Enhance Place Pty Limited
ABN: 31 077 105 867

PINE DALE MINE

ANNUAL ENVIRONMENTAL MANAGEMENT REPORT 2015

Prepared by: Enhance Place Pty Ltd
February 2016

TITLE

Name of Mine:	Pine Dale Mine
Titles/Mining Leases:	ML1569, ML1578, ML1664, ML1637
Project Approval Number:	10_0041
MOP Commencement Date	April 2014
MOP Completion Date	April 2017
AEMR Commencement Date:	1 January 2015
AEMR Completion Date:	31 December 2015
Name of Leaseholder:	Enhance Place Pty Limited
Reporting Officer:	Mr Graham Goodwin
Title:	Mining Engineering Manager
Signature:	
Date:	26-2-16

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EXECUTIVE SUMMARY

Energy Australia (EA) owns Enhance Place Pty Ltd (Enhance Place) which operates the Pine Dale Mine located approximately 17km northwest of Lithgow in the Western Coalfields of New South Wales.

Coal extraction was most recently undertaken within the Yarraboldy Extension consistent with Project Approval 10_0041 (Approval). Granted by the Minister for Planning and Infrastructure on 20 February 2011 the Approval provided for the extraction of up to 800,000 tonnes of Run of Mine coal through to 31st December 2014. In April 2014 approved mineable resources were exhausted with the mine then entering into care and maintenance.

The Pine Dale Mine Annual Environmental Management Report (AEMR) has been prepared pursuant to Schedule 5, Condition 3 of the Project Approval 10_0041 and in accordance with the *Department of Trade and Investment - Division of Resources and Energy Guidelines to the Mining, Rehabilitation and Environmental Management Process* (EDG03).

The Pine Dale Mine achieved an acceptable standard of environmental performance during the reporting period as evidenced by the following:

- Air quality monitoring results recorded during the reporting period for depositional dust, total suspended particulates (TSP) and fine particulate matter (PM_{10}) were well below the NSW Environmental Protection Authority (EPA) assessment criteria in Blackmans Flat and other privately owned properties adjacent to Enhance Place Mining Leases;
- There were no noise exceedances from mining activities recorded at privately owned properties recorded during the reporting period;
- There were no surface water discharge events during the reporting period;
- Water monitoring results were compliant with Environment Protection Licence 4911.

During the reporting period, an assessment of rehabilitation areas was completed (refer to Appendix C). Rehabilitation areas are generally stable in both the pasture and treed revegetation areas with an overall reduction in weed presence. In the 2016 reporting period it is recommended to continue weed management and implement strategies to enhance pasture establishment within Areas B and C and increase groundcover within the Area A treed rehabilitation site.

A localised oil spill from large mining machinery was observed in the Workshop area during the 2014 AEMR site inspection. DRE and EPA requested that the issue be addressed as a priority, with the provision of a report detailing the actions taken to stop the leaking machinery; the clean-up of the contaminated material; and the monitoring undertaken to confirm hydrocarbon contamination had been removed. A Validation of Contamination Removal Report was submitted to DRE in December 2015 detailing the validation testing of the site and the confirmation that residual risks were low for both human health and the environment. DRE were satisfied with the report and the remedial actions undertaken at the site.

1 INTRODUCTION AND GENERAL OBJECTIVES

EnergyAustralia (EA) owns Enhance Place Pty Ltd (Enhance Place) which operates the Pine Dale Mine near Lithgow in the Western Coalfields of New South Wales (refer to Plan 1.) EA acquired the Pine Dale Mine in June 2012.

Pine Dale Mine is located at Blackmans Flat, 17km north of Lithgow off the Castlereagh Highway. The site is approximately 3km via the Castlereagh highway from the Mt. Piper Power Station (MPPS) and immediately across the Highway from the Springvale Joint Venture Coal Preparation & Handling Facility.

This Annual Environmental Management Report (AEMR) refers to the environment and community performance of the Pine Dale Mine from 1 January 2015 to 31 December 2015 (Reporting period).

This report has been prepared in accordance with the *Department of Trade and Investment - Division of Resources and Energy (DRE) Guidelines to the Mining, Rehabilitation and Environmental Management Process* (EDG03).

This AEMR has been prepared pursuant to Schedule 5, Condition 3 of Project Approval (PA) 10_0041 granted by the Department of Planning and Infrastructure (DP&I) under section 75J of the Environmental Planning & Assessment Act 1979 (EP&A Act) 20 February 2011.

The Yarraboldy Extension PA10_0041 provides for the extraction of up to 800,000 tonnes (t) of Run of Mine (ROM) through to 31 December 2014 at a maximum rate of 350,000 tonnes per annum (tpa).

During the reporting period no mining extraction occurred as Approved mining resources were exhausted in March 2014. For the entire 2015 reporting period, the mine was under care and maintenance, with only rehabilitation activities undertaken at the site.

This AEMR is distributed to the following stakeholders:

- NSW Department of Planning & Environment (DPE);
- NSW Department of Industry - Resources and Energy (DRE);
- Environment Protection Authority (EPA);
- Lithgow City Council (LCC).
- Pine Dale Mine Community Consultative Committee (CCC)

1.1 Consents, Leases and Licences

Pine Dale Mine operates in accordance with relevant licenses and approvals which are summarised in **Table 1**.

Table 1
Status of Consents, Leases and Licences

Permit Type	Permit Number	Relevant Dates	Description
Project Approval	PA 10_0041	Granted 20 February 2012 Expires 31 December 2014	Granted by Minister of DP&I, Section 75J of the EP&A Act. A modification to PA 10_0041 was granted in March 2012.
Environmental Protection Licence	EPL 4911	Review Due Date 29 Aug 2018	EPL held by Enhance Place Pty Ltd
Mining Lease	ML1578 (Act 1992)	Granted 15 March 2006	ML 1578 incorporates 69.4ha of land within the boundary of the Pine Dale Mine site.
Mining Lease	ML 1569 (Act 1992)	Granted 4 July 2007	ML1569 incorporates 161 ha
Mining Lease	ML1664 (Act 1992)	Granted 10 January 2012	ML 1664 incorporates 4.1 Hectares of land within the boundary of the Pine Dale Mine site.
Mining Lease	ML1637 (Act 1992)	Granted 18 June 2012	ML1637 covers an area to the south of Pine Dale Mine for the purpose of proposed rail infrastructure.
Consolidated Coal Lease	CCL770	Expires 2025	CCL770 covered 432 ha of land, approximately 40 ha of which is now owned by Enhance Place. The remainder is NSW State Forest land.
Bore Licence	10BL165933	Granted 22 December 2005	Issued by the Department of Natural Resources (DNR) under Part 5 of the Water Act 1912 for the use of six piezometers for monitoring groundwater levels and quality.
Bore Licence	10BL604181	Dated 23 November 2010	This licence was issued by DECCW – NOW under Part 5 of the *Water Act 1912* for interception and use of up to 200ML of groundwater per year.
Flood Control Works Licence	10CW801601	Dated 23 December 2005	Issued by the DNR under Part 8 of the *Water Act 1912* for the construction of noise/flood bunding along the boundaries of Mining Areas A, B and C.

1.2 Actions Required from Previous AEMR Review

A letter of acceptance for the 2014 AEMR was received from DRE on the 11 August 2015. Actions required by DRE, and where they have been addressed in the 2015 AEMR are provided in **Table 2**.

Table 2
Actions Required from 2014 AEMR Review

Item	Action Required (2014 AEMR)	AEMR Section
1	*Report on the progress of the recommendations made in the Pine Dale Mine 2014 Rehabilitation Monitoring Report.*	Section 5.2
2	*Oil Leaks from machinery parked in workshop area – Provide a report of the actions taken to stop the leaking machinery and clean up the contaminated material including monitoring undertaken / planned to confirm the hydrocarbon material has been removed.*	Section 3.16
3	*Infestation of African Lovegrass in Area C – Please provide details of the weed management program and report on the results of this program in the next AEMR.*	Section 3.8
4	*Commitments made in the Pine Dale Mine Care and Maintenance MOP regarding the addition of soil ameliorants across the Pine Dale rehabilitation sites have not been initiated. A Soil Amelioration Plan needs to be submitted to DRE detailing the process, timing and management of the soil amelioration that is to be undertaken.*	Section 5.2

1.3 Mine Contacts

The Contact details for Pine Dale Mine are listed in **Table 3**.

Table 3
Mine Contacts

Contact Person	Position	Telephone	Facsimile
Mr Graham Goodwin	Mining Engineering Manager	(02) 6355 7893	(02) 6355 7894

2 SUMMARY OF OPERATIONS

2.1 Exploration

There was no exploration drilling activities carried out at the Pine Dale Mine during the reporting period.

2.2 Land Preparation

Land preparation, which occurs directly in advance of open cut mining, involves the clearing of generally remnant vegetation, stripping and removal of topsoil, subsoil and clay, and the removal of overburden by trucks. The waste rock is loaded by an excavator into the haul trucks where it is transported to previously mined areas waiting to be backfilled.

During the reporting period, there were no land preparation activities carried out at Pine Dale Mine.

2.3 Construction

No construction work was undertaken at the Pine Dale Mine during the reporting period.

2.4 Mining

During periods of operation, Pine Dale Mine uses an excavator and fleet of trucks for the extraction of coal from multiple seams and the removal of overburden. The overburden and interburden waste rock is removed using a combination of rip, push and blasting methods. Blasted and ripped waste rock is loaded by an excavator into the haul trucks where it is transported to previously mined areas waiting to be backfilled.

During the reporting period there were no mining activities occurring at the Pine Dale Mine. The production and waste volumes during the reporting period are summarised in **Table 4**.

Table 4
Production and Waste Summary

	Cumulative Production		
	Start of Reporting Period	**End of Reporting Period**	**End of Next Reporting Period (estimated)**
Topsoil Stripped	0	0	0
Topsoil used/spread	0	0	0
Waste Rock	0	0	0
Ore	n/a	n/a	n/a
Processing Waste	n/a	n/a	n/a
Product	0	0	0

2.5 Coal Processing

There is no Coal Preparation Plant at the Pine Dale Mine and so no processing waste is produced. All ROM coal extracted from the open cut is transported by haul trucks to the onsite coal crushing plant where it is sized and screened into product coal with a top size ≤50 mm. The screened coal is either temporarily stockpiled or transported directly to the MPPS.

At the completion of mining extraction in April 2014 the coal crushing plant was decommissioned.

COAL TRANSPORTING

Product coal is delivered to the MPPS by covered road trucks via the Angus Place to MPPS Private Haul Road. In accordance with PA 10_0014, coal transport activities occur between the hours of 7:00am to 8:00pm, Monday to Saturday, and at no time on Sundays or public holidays. Pursuant to Schedule 3, Condition 35 of PA 10_0041, no product coal was transported to the MPPS via the Castlereagh Highway during the reporting period.

Due to the care and maintenance status, no product coal was transported during the reporting 2015 period.

2.6 Waste Management

Overburden and interburden is placed in waste dumps until shaping of the final land formation is required. No overburden or interburden was removed from site during the reporting period.

All hydrocarbon products are securely stored within a bund to prevent any land or water contamination. Hydrocarbons from equipment maintenance undertaken on the site are collected in drums and removed from site by the Mining Contractor.

A localised oil spill was observed in the Workshop area during the 2014 AEMR site inspection on the 9th June 2015. Details of the actions taken in relation to the clean-up of the site and prevention of reoccurrence are presented in **Section 3.16**.

All general wastes originating from the office, amenities, ablutions and first-aid facilities, together with routine maintenance consumables from the servicing of mobile equipment (e.g. air filters) are disposed of in closed garbage bins located adjacent to the amenities building. The bins are collected weekly by licensed waste contractors (SITA Lithgow) and the contents disposed of at Council's Waste Depot. All recyclables are placed in separate bins for collection and recycling.

2.7 Product Stockpiles

When mining extractions activities were being undertaken, the capacity of the ROM stockpile was 20,000 t whilst the capacity of the product stockpile was limited to 5,000 t. As the mine entered into care and maintenance in early 2014, the product stockpiles were decommissioned during the entire 2015 period.

2.8 Water Management

On a regional scale, the Pine Dale Mine lies within the Neubeck's Creek catchment which is a sub-catchment of the Upper Cox's River catchment, which in turn is part of the Warragamba Catchment, administered by Water NSW.

The runoff from the surrounding area reports to the Cox's River via Neubeck's Creek (a perennial tributary) which runs into Blue Lake, a former open cut mining void. Neubeck's Creek is understood to flow intermittently (noting that many of its tributaries are temporary), with flows influenced by water discharges from other upstream industrial land uses.

The water management system at Pine Dale Mine has been designed as a closed loop system, with all clean water diverted around the mining site. It is also designed not to discharge any water from the site into Neubeck's Creek unless required to under an emergency. Drainage of surface water within the site is generally to the south and southeast following the natural topography for treatment prior to discharge into the underground workings (see **Plan 4**). The runoff from the north is captured in temporary sumps and used as dust suppression when required.

STORED WATER

There are no permanent water storage structures at the Pine Dale Mine. Clean water diversion structures are utilised at the site in conjunction with temporary sediment ponds. Temporary sediment ponds are constructed downslope of disturbed areas to ensure the capture of 'dirty' water and treatment prior to discharge into the underground workings.

GROUND WATER

There was no measurable groundwater intercepted during the reporting period. More details and results of groundwater monitoring are discussed in **Section 0**.

SURFACE WATER

During the reporting period, all surface water monitoring at the Pine Dale Mine was undertaken in accordance with EPL 4911. **Table 5** details the locations, frequency and sampling methods for surface water monitoring. The parameters analysed were consistent with the requirements of EPL 4911. Results of surface water monitoring are discussed in **Section 3.4** and at **Appendix B**.

No discharge of waters via LDP13 occurred during the reporting period.

Potable Water for use in the offices and amenities is sourced from town water mains supply.

Table 5
Surface Water Monitoring Locations and Frequency

Monitoring Location	Type of Monitoring Point	Frequency	Sampling Method
Point 2	Ambient Water Monitoring	*Quarterly*	Grab sample for Oil & Grease, TSS, filtered iron and sulphate concentrations. Probe for pH, Electrical Conductivity and Turbidity measurements.
		Daily during discharge for pH, EC and turbidity	
Point 3	Ambient Water Monitoring	*Quarterly*	
		Daily during discharge for pH, EC and Turbidity	
LDP 13	Discharge monitoring (to surface water)	*Weekly during discharge*	
		Daily during discharge for pH, EC and Turbidity	
Point 14	Ambient Water Monitoring	*Quarterly*	
		Daily during discharge for pH, EC and turbidity	

2.9 Hazardous Materials Management

During mining activity, hazardous materials stored on site are limited to bulk storage of diesel fuel and small quantities of miscellaneous chemicals for vehicle maintenance (i.e. oils and lubricants). The diesel storage capacity at the Pine Dale Mine is 30,000L and is stored in a tank located within a bunded steel container with lockable doors. It is located together with the associated bowser in the fuel bay in the northern corner of the maintenance area. Diesel fuel is delivered to site by a mobile diesel tanker as required.

There are no bulk oils stored on site. Oils are brought onto site as required by the Mining Contractor. Waste oil and oil drums are removed from site by the Mining Contractor for disposal. Material Safety Data Sheets (MSDS) accompany the materials on site and are kept in a folder with the Hazardous Materials Register, located in the main office.

During the care and maintenance term, fuel and oils was held on site in the event machinery is required to assist with rehabilitation activities.

2.10 Other Infrastructure Management

There is no other infrastructure outside that described above at the Pine Dale Mine.

3 ENVIRONMENTAL MANAGEMENT

The Pine Dale Mine regards sound environmental performance and community liaison as integral components of its operations. Pine Dale Mine seeks to:

- Minimise the impact of its operations on the environment through effective environmental management;
- Communicate with the community, consider its concerns and expectations and move to a solution;
- Ensure that employees and contractors recognise they are accountable for their actions;
- Comply with applicable environmental laws and other obligations;
- Use effective environmental management to comply with all environmental laws and minimise adverse environmental impacts;
- Provide awareness training for employees;
- Monitor, audit, and review performance;
- Communicate with key stakeholders, the community and government;
- Promote active employee participation to continuously improve environmental management and performance;
- Reduce and reuse waste where practicable; and
- Undertake appropriate decommissioning and rehabilitation.

ENVIRONMENTAL MONITORING

The monitoring program in the MOP provides a reference for all the environmental monitoring procedures and timing for monitoring to be undertaken during the care and maintenance of the Pine Dale Mine.

Locations of monitoring sites are shown in **Appendix A**.

RISK ASSESSMENT

In order to identify areas where mining and mining related activities have the potential to place the natural environment at risk, the risk matrix shown in **Table 6** has been developed for the Pine Dale Mine. The identification and assessment of environmental risks at the mine has allowed appropriate management plans and procedures to be developed to minimise the potential risk to the environment.

Table 6
Environmental and Rehabilitation Risk Matrix

	Issue	Land preparation, vegetation and topsoil stripping[6]	All construction activities including earth moving[6]	Mine development and mining, surface and underground[6]	Use/maintenance of roads, tracks and equipment	Waste rock emplacement management	Mineral processing facilities and infrastructure	Ore/product stockpiling and handling[6]	Water management including term event contingencies	Hazardous materials and fuel, handling/spills management	Sewerage	Rubbish disposal	Rehabilitation activities	Rehabilitated land and remaining features
Air Quality	Air pollution – dust/other	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	
Water	Erosion / sediment minimisation	✓	✓		✓		✓	✓					✓	
	Surface water pollution[1]	✓	✓		✓		✓	✓		✓	✓	✓	✓	
	Ground water pollution			✓					✓					
Soil	Contaminated or polluted land	✓	✓	✓	✓								✓	
Flora	Threatened flora protection	✓	✓											
Fauna	Threatened fauna protection	✓	✓											
Flora	Weed control and management	✓	✓		✓								✓	✓
Noise	Operational noise	✓	✓	✓	✓		✓	✓					✓	
	Vibration / air blast				✓									
Visual Amenity	Visual amenity, stray light[2]	✓	✓	✓	✓		✓	✓				✓	✓	
Heritage	Aboriginal heritage[3]													
	Natural heritage conservation[4]													
Fire Mgt	Spontaneous combustion			✓				✓						
	Bushfire	✓			✓								✓	
	Mine subsidence													
Soil and Water	Hydrocarbon contamination						✓			✓				
	Methane drainage / venting													
Public Safety	Public safety[5]	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	

1 - Off site pollution only.
2 - Construction and production activities will occur between 7:00am and 6:00pm and hence stray light is not likely to affect visual amenity. Transport and maintenance activities are permitted at later times each day.
3 - No items of Aboriginal heritage significance have been identified within the site.
4 - The site is highly disturbed and does not contain items / areas of natural heritage significance.
5 - All activities carry some form of risk to public safety; however, there will be no public access to areas where these activities are undertaken.
6 – Not relevant when mine in care and maintenance

ENVIRONMENTAL MANAGEMENT

Environmental management is reflected in procedures outlined in the MOP.

3.1 Meteorological Monitoring

In accordance with Schedule 3, Condition 22 of PA 10_0041, Pine Dale Mine operates a meteorological monitoring station. A summary of monthly meteorological monitoring results are presented in the following sections and **Appendix B**.

RAINFALL

Pine Dale Mine received 756.2mm of rainfall and experienced 144 rainfall days during the 2015 reporting period. Rainfall during this reporting period was observed to be greater than rainfall recorded in 2014 (704.8mm and 145 rainfall days). The monthly rainfall data for 2015 is summarised in **Table 7.**

TEMPERATURE

Temperature is monitored at two heights (2 metres and 10 metres respectively) to account for temperature inversions. The maximum temperature recorded during the reporting period was 35.5°C at 2m and 32.7°C at the 10m sensor, during December. The lowest temperature occurred in July, with a recording of -7.9°C at 2m and 10m. A summary of monthly temperatures for 2015 is included in **Table 7**.

WIND SPEED, DIRECTION & SIGMA THETA

Recordings of wind parameters are monitored from the stations' 10 metre mast. Predominant wind directions at the site in 2015 were observed to be from the west to north-westerly quadrant, and from a south-easterly direction; however wind directions were shown to fluctuate on a seasonal basis. During Summer the predominant direction was observed to be south east and east-south-east, whilst during Autumn, Winter and Spring the wind was predominantly from the west-north-west.

The maximum wind speed measured at the site was 17.9m/s in July 2015 from a north-westerly direction. Sigma theta data was measured continuously throughout the entire 2015 monitoring period. A summary of monthly wind speed, predominant directions and sigma theta recordings in 2015 is included in **Table 7**.

RELATIVE HUMIDITY

Relative humidity was measured in the 2015 monitoring period. A summary of monthly humidity variations for 2015 is included in **Table 7**.

Table 7
Pine Dale Mine Meteorological Station Summary 2015

Month	Rainfall (mm)	Cumulative Rainfall (mm)	No of Rain Days/ Month	Air Temp. @ 2m (°C)			Air Temp. @ 10m (°C)			Sigma theta (º)			Relative Humidity (%)			Wind Speed (m/s)			Modal Wind Direction
				Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	
January	124.2	124.2	13	18.7	4.8	31.9	18.3	4.7	30.3	32.1	0.0	103.6	72.8	16.3	97.0	1.5	0.0	12.3	SE
February	36.4	160.6	14	18.5	8.0	32.8	18.0	7.9	30.9	36.4	0.0	103.1	73.7	19.7	97.0	1.1	0.0	10.0	ESE
March	30.0	190.6	7	16.4	1.3	32.3	16.4	1.6	31.0	31.3	0.0	102.1	67.3	13.2	96.8	1.4	0.0	12.8	SE
April	177.8	368.4	20	12.0	-0.6	25.9	11.8	-0.6	24.5	26.9	0.0	100.2	81.4	34.9	96.9	1.5	0.0	16.5	SSE
May	25.0	393.4	14	8.8	-3.3	20.0	8.8	-3.2	19.5	26.3	0.0	102.8	78.3	30.6	97.5	1.7	0.0	15.1	WNW
June	27.6	421.0	14	5.6	-7.0	17.1	5.7	-7.0	16.5	23.0	0.0	100.6	81.4	21.4	96.6	1.0	0.0	13.7	WNW
July	46.0	467.0	15	4.1	-7.9	15.5	4.1	-7.9	14.6	24.5	0.0	100.2	79.5	22.0	97.0	1.7	0.0	17.9	WNW
August	47.6	514.6	11	6.3	-5.7	20.4	6.2	-5.5	19.4	23.1	0.0	102.1	75.3	30.7	96.9	1.7	0.0	13.8	W
September	17.0	531.6	13	8.7	-4.1	23.5	8.5	-4.3	22.3	25.2	0.0	100.0	70.9	9.1	96.9	1.4	0.0	17.2	WNW
October	71.6	603.2	9	14.9	0.8	30.7	14.6	0.8	29.8	28.6	0.0	100.9	68.1	11.1	96.7	1.2	0.0	13.9	WNW
November	77.0	680.2	9	16.8	3.7	33.6	16.4	3.6	32.6	30.1	0.0	101.5	67.1	12.4	97.3	1.6	0.0	15.1	SE
December	76.0	756.2	5	19.0	5.2	35.5	18.4	5.2	32.7	31.2	0.0	101.3	58.5	7.3	95.3	1.4	0.0	14.9	ESE
TOTAL	**756.2**	**-**	**144**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Minimum	**17.0**	**-**	**5**	**-**	**-7.9**	**-**	**-**	**-7.9**	**-**	**-**	**0.0**	**-**	**-**	**7.3**	**-**	**-**	**0.0**	**-**	**-**
Maximum	**177.8**	**-**	**20**	**-**	**-**	**35.5**	**-**	**-**	**32.7**	**-**	**-**	**103.6**	**-**	**-**	**97.5**	**-**	**-**	**17.9**	**-**

3.2 Air Quality

Air quality management is a priority at the Pine Dale Mine. During mining extraction, onsite dust suppression is performed using a 50,000L tanker from water accumulated in the in-pit sumps, sediment basins, or from the abandoned Wallerawang Colliery underground workings. The tanker will typically make four trips on dry days targeting the active haul roads, and only if necessary on wet days. During care and maintenance water for dust suppression was sourced from the onsite sediment basins.

Air quality is monitored at eleven locations including ten depositional dust gauges (DDG) and one high volume air sampling (HVAS) site which monitors Total Suspended Particulates (TSP) and particulates less than 10µm (PM_{10}). Monitoring is performed by RCA Laboratories- Environmental and a summary report on data collected throughout the reporting period is available in **Appendix B**.

DEPOSTIONAL DUST

Depositional Dust results for the period January – December 2015 show an annual average insoluble solids range of 0.5 g/m² per month to 1.5 g/m² per month for all dust gauges. These results fall well below the nominated assessment criteria of an annual average of 4.0 g/m² per month, as stipulated in the OEH (DEC) document Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (August 2005)

Table 8
Depositional Dust Monitoring Results

Date	Total Insoluble Solids (g/m².month)									
	Dust Gauge ID									
	D1	D2	D3	D4	D5	D6	PCB1	PCB2	PCB3	PCB7
Jan-15	1.1	0.8	1.2	1.0	1.2	2.9	1.6	0.7	0.7	1.4
Feb-15	0.8	0.9	1.2	0.8	2.3	1.0	0.8	0.5	0.8	1.2
Mar-15	1.0	0.8	1.3	0.8	4.4	1.2	1.3	0.9	0.9	1.4
Apr-15	0.7	0.7	FB	0.8	0.5	1.6	2.1	0.4	0.6	0.7
May-15	0.4	0.3	1.0	0.4	0.4	0.6	1.4	1.0	0.9	0.4
Jun-15	0.6	0.2	0.5	0.3	2.4	0.7	0.5	0.4	0.3	0.3
Jul-15	0.4	0.2	0.3	0.1	0.1	0.6	0.5	0.3	0.2	1.0
Aug-15	0.4	0.3	0.6	0.2	2.0	0.9	0.6	0.2	0.5	0.3
Sep-15	RN	0.3	0.6	0.4	0.4	6.8	0.6	0.5	0.6	0.4
Oct-15	0.5	0.4	0.8	0.4	1.3	0.5	0.8	0.6	0.2	0.5
Nov-15	0.1	0.6	1.0	0.5	1.7	0.8	1.7	1.0	0.5	0.6
Dec-15	0.7	0.6	0.9	0.5	0.3	0.6	0.6	0.2	0.1	0.3
Annual Averages										
2012	0.9	0.6	1.0	0.5	0.7	0.8	4.9	1.1	0.7	1.7
2013	1.6	0.7	0.9	0.6	0.6	1.0	0.8	0.6	0.6	0.4
2014	0.9	0.6	0.9	0.5	0.7	0.6	0.9	0.7	0.7	0.7
2015	0.6	0.5	0.9	0.5	1.4	1.5	1.0	0.6	0.5	0.6
OEH Annual Average Assessment Criteria	**4.0**									

Notes: RN – Sample invalid; crucible broken during analysis.
FB – Sample contaminated by feathers and bird droppings; sample rejected.

HIGH VOLUME AIR SAMPLES

Annual average PM_{10} and TSP monitoring results are summarised in **Table 9** and presented in **Appendix B**. All PM_{10} results recorded 24-hour average concentrations below the 50µg/m³ Impact Assessment Criteria (IAC) for 2015. The highest PM_{10} result recorded for 2015 was 27µg/m³ on 19th December 2015. The annual average PM_{10} result recorded in 2015 was 8.4µg/m³ which is well below the long term 30µg/m³ annual average assessment criteria. The highest TSP result recorded for 2014 was 57µg/m³ on 18th March 2015. The 2015 period's annual average TSP result recorded was 18.0µg/m³ which is well below the 90µg/m³ assessment criteria.

The long term average annual PM_{10} and TSP levels are all within the nominated assessment criteria. Results also demonstrate consistent PM_{10} and TSP levels were recorded at the site throughout the 2011 to 2015 monitoring period (see **Table 9**). A slight increase in both PM_{10} and TSP levels between 2011 and 2012 is most likely attributed to the commencement of mining in 2012, whilst the increase in particulate concentrations between 2012 and 2013 may be attributable to considerably lower rainfall received at the site during the 2013 monitoring period. There has been a notable decrease in levels during 2014 and 2015; this is likely due to the higher rainfall recorded during 2015 and the cessation of mining activities in April 2014.

Table 9
PM_{10} and TSP Summary

	Particulate Matter <10µm (µg/m³)	TSP (µg/m³)
Maximum 24h Average result 2011	35	n/a
Maximum 24h Average result 2012	33	n/a
Maximum 24h Average result 2013	85*	n/a
Maximum 24h Average result 2014	34	n/a
Maximum 24h Average result 2015	27	n/a
PM_{10} 24h Assessment Criteria **	50	Not Required
Annual Average 2011	11	20
Annual Average 2012	11	25
Annual Average 2013	13	26
Annual Average 2014	10	20
Annual Average 2015	8	18
Total Suspended Particulate (TSP)Annual Average Assessment Criteria**	30	90

* Result was influenced by external sources (bushfires) that are outside of the control of the project.
**Air Quality Assessment Criteria listed in the OEH (DEC) document Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (August 2005).

The existing air quality monitoring program and dust management practices will continue to be implemented throughout 2016. All air quality monitoring units will be regularly

calibrated and audited to ensure compliance with the appropriate Australian Standard in 2016.

3.3 Erosion and Sediment

The erosion and sediment controls for Pine Dale Mine have been implemented to safeguard against soil loss and minimise potential water quality impacts. Erosion control structures have been installed around the site with the principle aim of containing sediment at its source. All runoff from disturbed areas is contained in temporary pollution control ponds within the open cut itself and surrounding hardstand areas.

Exposed areas which have been disturbed by the operation are controlled though the use of windrows constructed by subsoil and/or clay material. Once vegetation has been cleared and topsoil removed, subsoil and clay material is pushed against the interface between the disturbed and undisturbed area(s). Dozers are used to build a windrow where the potential for erosion impacts exist, and are also managed through the use of temporary measures, such as silt fencing, to avoid sedimentation impacts on downstream waterways until the area has been rehabilitated. Additionally, temporary sediment ponds are constructed downslope of disturbed areas to ensure the capture of 'dirty' water and treatment prior to discharge into the underground workings. The management measures for the control of erosion described above is also put in place to increase batter and bench stability prior to establishment of permanent rehabilitation measures, where possible.

Erosion control structures at Pine Dale Mine are inspected on a monthly basis, particularly after significant rainfall events and repaired where necessary. Erosion and sediment control works which were undertaken during the 2015 reporting period included:

- The inspection and maintenance of windrows and silt fencing to prevent potential surface water impacts and sediment entering Neubeck's Creek;
- Reshaping and repair of spillway and dam wall at the workshop Sediment dam 2
- Reshaping and repair of drainage lines in Area 8 (further details provided in **Section 5.2**).
- Reshaping, repair and installation of erosion control structures within a drainage line in the Yarraboldy extension area

The effectiveness of the erosion and sediment control structures at Pine Dale Mine was demonstrated by their performance against a number of high rainfall events throughout the reporting period (January 124.2mm and April 177.8mm).

3.4 Surface Water Pollution

Surface water quality at Pine Dale Mine is managed in accordance with the Water Management Plan and the site EPL. Sampling is conducted at a total of eleven locations within and surrounding the mine site. Surface water data is collected by RCA Laboratories and analysed at a NATA registered laboratory.

In accordance with EPL 4911 the following four points are required to be monitored at Pine Dale Mine:

- Ambient Water Monitoring **Point 2** – Upstream of Energy Australia flow gauge;
- Ambient Water Monitoring **Point 3** – 100m downstream of bridge near site office;
- Discharge and Monitoring **Point 13** – Neubeck's Creek concrete lined section; and
- Ambient Water Monitoring **Point 14** – Cox's River downstream of Blue Lake.

A further eight locations are monitored in accordance with the site Water Management Plan:

- S1 – Lamberts Gully Downstream, Neubeck's Creek;
- S2 – Neubeck's Creek at the bridge (site office)
- S3 – Neubeck's Creek, 100m downstream of bridge near site office;
- S4 – Cox's River upstream of Blue Lake
- S5 – Blue Lake upstream of Neubeck's Creek confluence;
- S6 – Neubeck's Creek downstream of discharge point
- S7 – Cox's River downstream of Neubeck's Creek confluence
- The Bong – water dam for dust suppression

The locations of the monitoring points are indicated on the Site Plan in **Appendix A**.

SURFACE WATER CRITERIA AND TRIGGER LEVELS

The site specific Trigger Values developed for the Pine Dale Mine, as stipulated in the sites' Surface Water Management Plan in accordance with Schedule 3, Condition 27(b) of the Project Approval (PA 10_0041) were reviewed in August 2015. The adopted trigger values are detailed in **Appendix B**.

The Surface Water Management Plan details the protocol for the investigation, notification, and mitigation of any identified adverse impacts on surface water quality. The Surface Water Management Plan also provides impact assessment criteria, including trigger levels for investigating any potentially adverse surface water impacts.

SURFACE WATER QUALITY

Surface water samples collected for EPL compliance during the January – December 2015 period show water quality analysis results are generally compliant with the Concentration Limits specified by the Water Management Plan and EPL 4911, however, sites Point 2 and Point 14 exhibited pH concentrations which were intermittently found to be outside of the adopted trigger level range. Surface water monitoring Point 3 was also greater than the adopted Electrical Conductivity trigger value on one occasion during the 2015 monitoring period.

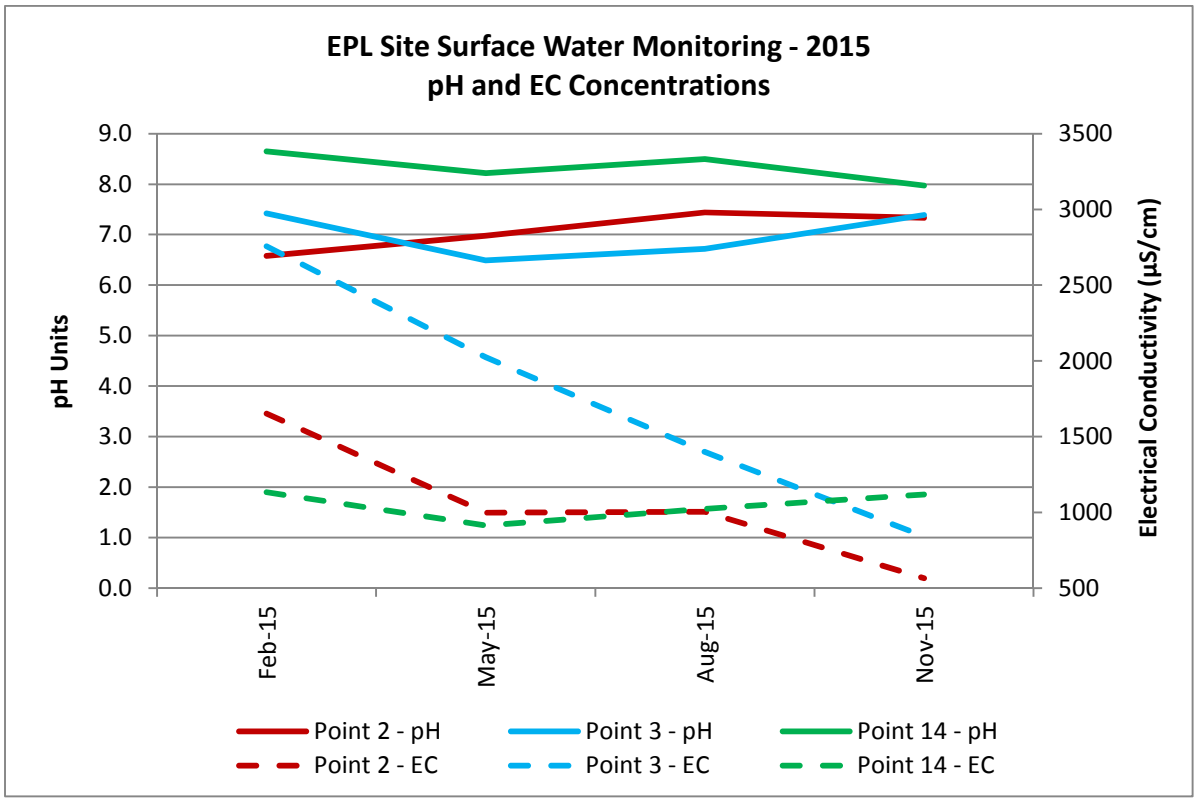
Monitoring Point 2 and Point 3 are ambient surface water monitoring points on Neubeck's Creek and are required to be sampled on a quarterly basis. Monitoring Point 14 is an ambient surface water monitoring point located on the Cox's River which assesses the water quality downstream of the Pine Dale Mine. Point 14 is also required to be sampled on a quarterly basis. There are no EPL Limits for monitoring Points 2, 3 and 14.

There were no controlled surface water discharge events during the reporting period. As such no samples were collected from licensed discharge monitoring Point 13 during the 2015 reporting period. As there was no discharge from licenced discharge Point 13 during the reporting period, EPL 4911 limits were not exceeded.

During the monitoring period, EC was generally shown to decrease or remain stable at the three EPL monitoring sites, whilst pH was observed to be reasonably consistent.

Surface water monitoring results for Environmental Protection Licence compliance for the 2015 period are summarised in **Appendix B**. Results are presented graphically in **Figure 1**.

Figure 1
EPL Surface Water Results Summary



Additional site surface water samples (S1 to S7 & The Bong) associated with the Water Management Plan collected during the January – December 2015 period are generally shown to be consistent over the duration of the monitoring period.

The pH results recorded at monitoring sites S1 to S7 are shown to be stable throughout the sampling period, however, the pH recorded at monitoring site The Bong was shown to fluctuate to a small extent. During the monitoring period, EC was observed to fluctuate across the Neubeck's Creek sampling sites (S1, S3 and S6), whilst S4, S5, S7 and The Bong were observed to be relatively stable. No clear EC trend is evident for the sampling sites. The water level of Neubeck's Creek at monitoring location S2 was stable throughout the duration of the monitoring period.

Additional site surface water monitoring results for Water Management Plan compliance for the 2015 period are summarised in **Appendix B**. Results are presented graphically in **Figure 2** and **Figure 3**.

Figure 2
Additional Site Surface Water Results Summary

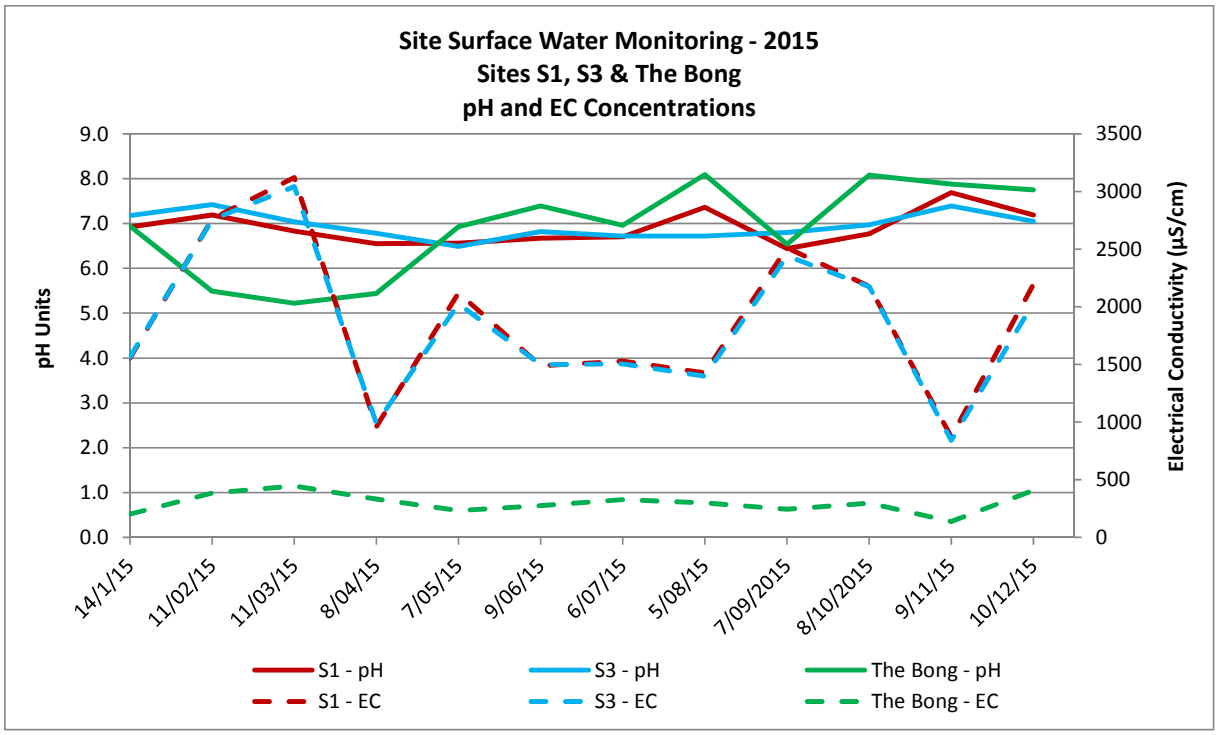
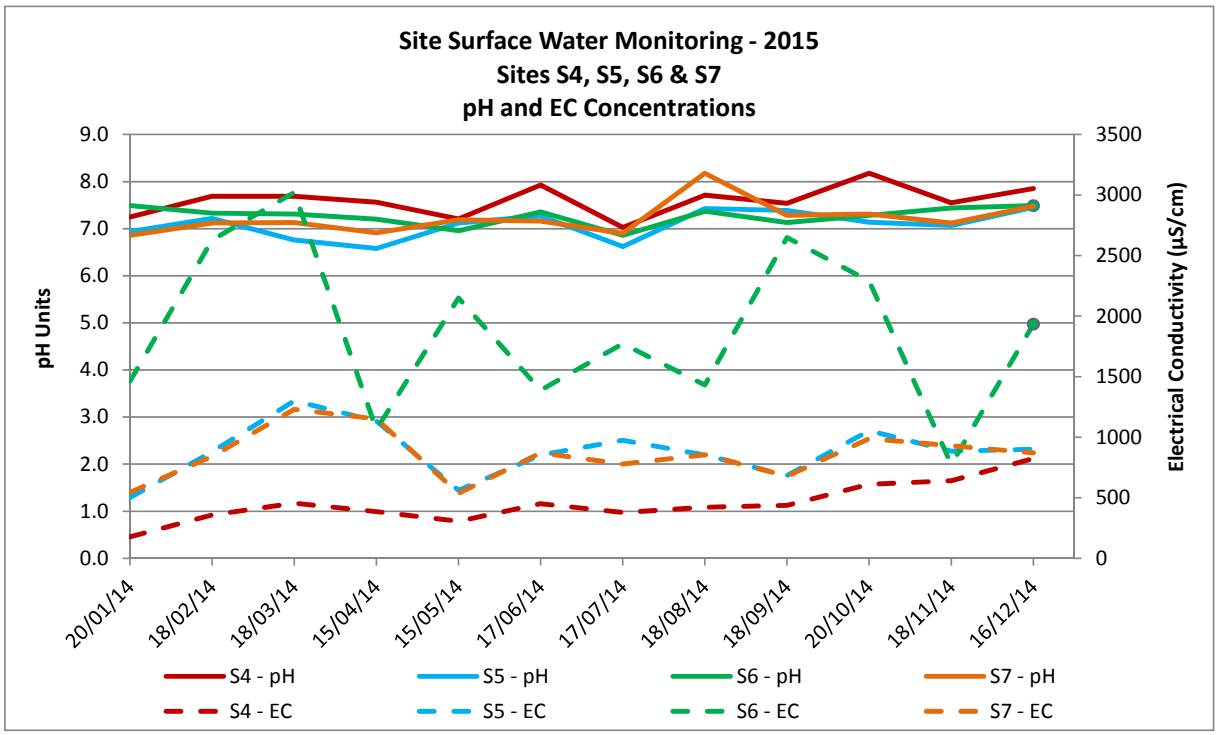


Figure 3
Additional Site Surface Water Results Summary



3.5 Ground Water Pollution

Groundwater data is collected by RCA Laboratories and analysed at a NATA registered laboratory. Groundwater monitoring for the Pine Dale Mine is undertaken in accordance with the approved Groundwater Management Plan (documented within the site Water Management Plan, August 2015). Sampling is conducted at a total of three locations within the mine site; a further five locations surrounding the Yarraboldy Extension area; and two locations at the former Enhance Place Mine Site. Groundwater monitoring is not a requirement of EPL 4911. A copy of the monitoring results is provided in full in **Appendix B**.

GROUNDWATER CRITERIA AND TRIGGER LEVELS

The site specific Trigger Values developed for the Pine Dale Mine, as stipulated in the sites' Groundwater Management Plan in accordance with Schedule 3, Condition 27(c) of the Project Approval (PA 10_0041) were reviewed in August 2015. The adopted trigger level values are detailed in **Appendix B**.

The Groundwater Management Plan details the protocol for the investigation, notification, and mitigation of any identified exceedences of the impacts on groundwater levels. The Groundwater Management Plan also provides the groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts.

GROUNDWATER WATER QUALITY

Groundwater samples collected from the on-site groundwater bores during the January – December 2015 period show water quality results which are consistent throughout the monitoring period. Water quality within the site bores was shown to be somewhat compliant with the trigger levels for key water monitoring parameters pH and EC, as nominated in the Groundwater Monitoring Program (Aug 2015), however, concentrations were intermittently recorded outside of the trigger level ranges.

The EC concentration recorded at the Old Shaft was shown to continuously exceed the conductivity trigger level throughout the 2015 monitoring period. In accordance with the site's Water Management Plan, a continued exceedance of the groundwater quality triggers will act as a prompt for further investigations. An internal investigative report was compiled to examine the exceedances of the trigger level criteria at the Old Shaft sampling well in relation to operations and activities occurring at the site, and local meteorological conditions over the period January 2013 to December 2015 (refer **Appendix B**).

All site bores exhibited standing water levels which were consistent throughout the 2015 monitoring period. There was a slight increase in water level from May to September 2015 at bores P6 and the Old Shaft; however the water level has stabilized to historical levels since November 2015. Trigger levels for water depth were shown to be compliant for the entire monitoring period during at all site bores.

Results of site groundwater bores are presented graphically in **Figures 4** and **5**.

Figure 4
Site Groundwater Bores pH & EC Result Summary – Bores P6, P7 & Old Shaft

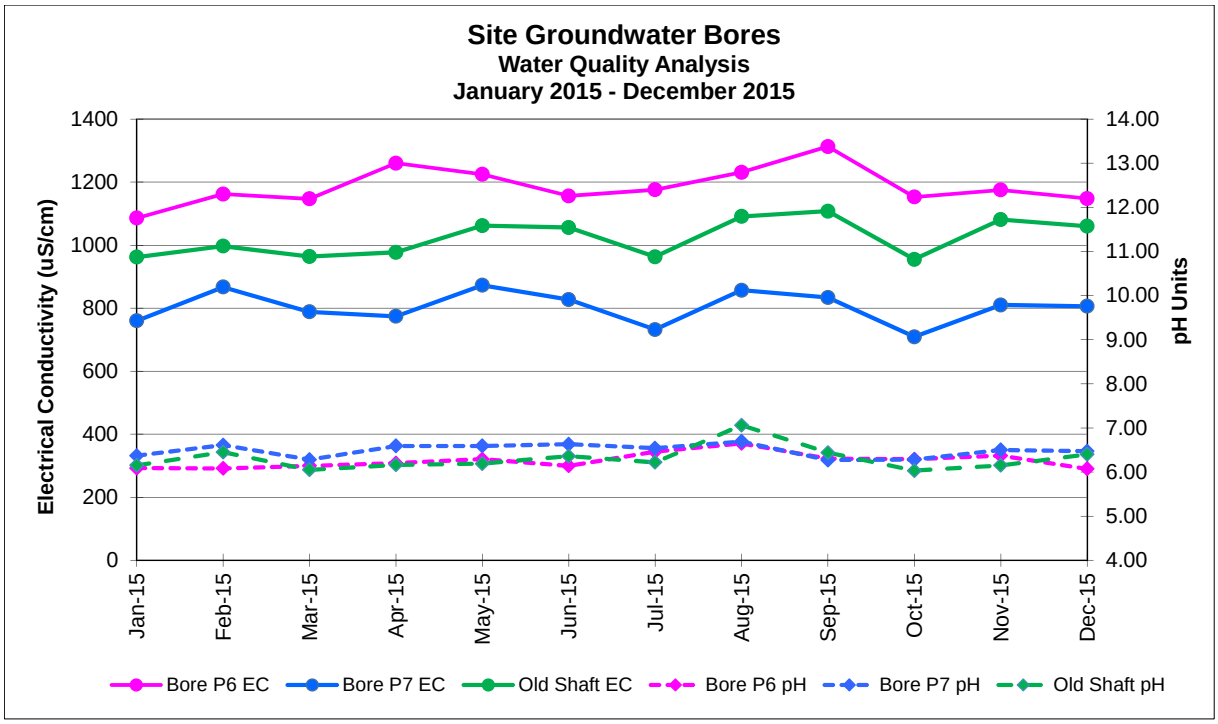
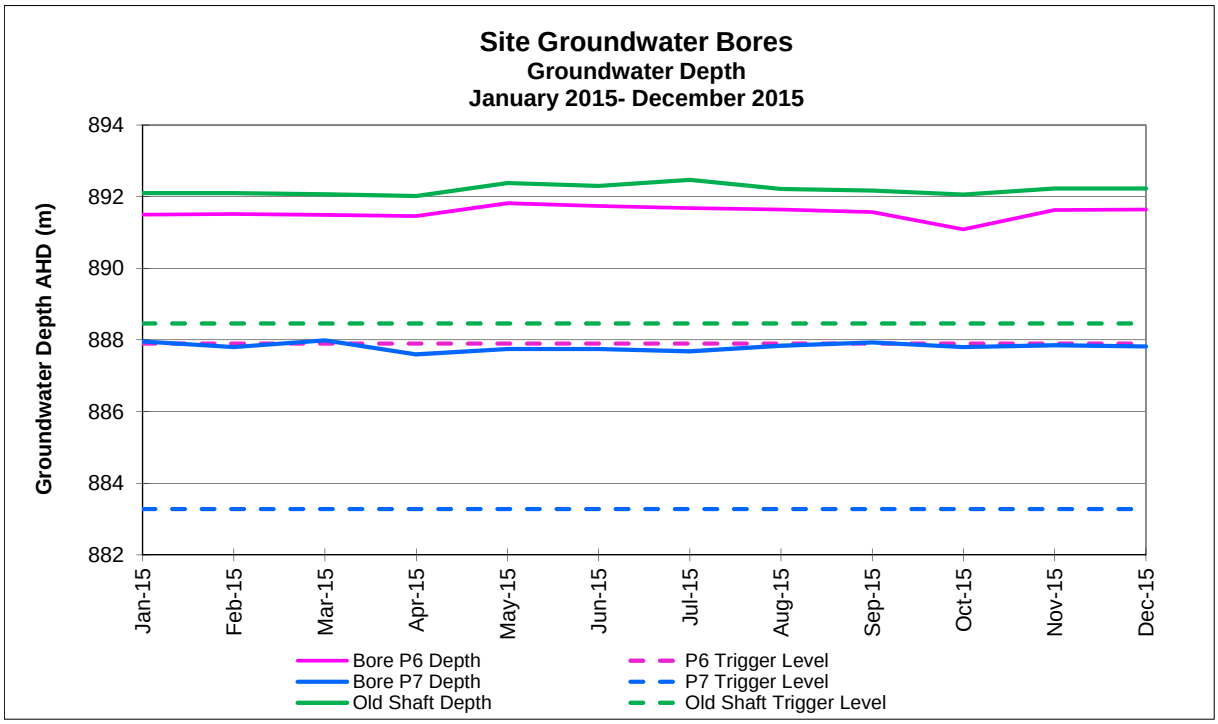


Figure 5
Site Groundwater Bores Water Level Summary – Bores P6, P7 & Old Shaft



The results of quarterly water quality monitoring within the off-site groundwater bores are generally shown to be consistent throughout the 2015 monitoring period. The electrical conductivity levels in Bore D are shown to decrease during December 2015; whilst Bore A exhibited a decrease in electrical conductivity during the June to September 2015 period, however the concentrations are shown to increase again during sampling in December.

Groundwater samples collected from off-site bores are shown to be compliant with the respective pH trigger levels with the exception of Bore A during September 2015; Bore C during June and December 2015 and Bore D during December 2015. During these instances the pH was below the lower pH trigger levels. Electrical conductivity levels were below the respective conductivity trigger levels for all off-site bores during the 2015 monitoring period.

All off-site bores exhibited consistently stable standing water levels throughout the 2015 monitoring period. Trigger levels for water depth were shown to be compliant at all of the off-site groundwater bores during the 2015 monitoring period. Results for off-site groundwater bores are presented graphically in **Figures 6** and **7**.

Figure 6
Off-Site Groundwater Bores Result Summary

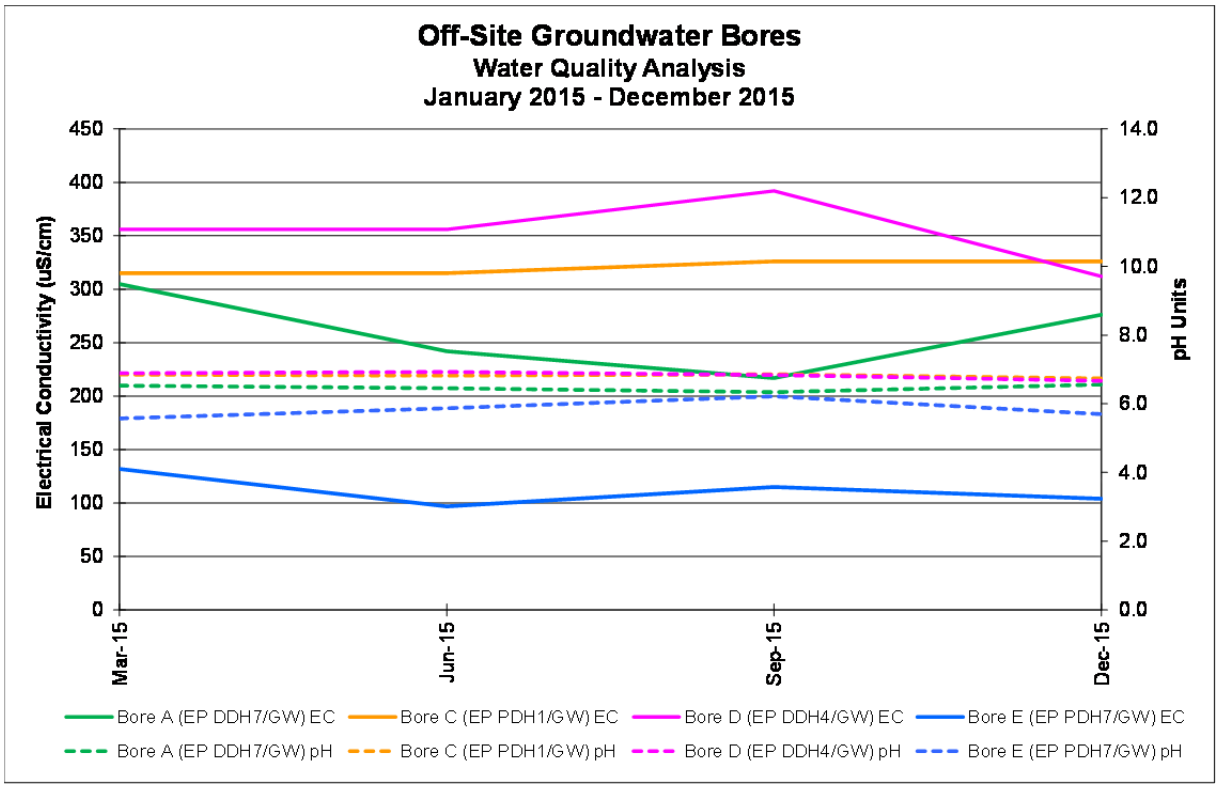
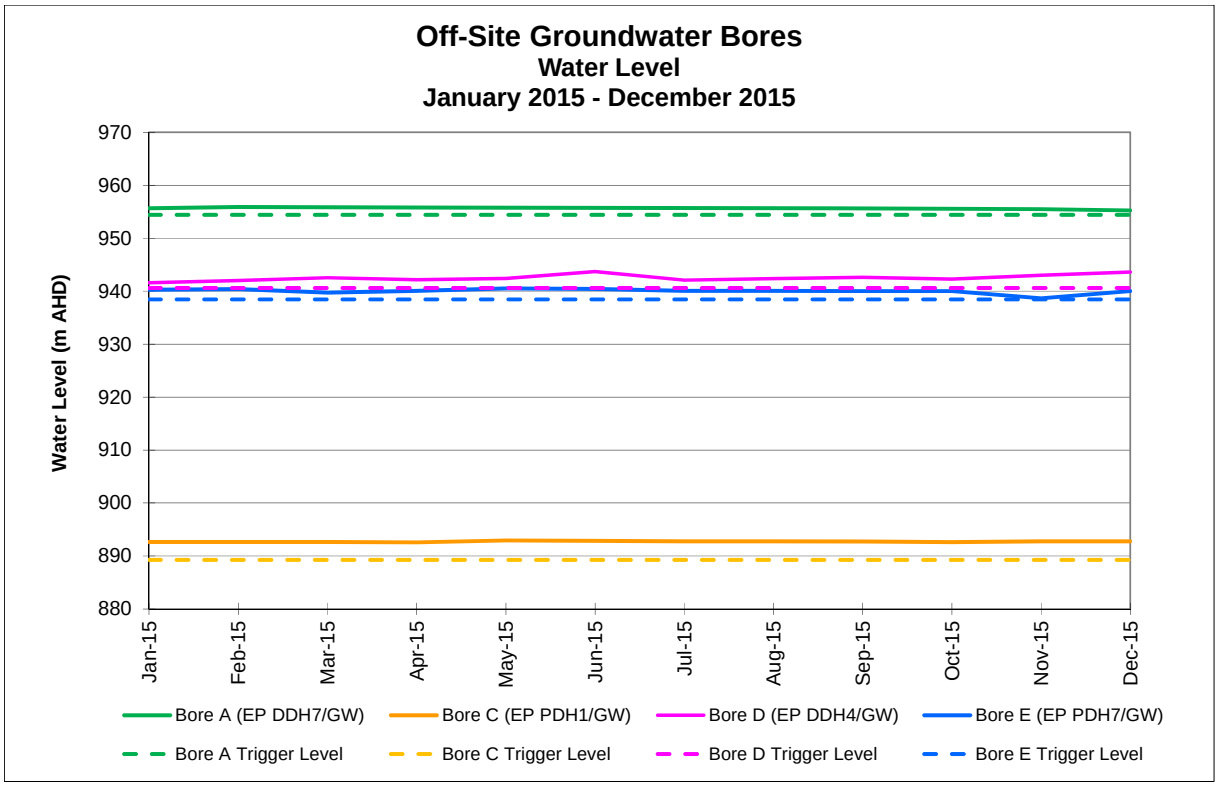


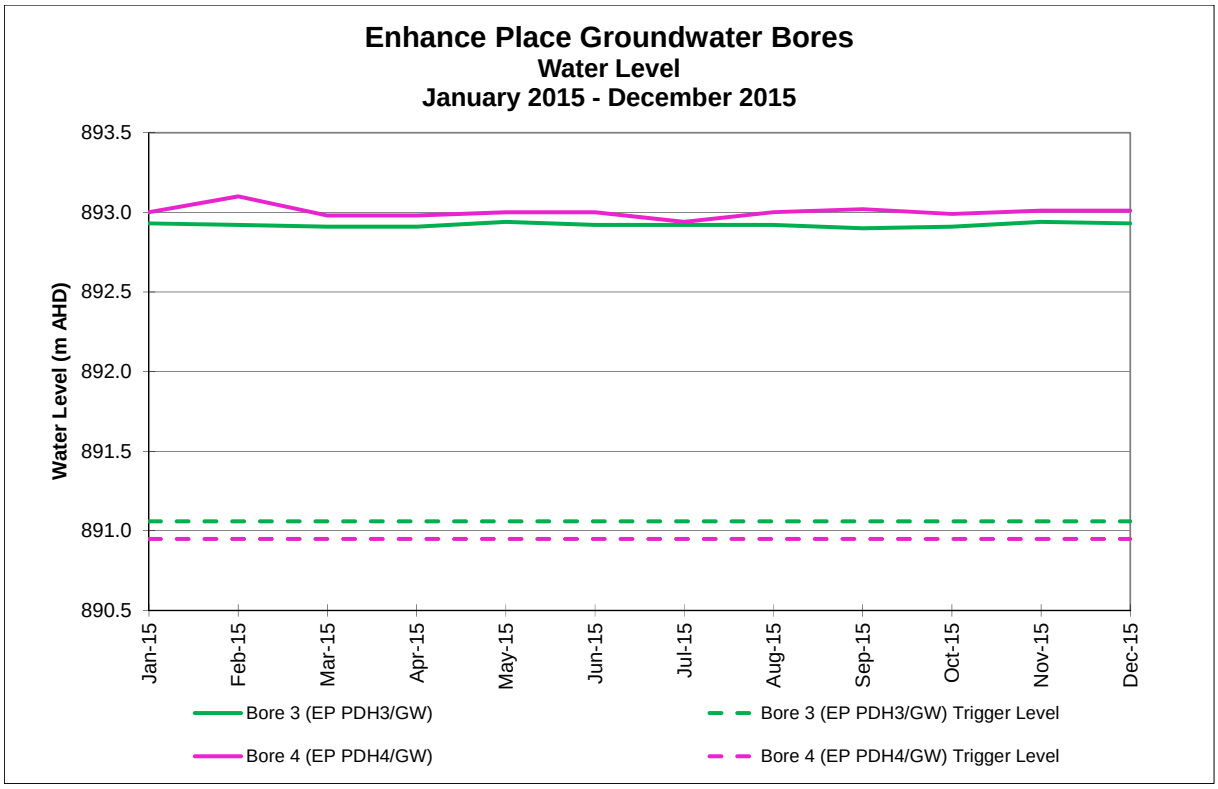
Figure 7
Off-Site Groundwater Bores Water Level Summary



The two monitoring bores located at the former Enhance Place mine generally exhibited standing water levels which were stable throughout the 2015 monitoring period. A slight fluctuation in standing water level was observed between January to March and June to August at Bore 4 (EP PDH4/GW). Water levels recorded were shown to be compliant with the respective standing water level triggers at both bores during the 2015 monitoring period.

Results for the Enhance Place groundwater bores are presented graphically in **Figure 8**.

Figure 8
Enhance Place Groundwater Bores Water Level Summary



A detailed summary of groundwater results can be found in **Appendix A**.

3.6 Contaminated Polluted Land

There was no land identified as being significantly contaminated or polluted during the reporting period, however a localised oil spill was observed in the Workshop area during the 2014 AEMR site inspection on the 9th June 2015. Recommendations were made during the site inspection for the clean-up of the localised spill with waste material to be disposed of at an appropriately licenced facility. Details of the actions taken are presented in **Section 3.16**

3.7 Threatened Flora & Fauna

Measures for the management and mitigation of flora and fauna impacts at Pine Dale Mine and in the surrounding area are provided in the Care and Maintenance MOP and the Flora and Fauna Management Plan. There was no threatened flora or fauna identified during the reporting period.

BATHURST COPPERWING BUTTERFLY

The Bathurst Copperwing Butterfly (BCB), listed as an Endangered species under the *Threatened Species Conservation Act 1995* and Vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999* has been identified adjacent to the eastern boundary of the Pine Dale Mine Yarraboldy Extension within an area of its habitat native Blackthorn (Bursaria spinosa subsp. Lasiophylla). Native Blackthorn is found throughout the local area.

To minimise potential direct and indirect impacts of dust and vibration from the Pine Dale Mine on the BCB, the following mitigation measures have been implemented:

a) maintenance of fencing and earth bunds around known BCB habitat;
b) mining activity not occurring within 200m of the main habitat area between September 2013 through end February 2014, and September 2014 through end February 2015 when the flying season of the adult and larvae stages of the BCB were apparent as determined by an independent ecologist; and
c) implementation of further management and mitigation measures in accordance with Project Approval and *Particular Manner Decision 2011/6016*.

A BCB Monitoring Program has been implemented to monitor potential indirect impacts from extractive mining activities (particularity blasting and vibration) on the known populations of the butterfly. The field survey monitoring is conducted to coincide with the adult and larvae stages of the BCB with monitoring being undertaken by ecologists from Ecological Australia Pty Ltd.

Two field surveys were conducted during the 2015 reporting period in accordance with the Commonwealth Department of Environment (DoE) Notification of Referral Decision measure, as follows:

- March 2015 - field survey of the Purple Copper Butterfly (PCB) within and adjacent to the locations identified in the Notification of Referral Decision to determine the completion of the larval stage.
- September 2015 - weekly survey for the Purple Copper Butterfly (PCB) within monitoring locations identified in the Notification of Referral Decision, to determine whether the adult and therefore the breeding stage of PCB lifecycle had commenced.

Results of the ecologist field monitoring are provided in **Table 10**.

Data collected from dust gauges located within the butterfly habitat area is provided within **Appendix B.**

Table 10
Bathurst Copperwing Butterfly Field Survey Summary

Monitoring season	Purpose of field survey	Date of field surveys	Survey results	Conclusion	Response
2013-2014	To confirm commencement of BCB larval feeding season	5 September 2013	No larvae or evidence of larvae identified; eight adult BCB identified	Due to evidence of adult BCB, precautionary approach taken that BCB larval feeding season has commenced.	No mining activities to occur within 200m of BCB main habitat area.
		13 September 2013	No larvae or evidence of larvae identified; one adult BCB identified		
	To confirm completion of larval stage i.e. larvae not actively foraging above ground, within habitat area	Evening 11- 12 March 2014	No larvae identified	The BCB in larvae form is no longer coming to the surface	Mining activities can recommence within 200m of BCB main habitat area.
2014-2015	To confirm commencement of BCB larval feeding season	5 September 2014	No larvae or evidence of larvae identified; no adult BCB identified	Lack of active larvae observed on the plants inspected suggests that the PCB breeding season had only recently commenced and the adult individuals observed had only recently emerged.	No mining activities to occur within 200m of BCB main habitat area.
		12 September 2014	No larvae or evidence of larvae identified; >36 adult BCB identified		
	To confirm completion of larval stage i.e. larvae not actively foraging above ground, within habitat area	Evening 5 - 6 March 2015	No larvae identified	Larvae have commenced pupation and are no longer active. Larvae stage is complete. The PCB is not expected to reappear above ground until late August/early September.	Mining activities can recommence within 200m of BCB main habitat area.
	To confirm commencement of BCB larval feeding season	4 September 2015	No larvae identified; five adult BCB identified	Lack of active larvae observed on the plants inspected suggests that the PCB breeding season had only recently commenced and the adult individuals observed had only recently emerged.	No mining activities to occur within 200m of BCB main habitat area.

The monitoring program will be reviewed following the completion of the current season monitoring, in line with the mine's current care and maintenance status.

AUSTRAL TOADFLAX (THESIUM AUSTRALE)

Austral Toadflax is listed as vulnerable under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). An erect to scrambling perennial herb it occurs in small population's parasitising a range of grass species which at Pine Dale Mine is Kangaroo Grass. At subalpine and tableland climates the species dies back to rootstock during winter and re-sprouts in spring.

Surveys conducted by Eco Logical Australia in March 2011 identified a total of 260 individual Austral toadflax plants in three patches located beyond the north-west crest of the Yarraboldy Stage 1 Extension pit.

A Species Management Plan completed in consultation with the Department of Environment has been developed to mitigate the impact of open cut mining on the host habitat within the *Austral Toadflax buffer area*. This includes:

- Inclusion of 50m buffer zone from known specimens referred to as the *Austral Toadflax buffer area;*
- installation and maintenance of fencing and signage between the open cut boundary and known location of specimens;
- installation of additional signage and barriers (e.g. tape) when operating in close proximity to the Austral toadflax buffer area; and,
- Control of noxious weed infestations and feral animals.

During the reporting period, mining activity did not encroach within the habitat area (refer to Appendix C). Control of noxious weeds within and surrounding the habitat area will continue to be undertaken in the next reporting period.

3.8 Weeds

Weed control activities at Pine Dale Mine are undertaken in accordance with the Care and Maintenance MOP. Weed control methods target four noxious weeds previously identified within the Pine Dale Mine and Yarraboldy Extension area, namely:

- African Lovegrass (*Eragrostis curvula*);
- Blackberry (*Rubus fruticosus aggregate species*);
- Briar Rose (*Rosa rubiginosa*); and
- St John's Wort (*Hypericum perforatum*).

Weed inspections were undertaken on a regular basis with a large portion of weed problems on the mine's property being sprayed during the reporting period. Active weed control was undertaken during the reporting period in accordance with the following schedule:

- African Love Grass - sprayed in Summer (December 2014, Jan & Feb 2015) and Spring (September, October, November 2015).
- Blackberry - sprayed in Summer (December 2014, Jan & Feb 2015) and Spring (November 2015).
- Briar Rose - sprayed in Summer (December 2014, Jan & Feb 2015) and Spring (October, November 2015).
- St John's Wort - sprayed in Summer (December 2014) and Spring (November 2015).

The Pine Dale Mine Rehabilitation Monitoring Report (Firstfield Environmental, **Appendix C**) indicated some outbreaks of African lovegrass were present at each of the pasture and treed rehabilitation areas, however all occurrences had been recently sprayed and are no longer extant. The report also found the method of African lovegrass control was consistent with legislative requirements.

The control of weeds will be undertaken on an ongoing basis consistent with the Care and Maintenance MOP as required to ensure noxious species are managed accordingly.

3.9 Blasting

During the reporting period there was no blasting activities undertaken at the site, as the site is currently managed under care and maintenance.

3.10 Operational Noise

Mining related noise impacts at Pine Dale Mine are managed in accordance with PA 10_0041, EPL 4911 and the approved Noise Monitoring Program. Noise emissions from Pine Dale Mine operations were monitored on a quarterly basis at six locations surrounding the site during the reporting period by RCA Laboratories (see **Plan 1A**). These locations included:

- NM1 – the Green residence, Blackman's flat;
- NM2 – the Cherry residence, Blackman's flat;
- NM3 – Castlereagh Highway, east of Blackman's flat;
- NM4 – the Rensen residence, north of View Street, Blackman's flat;
- NM5 – the Fraser residence, Wolgan Road, Lidsdale; and
- NM6 – the Turek residence, Wolgan Road, Lidsdale.

The operational noise assessment criteria is 42 dB $L_{Aeq\ (15\ minute)}$ at three of the six monitoring locations (NM1 to NM3); and a noise assessment criteria of 35dB $L_{Aeq\ (15\ minute)}$ at the remaining three monitoring locations (NM4 to NM6). During construction and removal of the amenity bund the noise assessment criteria is 46dB $L_{Aeq\ (15\ minute)}$ at receptors NM1, NM2 and NM3.

Attended quarterly noise monitoring was undertaken routinely during the 2015 reporting period (March, April, July and October) to assess any noise impacts from Pine Dale Mine against relevant criteria detailed within PA 10_0041 and EPL 4911. The measured $L_{Aeq,\ 15min}$ noise contribution from the Pinedale Mine at all noise monitoring locations measured during 2015 were below the target noise goal for all 15-minute surveys.

Results for each noise survey during the reporting period are presented in full in **Appendix B**.

3.11 Visual, Stray Light

There were no adverse impacts associated with stray light or visual disturbance identified during the reporting period. There were no complaints received during the reporting period regarding visual and stray light impacts.

3.12 Aboriginal Heritage

There were no artefacts of Aboriginal Cultural Heritage found at the Pine Dale Mine during the reporting period.

3.13 Natural Heritage

No items or areas of natural heritage significance were recorded or are considered to occur within the approved disturbance area at Pine Dale Mine.

3.14 Spontaneous Combustion

There were no incidences of spontaneous combustion in coal stockpiles or overburden material during the reporting period. The Lithgow Seam is known to have a low propensity for spontaneous combustion. Following approved resources being exhausted, all coal stockpiles have been decommissioned.

3.15 Mine Subsidence

There were no issues regarding mine subsidence during the reporting period.

3.16 Hydrocarbon Contamination

A localised oil spill was observed in the Workshop area during the 2014 AEMR site inspection on the 9th June 2015. Oil leaks were observed from the large mining machinery parked at the site since the start of the care and maintenance period. DRE and EPA requested that the issue be addressed as a priority, with the provision of a report detailing the actions taken to stop the leaking machinery; the clean-up of the contaminated material; and the monitoring undertaken to confirm hydrocarbon contamination had been removed.

A *Validation of Contamination Removal Report* was prepared by RCA Australia and submitted to DRE (received 14 December 2015), which complied with the actions requested by DRE. A total of 70 tonnes of excavated material containing the localised oil leaks was removed from site and disposed of at a Licenced Waste Facility. Validation testing of the site confirmed the residual risks were low for both human health and the environment. A letter from the DRE on 8 January 2016 indicated it was satisfied with the report and the remedial actions undertaken at the site.

It should be noted that the oil spill occurred within a localised zone in the nominated hardstand area designated for heavy machinery park up. As outlined in the Care and Maintenance MOP (Section 3.2.14) there is no contaminated land known to occur at Pine Dale Mine. In the unlikely event that contaminated land is identified at the site, the remedial actions taken shall be those outlined in the MOP, whereby the affected material is either treated on-site or disposed off-site by a licenced contractor.

3.17 Bushfire

Bush fire control strategies for Pine Dale Mine are managed in accordance with the approved Bush Fire Management Plan. These strategies are employed for preventing the occurrence and spread of any fire events that may impact on the site or in surrounding lands (i.e. Ben Bullen State Forest). As such, measures are taken at Pine Dale Mine to prevent the occurrence and spread of fire through proper maintenance of machinery and equipment, and the maintenance of access roads.

During the reporting period there were no bush fire events at or in close proximity to Pine Dale Mine.

3.18 Methane Drainage/Ventilation

The underground workings at this site were closed in 1986 and decommissioned over the period from 1987 to 1990. Methane levels are considered to be negligible at the Pine Dale Mine. There are two remaining entries to the underground workings, being the 1A mine entry and the Punch Mine Entry. These are used as surface water storage facilities as per the approved Water Management Plan.

3.19 Public Safety

No issues of public safety occurred during the reporting period. The entire perimeter of the Pine Dale Mine property is fenced, with "No Trespassing" signs displayed at various intervals. "Do Not Enter" and "Danger" signs are also displayed along the fence of the private sealed haul road. Continuation of the control of trespassing during the reporting period has occurred through routine inspection, monitoring, upgrades and repairs of fencing structures. During the care and maintenance term, the site has continued to be regularly monitored by mine personnel.

3.20 Other Issues and Risks

There are no other known issues or identified hazards at the operating Pine Dale Mine.

4 COMMUNITY RELATIONS

4.1 Environmental Complaints

All stakeholder and community complaints regarding Pine Dale Mine are documented, with appropriate actions taken as soon as possible to determine the likely cause of the complaint and all possible corrective actions to resolve the problem and prevent its recurrence. Complaints are recorded and retained at the site office.

During the reporting period no complaints were recorded, however there were four enquiries /notifications received.

Two enquiries received during the reporting period related to noise monitoring and the potential noise emissions from the proposed Stage 2 works; whilst another enquiry was made regarding dust generation during the application of lime for Pine Dale Mine rehabilitation program. Notification was also received of an incident of trespassing during the reporting period. (see **Table 11**).

Table 11
Community Complaints

Complaint Type	Complaints Received 2015
Noise	0
Air Quality	0
Blasting	0
Traffic	0
Water	0
Other	0
Total Complaints Recieved	**0**
Enquiries/Notifications Received	**4**

4.2 Community Liaison

COMMUNITY CONSULTATIVE COMMITTEE

During the reporting period Community Consultative Committee (CCC) meetings were held on the 25th June and 3rd December 2015.

The Pine Dale Mine CCC commenced in January 2012 and comprises representatives from the local community, LCC and Pine Dale Mine. The Committee meets on a biannual basis to discuss matters relating to the Pine Dale mine. The CCC meeting minutes are made publicly available via the Company's website www.energyaustralia.com.au.

WEBSITE INFORMATION

A website has been established to keep the broader community up to date with recent activities at the Pine Dale Mine in accordance with Schedule 5, Condition 10 of the PA 10_0041. Copies of the following documents are made publicly available on the Energy Australia Website:

- EPL 4911;
- The Environmental Impact Statement;
- Project Approval 10_0041;
- The Care and Maintenance Mining Operation Plan
- Environmental Management Plans for the Pine Dale Mine;
- AEMR Reports;
- Independent Environmental Audits;
- Community Consultative Committee minutes;
- Community complaints;
- Blasting information; and
- Monthly Environmental Performance reports

SOCIAL/ ECONOMIC CONTRIBUTIONS

Pine Dale Mine has contributed to the economy of the district and State by providing direct employment, indirect employment and through the purchase of services and materials from regional suppliers. Coal supplies to MPPS provide competitively priced energy for the NSW electricity market which ultimately flows through to provide economic benefit to electricity consumers.

5 REHABILITATION

5.1 Buildings

There were no buildings removed or constructed during the reporting period.

5.2 Rehabilitation of Disturbed Land

An agronomist was engaged by Pine Dale Mine to inform development of quantitative rehabilitation completion criteria and provide advice and recommendations for pasture improvement strategies, including the addition of soil ameliorants for each of the rehabilitation domains at Pine Dale Mine. The agronomist recommendations have been incorporated within the Care and Maintenance MOP, approved by DRE.

Pine Dale Mine is made up of a series of rehabilitation areas, comprising a series of parcels of land which are at various stages of being progressively rehabilitated back to a self-sustainable native ecosystem (acceptable post-mining land use and capability). This includes Areas A, B, C and 8. As the Yarraboldy Extension may form part of future mining operations, only temporary maintenance activities have and will be undertaken within this area until such time as project approval is obtained. The location of each rehabilitation domain is depicted at **Appendix A**.

A Rehabilitation Monitoring Report was commissioned by FirstField Environmental (2014) which provided an overview of the rehabilitation monitoring conducted at the site and a series of recommendations for the improvement of rehabilitation outcomes. The recommendations made for each rehabilitation area (Area A, B, C and Area 8) and the actions undertaken within each area during this reporting period are detailed further below.

The principal re-vegetation technique currently employed is direct seeding using native tree and shrub species for woodland communities and pasture species for areas intended for agricultural activities.

The proposed final landform aims to emulate the pre-mining environment and to enhance local and regional ecological linkages across the site and surrounding areas. A summary of the disturbed and rehabilitated areas at the Pine Dale Mine can be seen in **Table 15**.

YARRABOLDY EXTENSION

To minimise dust dispersion and soil erosion, overburden stockpiles located within the northern area of the Yarraboldy Extension have been re-contoured and seeded with pasture species.

The amenity bund located along the southern boundary of the Yarraboldy Extension has been re-profiled with the southern batter having a gradient of 18^{o} to minimise erosion and enhance establishment of seedlings. Following the application and tilling of topsoil, a native species grass and tree species seed mix has been applied followed by mulch.

During the reporting period, no additional rehabilitation works were undertaken in the Yarraboldy Extension.

Plate 1 Amenity bund

Plate 2 Amenity bund - application of mulch, grass and native species seed mix.

REHABILITATION AREA A

Seeding of Area A (8 ha) commenced in 2008, with 1500 trees planted. In 2010 an additional 400 trees were planted with the assistance of the Gundungurra Tribal Aboriginal Council. In October 2013 further direct seeding and application of an organic mulch layer and lime was applied however drought conditions in quarter four 2013 limited the outcomes of this work.

A revised rehabilitation strategy was developed in 2014, incorporating recommendations from an agronomist for input within the Care and Maintenance MOP (refer *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place*, SLR 2014). A rehabilitation monitoring report (FirstField Environmental, 2014) also provided recommendations for the improvement of rehabilitation within Area A. The recommendations included in both of these reports are summarised in **Table 12**, below.

Table 12
Recommended Actions for Rehabilitation Area A

Report: *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place* (SLR, 2014)	**Report:** *Pine Dale Mine 2014 Rehabilitation Monitoring Report* (FirstField Environmental, 2014)
Recommended Actions:	**Recommended Actions:**
Continue control of Biddy Bush with current spot spraying regime	Treat surface soil erosion on slopes via placement of cut vegetation or rocks in erosion channels
Continue with further application of mushroom compost, lime & gypsum (10:3:2 tonnes/ha)	Re-sow exposed surfaces with fast-growing groundcover herbs and grasses
Increase potassium by application of Muriate of Potash or similar (0.25tonnes/ha)	Install nesting boxes in close proximity treed rehabilitation area

During the reporting period rehabilitation activities undertaken at Area A included:

- the application of a mushroom compost, lime & gypsum mixture at a rate of 10:3:2 tonnes/ha;
- the direct seeding using local species with locally sourced seed mix comprising Kasbah Cocksfoot (5kg/ha); Atlas Phalaris (1kg/ha); Zulu Arrowleaf Clover (2kg/ha) and Goulburn Sub Clover (2kg/ha);
- the re-application of coarse woody debris along the contour rills to reduce runoff rate and soil loss.
- application of Muriate of Potash at 0.25 tonnes/ha
- intensive weed spraying within Area A (refer **Section 3.8**).

The installation of nesting boxes will be undertaken in Area A when the native tree species are of a suitable size to support the nesting boxes.

The Pine Dale Mine Rehabilitation Monitoring Report (refer **Appendix C**) indicated the living groundcover within the monitoring transects in Area A had increased from 40% in 2014 to 50% in 2015 at Transect 5; whilst an increase from 30% in 2014 to 40% in 2015 was observed at Transect 6.

Plate 3 Area A – Direct Seeding, October 2015

Plate 4 Area A – Revegetation, February 2016, looking north

Plate 5 Area A – Revegetation, December 2015, looking south

REHABILITATION AREA B AND C

Rehabilitation Areas B and C cover an area of approximately 25 ha and have been rehabilitated as pasture. The final landform and water management structures have been completed and the areas seeded for pasture in accordance with Planning Approval 10_0041 and the requirements of the landowner.

The actions recommended for improved rehabilitation of Areas A and B, as presented in the *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place* (SLR 2014) and the Pine Dale Mine Rehabilitation Monitoring Report (FirstField Environmental, 2014) are summarised in **Table 13**.

Table 13
Recommended Actions for Rehabilitation Areas B & C

Report: *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place* (SLR, 2014)	**Report:** *Pine Dale Mine 2014 Rehabilitation Monitoring Report* (FirstField Environmental, 2014)
Recommended Actions:	**Recommended Actions:**
Control of African Lovegrass prior to pasture establishment works	Integrate weed management control methods for noxious weeds.
Ripping with a plough to create furrows, followed by application of pasture seed mix, Muriate of Potash (0.25 tonnes/ha) and Di-ammonium phosphate (DAP) (0.20 tonnes/ha)	
Application of mushroom compost, lime and gypsum over the seed mix (10:4:1 tonnes/ha)	

During the 2015 reporting period the following rehabilitation works were undertaken at Areas B and C:

- tilling of the drainage lines;
- application of hydro-mulch containing a seed mix comprising Kasbah Cocksfoot, Atlas Phalaris, Zulu Arrowleaf and Goulburn Sub Clover; and follow-up watering;
- application of a lime, gypsum and mushroom compost mixture (10:4:1 tonnes/ha);
- application of Muriate of Potash (MOP) at 0.25 tonnes/ha and di-ammonium phosphate (DAP) at 0.20 tonnes/ha.
- intensive weed spraying (refer **Section 3.8**).

Rehabilitation monitoring of Areas B and C will continue to be undertaken to ensure the rehabilitated areas are progressing towards the agreed target levels.

Plate 6 Area B & C – Hydro-mulching of drainage lines, October 2015

Plate 7 Area B & C – Lime, gypsum & compost application, October 2015

Plate 8 Area B & C – Watering of hydro-mulch drainage lines, December 2015

Plate 9 Area B & C – Germination of hydro-mulched drain, December 2015

Plate 10 Area B & C – looking west, December 2015

REHABILITATION AREA 8

Seeding of area 8 (10 ha) commenced in 2008, with a pasture mixture known as 'Cox's River Mix'. The vegetation communities prior to mining include a mixture of cleared land, pasture, pines and eucalyptus.

The actions recommended for improved rehabilitation of Area 8, as presented in the *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place* (SLR 2014) and the Pine Dale Mine Rehabilitation Monitoring Report (FirstField Environmental, 2014) are summarised in **Table 14**.

Table 14
Recommended Actions for Rehabilitation Area 8

Report: *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place* (SLR, 2014)	**Report:** *Pine Dale Mine 2014 Rehabilitation Monitoring Report* (FirstField Environmental, 2014)
Recommended Actions:	**Recommended Actions:**
Control of African Lovegrass prior to pasture establishment works	Treat surface soil erosion on slopes via placement of cut vegetation or rocks in erosion channels
Ripping with a plough to create furrows, followed by application of pasture seed mix, Muriate of Potash (0.25 tonnes/ha) and Di-ammonium phosphate (DAP) (0.20 tonnes/ha)	Re-sow exposed surfaces with fast-growing groundcover herbs and grasses
Application of mushroom compost, lime and gypsum over the seed mix (10:1:3 tonnes/ha)	Install nesting boxes in close proximity treed rehabilitation area

During the reporting period the rehabilitation activities undertaken at Area 8 included:

- the application of a lime, gypsum and mushroom compost mixture a rate of 10:1:3 tonnes/ha; and
- application of
- re-shaping of drainage lines within the area and rock placement in erosion channels.
- intensive weed spraying was undertaken (refer **Section 3.8**).
- application of pasture seed mix along with Muriate of Potash (0.25 tonnes/ha) and Di-ammonium phosphate (DAP) at 0.20 tonnes/ha

The installation of nesting boxes will be undertaken in Area A when the native tree species are of a suitable size to support the nesting boxes.

The Rehabilitation Monitoring Report (refer **Appendix C**) indicated the eastern portion of Area 8 had 80% groundcover, which had decreased 10% since monitoring in the previous reporting period (2014).

Plate 11 Area 8 – Lime, gypsum & compost prior to spreading, October 2015

Table 15
Rehabilitation Summary

	Area Affected/Rehabilitated (ha)		
	To end 2014	**2015**	**2016 (estimated)**
A: MINE LEASE AREA			
A1 Mine Lease Area	98.1	98.1	98.1
B: DISTURBED AREAS			
B1 Infrastructure Area	21.0	21.0	21.0
B2 Active Mining Area	6.6	6.6	6.6
B3 Waste emplacements	17.7	17.7	17.7
B4 Tailings emplacements	N/A	N/A	N/A
B5 Shaped Waste Placement	11.5	11.5	11.5
ALL DISTURBED AREAS	56.8	56.8	56.8
C: REHABILITATION PROGRESS			
C1 Total Rehabilitated Area (except for maintenance)	32	32	32
D: REHABILITATION ON SLOPES			
D1 10 to 18 degrees	3.2	3.2	3.2
D2 Greater than 18 degrees	3	3	3
E: SURFACE OF REHABILITATED LAND			
E1 Pasture and grasses	24.5	24.5	24.5
E2 Native forest/ecosystems	7.5	7.5	7.5
E3 Plantations and crops	0	0	0
E4 Other (include non-vegetative outcomes)	0	0	0

During 2015 additional maintenance activities were conducted on rehabilitated lands in the form of erosion control, fertilizing, seeding and weed mitigation (see

Table 16).

Table 16
Maintenance Activities on Rehabilitated Land

	Area Treated (ha)		
	2015 Period	**Estimated 2016 Period**	**Comment/control strategies/treatment detail**
Additional erosion control works	7	7	Ongoing maintenance of sedimentation fencing was conducted in and around the rehabilitated areas. Re-shaping of drainage lines and rock placement in erosion channels in Area 8. Application of coarse woody debris along the contour rills to reduce runoff rate and soil loss in Area A.
Recovering	0	0	No further topsoil or subsoil sealing was required during the reporting period.
Soil treatment	28	28	Treatment of soils with mushroom compost, lime, gypsum, Muriate of Potash and Di-ammonium phosphate.
Treatment/Management	0	0	No grazing cropping or slashing was conducted during the reporting period.
Re-seeding/Replanting	7 14	7 14	Application of hydro-mulch containing a seed mix comprising Kasbah Cocksfoot, Atlas Phalaris, Zulu Arrowleaf and Goulburn Sub Clover to Area B & C. Direct seeding using local species with locally sourced seed mix comprising Kasbah Cocksfoot (5kg/ha); Atlas Phalaris (1kg/ha); Zulu Arrowleaf Clover (2kg/ha) and Goulburn Sub Clover (2kg/ha) to Area A & Area 8;
Adversely affected by weeds	28	28	Intensive weed spraying was conducted through all rehabilitated areas.
Feral animal control	0	0	No feral animal control was required during the reporting period.

5.3 Other Infrastructure

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

5.4 Rehabilitation Trials and Research

There were no rehabilitation trials or research undertaken during the reporting period.

5.5 Further Development of the Final Rehabilitation Plan

A Care and Maintenance MOP has been formally approved by DRE in February 2015. The CMMOP sets out the rehabilitation objective and criteria during the Care and Maintenance Term. The final landform and rehabilitation plan remains unchanged from that MOP Approved in February 2015.

6 ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

The activities proposed for the 2016 reporting period are consistent with the Care & Maintenance MOP.

MINING

All recoverable coal within the approved mining area were extracted during early 2014. No mining activities are proposed during the 2016 monitoring period.

REHABILATION

Rehabilitation activities were undertaken during the 2015 period on areas that will not be directly impacted by a future mining operation at the Pine Dale Mine. Maintenance and rehabilitation activities as recommended in the Care and Maintenance MOP will continue throughout 2016 (sediment fences, fertilizing, re-seeding, weed control etc).

Further weed spraying is proposed to be undertaken in the next spraying season, followed by re-sowing exposed surfaces with groundcover herbs and grasses as per the recommendations made in the Rehabilitation Monitoring Report (Appendix C).

All maintenance activities required on the rehabilitation areas will continue throughout 2016 (sediment fences, fertilizing, re-seeding, weed control etc.)

FUTURE MINING DEVELOPMENT

Subject to market conditions, in order to maintain supply of commercial coal to MPPS, Enhance Place intends to lodge an application with the Department of Planning and Environment to extend the existing mining operations. Engagement with regulators and other key stakeholders will continue to be undertaken throughout 2016.

APPENDIX A

SITE PLANS 2015

NOTES:

CRAVEN, ELLISTON & HAYES (LITHGOW) PTY.LTD.
CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
ACN 056 544 551
"ASTROLABE" RUTHERFORD LANE, LITHGOW, 2790 PH: (02) 6351 2281, FAX: (02) 6352 1339
EMAIL : survey@ceh.com.au

DATE	31-12-13
AMENDED	
SURVEYOR	AERIAL PHOTO/TE/TH
DRAWN	K.L.F./D.M.
CHECKED	

PINEDALE MINE
AEMR PLAN
END DECEMBER 2013

SCALE - 1 : 4000 (A1 Sheet)

100 80 60 40 20 0 100 200 300 400

DWG No

PINE-AEMR13

Plan 1

Y:\Jobs 531 to 1000\613\Reports\61309 EIS 2013\CAD\ 613EA.dwg 4.4 Ownership-04.03.2014-4:26 PM

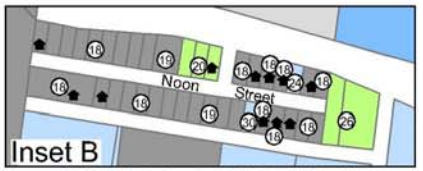
REFERENCE
- Approved Yarraboldy (Stage 1) Extension
- Cadastral Boundary
- Crown Road
- Residence
- (1) Landowner Reference (See Table)
- Energy Australia / Enhance Place Land
- Mining-related Land
- Crown / Government Land
- Ben Bullen State Forest (Forestry Corporation of NSW)
- Privately Owned Land

SCALE 1:25 000 (A4)

250 0 250 500 750 1000 1250 m

Land Ownership Source: Department of Lands - LPI Online Search
Base Map Source: Craven Elliston & Hayes Pty Ltd

Ref	Landowner	Ref	Landowner
1	Crown Land	15	State Land Services
1b	Ben Bullen State Forest (Forestry Corporation of NSW)	16	GC Springvale Pty Limited & Samsung Development (Aust) Pty Limited
2	Centennial Fassifern Pty Limited	17	Centennial Springvale Pty Limited & Samsung Development (Aust) Pty Limited
3	G. & A. Jenkins	18	Centennial Springvale Pty Limited & Springvale SK Kores Pty Limited
4	A. Fraser	19	Ivanhoe Coal Pty Limited
6	R. & H. Taylor	20	W. Doherty
7	K. May	24	The Council of the Shire of Blaxland
8	N. & J. Watson	26	The Trustees of the Catholic Church
9	Enhance Place Pty Ltd	30	The Council of the City of Lithgow
10	P. & E. Barnes	34	Delta Electricity
11	C. Jonkers & J. Favell	38	D.J & J.W Hunt
12	M S & L J Morris	39	Lidsdale Holdings Pty Ltd
13	J. Cope	40	T.L Elms
14	J. Cherry		



INSET A SCALE (A4)

0 100 200 300 400 500 m

Plan 2

LAND OWNERSHIP

BEN BULLEN STATE FOREST

No. 434

No. 1 EXTENSION

Pinedale Leases		
Portion	Coal Lease	Plan
ML81	ML1578	M27054
ML82	ML1569	M27055
ML119	ML1664	M27204
ML340	ML1637	M27161

Enhance Place Leases		
Portion	Coal Lease	Plan
ML35	ML1422	M26857
ML79	ML1458	M26893R
ML80	ML1520	M26982R

ML1637
(Extends to Lidsdale Siding - See Plan M27161)

NOTES:

N

MGA Zone 56

CRAVEN, ELLISTON & HAYES (LITHGOW) PTY.LTD.
CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
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"ASTROLABE" RUTHERFORD LANE, LITHGOW, 2790 PH: (02) 6351 2281, FAX: (02) 6352 1339
Email : survey@ceh.com.au

DATE	19.12.2013
AMENDED	
SURVEYOR	T.E.
DRAWN	D.M.
CHECKED	

ENHANCE PLACE PTY LIMITED
LEASES
PINEDALE OPENCUT MINE & ENHANCE OPENCUT MINE

SCALE - 1:12500 (A3)

DWG No

Plan 3

Plan 4

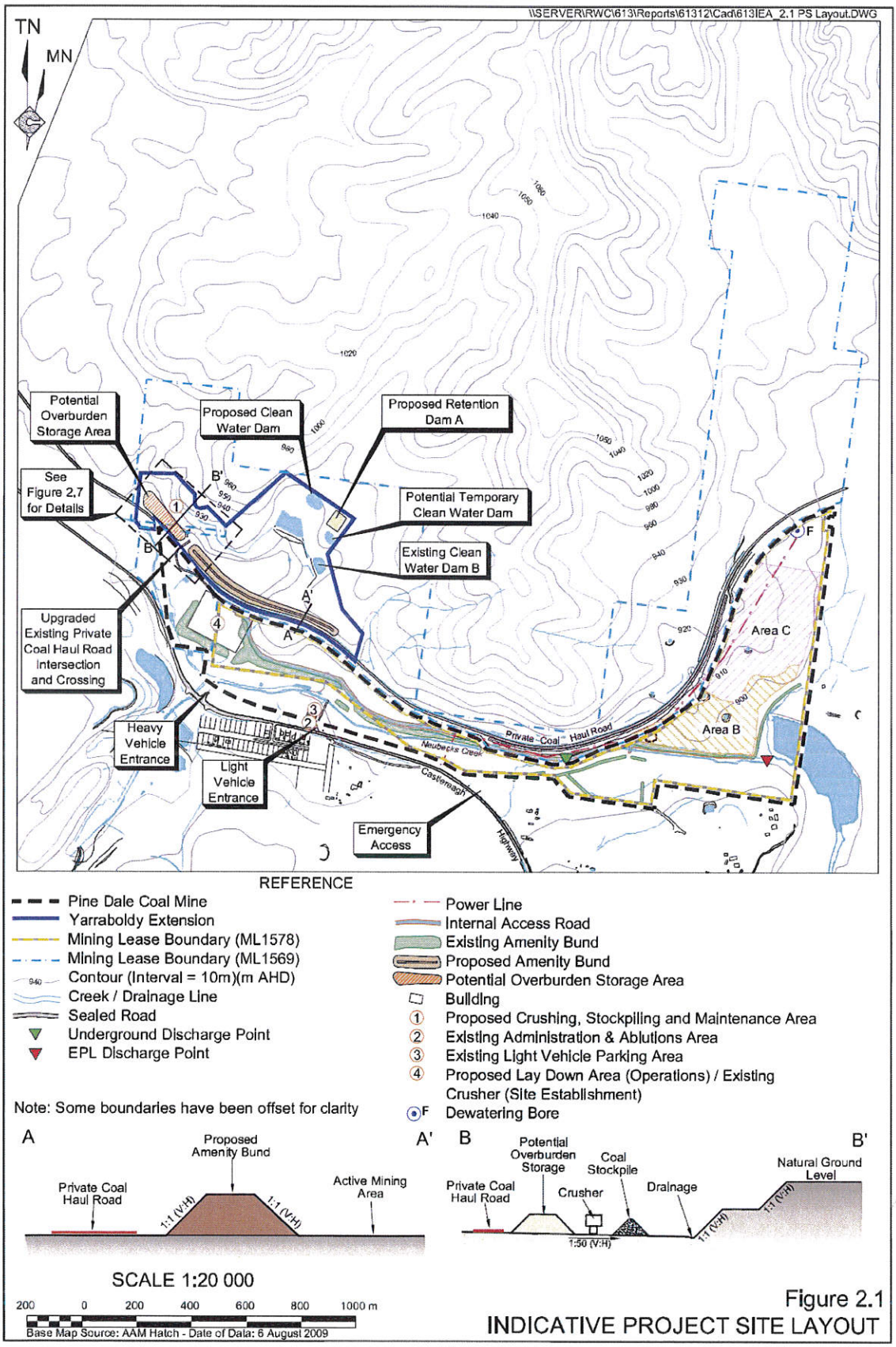
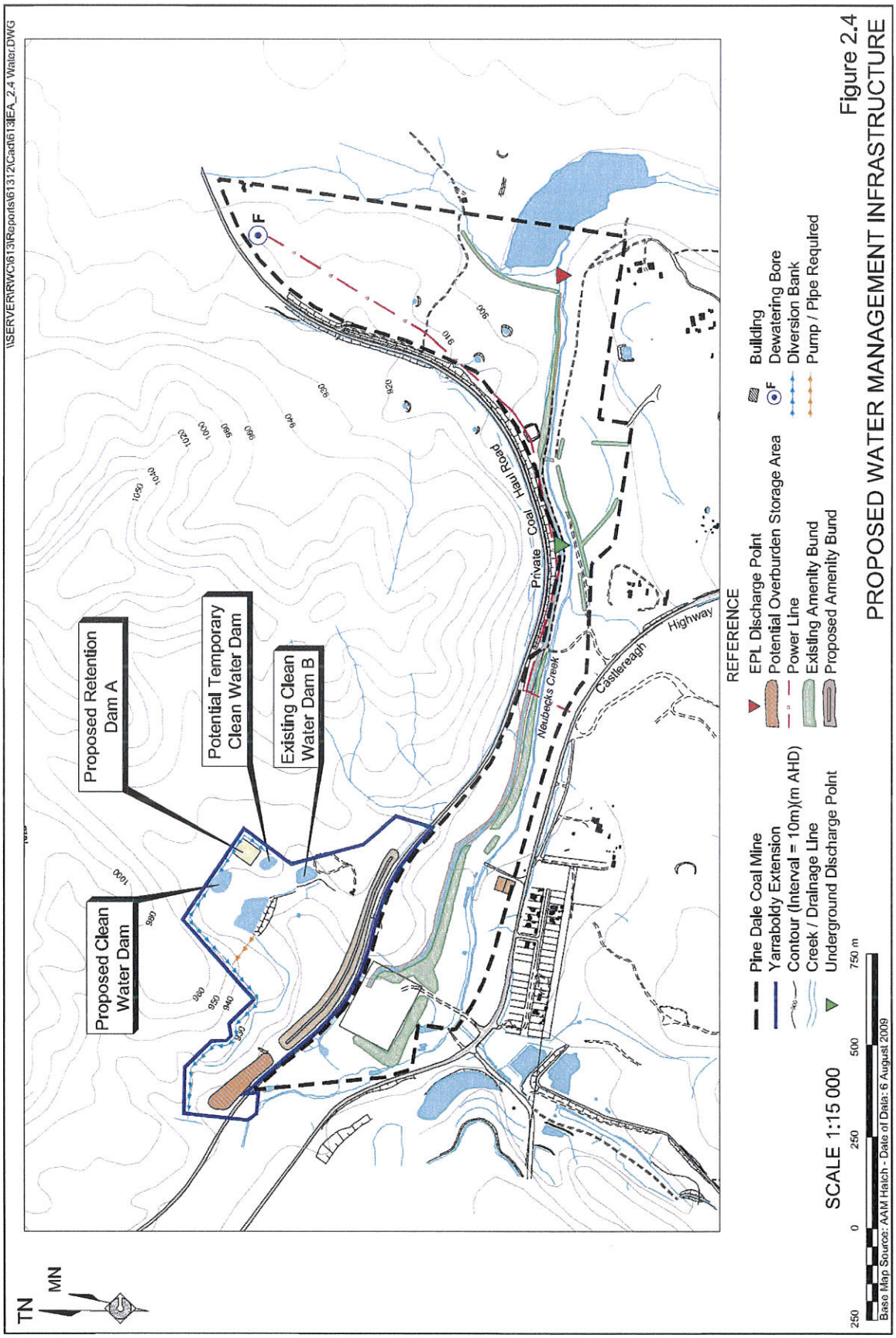


Figure 2.1
INDICATIVE PROJECT SITE LAYOUT

Plan 5


\\SERVER\RWC\613\Reports\61312\Cad\613EA_2.4 Water.DWG
Proposed Retention Dam A
Potential Temporary Clean Water Dam
Existing Clean Water Dam B
Proposed Clean Water Dam
Haul Road
Private Coal
Neubecks Creek
Castlereagh Highway
TN
MN
REFERENCE
Pine Dale Coal Mine
Yarraboldy Extension
Contour (Interval = 10m)(m AHD)
Creek / Drainage Line
Underground Discharge Point
EPL Discharge Point
Potential Overburden Storage Area
Power Line
Existing Amenity Bund
Proposed Amenity Bund
Building
Dewatering Bore
Diversion Bank
Pump / Pipe Required
SCALE 1:15 000
0
250
500
750 m
250
Base Map Source: AAM Hatch - Date of Data: 6 August 2009
Figure 2.4
PROPOSED WATER MANAGEMENT INFRASTRUCTURE

Plan 6

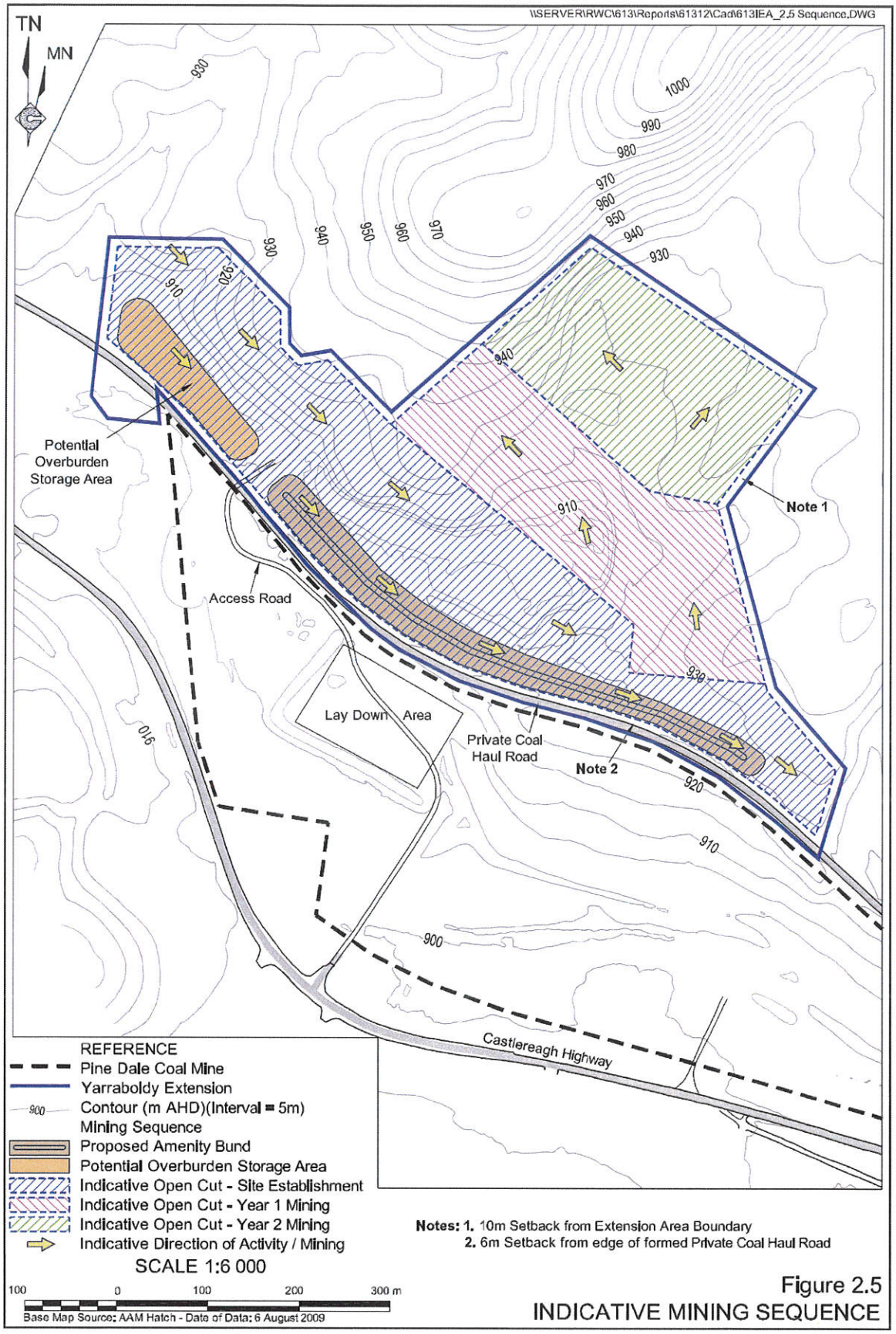


Figure 2.5
INDICATIVE MINING SEQUENCE

Plan 7

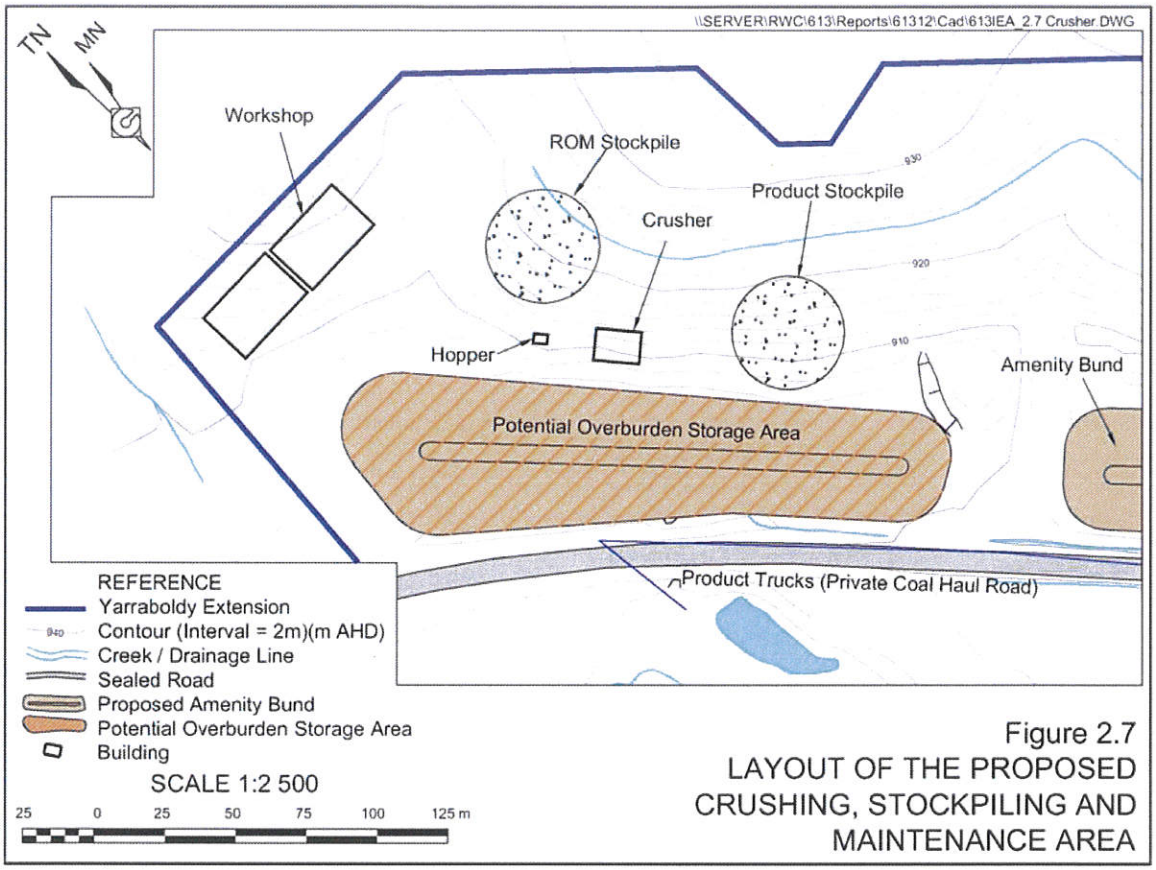


Figure 2.7
LAYOUT OF THE PROPOSED CRUSHING, STOCKPILING AND MAINTENANCE AREA

Plan 8

R.W. CORKERY & CO. PTY. LIMITED
TN
MN
Castlereagh Highway
Private Coal Haul Road
REFERENCE
Pine Dale Coal Mine
Yarraboldy Extension
Existing Contour (m AHD)(Interval = 5m)
Final Landform Contour (Interval = 5m)
Existing Drainage Line
Proposed Drainage Line
Revegetation
Pasture
Native Woodland
SCALE 1:12 000
200 0 200 400 600 m
Base Map Source: AAM Hatch - Date of Data: 6 August 2009
INDICATIVE FINAL LANDFORM AND REVEGETATION
Figure 2.8
\\SERVER\RWC\613\Reports\613\2\Cad\613EA_2.8 Final Landform.DWG

APPENDIX B

ENVIRONMENTAL MONITORING SUMMARY REPORT

RCA Laboratories- Environmental Report 6880-1702a-2

AEMR SUMMARY REPORT COMPILED FOR PINE DALE MINE

Environmental Performance Monitoring
January – December 2015

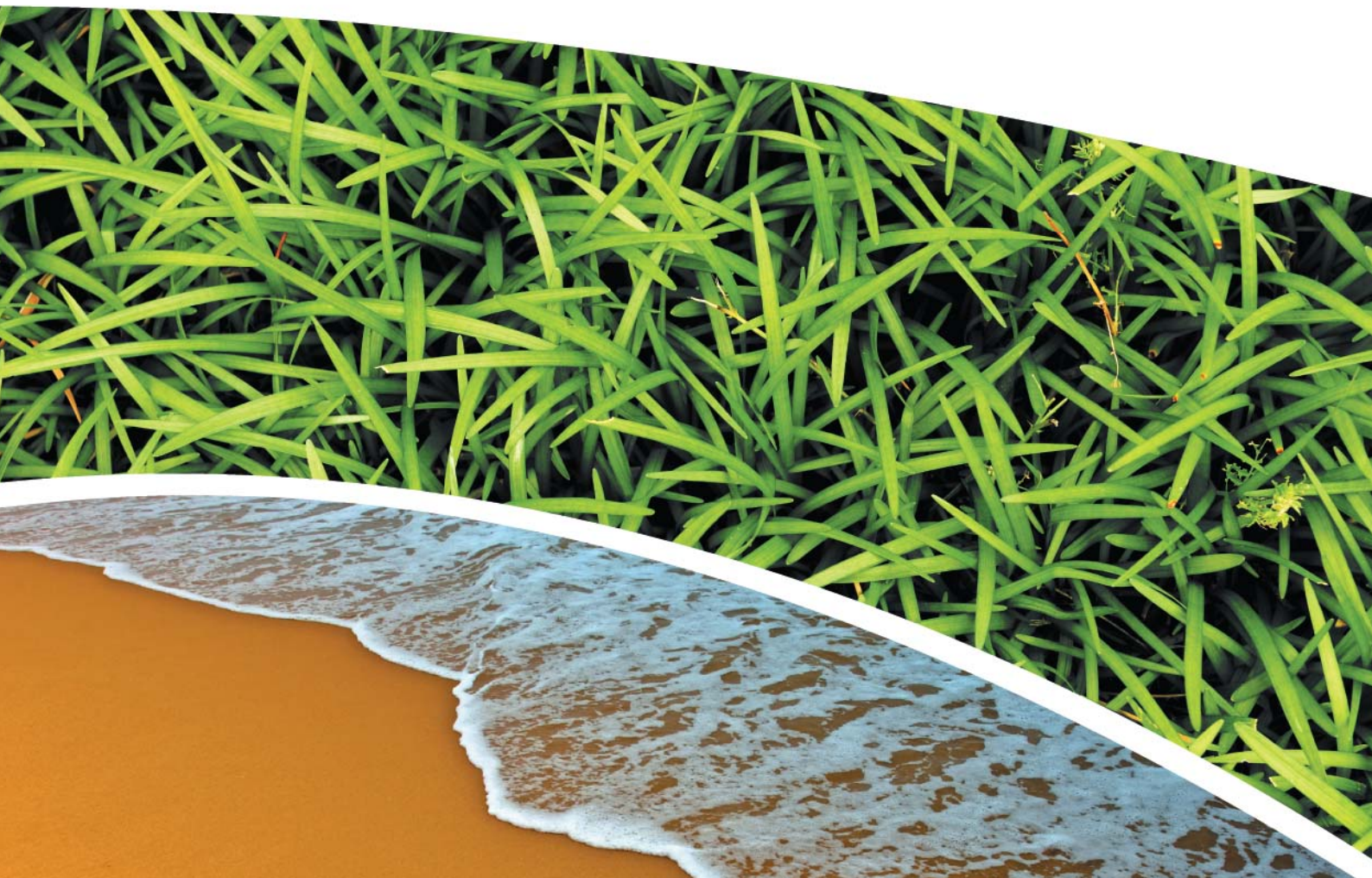
Pine Dale Mine

RCA Australia

RCA ref 6880-1702a/2

26 February 2016

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL



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				Name	**Signature**	**Date**
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/1	1	DRAFT Electronic (email)	Pine Dale Mine – Mr Graham Goodwin; Mr Mark Frewin; Alicia d Vos	25/02/16
/2	1	Electronic (email)	Pine Dale Mine – Mr Graham Goodwin; Mr Mark Frewin; Alicia d Vos	26/02/16
/2	1	Bound report	RCA – job archive	26/02/16
/2	1	Electronic report	RCA – job archive	26/02/16

RCA-LE ref 6880-1702a/2

26 February 2016

Pine Dale Mine
PO Box 202
WALLERAWANG NSW 2845

Attention: Mr Graham Goodwin

AEMR SUMMARY REPORT
COMPILED FOR PINE DALE MINE
DETAILING ENVIRONMENTAL PERFORMANCE MONITORING
JANUARY – DECEMBER 2015

Robert Carr & Associates Pty Ltd
T/A RCA Laboratories ABN 53 063 515 711
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APPENDIX

1 EXECUTIVE SUMMARY

Pine Dale Mine achieved an acceptable standard of environmental performance during the 2015 reporting period, as evidenced by the following:

- Air quality monitoring results recorded during the reporting period for depositional dust, total suspended particulate matter (TSP) and fine particulate matter (PM_{10}) were well below the Environmental Protection Authority assessment criteria in Blackmans Flat and other privately owned properties adjacent to the Mining Leases;
- There were no noise exceedances from mining activities recorded at privately owned properties recorded during the reporting period;
- There were no surface water discharge events during the reporting period and monitoring was conducted in accordance with EPL 4911 and the site Water Management Plan.

2 INTRODUCTION

The following report provides a summary of monthly environmental monitoring data for Pine Dale Mine for the year 2015. Summary data is comprised of High Volume Air Samples (TSP & PM_{10}), Depositional Dust, Surface Water, Groundwater monitoring and Noise monitoring.

This report satisfies the requirements to monitor environmental parameters as presented in the Pine Dale Mine Environmental Protection Licence (EPL 4911) and Project Approval (PA 10_0041). Monitoring is undertaken in accordance with the site's *Water Management Plan;* the *Air Quality and Greenhouse Gas Management Plan*; *Purple Copper Butterfly Monitoring Programme*; and the *Noise Management Plan*.

A compliance assessment of each environmental monitoring parameter is made in accordance with the relevant assessment criteria outlined in Project Approval (PA 10_0041), the site Management Plans and Environmental Protection Licence (EPL 4911).

3 AIR QUALITY MONITORING

3.1 DEPOSITIONAL DUST AND HVAS PARTICULATE MATTER ASSESSMENT CRITERIA

The Pine Dale Mine Project Approval (PA 10_0041, Schedule 3 Condition 18) and *Air Quality and Greenhouse Gas Management Plan* stipulates that dust emissions generated by the project must not cause additional exceedances of the long term impact assessment criteria listed in **Table 1, 2** and **3** (below).

Table 1 *Depositional Dust: Long Term Assessment Criteria*

Pollutant	Average Period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c]Deposited dust	Annual	[b]2 g/m^2.month	[a]4g/m^2.month

Table 2 *HVAS Particulate Matter: Long Term Assessment Criteria*

Pollutant	Average Period	[d]Criterion
Total suspended particulate (TSP) matter	Annual	[a]90µg/m^3
Particulate matter < 10µm (PM_{10})	Annual	[a]30µg/m^3

Table 3 *HVAS Particulate Matter: Short Term Assessment Criteria*

Pollutant	Average Period	[d]Criterion
Particulate matter < 10µm (PM_{10})	24 hours	[a]50µg/m^3

- *a Total impact ie, incremental increase in concentrations due to the project plus background concentrations due to other sources);*
- *b Incremental impact (i.e. incremental increase in concentrations due to the project on its own);*
- *c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method;*
- *d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agree to by the Director-General in consultation with DECCW.*

3.1 AIR MONITORING RESULTS – DEPOSITIONAL DUST GAUGE DATA SUMMARY

Depositional dust monitoring is undertaken at 10 locations across the Pine Dale Mine site. A total of six (6) depositional dust gauges are monitored in accordance with the Pine Dale Mine *Air Quality and Green House Gas Management Plan* and Environmental Protection Licence (No. 4911). Two of these gauges are located within the settlement of Blackmans Flat (gauges D1 & D2). A third gauge is located to the east of Blackmans Flat along the Castlereagh Highway (gauge D3). The remaining three gauges (D4, D5 & D6) were installed in November 2006 to coincide with the commencement of mining in Areas B & C. Gauge D4 is located to the north of View St, Blackmans Flat. Gauges D5 & D6 are located to the east of Mining Areas B & C, along Wolgan Road, Lidsdale (refer Drawing 1, **Appendix 1**).

The remaining four (4) depositional dust gauges are monitored in accordance with the Pine Dale Mine *Purple Copper Butterfly Monitoring Program*. These gauges are named PCB1, PCB2, PCB3 and PCB7. Three of the dust gauges are located within the major butterfly population to the east of the mine workings in the Yarraboldy Extension (PCB1-3), whilst the fourth dust gauge (PCB7) is located to the south west of the butterfly habitat area (refer Drawing 1, **Appendix 1**).

Depositional Dust summary results for the period January – December 2015 are shown in **Tables 4** to **13**. Graphical presentations are shown in **Figures 1** and **2**. A discussion of results is presented in **Section 2.3**.

Table 4 *Depositional Dust Data Summary Gauge D1 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	D1	1.1	0.6	0.5
Feb-15	D1	0.8	0.4	0.4
Mar-15	D1	1	0.4	0.6
Apr-15	D1	0.7	0.4	0.3
May-15	D1	0.4	0.2	0.2
Jun-15	D1	0.6	0.3	0.3
Jul-15	D1	0.4	0.05*	0.4
Aug-15	D1	0.4	0.2	0.2
Sep-15	D1	RN	--	--
Oct-15	D1	0.5	0.2	0.3
Nov-15	D1	0.1	0.1	0.05*
Dec-15	D1	0.7	0.2	0.5
ANNUAL AVERAGE		***0.6***	***0.3***	***0.3***

RN- Stand and bottle assembly stolen. No result available.

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 5 *Depositional Dust Data Summary Gauge D2 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	D2	0.8	0.4	0.4
Feb-15	D2	0.9	0.4	0.5
Mar-15	D2	0.8	0.3	0.5
Apr-15	D2	0.7	0.3	0.4
May-15	D2	0.3	0.1	0.2
Jun-15	D2	0.2	0.1	0.1
Jul-15	D2	0.2	0.05*	0.2
Aug-15	D2	0.3	0.1	0.2
Sep-15	D2	0.3	0.1	0.2
Oct-15	D2	0.4	0.1	0.3
Nov-15	D2	0.6	0.2	0.4
Dec-15	D2	0.6	0.3	0.3
ANNUAL AVERAGE		***0.5***	***0.2***	***0.3***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 6 *Depositional Dust Data Summary Gauge D3 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	D3	1.2	0.6	0.6
Feb-15	D3	1.3	0.7	0.6
Mar-15	D3	BF	--	--
Apr-15	D3	1	0.5	0.5
May-15	D3	0.5	0.3	0.2
Jun-15	D3	0.3	0.1	0.2
Jul-15	D3	0.6	0.4	0.2
Aug-15	D3	0.6	0.1	0.5
Sep-15	D3	0.8	0.4	0.4
Oct-15	D3	1	0.4	0.6
Nov-15	D3	0.9	0.5	0.4
Dec-15	D3	0.2	0.05	0.2
ANNUAL AVERAGE		***0.9***	***0.4***	***0.4***

BF- Broken funnel. No result available.

Table 7 *Depositional Dust Data Summary Gauge D4 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	D4	1.0	0.4	0.6
Feb-15	D4	0.8	0.2	0.6
Mar-15	D4	0.8	0.3	0.5
Apr-15	D4	0.8	0.3	0.5
May-15	D4	0.4	0.05*	0.4
Jun-15	D4	0.3	0.1	0.2
Jul-15	D4	0.05*	0.05*	0.05*
Aug-15	D4	0.2	0.1	0.1
Sep-15	D4	0.4	0.1	0.3
Oct-15	D4	0.4	0.2	0.2
Nov-15	D4	0.5	0.2	0.3
Dec-15	D4	0.5	0.2	0.3
ANNUAL AVERAGE		***0.5***	***0.2***	***0.3***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 8 *Depositional Dust Data Summary Gauge D5 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	D5	1.2	0.6	0.6
Feb-15	D5	2.3	1.2	1.1
Mar-15	D5	4.4	1.9	2.5
Apr-15	D5	0.5	0.3	0.2
May-15	D5	0.4	0.2	0.2
Jun-15	D5	2.4	1.3	1.1
Jul-15	D5	0.1	0.1	0.05*
Aug-15	D5	2.0	0.3	1.7
Sep-15	D5	0.4	0.2	0.2
Oct-15	D5	1.3	0.5	0.8
Nov-15	D5	1.7	0.5	1.2
Dec-15	D5	0.3	0.05*	0.3
ANNUAL AVERAGE		***1.4***	***0.6***	***0.8***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 9 *Depositional Dust Data Summary Gauge D6 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	D6	2.9	2.1	0.8
Feb-15	D6	1.0	0.5	0.5
Mar-15	D6	1.2	0.6	0.6
Apr-15	D6	1.6	0.7	0.9
May-15	D6	0.6	0.2	0.4
Jun-15	D6	0.7	0.3	0.4
Jul-15	D6	0.6	0.1	0.5
Aug-15	D6	0.9	0.6	0.3
Sep-15	D6	6.8	2.9	3.9
Oct-15	D6	0.5	0.2	0.3
Nov-15	D6	0.8	0.4	0.4
Dec-15	D6	0.6	0.2	0.4
ANNUAL AVERAGE		***1.5***	***0.7***	***0.8***

Table 10 *Depositional Dust Data Summary Gauge PCB1 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	PCB1	1.6	0.7	0.9
Feb-15	PCB1	0.8	0.2	0.6
Mar-15	PCB1	1.3	0.4	0.9
Apr-15	PCB1	2.1	0.6	1.5
May-15	PCB1	1.4	0.1	1.3
Jun-15	PCB1	0.5	0.2	0.3
Jul-15	PCB1	0.5	0.05*	0.5
Aug-15	PCB1	0.6	0.1	0.5
Sep-15	PCB1	0.6	0.1	0.5
Oct-15	PCB1	0.8	0.3	0.5
Nov-15	PCB1	1.7	0.3	1.4
Dec-15	PCB1	0.6	0.05*	0.6
ANNUAL AVERAGE		***1.0***	***0.3***	***0.8***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 11 *Depositional Dust Data Summary Gauge PCB2 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	PCB2	0.7	0.2	0.5
Feb-15	PCB2	0.5	0.1	0.4
Mar-15	PCB2	0.9	0.2	0.7
Apr-15	PCB2	0.4	0.1	0.3
May-15	PCB2	1.0	0.1	0.9
Jun-15	PCB2	0.4	0.1	0.3
Jul-15	PCB2	0.3	0.05*	0.3
Aug-15	PCB2	0.2	0.05*	0.2
Sep-15	PCB2	0.5	0.05*	0.5
Oct-15	PCB2	0.6	0.1	0.5
Nov-15	PCB2	1.0	0.1	0.9
Dec-15	PCB2	0.2	0.1	0.1
ANNUAL AVERAGE		***0.6***	***0.1***	***0.5***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 12 *Depositional Dust Data Summary Gauge PCB3 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	PCB3	0.7	0.2	0.5
Feb-15	PCB3	0.8	0.2	0.6
Mar-15	PCB3	0.9	0.3	0.6
Apr-15	PCB3	0.6	0.2	0.4
May-15	PCB3	0.9	0.1	0.8
Jun-15	PCB3	0.3	0.1	0.2
Jul-15	PCB3	0.2	0.05*	0.2
Aug-15	PCB3	0.5	0.2	0.3
Sep-15	PCB3	0.6	0.2	0.4
Oct-15	PCB3	0.2	0.05*	0.2
Nov-15	PCB3	0.5	0.1	0.4
Dec-15	PCB3	0.05	0.05*	0.05*
ANNUAL AVERAGE		***0.5***	***0.1***	***0.4***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

Table 13 *Depositional Dust Data Summary Gauge PCB7 Jan – Dec 2015*

Month	Gauge No.	Insoluble Solids (g/m^2.month)	Ash Residue (g/m^2.month)	Combustible Matter (g/m^2.month)
Jan-15	PCB7	1.4	0.4	1.0
Feb-15	PCB7	1.2	0.3	0.9
Mar-15	PCB7	1.4	0.4	1.0
Apr-15	PCB7	0.7	0.3	0.4
May-15	PCB7	0.4	0.1	0.3
Jun-15	PCB7	0.3	0.2	0.1
Jul-15	PCB7	1.0	0.6	0.4
Aug-15	PCB7	0.3	0.1	0.2
Sep-15	PCB7	0.4	0.2	0.2
Oct-15	PCB7	0.5	0.2	0.3
Nov-15	PCB7	0.6	0.05*	0.6
Dec-15	PCB7	0.3	0.05*	0.3
ANNUAL AVERAGE		***0.7***	***0.3***	***0.5***

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes.

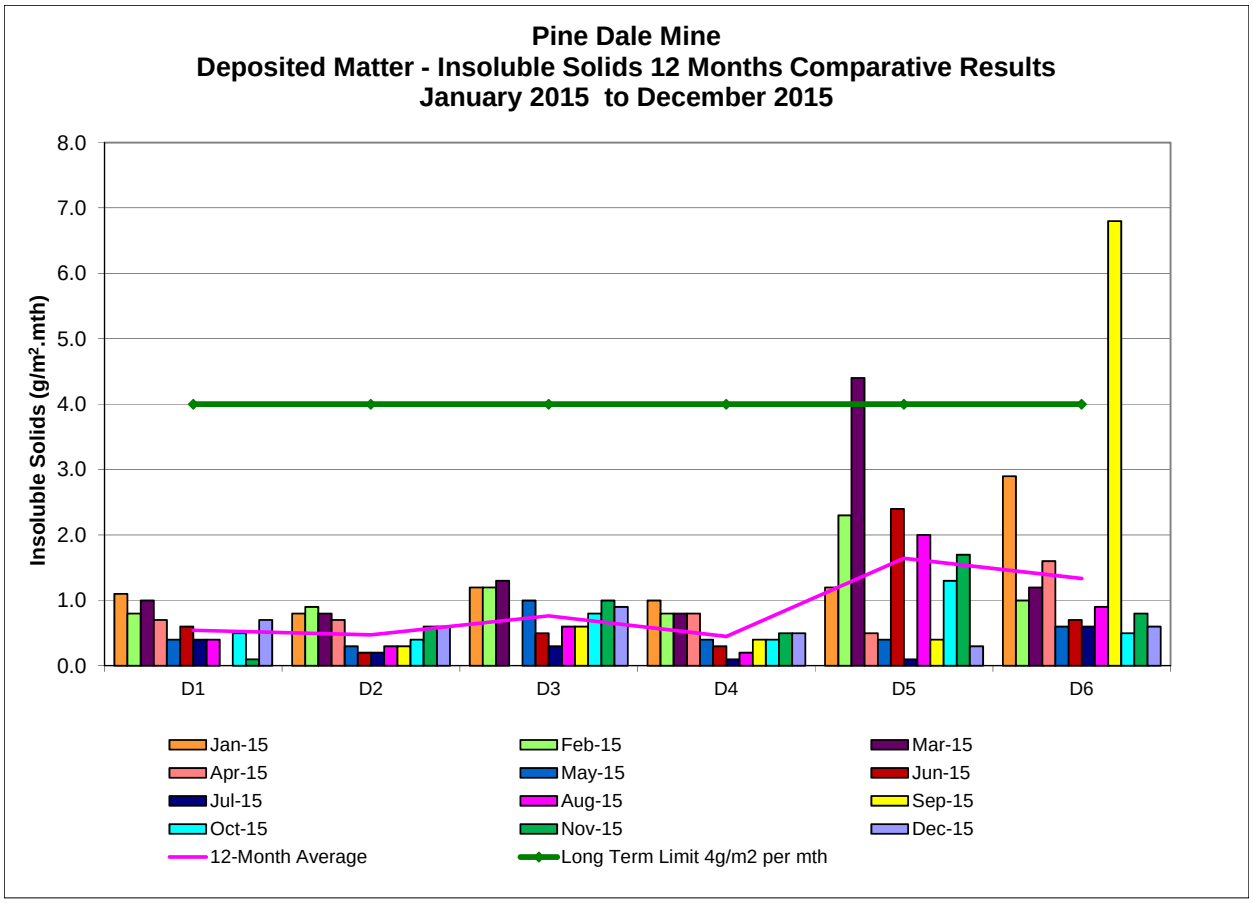


Figure 1 *Depositional Dust Results - Gauges D1 to D6*

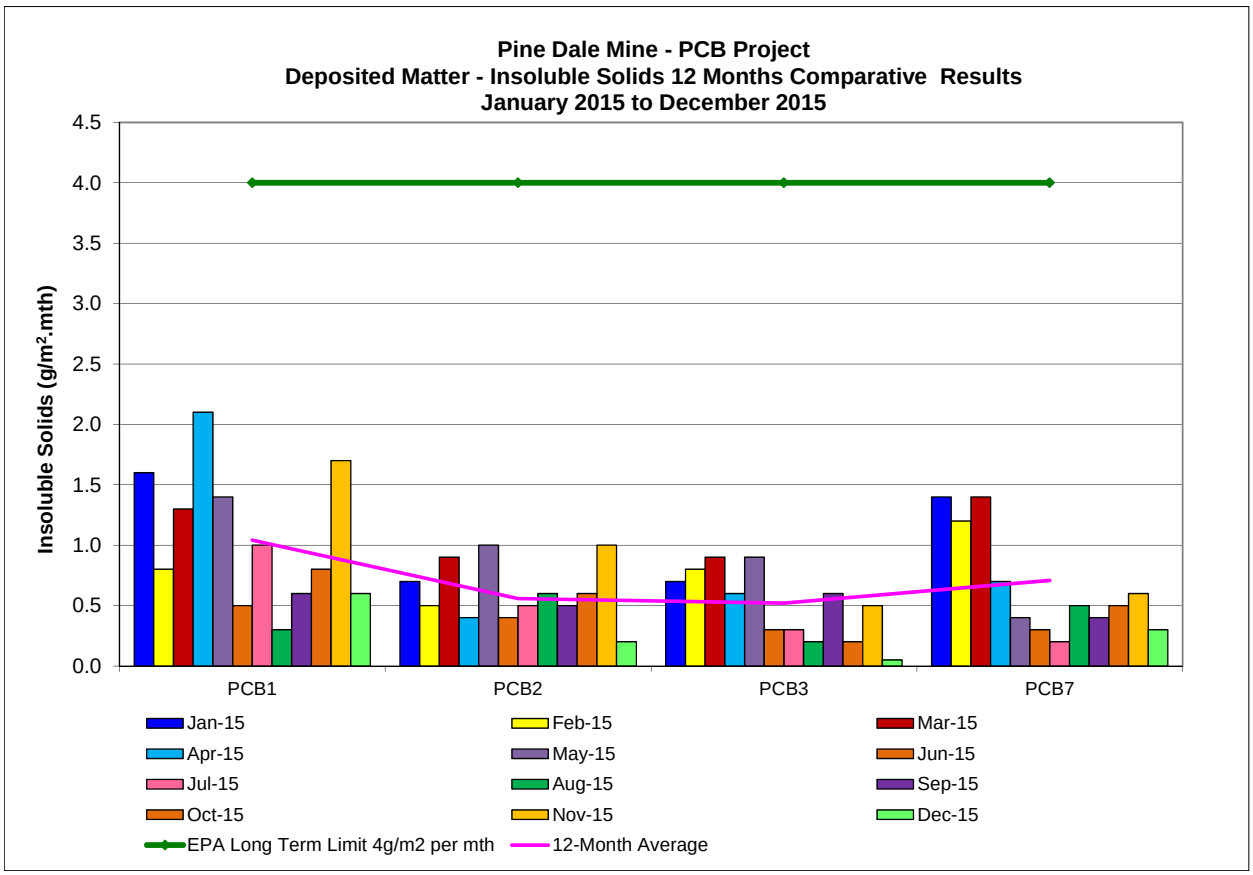


Figure 2 *Depositional Dust Results – Gauges PCB1-3 & PCB7*

3.2 AIR MONITORING RESULTS – HVAS PARTICULATE MATTER DATA SUMMARY

Pine Dale Coal Mine monitors Total Particulate Matter <10µm (PM_{10}) and Total Suspended Particulate matter (TSP) at one location in accordance with the Pine Dale Mine *Air Quality and Green House Gas Management Plan* and Environmental Protection Licence (No. 4911). The HVAS TSP and PM_{10} units are both located adjacent to the mine office at Blackmans Flat (refer Drawing 1, **Appendix 1**).

HVAS Particulate Matter summary results for the period January – December 2015 are shown in **Table 14**. Graphical presentations are shown in **Figure 3**.

Table 14 *HVAS Particulate Matter Summary Jan – Dec 2015*

Run Date	HVAS TSP (µg/m^3)	HVAS PM_{10} (µg/m^3)	Run Date	HVAS TSP (µg/m^3)	HVAS PM_{10} (µg/m^3)
5-Jan-15	9	7	10-Jul-15	6	1
11-Jan-15	6	4	16-Jul-15	1	0
17-Jan-15	41	17	22-Jul-15	11	4
23-Jan-15	21	14	28-Jul-15	12	2
29-Jan-15	10	4	3-Aug-15	7	3
4-Feb-15	12	6	9-Aug-15	10	4
10-Feb-15	15	9	15-Aug-15	9	3
16-Feb-15	19	9	21-Aug-15	14	7
22-Feb-15	5	5	27-Aug-15	7	1
28-Feb-15	16	9	2-Sep-15	20	7
6-Mar-15	43	16	8-Sep-15	19	4
12-Mar-15	24	11	14-Sep-15	43	14
18-Mar-15	57	21	20-Sep-15	11	3
24-Mar-15	19	7	26-Sep-15	13	4
30-Mar-15	11	8	2-Oct-15	32	13
5-Apr-15	9	4	8-Oct-15	20	14
11-Apr-15	7	9	14-Oct-15	16	14
17-Apr-15	17	12	20-Oct-15	17	12
23-Apr-15	12	8	26-Oct-15	24	9
29-Apr-15	7	7	1-Nov-15	12	6
5-May-15	54	19	7-Nov-15	13	7
11-May-15	17	7	13-Nov-15	13	8
17-May-15	8	5	19-Nov-15	47	17
23-May-15	9	5	25-Nov-15	37	14
29-May-15	10	6	1-Dec-15	39	15
4-Jun-15	19	10	7-Dec-15	23	11
10-Jun-15	10	4	13-Dec-15	34	20
16-Jun-15	2	0	19-Dec-15	43	27
22-Jun-15	9	2	25-Dec-15	11	8
28-Jun-15	8	1	31-Dec-15	17	9
4-Jul-15	13	3			
			Annual Average	***18.0***	***8.6***

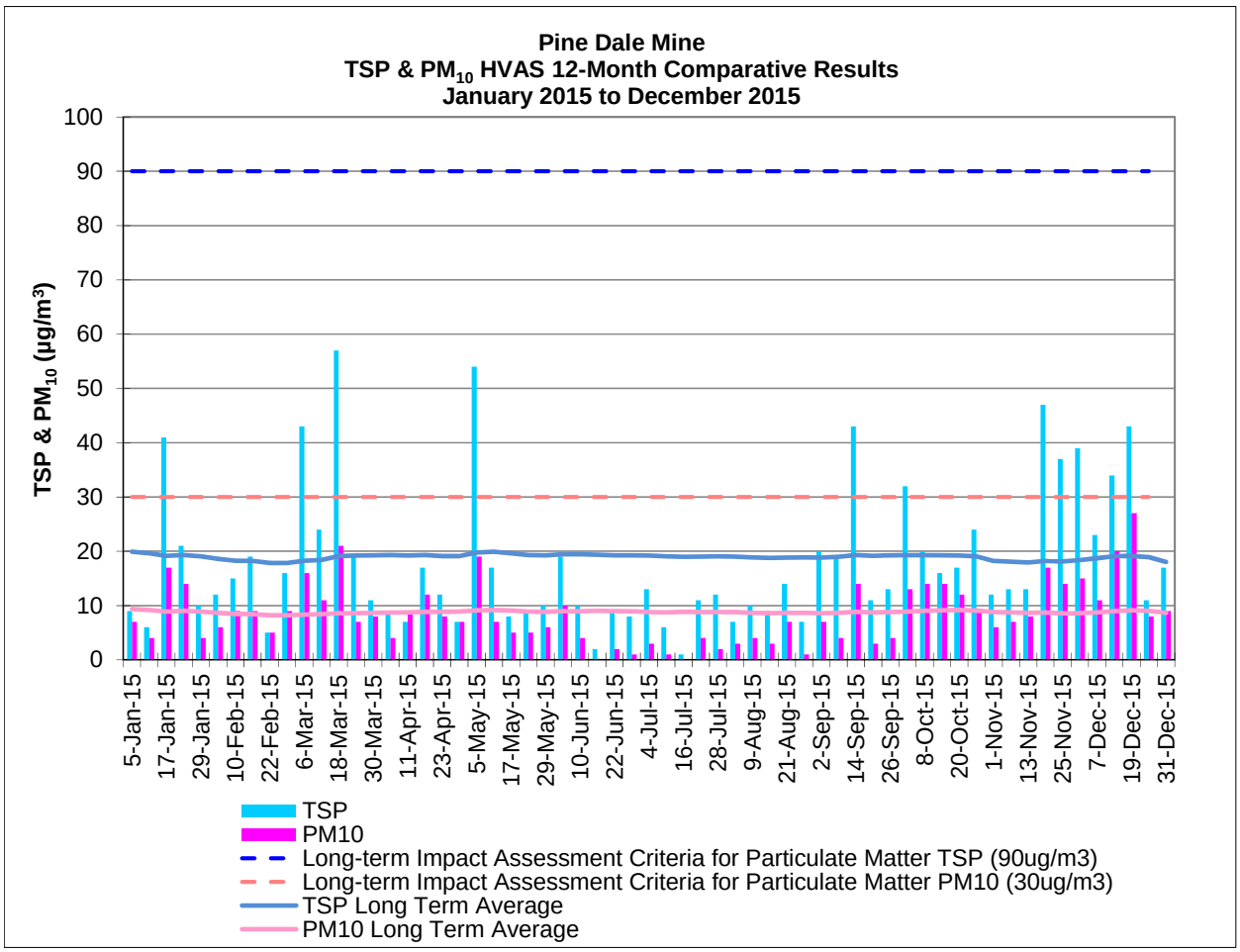


Figure 3 *HVAS TSP & PM_{10} Particulate Matter Summary Jan- Dec 2015*

3.3 REVIEW & INTERPRETATION OF AIR MONITORING RESULTS

3.3.1 DEPOSITIONAL DUST RESULTS

Depositional Dust results for the period January – December 2015 show an average insoluble solids range of 0.5 g/m^2 per month to 1.5 g/m^2 per month for dust gauges D1 to D6. These results fall well below the nominated annual average assessment criteria of 4.0g/m^2 per month, as stipulated in the *Air Quality Monitoring Program*.

During the 2015 monitoring period, there were no instances where the dust gauges showed results which were greater than the maximum annual average increase of 2g/m^2 per month deposited matter, as stipulated in the site's Air Quality Monitoring Program. No result was recorded for dust gauge D1 in September 2015 as the dust gauge and bottle setup had been stolen. No results were available at dust gauge D3 for the month of April 2015 as the glass funnel was found to be broken.

It should be noted that dust gauges PCB1, PCB2, PCB3 and PCB7 are located in a bushland setting under the canopy of tall trees and as such, these gauges do not conform to the siting requirements of AS/NZS 35801.1 (2007). The purpose of these gauges is to determine the level of dust present at each location to aid in study of the Purple Copper Butterfly population.

3.3.2 HVAS PARTICULATE MATTER RESULTS

HVAS Total Suspended Particulate (TSP) results for the period January – December 2015 show an average result of 18.0μg/m^3, which is well below the nominated annual average assessment criterion of 90μg/m^3 for total suspended particulates. During the reporting period the TSP HVAS recorded 100% data capture, with sampling undertaken in accordance with AS/NZS 3580.9.3.

Similarly, the HVAS particulate matter results <10μm (PM_{10}) also show results within the required *Air Quality Monitoring Program* assessment criteria. The average PM_{10} result was 8.6μg/m^3, which is below the annual average PM_{10} assessment criteria of 30μg/m^3. All HVAS results were below the OEH 24 hour maximum assessment criteria of 50μg/m^3.

During the reporting period the PM10 HVAS recorded 100% data capture, with sampling undertaken in accordance with AS/NZS 3580.9.3.

4 GROUNDWATER QUALITY MONITORING

4.1 GROUNDWATER ASSESSMENT CRITERIA

The purpose of groundwater monitoring is to ensure that any impact of the mining operations on the local groundwater can be identified. Site specific Trigger Values for water quality parameters pH and Electrical Conductivity were developed for the Pine Dale Mine, as stipulated in the sites' *Water Management Plan* in accordance with Schedule 3, Condition 27(c) of the Project Approval (PA 10_0041). The groundwater trigger values are shown in **Table 15**.

Table 15 *Groundwater Trigger Levels*

Bore	pH (range)	Electrical Conductivity (μS/cm)	SWL Trigger (m, AHD)
P6	6.2 - 8.0	1180	887.90
P7	6.3 - 8.0	852	883.28
EP DDH4/GW (Bore D)	6.8 - 8.0	608	940.61
EP DDH7/GW (Bore A)	6.5 - 8.5	326	954.40
EP PDH1/GW Bore C)	6.9 - 8.0	490	889.25
EP PDH3/GW (Enhance)	NA	NA	891.06
EP PDH4/GW (Enhance)	NA	NA	890.95
EP PDH7/GW (Bore E)	5.5 - 8.0	151	938.43
Old ventilation shaft	6.3 - 8.0	908	888.46
The Bong (at SW location)	5.8 - 8.0	1157	NA

NA – no trigger value required for these locations.

4.2 GROUNDWATER MONITORING DATA SUMMARY

Groundwater monitoring for the Pine Dale Mine is undertaken in accordance with the *Groundwater Monitoring Program* and the *Water Management Plan.* Sampling is conducted at a total of three locations within the mine site; a further seven locations surrounding the Yarraboldy Extension area (4 sampling wells & 3 vibrating wire piezometer wells); and two locations at the former Enhance Place Mine Site (refer Drawing 1, **Appendix 1**.). Groundwater monitoring is not a requirement of EPL 4911.

Groundwater summary results for the period January – December 2015 are shown in **Tables 16** to **24**. Graphical presentations of standing water levels are shown in **Figures 4** to **6**.

Table 16 *Groundwater Monitoring Bore P6 Results Jan - Dec 2015*

Location	Site Bore P6												
Sample Number	01156880009	02156880011	03156880009	04156880009	05156880011	06156880009	07156880009	08156880011	09156880009	10156880009	11156880011	12156880009	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/1/15	11/02/15	11/03/15	08/04/15	07/05/15	09/06/15	06/07/15	05/08/15	07/09/15	08/10/15	09/11/15	10/12/15	
Time Sampled	14:10	14:03	13:20	13:00	13:56	14:24	9:57	7:37	12:00	10:21	13:46	12:47	**Trigger Levels**
Standing Water Level (m)	26.40	26.38	26.41	26.44	26.08	26.16	26.22	26.26	26.33	26.81	26.27	26.26	
Standpipe Height	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Relative Water Level (m)	25.45	25.43	25.46	25.49	25.13	25.21	25.27	25.31	25.38	25.86	25.32	25.31	
Water Level AHD (m)#	891.50	891.52	891.49	891.46	891.82	891.74	891.68	891.64	891.57	891.09	891.63	891.64	**887.90**
Temperature (°C)	16.5	16.8	17.0	14.0	14.5	15.5	14.0	14.0	15.3	15.0	16.5	17.5	
pH	*6.09*	*6.08*	*6.14*	6.20	6.29	*6.14*	6.46	6.65	6.30	6.29	6.37	*6.07*	**6.2 to 8.0**
Conductivity (µS/cm)	1086	1162	1147	*1260*	*1225*	1156	1176	*1231*	*1313*	1153	1175	1148	**1180**
Turbidity (NTU)	43	25	14	28	23	46	16	17	40	59	65	16	
Dissolved Oxygen (mg/L)	5.1	3.8	5.0	6.5	7.6	3.6	10.1	4.4	7.6	8.8	4.0	4.8	
TSS (mg/L)	31	12	28	26	17	28	10	17	26	36	40	34	
Oil & Grease (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Bicarbonate Alkalinity	43	50	61	53	39	49	60	63	43	36	34	56	
Total Alkalinity	43	50	61	53	39	49	60	63	43	36	34	56	
Sulphate	648	587	644	600	529	581	687	656	591	668	645	631	
Chloride	21	29	35	36	25	28	31	21	34	32	28	24	
Calcium	123	120	130	130	135	122	136	135	135	128	128	131	
Magnesium	56	61	63	64	64	57	65	59	65	65	60	64	
Sodium	48	56	51	54	55	46	57	51	54	59	52	57	
Potassium	18	19	18	21	19	17	20	18	20	20	17	20	
Cobalt (dissolved)	0.062	0.063	0.066	0.059	0.061	0.053	0.062	0.061	0.063	0.06	0.058	0	
Manganese (dissolved)	2.4	2.64	2.8	2.74	2.77	2.58	2.6	2.93	2.58	2.53	2.46	2.74	
Nickel (dissolved)	0.104	0.105	0.106	0.103	0.099	0.093	0.099	0.099	0.105	0.107	0.105	0.11	
Zinc (dissolved)	0.302	0.181	0.072	0.178	0.046	0.212	0.074	0.277	0.335	0.248	0.192	0.132	
Iron (dissolved)	13.4	19.1	29.7	25.2	29.3	13.4	26.9	25	22.3	19.1	20	24.7	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 17 *Groundwater Monitoring Bore P7 Results Jan - Dec 2015*

Location	Site Bore P7												
Sample Number	01156880010	02156880012	03156880010	04156880010	05156880012	06156880010	07156880010	08156880012	09156880010	10156880010	11156880012	12156880010	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/1/15	11/02/15	11/03/15	08/04/15	07/05/15	09/06/15	06/07/15	05/08/15	07/09/15	08/10/15	09/11/15	10/12/15	
Time Sampled	15:45	14:57	13:40	13:55	14:37	15:05	11:14	8:38	12:22	9:53	14:43	13:25	**Trigger Levels**
Standing Water Level (m)	7.44	7.60	7.41	7.80	7.65	7.65	7.72	7.56	7.47	7.60	7.55	7.58	
Standpipe Height (m)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Relative Standing Water Level (m)	6.44	6.60	6.41	6.80	6.65	6.65	6.72	6.56	6.47	6.60	6.55	6.58	
Water Level AHD (m)#	887.96	887.80	887.99	887.60	887.75	887.75	887.68	887.84	887.93	887.80	887.85	887.82	**883.28**
Temperature (°C)	16.5	18.0	15.0	14.0	13.5	15.2	4.5	12.5	15.0	14.5	15.3	17.0	
pH (pH units)	6.37	6.61	6.28	6.59	6.59	6.63	6.54	6.69	6.27	6.28	6.50	6.47	**6.3 to 8.0**
Conductivity (µS/cm)	760	*867*	788	774	*873*	827	732	*857*	834	709	810	806	**852**
Total Alkalinity (mg/L $CaCO_3$)	---	221	---	---	235	---	---	235	---	---	204	---	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	221	---	---	235	---	---	235	---	---	204	---	
Chloride (mg/L)	---	64	---	---	64	---	---	76	---	---	78	---	
Sulphate (mg/L)	---	118	---	---	110	---	---	54	---	---	74	---	
Calcium (mg/L)	---	42	---	---	48	---	---	47	---	---	43	---	
Magnesium (mg/L)	---	50	---	---	52	---	---	48	---	---	49	---	
Sodium (mg/L)	---	70	---	---	54	---	---	45	---	---	48	---	
Potassium (mg/L)	---	8	---	---	8	---	---	7	---	---	7	---	
Filtered Iron (mg/L)	---	<0.05	---	---	<0.05	---	---	3.98	---	---	<0.05	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 18 *Groundwater Monitoring Bore Old Shaft Results Jan - Dec 2015*

Location	Site Bore 'Old Shaft'												
Sample Number	01156880013	02156880015	03156880013	04156880013	05156880015	06156880013	07156880013	08156880015	09156880013	10156880013	11156880015	12156880013	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/01/15	11/02/15	11/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/15	8/10/15	9/11/15	14/01/15	
Time Sampled	13:10	12:46	10:32	11:07	13:30	13:20	13:03	16:42	11:44	12:05	13:13	12:18	**Trigger Levels**
Standing Water Level (m)	12.64	12.64	12.67	12.72	12.36	12.44	12.27	12.52	12.57	12.68	12.51	12.51	
Standpipe Height (m)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	
Relative Standing Water Level (m)	10.94	10.94	10.97	11.02	10.66	10.74	10.57	10.82	10.87	10.98	10.81	10.81	
Water Level AHD (m)#	892.1	892.1	892.07	892.02	892.38	892.3	892.47	892.22	892.17	892.06	892.23	892.23	**888.46**
Temperature (°C)	17.0	16.5	16.0	14.8	14.5	15.5	3.9	14.0	15.5	15.5	16.0	17.5	
pH (pH units)	*6.15*	6.45	*6.05*	*6.16*	*6.19*	6.36	*6.22*	7.06	6.44	*6.03*	*6.15*	6.40	**6.3 to 8.0**
Conductivity (µS/cm)	*962*	*997*	*964*	*977*	*1062*	*1056*	*963*	*1091*	*1108*	*955*	*1081*	*1060*	**908**
Turbidity (NTU)	14	55	38	123	27	419	107	12	107	22	54	12	
Dissolved Oxygen (mg/L)		5.2			7.9			10.6			3.3		
TSS (mg/L)		13			15			60			44		
Oil & Grease (mg/L)		<2			<2			<2			<2		
Bicarbonate Alkalinity (mg/L $CaCO_3$)		74			48			59			30		
Total Alkalinity (mg/L $CaCO_3$)		74			48			59			30		
Chloride (mg/L)		456			504			590			598		
Sulphate (mg/L)		12			13			10			13		
Calcium (mg/L)		99			112			126			125		
Magnesium (mg/L)		49			51			50			55		
Sodium (mg/L)		40			35			36			39		
Potassium (mg/L)		16			17			17			17		
Filtered Cobalt (mg/L)		0.198			0.224			0.219			0.228		
Filtered Manganese (mg/L)		6.59			6.3			6.98			6.86		
Filtered Nickel (mg/L)		0.191			0.211			0.204			0.232		
Filtered Zinc (mg/L)		0.135			0.166			0.195			0.201		
Filtered Iron (mg/L)		26.6			24.3			13.5			27		

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 19 *Groundwater Monitoring Bore A (EP DDH77/GW) Results Jan - Dec 2015*

Location	Off-Site Bore A (EP DDH7/GW)												
Sample Number	01156880014	02156880017	03156880014	04156880014	05156880016	06156880014	07156880014	08156880016	09156880014	10156880014	11156880016	12156880014	**Trigger Levels**
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/1/15	11/02/2015	11/03/2015	8/04/2015	7/05/2015	9/06/2015	6/07/2015	5/08/2015	7/09/2015	8/10/2015	9/11/2015	10/12/2015	
Standing Water Level (m)	68.89	68.66	68.70	68.8	68.79	68.77	68.82	68.88	68.92	69.0	69.0	69.3	
Standpipe Height (m)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.83	
Relative Standing Water Level (m)	68.14	67.91	67.95	68.05	68.04	68.02	68.07	68.13	68.17	68.25	68.29	68.5	
Water level AHD (m)#	955.66	955.89	955.85	955.75	955.76	955.78	955.73	955.67	955.63	955.55	955.51	955.33	**954.40**
pH	---	---	6.53	---	---	6.45	---	---	*6.34*	---	---	6.56	**6.5 to 8.0**
Conductivity (µS/cm)	---	---	214	---	---	218	---	---	324	---	---	270	**326**
Temperature (°C)	---	---	17.0	---	---	15.5	---	---	15.5	---	---	19	
TDS (mg/L)	---	---	132	---	---	104	---	---	111	---	---	146	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	---	89	---	---	97	---	---	81	---	---	93	
Total Alkalinity (mg/L $CaCO_3$)	---	---	89	---	---	97	---	---	81	---	---	93	
Sulfate (mg/L)	---	---	5	---	---	5	---	---	5	---	---	4	
Chloride (mg/L)	---	---	5	---	---	5	---	---	4	---	---	<1	
Calcium (mg/L)	---	---	18	---	---	19	---	---	18	---	---	19	
Magnesium (mg/L)	---	---	7	---	---	7	---	---	7	---	---	7	
Sodium (mg/L)	---	---	4	---	---	4	---	---	5	---	---	5	
Potassium (mg/L)	---	---	11	---	---	11	---	---	11	---	---	11	
Filtered Arsenic (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Cadmium (mg/L)	---	---	0.0003	---	---	0.0004	---	---	0.0005	---	---	0.0003	
Filtered Chromium (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Copper (mg/L)	---	---	0.001	---	---	<0.001	---	---	0.001	---	---	<0.001	
Filtered Lead (mg/L)	---	---	<0.001	---	---	0.001	---	---	<0.001	---	---	<0.001	
Filtered Nickel (mg/L)	---	---	0.004	---	---	0.001	---	---	<0.001	---	---	0.001	
Filtered Zinc (mg/L)	---	---	0.041	---	---	0.033	---	---	0.026	---	---	0.046	
Filtered Iron (mg/L)	---	---	<0.05	---	---	<0.05	---	---	<0.05	---	---	<0.05	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 20 *Groundwater Monitoring Bore C (EP PDH1/GW) Results Jan - Dec 2015*

Location	Off-Site Bore C (EP PDH1/GW)												
Sample Number	01156880016	02156880019	03156880016	04156880016	05156880018	06156880016	07156880016	08156880018	09156880016	10156880016	11156880018	12156880016	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/1/15	11/02/2015	11/03/2015	8/04/2015	7/05/2015	9/06/2015	6/07/2015	5/08/2015	7/09/2015	8/10/2015	9/11/2015	10/12/2015	**Trigger Levels**
Standing Water Level (m)	75.58	75.57	75.59	75.68	75.30	75.39	75.45	75.46	75.51	75.64	75.46	75.45	
Standpipe Height (m)	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	
Relative Standing Water Level (m)	74.84	74.83	74.85	74.94	74.56	74.65	74.71	74.72	74.77	74.9	74.72	74.71	
Water level AHD (m)#	892.66	892.67	892.65	892.56	892.94	892.85	892.79	892.78	892.73	892.60	892.78	892.79	**889.25**
pH	---	---	6.85	---	---	*6.82*	---	---	6.86	---	---	*6.74*	**6.9 to 8.0**
Conductivity (µS/cm)	---	---	315	---	---	315	---	---	326	---	---	326	**490**
Temperature (°C)	---	---	18.5	---	---	18.5	---	---	18.5	---	---	20	
TDS (mg/L)	---	---	166	---	---	164	---	---	145	---	---	177	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	---	152	---	---	169	---	---	140	---	---	144	
Total Alkalinity (mg/L $CaCO_3$)	---	---	152	---	---	169	---	---	140	---	---	144	
Sulfate (mg/L)	---	---	<1	---	---	1	---	---	<1	---	---	1	
Chloride (mg/L)	---	---	5	---	---	5	---	---	4	---	---	<1	
Calcium (mg/L)	---	---	34	---	---	34	---	---	34	---	---	32	
Magnesium (mg/L)	---	---	11	---	---	12	---	---	12	---	---	12	
Sodium (mg/L)	---	---	4	---	---	4	---	---	4	---	---	5	
Potassium (mg/L)	---	---	13	---	---	13	---	---	13	---	---	13	
Filtered Arsenic (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Cadmium (mg/L)	---	---	0.0003	---	---	0.0002	---	---	0.0001	---	---	0.0002	
Filtered Chromium (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Copper (mg/L)	---	---	0.002	---	---	<0.001	---	---	<0.001	---	---	0.001	
Filtered Lead (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Nickel (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Zinc (mg/L)	---	---	0.022	---	---	0.011	---	---	0.013	---	---	0.033	
Filtered Iron (mg/L)	---	---	<0.05	---	---	<0.05	---	---	<0.05	---	---	<0.05	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 21 *Groundwater Monitoring Bore D (EP DDH4/GW) Results Jan - Dec 2015*

Location	Off-Site Bore D (EP DDH4/GW)												
Sample Number	01156880017	02146880020	03156880017	04156880017	05156880019	06156880017	06156880017	08156880019	09156880017	10156880017	11156880019	12156880017	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/1/15	11/02/15	11/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/15	8/10/15	9/11/15	10/12/15	**Trigger Levels**
Standing Water Level (m)	37.62	37.2	36.68	37.03	36.8	35.51	37.12	36.85	36.6	36.91	36.20	35.58	
Standpipe Height (m)	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	
Relative Standing Water Level (m)	36.91	36.49	35.97	36.32	36.09	34.80	36.41	36.14	35.89	36.20	35.49	34.87	
Water level AHD (m)#	941.59	942.01	942.53	942.18	942.41	943.70	942.09	942.36	942.61	942.30	943.01	943.63	**940.61**
pH	---	---	6.89	---	---	6.93	---	---	6.84	---	---	*6.67*	**6.8 to 8.0**
Conductivity (µS/cm)	---	---	356	---	---	356	---	---	392	---	---	312	**608**
Temperature (°C)	---	---	17.0	---	---	17.5	---	---	16.5	---	---	18.5	
TDS (mg/L)	---	---	310	---	---	192	---	---	244	---	---	209	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	---	135	---	---	153	---	---	137	---	---	119	
Total Alkalinity (mg/L $CaCO_3$)	---	---	135	---	---	153	---	---	137	---	---	119	
Sulfate (mg/L)	---	---	35	---	---	19	---	---	22	---	---	17	
Chloride (mg/L)	---	---	9	---	---	10	---	---	8	---	---	<1	
Calcium (mg/L)	---	---	4	---	---	4	---	---	4	---	---	3	
Magnesium (mg/L)	---	---	1	---	---	1	---	---	1	---	---	1	
Sodium (mg/L)	---	---	76	---	---	68	---	---	68	---	---	64	
Potassium (mg/L)	---	---	5	---	---	5	---	---	5	---	---	5	
Filtered Arsenic (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Cadmium (mg/L)	---	---	<0.0001	---	---	<0.0001	---	---	0.0007	---	---	0.0003	
Filtered Chromium (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Copper (mg/L)	---	---	0.001	---	---	0.003	---	---	0.004	---	---	0.002	
Filtered Lead (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Nickel (mg/L)	---	---	0.003	---	---	0.002	---	---	0.002	---	---	0.002	
Filtered Zinc (mg/L)	---	---	0.02	---	---	0.022	---	---	0.109	---	---	0.044	
Filtered Iron (mg/L)	---	---	0.29	---	---	<0.05	---	---	0.07	---	---	0.14	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 22 *Groundwater Monitoring Bore E (EP PDH7/GW) Results Jan - Dec 2015*

Location	Off-Site Bore E (EP PDH7/GW)												
Sample Number	01156880018	02156880021	03156880018	04156880018	05156880020	06156880018	06156880018	08156880020	09156880018	10156880018	11156880020	12156880018	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/1/15	11/02/2015	11/03/2015	8/04/2015	7/05/2015	9/06/2015	6/07/2015	5/08/2015	7/09/2015	8/10/2015	9/11/2015	10/12/2015	**Trigger Levels**
Standing Water Level (m)	15.36	15.23	15.91	15.57	15.1	15.2	15.56	15.58	15.6	15.63	16.97	15.59	
Standpipe Height (m)	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	
Relative Standing Water Level (m)	14.63	14.50	15.18	14.84	14.37	14.47	14.83	14.85	14.87	14.90	16.24	14.86	
Water level AHD (m)#	940.27	940.40	939.72	940.06	940.53	940.43	940.07	940.05	940.03	940.00	938.66	940.04	**938.43**
pH	---	---	5.57	---	---	5.87	---	---	6.22	---	---	5.7	**5.5 to 8.0**
Conductivity (µS/cm)	---	---	132	---	---	97	---	---	115	---	---	104	**151**
Temperature (°C)	---	---	17.0	---	---	14.5	---	---	15.3	---	---	19.0	
TDS (mg/L)	---	---	80	---	---	52	---	---	60	---	---	220	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	---	16	---	---	15	---	---	18	---	---	14	
Total Alkalinity (mg/L $CaCO_3$)	---	---	16	---	---	15	---	---	18	---	---	14	
Sulfate (mg/L)	---	---	5	---	---	5	---	---	6	---	---	3	
Chloride (mg/L)	---	---	8	---	---	10	---	---	8	---	---	<1	
Calcium (mg/L)	---	---	1	---	---	1	---	---	2	---	---	1	
Magnesium (mg/L)	---	---	2	---	---	2	---	---	2	---	---	2	
Sodium (mg/L)	---	---	6	---	---	7	---	---	8	---	---	8	
Potassium (mg/L)	---	---	5	---	---	5	---	---	5	---	---	5	
Filtered Arsenic (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Cadmium (mg/L)	---	---	0.0001	---	---	<0.0001	---	---	<0.0001	---	---	<0.0001	
Filtered Chromium (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Copper (mg/L)	---	---	0.001	---	---	<0.001	---	---	0.001	---	---	<0.001	
Filtered Lead (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	
Filtered Nickel (mg/L)	---	---	0.002	---	---	<0.001	---	---	<0.001	---	---	0.001	
Filtered Zinc (mg/L)	---	---	0.015	---	---	0.031	---	---	0.025	---	---	0.059	
Filtered Iron (mg/L)	---	---	5.09	---	---	4.64	---	---	6.41	---	---	5.53	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required

Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 23 *Groundwater Monitoring Bore - EP PDH3/GW Results Jan - Dec 2015*

Location	Enhance Place Bore EP PDH3/GW												
Sample Number	01156880011	02156880013	03156880011	04156880011	05156880013	06156880011	07156880011	08156880013	09156880011	10156880011	11156880013	12156880011	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/01/15	11/02/15	12/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/15	8/10/15	9/11/15	10/12/15	**Trigger Level**
Standing Water Level (m)	23.79	23.80	23.81	23.81	23.78	23.80	23.80	23.80	23.82	23.81	23.78	23.79	
Standpipe Height	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	
Relative Standing Water Level (m)	23.07	23.08	23.09	23.09	23.06	23.08	23.08	23.08	23.1	23.09	23.06	23.07	
Water Level AHD (m)#	892.93	892.92	892.91	892.91	892.94	892.92	892.92	892.92	892.9	892.91	892.94	892.93	**891.06**

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required
Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

Table 24 *Groundwater Monitoring Bore - EP PDH4/GW Results Jan - Dec 2015*

Location	Enhance Place Bore EP PDH4/GW												
Sample Number	01156880012	02156880014	03156880012	04156880012	05156880014	06156880012	07156880012	08156880014	09156880012	10156880012	11156880014	12156880012	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	14/01/15	11/02/15	12/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/15	8/10/15	9/11/15	10/12/15	**Trigger Level**
Standing Water Level (m)	23.28	23.18	23.3	23.3	23.28	23.28	23.29	23.28	23.26	23.29	23.27	23.27	
Standpipe Height	0.2	0.2	0.2	0.2	0.2	0.2	0.15	0.2	0.2	0.2	0.2	0.2	
Relative Standing Water Level (m)	23.08	22.98	23.10	23.10	23.08	23.08	23.14	23.08	23.06	23.09	23.07	23.07	
Water Level AHD (m)#	893.00	893.10	892.98	892.98	893.00	893.00	892.94	893.00	893.02	892.99	893.01	893.01	**890.95**

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level. --- Indicates no sampling required
Water Level trigger is exceeded if the AHD water level drops below the nominated trigger level.

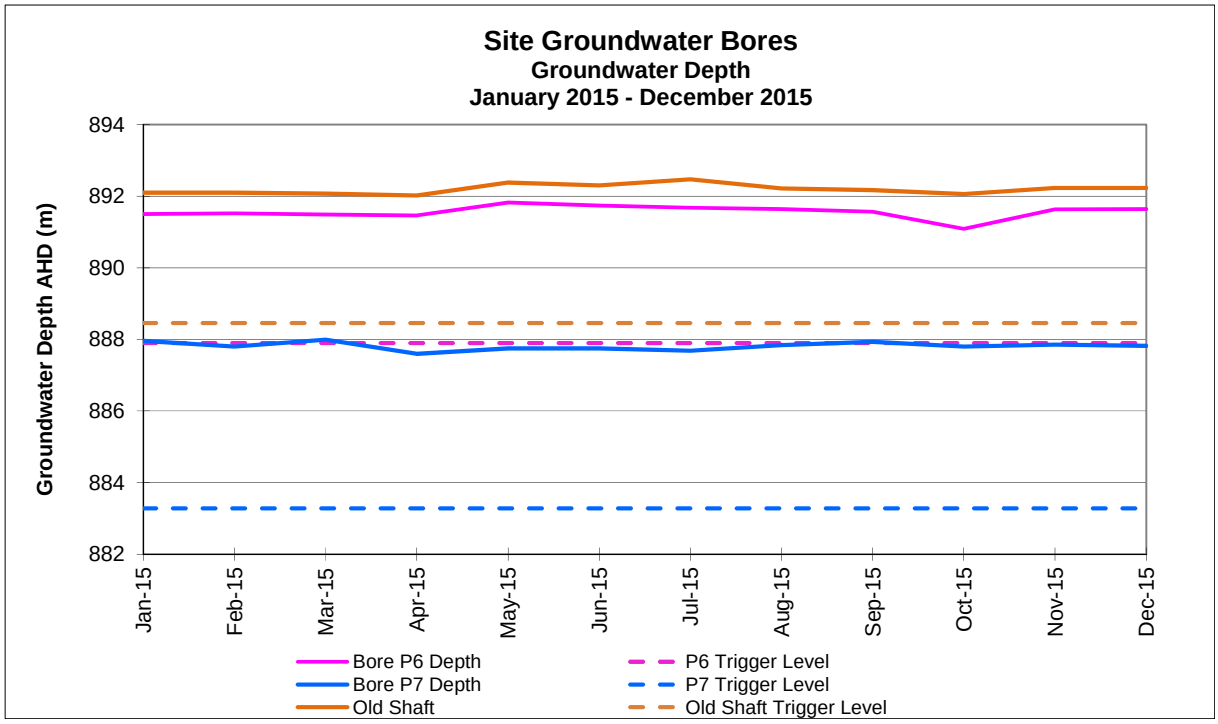


Figure 4 *Site Groundwater Monitoring Bore Depths 2015 – Site Groundwater Bores*

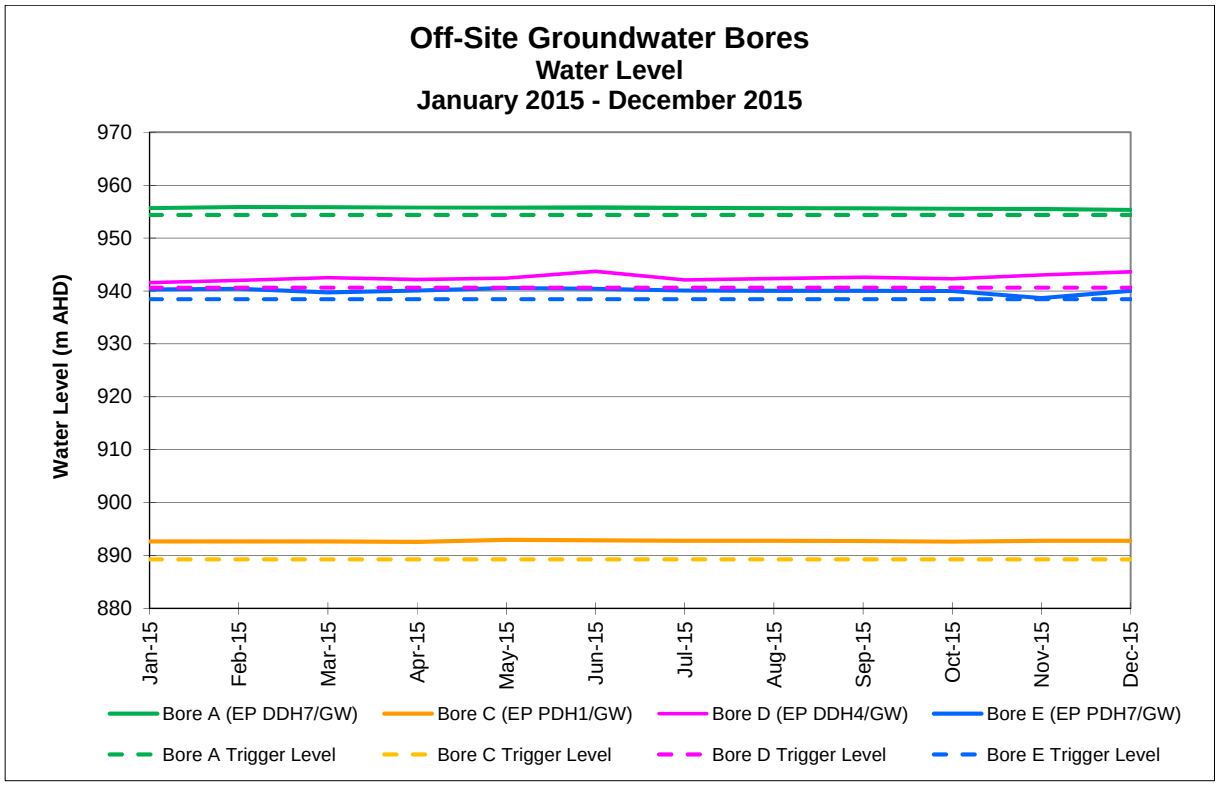


Figure 5 *Off-Site Groundwater Monitoring Bore Depths 2015*

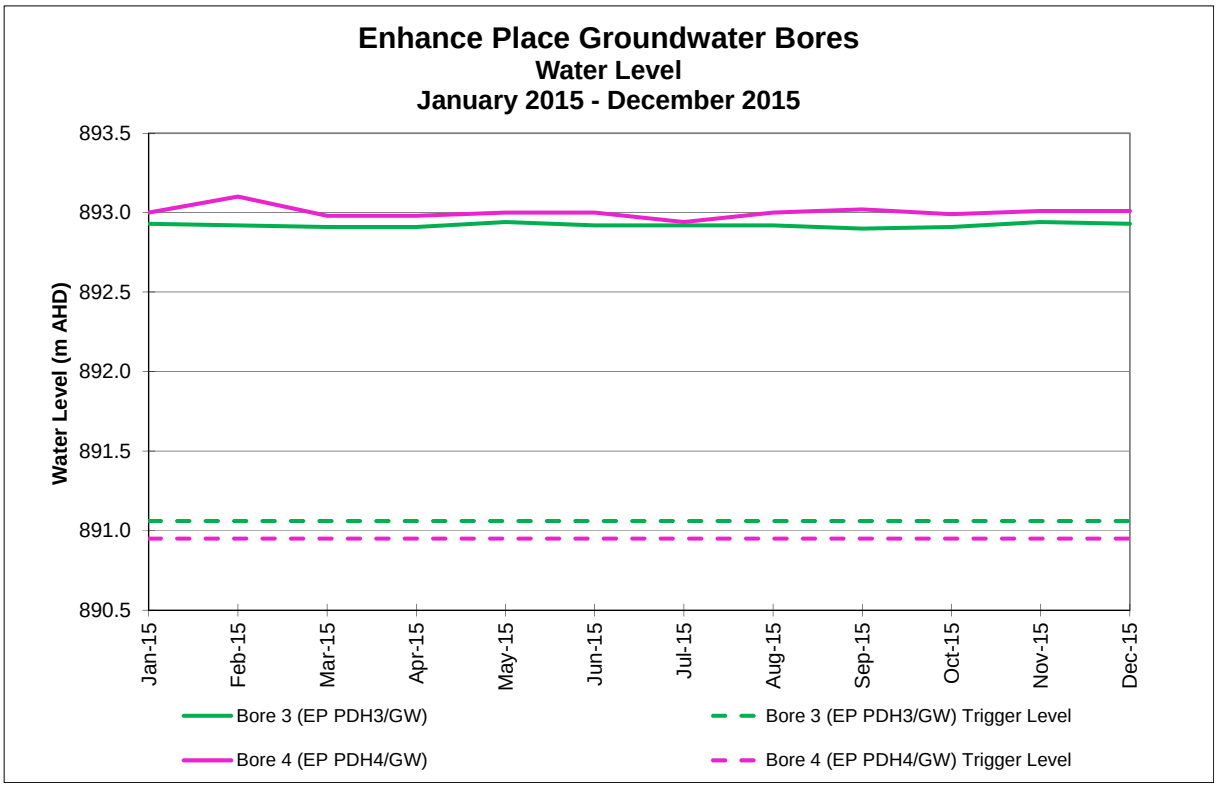


Figure 6 *Enhance Place Groundwater Monitoring Bore Depth 2015*

4.3 REVIEW & INTERPRETATION OF GROUND WATER MONITORING RESULTS

4.3.1 SITE GROUNDWATER BORES

Groundwater samples collected from the on-site groundwater bores during the January – December 2015 period generally show water quality results which are consistent throughout the monitoring period. There were no instances during the 2015 monitoring period where the groundwater level dropped below their respective water level triggers.

The pH within the site bores were shown to have dropped below the lower pH trigger level criterion intermittently throughout the January – December 2015 monitoring period. The pH at Bore P6 ranged between 6.07 and 6.65 pH units and dropped below the lower pH trigger level (6.2 pH units) during five of the twelve monitoring events. The pH at Bore P7 ranged between 6.27 and 6.69 pH units and was equal to the lower pH trigger level (6.3 pH units) during three of the twelve monitoring events. The pH at Old Shaft ranged between 6.03 and 7.06 pH units and dropped below the lower pH trigger level of 6.3 pH units during seven of the twelve monitoring events. There were no instances during 2015 where the upper level pH trigger levels were exceeded.

The electrical conductivity levels at the site bores have also intermittently exceeded their respective conductivity trigger levels throughout the January – December 2015 monitoring period. Bore P6 exceeded its conductivity trigger level of 1180µS/cm during four monitoring events; P7 exceeded its trigger level of 852µS/cm during three monitoring events; whilst the Old Shaft exceeded the 908µS/cm trigger level continuously throughout the 2015 monitoring period.

In accordance with the site's Water Management Plan, a continued exceedance of the groundwater quality triggers will act as a prompt for further investigations. An internal

investigative report was compiled to examine the exceedances of the trigger level criteria at the Old Shaft sampling well in relation to operations and activities occurring at the site and local meteorological conditions over the period January 2013 to December 2015 (Ref [1]). The outcome of this investigation indicated that the elevated electrical conductivity concentrations were most likely attributed to the below average rainfall observed since 2013. It was also considered that the water levels within the Old Shaft were adjusting as a result of the cessation of water extraction from the Wallerawang underground workings during the Care and Maintenance phase.

4.3.2 OFF-SITE GROUNDWATER BORES

The results of water quality monitoring within the off-site groundwater bores are generally shown to be compliant with their respective water quality trigger levels. Groundwater samples collected from off-site bores are shown to be compliant with the respective pH trigger levels with the exception of Bore A during September 2015; Bore C during June 2015 and December 2015 and Bore D during December 2015. During these instances the pH was below the lower pH trigger levels. Electrical conductivity levels were below the respective conductivity trigger levels for all off-site bores during the 2015 monitoring period.

All off-site bores generally exhibited standing water levels which were consistent throughout the 2015 monitoring period. Trigger levels for water depth were shown to be compliant at all of the off-site bores during the 2015 monitoring period.

4.3.3 ENHANCE PLACE GROUNDWATER BORES

The two monitoring bores located at the former Enhance Place mine generally exhibited standing water levels which were stable throughout the 2015 monitoring period. A slight fluctuation in standing water level was observed between January – March and June – August at Bore 4 (EP PDH4/GW). Water levels recorded were shown to be compliant with the respective standing water level triggers at both bores during the 2015 monitoring period.

5 SURFACE WATER QUALITY MONITORING

5.1 SURFACE WATER ASSESSMENT CRITERIA

The purpose of surface water monitoring is to ensure that any impact of the mining operations on the surface water bodies / streams can be identified, and to show compliance with relevant legislative requirements. Site specific Trigger values for water quality parameters pH and electrical conductivity were developed for Pine Dale Mine as stipulated in the sites' *Water Management Plan* in accordance with Schedule 3, Condition 27(c) of the Project Approval (Pa 10_0041). Trigger values for oil and grease and total suspended solids are non-site specific and are constant across all surface water sites. Surface water assessment criteria are presented in **Table 25.**

Table 25 *EPL Surface Water Assessment Criteria*

Surface Water Site	pH (range)	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Oil and Grease (mg/L)
The Bong	5.8 – 8.0	1157	NA	NA
S1	6.2 – 8.0	2325	30	10
S2	NA	NA	NA	NA
S3	6.4 – 8.0	2223	30	10
S4	7.3 – 8.0	957	30	10
S5	7.0 – 8.0	1013	30	10
S6	6.7 – 8.0	1941	30	10
S7	6.8 – 8.0	1007	30	10
EPA Point 2	7.1 – 8.0	2055	30	NA
EPA Point 3	6.4 – 8.0	2223	30	NA
EPA Point 13	6.5 – 8.0	NA	30	10
EPA Point 14	7.5 – 8.0	1166	30	NA

NA – no trigger value required for these locations.

5.2 SURFACE WATER MONITORING DATA SUMMARY

Surface water monitoring for the Pine Dale Mine is undertaken in accordance with the *Water Management Plan* and Environmental Protection Licence EPL 4911. Surface water sampling is undertaken at twelve monitoring locations within and surrounding the mine site (refer Drawing 1, **Appendix 1**.).

During the period January to December 2015, monitoring was undertaken on a monthly and quarterly basis for routine samples associated with the *Water Management Plan* and site EPL.

No samples were collected at EPL Point 13 (discharge to concrete lined section of Neubeck's creek), as there was no discharge from the mine during the 2015 monitoring period.

Surface water summary results for the period January – December 2015 are shown in **Tables 26** to **36**. Graphical presentations are shown in **Figures 7** to **11**.

Table 26 *Surface Water Monitoring Location EPL Point 2 Results 2015*

Location	EPL Point 2				
Sample No	02156880009	05156880009	08156880009	11156880009	**Trigger Values**
Sampling Month	**Feb**	**May**	**Aug**	**Nov**	
Date Sampled	11/02/2015	7/05/2015	5/08/2015	9/11/2015	
Time Sampled	13:11	13:45	17:01	15:04	
pH (pH units)	*6.58*	*6.98*	7.44	7.33	**7.1 – 8.0**
Conductivity (µS/cm)	1653	998	1004	567	**2055**
TSS (mg/L)	8	<5	<5	5	**30**
Sulphate (mg/L)	775	442	467	186	
Iron filterable (mg/L)	0.11	0.05	0.07	0.06	
Turbidity (NTU)	1	1	<1	8	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

Table 27 ***Surface Water Monitoring Location EPL Point 3 Results 2015***

Location	EPL Point 3				
Sample No	02156880004	05156880004	8156880004	11156880004	**Trigger Values**
Sampling Month	**Feb**	**May**	**Aug**	**Nov**	
Date Sampled	11/02/2015	7/05/2015	5/08/2015	9/11/2015	
Time Sampled	13:38	12:01	17:20	11:50	
pH (pH units)	7.42	6.49	6.72	7.39	**6.4 – 8.0**
Conductivity (µS/cm)	*2757*	2025	1399	842	**2223**
TSS (mg/L)	<5	8	9	8	**30**
Sulphate (mg/L)	1470	1050	694	313	
Iron filterable (mg/L)	0.14	1.22	1.22	0.26	
Turbidity (NTU)	1	4	3	8	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

Table 28 *Surface Water Monitoring Location EPL Point 14 Results 2015*

Location	EPL Point 14				
Sample No	02156880010	05156880010	08156880010	11156880010	**Trigger Values**
Sampling Month	**Feb**	**May**	**Aug**	**Nov**	
Date Sampled	11/02/2015	7/05/2015	5/08/2015	9/11/2015	
Time Sampled	10:22	09:36	15:02	09:52	
pH (pH units)	*8.65*	*8.22*	*8.5*	7.97	**7.5 – 8.0**
Conductivity (µS/cm)	1134	914	1025	1118	**1166**
TSS (mg/L)	17	7	6	8	**30**
Sulphate (mg/L)	72	70	71	147	
Iron filterable (mg/L)	<0.05	0.06	<0.05	0.08	
Turbidity (NTU)	15	6	3	7	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.

Table 29 *Surface Water Monitoring Location S1 Results 2015*

Location	Surface Water S1												
Month	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Trigger Levels**
Sample Number	01156880002	02156880002	03156880002	04156880002	05156880002	06156880002	07156880002	08156880002	09156880002	10156880002	11156880002	12156880002	
Date Sampled	14/1/15	11/02/15	11/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/2015	8/10/2015	9/11/15	10/12/15	
Time Sampled	13:39	13:20	10:53	11:18	13:48	14:16	1:18	17:05	11:55	12:19	14:58	12:33	
Temperature (°C)	22.0	21.5	18.0	12.0	10.5	8.5	4.0	5.5	11.8	14	18.8	20.3	
pH	6.92	7.19	6.83	6.55	6.56	6.67	6.70	7.36	6.44	6.77	7.69	7.19	**6.2 – 8.0**
Conductivity (µS/cm)	1555	2763	3120	959	2122	1489	1528	1426	2511	2177	872	2195	**2325**
TSS (mg/L)	---	7	---	---	7	---	---	< 5	---	---	<5	---	**30**
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---	**10**
Turbidity (NTU)	3	2	2	3	<1	<1	<1	<1	4	2	6	4	
Dissolved Oxygen (mg/L)	---	8.9	---	---	11.1	---	---	13.3	---	---	8.4	---	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	45	---	---	46	---	---	42	---	---	56	---	
Total Alkalinity (mg/L $CaCO_3$)	---	45	---	---	46	---	---	42	---	---	56	---	
Sulfate (mg/L)	---	1530	---	---	1120	---	---	700	---	---	300	---	
Chloride (mg/L)	---	236	---	---	166	---	---	54	---	---	33	---	
Calcium (mg/L)	---	192	---	---	157	---	---	94	---	---	48	---	
Magnesium (mg/L)	---	149	---	---	117	---	---	66	---	---	33	---	
Sodium (mg/L)	---	427	---	---	282	---	---	153	---	---	73	---	
Potassium (mg/L)	---	29	---	---	21	---	---	10	---	---	7	---	
Filtered Cobalt (mg/L)	---	0.002	---	---	0.007	---	---	0.004	---	---	0.002	---	
Filtered Manganese (mg/L)	---	0.716	---	---	1.1	---	---	0.619	---	---	0.302	---	
Filtered Nickel (mg/L)	---	0.107	---	---	0.09	---	---	0.039	---	---	0.017	---	
Filtered Zinc (mg/L)	---	0.051	---	---	0.049	---	---	0.03	---	---	0.007	---	
Filtered Iron (mg/L)	---	0.09	---	---	0.2	---	---	0.14	---	---	0.06	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.
--- Indicates no sampling required during particular period.

Table 30 *Surface Water Monitoring Location S2 Results 2015*

Location	Surface Water Site S2											
Month	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Sample Number	01156880003	02156880003	03156880003	04156880003	05156880003	06156880003	07156880003	08156880003	09156880003	10156880003	11156880003	12156880003
Date Sampled	14/1/15	11/02/15	11/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/15	8/10/2015	9/11/15	10/12/15
Time Sampled	11:45	11:41	11:01	11:26	12:04	14:16	9:53	17:10	10:17	10:35	11:56	12:37
Depth to Surface from Top of Rail Bridge (m)	3.71	3.74	3.73	3.74	3.76	3.75	3.76	3.76	3.73	3.74	3.74	3.77

Table 31 *Surface Water Monitoring Location S3 Results 2015*

Location	Surface Water S3												
Month	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Trigger Levels**
Sample Number	01156880004	02156880004	03156880004	04156880004	05156880004	06156880004	07156880004	08156880004	09156880004	10156880004	11156880004	12156880004	
Date Sampled	14/1/15	11/02/15	11/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/2015	8/10/2015	9/11/15	10/12/15	
Time Sampled	13:55	13:38	11:07	11:29	12:01	11:35	9:50	17:20	10:20	10:31	11:50	12:38	
Temperature (°C)	23.0	25.3	20.0	12.2	11.2	9.5	2.0	5.5	12.0	13.5	19.4	24.8	
pH	7.18	7.42	7.04	6.78	6.49	6.82	6.72	6.72	6.80	6.97	7.39	7.05	**6.4 – 8.0**
Conductivity (µS/cm)	1563	*2757*	*3042*	989	2025	1498	1506	1399	*2441*	2176	842	2033	**2223**
TSS (mg/L)	---	<5	---	---	8	---	---	9	---	---	8	---	**30**
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---	**10**
Turbidity (NTU)	4	1	2	3	4	4	4	3	4	2	8	6	
Dissolved Oxygen (mg/L)	---	8.9	---	---	11.5	---	---	13.3	---	---	8.8	---	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	35	---	---	28	---	---	27	---	---	45	---	
Total Alkalinity (mg/L $CaCO_3$)	---	35	---	---	28	---	---	27	---	---	45	---	
Sulfate (mg/L)	---	1470	---	---	1050	---	---	694	---	---	313	---	
Chloride (mg/L)	---	224	---	---	159	---	---	52	---	---	33	---	
Calcium (mg/L)	---	184	---	---	154	---	---	96	---	---	50	---	
Magnesium (mg/L)	---	132	---	---	104	---	---	64	---	---	32	---	
Sodium (mg/L)	---	374	---	---	254	---	---	148	---	---	71	---	
Potassium (mg/L)	---	25	---	---	19	---	---	10	---	---	6	---	
Filtered Cobalt (mg/L)	---	0.007	---	---	0.018	---	---	0.012	---	---	0.008	---	
Filtered Manganese (mg/L)	---	0.964	---	---	2.07	---	---	1.72	---	---	1.03	---	
Filtered Nickel (mg/L)	---	0.103	---	---	0.096	---	---	0.048	---	---	0.028	---	
Filtered Zinc (mg/L)	---	0.047	---	---	0.097	---	---	0.078	---	---	0.039	---	
Filtered Iron (mg/L)	---	0.14	---	---	1.22	---	---	1.22	---	---	0.26	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.
--- Indicates no sampling required during particular period.

Table 32 *Surface Water Monitoring Location S4 Results 2015*

Location	Surface Water S4												
Month	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Trigger Levels**
Sample Number	01156880005	02156880005	03156880005	04156880005	05156880005	06156880005	07156880005	08156880005	09156880005	10156880005	11156880005	12156880005	
Date Sampled	14/1/15	11/02/15	11/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/2015	8/10/2015	9/11/15	10/12/15	
Time Sampled	14:55	14:50	13:40	13:35	14:55	14:59	11:00	8:09	12:20	9:35	14:34	13:25	
Temperature (°C)	23.0	23.0	20.0	10.0	9.2	7.5	1.1	3.5	9	12.1	19.5	23.75	
pH	7.25	7.69	7.69	7.56	*7.21*	7.93	*7.03*	7.71	7.54	*8.18*	7.60	7.85	**7.3 – 8.0**
Conductivity (µS/cm)	179	359	457	386	307	452	379	421	438	612	640	825	**957**
TSS (mg/L)	---	21	---	---	<5	---	---	< 5	---	---	<5	---	**30**
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---	**10**
Turbidity (NTU)	13	7	9	5	3	3	11	4	5	8	11	12	
Dissolved Oxygen (mg/L)	---	7.9	---	---	11.4	---	---	13.8	---	---	8.7	---	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	194	---	---	140	---	---	197	---	---	153	---	
Total Alkalinity (mg/L $CaCO_3$)	---	194	---	---	140	---	---	197	---	---	156	---	
Sulfate (mg/L)	---	<1	---	---	10	---	---	21	---	---	<1	---	
Chloride (mg/L)	---	3	---	---	8	---	---	6	---	---	5	---	
Calcium (mg/L)	---	14	---	---	9	---	---	10	---	---	12	---	
Magnesium (mg/L)	---	9	---	---	6	---	---	7	---	---	7	---	
Sodium (mg/L)	---	54	---	---	46	---	---	74	---	---	47	---	
Potassium (mg/L)	---	7	---	---	9	---	---	12	---	---	11	---	
Filtered Cobalt (mg/L)	---	<0.001	---	---	<0.001	---	---	0.003	---	---	<0.001	---	
Filtered Manganese (mg/L)	---	0.032	---	---	0.007	---	---	0.103	---	---	0.021	---	
Filtered Nickel (mg/L)	---	0.001	---	---	<0.001	---	---	0.006	---	---	<0.001	---	
Filtered Zinc (mg/L)	---	0.01	---	---	0.008	---	---	0.22	---	---	<0.005	---	
Filtered Iron (mg/L)	---	0.39	---	---	0.14	---	---	0.48	---	---	0.42	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.
--- Indicates no sampling required during particular period.

Table 33 *Surface Water Monitoring Location S5 Results 2015*

Location	Surface Water S5												
Month	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Trigger Levels**
Sample Number	01156880006	02156880006	03156880006	04156880006	05156880006	06156880006	07156880006	08156880006	09156880006	10156880006	11156880006	12156880006	
Date Sampled	14/1/15	11/02/15	11/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/2015	8/10/2015	9/11/15	10/12/15	
Time Sampled	15:10	14:45	13:45	13:41	15:07	14:08	11:02	8:18	12:25	9:39	14:37	13:30	
Temperature (°C)	22.0	25.5	23.0	14.5	11.0	11.0	4.2	4.0	12.5	14.5	25.2	26.0	
pH	*6.94*	7.22	*6.76*	*6.58*	7.12	7.27	*6.62*	7.43	7.39	7.14	7.07	7.45	**7.0 – 8.0**
Conductivity (µS/cm)	502	881	*1300*	*1133*	562	854	975	853	684	*1054*	884	900	**1013**
TSS (mg/L)	---	<5	---	---	7	---	---	< 5	---	---	9	---	**30**
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---	**10**
Turbidity (NTU)	11	4	4	12	12	17	15	9	7	7	15	1	
Dissolved Oxygen (mg/L)	---	7.7	---	---	10.9	---	---	12.2	---	---	8.0	---	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	105	---	---	79	---	---	106	---	---	84	---	
Total Alkalinity (mg/L $CaCO_3$)	---	105	---	---	79	---	---	106	---	---	84	---	
Sulfate (mg/L)	---	309	---	---	161	---	---	291	---	---	314	---	
Chloride (mg/L)	---	46	---	---	22	---	---	23	---	---	34	---	
Calcium (mg/L)	---	49	---	---	32	---	---	50	---	---	51	---	
Magnesium (mg/L)	---	36	---	---	21	---	---	30	---	---	34	---	
Sodium (mg/L)	---	108	---	---	57	---	---	72	---	---	89	---	
Potassium (mg/L)	---	11	---	---	10	---	---	12	---	---	12	---	
Filtered Cobalt (mg/L)	---	0.004	---	---	0.009	---	---	0.017	---	---	0.011	---	
Filtered Manganese (mg/L)	---	0.434	---	---	0.549	---	---	1.17	---	---	0.773	---	
Filtered Nickel (mg/L)	---	0.032	---	---	0.028	---	---	0.053	---	---	0.045	---	
Filtered Zinc (mg/L)	---	0.019	---	---	0.033	---	---	0.136	---	---	0.038	---	
Filtered Iron (mg/L)	---	0.23	---	---	0.2	---	---	0.16	---	---	0.24	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.
--- Indicates no sampling required during particular period.

Table 34 *Surface Water Monitoring Location S6 Results 2015*

Location	Surface Water S6												
Month	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Trigger Levels**
Sample Number	01156880007	02156880007	03156880007	04156880007	05156880007	06156880007	07156880007	08156880007	09156880007	10156880007	11156880007	12156880007	
Date Sampled	14/1/15	11/02/15	11/03/15	8/04/15	7/05/15	9/06/15	6/07/15	5/08/15	7/09/2015	8/10/2015	9/11/15	10/12/15	
Time Sampled	15:25	14:55	13:50	13:45	15:15	14:15	10:52	8:30	12:30	9:44	14:26	13:21	
Temperature (°C)	25.0	24.0	22.0	11.0	10.0	10.5	2.2	3.0	13.0	12.5	22.3	29.0	
pH	7.49	7.33	7.31	7.20	6.96	7.36	6.86	7.37	7.13	7.28	7.44	7.49	**6.7 – 8.0**
Conductivity (µS/cm)	1464	*2629*	*3021*	1063	*2150*	1389	1772	1431	2650	2291	777	1934	**1941**
TSS (mg/L)	---	19	---	---	<5	---	---	< 5	---	---	<5	---	**30**
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---	**10**
Turbidity (NTU)	3	4	1	1	1	1	2	1	1	1	4	2	
Dissolved Oxygen (mg/L)	---	9.5	---	---	11.2	---	---	13.6	---	---	9.8	---	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	33	---	---	29	---	---	27	---	---	46	---	
Total Alkalinity (mg/L $CaCO_3$)	---	33	---	---	29	---	---	27	---	---	46	---	
Sulfate (mg/L)	---	1520	---	---	1100	---	---	729	---	---	283	---	
Chloride (mg/L)	---	224	---	---	171	---	---	51	---	---	30	---	
Calcium (mg/L)	---	191	---	---	169	---	---	99	---	---	46	---	
Magnesium (mg/L)	---	137	---	---	114	---	---	68	---	---	30	---	
Sodium (mg/L)	---	390	---	---	280	---	---	161	---	---	64	---	
Potassium (mg/L)	---	27	---	---	22	---	---	10	---	---	6	---	
Filtered Cobalt (mg/L)	---	0.002	---	---	0.012	---	---	0.011	---	---	0.003	---	
Filtered Manganese (mg/L)	---	0.446	---	---	1.53	---	---	1.53	---	---	0.493	---	
Filtered Nickel (mg/L)	---	0.08	---	---	0.101	---	---	0.054	---	---	0.016	---	
Filtered Zinc (mg/L)	---	0.026	---	---	0.067	---	---	0.07	---	---	0.007	---	
Filtered Iron (mg/L)	---	<0.05	---	---	<0.05	---	---	0.2	---	---	<0.05	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.
--- Indicates no sampling required during particular period.

Table 35 *Surface Water Monitoring Location S7 Results 2015*

Location	Surface Water S7												
Month	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Trigger Levels**
Sample Number	01156880008	02156880008	03156880008	04156880008	05156880008	06156880008	07156880008	08156880008	09156880008	10156880008	11156880008	12156880008	
Date Sampled	**14/1/15**	**11/02/15**	**11/03/15**	**8/04/15**	**7/05/15**	**9/06/15**	**6/07/15**	**5/08/15**	7/09/2015	8/10/2015	**9/11/15**	**10/12/15**	
Time Sampled	14:40	14:32	14:00	13:26	14:29	14:50	10:43	9:46	12:14	9:24	14:13	13:12	
Temperature (°C)	21.5	22.8	21.5	13.0	11.0	9.5	4.8	5.0	11.5	15.0	19.5	25.0	
pH	6.86	7.12	7.13	6.91	7.19	7.16	6.90	*8.18*	7.28	7.31	7.12	7.48	6.8 – 8.0
Conductivity (µS/cm)	547	843	*1231*	*1151*	538	872	778	856	680	990	930	871	1007
Turbidity (NTU)	7	1	1	3	6	4	4	2	4	2	6	2	
Dissolved Oxygen (mg/L)	---	6.8	---	---	8.9	---	---	11.2	---	---	6.4	---	
TSS (mg/L)	---	16	---	---	<5	---	---	< 5	---	---	<5	---	30
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<2	---	10
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	109	---	---	78	---	---	106	---	---	90	---	
Total Alkalinity (mg/L $CaCO_3$)	---	109	---	---	78	---	---	106	---	---	90	---	
Sulfate (mg/L)	---	279	---	---	154	---	---	273	---	---	355	---	
Chloride (mg/L)	---	42	---	---	20	---	---	21	---	---	37	---	
Calcium (mg/L)	---	44	---	---	31	---	---	46	---	---	56	---	
Magnesium (mg/L)	---	32	---	---	20	---	---	28	---	---	37	---	
Sodium (mg/L)	---	94	---	---	51	---	---	72	---	---	93	---	
Potassium (mg/L)	---	11	---	---	9	---	---	12	---	---	12	---	
Filtered Cobalt (mg/L)	---	0.001	---	---	0.002	---	---	0.003	---	---	0.002	---	
Filtered Manganese (mg/L)	---	0.426	---	---	0.269	---	---	0.284	---	---	0.530	---	
Filtered Nickel (mg/L)	---	0.019	---	---	0.018	---	---	0.026	---	---	0.039	---	
Filtered Zinc (mg/L)	---	0.007	---	---	0.013	---	---	0.088	---	---	0.025	---	
Filtered Iron (mg/L)	---	0.17	---	---	0.35	---	---	0.4	---	---	0.29	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.
--- Indicates no sampling required during particular period.

Table 36 *Site Surface Water Monitoring Location 'The Bong' Results 2015*

Location	Surface Water The Bong												
Month	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Trigger Levels**
Sample Number	01156880001	02156880001	03156880001	04156880001	05156880001	06156880001	07156880001	08156880001	0915688001	10156880001	11156880001	12156880001	
Date Sampled	**14/1/15**	**11/02/15**	**11/03/15**	**8/04/15**	**7/05/15**	**9/06/15**	**6/07/15**	**5/08/15**	**7/09/15**	**8/10/2015**	**9/11/15**	**10/12/2015**	
Time Sampled	13:25	13:01	10:48	11:13	13:37	14:10	01:11	16:48	11:50	12:15	13:27	12:28	
Temperature (°C)	30.0	26.2	21.0	12.0	10.6	11.5	7.2	3.0	14.0	15.5	29.8	29.75	
pH	6.94	*5.49*	*5.22*	*5.44*	6.93	7.39	6.96	*8.09*	6.54	*8.08*	7.88	7.75	5.8 – 8.0
Conductivity (µS/cm)	201	383	446	331	232	274	327	299	245	297	137	407	1157
Turbidity (NTU)	293	3	12	3	47	12	30	7	180	141	>1000	86.2	
Bicarbonate Alkalinity (mg/L $CaCO_3$)	---	<1	---	---	2	---	---	3	---	---	6	---	
Total Alkalinity (mg/L $CaCO_3$)	---	<1	---	---	2	---	---	3	---	---	6	---	
Sulfate (mg/L)	---	148	---	---	74	---	---	111	---	---	42	---	
Chloride (mg/L)	---	6	---	---	4	---	---	3	---	---	2	---	
Calcium (mg/L)	---	31	---	---	17	---	---	27	---	---	9	---	
Magnesium (mg/L)	---	15	---	---	9	---	---	10	---	---	4	---	
Sodium (mg/L)	---	9	---	---	6	---	---	6	---	---	3	---	
Potassium (mg/L)	---	5	---	---	3	---	---	3	---	---	2	---	
Filtered Arsenic (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Filtered Cadmium (mg/L)	---	0.0003	---	---	0.0001	---	---	<0.0001	---	---	<0.0001	---	
Filtered Chromium (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Filtered Copper (mg/L)	---	<0.001	---	---	<0.001	---	---	0.002	---	---	<0.001	---	
Filtered Lead (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Filtered Nickel (mg/L)	---	0.05	---	---	0.022	---	---	0.011	---	---	0.005	---	
Filtered Zinc (mg/L)	---	0.069	---	---	0.01	---	---	0.024	---	---	0.007	---	
Filtered Iron (mg/L)	---	<0.05	---	---	<0.05	---	---	<0.05	---	---	<0.05	---	

Shaded Cells & Italics - Indicates results are outside of the nominated Trigger Level.
--- Indicates no sampling required during particular period.

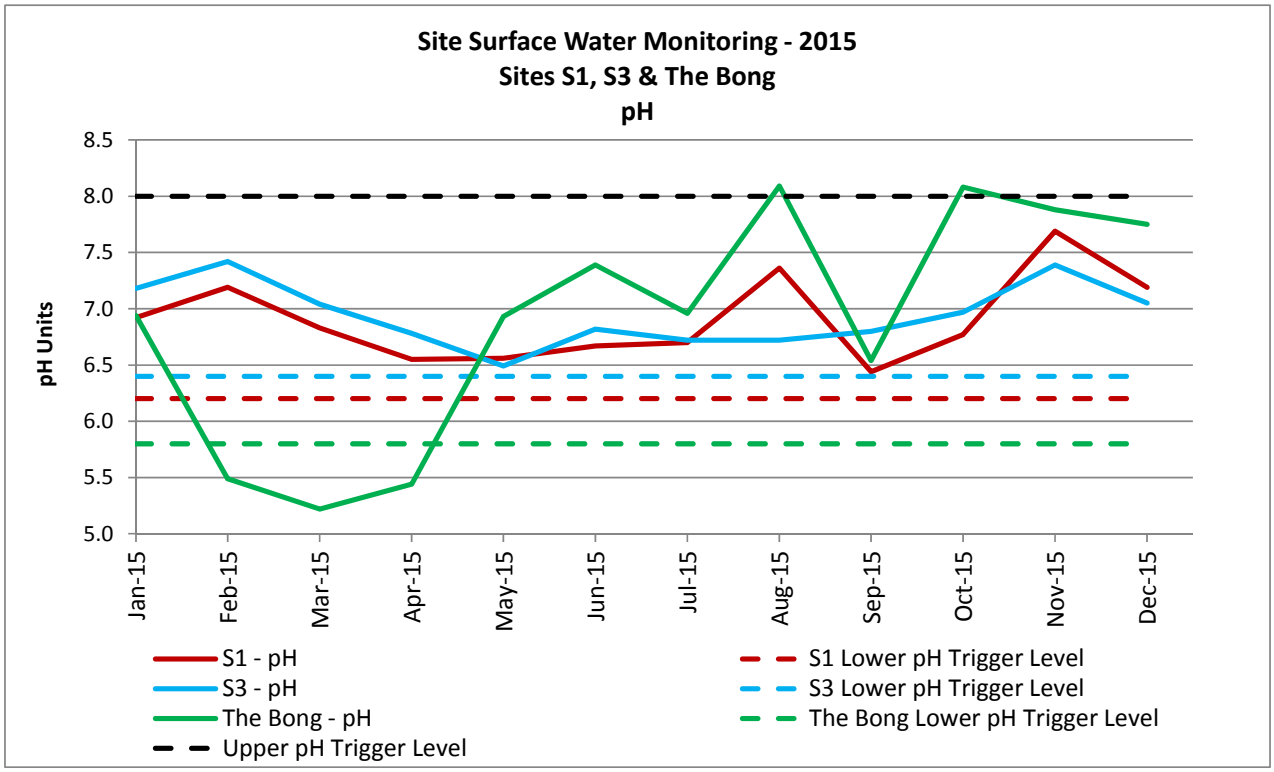


Figure 7 *Site Surface Water S1, S3 & the Bong pH Results 2015*

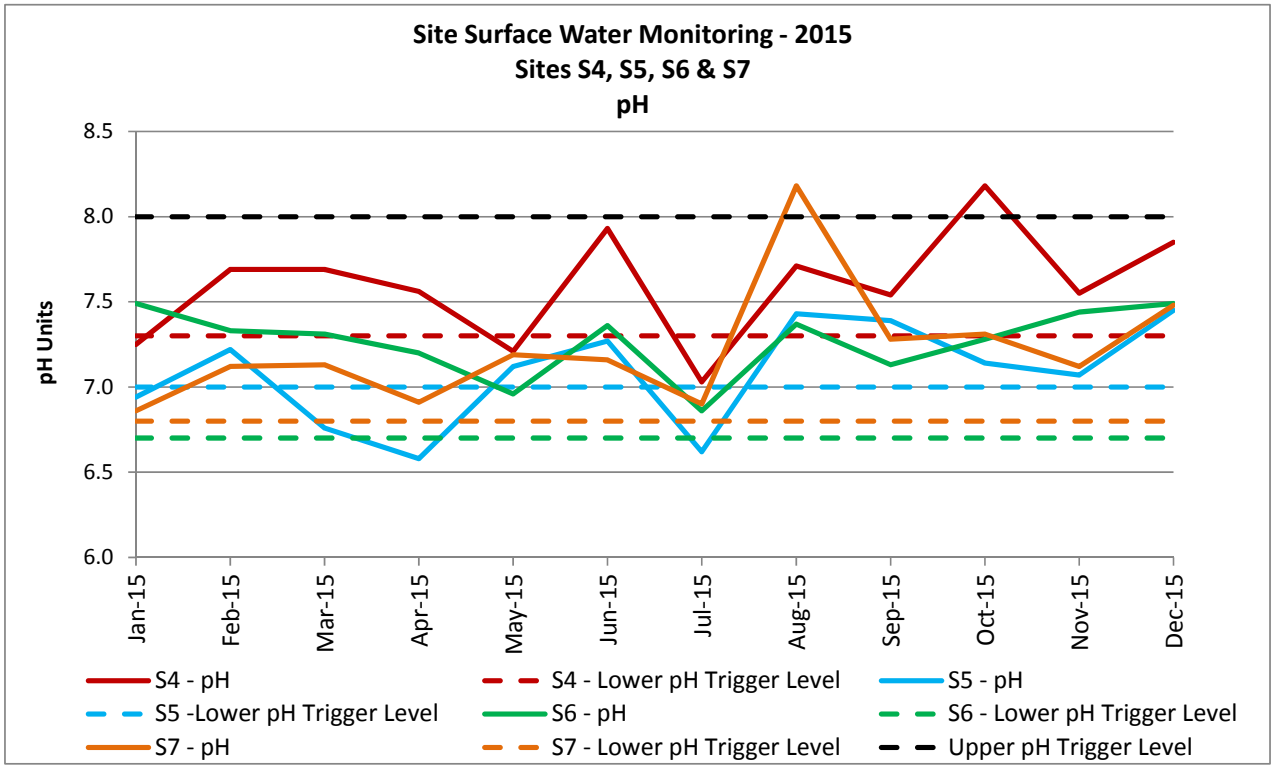


Figure 8 *Site Surface Water S4, S5, S6 & S7 pH Results 2015*

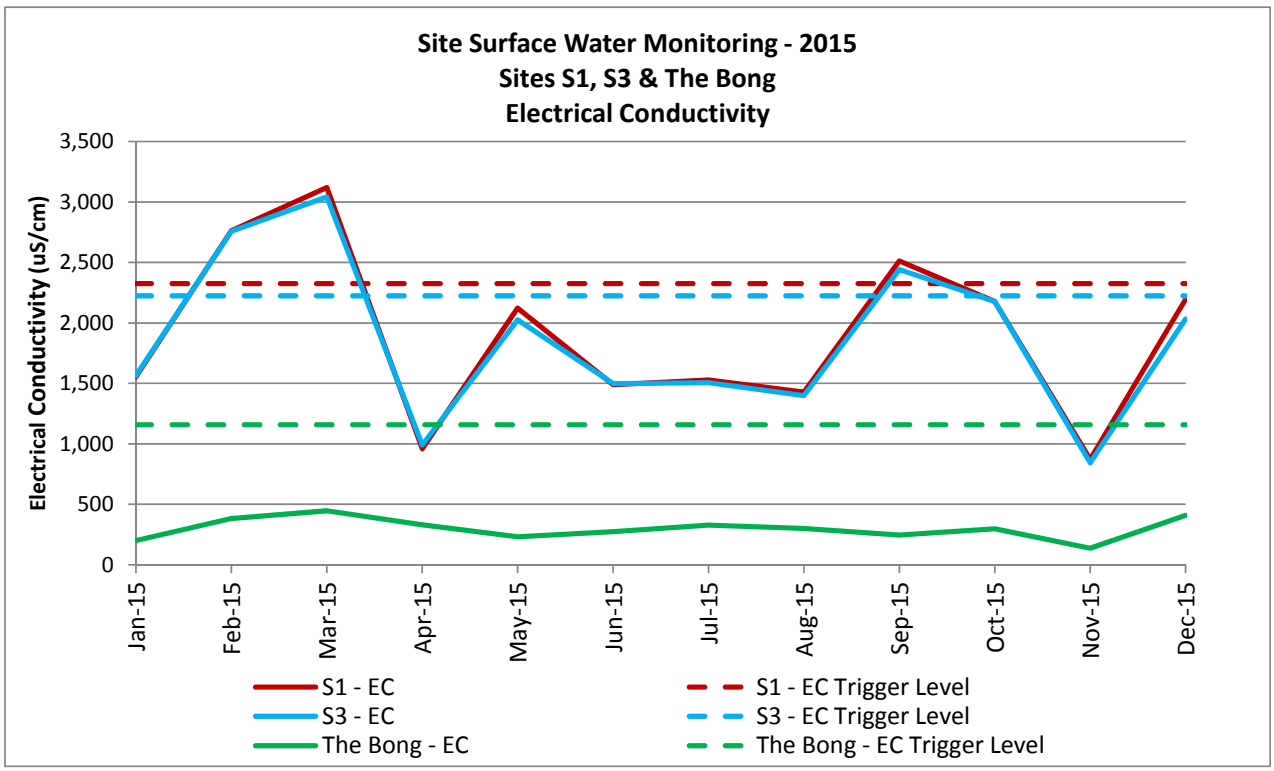


Figure 9 *Site Surface Water S1, S3 & the Bong Electrical Conductivity Results 2015*

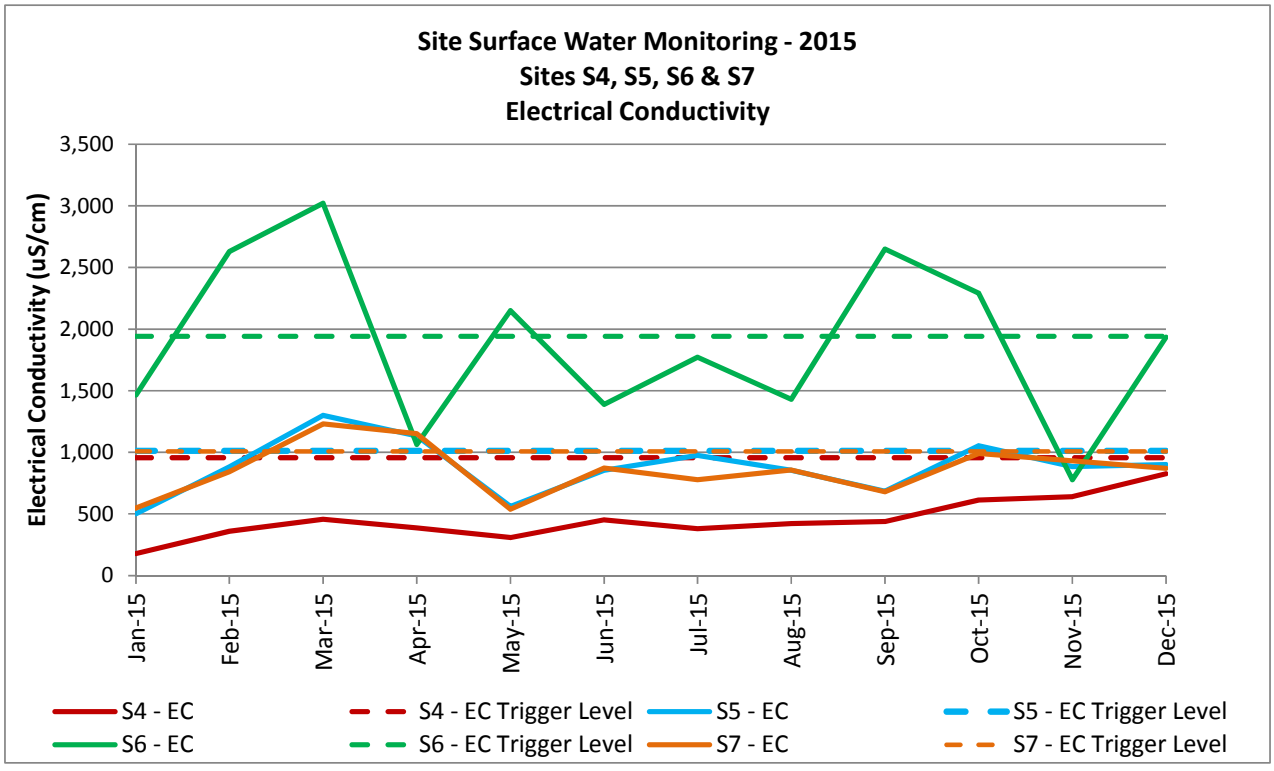


Figure 10 *Site Surface Water S4, S5, S6 & S7 Electrical Conductivity Results 2015*

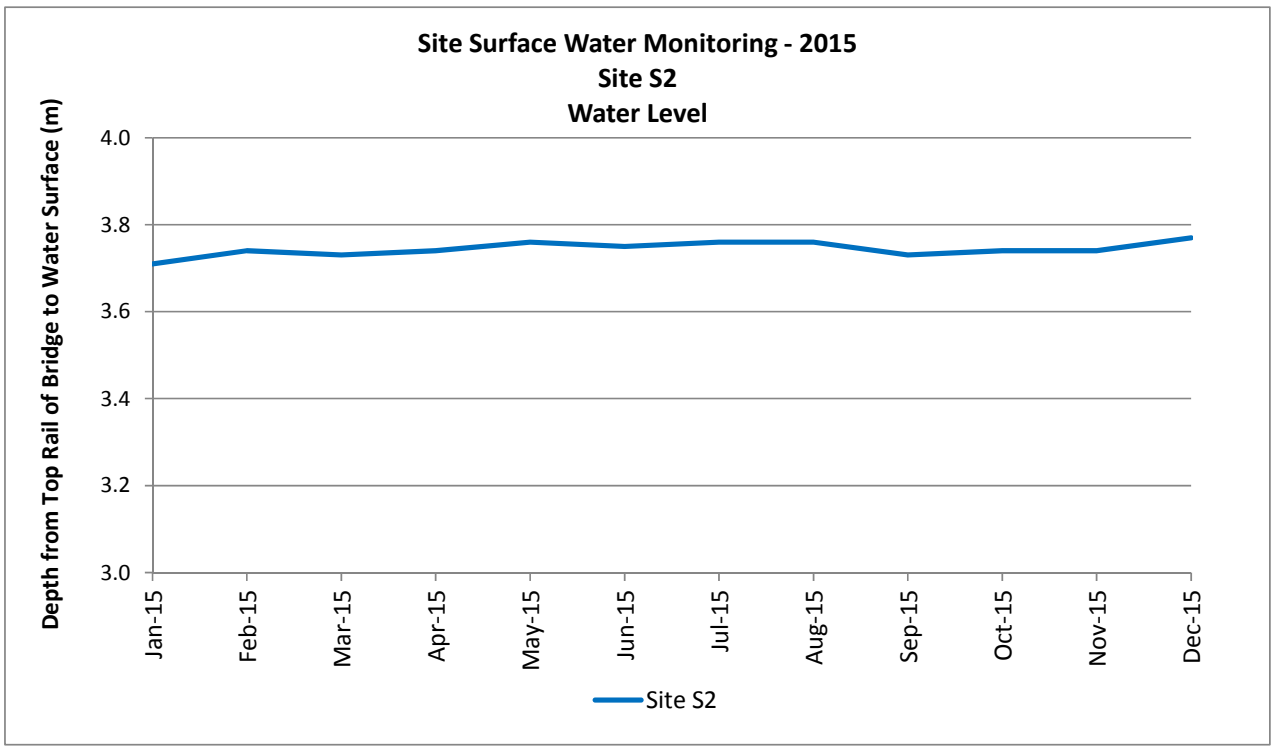


Figure 11 *Site Surface Water S2 - Water Level 2015*

5.3 REVIEW & INTERPRETATION OF SURFACE WATER MONITORING RESULTS

5.3.1 EPL SURFACE WATERS

During the 2015 monitoring period, four quarterly EPL surface water monitoring events were conducted. These events were conducted during February, May, August and November 2015. The results of the water quality monitoring at the EPL surface water sites are generally shown to be compliant with their respective water quality trigger levels. All EPL surface water sites reported Total Suspended Solids (TSS) concentrations less than the trigger level (30mg/L) during the four quarterly monitoring events. The pH at surface water site EPL 2 was below the lower pH trigger level (7.1 pH units) during the February and May 2015 monitoring events. The pH at surface water site EPL 14 was above the upper pH trigger level (8.0 pH units) during the February, May and August 2015 monitoring events. The electrical conductivity at site EPL 3 exceeded the trigger level (2223µS/cm) during the February 2015 monitoring event.

Monitoring at EPL Point 13 was not undertaken during the 2015 monitoring period as there was no surface water discharge from the site into Neubeck's Creek.

5.3.2 SITE SURFACE WATERS

Site surface water samples were collected monthly during the January to December 2015 monitoring period.

The pH at surface water sites S1, S3 and S6 were within the respective upper and lower pH trigger level range for the entire 2015 monitoring period. The pH levels at the Bong was below its respective lower pH trigger level (5.8 pH units) during February, March and April and above the upper pH trigger level (8.0 pH units) during August and October. The pH concentration at surface water site S4 was marginally below the lower pH trigger level (7.3 pH units) during January, May

and July and above the upper pH trigger level (8.0 pH units) during October. The pH at surface water site S5 was below the lower pH trigger level (7.0 pH units) during the January, March, April and July monitoring events. During the August 2015 monitoring event the pH at surface water site S7 was above the upper pH trigger level of 8.0 pH units.

The electrical conductivity at surface water sites the Bong and S4 were below their respective trigger levels for the 2015 monitoring period. Surface water sites S1 and S3 reported electrical conductivity levels above their respective trigger levels during the February, March and September monitoring periods. Surface water site S5 reported conductivity levels above the respective trigger level during the March, April and October monitoring periods; whilst S7 reported conductivity levels above the respective trigger level during the March and April monitoring periods. Surface water site S6 exceeded the electrical conductivity level during five of the twelve 2015 monitoring events (January, February, March, May, September and October).

Overall, during the 2015 monitoring period conductivity levels are generally shown to fluctuate. The water monitoring locations in Neubeck's Creek (surface water sites S1, S3 and S6) show consistency in their conductivity and pH concentrations recorded throughout the 2015 monitoring period. Similarly, surface water sites S5 and S7, which are collected at Blue Lake, and downstream Cox's River, show a similar pattern in fluctuating conductivity and pH levels throughout the 2015 monitoring period.

The water level at surface water site S2 remained relatively stable throughout the 2015 monitoring period.

6 METEOROLOGICAL MONITORING

6.1 METEOROLOGICAL MONITORING REQUIREMENTS

Pine Dale Mine records meteorological data continuously via an on-site meteorological monitoring station in accordance with the requirements of Environmental Protection License No. 4911. The meteorological monitoring requirements of EPL 4911 are presented in **Table 37**.

Table 37 *EPL Meteorological Monitoring Requirements*

Parameter	Units of Measure	Frequency	Averaging Period
Air temperature	°C	Continuous	1 hour
Wind direction	°	Continuous	15 minute
Wind speed	m/s	Continuous	15 minute
Sigma theta	°	Continuous	15 minute
Rainfall	mm	Continuous	15 minute
Relative humidity	%	Continuous	1 hour

6.2 METEOROLOGICAL MONITORING RESULTS

Meteorological monitoring Parameters recorded at the Pine Dale Mine Meteorological Monitoring Station include Wind Speed, Wind Direction, Temperature at 10m height, Temperature at 2m height, Rainfall, Humidity, Solar Radiation, Sigma Theta and Evapotranspiration. Details of weather data recorded for the period January to December 2015 are summarised in **Table 38**. Windrose plots for the 2015 period are presented in **Figures 12** and **13**.

Table 38 *Meteorological Monitoring Summary Data 2015*

Month (2014)	Rainfall (mm)	Cumulative Rainfall (mm)	No of Rain Days/ Month	Air Temp. @ 2m (°C)			Air Temp. @ 10m (°C)			Sigma theta (º)			Relative Humidity (%)			Wind Speed (m/s)			Modal Wind Direction
				Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	
January	124.2	124.2	13	18.7	4.8	31.9	18.3	4.7	30.3	32.1	0.0	103.6	72.8	16.3	97.0	1.5	0.0	12.3	SE
February	36.4	160.6	14	18.5	8.0	32.8	18.0	7.9	30.9	36.4	0.0	103.1	73.7	19.7	97.0	1.1	0.0	10.0	ESE
March	30.0	190.6	7	16.4	1.3	32.3	16.4	1.6	31.0	31.3	0.0	102.1	67.3	13.2	96.8	1.4	0.0	12.8	SE
April	177.8	368.4	20	12.0	-0.6	25.9	11.8	-0.6	24.5	26.9	0.0	100.2	81.4	34.9	96.9	1.5	0.0	16.5	SSE
May	25.0	393.4	14	8.8	-3.3	20.0	8.8	-3.2	19.5	26.3	0.0	102.8	78.3	30.6	97.5	1.7	0.0	15.1	WNW
June	27.6	421.0	14	5.6	-7.0	17.1	5.7	-7.0	16.5	23.0	0.0	100.6	81.4	21.4	96.6	1.0	0.0	13.7	WNW
July	46.0	467.0	15	4.1	-7.9	15.5	4.1	-7.9	14.6	24.5	0.0	100.2	79.5	22.0	97.0	1.7	0.0	17.9	WNW
August	47.6	514.6	11	6.3	-5.7	20.4	6.2	-5.5	19.4	23.1	0.0	102.1	75.3	30.7	96.9	1.7	0.0	13.8	W
September	17.0	531.6	13	8.7	-4.1	23.5	8.5	-4.3	22.3	25.2	0.0	100.0	70.9	9.1	96.9	1.4	0.0	17.2	WNW
October	71.6	603.2	9	14.9	0.8	30.7	14.6	0.8	29.8	28.6	0.0	100.9	68.1	11.1	96.7	1.2	0.0	13.9	WNW
November	77.0	680.2	9	16.8	3.7	33.6	16.4	3.6	32.6	30.1	0.0	101.5	67.1	12.4	97.3	1.6	0.0	15.1	SE
December	76.0	756.2	5	19.0	5.2	35.5	18.4	5.2	32.7	31.2	0.0	101.3	58.5	7.3	95.3	1.4	0.0	14.9	ESE
TOTAL	**756.2**	**-**	**144**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Minimum	**17.0**	**-**	**5**	**-**	**-7.9**	**-**	**-**	**-7.9**	**-**	**-**	**0.0**	**-**	**-**	**7.3**	**-**	**-**	**0.0**	**-**	**-**
Maximum	**177.8**	**-**	**20**	**-**	**-**	**35.5**	**-**	**-**	**32.7**	**-**	**-**	**103.6**	**-**	**-**	**97.5**	**-**	**-**	**17.9**	**-**

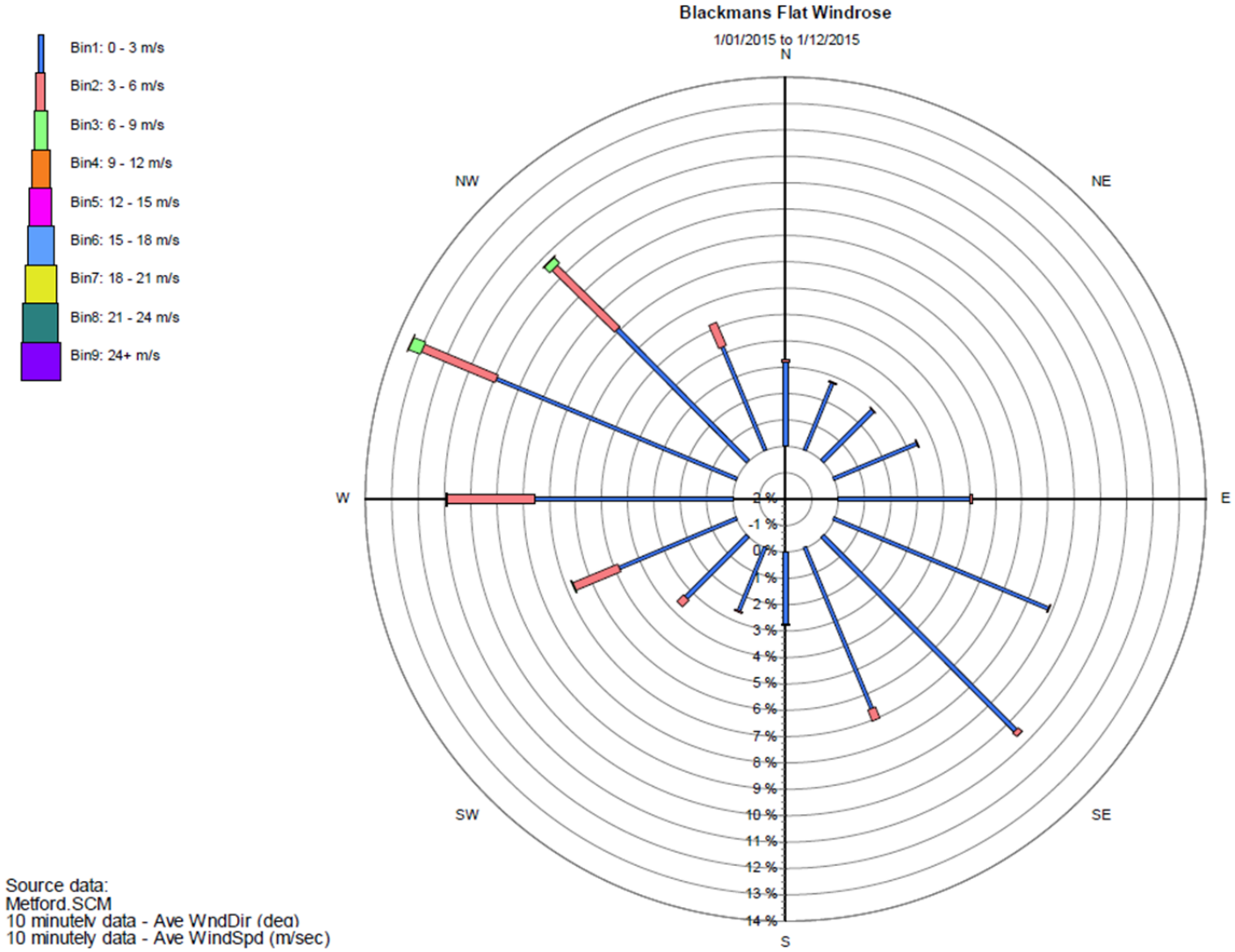


Figure 12 *Pine Dale Mine Windrose Plot - 2015*

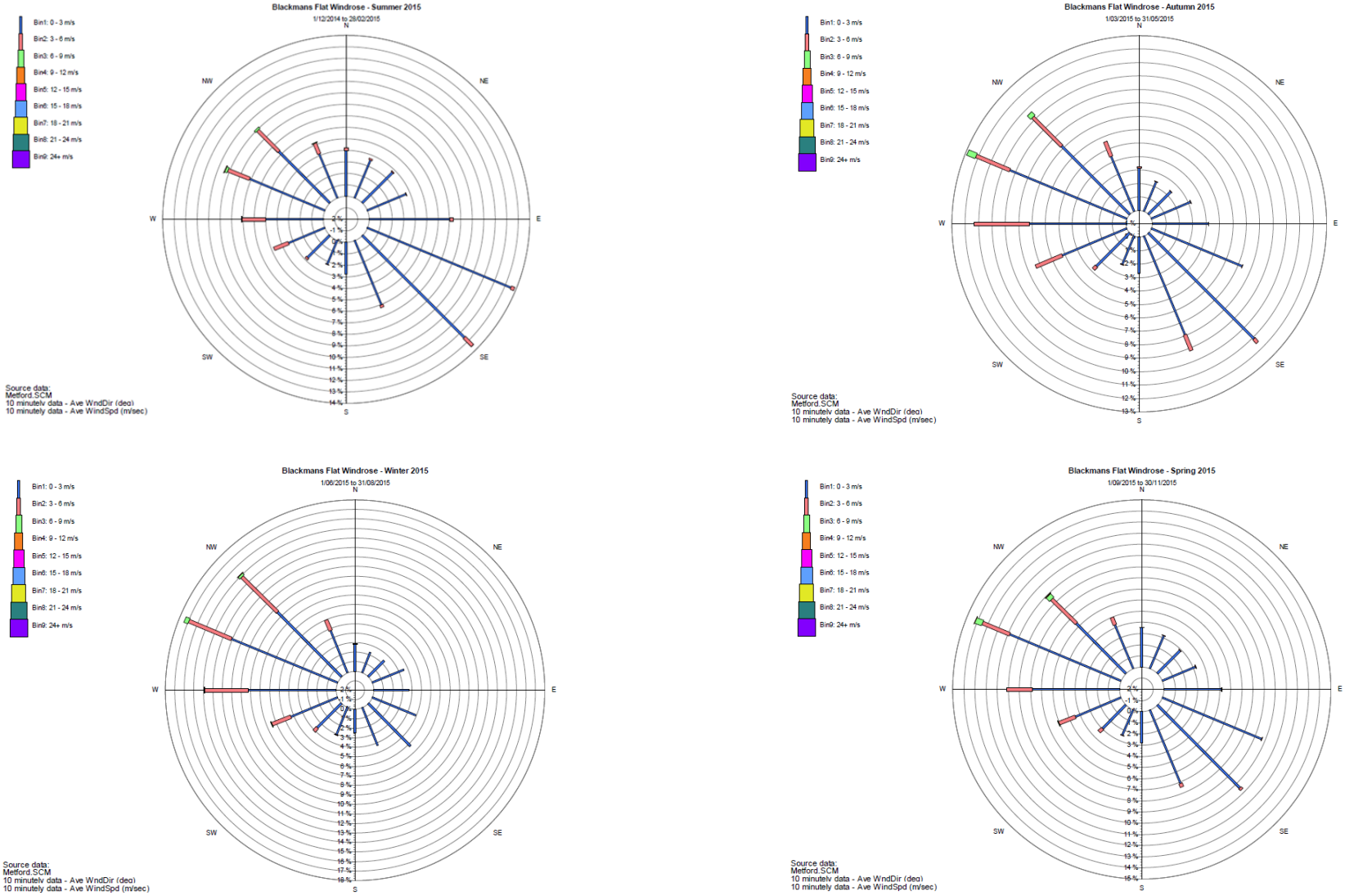


Figure 13 *Pine Dale Mine Seasonal Windrose Plots - 2015*

6.3 REVIEW OF METEOROLOGICAL MONITORING RESULTS

Pine Dale Mine received 756.2mm of rainfall and experienced 144 rainfall days during the 2015 reporting period. Rainfall during this period was observed to be greater than rainfall recorded in 2014 (704.8mm and 145 rainfall days). The maximum temperature recorded during the reporting period was 35.5°C at 2m and 32.7°C at 10m during December 2015. The lowest temperature was observed during July with -7.9°C recorded at both 2m and 10m. Predominant wind directions at the site during 2015 were observed to be from the south-east and east-south-east during Summer and from the west-north-west during Autumn, Winter and Spring. The maximum wind speed measured at the site was 17.9m/s on the 11th July from a north-westerly direction.

7 STREAM HEALTH & CHANNEL STABILITY MONITORING

7.1 STREAM HEALTH & CHANNEL STABILITY MONITORING SUMMARY

Schedule 3 Condition 27(b) of Project Approval PA 10_0041 requires performance criteria and a programme to monitor the stream health, riparian vegetation health and channel stability of creeks and other water bodies that could potentially be affected by the project (Pine Dale Mine). As defined in Schedule 3 Condition 27(b) of the Project Approval, the creeks and other water bodies that could potentially be affected by the project include Neubeck's Creek, the Blue Lake and Cox's River.

A Channel Stability and Stream Health Monitoring programme is outlined in Section 4.6.5 of the *Pine Dale Mine Water Management Plan* for the purpose of monitoring channel stability, stream health and vegetation health of Neubeck's Creek to ensure mining operations do not have an adverse effect upon the Neubeck's Creek drainage line. In addition to the requirements of the Channel Stability and Stream Health Monitoring programme, the water bodies of Blue Lake and Cox's River have also been included in the monitoring programme, to satisfy the conditions outlined in the Project Approval.

In accordance with the Channel Stability and Stream Health Monitoring programme, routine six-monthly assessments of Neubeck's Creek, Blue Lake and Cox's River were undertaken in February and August 2015 (refer RCA Reports 6880-876, Feb 2015; and 6880-890, Aug 2015 respectively).

Visual assessments and photographic documentation of each site are also undertaken on a monthly basis detailing evidence of erosion, newly exposed soils, and vegetation disturbance [refer to monitoring field sheets presented in **Appendix 2**]. Results of the routine six-monthly assessments are presented in **Tables 40** to **44**. The location of Stream Health monitoring sites are presented in **Drawing 2**, **Appendix 1**.

A stream health assessment of the Blue Lake site was not undertaken, as the site does not fit the requirements of the *Ephemeral Stream Assessment* protocol, which is targeted at streams and drainage lines. However, the Blue Lake is still included in monthly erosion and vegetation disturbance observation inspections.

The performance criteria utilized for the stream health assessment of each monitoring point is derived from the CSIRO *Ephemeral Stream Assessment* protocol and is reproduced in **Table 39**.

Table 39 *Classification of Different Drainage Line States (CSIRO)*

Activity Rating (%)	Classification	Discussion of Classification
80 +	Very Stable	Drainage line is very stable and likely to be in original form. It is able to withstand all flow velocities that have previously occurred in this area and only minimal monitoring is required, predominantly after high flow events, to ensure condition does not deteriorate.
70-80	Stable	Drainage line is stable. It is important to assess this zone in relation to the other classifications and define whether this zone is moving from potentially stabilising to a more stable form, or if it is deteriorating from a very stable form. The nature of this relationship will identify the type of monitoring required.
60-69	Potentially Stabilising	Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
50-59	Active	Drainage line is actively eroding and remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.
< 50	Very Active	Drainage line is very actively eroding and immediate remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.

Table Source: CSIRO Ephemeral Stream Assessment (CSIRO, undated)

Table 40 *Classification of Different Drainage Line State – Site SH1*

Location:		**SH1**	
Assessment Date:		**6/8/2015 & 12/02/15**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	3	Dense perennial plant cover, similar to vegetation on floodplain/riparian zone. Characteristic wetland species composition. No observable plant burial by sediment.
Profile of D/L	Shape and Aspect of Drainage Line Section	3	Potentially stabilising. Side walls become rounded and crusted alluvial fan at foot of side walls. Width>depth.
	Longitudinal Morphology of Drainage Line	3	Flat with a cohesive fine textured 'soil-like' bed.
	Particle Size of Materials on Drainage Line Floor	3	Material on floor is much larger in particle size and/ or denser than material on walls. Surface armouring (e.g., cobbles, competent country rock).
Wall Materials	Nature of Drainage Line Materials	2	Materials that slake and/or disperse are exposed on less than 0.3m of wall height.
Bank Edge	Shape of Stream Bordering Slopes	4	Gently slopes bank/ floodplain, laterally extensive, <5º
	Nature of Lateral Flow Regulation	3	Sparse grassland/ woodland with bare soil bank lip. Moderate flow rate, some highly focused inflow locations.
Classification of Drainage Line August 2015 survey		Score 22/32 69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
Comparative Survey Results			
Classification of Drainage Line February 2015 survey		69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 41 *Classification of Different Drainage Line State – Site SH2*

Location:		**SH2**	
Assessment Date:		**6/8/2015 & 12/02/15**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	3	Dense perennial plant cover, similar to vegetation on floodplain/ riparian zone. Characteristic wetland species composition. No observable plant burial by sediment.
Profile of D/L	Shape and Aspect of Drainage Line Cross Section	3	Potentially stabilising. Side walls become rounded and crusted alluvial fan at foot of side walls. Width>depth.
	Longitudinal Morphology of Drainage Line	2	Flat, continuous, loose sediment with signs of recent/ frequent movement.
	Particle Size of Materials on Drainage Line Floor	3	Material on floor is much larger in particle size and/ or denser than material on walls. Surface armouring (e.g. cobbles, competent country rock).
Wall Materials	Nature of Drainage Line Materials	3	Materials that slake and/or disperse are exposed on less than 0.3m of wall height.
Bank Edge	Shape of Stream Bordering Slopes	3	Moderately sloped bank, 5-10º
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line August 2015 survey		Total Score 22/32 69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
Comparative Survey Results			
Classification of Drainage Line February 2015 survey		69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 42 *Classification of Different Drainage Line State – Site SH3*

Location:		**SH3**	
Assessment Date:		**6/8/2015 & 12/02/15**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	3	Dense perennial plant cover, similar to vegetation on floodplain/ riparian zone. Characteristic wetland species composition. No observable plant burial by sediment.
Profile of D/L	Shape and Aspect of Drainage Line Cross Section	2	Actively eroding. Slight undercutting, near vertical walls, alluvial fans also eroding. Depth=width.
	Longitudinal Morphology of Drainage Line	3	Flat with a cohesive fine textured “soil like” bed
	Particle Size of Materials on Drainage Line Floor	2	Material on floor is slightly larger in particle size and/or denser (more consolidated) than material on walls (e.g. well sorted gravel).
Wall Materials	Nature of Drainage Line Materials	3	Materials that slake and / or disperse are exposed on less than 0.3 metre of wall height.
Bank Edge	Shape of Stream Bordering Slopes	2	Steep bank, 10-30º, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line August 2015 survey		Total Score 20/32 63%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
Comparative Survey Results			
Classification of Drainage Line February 2015 survey		63%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

Table 43 *Classification of Different Drainage Line State – Site SH3A*

Location:		**SH3A**	
Assessment Date:		**6/8/2015 & 12/02/15**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	1	Little or no vegetation growing on drainage line walls.
Profile of D/L	Shape and Aspect of Drainage Line Cross Section	NA	This section of drainage line coated with spray-concrete.
	Longitudinal Morphology of Drainage Line	NA	
	Particle Size of Materials on Drainage Line Floor	NA	
Wall Materials	Nature of Drainage Line Materials	NA	
Bank Edge	Shape of Stream Bordering Slopes	2	Steep bank, 10-30º, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line		NA	Drainage line is considered stabile due to spray-concrete lining.

Table 44 *Classification of Different Drainage Line State – Site SH5*

Location:		**SH5**	
Assessment Date:		**6/8/2015 & 12/02/15**	
Activity		**Rating**	**Explanation of Rating**
Vegetation	On Drainage Line Floor	1	Little or no vegetation growing on drainage line floor.
	On Drainage Line Walls	3	Dense perennial plant cover, similar to vegetation on floodplain/ riparian zone. Characteristic wetland species composition. No observable plant burial by sediment.
Profile of D/L	Shape and Aspect of Drainage Line Cross Section	5	Stable. Gently sloping walls, generally low, "S" shaped bed/bank continuum. Width>>Depth (aspect ratio very low).
	Longitudinal Morphology of Drainage Line	3	Flat with a cohesive fine textured "soil like" bed.
	Particle Size of Materials on Drainage Line Floor	3	Material on floor is much larger in particle size and/or denser than material on walls: surface armoring (e.g. cobbles, competent country rock).
Wall Materials	Nature of Drainage Line Materials	4	Materials that do not slake or disperse are exposed on wall surface.
Bank Edge	Shape of Stream Bordering Slopes	3	Moderately sloped bank, 5-10^{o}
	Nature of Lateral Flow Regulation	3	Sparse grassland / woodland with bare soil bank lip. Moderate flow rate, some highly focused inflow locations.
Classification of Drainage Line August 2015 survey		Total Score 22/32 69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
Comparative Survey Results			
Classification of Drainage Line February 2015 survey		69%	Drainage line is potentially stabilizing. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

7.2 REVIEW & INTERPRETATION OF STREAM HEALTH MONITORING RESULTS

The routine six-monthly assessment of channel stability, stream health and vegetation health of the Neubeck's Creek monitoring locations (SH1, SH2, SH3 and SH3A) at Pine Dale Mine indicates the drainage line is classified as potentially stabilizing at locations SH1, SH2 and SH3. The drainage line at location SH3a is considered stable. An assessment of the Cox's River monitoring site (SH5) indicated the drainage line is also potentially stabilising.

The CSIRO *Ephemeral Stream Assessment* protocol indicates ongoing monitoring of both Neubeck's Creek and Cox's River drainage line is required; however, rehabilitation works are not required in the immediate future.

In accordance with the Pine Dale Mine *Water Management Plan*, monitoring of the six Stream Health assessment locations was conducted on a monthly basis throughout 2015. The ongoing monitoring encompasses monthly visual assessments and photographic documentation of each site over time. Results of this monthly monitoring indicate no evidence of erosion, newly exposed soils, or vegetation disturbance.

8 NOISE MONITORING

8.1 NOISE ASSESSMENT CRITERIA

The purpose of noise monitoring is to ensure that any impact of mining operations on the surrounding sensitive receivers can be identified; and to show compliance with relevant legislative requirements. The conditional requirements within Project Approval 10_0041 (Schedule 3, Condition 1) and Environmental Protection License (EPL 4911) are presented in **Table 50**.

Table 45 *Noise Assessment Criteria*

Location		Noise Monitoring Location	Day LAeq (15 min) dBA	Evening LAeq (15 min) dBA
Residences 18, 32 and 33		NM1 - (EPL Ref No.33)	42	39
Residences 20-23, 25 and 27-29		N/A	42	36
Residences 8, 10-12 and14		NM2 - (EPL Ref No.14); NM3 - (EPL Ref No.10)	42	35
Residences 2, 5-7 and 35		NM4 - (EPL Ref No.5); NM6 - (EPL Ref No.2)	35	35
All other residences		NM5 - (EPL Ref No.4)	35	35
During construction and removal of the amenity bund	Residences 8, 10-12, 14, 18, 20-23, 25, 27-29 and 32 - 33	N/A	46	N/A

- *Noise generated by the project should not exceed the above criteria at any residence on privately-owned land or on more than 25% of any privately-owned land.*
- *Day: The period from 7:00am to 6:00pm Monday to Saturday and 8:00am to 6:00pm Sundays and Public Holidays*
- *Evening: The period from 6:00pm to 10:00pm Monday to Sunday*

8.2 NOISE MONITORING DATA SUMMARY

In accordance with the Pine Dale Mine *Noise Management Plan*, Environmental Protection Licence (EPL) No. 4911 and Project Approval (10_0041 Schedule 3-1) conditions attended noise surveys are undertaken on a quarterly basis.

Quarterly monitoring was undertaken at the following intervals during the 2015 period:

- Quarter 1 – January to March, monitoring conducted 11 and 12 March 2015
- Quarter 2 – April to June, monitoring conducted 8 and 9 April 2015
- Quarter 3 – July to September, monitoring conducted on 6 and 7 July 2015
- Quarter 4 – October to December, monitoring conducted on 8 and 9 October 2015

The aim of the attended noise survey is to record any impact of operational noise on the surrounding community. Two to three consecutive 15-minute surveys are conducted at each of the six monitoring locations. Results of attended noise surveys carried out during the 2015 monitoring period are presented in **Tables 46** to **49**. Meteorological conditions recorded during each noise survey are presented in **Table 50**. Noise survey locations are presented in **Drawing 1**, **Appendix 1**.

Table 46 *Attended Noise Survey – Quarter 1, March 2015*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Road Traffic L_{Aeq} 15min Contribution	Birds & Other L_{Aeq} 15min Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$						
11 Mar 2015	9:02	NM1	54.1	57.7	40.4	NIL	42	53.5	45.3	Pine Dale Mine Road Traffic Birds & Other	NIL 36 to 67 33 to 57
11 Mar 2015	9:17	NM1	50.8	54.1	38.6	NIL	42	50.3	41.4	Pine Dale Mine Road Traffic Birds & Other	NIL 37 to 62 34 to 63
11 Mar 2015	9:32	NM1	52.5	56.2	40.8	NIL	42	51.5	45.7	Pine Dale Mine Road Traffic Birds & Other	NIL 40 to 65 40 to 63
11 Mar 2015	10:20	NM2	50.8	54.7	38.2	NIL	42	50.0	42.9	Pine Dale Mine Road Traffic Birds & Other	NIL 37 to 62 34 to 58
11 Mar 2015	10:35	NM2	51.2	55.1	37.7	NIL	42	50.1	44.9	Pine Dale Mine Road Traffic Birds & Other	NIL 36 to 62 33 to 58
11 Mar 2015	10:50	NM2	52.2	55.9	41.3	NIL	42	49.5	48.9	Pine Dale Mine Road Traffic Birds & Other	NIL 37 to 63 36 to 59
12 Mar 2015	07:28	NM3	57.6	61.3	41.6	NIL	42	56.8	49.9	Pine Dale Mine Road Traffic Birds & Other	NIL 40 to 73 37 to 68
12 Mar 2015	07:43	NM3	62.3	64.2	45.1	NIL	42	56.0	61.1	Pine Dale Mine Road Traffic Birds & Other	NIL 40 to 79 37 to 75
12 Mar 2015	07:58	NM3	55.0	57.4	38.6	NIL	42	53.8	48.7	Pine Dale Mine Road Traffic Birds & Other	NIL 39 to 75 35 to 70
12 Mar 2015	08:34	NM4	45.3	45.31	39.7	NIL	35	NIL	43.4	Pine Dale Mine Road Traffic Birds & Other	NIL NIL 38 to 57
12 Mar 2015	08:49	NM4	42.0	43.4	38.8	NIL	35	29.0	41.8	Pine Dale Mine Road Traffic Birds & Other	NIL 38 to 46 37 to 62
12 Mar 2015	09:04	NM4	46.0	44.5	37.9	NIL	35	NIL	46.0	Pine Dale Mine Road Traffic Birds & Other	NIL NIL 36 to 68
11 Mar 2015	15:13	NM5	50.4	51.3	49.3	NIL	35	NIL	50.2	Pine Dale Mine Road Traffic Birds & Other	NIL NIL 48 to 56
11 Mar 2015	15:28	NM5	53.4	54	51.8	NIL	35	37.1	53.1	Pine Dale Mine Road Traffic Birds & Other	NIL 54 to 55 50 to 68
11 Mar 2015	15:43	NM5	54.6	55.1	53.9	NIL	35	38.2	54.3	Pine Dale Mine Road Traffic Birds & Other	NIL 54 to 56 53 to 56
11 Mar 2015	17:20	NM6	46.7	47.3	44.69	NIL	35	25.1	45.9	Pine Dale Mine Road Traffic Birds & Other	NIL 45 to 49 43 to 53
11 Mar 2015	17:35	NM6	45.7	46.4	43.3	NIL	35	30.1	45.0	Pine Dale Mine Road Traffic Birds & Other	NIL 44 to 47 41 to 57
11 Mar 2015	17:50	NM6	44.4	45.8	42.4	NIL	35	35.1	43.8	Pine Dale Mine Road Traffic Birds & Other	NIL 42 to 48 41 to 58

Table 47 *Attended Noise Survey – Quarter 2, April 2015*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Road Traffic L_{Aeq} 15min Contribution	Birds & Other L_{Aeq} 15min Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$						
08 Apr 2015	10:41	NM1	51.5	54.3	45.5	NIL	42	51.3 *	38.4 *(Springvale Construction)*	Pine Dale Mine Road Traffic & Wind Springvale	NIL 43 to 64 42 to 57
08 Apr 2015	10:56	NM1	48.9	51.4	43.5	NIL	42	48.7 *	35.5 *(Springvale Construction)*	Pine Dale Mine Road Traffic & Wind Springvale	NIL 41 to 60 41 to 56
08 Apr 2015	11:11	NM1	51.2	54.1	44	NIL	42	51.2 *	29.9 *(Springvale Construction)*	Pine Dale Mine Road Traffic & Wind Springvale	NIL 41 to 63 44 to 57
08 Apr 2015	09:43	NM2	53.3	48.5	55.7	NIL	42	52.6 *	45.1	Pine Dale Mine Road Traffic & Wind Birds & Other	NIL 43 to 60 47 to 65
08 Apr 2015	9:58	NM2	52.9	46.2	55.8	NIL	42	52.9 *	Nil	Pine Dale Mine Road Traffic & Wind Birds & Other	NIL 44 to 59 NIL
08 Apr 2015	10:13	NM2	50.8	42.2	54.3	NIL	42	50.5 *	39.5	Pine Dale Mine Road Traffic & Wind Birds & Other	NIL 37 to 62 51 to 61
09 Apr 2015	9:35	NM3	42.1	45.2	35.8	NIL	42	41.7	31.6	Pine Dale Mine Road Traffic Birds & Other	NIL 32 to 53 35 to 57
09 Apr 2015	9:50	NM3	44.9	48.3	36.4	NIL	42	44.6	33.3	Pine Dale Mine Road Traffic Birds & Other	NIL 29 to 61 38 to 64
09 Apr 2015	10:05	NM3	42.3	45.4	35.6	NIL	42	41.3	35.8	Pine Dale Mine Road Traffic Birds & Other	NIL 30 to 54 34 to 56
08 Apr 2015	15:47	NM4	43.9	45.9	40.1	NIL	35	42.7 *	37.7	Pine Dale Mine Road Traffic & Wind Birds & Other	NIL 37 to 50 40 to 56
08 Apr 2015	16:02	NM4	43.6	45.6	40.6	NIL	35	42.5 *	37.4	Pine Dale Mine Road Traffic & Wind Birds & Other	NIL 38 to 52 40 to 62
08 Apr 2015	16:17	NM4	40.9	42.5	38.4	NIL	35	40.4 *	31.2	Pine Dale Mine Road Traffic & Wind Birds & Other	NIL 37 to 47 38 to 52
09 Apr 2015	7:29	NM5	40.3	42.2	35.9	NIL	35	38.7	35.4	Pine Dale Mine Road Traffic Birds & Other	NIL 33 to 54 35 to 60
09 Apr 2015	7:44	NM5	46.9	40	35.8	NIL	35	38.1	25	Pine Dale Mine Road Traffic Birds & Other	NIL 34 to 48 36 to 50
09 Apr 2015	7:59	NM5	38.9	39.9	35.7	NIL	35	36.8	34.9	Pine Dale Mine Road Traffic Birds & Other	NIL 34 to 50 35 to 66
09 Apr 2015	8:29	NM6	41.6	43.9	36.8	NIL	35	39.6	37.3	Pine Dale Mine Road Traffic Birds & Other	NIL 35 to 59 36 to 63
09 Apr 2015	8:44	NM6	43.3	45	38.4	NIL	35	41.7	38.3	Pine Dale Mine Road Traffic Birds & Other	NIL 37 to 57 37 to 69
09 Apr 2015	8:59	NM6	42.8	44.6	37.8	NIL	35	40.2	39.3	Pine Dale Mine Road Traffic Birds & Other	NIL 35 to 53 35 to 64

Table 48 *Attended Noise Survey – Quarter 3, July 2015*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Road Traffic L_{Aeq} 15min Contribution	Birds & Other L_{Aeq} 15min Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$						
6 July 2015	09:44	NM1	53.1	56.1	44.0	NIL	42	52.5	43.7	Pine Dale Mine Road Traffic Birds & Other	NIL 42 to 66 39 to 55
6 July 2015	09:59	NM1	50.0	53.3	42.8	NIL	42	49.5	41.0	Pine Dale Mine Road Traffic Birds & Other	NIL 41 to 63 40 to 53
6 July 2015	10:30	NM2	51.3	55.3	40.8	NIL	42	51.0	40.4	Pine Dale Mine Road Traffic Birds & Other	NIL 39 to 63 37 to 55
6 July 2015	10:45	NM2	51.0	55.4	49.7	NIL	42	50.8	36.8	Pine Dale Mine Road Traffic Birds & Other	NIL 37 to 58 35 to 52
6 July 2015	16:43	NM3	62.0	66.5	41.3	NIL	35	62.0	41.2	Pine Dale Mine Road Traffic Birds & Wind	NIL 42 to 80 36 to 63
6 July 2015	16:58	NM3	62.0	66.9	43.8	NIL	35	62.3	40.0	Pine Dale Mine Road Traffic Birds & Other	NIL 43 to 79 39 to 54
7 July 2015	07:23	NM4	40.2	41.6	36.3	NIL	35	21.8	40.2	Pine Dale Mine Road Traffic Birds & Other	NIL 36 to 48 34 to 59
7 July 2015	07:38	NM4	39.6	40.5	36.9	NIL	35	NIL	39.6	Pine Dale Mine Road Traffic Birds & Other	NIL NIL 35 to 59
6 July 2015	15:56	NM5	44.3	46.5	39.6	NIL	35	NIL	44.3*	Pine Dale Mine Road Traffic Birds & Other	NIL NIL 35 to 61
6 July 2015	16:26	NM5	42.8	44.8	38.9	NIL	35	NIL	42.8*	Pine Dale Mine Road Traffic Birds & Wind	NIL NIL 36 to 57
6 July 2015	15:10	NM6	42.5	45.4	36.5	NIL	42	38.4	40.4*	Pine Dale Mine Road Traffic Birds & Wind	NIL 38 to 54 34 to 58
6 July 2015	15:25	NM6	48.2	47.4	37.4	NIL	42	40.9	47.3*	Pine Dale Mine Road Traffic Birds & Wind	NIL 37 to 55 35 to 76

Table 49 *Attended Noise Survey – Quarter 4, October 2015*

Survey Date	Survey Start Time	Location	Overall			Pine Dale Mine $L_{Aeq\ 15min}$ Contribution	Pine Dale Mine $L_{Aeq\ 15min}$ Limit	Road Traffic L_{Aeq} 15min Contribution	Birds & Other L_{Aeq} 15min Contribution	Comments, Noise Sources and Level Ranges (Min to Max) dB(A)	
			$L_{Aeq\ 15min}$	$L_{A10\ 15min}$	$L_{A90\ 15min}$						
8 October 2015	16:11	NM1	54.2	57.3	41.3	NIL	35	54.0	36.2	Pine Dale Mine Road Traffic Birds & Other	NIL 39 to67 33 to63
8 October 2015	16:26	NM1	55.4	58.9	43.8	NIL	35	55.4	29.8	Pine Dale Mine Road Traffic Birds & Other	NIL 39 to 67 36 to 50
8 October 2015	15:32	NM2	52.8	55.8	42.2	NIL	35	52.6	39.7	Pine Dale Mine Road Traffic Birds & Other	NIL 41 to 66 35 to 56
8 October 2015	15:47	NM2	52.5	56.0	40.0	NIL	35	52.4	35.0	Pine Dale Mine Road Traffic Birds & Other	NIL 39 to 62 31 to 54
9 October 2015	10:45	NM3	39.8	42.0	34.9	NIL	35	38.8	32.9	Pine Dale Mine Road Traffic Birds & Other	NIL 32 to 58 31 to 50
9 October 2015	11:00	NM3	38.6	40.9	32.9	NIL	35	37.8	30.9	Pine Dale Mine Road Traffic Birds & Other	NIL 31 to 59 29 to 50
8 October 2015	09:44	NM4	39.0	40.8	34.4	NIL	42	33.3	37.7	Pine Dale Mine Road Traffic Birds & Other	NIL 34 to 46 30 to 61
8 October 2015	09:59	NM4	40.0	43.7	35.1	NIL	42	31.4	40.0	Pine Dale Mine Road Traffic Birds & Other	NIL 33 to 51 32 to 58
8 October 2015	14:33	NM5	40.1	42.5	32.2	NIL	42	38.1	39.2	Pine Dale Mine Road Traffic Birds & Other	NIL 30 to 47 29 to 58
8 October 2015	14:48	NM5	39.3	41.5	34.4	NIL	42	39.8	37.4	Pine Dale Mine Road Traffic Birds & Other	NIL 31 to 54 32 to 55
8 October 2015	13:49	NM6	36.1	39.0	27.7	NIL	42	32.9	33.3	Pine Dale Mine Road Traffic Birds & Other	NIL 29 to 58 25 to 56
8 October 2015	14:04	NM6	35.9	38.2	29.8	NIL	42	32.7	33.0	Pine Dale Mine Road Traffic Birds & Other	NIL 30 to 46 26 to 61

Table 50 *Meteorological Conditions during Attended Noise Surveys*

Survey Date (2015)	Start Time	Location	Cloud (octa)	Temp at 10m (°C)	Ground Level Wind Speed At Receiver (m/s)	Wind Speed at 10m (m/s)	Wind Direction
11 March 2015	09:02	NM1	8-6	1	NIL	2	NW
11 March 2015	10:20	NM2	1-0	2	0 – 1.2 m/s	3	NNW
12 March 2015	07:28	NM3	0	1	NIL	0.5	E
12 March 2015	08:34	NM4	0	2	NIL	0 - 2	SSW
11 March 2015	15:13	NM5	6	2	0—5 m/s	2	NW – N - E
11 March 2015	17:20	NM6	5-6	2	0 – 2 m/s	1	NW - S
8 April 2015	10:41:45	NM1	8	10	0.5 – 4.5	3	W
8 April 2015	9:43:21	NM2	6-8	9	1- 4	4	W
9 April 2015	9:35:43	NM3	1	23	1 – 2.5	1.5	SW
8 April 2015	15:47:00	NM4	6-4	12	1 – 3.5	3	WSW
9 April 2015	7:29:10	NM5	1	10	0.5 – 2.5	2	W
9 April 2015	8:29:32	NM6	1	10	1 – 4	1	SW
6 July 2015	9:44:42	NM1	0	2.4	0 - 2.9	3.0	N - E
6 July 2015	10:30:29	NM2	0	1.9	0 - 2.7	3.4	N - E
6 July 2015	16:43:52	NM3	2	6	1 - 2.9	2.1	NE - SE
7 July 2015	07:23:49	NM4	7	3.5	0	0.5	N/A
6 July 2015	15:56:05	NM5	2-3	6.7	0 - 3	4.1	N
6 July 2015	15:10:13	NM6	3	7	0 - 3.1	4.1	N - NE
8 October 2015	16:11:06	NM1	8	13	0 - 2	1.75	E
8 October 2015	15:32:04	NM2	8	14	0 - 2.9	1.5	E
9 October 2015	10:45:21	NM3	0	22	0 - 1	1.0	E - SE
8 October 2015	09:15:55	NM4	8	12	0.5 - 3	2.5	E
8 October 2015	14:33:36	NM5	7	15	0 - 3	1.75	N
8 October 2015	13:49:21	NM6	8	14	0 - 1	2	N - E

8.3 REVIEW & INTERPRETATION OF OPERATIONAL NOISE MONITORING RESULTS

Attended noise surveys of the Pine Dale mine for the 2015 monitoring period were undertaken when the mine was in care and maintenance. The conditions and operations during noise surveys were considered to be representative of those undertaken on a normal daily basis during the care and maintenance period.

Time based source coding was used during the attended noise surveys to record the overall noise levels and identify the sound sources that contribute to the sound environment at each of the six noise monitoring locations. Sound sources audible during the attended surveys were classified into three categories, Mine noise (from Pine Dale Mine); Birds & Insects; and Traffic & Other noise sources. Contributions from these sources were determined by analysis of the time coded survey data using the sound level meter manufacturer's proprietary software. The software analysis determines the overall L_{Aeq} and L_n statistical values for the entire survey, as well as identifying the individual sound sources that were coded during the attended surveys and shows the energy average contribution and L_{min} and L_{max} values, for each source, for each of the 15 minute survey periods.

8.3.1 FIRST QUARTER 2015

Attended noise surveys of the Pine Dale mine operations for the January to March 2015 quarter were undertaken on the 11th & 12th of March 2015. During the surveys the mine was observed to be non-operational and in a state of care and maintenance.

All surveys conducted for this assessment period showed Nil $L_{Aeq,\ 15min}$ noise contributions from the Pinedale Mine, at all noise monitoring locations NM1 through NM6.

The attended surveys conducted at NM1, NM2 & NM3 showed that road traffic was the dominant noise source over the survey period with intermittent contributions from Birds & Other sources. At NM4 Haul Road traffic and birds & other sources were both significant contributors to the acoustic climate. The attended surveys conducted at NM4, NM5 & NM6 showed that bird & other noise sources (insects) dominated the acoustic climate, with road traffic intermittently audible.

8.3.2 SECOND QUARTER 2015

Attended noise surveys of the Pine Dale mine operations for the April to June 2015 quarter were undertaken on the 8th & 9th of April 2015. During the surveys the mine was observed to be non-operational and in a state of care and maintenance, with no traffic observed to be using the privately owned Angus Place haul road.

All surveys conducted for this assessment period showed Nil $L_{Aeq,\ 15min}$ noise contributions from the Pinedale Mine, at all noise monitoring locations NM1 through NM6.

The attended surveys conducted at NM1 showed that the combined road traffic noise and wind in trees dominated the acoustic climate over the survey period, with construction works audible from the south west of the monitoring location, within the Lamberts Gully Mine area. This was observed when road traffic & wind levels were minimal.

The surveys conducted at NM2, NM3 and NM4 indicated that road traffic and wind were the dominant noise source over the survey period, with bird calls intermittently contributing to the acoustic climate.

At NM5 and NM6, road traffic and birds were both significant contributors to the acoustic climate.

8.3.3 THIRD QUARTER 2015

Attended noise surveys of the Pine Dale mine operations for the July to September 2015 quarter were undertaken on the 6th & 7th of July 2015. During the surveys the mine was observed to be non-operational and in a state of care and maintenance, with no traffic observed to be using the privately owned Angus Place haul road

There was Nil $L_{Aeq,\ 15min}$ noise contribution measured from the Pine Dale Mine, at any noise monitoring location during this period.

The attended surveys conducted at NM1 showed that the combined Road Traffic noise and wind in trees dominated the acoustic climate over the surveyed period. Again, construction works were audible from the south west of the monitoring location, within the Lamberts Gully Mine area, when road traffic & wind levels were minimal.

The surveys conducted at NM2, NM3 and NM6 showed that road traffic and wind were the dominant noise source over the survey period, with bird calls intermittently contributing to the acoustic climate.

At NM4 and NM5, birdcall was the dominant noise source with wind intermittently contributing to the acoustic climate.

8.3.4 FOURTH QUARTER 2015

Attended noise surveys of the Pine Dale mine operations for the October to December 2015 quarter were undertaken on the 8th & 9th of October 2015. During the surveys the mine was observed to be non-operational and in a state of care and maintenance, with no traffic observed to be using the privately owned Angus Place haul road.

All surveys conducted for this assessment period showed *Nil* $L_{Aeq,\ 15min}$ noise contributions from the Pinedale Mine, at all noise monitoring locations NM1 through NM6.

The attended surveys conducted at NM1, NM2 and NM3 showed that road traffic noise dominated the acoustic climate over the survey period, with birds and other noises intermittently audible. The surveys conducted at NM4 showed that bird calls were the dominant noise source with traffic intermittently contributing to the acoustic climate. The surveys conducted at NM5 and NM6 showed that road traffic and bird calls contributed evenly to the acoustic climate.

8.3.5 OVERALL ASSESSMENT FOR 2015

The assessable sound levels from Pine Dale Mine were below the assessment criteria during all survey periods during the year.

It is a requirement under AS 1055 that the noise surveys also document levels of ambient sound resulting from non-mine sound sources. In the surveys conducted for Pine Dale Mine during the 2015 period, traffic and natural sounds, which are represented by the “Overall” LAeq (15 minute) noise levels set out in **Tables 46** to **49**, were observed to be a significant contributor to the acoustic climate.

9 BLAST MONITORING

9.1 BLASTING OPERATIONS ASSESSMENT CRITERIA

The purpose of blast monitoring is to ensure that any impact of blasting operations on the surrounding land and nearby sensitive locations can be identified, and to show compliance with relevant legislative requirements. Conditional requirements within Project Approval 10_0041 (Schedule 3, Condition 8) and Environmental Protection License (EPL 4911) are presented in **Table 51**.

Table 51 *Blasting Operations: Compliance Requirements*

Location	***Airblast overpressure (dB(Lin Peak))***	***Ground vibration (mm/s)***	***Allowable exceedance***
Residence on privately-owned land	115	5	5% of the total number of blasts over a period of 12 months
	120	10	0%

9.2 BLASTING OPERATIONS MONITORING DATA SUMMARY

The monitoring of blasts for Pine Dale Mine is undertaken in accordance with the Pine Dale Mine Environmental Protection License (EPL 4911).

Throughout the 2015 monitoring period there were nil blast events conducted at the site as a result of the mine operating under Care and Maintenance.

10 LIMITATIONS

This report has been prepared for Pine Dale Mine. The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the use of Pine Dale Mine. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without written permission from RCA.

The information in this report is considered accurate at the date of issue. Please contact the undersigned if you have any queries on the above.

Yours sincerely

Karen Tripp
Senior Environmental Scientist / Hygienist
Robert Carr and Associates trading as
RCA Laboratories – Environmental

Geoff Mason
Environment Manager
Robert Carr and Associates trading as
RCA Laboratories – Environmental

Appendix 1

Drawing 1 - Environmental Monitoring Locations

Drawing 2 - Stream Health & Channel Stability Monitoring Locations

Legend

- Noise Monitoring Location
- Depositional Dust Monitoring Location
- Enhance Groundwater Monitoring Location
- Groundwater Monitoring Location
- High Volume Air Sampling Location
- Metorological Monitoring Location
- Surface Water Monitoring Location

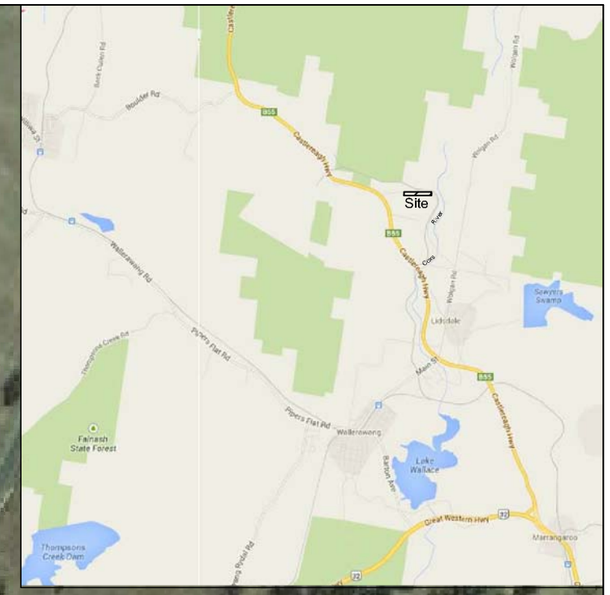
500 250 0 500 1,000 1,500
metres

N

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PINE DALE MINE
ENVIRONMENTAL MONITORING LOCATIONS

CLIENT	Pine Dale Mine			PROJECT No	6880-1702a
DRAWN BY	KT	SCALE	1:30,000 (A3)	DRAWING No	1
APPROVED BY	KT	DATE	1/03/2016	OFFICE	NEWCASTLE



Mine Office

SH1

Clean Water Diversion

SH2

SH3

SH3a

LDP13

SH4

SH5

Castlereagh Highway

View Street

LEGEND

Monitoring location

Licence discharge point location

Clean water diversion location

0 50 100 150 200 250

metres

Aerial image taken from Google Earth, 23 May 2006

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

LOCATION PLAN OF CHANNEL STABILITY, STREAM AND VEGETATIVE HEALTH OF NEUBECKS CREEK MONITORING SITES

CLIENT	Pine Dale Mine			RCA Ref	6880-1702a
DRAWN BY	KS	SCALE	1 : 5000 (A3)	DRAWING No 2	REV 0
APPROVED BY	KT	DATE	1/03/2016	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1

APPENDIX C

REHABILITATION MONITORING REPORT

Pine Dale Mine

Rehabilitation Monitoring Report 2015

Report prepared by First Field Environmental
on behalf of EnergyAustralia

October 2015

Revision history			
Version	Date	Author	Authorised by
Draft	12 October 2015	Michelle Evans	

This report has been prepared by First Field Environmental for EnergyAustralia. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report.

First Field Environmental

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Contents

Appendices

Figures

Tables

1. Introduction

Pine Dale Mine is located in the Western Coalfields of NSW at Blackmans Flat, 15km north of Lithgow on the northern side of Castlereagh Highway. The property is approximately 3km south west of Mount Piper Power Station.

Pine Dale Mine is managed in accordance with Project Approval 10_0041 and relevant subsidiary licenses and approvals. The *Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd, 2014) has been prepared in accordance with the above approval documentation and describes the following rehabilitation objectives:

- *"The rehabilitated landform is safe, stable, non-polluting and sustainable;*
- *Rehabilitation maintains or improves species diversity and habitat values of the Yarraboldy Extension Area, particularly the former Yarraboldy Open Cut Mine; and*
- *The agreed post mining land use is compatible with the surrounding land fabric and land use requirements."*

The preparation of this Rehabilitation Monitoring Report has been prepared to satisfy Schedule 3, Condition 55 of Project Approval 10_0041.

This report aims to identify successes and failures in rehabilitation in regard to agreed performance indicators and completion criteria. Recommendations are made in areas that could be improved.

2. Performance indicators

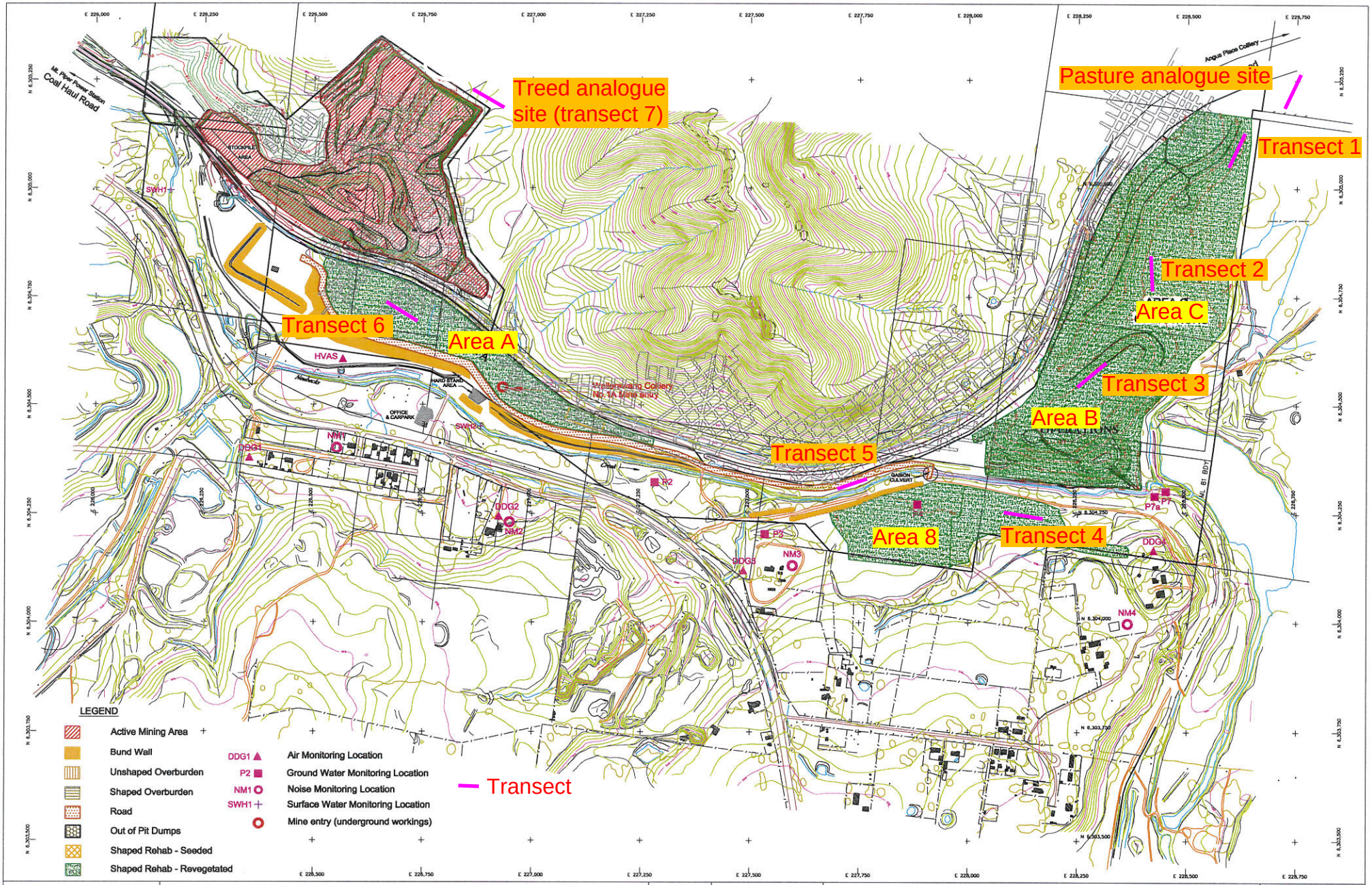
Table 1 identifies the performance indicators and completion criteria for Pine Dale Mine as determined by the Care and Maintenance Mining Operations Plan (Enhance Place Pty Ltd, 2014).

Table 1 Performance indicators and completion criteria

Performance indicator	Completion criteria
Feral animal and noxious weed presence	• Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use.
Feral animal and noxious weed control	• Feral animals and noxious weeds are controlled in accordance with legislation.
Fuel loads	• Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan.
Access	• Adequate access for firefighting is maintained on rehabilitation areas.
Habitat features	• Habitat features are installed on native forest rehabilitation areas including: - Nesting boxes and salvaged hollows - Crushed timber spread over native forest rehabilitation areas - Rock pile clusters.

Performance indicator	Completion criteria
Vegetation health	• More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.
	• Native forest indicator species tree height and girth is within the range of analogue sites.
Soil loss	• Net annual soil loss is comparable to analogue sites at year 10.
Erosion	• There are no significant erosion features that compromise landform stability or public safety (including gullying or tunnelling).
Woodland birds present	• Evidence of woodland birds utilising rehabilitation areas.
Evidence of mammals	• Evidence of target mammal species presence in rehabilitation areas.
Natural regeneration	• Evidence of second generation of native forest indicator species from desired vegetation community. • Evidence of natural regeneration of at least four pasture species at year 5.
Structure	• Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites.
Management inputs	• Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.
Rural land capability	• Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).
Species composition	• Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites. • Vegetation within the treed rehabilitation areas are established in accordance with the approved species mix.
	• Approved pasture species mix is sown at the specified rate per hectare.
Weed presence	• Weeds including African Lovegrass to comprise <10% of the pasture sward.
Ground cover	• Ground cover (vegetation, leaf litter, mulch) >70% at year 5.

Source: Care and Maintenance Mining Operations Plan for Pine Dale Mine (Enhance Place Pty Ltd, 2014).



NOTES:

CRAVEN, ELLISTON & HAYES (LITHGOW) PTY.LTD.
CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
ACN 056 544 551
"ASTROLABE" RUTHERFORD LANE, LITHGOW, 2790 PH: (02) 6351 2281, FAX: (02) 6352 1339
EMAIL : survey@ceh.com.au

DATE	31–12–12
AMENDED	
SURVEYOR	AERIAL PHOTO/TE/TH
DRAWN	K.L.F.
CHECKED	

PINEDALE MINE
AEMR PLAN
END DECEMBER 2012

SCALE - 1 : 4000 (A1 Sheet)

DWG No
PINE-AEMR12

3. Survey methodology

3.1 Rehabilitation monitoring

Monitoring locations - Previous studies have seen the establishment of six monitoring transects; four transects are located within rehabilitated pastures while the remaining two transects are within treed rehabilitation areas. Additional transects exist as analogue sites in grazed pasture and an undisturbed naturally vegetated area of the property to provide benchmarks against which the pasture and treed rehabilitation areas are assessed. Monitoring locations are shown in Figure 1.

Photopoint monitoring - Coordinates for each transect and analogue site are provided in Appendix A. Each transect area contains previously established photo monitoring points. Photos taken from these points enable a visual comparison to photos from previous surveys and are provided in Appendix E.

3.2 Erosion and sedimentation

Evidence of erosion and sedimentation along and within the vicinity of each transect has been determined in accordance with *Best Practice Erosion and Sediment Control* (IECA 2006) and *Managing Urban Stormwater: Soils and Construction* (OEH 2004).

3.3 Soil loss

The *Pine Dale Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2014) recommends that net soil loss be determined in accordance with the *Ecosystem Function Analysis* (CSIRO 2008). This method has been found to be inadequate for determining soil loss in comparison with the widely-used *RUSLE* (IEAC Australasia 2012).

An estimation of soil loss at each transect site has been calculated using the *Revised Universal Soil Loss Equation* (RUSLE) (IEAC Australasia 2012). Values used for these calculations are presented in Appendix C.

3.4 Vegetation assessment

Pasture rehabilitation areas – Cox's River seed mix was sown in 2010-2011 at Areas B, C and Area 8 at the following rates:

- 40% Fescue
- 25% Cocksfoot
- 20% Subterranean clover
- 6% Perennial rye grass
- 5% White clover
- 4% Phalaris

The proportion of perennial grasses and annual legumes currently in evidence at pasture transects has been recorded and compared with the proportion at which these species were initially sown.

Tree rehabilitation areas – The *Pine Dale Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2014) recommends that vegetation structure be determined in accordance with the *Ecosystem Function Analysis* (CSIRO 2008).

This method does not adequately enable the identification of all completion criteria as required by the *Pine Dale Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2014). Vegetation health, natural regeneration, structure and species composition has instead been determined in accordance with the Australian Soil and Land Survey Field Handbook (CSIRO 2009).

3.5 Evidence of fauna and habitat features

Fauna - Evidence of woodland birds and native fauna utilising rehabilitated areas has been recorded through the observation of scats and tracks and sightings.

Habitat features - The presence of nesting boxes, crushed timber piles and rock pile clusters within the rehabilitation areas is noted.

3.6 Pest animal and weed survey

Pest animal presence - Evidence of feral animal presence across the rehabilitation areas has been determined through scat and trail identification.

Noxious weeds - The location and extent of noxious weeds (as declared for the Upper Macquarie County Council area (NSW DPI, 2013) have been recorded. Target weed species, particularly African Lovegrass were identified in accordance with field guides and botanical keys.

3.7 Fuel loads and fire-fighting access

Fuel loads - Fuel loads within and adjacent to rehabilitation areas have been assessed in accordance with the *Overall Fuel Hazard Assessment Guide* (Department of Sustainability 2010).

Fire-fighting access - Access trails within rehabilitated areas have been assessed in accordance with *Policy No. 2/2007 Fire Trails* (Bush Fire Coordinating Committee 2007).

3.8 Rural land capability assessment

Pasture rehabilitation areas have been assessed in accordance with the *Land and Soil Capability Assessment* (OEH 2007) and against *Pastures for Horses* (NSW DPI 2007).

3.9 Management input assessment

Land management activities - Land management and soil amelioration activities carried out in the past year have been identified through discussions with the land manager.

Pest animal and weed management - Evidence of feral animal and noxious weed control have been sought from the land manager and audited against relevant legislative requirements.

4. Field survey results

Field survey was conducted on 11th September 2015 by a qualified ecologist. The survey revisited six transects representing rehabilitated pasture and treed areas as well as pasture and a treed analogue sites.

4.1 Weather conditions

The beginning of 2015 was characterised by a relatively wet summer and dry early autumn. Average monthly rainfall for the leading up to the survey was variable, with April receiving significantly higher rainfall than the statistical average for that month, followed by less than average rainfall for May and June. Recorded rainfall in July and August was representative of average statistical rainfall for those months. Table 2 presents regional rainfall data for the period commencing 2010.

Significant rainfall (approximately 20 mm per day) was recorded on the 4th and 5th of April. No rainfall was recorded during the four days leading up to survey work on the 9th of April.

Less than 1mm rainfall was recorded within the week prior to field survey (Bureau of Meteorology 2015).

Table 2 Rainfall (in mm) recorded at Lidsdale (Maddox Lane) January 2010 - September 2015

Year	2010	2011	2012	2013	2014	2015
Month						
January	76.6	63	48.2	87.4	9.2	156.2
February	107	68.2	173.8	149	85	21.2
March	60.8	78	187	43.2	155	39.4
April	37.6	23.8	31.6	26.8	63	158.2
May	54	42.4	40.6	23.6	14	25.2
June	39.8	41.2	70.6	87	43.2	24.8
July	87.4	18.2	48.8	19.6	25.6	44.6
August	84.4	54.8	23.2	22.4	56.4	43.8
September	64	65.4	40.4	44	35.2	
October	75.8	36.8	16.6	20.8	51.6	
November	101.6	158	39	68.6	36.8	
December	217	86	61.2	38.4	160.4	
Annual	1006	735.8	781	630.8	735.4	

Source: Bureau of Meteorology (2015).

4.2 Erosion and sedimentation

There are no significant erosion features that compromise landform stability or public safety within the rehabilitation areas. The presence and extent of active surface erosion within transect areas is recorded in Appendix A.

Pasture rehabilitation areas - The pasture rehabilitation areas support evidence of active, minor to moderate wind erosion where groundcover is poorly established or absent. Figure 2 shows areas of exposed soils at transect 3. Note some shallow rill erosion in the left of the picture.

Minor rill erosion to a depth of approximately 5cm is occurring on exposed slopes at transect 3.

Figure 2 Exposed soils at transect 3

Treed rehabilitation areas - Moderate wind erosion is occurring at treed rehabilitation areas; however it is difficult to determine the severity as soils here are characteristically coarse.

Severe rill erosion to an approximate depth of 20cm is occurring across exposed slopes of the treed rehabilitation areas (see Figure 3).

Figure 3 Rill erosion at transect 5

Analogue sites - No active erosion is evident at the pasture and treed analogue sites.

4.3 Soil loss

Estimated annual soil loss at rehabilitated transects is not comparable to soil loss at the pasture and treed analogue sites.

An estimate of soil loss at each transect is summarised in Table 3. Full calculations are provided in Appendix C.

Table 3 Estimated soil loss due to erosion

Estimated annual soil loss t/ha	Pasture analogue site	Transect 1 (pasture)	Transect 2 (pasture)	Transect 3 (pasture)	Transect 4 (pasture)	Transect 5 (treed)	Transect 6 (treed)	Treed analogue site (transect 7)
	0.0 t/ha	0.09 t/ha	0.09 t/ha	0.18 t/ha	0.03 t/ha	4.73 t/ha	2.91 t/ha	0.0 t/ha

Soils at transects 1, 2 and 3 are of fine sandy loam texture and support at least 80% grassy groundcover. Differences in soil loss between these transects are primarily influenced by differences in slope gradient. Soil and topographic characteristics within the pasture analogue site are similar to those at nearby pasture transects 1, 2 and 3. It is estimated that no annual soil loss occurs at the analogue site due to almost complete groundcover.

Transect 4 supports similar groundcover to transects 1, 2 and 3 and is subject to an almost flat gradient. The estimated annual soil loss at this location is primarily a result of soil texture.

The soils of treed rehabilitation transects share a sandy clay-loam texture and similar gradient. Differences in estimated annual soil loss at transects 5 and 6 are the result of differing percentage canopy cover.

4.4 Vegetation assessment

Flora species identified along and within the vicinity of transects are listed in Appendix D.

Species composition at pasture rehabilitation areas – Pasture rehabilitation areas are established with a mix of 70% perennial grasses and 20% annual legumes and are representative of species composition at the analogue pasture site. An example of transect 1, 2 and 3 pasture is shown in Figure 4.

Figure 4 Pasture composition representative of transects 1, 2 and 3

Groundcover at pasture rehabilitation areas – Rehabilitated pasture surfaces in the areas of transect 1, 2 and 3 support living groundcover of approximately 80% with an additional 10% litter cover. Transect 1 has experienced a decrease from 90% living ground cover in 2014. Transect 2 has experienced an increase in living cover from 70% in 2014. No change from 80% living cover in 2014 has been observed at transect 3.

Areas currently exist within each pasture rehabilitation area where groundcover is becoming sparse to absent. It is estimated that these areas account for less than 10% of each pasture area.

Previous recordings of cover percentage at transect 4 provide an indication of cover change over time. Note that quadrat 1 became transect 4 in 2014. Photopoint monitoring provides a comparison of cover between 2014 and 2015 (see Appendix E).

Table 4 Percentage cover at transect 4 over time

Cover class	Percentage cover at each observation					Overall % change since 2010
	February 2010 (quadrat 1)	September 2011 (quadrat 1)	November 2012 (quadrat 1)	April 2014 (transect 4)	September 2015 (transect 4)	
Total living cover	97%	99%	95%	90%	80%	17% decrease
Bare surface and litter	3%	1%	5%	10%	20%	17% increase

Table 4 shows that initial rates of living cover at transect 4 have decrease over time, while the percentage of bare surface and litter has increased since the 2010 survey.

Natural regeneration at pasture rehabilitation areas – Natural regeneration of at least four groundcover species is evident across pasture rehabilitation areas (see Appendix D).

Species composition at treed rehabilitation areas – Treed rehabilitation areas are established in accordance with an approved species mix representing local native species.

Structure of vegetation at treed rehabilitation areas – Structural layers of vegetation at treed rehabilitation areas are not comparable to those of the treed analogue site.

Figure 5 Vegetation structure of treed analogue site (transect 7)

The treed analogue site is characterised by a canopy to 12m height with 40% canopy cover over a sparse shrubby mid-storey to 3m height and isolated shrubs to 1.5m height in the understorey. Groundcover consists of grasses and herbs with a cover of 70% Figure 6.

Figure 6 Transect 6 vegetation structure

Canopy cover is absent in treed rehabilitation areas. A sparse mid-storey of isolated juvenile trees and shrubs exists over a sparse, low, shrubby understorey (seen in Figure 6). Groundcover is a sparse mix of broadleaf herbs and grasses. Changes in vegetation structure over time (as shown in Appendix B) are not considered significant.

Groundcover at treed rehabilitation areas – Transect 5 supports a total living groundcover of 50%. The area of transect 6 supports total living groundcover of approximately 70%.

Previous recordings of cover percentage at transect 5 provide an indication of cover change over time. Note that the proposed quadrat 2 became transect 5 in 2014.

Table 5 Percentage cover at transect 5 over time

Cover class	Percentage cover at each observation			Overall % change since 2012
	November 2012 (proposed quadrat 2)	April 2014 (transect 5)	September 2015 (transect 5)	
Total living cover	87.5%	<40%	50%	37.5% decrease
Bare surface and litter	12.5%	>60%	50%	37.5% increase

Table 5 shows that while the rehabilitation activities have not maintained initial rates of living cover at transect 5 living cover has increased since the 2014 survey.

There has been significant change in percentage cover at transect 6, with 2014 data showing 30% living cover, increasing to 70% living cover at 2015. Bare ground and litter has decreased from 70% in 2014 to 30% in 2015. See Appendix E for a visual comparison of cover at 2014 and 2015.

Vegetation health at treed rehabilitation areas – Native forest indicator species are those which occur both in treed rehabilitation areas and the treed analogue site and provide a an opportunity for comparison of growth between natural and rehabilitation conditions. Indicator species include native trees, shrubs and groundcovers, with the notable exceptions of *Cassinia arcuata* shrubs. Establishment of vegetation on treed rehabilitation areas is poor and less than 75% of native forest indicator species are considered to be healthy and growing.

It is difficult to determine whether native forest indicator tree species on treed rehabilitation areas are within the height and girth measurements of trees on the treed analogue site. While there is evidence of recruitment on the treed analogue site it is not possible to determine the whether the age of juvenile trees is comparable to those establishing on the treed rehabilitation areas.

Natural regeneration of treed rehabilitation areas - There is no evidence of second generation native forest indicator tree or shrub species on treed rehabilitation areas; however natural regeneration of groundcover species is evident.

4.5 Evidence of fauna and habitat features

Fauna – Macropod scats and tracks were evident throughout the property and numerous skinks were observed, particularly within treed rehabilitation areas of transects 5 and 6, and the treed analogue site. An active wombat burrow was noted within the analogue site.

Native woodland birds were observed landing on trees and foraging within mulch in each of the treed vegetation areas and in the treed analogue site. Generalist birds including Currawong, Magpie and Noisy Miner were observed flying over and landing on the margins of pasture areas.

Habitat features – Crushed timber piles and rock pile clusters were observed within the treed rehabilitation areas of transects 5 and 6 (Figure 7). Habitat features at the treed analogue site include fallen trees and scattered piles of fallen vegetation (visible in Figure 5).

Figure 7 Crushed timber placed as habitat at transect 6

4.6 Pest animal and weed survey

The presence or evidence of pests and weeds within and in the vicinity of each transect is recorded in Appendix A.

Pest animal presence – A number of rabbits were observed during the survey and rabbit scats were noted within each of the monitoring locations.

Noxious and targeted weed species - No noxious weeds were observed at any of the monitoring locations during this survey. The presence of African Lovegrass was noted at transects 1, 2 and 4 and occurred across less than 10% of the pasture area. These outbreaks have been subjected to ongoing chemical control and were not observed to be growing or producing seed. Recently sprayed African lovegrass can be seen in Figure 8.

Figure 8 Recently sprayed African lovegrass at transect 4

4.7 Fuel loads and fire-fighting access

Fuel loads – Fuel loads within Areas A, B and C and Area 8 are low and fuel hazard mitigation activities are not required at this time.

Firebreaks - The internal road provides a mineral earth firebreak between Area A and Pine Dale Mine infrastructure to the south, while the Coal Haul Road provides a mineral earth firebreak immediately to the north of Area A.

The Coal Haul Road and internal road provide a mineral earth firebreak to the north and west of Areas B and C and Area 8. Private grazing land is located immediately adjacent to the east and south of Areas B and C and Area 8. The majority of this interface supports mature Pine and Eucalypt trees which would provide a barrier to wind-borne embers spreading to private grazing land during a fire event.

Fire-fighting access - Access to each of the rehabilitation areas is considered to be adequate. The Coal Haul Road is a private road located immediately to the north of Areas A, B and C and Area 8 and allows movement from within Wallerawang Power Station, through Pine Dale Mine and to Mount Piper Power Station. An internal road is located immediately to the south of Areas A and B and to the north of Area 8. This road connects to Castlereagh Highway through the administration area of Pine Dale Mine. Area C is accessible by following the internal road through Area B. All access roads within rehabilitated areas are maintained in good condition and are suitable for the passage of Category 1 tankers, having a vertical clearance of >4m and a width of >2.8m (*Policy No. 2/2007 Fire Trails* (Bush Fire Coordinating Committee 2007)).

4.8 Rural land capability assessment

Pasture rehabilitation areas are assessed as being Land and Soil Capability Class V and are suitable for grazing. The limiting factors for land use are generally related to wind erosion hazard. Note that the area of transect 4 is also subject to soil acidification hazard due to soil texture (Table 6).

Table 6 Rural land capability assessment of pasture areas

Class	Transect 1	Transect 2	Transect 3	Transect 4
Water erosion hazard class	2 1 - <3% slope	3 3 - <10% slope	4 10 - <20% slope, no gully erosion present	2 1 - <3% slope
Wind erosion hazard class	5 Moderate wind erodibility class of surface soil, high winds erosive power, high exposure to wind, average annual rainfall >500mm			
Soil structural decline class	4 Fragile light textured soil - hardsetting			
Soil acidification hazard class	4 Very low texture /buffering capacity, pH 6.7 – 7.5 ($CaCl_2$)			5 Very low texture /buffering capacity, pH 4.0 – 4.7 ($CaCl_2$)
Salinity hazard class	1 Moderate to high recharge potential, low discharge potential, low salt store			
Waterlogging hazard class	2 0 – 0.25 months typical waterlogging duration, moderately well drained soils			
Shallow soils and rockiness hazard class	1 Nil rocky outcrop, soil depth >100cm			
Mass movement hazard class	1 No mass movement present			

4.9 Management input assessment

Control of noxious and targeted weed species has been undertaken across all rehabilitation areas as required and in accordance with the recommendations of the *Pine Dale Mine Rehabilitation Monitoring Report 2014* (First Field Environmental 2014).

The areas of transect 5 and transect 6 were mulched in 2014 with a mixture of mushroom compost and charcoal and fertilised with gypsum and agricultural lime. Groundcover was reseeded mid-2014 and additional direct seeding was conducted in spring of 2014.

5. Rehabilitation status

The status of performance indicators and completion criteria are summarised in Table 7.

Table 7 Status of completion criteria

Performance indicator	Completion criteria	Status
Feral animal and noxious weed presence	• Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use.	• **Satisfactory** – continue to monitor
Feral animal and noxious weed control	• Feral animals and noxious weeds are controlled in accordance with legislation.	• **Satisfactory** – continue to monitor
Fuel loads	• Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan.	• **Satisfactory** – continue to monitor
Access	• Adequate access for firefighting is maintained on rehabilitation areas.	• **Satisfactory** – continue to monitor
Habitat features	• Habitat features are installed on native forest rehabilitation areas including: - Nesting boxes and salvaged hollows - Crushed timber spread over native forest rehabilitation areas - Rock pile clusters.	• **Ongoing** - nesting boxes to be installed
Vegetation health	• More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.	• **Ongoing** - additional planting and management inputs required
	• Native forest indicator species tree height and girth is within the range of analogue sites.	• **Not possible to measure** – see Section 4.4
Soil loss	• Net annual soil loss is comparable to analogue sites at year 10.	• **Ongoing** - additional planting and management inputs required
Erosion	• There are no significant erosion features that compromise landform stability or public safety (including gullying or tunnelling).	• **Satisfactory** – continue to monitor
Woodland birds present	• Evidence of woodland birds utilising rehabilitation areas.	• **Satisfactory** – continue to monitor

Performance indicator	Completion criteria	Status
Evidence of mammals	• Evidence of target mammal species presence in rehabilitation areas.	• **Satisfactory** – continue to monitor
Natural regeneration	• Evidence of second generation of native forest indicator species from desired vegetation community. • Evidence of natural regeneration of at least four pasture species at year 5.	• **Not achieved** - additional planting and management inputs required in treed areas • **Satisfactory** in pasture areas – continue to monitor
Structure	• Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites.	• **Not achieved** – additional planting and management inputs required
Management inputs	• Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.	• **Ongoing** – additional planting and management inputs required
Rural land capability	• Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).	• **Satisfactory** – continue to monitor
Species composition	• Establishment of pasture comprising approximately 70% perennial grass and 20% annual legume, representative of species at analogue sites. • Vegetation within the treed rehabilitation areas is established in accordance with the approved species mix.	• **Satisfactory** – continue to monitor • **Ongoing** - additional planting and management inputs required in treed areas
	• Approved pasture species mix is sown at the specified rate per hectare.	• **Ongoing** – additional sowing and management inputs required on exposed soils
Weed presence	• Weeds including African Lovegrass to comprise <10% of the pasture sward.	• **Satisfactory** – continue to monitor
Ground cover	• Ground cover (vegetation, leaf litter, mulch) >70% at year 5.	• **Satisfactory** in pasture areas – continue to monitor • **Not achieved in treed areas** – additional planting and management inputs required

6. Key findings

General

- Levels of rabbit activity at each of the rehabilitation and analogue sites are low and are not considered to adversely impact the intended final land use.
- The areas surveyed during this project are not affected by noxious weeds (as declared for the Upper Macquarie County Council area (NSW DPI 2013).
- While outbreaks of African lovegrass are present at each of the pasture and treed rehabilitation areas, all occurrences have been recently sprayed and are no longer extant.
- Methods of African lovegrass control are consistent with legislative requirements.
- Fuel loads in and surrounding rehabilitation areas are low and do not require management at this time.
- Fire breaks and access trails in and surrounding rehabilitation areas are adequate and allow for the movement of Category 1 fire-fighting vehicles.
- Macropods are active in each of the rehabilitation and analogue sites.
- Minor to moderate wind erosion is occurring on exposed soils of all rehabilitation areas.

Pasture rehabilitation areas

- African lovegrass outbreaks comprise <10% of the pasture sward.
- Generalist birds are active in the vicinity of pasture rehabilitation and analogue sites.
- Rehabilitated pasture areas are consistent with Soil and Land Capability Class V land and can withstand occasional cultivation associated with pasture establishment or renewal but are not capable of supporting regular cultivation.
- At least four species within the pasture rehabilitation areas are regenerating naturally.
- The proportion of annual legume and perennial grass species at pasture rehabilitation areas is representative of species composition at the analogue pasture site.
- Ground cover in pasture rehabilitation areas is >70% however areas of sparse to no groundcover do exist.
- The percentage of total living cover has decreased at transects 1 and 4 from 2014.
- Soil loss is occurring at a greater rate at pasture rehabilitation areas than at the pasture analogue site.
- Minor rill erosion to a depth of 3cm is occurring on exposed slopes of transect 4.

Treed rehabilitation areas

- Hollow logs, crushed timber and rock piles are in place at treed rehabilitation areas and are providing habitat for native reptiles.
- Nesting boxes are not installed in or adjacent to the treed rehabilitation areas.
- Native woodland birds are active within treed rehabilitation and analogue sites.
- Less than 75% of native forest indicator species within treed rehabilitation areas are considered healthy and growing.
- There is no evidence of second generation establishment at treed rehabilitation areas.
- Structural vegetation layers at treed rehabilitation areas are not comparable to the vegetation structure at the treed analogue site.
- Vegetation within the treed rehabilitation areas is established in accordance with the approved species list.
- Mulch was reapplied to the areas of transect 5 and transect 6 mid-2014.
- Transect 5 and transect 6 were reseeded mid-2014.
- Living groundcover at the area of transect 5 has increased from 40% in 2014 to 50% in 2015.

- Living groundcover at the area of transect 6 has increased from 30% in 2014 to 70% in 2015.
- Soil loss is occurring at a greater rate at the treed rehabilitation areas than at the treed analogue site.
- Severe rill erosion to a depth of 20cm is occurring on exposed slopes of treed rehabilitation areas.

7. Recommendations

The following recommendations for mitigation and management are consistent with intervention and adaptive management measures contained within the C&M MOP.

General

- Continue to spot-spray outbreaks of African lovegrass

Pasture rehabilitation areas

- Rip along contours of poorly established pasture rehabilitation areas and re-sow pasture mix and fertiliser. Cover with a mixture of mushroom compost, lime and gypsum as per the recommendations of *Soil Assessment and Recommendations for Rehabilitated Areas* (SLR 2014).
- Increase and maintain groundcover in pasture rehabilitation Areas B and C and in Area 8 to at least 95%.

Treed rehabilitation areas

- Install nesting boxes in or adjacent to treed rehabilitation areas.
- Re-apply a mixture of mushroom compost, lime and gypsum to treed rehabilitation areas as per the recommendations of *Soil Assessment and Recommendations for Rehabilitated Areas* (SLR 2014).
- Increase canopy cover of tall herbs and shrubs at treed rehabilitation Area A (including the location of transect 5) to 75% canopy cover of tall herbs and shrubs with 80% groundcover of grasses and broadleaf herbs.
- Concentrate tube stock planting in benches of treed rehabilitation areas to take advantage of run-on from banks.
- Place additional coarse woody debris along contours above rills to reduce runoff rate and volume at treed rehabilitation areas.

8. References

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Appendix A
Survey data 2015

Pasture analogue site	
Easting	Northing
228300	6304880
228317	6304925
Landform and soils	
Slope	1 - <3% slope inclining to the northwest.
Erosion	Not present.
Cracking soils	Not present.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.
Species richness	>30 herb and 15 grass species identified.
Cover classification	
Total living cover	>90%
Annual living cover	40%
Perennial living cover	50%
Litter cover	<10%
Bare surface	-

Transect 1 Pasture rehabilitation area	
Easting	Northing
228621	6305093
228594	6305048
Landform and soils	
Slope	Transect located along a contour. 1 - <3% slope inclining to the northwest.
Erosion	Minor to moderate wind erosion present on exposed soils.
Cracking soils	Not present.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.
Species richness	>30 herb and 15 grass species identified.
Cover classification	
Total living cover	80%
Annual living cover	40%
Perennial living cover	50%
Litter cover	-
Bare surface	20%
Target weed presence	
E. curvula	<10%

Transect 2 Pasture rehabilitation area	
Easting	Northing
228454	6304718
228400	6304744
Landform and soils	
Slope	Transect located along a contour. 3 - <10% slope inclining to the west.
Erosion	Minor to moderate wind erosion present on exposed soils.
Cracking soils	Not present.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.
Species richness	>30 herb and 15 grass species identified.
Cover classification	
Total living cover	80%
Annual living cover	40%
Perennial living cover	50%
Litter cover	-
Bare surface	20%
Target weed presence	
E. curvula	<10%

Transect 3 Pasture rehabilitation area	
Easting	Northing
228267	6304532
228306	6304560
Landform and soils	
Slope	Transect located along a contour. 10 - <20% slope declining to the northwest.
Erosion	Minor to moderate wind erosion present on exposed soils.
Cracking soils	Not present.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.
Species richness	>30 herb and 16 grass species identified.
Cover classification	
Total living cover	80%
Annual living cover	40%
Perennial living cover	50%
Litter cover	-
Bare surface	20%
Target weed presence	
E. curvula	<10%

Transect 4 Pasture rehabilitation area	
Easting	Northing
228318	6304224
228249	6304227
Landform and soils	
Slope	Transect located along a contour. 1 - <3% slope declining to the west.
Erosion	Minor to moderate wind erosion present on exposed soils. Minor rills to 5cm depth.
Cracking soils	Not present.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Sparse shrub layer. Groundcover dominated by native and exotic grasses. Mixed herbs present.
Species richness	Shrub layer consists of <5 species, including *C. arcuata and Acacia* spp. Some early Eucalypt regeneration observed. Diverse groundcover supporting >20 herb and grass species.
Cover classification	
Total living cover	80%
Annual living cover	40%
Perennial living cover	50%
Litter cover	-
Bare surface	20%
Target weed presence	
E. curvula	<10%

Transect 5 Treed rehabilitation area	
Easting	Northing
227846	6304272
227787	6304251
Landform and soils	
Slope	Transect located along contour of mid slope inclining 10-20% to the north.
Erosion	Severe rill erosion present along slope. Channels becoming evident beneath logs and perpendicular to slope.
Cracking soils	Not present.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Sparse tree layer to 3m height with isolated saplings. Sparse mixed native low shrub layer. Groundcover sparse and dominated by broadleaf herbs and grass species.
Species richness	Shrub layer consists of <5 species. Diverse groundcover dominated by >40 broadleaf herb and grass species.
Cover classification	
Total living cover	50%
Annual living cover	20%
Perennial living cover	30%
Litter cover	10%
Bare surface	40%
Target weed presence	
E. curvula	<10%

Transect 6 Treed rehabilitation area	
Easting	Northing
226604	6304724
226647	6304706
Landform and soils	
Slope	Transect located along contour of mid slope inclining 10-20% to the northeast.
Erosion	Severe rill erosion present along slope. Channels becoming evident beneath logs and perpendicular to slope.
Cracking soils	Not present.
Surface drainage impediments	No significant drainage impediments.
Vegetation	
Vegetation structure	Sparse tree layer to 3m height with isolated saplings. Sparse mixed native low shrub layer. Groundcover sparse and dominated by broadleaf herbs and grass species.
Species richness	Shrub layer consists of <5 species. Diverse groundcover dominated by >40 broadleaf herb and grass species.
Cover classification	
Total living cover	70%
Annual living cover	10%
Perennial living cover	60%
Litter cover	10%
Bare surface	20%
Target weed presence	
E. curvula	<10%

Treed analogue site (transect 7)	
Easting	Northing
226801	6305097
226838	6305039
Landform and soils	
Slope	Transect located along contour of mid slope gently inclining to the north.
Erosion	No erosion observed.
Cracking soils	Not present.
Surface drainage impediments	No drainage impediments.
Vegetation	
Vegetation structure	Eucalyptus dominated canopy to 12m high with a canopy cover of 40%. Sparser shrub layer to 3m height with isolated shrubs to 1.5m height. 70% groundcover to 0.5m height, dominated by native grasses with mixed native herbs.
Species richness	More than 5 tree species, dominated by *Eucalyptus* spp. Shrub layer of >7 native species. Diverse groundcover dominated by *Poa* spp. with mixed native herbs.
Cover classification	
Total living cover	90%
Annual living cover	10%
Perennial living cover	80%
Litter cover	10%
Bare surface	-
Target weed presence	
None observed.	

Appendix B
Vegetation assessment of treed areas

Vegetation assessment treed areas 2015

Transect	Treed rehabilitation area (transect 5)	Treed rehabilitation area (transect 6)	Treed analogue site (transect 7)
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>30	>30	>50
Trees	0	Sparse. To 3 m height.	>5 species, 12-14 m height. 20% canopy cover.
Understorey	Sparse, to 2 m height. Juvenile Eucalyptus and Acacia species. *Cassinia arcuata.*	Sparse, to 2 m height. Juvenile Eucalyptus and Acacia species. *Cassinia arcuata.*	>7 species, 1-2 m height, 10% cover
Groundcover	<40%. Mix of exotic grasses, native and exotic herbs.	Dominated by exotic grasses and herbs. Some native herbs present. 20% cover.	Dominated by *Poa* spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>10, including *Rubus fruticosus.*	>10	<10
Recruitment	0	0	Present
Organic litter	Thin mulch present.	Thin mulch present.	Well-developed to 2 cm depth.
Logs	Large logs placed along contours on upper slope.	Large logs placed along contours on upper slope.	8 fallen logs of >20 cm diameter present along transect.

Vegetation assessment treed areas 2014

Transect	Transect 5	Transect 6	Transect 7
Vegetation type	Rehabilitated	Rehabilitated	Dry Sclerophyll Forest (grassy)
Native plant species richness	>30	>30	>50
Trees	Sparse. To 3m height.	Sparse. To 3m height.	>5 species, 12-14 m height. 40% canopy cover.
Understorey	Sparse. Juvenile Eucalyptus spp. present with Acacia shrubs.	Sparse. Juvenile Eucalyptus spp. present with Acacia shrubs.	>7 species, 1.5 - 3 m height, 35% cover
Groundcover	Sparse. Mix of exotic grasses, native and exotic herbs.	Sparse. Mix of exotic grasses, native and exotic herbs.	70% cover. Dominated by *Poa* spp. with mixed native herbs.
Non-native species	>10	>10	<10
Recruitment	-	-	Present
Organic litter	Thin mulch present.	Thin mulch present.	Well-developed to >2cm depth.
Logs	Large logs placed along contours on upper slope.	Large logs placed along contours on upper slope.	8 fallen logs of >20 cm diameter present along transect.

Appendix C
Estimation of annual soil loss in pastures

Annual soil loss factors	Pasture analogue site	Transect 1 (pasture)	Transect 2 (pasture)	Transect 3 (pasture)	Transect 4 (pasture)	Transect 5 (treed)	Transect 6 (treed)	Treed analogue site (transect 7)
Annual rainfall erosivity factor **(R)**	**1365** Bathurst							
Soil erodibility factor **(K)**	**0.03** Sandy loam /fine sandy loam				**0.025** Sandy clay-loam			**0.03** Sandy loam /fine sandy loam
Topographic factor **(LS)**	**0.17** 3% gradient, 5m slope length			**0.34** 8% gradient, 5m slope length	**0.09** 1% gradient, 5m slope length	**0.89** 20% gradient, 5m slope length		**0.52** 12% gradient, 5m slope length
Cover and management factor **(C)**	**0.0** No appreciable canopy cover, 95% grassy groundcover	**0.01** No appreciable canopy cover, 80% grassy groundcover				**0.13** 25% canopy cover of tall weeds or short brush, 40% non-grassy groundcover	**0.08** 25% canopy cover of tall weeds or short brush, 60% non-grassy groundcover	**0.00** Canopy of tall weeds or short brush, 75% canopy cover, 95% grassy groundcover
Erosion control practice factor **(P)**	**1.3** Compacted					**1.2** Trackwalked along contour		**1.3** Compacted
Annual soil loss due to erosion **(A)**	**0.0 t/ha**	**0.09 t/ha**	**0.09 t/ha**	**0.18 t/ha**	**0.03 t/ha**	**4.73 t/ha**	**2.91 t/ha**	**0.0 t/ha**

Appendix D
Species list

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Acacia dealbata subsp. *dealbata*					x	x	X
Acacia nana					x	x	
Acacia rubida							x
Acacia ulcifolia							x
Acacia sp.					x	x	X
Acaena novae-zeylandiae					x	x	
Ajuga australis							X
Amaranthus sp.	x	x	x	x	x	x	
Austrostipa sp.			x	X			
Brassica juncea	x	x	x	x	x	X	
Brassica rapa	x	x	x	x	x	X	
Bursaria spinosa subsp. *lasiophylla*					x	x	x
Calandrinia calyptrata							x
Conyza bonariensis	x	x	x	x	x	x	
Dactylis glomerata	x	x	x	x			
Desmodium varians							x

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Dillwynia phylicoides							x
Eragrostis sp.	x	x	x	x			
Eucalyptus dalrympleana subsp. *dalrympleana*							x
Eucalyptus dives					x	x	x
Eucalyptus macrorhyncha							x
Eucalyptus mannifera subsp. *mannifera*							x
Eucalyptus rubida subsp. *rubida*							x
Festuca arundinacea	x	x	x	x			
Geranium sp.	x	x	x	x	x	x	x
Gompholobium huegelii							x
Goodenia hederacea							x
Hibbertia aspera subsp. *aspera*							x
Hibbertia obtusifolia							x
Leucopogon sp.							x
Lissanthe strigose subsp. *subulata*							x
Lomandra filiformis							x

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Persoonia laurina							x
Persoonia oblongata							x
Phalaris aquatica	x	x	x	x			
Plantago lanceolata	x	x	x	x	x	x	
Poa labillardierei							x
Poa sp.	x	x	x	x	x	x	x
Ranunculus lappaceus							x
Ranunculus sp.	x	x	x	x	x	x	
Rorippa sp.			x				
Sonchus asper	x	x	x	X			
Sonchus hydrophilus	X	x	x	x			
Sonchus oleraceus	x	x	x	x			
Themeda australis							x
Trifolium arvense	x	x	x	X			
Trifolium repens	x	x	x	x			
Trifolium subterraneum	x	x	x	x			

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7
Veronica calycina							x
Vicia spp.					x		
Vulpia spp.	x	x	x	x			

Appendix E
Photopoint monitoring to 2015

Transect 1 looking south 2014

Transect 1 looking south 2015

Transect 2 looking southeast 2014

Transect 2 looking southeast 2015

Transect 3 looking southwest 2014

Transect 3 looking southwest 2015

Transect 4 looking west 2014

Transect 4 looking west 2015

Transect 5 looking west 2014

Transect 5 looking west 2015

Transect 6 looking east 2014

Transect 6 looking east 2015

Transect 7 looking east 2014

Transect 7 looking east 2015

Quadrat 1 February 2010 (Cunningham 2012)

Quadrat 1 September 2011 (Cunningham 2012)

Quadrat 1 November 2012 (Cunningham 2012)

Quadrat 1 April 2014

Quadrat 1 September 2015