring of the effectiveness of the bushfire management activities.



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Avondale Pit Top

There has been no monitoring of the effectiveness of the bushfire management activities.



WONGAWILLI COLLIERY

Heritage Sites

FIGURE 11

3.16 Mine Subsidence

Environmental Management

SMP and Catchment Lease Areas

The current subsidence management procedures have proven to be adequate.

During the reporting period, secondary extraction was undertaken in LW N2 using longwall mining methods from 12 June 2013 to 26 February 2014. Mining of LW N2 was suspended due to a roof fall on the longwall miner. Baseline monitoring for subsidence, surface water and ground water as well as aquatic and terrestrial ecology was undertaken prior to extraction of LW N2. Key aspects with regard to management of mine subsidence are dealt with in the relevant headings within **Section 3**. Monitoring undertaken for LW N2 is summarised in **Table 3-3**.

Figure 12 illustrates the predicted vertical movements associated with LW N2 extraction. Additionally, subsidence monitoring is undertaken in SMP and catchment lease areas regularly in accordance with SMP and EP approval requirements.

Table 3-3 Summary of Monitoring During Reporting Period

Type of Monitoring	Timing	LW N2
Subsidence Effects - Survey Monitoring	<ul style="list-style-type: none"> Baseline studies prior to mining (2D and 3D Surveys) During Mining Once Post Mining 	✓
Regional 3D Points	<ul style="list-style-type: none"> Baseline studies prior to mining (3D Survey) During Mining Post Mining 	✓
Electricity Transmission lines	<ul style="list-style-type: none"> Baseline 3D survey and inspection prior to mining 3D survey and inspection during mining if triggered; 3D survey and inspection post mining 	✓
Fire Roads & 4WD Tracks	<ul style="list-style-type: none"> Baseline studies prior to mining During Mining Monthly following mining for 6 months 	Observational

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Heritage Sites	<ul style="list-style-type: none"> Baseline studies prior to mining During Mining Within 6 months of completion of Mining 	✓
Stream Water Quality & Flow	<ul style="list-style-type: none"> Baseline studies prior to mining During Mining Post Mining 	✓
Groundwater – Hawkesbury Sandstone	<ul style="list-style-type: none"> Baseline studies prior to mining During Mining Post Mining 	✓
Groundwater – Upland Swamps	<ul style="list-style-type: none"> Baseline studies prior to mining During Mining Post Mining 	✓
Inflow into mine workings during active mining	Daily	✓
Aquatic Ecology	<ul style="list-style-type: none"> Prior to mining (2 years baseline) During mining Post mining (minimum 1 years) 	✓
Terrestrial Ecology	<ul style="list-style-type: none"> Prior to mining (2 years baseline) During mining Post mining (minimum 1 years) 	✓

Table 3-4 Summary of Predicted and Observed Impacts from LW N2 on Surface Infrastructure

Surface Infrastructure	Predicted Impacts	Observed Impacts
Electricity Transmission	No predicted impacts	No observed Impacts
Fire Roads & 4WD Tracks	No predicted impacts	No observed impacts
Historic Heritage Sites	Potential for ground cracking or tree falls	No observed impacts

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Environmental Performance

A regular subsidence status report provided to DRE, DP&E, DSC, SCA, Electricity Infrastructure Owners and other relevant agencies during mining of LW N2. The summary of predicted and observed impacts from LW N2 on Surface Infrastructure is summarised in **Table 3-4**. The observed subsidence effects induced by mining of LW N2 are generally consistent with the predictions. The detail of predicted and observed impacts from LW N2 on natural and man made features is provided in **Appendix C**.

3.17 Hydrocarbon Contamination

Environmental Management

Wongawilli Colliery Pit Top

The current hydrocarbon management procedures have proven to be adequate. As outlined in Section 3.5, all potential contaminating substances are stored in bunded areas to prevent the potential for leakage to contaminate soil or water. There are absorbent materials, booms and other control materials stored in a variety of high activity areas around site to allow rapid response to small and large hydrocarbon spills. The storage areas for oil are identified on Drawing No **WON-01-0605**.

Avondale Pit Top

The current hydrocarbon management procedures have proven to be adequate. There are no hydrocarbons stored at Avondale Pit Top.

SMP and Catchment Lease Areas

The current hydrocarbon management procedures have proven to be adequate. There are small quantities of hydrocarbons (diesel) stored at No.4 Shaft site in the catchment areas (see Section 3.5). Vehicles that access the site such as servicing shaft sites, for exploration related activities or SMP monitoring contain oil, diesel, petrol and/or other hydrocarbons.

Environmental Performance

Wongawilli Colliery Pit Top

Hydrocarbon management is under constant review by operational staff.

Avondale Pit Top

There are no hydrocarbons at the site.

SMP and Catchment Lease Areas

There is only visual monitoring of hydrocarbons in the SMP and catchment areas

3.18 Methane Drainage & Ventilation

Ventilation via the fan at No.4 Shaft provides the methane drainage mechanism for the mine. There has been no change to this facility or the management of ventilation during the period.

3.19 Public Safety

Environmental Management

Wongawilli Colliery Pit Top

The current public safety management procedures have proven to be adequate.

Wongawilli Colliery pit top sites have established perimeter fencing with entry gates that are locked during periods of non-operation to secure the sites against unauthorised access and the consequential risk to public safety. Random security patrols are also maintained to provide additional security during weekends and at night. Currently the mine site is continuously manned with a control officer stationed at the mine during all operational and non-operational periods.

Several surveillance cameras were installed during the previous reporting period that covers the main access areas and infrastructure at the mine. The footage from the cameras is streamed directly to the Colliery Control Room and is also available to the Colliery Security Guards.

Signage is in place that identifies:

- Mine site entry gates;
- The type and nature of chemicals stored or used;
- The voltage level of electrical equipment within protected enclosures;
- Personal protective equipment requirements;
- Authorised access areas; and
- Contents of pipelines e.g.: gases, water compressed air etc.

Avondale Pit Top

The current public safety management procedures have proven to be adequate.

The site is maintained in a stable and non-polluting condition, with existing portals secured to prevent unauthorised access.

A small sink hole has developed at the portal bench at the Avondale Pit Top. The DRE required that it be filled to prevent it from becoming a public safety hazard. The sinkhole was filled.

SMP and Catchment Lease Areas

The current public safety management procedures have proven to be adequate.

The plateau land above the longwall panels is primarily natural bushland environment with access restricted to authorised persons only. The land is covered by the Metropolitan Special Area, a Sydney Water Catchment Schedule 1 Area. No residents are located within this area. As such, mining activities on the plateau have negligible implications for public safety over the present and proposed longwall panels or in the areas where mine

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

infrastructure is established. Access into the Sydney Catchment Area is via locked gates. Areas on catchment land and on the mine site that have individual security and controlled access include:

- Fan sites;
- Hazardous materials storage compounds;
- Compressed gases storage compounds;
- Rooms, compounds and enclosures containing electrical equipment;
- All electricity substations; and
- Gates accessing the Catchment area.

Monitoring of public safety issues in relation to mine subsidence is as follows:

- Fortnightly visual inspection of cliffs and steep slopes, fire roads, 4WD tracks, rocky outcrops and cuttings during extraction; and
- Monthly visual inspection of cliffs and steep slopes, fire roads, 4WD tracks, rocky outcrops and cuttings for six months following the completion of extraction of the longwalls.

Environmental Performance

Wongawilli Colliery Pit Top

There have been no observed public safety incidents during the reporting period. Security guards ensure unauthorised access is kept to a minimum.

Avondale Pit Top

There have been no observed public safety incidents during the reporting period at Avondale Pit Top.

SMP and Catchment Lease Areas

There have been no observed public safety incidents during the reporting period

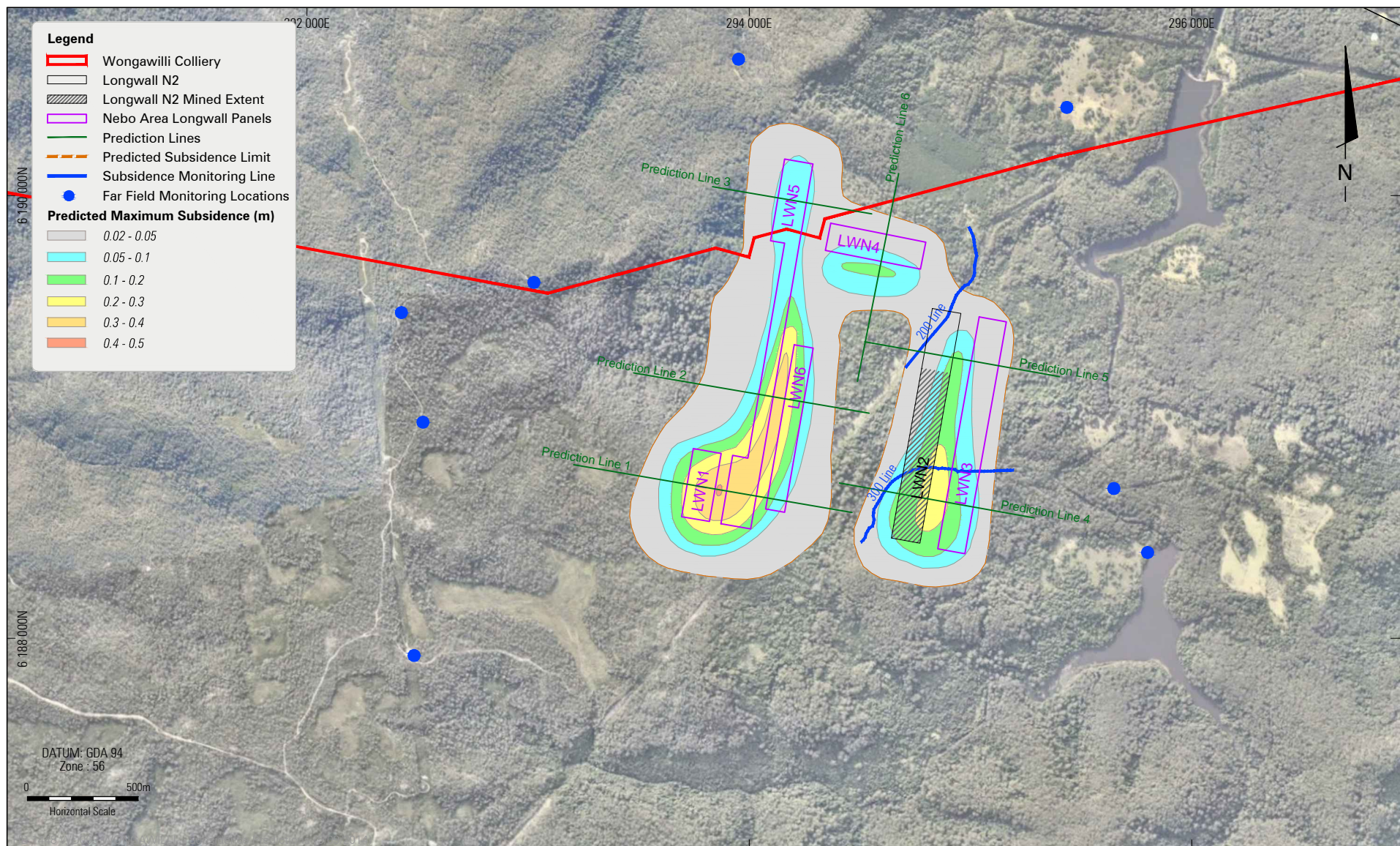
3.20 Other Issues & Risks

Environmental Management

N/A

Environmental Performance

N/A



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

4 COMMUNITY RELATIONS

4.1 Complaints Procedure

All complaints received are recorded and documented in accordance with the EPL conditions.

Wongawilli Colliery has a 'hotline' that is in operation 24 hours a day, 7 days a week. Upon receipt of a complaint, by either Government agencies or the 'hotline', a Wongawilli Colliery site representative responds to the complainant within 24 hours where possible.

4.2 Environmental Complaints & Non-Compliances

All environmental complaints are summarised in the **Table 4-1**. The complaints register is publicly available on the WCL website. In accordance with MP09_0161 approval **Condition 8/Schedule 6**, an independent environmental audit was completed for Wongawilli Colliery in March 2014. The summary of audit findings (non-compliance), audit recommendations and Wongawilli Colliery responses were also submitted to DP&E along with audit report. A further update on this is provided in the **Table 4-2**.

Table 4-1 Environmental Complaints Summary

Date	Complainant	Nature of Complaint	Investigation/Action Taken/Follow - up
31/08/13	Community	Complaint regarding suspected coal dust deposited on house/back over recent weeks leading up to complaint. Purpose of complaint was to ensure colliery addressed issue to prevent future occurrence.	<p>31August - EM spoke to resident regarding issue and that sample would be collected for analysis to conform material type. Also advised that monitoring data for August was due to be collected between 2-4 September and would also help in assessing issue. Discussed potential cause/source of material.</p> <p>2 September – EM contacted and visited resident to further discuss and collect sample. Sent to ALS lab for analysis. Further analysis of sample showed 50% coal dust 50% other matter. Issue was attributed to strong winds in the area at the time and passing trains. Action coming from low moisture content of coal being</p>

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Date	Complainant	Nature of Complaint	Investigation/Action Taken/Follow - up
			loaded into wagons from stockpile.
03/12/13	Community	Complaint regarding the apparent deposit of a small amount of coal wash on the corner of site Access Rd and Jersey Farm Rd.	4 December – EO investigated incident and no coal wash was found in area. Area monitored further with no evidence of coal wash. 4 December – Incident put down to possible droppings from dozer tracks whilst leaving the stockpile area to travel back to contractor's yard. May have been washed down further with rain at the time. Regular monitoring undertaken with no further evidence of material found. Issue has been explained at next CCC meeting.
17/01/14	Community	Noise complaint received for excessive horn blasting from trains. On Wednesday 15/1 at 11:30pm the train used the horn 3-4 times. On Thursday 16/1 at 11:50pm it was used 4 times including double blasts at most driveway crossings and the road crossing.	17 January - EM Contacted Logistics Manager and further contact was made with Pacific National. An investigation to review the locomotive on board computer to analyse the driver's behaviour is being carried out on 22/1/14. Complainant updated on findings. 29 January - Results forwarded to complainant. Awaiting results from RA to be undertaken and will forward to complainant. Complainant satisfied with results and progress.

Table 4-2 Non-Compliance Summary

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
Project Approval – Sch. 2, Condition 6	With respect to train movements at night, where night time is defined as 11.00 pm to 7.00 am by the project approval, the auditor noted instances where a train arrives at site prior to 7.00 am and	Train movement monthly summary report, including a compliance summary against the train movement criteria in Sch.2 Condition 6, has been developed and will	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	<p>combined with a train arrival and departure after 11.00 pm results in three (3) train movements at night and is a breach of the two (2) train movements a night restriction during normal operations.</p> <p>Wongawilli Coal to include a train movement summary (additional column) as part of its web site based report for monitoring coal transport so as to facilitate interpretation and compliance assessment.</p> <p>Wongawilli Coal to include a compliance statement as part of its web site based report for monitoring coal transport. The Compliance statement should address the train movement criteria as specified by Sch.2, Condition 6 and the quantity criteria for ROM coal.</p> <p>Wongawilli Coal to implement a logistical control to ensure train movements comply with the criteria specified by Sch. 2, Condition 6.</p>	<p>be available on website and regularly updated once the WCL website has been developed and is online.</p> <p>The logistical control for ensuring compliance with train movement restrictions already exists. The haulage contractor schedules trains to attend site within the allowable train movement times outlined in the approval.</p>	Complete
Project Approval – Sch.2, Condition 7	<p>Longwall change-out notification was not issued to Community Consultative Committee (CCC).</p> <p>Ensure future longwall change-out notifications are also sent to the CCC where longwall change-outs involve extended hours of operations as detailed in Sch.2, Condition 7(b).</p>	<p>A new section of the WW CCC Agenda has been added to notify the CCC members of planned longwall change-outs and possible extended operational hours.</p> <p>A Notification of extended stockpile operational hours will also be placed on the Website by the logistics manager as required.</p>	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
Project Approval – Sch.4, Condition 1	Wongawilli Coal advised that the current noise monitoring program is complaint driven and there is no established noise monitoring program. This arrangement prevents an assessment of compliance against the noise criteria and goals detailed in the project approval.	The Noise Audit was accepted by the EPA as adequate on 6 January 2014 and approved by DP&E on 22 January 2014.	Complete
	<p>Finalise and gain DP&E approval of the Noise Audit Report.</p> <p>Finalise and gain DP&E approval of the Noise Management Plan.</p> <p>Implement Noise Audit recommendations.</p> <p>Implement the noise monitoring plan as detailed in the updated and DP&E approved Noise Management Plan.</p>	<p>Wilkinson Murray conducted onsite noise testing with attended and unattended loggers in Feb and March. They have the results and are currently developing draft noise management plan and analysis of noise results. Due to operational difficulties at the Colliery restricting coal production during the period of the Audit, a preliminary management plan will be produced for DP&E review.</p> <p>This will be followed by a more complete review as part of the Annual Review report process including updating of the Noise Management Plan.</p>	Complete 31/12/14
Project Approval – Sch.4, Condition 3	As per above for Project Approval – Sch. 4, Condition 1.	The Noise Audit was accepted by the EPA as adequate on 6 January 2014 and approved by DP&E on 22 January 2014.	Complete
		<p>Wilkinson Murray conducted onsite noise testing with attended and unattended loggers in Feb and March. They have the results and are currently developing draft noise management plan and analysis of noise results. Due to operational difficulties at the Colliery restricting coal production</p>	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
		<p>during the period of the Audit, a preliminary management plan will be produced for DP&E review.</p> <p>This will be followed by a more complete review as part of the Annual Review report process including updating of the Noise Management Plan.</p>	31/12/14
Project Approval – Sch. 4, Condition 4(b)	<p>Train wagon numbers are less than the specified 30 wagons.</p> <p>Wongawilli Coal to prepare a report confirming current site constraints regarding train wagon numbers including photographs for due diligence and compliance reporting evidence.</p> <p>Wongawilli Coal to seek an agreement with DP&E regarding a revised train wagon number.</p>	The current haulage contractor for Wongawilli Colliery will not commit to providing 33 wagons. As a result, and constrained by current contractual limitations, Wongawilli Colliery is investigating other options for haulage contractor services once the existing contract expires. The basis of any new haulage contract will be the provision of 33 wagon trains.	12/2015
Project Approval – Sch. 4, Condition 6(b)	<p>Lack of an established noise monitoring program prevents an assessment of compliance against the noise criteria and goals detailed in the project approval.</p> <p>Finalise and gain DP&E approval of the Noise Audit Report.</p> <p>Finalise and gain DP&E approval of the Noise Management Plan.</p> <p>Implement Noise Audit recommendations.</p>	<p>The Noise Audit was accepted by the EPA as adequate on 6 January 2014 and approved by DP&E on 22 January 2014.</p> <p>Wilkinson Murray conducted onsite noise testing with attended and unattended loggers in Feb and March. They have the results and are currently developing draft noise management plan and analysis of noise results. Due to operational difficulties at the Colliery restricting coal production</p>	<p>Complete</p> <p>Complete</p>

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	Implement the noise monitoring plan as detailed in the updated and DP&E approved Noise Management Plan.	during the period of the Audit, a preliminary management plan will be produced for DP&E review. This will be followed by a more complete review as part of the Annual Review report process including updating of the Noise Management Plan.	31/12/14
Project Approval – Sch. 4, Condition 7(b)	Failure to prepare and submit a Noise Audit for the Director-General's approval by the end of June 2013. Finalise the Noise Audit Report and gain DP&E approval of the Noise Audit Report.	The Noise Audit was accepted by the EPA as adequate on 6 January 2014 and submitted to DP&E on 22 January 2014.	Complete
Project Approval – Sch. 4, Condition 8	DP&E approval of the Noise Management Plan had not been achieved. The Noise Management Plan does not provide details of a noise monitoring program. Finalise and gain DP&E approval of the Noise Audit Report. Finalise and gain DP&E approval of the Noise Management Plan.	The Noise Audit was accepted by the EPA as adequate on 6 January 2014 and approved by DP&E on 22 January 2014. Wilkinson Murray conducted onsite noise testing with attended and unattended loggers in Feb and March. They have the results and are currently developing draft noise management plan and analysis of noise results. Due to operational difficulties at the Colliery restricting coal production during the period of the Audit, a preliminary management plan will be produced for DP&E review.	Complete Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
		This will be followed by a more complete review as part of the Annual Review report process including updating of the Noise Management Plan.	31/12/14
Project Approval – Sch. 4, Condition 11	<p>Lack of an established real-time dust monitoring program for PM10 and TSP which prevents an assessment of compliance against the air quality criteria detailed in the project approval.</p> <p>Ensure real-time air quality monitoring equipment is established, operated and maintained.</p>	<p>WCL has obtained and is reviewing a proposal for the installation of a real time air quality, noise monitoring and meteorological monitoring system.</p> <p>PEL are waiting on the results of the unattended and attended noise loggers to see what system would best suit the needs of Wongawilli Colliery.</p>	31/12/14
Project Approval – Sch. 4, Condition 12	As per above for Project Approval – Sch. 4, Condition 11.	<p>WCL has obtained and is reviewing a proposal for the installation of a real time air quality, noise monitoring and meteorological monitoring system.</p> <p>PEL are waiting on the results of the unattended and attended noise loggers to see what system would best suit the needs of Wongawilli Colliery.</p>	31/12/14
Project Approval – Sch. 4, Condition 13(c)	<p>Lack of an established real-time dust monitoring program and meteorological station.</p> <p>Ensure real-time air quality monitoring equipment is established, operated and maintained.</p> <p>Ensure meteorological station is established,</p>	<p>WCL has obtained and is reviewing a proposal for the installation of a real time air quality, noise monitoring and meteorological monitoring system.</p> <p>PEL are waiting on the results of the unattended and attended noise loggers to</p>	31/12/14

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	operated and maintained.	see what system would best suit the needs of Wongawilli Colliery.	
Project Approval – Sch. 4, Condition 14	DP&E approval of the Air Quality and Greenhouse Gas Management Plan had not been achieved. Finalise and gain DP&E approval of the Air Quality and Greenhouse Gas Management Plan.	The Air Quality and Greenhouse Gas Management Plan was approved by DP&E on 25 September 2013.	Complete
Project Approval – Sch. 4, Condition 15	Lack of an established meteorological station. Ensure meteorological station is established, operated and maintained.	WCL has obtained and is reviewing a proposal for the installation of a real time air quality, noise monitoring and meteorological monitoring system. PEL are waiting on the results of the unattended and attended noise loggers to see what system would best suit the needs of Wongawilli Colliery.	31/12/14
Project Approval – Sch. 4, Condition 19	Environment Protection Licence (1087) non-compliance (discharge of dirty water) reported in Annual Return for October 2011 – September 2012.		N/A
Project Approval – Sch. 4, Condition 20	DP&E approval of the Surface Water Management Plan had not been achieved. Finalise and gain DP&E approval of the Surface Water Management Plan.	The Surface Water Management Plan was approved by DP&E on 25 September 2013.	Complete
Project Approval – Sch. 4, Condition 21	DP&E approval of the Heritage Management Plan had not been achieved. Finalise and gain DP&E approval of the Heritage	The Heritage Management Plan was approved by DP&E on 25 September 2013.	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	Management Plan.		
Project Approval – Sch. 4, Condition 23(b & c)	<p>No inspection of external colliery lighting has been undertaken.</p> <p>Wongawilli Coal to engage a suitably qualified lighting consultant to inspect all external lighting and assess compliance with the requirements of Schedule 4, Condition 23. Where non-compliance issues are identified, recommendations for rectification are to be provided by the lighting consultant.</p>	A lighting consultant will be engaged as part of the Annual Review process and outcomes will be integrated into appropriate management plans as a part of the Annual Review process.	31/12/14
Project Approval – Sch. 5, Condition 1	<p>Lack of an established noise monitoring program and real-time dust monitoring program.</p> <p>Finalise and gain DP&E approval of the Noise Audit Report.</p> <p>Finalise and gain DP&E approval of the Noise Management Plan.</p> <p>Implement Noise Audit recommendations.</p> <p>Implement the noise monitoring plan as detailed in the updated and DP&E approved Noise Management Plan.</p> <p>Finalise and gain DP&E approval of the Air Quality and Greenhouse Gas Management Plan.</p>	<p>The Noise Audit was accepted by the EPA as adequate on 6 January 2014 and approved by DP&E on 22 January 2014</p> <p>Wilkinson Murray are currently assessing the attended and unattended noise loggers that were placed on site for Feb and March. There was a delay due to low production that would have given unrealistic noise levels. We needed realistic noise to record accurate data. They now have the results and are currently developing draft noise management plan and analysis of noise results. Due to operational difficulties at the Colliery restricting coal production during the period of the Audit, a preliminary management plan will be produced for</p>	<p>Complete</p> <p>Complete</p>

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	Ensure real-time air quality monitoring equipment is established, operated and maintained.	<p>DP&E review.</p> <p>This will be followed by a more complete review as part of the Annual Review report process including updating of the Noise Management Plan.</p> <p>The Air Quality and Greenhouse Gas Management Plan was approved by DP&E on 25 September 2013.</p> <p>WCL has obtained and is reviewing a proposal for the installation of a real time air quality, noise monitoring and meteorological monitoring system.</p> <p>PEL are waiting on the results of the unattended and attended noise loggers to see what system would best suit the needs of Wongawilli Colliery.</p>	<p>31/12/14</p> <p>Complete</p> <p>31/12/14</p>
Project Approval – Sch. 6, Condition 1	DP&E approval of the Environmental Management Strategy was obtained after the required 6 months from the date of the project approval.		N/A
Project Approval – Sch. 6, Condition 4	<p>Wongawilli Coal advised that no specific reviews of strategies, plans or programs has been undertaken with respect to the requirements of this condition of approval.</p> <p>Management plans (including the Environmental Management Strategy) to be updated to reflect</p>	On 8 January 2014 the DP&E approved the merging of the Annual Review and Annual Environmental Management Report (for DRE) in order to increase efficiency and reduce WCL resource requirements. This report is due by 30 September 2014 and	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	the review/revision requirements of Schedule 6, Condition 4. A review of all strategies, plans and programs to be undertaken in response to this audit and the Noise Audit.	WCL would request that rather than producing another Annual Review as a result of the triggering of the Review by the submission of the Noise Audit, the company be allowed to continue its approved Annual Review process with submission on 30 September 2014.	
Project Approval – Sch. 6, Condition 6	<p>Instances whereby DP&E was not notified of environmental incidents.</p> <p>Wongawilli Coal to develop a notification protocol identifying relevant agencies for a) incidents that cause, or have the potential to cause significant risk of material harm to the environment and b) other incidents associated with the project and c) un-approved work events and non-compliance incidents.</p> <p>Wongawilli Coal to establish an environmental incidents register.</p> <p>Amend MOP as required to address future earthwork requirements in North West Portal area.</p>	<p>WCL will develop an Incident Notification Protocol and incident register as part of the Annual Review process.</p> <p>An incident report was submitted to DRE with regard to the unauthorised land clearing. The DRE responded to WCL on 21 March 2014 indicating its satisfaction with the incident report and proposed action to prevent recurrence of this type of incident. No MOP amendment was required.</p>	<p>Complete</p> <p>Complete</p>
Project Approval – Sch. 6, Condition 8	Failure to have completed an independent environmental audit by 30 June 2013.		N/A
Project Approval – Sch. 6, Condition 10	<p>Company website does not provide access to all of the information specified by this condition of approval.</p> <p>Wongawilli Coal to update website with all information as required by Sch. 6, Condition 10.</p>	All necessary information has been collated and will be uploaded to the WCL website once it has been launched.	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
SoC – Bushfire Management Plan	Bushfire Management Plan has not been finalised. Finalise the Bushfire Management Plan and make it available on the company's website.	The draft Bushfire Management Plan is under final review and will be placed on the WCL website when it is launched.	Complete
SoC – Surface Water Management Plan	DP&E approval of the Surface Water Management Plan had not been achieved. Finalise and gain DP&E approval of the Surface Water Management Plan.	The Surface Water Management Plan was approved by DP&E on 25 September 2013.	Complete
SoC – Rainfall Monitoring at Pit Top	Lack of an established meteorological station (including rain gauge) at Pit Top. Ensure meteorological station is established, operated and maintained.	WCL has obtained and is reviewing a proposal for the installation of a real time air quality, noise monitoring and meteorological monitoring system. PEL are waiting on the results of the unattended and attended noise loggers to see what system would best suit the needs of Wongawilli Colliery.	31/12/14
SoC – Air Quality	Lack of an established real-time dust (PM10 and TSP) monitoring program. Ensure real-time air quality monitoring equipment is established, operated and maintained.	WCL has obtained and is reviewing a proposal for the installation of a real time air quality, noise monitoring and meteorological monitoring system. PEL are waiting on the results of the unattended and attended noise loggers to see what system would best suit the needs of Wongawilli Colliery.	31/12/14
SoC – Prevention of Rail Wagon Overfilling	Lack of a protocol to prevent the overfilling of rail wagons.	A concept plan has been developed and is currently undergoing feasibility review by	31/3/15

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	Develop a protocol/procedure to prevent the overfilling of rail wagons or implement an automated system to prevent overfilling.	the Mechanical Engineering Department with an aim to install a system by early 2015.	
SoC –Depositional Dust Gauges	Depositional dust gauges along the rail line were not installed within the specified timeframe.	Depositional dust gauges have been installed.	Complete
SoC – Energy Audits	No energy audits have been undertaken to date. Wongawilli Coal to establish an energy audit schedule and conduct energy audits as per the schedule.	An energy audit will be undertaken and the results, as well as a schedule for regular audits will be incorporated into the Air Quality and Greenhouse Gas Management Plan as part of the next Annual Review process.	30/12/14
SoC – Emissions Inventory	The emissions inventory prepared for the project's environmental assessment has not been updated. Wongawilli Coal to review and update the emissions inventory. Ensure proposed Annual Greenhouse Gas Audits are undertaken.	Inventory related to underground emission of gases are updated monthly and at present has been updated up to March 2014. The inventory of the emission of gases emitted on the surface of the mine are maintained and taken into account during the Annual Greenhouse Gas Audit and NGERs Reporting. Annual Greenhouse Gas Audits are conducted annually (completed in October 2013 for 2012-13 and for 2013-14 the process has been initiated and expected to be completed by July 2014).	Complete
SoC – Emissions and Abatement Strategies	Emissions and abatement strategies are not being reported be it via internal reports or reports	The Annual Review report will be modified to include updates on GHG emissions.	30/12/14

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	<p>prepared for external parties.</p> <p>Annual Review reports to include details regarding greenhouse gas emissions and abatement strategies.</p>	<p>This will be followed by a more complete review as part of the Annual Review report process including updating of the Air Quality & Greenhouse Gas Management Plan</p>	
SoC - Acoustics	<p>Lack of an established noise monitoring program.</p> <p>Finalise and gain DP&E approval of the Noise Audit Report.</p> <p>Finalise and gain DP&E approval of the Noise Management Plan.</p> <p>Implement Noise Audit recommendations.</p> <p>Implement the noise monitoring plan as detailed in the updated and DP&E approved Noise Management Plan.</p>	<p>The Noise Audit was accepted by the EPA as adequate on 6 January 2014 and approved by DP&E on 22 January 2014.</p> <p>Wilkinson Murray conducted onsite noise testing with attended and unattended loggers in Feb and March. They have the results and are currently developing draft noise management plan and analysis of noise results. Due to operational difficulties at the Colliery restricting coal production during the period of the Audit, a preliminary management plan will be produced for DP&E review.</p> <p>This will be followed by a more complete review as part of the Annual Review report process including updating of the Noise Management Plan.</p>	<p>Complete</p> <p>Complete</p> <p>31/12/14</p>
SoC - Acoustics	<p>DP&E approval of the Noise Management Plan had not been achieved.</p> <p>Finalise and gain DP&E approval of the Noise Audit</p>	<p>The Noise Audit was accepted by the EPA as adequate on 6 January 2014 and approved by DP&E on 22 January 2014.</p>	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	Report. Finalise and gain DP&E approval of the Noise Management Plan.	Wilkinson Murray conducted onsite noise testing with attended and unattended loggers in Feb and March. They have the results and are currently developing draft noise management plan and analysis of noise results. Due to operational difficulties at the Colliery restricting coal production during the period of the Audit, a preliminary management plan will be produced for DP&E review. This will be followed by a more complete review as part of the Annual Review report process including updating of the Noise Management Plan.	Complete 31/12/14
SoC – Waste	Waste skip bins were not covered or located under a roofed area. A Waste Management Plan should be prepared for the project and the Colliery's operations.	A Waste Management Plan will be developed and submitted as part of the Annual Review that will be submitted to DP&E on 30 December 2014.	30/12/14
Mining Lease – Condition 3b	Un-authorized land clearing and earthworks took place in the North West Mains Portal area. This work was not covered by the approved Mining Operations Plans. Amend MOP as required to address future earthwork requirements in North West Portal area. Wongawilli Coal to establish an environmental incidents register.	An incident report was submitted to DRE with regard to the unauthorised land clearing. The DRE responded to WCL on 21 March 2014 indicating its satisfaction with the incident report and proposed action to prevent recurrence of this type of incident. WCL will develop an Incident Notification Protocol and incident register as part of the	Complete 30/12/14

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	Wongawilli Coal to develop a notification protocol identifying relevant for a) incidents that cause, or have the potential to cause significant risk of material harm to the environment and b) other incidents associated with the project and c) un-approved work events and non-compliance incidents.	Annual Review process.	
Mining Lease – Condition 15a	<p>No vibration monitoring of underground blasting associated with underground construction activities is undertaken. No evidence of a documented risk assessment justifying why vibration monitoring is not required.</p> <p>Wongawilli Coal to develop a blasting approval checklist that incorporates a risk assessment with respect to the blasting criteria presented in Condition 15a of the Mining Lease.</p>	<p>All blasting is conducted underground, and several km's from the portals. Quantities of permitted explosives are low. Vibration is very localised and has no impact on the stability of the workings. Blasting activities are infrequent</p> <p>A risk assessment is not considered necessary.</p>	N/A
Mining Lease – Condition 15b	<p>No blast overpressure monitoring of underground blasting is undertaken. No evidence of a documented risk assessment justifying why blast overpressure monitoring is not required.</p> <p>Wongawilli Coal to develop a blasting approval checklist that incorporates a risk assessment with respect to the blasting criteria presented in Condition 15a of the Mining Lease.</p>	<p>Overpressure from blasting causes only minor impacts on the u/g infrastructure.</p> <p>A risk assessment is not considered necessary.</p>	N/A
Mining Lease – Condition 17(1)	NSW Office of Water (NOW) has not been notified in advance of drilling operations and the required	Wollongong Coal, as part of its exploration documentation, has developed a checklist	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Reference	Summary of Audit Finding (non-compliance) and Recommendations	Wongawilli Colliery Response	Delivery Date
	information to accompany the notification has not been supplied.	covering requirements for various government agencies. NOW are covered by this checklist.	
Mining Lease – Condition 18	<p>A number of environmental management housekeeping issues were observed at the time of the on-site audit (September 2013) including excessive build-up of dirt on paved sections of the Colliery work areas, instances of poor chemical storage practices and steep banking with limited ground cover.</p> <p>Increase frequency of road sweeper use on paved sections of Colliery work areas.</p> <p>Review and improve chemical storage practices.</p> <p>Revegetated steep banking adjacent to access track in Colliery Pit Top area.</p>	<p>Veolia sweeping truck to be site introduced. Sweeping will be conducted once a week.</p> <p>Environmental chemicals and calibrations solutions are now kept in a locked cabinet.</p> <p>Steep banking is primarily rocky and doesn't accept vegetative growth readily. Revegetation will be undertaken where possible but was not required as part of the DRE response to the unauthorised clearing incident where much low vegetated banking occurs.</p>	Complete

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

4.3 Community Consultation

WCL has established a Community Consultative Committee (CCC) in accordance with the requirements of the **Condition 5/Schedule 6** of the Approved Project (MP 09_0161) which has, without limitation, the following objectives:

- to develop this CCC with its community;
- to outline what is planned for WCL and its mine sites; and
- to share information with the CCC to date.

Previous to establishing a CCC, WCL undertook interviews with the community utilising an independent third party to assist in understanding the community's key interests. WCL identified some key steps in Community Engagement as follows:

- **Step 1** – Identifying stakeholders / community of interest and the role they can play in WCL's community engagement.
- **Step 2** – Interview those key community stakeholders and research / understand their interests and experience of effective community engagement.
- **Step 3** – Determine from these key community areas/groups, what is believed to constitute effective community engagement and interpret the key messages.
- **Step 4** – Build community engagement with the community utilising Community Engagement Principles drawn from Step 2 - Community Interviews.
- **Step 5** – Integrate the above into a Community Consultative Committee.

Communications for this project aim to ensure all local stakeholders are informed of proposed works and mining processes. Accordingly, WCL interviewed 12 community members from the Wongawilli and Russell Vale / Bellambi areas between 7 and 25 February 2012. A key message identified during these interviews was that effective community engagement is about being a 'good neighbour'.

Following from this WCL, in conjunction with Twyforde, undertook three co-design community forums in March 2012. These forums identified that the community were seeking further information regarding mining process in particular with respect to dust, noise and legislation.

Finally, an Independent Chair has been appointed to ensure effective and efficient CCC meetings are convened. The initial meeting of the Wongawilli Colliery CCC occurred on 28 August 2012. Regular meetings were held thereafter, to provide timely and accurate information on major approvals issues and general operational aspects of the Colliery. WCL also intends that the CCC and its interested parties be dynamic to ensure this communication process and dissemination of information is maximized. The CCC meeting minutes are publicly available on the WCL website.



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

4.4 Agency Consultation

Consultation with key NSW State Government agencies in relation to WCL's Projects will continue on a regular basis in relation to its current mining operations in the Southern Coalfield.

Generally, WCL's consultation is undertaken to ensure that all aspects of the proposed project are conveyed and respective issues identified to be addressed. Mitigation, monitoring and management measures can also be discussed and included in detail within the respective plans of management and Trigger Action Response Plans (TARPs) accordingly.

Correspondence from the relevant agencies may be provided on request.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

5 REHABILITATION

5.1 Buildings

There have been no buildings demolished or rehabilitated during the period.

5.2 Rehabilitation of Disturbed Land

There has been no rehabilitation activity undertaken during the past 12 months at Wongawilli Colliery. The summary and current status of disturbed areas and proposed rehabilitation is detailed in **Table 5-1** and **Table 5-2**.

Rehabilitation completed within Wongawilli lease holdings has been limited to areas at both the Avondale Colliery pit top and Nebo pit top. 14ha located at the Avondale Colliery was rehabilitated by BHP as previous operators of the Avondale Colliery. The Nebo portals N1 to N5, along with the Nebo Platform have also been rehabilitated.

A revision of the rehabilitation cost schedule for Wongawilli Colliery was undertaken and is included in the current MOP approved in March 2012 during the review period.

5.3 Other Infrastructure

There was no rehabilitation of other infrastructure undertaken during the reporting period.

An important matter has been the continuing upgrade of the rail facility during this, and previous periods, to ensure that it is operated safely. This maintenance work is expected to be ongoing to cater for the increase in production that will come from the longwall operations.

The only infrastructure remaining at the Avondale Colliery is two portals, an access track and associated gates and fencing as shown on **Figure 6**. There are no current plans to utilise the Avondale Colliery as an active area. Currently, the remaining portals are fenced off to restrict access by unauthorised persons into the old workings. The remaining portals may be utilised in the future to provide ventilation to new workings. The access track will be maintained to achieve access to the remaining portals and fencing and gates will remain for security purposes.

5.4 Rehabilitation Trials & Research

There have been no rehabilitation trials or research undertaken during the period.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

5.5 Final Rehabilitation Plan

An assessment of rehabilitation issues has previously been undertaken as part of the Major Development application MP 09-0161.

The current MOP that meets the Interim MOP Guidelines was approved in March 2012 and is valid until September 2015. However, as Wongawilli Colliery is now under Care and Maintenance (C&M) a C&M MOP will be submitted to DRE by 31 December 2014. Drawing No **WON-01-0608** included in **Appendix E** shows the broad areas of the Wongawilli pit top that will be addressed in any future rehabilitation plan for the site.

Table 5-1 Rehabilitation Summary

Cumulative Area Affected (hectares)			
	To date	Last report	Next Report (estimated)
A: Mine Lease Area			
A1 Mine Lease (s) Area	14,767ha	14,767ha	14,767ha
B: Disturbed Areas			
B1 Infrastructure area (other disturbed areas to be rehabilitated at closure including facilities, roads)	36.85ha	36.85ha	36.85ha
B2 Active Mining Area (excluding items B3 – B5 below)	0	0	0
B3 Waste emplacements, (active/unshaped/in or out-of-pit)	0	0	0
B4 Tailings emplacements, (active/unshaped/uncapped)	0	0	0
B5 Shaped waste emplacement (awaits final vegetation)	0	0	0
All Disturbed Areas	36.85ha	36.85ha	36.85ha
C: Rehabilitation Progress			

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

C1 Total Rehabilitated area
(except for maintenance)

14ha 14ha 14ha

D: Rehabilitation On Slopes

D1 10 to 18 degrees	0	0	0
D2 Greater than 18 degrees	0	0	0

E: Surface Of Rehabilitated Land

E1 Pasture and grasses	0	0	0
E2 Native forest/ecosystems	14	14	14
E3 Plantation and crops	0	0	0
E4 Other (include non-vegetative outcomes)	0	0	0

Table 5-2 Maintenance Activities on Rehabilitated Land

Nature Of Treatment	Area Treated (Ha)		Comment/Control Strategies/ Treatment Detail
	Report Period	Next Period	
Additional erosion control works (drains re-contouring, rock protection)	0	0	
Re-covering (detail – further topsoil, subsoil sealing etc)	0	0	
Soil treatment (detail – fertilizer, lime, gypsum etc)	0	0	N/A
Treatment/Management (detail – grazing, cropping, slashing etc)	0	0	N/A
Adversely Affected by Weeds	0	0	See Section 3.8



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

(detail – type and treatment)

Feral animal control

32.6ha

32.6ha

See **Section 3.7**

(detail – additional fencing,
trapping, baiting etc)

6 ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD

6.1 Activities Proposed

Activities proposed during the next reporting period are outlined in **Table 6-1**.

Table 6-1 Activities Proposed during the next period

Activity	Details	Proposed Timing
Exploration	One ground water monitoring bore hole and one exploration bore hole	Within the next 12 months
Site Improvement works	Installation of Real time Air Monitor, Noise Monitor and Weather station	Within the next 12 months
Lighting and Energy Audit	Assessment of site lighting compliance with appropriate standards and determination of options to reduce energy use and greenhouse gas emissions	By 31 December 2014
MOP	Preparation of a C&M MOP	By 31 December 2014

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

7 REFERENCES

Australian Standard AS/NZS 4360:2004 Risk Management

Commonwealth Government (1999), Environment Protection and Biodiversity Conservation Act 1999.

Department of Housing (2004), Managing Urban Stormwater: Soils and Construction (4th Edition), NSW Government.

Hazelton, P.A., and Tille, P.J. (1990) Soil Landscapes of the Wollongong-Port Hacking 1:100,000 Sheet, Soil Conservation Service NSW, Sydney.

Wongawilli Colliery (2014), LW N2 End of Panel Report.

Wongawilli Colliery (2011), Mining Operation Plan

Wollongong City Council (2009), Wollongong Local Environmental Plan 2009.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

8 CONTROL AND REVISION HISTORY

PROPERTY	VALUE
Approved by	Group Environment Manager
Document Owner	Group Environment Coordinator
Effective Date	16/01/2015

Revisions

VERSION	DATE REVIEWED	REVIEW TEAM (CONSULTATION)	NATURE OF THE AMENDMENT
1	29/09/2014	K. Prajapati, D. Clarkson	Final Draft
2	16/01/2015	K. Prajapati	Incorporated comments from DP&E



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Appendix A - WCL Environmental Policy

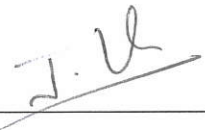
ENVIRONMENT POLICY

1. POLICY

We strive to preserve the long-term health, function, and viability of the natural environments affected by our operations.

We will :

- Act as responsible caretakers of our owners' assets and operate to high environmental standards;
- Monitor, measure and review our environmental controls, procedures and systems;
- Mitigate or remediate any potential environmental impacts of our activities and adverse environmental incidents;
- Continually improve the efficiency with which we use raw materials , energy and natural resources;
- Work in consultation with our government and community agencies
- Minimize harmful emissions of air, water and dust; and
- Manage waste.



Jasbir Singh
Chief Executive Officer



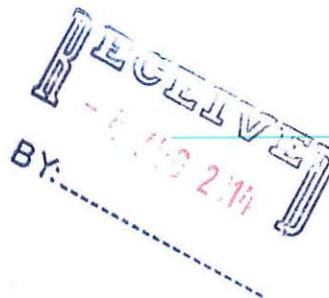
Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Appendix B - Environmental Protection Licence - 1087

Our reference: EF13/3970: DOC14/145752:ATC
Contact: Andrew Couldridge, (02) 4224 4100

REGISTERED POST

Mr Dave Clarkson
Wollongong Coal Limited
PO Box 281
FAIRY MEADOW NSW 2519



Dear Mr Clarkson

LICENCE REVIEW
ENVIRONMENT PROTECTION LICENCE 1087

I refer to the Environment Protection Authority's (EPA) letter to Wollongong Coal dated 6 May 2014 requesting comment on the licence review for Environment Protection Licence Number 1087 (Wongawilli Colliery).

The licence review was conducted under the *Protection of the Environment Operations Act 1997* which requires that the EPA review licences at an interval of not more than five years. The review appraised the appropriateness of licence conditions, consistency within the sector group, and with internal EPA licensing protocols. The review also considered any comments made by the licensee and any public submissions on the licence. The EPA received no public submissions during the review period.

The EPA has completed the review of Wongawilli Colliery's Licence and has made minor changes to the licence. These include removal of completed Pollution Reduction Program Conditions "PRP9 - Coal Mine Particulate Matter Control Best Practice" and "PRP11 - Noise Reduction from the Screener/Sizer Building". Condition "O4.1 Stockpile Filter Pond" has also been removed because it is not consistent with coal mine sector licences.

The attached Notice under Section 58 of the POEO Act enacts the variation to EPL Number 1087.

Please find attached a copy of the finalised and issued Notice. Once the variation is in effect, Wollongong Coal should download an updated copy of the licence from the EPA's Public Register: www.epa.nsw.gov.au/prpoeoapp/.

If you have questions regarding the above please phone the contact officer on (02) 4224 4100.

Yours sincerely



31/7/14

PETER BLOEM
Manager Illawarra
Environment Protection Authority

Att: Notice 1523819

Licence Variation

Licence - 1087



WOLLONGONG COAL LIMITED

Trading as WOLLONGONG COAL LIMITED

ABN 28 111 244 896

PO BOX 281

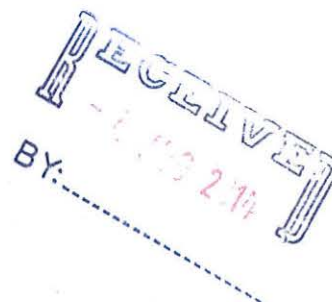
FAIRY MEADOW NSW 2519

Attention: Mr Kamlesh Prajapati

Notice Number 1523819

File Number EF13/3970

Date 29-Jul-2014



NOTICE OF VARIATION OF LICENCE NO. 1087

BACKGROUND

- A. WOLLONGONG COAL LIMITED Trading as WOLLONGONG COAL LIMITED ("the licensee") is the holder of Environment Protection Licence No. 1087 ("the licence") issued under the *Protection of the Environment Operations Act 1997* ("the Act"). The licence authorises the carrying out of activities at MAIN ROAD, WONGAWILLI, NSW, 2530 ("the premises").
- B. A licence review was conducted under the *Protection of the Environment Operations Act 1997* which requires that the EPA review licences at an interval of not more than 5 years. The review appraised the appropriateness of licence conditions, consistency within the sector group, and with internal EPA licensing protocols. The review also considered any comments made by the licensee and any public submissions on the licence. The EPA received no public submissions during the review.
- C. The EPA has completed the review of Licence No. 1087 and has made minor changes to the licence. These include removal of completed Pollution Reduction Program conditions and an operating condition.

VARIATION OF LICENCE NO. 1087

1. By this notice the EPA varies licence No. 1087. The attached licence document contains all variations that are made to the licence by this notice.
2. The following variations have been made to the licence:
 - condition PRP9-Coal Mine Particulate Matter Control Best Practice and PRP11- Noise Reduction from the Screener/Sizer Building have been removed from the licence.
 - O4.1 Stockpile Filter Pond has been removed from the licence.

Licence Variation



William Dove 29/07/2014

William Dove
Head Regional Operations Unit
Metropolitan - Illawarra
(by Delegation)

INFORMATION ABOUT THIS NOTICE

- This notice is issued under section 58(5) of the Act.
- Details provided in this notice, along with an updated version of the licence, will be available on the EPA's Public Register (<http://www.epa.nsw.gov.au/prpoeo/index.htm>) in accordance with section 308 of the Act.

Appeals against this decision

- You can appeal to the Land and Environment Court against this decision. The deadline for lodging the appeal is 21 days after you were given notice of this decision.

When this notice begins to operate

- The variations to the licence specified in this notice begin to operate immediately from the date of this notice, unless another date is specified in this notice.
- If an appeal is made against this decision to vary the licence and the Land and Environment Court directs that the decision is stayed the decision does not operate until the stay ceases to have effect or the Land and Environment Court confirms the decision or the appeal is withdrawn (whichever occurs first).

Licence Variation Summary

Licence - 1087



This Summary serves merely to highlight changes made to areas of this licence. Changes made to tables within the licence are indicated using underline (for additions) and Strikethrough (for deletions).

While changes to conditions are indicated under subheadings such as 'New condition', 'Old condition', 'Replaced by', and 'Removed condition'.

The attached licence document contains all the changes made to this licence by the attached variation notice.

1 Administrative Conditions

2 Discharges to Air and Water and Applications to Land

3 Limit Conditions

4 Operating Conditions

Other operating conditions

Removed condition:

Stockpile filter pond

The water level in the stockpile filter pond must be maintained at a low water level and/or less than 33 per cent capacity by use of the dewatering pump to minimise the risk of overflow during a rainfall event(s).

5 Monitoring and Recording Conditions

7 General Conditions

Other general conditions

PRP No	PRP	Description	Completed Date
<u>9</u>	<u>PRP9: Coal Mine Particulate Matter Control Best Practice</u>	<u>Requires the licensee to conduct a site specific Best Management Practice (BMP) determination to identify ways to reduce particle emissions</u>	<u>29-Jun-2012</u>
<u>11</u>	<u>PRP11: Noise Reduction from the Screener/Sizer Building</u>	<u>Requires the licensee to enclose the vibrating screen located in the Screener Sizer Building</u>	<u>31-May-2012</u>

Licence Variation Summary

Licence - 1087



Environment Protection Licence

Licence - 1087



Licence Details

Number: 1087
Anniversary Date: 01-October

Licensee

WOLLONGONG COAL LIMITED

PO BOX 281

FAIRY MEADOW NSW 2519

Premises

WONGAWILLI COLLIERY

MAIN ROAD

WONGAWILLI NSW 2530

Scheduled Activity

Coal Works

Mining for Coal

Fee Based Activity

Coal works

Mining for coal

Scale

0-2000000 T handled

> 500000-2000000 T produced

Region

Metropolitan - Illawarra

Level 3, NSW Govt Offices, 84 Crown Street

WOLLONGONG NSW 2500

Phone: (02) 4224 4100

Fax: (02) 4224 4110

PO Box 513 WOLLONGONG EAST

NSW 2520

Environment Protection Licence

Licence - 1087



INFORMATION ABOUT THIS LICENCE	4
Dictionary	4
Responsibilities of licensee	4
Variation of licence conditions	4
Duration of licence	4
Licence review	4
Fees and annual return to be sent to the EPA	4
Transfer of licence	5
Public register and access to monitoring data	5
1 ADMINISTRATIVE CONDITIONS	6
A1 What the licence authorises and regulates	6
A2 Premises or plant to which this licence applies	6
A3 Information supplied to the EPA	7
2 DISCHARGES TO AIR AND WATER AND APPLICATIONS TO LAND	7
P1 Location of monitoring/discharge points and areas	7
3 LIMIT CONDITIONS	8
L1 Pollution of waters	8
L2 Concentration limits	8
L3 Volume and mass limits	10
4 OPERATING CONDITIONS	10
O1 Activities must be carried out in a competent manner	10
O2 Maintenance of plant and equipment	10
O3 Dust	11
5 MONITORING AND RECORDING CONDITIONS	11
M1 Monitoring records	11
M2 Requirement to monitor concentration of pollutants discharged	11
M3 Testing methods - concentration limits	13
M4 Recording of pollution complaints	13
M5 Telephone complaints line	13
M6 Requirement to monitor volume or mass	14
6 REPORTING CONDITIONS	14
R1 Annual return documents	14
R2 Notification of environmental harm	15
R3 Written report	16

Environment Protection Licence

Licence - 1087



7	GENERAL CONDITIONS	16
G1	Copy of licence kept at the premises or plant	16
G2	Other general conditions	16
DICTIONARY		19
	General Dictionary	19

Environment Protection Licence

Licence - 1087



Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

Environment Protection Licence

Licence - 1087



The EPA publication "A Guide to Licensing" contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

WOLLONGONG COAL LIMITED

PO BOX 281

FAIRY MEADOW NSW 2519

subject to the conditions which follow.

Environment Protection Licence

Licence - 1087



1 Administrative Conditions

A1 What the licence authorises and regulates

- A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Coal Works	Coal works	0 - 2000000 T handled
Mining for Coal	Mining for coal	> 500000 - 2000000 T produced

A2 Premises or plant to which this licence applies

- A2.1 The licence applies to the following premises:

Premises Details

WONGAWILLI COLLIERY

MAIN ROAD

WONGAWILLI

NSW 2530

LOT 1 DP 44325, LOT 1 DP 255284, LOT 8 DP 255285, LOT 1 DP 321054,
LOT 1 DP 383829

- A2.2 Other Premises Details

Property	Comments
Pt 255 DP751278	Elouera Colliery Pit Top and upper section of decline conveyor. This property contains Licence Discharge Point No 2.
Pt Portion 258 DP751278	Mid section of decline conveyor.
Pt Portion 244 DP751278	Lower portion of decline conveyor and lower level access road.
Lot 1 Pt Portion 14 DP255284, Lot 1 DP44325, Lot 1 DP321054, and DP383829	Elouera Colliery stockpile, the lower level bathhouse and office facilities, and the Pit Top access road. This property contains Licence Discharge Point No 1,3 and 4.
Lot 8 DP255285	This property contains Licence Discharge Point No 11 (Forrest 11 Portal).

Environment Protection Licence

Licence - 1087



A3 Information supplied to the EPA

- A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:

- a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
- b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

- P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

<i>Air</i>			
EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
9	Dust Deposition Site		South Western Boundary, Wongawilli Emplacement - A697 on photograph "Wongawilli Monitoring Locations, July 1998"
10	Dust Deposition Site		Wongawilli Mine Bins - A692 on photograph "Wongawilli Monitoring Locations, July 1998"
11	Dust Deposition Site		Wongawilli Township (behind old school) - A693 on photograph "Wongawilli Monitoring Locations, July 1998"
12	Dust Deposition Site		Shone Avenue - A694 on photograph "Wongawilli Monitoring Locations, July 1998"
13	Dust Deposition Site		West Dapto Road/Bong Bong Road Intersection - A695 on photograph "Wongawilli Monitoring Locations, July 1998"

- P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

- P1.3 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

Water and land

Environment Protection Licence

Licence - 1087



EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Discharge to waters Discharge quality monitoring	Discharge to waters Discharge quality monitoring	Secondary Stabilisation Lagoon - STP discharge labelled as "Point 1" on map titled "Elouera Colliery Licensed Discharge Points" dated 1 July 2003.
2	Discharge to waters Discharge quality monitoring	Discharge to waters Discharge quality monitoring	Minewater discharge from open drain at Transport Portal labelled as "Point 2" on map titled "Elouera Colliery Licensed Discharge Points" dated 1 July 2003.
3	Discharge to waters Discharge quality monitoring	Discharge to waters Discharge quality monitoring	Underflow from coal sedimentation/filter Pond labelled as "Point 3" on map titled "Elouera Colliery Licensed Discharge Points" dated 1 July 2003.
4		Discharge to waters	Overflow from coal sedimentation/filter pond labelled as "Point 4" on map titled "Elouera Colliery Licensed Discharge Points" dated 1 July 2003.
7	Discharge quality monitoring for mine water discharged via Point 8		Minewater discharge from old portals - Junction of three separate pipes 15 metres from Forest 11 Portal labelled as "Point 7" on map titled "Elouera Colliery No. 3 Seam" dated 14 April 2003.
8		Discharge to waters	Minewater discharge from old portals - Hunter 2 Dam labelled as "Point 8" on map titled "Elouera Colliery No. 3 Seam" dated 14 April 2003

3 Limit Conditions

L1 Pollution of waters

- L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

- L2.1 For each monitoring/discharge point or utilisation area specified in the table/s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.
- L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

Environment Protection Licence

Licence - 1087



L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table/s.

L2.4 Water and/or Land Concentration Limits

POINT 1

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Biochemical oxygen demand	milligrams per litre				20
Oil and Grease	milligrams per litre				10
pH	pH				6.5-8.5
Total suspended solids	milligrams per litre				30

POINT 2

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	milligrams per litre				10
pH	pH				6.5-8.5
Total suspended solids	milligrams per litre				50

POINT 3

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	milligrams per litre				10
pH	pH				6.5-8.5
Total suspended solids	milligrams per litre				50

Environment Protection Licence

Licence - 1087



POINT 8

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	milligrams per litre				10
pH	pH				6.5-8.5
Total suspended solids	milligrams per litre				50

L3 Volume and mass limits

- L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
- liquids discharged to water; or;
 - solids or liquids applied to the area;
- must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	30
2	kilolitres per day	10000
8	kilolitres per day	2500

4 Operating Conditions

O1 Activities must be carried out in a competent manner

- O1.1 Licensed activities must be carried out in a competent manner.
This includes:
- the processing, handling, movement and storage of materials and substances used to carry out the activity; and
 - the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

- O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
- must be maintained in a proper and efficient condition; and
 - must be operated in a proper and efficient manner.

Environment Protection Licence

Licence - 1087



O3 Dust

- O3.1 Activities occurring in or on the premises must be carried out in a manner that will minimise the generation, or emission from the premises, of wind-blown or traffic generated dust.
- O3.2 All trafficable areas, coal storage areas and vehicle manoeuvring areas in or on the premises must be maintained, at all times, in a condition that will minimise the generation, or emission from the premises, of wind-blown or traffic generated dust.

5 Monitoring and Recording Conditions

M1 Monitoring records

- M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.
- M1.2 All records required to be kept by this licence must be:
- a) in a legible form, or in a form that can readily be reduced to a legible form;
 - b) kept for at least 4 years after the monitoring or event to which they relate took place; and
 - c) produced in a legible form to any authorised officer of the EPA who asks to see them.
- M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
- a) the date(s) on which the sample was taken;
 - b) the time(s) at which the sample was collected;
 - c) the point at which the sample was taken; and
 - d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

- M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 9,10,11,12,13

Pollutant	Units of measure	Frequency	Sampling Method
Ash	grams per square metre per month	Continuous	Australian Standard 3580.10.1-2003
Combustible solids	grams per square metre per month	Continuous	Australian Standard 3580.10.1-2003

Environment Protection Licence

Licence - 1087



Insoluble solids	grams per square metre per month	Continuous	Australian Standard 3580.10.1-2003
------------------	----------------------------------	------------	------------------------------------

M2.3 Water and/ or Land Monitoring Requirements

POINT 1

Pollutant	Units of measure	Frequency	Sampling Method
BOD	milligrams per litre	Monthly during discharge	Grab sample
Oil and Grease	milligrams per litre	Monthly during discharge	Grab sample
pH	pH	Monthly during discharge	Grab sample
Total suspended solids	milligrams per litre	Monthly during discharge	Grab sample

POINT 2

Pollutant	Units of measure	Frequency	Sampling Method
Oil and Grease	milligrams per litre	Once a month (min. of 4 weeks)	Grab sample
pH	pH	Once a month (min. of 4 weeks)	Grab sample
Total suspended solids	milligrams per litre	Once a month (min. of 4 weeks)	Grab sample

POINT 3

Pollutant	Units of measure	Frequency	Sampling Method
Oil and Grease	milligrams per litre	Monthly during discharge	Grab sample
pH	pH	Monthly during discharge	Grab sample
Total suspended solids	milligrams per litre	Monthly during discharge	Grab sample

POINT 7

Pollutant	Units of measure	Frequency	Sampling Method
Oil and Grease	milligrams per litre	Monthly during discharge	Grab sample
pH	pH	Monthly during discharge	Grab sample
Total suspended solids	milligrams per litre	Monthly during discharge	Grab sample

Environment Protection Licence

Licence - 1087



M3 Testing methods - concentration limits

- M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:
- a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
 - b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
 - c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.
- M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M4 Recording of pollution complaints

- M4.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.
- M4.2 The record must include details of the following:
- a) the date and time of the complaint;
 - b) the method by which the complaint was made;
 - c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
 - d) the nature of the complaint;
 - e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
 - f) if no action was taken by the licensee, the reasons why no action was taken.
- M4.3 The record of a complaint must be kept for at least 4 years after the complaint was made.
- M4.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M5 Telephone complaints line

- M5.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of

Environment Protection Licence

Licence - 1087



receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M5.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M5.3 The preceding two conditions do not apply until 3 months after:

- a) the date of the issue of this licence or
- b) if this licence is a replacement licence within the meaning of the Protection of the Environment Operations (Savings and Transitional) Regulation 1998, the date on which a copy of the licence was served on the licensee under clause 10 of that regulation.

M6 Requirement to monitor volume or mass

M6.1 For each discharge point or utilisation area specified below, the licensee must monitor:

- a) the volume of liquids discharged to water or applied to the area;
- b) the mass of solids applied to the area;
- c) the mass of pollutants emitted to the air;

at the frequency and using the method and units of measure, specified below.

POINT 1

Frequency	Unit of Measure	Sampling Method
Continuous	kilolitres per day	By Calculation (volume flow rate or pump capacity multiplied by operating time)

POINT 2

Frequency	Unit of Measure	Sampling Method
Continuous	kilolitres per day	By Calculation (volume flow rate or pump capacity multiplied by operating time)

POINT 3

Frequency	Unit of Measure	Sampling Method
Daily during any discharge	kilolitres per day	Estimate

POINT 7

Frequency	Unit of Measure	Sampling Method
Continuous	kilolitres per day	By Calculation (volume flow rate or pump capacity multiplied by operating time)

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:

- a) a Statement of Compliance; and

Environment Protection Licence

Licence - 1087



b) a Monitoring and Complaints Summary.

At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

R1.3 Where this licence is transferred from the licensee to a new licensee:

a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and

b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:

a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or

b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:

a) the licence holder; or

b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R2 Notification of environmental harm

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

Environment Protection Licence

Licence - 1087



R3 Written report

- R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
- a) where this licence applies to premises, an event has occurred at the premises; or
 - b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
- and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.
- R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.
- R3.3 The request may require a report which includes any or all of the following information:
- a) the cause, time and duration of the event;
 - b) the type, volume and concentration of every pollutant discharged as a result of the event;
 - c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
 - d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
 - e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
 - f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
 - g) any other relevant matters.
- R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

7 General Conditions

G1 Copy of licence kept at the premises or plant

- G1.1 A copy of this licence must be kept at the premises to which the licence applies.
- G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.
- G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Other general conditions

G2.1 Completed Pollution Studies and Reduction Programs (PRPs)

Environment Protection Licence

Licence - 1087



PRP	Description	Completed Date
PRP1: Investigate effluent reuse and/or effluent treatme	BHP to investigate effluent reuse and/or effluent treatment options for stormwater captured in the stockpile filter pond.. By treating and discharging, or reusing the effluent from the pond it will be possible to maintain the pond at a low water level and reduce the frequency and volume of any overflows from the pond.	18-December-1998
PRP2: Install a diesel pump and associated pipework at t	BHP to install a diesel pump and associated pipework at the stockpile filter pond to facilitate pumping water from the pond into a water tanker.. Water can be removed from the site or reused around the stockpile for dust suppression.	28-February-1999
PRP3: Construct an additional filtration dam in the coal	BHP to construct an additional filtration dam in the coal stockpile yard on the inlet side to the primary lagoon. . Provide additional water treatment for any runoff from the coal stockpile area of the premises.	28-February-1999
PRP4: Install a pipeline at the stockpile filter pond	BHP to install a pipeline at the stockpile filter pond that can be used to dewater the stockpile filter pond by pumping wastewater to the wastewater storage ponds at the Wongawilli Emplacement.. Management Plan objective must be to minimise the frequency and volume of overflows from the Elouera stockpile filter pond while also being compatible with the stormwater management plans in place for Wongawilli.	30-November-1999
PRP5: Investigate ways of reducing clean stormwater infl	BHP to investigate ways of reducing clean stormwater inflows to the Elouera Colliery stockpile filter pond and then install the identified works.	30-November-1999
PRP6: 4 stage process to construct, install improved sto	4 stage process to construct, install improved storwater controls about the decline conveyor. Stages 1, 2 & 3 complete 31 December 2001.. To improve the performance of the stormwater controls about the decline conveyor.	25-July-2002
PRP7: Undertake investigations and to implement the reco	Undertake investigations and to implement the recommendations to improve the effectiveness of dust suppression strategies at the Elouera Stockpiles.. Reduce dust emissions	30-August-2002
PRP 8: Investigation of Dust Sources in Dust Gaug	Investigation of Dust Sources in Dust Gauges. If dust is determined to be sourced from coal mining activities, a dust reduction PRP will be added to the licence to reduce the impact on the community. To be reviewed in 12 months. (*)	17-November-2007
PRP9: Coal Mine Particulate Matter Control Best Practice	Requires the licensee to conduct a site specific Best Management Practice (BMP) determination to identify ways to reduce particle emissions	29-June-2012

Environment Protection Licence

Licence - 1087



PRP10: Decline Conveyor
Stormwater Management

Licensee is to install diversion drains and
sediment ponds to capture overflow from the
decline conveyor sedimentation dam

28-February-2012

PRP11: Noise Reduction
from the Screener/Sizer
Building

Requires the licensee to enclose the vibrating
screen located in the Screener Sizer Building

31-May-2012

Environment Protection Licence

Licence - 1087



Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

Environment Protection Licence

Licence - 1087



flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder described at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 months. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .

Environment Protection Licence

Licence - 1087



TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non - putrescible), special waste or hazardous waste

Mr Bernie Weir

Environment Protection Authority

(By Delegation)

Date of this edition: 08-March-2000

Environment Protection Licence

Licence - 1087



End Notes

- 1 Licence varied by notice V/M upgrade, issued on 07-Jul-2000, which came into effect on 07-Jul-2000.
- 2 Licence varied by notice 1012136, issued on 04-Dec-2001, which came into effect on 29-Dec-2001.
- 3 Licence varied by notice 1014403, issued on 21-Feb-2002, which came into effect on 18-Mar-2002.
- 4 Licence varied by PREMISES LOCATION DETAILS INCORRECT, issued on 20-Mar-2002, which came into effect on 20-Mar-2002.
- 5 Licence varied by notice 1017563, issued on 28-May-2002, which came into effect on 22-Jun-2002.
- 6 Licence varied by notice 1019297, issued on 25-Jul-2002, which came into effect on 13-Aug-2002.
- 7 Licence transferred through application 141376, approved on 16-Aug-2002, which came into effect on 01-Jul-2002.
- 8 Licence varied by notice 1020008, issued on 21-Aug-2002, which came into effect on 15-Sep-2002.
- 9 Licence varied by notice 1027943, issued on 28-Apr-2004, which came into effect on 23-May-2004.
- 10 Licence transferred through application 143872, approved on 22-Dec-2005, which came into effect on 13-Dec-2005.
- 11 Licence varied by change to DEC Region allocation, issued on 16-Mar-2006, which came into effect on 16-Mar-2006.
- 12 Licence varied by notice 1058272, issued on 06-Apr-2006, which came into effect on 06-Apr-2006.
- 13 Licence varied by notice 1063711, issued on 17-Nov-2006, which came into effect on 17-Nov-2006.
- 14 Licence transferred through application 145311, approved on 19-Dec-2007, which came into effect on 19-Dec-2007.
- 15 Licence varied by notice 1085196, issued on 01-May-2008, which came into effect on 01-May-2008.
- 16 Condition A1.3 Not applicable varied by notice issued on <issue date> which came into effect on <effective date>
- 17 Licence varied by change to Premises details, issued on 21-Nov-2008, which came into effect on 21-Nov-2008.
- 18 Licence varied by notice 1104264, issued on 02-Nov-2009, which came into effect on 02-Nov-2009.

Environment Protection Licence

Licence - 1087



- 19 Licence varied by notice 1501818 issued on 01-Nov-2011
 - 20 Licence varied by notice 1502933 issued on 01-Dec-2011
 - 21 Licence varied by notice 1503450 issued on 20-Dec-2011
 - 22 Licence varied by notice 1504282 issued on 27-Feb-2012
 - 23 Licence varied by notice 1509063 issued on 27-Sep-2012
 - 24 Licence format updated on 06-Mar-2014
-



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Appendix C - LW N2 End of Panel Report



Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

WONGAWILLI COLLIERY NEBO AREA

END OF PANEL REPORT FOR LONGWALL N2

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

EXECUTIVE SUMMARY

Wongawilli Coal Pty Limited, a subsidiary of Wollongong Coal Limited, operates the Wongawilli Colliery, located approximately 15 km south-west of Wollongong. Longwall mining operations in the Nebo Area at Wongawilli Colliery are undertaken pursuant to Project Approval 09_0162 and Subsidence Management Plan Approval 09_5341. This End of Panel Report has been prepared in accordance with Condition 18 of Subsidence Management Plan Approval 09_5341. This End of Panel Report describes the subsidence effects and environmental consequences observed during mining of Longwall N2, and compares these to the predicted subsidence effects and consequences.

Secondary extraction of Longwall N2 panel was undertaken from 12 June 2013 to 26 February 2014. Extraction of Longwall N2 has been suspended due to a roof fall on the longwall miner, with recommencement unlikely for an indeterminate period.

The observed subsidence effects induced by mining of Longwall N2 are generally consistent with the predictions for Longwall N2 and N3, as indicated in the table below.

	Maximum Vertical Subsidence (mm)	Maximum Tilt (mm/m)	Maximum Tensile Strain (mm/m)	Maximum Compressive Strain (mm/m)
Predicted Subsidence for LW N2 and LW N3	230	1.7	0.3 – 0.4	0.5
Observed Subsidence for LW N2	92	0.5	0.2	0.2

The mining of Longwall N2 did not result in any environmental consequences that were greater than the predicted environmental consequences, as summarised in the table below.

Feature	Predicted Consequences	Actual Consequences
Transmission Lines	No observable impact on the transmission line poles	No observed impacts to transmission line poles
Access Tracks	No potential for significant impact	No impacts observed
Historic Heritage Sites	Potential for ground cracking or tree falls	No impacts

Feature	Predicted Consequences	Actual Consequences
Surface Water	<ul style="list-style-type: none"> No impact on stream flows Potential increase in iron hydroxide precipitation Potential lowering of pH 	No changes to stream flows or water chemistry were identified.
Groundwater	<ul style="list-style-type: none"> No connectivity of aquifers and aquitards within 20 m of surface Increased rainfall recharge to basement Reduction in water levels of up to 10 m, followed by full recovery Increase in iron and manganese hydroxide precipitation Potential lowering of pH 	<ul style="list-style-type: none"> No connectivity between aquifers and aquitards within 20 m of surface has been identified No increase in rate of rainfall recharge to basement has been identified Water levels reduced by a maximum of 8 m and have recovered to 4 m (to date) No observed change in water chemistry
Aquatic Ecology	No observable impact to ecological values	No observed impact to ecological values
Terrestrial Ecology	No observable impact to ecological values	No observed impact to ecological values

The observed consequences did not exceed any of the triggers in the relevant Trigger Action Response Plans. As such, no additional management or mitigation measures are required for Longwall N2. Wollongong Coal Limited will continue to undertake monitoring activities as required.

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

Table of Contents

Executive Summary	2
1. Introduction	6
1.1. Background.....	6
1.2. Regulatory Framework.....	9
1.3. Report Structure.....	10
2. Subsidence Effects.....	11
2.1. Mining Parameters.....	11
2.2. Predicted Subsidence.....	11
2.3. Subsidence Monitoring Measures.....	13
2.4. Observed Subsidence.....	13
3. Built Features	14
3.1. Surface Infrastructure	14
3.1.1. Description of Features.....	14
3.1.2. Predicted Consequences.....	14
3.1.3. Observed Consequences.....	15
3.2. Heritage Sites	17
3.2.1. Description of Features.....	17
3.2.2. Predicted Consequences.....	17
3.2.3. Observed Consequences.....	17
4. Natural Features	19
4.1. Surface Water	19
4.1.1. Description of Features.....	19
4.1.2. Predicted Consequences.....	19
4.1.3. Observed Consequences.....	19
4.2. Groundwater	20
4.2.1. Description of Features.....	20
4.2.2. Predicted Consequences.....	20
4.2.3. Observed Consequences.....	21
4.3. Aquatic Ecology	23
4.3.1. Description of Features.....	23
4.3.2. Predicted Consequences.....	23
4.3.3. Observed Consequences.....	23
4.4. Terrestrial Ecology	24

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

4.4.1.	Description of Features	24
4.4.2.	Predicted Consequences	25
4.4.3.	Observed Consequences	25
5.	Management and Mitigation Measures	26
6.	Abbreviations	29
7.	References	30
8.	Control and Revision History	30

List of Figures

Figure 1	Regional Locality	7
Figure 2	Site Layout	8
Figure 3	Subsidence Predictions and Monitoring	12
Figure 4	Surface Infrastructure	16
Figure 5	Heritage Sites	18
Figure 6	Water Monitoring	22
Figure 7	Aquatic Ecology Monitoring	27
Figure 8	Terrestrial Ecology Monitoring	28

List of Tables

Table 1	End of Panel Report Requirements	9
Table 2	Comparison of Predicted versus Observed Subsidence	14
Table 3	Abbreviations	29

List of Appendices

Appendix A	Wongawilli Colliery – LWN2 End of Panel Subsidence Report
Appendix B	Nebo Area – Longwall 2 End of Panel Report (Heritage)
Appendix C	Wongawilli Colliery Nebo Area Longwall N2 Groundwater & Surface Water End of Panel Report
Appendix D	Nebo Area – Longwall 2 End of Panel Report (Ecology)

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

1. INTRODUCTION

1.1. Background

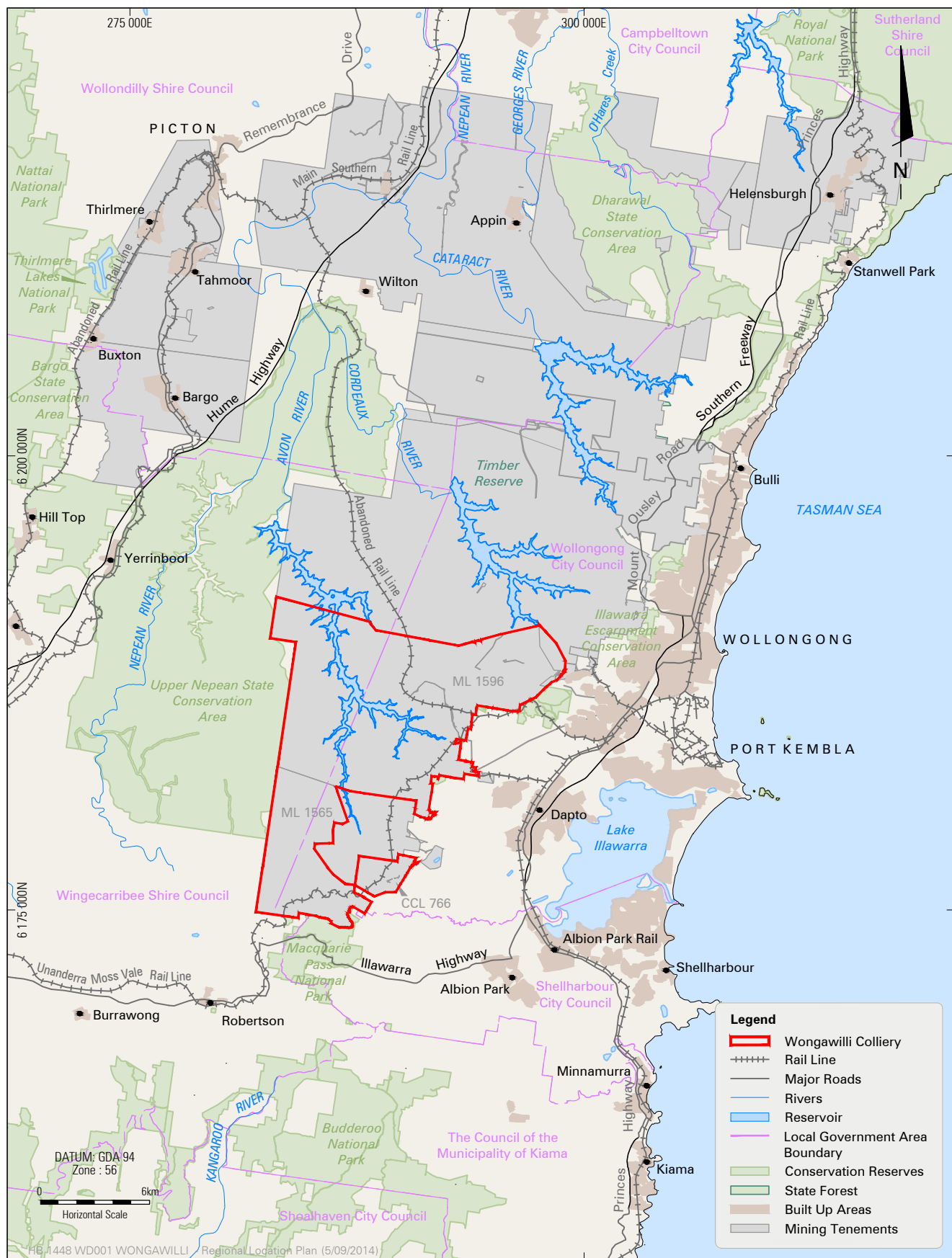
Wongawilli Coal Pty Limited operates the Wongawilli Colliery in the Southern Coalfield of New South Wales. Wongawilli Coal Pty Limited is a wholly owned subsidiary of Wollongong Coal Limited (WCL), formerly known as Gujarat NRE Coking Coal Limited. Wongawilli Colliery is located approximately 15 km south-west of Wollongong (see **Figure 1**), within the Wollongong and Wingecarribee Local Government Areas (LGAs).

Mining activities have been undertaken at the site since 1912. The WCL Wongawilli Colliery amalgamates the mining areas of the historical Elouera, Huntley and Avondale Collieries. Mining activities at Wongawilli Colliery are currently undertaken within Mining Lease (ML) 1565, ML 1596 and Consolidated Coal Lease (CCL) 766.

WCL has approval to mine six longwall panels (LW N1 to LW N6) in an area within ML 1596 known as the Nebo Area (see **Figure 2**). The Nebo Area includes Longwall N2 (LW N2), which is the subject of this End of Panel Report. LW N2 was the first of the longwall panels in the Nebo Area to be extracted. Secondary extraction of this panel was undertaken from 12 June 2013 to 26 February 2014. Extraction of LW N2 was undertaken in a south to north direction and was discontinued at the point where panel intersects the completed first workings in the Wongawilli seam (see **Figure 2**). Mining of LW N2 was suspended due to a roof fall on the longwall miner.

An Extraction Plan (formerly a Subsidence Management Plan) was prepared for longwall mining of LW N1 to LW N6 (Niche Environment and Heritage, 2012). This Extraction Plan was approved by the Division of Resources and Energy (DRE) on 25 January 2013. This End of Panel report has been prepared to satisfy the conditions of this Subsidence Management Plan (SMP) Approval (09/5341).

There is unlikely to be further extraction in LW N2 for an indeterminate period. As such, WCL has prepared this End of Panel Report which describes the subsidence effects and environmental consequences that resulted from the extraction of LW N2 (to date) and compares the observed impacts with earlier predictions. The information provided in this report has been collated by WCL and the specialist consultants responsible for environmental monitoring at Wongawilli Colliery.



WONGAWILLI COLLIERY

Regional Locality

FIGURE 1



Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Site Layout

FIGURE 2

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

1.2. Regulatory Framework

In 2009, WCL made an application (MP 09_0162) for planning approval to mine six longwall panels (LW N1 to LW N6) in the Nebo Area. A detailed assessment of the potential subsidence related impacts of these longwall was presented in the *NRE Wongawilli Colliery Nebo Area Environmental Assessment* (ERM, 2010) (Nebo EA). These workings are located within the Wongawilli coal seam. Project Approval under section 75J of the *Environmental Planning and Assessment Act 1979* (EP&A Act) was granted on 2 November 2011. Project Approval 09_0162 enables mining activities in the Nebo Area to take place until 31 December 2015.

In accordance with the conditions of Project Approval and ML 1596, WCL prepared an Extraction Plan for LW N1 to LW N6 in the Nebo Area, for which SMP Approval (09/5341) was granted. Condition 18 of SMP Approval 09/5341 requires that an End of Panel Report be prepared following the completion of a longwall panel. Condition 18 also outlines the requirements for an End of Panel Report.

Table 1 lists each of these requirements and indicates where these requirements have been addressed in this report.

*Table 1
End of Panel Report Requirements*

Requirement	Relevant Sections
Within 4 months of the completion of each longwall panel, an end of panel report must be submitted to the Director-General. The end of panel report must:	Sections 2, 3 & 4
a) Include a summary of the subsidence and environmental monitoring results for the applicable longwall panel;	
b) Include an analysis of these monitoring results against the relevant: <ul style="list-style-type: none"> Impact assessment criteria; Monitoring results from previous panels; Predictions in the SMP 	Sections 2, 3 & 4 LW N2 is the first panel mined in the Nebo Area
c) Identify any trends in the monitoring results over the life of the activity; and	Sections 2, 3 & 4
d) Describe what actions were taken to ensure adequate management of any potential subsidence impacts due to longwall mining.	Section 5

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

1.3. Report Structure

This End of Panel Report is structured as follows:

- **Section 2** presents the subsidence predictions contained in the Nebo EA and the SMP and summarises the subsidence effects measured during the mining of LW N2;
- **Section 3** describes the environmental consequences of subsidence that relate to built features and compares predicted environmental consequences with actual observations;
- **Section 4** describes the environmental consequences of subsidence that relate to natural features and compares predicted environmental consequences with actual observations;
- **Section 5** outlines the management and mitigation measures that have been and will be implemented to minimise and / or remediate environmental consequences;
- **Section 6** defines the abbreviations and terminology used in this report; and
- **Section 0** lists the sources referenced in this report.

Detailed analyses of monitoring results are provided in the appendices to this report, including:

- **Appendix A** provides a comprehensive discussion of subsidence monitoring results;
- **Appendix B** discusses impacts on Indigenous and historical heritage sites;
- **Appendix C** provides a comprehensive discussion of surface water and groundwater monitoring results; and
- **Appendix D** discusses impacts on aquatic and terrestrial ecology.

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

2. SUBSIDENCE EFFECTS

Strata Control Technology (SCT) has undertaken a detailed analysis of subsidence monitoring data and has compared the observed subsidence to the predictions in the Extraction Plan. This report is provided in **Appendix A**. A summary is provided below.

2.1. Mining Parameters

The depth of cover for LW N2 ranges from approximately 280 m at its southern end to 125 m at its northern end. A subsidence monitoring line (300 Line) crosses the panel at approximately mid-panel. The depth of cover at this subsidence monitoring line is approximately 180 m. Subsidence monitoring lines are shown on **Figure 3**.

The completed mining of LW N2 has generated a void that is approximately 789 m long and 132 m wide. The extraction height for the completion section of LW N2 ranged from 3.3 m to 3.4 m.

The overburden sequence has been intruded by a crinanite sill. This sill varies in thickness from 55 m to 98 m. The base of the sill is located 70 m to 120 m above the longwall panel, with the greatest separation occurring at the southern end of the panel.

2.2. Predicted Subsidence

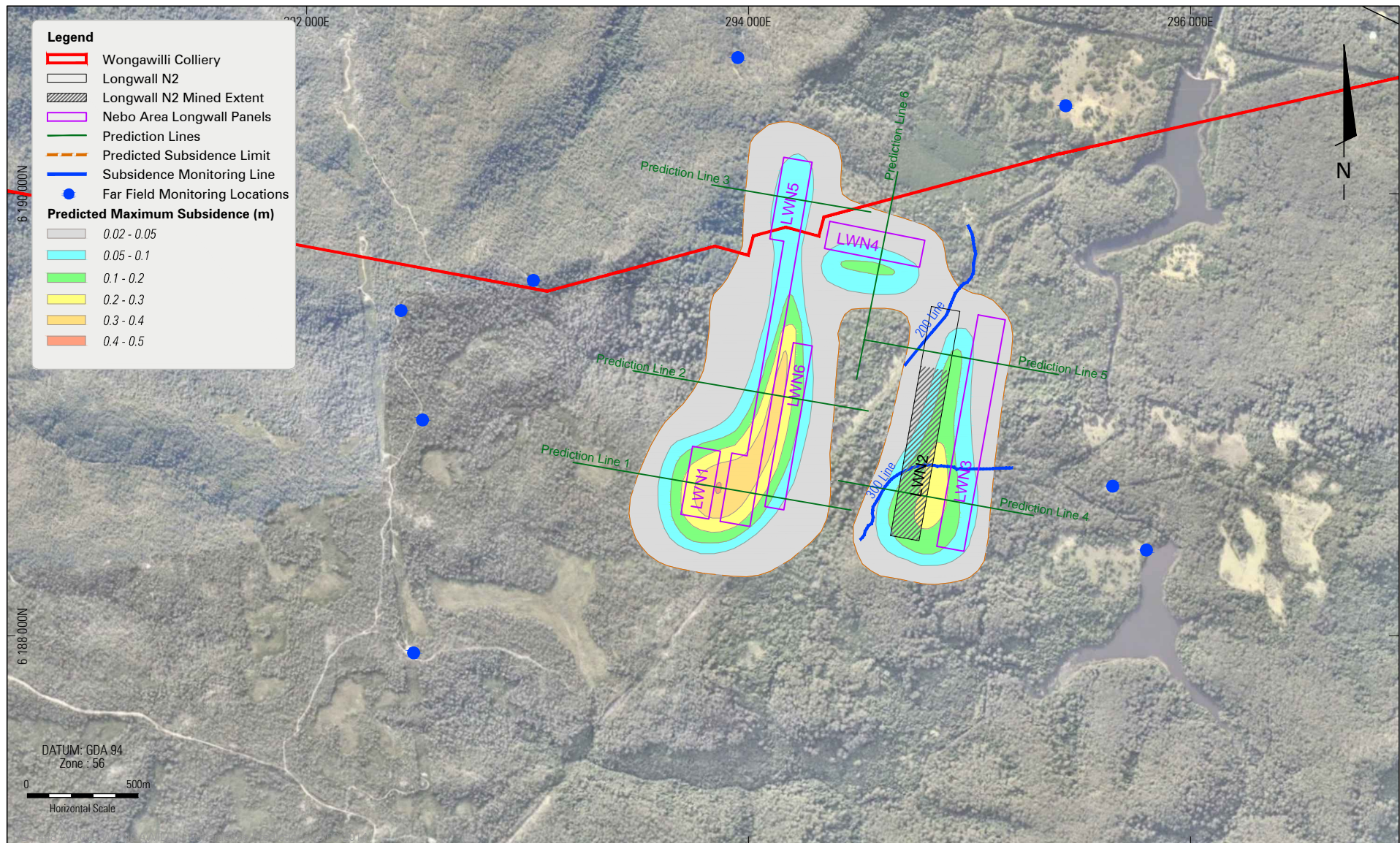
Mine Subsidence Engineering Consultants (MSEC) predicted the subsidence effects and consequences resulting from mining of the Nebo Area longwall panels. These subsidence predictions were included in the Extraction Plan. The predicted systematic subsidence is shown in **Figure 3**.

MSEC provided predictions of subsidence effects using six prediction lines (see **Figure 3**). Prediction Line 4 intersects both LW N2 and LW N3. For the purposes of comparing predictions with measured values, Prediction Line 4 is most comparable to the 300 Line.

MSEC predicted the following systematic subsidence movements for LW N2 and LW N3:

- Maximum conventional subsidence of 230 mm;
- Maximum conventional tilt of 1.7 mm/m;
- Maximum tensile strain of 0.3 mm/m; and
- Maximum compressive strain of 0.5 mm/m.

Predictions are only available for the cumulative impacts of LW N2 and LW N3. As expected, the recorded subsidence effects are less than the predicted values for LW N2 and LW N3.



WONGAWILLI COLLIERY

Subsidence Predictions and Monitoring

FIGURE 3



Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

2.3. Subsidence Monitoring Measures

The 300 Line follows an access road that crosses LW N2 at approximately mid-panel length. The 300 Line serves as the mid-panel crossline.

A second subsidence monitoring line (200 Line) has been established along the alignment of a nearby 33 kV transmission line (see **Figure 3**).

To measure far-field movements, nine pegs remote from the panel were surveyed using GPS. These far-field monitoring locations are shown on **Figure 3**.

2.4. Observed Subsidence

Mining of LW N2 to date has resulted in minimal systematic subsidence. The maximum vertical subsidence measured along the 300 Line is 92 mm. Vertical subsidence of approximately 90 mm occurs uniformly along the central 100 m of the panel width. The uniformity of the vertical subsidence is consistent with bridging of the overlying crininite sill. As a result, there is minimal sagging above the panel void. Rather, the observed subsidence is due to compression of the abutment coal. This compression tapers symmetrically from the goaf edge for a distance of about 200 m on both sides of the panel. The result is a broad zone of low magnitude compression that is approximately 500 m wide.

The measured maximum tilt is approximately 90 mm over a distance of 200 m, equating to a tilt of less than 0.5 mm/m. This level of tilt is imperceptible for all practical purposes.

The horizontal movements measured on 300 Line are smaller than the vertical subsidence movements. Measured horizontal movement along the axis of the panel is less than the survey tolerance of ± 20 mm. Horizontal movement across the panel is symmetrical about the centreline of the panel, with peak movement of approximately 30 mm occurring at a distance of 100 m out from the goaf edge. Measured horizontal strain is in the order of 30 mm over 150 m (or 0.2 mm/m). This level of strain is imperceptible for all practical purposes.

As shown in **Table 2**, the subsidence effects measured during mining of LW N2 are substantially lower than the predictions for the cumulative impact of LW N2 and LW N3. The observed subsidence movements resulting from mining of LW N2 are consistent with these predictions.

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

Table 2
Comparison of Predicted versus Observed Subsidence

	Maximum Vertical Subsidence (mm)	Maximum Tilt (mm/m)	Maximum Tensile Strain (mm/m)	Maximum Compressive Strain (mm/m)
Predicted Subsidence for LW N2 and LW N3	230	1.7	0.3 – 0.4	0.5
Observed Subsidence for LW N2	92	0.5	0.2	0.2

3. BUILT FEATURES

3.1. Surface Infrastructure

SCT has assessed the impacts of the observed subsidence movements on surface infrastructure. SCT has also compared the observed environmental consequences with the predictions in the Extraction Plan. This analysis is provided in **Appendix A** and is summarised in this section.

3.1.1. Description of Features

Two 33 kV electricity transmission lines pass over the northern portion of LW N2 (see **Figure 4**). The portion of LW N2 directly beneath the transmission lines has not been mined to date. One transmission line is owned by Sydney Water and is used to supply power to the Avon pump station. The other transmission line is owned by WCL and used to supply power to the No. 4 Ventilation Shaft Site for Wongawilli Colliery. Both 33 kV transmission lines are supported by timber poles.

An unsealed 4WD track crosses LW N2 and LW N3.

3.1.2. Predicted Consequences

Transmission Lines

The Extraction Plan predicted that the transmission lines will be subject to maximum vertical subsidence of 40 mm and maximum tilt of <0.1 mm/m. These small subsidence movements are unlikely to impact the poles supporting these transmission lines.

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

Access Tracks and Fire Trails

Subsidence movements along the unsealed 4WD track were predicted to be similar to the predicted profile for Prediction Line 4. The maximum predicted tensile and compressive strains were 0.3 mm/m and 0.5 mm/m respectively. These small subsidence movements are unlikely to impact the use of this track.

3.1.3. Observed Consequences

Transmission Lines

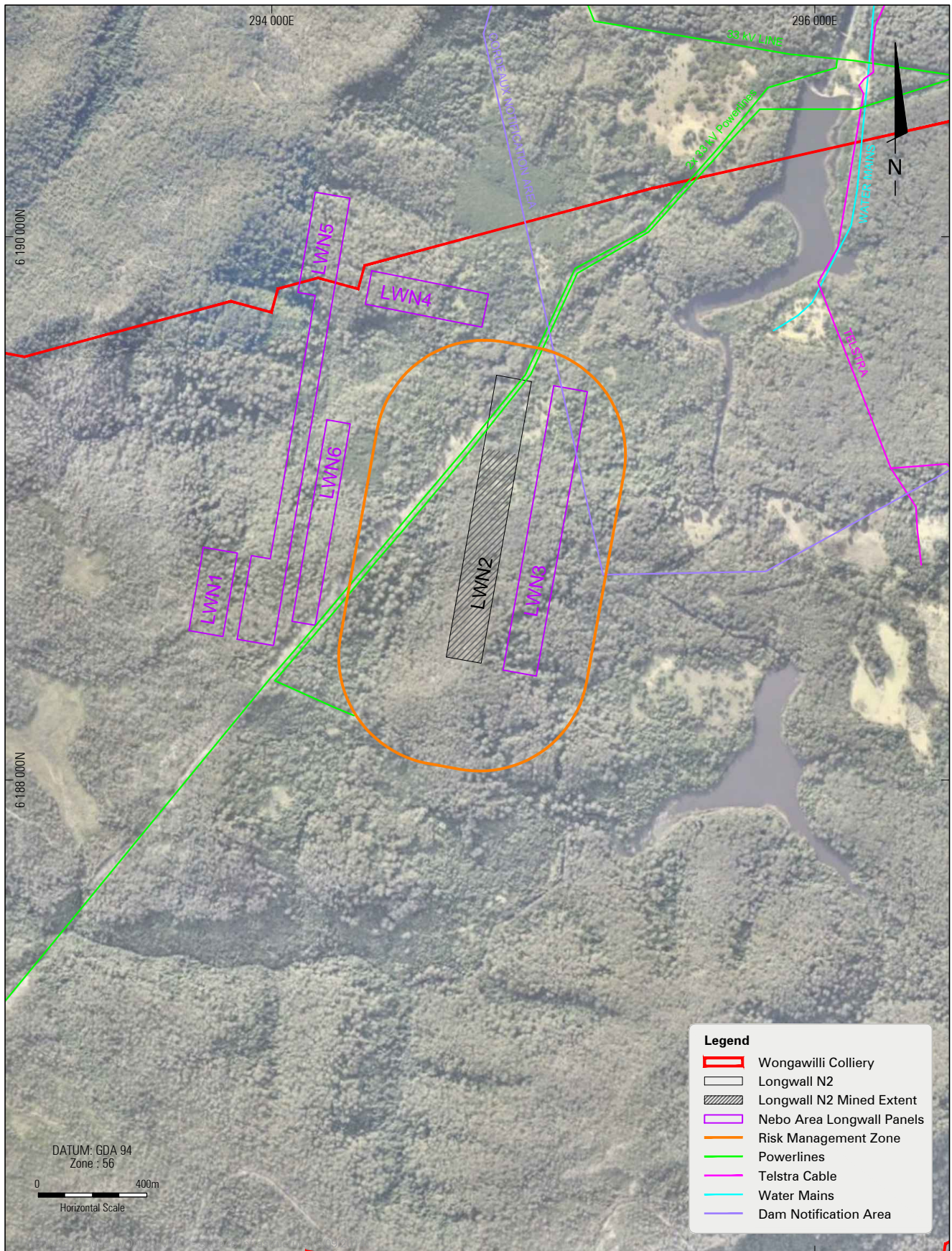
The poles along the two 33kV transmission lines were surveyed for tilt in both directions using an electronic protractor. The surveys found that no detectable tilts were observed within the 0.5 mm/m accuracy of the measurement system used.

The nearest power poles are PP15 and PP16. PP16 is likely to have experienced up to 30 mm of subsidence and a similar level of eastward horizontal movement toward LW N2. PP15 is likely to have subsided or moved southward 20 mm. The other poles on the line are unlikely to have experienced any subsidence movements as a result of mining LW N2.

The observed tilts and strains are very small and do not present any risk of impacts to these transmission lines.

Access Tracks and Fire Trails

The observed levels of subsidence, tilt and strain do not have the potential to cause any significant impacts to access tracks and fire trails.



WONGAWILLI COLLIERY

Surface Infrastructure

FIGURE 4



Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

3.2. Heritage Sites

Biosis has assessed the impacts of the observed subsidence movements on heritage sites. Biosis has also compared the observed environmental consequences with the predictions in the Extraction Plan. This analysis is provided in **Appendix B** and is summarised below.

3.2.1. Description of Features

Three historic heritage sites are located within the Nebo Area (see **Figure 5**):

- Cordeaux River Historic Site 1;
- Cordeaux River Historic Site 2; and
- Cordeaux River Historic Site 3.

The Southern Coalfields Inquiry concluded that subsidence impacts resulting from longwall mining will generally occur within 400 m of the boundary of secondary extraction. The area within 400 m of the extracted extent of LW N2 has been adopted as the Risk Management Zone (RMZ). Monitoring is only necessary for heritage sites located within the RMZ.

Cordeaux River Historic Site 3 is the only heritage site located within the RMZ for LW N2. This site consists of non-native floral gardens, remains of building foundations and historical artefact scatters of glass, metals and ceramics.

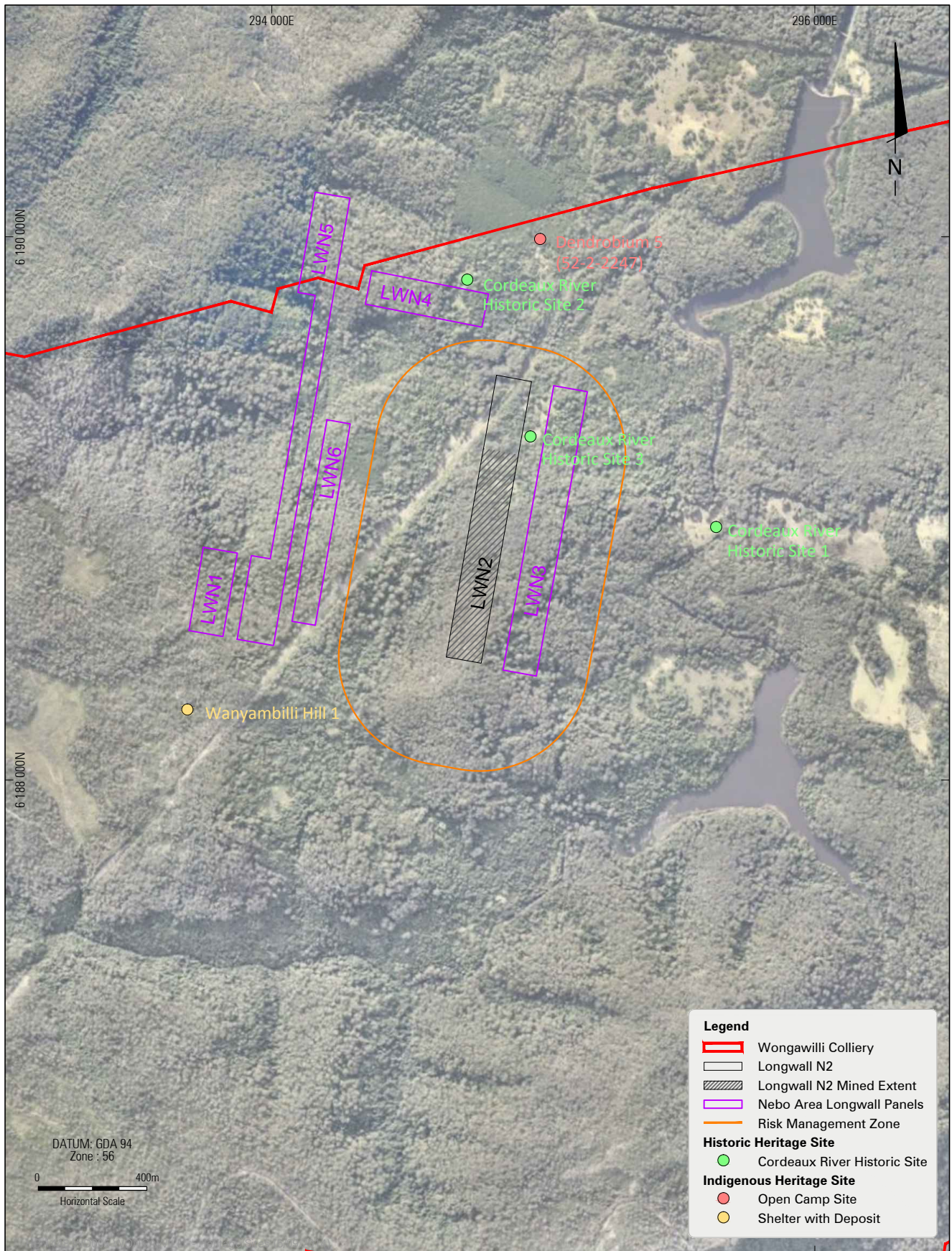
Two Indigenous heritage sites (Dendrobium 5 and Wanyambilli Hill 1) are located in the vicinity of the Nebo Area but are outside of the RMZ.

3.2.2. Predicted Consequences

The Extraction Plan predicted that Cordeaux River Historic Site 3 has the potential to be impacted through ground cracking or tree falls.

3.2.3. Observed Consequences

Baseline monitoring of Cordeaux River Historic Site 3 was undertaken on 9 November 2011. Subsequent monitoring was undertaken on 26 February 2014 (during mining) and 2 June 2014 (post-mining) to determine whether there were any impacts caused by mining of LW N2. No changes to the condition of the artefact scatter were observed. Accordingly, mining of LW N2 did not trigger any management actions under the Trigger Action Response Plan (TARP) contained in the Extraction Plan.



WONGAWILLI COLLIERY

Heritage Sites

FIGURE 5

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

4. NATURAL FEATURES

4.1. Surface Water

GeoTerra has assessed the impacts of the observed subsidence movements on streams, and has compared the observed environmental consequences with the predictions in the Extraction Plan. This analysis is provided in **Appendix C** and is summarised in this section.

4.1.1. Description of Features

The streams in the vicinity of the Nebo Area are Wattle Tree Creek, Little Wattle Tree Creek and Jacksons Creek. Wattle Tree Creek is a third-order stream immediately north of LW N2. Baseflow supports continuous flow in the 3rd order reaches of this stream. Jacksons Creek is a 2nd order tributary of Wattle Tree Creek.

Little Wattle Tree Creek is a 2nd order stream characterised by a series of small boulder and cobble based pools. Wattle Tree Creek and Little Wattle Tree Creek both drain to Upper Cordeaux no. 2 Reservoir.

4.1.2. Predicted Consequences

Due to the small magnitude of the predicted strains and tilts, there was not expected to be any impact on stream flows.

Mining of LW N2 has the potential to result in a change to surface water chemistry. There was predicted to be the potential for increased iron hydroxide precipitation and lowering of pH.

4.1.3. Observed Consequences

The surface water monitoring network consists of five sites across Wattle Tree Creek, Little Wattle Tree Creek and Jacksons Creek. These monitoring locations are shown in **Figure 6**. Surface water monitoring has been undertaken at these monitoring locations since 2009.

Compared with baseline data, mining of LW N2 did not have any observable impact on the water levels in Wattle Tree Creek, Little Wattle Tree Creek and Jacksons Creek.

Water quality monitoring data indicates that salinity ranges from 50 – 250 $\mu\text{S}/\text{cm}$ and pH ranges from 5.5 to 8.0. Elevated pH readings (up to 10.0) were identified to be a result of cement contamination of the pH probe. Laboratory analyses indicate that concentrations of nitrogen, phosphorous and some metals are regularly above the thresholds in the ANZECC guidelines. This is consistent with the background water quality monitoring data.

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

Compared to baseline conditions, mining of LW N2 did not result in any observable changes to water quality beyond variability caused by climatic influences.

The observed impacts do not trigger any management actions under the TARP contained in the Extraction Plan.

4.2. Groundwater

GeoTerra has assessed the impacts of the observed subsidence movements on groundwater systems as a result of mining LW N2, and has compared the observed environmental consequences with the predictions in the Extraction Plan. This analysis is provided in **Appendix C** and is summarised in this section.

4.2.1. Description of Features

The crinanite sill is the dominant structure in the overburden sequence. This sill is up to 98 m thick and possesses very low hydraulic conductivity. The crinanite acts as an aquitard, providing separation between the creeks and the coal seams.

The crinanite is underlain by the sedimentary units of the Narrabeen Group. The sandstones within the Narrabeen Group provide porous storage but with limited transmitting capacity. The mudstones, siltstones and shales within the Narrabeen Group are effectively aquitards. The Bulli, Balgownie and Wongawilli coal seams underlie the Narrabeen Group.

4.2.2. Predicted Consequences

Subsidence resulting from mining of LW N2 has the potential to increase rainfall recharge by increasing secondary permeability through fracturing of the rock strata. However, mining was not expected to result in interconnection of aquifers and aquitards within 20 m of the surface.

Depressurisation of groundwater systems was predicted to result in up to a 10 m reduction in water levels. Water levels were expected to recover as the newly developed secondary permeability is recharged. Water levels were expected to recover fully over time unless a new outflow path develops.

Mining of LW N2 has the potential to result in a change to groundwater chemistry. There was predicted to be the potential for increased iron and manganese hydroxide precipitation and a lowering of pH.

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

4.2.3. Observed Consequences

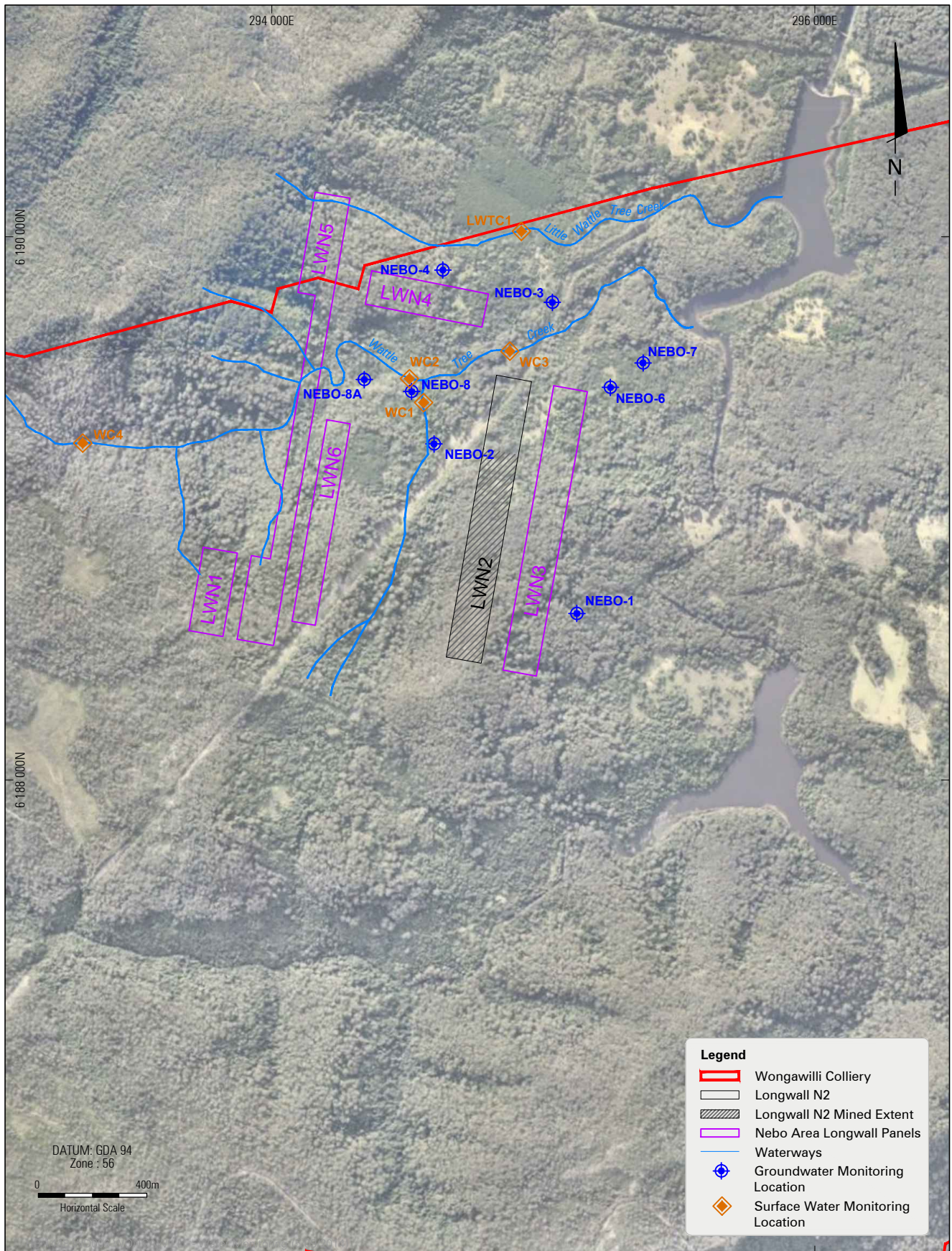
The groundwater monitoring network consists of 6 open standpipe piezometers and 4 vibrating wire piezometers (see **Figure 6**). All piezometers were installed during 2009 and 2010.

Monitoring data indicates that there has been no increase in the rate of groundwater recharge as a result of mining LW N2. Similarly, subsidence has not resulted in connectivity of aquifers and aquitards within 20 m of the surface.

Water level monitoring was undertaken for all locations prior to and during mining of LW N2. A decline in the water level was observed at piezometer Nebo1D. A maximum reduction of 8 m was observed, followed by the partial recovery of the water level. To date, the water level has recovered to approximately 4 m below pre-mining levels and expected to continue to recover. This impact is within the predicted maximum drawdown of 10 m. No responses to mining have been recorded at any of the other monitoring locations.

A number of the monitoring locations exhibited elevated pH (alkalinity) due to cement contamination during installation or sampling. Groundwater samples also contained elevated concentrations of metals due to the elevated solubility of metals in alkaline conditions. Groundwater quality during mining was similar with baseline monitoring data, indicating that mining of LW N2 did not have any impacts on groundwater quality.

The observed impacts did not trigger any management actions under the TARP contained in the Extraction Plan.



WONGAWILLI COLLIERY

Water Monitoring

FIGURE 6



Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

4.3. Aquatic Ecology

Biosis has assessed the impacts of the observed subsidence movement on aquatic ecology, and has compared the observed environmental consequences with the predictions in the Extraction Plan. This analysis is provided in **Appendix D** and is summarised in this section.

4.3.1. Description of Features

Wattle Tree Creek is relatively undisturbed and provides suitable habitat for an extensive suite of aquatic organisms. Wattle Tree Creek exhibits continuous flow characterised by small, shallow pools separated by frequent short riffle sequences.

Little Wattle Tree Creek is a second-order stream located north of Wattle Tree Creek. Little Wattle Tree Creek is an ephemeral stream characterised by small pools that dry out during prolonged dry periods. Little Wattle Tree Creek provides limited habitat for aquatic organisms.

Three listed aquatic species are considered as having the potential to occur in the vicinity of the Nebo Area:

- Adam's Emerald Dragonfly (*Archaeophya adamsi*);
- Sydney Hawk Dragonfly (*Austrocordulia leonardi*); and
- Macquarie Perch (*Macquaria australasica*).

4.3.2. Predicted Consequences

The systematic tilts and strains resulting from mining of LW N2 were predicted to be minimal. The strains were not expected to result in cracking of the bedrock along the streams. The predicted tilts were not expected to result in additional ponding, flooding or scouring. Accordingly, mining of LW N2 was not expected to impact threatened species and populations in Wattle Tree Creek and Little Wattle Tree Creek.

4.3.3. Observed Consequences

Aquatic ecology monitoring in the Nebo Area has been undertaken since March 2011. The following seasonal surveys have been completed to date:

- Autumn 2011;
- Autumn and Spring 2012;
- Autumn and Spring 2013; and
- Autumn 2014.

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

The ecological monitoring program utilises a Before-After Control Impact (BACI) design. This approach involves comparing sites that are predicted to be subject to subsidence (known as impact sites) with sites that are not predicted to be subject to subsidence (known as control sites). A BACI approach also involves comparing impact sites before and after mining (see **Figure 7**). A visual habitat inspection (HABSCORE) was undertaken at each monitoring site. Water quality monitoring was also undertaken at each site during each survey period. No adverse impacts on water quality have been observed during and after mining of LW N2.

The monitoring undertaken to date has found that the ecological values at the impact sites have remained consistent with baseline data. The ecological values at the impact sites are also comparable with those at the control sites. Therefore, mining of LW N2 has not adversely impacted the threatened species and populations in Wattle Tree Creek and Little Wattle Tree Creek.

4.4. Terrestrial Ecology

Biosis has assessed the impacts of the observed subsidence movement on terrestrial ecology, and has compared the observed environmental consequences with the predictions in the Extraction Plan. This analysis is provided in **Appendix D** and is summarised in this section.

4.4.1. Description of Features

Eleven vegetation communities were identified within the Nebo Area. Two rare flora species listed on the Rare or Threatened Australian Plants (RoTAP) register were recorded, namely *Darwinia grandiflora* and *Boronia fraseri*. An additional 12 rare and threatened flora species have the potential to occur.

The following threatened species were recorded in the Nebo Area during ecological surveys:

- Rosenberg's Goanna;
- Giant Dragonfly;
- Powerful Owl;
- Beautiful Firetail;
- Southern Emu Wren;
- Eastern Bent-wing Bat; and
- Koala.

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

No threatened frog species were recorded, however the following species are considered as having the potential to occur:

- Giant Burrowing Frog;
- Red-crowned Toadlet;
- Littlejohn's Tree Frog; and
- Stuttering Barred Frog.

4.4.2. Predicted Consequences

Subsidence has the potential to impact terrestrial species and populations through a variety of mechanisms, including:

- Cracking of bedrock and changes to morphology of streams;
- Changes to stream water quality;
- Depressurisation of groundwater systems;
- Tree falls due to tilt; and
- Cracking or collapse of clifflines.

Due to the small magnitude of the predicted subsidence movements, terrestrial species and populations were not expected to be impacted by mining of LW N2.

4.4.3. Observed Consequences

The terrestrial ecology monitoring network is shown in **Figure 8**. The ecological monitoring program utilises a BACI design. This approach involves comparing sites that are predicted to be subject to subsidence (known as impact sites) with sites that are not predicted to be subject to subsidence (known as control sites). A BACI approach also involves comparing impact sites before and after mining.

Terrestrial ecological monitoring in the Nebo Area has been undertaken since Spring 2010. The following seasonal surveys have been completed to date:

- Spring 2010;
- Autumn and Spring 2011;
- Autumn and Spring 2012;
- Autumn and Spring 2013; and
- Autumn 2014.



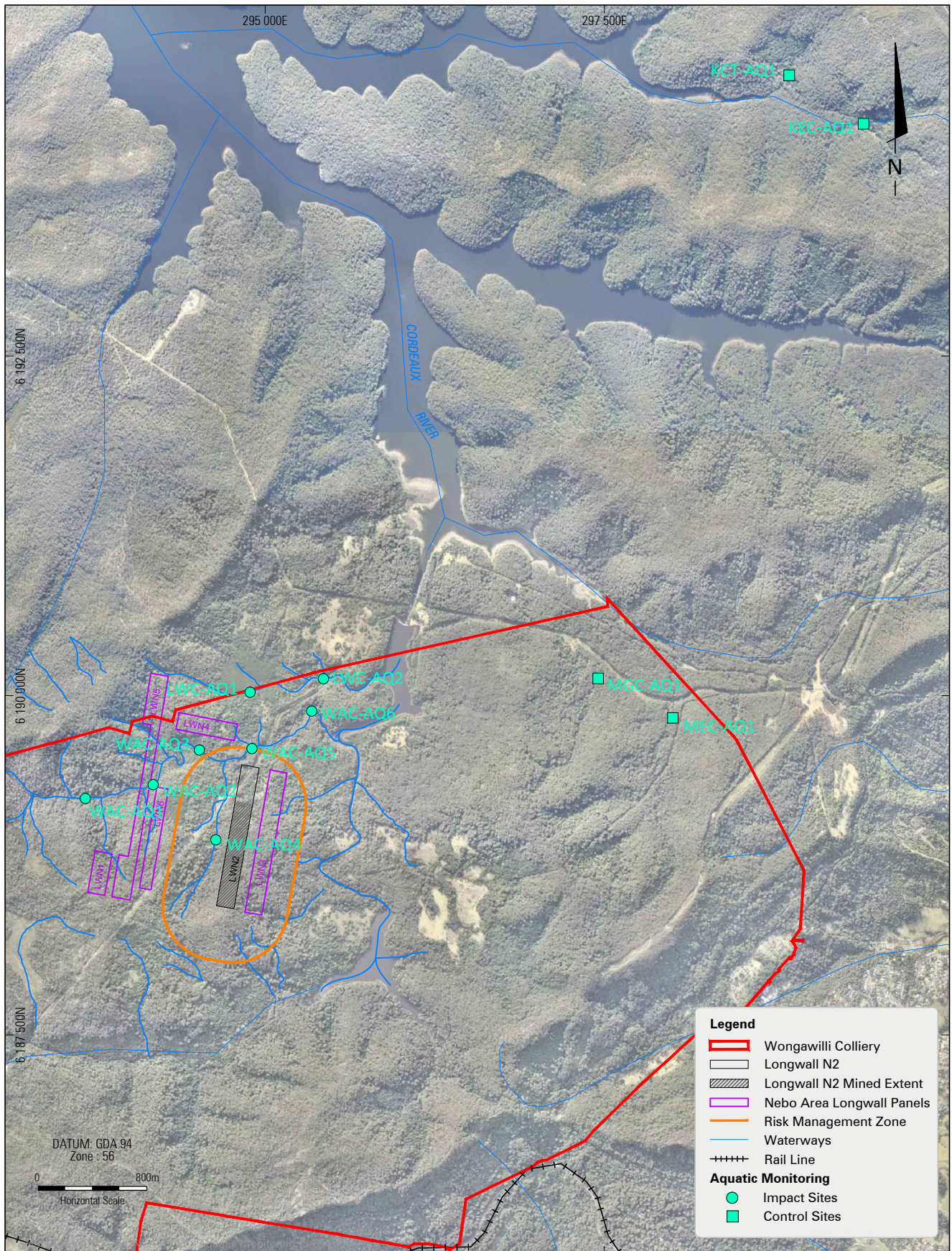
Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

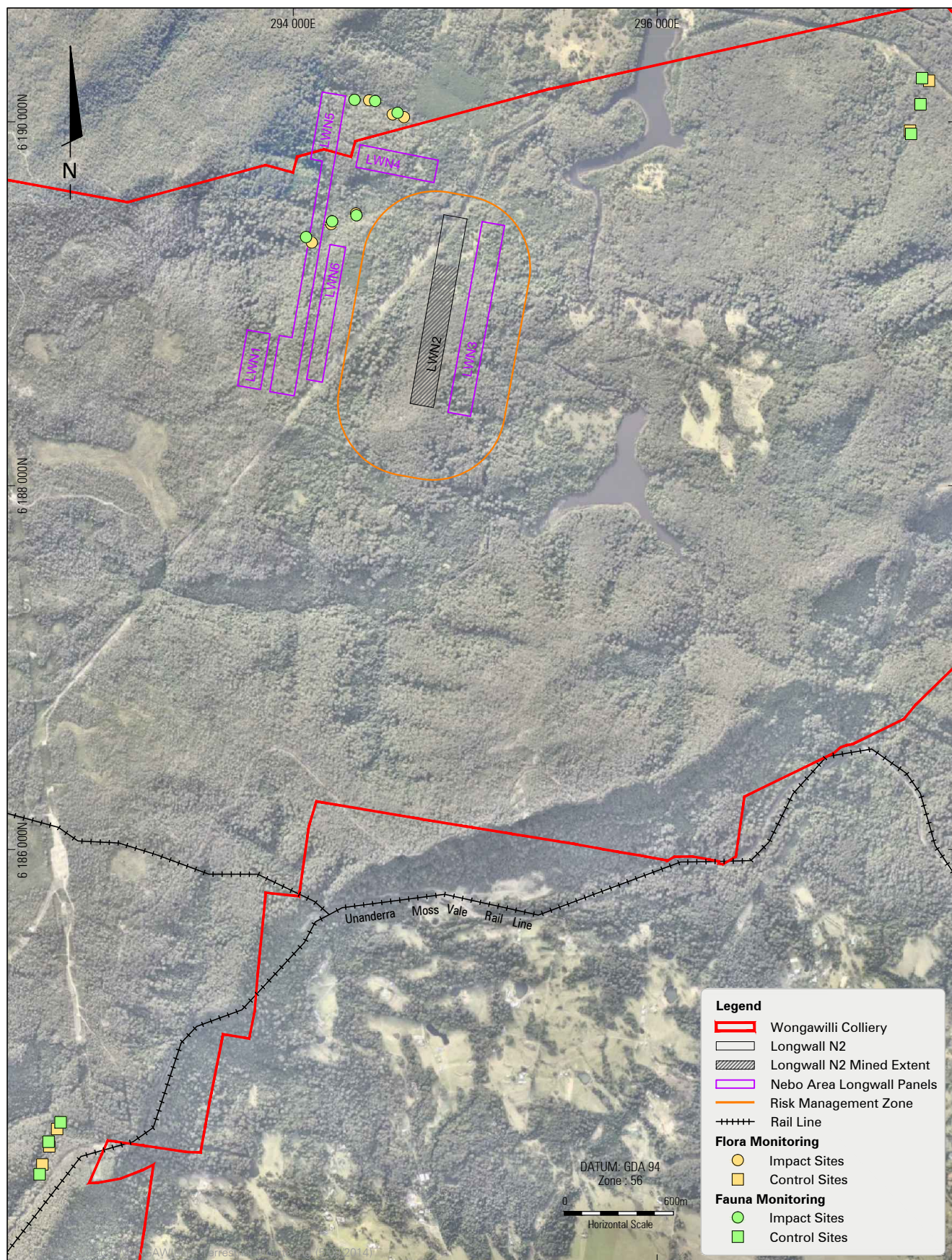
All of the monitoring sites are established at a creek location. At each monitoring site, riparian vegetation surveys are undertaken within three quadrats (20 m x 20 m). A subjective cover abundance score is given for each quadrat using a modified Braun-Blanquet scale. In addition, nocturnal frog surveys are undertaken along three transects (50 m long) at each monitoring site. Monitoring of riparian vegetation was also undertaken at the control sites between 2004 and 2009.

Based on the monitoring undertaken to date, there are no observable impacts on terrestrial species and populations as a result of mining LW N2. Mining of LW N2 has not triggered any management actions under the TARP contained in the Extraction Plan.

5. MANAGEMENT AND MITIGATION MEASURES

As discussed in **Sections 3, 4 and 5**, the observed subsidence effects and environmental consequences during mining of LW N2 are less than the predicted effects and consequences for LW N2 and LW N3. The observed effects and consequences have not activated any of the triggers under the relevant TARPs. Therefore, no additional management or mitigation measures are necessary. WCL will continue to monitor subsidence effects and environmental consequences in accordance with its approved management plans and record the observations for the cumulative mining of LW N2 and LW N3.





Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

6. ABBREVIATIONS

Table 3
Abbreviations

Term	Definition
ANZECC	Australian and New Zealand Environment Conservation Council
BACI	Before-After Control-Impact
CCL	Consolidated Coal Lease
DRE	Division of Resources and Energy (with the Department of Trade & Investment, Regional Infrastructure and Services)
EP&A Act	<i>Environmental Planning & Assessment Act 1979</i>
GPS	Global Positioning System
kV	Kilovolt
LGA	Local Government Area
LW	Longwall
ML	Mining Lease
MSEC	Mine Subsidence Engineering Consultants
Nebo EA	<i>NRE Wongawilli Colliery Nebo Area Environmental Assessment (ERM, 2010)</i>
RoTAP Register	Rare or Threatened Australian Plants Register
SMP	Subsidence Management Plan
TARP	Trigger Action Response Plan
WCL	Wollongong Coal Limited

Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

7. REFERENCES

- ERM (2010) NRE Wongawilli Colliery Nebo Area Environmental Assessment
- Niche Environment and Heritage (2012), *NRE Wongawilli Colliery Nebo Longwalls N1-N6 Extraction Plan November 2012 – Revision 1*

8. CONTROL AND REVISION HISTORY

PROPERTY	VALUE
Approved by	David Clarkson
Document Owner	David Clarkson
Effective Date	5 September 2014

Revisions

VERSION	DATE REVIEWED	REVIEW TEAM (CONSULTATION)	NATURE OF THE AMENDMENT
1	04/09/14	Andrew Wu Hansen Bailey	Draft for WCL review
2	04/09/14	David Clarkson WCL	Minor amendments
3			



Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

APPENDIX A

Wongawilli Colliery – LWN2 End of Panel Subsidence Report



R E P O R T T O :

WOLLONGONG COAL LIMITED

Wongawilli Colliery – LWN2 End of Panel Subsidence
Report

WCW04319

REPORT TO

David Clarkson
Group Environment Manager
Wollongong Coal Limited
7 Princes Highway,
cnr Bellambi Lane
Corrimal NSW 2518

SUBJECT

Wongawilli Colliery – LWN2 End
of Panel Subsidence Report

REPORT NO

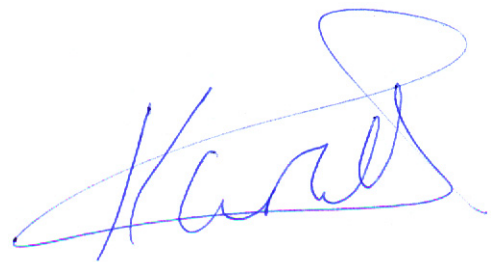
WCWO4319

PREPARED BY

Ken Mills

DATE

29 August 2014



Ken Mills
Principal Geotechnical Engineer

SUMMARY

Wollongong Coal Limited (WCL) has mined Longwall LWN2 in the Wongawilli Seam at Wongawilli Colliery. Mining commenced on 12 June 2013 and continued until 26 February 2014 when mining was suspended due to a roof fall on the longwall face. WCL measured the surface subsidence on one mid-panel subsidence line that follows an access road across the panel, a line along a power transmission line to the side of and north of the panel, and at a number of remote far field monitoring stations. WCL commissioned SCT Operations Pty Ltd (SCT) to analyse the subsidence monitoring, to compare the results with subsidence predictions made in the Extraction Plan / SMP (Niche 2012) based on the Part 3A Application (MSEC 2010), and to prepare a report suitable to meet the end of panel requirements for subsidence. This report presents the results of our analysis and review of the subsidence monitoring data from Longwall LWN2 in accordance with Condition 18 of SMP Approval 09/5341.

Vertical subsidence was measured above LWN2 with a nominal survey accuracy of $\pm 20\text{mm}$ consistent with normal survey practice. A maximum measured value of approximately 90mm was observed uniformly across the central 100m of the panel. This level of movement is imperceptible for all practical purposes. There is no significant sag directly over the panel consistent with the anticipated bridging of the crinanite. All the subsidence comes from compression of the abutment coal. This compression tapers symmetrically from the goaf edge for a distance of about 200m on both sides of the panel and represents a broad zone of compression that is about 500m wide and of low magnitude.

The subsidence behaviour observed above LWN2 is consistent with the predictions made in the EP/SMP and Part 3A Application. Subsidence predictions of 230mm and 110mm were made on Prediction Lines 4 and 5 respectively for the combined extraction of Longwalls LWN2 and LWN3. The 300 Line subsidence monitoring line is located between these two prediction lines. The maximum measured subsidence on the 300 Line after completion of mining of LWN2 was approximately 90mm and so is within the range that would be expected for just the first panel mined. Maximum tilts were predicted to be between 1.2mm/m and 1.7mm/m. The measured maximum tilt was 0.5mm/m and less than predicted. Maximum strains were predicted to be 0.3-0.4mm/m in tensile and 0.5mm/m compressive. Maximum measured strains were 0.2mm/m in both tension and compression and less than predicted.

Horizontal movements measured on 300 Line are smaller than the vertical subsidence. Horizontal movements along the axis of the panel are less than survey tolerance of $\pm 20\text{mm}$. Horizontal movements across the panel are symmetrical about the centreline of the panel with peak movement of about 30mm occurring at a distance of 100m out from the goaf edge.

Bridging of the crinanite intrusion within the overburden strata has limited the magnitude of the maximum subsidence and associated parameters to the low levels observed. These low levels of subsidence, horizontal

movement, tilt, and strain are imperceptible for all practical purposes and are not considered to have any potential to cause any significant impacts to power lines, access roads, or any other man-made or natural features in the vicinity of LWN2 consistent with the predictions made in the EP/SMP and Part 3A Application.

TABLE OF CONTENTS

	PAGE No
SUMMARY	I
TABLE OF CONTENTS	I
1. INTRODUCTION	2
2. SITE DESCRIPTION.....	2
3. SUBSIDENCE MONITORING RESULTS.....	5
3.1 300 Line	5
3.2 200 Line	6
3.4 Measurements on Power Poles	7
4. COMPARISON WITH PREDICTIONS	9
5. CONCLUSIONS	9
6. REFERENCES	11

1. INTRODUCTION

Wollongong Coal Limited (WCL) has mined Longwall LWN2 in the Wongawilli Seam at Wongawilli Colliery. Mining commenced on 12 June 2013 and continued until 26 February 2014 when mining was suspended due to a roof fall on the longwall face. WCL measured the surface subsidence on one mid-panel subsidence line that follows an access road across the panel, a line along a power transmission line to the side of and north of the panel, and at a number of remote far field monitoring stations. WCL commissioned SCT Operations Pty Ltd (SCT) to analyse the subsidence monitoring, to compare the results with subsidence predictions made in the Extraction Plan / SMP (Niche 2012) based on the Part 3A Application (MSEC 2010), and to prepare a report suitable to meet the end of panel requirements for subsidence. This report presents the results of our analysis and review of the subsidence monitoring data from Longwall LWN2 in accordance with Condition 18 of SMP Approval 09/5341.

The report is structured to provide a site description in Section 2, a summary of the results in Section 3, a comparison with predictions in Section 4, and conclusions in Section 5.

2. SITE DESCRIPTION

LWN2 is located 13km due west of Wollongong in NSW in the upper reaches of the Cordeaux River valley. The mining area was originally developed as part of Nebo Colliery but has subsequently been longwall mined by WCL from Wongawilli Colliery.

Figure 1 shows a plan of the mining layout superimposed onto a 1:25,000 topographic series map. The locations of the two subsidence monitoring lines are also shown. Some of the monitoring pegs on the 200 Line (northern line) near the end of LWN2 were disturbed by power line maintenance work during the period of monitoring and did not yield meaningful data.

The panel is located some 100-200m east of an unnamed tributary to Wattle Creek and was mined from south to north below a topographic spur that slopes to the north.

The panel is located outside the Dams Safety Committee Notification Area.

The panel created a void that is 132m wide and 789m long. The mining height on the longwall face ranged from 3.3m to 3.4m increasing locally at the dyke directly below the subsidence line over a narrow band. The depth to the mining horizon ranges from 280m at the start of the panel to 125m at the northern end and is approximately 180m directly below the mid-panel subsidence line.

The overburden strata in the general vicinity has been intruded by a crinanite (dolerite) sill as shown in Figure 2. This crinanite intrusion ranges in thickness from 55m to 98m generally thickening toward the south and east.

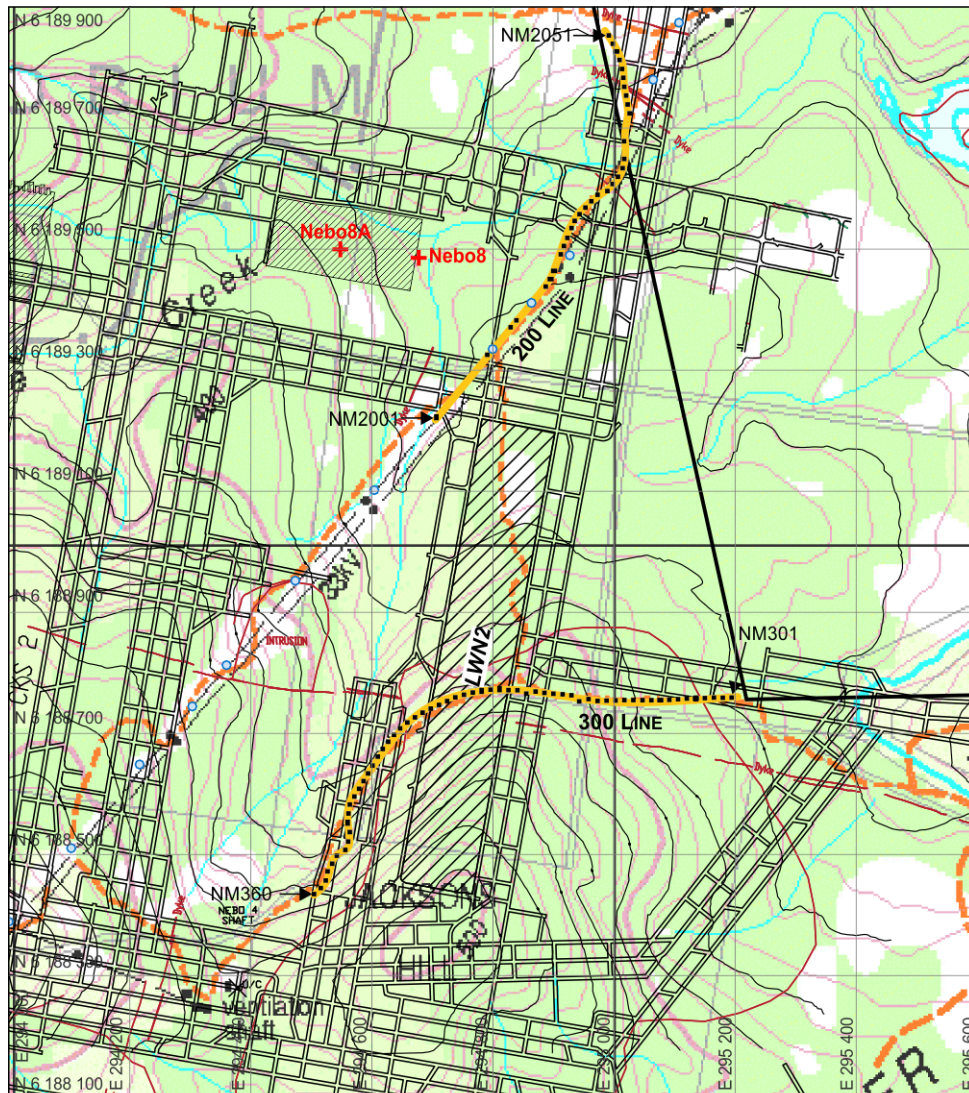


Figure: 1: Site plan showing location of LWN2 plotted on 1:25,000 series topographic map.

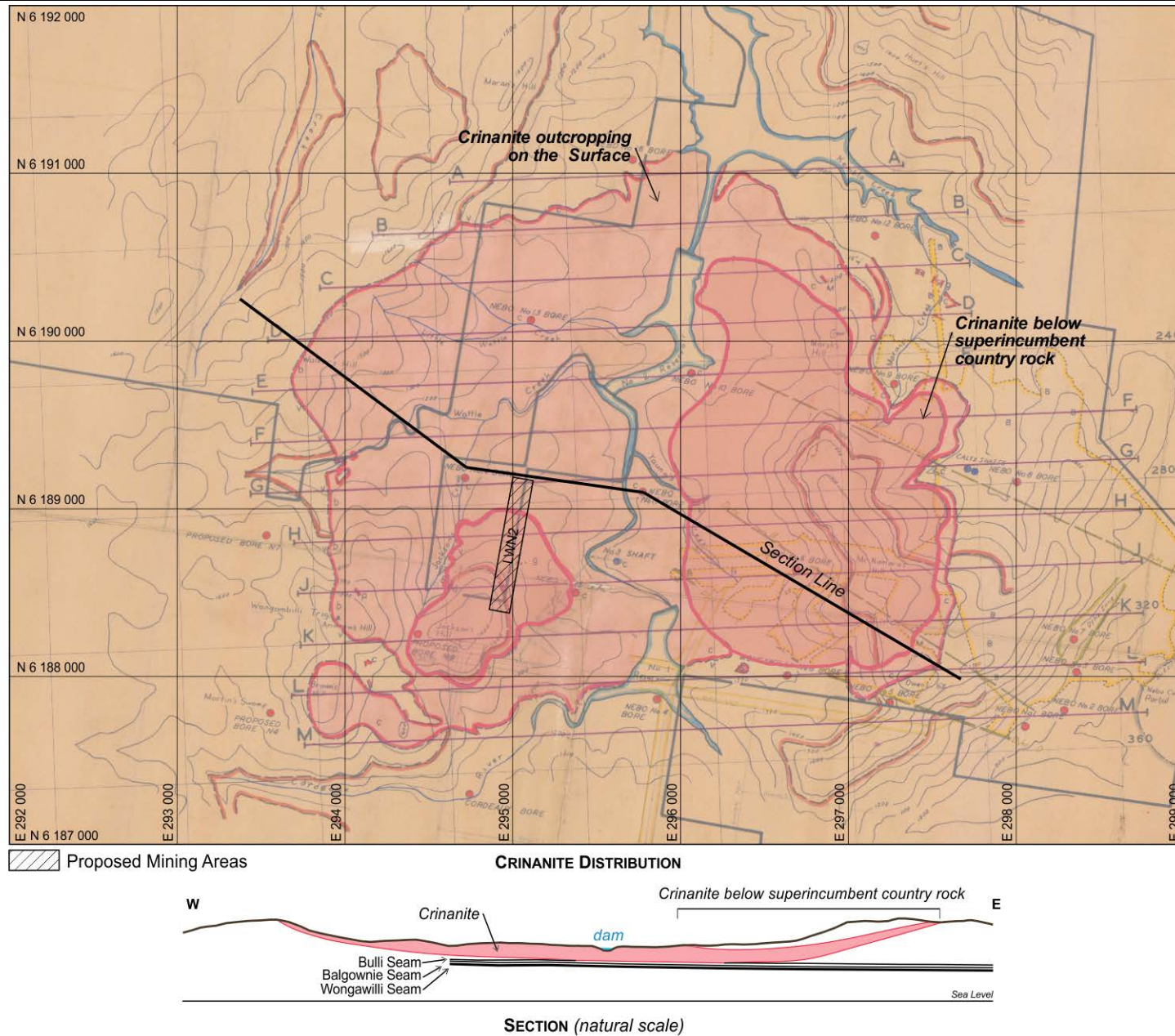


Figure 2: Crinanite distribution based on AIS Coal Geology Plan S3-64 (accuracy is estimated to be generally better than 50m).

The base of the crinanite is located approximately 70m above the mining horizon at the northern end of the panel and about 120m at the southern end of the panel. Exploratory work undertaken in support of the Part 3A Application for a panel to the northwest (SCT 2010) showed that a 65m section of the crinanite is sufficiently massive to be able to bridge across a 120m wide void at an overburden depth to the mining horizon of 116m. Subsidence behaviour is expected to have been significantly influenced by the presence of this crinanite sill.

3. SUBSIDENCE MONITORING RESULTS

In this section, the subsidence monitoring results from the mid panel cross-line (300 Line) located alongside an access road, the northern line (200 Line) located alongside the power transmission line, and the far field monitoring array are presented and discussed.

3.1 300 Line

The locations of the individual pegs on 300 Line are shown in Figure 1. The line follows an access track that crosses LWN2 in about the middle of the panel.

Figure 3 shows a plot of the subsidence movements measured on the 300 Line subsidence line with the horizontal axis plotted as distance relative to the western edge of the panel as if the line were located perpendicular to the panel. All three components of movement are plotted with the two horizontal components resolved into cross panel movements and along panel movements positive to the east and the north (i.e. the direction of mining).

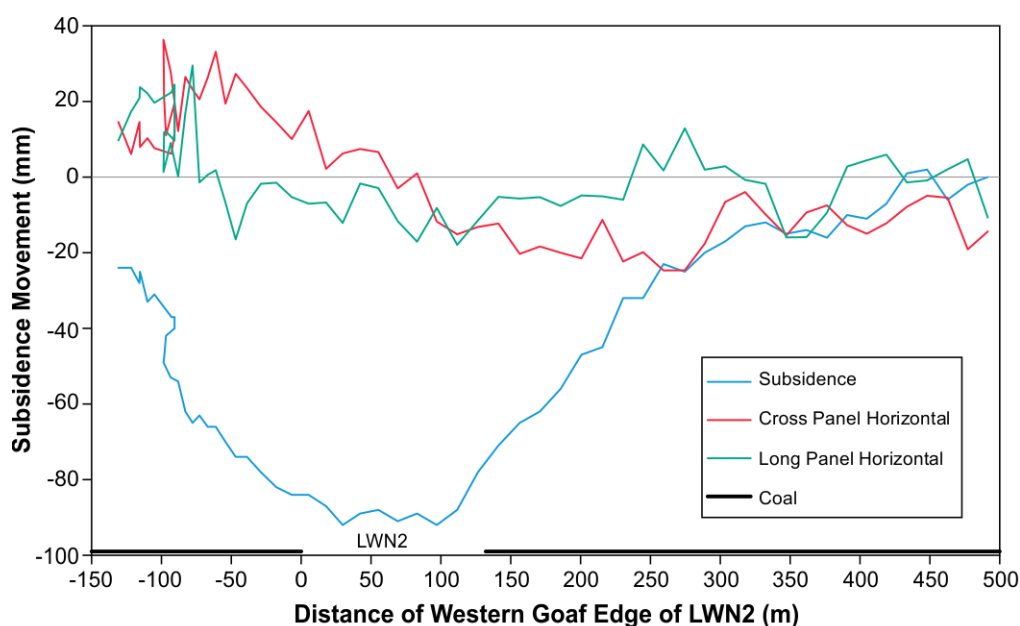


Figure 3: 300 Line subsidence movements measured above LWN2.

Vertical subsidence has been assumed to be zero at the eastern end of the line remote from mining and given the flat subsidence profile over the next 200m toward the longwall this appears to be a reasonable assumption. Vertical subsidence reaches a peak of approximately 90mm across the central 100m of the panel. For all practical purposes this level of subsidence is imperceptible.

There is no significant sag directly over the panel consistent with the anticipated bridging of the crinanite. All the subsidence comes from compression of the abutment coal. This compression tapers symmetrically from the goaf edge for a distance of about 200m on both sides of the panel and represents a broad zone of compression that is about 500m wide and of low magnitude.

Maximum tilt is about 90mm over 200m or less than 0.5mm/m. This level of tilt is imperceptible for all practical purposes.

The horizontal movements measured on 300 Line are smaller than the vertical subsidence. Horizontal movement along the axis of the panel is less than survey tolerance of ± 20 mm. Horizontal movement across the panel is symmetrical about the centreline of the panel with peak movement of about 30mm occurring at a distance of 100m out from the goaf edge.

Horizontal strain is of the order of 30mm over 150m or 0.2mm/m. This level of strain is imperceptible for all practical purposes.

3.2 200 Line

The positions of the pegs on 200 Line are shown in Figure 1. The pegs were initially set out at about 15m centres from Peg NM2001 in the south to Peg NM2051 in the north. However, power line maintenance activities caused many of the pegs at the southern end of the line to be damaged.

Figure 4 shows a plot of the subsidence movements measured on the individual pegs that remain. The vertical and horizontal movements are plotted as a function of distance from the northern end of LWN2. Peg NM2001 is plotted as being 14m over the goaf, but it should be recognised that this peg is actually located 70m to the west of the western edge of the panel. The subsidence movements are determined relative to an assumed reference. In Figure 3, the data plotted has been adjusted to reduce offset errors by using the section of line 150m to 500m north of the line as a control and assuming this section has not moved as a result of mining subsidence. The adjustments to all the data have been 6mm down, 25mm to the east (for the eastward component), and 5mm to the south (for the northward component).

In general, the subsidence movements measured on 200 Line are less than survey tolerance. The eastward horizontal movement of 30mm observed on Peg NM2001 is consistent with the cross panel movements observed on 300 Line. The vertical subsidence is only just greater than survey tolerance but is also consistent with the 300 Line data recognising that subsidence is likely to be reduced around the end of the panel.

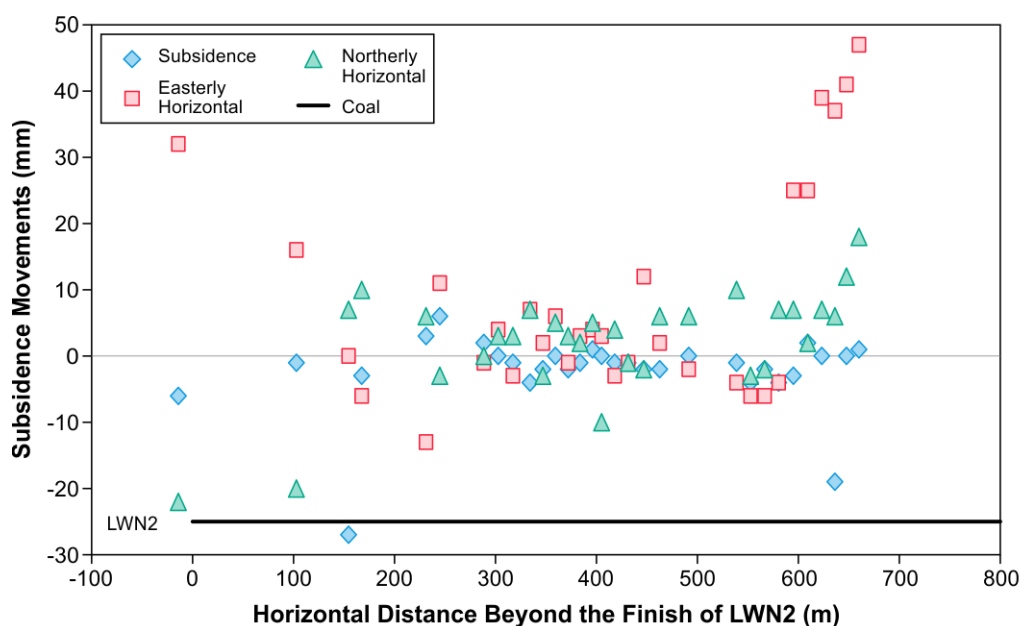


Figure 4: 200 Line subsidence movements measured north of LWN2.

The eastward horizontal movements on a group of pegs 600m to the north of the end of the panel is considered likely to be a survey control issue and not mining related.

3.3 Regional Ground Movements

An array of nine pegs located remote from LWN2 on all sides of the panel were surveyed using GPS to determine if there was any pattern of consistent far field movements that could be related to mining.

Figure 5 shows the locations of the points and the horizontal vectors of movement that were observed. There is no consistent pattern apparent. This result indicates that the survey results are random variations within survey tolerance rather than meaningful measurements of any systematic process. The low levels of far field movements are consistent with the low levels of horizontal ground movements observed immediately adjacent to the longwall panel on 300 Line.

3.4 Measurements on Power Poles

The poles on two 33kV power lines located to the west of LWN2 were surveyed for tilt in both directions using an electronic protractor. The surveyor reports that no detectable tilts were observed within the 0.5mm/m accuracy of the measurement system used.

The nearest poles on these lines are PP16, located 150m to the west of LWN2 about 180m from the point where the longwall has stopped, and PP15, located 105m north of where the longwall has stopped. PP16 is likely to have experienced up to 30mm of subsidence and a similar level of eastward horizontal movement toward LWN2. PP15 is likely to have subsided or moved southward 20mm. The other poles on the line are unlikely to have been impacted by mining subsidence at all.

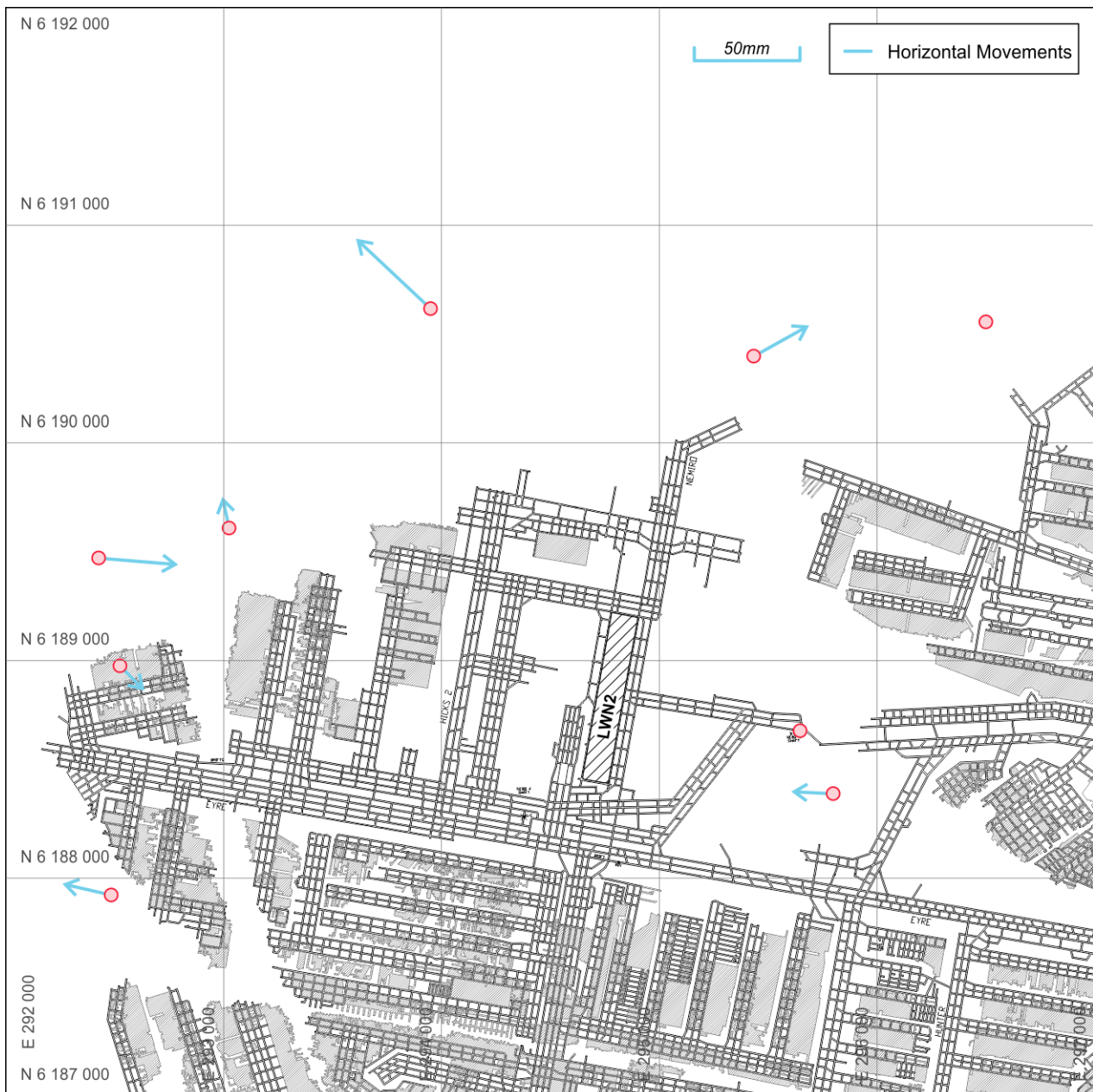


Figure 5: Far-field horizontal movements measured on distributed array of pegs.

4. COMPARISON WITH PREDICTIONS

Mine Subsidence Engineering Consultants (MSEC) provided predictions of the subsidence parameters and likely impacts of mining in the Part 3A Application for Longwalls N1 to N6 (MSEC 2010) and these predictions were used in the EP/SMP Application (Niche 2012).

Figure 6 shows the predictions of subsidence that were made above LWN2. The subsidence behaviour observed above LWN2 is consistent with the predictions made in the EP/SMP and Part 3A Application.

Subsidence of 230mm and 110mm was predicted on Prediction Lines 4 and 5 respectively for the combined extraction of Longwalls LWN2 and LWN3. The 300 Line subsidence monitoring line is located between these two prediction lines. The maximum measured subsidence on the 300 Line after completion of mining of LWN2 was approximately 90mm and so is within the range that would be expected for just the first panel mined. Maximum tilts were predicted to be between 1.2mm/m and 1.7mm/m. The measured maximum tilt was 0.5mm/m and less than predicted. Maximum strains were predicted to be 0.3-0.4mm/m in tensile and 0.5mm/m compressive. Maximum measured strains were 0.2mm/m in both tension and compression and less than predicted.

The subsidence observed above LWN2 is considered to be consistent with the predictions made in the EP/SMP and Part 3A Application. Bridging of the crinanite intrusion within the overburden strata has limited the magnitude of the maximum subsidence and associated parameters to levels that are imperceptible for all practical purposes.

At these low levels of ground movement, there is considered to be no potential for significant impacts on the power lines, access roads, or any natural features including cliffs and steep slopes in the vicinity of LWN2.

5. CONCLUSIONS

Vertical subsidence above LWN2 reached a maximum measured value of approximately 90mm uniformly across the central 100m of the panel, and would be imperceptible for all practical purposes. There is no significant sag directly over the panel consistent with the anticipated bridging of the crinanite. All the subsidence comes from compression of the abutment coal. This compression tapers symmetrically from the goaf edge for a distance of about 200m on both sides of the panel and represents a broad zone of compression that is about 500m wide and of low magnitude.

Maximum average tilt is less than 0.5mm/m. The horizontal movements measured on 300 Line are smaller than the vertical subsidence. Horizontal movement along the axis of the panel is less than survey tolerance of ± 20 mm. Horizontal movement across the panel is symmetrical about the centreline of the panel with peak movement of about 30mm occurring at a distance of 100m out from the goaf edge. Maximum average horizontal strain is of the order of 30mm over 150m or 0.2mm/m.

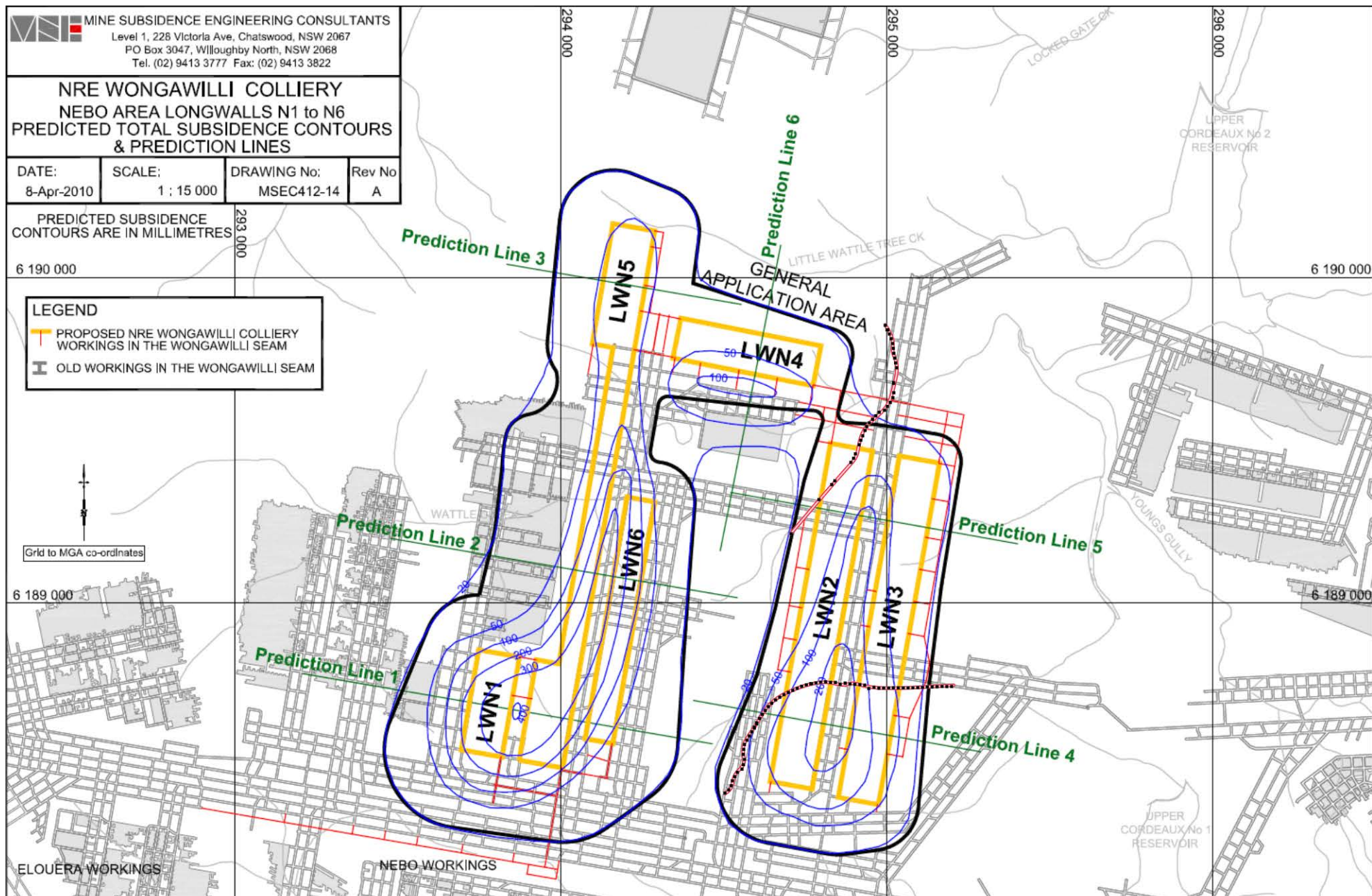


Figure 6: Subsidence predicted in MSEC (2010) with subsidence lines superimposed.

Bridging of the crinanite intrusion within the overburden strata has limited the magnitude of the maximum subsidence and associated parameters to the low levels observed. These low levels of subsidence, horizontal movement, tilt, and strain are imperceptible for all practical purposes and are not considered to have any potential to cause any significant impacts to power lines, access roads, or any other man-made or natural features in the vicinity of LWN2.

The subsidence behaviour observed above LWN2 is consistent with the predictions made in the EP/SMP and Part 3A Application.

6. REFERENCES

MSEC 2010 "Prediction of subsidence parameters and the assessment of mine impacts on natural features and surface infrastructure resulting from the proposed extraction of Longwalls N1 to N6 in the Nebo area in support of a Part 3A Application" Report to Gujarat NRE FCGL Pty Ltd, Report Number MSEC412, Revision B, dated June 2010.

Niche 2012 "NRE Wongawilli Colliery Nebo Longwalls N1-N6 Extraction Plan – November 2012 – Revision 1" Niche Environment and Heritage Report to Gujarat NRE Wonga Pty Ltd dated 22 November 2012.

SCT 2010 "Implications of Nebo 8/8A results for subsidence and groundwater modelling" SCT Report GUJWO3548A dated 8 April 2010.



Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

APPENDIX B

Nebo Area – Longwall 2 End of Panel Report (Heritage)

Nebo Area - Longwall N2
End of Panel Report (Heritage)

Prepared for Wollongong Coal Limited

4 September 2014



Biosis offices

AUSTRALIAN CAPITAL TERRITORY

Canberra

Floor 1, Unit 3, 38 Essington Street
Mitchell, ACT 2911

Phone: (02) 6241 2333

Fax: (03) 9646 9499

Email: canberra@biosis.com.au

NEW SOUTH WALES

Newcastle

39 Platt Street
Waratah NSW 2298

Phone: (02) 4968 4901

Fax: (03) 9646 9242

Email: newcastle@biosis.com.au

Sydney

Unit 14, 17-27 Power Avenue
Alexandria NSW 2015

Phone: (02) 9690 2777

Fax: (02) 9690 2577

Email: sydney@biosis.com.au

Wollongong

8 Tate Street
Wollongong NSW 2500

Phone: (02) 4229 5222

Fax: (02) 4229 5500

Email: wollongong@biosis.com.au

QUEENSLAND

Brisbane

Suite 4 First Floor, 72 Wickham Street
Fortitude Valley QLD 4006

Phone: (07) 3831 7400

Fax: (07) 3831 7411

Email: brisbane@biosis.com.au

VICTORIA

Ballarat

506 Macarthur Street
Ballarat VIC 3350

Phone: (03) 5331 7000

Fax: (03) 5331 7033

Email: ballarat@biosis.com.au

Melbourne (Head Office)

38 Bertie Street
Port Melbourne VIC 3207

Phone: (03) 9646 9499

Fax: (03) 9646 9242

Email: melbourne@biosis.com.au

Wangaratta

16 Templeton Street
Wangaratta VIC 3677

Phone: (03) 5721 9453

Fax: (03) 5721 9454

Email: wangaratta@biosis.com.au

Document information

Report to: Wollongong Coal Ltd

Prepared by: Nicole Castle and Mathew Misdale

Biosis project no.: 18792

File name: 18792.Nebo.LW.N2.EoP.Report.CH.FIN01.20140904.docx

Citation: Biosis 2014. Nebo Area - Longwall N2. End of Panel Report (Heritage). Report for Wollongong Coal Ltd. Authors: Castle N, Misdale M. Biosis Pty Ltd. Project no. 18792

Document control

Version	Internal reviewer	Date issued
Draft version 01	Alexander Beben	27 August 2014-
Draft version 02	Nathan Garvey	29 August 2014
Final version 01	Nathan Garvey	4 September 2013

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- Wollongong Coal: Dave Clarkson, Kristen Lee
- Hansen Bailey: Andrew Wu and Dianne Munro

The following Biosis staff were involved in this project:

- Ashleigh Pritchard for mapping
- Alexander Beben and Nathan Garvey for quality assurance

© Biosis Pty Ltd

This document is and shall remain the property of Biosis Pty Ltd. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of the Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Disclaimer:

Biosis Pty Ltd has completed this assessment in accordance with the relevant federal, state and local legislation and current industry best practice. The company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report content or for any purpose other than that for which it was intended.

Contents

1	Introduction	1
2	Monitoring program	3
2.1	Heritage monitoring program	3
3	Impact Assessment.....	6
3.1	Subsidence monitoring program.....	6
3.2	Results of monitoring programs	6
3.3	Observed versus predicted impacts	7
3.4	TARP assessment	7
3.4.2	Longwall N2	7
3.4.3	Cumulative Impacts within the Nebo Mining Domain.....	7
4	Conclusions and Recommendations	8
5	References	9
	Appendices	10
	Appendix 1: Trigger Action Response Plan	11

List of Tables

Table 1: Heritage monitoring program	3
Table 2: Observed versus predicted impacts.....	7
Table 3: Trigger Action Response Plan (TARP) Table for Heritage, including assessment of actions required by the Extraction Plan for Longwalls 1-6	12

List of Figures

Figure 1: Longwall 2, Nebo Mining Domain	2
Figure 2: Heritage Monitoring Sites.....	5

List of Plates

Plate 1: Baseline recording of Cordeaux River Historic 3 – detailed view of building foundations	6
Plate 2: Most recent monitoring at Cordeaux River Historic 3 – detailed view of building foundations	6
Plate 3: Baseline recording of Cordeaux River Historic 3 –concrete blocks view south-west.....	7
Plate 4: Most recent monitoring at Cordeaux River Historic 3 –concrete blocks view south-west.....	7

1 Introduction

Biosis Pty Ltd (Biosis) was commissioned by Wollongong Coal Ltd (WCL) to undertake an End of Panel (EoP) assessment of potential impacts from extraction of Longwall N2 in the Nebo Area at Wongawilli Colliery. This report assesses the post mining conditions in relation to cultural and historic heritage within the area potentially impacted by subsidence effects associated with mining of Longwall N2 (Figure 1).

Extraction of secondary workings was completed between 12th June 2013 and 26th February 2014. The full longwall panel length was not extracted. Figure 1 illustrates both the initial estimated extraction area for Longwall N2 and the completed extraction area.

This report has been prepared in accordance with Subsidence Management Plan Approval 09/5341 (Condition 18) (DTIRIS, 2013) and includes:

- An outline of monitoring programs conducted to date.
- An assessment of the results of monitoring undertaken to date.
- A comparison of observed impacts versus those predicted to occur.
- An assessment of whether any actions outlined in the Trigger Action Response Plan (TARP) have been triggered.
- Conclusions on impacts to heritage resulting from the extraction of Longwall N2, as well as cumulative impacts from longwall mining in the Nebo Area.

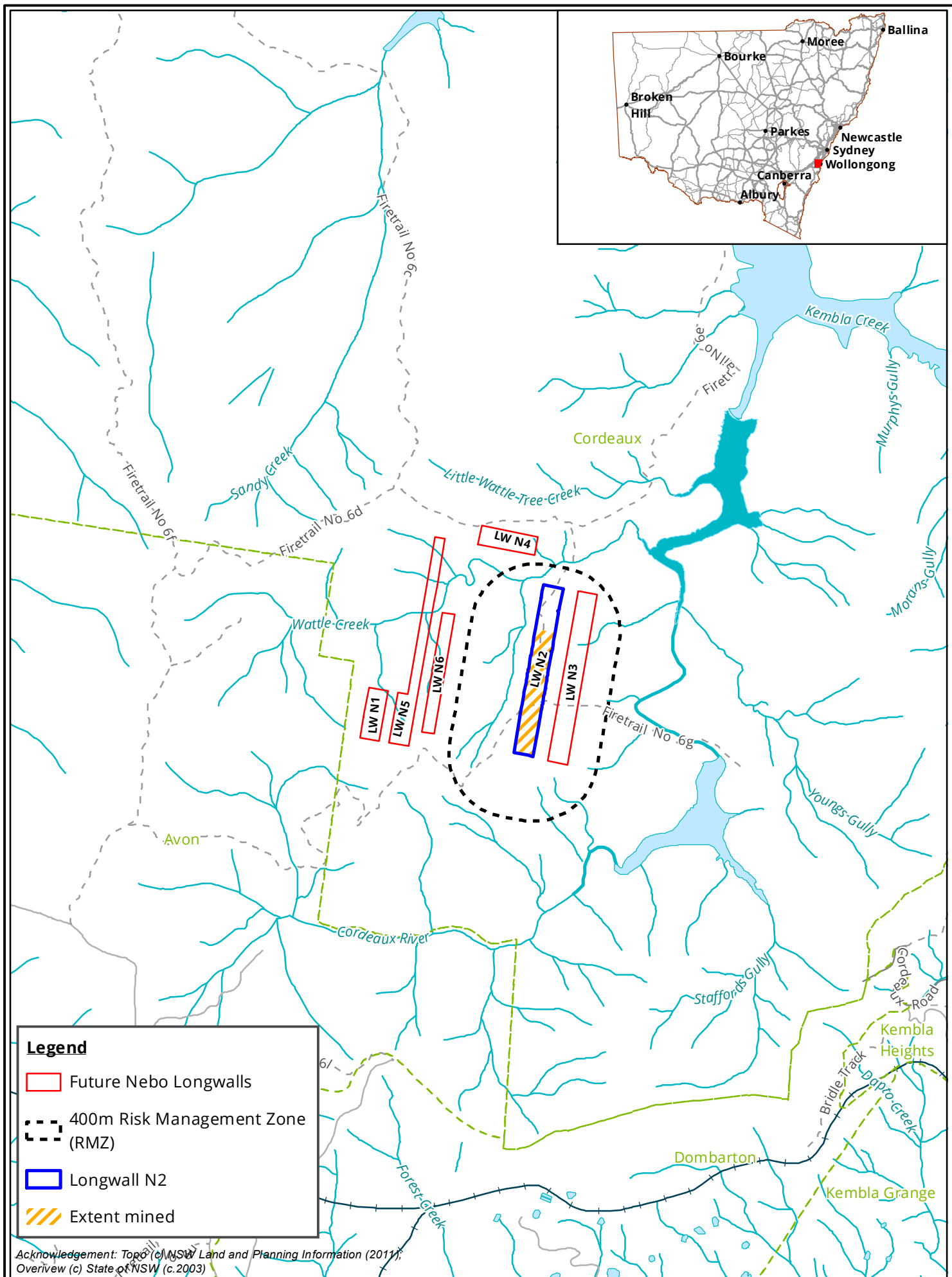
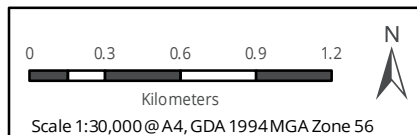


Figure 1: Longwall N2, Nebo Area



Biosis Pty Ltd
Ballarat, Brisbane, Canberra, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 18792
Date: 03 September 2014,
Checked by: MJM, Drawn by: ANP, Last edited by: aprichard
Location: P:\18700s\18792\Mapping\



2 Monitoring program

Three historic sites (Cordeaux River Historic Site 1, Cordeaux River Historic 2 and Cordeaux River Historic 3) and two Aboriginal sites (Dendrobium 5 and Wanyambilli Hill 1) were identified within the Nebo Area (Biosis, 2013). A full description of these sites is provided in Biosis (2013).

The heritage monitoring program for the Nebo Area is detailed within the Nebo Longwalls N1-N6 Subsidence Monitoring Plan (NRE, 2014), Nebo Longwalls N1-N6 Extraction Plan (Chapter 10: Heritage Management Plan) (Niche, 2012) and the Nebo Area Environmental Assessment (ERM, 2010). These documents outline the heritage monitoring actions that are required to satisfy on-going conditions of approval as detailed within the Nebo Longwalls N1-N6 Subsidence Management Plan Approval (DTIRIS, 2013) and NRE Wongawilli Colliery – Nebo Area Project Approval (MP09_0161).

Two sites, Cordeaux River Historic 2 and Cordeaux River Historic 3, are located within the predicted subsidence impact boundary of the Nebo Area (Biosis 2013). These sites are monitored as a part of the approved Heritage Monitoring Plan (Niche 2012).

Monitoring is undertaken within three months of a longwall making it closest traverse to a site (Biosis, 2013). Impact monitoring was scheduled for the heritage sites, Cordeaux River Historic 2 and Cordeaux River Historic 3, as they fell within a 400 metre Risk Management Zone (RMZ) (based on the full length of Longwall N2 being mined). Monitoring of heritage sites Cordeaux River Historic 2 and Cordeaux River Historic 3 commenced with baseline archival recording being conducted on 9 November 2011 (Biosis, 2013).

Extraction of Longwall N2 has been suspended short of the full panel length. As a result, Cordeaux River Historic 2 is located outside a 400 metre RMZ. Accordingly, monitoring during mining and the Trigger Action Response Plan (TARP) was no longer applicable for this site. Monitoring continued to be conducted for Cordeaux River Historic 3 as seen below.

2.1 Heritage monitoring program

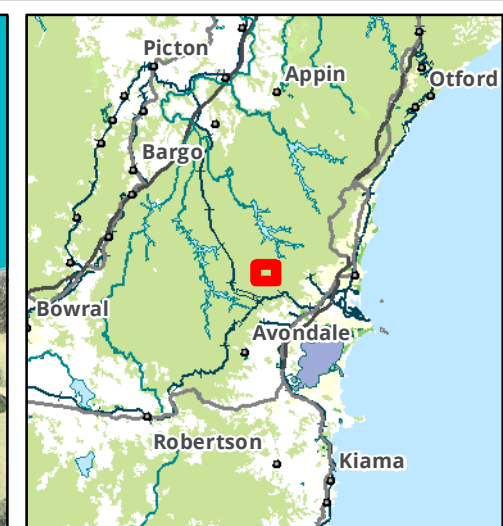
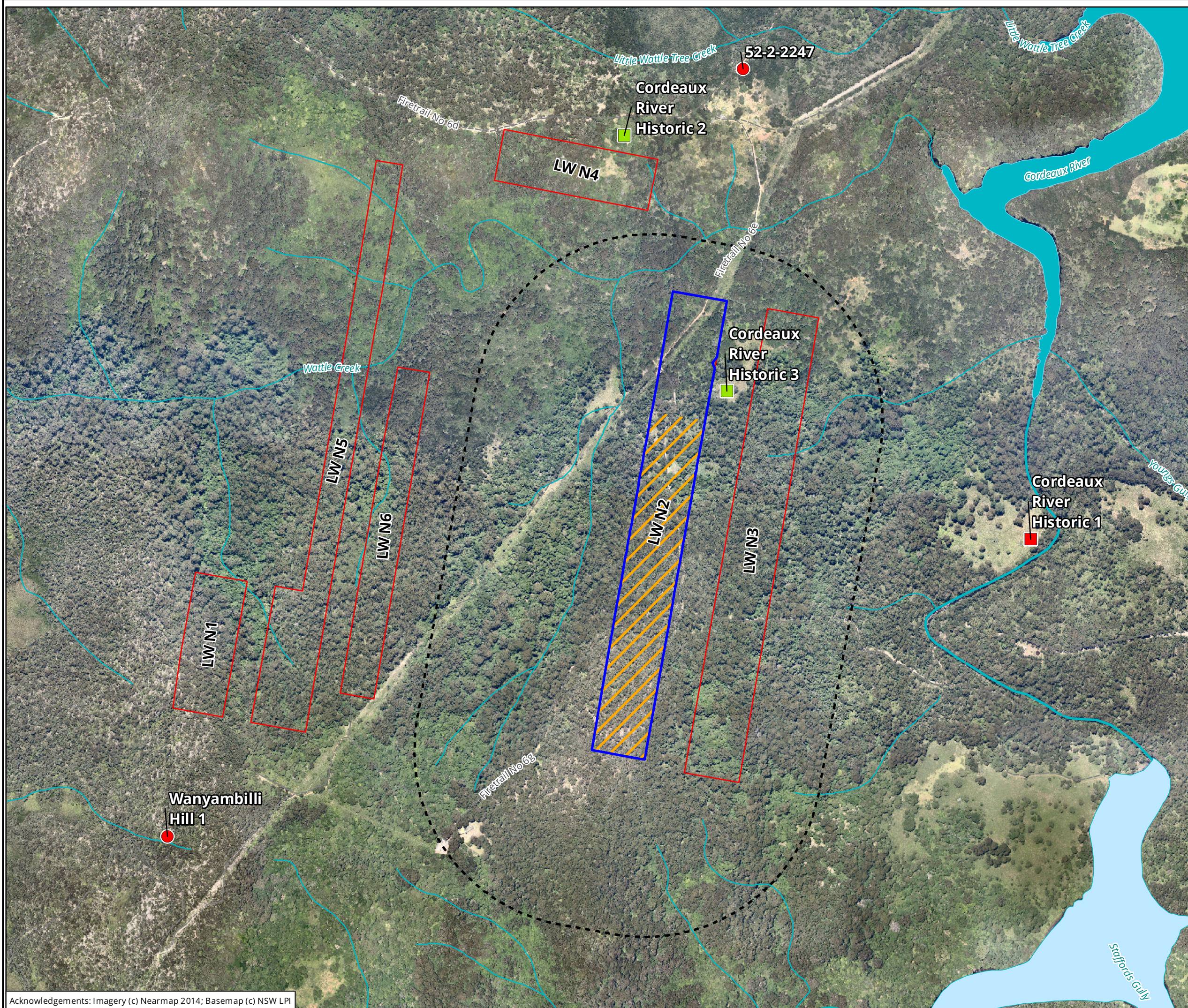
The heritage monitoring program consists of monitoring of heritage sites that have experienced mining activity within the Nebo Area. Monitoring is conducted prior to the commencement of mining as a part of the baseline archival recording, during mining (within 3-6 months of the longwall closest point of approach) and after mining (within six months of the completion of mining).

Baseline recording was conducted for Cordeaux River Historic 2 and Cordeaux River Historic 3 on 9 November 2011. Cordeaux River Historic 3 was inspected during mining on 26 February 2014 and most recently after mining on 2 June 2014. Cordeaux River Historic 2 was not required to be monitored during mining due to the site being outside of a 400 metre RMZ. Heritage monitoring sites are shown in Figure 2. Table 1 below provides an outline of the heritage monitoring methodology.

Table 1: Heritage monitoring program

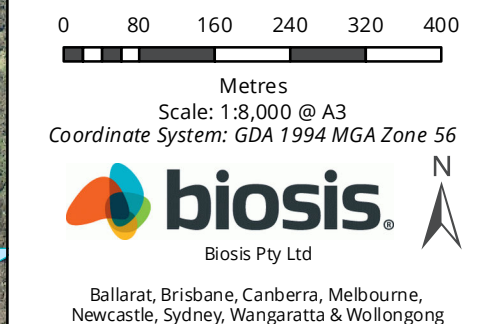
Monitoring	Site(s)	Methodology	Frequency	Most recently monitored
Cordeaux River Historic 2 (historical artefact scatter) (Figure 2: Heritage Monitoring Sites)	Historical artefact scatter	Visual observation, photographic coverage.	Baseline recording,	Baseline monitoring conducted on 9 November 2011

Cordeaux River Historic 3 (historical artefact scatter) (Figure 2: Heritage Monitoring Sites)	Historical artefact scatter	Visual observation, photographic coverage.	Baseline recording, during mining and within 6 months of completion of mining.	2 June 2014
--	--------------------------------	--	---	-------------



- Legend**
- Cultural Sites**
- Monitoring Not Required
- Historic Sites**
- Monitored
 - Monitoring Not Required
- Survey Area**
- Future Nebo Longwalls
 - 400m Risk Management Zone (RMZ)
 - Longwall N2
 - Extent mined

Figure 2: Heritage Monitoring Sites



Matter: 18792
Date: 03 September 2014
Checked by: MJM, Drawn by: ANP, Last edited by: apritchard
Location: P:\18700s\18792\Mapping\18792_CH_F2_Arch Sites

3 Impact Assessment

3.1 Subsidence monitoring program

A maximum of approximately 90 millimetres of vertical subsidence was observed across the central 100 metres of the panel, with maximum average tilt of less than 0.5 mm/m and strain of 0.2 mm/m (SCT Operations 2014).

This measured value is below the maximum predicted subsidence levels for Prediction Lines 4 (NM3) and 5 (NM2) (Niche Environment & Heritage 2012). As this is the first longwall extracted within the Nebo Area, there is no cumulative subsidence.

3.2 Results of monitoring programs

Baseline recording of Cordeaux River Historic 3 was undertaken on 9 November 2011. Monitoring of Cordeaux River Historic 3 occurred on 26 February 2014 (during mining) and most recently on 2 June 2014 (after mining). No impacts to heritage values have been documented during monitoring (see Plate 21 to Plate 4).



Plate 1: Baseline recording of Cordeaux River Historic 3 – detailed view of building foundations



Plate 2: Most recent monitoring at Cordeaux River Historic 3 – detailed view of building foundations



Plate 3: Baseline recording of Cordeaux River Historic 3 –concrete blocks view south-west



Plate 4: Most recent monitoring at Cordeaux River Historic 3 –concrete blocks view south-west

3.3 Observed versus predicted impacts

A summary of predicted versus observed impacts is provided in Table 2 below.

Table 2: Observed versus predicted impacts

Value	Predicted Impact (Niche 2012)	Observed Impact	Within Prediction
Cordeaux River Historic 3 (historical artefact scatter)	The low levels of subsidence predicted at the sites are not expected to result in any impacts to the Cordeaux River Historic Site 2 and Cordeaux River Historic Site 3.	No change in the condition of the artefact scatter was observed.	Yes

3.4 TARP assessment

A Trigger Action Response Plan (TARP) was developed for Longwalls N1-6 as a part of the Cultural Heritage Management Plan (Niche Environment and Heritage, 2012). This section assesses whether triggers have been met and whether additional actions are required due to extraction of Longwall N2.

A TARP assessment is provided in Table 3.

3.4.2 Longwall N2

No impacts to heritage site Cordeaux River Historic 3 were observed. Thus we conclude that this does not trigger any actions.

No further management actions have been triggered by Longwall 2.

3.4.3 Cumulative Impacts within the Nebo Mining Domain

Longwall N2 is the first longwall to be mined within the Nebo Area. As such, there are no cumulative impacts to be assessed until further longwall mining takes place within the Nebo Area.

4 Conclusions and Recommendations

This report assesses the post mining conditions in relation to heritage within the area potentially impacted by subsidence effects associated with extraction of Longwall N2, and compares these observed impacts to impacts predicted to occur.

We conclude that observed impacts are within predictions and that significant impacts to heritage values have not resulted from extraction of Longwall N2. No management actions have been triggered.

We make the following recommendations:

- Final monitoring of Cordeaux River Historic 3 be undertaken.
- Monitoring of heritage items that may be subsided by other longwalls continue as per the approved Heritage Management Plan (Niche 2012).

5 References

Biosis 2011. NRE Wongawilli Colliery Nebo Longwalls N1 - N6: Heritage Management Plan. Report prepared for Gujarat NRE Coking Coal Ltd. Authors: Ford A, Biosis Pty Ltd. Project 13748.

Biosis 2013. NRE Wongawilli Colliery, Nebo Longwalls N1-N6: Heritage Baseline Recording Report. Report prepared for Gujarat NRE Coking Coal Ltd. Authors: Ford A, Biosis Pty Ltd. Project 13748.

Niche Environment & Heritage 2012. Nebo Longwalls N1-N6 Extraction Plan. Prepared for Gujarat NRE and NSW Department of Planning and Infrastructure.

Appendices

Appendix 1: Trigger Action Response Plan

Table 3: Trigger Action Response Plan (TARP) Table for Heritage, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6

Feature	Monitoring Plan			Impact Assessment		TARPs		
	Prior to Mining	During Mining	Post mining and Future Monitoring	Predicted Impacts	Observed Impacts	Trigger	Response	Action as a result of Longwall N2
Heritage sites: Cordeaux River Historic 2 and Cordeaux River Historic 3	<p>Baseline heritage assessment involves baseline archival recording prior to longwall mining beginning in the SMP Area. This provides a set of baseline records for the monitoring program.</p> <p>Completed for Cordeaux River Historic Site 2 and 3.</p>	<p>Impact Assessment recording, three to six months after each predicted subsidence movement at the site (that is when a longwall makes it closest traverse to the site), and/or (if the longwall is to finish mining within six months).</p> <p>Completed for Cordeaux River Historic Site 3, not required for Cordeaux River Historic Site 2.</p>	<p>Final assessment recording at the completion of all subsidence movements at the site. The results of the assessment to be reported in End of Panel Reports and/or Annual Environmental management reports.</p> <p>To be completed.</p>	<p>Ground cracking or tree fall may impact potential archaeological deposits.</p>	<p>No impacts to heritage sites monitored were observed.</p>	<p>NORMAL</p> <p>No change as compared to baseline observed.</p> <p>WITHIN PREDICTIONS</p> <p>Survey results within performance criteria. Observation of unstable conditions or damage, cracking or tree falls. If a change is observed but no threat to heritage values is identified then the monitoring program should continue.</p> <p>EXCEEDS PREDICTIONS</p> <p>Observed physical impacts to heritage that exceeds the performance criteria.</p> <p>If a change is observed then an appropriate mitigation strategy should be developed in consultation with a heritage specialist, registered Aboriginal parties, and the landowner to avoid or minimise impacts to</p>	<ul style="list-style-type: none"> Continue monitoring Report in end of panel report. No further mitigation or management required Continue monitoring Report impacts as required in end of panel report. Site inspection with registered Aboriginal parties to document and photograph any observed changes / impacts to Aboriginal sites. Inform RAPs and OEH in writing. Notify relevant government agencies including OEH, DP&E, DRE and SCA immediately. Review and undertake remediation options as agreed with Agencies. Consultation with OEH will be required if remediation or mitigation measures affect the archaeological values at individual sites Commence preparation of mitigation/action plan within 1 week if 	<p>No management action/s required.</p> <p>No change in heritage sites observed when compared to baseline recording.</p>

Feature	Monitoring Plan			Impact Assessment		TARPs		
	Prior to Mining	During Mining	Post mining and Future Monitoring	Predicted Impacts	Observed Impacts	Trigger	Response	Action as a result of Longwall N2
						heritage values.	<p>required</p> <ul style="list-style-type: none"> Results of investigation reported to SCA, OEH and DRE within 1 week of completion Monthly updates of investigation progress, if required by SCA / OEH If subsidence movement occurs above the expected maximum predictions in the SMP, then site inspections of Dendrobium 5 and Wanyambilli Hill 1 (located outside the application area) should occur in consultation with Registered Aboriginal parties including the Illawarra LALC and CBNTCAC to document and photograph any observed changes / impacts. Site inspection by archaeologist to document and photograph any observed changes / impacts. Report in End of panel report Reporting in Incident and Annual Reviews 	



Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

APPENDIX C

Wongawilli Colliery Nebo Area Longwall N2 Groundwater & Surface Water End of Panel Report



**WOLLONGONG COAL LTD
WONGAWILLI COLLIERY
NEBO AREA
LONGWALL N2
GROUNDWATER & SURFACE WATER
END OF PANEL REPORT
Wollongong, NSW**

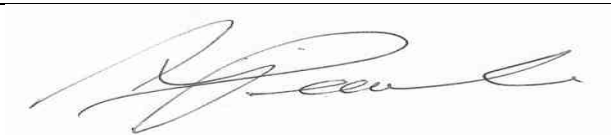
NEB4-R1A
4 SEPTEMBER 2014

GeoTerra PTY LTD ABN 82 117 674 941

Suite 4 186-192 Canterbury Road Canterbury NSW 2193

PO Box 220 Canterbury NSW 2193

Phone: 02 9787 9137 Fax: 02 9787 1874 Mobile 0417 003 502 Email: GeoTerra@iinet.net.au

Authorised on behalf of GeoTerra Pty Ltd:	
Name:	Andrew Dawkins
Signature:	
Position:	Managing Geoscientist

Date	Rev	Comments
02.09.2014		Initial Report
04.09.2014	A	Incorporate review comments

GeoTerra PTY LTD ABN 82 117 674 941

Suite 4 186-192 Canterbury Road Canterbury NSW 2193

PO Box 220 Canterbury NSW 2193

Phone: 02 9787 9137 Fax: 02 9787 1874 Mobile 0417 003 502 Email: GeoTerra@iinet.net.au

TABLE OF CONTENTS

1. INTRODUCTION	3
1.1 Subsidence	3
2. SCOPE OF WORK	3
3. WATER MONITORING DESCRIPTIONS	3
3.1 Surface Water	3
3.2 Groundwater	4
3.2.1 Open Standpipe Piezometers	4
3.2.2 Vibrating Wire Piezometers	4
4. PREDICTED AND OBSERVED GROUNDWATER IMPACTS	5
4.1 Aquifer / Aquitard Interconnection	5
4.1.1 Potential Impacts	5
4.1.2 Aquifer / Aquitard Interconnection Observations	5
4.2 Groundwater Levels	5
4.2.1 Potential Impacts	5
4.2.2 Groundwater Level Observations	5
4.5 Groundwater Chemistry	14
4.5.1 Potential Impacts	14
4.5.2 Groundwater Chemistry Observations	14
4.6 Inflow to Mine Workings	18
4.6.1 Predicted Impacts	18
4.6.2 Mine Inflow Observations	18
5 PREDICTED AND OBSERVED SURFACE WATER SYSTEM IMPACTS	19
5.1 Stream Flow	19
5.1.1 Potential Impacts	19
5.1.2 Stream Water Level and Flow Observations	19
5.2 Stream Water Quality	20
5.2.1 Potential Impacts	20
5.2.2 Creek Observations	20
5.3 Stream Bed and Bank Stability	21
5.3.1 Potential Impacts	21
5.3.2 Observed Impacts	21
6 SUMMARY OF RESULTS	22

7 REFERENCES

23

FIGURES

Figure 1	Alluvium / Colluvium Groundwater Levels	7
Figure 2	Crinanite Groundwater Levels	8
Figure 3	Narrabeen Group Groundwater Levels	9
Figure 4	Bulli Seam Groundwater Levels	9
Figure 5	Nebo 6 VWP	10
Figure 6	Nebo 7 VWP	11
Figure 7	Nebo 8 VWP	12
Figure 8	Nebo 8A VWP	13
Figure 9	Alluvium / Colluvium pH and EC	14
Figure 10	Crinanite pH and EC	15
Figure 11	Narrabeen Group pH and EC	16
Figure 12	Bulli Seam pH and EC	17
Figure 13	Iron and manganese (mg/L)	18
Figure 14	Nebo Stream Water Level	19
Figure 15	Stream Salinity and pH	20

TABLES

Table 1	Wattle Creek Stream Monitoring Sites	3
Table 2	Nebo Open Standpipe Piezometers	4
Table 3	Nebo Vibrating Wire Piezometers	4
Table 4	Summary of Groundwater and Surface Water Impacts	22

DRAWINGS

Drawing 1	Stream Monitoring Locations
Drawing 2	Groundwater Monitoring Locations

1. INTRODUCTION

This document outlines the observed variations in the surface water and groundwater systems associated with extraction of Longwall N2 in the Nebo Area within the Wollongong Coal Limited (WCL) operated Wongawilli Colliery.

Extraction of the Wongawilli Seam in Longwall N2 was conducted between 12/6/2013 and 26/2/2014, with the planned longwall extraction suspended due to collapse of the roof onto the longwall equipment mid way through the panel.

The mining created a void 132m wide, 789m long with a mined face of 3.3 – 3.4m high, and had a 125 – 280m depth of cover.

1.1 Subsidence

Up to 210mm of subsidence was predicted along the 300 subsidence line (after the extraction of both N2 and LWN3), with a maximum of 92mm observed over Longwall N2, along with a tilt of <0.5mm/m and tensile strain of 0.2m/m (SCT Operations, 2014).

No subsidence related TARP trigger levels have been reached or exceeded during extraction of Longwall N2 and no ameliorative actions are required.

2. SCOPE OF WORK

GeoTerra were commissioned by WCL to report on any observed groundwater system or surface water changes resulting from extraction of Longwall N2 in accordance with the Nebo Longwalls N1-N6 Extraction Plan (Niche 2011).

3. WATER MONITORING DESCRIPTIONS

3.1 Surface Water

Surface water monitoring associated with the extraction of N2 comprised field and laboratory assessment of five stream sites in three streams as shown in **Table 1**.

Monitoring sites were initiated in Wattle Tree Creek, Little Wattle Tree Creek and Jacksons Creek in June 2009 by GeoTerra as shown in **Drawing 1**, with the field and laboratory monitoring program subsequently conducted by WCL up to July 2014.

Table 1 Wattle Creek Stream Monitoring Sites

SITE	E (MGA)	N (MGA)	DESCRIPTION
WC1	294560	6189435	2 nd order tributary draining off Jacksons / Wanyambilli Hill
WC2	294530	6189470	2 nd order tributary draining over LWN5
WC3	294875	6189570	3 rd order channel downstream of WC1 / WC2 junction
WC4	293303	6189240	Wattle Creek headwaters west of Nebo workings
LWTC1	294920	6190020	At Fire Road 6 crossing

3.2 Groundwater

No NOW registered private bores are located within the Nebo area as it is within a restricted access water catchment area administered by the SCA.

It is worth noting that the overburden strata at Nebo is significantly different to the standard Southern Coalfield stratigraphy, as the igneous Cordeaux Crinanite sill complex has intruded into the overburden and dominates the overburden profile.

In some cases the sill complex has replaced the majority of the standard sequence of sandstone / shale seen in all other Southern Coalfields mining areas. In the vicinity of N2, the crinanite varies from 55 - 98m thick and lies from 70 – 120m above the mining horizon of N2.

3.2.1 Open Standpipe Piezometers

Open standpipe piezometers installed within the Nebo area include seven (6.5 to 109.5m deep) open standpipe piezometers installed by Gujarat NRE FCGL Pty Ltd (now Wollongong Coal Limited) in January 2010 as summarised in **Table 2** and shown in **Drawing 2**.

Each piezometer has been installed with a pressure transducer that reads water pressure at least twice per day.

Table 2 Nebo Open Standpipe Piezometers

Piezometer	Licence	E	N	RL mAHD	TD mbg	Intake (mbgl)
Nebo 1 (S)	10BL603365	295153	6188762	366.4	6.0	5.0 – 6.0
Nebo 1 (D)	10BL603365	295152	6188761	366.5	97.6	85.6 – 97.6
Nebo 2 (S)	10BL603365	294662	6189246	347.7	6.5	5.5 – 6.5
Nebo 2 (D)	10BL603365	294662	6189237	348.5	31.0	19.0 – 31.0
Nebo 3	10BL603365	295033	6189838	356.7	33.6	21.6 – 33.6
Nebo 4	10BL603365	294661	6189893	374.1	110.0	107.5 – 109.5

NOTE: n/a - not available mbgl - metres below ground level SWL - standing water level
mbtoc - metres below top of casing Nebo 5 was not drilled all bores drilled in Dec 2009

3.2.2 Vibrating Wire Piezometers

Four vibrating wire piezometer arrays were installed within the Nebo area in December 2009 and January 2010 as outlined in **Table 3** and shown in **Drawing 2**.

Table 3 Nebo Vibrating Wire Piezometers

Piezometer	Installed	E	N	RL mAHD	TD mbg	VWP Intakes (mbgl)
Nebo 6	Dec 2009	295237	6189510	354.2	119	60, 80, 100 (CC), 119 (KS)
Nebo 7	Dec 2009	295477	6189585	336.4	92	30, 45, 63 (CC), 90 (WW)
Nebo 8	Dec 2009	294679	6189485	343.4	91	15, 35, 52 (CC), 72 (SS)
Nebo 8A	Jan 2010	294549	6189499	359.6	69	25, 45, (CC)

NOTE: CC – Cordeaux Crinanite SS - Scarborough Sandstone WW – Wongawilli Coal Seam
KS – Kembla Sandstone

4. PREDICTED AND OBSERVED GROUNDWATER IMPACTS

4.1 Aquifer / Aquitard Interconnection

4.1.1 Potential Impacts

- no adverse interconnection of aquifers and aquitards was anticipated within 20m of the surface;
- potential increase in the rate of groundwater recharge into the basement following rainfall due to increased porosity and permeability of the fractured strata.

4.1.2 Aquifer / Aquitard Interconnection Observations

No adverse aquitard / aquifer interconnection or increased recharge has been observed in the vicinity of, or resulting from, extraction of Longwall N2.

No aquifer / aquitard interconnection TARP trigger levels have been reached or exceeded during extraction of Longwall N2 and no ameliorative actions are required.

4.2 Groundwater Levels

The open standpipe and vibrating wire piezometer (VWP) piezometer suite has been used to determine the pre, during and post Longwall N2 groundwater levels and head pressures.

The data has been used to indicate variations in groundwater systems within the alluvial / colluvial and basement strata to a maximum depth of 119m below surface.

4.2.1 Potential Impacts

The following groundwater level impacts could potentially occur;

- groundwater levels may reduce by up to 10m, and may stay at that reduced level until maximum subsidence develops at a specific location;
- groundwater levels should recover over a few months as the newly developed secondary porosity is recharged by rainfall;
- no permanent post mining reduction in groundwater levels unless a new outflow path develops, and;
- temporary lowering of the deep piezometric surface over the subsidence area due to horizontal dilation of strata and resultant increase in secondary porosity.

4.2.2 Groundwater Level Observations

Standing water levels in the open standpipe piezometers range from

- 4.5 - 5.0 mbgl in the soil / colluvium / alluvium piezometers
- 4.5 - 14.5 mbgl in the crinanite
- 51mbgl in the Narrabeen group and
- 92mbgl in the Bulli Seam

Neither of the shallow soil / alluvium / colluvium piezometers Nebo1S or Nebo2S overlie N2, and both have varied in response to rainfall in the catchment as shown in **Figure 1**, with no influence from N2 during its period of extraction.

Neither of the crinanite piezometers Nebo2D or Nebo3 overlie N2, and both have varied in response to rainfall in the catchment as shown in **Figure 2**, with no apparent diversion from the natural water level trends from N2 during its period of extraction.

Piezometer Nebo1D was installed in the Narrabeen Group approximately 110m east of N2, between the longwall and 125m west of an inflow channel of Cordeaux Dam, above the Full Storage Level of the dam. Nebo1D showed a response to extraction of N2 as shown in **Figure 3**, with a maximum reduction in its water level of 8m, followed by a recovery to 4m below its pre N2 level.

Piezometer Nebo4, which was installed in the Bulli Seam, to the north of LWN4, showed a rising water level during extraction of N2, albeit with short term drops and recoveries following water extraction sampling events, along with no response to extraction of N2, as shown in **Figure 4**.

The vibrating wire array installed in Nebo6 demonstrated a significant rise in the two shallowest crinanite intakes (60, 80mbgl) of 40.83m and 22.42m, whilst the lower crinanite (100mbgl) and coal measures (115m) showed no response during early October to mid December 2011, some 2½ years before the start of N2. Both shallower intakes then showed a reduction in water level, with a more pronounced reduction at 80mbgl, prior to the start of N2. During mining of N2, the 60m crinanite intake showed no response to N2 extraction, whilst the falling trend at 80mbgl gradually tailed off during and after extraction of N2. The lack of response to N2 extraction was apparent in the underlying 100m crinanite or 115m coal measure intakes which indicates no mining subsidence effect in the crinanite. In addition, no correlation with the water level of Cordeaux dam and Nebo6 is apparent.

The 45m deep crinanite intake in Nebo7 showed a significantly smaller recharge at the same time as the recharge observed in Nebo6, however no notable response to the recharge event occurred in the 30m and 63m deep crinanite or the 90m coal measure intakes. No response to extraction of N2 and no correlation to dam levels in any of the Nebo7 intakes are apparent.

The 15m deep crinanite intake in Nebo8 showed a significantly smaller recharge at the same time as the recharge observed in Nebo6, however no notable response to the recharge event occurred in the 52m crinanite or 72m deep coal measure intakes. No response to extraction of N2 and no correlation to dam levels in any of the Nebo8 intakes are apparent.

No response to the mid to late 2011 recharge event is apparent in the Nebo8A VWP, with no response to extraction of N2 and no correlation to groundwater levels in Cordeaux Dam.

No basement groundwater level related TARP triggers were exceeded during extraction of Longwall N2 and no ameliorative action are required.

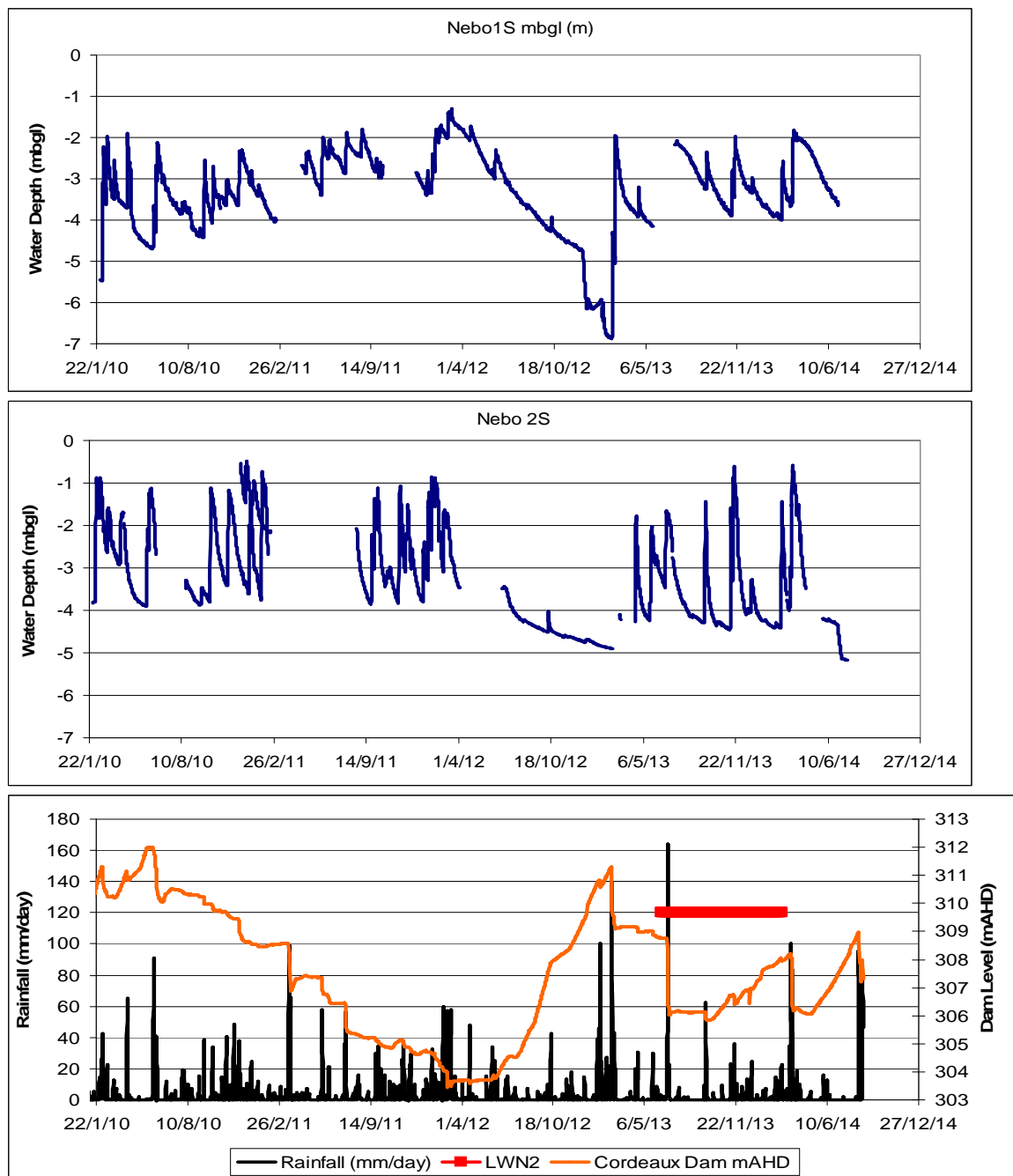


Figure 1 Alluvium / Colluvium Groundwater Levels

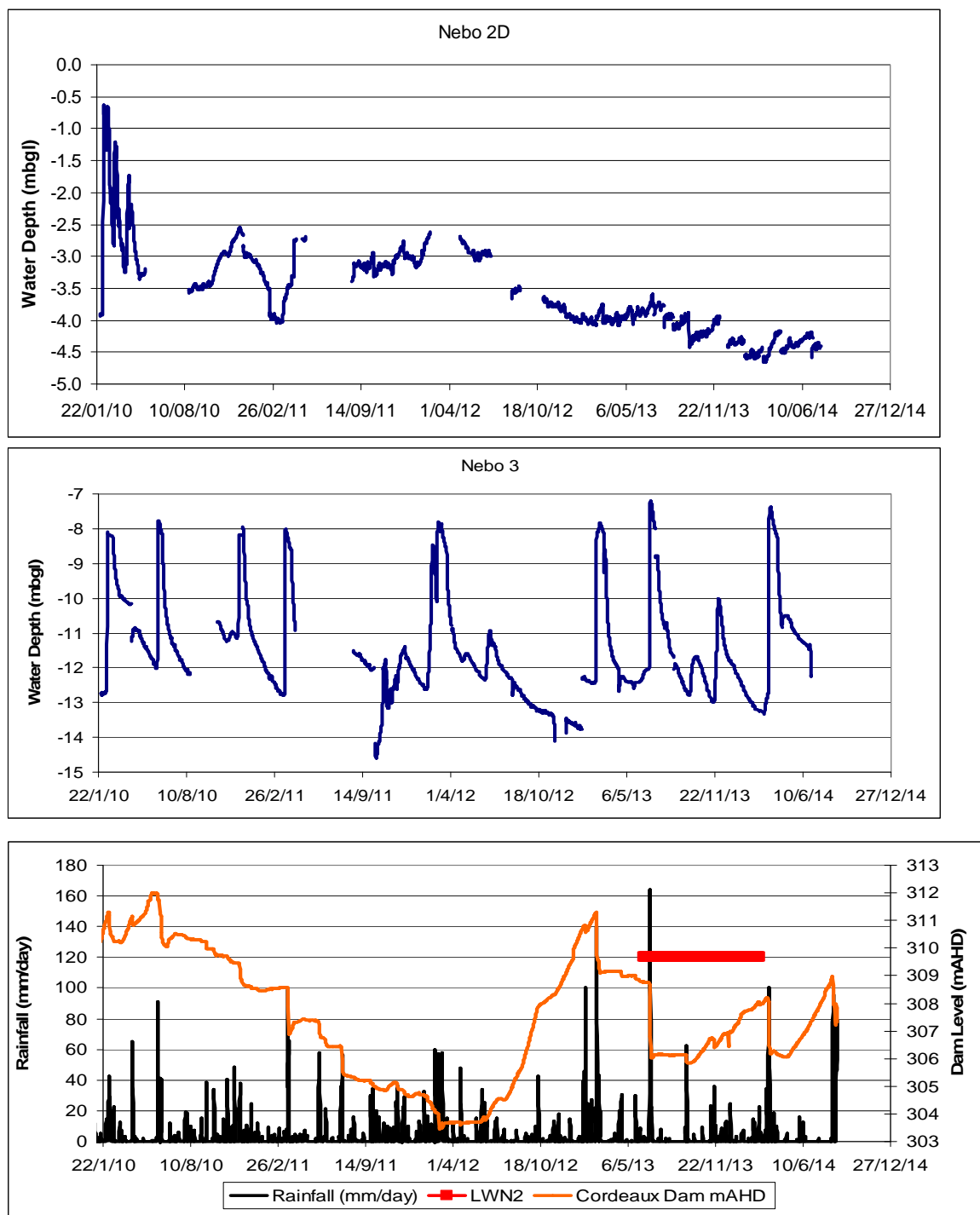


Figure 2 Crinanite Groundwater Levels

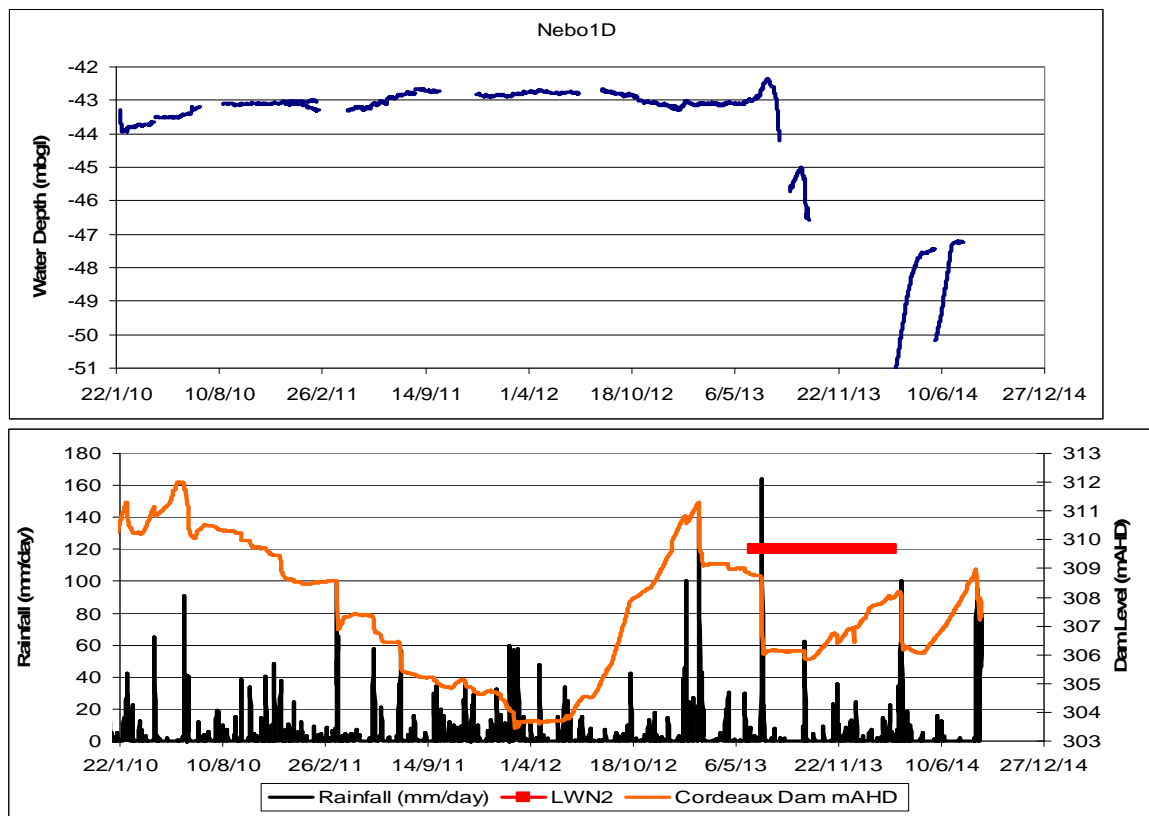


Figure 3 Narrabeen Group Groundwater Levels

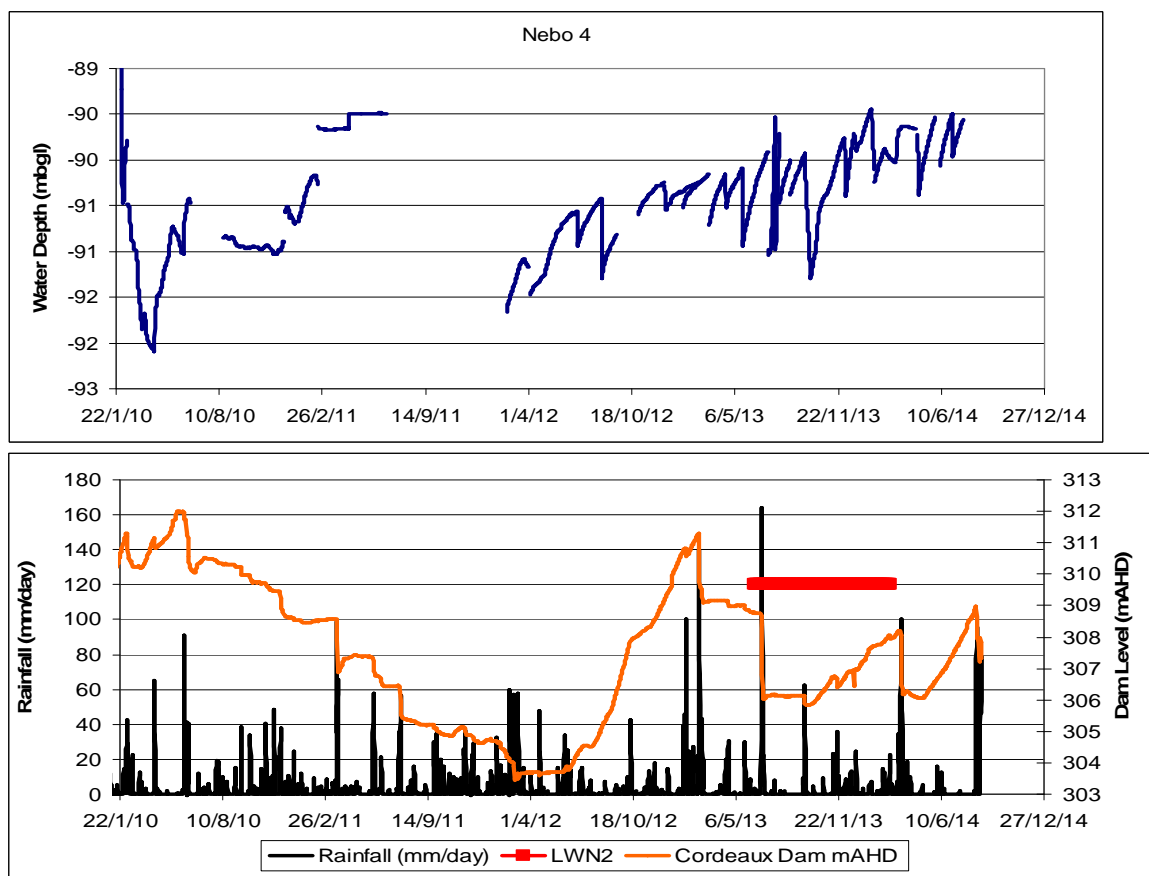


Figure 4 Bulli Seam Groundwater Levels

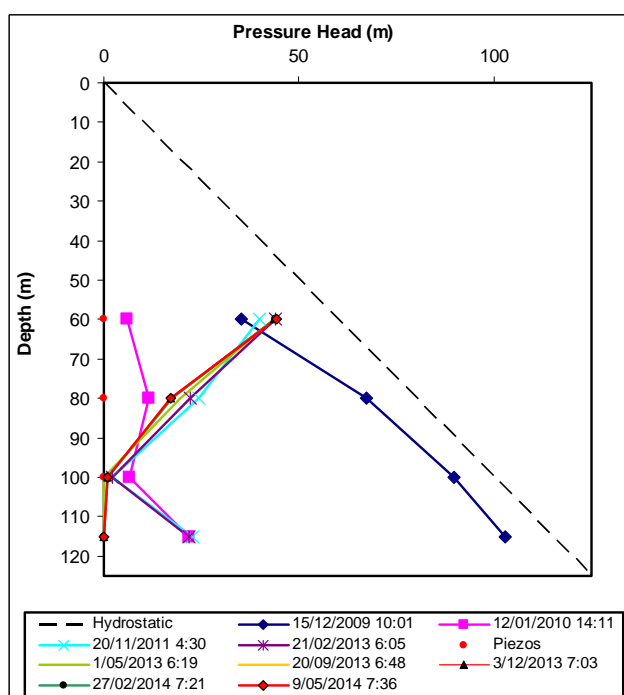
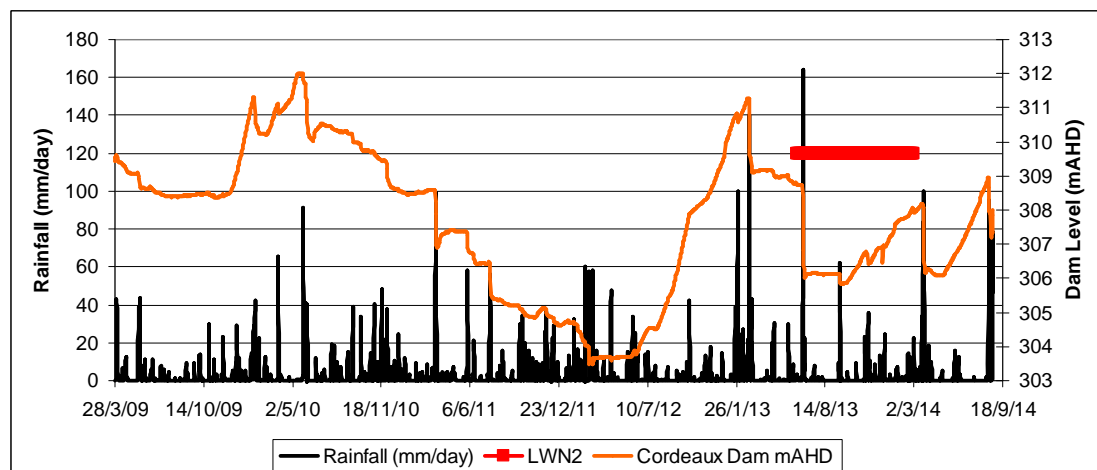
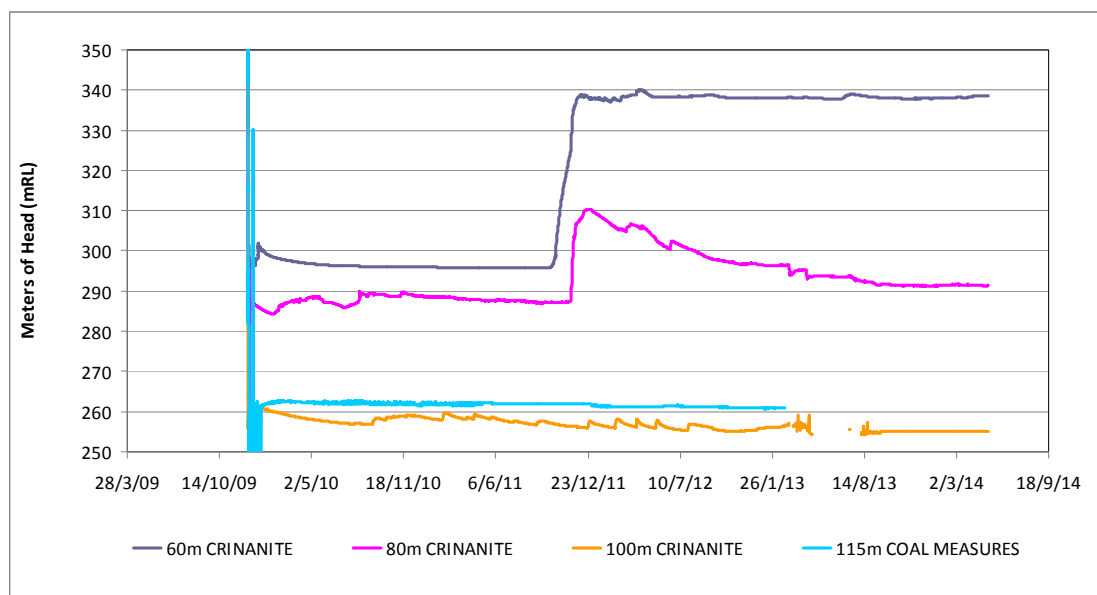


Figure 5 Nebo 6 VWP

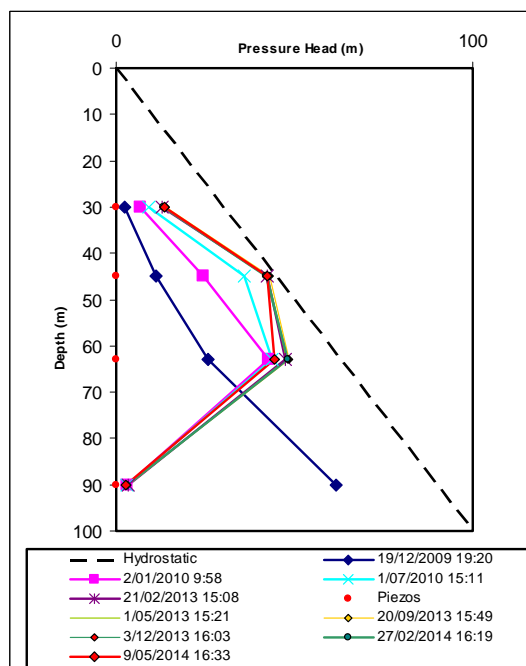
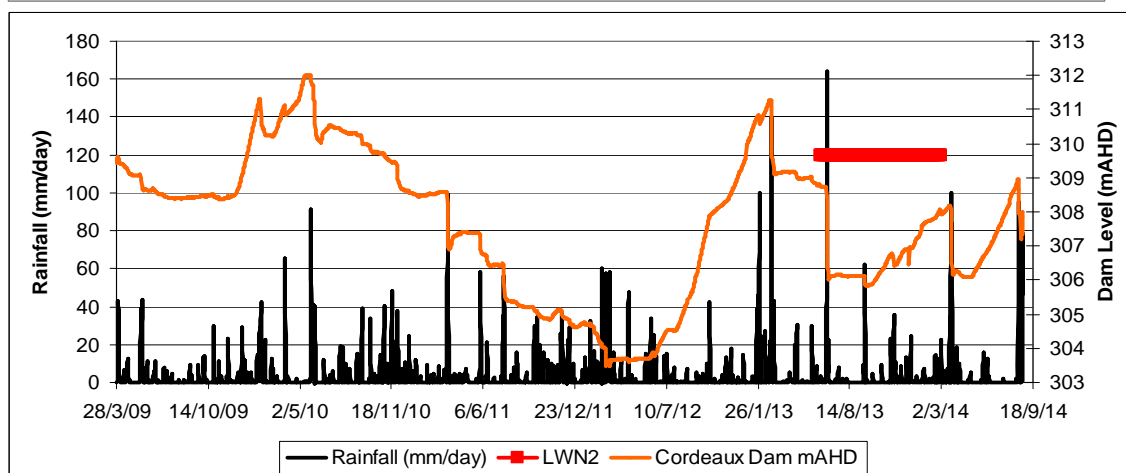
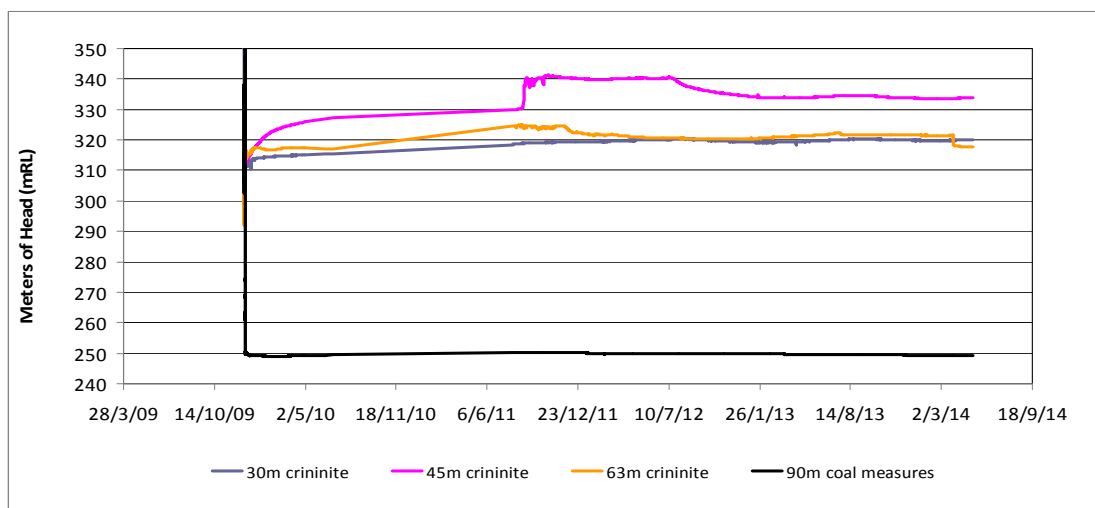


Figure 6 Nebo 7 VWP

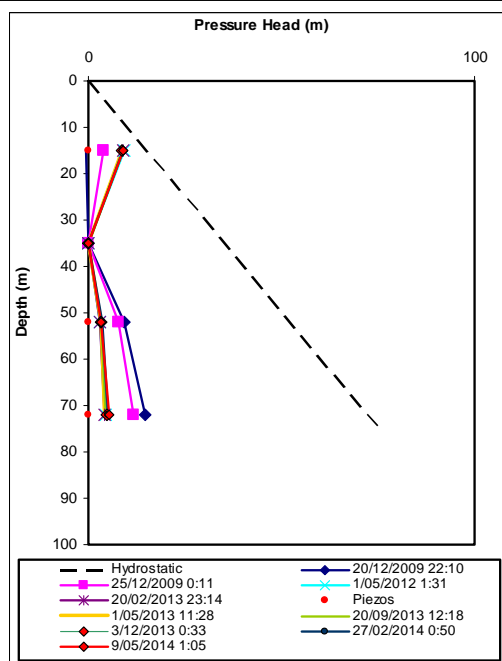
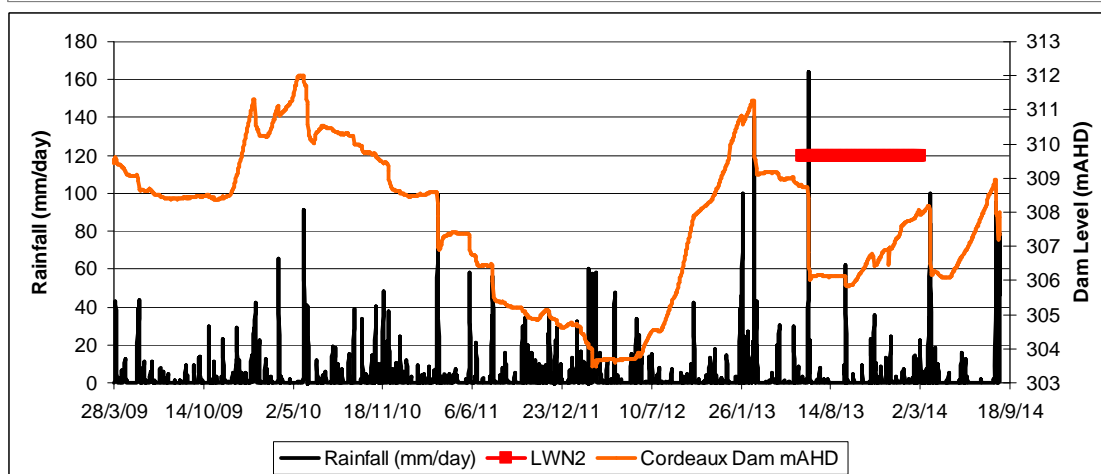
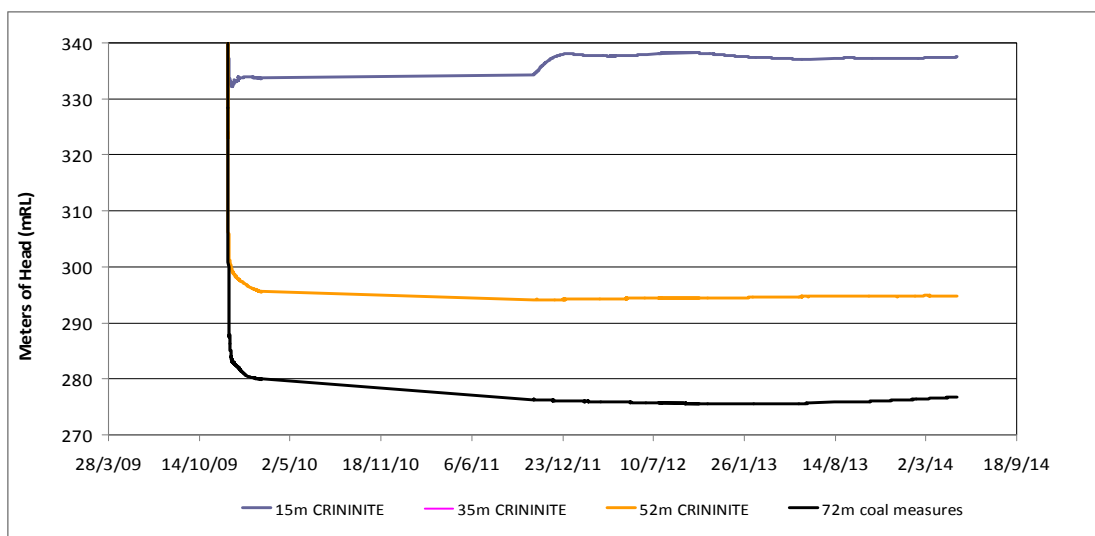


Figure 7 Nebo 8 VWP

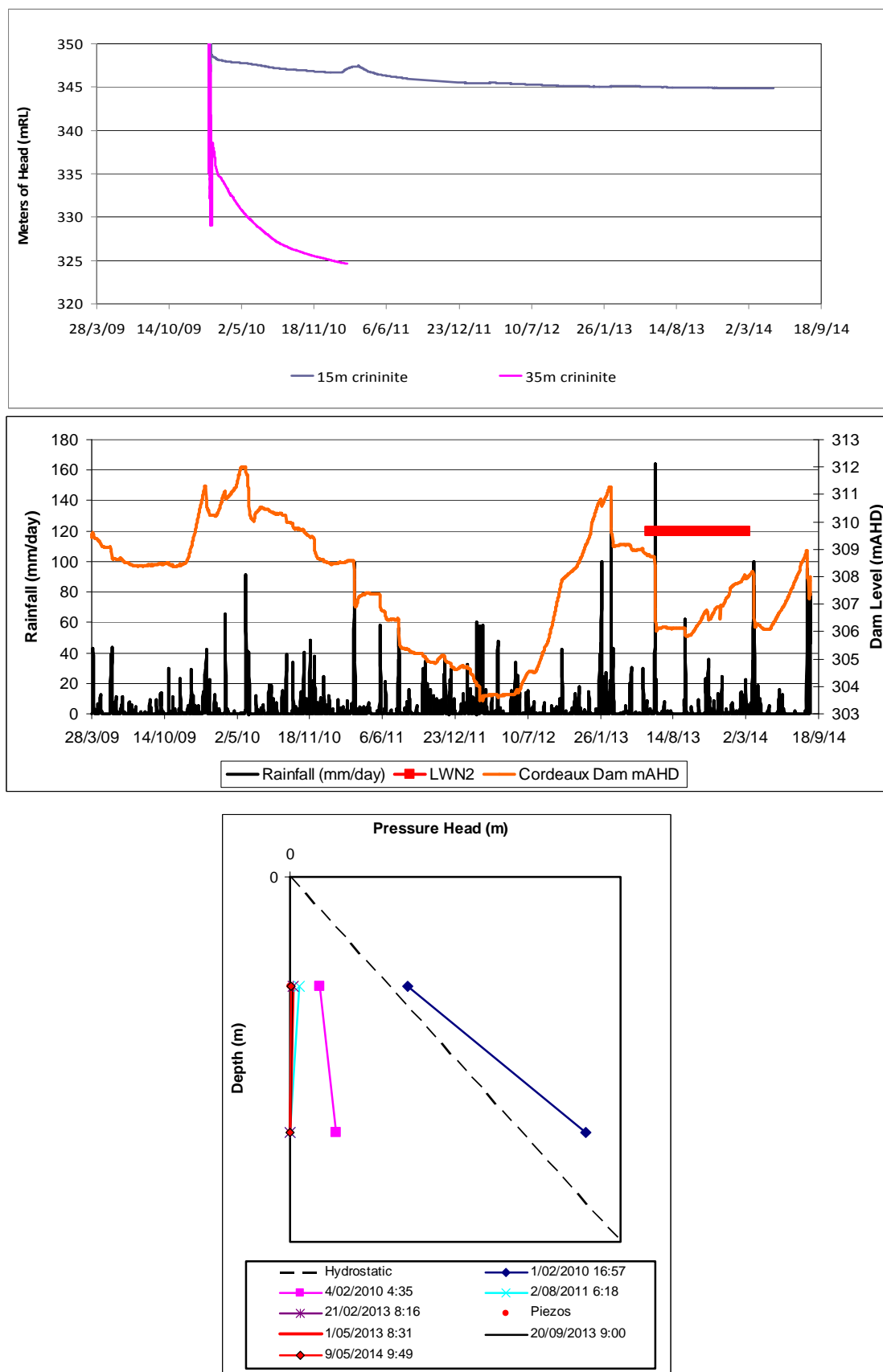


Figure 8 Nebo 8A VWP

4.5 Groundwater Chemistry

4.5.1 Potential Impacts

The potential impacts from extraction of the workings at Nebo in relation to groundwater chemistry were;

- increased iron and manganese hydroxide precipitation in groundwater, and;
- lowering (acidification) of pH.
- minor to moderate increase in salinity

4.5.2 Groundwater Chemistry Observations

The water quality data obtained by WCL from the shallow soil / alluvium / colluvium piezometers as shown in **Figure 9** and **Appendix A** indicate the Quaternary aquifers have generally low salinity (<400 μ S/cm) and pH ranging from 5.0 – 7.0 (except when cement contamination of the bore and / or sampling equipment significantly raises the alkalinity). The laboratory analyses indicate the Quaternary aquifers are generally outside of ANZECC 2000 Upland Stream and 95% Protection of Freshwater Aquatic Ecosystems guidelines for total Nitrogen and phosphorous, filtered copper and zinc, and occasionally for filtered lead, nickel, and aluminium.

It should be noted that due to the high pH (6 - 9.5 for 1S, 5 – 9 for 2S) as a result of cement contamination either during piezometer installation or sampling of these waters, they contain unnaturally elevated metals due to their high solubility of the metals in the highly alkaline conditions.

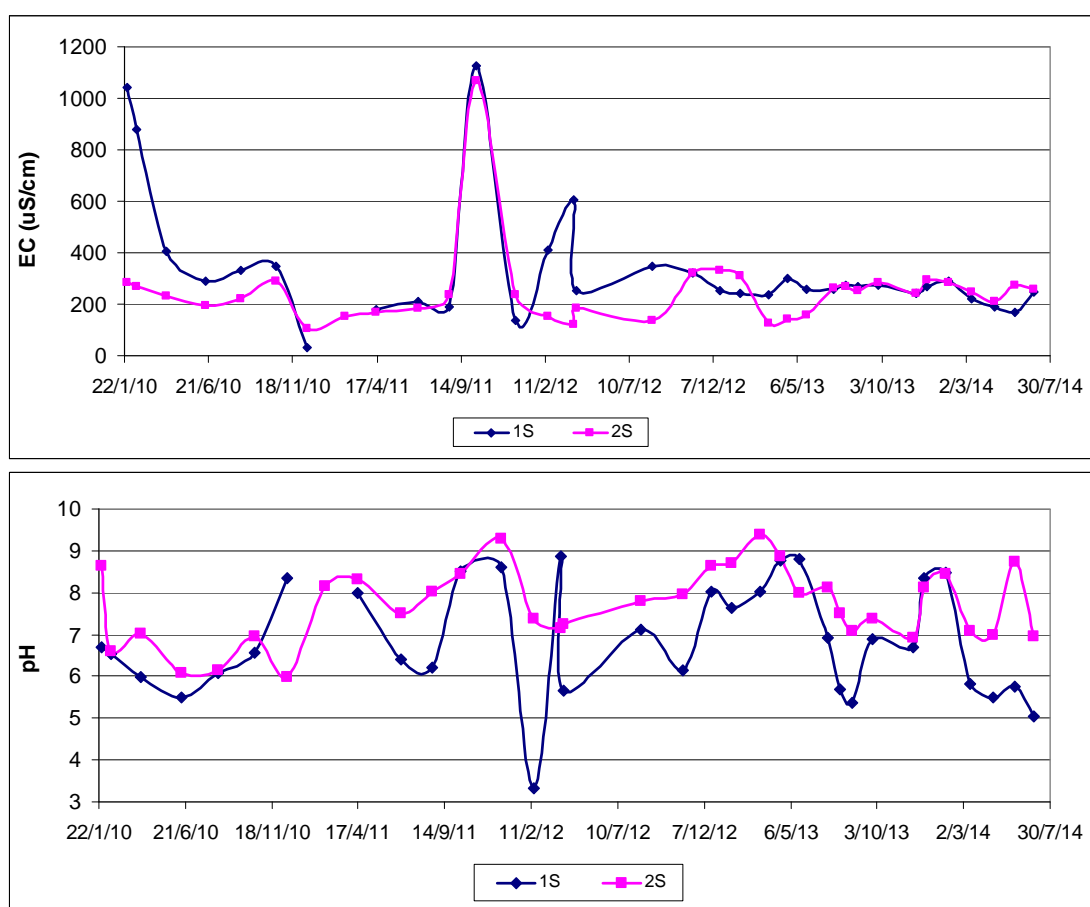


Figure 9 Alluvium / Colluvium pH and EC

The water quality data obtained by WCL from the crinanite piezometers as shown in **Figure 10** and **Appendix A** indicate the crinanite has low salinity (<500 μ S/cm) in Nebo 3 but high salinity (due to cement contamination) in Nebo 2D (7000 μ S/cm, reducing to 1880 μ S/cm more recently) and pH ranging from 7.0 - 10 in Nebo 3 and 11 – 13.5 in Nebo 2D (due to cement contamination of both piezometers). The laboratory analyses indicate the crinanite is generally outside of ANZECC 2000 Upland Stream and 95% Protection of Freshwater Aquatic Ecosystems guidelines for total Nitrogen and phosphorous, filtered copper and zinc, and occasionally for filtered lead, nickel, and aluminium.

It should be noted that the high pH in the piezometers is due to cement contamination either during piezometer installation or sampling of these waters, and that they contain unnaturally elevated metals due to their high solubility of the metals in the strongly alkaline conditions.

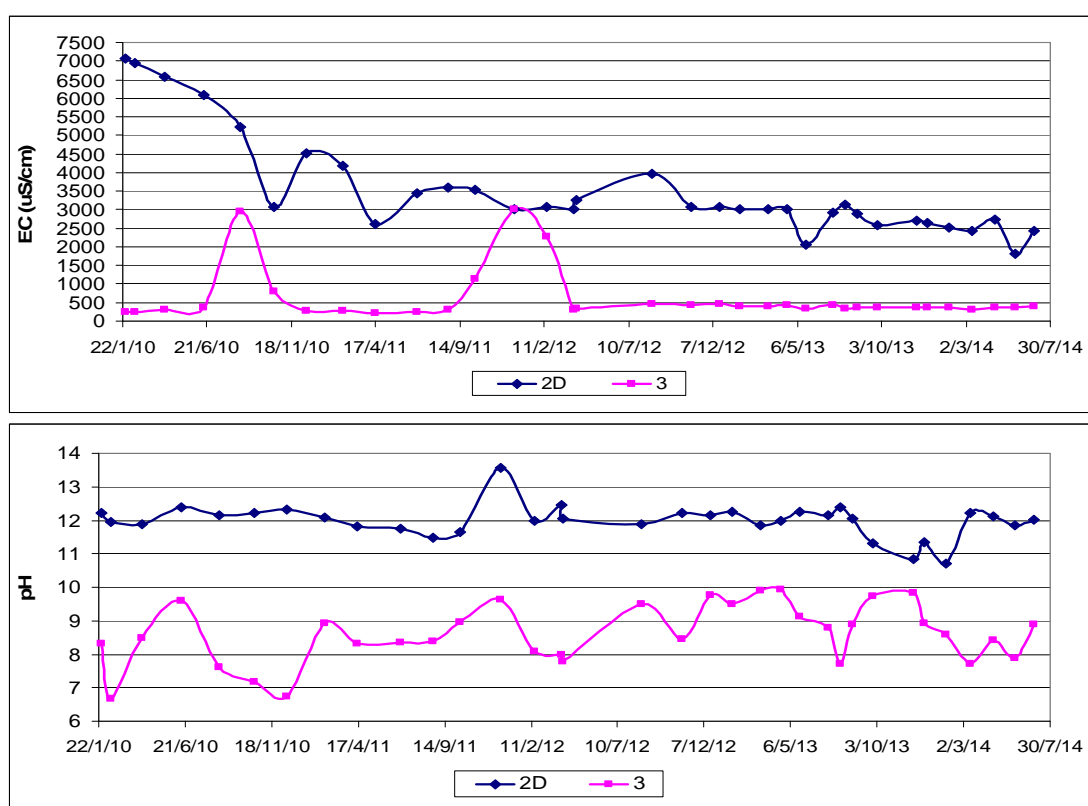


Figure 10 Crinanite pH and EC

The water quality data obtained by WCL from the Narrabeen Group piezometer as shown in **Figure 11** and **Appendix A** indicate the Narrabeen Group has low to moderate salinity (450 - 1450 μ S/cm) in Nebo 1D and pH ranging from 7.0 – 10.5 (due to cement contamination). The laboratory analyses indicate the Nebo1D waters are generally outside of ANZECC 2000 Upland Stream and 95% Protection of Freshwater Aquatic Ecosystems guidelines for total Nitrogen and phosphorous, filtered copper and zinc, and occasionally for filtered lead and aluminium.

It should be noted that the high pH in the piezometer is due to cement contamination either during piezometer installation or sampling of these waters, and that it contains unnaturally elevated metals due to the high solubility of the metals in the strongly alkaline conditions.

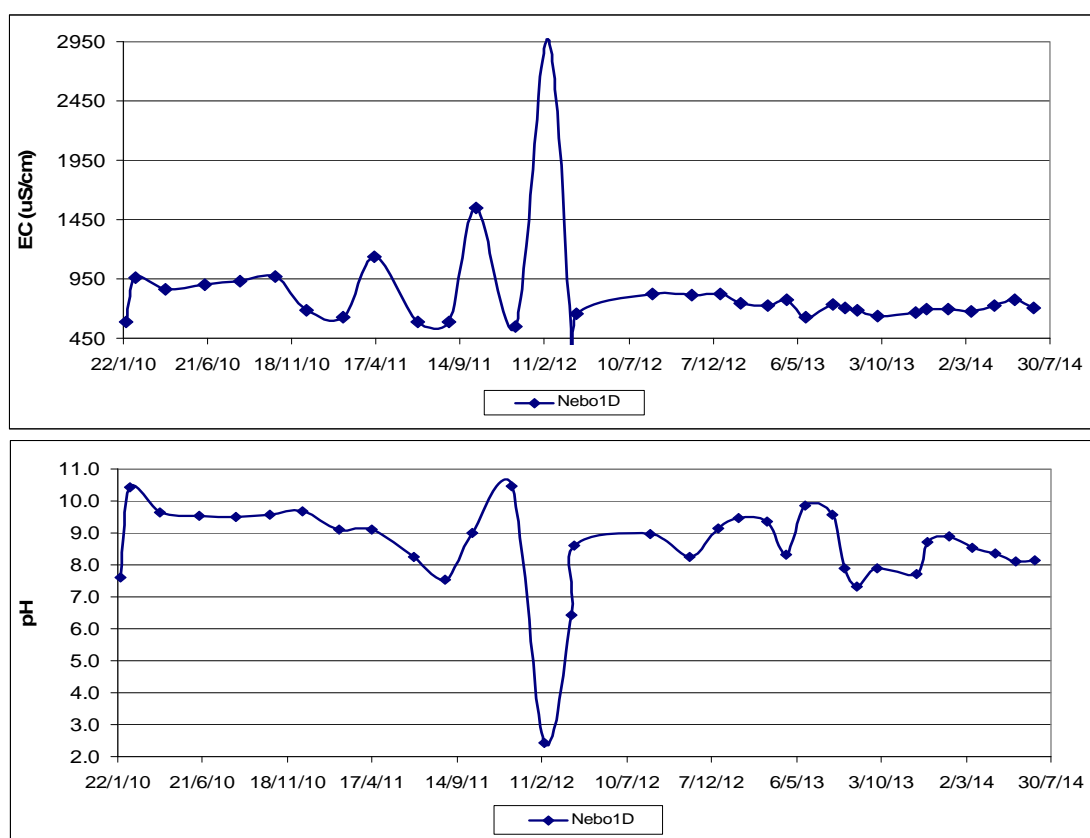


Figure 11 Narrabeen Group pH and EC

The water quality data obtained by WCL from the Bulli Seam piezometer as shown in **Figure 12** and **Appendix A** indicate the Bulli Seam has moderate to high salinity (1100 - 1440 $\mu\text{S}/\text{cm}$) in Nebo4 and pH ranging from 8.0 – 14 due to cement contamination. The laboratory analyses indicate the Nebo4 waters are generally outside of ANZECC 2000 Upland Stream and 95% Protection of Freshwater Aquatic Ecosystems guidelines for total Nitrogen and phosphorous, filtered copper, lead, zinc and aluminium, and occasionally for filtered nickel.

It should be noted that the high pH in the piezometer is due to cement contamination either during piezometer installation or sampling of these waters, and that it contains unnaturally elevated metals due to the high solubility of the metals in the strongly alkaline conditions.

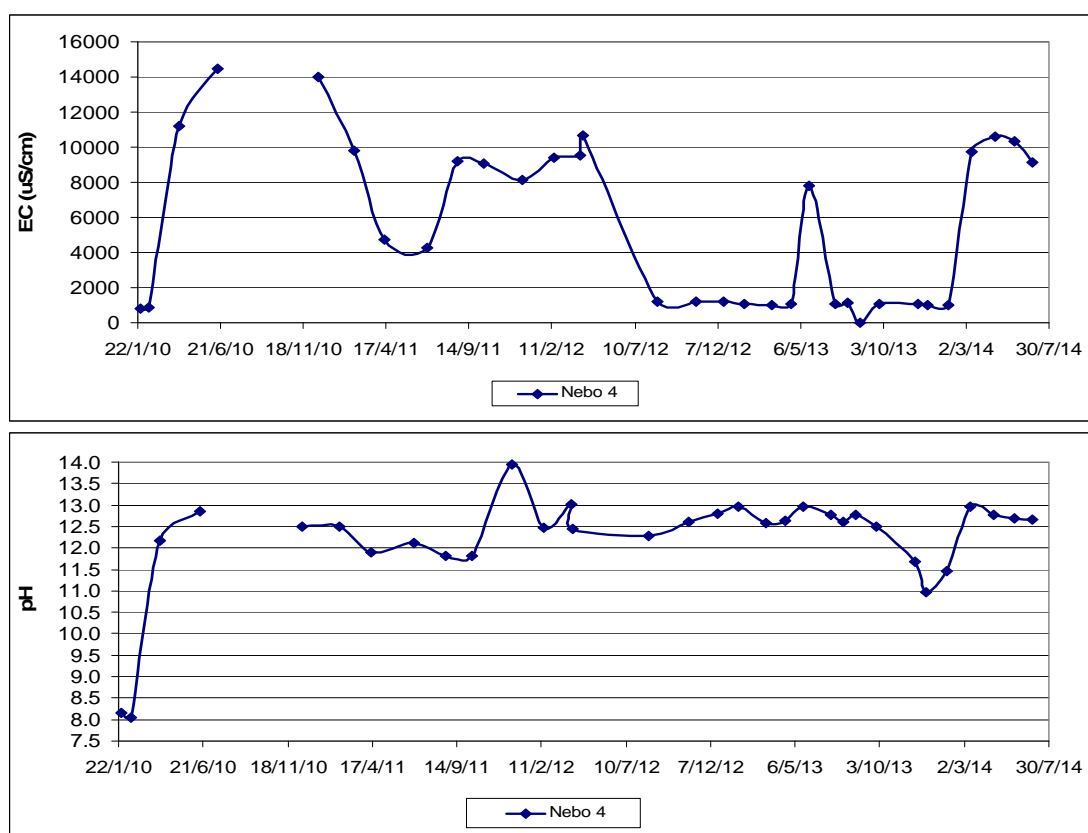


Figure 12 Bulli Seam pH and EC

Overall, there was no observable trend in pH due to extraction of Longwall N2 in all monitored bores.

The piezometers at Nebo also contain elevated iron and manganese due to their solubility in the highly alkaline water, however no increasing or decreasing trend in these metals is evident during the sampling period as shown in **Figure 13**.

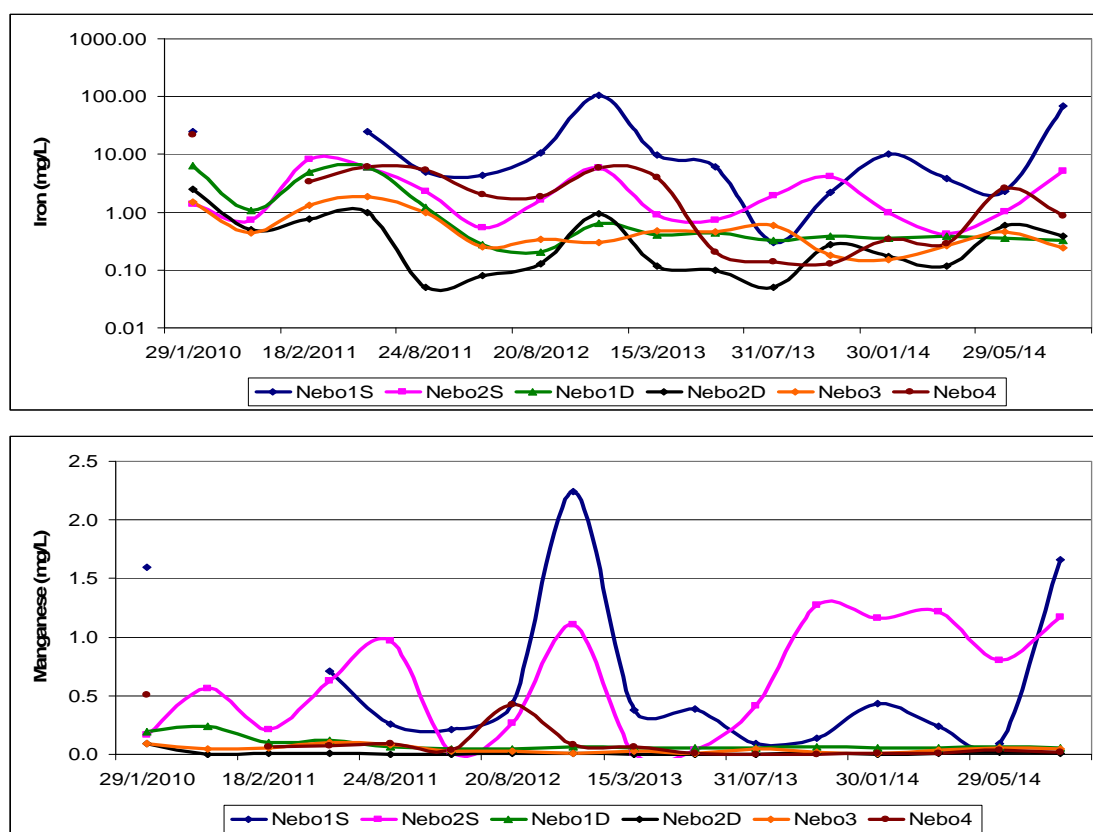


Figure 13 Iron and manganese (mg/L)

4.6 Inflow to Mine Workings

4.6.1 Predicted Impacts

- No observable increase in groundwater inflow to mine workings.

4.6.2 Mine Inflow Observations

No mine water was discharged from the Wongawilli mine, including from the Nebo workings, during the extraction period of N2

Based on mine pump out data records, no observable increased inflow to the Wongawilli mine workings following extraction of Longwall N2 has occurred and no TARP trigger levels have been reached or exceeded.

5 PREDICTED AND OBSERVED SURFACE WATER SYSTEM IMPACTS

5.1 Stream Flow

5.1.1 Potential Impacts

- No anticipated adverse effect on stream flow in the Nebo Creeks and tributaries.

5.1.2 Stream Water Level and Flow Observations

No observed adverse stream flow or pool level effects on Wattle Creek or its tributary, Jacksons Creek (WC1) has been observed due to extraction of Longwall N2 as shown in **Figure 14**.

Visual observation has not indicated any adverse effects on Little Wattle Tree Creek stream flow or pool levels.

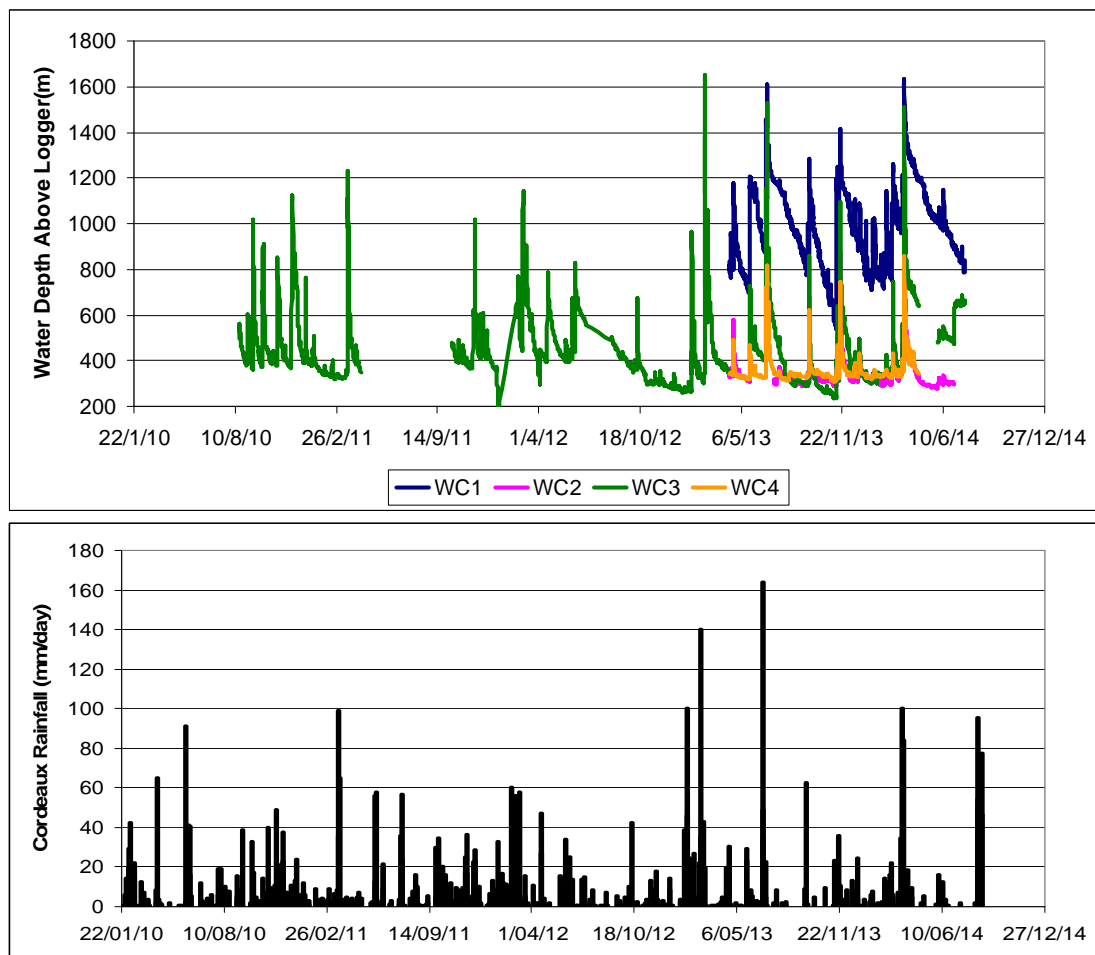


Figure 14 Nebo Stream Water Level

No stream flow or pool level related TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2.

5.2 Stream Water Quality

5.2.1 Potential Impacts

- increased iron hydroxide precipitation, and;
- lowering (acidification) of pH, and;
- minor to moderate increase in salinity.

5.2.2 Creek Observations

During and after extraction of Longwall N2, field water quality in Wattle Creek, Little Wattle Tree Creek and Jacksons Creek did not observably change outside of climatic influences as shown in **Figure 15**.

The field and laboratory data supplied by WCL indicates that the creek salinity generally varies from 50 – 250uS/cm, whereas the pH, which is naturally between 5.5 and 8, is shown as reaching up to 10; however the more alkaline readings are a result of cement contamination of the pH probe.

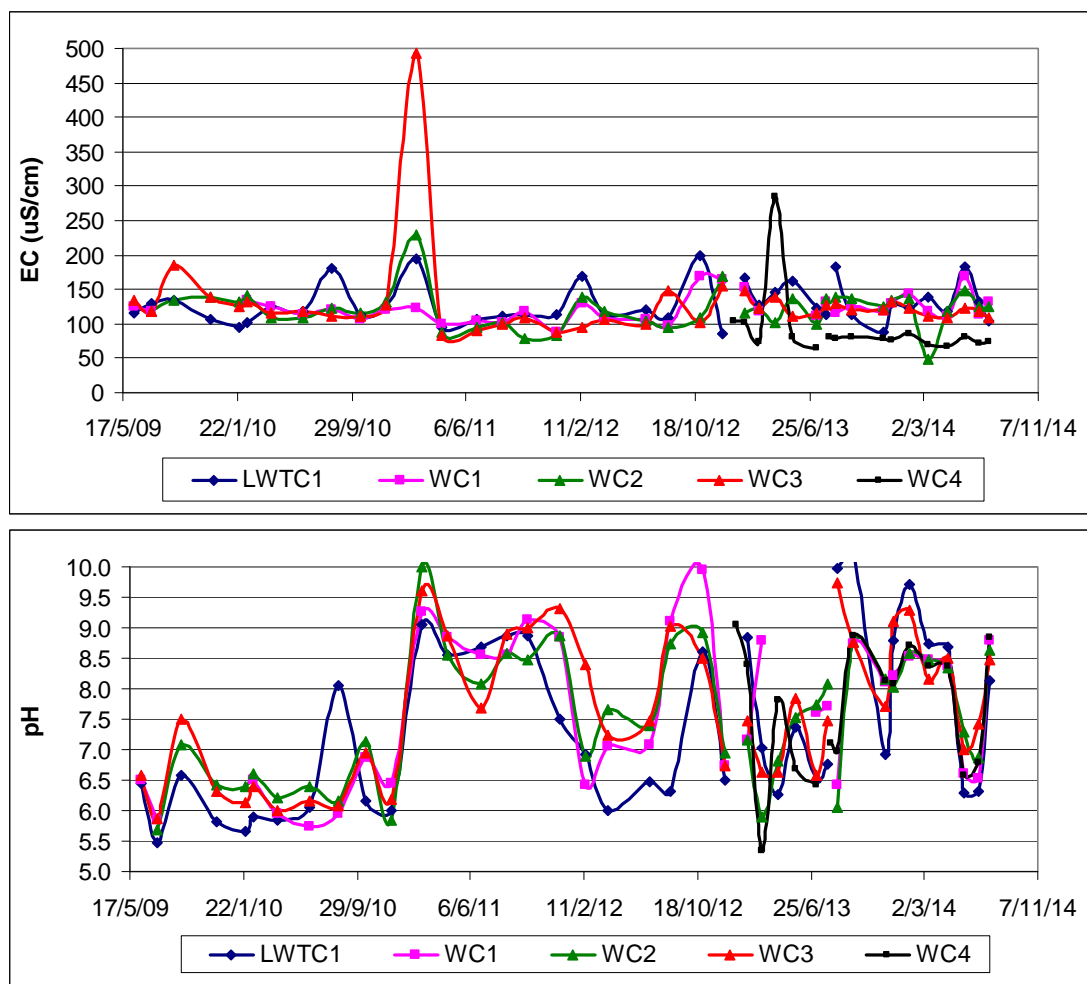


Figure 15 Stream Salinity and pH

The laboratory analyses indicate the Jacksons Creek (WC1), WC2 (Wattle Creek upstream of Jacksons Creek) and WC3 (downstream of Jacksons Creek waters are occasionally to generally outside of ANZECC 2000 Upland Stream and 95% Protection of Freshwater Aquatic Ecosystems guidelines for total Nitrogen and phosphorous, as well as filtered aluminium, and occasionally for filtered copper, lead, zinc and nickel.

The headwaters of Wattle Creek at WC4, however, exceeded the guidelines for filtered zinc in all samples, and occasionally for total nitrogen and total phosphorous, as well as aluminium.

The stream water quality related TARP trigger levels in the Nebo area were not exceeded during extraction of Longwall N2.

5.3 Stream Bed and Bank Stability

5.3.1 Potential Impacts

- increased stream bed or bank instability;
- cracking of exposed sandstone rock faces;
- no anticipated adverse effect on Wattle, Little Wattle Tree or Jacksons Creeks resulting from extraction of Longwall N2.

5.3.2 Observed Impacts

No observed adverse effect has been observed on the main creek channels or tributaries in the Nebo area resulting from extraction of Longwall N2.

No stream bed or bank stability TARP trigger levels have been reached or exceeded and no ameliorative actions are required due to extraction of Longwall N2.

6 SUMMARY OF RESULTS

During extraction of Longwall N2, no surface water or groundwater TARP triggers have been exceeded.

Table 4 summarises the predicted and observed effects on the Nebo area surface water and groundwater systems.

Table 4 Summary of Groundwater and Surface Water Impacts

Predicted Impacts	Observed Impacts Due to Extraction of Longwall N2
<i>Adverse interconnection of aquifers and aquitards is not anticipated within 20m of the surface</i>	No adverse interconnection between aquifers and aquitards has been observed within 20m of the surface
<i>Potential increased rate of recharge into the plateau</i>	No increased rate of recharge has been observed
<i>Temporary lowering of shallow groundwater by up to 10m which may stay at that level until maximum subsidence develops</i>	Based on the available data, no above trigger lowering of the shallow piezometric surface has been observed in relation to extraction of Longwall N2, however Nebo1 fell by approximately 8m and subsequently recovered to 4m below the pre N2 level, which was within the predicted water level change parameters.
<i>Shallow groundwater levels should recover over a few months</i>	Based on the available data, the Nebo1D water level is recovering
<i>No permanent post mining reduction in the shallow groundwater levels unless a new outflow path develops</i>	Based on the available data, the Nedo1D water level has not yet fully recovered
<i>Strata dilation and subsequent re-filling of secondary voids may temporarily lower the shallow standing water levels</i>	Based on the available data, the Nebo1D water level has not yet recovered
<i>The shallow piezometers may experience increased iron / manganese hydroxide precipitation and / or lowering of pH</i>	The water quality in the shallow piezometers has not been affected by subsidence related effects
<i>Interface drainage, ferruginous, brackish seeps may be generated in streams</i>	No interface drainage, ferruginous, brackish seeps have been generated in local streams
<i>Increased basement groundwater seepage inflow into the workings should not occur</i>	No increased rate of groundwater seepage into the workings has occurred
<i>Stream flow in creeks overlying the extracted workings may be adversely affected by subsidence</i>	Stream flow in local streams has not been adversely affected by subsidence related effects
<i>Stream water quality may be adversely affected by subsidence</i>	Stream water quality in local streams has not been affected in the long term, with both pH and EC remaining in their baseline, pre N2 range
<i>Stream bed and bank stability may be adversely affected by subsidence</i>	Stream bed and bank stability in the local creeks has not been adversely affected by subsidence related effects

7 REFERENCES

- ANZECC 2000 Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Vol 1 & 2
- Department of Environment and Conservation, 2004 Contaminated Sites: Draft Guidelines for the Assessment and Management of Groundwater Contamination
- Department of Land and Water Conservation, 1997 The NSW State Groundwater Policy Framework Document
- Department of Land and Water Conservation, 1998 The NSW State Groundwater Quality Protection Policy
- Department of Land and Water Conservation, 1998 Aquifer Risk Assessment Report
- Department of Land and Water Conservation, 2002 The NSW Groundwater Dependent Ecosystems Policy
- DIPNR, 2002 Draft Guidelines For Management of Stream Systems in Coal Mining – Hunter Valley
- DIPNR, 2003 Groundwater Monitoring Guidelines for Mines Within the Hunter Region
- GeoTerra, 2010 Gujarat NRE FCGL Pty Ltd NRE Wongawilli Colliery Nebo Panels 1 to 6 Groundwater Assessment
- GeoTerra, 2010A Gujarat NRE FCGL Pty Ltd NRE Wongawilli Colliery Nebo Panels 1 to 6 Surface Water Assessment
- MSEC, 2010 Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts of Natural Features and Surface Infrastructure Resulting From the Proposed Extraction of Longwalls N1 to N6 in the Nebo Area in Support of a Part 3A Application
- Niche, 2011 Gujarat NRE FCGL Pty Ltd NRE Wongawilli Colliery Nebo Longwalls N1-N6 Extraction Plan, Rev. D2
- SCT Operations, 2014 Wongawilli Colliery N2 End of Panel Subsidence Report

DISCLAIMER

This report was prepared in accordance with the scope of services set out in the contract between GeoTerra Pty Ltd (GeoTerra) and the client, or where no contract has been finalised, the proposal agreed to by the client. To the best of our knowledge the report presented herein accurately reflects the client's intentions when it was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document.

The findings contained in this report are the result of discrete / specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site / sites in question. Under no circumstances, however, can it be considered that these findings represent the actual state of the site / sites at all points. Should information become available regarding conditions at the site, GeoTerra reserve the right to review the report in the context of the additional information.

In preparing this report, GeoTerra has relied upon certain verbal information and documentation provided by the client and / or third parties. GeoTerra did not attempt to independently verify the accuracy or completeness of that information. To the extent that the conclusions and recommendations in this report are based in whole or in part on such information, they are contingent on its validity. GeoTerra assume no responsibility for any consequences arising from any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to GeoTerra.

Interpretations and recommendations provided in this report are opinions provided for our Client's sole use in accordance with the specified brief. As such they do not necessarily address all aspects of water, soil or rock conditions on the subject site. The responsibility of GeoTerra is solely to its client and it is not intended that this report be relied upon by any third party, who should make their own enquiries.

The advice herein relates only to this project and all results, conclusions and recommendations made should be reviewed by a competent and experienced person with experience in environmental and / or hydrological investigations before being used for any other purpose. The client should rely on its own knowledge and experience of local conditions in applying the interpretations contained herein.

To the extent permitted by law, GeoTerra, excludes all warranties and representations relating to the report. Nothing in these terms will exclude, restrict or modify any condition, warranty, right or remedy implied or imposed by any statute or regulation to the extent that it cannot be lawfully excluded, restricted or modified. If any condition or warranty is implied into this license under a statute or regulation and cannot be excluded, the liability of GeoTerra for a breach of the condition or warranty will be limited to the supply of the service again.

This report shall not be reproduced either wholly or in part without the prior written consent of GeoTerra.

APPENDIX A
WATER CHEMISTRY ANALYSES

Nebo Surface Water Laboratory Analyses (mg/L)																							
ANZECC												0.25	0.02			1.9	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)
		DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As
9/6/2009	WC1	2	78	17	4.2	0.5	5.3	36	0.10	4	33	0.50	0.01	0.17	0.13	0.020	0.01	0.001	0.001	0.002	0.01	0.100	0.01
17/7/2009	WC1	1	69	14	4.1	0.7	5.3	26	0.10	4	26	0.20	0.03	0.08	0.1	0.010	0.01	0.001	0.001	0.01	0.01	0.030	0.01
6/4/2010	WC1	3	65	12	5.3	0.4	4.9	20	0.10	4	31	0.40	0.01	1.5	0.13	0.070	0.06	0.001	0.001	0.012	0.01	0.030	0.01
15/6/2010	WC1	2	65	12	5.2	0.2	3.6	21	0.10	4	25	0.20	0.01	0.12	0.09	0.01	0.01	0.001	0.001	0.002	0.01	0.03	0.01
18/8/2010	WC1	1	87	11	3	1	4	20	0.50	3	35	0.10	0.01	0.05	0.05	0.001	0.001	0.001	0.001	0.005	0.001	0.060	0.001
19/10/2010	WC1	1	72	13	3	1	4	20	0.10	3	27	0.10	0.01	0.09	0.05	0.002	0.002	0.001	0.001	0.005	0.001	0.1	0.001
14/12/2010	WC1	1	65	12	4	1	4	26	0.10	3	24	0.10	0.01	0.15	0.25	0.002	0.007	0.031	0.06	0.15	0.028	0.1	0.001
18/2/2011	WC1	1	69	15	4	1	5	20	0.2	3	25	0.10	0.01	0.18	0.06	0.006	0.004	0.001	0.001	0.005	0.001	0.06	0.001
15/4/2011	WC1	2	101	13	4	1	4	18	0.10	3	25	0.30	0.15	0.21	0.14	0.01	0.007	0.001	0.001	0.005	0.001	0.09	0.001
7/1/2011	WC1	1	81	12	4	1	5	20	0.10	14	18	0.20	0.01	0.21	0.13	0.004	0.001	0.001	0.001	0.005	0.001	0.19	0.001
26/8/2011	WC1	2	71	11	4	1	4	21	0.10	3	25	0.50	0.01	0.12	0.09	0.002	0.001	0.001	0.001	0.005	0.001	0.12	0.001
20/12/2011	WC1	1	89	14	4	1	5	21	0.10	3	28	0.40	0.02	0.14	0.07	0.002	0.002	0.001	0.001	0.005	0.001	0.07	0.001
16/2/12	WC1	8	91	11	3	1	4	19	0.10	3	20	0.40	0.03	0.38	0.19	0.008	0.006	0.001	0.001	0.005	0.001	0.2	0.001
4/3/2012	WC1	1	69	13	4	1	5	21	0.10	3	22	0.40	0.01	0.23	0.09	0.006	0.004	0.001	0.001	0.005	0.001	0.05	0.001
7/4/2012	WC1	1	75	12	4	1	4	22	0.10	3	23	0.40	0.01	0.16	0.1	0.004	0.002	0.001	0.001	0.005	0.001	0.07	0.001
20/8/2012	WC1	1	86	12	3	1	4	23	0.10	4	22	0.20	0.01	0.47	0.15	0.006	0.005	0.001	0.001	0.005	0.001	0.08	0.001
30/10/2012	WC1	1	72	14	4	1	6	24	0.10	4	27	0.80	0.02	0.4	0.24	0.011	0.006	0.001	0.001	0.005	0.001	0.02	0.001
17/12/2012	WC1	1	119	13	4	2	5	23	0.10	4	30	0.40	0.04	0.55	0.38	0.014	0.007	0.001	0.001	0.005	0.001	0.04	0.001
4/2/2013	WC1	2	89	14	4	1	4	25	0.10	4	17	1.10	0.01	0.1	0.005	0.003	0.001	0.001	0.001	0.005	0.001	0.05	0.001
8/3/2013	WC1	2	92	11	3	1	4	21	0.10	4	14	0.50	0.01	0.09	0.05	0.002	0.001	0.001	0.001	0.005	0.001	0.05	0.001
31/7/2013	WC1	1	88	11	2	1	2	21	0.10	4	13	0.20	0.07	0.1	0.05	0.001	0.001	0.001	0.001	0.005	0.001	0.14	0.001
1/10/2013	WC1	5	73	13	4	1	4	19	0.10	3	29	0.40	0.01	0.11	0.08	0.001	0.001	0.001	0.001	0.005	0.001	0.14	0.001
5/12/2013	WC1	1	97	12	3	1	4	20	0.10	4	21	0.10	0.01	0.08	0.07	0.002	0.001	0.001	0.001	0.005	0.001	0.08	0.001
13/3/2014	WC1	1	69	13	4	1	4	25	0.10	3	25	0.20	0.01	0.05	0.05	0.002	0.002	0.001	0.001	0.005	0.001	0.05	0.001
30/5/2014	WC1	1	65	15	3	1	4	17	0.01	4	26	0.50	0.01	0.43	0.14	0.038	0.019	0.001	0.001	0.007	0.001	0.08	0.001
23/7/2014	WC1	1	92	15	4	1	4	19	0.1	4	26	0.90	0.04	1.47	0.15	0.073	0.024	0.001	0.001	0.016	0.001	0.12	0.001

ST Dev	1.564	13.623	1.532	0.713	0.302	0.770	3.738	0.083	2.115	5.278	0.25	0.030	0.376	0.079	0.019	0.012	0.006	0.012	0.028	0.006	0.047	0.003
Max	8.000	119.000	17.000	5.300	2.000	6.000	36.000	0.500	14.000	35.000	1.10	0.150	1.500	0.380	0.073	0.060	0.031	0.060	0.150	0.028	0.200	0.010
Min	1.000	65.000	11.000	2.000	0.200	2.000	17.000	0.010	3.000	13.000	0.10	0.010	0.050	0.005	0.001	0.001	0.001	0.001	0.002	0.001	0.020	0.001
Median	1.000	76.500	13.000	4.000	1.000	4.000	21.000	0.100	4.000	25.000	0.40	0.010	0.155	0.095	0.005	0.004	0.001	0.001	0.005	0.001	0.075	0.001

Nebo Surface Water Laboratory Analyses (mg/L)																							
ANZECC												0.25	0.02			1.9	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)
		DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	1.9 Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As
17/7/2009	WC2	2	68	16	4.1	0.7	5.1	27	0.01	5	25	0.10	0.01	0.2	0.12	0.01	0.01	0.001	0.001	0.006	0.01	0.040	0.01
7/9/2009	WC2	2	62	12	3.5	0.5	5	21	0.01	5	25	0.10	0.01	0.19	0.14	0.020	0.01	0.002	0.001	0.003	0.01	0.020	0.01
27/11/2009	WC2	3	65	14	3.6	0.6	5.2	23	0.01	4	32	0.10	0.01	0.3	0.28	0.01	0.01	0.001	0.001	0.005	0.01	0.030	0.01
29/1/2010	WC2	4	73	14	4.9	0.8	5.2	24	0.01	3	36	0.10	0.03	1.3	0.45	0.040	0.02	0.001	0.001	0.005	0.01	0.030	0.01
6/4/2010	WC2	4	68	14	3.8	0.3	5	23	0.01	4	26	0.40	0.01	9.2	0.17	0.100	0.05	0.001	0.001	0.011	0.01	0.030	0.01
15/6/2010	WC2	2	67	14	5.7	0.3	4.7	25	0.01	4	28	0.10	0.01	0.16	0.11	0.01	0.01	0.001	0.001	0.001	0.01	0.02	0.01
18/8/2010	WC2	1	78	12	3	1	4	21	0.50	4	26.8	0.10	0.08	0.18	0.1	0.005	0.005	0.001	0.001	0.005	0.001	0.030	0.001
19/10/2010	WC2	1	72	14	3	1	4	22	0.01	4	25	0.20	0.11	0.24	0.16	0.008	0.007	0.001	0.001	0.007	0.001	0.05	0.001
14/12/2010	WC2	2	76	14	4	1	5	28	0.01	3	28	0.10	0.01	0.33	0.26	0.007	0.011	0.01	0.016	0.04	0.008	0.08	0.001
18/2/2011	WC2	3	58	14	3	1	5	21	0.4	3	31	0.10	0.06	1.16	0.34	0.046	0.008	0.001	0.001	0.005	0.001	0.05	0.001
15/4/2011	WC2	2	87	14	4	1	5	21	0.1	3	23	0.20	0.06	0.26	0.2	0.007	0.006	0.001	0.001	0.005	0.001	0.05	0.001
7/1/2011	WC2	1	96	13	4	1	5	21	0.1	4	16	0.10	0.01	0.29	0.19	0.009	0.007	0.001	0.001	0.005	0.001	0.1	0.001
26/8/2011	WC2	2	71	12	3	1	5	20	0.1	4	21	0.10	0.01	0.21	0.16	0.006	0.006	0.001	0.001	0.005	0.001	0.09	0.001
20/12/2011	WC2	2	77	13	3	1	4	20	0.1	2	15	0.10	0.02	0.4	0.37	0.011	0.012	0.001	0.001	0.005	0.001	0.13	0.001
16/2/12	WC2	3	90	12	3	1	4	19	0.1	2	20	0.10	0.03	0.51	0.27	0.021	0.016	0.001	0.001	0.005	0.002	0.16	0.001
4/3/2012	WC2	2	74	14	4	1	5	22	0.1	3	24	0.20	0.01	0.67	0.32	0.017	0.014	0.001	0.001	0.005	0.001	0.07	0.001
7/4/2012	WC2	1	71	13	3	1	4	22	0.1	3	24	0.30	0.01	0.34	0.18	0.007	0.005	0.001	0.001	0.005	0.001	0.03	0.001
20/8/2012	WC2	1	62	13	3	1	4	22	0.1	4	28	0.10	0.01	0.24	0.19	0.005	0.005	0.001	0.001	0.005	0.001	0.02	0.001
30/10/2012	WC2	1	88	16	5	1	6	23	0.1	5	26	0.50	0.02	0.59	0.25	0.02	0.005	0.001	0.001	0.005	0.001	0.02	0.001
17/12/2012	WC2	1	111	13	4	1	5	23	0.1	4	31	0.20	0.2	0.48	0.36	0.012	0.008	0.001	0.001	0.005	0.001	0.02	0.001
4/2/2013	WC2	3	86	16	3	1	4	25	0.1	6	18	0.30	0.01	0.38	0.23	0.018	0.011	0.001	0.001	0.005	0.001	0.06	0.001
8/3/2013	WC2	2	84	12	3	1	4	22	0.1	4	15	0.10	0.01	0.25	0.17	0.014	0.01	0.001	0.001	0.005	0.001	0.07	0.001
12/4/2013	WC2	2	64	14	4	1	5	21	0.1	5	27	0.40	0.01	0.2	0.16	0.009	0.008	0.001	0.001	0.01	0.001	0.03	0.001
31/7/2013	WC2	2	101	12	2	1	3	23	0.1	4	18	0.30	0.02	0.3	0.11	0.011	0.005	0.001	0.001	0.005	0.001	0.04	0.001
1/10/2013	WC2	5	70	14	4	1	4	21	0.1	4	31	0.20	0.04	0.17	0.11	0.006	0.005	0.001	0.001	0.005	0.001	0.05	0.001
5/12/2013	WC2	3	72	13	3	1	4	21	0.1	5	24	0.10	0.01	0.23	0.18	0.008	0.007	0.001	0.001	0.005	0.001	0.08	0.001
30/1/2014	WC2	2	81	22	4	1	5	24	0.1	4	24	0.10	0.24	0.26	0.16	0.009	0.008	0.001	0.001	0.005	0.001	0.02	0.001
13/3/2014	WC2	2	83	15	4	1	5	27	0.1	3	26	0.10	0.01	0.31	0.25	0.009	0.008	0.001	0.001	0.005	0.001	0.04	0.001
30/5/2014	WC2	2	72	16	4	1	5	23	0.1	4	29	0.40	0.01	0.14	0.11	0.005	0.005	0.001	0.001	0.005	0.001	0.02	0.001
23/7/2014	WC2	1	82	17	4	1	5	23	0.1	2	27	1.00	0.01	0.09	0.06	0.007	0.003	0.001	0.001	0.005	0.001	0.01	0.001

ST Dev	1.008	12.175	2.033	0.756	0.208	0.624	2.143	0.104	0.961	5.130	0.19	0.056	1.637	0.093	0.019	0.008	0.002	0.003	0.007	0.004	0.035	0.004
Max	5.000	111.000	22.000	5.700	1.000	6.000	28.000	0.500	6.000	36.000	1.00	0.240	9.200	0.450	0.100	0.050	0.010	0.016	0.040	0.010	0.160	0.010
Min	1.000	58.000	12.000	2.000	0.300	3.000	19.000	0.010	2.000	15.000	0.10	0.010	0.090	0.060	0.005	0.003	0.001	0.001	0.001	0.001	0.010	0.001
Median	2.000	73.500	14.000	3.900	1.000	5.000	22.000	0.100	4.000	25.500	0.10	0.010	0.275	0.180	0.010	0.008	0.001	0.001	0.005	0.001	0.040	0.001

Nebo Surface Water Laboratory Analyses (mg/L)																							
ANZECC												0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)
		DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As
9/6/2009	WC3	3	140	37	4.7	0.9	7.6	57	0.10	11	35	0.70	0.05	0.26	0.17	0.010	0.01	0.001	0.001	0.004	0.01	0.100	0.01
17/7/2009	WC3	2	68	15	3.4	0.8	4.8	26	0.10	5	22	0.10	0.01	0.51	0.11	0.01	0.01	0.001	0.001	0.008	0.01	0.020	0.01
7/9/2009	WC3	2	55	11	3.3	0.6	4.7	19	0.10	4	25	0.10	0.03	0.27	0.15	0.020	0.01	0.002	0.001	0.003	0.01	0.040	0.01
27/11/2009	WC3	3	61	13	3.1	0.9	5.1	22	0.10	3	31	0.10	0.01	0.36	0.33	0.01	0.01	0.001	0.001	0.006	0.01	0.030	0.01
29/1/2010	WC3	3	90	16	12	1	3.6	24	0.10	3	57	0.10	0.01	1.3	0.6	0.040	0.03	0.001	0.001	0.001	0.01	0.030	0.01
6/4/2010	WC3	3	65	13	3.8	0.4	5.1	22	0.10	4	26	0.20	0.01	1.7	0.16	0.080	0.03	0.001	0.001	0.007	0.01	0.030	0.01
15/6/2010	WC3	1	65	14	3.8	0.2	4.3	23	0.10	4	27	0.20	0.01	0.75	0.10	0.03	0.01	0.001	0.001	0.001	0.01	0.02	0.01
18/8/2010	WC3	1	82	12	2	1	4	19	0.40	4	22	0.10	0.01	0.12	0.09	0.004	0.005	0.001	0.001	0.005	0.001	0.030	0.001
19/10/2010	WC3	1	78	13	3	1	4	21	0.10	3	23	0.10	0.08	0.24	0.17	0.011	0.009	0.001	0.001	0.005	0.001	0.05	0.001
14/12/2010	WC3	2	66	14	4	1	5	25	0.10	3	27	0.10	0.01	0.5	0.28	0.015	0.013	0.018	0.017	0.056	0.015	0.11	0.001
18/2/2011	WC3	3	66	14	4	1	5	20	0.3	3	24	0.10	0.04	0.58	0.31	0.014	0.01	0.001	0.001	0.005	0.001	0.07	0.001
15/4/2011	WC3	2	87	13	3	1	4	18	0.10	3	21	0.30	0.14	0.22	0.14	0.011	0.01	0.001	0.001	0.005	0.001	0.03	0.001
7/1/2011	WC3	1	73	12	4	1	4	20	0.10	3	25	0.10	0.01	0.24	0.15	0.008	0.006	0.001	0.001	0.005	0.001	0.09	0.001
26/8/2011	WC3	1	72	11	3	1	4	21	0.10	3	17	0.10	0.01	0.34	0.18	0.01	0.006	0.001	0.001	0.01	0.001	0.08	0.001
20/12/2011	WC3	2	85	12	3	1	4	20	0.10	2	16	0.40	0.01	0.36	0.24	0.011	0.008	0.001	0.001	0.007	0.001	0.13	0.001
16/2/12	WC3	4	94	11	3	1	4	19	0.10	2	20	0.20	0.02	0.46	0.26	0.015	0.011	0.001	0.001	0.005	0.001	0.17	0.001
4/3/2012	WC3	1	75	13	4	1	5	22	0.10	3	24	0.30	0.01	0.64	0.31	0.022	0.016	0.001	0.001	0.037	0.001	0.08	0.001
7/4/2012	WC3	1	65	12	3	1	4	18	0.10	3	22	0.20	0.01	0.26	0.14	0.006	0.005	0.001	0.001	0.005	0.001	0.03	0.001
20/8/2012	WC3	1	77	11	3	1	4	20	0.10	4	26	0.10	0.01	0.19	0.13	0.006	0.006	0.001	0.001	0.005	0.001	0.03	0.001
30/10/2012	WC3	1	78	13	4	1	5	21	0.10	4	24	0.50	0.01	0.61	0.34	0.024	0.017	0.001	0.001	0.005	0.001	0.02	0.001
17/12/2012	WC3	1	98	12	4	1	5	22	0.10	3	27	0.20	0.2	0.65	0.45	0.025	0.023	0.001	0.001	0.005	0.001	0.02	0.001
4/2/2013	WC3	3	93	15	3	1	4	25	0.10	6	18	0.40	0.01	0.28	0.26	0.008	0.01	0.001	0.001	0.005	0.001	0.08	0.001
8/3/2013	WC3	2	118	12	3	1	4	24	0.10	4	24	0.80	0.01	0.29	0.16	0.017	0.014	0.001	0.001	0.005	0.001	0.07	0.001
12/4/2013	WC3	1	57	14	4	1	4	20	0.10	4	23	0.10	0.01	0.18	0.11	0.011	0.011	0.001	0.001	0.005	0.001	0.02	0.001
31/7/2013	WC3	1	105	11	2	1	3	20	0.10	4	16	0.20	0.06	0.18	0.12	0.008	0.008	0.001	0.001	0.005	0.001	0.06	0.001
1/10/2013	WC3	5	67	13	3	1	4	18	0.10	4	26	0.20	0.03	0.17	0.11	0.01	0.006	0.001	0.001	0.005	0.001	0.06	0.001
5/12/2013	WC3	3	76	13	3	1	4	15	0.10	4	22	0.20	0.01	0.49	0.26	0.031	0.026	0.001	0.001	0.005	0.001	0.09	0.001
30/1/2014	WC3	2	81	14	4	1	5	22	0.10	3	23	2.30	0.01	0.22	0.13	0.014	0.011	0.001	0.001	0.005	0.001	0.03	0.001
13/3/2014	WC3	2	79	13	4	1	4	26	0.10	3	23	0.10	0.01	0.27	0.2	0.01	0.009	0.001	0.001	0.005	0.001	0.05	0.001
29/5/2014	WC3	1	52	13	2	1	4	20	0.10	3	21	0.30	0.07	0.46	0.08	0.026	0.008	0.001	0.001	0.005	0.001		0.001
23/7/2014	WC3	1	84	16	3	1	4	20	0.10	9	23	1.00	0.01	0.17	0.05	0.012	0.006	0.001	0.001	0.005	0.001	0.03	0.001

ST Dev	1.063	18.600	4.531	1.690	0.188	0.795	6.932	0.064	1.832	7.211	0.43	0.043	0.336	0.118	0.014	0.007	0.003	0.003	0.011	0.004	0.037	0.004
Max	5.000	140.000	37.000	12.000	1.000	7.600	57.000	0.400	11.000	57.000	2.30	0.200	1.700	0.600	0.080	0.030	0.018	0.017	0.056	0.015	0.170	0.010
Min	1.000	52.000	11.000	2.000	0.200	3.000	15.000	0.100	2.000	16.000	0.10	0.010	0.120	0.050	0.004	0.005	0.001	0.001	0.001	0.001	0.020	0.001
Median	2.000	77.000	13.000	3.100	1.000	4.000	21.000	0.100	3.000	23.000	0.20	0.010	0.290	0.160	0.011	0.010	0.001	0.001	0.005	0.001	0.045	0.001

Nebo Surface Water Laboratory Analyses (mg/L)																							
ANZECC												0.25	0.02			1.9	1.9	0.0014	0.0034	0.008	0.011	0.055	0.024 (III) / 0.013(V)
		DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As
10/1/2013	WC4	2	69	10	1	1	2	20	0.1	5	3	0.1	0.01	0.42	0.14	0.112	0.106	0.001	0.001	0.011	0.002	0.02	0.001
5/2/2013	WC4	1	61	12	1	1	2	21	0.1	6	2	0.1	0.1	0.19	0.15	0.116	0.11	0.001	0.001	0.014	0.002	0.04	0.001
8/3/2013	WC4	2	50	9	1	1	1	15	0.1	4	1	0.30	0.01	0.41	0.13	0.099	0.088	0.001	0.001	0.012	0.002	0.12	0.001
12/4/2013	WC4	1	37	10	1	1	2	17	0.1	5	2	0.1	0.01	0.37	0.12	0.099	0.088	0.001	0.001	0.012	0.002	0.02	0.001
7/8/2013	WC4	2	38	10	1	1	1	23	0.1	4	1	0.20	0.02	0.29	0.16	0.081	0.08	0.001	0.001	0.015	0.001	0.04	0.001
2/10/2013	WC4	1	37	10	1	1	2	10	0.1	4	1	0.20	0.06	0.3	0.11	0.069	0.065	0.001	0.001	0.014	0.002	0.04	0.001
5/12/2013	WC4	2	51	10	1	1	1	12	0.1	4	1	0.10	0.02	0.3	0.09	0.07	0.067	0.001	0.001	0.012	0.001	0.06	0.001
30/1/2014	WC4	1	51	11	1	1	2	20	0.1	4	1	0.1	0.01	0.19	0.06	0.062	0.056	0.001	0.001	0.014	0.002	0.01	0.001
13/3/2014	WC4	1	34	10	1	1	2	24	0.1	3	1	0.1	0.01	0.2	0.09	0.067	0.062	0.001	0.001	0.011	0.001	0.02	0.001
30/5/2014	WC4	6	40	11	1	1	1	16	0.1	4	3	0.10	0.01	0.32	0.1	0.075	0.068	0.001	0.001	0.011	0.002	0.02	0.001
23/7/2014	WC4	1	56	12	1	1	2	18	0.1	6	2	0.40	0.01	0.22	0.1	0.061	0.055	0.001	0.001	0.012	0.001	0.01	0.001

ST Dev	1.471	11.387	0.934	0.000	0.000	0.505	4.378	0.000	0.934	0.809	0.10	0.029	0.085	0.030	0.020	0.019	0.000	0.000	0.001	0.001	0.032	0.000
Max	6.000	69.000	12.000	1.000	1.000	2.000	24.000	0.100	6.000	3.000	0.40	0.100	0.420	0.160	0.116	0.110	0.001	0.001	0.015	0.002	0.120	0.001
Min	1.000	34.000	9.000	1.000	1.000	1.000	10.000	0.100	3.000	1.000	0.10	0.010	0.190	0.060	0.061	0.055	0.001	0.001	0.011	0.001	0.010	0.001
Median	1.000	50.000	10.000	1.000	1.000	2.000	18.000	0.100	4.000	1.000	0.10	0.010	0.300	0.110	0.075	0.068	0.001	0.001	0.012	0.002	0.020	0.001

Nebo Groundwater Chemistry

	ANZECC 2000											0.25	0.02			1.9	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)
		DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As
29/1/2010	Nebo 1S	2	675	135	72	2.1	28	89	0.11	175	370	1.5	3.6	25.00	0.08	1.600	0.63	0.002	0.001	0.005	0.01	0.04	0.01
30/6/2011	Nebo 1S	1	194	27	10	2	7	4.1	0.1	18	48	3.4	1.17	25.30	0.5	0.712	0.304	0.008	0.001	0.029	0.01	0.03	0.001
24/8/2011	Nebo 1S		171	26	5	1	5	53	0.1	4	17	0.3	0.13	4.89	0.05	0.260	0.199	0.012	0.001	0.024	0.016	0.04	0.001
16/2/2012	Nebo 1S	2	200	24	4	1	4	39	0.1	21	1	15.7	0.23	4.33	0.18	0.215	0.156	0.008	0.001	0.013	0.007	0.14	0.001
20/8/2012	Nebo 1S	1	176	35	4	2	7	68	0.1	4	27	0.8	0.54	10.60	0.18	0.438	0.385	0.011	0.001	0.028	0.014	0.05	0.001
24/1/2013	Nebo 1S	3	128	26	5	2	4	44	0.1	6	31	2.9	6.26	106.00	13.4	2.240	0.797	0.001	0.001	0.017	0.012	0.03	0.001
15/3/2013	Nebo 1S	2	136	24	6	1	6	39	0.1	5	35	0.9	0.5	9.55	0.07	0.378	0.205	0.013	0.001	0.055	0.014	0.1	0.001
18/04/2013	Nebo 1S	2	182	43	5	2	6	62	0.1	11	8	5.2	0.08	6.11	0.05	0.386	0.216	0.015	0.001	0.055	0.017	0.06	0.001
31/07/2013	Nebo 1S	1	151	30	2	2	5	64	0.1	4	1	6	0.02	0.30	0.05	0.096	0.093	0.009	0.001	0.03	0.009	0.08	0.001
4/12/2013	Nebo 1S	4	141	34	5	2	6	58	0.1	4	15	0.3	0.14	2.25	0.2	0.142	0.197	0.018	0.001	0.051	0.01	0.011	0.001
30/01/2014	Nebo 1S	2	171	38	4	2	7	68	0.1	4	14	0.3	0.44	10.20	0.49	0.437	0.233	0.009	0.001	0.042	0.011	0.05	0.001
13/03/2014	Nebo 1S	1	151	31	4	1	5	57	0.1	4	16	0.2	0.15	3.85	0.16	0.242	0.158	0.006	0.001	0.028	0.009	0.1	0.001
29/05/2014	Nebo 1S	5	80	19	3	2	3	24	0.1	4	26	1.1	0.07	2.30	0.21	0.093	0.067	0.007	0.001	0.076	0.006		0.001
23/07/2014	Nebo 1S	6	194	43	4	2	5	66	0.1	4	27	2.6	3.92	70.10	12	1.660	0.849	0.007	0.001	0.075	0.01	0.18	0.001
29/1/2010	Nebo 2S	2	140	17	23	1.9	8.7	24		15	110	0.3	0.1	1.40	0.02	0.170	0.05	0.003	0.005	0.042	0.01	0.01	0.01
18/8/2010	Nebo 2S	5	138	14	11	2	10	16	1.1	6	96	0.5	0.25	0.72	0.11	0.566	0.566	0.003	0.001	0.036	0.004	0.01	0.001
18/2/2011	Nebo 2S	10	93	11	16	6	5	9	0.5	6	62	1.2	0.01	8.38	0.93	0.21	0.165	0.006	0.001	0.02	0.004	0.05	0.001
30/6/2011	Nebo 2S	6	158	15	13	3	10	15	0.1	13	69	2.3	0.02	5.75	0.45	0.627	0.518	0.004	0.001	0.026	0.008	0.04	0.001
24/8/2011	Nebo 2S		176	17	11	1	15	19	0.2	1	96	0.7	0.16	2.26	1.72	0.97	0.924	0.001	0.001	0.006	0.003	0.01	0.001
16/2/2012	Nebo 2S	7	140	7	28	4	2	9	0.1	45	14	6.3	0.1	0.55	0.33	0.018	0.005	0.006	0.001	0.017	0.002	0.06	0.001
20/8/2012	Nebo 2S	5	118	12	17	4	8	10	0.2	7	90	1.4	0.05	1.62	0.05	0.272	0.012	0.007	0.001	0.196	0.002	0.02	0.001
24/1/2013	Nebo 2S	4	166	20	13	1	20	22	0.2	1	130	0.9	0.09	5.84	0.05	1.110	1.1	0.002	0.001	0.01	0.004	0.01	0.001
15/3/2013	Nebo 2S	6	62	6	11	2	1	10	0.1	4	29	1.1	0.02	0.92	0.24	0.013	0.004	0.005	0.001	0.015	0.004	0.02	0.001
18/04/2013	Nebo 2S	5	131	8	13	5	2	10	0.1	7	1	14.8	0.01	0.72	0.2	0.036	0.026	0.006	0.001	0.019	0.006	0.03	0.001
31/07/2013	Nebo 2S	3	138	17	9	2	12	11	0.3	3	93	1.4	0.06	1.92	1.28	0.419	0.339	0.008	0.005	0.026	0.004	0.15	0.001
4/12/2013	Nebo 2S	4	140	17	14	1	14	21	0.2	1	94	0.2	0.08	4.16	2.14	1.270	0.903	0.004	0.001	0.013	0.01	0.01	0.003
30/01/2014	Nebo 2S	4	164	20	13	2	19	20	0.2	1	112	1.2	0.05	0.98	0.32	1.160	1.05	0.002	0.001	0.009	0.008	0.01	0.001
13/03/2014	Nebo 2S	1	181	20	11	1	16	22	0.3	1	110	0.3	0.08	0.42	0.17	1.220	1.19	0.001	0.001	0.005	0.005	0.01	0.001
29/05/2014	Nebo 2S	4	138	18	10	2	12	13	0.3	1	100	1	0.03	1.03	0.24	0.800	0.759	0.002	0.001	0.022	0.004		0.001

23/07/2014	Nebo 2S	4	156	23	11	1	15	16	0.3	3	119	0.18	0.06	5.24	0.37	1.170	1.09	0.002	0.001	0.012	0.003	0.02	0.001
------------	---------	---	-----	----	----	---	----	----	-----	---	-----	------	------	------	------	-------	------	-------	-------	-------	-------	------	-------

ST Dev	2.2	101.3	22.8	12.8	1.2	6.2	23.9	0.2	31.9	71.4	3.85	1.42	22.40	3.17	0.571	0.388	0.004	0.001	0.036	0.004	0.05	0.002
Max	10.0	675.0	135.0	72.0	6.0	28.0	89.0	1.1	175.0	370.0	15.70	6.26	106.00	13.40	2.240	1.190	0.018	0.005	0.196	0.017	0.18	0.010
Min	1.0	62.0	6.0	2.0	1.0	1.0	4.1	0.1	1.0	1.0	0.18	0.01	0.30	0.02	0.013	0.004	0.001	0.001	0.005	0.002	0.01	0.001
Median	4.0	151.0	20.0	10.5	2.0	7.0	22.0	0.1	4.0	41.5	1.10	0.10	4.01	0.21	0.428	0.269	0.006	0.001	0.025	0.008	0.04	0.001

Nebo Groundwater Chemistry

	ANZECC 2000											0.25	0.02			1.9	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)
		DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As
29/1/2010	Nebo 1D	8	340	110	12	6.9	7.8	51	0.14	11	270	1.5	0.37	6.50	0.04	0.190	0.04	0.009	0.084	0.47	0.01	0.04	0.01
18/8/2010	Nebo 1D	1	226	29	11	1	6	48	0.1	6	38	0.4	0.25	1.09	0.12	0.240	0.261	0.015	0.001	0.021	0.011	0.12	0.001
18/2/2011	Nebo 1D	8	440	125	8	26	5	42	2	103	168	2.4	0.08	5.02	0.05	0.103	0.023	0.001	0.001	0.005	0.002	0.15	0.003
30/6/2011	Nebo 1D	8	452	121	6	19	5	41	0.3	118	146	5.8	0.18	6.04	0.1	0.12	0.032	0.003	0.001	0.018	0.002	0.15	0.002
24/8/2011	Nebo 1D		464	123	6	19	6	47	0.4	100	150	2.1	0.11	1.22	0.05	0.065	0.033	0.002	0.001	0.02	0.002	0.06	0.002
16/2/2012	Nebo 1D	4	910	133	9	18	6	43	0.3	430	1	47	0.01	0.28	0.06	0.047	0.042	0.003	0.001	0.014	0.003	0.05	0.003
20/8/2012	Nebo 1D	4	392	134	8	16	6	48	0.3	104	181	2.1	0.07	0.2	0.07	0.049	0.048	0.002	0.001	0.006	0.002	0.04	0.003
24/1/2013	Nebo 1D	5	370	150	10	14	7	50	0.3	126	183	2.2	0.07	0.65	0.11	0.06	0.05	0.002	0.001	0.011	0.002	0.04	0.002
15/3/2013	Nebo 1D	2	378	124	9	13	7	44	0.3	93	177	1.7	0.07	0.41	0.07	0.057	0.049	0.002	0.001	0.006	0.002	0.03	0.002
18/04/2013	Nebo 1D	4	354	140	8	18	6	47	0.4	103	186	5.8	0.02	0.43	0.07	0.055	0.053	0.002	0.001	0.005	0.002	0.04	0.002
31/07/2013	Nebo 1D	5	425	123	7	14	5	48	0.4	95	158	3.9	0.01	0.32	0.05	0.058	0.05	0.002	0.001	0.009	0.002	0.04	0.002
4/12/2013	Nebo 1D	8	385	139	6	16	5	52	0.4	94	168	0.4	0.08	0.38	0.08	0.064	0.048	0.011	0.001	0.035	0.005	0.04	0.003
30/01/2014	Nebo 1D	4	403	132	6	16	5	48	0.4	85	181	1.2	0.05	0.35	0.06	0.056	0.046	0.002	0.001	0.01	0.004	0.03	0.002
13/03/2014	Nebo 1D	4	327	119	8	14	6	49	0.4	91	169	1.5	0.06	0.39	0.05	0.052	0.044	0.001	0.001	0.006	0.005	0.03	0.002
30/05/2014	Nebo 1D	6	360	136	6	13	5	47	0.4	79	200	2.1	0.1	0.35	0.1	0.065	0.053	0.002	0.001	0.016	0.005		0.002
23/07/2014	Nebo 1D	4	392	138	9	12	6	45	0.4	103	197	1.5	0.08	0.32	0.13	0.055	0.054	0.001	0.001	0.007	0.003	0.04	0.003

ST Dev	2	144	27	2	5.5	0.9	3.1	0.4	91.8	62.2	11.3	0.09	2.20	0.03	0.056	0.055	0.004	0.022	0.115	0.003	0.044	0.002
Max	8	910	150	12	26.0	7.8	52.0	2.0	430.0	270.0	47.0	0.37	6.50	0.13	0.240	0.261	0.015	0.084	0.470	0.011	0.150	0.010
Min	1	226	29	6	1.0	5.0	41.0	0.1	6.0	1.0	0.4	0.01	0.20	0.04	0.047	0.023	0.001	0.001	0.005	0.002	0.030	0.001
Median	5	392	125	8	16	6	48	0	100	168	2.10	0.07	0.43	0.07	0.060	0.048	0.002	0.001	0.011	0.002	0.040	0.002

Nebo Groundwater Chemistry

	ANZECC 2000											0.25	0.02			1.9	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)
		DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As
29/1/2010	Nebo 2D	25	2410	80	770	105	50	47	0.1	860	1	2.2	0.06	2.50	0.01	0.090	0.01	0.003	0.003	0.013	0.01	0.03	0.01
18/8/2010	Nebo 2D	29	2080	51	596	47	1	28	0.1	569	1	0.7	0.21	0.5	0.05	0.004	0.001	0.025	0.003	0.027	0.005	0.05	0.001
18/2/2011	Nebo 2D	59	1780	57	505	42	1	26	0.1	392	868	1.7	0.05	0.75	0.05	0.011	0.001	0.031	0.003	0.018	0.002	0.05	0.001
30/6/2011	Nebo 2D	74	1630	72	335	39	1	21	0.1	331	734	3.3	0.03	0.97	0.5	0.012	0.001	0.031	0.004	0.018	0.005	0.07	0.001
24/8/2011	Nebo 2D		1720	65	309	32	1	21	0.1	254	702	2.1	0.08	0.05	0.5	0.003	0.001	0.03	0.002	0.01	0.005	0.02	0.001
16/2/2012	Nebo 2D	57	1500	78	343	42	1	18	0.1	397	609	13.9	0.1	0.08	0.05	0.001	0.001	0.03	0.002	0.011	0.003	0.04	0.001
20/8/2012	Nebo 2D	58	1930	80	248	33	1	23	0.1	238	496	2.9	0.02	0.13	0.05	0.008	0.001	0.039	0.004	0.014	0.004	0.12	0.001
24/1/2013	Nebo 2D	58	1350	80	280	29	1	29	0.1	285	495	6.3	0.03	0.93	0.05	0.013	0.002	0.036	0.002	0.014	0.004	0.08	0.001
15/3/2013	Nebo 2D	66	1300	82	305	32	1	25	0.1	260	585	3.5	0.05	0.12	0.05	0.003	0.001	0.038	0.002	0.013	0.005	0.19	0.001
18/04/2013	Nebo 2D	57	1340	81	202	28	1	31	0.1	350	270	7.2	0.01	0.1	0.05	0.003	0.001	0.033	0.002	0.007	0.004	0.1	0.001
31/07/2013	Nebo 2D	115	1230	82	257	28	1	31	0.1	338	372	3.1	0.09	0.05	0.05	0.002	0.001	0.041	0.002	0.008	0.003	0.05	0.001
4/12/2013	Nebo 2D	63	1160	108	262	34	1	30	0.1	293	418	2.4	0.02	0.27	0.05	0.006	0.001	0.048	0.002	0.012	0.005	0.06	0.001
30/01/2014	Nebo 2D	55	1200	102	214	31	1	30	0.1	292	366	2.8	0.02	0.17	0.05	0.003	0.002	0.038	0.001	0.008	0.004	0.05	0.001
13/03/2014	Nebo 2D	56	1190	90	234	28	1	31	0.1	261	359	3	0.01	0.12	0.05	0.005	0.003	0.036	0.001	0.005	0.004	0.09	0.001
30/05/2014	Nebo 2D	59	896	104	200	26	1	28	0.1	231	346	3.7	0.02	0.6	0.05	0.015	0.002	0.034	0.001	0.039	0.004		0.001
23/07/2014	Nebo 2D	210	1100	97	192	23	1	28	0.1	258	320	1.9	0.01	0.38	0.05	0.007	0.001	0.028	0.001	0.011	0.004	0.17	0.001
29/1/2010	Nebo 3	3	130	27	17	2.6	5.7	16	0.1	12	120	1	0.13	1.50	0.02	0.090	0.04	0.004	0.05	0.091	0.01	0.01	0.01
18/8/2010	Nebo 3	7	240	26	20	2	6	9	0.1	12	80	0.12	0.08	0.43	0.05	0.042	0.001	0.001	0.001	0.005	0.001	0.03	0.001
18/2/2011	Nebo 3	10	148	33	21	3	6	12	0.6	9	129	0.9	0.01	1.34	0.05	0.054	0.007	0.005	0.001	0.068	0.008	0.06	0.001
30/6/2011	Nebo 3	9	252	37	19	4	7	13	0.3	23	118	1.6	0.02	1.87	0.1	0.1	0.069	0.031	0.048	0.097	0.03	0.18	0.001
24/8/2011	Nebo 3		242	41	20	5	7	13	0.4	10	146	1.4	0.3	0.97	0.05	0.082	0.061	0.003	0.011	0.034	0.014	0.06	0.001
16/2/2012	Nebo 3	18	272	52	17	5	6	13	0.6	33	133	3.6	0.07	0.25	0.05	0.027	0.018	0.003	0.004	0.034	0.19	0.03	0.001
20/8/2012	Nebo 3	15	206	62	19	4	5	13	0.6	22	152	7.4	0.08	0.34	0.05	0.024	0.008	0.004	0.004	0.032	0.016	0.03	0.001
24/1/2013	Nebo 3	10	156	70	13	4	5	13	0.5	20	165	2	0.06	0.3	0.05	0.011	0.007	0.002	0.001	0.024	0.009	0.04	0.001
15/3/2013	Nebo 3	11	300	65	13	3	4	12	0.8	13	165	1.9	0.1	0.48	0.05	0.024	0.015	0.006	0.001	0.017	0.008	0.06	0.001
18/04/2013	Nebo 3	8	256	62	9	3	4	8	0.8	18	142	1.6	0.11	0.46	0.05	0.01	0.004	0.002	0.001	0.01	0.008	0.05	0.001
31/07/2013	Nebo 3	10	184	66	7	3	3	10	0.8	17	139	2.1	0.01	0.59	0.05	0.042	0.007	0.004	0.001	0.019	0.008	0.09	0.001
4/12/2013	Nebo 3	10	230	68	10	4	4	10	0.8	17	155	0.7	0.04	0.18	0.05	0.019	0.011	0.004	0.003	0.018	0.007	0.07	0.001
30/01/2014	Nebo 3	6	217	64	5	4	3	8	0.8	17	146	1.5	0.05	0.15	0.05	0.012	0.007	0.003	0.001	0.02	0.008	0.01	0.001

13/03/2014	Nebo 3	3	222	66	9	4	4	9	0.8	20	138	1.7	0.11	0.26	0.05	0.041	0.021	0.001	0.001	0.014	0.008	0.01	0.001
30/05/2014	Nebo 3	4	231	74	5	3	2	9	0.9	19	142	1.6	0.14	0.46	0.05	0.057	0.034	0.001	0.001	0.014	0.007		0.002
23/07/2014	Nebo 3	5	231	78	7	3	3	10	0.9	21	152	1.7	0.11	0.24	0.05	0.047	0.044	0.001	0.001	0.018	0.007	0.02	0.001
	ST Dev	43.7	406.5	16.0	161.3	19.2	12.3	6.5	0.0	160.0	237.8	3.1	0.052	0.623	0.155	0.021	0.002	0.010	0.001	0.008	0.002	0.049	0.002
	Max	210.0	2410.0	108.0	770.0	105.0	50.0	47.0	0.1	860.0	868.0	13.9	0.210	2.500	0.500	0.090	0.010	0.048	0.004	0.039	0.010	0.190	0.010
	Min	25.0	896.0	51.0	192.0	23.0	1.0	18.0	0.1	231.0	1.0	0.7	0.010	0.050	0.010	0.001	0.001	0.003	0.001	0.005	0.002	0.020	0.001
	Median	58.0	1345.0	80.5	271.0	32.0	1.0	28.0	0.1	292.5	395.0	3.0	0.030	0.220	0.050	0.006	0.001	0.034	0.002	0.013	0.004	0.060	0.001

Nebo Groundwater Chemistry

	ANZECC 2000											0.25	0.02			1.900	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013(V)
		DOC	TDS	Na	Ca	K	Mg	Cl	F	SO4	HCO3	Tot N	Tot P	Fe	Fe Filt	Mn	Filt Mn	Filt Cu	Filt Pb	Filt Zn	Filt Ni	Filt Al	Filt As
29/1/2010	Nebo 4	18	460	130	30	7.1	15	110	0.16	6	310	4.1	0.19	22.00	0.06	0.510	0.13	0.008	0.16	1.2	0.01	0.04	0.01
18/2/2011	Nebo 4	17	2760	249	681	300	1	29	0.1	1	2710	8.3	0.01	3.32	0.05	0.06	0.001	0.022	0.012	0.084	0.005	0.31	0.001
30/6/2011	Nebo 4	13	3030	241	534	292	1	34	0.1	11	2100	9.8	0.14	6.14	0.5	0.076	0.001	0.017	0.006	0.074	0.005	0.38	0.001
24/8/2011	Nebo 4		3020	251	506	287	1	28	0.1	1	2290	12.2	0.41	5.36	0.55	0.088	0.078	0.014	0.043	0.067	0.17	0.43	0.001
16/2/2012	Nebo 4	3	2920	264	425	230	1	24	0.1	14	2110	17	0.16	2.03	0.05	0.038	0.001	0.097	0.02	0.115	0.002	0.37	0.001
20/8/2012	Nebo 4	13	2630	282	397	229	1	35	0.1	4	2040	12.5	0.1	1.85	0.5	0.42	0.001	0.076	0.017	0.1	0.003	0.36	0.001
24/4/2013	Nebo 4	11	2600	258	641	181	1	41	0.1	3	2380	14	0.17	5.76	0.05	0.083	0.001	0.054	0.02	0.076	0.002	0.39	0.001
15/3/2013	Nebo 4	14	2340	241	736	154	1	36	0.1	2	2300	12.1	0.15	3.98	0.024	0.067	0.001	0.046	0.024	0.07	0.002	0.42	0.001
18/04/2013	Nebo 4	11	2270	225	528	162	1	45	0.1	1	1880	14.1	0.02	0.2	0.05	0.005	0.001	0.049	0.018	0.058	0.002	0.46	0.001
31/07/2013	Nebo 4	12	6560	239	677	219	1	47	0.1	1	2190	16.6	0.14	0.14	0.05	0.004	0.001	0.057	0.014	0.065	0.002	0.4	0.001
4/12/2013	Nebo 4	13	2390	224	465	203	1	51	0.1	1	1840	8.8	0.01	0.13	0.05	0.003	0.001	0.082	0.016	0.073	0.003	0.35	0.001
30/01/2014	Nebo 4	9	2370	205	742	156	1	51	0.1	1	2200	9.3	0.01	0.34	0.05	0.009	0.001	0.071	0.016	0.059	0.002	0.37	0.001
13/03/2014	Nebo 4	15	2420	242	704	181	1	49	0.1	1	2160	12.1	0.03	0.29	0.05	0.006	0.001	0.103	0.012	0.062	0.003	0.42	0.001
30/05/2014	Nebo 4	16	2380	254	780	282	1	45	0.1	1	2480	10.3	0.2	2.59	0.05	0.04	0.001	0.077	0.012	0.042	0.003		0.001
23/07/2014	Nebo 4	14	2330	233	730	142	1	47	0.1	8	2130	16.6	0.04	0.86	0.05	0.017	0.002	0.074	0.008	0.068	0.003	0.42	0.001

ST Dev	3.7	1225.7	34.5	195.4	76.4	3.9	20.0	0.0	4.3	535.0	3.6	0.11	5.87	0.21	0.154	0.040	0.030	0.038	0.292	0.043	0.104	0.002
Max	18.0	6560.0	282.0	780.0	300.0	15.0	110.0	0.2	14.0	2710.0	17.0	0.41	22.00	0.55	0.510	0.130	0.103	0.160	1.200	0.170	0.460	0.010
Min	3.0	460.0	130.0	30.0	7.1	1.0	24.0	0.1	1.0	310.0	4.1	0.01	0.13	0.02	0.003	0.001	0.008	0.006	0.042	0.002	0.040	0.001
Median	13.0	2615.0	241.0	531.0	211.0	1.0	38.5	0.1	1.5	2150.0	12.2	0.14	2.68	0.05	0.064	0.001	0.052	0.018	0.074	0.003	0.375	0.001



Site	Wollongong Coal	DOC ID	001
Type	Plan	Date Published	5 September 2014
Doc Title	140904 Nebo LW N2 End of Panel Report		

APPENDIX D

Nebo Area – Longwall 2 End of Panel Report (Ecology)

Nebo Area - Longwall N2
End of Panel Report (Ecology)

Prepared for Wollongong Coal Limited

4 September 2014



Biosis offices

AUSTRALIAN CAPITAL TERRITORY

Canberra

Floor 1, Unit 3, 38 Essington Street
Mitchell, ACT 2911

Phone: (02) 6241 2333

Fax: (03) 9646 9499

Email: canberra@biosis.com.au

NEW SOUTH WALES

Newcastle

39 Platt Street
Waratah NSW 2298

Phone: (02) 4968 4901

Fax: (03) 9646 9242

Email: newcastle@biosis.com.au

Sydney

Unit 14, 17-27 Power Avenue
Alexandria NSW 2015

Phone: (02) 9690 2777

Fax: (02) 9690 2577

Email: sydney@biosis.com.au

Wollongong

8 Tate Street
Wollongong NSW 2500

Phone: (02) 4229 5222

Fax: (02) 4229 5500

Email: wollongong@biosis.com.au

QUEENSLAND

Brisbane

Suite 4 First Floor, 72 Wickham Street
Fortitude Valley QLD 4006

Phone: (07) 3831 7400

Fax: (07) 3831 7411

Email: brisbane@biosis.com.au

VICTORIA

Ballarat

506 Macarthur Street
Ballarat VIC 3350

Phone: (03) 5331 7000

Fax: (03) 5331 7033

Email: ballarat@biosis.com.au

Melbourne (Head Office)

38 Bertie Street
Port Melbourne VIC 3207

Phone: (03) 9646 9499

Fax: (03) 9646 9242

Email: melbourne@biosis.com.au

Wangaratta

16 Templeton Street
Wangaratta VIC 3677

Phone: (03) 5721 9453

Fax: (03) 5721 9454

Email: wangaratta@biosis.com.au

Document information

Report to:	Wollongong Coal Ltd
Prepared by:	Mathew Misdale, Jodie Cooper, and Anthony Steelcable
Biosis project no.:	18792
File name:	18792.Nebo.LW2.EoP.Report.FF.FIN01.20140904.docx
Citation:	Biosis 2014. Nebo Longwall N2. End of Panel Report (Ecology). Report for Wollongong Coal Ltd. Authors: Misdale M, Cooper J, & Steelcable A. Biosis Pty Ltd. Project no. 18792

Document control

Version	Internal reviewer	Date issued
Draft version 01	Nathan Garvey	29 August 2014
Final version 01	Nathan Garvey	4 September 2014

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- Wollongong Coal: Dave Clarkson, Kristen Lee
- Hansen Bailey: Andrew Wu and Dianne Munro

The following Biosis staff were involved in this project:

- Ashleigh Pritchard and for mapping
- Nathan Garvey for quality assurance

© Biosis Pty Ltd

This document is and shall remain the property of Biosis Pty Ltd. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of the Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Disclaimer:

Biosis Pty Ltd has completed this assessment in accordance with the relevant federal, state and local legislation and current industry best practice. The company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report content or for any purpose other than that for which it was intended.

Contents

1	Introduction	1
2	Monitoring programs.....	3
2.1	Terrestrial ecology monitoring program	3
2.1.2	Monitoring to Date.....	4
2.2	Aquatic ecology monitoring program	8
2.2.2	Monitoring to Date.....	8
3	Impact Assessment	11
3.1	Subsidence monitoring program.....	11
3.2	Results of monitoring programs	11
3.2.2	Terrestrial ecology.....	11
3.2.3	Aquatic ecology	12
3.3	Observed versus predicted impacts.....	12
3.4	TARP assessment.....	13
3.4.2	Longwall N2.....	13
3.4.3	Cumulative Impacts within the Nebo Mining Domain	13
4	Conclusions and Recommendations	14
5	References	15
	Appendices	16
	Appendix 1: Trigger Action Response Plan	17

List of Tables

Figure 1: Longwall N2, Nebo Area	2
Figure 2: Terrestrial ecology monitoring impact sites.....	6
Figure 3: Terrestrial ecology monitoring control sites	7
Figure 4: Aquatic ecology monitoring control and impact reaches.....	10

List of Figures

Table 1: Terrestrial ecology monitoring program.....	5
Table 2: Aquatic ecology monitoring program.....	8
Table 3: Observed versus predicted impacts	12
Table 4: Trigger Action Response Plan (TARP) Table, Riparian Vegetation, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6.....	17
Table 5: Trigger Action Response Plan (TARP) Table, Amphibians, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6.....	18
Table 6: Trigger Action Response Plan (TARP) Table, Aquatic Ecology, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6.....	19

1 Introduction

Biosis Pty Ltd (Biosis) was commissioned by Wollongong Coal Ltd (WCL) to undertake an End of Panel assessment of potential impacts from extraction of Longwall N2 in the Nebo Area at Wongawilli Colliery. This report assesses the post mining conditions in relation to terrestrial and aquatic ecology within the area potentially impacted by subsidence effects associated with mining of Longwall N2 (Figure 1).

Extraction of secondary workings was completed between 12th June 2013 and 26th February 2014. The full longwall panel length was not extracted. Figure 1 illustrates both the initial estimated extraction area for Longwall N2 and the completed extraction area.

This report has been prepared in accordance with Subsidence Management Plan Approval 09/5341 (Condition 18) (DTIRIS, 2013) and includes:

- An outline of monitoring programs conducted to date.
- An assessment of the results of monitoring undertaken to date.
- A comparison of observed impacts versus those predicted to occur.
- An assessment of whether any actions outlined in the Trigger Action Response Plan (TARP) have been triggered.
- Conclusions on impacts to ecology resulting from the extraction of Longwall N2, as well as cumulative impacts from longwall mining in the Nebo Area.

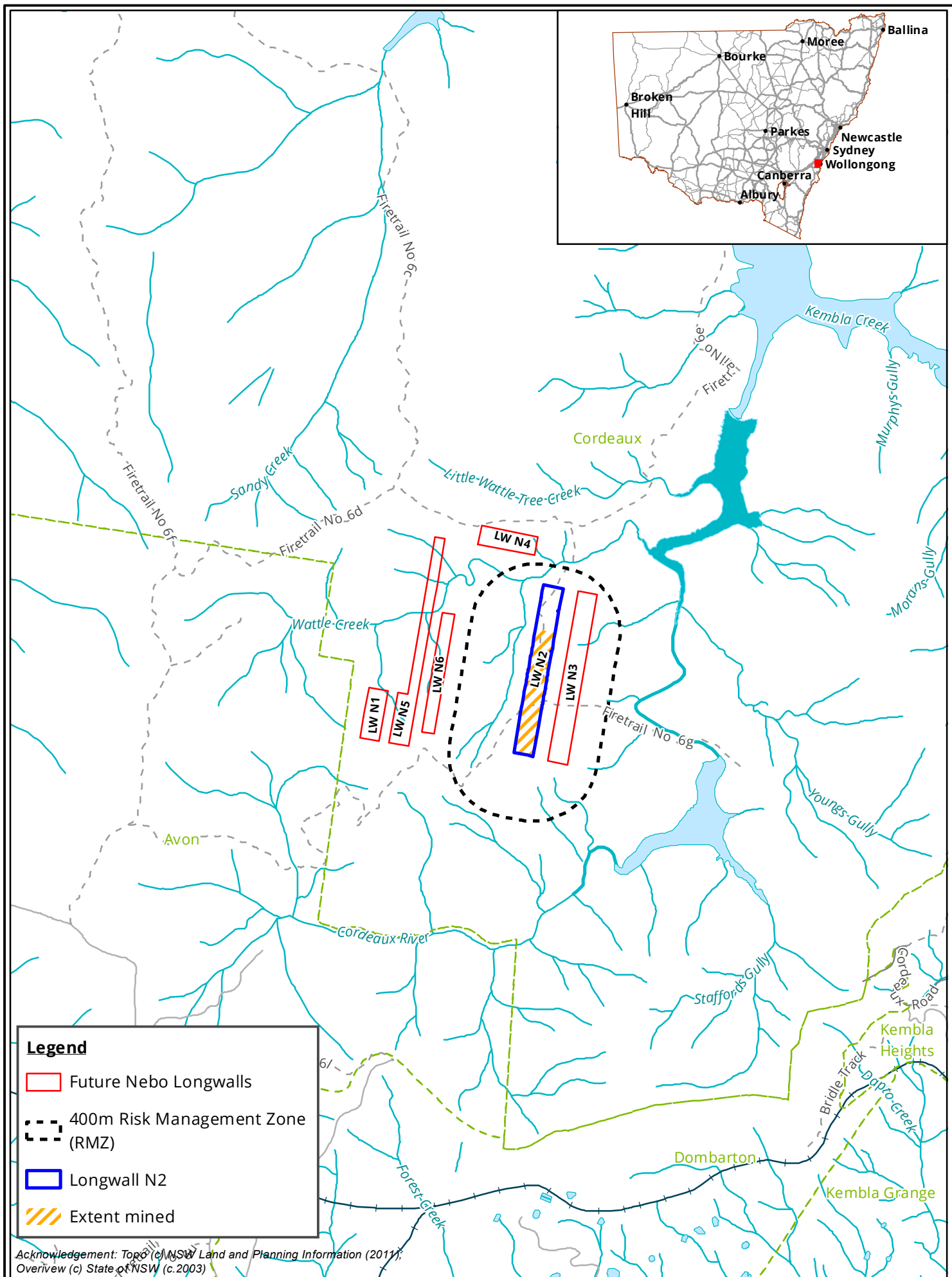
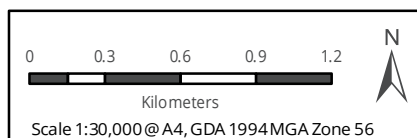


Figure 1: Longwall N2, Nebo Area



Biossis Pty Ltd
Ballarat, Brisbane, Canberra, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 18792
Date: 03 September 2014,
Checked by: MJM, Drawn by: ANP, Last edited by: aprichard
Location: P:\18700s\18792\Mapping\



2 Monitoring programs

The ecological monitoring programs for the Nebo Area are detailed within the Nebo Longwalls N1-N6 Subsidence Monitoring Plan (NRE, 2014), Nebo Longwalls N1-N6 Extraction Plan (Chapter 8: Biodiversity Management Plan) (Niche, 2012) and the Nebo Area Environmental Assessment (ERM, 2010). These documents outline the biodiversity monitoring actions that are required to satisfy on-going conditions of approval as detailed within the Nebo Longwalls N1-N6 Subsidence Management Plan Approval (DTIRIS, 2013) and NRE Wongawilli Colliery – Nebo Area Project Approval (MP09_0161).

Ecological monitoring to date within the Nebo Area has been completed within the requirements set out in Niche (2012) and summarized in Appendix 1: Tables 4- 6. Details of the terrestrial and aquatic monitoring programs are provided below.

2.1 Terrestrial ecology monitoring program

The terrestrial ecological monitoring program for Longwalls N1- N6 includes:

- Flora monitoring, including:
 - Riparian vegetation monitoring conducted at two creek line impact sites (Figure 2) and two control sites (Figure 3). Each creekline site contains three quadrat locations.
 - Photo point monitoring at each creek monitoring site (control and impact) (Figure 2 and Figure 3).
- Fauna monitoring, including:
 - Nocturnal frog monitoring conducted at two creek line impact sites (Figure 2) and two control sites (Figure 3).

There are no significant swamps, threatened frog habitat (Biosis, 2014) or ridgeline features in the vicinity of Longwall N2.

Terrestrial monitoring, including collection of baseline data, commenced in December 2010. To date, two and a half years of baseline data has been collected prior to mining. Monitoring is scheduled to be conducted during mining and for a minimum of one year post mining, or greater if required to detect impacts.

The terrestrial monitoring program, including monitoring type, sites, site type and methodology, is outlined in

Table 1.

2.1.2 Monitoring to Date

The terrestrial flora and fauna monitoring program commenced in spring 2010 and has been completed for:

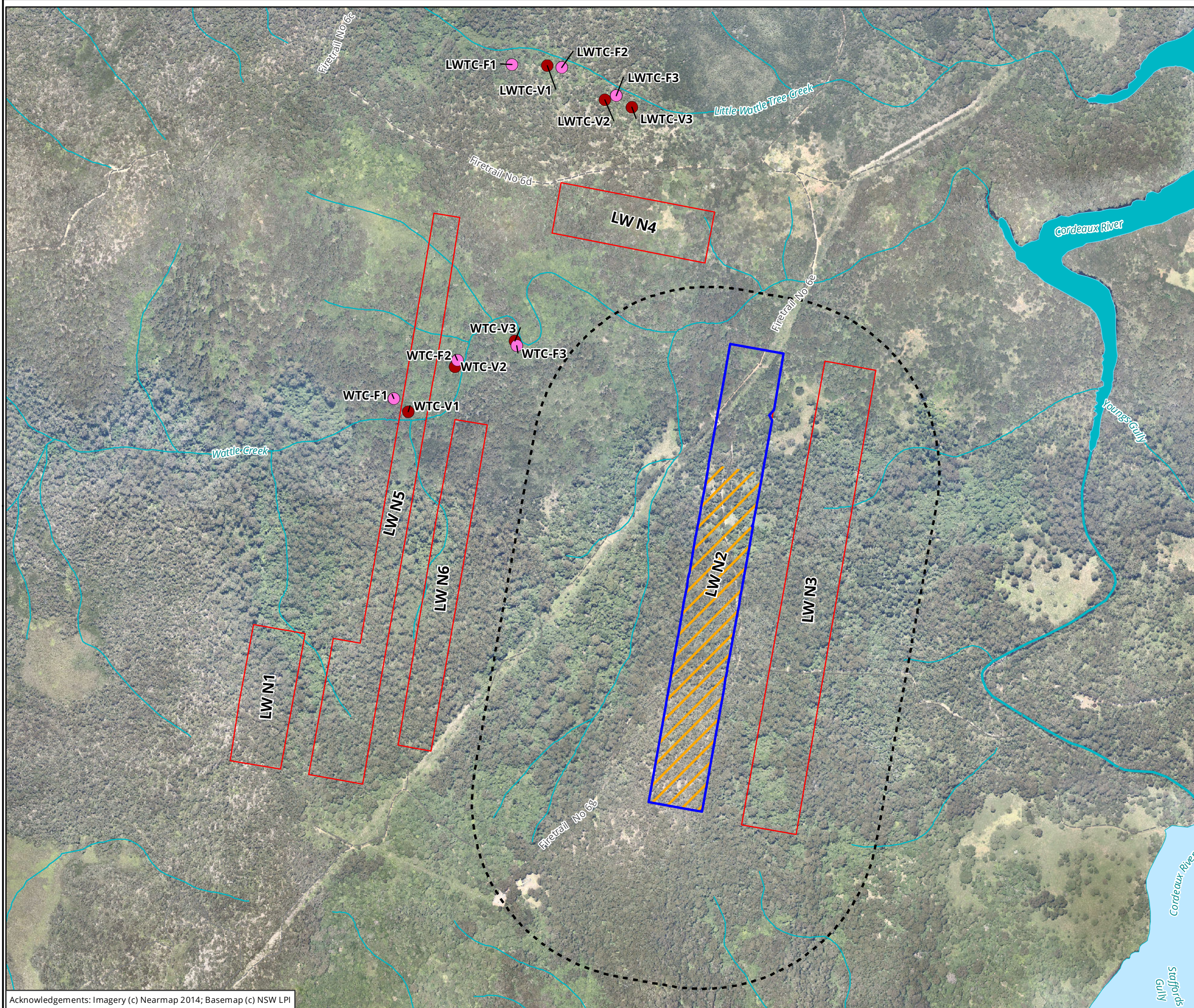
- Spring 2010.
- Autumn and spring 2011.
- Autumn and spring 2012.
- Autumn and spring 2013.
- Autumn 2014.

Riparian vegetation monitoring was also conducted at Morans Gully and Flying Fox #3 control sites between 2004 and 2009 (Figure 3).

The terrestrial ecological monitoring programs employ a Before-After Control-Impact (BACI) design, comparing sites pre- and post-mining and comparing sites that have been mined beneath (impact sites) with sites that have not been mined beneath (control sites).

Table 1: Terrestrial ecology monitoring program

Monitoring	Impact Sites (Figure 2)	Control Sites (Figure 3)	Methodology
Riparian Vegetation	Wattle Tree Creek Little Wattle Tree Creek	Flying Fox Creek #3 Morans Gully	<p>Vegetation surveys within creeks are undertaken at three 20m x 20m (400m²) quadrats per creek located at least 150m apart. Within each quadrat, subjective cover abundance scores are given to each species occurring within the quadrat using a modified Braun-Blanquet scale.</p> <p>Where there is potential for misidentification, or where species cannot be reliably identified to species level in the field, species have been grouped into identification units for analysis. Each of these units is referred to as a species complex.</p> <p>Surveys are undertaken once in spring and once in autumn each year.</p>
Frogs – Point Surveys	Wattle Tree Creek Little Wattle Tree Creek	Flying Fox Creek #3 Morans Gully	<p>Nocturnal frog surveys within creeks are undertaken at three 50m long transects per creek located at least 150m apart. Transects are surveyed by walking down the creek and counting all frogs seen or heard. Counts of tadpoles and egg mass are also undertaken where present.</p>



Legend

Flora Monitoring

- Flora creek impact site

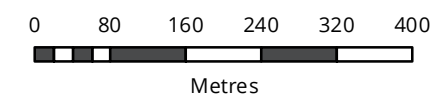
Fauna Monitoring

- Fauna creek impact site

Survey Area

- Future Nebo Longwalls
- 400m Risk Management Zone (RMZ)
- Longwall N2
- Extent mined

Figure 2: Terrestrial ecology monitoring impact sites

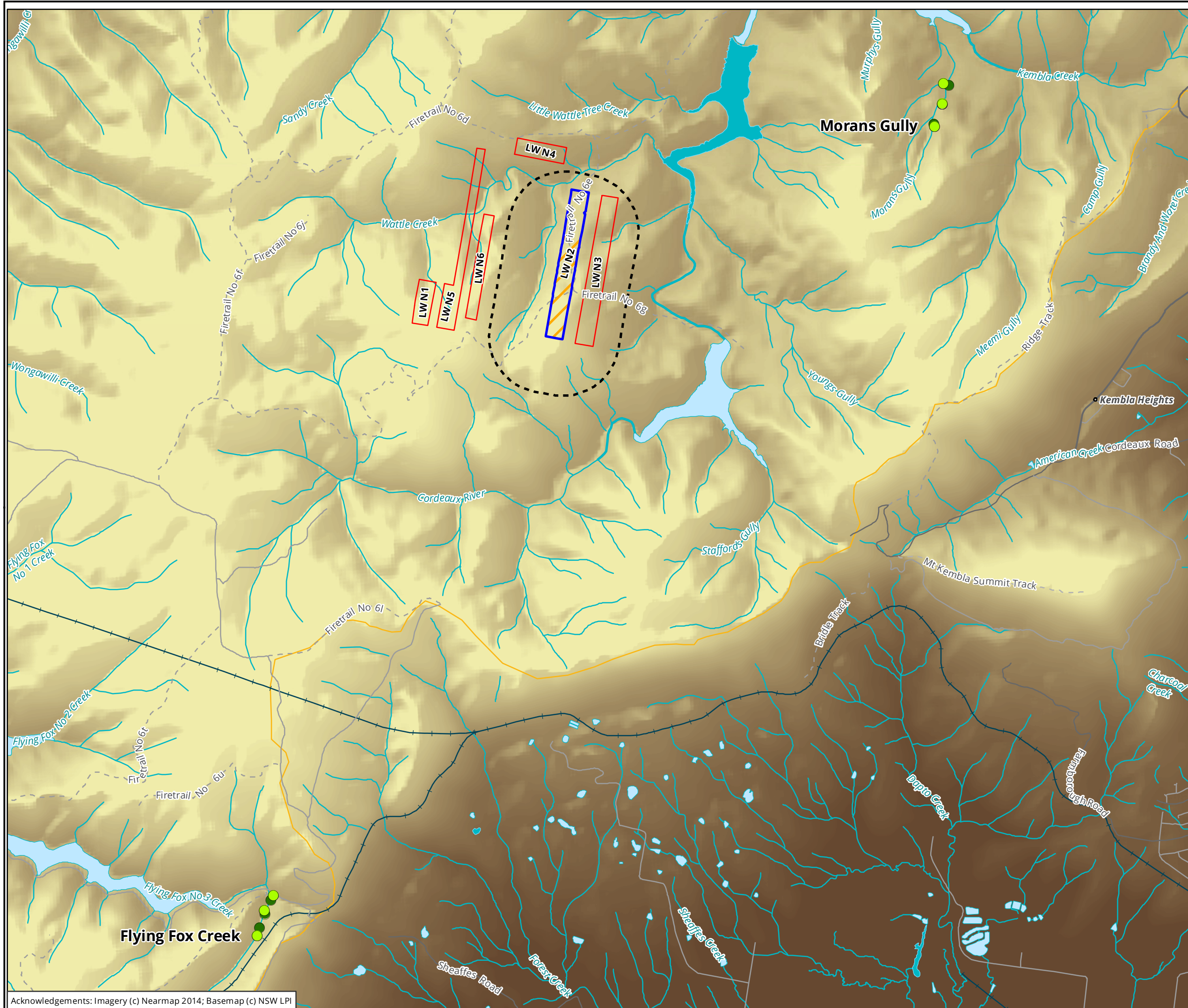


Scale: 1:8,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56



Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong


Matter: 18792
Date: 03 September 2014
Checked by: MJM, Drawn by: ANP, Last edited by: apritchard
Location: P:\18700s\18792\Mapping\18792_F2_Eco_Impact_Monitoring



- Legend**
- Flora Monitoring**
- Flora creek control site
- Fauna Monitoring**
- Fauna creek control site
- Survey Area**
- Future Nebo Longwalls
 - 400m Risk Management Zone (RMZ)
 - Longwall N2
 - ▨ Extent mined

Figure 3: Terrestrial ecology monitoring control sites

0 250 500 750 1,000 1,250
Metres
Scale: 1:25,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

 **biosis.**
Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 18792
Date: 03 September 2014
Checked by: MJM, Drawn by: ANP, Last edited by: apritchard
Location: P:\18700s\18792\Mapping\18792_F3_Eco Control Monitoring

2.2 Aquatic ecology monitoring program

The aquatic ecology monitoring program is shown on Figure 4 for Longwalls N1-6 and includes:

- Aquatic habitat monitoring, including surface water quality monitoring, at eight impact sites and four control sites (Figure 4) during spring and autumn.
- Monitoring of aquatic macroinvertebrates (AUSRIVAS) at eight impact sites and four control sites (Figure 4).
- Photo point monitoring at eight impact sites and four control sites (Figure 4).

The aquatic ecology monitoring program is scheduled to be conducted for a minimum of two year's pre-mining, during mining and a minimum of one year post mining. The aquatic monitoring program, including monitoring type, monitoring reaches, and methodology, is outlined in Table 2: Aquatic ecology monitoring program Table 2.

2.2.2 Monitoring to Date

The aquatic ecological monitoring commenced in March 2011 and has been completed for:

- Autumn 2011.
- Autumn and spring 2012.
- Autumn and spring 2013.
- Autumn 2014.

The aquatic ecological monitoring programs employ a Before-After Control-Impact (BACI) design, comparing sites pre- and post- mining and comparing sites that have been mined beneath (impact sites) with sites that have not been mined beneath (control sites).

Table 2: Aquatic ecology monitoring program

Monitoring	Impact Reaches (Figure 4)	Control Reaches (Figure 4)	Methodology
Aquatic Habitat monitoring including surface water quality monitoring	WAC-AQ3 WAC-AQ4 WAC-AQ5 WAC-AQ6	KEC-AQ1 KCT-AQ1 MGC-AQ1 MEC-AQ1	<p>At each monitoring reach, a visually based habitat assessment (HABSCORE) is undertaken, which evaluates the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour et al. 1999). Based on this methodology, the aquatic habitat within the study area is described in terms of four category types: Optimal, Suboptimal, Marginal or Poor.</p> <p>Physico-chemical water quality variables are measured at each monitoring reach. These are collected to support the data analysis of aquatic ecological values and are not used as an indicator for potential impacts from underground mining.</p>

Monitoring	Impact Reaches (Figure 4)	Control Reaches (Figure 4)	Methodology
			Habitat assessments and surface water quality measurements are undertaken once in spring and once in autumn each year.
Aquatic Macroinvertebrate Monitoring	WAC-AQ3 WAC-AQ4 WAC-AQ5 WAC-AQ6	KEC-AQ1 KCT-AQ1 MGC-AQ1 MEC-AQ1	<p>At each monitoring reach, aquatic macroinvertebrates are surveyed according to the techniques described in the NSW AUSRIVAS Rapid Assessment Method (Turak et al. 2004). This methodology provides for an assessment of the ecological health of each reach through its respective macroinvertebrate community via the application of a data modelling approach.</p> <p>Each year, monitoring is conducted between March 15 and June 15 (autumn survey), and between September 15 and December 15 (spring survey) in order to appropriately apply the AUSRIVAS modelling approach.</p>
Photopoint Monitoring	WAC-AQ3 WAC-AQ4 WAC-AQ5 WAC-AQ6	KEC-AQ1 KCT-AQ1 MGC-AQ1 MEC-AQ1	<p>Permanent photo monitoring points have been established at each aquatic monitoring reach. Photos are taken of the wetted channel at each fixed point in a (1) downstream and an (2) upstream direction.</p> <p>Photos are taken once in spring and once in autumn each year.</p>

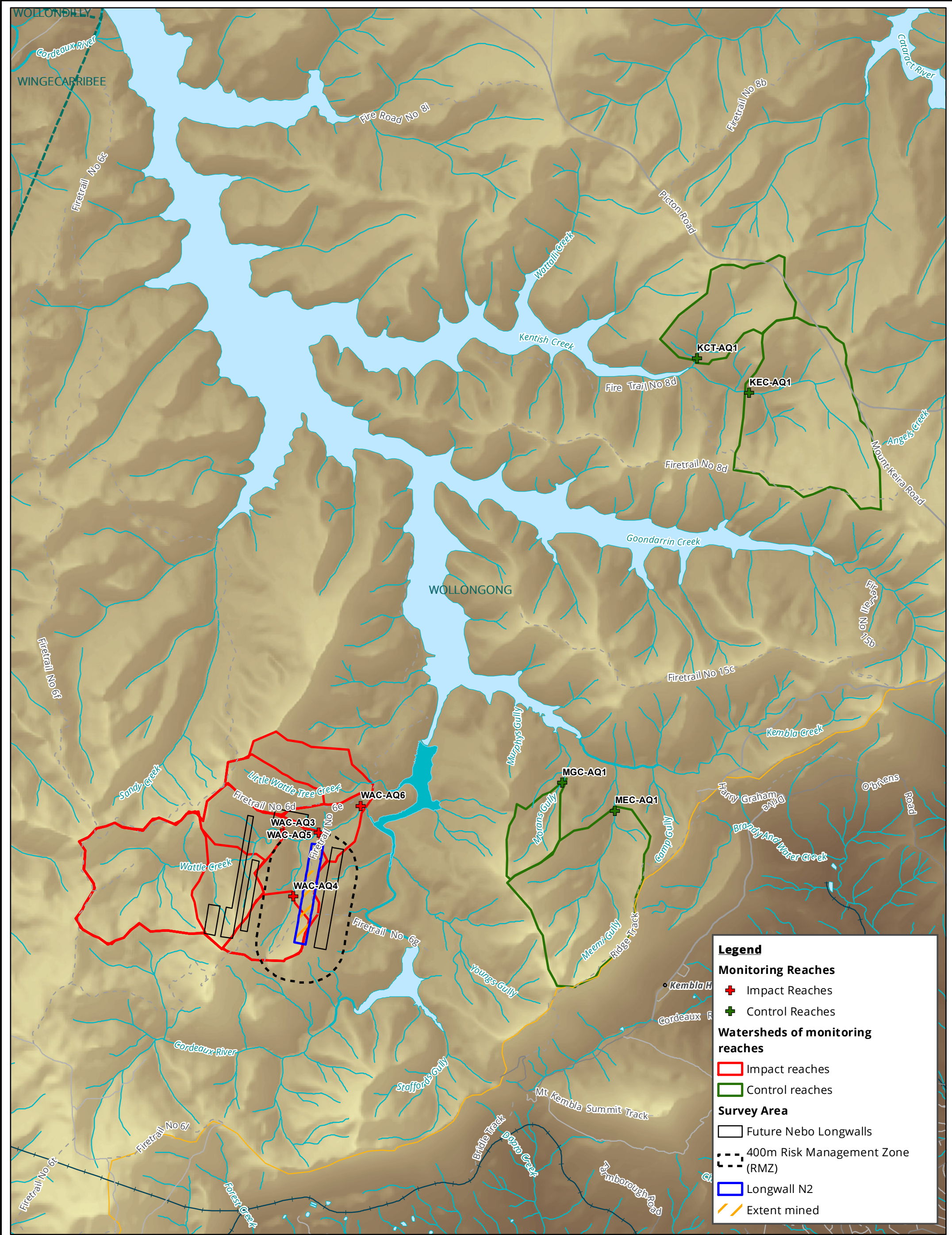
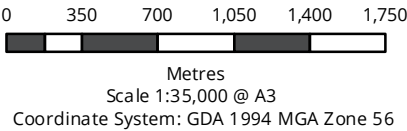


Figure 4: Aquatic ecology monitoring control and impact reaches

Acknowledgements: Topo (c) NSW Land and Planning Information (2012)

Matter: 18792
Date: 03 September 2014,
Checked by: APS, Drawn by: ANP, Last edited by: apritchard
Location: P:\18700s\18792\Mapping\18792_F4_CatchmentsOverview



3 Impact Assessment

3.1 Subsidence monitoring program

A maximum of approximately 90 millimetres of vertical subsidence was observed across the central 100 metres of the panel, with maximum average tilt of less than 0.5 mm/m and strain of 0.2 mm/m (SCT Operations 2014).

This measured value is below the maximum predicted subsidence levels for Prediction Lines 4 (NM3) and 5 (NM2) (Niche Environment & Heritage 2012). As this is the first longwall extracted within the Nebo Area, there is no cumulative subsidence.

3.2 Results of monitoring programs

3.2.2 Terrestrial ecology

The Nebo terrestrial ecological monitoring program has been underway since spring 2010. Natural features requiring monitoring included Wattle Tree Creek and Little Wattle Tree Creek. The creekline impact sites listed in

Table 1 are not positioned to detect potential impacts from Longwall N2. No significant terrestrial ecological features were identified within the Longwall N2 area therefore, no terrestrial monitoring is outlined in the approved Biodiversity Management Plan (Niche 2012).

The monitoring sites at Wattle Tree Creek and Little Wattle Tree Creek are currently monitored to collect baseline data within a 400 metre Risk Management Zone (RMZ) for Longwalls 4 and 5. Detailed results of the terrestrial ecology monitoring program are presented in the annual monitoring reports (Biosis, In Draft a).

3.2.3 Aquatic ecology

To date, results from aquatic monitoring listed in Table 2 have not detected any subsidence effects on aquatic ecological values in the Wattle Tree Creek and Little Wattle Tree Creek catchments. Detailed results of the aquatic ecology monitoring program are presented in the annual monitoring reports (Biosis, In Draft b). The aquatic survey data collected indicates that aquatic ecological values have not deviated from baseline and remain comparable with control sites.

3.3 Observed versus predicted impacts

A summary of predicted versus observed impacts as per Niche (2012) is provided in Table 3 below.

Table 3: Observed versus predicted impacts

Value	Predicted Impact (Niche 2012)	Observed Impact	Within Prediction
Rivers (creeks, streams, tributaries)	Low - The maximum predicted subsidence along the creeks is approximately 250mm which occurs above Longwall N5. The predicted subsidence movements and valley related movements along the creeks are predicted to be very low (MSEC 2010). GeoTerra (2010) anticipate that no significant adverse effects will be observed in the creek bed or catchment of Wattle Creek or Little Wattle Tree Creek. Consequently the potential for related impacts on flora and fauna will be low.	No observable changes to frog populations in Wattle Tree Creek or Little Wattle Tree Creek.	Yes
Vegetation	Low – Tree tilt and fall has potential to occur within terrestrial habitats. Low – The maximum subsidence prediction is within rainforest communities including Coachwood Warm Temperate Rainforest and Moist Gully Gum Forest. The potential for impacts on the	No observable changes to vegetation composition in Wattle Tree Creek or Little Wattle Tree Creek.	Yes

Value	Predicted Impact (Niche 2012)	Observed Impact	Within Prediction
	water table in this locality are expected to be low. As a result the potential for associated consequences for flora and fauna are expected to be low		
Upland Swamps	Low – Swamp No.22 and Swamp No.39 are at least 40m from the predicted subsidence footprint and over 400m from the greatest predicted subsidence. The potential for the predicted subsidence to impact on upland swamps is therefore expected to be low.	No upland swamps are located in the vicinity of Longwall N2.	N/A
Rocky habitats	Low - There are no rock faces or rocky areas within the zone of greatest subsidence.	No rocky habitats are located in the vicinity of Longwall N2.	N/A

3.4 TARP assessment

A Trigger Action Response Plan (TARP) was developed for Longwalls N1-N6 as a part of the Biodiversity Management Plan (Niche, 2012). This section assesses whether triggers have been met and whether additional actions are required due to extraction of Longwall N2.

A TARP assessment is provided in Table 4 (riparian vegetation), Table 5 (amphibians), and Table 6 (aquatic ecology).

3.4.2 Longwall N2

Monitoring to date in the Nebo Area has not identified any impacts to flora and fauna, and aquatic ecology sites as a result of subsidence associated with mining of Longwall N2. No other management actions have been triggered under the TARP (Table 4, Table 5 and Table 6).

3.4.3 Cumulative Impacts within the Nebo Mining Domain

Longwall N2 is the first longwall extraction completed within the within the Nebo Area. Therefore, there is no cumulative data to be reported on.

4 Conclusions and Recommendations

This report assesses the post mining conditions in relation to terrestrial and aquatic ecology within the area potentially impacted by subsidence effects associated with mining of Longwall N2, and compares these observed impacts to impacts predicted to occur.

Observed impacts are within predictions and significant impacts to ecological values have not resulted from the extraction of Longwall N2. No management actions under the TARP have been triggered.

It is recommended that monitoring of all natural features above Longwall N2 be monitored for one year post-mining. If no impacts are observed during this time monitoring should cease, as per the Biodiversity Management Plan (Niche 2012).

5 References

Barbour M.T., Gerritsen J., Snyder B.D., & Stribling J.B. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish. U.S. Environmental Protection Agency, Office of Water, Washington, No. 841-B-99-002.

Biosis2014. Wongawilli and Nebo Areas Ecological Monitoring Program Annual Report for 2012/2013 Financial Year. Report for Gujarat NRE Wonga Pty Ltd. Author: J.Cooper, Biosis Pty. Ltd., Wollongong.

Biosis In Draft a. Wongawilli and Nebo Areas Ecological Monitoring Program Annual Report for 2013/2014 Financial Year. Report for Gujarat NRE Wonga Pty Ltd. Author: J.Cooper, Biosis Pty. Ltd., Wollongong Resource Group.

Biosis In Draft b. Wongawilli Colliery Aquatic Ecology Monitoring Program, Spring 2013. Report for Gujarat NRE No 1 Colliery. Authors: A. Steelcable and K. Beyer, Biosis Pty Ltd, Sydney Resource Group.

DTIRIS 2013. Subsidence Management Plan Approval – NRE Wongawilli Colliery Nebo Longwalls N1-N6, (dated 25 January 2013, file no. 09/5341).

ERM 2010. NRE Wongawilli Colliery Nebo Area Environmental Assessment.

Gujarat NRE 2014. NRE Wongawilli Colliery Nebo Longwalls N1-N6: Subsidence Monitoring Plan. Revision 3 (dated 14 February 2014).

Niche Environment and Heritage 2012. Nebo Longwalls N1-N6 Extraction Plan. Prepared for Gujarat NRE and NSW Department of Planning and Infrastructure.

Pogonoski J., Tippng J., Hoese D., Reader S., Semeniuk M. & McCaffrey L. 2011. Survey guidelines for Australia's threatened fish, DSEWPac, Australian Museum.

SCT Operations 2014. Wongawilli Colliery – LWN2 End of Panel Subsidence Report. Report to Wollongong Coal Ltd.

Turak T., Waddell N. & Johnstone G. 2004. New South Wales (NSW) AUSRIVAS Sampling and Processing Manual 2004. Canberra.

Appendices

Appendix 1: Trigger Action Response Plan

Table 4: Trigger Action Response Plan (TARP) Table, Riparian Vegetation, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6

Feature	Monitoring Program			Impact Assessment		TARPs		
	Prior to Mining	During Mining	Post mining and Future Monitoring	Predicted Impacts	Observed Impacts	Trigger	Response	Action as a result of Longwall N2
Riparian vegetation 3 Monitoring sites on Wattle Tree Creek 3 Monitoring sites on Little Wattle Tree Creek 6 Reference sites	Species inventory and modified Braun Blanquette cover - Abundance for each species.	Species inventory and modified Braun Blanquette cover - Abundance for each species.	Species inventory and modified Braun Blanquette cover - Abundance for each species.	Unlikely that any threatened flora species would be significantly impacted by subsidence resulting from Longwall mining.	No impact to flora species or vegetation communities observed to date.	NORMAL No change as compared to baseline observed	<ul style="list-style-type: none"> Continue monitoring Report in end of panel report 	No management action/s required.
	At least once prior to mining (conducted Autumn and Spring).	Autumn and spring during entire extraction period.	Autumn and Spring for a minimum of one year post-mining (in consultation with key regulators.	Unlikely to be impacts to vegetation communities.		WITHIN PREDICTIONS Survey results within baseline variability	<ul style="list-style-type: none"> Continue monitoring Report in end of panel report 	No change to flora species or vegetation communities was observed when compared to baseline and control sites.
	Baseline monitoring ongoing.	Not started.	Not started.			EXCEEDS PREDICTIONS Observed deterioration in vegetation health against baseline surveys Significant change/ decline in cover - abundance against baseline surveys. Statistically significant change in species composition against baseline surveys	<ul style="list-style-type: none"> Notification to SCA/DP&E/OEH immediately Proposal for management within 1 week if required Completion of management task following approval from agencies Additional monitoring as required by the relevant government agencies Report in end of panel report Reporting in Incident Reports and Annual Reviews 	

Table 5: Trigger Action Response Plan (TARP) Table, Amphibians, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6

Feature	Monitoring Program			Impact Assessment		TARPs		
	Prior to Mining	During Mining	Post mining and Future Monitoring	Predicted Impacts	Observed Impacts	Trigger	Response	Action as a result of Longwall N2
Amphibians 3 Monitoring sites on Wattle Tree Creek 3 Monitoring sites on Little Wattle Tree Creek 6 Reference sites	Baseline ecological assessment. Observational monitoring– 50 m nocturnal stream searches and tadpole surveys at three locations ~150-200m apart along Wattle Tree Creek and Little Wattle Tree Creek conducted Autumn and Spring. Baseline monitoring ongoing. Targeted Threatened Amphibian searches each Winter along Wattle Tree Creek and Little Wattle Tree Creek. Completed, no threatened frog habitat found.	Observational monitoring– 50 m nocturnal stream searches and tadpole surveys at three locations ~150-200m apart along Wattle Tree Creek and Little Wattle Tree Creek conducted Autumn and Spring during entire extraction period. Not started. Targeted Threatened Amphibian searches each Winter along Wattle Tree Creek and Little Wattle Tree Creek. Not required.	Observational monitoring– Autumn and Spring for a minimum of one year post-mining (in consultation with key regulators). Not started. Targeted Threatened Amphibian searches in Winter period for a minimum of one year post-mining (in consultation with key regulators). Not required.	Unlikely that any threatened amphibian species would be significantly impacted by subsidence resulting from Longwall mining. Unlikely to be impacts to amphibians or loss of amphibian habitat.	No impact to amphibian populations or habitats observed to date.	NORMAL No change as compared to baseline observed WITHIN PREDICTIONS Survey results within baseline variability EXCEEDS PREDICTIONS Observed physical impacts to habitat. Statistically significant decrease in population numbers and/or species composition against baseline	<ul style="list-style-type: none"> Continue monitoring Report in end of panel report Continue monitoring Report in end of panel report Notification to SCA/D&PE/OEH immediately Proposal for threatened species management within 1 week if required Completion of management task following approval from agencies Additional monitoring as required by the relevant government agencies Report in end of panel report Reporting in Incident Reports and Annual Reviews 	No management action/s required. No changes in amphibian populations or habitats were observed when compared to baseline and control sites.

Table 6: Trigger Action Response Plan (TARP) Table, Aquatic Ecology, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6

Feature	Monitoring Program			Impact Assessment		TARPs		
	Prior to Mining	During Mining	Post mining and Future Monitoring	Predicted Impacts	Observed Impacts	Trigger	Response	Action as a result of Longwall N2
Aquatic ecology	Observational monitoring for presence/absence of aquatic habitat during water quality monitoring regime	Observational monitoring for presence/absence of aquatic habitat during water quality monitoring regime	Observational monitoring for presence/absence of aquatic habitat during water quality monitoring regime for a minimum of one year post-mining (in consultation with key regulators)	Unlikely that any threatened aquatic species would be significantly impacted by subsidence resulting from Longwall mining.	No impact to aquatic ecology or habitats observed to date.	NORMAL No change in aquatic biota compared to baseline observed	<ul style="list-style-type: none"> Continue monitoring. Report in end of panel report. 	No management action/s required.
6 Monitoring sites on Wattle Tree Creek	Baseline monitoring completed for Longwall N2 and ongoing as it relates to the Nebo Area.	Impact monitoring completed for this stage as it relates to the extraction of Longwall N2.	Monitoring ongoing for this stage as it relates to Longwall N2. AUSRIVAS macroinvertebrate sampling of reference and impact sites. Descriptions of instream habitat, algal levels, riparian condition, presence /absence of litter, flow level and water quality for a minimum of one year post-mining (in consultation with key regulators) (Biannually in Autumn and Spring)	Unlikely to be impacts to aquatic ecology or loss of aquatic habitat.		WITHIN PREDICTIONS Water flow and quality results within predictions. Survey results within baseline variability	<ul style="list-style-type: none"> Continue monitoring. Report in end of panel report. 	No change in aquatic biota was observed when compared to baseline and control sites.
2 Monitoring sites on Little Wattle Tree Creek	AUSRIVAS macroinvertebrate sampling of reference and impact sites. Descriptions of instream habitat, algal levels, riparian condition, presence/absence of litter, flow level and water quality (Biannually in Autumn and Spring)	AUSRIVAS macroinvertebrate sampling of reference and impact sites. Descriptions of instream habitat, algal levels, riparian condition, presence/absence of litter, flow level and water quality (Biannually in Autumn and Spring).	Monitoring ongoing for this stage as it relates to Longwall N2. AUSRIVAS macroinvertebrate sampling of reference and impact sites. Descriptions of instream habitat, algal levels, riparian condition, presence /absence of litter, flow level and water quality for a minimum of one year post-mining (in consultation with key regulators) (Biannually in Autumn and Spring)			EXCEEDS PREDICTIONS Water flow and quality results exceed predictions. Statistically significant change observed in survey results against baseline	<ul style="list-style-type: none"> Notification to SCA/D&PE/OEH immediately. Proposal for any proposed additional monitoring and management measures within 1 week if required. Completion of agreed management task following approval from regulators. Additional monitoring as required by the relevant government agencies. Report in end of panel report. Reporting in Incident Reports and Annual Review. 	Continue impact monitoring to the completion of one year post mining. Review post mining data and make recommendations on future requirements.
4 Reference sites	Baseline monitoring completed for Longwall N2 and ongoing as it relates to the Nebo Area.	Impact monitoring completed for this stage as it relates to the extraction of Longwall N2	Monitoring ongoing for this stage as it relates to Longwall N2.					

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Appendix D - Wongawilli Colliery Register of Compliance

Legal Document	Department	Brief Description	Compliant with the intent Y/N/NA/COMMENT
<i>Coal Mine Health & Safety Act 2002 (NSW)</i>	DRE	The <i>Coal Mine Health and Safety Act 2002</i> is administered by the DRE and regulates activities undertaken on coal mines to ensure that the health, safety and welfare of persons involved in their operation are protected.	Y
<i>Dams Safety Act 1978 (NSW)</i>	DSC	Government Statutory Authority, which has as one of its functions, the surveillance of mining within the Notification Area of any Prescribed Dam in NSW.	Y
<i>Drinking Water Catchments Regional Environmental Plan No.1 (NSW)</i>	DP&E	The <i>Drinking Water Catchments Regional Environmental Plan No. 1 (DWCREP)</i> applies to land within the hydrological catchments that contribute to Sydney's drinking water supply. It aims to create healthy water catchments that will deliver high quality water whilst sustaining diverse and prosperous communities.	A large part of the Colliery lease areas is designated as a Schedule 1 Restricted Access Area (Metropolitan Special Area) under the <i>Sydney Water Catchment Management Act 1998</i> and is managed by the Sydney Catchment Authority (SCA). All catchment activities are undertaken in close liaison with the SCA.
<i>Environmentally Hazardous Chemicals Act 1985 (NSW)</i>	OEH	The EPA may make chemical control orders (CCOs) with respect to assessed chemicals or declared chemical wastes. These CCOs may regulate activities such as the manufacture, processing, conveying, buying, selling or disposal of the chemical or declared waste. Chemicals for which a CCO has been made are referred to as environmentally hazardous chemicals.	NA – No CCO's in effect for WCL.
<i>Environmentally Hazardous Chemicals Regulation 2008 (NSW)</i>	OEH	This regulation sets various fees in relation to assessment of technology and prescribed activities by the EPA and in relation to licences to carry on prescribed activities and specify the matters to be included in applications for assessment of prescribed activities.	NA
<i>Environmental Planning and Assessment Act 1979 (NSW)</i>	DP&E	To protect the environment, involving the conservation and protection of native plants and animals, the community, threatened species, and their habitats in accordance with the principles of Ecologically Sustainable Development.	Y Baseline studies undertaken in support of SMP applications – as req'd by DRE

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Environment Protection and Biodiversity Conservation Act 1999 (Cth)	DoE	Applies to developments that may have environmental impact on Commonwealth land or any matter of National Environmental Significance.	Y Baseline studies undertaken in support of SMP applications – as req'd by DRE.
Fisheries Management Act 1994 (NSW)	DRE	The <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) requires approval of the Commonwealth Minister for the Environment for actions that may have a significant impact on matters of National Environmental Significance (NES).	Y Mine subsidence has the potential to impact on listed threatened species and these issues are directed to DoE as required.
Heritage Act 1977 (NSW)	DP&E	Ensure that the non-Aboriginal cultural heritage of New South Wales is adequately identified and conserved.	Y Baseline studies undertaken in support of approval to mine applications – as req'd by DP&E.
Illawarra Regional Environmental Plan No. 1 (NSW)	DP&E	Part 4 of the IREP applies to coal mining, transportation and refuse emplacement. The objectives of Part 4 are: a) <i>to ensure that proposed development is assessed in relation to the feasibility of its rendering coal resources unavailable,</i> b) <i>to eliminate haulage of coal on public roads as far as practicable in order to overcome conflict with other road users and the adverse environmental impact of such haulage, and</i> c) <i>to provide guidelines for ensuring coal washery refuse emplacements are located and designed with minimum adverse environmental impact.</i>	NA as there is no coal washery emplacement or road based coal transport.
Mining Act 1992 (NSW)	DRE	The <i>Mining Act 1992</i> refers to the granting of Mining Leases and mining activities generally and, amongst other legislative instruments, places controls on methods of exploration and mining, the disposal of mining waste, and rehabilitation and environmental management activities	Y Mining leases granted. Approvals in place to mine.
Mine Subsidence Compensation Act 1961 (NSW)	MSB	The <i>Mine Subsidence Compensation Act 1961</i> provides for compensation or repair services where improvements are damaged by mine subsidence resulting from the extraction of coal. The Mine Subsidence Board (MSB) is a service organisation operating for the community in coal mining areas of NSW and is responsible for administering the Act. The Act also makes the Board responsible for reducing the risk of mine subsidence damage to properties by assessing and controlling the types of buildings and improvements which can be erected in Mine Subsidence Districts. The MSB is financed through a levy on all coal producers	Y Subsidence impacts evaluated by MSB – as per approval conditions.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

<i>National Environment Protection Council Act 1994 (Cth)</i>	DoE	<p>The National Environment Protection Council (NEPC) is a statutory body with law making powers established under the <i>National Environment Protection Council Act 1994</i> (Commonwealth), and corresponding legislation in other Australian jurisdictions. The objective of the NEPC is to ensure the protection of the environment and heritage of Australia. The NEPC has two primary functions:</p> <ul style="list-style-type: none"> to make National Environment Protection Measures (NEPM); and to assess and report on the implementation and effectiveness of NEPMs in participating jurisdictions. 	Y One NEPM applies to the Colliery and this is the Ambient Air Quality NEPM which will be addressed in any relevant development at the site.
<i>National Greenhouse & Energy Reporting Act 2007 (Cth)</i>	Clean Energy Regulators	The <i>National Greenhouse and Energy Reporting Act 2007</i> ('NGER Act') establishes a national framework for Australian corporations to report greenhouse gas emissions, reductions, removals and offsets, and energy consumption and production, from 1 July 2008. The NGER Act requires corporations that control facilities emitting 25 kilotonnes (25 000 tonnes) or more of greenhouse gas (CO ₂ equivalent) per year to register and report their greenhouse gas emissions.	WCI is a registered corporation under NGER Act. Scope 1 to 3 greenhouse emissions will be calculated in the EA in accordance with relevant legislation and guidance documents.
<i>National Parks and Wildlife Act 1974 (NSW)</i>	OEH	Aims to prevent unnecessary or unwarranted destruction of relics (Aboriginal), and the active protection and conservation of relics, which are of high cultural significance.	Y Archaeological surveys conducted. Consents to Destroy sought where req'd - NPWS.
<i>Native Title Act 1993 (Cth)</i>	Attorney General Department	The New South Wales mining and petroleum legislation must be administered in accordance with the Commonwealth Native Title Act 1993 (CNTA), which came into effect on 1 January 1994. The primary effect of this Act on exploration and mining approvals is to provide native title parties with rights to negotiate about the grant and some renewals by governments of exploration and mining titles. The process is informally known as the "right to negotiate" process. The legislation must also be administered in accordance with various subsequent decisions of the courts, and in particular, the Wik decision of the High Court in December 1996.	Any future surface lease for mining purposes under the NSW Mining Act 1992 will require Native Title considerations to be included in the assessment process for the issue of this type of lease.
<i>Native Vegetation Act 2003 (NSW)</i>	OEH	Provides for the conservation and management of native vegetation in accordance with the principles of Ecologically Sustainable Development.	Y Baseline assessments undertaken and included into all relevant Environmental Approvals.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Noxious Weeds Act 1993 (NSW)	DTIRIS - DPI	This act aims to identify noxious weeds and specify their control measures. It outlines the control duties of public and private landholders, and to provide a framework for the state-wide control of those noxious weeds.	Y Noxious weeds inspections undertaken periodically – control undertaken as required.
Noxious Weeds Regulation 2008 (NSW)	DTIRIS - DPI	Control measures are set out for each control category and fines are applicable for non-compliance.	Y Noxious weeds inspections undertaken periodically – control undertaken as required.
Occupational Health and Safety Act 2000 (NSW)	WorkCover	The objectives of this act aim to secure and promote the health, safety and welfare of people at work, whilst providing consultation and co-operation between employers and employees.	Y OHS / HSEC committees in place.
Occupational Health and Safety Regulation 2001 (NSW)	WorkCover	This Regulation applies to all places of work under the <i>Occupational Health and Safety Act 2000 (NSW)</i>	Y
Ozone Protection Act 1989 (Commonwealth)	DoE	This Act offers a system of controls on the manufacture, import and export of substances that deplete ozone in the atmosphere.	N/A
Ozone Protection Act 1989 (NSW)	EPA	This Act provides a broad power to make regulations to control or prohibit the production and use of: <ul style="list-style-type: none"> Substances that deplete stratospheric ozone when emitted into the atmosphere, and Articles that contain or use those substances in their operation. 	N/A
Pesticides Act 1999 (NSW)	EPA	This act aims to promote the protection of human health, the environment property and trade in relation to the use of pesticides, with regard to the principles of Ecologically Sustainable Development.	Y Use of approved chemicals and competent service providers.
Pesticides Regulation 2009 (NSW)	EPA	Requires users of pesticides for commercial or occupational purposes, or in connection with agriculture, farming or forestry operations, to make and keep record of pesticide use.	Y Use of approved chemicals and competent service providers.
Protection of the Environment Operations Act 1997 (NSW)	EPA	Aims to protect restore and enhance the quality of the environment in NSW, whilst maintaining Ecologically Sustainable Development.	Y EPL is current and activities are licensed
Protection of the Environment Operations (General) Regulation 2009 (NSW)	EPA	This Regulation sets out fees for environment protection licences and notices. It also gives effect to the National Environment Protection (National Pollution Inventory) Measure.	Y EPL is current and activities are licensed. NPI reporting annually.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Protection of the Environment Operations (Noise Control) Regulation 2008 (NSW)	EPA	This regulation controls noise emissions from motor vehicles, vessel and certain articles such as lawn mowers, air conditioners, chainsaws, sirens, horns, sound systems and alarms by regulating their sale and/ or use. It also provides for the inspection and testing of noise emission levels and provides for the issuing of defective vehicle and vessel notices.	Y Noise conditions and controls assigned to relevant sites. Evident within EPL's and consents where relevant.
Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008 (NSW)	EPA	To regulate the commissioning and decommissioning of underground petroleum storage tanks	Y Only has above ground bulk diesel storage.
Protection of the Environment Operations (Waste) Regulation 2005 (NSW)	EPA	This Regulation sets out the way in which waste must be stored or transported, and the reporting, record keeping requirements and describes the types of licences needed for the handling of waste.	Y Licensed service providers are used.
Radiation Control Act 1990	EPA	The object of this Act is to secure the protection of persons and the environment from exposure to harmful ionising and non-ionising radiation to the maximum extent that is reasonably practicable, taking into account social and economic factors and recognising the need for the use of radiation for beneficial purposes.	Y Required radiation substances registered. Relevant sites registered to 'sell / posses radiation substances.
Rail Safety Act 2008 (NSW)	ITSRR	Having regard to the importance of rail safety and regulatory efficiency, the objects of this Act are to provide for improvement of the safe carrying out of railway operations, to provide for the management of risks associated with railway operations, to make special provision for the control of particular risks arising from railway operations, and to promote public confidence in the safety of transport of persons or freight by rail.	Y Use licensed service providers to manage the rail line maintenance and operations and to provide rail haulage services.
Soil Conservation Act 1938 (NSW)	EPA	This Act provides for the conservation of soil resources, farm water resources and for the mitigation of erosion.	Y Mining and construction activities approved by relevant authorities.

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

State Environmental Planning Policy (Major Development) 2005 (NSW)	DP&E	SEPP MD was prepared to identify projects which would fall under Part 3A of the EP&A Act and clearly articulate the role of the Minister for Planning as the consent authority. Schedule 1 of SEPP MD identifies the different classes of development which are defined as Major Development. Clause 5 refers to mining, petroleum production, extractive industries and related industries, including: (1) <i>Development for the purpose of mining that:</i> (a) <i>is coal or mineral sands mining, or</i> (b) <i>is in an environmentally sensitive area of State significance, or</i> (c) <i>has a capital investment value of more than \$30 million or employs 100 or more people.</i>	Y All proposed development is assessed to determine if it meets the criteria of being Major Development.
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (NSW)	DP&E	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (SEPP Mining) consolidates and updates planning provisions related to mining and extractive industries as well as requiring potential environmental and social impacts to be addressed. Notwithstanding the provisions of any other planning instrument Part 2 of SEPP Mining enables underground mining on any land with consent.	The SEPP is consulted to determine the approval requirements for any proposed project.
State Environmental Planning Policy No.44 – Koala Habitat Protection (NSW)	DP&E	Schedule 1 of State Environmental Planning Policy 44 - Koala Habitat Protection (SEPP 44) identifies local government areas where koalas are known to occur. Under SEPP 44, core koala habitat is defined as an area of land with a resident population of koalas, as evidenced by attributes such as breeding females (that is, females with young) and recent sightings and historical records of a population. Potential koala habitat is defined under SEPP 44 as areas of native vegetation where the trees of the types listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.	Wollongong and Wingecarribee Local Government Areas (LGAs) are identified in Schedule 1 of SEPP 44.
State Environmental Planning Policy No.33 – Hazardous and Offensive Development (NSW)	DP&E	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) provides definitions for ‘hazardous industry’, ‘hazardous storage establishments’, ‘offensive industry’ and ‘offensive storage establishment’. The definitions enable decisions to approve or refuse a development to be based on the merit of a proposal.	N/A
State Environmental Planning Policy (Infrastructure) 2007 (NSW)	DP&E	State Environmental Planning Policy (Infrastructure) 2007 (SEPP Infrastructure) facilitates the effective delivery of infrastructure across the State.	May apply to the Wongawilli Rail Spur

Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Sydney Water Catchment Management Act 1998 (NSW)	SCA	The Sydney Water Catchment Management Act 1998 is administered by the SCA. The role of the SCA is to: a) to manage and protect the catchment areas and catchment infrastructure works, and b) to be a supplier of raw water, and c) to regulate certain activities within or affecting the outer catchment area as well as the inner catchment area.	WCL liaises with the SCA with regard to all its activities in the catchment.
Threatened Species Conservation Act 1995 (NSW)	OEH	Set of factors to investigate impacts on threatened species.	Y 7 Part tests conducted by expert service providers.
Water Act 1912 (NSW)	DTIRIS – DPI (Office of Water)	Concerned with the redirection, or variation of a watercourse, the discharge of any mine-water from the site, and any quality or changes to subsurface waters.	Y Considered and addressed within all necessary mining related approval applications.
Waste Avoidance and Resource Recovery Act 2001 (NSW)	EPA	This Act promotes waste avoidance and resource recovery. It establishes a scheme to promote extended producer responsibility in place of industry waste reduction plans.	Y Use of licensed contractors for the removal of waste.
Water Management Act 2000 (NSW)	DTIRIS – DPI (Office of Water)	The objectives of this Act are to provide the sustainable and integrated management of the water sources of NSW for the benefit of present and future generations. It applies the principles of Ecologically Sustainable Development, and aims to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity.	Y Considered and addressed within all necessary mining related approval applications.
Wollongong Local Environmental Plan 2009 (NSW)	WCC	The Wollongong Local Environmental Plan 2009 (WLEP 2009) was gazetted in February 2010 and applies to part of the Wongawilli pit top area and to the underground mining area located within the Wollongong LGA. The LEP has listed parts of the NRE Wongawilli Colliery as possessing heritage value.	Y
Wollongong Local Environmental Plan (West Dapto) 2010 (NSW)	WCC	The Wollongong Local Environment Plan (West Dapto) LEP 2010 (WDLEP 2010) rezoned land in the vicinity of Wongawilli Village and West Dapto for urban expansion. The LEP has listed parts of the NRE Wongawilli Colliery as possessing heritage value	Y Site will be managed in accordance with heritage guidelines
Wingecarribee Local Environmental Plan 1989 (NSW)	WSC	Part of the Colliery lease area is within Wingecarribee LGA and is zoned 5(c) Special Uses (Water Catchment) under the Wingecarribee Local Environmental Plan 1989 (Wingecarribee LEP 1989)	Y Site will be managed in accordance with heritage guidelines

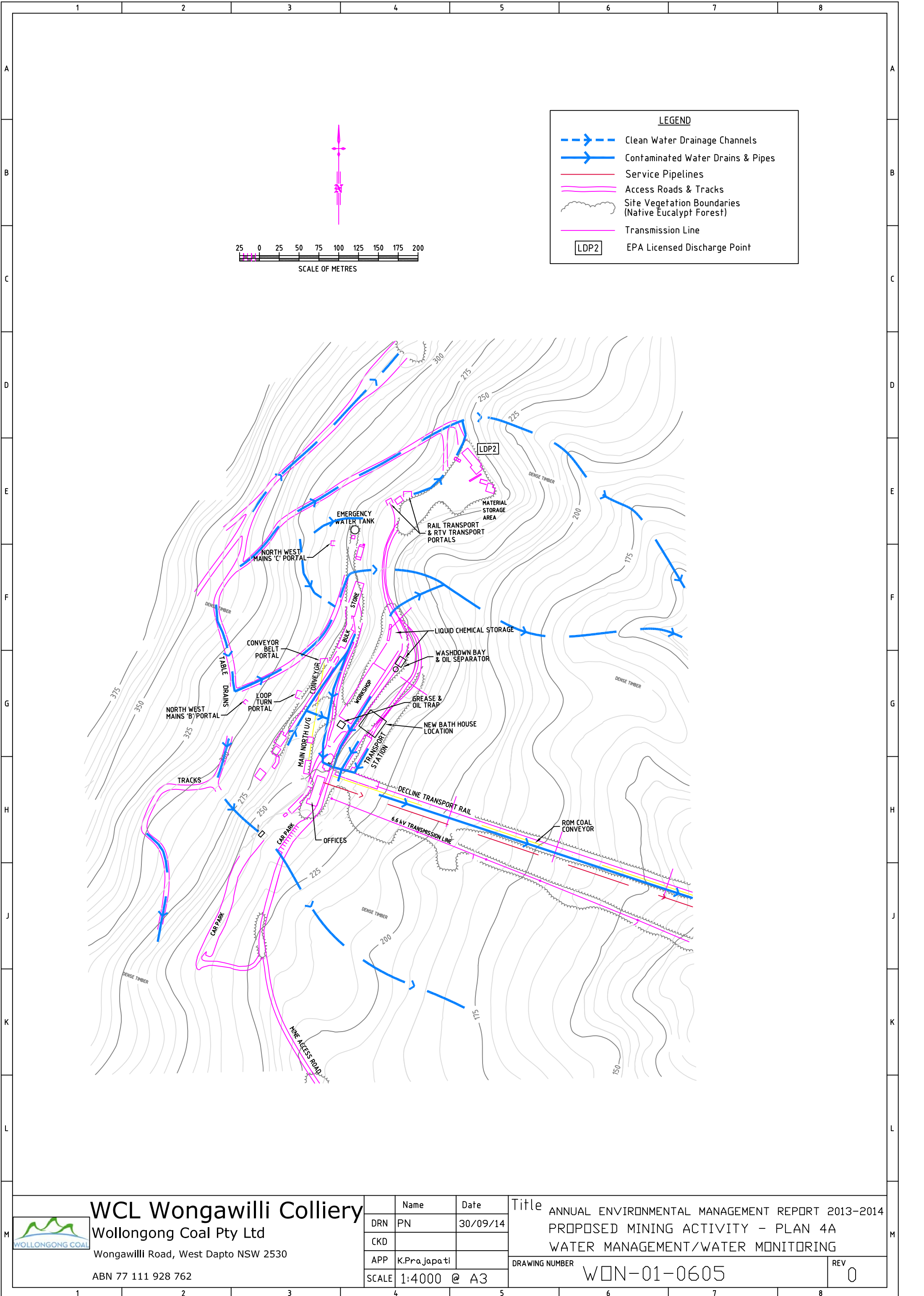
Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

Draft Wingecarribee Local Environmental Plan 2007 (NSW)	WSC	<p>Under the Draft Wingecarribee Local Environmental Plan 2007 (Draft Wingecarribee LEP 2007) land within the PAA is zoned E2 Environmental Conservation. The objectives of the zone are to:</p> <ul style="list-style-type: none"> to protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values; and to prevent development that could destroy, damage or otherwise have an adverse effect on those values. <p>Industry is prohibited within zone E2 Environmental Conservation. It is noted that SEPP Mining permits the development, notwithstanding the provisions of the draft LEP.</p>	Y
---	-----	---	---



Site	Wongawilli Colliery	DOC ID	
Type	Report	Date Published	16/01/2015
Doc Title	Annual Review/Annual Environmental Management Report		

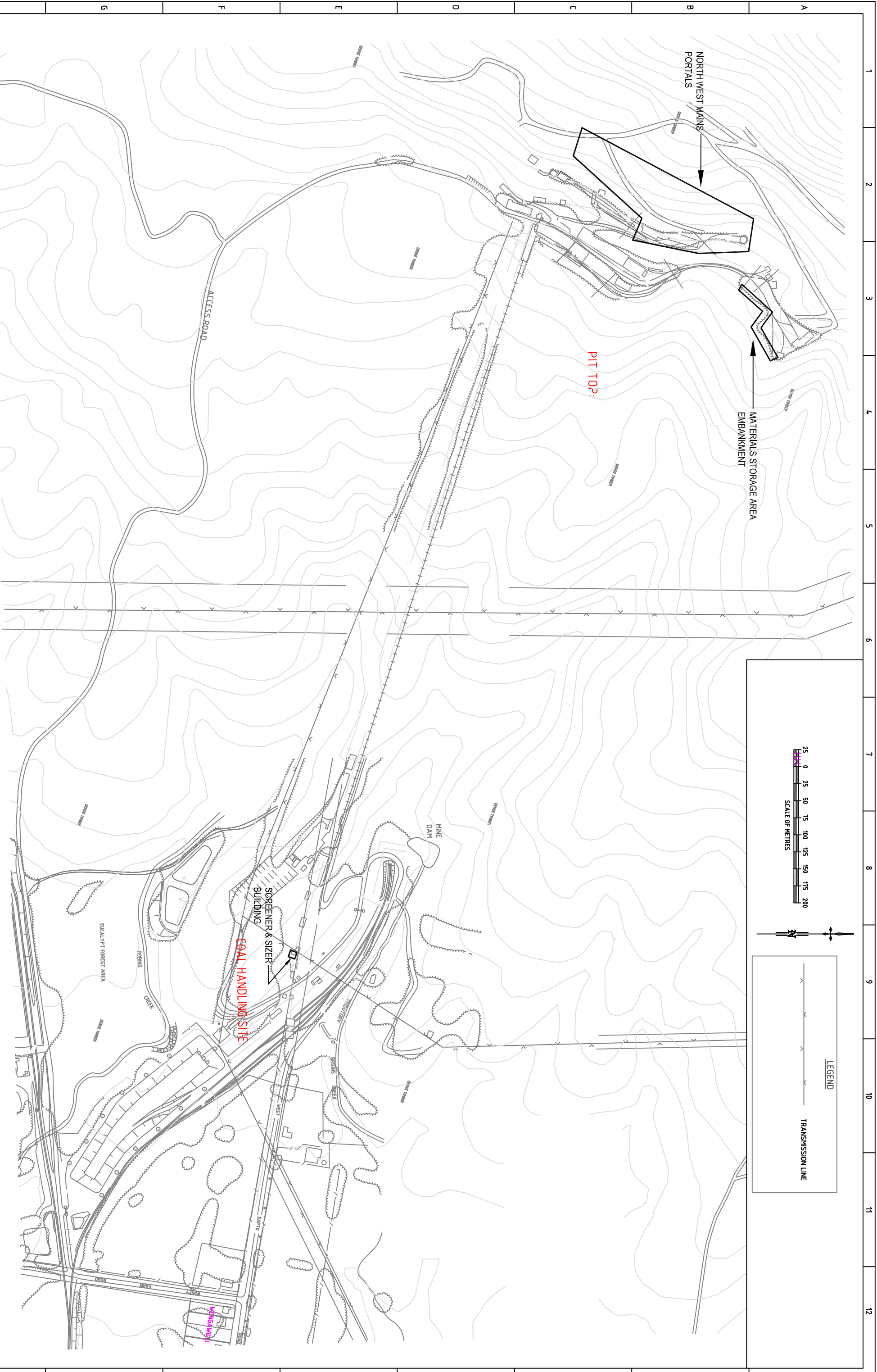
Appendix E - Drawings



WCL Wongawilli Colliery
Wollongong Coal Pty Ltd
Wongawilli Road, West Dapto NSW 2530
ABN 77 111 928 762

	Name	Date
DRN	PN	30/09/14
CKD		
APP	K.PraJapati	
SCALE	1:4000 @ A3	

Title	ANNUAL ENVIRONMENTAL MANAGEMENT REPORT 2013-2014	
	PROPOSED MINING ACTIVITY - PLAN 4A	
	WATER MANAGEMENT/WATER MONITORING	
DRAWING NUMBER		WON-01-0605
		REV 0

[illegible]

