



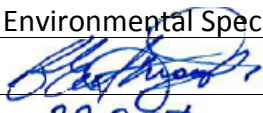
PINE DALE MINE

ANNUAL REVIEW 2016

Prepared by: Enhance Place Pty Ltd
February 2017

Revision 1.0 – 9 March 2017

TITLE

Name of Operation:	Pine Dale Mine
Name of Operator:	Enhance Place Pty Limited
Project Approval Number:	10_0041
Project Approval Holder:	Enhance Place Pty Limited
Mining Lease Numbers:	ML1569, ML1578, ML1664, ML1637
Mining Lease Holder:	Enhance Place Pty Limited
Water Licence Number:	10WA118780
Water Licence Holder:	Enhance Place Pty Limited
MOP Commencement Date	April 2014
MOP Completion Date	April 2017
Annual Review Start Date:	1 January 2016
Annual Review End Date:	31 December 2016
Annual Review Report Author:	Karen Tripp (RCA Australia)
<p>I, Ben Eastwood, certify that this audit report is a true and accurate record of the compliance status of Pine Dale Mine, for the period 1 January 2016 to 31 December 2016 and that I am authorised to make this statement on behalf of Enhance Place Pty Ltd.</p> <p><i>Note.</i></p> <p>a) <i>The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</i></p> <p>b) <i>The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).</i></p>	
Authorised Reporting Officer:	Ben Eastwood
Title:	Environmental Specialist
Signature:	
Date:	28.2.17

CONTENTS

1	STATEMENT OF COMPLIANCE	1
2	INTRODUCTION	3
2.1	KEY PERSONNEL	4
3	APPROVALS, LEASES AND LICENCES	4
4	OPERATIONS SUMMARY	5
4.1	EXPLORATION	5
4.2	LAND PREPARATION	5
4.3	CONSTRUCTION	5
4.4	MINING	5
4.5	COAL PROCESSING	5
4.6	COAL TRANSPORTING	5
4.7	WASTE MANAGEMENT	5
4.8	PRODUCT STOCKPILES	5
4.9	HAZARDOUS MATERIALS MANAGEMENT	6
4.10	OTHER INFRASTRUCTURE MANAGEMENT	6
4.11	FORECAST OPERATIONS	6
5	ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW	6
6	ENVIRONMENTAL PERFORMANCE	8
6.1	NOISE	9
6.2	AIR QUALITY	10
6.3	METEOROLOGICAL MONITORING	14
6.4	EROSION AND SEDIMENT	17
6.5	CONTAMINATED POLLUTED LAND	17
6.6	THREATENED FLORA & FAUNA	17
6.7	WEEDS	20
6.8	BLASTING	21
6.9	VISUAL, STRAY LIGHT	21
6.10	ABORIGINAL HERITAGE	21
6.11	NATURAL HERITAGE	21
6.12	SPONTANEOUS COMBUSTION	21
6.13	MINE SUBSIDENCE	21
6.14	HYDROCARBON CONTAMINATION	21
6.15	BUSHFIRE	22
6.16	METHANE DRAINAGE/VENTILATION	22
6.17	PUBLIC SAFETY	22
6.18	OTHER ISSUES AND RISKS	22
7	WATER MANAGEMENT	22
7.1	STORED WATER	23
7.2	SURFACE WATER	23
7.3	SURFACE WATER MONITORING	23
7.4	CHANNEL STABILITY & STREAM HEALTH MONITORING	30
7.5	GROUNDWATER	31
7.6	GROUNDWATER MONITORING	31
8	REHABILITATION	40
8.1	REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD	40
8.2	ACTIONS FOR THE NEXT REPORTING PERIOD	52
9	COMMUNITY RELATIONS	53
9.1	ENVIRONMENTAL COMPLAINTS, INCIDENTS & NOTIFICATIONS	53
9.2	COMMUNITY LIAISON	53

10 INDEPENDENT ENVIRONMENTAL AUDIT.....	54
11 INCIDENTS AND NON COMPLIANCES	61
12 ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD.....	61
12.1 MINING	61
12.2 FUTURE MINING DEVELOPMENT	61
12.3 DOCUMENT REVIEWS.....	61
13 REFERENCES	62

LIST OF TABLES

Table 1	Statement of Compliance During 2016 Reporting Period	1
Table 2	Details of Non-Compliance during 2016 Reporting Period	1
Table 3	Compliance Status Key	2
Table 4	Key Contacts.....	4
Table 5	Pine Dale Mine Consents, Leases and Licences.....	4
Table 6	Production and Waste Summary.....	5
Table 7	Actions Required from 2015 Annual Review.....	6
Table 8	Environmental Performance	9
Table 9	Depositional Dust Monitoring Results.....	12
Table 10	PM ₁₀ and TSP Summary.....	13
Table 11	Pine Dale Mine Meteorological Station Summary 2016	16
Table 12	Purple Copper Butterfly Field Survey Summary	19
Table 13	WMP & EPL Surface Water Trigger Values & Limits.....	24
Table 14	Groundwater Trigger Values & Levels.....	32
Table 15	Rehabilitation Area Summary	41
Table 16	Rehabilitation Status Summary	41
Table 17	Recommended and Completed Rehabilitation Actions in Area A.....	44
Table 18	Recommended and Completed Rehabilitation Actions in Areas B & C.....	47
Table 19	Recommended and Completed Rehabilitation Actions in Area 8	50
Table 20	Threats to Rehabilitation Success	52
Table 21	Community Complaints, Incidents & Notifications	53
Table 22	Independent Environmental Audit Action Plan.....	55
Table 23	Auditors Recommendations and Pine Dale Mine’s Proposed Actions	58

LIST OF FIGURES

Figure 1	Historical Depositional Dust Data.....	11
Figure 2	Historical HVAS Data	14
Figure 3	Annual Temperature & Rainfall Summary.....	15
Figure 4	EPL Surface Water Historical Results.....	25
Figure 5	EPL Surface Water Historical Results and Rainfall.....	26
Figure 6	WMP S1, S3 & S6 Historical pH Results	28
Figure 7	WMP S4, S5 & S6 Historical pH Results	28
Figure 8	WMP S1, S3 & S6 Historical EC Results & Rainfall	29
Figure 9	WMP S4, S5 & S6 Historical EC Results & Rainfall	29
Figure 10	Channel Stability and Stream Health Results	30
Figure 11	Site Groundwater Bores Historical pH Results	34
Figure 12	Site Groundwater Bores Historical EC Results & Rainfall	34
Figure 13	Site Groundwater Bores Historical SWL & Rainfall.....	35
Figure 14	Off-Site Groundwater Bores Historical pH Results.....	37
Figure 15	Off-Site Groundwater Bores Historical EC Results & Rainfall.....	37
Figure 16	Off-Site Groundwater Bores Historical SWL & Rainfall	38
Figure 17	Off-Site Bore B-VWP Historical SWL & Rainfall	38
Figure 18	Off-Site Bore C-VWP Historical SWL & Rainfall	39
Figure 19	Off-Site Bore E-VWP Historical SWL & Rainfall.....	39

LIST OF PLATES

Plate 1	Amenity bund – application of mulch & native seed mix (2015)	43
Plate 2	Amenity bund – vegetation growth during 2016 period.....	43
Plate 3	Area A – Vegetation cover, October 2016.....	45
Plate 4	Area A – Mechanical ripping prior to seed sowing, November 2016.....	45
Plate 5	Area A – Ripped prior to seed sowing, November 2016	46
Plate 6	Area B & C – Mechanical ripping of poorly established pasture, November 2016	48
Plate 7	Area B & C – Re-sowing of mechanically ripped area, November 2016.....	48
Plate 8	Area B & C – Pasture growth, November 2016	49
Plate 9	Area 8 – Pasture growth around rock-lined drainage lines, November 2016.....	51
Plate 10	Area 8 – Pasture growth / ground coverage, November 2016	51

LIST OF PLANS

PLAN 1	Regional Locality Plan
PLAN 2a	Environmental Monitoring Locations
PLAN 2b	Stream Health Monitoring Locations
PLAN 3	Rehabilitation Domains
PLAN 4	Mining & Exploration Leases

LIST OF APPENDICIES

APPENDIX A	– Site Plans
APPENDIX B	– Environmental Monitoring Summary Report
APPENDIX C	– Rehabilitation Monitoring Report

1 STATEMENT OF COMPLIANCE

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 Review (formerly the AEMR) has been prepared pursuant to Schedule 5, Condition 3 of the Project Approval 10_0041, and in accordance with the *Annual Review Guideline* developed by the NSW Department of Planning and Environment (October 2015).

A summary of the Pine Dale Mine compliance achieved during this reporting period is provided in **Table 1**, below. Any non-compliance during the reporting period is provided in **Table 2**, with a key of the compliance provided in **Table 3**.

Table 1
Statement of Compliance During 2016 Reporting Period

Approval No.	Were all conditions of the approval complied with?
PA 10_0041	YES
EPL 4911	NO
ML1569	YES
ML1578	YES
ML1664	YES
ML1637	YES
10WA118780	YES

Table 2
Details of Non-Compliance during 2016 Reporting Period

Relevant Approval	Condition No.	Summary of Condition.	Compliance Status	Comment	Where addressed in Annual Report
PA 10_0041	NA	NA	NA	NA	NA
EPL 4911	M2.2	Requirement for monthly dust monitoring.	Non-compliant (Low Risk)	Dust gauge stolen. One monitoring event lost.	Section 6.2.1 Page 11
ML1569	NA	NA	NA	NA	NA
ML1578	NA	NA	NA	NA	NA
ML1664	NA	NA	NA	NA	NA
ML1637	NA	NA	NA	NA	NA
10WA118780	NA	NA	NA	NA	NA

Table 3
Compliance Status Key

Risk Level	Colour Code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: <ul style="list-style-type: none"> • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur.
Low	Non-compliant	Non-compliance with: <ul style="list-style-type: none"> • Potential for moderate environmental consequences, but is unlikely to occur; or • Potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions).

An acceptable standard of environmental performance was achieved 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 (PM₁₀) were well below the NSW Environmental Protection Authority (EPA) assessment criteria in Blackmans Flat and other privately owned properties adjacent to Pine Dale Mine;
- There was one minor non-compliance with section M2.2 of EPL 4911 during November 2016 where the requirement to monitor air pollution at dust gauge D1 (EPL Point 6) was not met as the dust gauge was found to be missing (stolen). As a result, there was no depositional dust data recorded at dust gauge D1 during November 2016.
- 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 **Appendix C**). Rehabilitation areas are generally stable in both the pasture and treed revegetation areas with an overall reduction in weed presence. In the 2017 reporting period it is recommended to continue weed management and implement strategies to enhance pasture establishment within Areas B and C.

2 INTRODUCTION

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. EA acquired the Pine Dale Mine in June 2012.

Pine Dale Mine is located at Blackmans Flat in NSW, 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. A locality plan is provided in **Plan 1, Appendix A**.

The Pine Dale Mine operates under 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) on 20 February 2011. The project approval provides for the extraction of up to 800,000 tonnes (t) of Run of Mine (ROM) from the Yarraboldy Extension at Pine Dale Mine through to 31 December 2014 at a maximum rate of 350,000 tonnes per annum (tpa).

Additionally, the Mine is also bound by the conditions of several mining leases and a water licence.

Approved mining resources at the Pine Dale Mine were exhausted in March 2014. From April 2014 the mine was placed under care and maintenance, with only rehabilitation activities undertaken at the site from this time.

This Annual Review (formerly AEMR) details the compliance status of the Pine Dale Mine in accordance with Schedule 5, Condition 3 of Project Approval (PA) 10_0041; Mining Lease ML1569, ML1578, ML1664 and ML1637; and water licence number 10WA118780 (refer **Table 5**). The assessment of compliance status covers the 2016 reporting period which runs from 1 January 2016 to 31 December 2016.

The format of this report is presented in accordance with the *Annual Review Guideline* dated 2015 as developed by the NSW Department of Planning and Environment. The following report has been generated to meet:

- the Annual Review requirements of the Department of Planning and Environment under the conditions of a development consent or project approval;
- the Annual Environmental Management Report (AEMR) requirements of the Division of Resources & Energy under the conditions of a mining lease;
- the routine reporting expectations of DPI Water; and
- the Annual Reporting requirements of the Environmental Protection Authority under the conditions of the site Environmental Protection Licence.

This report is distributed to the following stakeholders:

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

2.1 KEY PERSONNEL

The key personnel responsible for environmental management at the Pine Dale Mine are listed in **Table 4**.

Table 4
Key Contacts

Contact Person	Position	Telephone
Mr Graham Goodwin	Mining Engineering Manager	(02) 6355 7893
Mr Mark Frewin	Commercial Manager	(02) 6355 7893
Mr Ben Eastwood	Environment Specialist	(02) 6355 7893

3 APPROVALS, LEASES AND LICENCES

Pine Dale Mine operates in accordance with relevant licenses and approvals which are summarised in **Table 5**. One change was made to the approvals, leases and licences during the 2016 reporting period. In June 2016 a 10 year extension of the Water Access Licence (WAL36480) was granted by the DPI-Water under approval 10WA118780 extending the expiry date to July 2026.

Table 5
Pine Dale Mine Consents, Leases and Licences

Permit Type	Permit Number	Relevant Dates	Description
Project Approval	PA 10_0041	Granted 20 Feb 2012 Expired 31 Dec 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.
Referral Decision	2011/6016	Date of Decision 20 October 2011	Issued by Department of Sustainability, Environment, Water, Population and Communities under section 75 & 77A of the EPBC Act 1999; to avoid impact on Purple Copper Butterfly & Austral toadflax (<i>Thesium australe</i>).
Env. Protection Licence	EPL 4911	Review Due Date 29 Aug 2018	EPL held by Enhance Place Pty Ltd
Mining Lease	ML1578	Granted 5 November 2013	ML 1578 incorporates 69.4ha of land within the boundary of the Pine Dale Mine site.
Mining Lease	ML1664	Grouped under ML1578, 5 Nov 2013	ML 1664 incorporates 4.1 Hectares of land within the boundary of the Pine Dale Mine site.
Mining Lease	ML 1569	Grouped under ML1578, 5 Nov 2013	ML1569 incorporates 161 hectares of land with which the Yarraboldy Extension and a portion of Pine Dale Coal Mine.
Mining Lease	ML1637	Grouped under ML1578, 5 Nov 2013	ML1637 covers an area to the south of Pine Dale Mine for the purpose of proposed rail infrastructure.
Exploration Mining Lease	EL7621	Granted 1 October 2010	EL 7621 incorporates 312 Hectares of land within the north western and central parts of the Wallerawang Colliery.
Bore Licence	10BL165933	Issued 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 on the Pine Dale Mine site.
Bore Licence	10BL603588	Issued 17 December 2010	Issued by the Department of Natural Resources (DNR) under Part 5 of the Water Act 1912 for the use of eight piezometers for monitoring groundwater levels and quality on the Yarraboldy extension site.
Water Access Licence	WAL36480 (approval no 10WA118780)	Dated 1 July 2013 Expires 30 June 2026	This licence was issued by DECCW – NOW under Part 5 of the <i>Water Act 1912</i> for interception and use of up to 200ML of groundwater per year from The Bong.
Flood Control Works Licence	10CW801601 (approval no 10FW119292)	Dated 21 Sept 2015 Expires 21 Sep 2017	Issued by the DNR under Part 8 of the <i>Water Act 1912</i> for the construction of noise/flood bunding along the boundaries of Mining Areas A, B and C.

4 OPERATIONS SUMMARY

4.1 EXPLORATION

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

4.2 LAND PREPARATION

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

4.3 CONSTRUCTION

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

4.4 MINING

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 6**.

Table 6
Production and Waste Summary

	Approved Limit	Previous Reporting Period (actual)	This Reporting Period (actual)	Next Reporting Period (forecast)
Waste Rock / Overburden	NA	0	0	0
ROM Coal	800,000 t (over life of mine)	0	0	0
Coarse Reject	NA	0	0	0
Fine Reject (Tailings)	NA	0	0	0
Saleable product	350,000 t/year	0	0	0

4.5 COAL PROCESSING

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

4.6 COAL TRANSPORTING

Due to the care and maintenance status, no product coal was transported during the 2016 reporting period.

4.7 WASTE MANAGEMENT

Hydrocarbon based materials were stored or kept at the site in accordance with the currently approved Environmental Management Strategy and Waste Management Plan. Waste hydrocarbon materials were transported from the site by a licenced contractor.

General waste bins are kept at the site office for the collection of putrescible waste. These bins are inspected and emptied as part of the regular inspection and maintenance program for the site.

Sewage management facilities were maintained at the site during the reporting term with regular inspections and pump outs undertaken as required.

4.8 PRODUCT STOCKPILES

As the mine entered into care and maintenance in early 2014, the product stockpiles were decommissioned prior to the 2016 reporting period.

4.9 HAZARDOUS MATERIALS MANAGEMENT

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.

4.10 OTHER INFRASTRUCTURE MANAGEMENT

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

4.11 FORECAST OPERATIONS

There are no operations forecast at the Pine Dale Mine during the next reporting period. The mine will continue to remain under care and maintenance.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

A letter of acceptance for the 2015 Annual Review (AEMR) was received from DPE on the 14 May 2016. Actions required by DPE, and where they have been addressed in the 2016 Annual Review are provided in **Table 7**.

Table 7
Actions Required from 2015 Annual Review

Item	Action Required from 2015 Annual Review	Requested By	Action Taken	Where Discussed in Annual Review
1	<i>Complaints – a comparison of complaints with previous years and tabulated details of complaints is provided, including actions taken to address the complaint. It is noted that in the AEMR the complaints are classified as ‘notifications/enquiries’, whereas in the complaints register on the webpage they are classified as ‘complaints’. Reporting classification should be consistent.</i>	DPE	The complaints register was updated to better reflect the nature of the communications received. The Nature of the communication is now listed as either an Enquiry, Notification or Complaint. The term ‘complaint number’ has also been replaced with <i>Item Number</i> .	Section 9.1
2	<i>Trends – graphical representation of trends and comparisons with the previous five (5) years of data are to be provided. If this is not possible for all parameters (e.g. groundwater results) then key parameters should be selected.</i>	DPE	Graphical representation of trends and comparison of data for the previous five (5) years has been provided for air quality, surface water quality, groundwater quality and meteorological data.	Sections 6 & 7 Figures 1 through 15
3	<i>Comparison of results – a comparison of monitoring results for the previous five (5) years and with the predictions in the Environmental Assessment is to be provided.</i>	DPE	A comparison of data from the previous five (5) years and the predictions of the Environmental Assessment has been provided in this report.	Sections 6.2.1; 6.2.2; 6.3.1; 6.6.1; 7.3.2.1; 7.3.2.2; 7.5.2.1; 7.5.2.2
4	<i>Exceedances – an explanation to be provided for all exceedances of trigger levels stating the action, if any, that will be taken to address the exceedance, and justification for not conducting an investigation, if applicable.</i>	DPE	Notations on exceedances of trigger levels are provided for surface water and groundwater quality results.	Sections 7.3.2.1; 7.3.2.2; 7.5.2.1; 7.5.2.2

Item	Action Required from 2015 Annual Review	Requested By	Action Taken	Where Discussed in Annual Review
5	Plans – Plan 1 (Pine Dale Mine AEMR Plan) is to be updated to reflect the current reporting period and include labels for Areas B and 8, and Plan 5 (Proposed Water Management Infrastructure) is to be updated to reflect ‘actual’ rather than ‘proposed’ or ‘potential’ structures. In general, all plans need to be reviewed to reflect current conditions.	DPE	All plans associated with the Annual Review (AEMR) have been updated to reflect the current conditions at the Mine.	Appendix A
6	Reporting – ensure the format of the AEMR reflects the requirements of the Annual Review Guideline, published by the NSW Government in October 2015.	DPE	The reporting format has been updated to satisfy the requirements of the Annual Review Guideline (DPE, 2015)	Section 2
Note a)	Independent Environmental Audit – the progress against actions from the IEA dated October 2014 has not been reported in the AEMR. It is requested that an update on the progress of action close out is provided to the Department by 24 March 2016. If any actions remain outstanding in 2016, progress is to be reported in the AEMR for the next reporting period.	DPE	All items identified in the 2014 IEA have been addressed. The status of non-compliances and recommendations identified during the IEA are detailed in the IEA Action Plan 2014, which was made available on the Pine Dale Mine website by 24 March 2016.	Section 10
Note b)	Management Plans – in accordance with Schedule 5 Condition 4, a review of strategies, plans and programs required under the approval is to be undertaken following the submission of an IEA. It is noted that the plans provided on the website are dated 2011. In addition, this condition was found to be non-compliant in the IEA dated October 2014. It is required that by 24 March 2016, that an update on progress with the review of strategies, plans and programs required under the approval is provided to the Department.	DPE	A review of the Management Plans in accordance with Schedule 5 Condition 4 was completed in August 2015. Updated plans were circulated to the DPE for review prior to publication on the Pine Dale Mine website. The updated Management Plans were made available on the Pine Dale Mine website by 24 March 2016.	NA

Item	Action Required from 2015 Annual Review	Requested By	Action Taken	Where Discussed in Annual Review
Note c)	Website – a review of the website indicated that the Biodiversity Management Plan and Rehabilitation Management Plan were not available on the website. Please ensure that these are provided on the website by 24 March 2016.	DPE	The requirement to prepare a Biodiversity Management Plan was considered no longer relevant during the 2013 Independent External Audit following examination of correspondence from NSW EPA (8/02/12) which stated that “should NSW Department of Planning and Infrastructure accept the offset proposal that conditions 30 and 31 will no longer be relevant once the offset land has been incorporated into OEH Estate and following transfer of the one-off \$10,000 management fee”. Further correspondence from NSW DoP (28/02/12) documented the acceptance of the offset proposal and a receipt of funds, with the transfer of lands documented in a letter dated 26/06/12 from Duncan Cotterill Lawyers. The 2013 Independent External Audit therefore found compliance with Condition 3.30 not applicable. The Rehabilitation management at Pine Dale Mine is documented in Section 5 thru 9 of the Care & Maintenance MOP available on the Pine Dale Mine website.	NA
Note d)	Future Mining Development – Enhance Place intends to lodge an application with the Department to extend the existing mining operations. Engagement with regulators and key stakeholders will continue to be undertaken throughout 2016.	DPE	Engagement with regulators and key stakeholders continued to be undertaken throughout 2016 in the form of Community Consultative Committee meetings and through information displayed on the Pine Dale Mine Website, and other discussions as required.	Section 9.2

6 ENVIRONMENTAL PERFORMANCE

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

Environmental monitoring and management at Pine Dale Mine is governed by the requirements of Project Approval PA10_0041 and supporting Environmental Assessment. The following management plans have been developed for the Pine Dale Mine to minimise the potential risk to the surrounding environment.

- Mining Operations Plan
- Aboriginal Heritage Management Plan
- Air Quality and Greenhouse Gas Management Plan
- Blast Management Plan
- Bushfire Management Plan
- Purple Copper Butterfly Monitoring & Management Plan
- Waste Management Plan
- Water Management Plan
- Noise Management Plan
- Pollution Incident Response Management Plan

These management plans are displayed on the Pine Dale Mine website.

A summary of the environmental performance for noise monitoring and air quality monitoring is provided in **Table 8**. Detailed discussions of other key environmental performance indicators are presented further in this Section.

Table 8
Environmental Performance

Aspect	Approval Criteria	EA Prediction	Performance during 2016	Trends /Management Implications	Management Actions
Noise	NM1 – NM3 Daytime Criteria 42dB(A) LAeq(15minute)	NM1 41 NM2 32 NM3 39 dB(A) LAeq(15minute)	NM1 Nil detected NM2 Nil detected NM3 Nil detected dB(A) LAeq(15minute)	NA – no operational noise generated	Nil management actions required
	NM4 – NM6 Daytime Criteria 35dB(A) LAeq(15minute)	NM4 34 NM6 <30 dB(A) LAeq(15minute)	NM1 Nil detected NM2 Nil detected dB(A) LAeq(15minute)	NA – no operational noise generated	Nil management actions required
Air Quality: Depositional Dust	Maximum total deposited dust 4g/m ² /month	Annual average of 3.2g/m ² /month deposited dust	Annual average range of 0.4 to 1.1g/m ² /month deposited dust	Annual average dust levels show a slight decreasing trend	Maintain dust suppression measures as required
	Maximum increase in deposited dust 2g/m ² /month	Annual average increase of 1.2g/m ² /month deposited dust	Annual average <i>decreased</i> by 0 to 0.7g/m ² /month deposited dust	Annual average dust levels show a slight decreasing trend	Maintain dust suppression measures as required
Air Quality: High Volume Air Sampling	TSP Annual Average 90 µg/m ³	TSP Annual Average 45 µg/m ³	TSP Annual Average 18.7 µg/m ³	Annual average TSP shows a decreasing long term trend	Maintain dust suppression measures as required
	PM10 Annual Average 30 µg/m ³	PM10 Annual Average 18 µg/m ³	PM10 Annual Average 8.8 µg/m ³	Annual average TSP shows a decreasing long term trend	Maintain dust suppression measures as required
	PM10 24hr Average 50 µg/m ³	PM10 24hr Average 45.7 µg/m ³	Max PM10 24hr Average <27 µg/m ³	Max 24hr PM10 shows a decreasing trend	Maintain dust suppression measures as required

6.1 NOISE

Mining related noise impacts at Pine Dale Mine are managed in accordance with Schedule 3, Condition 1 of 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 Australia (see **Plan 2 & 4**). These locations included:

- NM1 – the Green residence, Blackman’s flat;
- NM2 – the Cherry residence, Blackman’s flat;
- NM3 – front of Barnes residence, 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 LAeq (15 minute) at three of the six monitoring locations (NM1 to NM3); and a noise assessment criteria of 35dB LAeq (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 LAeq (15 minute) at receptors NM1, NM2 and NM3.

Attended noise monitoring was undertaken routinely during the 2016 reporting period to assess any noise impacts from Pine Dale Mine against relevant criteria detailed within PA 10_0041 and EPL 4911. Quarterly monitoring was undertaken as follows:

- Quarter 1 – January to March; monitoring conducted 11 January 2016
- Quarter 2 – April to June; monitoring conducted 5 April 2016
- Quarter 3 – July to September; monitoring conducted 6 September 2016
- Quarter 4 – October to December monitoring conducted 6 & 7 October 2016

Although the mine is currently in care and maintenance, rehabilitation activities facilitating the use of mobile plant were conducted at the site during the 2016 reporting period. The measured LAeq, 15min noise contribution from the Pine Dale Mine was below the noise assessment criteria for all 15-minute surveys at all noise monitoring locations measured during the 2016 reporting period. Similarly, the measured noise contribution Pine Dale Mine was also below the noise levels predicted in the Environmental Assessment. Audible noise emanating from the Pine Dale Mine has not been detected during noise monitoring surveys since the cessation of mining operations in April 2014.

Results for each noise survey during the 2016 reporting period are presented in full in **Appendix B**.

During the reporting period no environmental performance or management measures were required to be implemented at the site in respect to noise generated by the site.

6.2 AIR QUALITY

Air quality management is a priority at the Pine Dale Mine. During care and maintenance water for dust suppression was sourced from the onsite sediment basins.

Air quality at Pine Dale Mine is managed in accordance with Schedule 3, Condition 18 of PA 10_0041, EPL 4911 and the approved Air Quality and Greenhouse Gas Management Plan. 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 (PM₁₀) (refer **Plan 2 & 4, Appendix A**). Monitoring is performed by RCA Laboratories- Environmental and a summary report on data collected throughout the reporting period is available in **Appendix B**.

6.2.1 DEPOSITIONAL DUST

Depositional Dust results for the period January – December 2016 show an annual average insoluble solids range of 0.4 g/m² per month to 1.1 g/m² per month for all dust gauges. These results fall well below the nominated annual average assessment criteria of 4.0 g/m² per month, as stipulated in the project approval (PA 10_0041).

Comparative annual average depositional dust data for the previous five year period is presented in **Table 9**, with data presented graphically in **Figure 1**.

An examination of the historical data indicates a slight decrease in the depositional dust concentrations at the site during the period 2012 to 2016. Operations at the mine ceased during April 2014, with a reduction in depositional dust concentrations reflected during the Care and Maintenance phase (2015 to 2016). All depositional dust results are shown to be considerably lower than the concentrations predicted in the site Environmental Assessment (predicted annual average of 3.2g/m²/month deposited dust).

There was one non-compliance with section M2.2 of EPL 4911 during November 2016 where the requirement to monitor air pollution at dust gauge D1 (EPL Point 6) was not met as the dust gauge was found to be missing (stolen). As a result, there was no depositional dust data recorded at dust gauge D1 during November 2016.

Dust gauge D1 is located on a residential property in the township of Blackmans Flat, where the houses have recently been sold and residents have moved away. Upon discovery, a replacement gauge was sourced and installed in the same position on the following day. In an effort to improve environmental performance, it was proposed that routine (weekly) checks of the dust gauge be undertaken to enable data capture to continue as soon as possible after a vandalism event.

Figure 1
Historical Depositional Dust Data

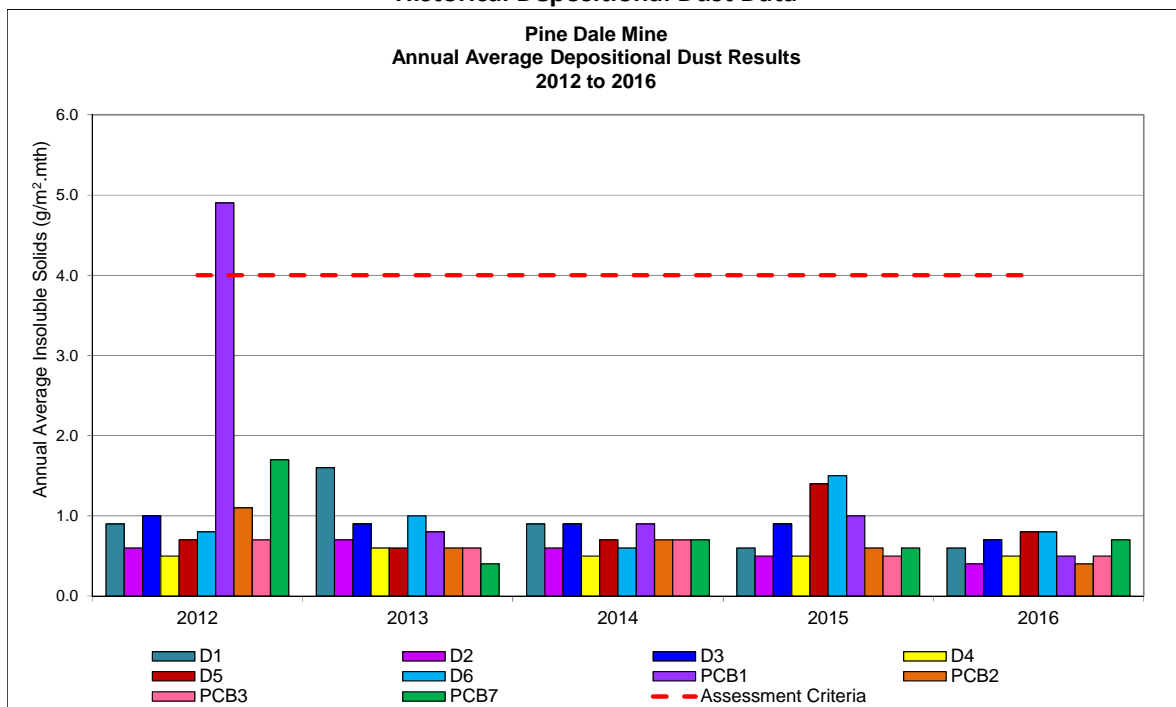


Table 9
Depositional Dust Monitoring Results

Date	Total Insoluble Solids (g/m ² .month)									
	Dust Gauge ID									
	D1	D2	D3	D4	D5	D6	PCB1	PCB2	PCB3	PCB7
Jan-16	0.4	0.4	0.2	0.2	3.9	0.7	0.4	0.2	0.6	0.4
Feb-16	0.5	0.4	0.7	0.5	0.6	1.5	0.7	0.6	0.6	1.2
Mar-16	1.2	0.8	1.0	0.7	0.7	0.8	0.7	1.0	0.8	0.9
Apr-16	0.5	0.3	0.9	0.6	0.8	1.9	0.4	0.3	0.6	1.4
May-16	0.5	0.3	0.8	0.4	0.5	1.1	0.3	0.7	0.4	0.3
Jun-16	0.1	<u>0.05</u>	0.5	0.6	0.5	0.7	0.4	0.4	0.2	0.8
Jul-16	0.2	0.1	0.1	<u>0.05</u>	<u>0.05</u>	0.1	<u>0.05</u>	0.2	0.2	<u>0.05</u>
Aug-16	0.3	0.1	0.4	0.1	1.3	0.3	0.4	0.3	0.2	0.3
Sep-16	<u>0.05</u>	<u>0.05</u>	0.2	<u>0.05</u>	0.5	0.1	0.2	0.1	0.2	<u>0.05</u>
Oct-16	0.9	0.7	0.9	0.6	2.7	0.7	0.6	<u>0.05</u>	0.6	0.8
Nov-16	RN	0.5	1.2	0.5	0.4	0.5	0.6	0.4	0.8	0.2
Dec-16	1.1	1.2	1.1	1.2	0.8	1.7	1.4	1.0	1.2	2.1
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
2016	0.5	0.4	0.7	0.5	1.1	0.8	0.5	0.4	0.5	0.7
PA Annual Average Assessment Criteria	4.0 g/m².month									

Notes: RN – Sample invalid; depositional dust gauge stolen.

Underlined results indicate result is less than detection limits, half the PQL has been reported.

6.2.2 HIGH VOLUME AIR SAMPLING

Annual average PM₁₀ and TSP monitoring results are summarised in **Table 10**. Detailed data analysis presented in **Appendix B**. During the 2016 reporting period all PM₁₀ 24-hour average results recorded were below the 50µg/m³ assessment criteria nominated in PA 10_0041. The highest PM₁₀ result recorded during 2016 was 27µg/m³ on 5th April 2016. The annual average PM₁₀ result recorded in 2016 was 9µg/m³ which is well below the long term 30µg/m³ annual average assessment criteria. The highest TSP result recorded for 2016 was 47µg/m³ on 14th September 2016. The annual average TSP result recorded during 2016 was 19µg/m³ which is well below the 90µg/m³ assessment criteria. Both the TSP and PM₁₀ annual average concentrations continue to remain below the concentrations predicted in the Environmental Assessment.

The long term average annual PM₁₀ and TSP levels are all within the nominated assessment criteria. Results also demonstrate consistent PM₁₀ and TSP levels were recorded at the site throughout the 2011 to 2016 monitoring period (see **Table 10** and **Figure 2**). A slight increase in both PM₁₀ 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 throughout 2014 to 2016; this is likely due to the higher rainfall recorded during 2015 and 2016, and the cessation of mining activities in April 2014.

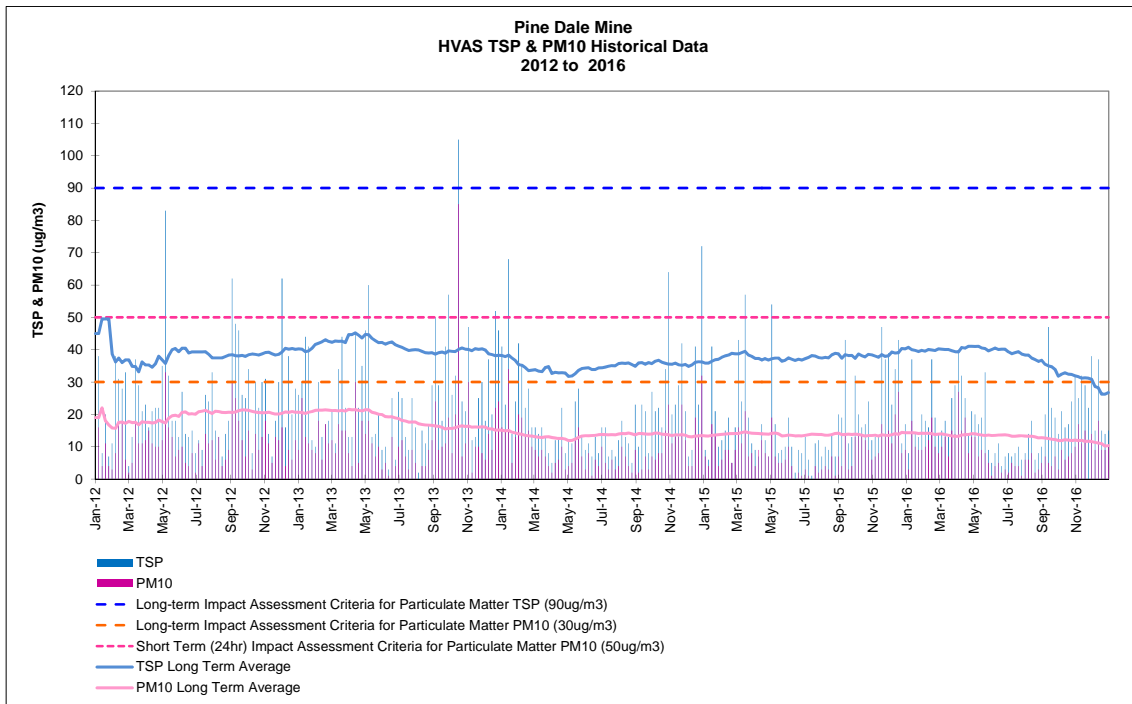
Table 10
PM₁₀ and TSP Summary

	Particulate Matter <10µm (µg/m ³)	TSP (µg/m ³)
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
Maximum 24h Average result 2016	27	n/a
PM ₁₀ 24h Assessment Criteria **	50	Not Required
Annual Average 2012	11	25
Annual Average 2013	13	26
Annual Average 2014	10	20
Annual Average 2015	8	18
Annual Average 2016	9	19
Annual Average Assessment Criteria**	30	90

* Result influenced by external sources (bushfires) outside of the control of the project.

**Air Quality Assessment Criteria listed in project approval PA 10_0041.

Figure 2
Historical HVAS Data



During the reporting period no additional environmental management measures were required to be implemented at the site in respect to depositional dust monitoring and high volume air sampling.

The existing air quality monitoring program and dust management practices will continue to be implemented throughout 2017. All air quality monitoring units will continue to be regularly calibrated and audited to ensure compliance with the appropriate Australian Standard.

6.3 METEOROLOGICAL MONITORING

In accordance with Schedule 3, Condition 22 of PA 10_0041 and EPL 4911, Pine Dale Mine operates a meteorological monitoring station measuring air temperature, wind direction, wind speed, solar radiation, sigma theta, rainfall, evapotranspiration and relative humidity. A summary of monthly meteorological conditions recorded during the 2016 reporting period are presented in the following sections and **Appendix B**.

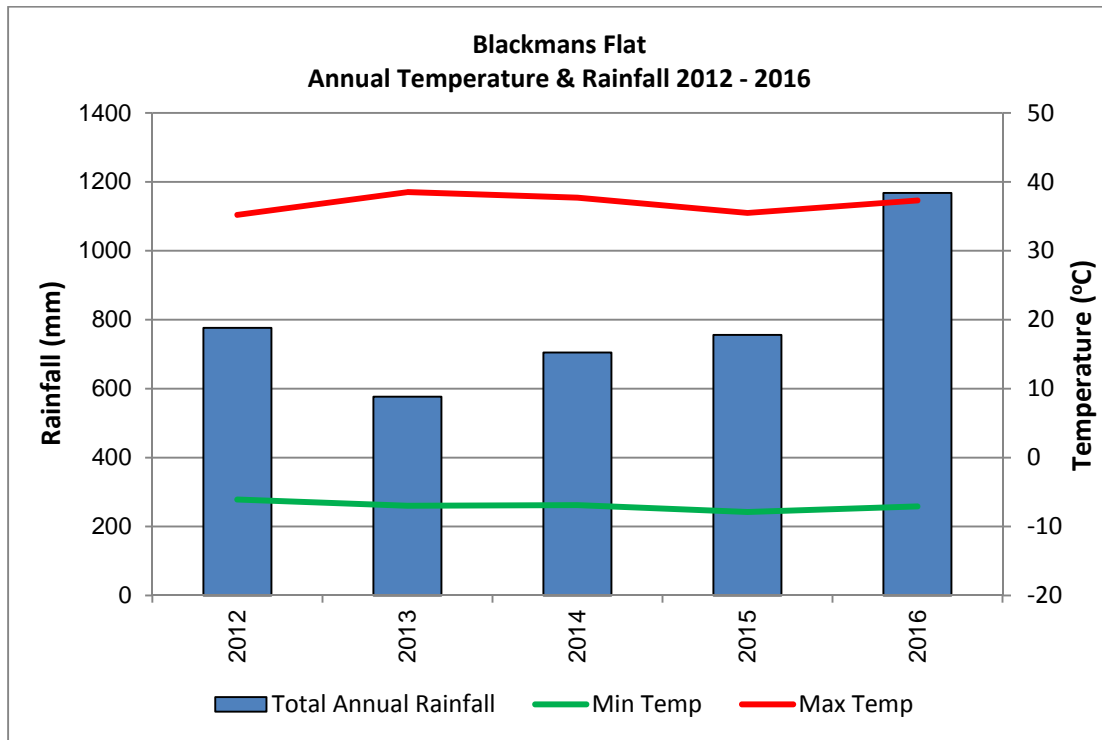
6.3.1 RAINFALL

Pine Dale Mine received 1167.6mm of rainfall and experienced 147 rainfall days during the 2016 reporting period. Rainfall during this reporting period was observed to be considerably greater than rainfall recorded in 2015 (756.2mm and 144 rainfall days). The monthly rainfall data for 2016 is summarised in **Table 11**. A graphical presentation of annual rainfall during the previous 5 years is presented in **Figure 3**.

6.3.2 TEMPERATURE

Temperature is monitored at two heights (2 metres and 10 metres) to account for temperature inversions. The maximum temperature recorded during the reporting period was 37.3°C at 2m and 34.9°C at the 10m sensor, during January. The lowest temperature occurred in May, with a recording of -7.1°C at 2m and -7.0°C at 10m. A summary of monthly temperatures for 2016 is included in **Table 11**. A graphical presentation of annual temperature variations during the previous 5 years is presented in **Figure 3**.

Figure 3
Annual Temperature & Rainfall Summary



6.3.3 WIND SPEED, DIRECTION & SIGMA THETA

Recordings of wind parameters are monitored from the stations' 10 metre mast. Predominant wind directions at the site in 2016 were observed to be from the west to north-westerly quadrant, 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 north-west and west-north-west.

The maximum wind speed measured at the site was 20.7m/s in September 2016 from a north-westerly direction. Sigma theta data was measured continuously throughout the entire 2016 monitoring period. A summary of monthly wind speed, predominant directions and sigma theta recordings in 2016 is included in **Table 11**.

6.3.4 RELATIVE HUMIDITY

Relative humidity was measured in the 2016 monitoring period. The maximum humidity recorded at the site was 96.8% during March. A summary of monthly humidity variations for 2016 is included in **Table 11**.

Table 11
Pine Dale Mine Meteorological Station Summary 2016

Month	Rainfall (mm)	Cumulative Rainfall (mm)	No of Rain Days/ Month	Air Temp. @ 2m (°C)			Air Temp. @ 10m (°C)			Sigma theta (°)			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	192.8	192.8	13	19.2	6.5	37.3	18.6	6.7	34.9	32.1	0.0	101	69.6	11.0	96.7	1.4	0.0	14.5	SE
February	37.4	230.2	5	19.6	6.7	34.9	19.0	6.9	33.5	33.3	0.0	102.1	65.4	13.2	96.3	1.1	0.0	13.9	SE
March	116.4	346.6	10	17.9	4.7	34.9	17.4	4.9	33	32.8	0.0	103.1	70.2	15.3	96.8	0.9	0.0	11.5	SE
April	10.8	357.4	9	14.1	1.9	29.3	13.8	2.2	27.9	29.7	0.0	99.8	71.5	12.3	96.0	0.9	0.0	11.2	WNW
May	32.0	389.4	9	9.5	-7.1	26.1	9.6	-7.0	24.8	23.0	0.0	101.9	71.9	8.3	96.0	2.0	0.0	15.4	W
June	212.4	601.8	20	6.3	-6.7	16.3	6.3	-6.7	15.3	24.4	0.0	101	82.4	31.9	96.3	2.1	0.0	15.1	NW
July	118.4	720.2	19	6.4	-7.1	18.1	6.3	-7.0	17.3	23.9	0.0	103.6	79.4	34.9	96.8	2.1	0.0	19.4	NW
August	67.8	788.0	12	6.2	-5.9	19.4	6.1	-5.8	18.1	24.1	0.0	99.0	75.5	17.9	96.0	1.4	0.0	15.3	NW
September	140.0	928.0	20	9.3	-1.7	22	9.1	-1.6	20.2	23.0	0.0	97.3	76.9	23.3	96.4	2.0	0.0	20.7	NW
October	88.4	1016.4	11	11.6	-2.4	26.8	11.3	-2.4	25.4	23.3	0.0	97.7	65.0	18.0	95.8	2.5	0.0	14.9	WNW
November	63.6	1080.0	8	15.7	-0.3	32.2	15.2	-0.3	30.5	26.4	0.0	103.1	60.7	10.2	96.5	1.9	0.0	15.7	WNW
December	87.6	1167.6	11	19.6	3.6	35.3	19.0	3.8	33.0	28.7	0.0	102.6	65.2	13.7	95.6	1.7	0.0	13.1	NW
TOTAL	1167.6	-	147	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	10.8	-	5	-	-7.1	-	-	-7.0	-	-	0	-	-	8.3	-	-	0	-	-
Maximum	212.4	-	20	-	-	37.3	-	-	34.9	-	-	103.6	-	-	96.8	-	-	20.7	-

6.4 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 through 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 2016 reporting period included:

- The inspection and maintenance of windrows and silt fencing to prevent potential surface water impacts and sediment entering Neubeck's Creek;
- Repair of drainage lines in Area 8 from overland runoff during storm event;
- Maintenance of erosion control structures within drainage lines 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 192.8mm and June 212.4mm).

6.5 CONTAMINATED POLLUTED LAND

There was no land identified as being contaminated or polluted during the reporting period.

6.6 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.

6.6.1 PURPLE COPPER BUTTERFLY

The Purple Copper Butterfly (PCB), also known as the Bathurst Copper Butterfly, is listed as an Endangered species under the *Threatened Species Conservation Act 1995* and Vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999*, and 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 PCB, the following mitigation measures have been implemented:

- a) maintenance of fencing and earth bunds around known PCB habitat;
- b) mining activity not occurring within 200m of the main habitat area between September through to the end February, when the flying season of the adult and larvae stages of the PCB were apparent as determined by an independent ecologist; and
- c) implementation of further management and mitigation measures in accordance with Project Approval PA 10_0041 and Particular Manner Decision 2011/6016.

A PCB Monitoring Program has been implemented to monitor potential indirect impacts from extractive mining activities (particularly 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 PCB with monitoring being undertaken by ecologists from Ecological Australia Pty Ltd.

Two field surveys were conducted during the 2016 reporting period in accordance with the Commonwealth Department of Environment (DoE) Notification of Referral Decision measure, as follows:

- February 2016 - 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 2016 - 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.

A review of the survey data recorded during the period 2013 to 2016 indicates the Pine Dale Mine has had minimal impact upon the life cycles of the Purple Copper Butterfly.

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

Results of the ecologist field monitoring are provided in **Table 12**.

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

Table 12
Purple Copper 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 Aug/Sept.		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.
2015-2016	To confirm completion of larval stage i.e. larvae not actively foraging above ground, within habitat area	Evening 22/23 February 2016	No larvae identified; no attendant ants observed near targeted plants.	No larvae detected indicate PCB larvae have commenced pupation and are no longer active. Larvae stage is complete. PCB not expected to reappear until Aug / Sep.	Mining activities can recommence within 200m of BCB main habitat area.	
	To confirm commencement of BCB larval feeding season	29 August 2016	Numerous adult PCB observed; no larvae observed.	Lack of active larvae observed indicates PCB breeding season had only recently commenced.	No mining activities to occur within 200m of BCB main habitat area.	

6.6.2 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 a 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 **Appendix C**). Control of noxious weeds within and surrounding the habitat area will continue to be undertaken in the next reporting period.

As the mine is currently in care and maintenance, there were no environmental performance or management issues in relation to impacts upon the sites' vulnerable species, the Purple Copper Butterfly and Austral Toadflax.

6.7 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 (Dec 2015, Jan & Feb 2016) and Spring (Sep, Oct & Nov 2016).
- Blackberry - sprayed in Summer (Dec 2015, Jan & Feb 2015) and Spring (Nov 2016).
- Briar Rose - sprayed in Summer (Dec 2015, Jan & Feb 2016) and Spring (Oct, Nov 2016).
- St John's Wort - sprayed in Summer (Dec 2015) and Spring (Nov 2016).

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 were 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.

6.8 BLASTING

As the mine is currently in care and maintenance there were no blasting activities undertaken at the site during the 2016 reporting period.

6.9 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.

6.10 ABORIGINAL HERITAGE

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

6.11 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.

6.12 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.

6.13 MINE SUBSIDENCE

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

6.14 HYDROCARBON CONTAMINATION

There were no reported incidents of hydrocarbon contamination at Pine Dale Mine during the reporting period. 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.

6.15 BUSHFIRE

Bush fire control strategies for Pine Dale Mine are managed in accordance with Project Approval PA 10_0041 and 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.

6.16 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.

6.17 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.

6.18 OTHER ISSUES AND RISKS

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

7 WATER MANAGEMENT

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.

Water resources at the Pine Dale Mine are managed in accordance with the Water Management Plan which was developed under the requirements of project approval PA 10_0041, Environmental Protection Licence (EPL 4911), respective groundwater bore licences and the water access licence (WAL 36480).

The water management system has been designed as a closed loop system, with all clean water diverted around the mining site where practicable. 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’s disturbed areas is generally to the south and

southeast following the natural topography for treatment prior to free draining into the underground workings (see **Plan 4**). The runoff from the north is captured in temporary sumps and used as dust suppression when required.

7.1 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 draining into the underground workings.

7.2 SURFACE WATER

During the reporting period, all surface water monitoring at the Pine Dale Mine was undertaken in accordance with the Surface Water Monitoring Program documented in the Pine Dale Mine Water Management Plan, and EPL 4911. Details of the locations, frequency and sampling methods for surface water monitoring are presented in **Table 13** and **14**. The parameters analysed were consistent with the requirements of the Water Management Plan and EPL 4911. Results of surface water monitoring are discussed in **Section 7.3.2** and at **Appendix B**.

No discharge of waters via the licenced discharge point (LDP13) occurred during the reporting period.

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

7.3 SURFACE WATER MONITORING

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 points are required to be monitored at Pine Dale Mine on a quarterly basis for pH, EC, turbidity, TSS, oil & grease, sulfate and dissolved iron; Point 2 – Upstream of Energy Australia flow gauge; Point 3 – 100m downstream of bridge near site office; and Point 14 – Cox's River downstream of Blue Lake. Licenced discharge point LDP13 is required to be sampled for pH, EC and turbidity daily during discharge.

A further eight locations, S1 to S7 are monitored in accordance with the site Water Management Plan. Monitoring is conducted on a monthly basis for pH, temperature, EC and turbidity, with an additional quarterly suite comprising major ions, anions and filtered metals. The locations of monitoring points are indicated on **Plan 2 & 4** in **Appendix A**.

7.3.1 SURFACE WATER CONCENTRATION LIMITS AND TRIGGER LEVELS

Concentration limits are specified in EPL 4911 for the licenced discharge point LDP13, whilst the remaining water monitoring locations have water quality trigger values stipulated in the sites' Surface Water Management Plan in accordance with Schedule 3, Condition 27(b) of the Project Approval (PA 10_0041). Water quality trigger values were reviewed in August 2015 and are presented in **Table 13**.

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.

Table 13
WMP & EPL Surface Water Trigger Values & Limits

Surface Water Site	pH (range)	Electrical Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Oil and Grease (mg/L)
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

* EPL Concentration Limit (daily during discharge)

7.3.2 SURFACE WATER QUALITY

7.3.2.1 EPL Surface Water Monitoring

During the 2016 monitoring period, four quarterly EPL surface water monitoring events were conducted. These events were conducted during February, May, August and November 2016. Monitoring Point 2 and Point 3 are ambient surface water monitoring points on Neubeck's Creek whilst 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. There are no EPL Concentration Limits for monitoring Points 2, 3 and 14.

Surface water samples collected for EPL compliance during the 2016 period show water quality analysis results are generally compliant with the Concentration Limits specified by the Water Management Plan.

- Monitoring Point 2 exhibited pH concentrations which were found to be slightly lower than the adopted trigger level range on two occasions (Feb, Nov).
- Point 14 was shown to be above the adopted pH trigger range on three occasions (Feb, Aug, Nov).
- Monitoring Point 3 and Point 14 were shown to be greater than the adopted Electrical Conductivity trigger value on one occasion each (Nov, Feb respectively).
- All EPL monitoring locations were in compliance with the total suspended solids (TSS) trigger value of 30mg/L during each of the monitoring events.

- There was no controlled surface water discharge from licensed discharge monitoring Point 13 during the 2016 reporting period. EPL 4911 limits were not exceeded.
- The intermittent exceedance of trigger values suggests the trigger values should be reviewed in line with recent monitoring data in the next management plan review.

During the 2016 monitoring period, EC was generally shown to decrease at Point 2 and Point 14 and increase at Point 3, whilst pH was observed to be reasonably consistent. Examination of the historical data set indicates the pH concentrations at all three EPL monitoring points has remained consistent, whilst the EC is shown to fluctuate considerably at Point 2 and Point 3. The EC at Point 14 is shown to remain fairly consistent over the five year period. Results of monitoring during the previous five (5) years are presented graphically in **Figure 4**.

A comparison of historical monitoring results compared to rainfall data indicates a correlation between EC concentration and rainfall levels, with periods of higher EC measured during months with less rainfall (August & November 2012; August 2013; February & May 2016). Due to the variability of sample collection times throughout the month across the five year period, and the variability of rainfall days throughout the month some lag time may appear on the graphical presentation (refer **Figure 5**).

The full suite of surface water monitoring results for Environmental Protection Licence compliance for the 2016 period are presented in **Appendix B**.

Figure 4
EPL Surface Water Historical Results

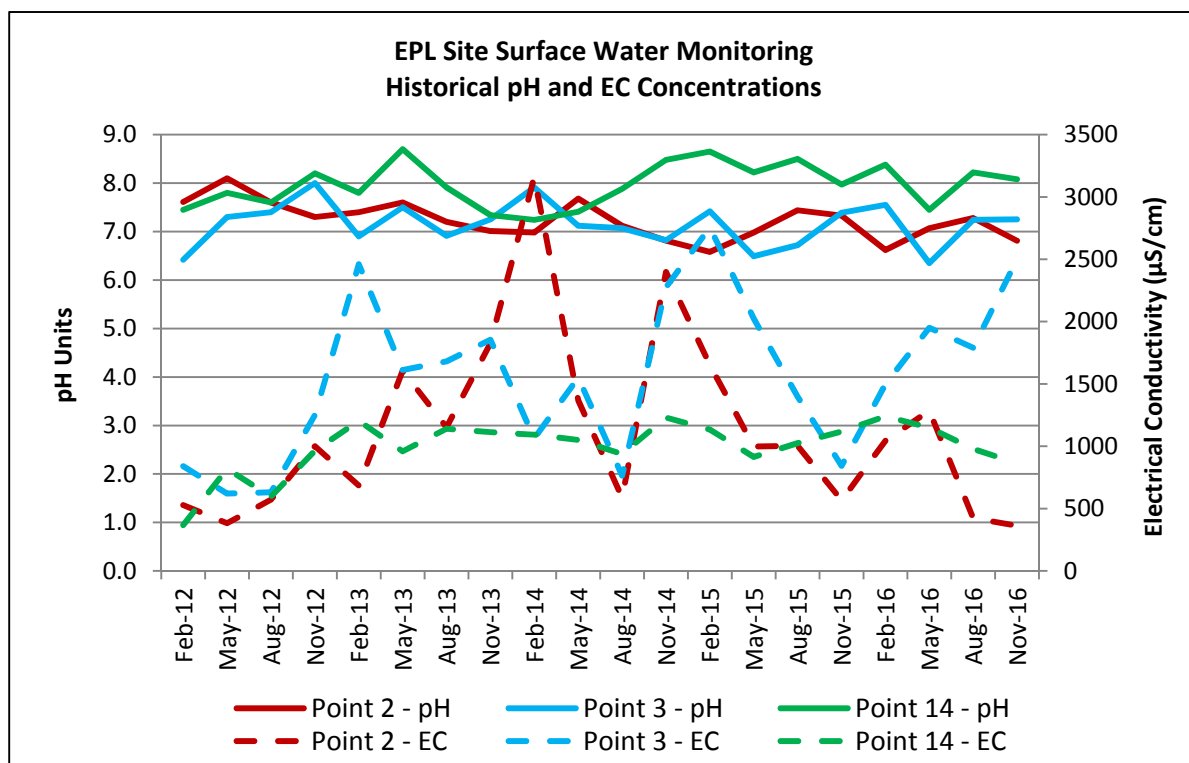
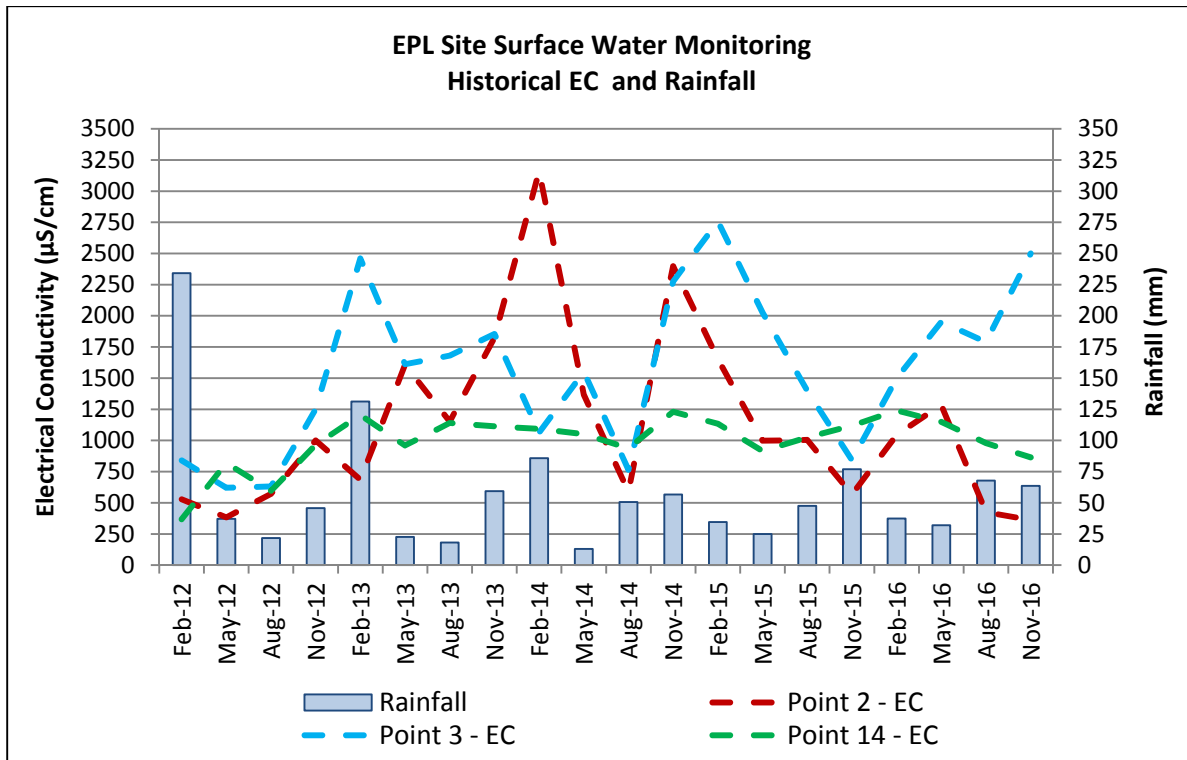


Figure 5
EPL Surface Water Historical Results and Rainfall



7.3.2.2 WMP Surface Water Monitoring

Site surface water samples associated with the Water Management Plan were collected monthly during the 2016 monitoring period. Site surface water samples S1 to S7 are generally shown to be consistent over the duration of the monitoring period.

- pH results recorded at monitoring sites S1 to S7 are shown to be stable throughout the 2016 sampling period.
- S3 and S6 were within the trigger range of pH for the duration of 2016.
- pH was recorded below the site specific lower trigger levels at S1 (May), S4 (February) and S7 (September).
- S5 exhibited a fluctuating pH range (6.6 to 7.5) with seven results outside of the site specific trigger range.
- EC was observed to fluctuate across the Neubeck’s Creek sampling sites (S1, S3 and S6) however the fluctuations were consistent at each sampling location along the creek.
- S1 and S3 reported electrical conductivity levels above their respective trigger levels during March, April and November.
- S6 reported conductivity levels above the respective trigger level during February, March, April and November.

- EC at monitoring locations S4, S5 and S7 were observed to be relatively stable, with consistency shown between the Blue lake (S5) samples and the Cox's River samples downstream of Blue Lake (S7).
- S4 reported conductivity levels above the respective trigger level during February and April.
- S5 and S7 both exceeded the electrical conductivity level between January and July inclusive, whilst S7 also exceeded the trigger level in December.
- All monitoring locations exhibited results below the Total Suspended Solids trigger level and the Oil and Grease trigger level.
- The water level of Neubeck's Creek at monitoring location S2 was stable throughout the duration of the monitoring period.
- The intermittent exceedance of trigger values suggests the trigger values should be reviewed in line with recent monitoring data in the next management plan review.

An examination of historical data collected over the previous five (5) years indicates fluctuations in both the pH and EC concentrations, however, the fluctuations are consistent between the Neubeck's Creek samples (S1, S3, S6), and the Blue Lake and Cox's River samples (S5 & S7). Historical results showing the last five (5) years of key analysis parameters are presented graphically in **Figures 6** and **Figure 7**.

When these fluctuations are compared against the monthly rainfall received at the site a correlation is evident, particularly with the EC concentration. During periods of low rainfall (July 2013 to January 2014; February to March 2015; February & July 2016) concentrations of EC are shown to increase at the site. It should be noted that due to the variability of sample collection times throughout the month over the five year period, and the variability of rainfall days throughout the month, some lag time may be evident on the graphical presentation (refer **Figure 8** and **Figure 9**).

The full 2016 dataset of surface water monitoring results for Water Management Plan compliance are presented in **Appendix B**.

Figure 6
WMP S1, S3 & S6 Historical pH Results

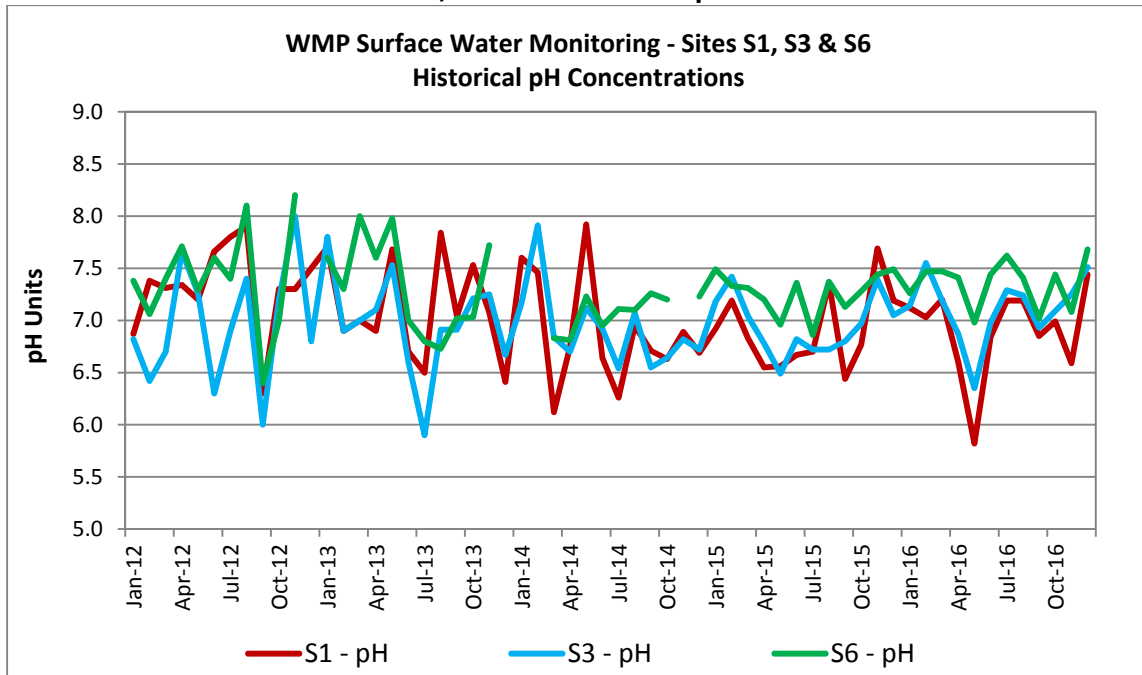


Figure 7
WMP S4, S5 & S6 Historical pH Results

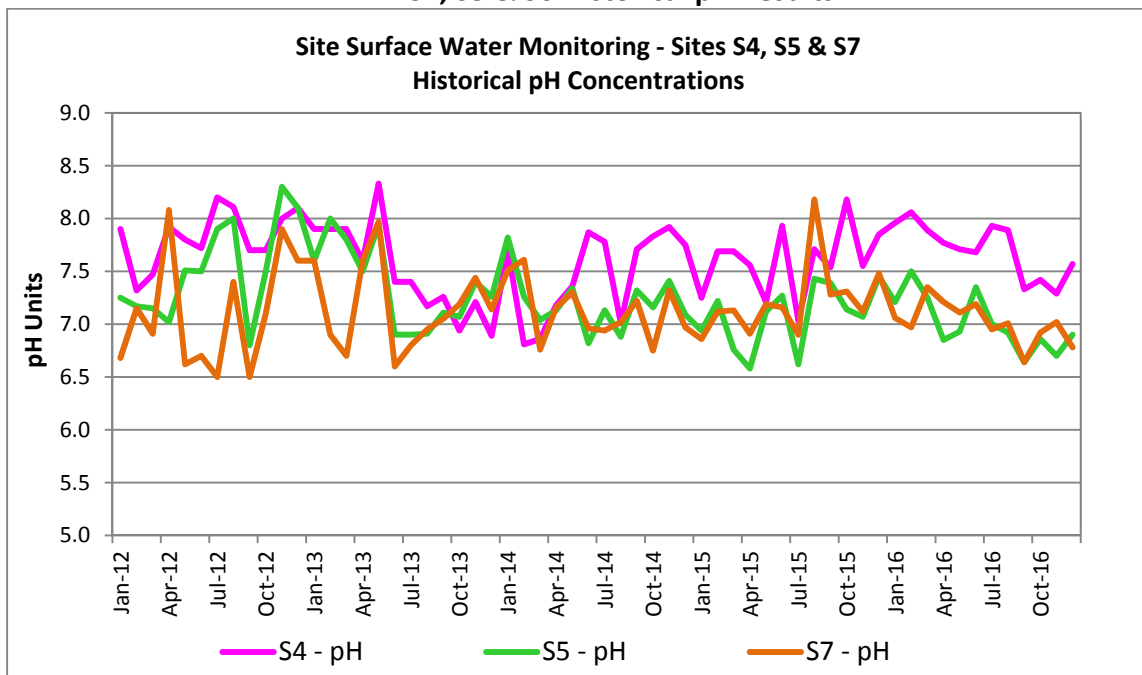


Figure 8
WMP S1, S3 & S6 Historical EC Results & Rainfall

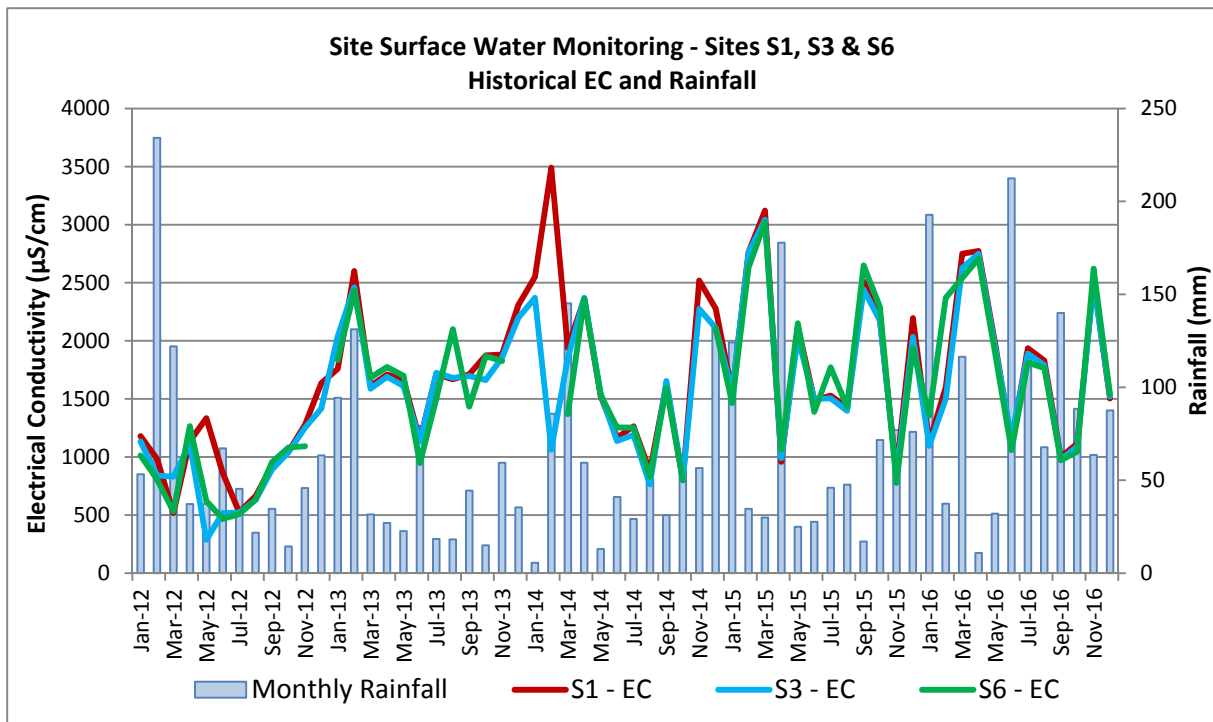
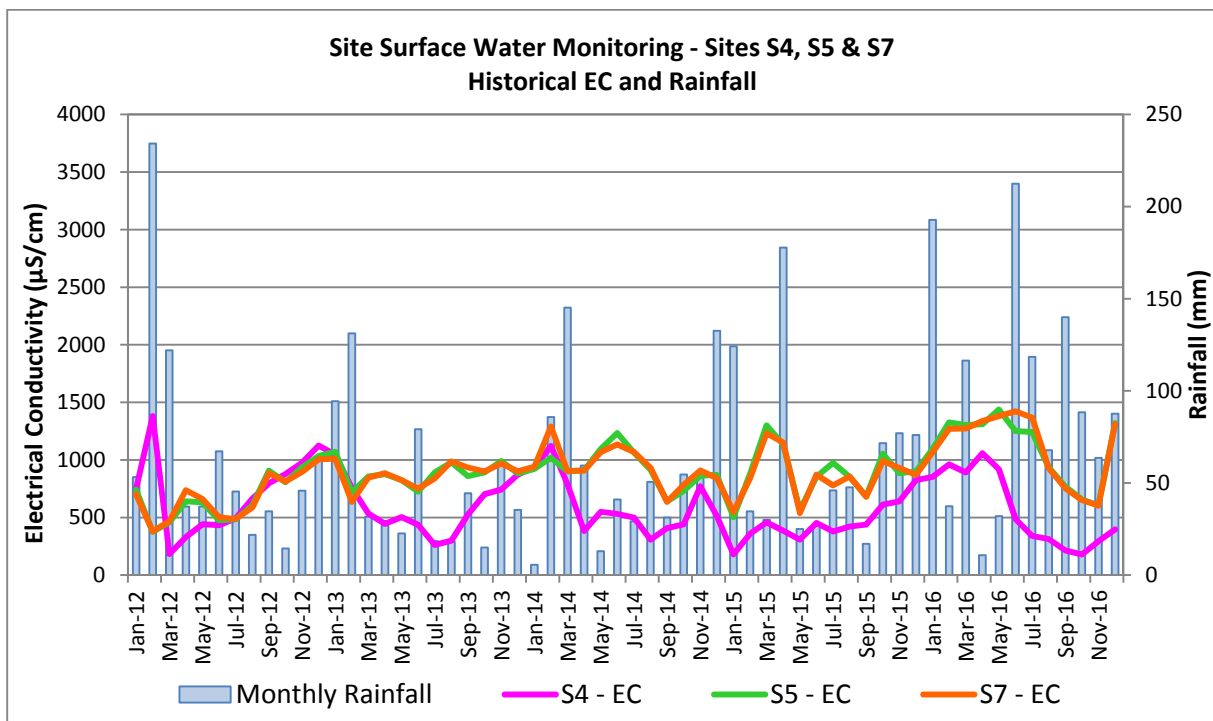


Figure 9
WMP S4, S5 & S6 Historical EC Results & Rainfall



7.4 CHANNEL STABILITY & STREAM HEALTH MONITORING

Channel stability and stream health monitoring of Neubeck’s Creek is conducted on a six monthly basis in accordance with project approval PA 10_0041 and the Water Management Plan. Monitoring was conducted in February and August 2016.

Monitoring is conducted at three monitoring points along Neubeck’s Creek (SH1, SH2 & SH3A) and one location at Cox’s River (SH5), downstream of Blue Lake (refer **Plan 2**). Two additional locations at Blue Lake (SH4) and the concrete lined section of Neubeck’s Creek (SH3A) are also included to allow for visual observation of the condition of the water bodies.

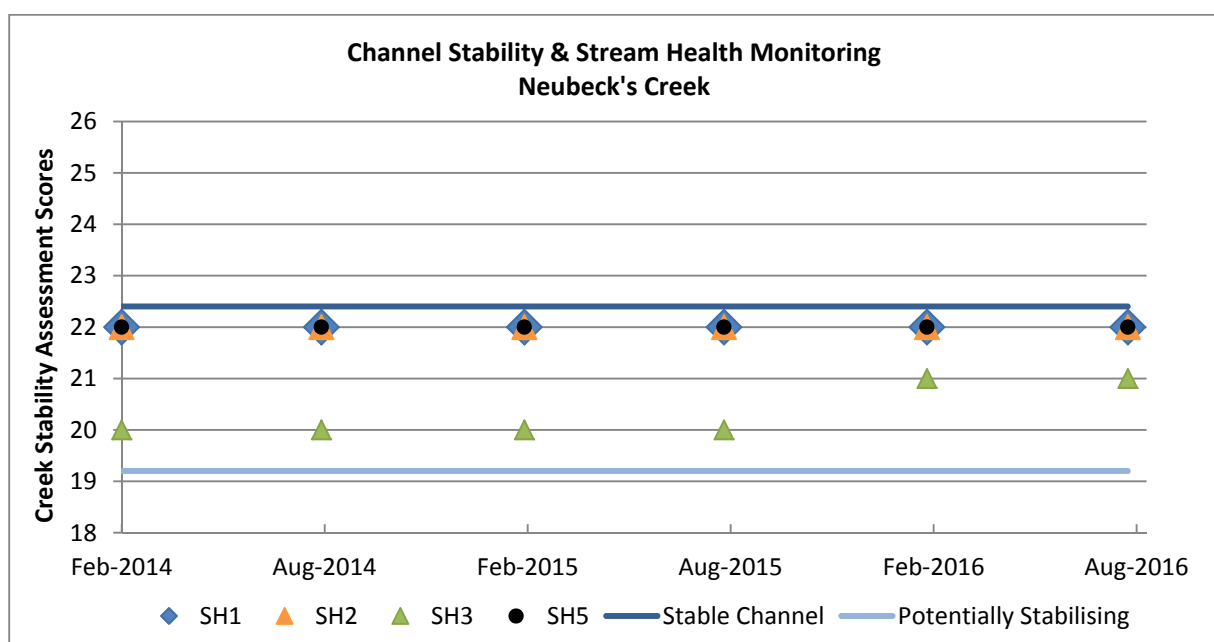
The monitoring involves an observational survey which provides a description of the locations and dimensions of erosive features. Indicators then produce a rating based on a scoring system. The combined total score of the indicators then rank each monitoring location from very actively eroding through to very stable. This assessment enables determinations to be made as to whether the section of creek has changed over time from the classification derived during the original baseline survey.

A Baseline Assessment of channel stability, stream health and vegetation health of Neubeck’s Creek and Cox’s River undertaken in 2013 indicated the drainage lines were classified as “Potentially Stabilizing”.

Follow-up (six-monthly) assessments were conducted at the same monitoring locations in February and August 2014; February and August 2015; February 2016 and August 2016. Results of the follow-up assessments indicated there had been no major change to the Neubeck’s Creek and Cox’s River drainage lines, with each monitoring location classified as “Potentially Stabilizing”.

Monitoring during the 2016 reporting period again indicates no major change to the Neubeck’s Creek and Cox’s River drainage lines, with each monitoring location again classified as “Potentially Stabilizing” (refer **Figure 10**). Detailed results are presented in **Appendix B**.

Figure 10
Channel Stability and Stream Health Results



7.5 GROUNDWATER

Management of groundwater at the Pine Dale Mine is undertaken in accordance with project approval PA 10_0041 and the approved Groundwater Management Plan (documented within the site Water Management Plan, August 2015). Groundwater monitoring is not a requirement of EPL 4911. The mine also has approval for a water access licence (WAL36480) for the interception and use of groundwater from the underground workings; and Bore Licences (10BL65933 & 10BL603588) for the monitoring of groundwater levels and quality. Results of groundwater monitoring are discussed in **Section 7.5.2**, with a full dataset provided in **Appendix B**.

There was no measurable groundwater intercepted from the underground workings during the 2016 reporting period. As such, a review of groundwater extraction data by a qualified groundwater consultant to validate the recorded data against the groundwater model predictions (in accordance with the groundwater access licences 10BL604437 and 10BL604438) was not required.

7.6 GROUNDWATER MONITORING

Groundwater monitoring for the Pine Dale Mine is undertaken in accordance with the *Groundwater Monitoring Program* documented in the *Water Management Plan*. Sampling is conducted at a total of four 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 **Plan 2 & 4, Appendix 1**). Sampling is conducted monthly at the site bores (Old Shaft, P6, P7 and The Bong) for standing water level and physical water quality parameters, and on a quarterly basis for cations, anions and dissolved metals. Bores within the Yarraboldy extension (Bores A, B, C & D) are sampled on a monthly basis for standing water level and on a quarterly basis for the extended analysis suite. The Enhance Place bores are sampled monthly for standing water level only. All parameters analysed are consistent with the requirements of the Water Management Plan. Groundwater data is collected by RCA Laboratories and analysed at a NATA registered laboratory.

It should be noted that The Bong is an opening to the old underground workings. Water from The Bong is sampled from a surface water location (water cart dam) where it is pumped to on an as required basis.

7.6.1 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 **Table 14**.

The Groundwater Management Plan details the protocol for the investigation, notification, and mitigation of any identified exceedances 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.

Table 14
Groundwater Trigger Values & Levels

Groundwater Site	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

7.6.2 GROUNDWATER WATER QUALITY

7.6.2.1 Site Groundwater Monitoring

Groundwater samples collected from the on-site groundwater bores during 2016 have generally shown water quality to be consistent throughout the monitoring period, however some fluctuations were observed where key water monitoring parameters pH and EC were intermittently recorded outside of the trigger level ranges.

- EC concentrations recorded at the Old Shaft was shown to exceed the conductivity trigger level throughout the entire 2016 monitoring period, while the pH was recorded below the trigger criterion range for the duration of the monitoring period.
- pH at Bore P6 dropped below the lower pH trigger level during three of the twelve monitoring events (September, November & December), whilst EC was greater than the trigger level during February, April, June, September, November & December.
- pH at Bore P7 was below the lower pH trigger level during three of the twelve monitoring events (April, November & December), with EC greater than the trigger level during April, June and September.
- The Bong showed one monitoring event (May 2016) where pH was below the lower trigger level. EC was shown to comply with the trigger level for the entire 2016 period.
- Trigger levels for standing water level were shown to be compliant for the entire monitoring period during at all site bores.
- An increasing trend in standing water level was observed at all site bores during 2016.
- The intermittent exceedance of trigger values suggests the trigger values should be reviewed in line with recent monitoring data in the next Water Management Plan review.

In accordance with the site's Water Management Plan, a continued exceedance of the groundwater quality triggers will act as a prompt for further investigation into correlations

between the data trends, land use and climatic conditions. An internal investigative report was compiled at the end of the 2015 monitoring period to examine the exceedances of the trigger level criteria at the Old Shaft sampling well. 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. It is considered that the findings of the investigation are still likely attributing to the exceedances observed during this monitoring period and these factors could be related to the elevated electrical conductivity reported within the other site bores.

In support of this, the predictions of the Environmental Assessment during the decommissioning phase (similar to Care & Maintenance phase) state 'following subsequent recovery and rising of the water table within the old Wallerawang Colliery underground void, development of acid water may then result, with a lowering of pH and the precipitation of iron". The decrease in acidity of the groundwater, however, is considered to be only short term until the groundwater levels reach equilibrium.

An examination of the historical data set shows consistency between the fluctuations of pH within groundwater bores P6, P7 and Old Shaft, whilst the EC shows a steadily increasing trend over the previous five (5) years. Results of monitoring during the previous five (5) years are presented graphically in **Figure 11** and **Figure 12**.

In accordance with the site's Water Management Plan, a comparison of historical monitoring results compared to rainfall data indicates a correlation between EC concentration and rainfall levels across all site bores, including The Bong samples. During periods of low rainfall (July 2013 to January 2014; September 2015; April 2016) concentrations of EC are shown to increase at the site (refer **Figure 12**). Standing water levels are observed to be consistent over the period January 2012 to May 2016, with an increase observed during the remainder of the 2016 reporting period. It should be noted that due to the variability of sample collection times throughout the month over the five year period, the variability of rainfall days throughout the month, and the rate of groundwater recharge, some lag time may be evident on the graphical presentation (refer **Figure 13**).

The full suite of groundwater results for the 2016 monitoring period are presented in **Appendix B**.

Figure 11
Site Groundwater Bores Historical pH Results

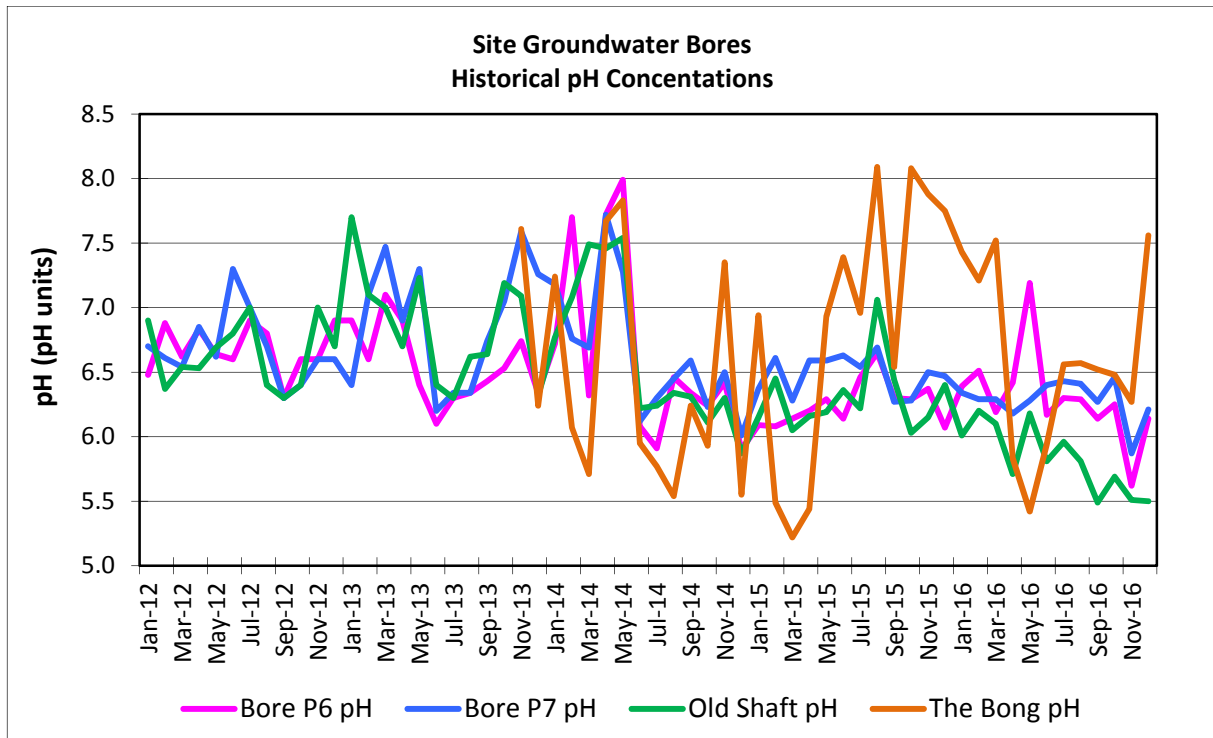


Figure 12
Site Groundwater Bores Historical EC Results & Rainfall

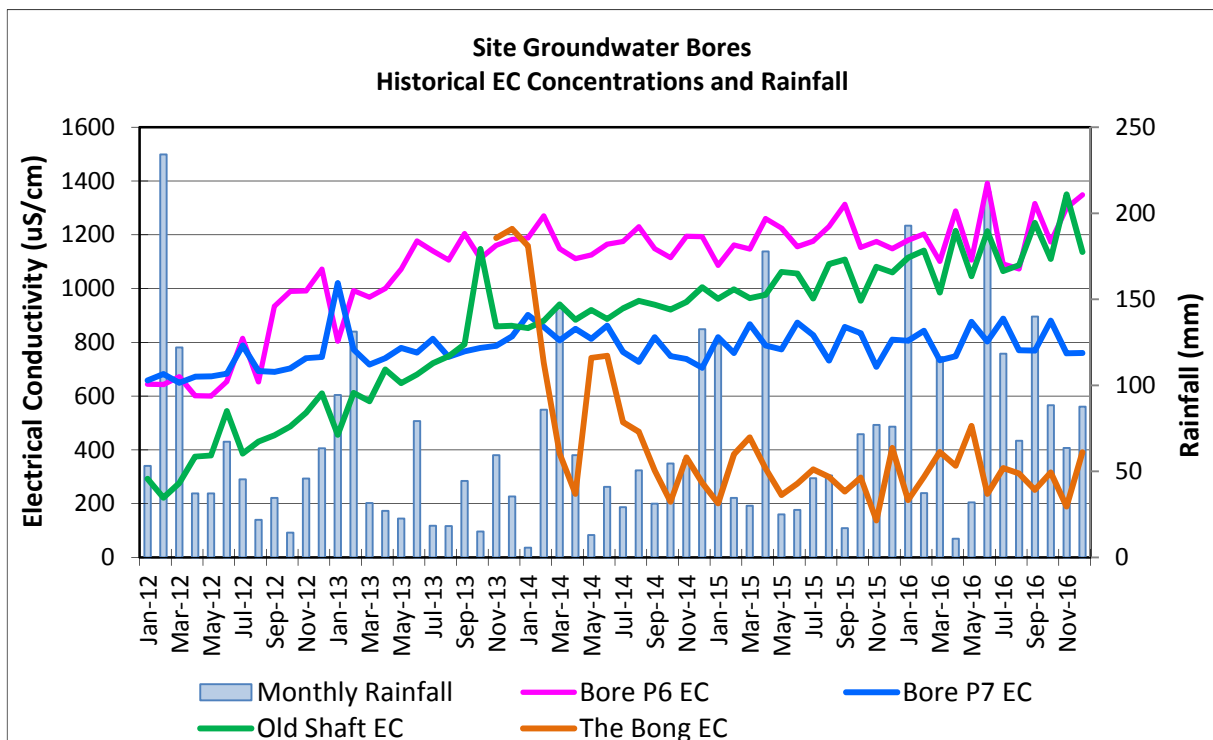
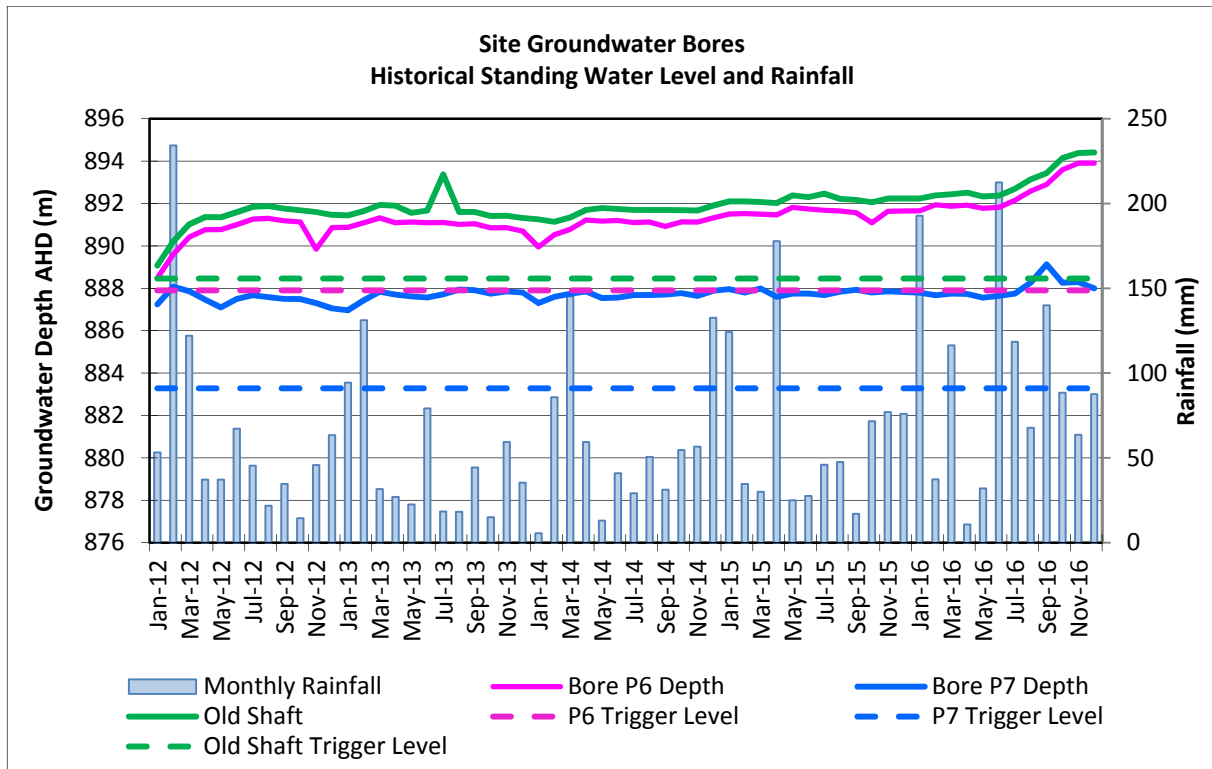


Figure 13
Site Groundwater Bores Historical SWL & Rainfall



7.6.2.2 Yarraboldy Groundwater Monitoring

The results of quarterly water quality monitoring within the Yarraboldy (off-site) groundwater bores for pH, EC and standing water level are generally shown to be consistent throughout the 2016 monitoring period, with the exception of Bore A, which shows a marked increase in both pH and EC during the November monitoring round.

Groundwater samples collected from off-site bores were shown to be partially compliant with the respective key trigger levels with the following exceptions:

- pH at Bore A during November 2016 was lower than the lower trigger value;
- pH at Bore C was lower than the trigger value during March and December;
- pH at Bore D was lower than the lower trigger value during March and November;
- Electrical conductivity levels were below the respective conductivity trigger levels for all off-site bores during the 2016 monitoring period, with the exception of Bore A during November and December.
- pH and EC in Bore A during November and December are considered an anomaly and the data cannot be relied upon. This bore has previously been damaged and may have been subject to additional vandalism and will be investigated further.
- All off-site bores and vibrating wire piezometers exhibited standing water levels compliant with their respective trigger levels.

- The predictions of the Environmental Assessment during the decommissioning phase (similar to Care & Maintenance phase) indicate a lowering of pH in the groundwater bores is to be expected over the short term until the groundwater levels reach equilibrium.

It is noted that the scheduled monitoring in September was delayed until November 2016 at Site C, D and E due to inclement weather conditions that caused felled trees and blocked access. The inclement weather damaged the bridge which was required to access Bore E and therefore the site has been, and will be, inaccessible until it has been repaired.

An examination of the historical data set shows consistency between the fluctuations of pH within groundwater Bores A, C and D, whilst the variation of pH in Bore E is more amplified. Historical electrical conductivity data show a slow decreasing trend over the previous five (5) years, with the exception of Bore A, which shows a marked increase during the last quarter of 2016. Results of monitoring during the previous five (5) years are presented graphically in **Figure 13**.

In accordance with the site's Water Management Plan, a continued exceedance of the groundwater quality triggers will act as a prompt for further investigation into correlations between the data trends, mining activities and climatic conditions. A comparison of historical monitoring results compared to rainfall data indicates a correlation between EC concentration and rainfall levels across all off-site bores, except for the Bore A anomaly during the last quarter of 2016 (refer **Figure 14**). During during periods of low rainfall (September 2012; March 2013; September 2013; September 2014; September 2015) concentrations of EC are shown to increase at the site. Standing water levels are observed to be consistent over the previous five (5) year period, with intermittent increases and decreases observed as a result of rainfall infiltration. It should be noted that due to the variability of sample collection times throughout the month over the five year period, the variability of rainfall days throughout the month, and the rate of groundwater recharge, some lag time may be evident on the graphical presentation (refer **Figure 15** thru **Figure 18**).

The full suite of groundwater results for the 2016 monitoring period are presented in **Appendix B**.

Figure 14
Off-Site Groundwater Bores Historical pH Results

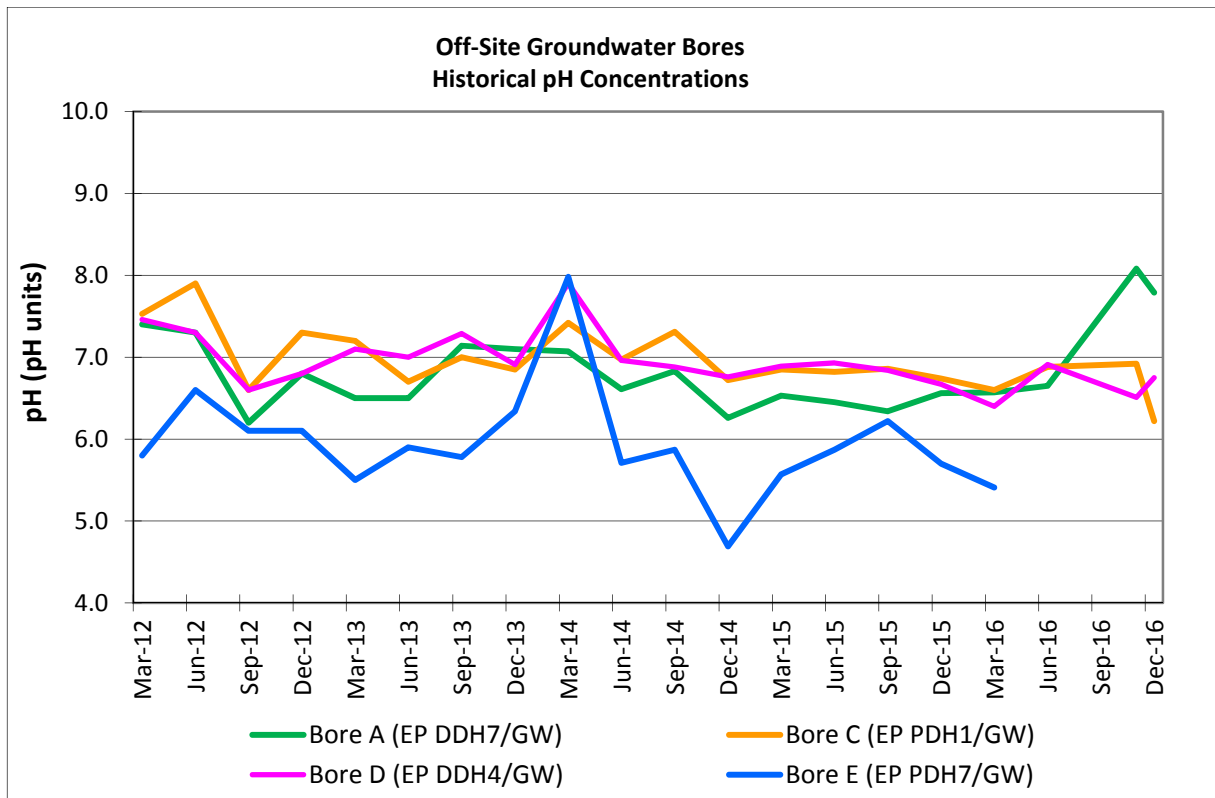


Figure 15
Off-Site Groundwater Bores Historical EC Results & Rainfall

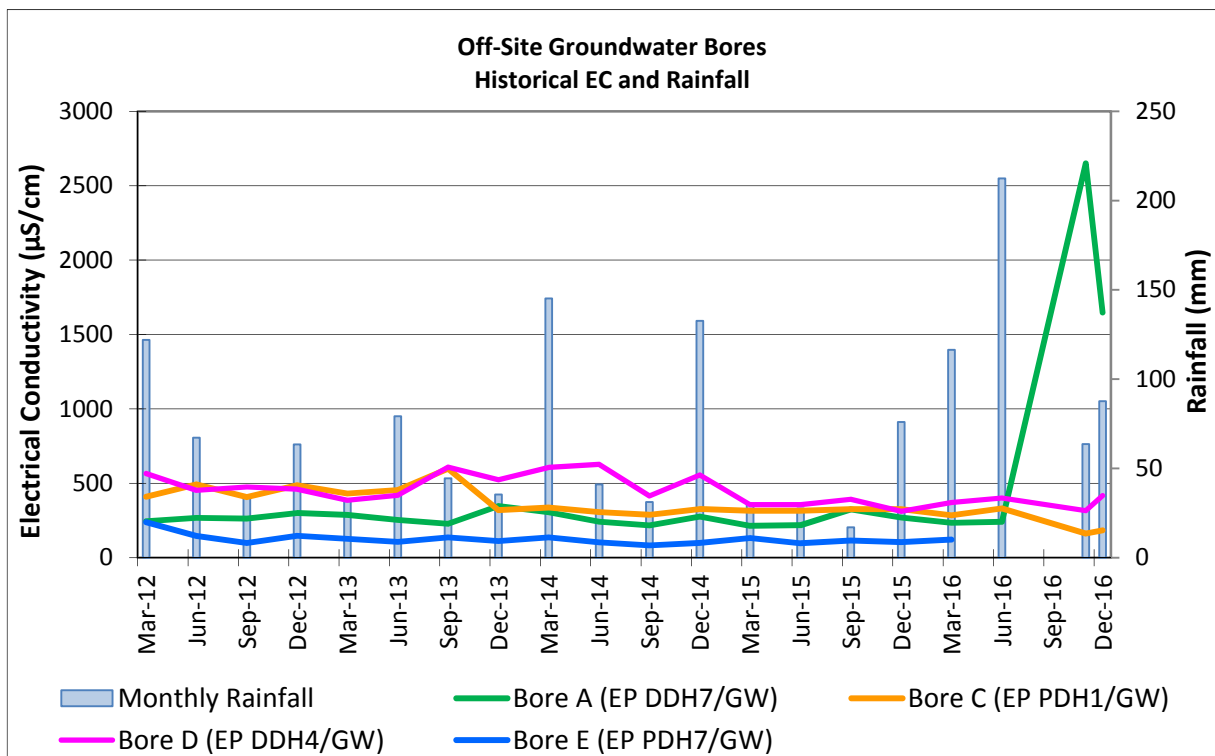


Figure 16
Off-Site Groundwater Bores Historical SWL & Rainfall

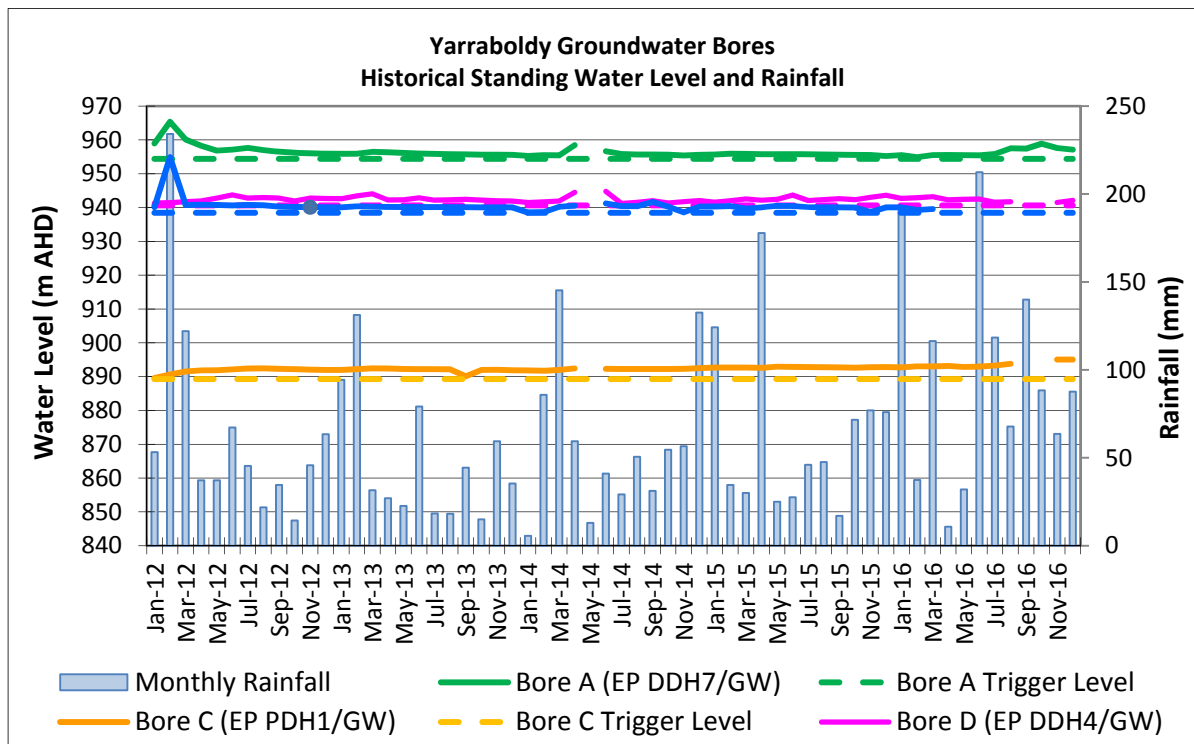


Figure 17
Off-Site Bore B-VWP Historical SWL & Rainfall

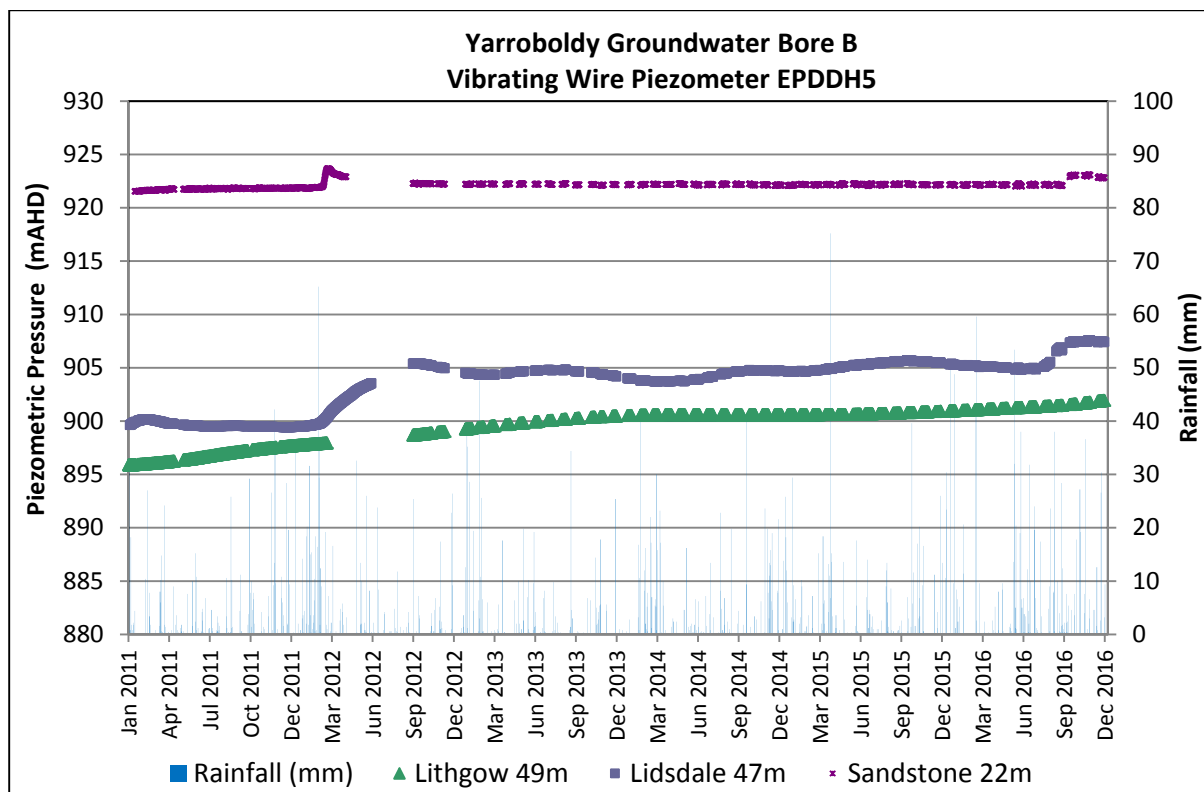


Figure 18
Off-Site Bore C-VWP Historical SWL & Rainfall

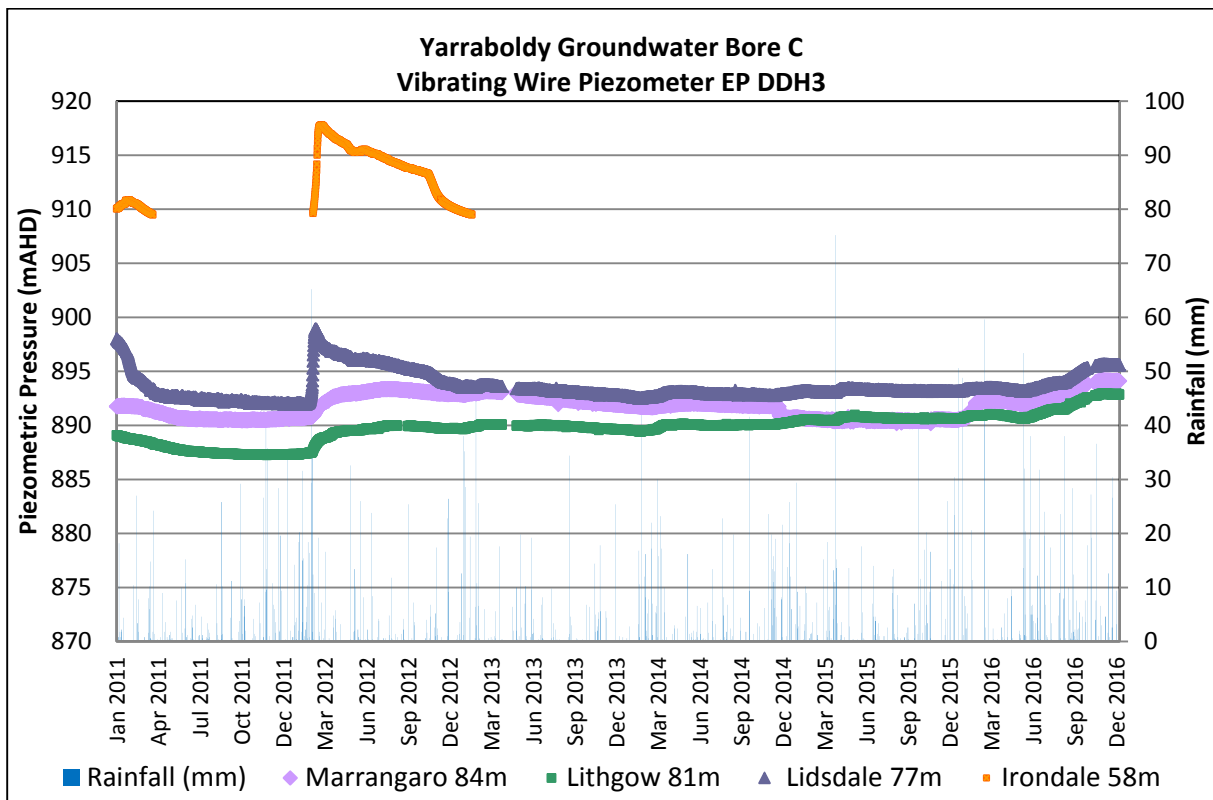
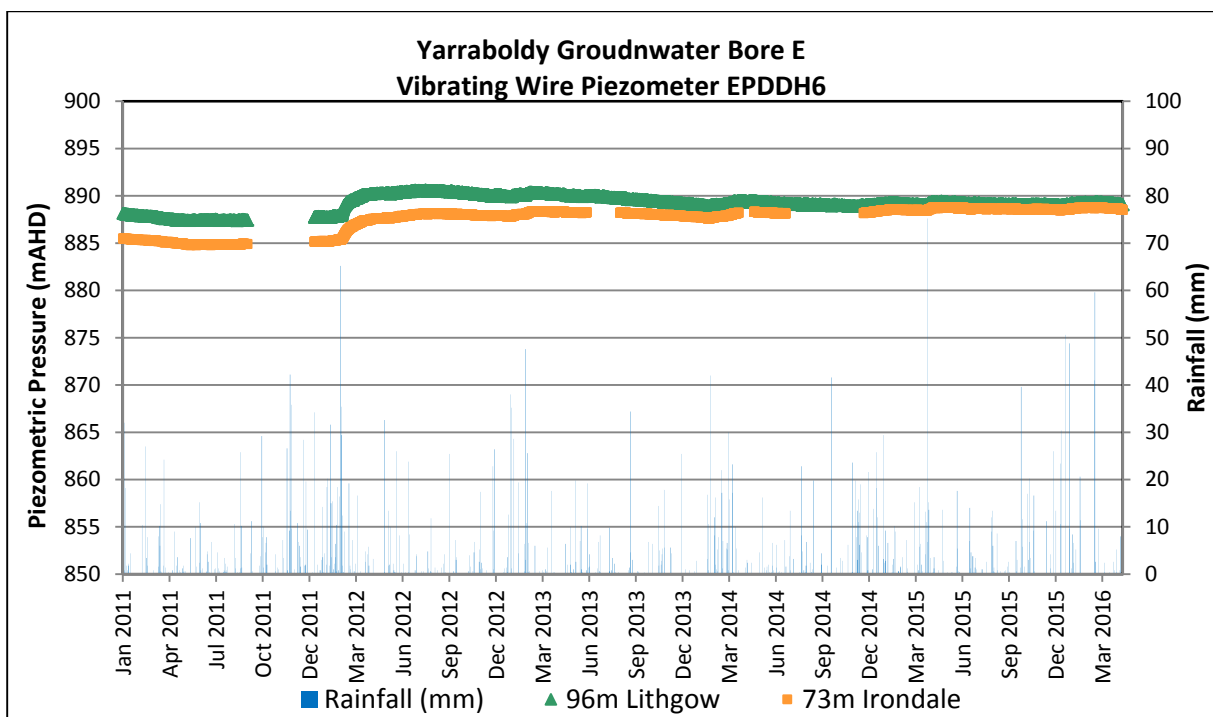


Figure 19
Off-Site Bore E-VWP Historical SWL & Rainfall



Note: Bore E was inaccessible during the period April to December 2016 due to an access bridge closure in the State Forest.

7.6.2.3 Enhance Place Groundwater Level Monitoring

The two monitoring bores located at the former Enhance Place mine generally exhibited standing water levels which were stable throughout the 2016 monitoring period. Water levels recorded were shown to be compliant with the respective standing water level triggers at both bores during the 2016 monitoring period.

A detailed summary of The Enhance Place groundwater bore standing water levels can be found in **Appendix B**.

8 REHABILITATION

Rehabilitation works at Pine Dale Mine are conducted in accordance with rehabilitation objectives in the approved Care and Maintenance MOP. Rehabilitation performance criteria documented in the MOP define the performance indicators, measuring criteria, status and progress of rehabilitation at the mine.

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 in **Plan 3, Appendix A**.

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.

8.1 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

8.1.1 AGREED POST REHABILITATION LAND USE

Areas of privately owned land within the Pine Dale Mine (Area B, C & 8) have been returned to pasture for agricultural purposes, including grazing, as per the approved rehabilitation strategy and landholder preferences.

The principal aim for the final land use of the Yarraboldy Extension rehabilitation area (including Area A) is for native vegetation conservation and for the use of Forests NSW.

8.1.2 REHABILITATION STATUS SUMMARY

A summary of the rehabilitation area status for the current and previous reporting period is presented in **Table 15** along with forecasts for the 2017 reporting period.

A Rehabilitation Monitoring Report was commissioned by FirstField Environmental (2016) which provides an overview of the rehabilitation status at the site and recommendations for the improvement of rehabilitation outcomes in reference to the approved completion criteria. A summary of the rehabilitation status for the 2016 reporting period compared to the MOP performance indicators and completion criteria are presented in **Table 16**.

Table 15
Rehabilitation Area Summary

Mine Area Type	Area Affected/Rehabilitated (ha)		
	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	2015	2016	2017
A. Total Mine Footprint	98.1	98.1	98.1
B. Total Active Disturbance	56.8	56.8	56.8
C. Land Being Prepared for Rehabilitation	0	0	0
D. Land Under Active Rehabilitation	32	32	32
E. Completed Rehabilitation	0	0	0

Table 16
Rehabilitation Status Summary

Performance indicator	Completion Criteria	Current Status (2016 Reporting Period)
Feral animal and noxious weed presence	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Feral animals and noxious weeds are controlled in accordance with legislation. 	Satisfactory – continue to monitor
Fuel loads	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Adequate access for firefighting is maintained on rehabilitation areas. 	Satisfactory – continue to monitor
Habitat features	<ul style="list-style-type: none"> Habitat features are installed on native forest rehabilitation areas including: <ul style="list-style-type: none"> - Nesting boxes and salvaged hollows - Crushed timber spread over native forest rehab areas - Rock pile clusters. 	Ongoing - nesting boxes to be installed once trees are established
Vegetation health	<ul style="list-style-type: none"> More than 75% of native forest indicator species are assessed to be healthy and growing at year 5. 	Ongoing – continue to monitor
	<ul style="list-style-type: none"> Native forest indicator species tree height and girth is within the range of analogue sites. 	Ongoing – continue to monitor
Soil loss	<ul style="list-style-type: none"> Net annual soil loss is comparable to analogue sites at year 10. 	Ongoing – continue to monitor
Erosion	<ul style="list-style-type: none"> There are no significant erosion features that compromise landform stability or public safety (including gullyng or tunnelling). 	Satisfactory – continue to monitor
Woodland birds present	<ul style="list-style-type: none"> Evidence of woodland birds utilising rehabilitation areas. 	Satisfactory

Performance indicator	Completion Criteria	Current Status (2016 Reporting Period)
Evidence of mammals	<ul style="list-style-type: none"> Evidence of target mammal species present in rehabilitation areas. 	Satisfactory
Natural regeneration	<ul style="list-style-type: none"> 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. 	Ongoing – continue to monitor
Structure	<ul style="list-style-type: none"> Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites. 	Ongoing – continue to monitor
Management inputs	<ul style="list-style-type: none"> Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites. 	Ongoing – continue to monitor
Rural land capability	<ul style="list-style-type: none"> Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing). 	Satisfactory – continue to monitor
Species composition	<ul style="list-style-type: none"> 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. Approved pasture species mix is sown at the specified rate per hectare. 	Satisfactory
Weed presence	<ul style="list-style-type: none"> Weeds including African Lovegrass to comprise <10% of the pasture sward. 	Satisfactory – continue to monitor
Ground cover	<ul style="list-style-type: none"> Ground cover (vegetation, leaf litter, mulch) >70% at year 5. 	Satisfactory – continue to monitor

8.1.3 YARRABOLDY EXTENSION REHABILITATION PERFORMANCE

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° 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 (refer **Plate 1**).

During the reporting period, no additional rehabilitation works were undertaken in the Yarraboldy Extension. Growth of vegetation on the bund during the 2016 reporting period is shown in **Plate 2**.



Plate 1 Amenity bund – application of mulch & native seed mix (2015)



Plate 2 Amenity bund – vegetation growth during 2016 period

8.1.4 AREA A REHABILITATION PERFORMANCE

Seeding of Area A (8 ha) commenced in 2008, with 1500 trees planted. In 2010 an additional 400 trees were planted. Further direct seeding and application of an organic mulch layer and lime occurred in October 2013; however drought conditions late in 2013 limited the outcomes of this work.

A revised rehabilitation strategy was developed in 2014, incorporating recommendations from an agronomist (SLR, 2014 report) for input within the Care and Maintenance MOP. Annual rehabilitation monitoring reports (FirstField Environmental, 2014, 2015 & 2016) also

provide recommendations for the improvement of rehabilitation within Area A. The recommendations included in these reports are summarised in **Table 17**. The rehabilitation activities undertaken in Area A during the reporting period are also presented in this table.

Table 17
Recommended and Completed Rehabilitation Actions in Area A

Recommended Rehabilitation Actions - Area A		Actions Completed (2014 to 2015)	Undertaken in 2016
Soil Assessment Report, 2014	Continue control of Bidy Bush with current spot spraying regime	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Continue with further application of mushroom compost, lime & gypsum (10:3:2 tonnes/ha)	Fertilizer and compost applied at recommended rates.	Yes
	Increase potassium by application of Muriate of Potash or similar (0.25tonnes/ha)	Application of Muriate of Potash at recommended rate.	Yes
Rehabilitation Monitoring Report, 2014	Treat surface soil erosion on slopes via placement of cut vegetation or rocks in erosion channels	Coarse woody debris placed along contours above rills to reduce runoff rate and volume.	No – not required
	Re-sow exposed surfaces with fast-growing groundcover herbs and grasses	Exposed surfaces ripped and reseeded with locally sourced seed mix.	Yes
	Install nesting boxes in close proximity treed rehabilitation area	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No
Rehabilitation Monitoring Report, 2015	Install nesting boxes in or adjacent to treed rehabilitation areas.	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No
	Re-apply a mixture of mushroom compost, lime and gypsum to treed rehabilitation areas as per the recommendations of SLR (2014) report.	Application of fertilizer and compost at recommended rates.	Yes
	Increase canopy cover of tall herbs and shrubs at treed rehabilitation Area A to 75% with 80% groundcover of grasses and broadleaf herbs.	Exposed surfaces ripped and reseeded with fast growing herbs and grasses. (Plates 3, 4 & 5) .	Yes
	Concentrate tube stock planting in benches of treed rehabilitation areas to take advantage of run-on from banks.	Tree planting undertaken in addition to direct seeding.	Yes
	Place additional coarse woody debris along contours above rills to reduce runoff rate and volume at treed rehabilitation areas.	Woody mulch placed along contours above rills to reduce runoff rate and volume	Yes
Rehabilitation Monitoring Report, 2016	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Install nesting boxes in or adjacent to treed rehabilitation areas.	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No
	Place additional coarse woody debris along contours above rills to reduce runoff rate and volume at treed rehabilitation areas.	Woody mulch placed along contours above rills to reduce runoff rate and volume	Yes

The Pine Dale Mine Rehabilitation Monitoring Report for 2016 (refer **Appendix C**) indicated the living groundcover within the monitoring transects in Area A had increased from 50% in

2015 to 75% in 2016 at Transect 5; whilst an increase from 70% in 2015 to 80% in 2016 was observed at Transect 6.



Plate 3 Area A – Vegetation cover, October 2016



Plate 4 Area A – Mechanical ripping prior to seed sowing, November 2016



Plate 5 Area A – Ripped prior to seed sowing, November 2016

8.1.5 AREA B AND C REHABILITATION PERFORMANCE

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 rehabilitation activities undertaken in Areas B and C during the reporting period are presented in Table 18, along with 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 Reports* (FirstField Environmental, 2014, 2015 & 2016).

Table 18
Recommended and Completed Rehabilitation Actions in Areas B & C

Recommended Rehabilitation Actions – Area B & C		Actions Completed (2014 to 2015)	Undertaken in 2016
Soil Assessment Report, 2014	Control of African Lovegrass prior to pasture establishment works.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Ripping with a plough to create furrows, followed by application of pasture seed mix	Furrows created along pasture poor areas and contour banks, seed, fertiliser & compost applied	Yes
	Application of Muriate of Potash (0.25tonnes/ha) and Di-ammonium phosphate 0.20 tonnes/ha)	MAP and DAP applied at recommended rates.	Yes
	Application of mushroom compost, lime & gypsum (10:4:1 tonnes/ha)	Fertilizer and compost applied at recommended rates.	Yes
Rehabilitation Monitoring Report, 2014	Continue to implement integrated weed management control methods for noxious weeds.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
Rehabilitation Monitoring Report, 2015	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 SLR (2014) report.	Poorly established pasture areas and drainage lines mechanically ripped prior to re-sowing with pasture species (Plate 6 & 7)	Yes
	Increase and maintain groundcover in pasture rehabilitation Areas B and C and in Area 8 to at least 95%.	Application of fertilizer and compost at recommended rates.	Yes
Rehabilitation Monitoring Report, 2016	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Continue to monitor pest animal numbers.	Pest and animal monitoring not required to be undertaken.	No

During the 2016 reporting period the Rehabilitation Monitoring Report documented the following findings for rehabilitation Areas B & C:

- Groundcover in pasture rehabilitation areas is 90 to 95% **(Plate 8)**.
- African Lovegrass comprises <10% of pasture sward.
- Rehabilitated pasture areas are consistent with Soil and Land Capability Class V land and can withstand occasional cultivation associated with pasture establishment or renewal.

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 – Mechanical ripping of poorly established pasture, November 2016



Plate 7 Area B & C – Re-sowing of mechanically ripped area, November 2016



Plate 8 Area B & C – Pasture growth, November 2016

8.1.6 AREA 8 REHABILITATION PERFORMANCE

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 rehabilitation activities undertaken in Area 8 during the reporting period are presented in **Table 19**, along with 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 Reports* (FirstField Environmental, 2014, 2015 & 2016).

Table 19
Recommended and Completed Rehabilitation Actions in Area 8

Recommended Rehabilitation Actions – Area 8		Actions Completed (2014 to 2015)	Undertaken in 2016
Soil Assessment Report, 2014	Control of African Lovegrass prior to pasture establishment works.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Ripping with a plough to create furrows, followed by application of pasture seed mix	Furrows created along poorly vegetated areas followed by direct seeding	Yes
	Application of Muriate of Potash (0.25tonnes/ha) and Di-ammonium phosphate 0.20 tonnes/ha)	MAP and DAP applied at recommended rates.	Yes
	Application of mushroom compost, lime & gypsum (10:4:1 tonnes/ha)	Fertilizer and compost applied at recommended rates.	Yes
Rehabilitation Monitoring Report, 2014	Treat surface soil erosion on slopes via placement of cut vegetation or rocks in erosion channels	Drainage lines re-shaped with rock placement in erosion channels (Plate 9).	No, not required
	Re-sow exposed surfaces with fast-growing groundcover herbs and grasses	Exposed areas re-sown with pasture seed mix.	Yes
	Install nesting boxes in close proximity treed rehabilitation area	Installation will be undertaken when the native tree species are of a suitable size to support the nesting boxes.	No
Rehabilitation Monitoring Report, 2016	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 SLR (2014) report.	Furrows created over the land, pasture seed mix applied, followed by fertiliser and compost (Plate 10)	Yes
	Increase and maintain groundcover in pasture rehabilitation Areas B and C and in Area 8 to at least 95%.	Application of fertilizer and compost at recommended rates.	Yes
Rehabilitation Monitoring Report, 2015	Continue to spot spray African Lovegrass outbreaks.	Weed spraying as per Weed Management Schedule (Section 6.7)	Yes
	Continue to monitor pest animal numbers.	Pest and animal monitoring not required to be undertaken.	No

The 2016 Rehabilitation Monitoring Report (refer **Appendix C**) indicated the eastern portion of Area 8 had 90% groundcover, which had increased 10% since monitoring in the previous reporting period (2015).



Plate 9 Area 8 – Pasture growth around rock-lined drainage lines, November 2016



Plate 10 Area 8 – Pasture growth / ground coverage, November 2016

8.1.7 ADDITIONAL REHABILITATION MAINTENANCE WORKS

During the 2016 reporting period additional maintenance activities were conducted on rehabilitated lands in the form of erosion control works and the maintenance of sedimentation fencing in and around the rehabilitated areas.

8.1.8 RENOVATION / REMOVAL OF BUILDINGS

There were no buildings removed or constructed during the 2016 reporting period.

8.1.9 REHABILITATION FORMAL SIGN OFF

There were no areas of rehabilitation which acquired formal sign off from DRE during the reporting period.

8.1.10 REHABILITATION TRIALS AND RESEARCH

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

8.1.11 THREATS TO REHABILITATION SUCCESS

Significant threats to rehabilitation at the Pine Dale Mine have been identified in the Care and Maintenance MOP. These threats and the proposed mitigation and management measures are summarised in **Table 20**.

Table 20
Threats to Rehabilitation Success

Secondary Domains (Post Mining Land Use)	Potential Threat(s)	Mitigation & Management Measures
Infrastructure (A) Water Management Structure (B)	Engineering design failure	Any infrastructure remaining in place post mining would be inspected and approved by a suitably qualified person (if required) and agreed by relevant stakeholders.
	Water damage (erosion, flooding etc.)	Infrastructure and water management structures would be constructed in accordance with relevant guidelines and to ensure erosion and damage from floods is minimised.
Rehabilitation - Pasture (C) Rehabilitation - Native Forest (D) Rehabilitation – Pine Plantation (E)	Adverse soil chemistry	Soil testing and amelioration
	Erosion	Design to relevant guidelines, regular maintenance as required
	Seed germination failure	Seed treatment, soil amelioration, annual monitoring
	Species diversity and density	Annual monitoring and supplementary tree planting and seeding as required
	Weed presence	Inspections and weed control (herbicide application).
	Drought	Drought tolerant species selection, timing seeding to coincide with appropriate soil moisture.
	Grazing	Restrict grazing particularly in early years to rehabilitated areas
Bushfire	Maintain low fuel loads, emergency preparedness and response	

8.2 ACTIONS FOR THE NEXT REPORTING PERIOD

During the 2016 reporting period rehabilitation activities were undertaken on areas that will not be directly impacted by any future mining operations at the Pine Dale Mine. Maintenance and rehabilitation activities recommended in the Care and Maintenance MOP will continue on these areas throughout 2017 (sediment fences, fertilizing, re-seeding, weed control etc).

As per the recommendations made in the Rehabilitation Monitoring Report (**Appendix C**) further weed spraying is proposed, in addition to the installation of nesting boxes once the treed area contains adequate structure to support nesting birds.

9 COMMUNITY RELATIONS

9.1 ENVIRONMENTAL COMPLAINTS, INCIDENTS & NOTIFICATIONS

During the 2016 reporting period the complaints register was updated to better reflect the nature of the communications received. The Nature of the communication is now listed as an Enquiry, Notification or Complaint. The term 'complaint number' has also been replaced with *Item Number*.

All stakeholder and community complaints, enquiries and notifications regarding the Pine Dale Mine are documented, with appropriate actions taken as soon as possible to determine the likely cause of the incident and all possible corrective actions to resolve the problem and prevent its recurrence. Complaints, enquiries and notifications are recorded and retained at the site office in addition to monthly publication on the Pine Dale Mine website.

During the 2016 reporting period two complaints were recorded (**Table 21**). In the first instance the complainant sent an email to DRE indicating lack of community consultation from Pine Dale Mine concerning the renewal of Exploration Licence EL7621. Pine Dale Mine responded to the DRE (letter dated 6 May 2016) providing evidence of compliance with conditions 5, 6 and 7 of EL7621 in relation to community consultation, and also provided a copy of the Annual Community Consultation Report. No further action was required.

The second complaint was received via email from the office of the Member for Bathurst regarding correspondence they had received from a neighbouring Pine Dale Mine resident regarding rehabilitation activities undertaken at the mine during December within close proximity to the residential boundary without prior notification to the resident. A response was provided to the Members Office indicating operational protocols had been reviewed. The Ministers office was further reviewing the matter. No further action has been required to date.

Table 21
Community Complaints, Incidents & Notifications

Incident Type	Incidents Received 2016
Noise	0
Air Quality	0
Blasting	0
Traffic	0
Water	0
Other	2
Total Complaints Received	2
Enquiries/Notifications Received	0

9.2 COMMUNITY LIAISON

9.2.1 COMMUNITY CONSULTATIVE COMMITTEE

During the reporting period Community Consultative Committee (CCC) meetings were held on the 30th June and 8th December 2016.

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.

It is noted that a proposal to merge the Pine Dale CCC with a wider regional EnergyAustralia CCC group is under consideration, subject to DPE approval. If approved, this new structure will likely commence in the first half of 2017.

9.2.2 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; and EPL 4911. Copies of the following documents are made publicly available on the Energy Australia Website:

- EPL 4911;
- Environmental Assessment;
- Project Approval 10_0041;
- EPBC Act Referral Decision 2011/6016;
- The Care and Maintenance Mining Operation Plan;
- Environmental Management Plans for Pine Dale Mine;
- AEMR Reports / Annual Review;
- PIRMP;
- Independent Environmental Audits;
- Community Consultative Committee minutes;
- Community Complaints (Enquiries & Notifications);
- Blasting information; and
- Monthly Environmental Performance reports

9.2.3 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.

10 INDEPENDENT ENVIRONMENTAL AUDIT

There was no requirement for an Independent Environmental Audit (IEA) to be conducted at the Pine Dale Mine during the 2016 reporting period. The last IEA was undertaken in August 2014. Copies of the audit report, the audit Action Plan and the auditor's recommendations and proposed actions by Pine Dale Mine are provided on the company website. All of the non-compliances identified and recommendations made in the IEA have been completed (refer **Table 22** and **Table 23**).

Table 22
Independent Environmental Audit Action Plan

Condition	Summary of Condition / Requirement	Auditors Comment	Compliance Status and Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
PA 10_0041, Condition 3.27 (c)	<p>c) a Groundwater Management Plan, which includes:</p> <ul style="list-style-type: none"> i. groundwater assessment criteria, including trigger levels for investigating and potentially adverse groundwater impacts; ii. a program to monitor: <ul style="list-style-type: none"> i. groundwater inflows to the open cut mining operation ii. the impacts of the project on; <ul style="list-style-type: none"> - baseflows to Neubecks Creek; - any groundwater bores on privately owned land; and iii. a program to validate the groundwater model for the project, and calibrate it to site specific conditions; and iv. a plan to respond to any exceedances of the performance criteria, and offset the loss of any baseflow to Neubecks Creek caused by the project. 	<p>The previous IEA (URS, 2013, p.A-18) identified that this condition was non-compliant on the basis that the Bushfire Management Plan was not approved by State Forests by the end of April 2011. The Bushfire Management Plan has not been developed to the satisfaction of State Forests and has not been updated to reflect the Site response for a care and maintenance situation, as opposed to a mining operation.</p>	<p>Preparation – Compliant (2013)</p> <p>Implementation – Non-compliant</p> <p>Repeat Recommendation 2013/IEA/009 Consult with NOW, OEH and DPE to review water quality trigger values and based on the consultation update and implement the WMP (incorporating the GWMP).</p>	<p>Unforeseen delays in the progress of the Pine Dale Mine Stage 2 Extension Project application has caused delays in the review and updates of existing management plans. Enhance Place intends to review relevant Environmental Management plans in light of the site being held in care and maintenance for an extended period.</p>	<p>Completed in September 2015</p>
PA 10_0041, Condition 3.52	<p>By the end of April 2011, the Proponent shall prepare and implement a Bushfire Management Plan for the site, to the satisfaction of the State Forest in consultation with the local Rural Fire Service.</p>	<p>The previous IEA (URS, 2013, p.A-18) identified that this condition was non-compliant on the basis that the Bushfire Management Plan was not approved by State Forests by the end of April 2011. The Bushfire Management Plan has not been developed to the satisfaction of State Forests and has not been updated to reflect the Site response for a care and maintenance situation, as opposed to a mining operation.</p>	<p>Non-compliant 2014IEA/022 Recommendation Update the Bushfire Management Plan with respect to the Site being on care and maintenance. Ensure State Forests and the local RFS have involvement in the update of the Plan and confirm satisfaction of the plan from State Forests.</p>	<p>Noted, relevant environmental management plans will be reviewed in light of site being held in care and maintenance for an extended period.</p>	<p>Completed in September 2015</p>

Condition	Summary of Condition / Requirement	Auditors Comment	Compliance Status and Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
PA 10_0041, Condition 5.1	Environmental Management Strategy Refer to Appendix A for full Condition requirements.	<i>Pine Dale has been found non-compliant with this Condition as a number of key revisions and updates have not occurred to the Environmental Management Strategy during the audit period.</i>	<i>Preparation – Compliant (2013) Implementation – Non-compliant 2014/IEA/011 Recommendation Update the Environmental Management Strategy and relevant figures and plans to reflect current monitoring programs and reports as well as explain and reflect that the Site has moved from operational activities to a care and maintenance status and that controls as detailed in the strategy and plans will remain relevant.</i>	Noted, relevant environmental management plans will be reviewed in light of site being held in care and maintenance for an extended period.	Completed in September 2015
PA 10_0041, Condition 5.4	Revision of Strategies, Plans and Programs Refer to Appendix A for full Condition requirements.	<i>This Condition was found non-compliant in accordance with Condition 5.4(c) as strategies, plans and programs were not updated following submission of the previous IEA (URS, 2013).</i>	Non-compliant 2014/IEA/012 Recommendation <i>Strategies, plans, and programs should be reviewed and revised to reflect recommendations provided in the previous Independent Environmental Audit report and to reflect the care and maintenance status of the Site.</i>	Noted, relevant environmental management plans will be reviewed in light of site being held in care and maintenance for an extended period.	Completed in September 2015
PA 10_0041, Condition 5.8	Independent Environmental Audit Refer to Appendix A for full Condition requirements.	<i>Pine Dale was found non-compliant with this Condition due to timing of the 2014 independent environmental audit as the audit was not commenced until August 2014 as compared to the condition requirement of June 2014.</i>	Non-compliant (due to timing)	Noted, no further action required.	Completed

Condition	Summary of Condition / Requirement	Auditors Comment	Compliance Status and Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
ML 1569, Condition 2	Mining, Rehabilitation, Environmental Management Process (MREMP) - Mining Operations Plan (MOP) Refer to Appendix A for full Condition requirements.	Refer to ML 1664, Condition 3(a). This condition was found to be non-compliant given the MOP expired on 28 February 2014 whilst mining operations were continuing (the Site went into care and maintenance in April 2014) and the draft Care and Maintenance MOP was yet to be formally approved at the time of writing this report.	Refer to ML 1664, Condition 3(a). Non-compliant (due to expiration of previous MOP and no approval of draft C&M MOP) 2014/IEA/018 Recommendation Prepare and implement a plan identifying detailed rehabilitation measures for the entire length of Neubecks Creek.	A draft C&M MOP was submitted to DRE in March 2014. DRE responded in May 2014 seeking clarifications which rely on external advice. The required external expert assessment and advice has been received. Enhance Place has been actively working on the preparation of a robust rehabilitation strategy to meet DRE requirements. A revised C&M MOP has been submitted to DRE for approval. A rehabilitation program for Neubecks Creek has been included in the C&M MOP submitted to DRE.	C&M MOP Completed in December 2014
ML 1569, Condition 3(a)	Mining Operations Plan Mining operations must not be carried out otherwise than in accordance with a Mining Operations Plan (MOP) which has been approved by the Director-General.	This condition was found to be non-compliant given the MOP expired on 28 February 2014 whilst mining operations were continuing (the Site went into care and maintenance in April 2014). Pine Dale has been consulting with DTRIS-DRE concerning the requirements for the draft Care and Maintenance Mining Operations Plan / Rehabilitation Management Plan since April 2014 and was in the process of actioning DTRIS-DRE requests for the draft MOP at the time of the audit with a view to approval by the end of 2014. Therefore DTRIS-DRE are aware of the situation with respect to the status of the MOP.	Non-compliant (due to expiration of previous MOP and no approval of draft C&M MOP)	See above comment	Completed December 2014

Condition	Summary of Condition / Requirement	Auditors Comment	Compliance Status and Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
ML 1569, Condition 3(e)	A MOP ceases to have effect 7 years after date of approval or other such period as identified by the Director-General.	This condition was found to be non-compliant given the 2011 MOP expired in February 2014 and a replacement MOP was in the process of being prepared but had not formally been approved.	Non-compliant	See above comment	Completed December 2014

Table 23
Auditors Recommendations and Pine Dale Mine's Proposed Actions

Condition	Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
PA 10_0041, Condition 3.7	2014/IEA/008 Recommendation The EPL should be changed to reflect the purchase of Centennial Coal residences and those residences that are no longer required on the licence. Repeat Recommendations 2013/IEA/028 and 2013/IEA/029	Enhance Place acknowledges that there have been substantial changes to landownership adjacent to Pine Dale Mine and will consult with the EPA regarding what changes (if any) are required to EPL 4911.	EPL reviewed August 2014, no changes required.
PA 10_0041, Condition 3.26	2014/IEA/021 Recommendation Prepare a formal report that analyses baseline monitoring data. The report to provide findings and recommendations concerning surface water flows/levels and quality in creeks and other waterbodies (including the Neubeck's Creek, the Blue Lake and the Cox's River).	Surface water monitoring undertaken to date has not identified any adverse impacts to water flows/levels and quality in creeks and other water bodies. All monitoring requirements to meet this condition have been undertaken and further surface water assessments completed. Any further assessment would depend on the future of Pine Dale Mine and the recommencement of mining activities.	Prior to the recommencement of mining activities
PA 10_0041, Condition 3.39	2014/IEA/001 Recommendation It is recommended that the workshop area be tidied and that redundant items be removed from Site. Localised oil spills should be cleaned up and waste material disposed of at an appropriately licenced facility. Equipment to remain on-site should be stored securely in the on-site containers.	Noted. Site contractor notified of housekeeping matters and general tidy up required. Manager of Mining engineering will inspect on a weekly basis as part of statutory inspection procedure.	Clean up and removal of contaminated soil materials undertaken in June 2015.

Condition	Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
PA 10_0041, Condition 3.51	2014/IEA/009 Recommendation <i>Review the suitability of the on-site fire truck and confirm if it is fit for purpose. It is recommended that Pine Dale invite NSW Rural Fire Services to inspect the Site and discuss fire management in the Blackmans Flat area.</i>	Noted, Enhance Place will liaise with the rural fire service regarding emergency response and preparedness in case of a fire.	Bush Fire Management Plan was updated in February 2015 (following review by the Rural Fire Service and Forestry Corporation of NSW). The on-site fire truck was removed from this plan.
PA 10_0041, Condition 5.2	Repeat Recommendation 2013/IEA/037 <i>The Bushfire Management Plan, Water Management Plan, Waste Management Plan and the Baseline Water Monitoring Plan should be updated to include a procedure for handling complaints and incidents as appropriate or reference other documents such as the Strategy where such processes are described.</i>	Noted, environmental Management Plans will be updated in light of Pine Dale Mine being put in care and maintenance.	Complete - Management Plans were updated in September 2015
PA 10_0041, Condition 5.6	Repeat Recommendation 2013/IEA/039 <i>Training on the use of the incident reporting systems for incidents, near misses and observations should be undertaken.</i>	Noted, Enhance Place will ensure all staff are adequately trained to report incidents following the recommencement of mining at the site. No further action required at this time.	Prior to the recommencement of mining activities.
PA 10_0041, Condition 5.7	2014/IEA/013 Recommendation <i>It is recommended that Pine Dale include an upload date next to each environmental monitoring document on the website so it is clear that they were uploaded within specified timeframe.</i>	All publically available reports including environmental monitoring data uploaded to the company website are tracked for auditing purposes using a 'digital change request form' confirmation of uploaded reports and the date is confirmed by the data team via email. This procedure is considered adequate to sufficiently demonstrate uploaded reports. No further action is proposed.	Complete
PA 10_0041, Condition 5.9	2014/IEA/014 Recommendation <i>Ensure all recommendations provided in the audit report are included in the response to any recommendations</i>	Noted	Complete
EPL 4911, Condition O1.1	2014/IEA/001 Recommendation <i>Refer to PA 10_0041 Condition 3.39</i> Repeat Recommendation 2013/IEA/042 <i>Update the induction and bi-annual refresher training to include training of the storage, handling and disposal of materials and waste.</i>	Noted.	Prior to the recommencement of mining activities.
EPL 4911, Condition M1.2	Recommendation 2013/IEA044 <i>Update the Excel monitoring data record sheet for surface water, groundwater and noise to include a column to record who took the sample.</i>	Noted, database spreadsheets updated accordingly. No further action required.	Complete

Condition	Auditors Recommendation	Enhance Place Comment (status as at 17 March 2016)	Timing
EPL 4911, Condition M5.1	2014/IEA/015 Recommendation <i>Review complaints received from sources other than that the complaints records and ensure these are entered into the complaints register and that follow-up action is documented. Provide training on complaints procedures to ensure complaints are recorded and actioned.</i>	Noted, complaints database updated accordingly. No further action required.	Complete
EPL 4911, Condition M5.2	2014/IEA/016 Recommendation <i>Complaint records must be completed in their entirety. In particular corrective actions carried out and a root cause description to minimise further occurrences should be included.</i>	Enhance Place will review and update the complaints database and records to ensure adequately completed.	Complete
EPL 4911, Condition M6.2	2014/IEA/017 Recommendation <i>Consolidate the telephone complaints phone number into one number and change the descriptor on the website to 'environmental and complaints hotline'.</i>	Noted, Enhance Place will review the website and complaints line accordingly.	Complete
ML 1664, Condition 4(b)	2014/IEA/019 Recommendation <i>Ensure actions in the Action Plan provided by DTRIS-DRE dated 16 July 2014 are incorporated in the 2014 AEMR.</i>	Noted.	Complete
ML 1664, Condition 5	Repeat Recommendation 2013/IEA/047 <i>An incident management procedure should be developed for the site and all staff and contractors are inducted on their responsibility to report all observations, near misses and incidents.</i>	Noted, to be completed prior to the recommencement of mining activities.	Prior to the recommencement of mining activities.
SoC, Condition 3.2	2014/IEA/023 Recommendation <i>Pine Dale should consider control and management of the number of Pine Trees on site.</i>	Noted, The revised Care and Maintenance Mining Operations Plan will include a discussion on the management and control of pine trees at Pine Dale Mine.	Care & Maintenance MOP Completed, December 2014
SoC, Condition 11.4	2014/IEA/020 Recommendation <i>Grass soil stockpiles to minimise soil erosion.</i>	Noted, Enhance Place has revegetated more than 5 hectares of land with temporary grass seeding in 2014. A further review of the need to undertake additional temporary seeding of stockpile areas will be undertaken.	Complete – additional seeding undertaken in March 2015.

11 INCIDENTS AND NON COMPLIANCES

During the 2016 reporting period there were no instances of non-compliance in relation to the project approval, mining leases, or the water access licence.

There was one non-compliance with section M2.2 of EPL 4911 during November 2016 where the requirement to monitor air pollution at dust gauge D1 (EPL Point 6) was not met due to the vandalism and theft of the dust gauge. As a result, there was no depositional dust data recorded at dust gauge D1 during November 2016.

There were no reportable incidents, official cautions, warning letters, penalty notices or prosecution proceedings by any regulatory body during the reporting period.

There were several exceedances of the water quality trigger levels for groundwater quality during the reporting period. However, as the mine has been under Care and Maintenance for the previous two years, it is considered these exceedances observed in the groundwater quality were not attributed to any operations occurring at the site. It is likely it is a reflection of rainfall variability and the long term recovery and return to equilibrium after the cessation of site operations.

The exceedances observed in surface water quality are considered to be due to rainfall variability at the site and the influence of water discharges from other upstream industrial land uses.

12 ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD

The activities proposed for the 2017 reporting period are consistent with the Care & Maintenance MOP. General maintenance will be undertaken at the site in addition to rehabilitation activities including weed management, fertilizing and re-seeding as required.

12.1 MINING

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

12.2 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. A request to update the *Secretary's Environmental Assessment Requirements (SEARs)* was lodged by the Company in late 2016. Engagement with regulators and other key stakeholders will continue to be undertaken throughout 2017 as appropriate.

12.3 DOCUMENT REVIEWS

During the 2017 reporting period the Pine Dale Mine Care & Maintenance MOP is scheduled for review. An application to extend the currently approved C&M MOP will be submitted to DRE.

A review of the Water Management Plan trigger values for surface and groundwater quality may also be undertaken in line with recent monitoring data reflecting the Care & Maintenance period.

13 REFERENCES

SLR (2014) *Soil Assessment and Recommendations for Rehabilitated Areas, Pine Dale Mine and Enhance Place.*

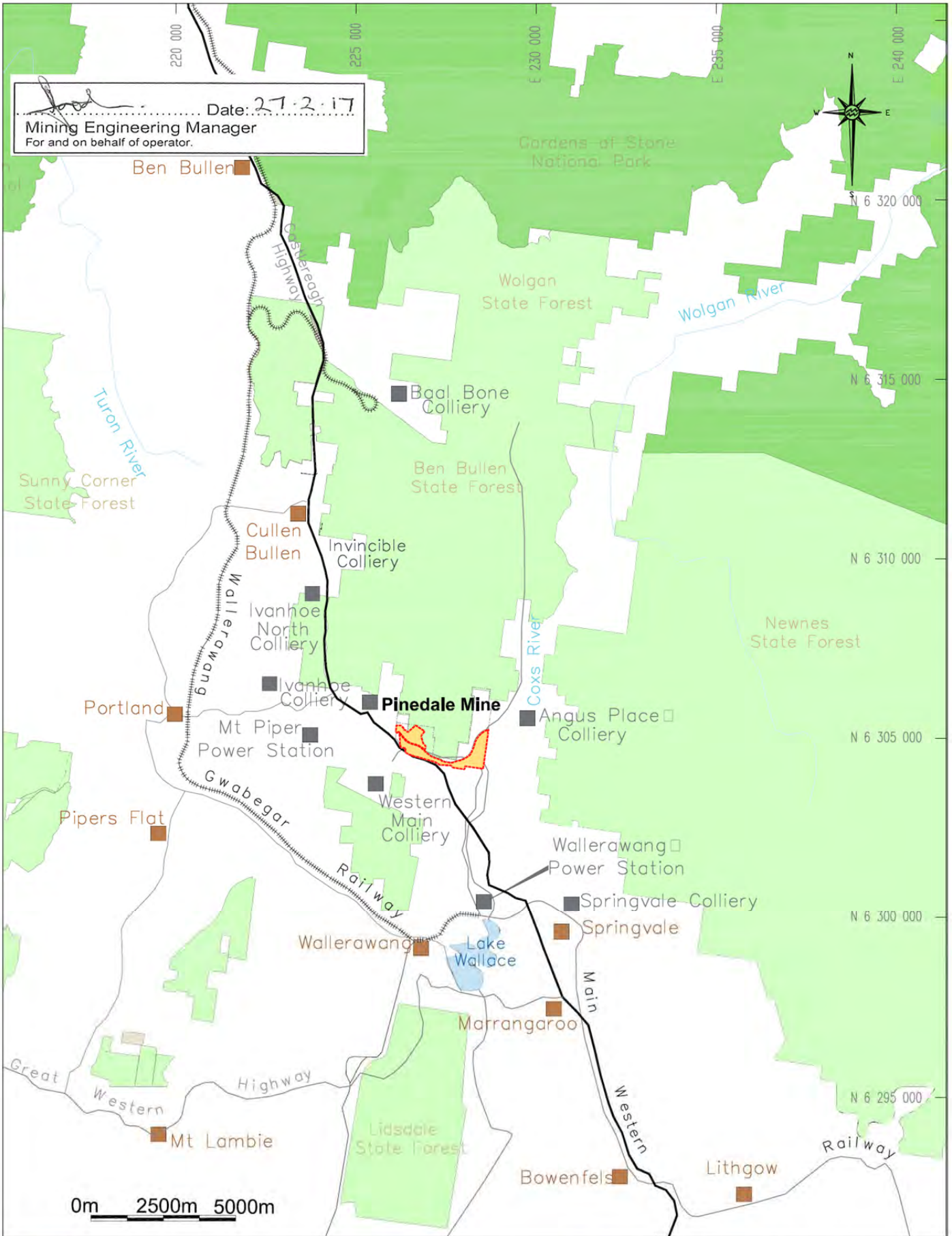
FirstField Environmental (2014) *Pine Dale Mine 2014 Rehabilitation Monitoring Report.*

FirstField Environmental (2015) *Pine Dale Mine 2014 Rehabilitation Monitoring Report.*

FirstField Environmental (2016) *Pine Dale Mine 2014 Rehabilitation Monitoring Report.*

APPENDIX A

SITE PLANS 2016

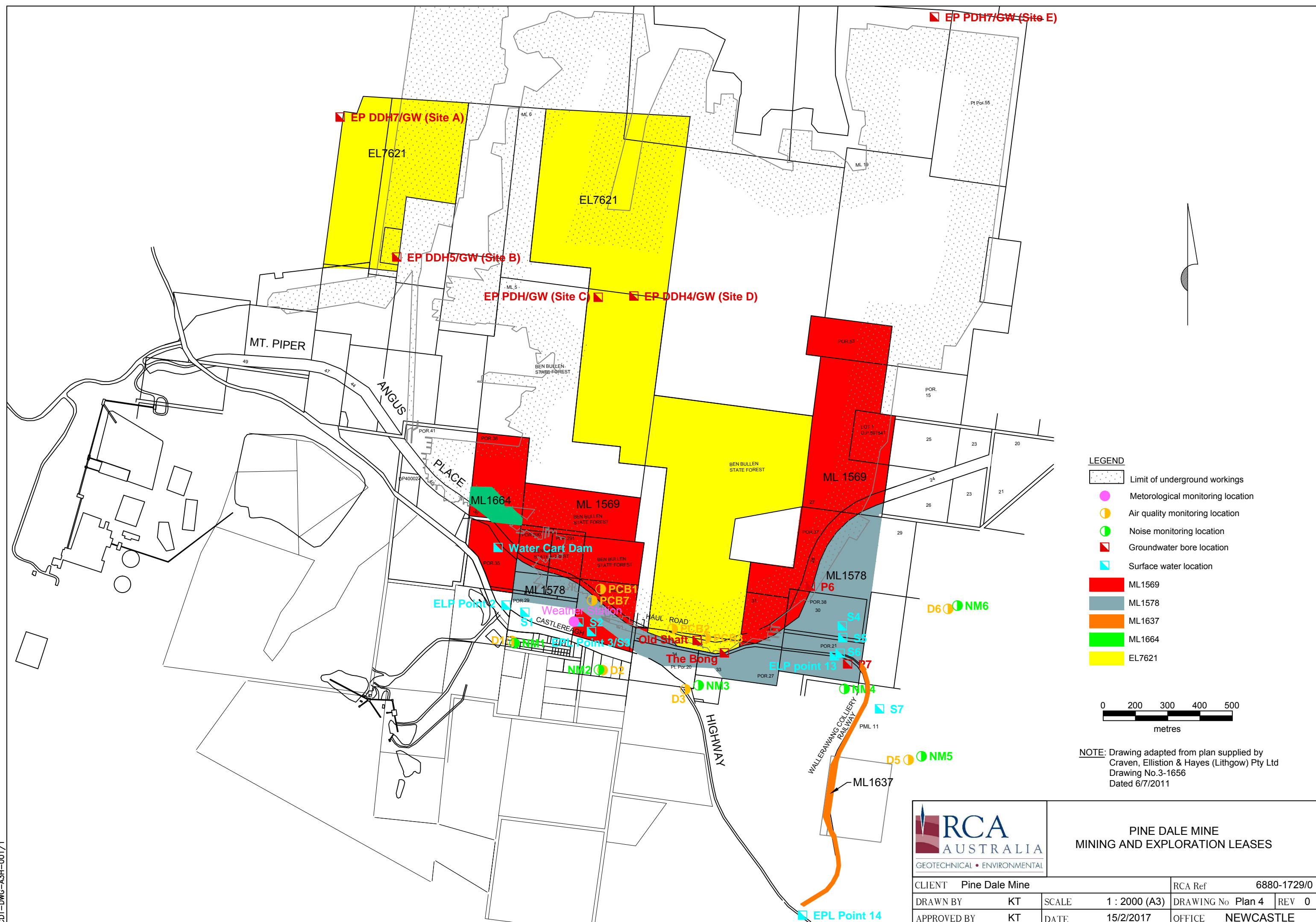



 Date: 27.2.17
 Mining Engineering Manager
 For and on behalf of operator.

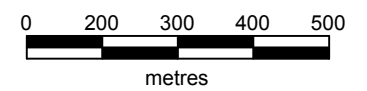
LEGEND	
	Pinedale Mine
	State Forest
	National Park
	Pinedale Mining Authority
	Castlereagh Highway
	Railway Line



Pine Dale Mine Regional Locality		Plant: 1	
		Drawn By: K Tripp	Date: 1/03/17
Revision: C	MGA Zone 56	Drawing No.: 23.4.11.6.1	



- LEGEND**
- Limit of underground workings
 - Meteorological monitoring location
 - Air quality monitoring location
 - Noise monitoring location
 - Groundwater bore location
 - Surface water location
 - ML 1569
 - ML 1578
 - ML 1637
 - ML 1664
 - EL 7621



NOTE: Drawing adapted from plan supplied by Craven, Ellistion & Hayes (Lithgow) Pty Ltd Drawing No.3-1656 Dated 6/7/2011



PINE DALE MINE MINING AND EXPLORATION LEASES

CLIENT	Pine Dale Mine		RCA Ref	6880-1729/0	
DRAWN BY	KT	SCALE	1 : 2000 (A3)	DRAWING No	Plan 4
APPROVED BY	KT	DATE	15/2/2017	OFFICE	NEWCASTLE
				REV	0

CDT-DWG-A3H-001/1

APPENDIX B

ENVIRONMENTAL MONITORING SUMMARY REPORT



AEMR SUMMARY REPORT COMPILED FOR PINE DALE MINE

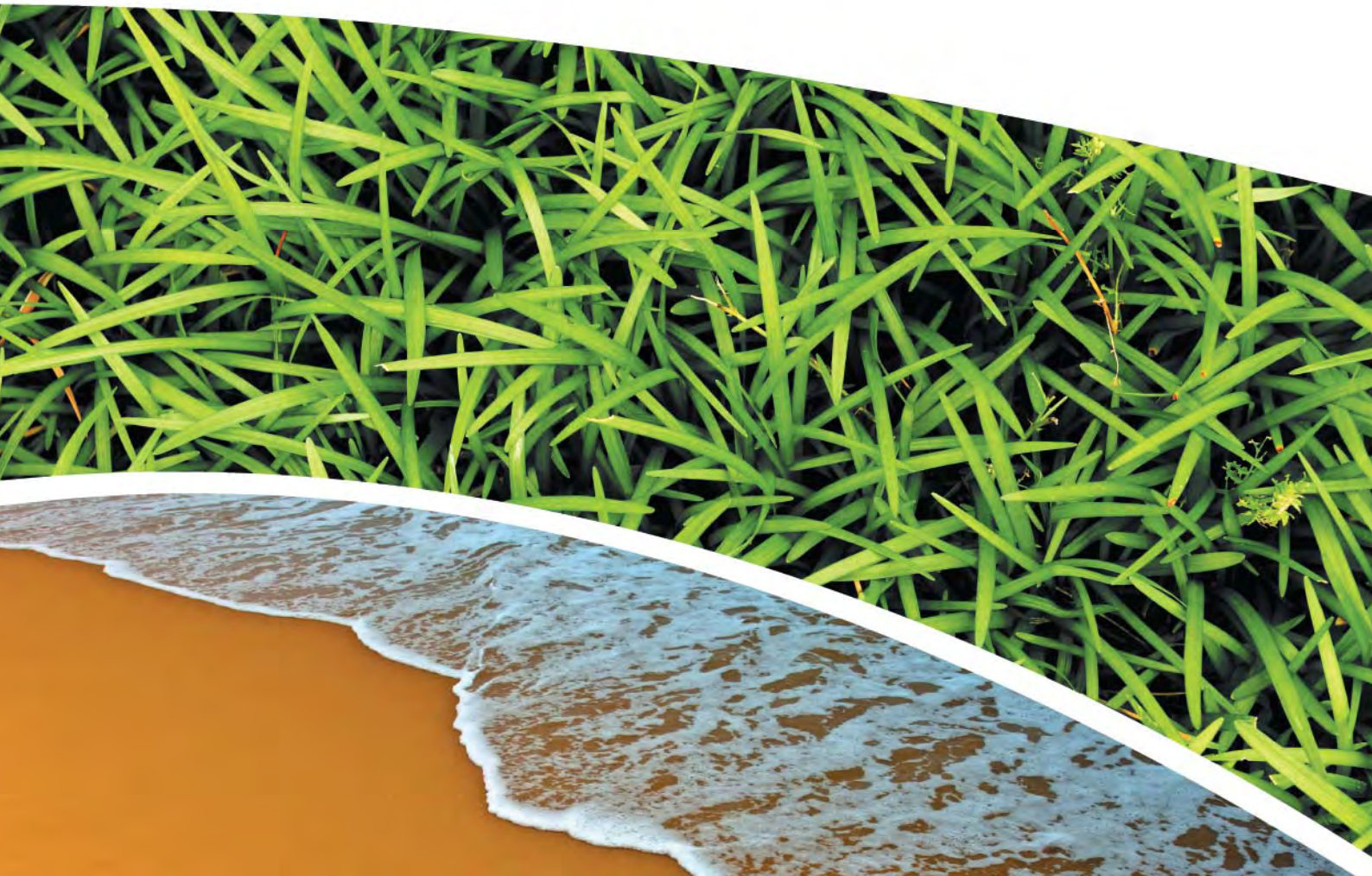
**Environmental Performance Monitoring
January – December 2016**

Pine Dale Mine

RCA Australia

RCA ref 6880-1729a/0

31 January 2017



RCA AUSTRALIA

ABN 53 063 515 711

92 Hill Street, CARRINGTON NSW 2294


Telephone: +61 2 4902 9200

Facsimile: +61 2 4902 9299

Email: administrator@rca.com.au

Internet: www.rca.com.au

This document is and shall remain the property of RCA Australia. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission supplied at the time of proposal. Unauthorised use of this document in any form whatsoever is prohibited.

DOCUMENT STATUS						
Rev No	Comment	Author	Reviewer	Approved for Issue (Project Manager)		
				Name	Signature	Date
/0	Final	Katy Shaw	Karen Tripp	Karen Tripp		31/01/17

DOCUMENT DISTRIBUTION				
Rev No	Copies	Format	Issued to	Date
/0	1	Electronic (email)	Pine Dale Mine – Mr Graham Goodwin; Mr Mark Frewin; Alicia d Vos	31/01/17
/0	1	Electronic report	RCA – job archive	31/01/17



RCA-LE ref 6880-1729a/0



31 January 2017

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 2016**

Contents

1	EXECUTIVE SUMMARY	5
2	INTRODUCTION	5
3	AIR QUALITY MONITORING	5
	3.1 DEPOSITIONAL DUST AND HVAS PARTICULATE MATTER ASSESSMENT CRITERIA	5
	3.1 AIR MONITORING RESULTS – DEPOSITIONAL DUST GAUGE DATA SUMMARY.....	6
	3.2 AIR MONITORING RESULTS – HVAS PARTICULATE MATTER DATA SUMMARY..	11
	3.3 REVIEW & INTERPRETATION OF AIR MONITORING RESULTS	13
	3.3.1 DEPOSITIONAL DUST RESULTS.....	13
	3.3.2 HVAS PARTICULATE MATTER RESULTS.....	13
4	GROUNDWATER QUALITY MONITORING	14
	4.1 GROUNDWATER ASSESSMENT CRITERIA	14
	4.2 GROUNDWATER MONITORING DATA SUMMARY	14
	4.3 REVIEW & INTERPRETATION OF GROUND WATER MONITORING RESULTS.....	25
	4.3.1 SITE GROUNDWATER BORES.....	25
	4.3.2 OFF-SITE GROUNDWATER BORES	26
	4.3.3 ENHANCE PLACE GROUNDWATER BORES	26
5	SURFACE WATER QUALITY MONITORING	26
	5.1 SURFACE WATER ASSESSMENT CRITERIA.....	26
	5.2 SURFACE WATER MONITORING DATA SUMMARY.....	27
	5.3 REVIEW & INTERPRETATION OF SURFACE WATER MONITORING RESULTS.....	38
	5.3.1 EPL SURFACE WATERS	38
	5.3.2 SITE SURFACE WATERS.....	38
6	METEOROLOGICAL MONITORING	39
	6.1 METEOROLOGICAL MONITORING REQUIREMENTS	39
	6.2 METEOROLOGICAL MONITORING RESULTS	39
	6.3 REVIEW OF METEOROLOGICAL MONITORING RESULTS	43
7	STREAM HEALTH & CHANNEL STABILITY MONITORING	43
	7.1 STREAM HEALTH & CHANNEL STABILITY MONITORING SUMMARY.....	43
	7.2 REVIEW & INTERPRETATION OF STREAM HEALTH MONITORING RESULTS.....	47
8	NOISE MONITORING	47
	8.1 NOISE ASSESSMENT CRITERIA.....	47
	8.2 NOISE MONITORING DATA SUMMARY	48
	8.3 REVIEW & INTERPRETATION OF OPERATIONAL NOISE MONITORING RESULTS ..	54
	8.3.1 FIRST QUARTER 2016.....	54
	8.3.2 SECOND QUARTER 2016.....	54
	8.3.3 THIRD QUARTER 2015	55
	8.3.4 FOURTH QUARTER 2016.....	55
	8.3.5 OVERALL ASSESSMENT FOR 2016.....	55
9	BLAST MONITORING	56
	9.1 BLASTING OPERATIONS ASSESSMENT CRITERIA	56
	9.2 BLASTING OPERATIONS MONITORING DATA SUMMARY	56
10	LIMITATIONS.....	56

LIST OF FIGURES

FIGURE 1	DEPOSITIONAL DUST RESULTS - GAUGES D1 TO D6.....	10
FIGURE 2	DEPOSITIONAL DUST RESULTS – GAUGES PCB1-3 & PCB7.....	11
FIGURE 3	HVAS TSP & PM ₁₀ PARTICULATE MATTER SUMMARY JAN- DEC 2016.....	13
FIGURE 4	ONSITE GROUNDWATER MONITORING BORE DEPTHS 2016.....	24
FIGURE 5	OFF-SITE GROUNDWATER MONITORING BORE DEPTHS 2016.....	24
FIGURE 6	ENHANCE PLACE GROUNDWATER MONITORING BORE DEPTH 2016	25
FIGURE 7	SITE SURFACE WATER S1, S3 & S6 PH RESULTS 2016.....	36
FIGURE 8	SITE SURFACE WATER S4, S5 & S7 PH RESULTS 2016.....	36
FIGURE 9	SITE SURFACE WATER S1, S3 & S6 ELECTRICAL CONDUCTIVITY RESULTS 2016.....	37
FIGURE 10	SITE SURFACE WATER S4, S5 & S7 ELECTRICAL CONDUCTIVITY RESULTS 2016.....	37
FIGURE 11	SITE SURFACE WATER S2 - WATER LEVEL 2016	38
FIGURE 12	PINE DALE MINE WINDROSE PLOT - 2016.....	41
FIGURE 13	PINE DALE MINE SEASONAL WINDROSE PLOTS - 2016	42

LIST OF TABLES

TABLE 1	DEPOSITIONAL DUST: LONG TERM ASSESSMENT CRITERIA	5
TABLE 2	HVAS PARTICULATE MATTER: LONG TERM ASSESSMENT CRITERIA	6
TABLE 3	HVAS PARTICULATE MATTER: SHORT TERM ASSESSMENT CRITERIA.....	6
TABLE 4	DEPOSITIONAL DUST DATA SUMMARY GAUGE D1 JAN – DEC 2016.....	7
TABLE 5	DEPOSITIONAL DUST DATA SUMMARY GAUGE D2 JAN – DEC 2016.....	7
TABLE 6	DEPOSITIONAL DUST DATA SUMMARY GAUGE D3 JAN – DEC 2016.....	7
TABLE 7	DEPOSITIONAL DUST DATA SUMMARY GAUGE D4 JAN – DEC 2016.....	8
TABLE 8	DEPOSITIONAL DUST DATA SUMMARY GAUGE D5 JAN – DEC 2016.....	8
TABLE 9	DEPOSITIONAL DUST DATA SUMMARY GAUGE D6 JAN – DEC 2016.....	8
TABLE 10	DEPOSITIONAL DUST DATA SUMMARY GAUGE PCB1 JAN – DEC 2016.....	9
TABLE 11	DEPOSITIONAL DUST DATA SUMMARY GAUGE PCB2 JAN – DEC 2016.....	9
TABLE 12	DEPOSITIONAL DUST DATA SUMMARY GAUGE PCB3 JAN – DEC 2016.....	9
TABLE 13	DEPOSITIONAL DUST DATA SUMMARY GAUGE PCB7 JAN – DEC 2016.....	10
TABLE 14	HVAS PARTICULATE MATTER SUMMARY JAN – DEC 2016.....	12
TABLE 15	GROUNDWATER TRIGGER LEVELS.....	14
TABLE 16	GROUNDWATER MONITORING BORE P6 RESULTS JAN - DEC 2016.....	15
TABLE 17	GROUNDWATER MONITORING BORE P7 RESULTS JAN - DEC 2016.....	16
TABLE 18	GROUNDWATER MONITORING BORE OLD SHAFT RESULTS JAN - DEC 2016.....	17
TABLE 19	GROUNDWATER MONITORING LOCATION 'THE BONG' RESULTS JAN – DEC 2016.....	18
TABLE 20	GROUNDWATER MONITORING BORE A (EP DDH7/GW) RESULTS JAN - DEC 2016.....	19
TABLE 21	GROUNDWATER MONITORING BORE C (EP PDH1/GW) RESULTS JAN - DEC 2016.....	20
TABLE 22	GROUNDWATER MONITORING BORE D (EP DDH4/GW) RESULTS JAN - DEC 2016.....	21
TABLE 23	GROUNDWATER MONITORING BORE E (EP PDH7/GW) RESULTS JAN - DEC 2016.....	22
TABLE 24	GROUNDWATER MONITORING BORE - EP PDH3/GW RESULTS JAN - DEC 2016.....	23
TABLE 25	GROUNDWATER MONITORING BORE - EP PDH4/GW RESULTS JAN - DEC 2016.....	23
TABLE 25	EPL SURFACE WATER ASSESSMENT CRITERIA.....	27
TABLE 27	SURFACE WATER MONITORING LOCATION EPL POINT 2 RESULTS 2016.....	27
TABLE 28	SURFACE WATER MONITORING LOCATION EPL POINT 3 RESULTS 2016.....	28
TABLE 29	SURFACE WATER MONITORING LOCATION EPL POINT 14 RESULTS 2016.....	28
TABLE 30	SURFACE WATER MONITORING LOCATION S1 RESULTS 2016.....	29
TABLE 31	SURFACE WATER MONITORING LOCATION S2 RESULTS 2016.....	30

TABLE 32	<i>SURFACE WATER MONITORING LOCATION S3 RESULTS 2016</i>	31
TABLE 33	<i>SURFACE WATER MONITORING LOCATION S4 RESULTS 2016</i>	32
TABLE 34	<i>SURFACE WATER MONITORING LOCATION S5 RESULTS 2016</i>	33
TABLE 35	<i>SURFACE WATER MONITORING LOCATION S6 RESULTS 2016</i>	34
TABLE 36	<i>SURFACE WATER MONITORING LOCATION S7 RESULTS 2016</i>	35
TABLE 37	<i>EPL METEOROLOGICAL MONITORING REQUIREMENTS</i>	39
TABLE 38	<i>METEOROLOGICAL MONITORING SUMMARY DATA 2016</i>	40
TABLE 39	<i>CLASSIFICATION OF DIFFERENT DRAINAGE LINE STATES (CSIRO)</i>	44
TABLE 40	<i>CLASSIFICATION OF DIFFERENT DRAINAGE LINE STATE – SITE SH1</i>	44
TABLE 41	<i>CLASSIFICATION OF DIFFERENT DRAINAGE LINE STATE – SITE SH2</i>	45
TABLE 42	<i>CLASSIFICATION OF DIFFERENT DRAINAGE LINE STATE – SITE SH3</i>	45
TABLE 43	<i>CLASSIFICATION OF DIFFERENT DRAINAGE LINE STATE – SITE SH3A</i>	46
TABLE 44	<i>CLASSIFICATION OF DIFFERENT DRAINAGE LINE STATE – SITE SH5</i>	46
TABLE 45	<i>NOISE ASSESSMENT CRITERIA</i>	47
TABLE 46	<i>ATTENDED NOISE SURVEY – QUARTER 1, JANUARY 2016</i>	49
TABLE 47	<i>ATTENDED NOISE SURVEY – QUARTER 2, APRIL 2016</i>	50
TABLE 48	<i>ATTENDED NOISE SURVEY – QUARTER 3, SEPTEMBER 2016</i>	51
TABLE 49	<i>ATTENDED NOISE SURVEY – QUARTER 4, OCTOBER 2016</i>	52
TABLE 50	<i>METEOROLOGICAL CONDITIONS DURING ATTENDED NOISE SURVEYS</i>	53
TABLE 51	<i>BLASTING OPERATIONS: COMPLIANCE REQUIREMENTS</i>	56

APPENDIX

APPENDIX 1

ENVIRONMENTAL MONITORING LOCATIONS

STREAM HEALTH & CHANNEL STABILITY MONITORING LOCATIONS

1 EXECUTIVE SUMMARY

Pine Dale Mine achieved an acceptable standard of environmental performance during the 2016 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 (PM₁₀) were below the Project Approval (PA 10_0041) and 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 2016. Summary data is comprised of High Volume Air Samples (TSP & PM₁₀), Depositional Dust, Surface Water, Groundwater, Channel Stability and Stream Health 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 **Tables 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 (EPL 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 2016 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 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	D1	0.4	0.05*	0.4
Feb-16	D1	0.5	0.2	0.3
Mar-16	D1	1.2	0.4	0.8
Apr-16	D1	0.5	0.05*	0.5
May-16	D1	0.5	0.3	0.2
Jun-16	D1	0.1	0.05*	0.1
Jul-16	D1	0.2	0.05*	0.2
Aug-16	D1	0.3	0.1	0.2
Sep-16	D1	0.05*	0.05*	0.05*
Oct-16	D1	0.9	0.2	0.7
Nov-16	D1	-	-	-
Dec-16	D1	1.1	0.6	0.5
ANNUAL AVERAGE		0.5	0.2	0.4

* Where results are found to be less than the detection limit, values of half the detection limit are used for reporting purposes. No result is available for November 2016 because the dust gauge was vandalised (stolen).

Table 5 *Depositional Dust Data Summary Gauge D2 Jan – Dec 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	D2	0.4	0.1	0.3
Feb-16	D2	0.4	0.2	0.2
Mar-16	D2	0.8	0.4	0.4
Apr-16	D2	0.3	0.05*	0.3
May-16	D2	0.3	0.1	0.2
Jun-16	D2	0.05*	0.05*	0.05*
Jul-16	D2	0.1	0.05*	0.05*
Aug-16	D2	0.1	0.05*	0.1
Sep-16	D2	0.05*	0.05*	0.05*
Oct-16	D2	0.7	0.1	0.6
Nov-16	D2	0.5	0.2	0.3
Dec-16	D2	1.2	0.4	0.8
ANNUAL AVERAGE		0.4	0.1	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 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	D3	0.2	0.05*	0.2
Feb-16	D3	0.7	0.4	0.3
Mar-16	D3	1.0	0.6	0.4
Apr-16	D3	0.9	0.4	0.5
May-16	D3	0.8	0.5	0.3
Jun-16	D3	0.5	0.1	0.4
Jul-16	D3	0.1	0.05*	0.05*
Aug-16	D3	0.4	0.1	0.3
Sep-16	D3	0.2	0.05*	0.2
Oct-16	D3	0.9	0.3	0.6
Nov-16	D3	1.2	0.7	0.5
Dec-16	D3	1.1	0.5	0.6
ANNUAL AVERAGE		0.7	0.3	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 7 *Depositional Dust Data Summary Gauge D4 Jan – Dec 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	D4	0.2	0.05*	0.2
Feb-16	D4	0.5	0.1	0.4
Mar-16	D4	0.7	0.3	0.4
Apr-16	D4	0.6	0.1	0.5
May-16	D4	0.4	0.2	0.2
Jun-16	D4	0.6	0.05*	0.6
Jul-16	D4	0.05*	0.05*	0.05*
Aug-16	D4	0.1	0.05*	0.1
Sep-16	D4	0.05*	0.05*	0.05*
Oct-16	D4	0.6	0.05*	0.6
Nov-16	D4	0.5	0.1	0.4
Dec-16	D4	1.2	0.3	0.9
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 8 *Depositional Dust Data Summary Gauge D5 Jan – Dec 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	D5	3.9	1.3	2.6
Feb-16	D5	0.6	0.3	0.3
Mar-16	D5	0.7	0.4	0.3
Apr-16	D5	0.8	0.2	0.6
May-16	D5	0.5	0.3	0.2
Jun-16	D5	0.5	0.1	0.4
Jul-16	D5	0.05*	0.05*	0.05*
Aug-16	D5	1.3	0.2	1.1
Sep-16	D5	0.5	0.2	0.3
Oct-16	D5	2.7	0.8	1.9
Nov-16	D5	0.4	0.1	0.3
Dec-16	D5	0.8	0.2	0.6
ANNUAL AVERAGE		1.1	0.3	0.7

* 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 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	D6	0.7	0.3	0.4
Feb-16	D6	1.5	0.8	0.7
Mar-16	D6	0.8	0.5	0.3
Apr-16	D6	1.9	1.1	0.8
May-16	D6	1.1	0.7	0.4
Jun-16	D6	0.7	0.2	0.5
Jul-16	D6	0.1	0.05*	0.05*
Aug-16	D6	0.3	0.05*	0.3
Sep-16	D6	0.1	0.05*	0.1
Oct-16	D6	0.7	0.05*	0.7
Nov-16	D6	0.5	0.2	0.3
Dec-16	D6	1.7	0.5	1.2
ANNUAL AVERAGE		0.8	0.4	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 10 *Depositional Dust Data Summary Gauge PCB1 Jan – Dec 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	PCB1	0.4	0.05*	0.4
Feb-16	PCB1	0.7	0.3	0.4
Mar-16	PCB1	0.7	0.2	0.5
Apr-16	PCB1	0.4	0.1	0.3
May-16	PCB1	0.3	0.1	0.2
Jun-16	PCB1	0.4	0.05*	0.4
Jul-16	PCB1	0.05*	0.05*	0.05*
Aug-16	PCB1	0.4	0.1	0.3
Sep-16	PCB1	0.2	0.05*	0.2
Oct-16	PCB1	0.6	0.05*	0.6
Nov-16	PCB1	0.6	0.2	0.4
Dec-16	PCB1	1.4	0.4	1
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 11 *Depositional Dust Data Summary Gauge PCB2 Jan – Dec 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	PCB2	0.2	0.05	0.2
Feb-16	PCB2	0.6	0.2	0.4
Mar-16	PCB2	1.0	0.3	0.7
Apr-16	PCB2	0.3	0.05*	0.3
May-16	PCB2	0.7	0.3	0.4
Jun-16	PCB2	0.4	0.05*	0.4
Jul-16	PCB2	0.2	0.05*	0.2
Aug-16	PCB2	0.3	0.05*	0.3
Sep-16	PCB2	0.1	0.05*	0.1
Oct-16	PCB2	0.05*	0.05*	0.05*
Nov-16	PCB2	0.4	0.05*	0.4
Dec-16	PCB2	1.0	0.1	0.9
ANNUAL AVERAGE		0.4	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 12 *Depositional Dust Data Summary Gauge PCB3 Jan – Dec 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-16	PCB3	0.6	0.1	0.5
Feb-16	PCB3	0.6	0.2	0.4
Mar-16	PCB3	0.8	0.2	0.6
Apr-16	PCB3	0.6	<0.1	0.6
May-16	PCB3	0.4	0.2	0.2
Jun-16	PCB3	0.2	< 0.1	0.2
Jul-16	PCB3	0.2	< 0.1	0.2
Aug-16	PCB3	0.2	<0.1	0.2
Sep-16	PCB3	0.2	<0.1	0.2
Oct-16	PCB3	0.6	<0.1	0.6
Nov-16	PCB3	0.8	0.2	0.6
Dec-16	PCB3	1.2	0.4	0.8
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 2016*

Month	Gauge No.	Insoluble Solids (g/m ² .month)	Ash Residue (g/m ² .month)	Combustible Matter (g/m ² .month)
Jan-15	PCB7	0.4	0.1	0.3
Feb-15	PCB7	1.2	0.1	1.1
Mar-15	PCB7	0.9	0.4	0.5
Apr-15	PCB7	1.4	0.6	0.8
May-15	PCB7	0.3	0.1	0.2
Jun-15	PCB7	0.8	0.2	0.6
Jul-15	PCB7	0.05*	0.05*	0.05*
Aug-15	PCB7	0.3	0.05*	0.3
Sep-15	PCB7	0.05*	0.05*	0.05*
Oct-15	PCB7	0.8	0.1	0.7
Nov-15	PCB7	0.2	0.05*	0.2
Dec-15	PCB7	2.1	0.8	1.3
ANNUAL AVERAGE		0.7	0.2	0.5

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

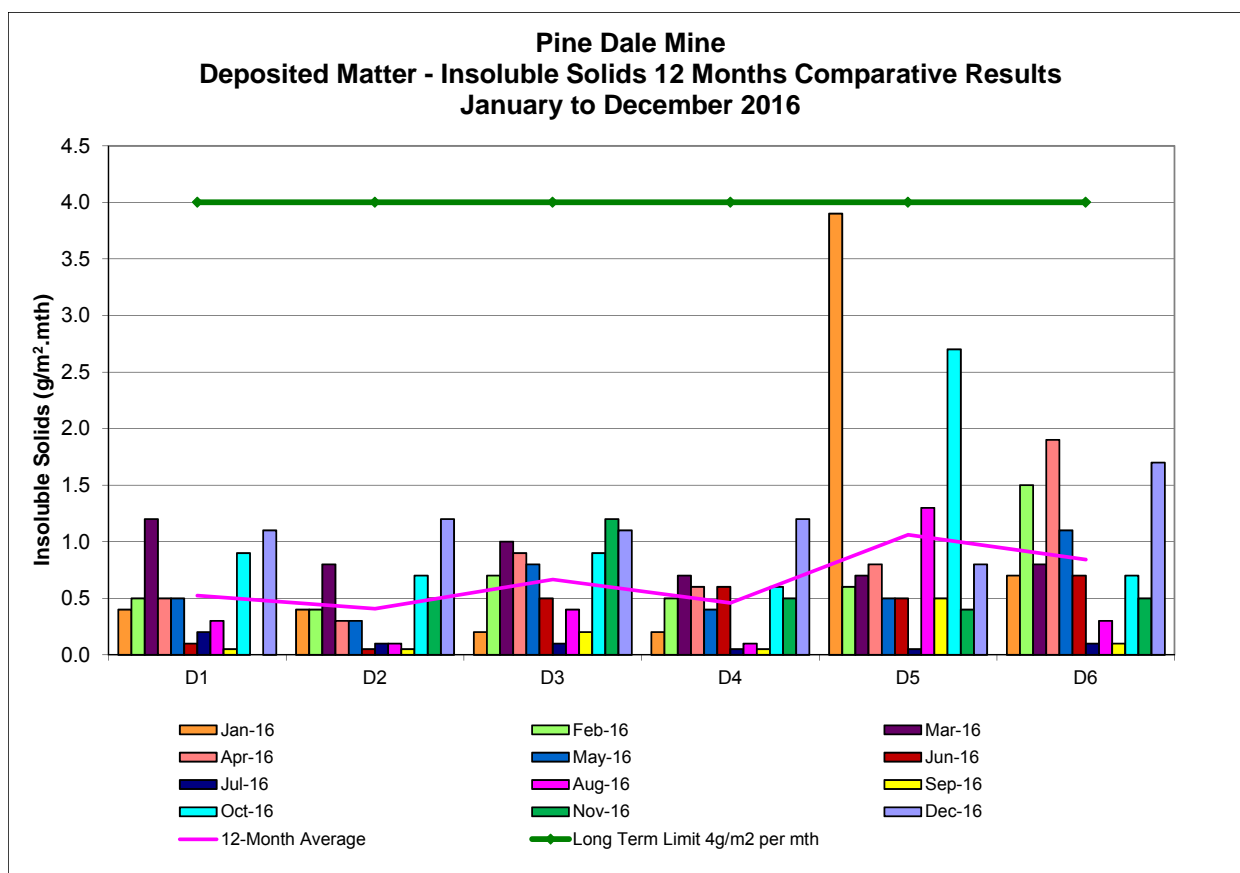


Figure 1 *Depositional Dust Results - Gauges D1 to D6*

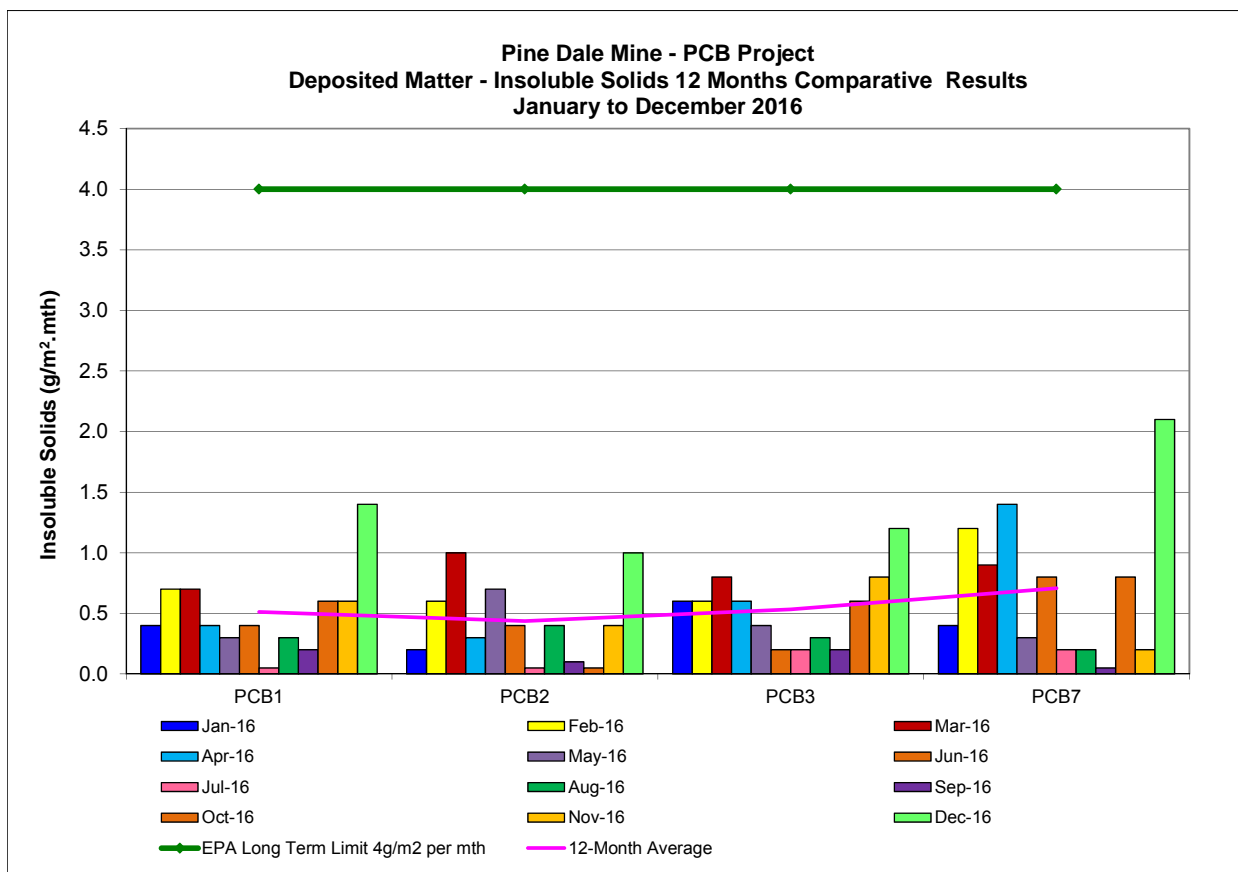


Figure 2 Depositional Dust Results – Gauges PCB1-3 & PCB7

3.2 AIR MONITORING RESULTS – HVAS PARTICULATE MATTER DATA SUMMARY

Pine Dale Coal Mine monitors Total Particulate Matter 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 2016 are shown in **Table 14**. Graphical presentations are shown in **Figure 3**.

Table 14 *HVAS Particulate Matter Summary Jan – Dec 2016*

Run Date	HVAS TSP ($\mu\text{g}/\text{m}^3$)	HVAS PM ₁₀ ($\mu\text{g}/\text{m}^3$)	Run Date	HVAS TSP ($\mu\text{g}/\text{m}^3$)	HVAS PM ₁₀ ($\mu\text{g}/\text{m}^3$)
06-Jan-16	8	3	10-Jul-16	7	5
12-Jan-16	37	18	16-Jul-16	8	4
18-Jan-16	14	10	22-Jul-16	10	4
24-Jan-16	13	9	28-Jul-16	6	1
30-Jan-16	20	9	03-Aug-16	8	6
05-Feb-16	18	10	09-Aug-16	14	6
11-Feb-16	16	12	15-Aug-16	18	8
17-Feb-16	37	19	21-Aug-16	6	2
23-Feb-16	19	10	27-Aug-16	8	3
29-Feb-16	14	8	02-Sep-16	10	5
06-Mar-16	15	10	08-Sep-16	20	7
12-Mar-16	18	13	14-Sep-16	47	5
18-Mar-16	13	7	20-Sep-16	22	4
24-Mar-16	25	15	26-Sep-16	19	7
30-Mar-16	29	14	02-Oct-16	14	3
05-Apr-16	40	27	08-Oct-16	21	9
11-Apr-16	32	15	14-Oct-16	16	6
17-Apr-16	25	19	20-Oct-16	17	7
23-Apr-16	14	8	26-Oct-16	24	8
29-Apr-16	21	13	01-Nov-16	32	10
05-May-16	20	13	07-Nov-16	25	17
11-May-16	17	7	13-Nov-16	32	11
17-May-16	19	9	19-Nov-16	29	15
23-May-16	33	8	25-Nov-16	22	<1
29-May-16	9	5	01-Dec-16	38	14
04-Jun-16	5	1	7-Dec-16	15	9
10-Jun-16	8	4	13-Dec-16	37	18
16-Jun-16	11	5	19-Dec-16	15	9
22-Jun-16	4	2	25-Dec-16	14	9
28-Jun-16	7	3	31-Dec-16	15	10
04-Jul-16	8	2			
Annual Average				18.7	8.8

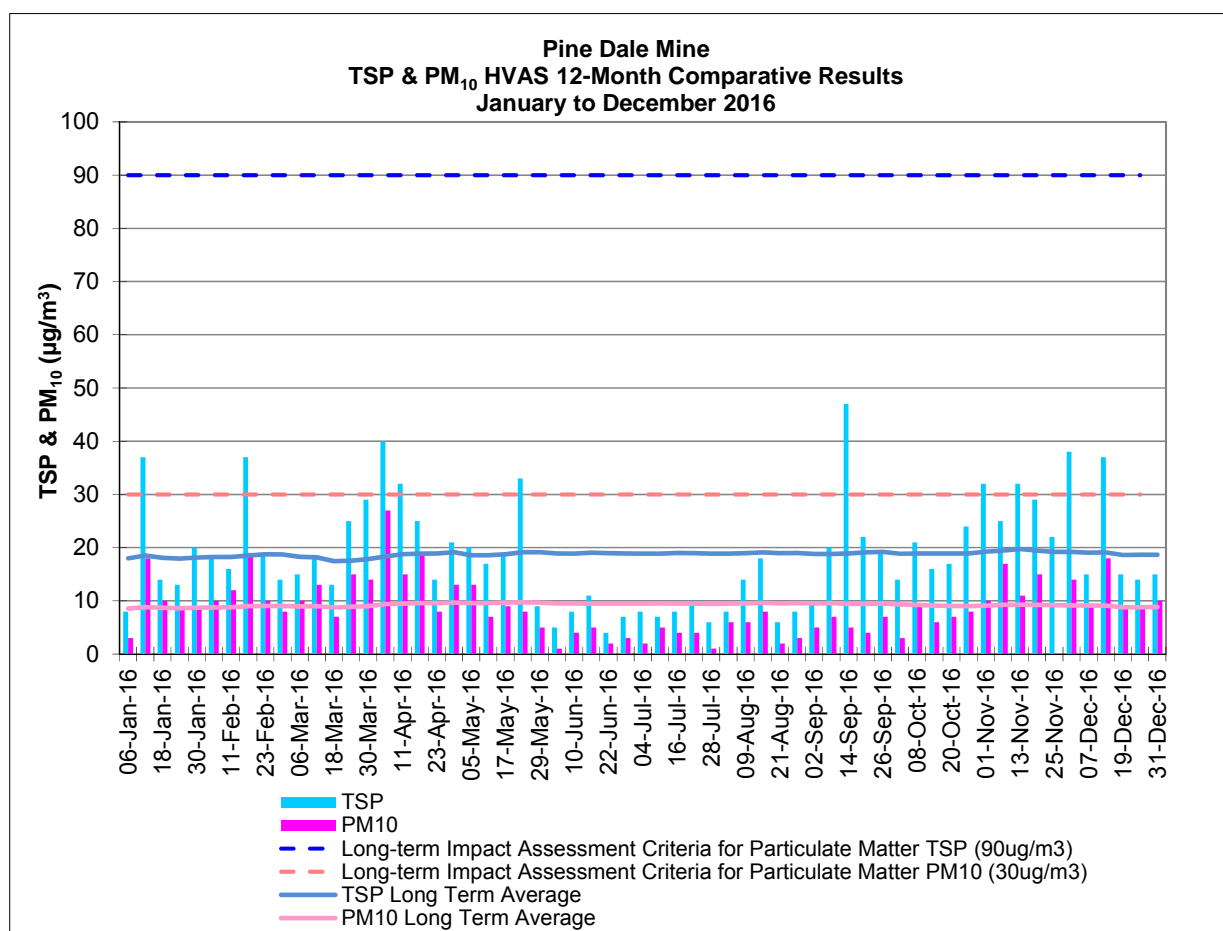


Figure 3 HVAS TSP & PM₁₀ Particulate Matter Summary Jan- Dec 2016

3.3 REVIEW & INTERPRETATION OF AIR MONITORING RESULTS

3.3.1 DEPOSITIONAL DUST RESULTS

Depositional Dust results for the period January – December 2016 show an average insoluble solids range of 0.4g/m² per month to 1.1g/m² per month for dust gauges D1 to D6. These results fall below the nominated annual average assessment criteria of 4.0g/m² per month, as stipulated in the *Air Quality Monitoring Program*.

A review of historical data captured over the previous five years indicate during the 2016 period there were no instances where the dust gauges showed results which were greater than the maximum annual average increase of 2g/m² per month deposited matter, as stipulated in the site's Air Quality Monitoring Program. No result was recorded for dust gauge D1 in November 2016 as the dust gauge and bottle setup had been stolen.

It is 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 2016 show an average result of 18.7 µg/m³, which is well below the nominated annual average assessment criterion of 90µg/m³ 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 $<10\mu\text{m}$ (PM_{10}) also show results within the required *Air Quality Monitoring Program* assessment criteria. The average PM_{10} result was $8.3\mu\text{g}/\text{m}^3$, which is below the annual average PM_{10} assessment criteria of $30\mu\text{g}/\text{m}^3$. All HVAS results were below the OEH 24 hour maximum assessment criteria of $50\mu\text{g}/\text{m}^3$ with the maximum concentration reported at $27\mu\text{g}/\text{m}^3$ on 5 April 2016.

During the reporting period the PM_{10} 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 Standing Water Level (SWL) and 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 ($\mu\text{S}/\text{cm}$)	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 2016 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 2016

Location	Site Bore P6													
Sample Number	01166880009	02166880011	03166880009	04166880007	05166880011	06166880009	07166880009	08166880011	09166880009	10166880009	11166880011	12166880009	Trigger Levels	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	11/01/16	09/02/16	08/03/16	05/04/16	05/05/16	06/06/16	07/07/16	09/08/16	06/09/16	06/10/16	07/11/16	08/12/16		
Time Sampled	9:48	13:25	14:58	10:58	12:30	13:43	14:56	13:45	9:50	10:55	12:54	10:59		
Standing Water Level (m)	26.25	25.96	26.03	25.98	26.13	26.08	25.75	25.31	25.00	24.31	24.00	24.00		
Standpipe Height (m)	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)	25.30	25.01	25.08	25.03	25.18	25.13	24.80	24.36	24.05	23.36	23.05	23.05		
Water Level AHD (m)#	891.65	891.94	891.87	891.92	891.77	891.82	892.15	892.59	892.90	893.59	893.90	893.90		887.90
Temperature (°C)	17.5	20.2	20.2	17.5	15.0	13.9	13.0	15.5	16.5	15.5	18.0	16.0		
pH	6.39	6.51	6.19	6.42	7.19	6.17	6.30	6.29	6.14	6.25	5.62	6.14		6.2 to 8.0
Conductivity (µS/cm)	1180	1203	1101	1288	1106	1391	1091	1073	1316	1173	1300	1348		1180
Turbidity (NTU)	139	28	15	117	19	28	25	36	64	53	94	12		
Dissolved Oxygen (mg/L)	5.4	7.1	6.2	7.1	8.3	7.9	4.7	9.5	3.9	0.0	4.3	5.8		
TSS (mg/L)	66	30	32	57	28	10	31	25	14	31	59	23		
Oil & Grease (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<5	<5	<5		
Bicarbonate Alkalinity (mg/L)	39	51	40	42	73	74	50	49	68	48	35	55		
Total Alkalinity (mg/L)	39	51	40	42	73	74	50	49	68	48	35	55		
Sulphate (mg/L)	626	662	712	529	646	594	612	565	638	672	667	617		
Chloride (mg/L)	29	32	32	32	36	35	36	33	36	38	39	35		
Calcium (mg/L)	133	116	127	126	143	132	124	128	135	132	124	123		
Magnesium (mg/L)	64	59	64	64	66	61	58	53	65	65	60	66		
Sodium (mg/L)	58	54	51	61	60	56	55	49	62	59	57	62		
Potassium (mg/L)	20	17	18	19	23	19	18	16	17	19	18	22		
Cobalt (dissolved) (mg/L)	0.065	0.056	0.058	0.058	0.062	0.056	0.052	0.05	0.004	0.059	0.054	0.060		
Manganese (dissolved) (mg/L)	2.58	2.48	2.64	2.48	2.66	2.52	2.32	2.62	2.68	2.81	2.33	2.43		
Nickel (dissolved) (mg/L)	0.112	0.1	0.101	0.112	0.109	0.104	0.098	0.097	0.007	0.11	0.106	0.106		
Zinc (dissolved) (mg/L)	0.088	0.345	0.469	1.97	0.072	0.545	0.66	0.572	0.026	0.4	0.569	0.068		
Iron (dissolved) (mg/L)	31.5	25.4	25.9	0.72	29.7	27.5	20.4	19.3	1.44	26.4	21.1	28.7		

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 2016

Location	Site Bore P7													
Sample Number	01166880010	02166880012	03166880010	04166880010	05166880012	06166880010	07166880010	08166880012	0916688010	10166880010	11166880012	12166880010	Trigger Levels	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	06/06/16	7/07/16	9/08/16	06/09/16	6/10/16	7/11/16	8/12/16		
Time Sampled	12:20	14:22	15:40	13:22	13:25	14:22	15:28	14:38	12:42	9:50	13:57	11:34		
Standing Water Level (m)	7.61	7.73	7.65	7.67	7.84	7.76	7.65	7.13	6.27	7.14	7.11	7.40		
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 Water Level (m)	6.61	6.73	6.65	6.67	6.84	6.76	6.65	6.13	5.27	6.14	6.11	6.40		
Water Level AHD (m)#	887.79	887.67	887.75	887.73	887.56	887.64	887.75	888.27	889.13	888.26	888.29	888.00		883.28
Temperature (°C)	17.5	26.7	17.0	16.0	15.0	14.7	13.0	15.5	16.2	14.8	16.0	15.0		
pH (pH units)	6.34	6.29	6.29	6.18	6.28	6.40	6.43	6.41	6.27	6.46	5.87	6.21		6.3 to 8.0
Conductivity (µS/cm)	843	733	748	876	803	888	770	769	880	759	760	771		852
Bicarbonate Alkalinity (mg/L)	---	231	---	---	225	---	---	253	---	---	197	---		
Total Alkalinity (mg/L)	---	231	---	---	225	---	---	253	---	---	197	---		
Sulphate (mg/L)	---	84	---	---	75	---	---	67	---	---	89	---		
Chloride (mg/L)	---	105	---	---	103	---	---	92	---	---	81	---		
Calcium (mg/L)	---	43	---	---	49	---	---	48	---	---	43	---		
Magnesium (mg/L)	---	50	---	---	52	---	---	48	---	---	49	---		
Sodium (mg/L)	---	51	---	---	52	---	---	44	---	---	47	---		
Potassium (mg/L)	---	8	---	---	9	---	---	8	---	---	7	---		
Iron (dissolved) (mg/L)	---	<0.05	---	---	<0.05	---	---	0.44	---	---	<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 2016

Location	Site Bore 'Old Shaft'													
Sample Number	01166880013	02166880015	03166880013	04166880013	05166880015	06166880013	07166880013	08166880015	09166880013	10166880013	11166880015	12166880013	Trigger Levels	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	06/06/16	7/07/16	9/08/16	06/09/16	6/10/16	7/11/16	8/12/16		
Time Sampled	11:37	12:22	14:30	10:14	11:42	13:20	14:35	13:30	11:33	12:17	12:13	10:40		
Standing Water Level (m)	12.51	12.36	12.3	12.23	12.41	12.37	12.05	11.60	11.31	10.60	10.36	10.33		
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 Water Level (m)	10.81	10.66	10.6	10.53	10.71	10.67	10.35	9.9	9.61	8.9	8.66	8.63		
Water Level AHD (m)#	892.23	892.38	892.44	892.51	892.33	892.37	892.69	893.14	893.43	894.14	894.38	894.41		888.46
Temperature (°C)	17.8	17.0	16.5	15.0	15.0	15.5	14.0	15.5	10.5	16.0	17.0	16.0		
pH	<i>6.01</i>	<i>6.20</i>	<i>6.10</i>	<i>5.71</i>	<i>6.18</i>	<i>5.81</i>	<i>5.96</i>	<i>5.81</i>	<i>5.49</i>	<i>5.69</i>	<i>5.51</i>	<i>5.50</i>		6.3 to 8.0
Conductivity (µS/cm)	<i>1115</i>	<i>1141</i>	<i>985</i>	<i>1214</i>	<i>1046</i>	<i>1213</i>	<i>1065</i>	<i>1087</i>	<i>1244</i>	<i>1110</i>	<i>1350</i>	<i>1136</i>		908
Turbidity (NTU)	19	11	54	201	170	19	319	75	18	20	67	44		
Dissolved Oxygen (mg/L)	---	7.5	---	---	6.8	---	---	9.6	---	---	6.0	---		
TSS (mg/L)	---	11	---	---	36	---	---	66	---	---	30	---		
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<5	---		
Bicarbonate Alkalinity (mg/L)	---	49	---	---	40	---	---	10	---	---	14	---		
Total Alkalinity (mg/L)	---	49	---	---	40	---	---	10	---	---	14	---		
Sulphate (mg/L)	---	700	---	---	642	---	---	608	---	---	722	---		
Chloride (mg/L)	---	16	---	---	18	---	---	19	---	---	37	---		
Calcium (mg/L)	---	119	---	---	144	---	---	141	---	---	128	---		
Magnesium (mg/L)	---	58	---	---	62	---	---	58	---	---	63	---		
Sodium (mg/L)	---	40	---	---	41	---	---	39	---	---	53	---		
Potassium (mg/L)	---	17	---	---	22	---	---	18	---	---	16	---		
Cobalt (dissolved) (mg/L)	---	0.244	---	---	0.242	---	---	0.206	---	---	0.147	---		
Manganese (dissolved) (mg/L)	---	5.05	---	---	4.23	---	---	4.16	---	---	2.86	---		
Nickel (dissolved) (mg/L)	---	0.253	---	---	0.282	---	---	0.271	---	---	0.23	---		
Zinc (dissolved) (mg/L)	---	0.292	---	---	0.371	---	---	0.564	---	---	0.699	---		
Iron (dissolved) (mg/L)	---	17.6	---	---	13.0	---	---	16.6	---	---	18.0	---		

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 Location 'The Bong' Results Jan – Dec 2016

Location	Surface Water The Bong												Trigger Levels
Month	January	February	March	April	May	June	July	August	September	October	November	December	
Sample Number	01166880001	02166880001	03166880001	0466880001	05166880001	06166880001	07166880001	08166880001	09166880001	10166880001	11166880001	12166880001	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	06/06/16	7/07/16	9/08/16	06/09/16	6/10/16	7/11/16	8/12/16	
Time Sampled	9:10	12:47	14:20	10:38	11:50	13:28	14:43	13:37	10:15	11:09	12:34	10:48	
Temperature (°C)	20.0	27.0	29.8	21.0	18.0	9.0	10.0	12.0	11.0	16.0	25.0	26.0	
pH	7.43	7.21	7.52	5.83	<i>5.42</i>	5.94	6.56	6.57	6.52	6.48	6.27	7.56	5.8 – 8.0
Conductivity (µS/cm)	213	299	392	341	489	236	332	312	251	316	189	391	1157
Turbidity (NTU)	560	92.7	57	15	26	647	5	7	342	39	576	15	
Bicarbonate Alkalinity (mg/L)	---	4	---	---	1	---	---	4	---	---	9	---	
Total Alkalinity (mg/L)	---	4	---	---	1	---	---	4	---	---	9	---	
Sulphate (mg/L)	---	104	---	---	165	---	---	118	---	---	68	---	
Chloride (mg/L)	---	3	---	---	7	---	---	3	---	---	3	---	
Calcium (mg/L)	---	21	---	---	36	---	---	28	---	---	16	---	
Magnesium (mg/L)	---	10	---	---	19	---	---	12	---	---	7	---	
Sodium (mg/L)	---	5	---	---	9	---	---	5	---	---	4	---	
Potassium (mg/L)	---	4	---	---	8	---	---	2	---	---	3	---	
Arsenic (dissolved) (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Cadmium (dissolved) (mg/L)	---	<0.0001	---	---	0.0001	---	---	<0.0001	---	---	<0.0001	---	
Chromium (dissolved) (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Copper (dissolved) (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Lead (dissolved) (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Nickel (dissolved) (mg/L)	---	0.012	---	---	0.02	---	---	0.022	---	---	0.003	---	
Zinc (dissolved) (mg/L)	---	0.007	---	---	0.029	---	---	0.018	---	---	<0.005	---	
Iron (dissolved) (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.

Table 20 Groundwater Monitoring Bore A (EP DDH7/GW) Results Jan - Dec 2016

Location	Off-Site Bore A (EP DDH7/GW)												Trigger Levels
Sample Number	01166880014	02166880014	03166880014	04166880014	05166880016	06166880014	07166880014	08166880016	09166880014	10166880014	11166880016	12166880014	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	06/06/16	7/07/16	9/08/16	06/09/16	6/10/16	7/11/16	8/12/16	
Standing Water Level (m)	69.05	69.65	69.04	69.03	69.08	69.11	68.70	67.04	67.12	65.67	66.93	67.43	
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	0.75	
Relative Water Level (m)	68.30	68.90	68.29	68.28	68.33	68.36	67.95	66.29	66.37	64.92	66.18	66.68	
Water level AHD (m)#	955.50	954.90	955.51	955.52	955.47	955.44	955.85	957.51	957.43	958.88	957.62	957.12	954.40
pH	---	---	6.57	---	---	6.65	---	---	---	---	8.08	7.79	6.5 to 8.0
Conductivity (µS/cm)	---	---	234	---	---	241	---	---	---	---	2650	1648	326
Temperature (°C)	---	---	17.0	---	---	14.0	---	---	---	---	19.0	17	
TDS (mg/L)	---	---	159	---	---	134	---	---	---	---	646	586	
Bicarbonate Alkalinity (mg/L)	---	---	79	---	---	96	---	---	---	---	987	775	
Total Alkalinity (mg/L CaCO ₃)	---	---	79	---	---	96	---	---	---	---	987	775	
Sulphate (mg/L)	---	---	5	---	---	4	---	---	---	---	4	11	
Chloride (mg/L)	---	---	5	---	---	5	---	---	---	---	127	81	
Calcium (mg/L)	---	---	18	---	---	18	---	---	---	---	44	42	
Magnesium (mg/L)	---	---	7	---	---	7	---	---	---	---	18	19	
Sodium (mg/L)	---	---	4	---	---	4	---	---	---	---	68	56	
Potassium (mg/L)	---	---	11	---	---	10	---	---	---	---	73	62	
Arsenic (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	---	---	0.002	0.003	
Cadmium (dissolved) (mg/L)	---	---	0.0006	---	---	0.0003	---	---	---	---	<0.0001	<0.0001	
Chromium (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	---	---	<0.001	<0.001	
Copper (dissolved) (mg/L)	---	---	0.001	---	---	<0.001	---	---	---	---	<0.001	<0.001	
Lead (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	---	---	<0.001	<0.001	
Nickel (dissolved) (mg/L)	---	---	0.003	---	---	<0.001	---	---	---	---	0.001	0.002	
Zinc (dissolved) (mg/L)	---	---	0.212	---	---	0.062	---	---	---	---	0.007	0.007	
Iron (dissolved) (mg/L)	---	---	<0.05	---	---	<0.05	---	---	---	---	<0.05	0.1	

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 C (EP PDH1/GW) Results Jan - Dec 2016

Location	Off-Site Bore C (EP PDH1/GW)													
Sample Number	01166880014	02166880014	03166880014	04166880014	05166880016	06166880014	07166880014	08166880016	09166880014	10166880014	11166880016	12166880016	Trigger Levels	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	06/06/16	7/07/16	9/08/16	06/09/16	6/10/16	7/11/16	8/12/16		
Standing Water Level (m)	75.51	75.20	75.26	75.12	75.37	75.31	74.98	74.44	Inaccessible	Inaccessible	73.23	73.23		
Standpipe Height (m)	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74			0.74	0.74		
Relative Water Level (m)	74.77	74.46	74.52	74.38	74.63	74.57	74.24	73.70			72.49	72.49		
Water level AHD (m)#	892.73	893.04	892.98	893.12	892.87	892.93	893.26	893.80			895.01	895.01		889.25
pH	---	---	6.60	---	---	6.88	---	---			6.92	6.22		6.9 to 8.0
Conductivity (µS/cm)	---	---	285	---	---	331	---	---			162	184		490
Temperature (°C)	---	---	19.5	---	---	17.2	---	---			19.5	19		
TDS (mg/L)	---	---	184	---	---	166	---	---			104	85		
Bicarbonate Alkalinity (mg/L)	---	---	124	---	---	152	---	---			48	51		
Total Alkalinity (mg/L CaCO ₃)	---	---	124	---	---	152	---	---			48	51		
Sulphate (mg/L)	---	---	1	---	---	<1	---	---			7	6		
Chloride (mg/L)	---	---	5	---	---	5	---	---			15	13		
Calcium (mg/L)	---	---	32	---	---	34	---	---			14	11		
Magnesium (mg/L)	---	---	12	---	---	11	---	---	5	4				
Sodium (mg/L)	---	---	4	---	---	4	---	---	8	8				
Potassium (mg/L)	---	---	12	---	---	12	---	---	5	5				
Arsenic (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	<0.001				
Cadmium (dissolved) (mg/L)	---	---	<0.0001	---	---	0.0002	---	---	0.0009	0.0002				
Chromium (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	<0.001				
Copper (dissolved) (mg/L)	---	---	0.014	---	---	<0.001	---	---	<0.001	<0.001				
Lead (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	<0.001				
Nickel (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	0.008	0.008				
Zinc (dissolved) (mg/L)	---	---	0.025	---	---	0.02	---	---	0.033	0.045				
Iron (dissolved) (mg/L)	---	---	<0.05	---	---	<0.05	---	---	0.06	0.98				

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 D (EP DDH4/GW) Results Jan - Dec 2016

Location	Off-Site Bore D (EP DDH4/GW)													
Sample Number	01166880017	02166880019	03166880017	04166880017	05166880019	06166880017	07166880017	08166880019	09166880017	10166880017	11166880019	12166880017	Trigger Levels	
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	06/06/16	7/07/16	9/08/16	06/09/16	6/10/16	7/11/16	8/12/16		
Standing Water Level (m)	36.53	36.31	36.00	36.94	36.79	36.70	37.64	37.53	Inaccessible	Inaccessible	37.72	37.07		
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	
Relative Water Level (m)	35.82	35.60	35.29	36.23	36.08	35.99	36.93	36.82			37.01	36.36		
Water level AHD (m)#	942.68	942.90	943.21	942.27	942.42	942.51	941.57	941.68			941.49	942.14	940.61	
pH	---	---	<i>6.40</i>	---	---	6.91	---	---			6.51	6.75	6.8 to 8.0	
Conductivity (µS/cm)	---	---	371	---	---	401	---	---			316	417	608	
Temperature (°C)	---	---	17.8	---	---	14.4	---	---			17.0	16.5		
TDS (mg/L)	---	---	239	---	---	243	---	---			233	155		
Bicarbonate Alkalinity (mg/L)	---	---	109	---	---	155	---	---			133	151		
Total Alkalinity (mg/L)	---	---	109	---	---	155	---	---			133	151		
Sulphate (mg/L)	---	---	22	---	---	19	---	---			22	28		
Chloride (mg/L)	---	---	9	---	---	10	---	---			13	16		
Calcium (mg/L)	---	---	4	---	---	5	---	---			3	5		
Magnesium (mg/L)	---	---	1	---	---	1	---	---			1	2		
Sodium (mg/L)	---	---	60	---	---	65	---	---			68	72		
Potassium (mg/L)	---	---	5	---	---	6	---	---			5	9		
Arsenic (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---			<0.001	<0.001		
Cadmium (dissolved) (mg/L)	---	---	0.0007	---	---	0.0009	---	---			0.0015	0.0001		
Chromium (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---			<0.001	<0.001		
Copper (dissolved) (mg/L)	---	---	0.01	---	---	0.002	---	---			0.001	0.005		
Lead (dissolved) (mg/L)	---	---	<0.001	---	---	<0.001	---	---	<0.001	<0.001				
Nickel (dissolved) (mg/L)	---	---	0.003	---	---	0.005	---	---	0.005	0.006				
Zinc (dissolved) (mg/L)	---	---	0.339	---	---	0.624	---	---	0.179	0.107				
Iron (dissolved) (mg/L)	---	---	<0.05	---	---	<0.05	---	---	0.42	0.16				

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 E (EP PDH7/GW) Results Jan - Dec 2016

Location	Off-Site Bore E (EP PDH7/GW)													
	01166880018	02166880020	03166880018	04166880018	05166880020	04166880019								
Sample Number														
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Date Sampled	11/01/201	09/02/201	08/03/201		05/05/201								Trigger Levels	
Standing Water Level (m)	15.6	16.35	16.05		15.6									
Standpipe Height (m)	0.73	0.73	0.73		0.73									
Relative Water Level (m)	14.87	15.62	15.32		14.87									
Water level AHD (m)#	940.03	939.28	939.58		940.03									938.43
pH	---	---	5.41		---									5.5 to 8.0
Conductivity (µS/cm)	---	---	121		---									151
Temperature (°C)	---	---	15.0		---									
TDS (mg/L)	---	---	54		---									
Bicarbonate Alkalinity (mg/L)	---	---	18		---									
Total Alkalinity (mg/L)	---	---	18		---									
Sulphate (mg/L)	---	---	6	Inaccessible	---	Inaccessible	Inaccessible	Inaccessible	Inaccessible	Inaccessible	Inaccessible	Inaccessible		
Chloride (mg/L)	---	---	8		---									
Calcium (mg/L)	---	---	1		---									
Magnesium (mg/L)	---	---	2		---									
Sodium (mg/L)	---	---	6		---									
Potassium (mg/L)	---	---	5		---									
Arsenic (dissolved) (mg/L)	---	---	<0.001		---									
Cadmium (dissolved) (mg/L)	---	---	<0.0001		---									
Chromium (dissolved) (mg/L)	---	---	<0.001		---									
Copper (dissolved) (mg/L)	---	---	0.003		---									
Lead (dissolved) (mg/L)	---	---	<0.001		---									
Nickel (dissolved) (mg/L)	---	---	0.001		---									
Zinc (dissolved) (mg/L)	---	---	0.022		---									
Iron (dissolved) (mg/L)	---	---	0.55		---									

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 PDH3/GW Results Jan - Dec 2016

Location	Enhance Place Bore EP PDH3/GW												
Sample Number	01166880011	02166880013	03166880011	04166880011	05166880013	06166880011	07166880011	08166880013	09166880011	10166880011	11166880013	12166880011	Trigger Level
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	06/06/16	7/07/16	9/08/16	06/09/16	6/10/16	7/11/16	8/12/16	
Standing Water Level (m)	23.79	23.81	23.78	23.7	23.8	23.78	23.76	23.72	23.73	23.72	23.8	23.74	
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 Water Level (m)	23.07	23.09	23.06	22.98	23.08	23.06	23.04	23.00	23.01	23.00	23.08	23.02	
Water Level AHD (m)#	892.93	892.91	892.94	893.02	892.92	892.94	892.96	893.00	892.99	893.00	892.92	892.98	

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 25 Groundwater Monitoring Bore - EP PDH4/GW Results Jan - Dec 2016

Location	Enhance Place Bore EP PDH4/GW												
Sample Number	01166880012	02166880014	03166880012	04166880012	05166880012	06166880012	07166880012	08166880014	09166880012	10166880012	11166880014	12166880012	Trigger Level
Sampling Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	06/06/16	7/07/16	9/08/16	06/09/16	6/10/16	7/11/16	8/12/16	
Standing Water Level (m)	23.23	23.26	23.2	23.26	23.24	23.25	23.15	23.19	23.2	23.2	23.22	23.23	
Standpipe Height	0.2	0.2	0.2	0.1	0.2	0.15	0.2	0.2	0.1	0.2	0.2	0.2	
Relative Water Level (m)	23.03	23.06	23.00	23.16	23.04	23.10	22.95	22.99	23.10	23.00	23.02	23.03	
Water Level AHD (m)#	893.05	893.02	893.08	892.92	893.04	892.98	893.13	893.09	892.98	893.08	893.06	893.05	

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.

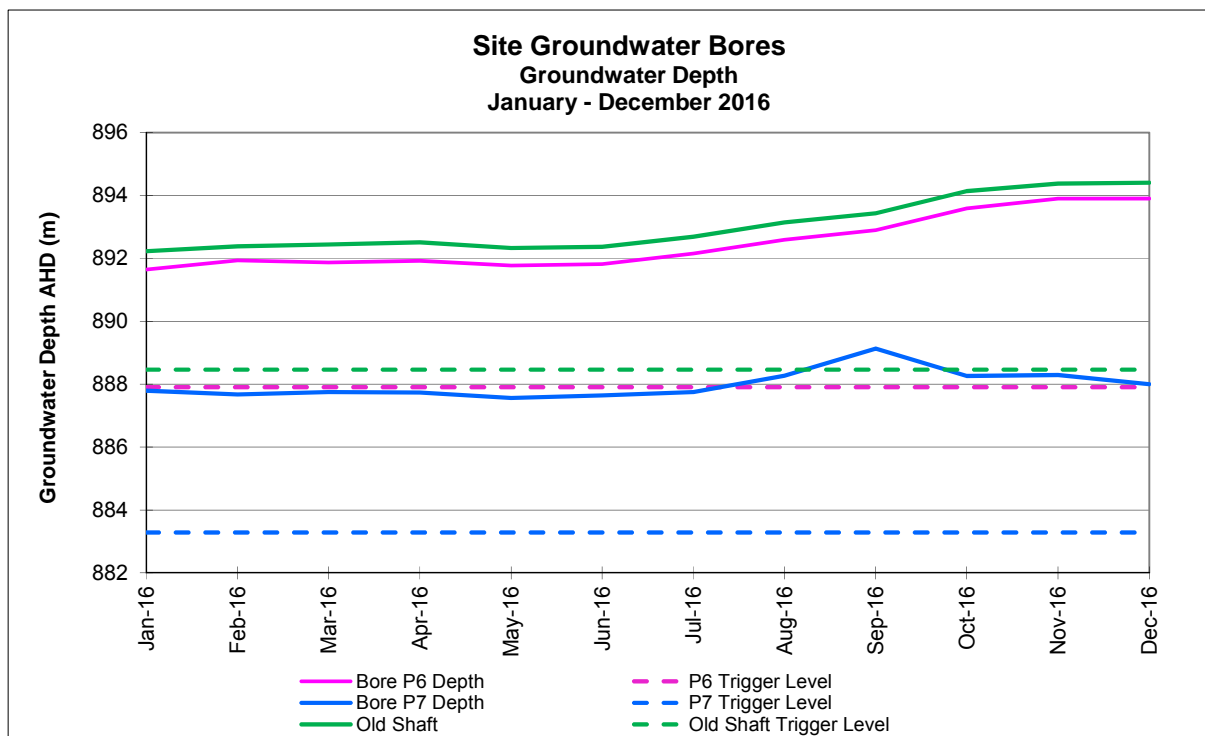


Figure 4 Onsite Groundwater Monitoring Bore Depths 2016

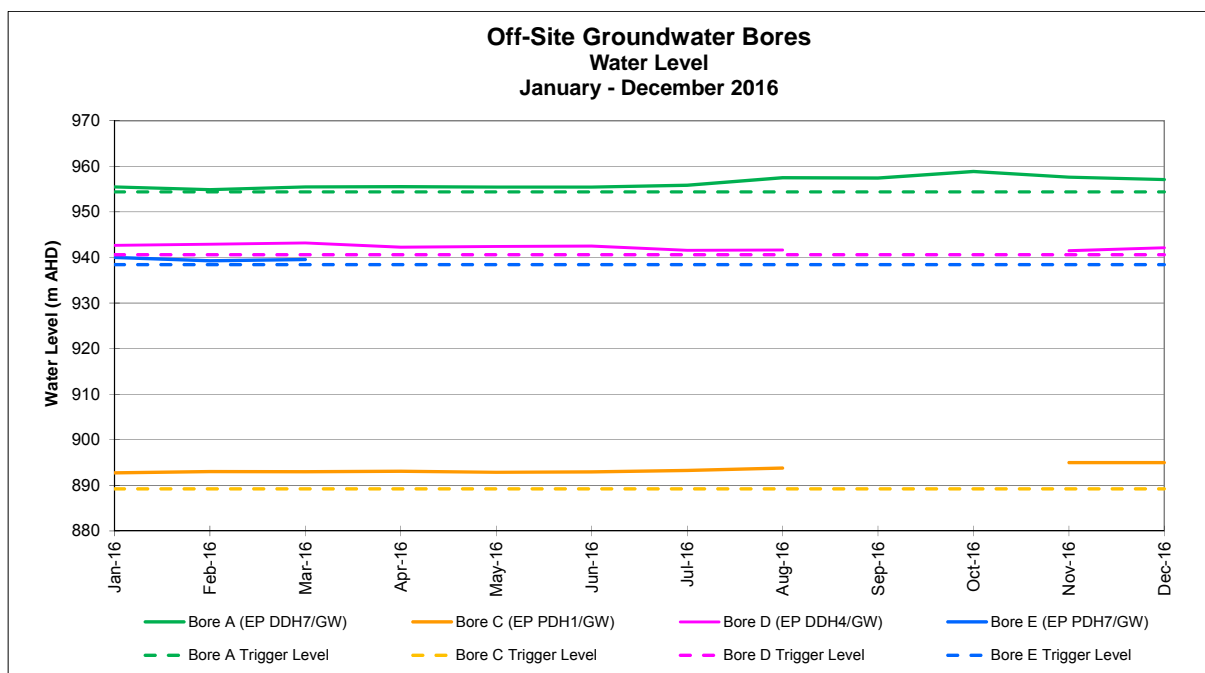


Figure 5 Off-Site Groundwater Monitoring Bore Depths 2016

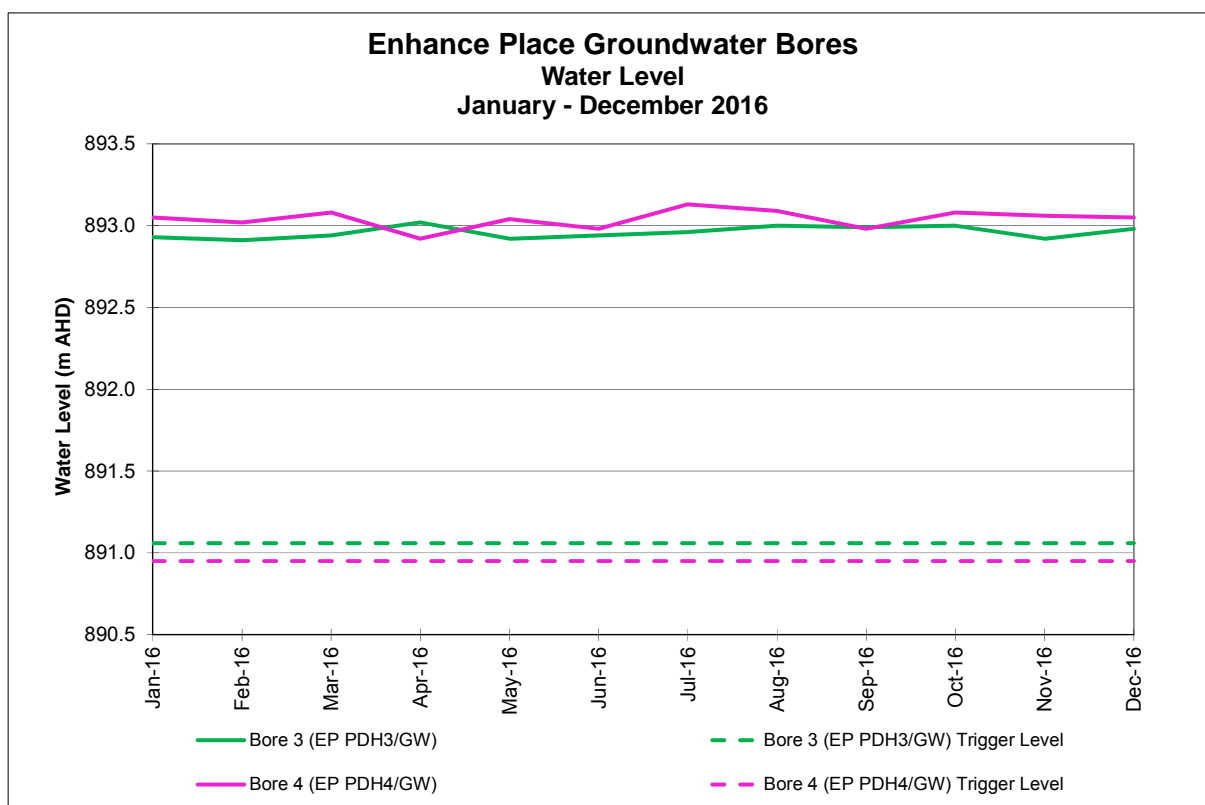


Figure 6 Enhance Place Groundwater Monitoring Bore Depth 2016

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 2016 period generally show water quality results which are consistent throughout the monitoring period. There were no instances during the 2016 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 2016 monitoring period. The pH at Bore P6 ranged between 5.62 and 7.19 pH units and dropped below the lower pH trigger level (6.2 pH units) during three of the twelve monitoring events. The pH at Bore P7 ranged between 5.87 and 6.46 pH units and was below the lower pH trigger level (6.3 pH units) during three of the twelve monitoring events. The pH at Old Shaft was below the lower pH trigger value of 6.3 pH units during every monitoring event in 2016 with pH levels varying between 5.49 pH units and 6.20 pH units. During 2016 there were no instances where the upper level pH trigger levels were exceeded at any of the onsite groundwater bores. The pH at the Bong ranged between 5.42 and 7.56 pH units during 2016, with one monitoring event in May 2016 reporting below the lower pH trigger level of 5.8pH units.

The electrical conductivity levels at the site bores have also intermittently exceeded their respective conductivity trigger levels throughout the January – December 2016 monitoring period with the exception of the Bong which was compliant throughout. Bore P6 exceeded the conductivity trigger level of 1180 $\mu\text{S}/\text{cm}$ during six monitoring events; P7 exceeded its trigger level of 852 $\mu\text{S}/\text{cm}$ during three monitoring events; whilst the Old Shaft exceeded the 908 $\mu\text{S}/\text{cm}$ trigger level continuously throughout the 2016 monitoring period.

Following exceedances at the Old Shaft sampling well and in accordance with the site's Water Management Plan, an internal investigative report was compiled following the end of the 2015 monitoring period (Ref [1]). It is considered that the findings of the investigation are still likely attributing to the exceedances observed during this monitoring period and these factors could be related to the non-conformances reported within the other site bores.

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 intermittently compliant with the respective pH trigger levels with the following exceptions which were reported to be below the lower trigger value; Bore A during November 2016; Bore C during March, and December; and Bore D during March, and November 2016. Electrical conductivity levels were below the respective conductivity trigger levels for all off-site bores during the 2016 monitoring period with the exception of Bore A during November and December 2016.

All off-site bores exhibited standing water levels which were consistent throughout the 2016 monitoring period and compliant with their respective trigger levels.

It is noted that the quarterly monitoring scheduled for September was delayed until November 2016 at Site C, D and E due to inclement weather conditions that caused felled trees which blocked access to the bores. Bore A was accessible during September; however the collection of a water sample was delayed to maintain consistency the other offsite bores. The inclement weather damaged the bridge which was required to access Bore E and therefore the site has been, and will be, inaccessible until it has been repaired.

4.3.3 ENHANCE PLACE GROUNDWATER BORES

The two monitoring bores located at the former Enhance Place mine exhibited stable standing water levels throughout the 2016 monitoring period. Standing water levels at Bore 3 (EP PDH3) fluctuated by 0.11m through the year, whilst Bore 4 (EP PDH4) fluctuated by 0.21m.

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 26 EPL Surface Water Assessment Criteria

Surface Water Site	pH (range)	Electrical Conductivity ($\mu\text{S}/\text{cm}$)	Total Suspended Solids (mg/L)	Oil and Grease (mg/L)
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 2016, 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 2016 monitoring period.

Surface water summary results for the period January – December 2016 are shown in **Tables 26 to 36**. Graphical presentations are shown in **Figures 7 to 11**.

Table 27 Surface Water Monitoring Location EPL Point 2 Results 2016

Location	EPL Point 2				Trigger Values
Sample No	02166880009	05166880009	08166880009	11166880009	
Sampling Month	Feb	May	Aug	Nov	
Date Sampled	09/02/16	05/05/16	09/08/16	07/11/16	
Time Sampled	13:10	12:05	11:58	12:46	
pH (pH units)	6.62	7.07	7.28	6.81	
Conductivity ($\mu\text{S}/\text{cm}$)	1044	1285	424	363	2055
TSS (mg/L)	<5	<5	13	<5	30
Sulphate (mg/L)	424	710	125	85	
Iron filterable (mg/L)	0.17	0.13	<0.05	<0.05	
Turbidity (NTU)	2	2	33	19	

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

Table 28 Surface Water Monitoring Location EPL Point 3 Results 2016

Location	EPL Point 3				Trigger Values
Sample No	02166880004	05166880004	08166880003	11166880004	
Sampling Month	Feb	May	Aug	Nov	
Date Sampled	09/02/16	05/05/16	09/08/16	07/11/16	
Time Sampled	15:22	10:27	15:15	14:12	
pH (pH units)	7.55	6.35	7.24	7.25	6.4 – 8.0
Conductivity ($\mu\text{S/cm}$)	1499	1950	1790	<i>2500</i>	2223
TSS (mg/L)	<5	7	11	7	30
Sulphate (mg/L)	814	1840	766	1020	
Iron filterable (mg/L)	0.35	0.17	0.26	0.09	
Turbidity (NTU)	6	4	14	11	

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

Table 29 Surface Water Monitoring Location EPL Point 14 Results 2016

Location	EPL Point 14				Trigger Values
Sample No	02166880010	05166880010	08166880010	11166880010	
Sampling Month	Feb	May	Aug	Nov	
Date Sampled	09/02/2016	05/05/2016	09/08/2016	07/11/2016	
Time Sampled	10:22	09:52	09:23	12:46	
pH (pH units)	<i>8.38</i>	7.45	<i>8.22</i>	<i>8.08</i>	7.5 – 8.0
Conductivity ($\mu\text{S/cm}$)	<i>1241</i>	1150	979	865	1166
TSS (mg/L)	<5	10	24	<5	30
Sulphate (mg/L)	95	174	162	94	
Iron filterable (mg/L)	<0.05	<0.05	0.06	0.1	
Turbidity (NTU)	3	4	19	5	

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

Table 30 Surface Water Monitoring Location S1 Results 2016

Location	Surface Water S1												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01166880002	02166880002	03166880002	04166880002	05166880002	06166880002	07166880002	08166880002	09166880002	10166880002	11166880002	12166880002	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	6/06/16	7/07/16	9/08/16	6/09/16	6/10/16	7/11/16	8/12/16	
Time Sampled	9:13	13:04	14:42	10:42	12:00	13:32	14:18	12:07	10:21	11:14	12:45	10:51	
Temperature (°C)	18.0	19.5	21.0	19.0	14.4	9.6	7.5	9.0	11.5	11.8	19.5	20.5	
pH	7.12	7.03	7.20	6.60	5.82	6.84	7.19	7.19	6.85	6.99	6.59	7.44	6.2 – 8.0
Conductivity (µS/cm)	1124	1598	2750	2773	1981	1123	1935	1829	1000	1115	2520	1504	2325
Turbidity (NTU)	2	3	3	3	4	114	2	14	122	11	12	2	30
Dissolved Oxygen (mg/L)	---	9.3	---	---	10.7	---	---	21.5	---	---	8.7	---	10
TSS (mg/L)	---	<5	---	---	7	---	---	11	---	---	6	---	
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<5	---	
Bicarbonate Alkalinity (mg/L)	---	66	---	---	58	---	---	68	---	---	70	---	
Total Alkalinity (mg/L)	---	66	---	---	58	---	---	68	---	---	70	---	
Sulphate (mg/L)	---	796	---	---	1910	---	---	773	---	---	1040	---	
Chloride (mg/L)	---	125	---	---	348	---	---	155	---	---	181	---	
Calcium (mg/L)	---	93	---	---	261	---	---	116	---	---	120	---	
Magnesium (mg/L)	---	72	---	---	185	---	---	82	---	---	93	---	
Sodium (mg/L)	---	198	---	---	559	---	---	280	---	---	327	---	
Potassium (mg/L)	---	13	---	---	48	---	---	21	---	---	26	---	
Cobalt (dissolved) (mg/L)	---	0.004	---	---	0.063	---	---	0.026	---	---	0.015	---	
Manganese(dissolved) (mg/L)	---	1.1	---	---	3.34	---	---	1.89	---	---	1.410	---	
Nickel (dissolved) (mg/L)	---	0.042	---	---	0.358	---	---	0.176	---	---	0.180	---	
Zinc (dissolved) (mg/L)	---	0.019	---	---	0.178	---	---	0.097	---	---	0.070	---	
Iron (dissolved) (mg/L)	---	0.13	---	---	0.11	---	---	0.09	---	---	<0.05	---	

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

--- Indicates no sampling required during particular period.

Table 31 Surface Water Monitoring Location S2 Results 2016

Location	Surface Water Site S2											
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sample Number	01166880003	02166880003	03166880003	0416880003	05166880003	06166880003	07166880003	08166880003	09166880003	10166880003	11166880003	12166880003
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	6/06/16	7/07/16	9/08/16	6/09/16	6/10/16	7/11/16	8/12/16
Time Sampled	9:03	13:10	12:59	9:53	10:31	14:45	15:43	15:05	10:32	9:01	14:06	9:15
Depth to Surface from Top of Rail Bridge (m)	3.76	3.76	3.74	3.71	3.72	3.73	3.70	3.71	3.64	3.70	3.72	3.73

Table 32 Surface Water Monitoring Location S3 Results 2016

Location	Surface Water S3												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01166880004	12156880004	01166880005	04166880004	05166880004	06166880004	07166880004	08166880004	09166880004	10166880004	11166880004	12166880004	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	6/06/16	7/07/16	9/08/16	6/09/16	6/10/16	7/11/16	8/12/16	
Time Sampled	9:58	15:22	14:50	9:49	10:27	14:50	15:45	15:15	10:30	10:21	14:12	11:58	
Temperature (°C)	19.6	24.0	25.5	15.0	14.1	9.6	8.0	10.0	10.8	11.8	20.5	20.5	
pH	7.14	7.55	7.19	6.87	6.35	6.98	7.29	7.24	6.93	7.09	7.25	7.51	6.4 – 8.0
Conductivity (µS/cm)	1097	1499	<i>2627</i>	<i>2750</i>	1950	1161	1889	1790	979	1088	<i>2500</i>	1522	2223
Turbidity (NTU)	4	6	3	3	4	109	16	14	121	13	11	4	30
Dissolved Oxygen (mg/L)	---	9.2	---	---	10.9	---	---	22.3	---	---	7.8	---	10
TSS (mg/L)	---	<5	---	---	7	---	---	11	---	---	7	---	
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<5	---	
Bicarbonate Alkalinity (mg/L)	---	43	---	---	57	---	---	63	---	---	69	---	
Total Alkalinity (mg/L)	---	43	---	---	57	---	---	63	---	---	69	---	
Sulphate (mg/L)	---	814	---	---	1840	---	---	766	---	---	1020	---	
Chloride (mg/L)	---	118	---	---	339	---	---	148	---	---	176	---	
Calcium (mg/L)	---	93	---	---	258	---	---	118	---	---	122	---	
Magnesium (mg/L)	---	70	---	---	177	---	---	80	---	---	94	---	
Sodium (mg/L)	---	189	---	---	539	---	---	269	---	---	326	---	
Potassium (mg/L)	---	13	---	---	48	---	---	21	---	---	26	---	
Cobalt (dissolved) (mg/L)	---	0.014	---	---	0.06	---	---	0.027	---	---	0.017	---	
Manganese(dissolved) (mg/L)	---	2.04	---	---	3.28	---	---	2.09	---	---	1.55	---	
Nickel (dissolved) (mg/L)	---	0.056	---	---	0.347	---	---	0.171	---	---	0.183	---	
Zinc (dissolved) (mg/L)	---	0.048	---	---	0.164	---	---	0.098	---	---	0.083	---	
Iron (dissolved) (mg/L)	---	0.35	---	---	0.17	---	---	0.26	---	---	0.09	---	

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 S4 Results 2016

Location	Surface Water S4												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01166880005	02166880005	03166880005	04166880005	05166880005	06166880005	07166880005	08166880005	09166880005	10166880005	11166880005	12166880005	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	6/06/16	7/07/16	9/08/16	6/09/16	6/10/16	7/11/16	8/12/16	
Time Sampled	12:13	14:10	15:41	13:04	13:15	14:22	15:27	14:08	12:20	9:35	13:50	11:38	
Temperature (°C)	19.5	21.5	23.5	19.0	12.0	9.0	8.0	9.0	15.0	9.8	18.0	21.0	
pH	7.96	8.06	7.89	7.77	7.71	7.68	7.93	7.89	7.33	7.42	7.29	7.57	7.3 – 8.0
Conductivity (µS/cm)	852	961	891	1058	919	487	339	313	214	178	294	396	957
Turbidity (NTU)	10	13	23	14	7	21	7	4	9	5	11	14	30
Dissolved Oxygen (mg/L)	---	7.8	---	---	10.7	---	---	23.5	---	---	7.6	---	10
TSS (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---	
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<5	---	
Bicarbonate Alkalinity (mg/L)	---	472	---	---	519	---	---	140	---	---	131	---	
Total Alkalinity (mg/L)	---	481	---	---	520	---	---	140	---	---	131	---	
Sulphate (mg/L)	---	5	---	---	15	---	---	16	---	---	6	---	
Chloride (mg/L)	---	4	---	---	11	---	---	9	---	---	6	---	
Calcium (mg/L)	---	19	---	---	20	---	---	8	---	---	10	---	
Magnesium (mg/L)	---	14	---	---	18	---	---	6	---	---	6	---	
Sodium (mg/L)	---	149	---	---	177	---	---	41	---	---	42	---	
Potassium (mg/L)	---	24	---	---	36	---	---	10	---	---	9	---	
Cobalt (dissolved) (mg/L)	---	<0.001	---	---	<0.001	---	---	<0.001	---	---	<0.001	---	
Manganese(dissolved) (mg/L)	---	0.013	---	---	0.006	---	---	0.006	---	---	0.027	---	
Nickel (dissolved) (mg/L)	---	0.002	---	---	0.001	---	---	<0.001	---	---	0.002	---	
Zinc (dissolved) (mg/L)	---	<0.005	---	---	<0.005	---	---	<0.005	---	---	<0.005	---	
Iron (dissolved) (mg/L)	---	0.25	---	---	0.16	---	---	0.23	---	---	0.28	---	

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 S5 Results 2016

Location	Surface Water S5												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01166880006	02166880006	03166880006	04166880006	05166880006	06166880006	07166880006	08166880006	09166880006	10166880006	11166880006	12166880006	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	6/06/16	7/07/16	9/08/16	6/09/16	6/10/16	7/11/16	8/12/16	
Time Sampled	12:08	14:22	15:38	12:59	13:20	14:26	15:30	14:15	12:25	9:31	13:45	11:42	
Temperature (°C)	23.6	23.0	25.5	19.5	16.8	9.8	9.0	10.0	18.0	11.8	21.0	23.0	
pH	7.21	7.50	7.25	<i>6.85</i>	<i>6.93</i>	7.35	7.00	<i>6.92</i>	<i>6.64</i>	<i>6.86</i>	<i>6.70</i>	<i>6.90</i>	7.0 – 8.0
Conductivity (µS/cm)	<i>1095</i>	<i>1327</i>	<i>1303</i>	<i>1310</i>	<i>1438</i>	<i>1250</i>	<i>1241</i>	937	769	657	607	1320	1013
Turbidity (NTU)	3	2.18	3	10	18	44	12	22	73	14	31	3	30
Dissolved Oxygen (mg/L)	---	8.7	---	---	9.9	---	---	21.3	---	---	7.3	---	10
TSS (mg/L)	---	<5	---	---	<5	---	---	10	---	---	9	---	
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<5	---	
Bicarbonate Alkalinity (mg/L)	---	126.0	---	---	87.0	---	---	81	---	---	80	---	
Total Alkalinity (mg/L)	---	126	---	---	87	---	---	81	---	---	80	---	
Sulphate (mg/L)	---	492	---	---	876	---	---	312	---	---	205	---	
Chloride (mg/L)	---	55	---	---	138	---	---	50	---	---	32	---	
Calcium (mg/L)	---	65	---	---	136	---	---	52	---	---	30	---	
Magnesium (mg/L)	---	45	---	---	90	---	---	34	---	---	21	---	
Sodium (mg/L)	---	148	---	---	241	---	---	107	---	---	66	---	
Potassium (mg/L)	---	16	---	---	27	---	---	12	---	---	10	---	
Cobalt (dissolved) (mg/L)	---	0.013	---	---	0.042	---	---	0.016	---	---	0.003	---	
Manganese(dissolved) (mg/L)	---	1.29	---	---	2.42	---	---	1.07	---	---	0.39	---	
Nickel (dissolved) (mg/L)	---	0.065	---	---	0.167	---	---	0.08	---	---	0.029	---	
Zinc (dissolved) (mg/L)	---	0.075	---	---	0.136	---	---	0.073	---	---	0.017	---	
Iron (dissolved) (mg/L)	---	0.11	---	---	0.09	---	---	0.21	---	---	0.27	---	

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

Table 35 Surface Water Monitoring Location S6 Results 2016

Location	Surface Water S6												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01166880007	02166880007	03166880007	04166880007	05166880007	06166880007	07166880007	08166880007	09166880007	10166880007	11166880007	12166880007	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	6/06/16	7/07/16	9/08/16	6/09/16	6/10/16	7/11/16	8/12/16	
Time Sampled	12:03	14:35	15:32	12:56	13:10	14:18	15:26	14:25	12:30	9:25	13:40	11:30	
Temperature (°C)	24.0	25.0	23.5	20.0	14.1	9.8	9.5	11.0	12.5	11.5	24.5	22.0	
pH	7.26	7.47	7.47	7.41	6.98	7.44	7.62	7.41	7.02	7.44	7.08	7.68	6.7 – 8.0
Conductivity (µS/cm)	1358	<i>2369</i>	<i>2541</i>	<i>2708</i>	1898	1060	1813	1766	971	1046	<i>2620</i>	1540	1941
Turbidity (NTU)	1	2	2	2	2	108	10	8	120	12	3	3	30
Dissolved Oxygen (mg/L)	---	8.5	---	---	11.4	---	---	23.5	---	---	8.1	---	10
TSS (mg/L)	---	<5	---	---	6	---	---	10	---	---	<5	---	
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<5	---	
Bicarbonate Alkalinity (mg/L)	---	39	---	---	52	---	---	57	---	---	67	---	
Total Alkalinity (mg/L)	---	39	---	---	52	---	---	57	---	---	67	---	
Sulphate (mg/L)	---	1330	---	---	1870	---	---	773	---	---	1120	---	
Chloride (mg/L)	---	224	---	---	335	---	---	143	---	---	187	---	
Calcium (mg/L)	---	139	---	---	253	---	---	118	---	---	124	---	
Magnesium (mg/L)	---	101	---	---	178	---	---	78	---	---	97	---	
Sodium (mg/L)	---	344	---	---	540	---	---	259	---	---	336	---	
Potassium (mg/L)	---	22	---	---	46	---	---	20	---	---	26	---	
Cobalt (dissolved) (mg/L)	---	0.002	---	---	0.049	---	---	0.033	---	---	0.016	---	
Manganese(dissolved) (mg/L)	---	0.556	---	---	2.770	---	---	2.27	---	---	1.59	---	
Nickel (dissolved) (mg/L)	---	0.063	---	---	0.320	---	---	0.181	---	---	0.172	---	
Zinc (dissolved) (mg/L)	---	0.013	---	---	0.113	---	---	0.109	---	---	0.047	---	
Iron (dissolved) (mg/L)	---	<0.05	---	---	<0.05	---	---	0.22	---	---	<0.05	---	

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

--- Indicates no sampling required during particular period.

Table 36 Surface Water Monitoring Location S7 Results 2016

Location	Surface Water S7												Trigger Levels
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sample Number	01166880008	02166880008	03166880008	04166880008	05166880008	06166880008	07166880008	08166880008	09166880008	10166880008	11166880008	12166880010	
Date Sampled	11/01/16	9/02/16	8/03/16	5/04/16	5/05/16	6/06/16	7/07/16	9/08/16	6/09/16	6/10/16	7/11/16	8/12/16	
Time Sampled	11:57	14:02	15:24	13:37	12:57	14:09	15:16	14:05	12:57	9:15	13:25	11:22	
Temperature (°C)	22.5	23.0	24.3	19.5	12.5	10.0	8.0	9.5	13.7	11.5	19.0	22.0	
pH	7.06	6.97	7.35	7.21	7.11	7.19	6.95	7.01	<i>6.64</i>	6.92	7.02	6.78	6.8 – 8.0
Conductivity (µS/cm)	<i>1067</i>	<i>1269</i>	<i>1272</i>	<i>1338</i>	<i>1381</i>	<i>1422</i>	<i>1368</i>	929	754	651	602	<i>1313</i>	1007
Turbidity (NTU)	171	2	1	3	4	44	7	14	58	11	9	2	30
Dissolved Oxygen (mg/L)	---	7.2	---	---	9.7	---	---	19.7	---	---	5.1	---	10
TSS (mg/L)	---	<5	---	---	<5	---	---	<5	---	---	<5	---	
Oil & Grease (mg/L)	---	<2	---	---	<2	---	---	<2	---	---	<5	---	
Bicarbonate Alkalinity (mg/L)	---	118	---	---	97	---	---	85	---	---	78	---	
Total Alkalinity (mg/L)	---	118	---	---	97	---	---	85	---	---	78	---	
Sulphate (mg/L)	---	485	---	---	785	---	---	311	---	---	191	---	
Chloride (mg/L)	---	56	---	---	116	---	---	48	---	---	31	---	
Calcium (mg/L)	---	61	---	---	126	---	---	52	---	---	30	---	
Magnesium (mg/L)	---	43	---	---	88	---	---	35	---	---	21	---	
Sodium (mg/L)	---	143	---	---	225	---	---	102	---	---	63	---	
Potassium (mg/L)	---	15	---	---	26	---	---	12	---	---	10	---	
Cobalt (dissolved) (mg/L)	---	<0.001	---	---	0.004	---	---	0.009	---	---	0.002	---	
Manganese(dissolved) (mg/L)	---	0.498	---	---	0.829	---	---	0.873	---	---	0.476	---	
Nickel (dissolved) (mg/L)	---	0.023	---	---	0.088	---	---	0.065	---	---	0.025	---	
Zinc (dissolved) (mg/L)	---	0.009	---	---	0.047	---	---	0.063	---	---	0.016	---	
Iron (dissolved) (mg/L)	---	0.19	---	---	0.23	---	---	0.39	---	---	0.33	---	

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

--- Indicates no sampling required during particular period.

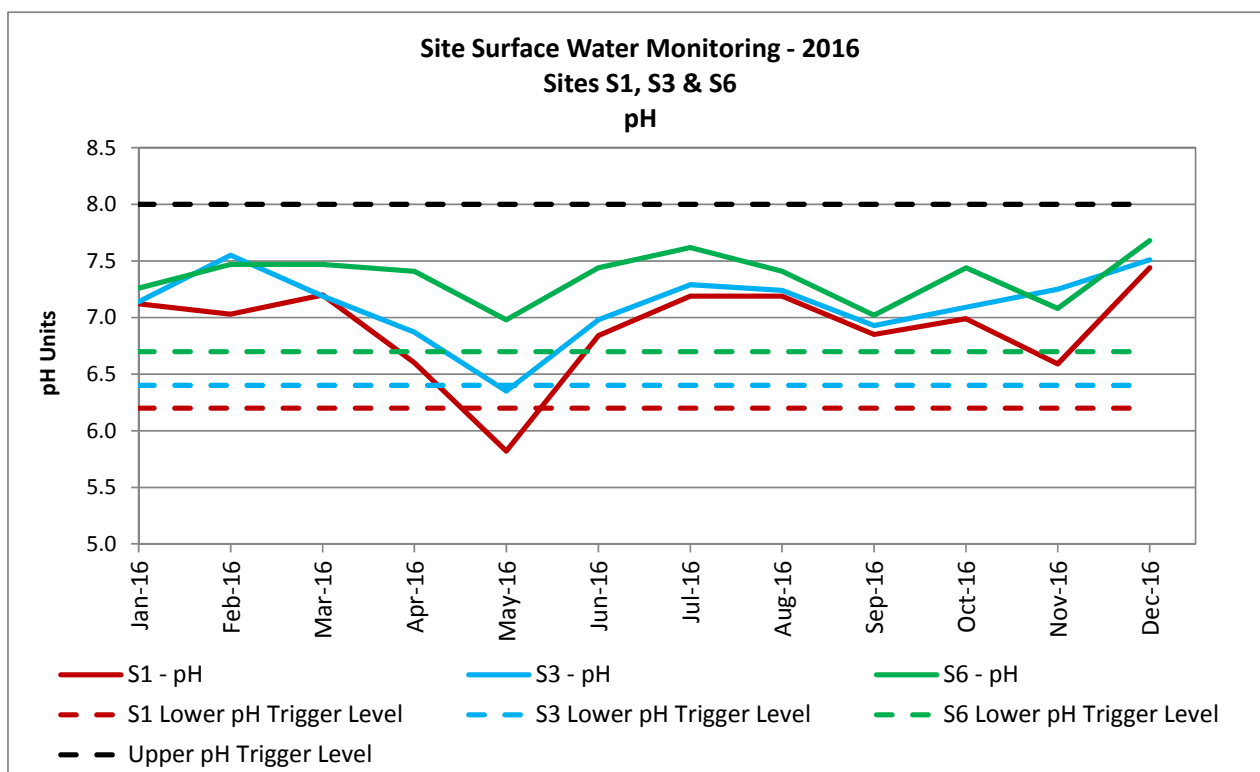


Figure 7 Site Surface Water S1, S3 & S6 pH Results 2016

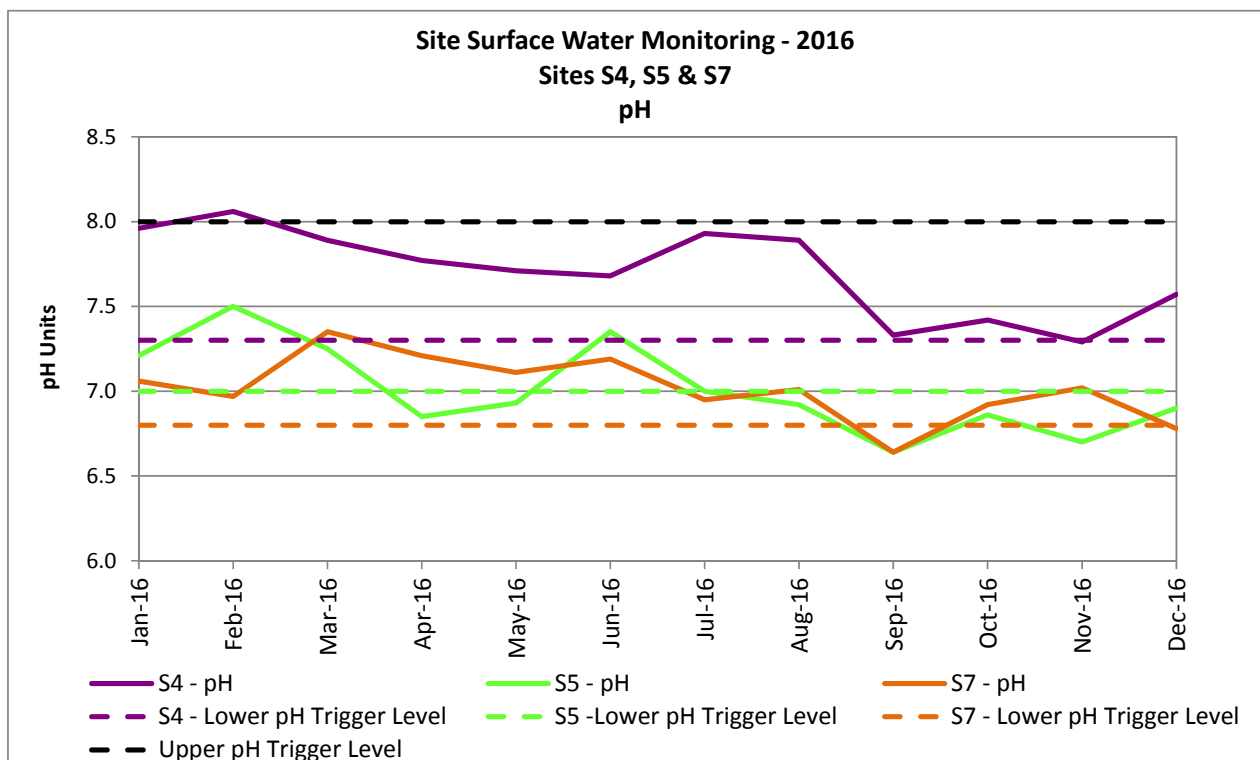


Figure 8 Site Surface Water S4, S5 & S7 pH Results 2016

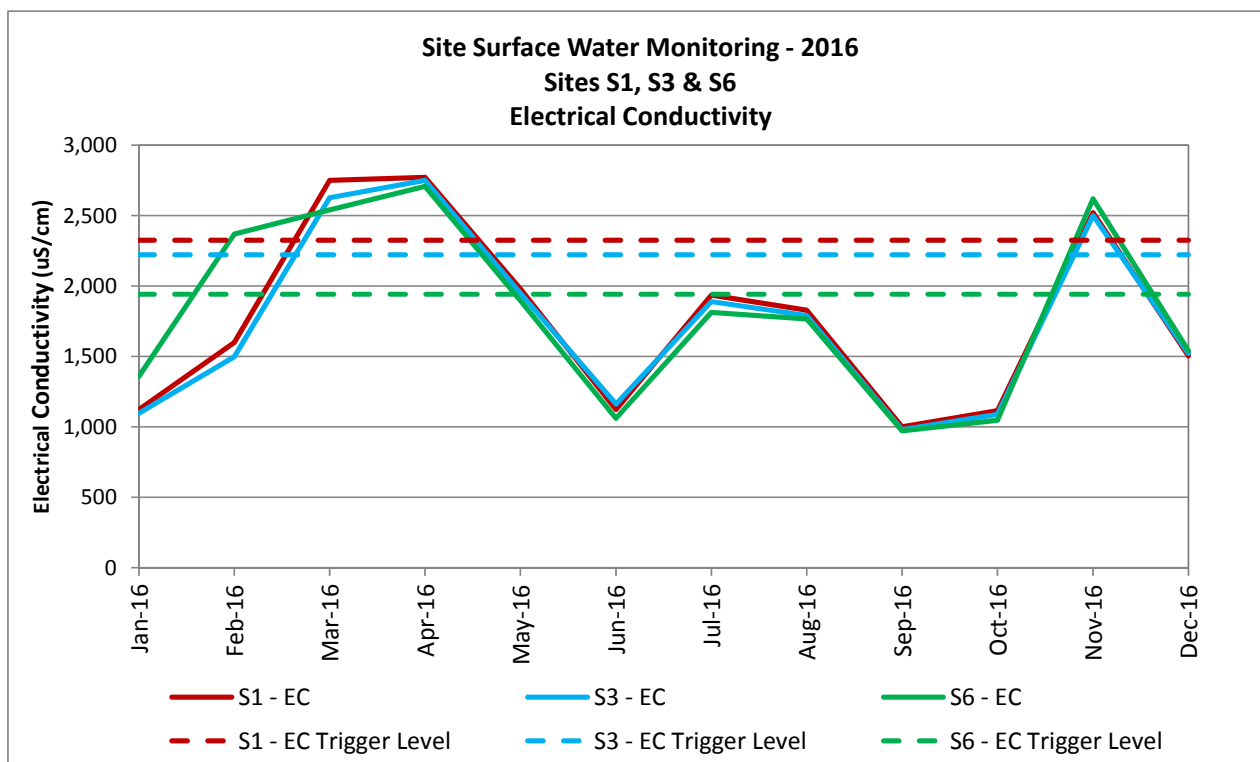


Figure 9 Site Surface Water S1, S3 & S6 Electrical Conductivity Results 2016

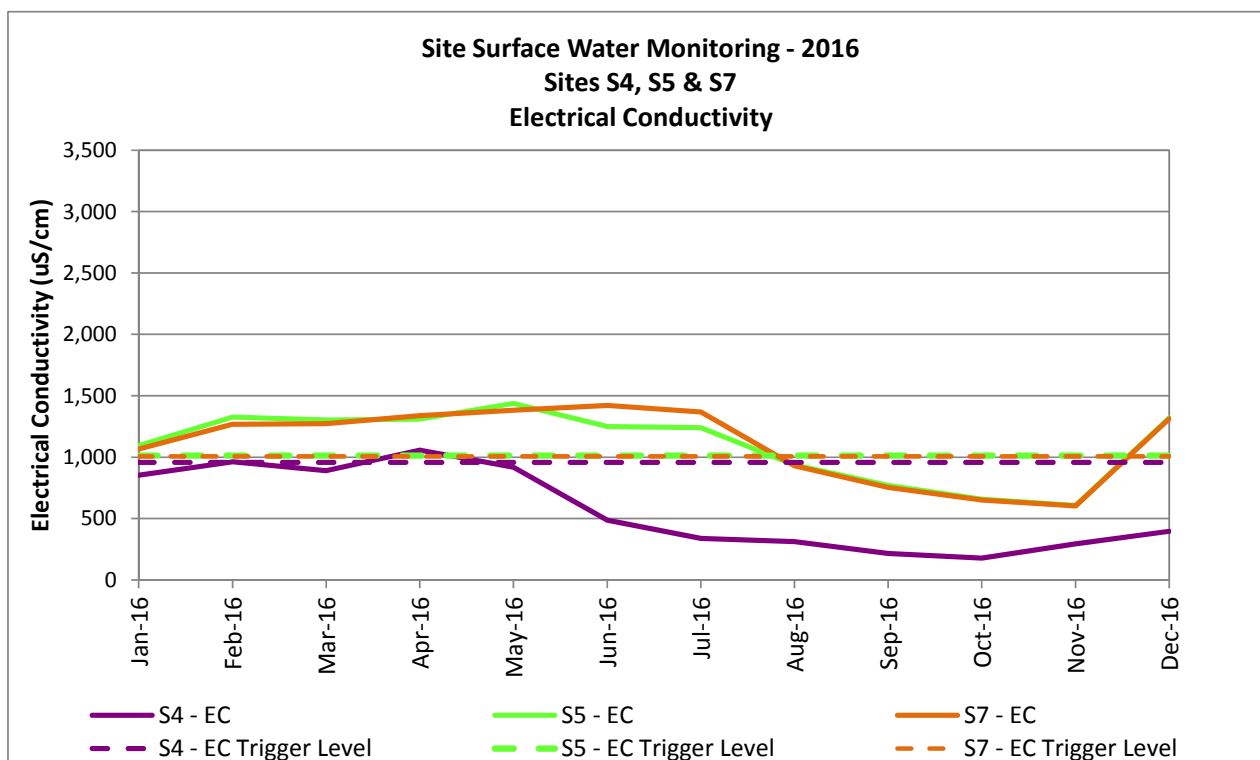


Figure 10 Site Surface Water S4, S5 & S7 Electrical Conductivity Results 2016

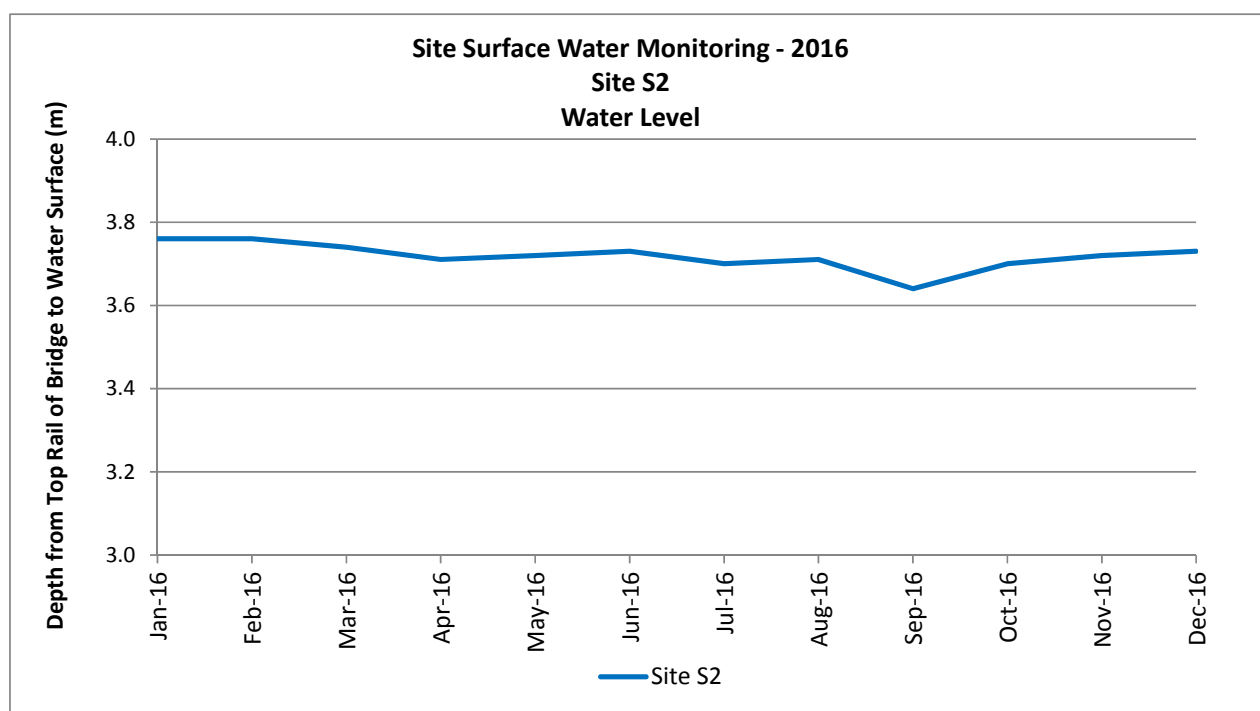


Figure 11 Site Surface Water S2 - Water Level 2016

5.3 REVIEW & INTERPRETATION OF SURFACE WATER MONITORING RESULTS

5.3.1 EPL SURFACE WATERS

During the 2016 monitoring period, four quarterly EPL surface water monitoring events were conducted. These events were conducted during February, May, August and November 2016. The results of the water quality monitoring at the EPL surface water sites are generally compliant with their respective water quality trigger levels. All EPL locations were in compliance with the total suspended solids (TSS) trigger value of 30mg/L, whilst EPL 3 was compliant with the trigger range for pH during all of the 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 November 2016 monitoring events. The pH at surface water site EPL 14 was above of the pH trigger range of 8.0 pH units in February, August and November 2016. The electrical conductivity at site EPL 3 exceeded the trigger level (2223 $\mu\text{S}/\text{cm}$) during the November 2016 monitoring event, whilst site EPL 14 exceeded the trigger level (1166 $\mu\text{S}/\text{cm}$) during the February 2016 monitoring event.

Monitoring at EPL Point 13 was not undertaken during the 2016 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 2016 monitoring period.

During the 2016 monitoring period, S3 and S6 were within the trigger range of pH for the entirety of the year. The pH levels were below the site specific lower trigger levels at S1 in May 2016, S4 in February 2016 and at S7 in September 2016. Much fluctuation was observed at S5, with pH

ranging between 6.64 and 7.50 pH units and the site reporting seven events outside of the site specific trigger range.

Surface water sites S1 and S3 reported electrical conductivity levels above their respective trigger levels during the March, April and November monitoring events. Surface water site S4 reported conductivity levels above the respective trigger level during the February and April monitoring periods; whilst S6 reported conductivity levels above the respective trigger level during the February, March, April and November monitoring periods. Surface water sites S5 and S7 both exceeded the electrical conductivity level between January and July inclusive, whilst S7 also exceeded the trigger level in December 2016.

Overall, during the 2016 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 2016 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 2016 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 2 m height, Rainfall, Humidity, Solar Radiation, Sigma Theta and Evapotranspiration. Details of weather data recorded for the period January to December 2016 are summarised in **Table 38**. Windrose plots for the 2016 period are presented in **Figures 12 and 13**.

Table 38 Meteorological Monitoring Summary Data 2016

Month (2016)	Rainfall (mm)	Cumulative Rainfall (mm)	No. of Rain Days/ Month	Air Temp. @ 2m (°C)			Air Temp. @ 10m (°C)			Sigma theta (°)			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	192.8	192.8	13	19.2	6.5	37.3	18.6	6.7	34.9	32.1	0.0	101	69.6	11.0	96.7	1.4	0.0	14.5	SE
February	37.4	230.2	5	19.6	6.7	34.9	19.0	6.9	33.5	33.3	0.0	102.1	65.4	13.2	96.3	1.1	0.0	13.9	SE
March	116.4	346.6	10	17.9	4.7	34.9	17.4	4.9	33	32.8	0.0	103.1	70.2	15.3	96.8	0.9	0.0	11.5	SE
April	10.8	357.4	9	14.1	1.9	29.3	13.8	2.2	27.9	29.7	0.0	99.8	71.5	12.3	96.0	0.9	0.0	11.2	WNW
May	32.0	389.4	9	9.5	-7.1	26.1	9.6	-7.0	24.8	23.0	0.0	101.9	71.9	8.3	96.0	2.0	0.0	15.4	W
June	212.4	601.8	20	6.3	-6.7	16.3	6.3	-6.7	15.3	24.4	0.0	101.0	82.4	31.9	96.3	2.1	0.0	15.1	NW
July	118.4	720.2	19	6.4	-7.1	18.1	6.3	-7.0	17.3	23.9	0.0	103.6	79.4	34.9	96.8	2.1	0.0	19.4	NW
August	67.8	788.0	12	6.2	-5.9	19.4	6.1	-5.8	18.1	24.1	0.0	99.0	75.5	17.9	96.0	1.4	0.0	15.3	NW
September	140.0	928.0	20	9.3	-1.7	22	9.1	-1.6	20.2	23.0	0.0	97.3	76.9	23.3	96.4	2.0	0.0	20.7	NW
October	88.4	1016.4	11	11.6	-2.4	26.8	11.3	-2.4	25.4	23.3	0.0	97.7	65.0	18.0	95.8	2.5	0.0	14.9	WNW
November	63.6	1080.0	8	15.7	-0.3	32.2	15.2	-0.3	30.5	26.4	0.0	103.1	60.7	10.2	96.5	1.9	0.0	15.7	WNW
December	87.6	1167.6	11	19.6	3.6	35.3	19.0	3.8	33.0	28.7	0.0	102.6	65.2	13.7	95.6	1.7	0.0	13.1	NW
TOTAL	1167.6	-	147	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	10.8	-	5	-	-7.1	-	-	-7.0	-	-	0	-	-	8.3	-	-	0	-	-
Maximum	212.4	-	20	-	-	37.3	-	-	34.9	-	-	103.6	-	-	96.8	-	-	20.7	-

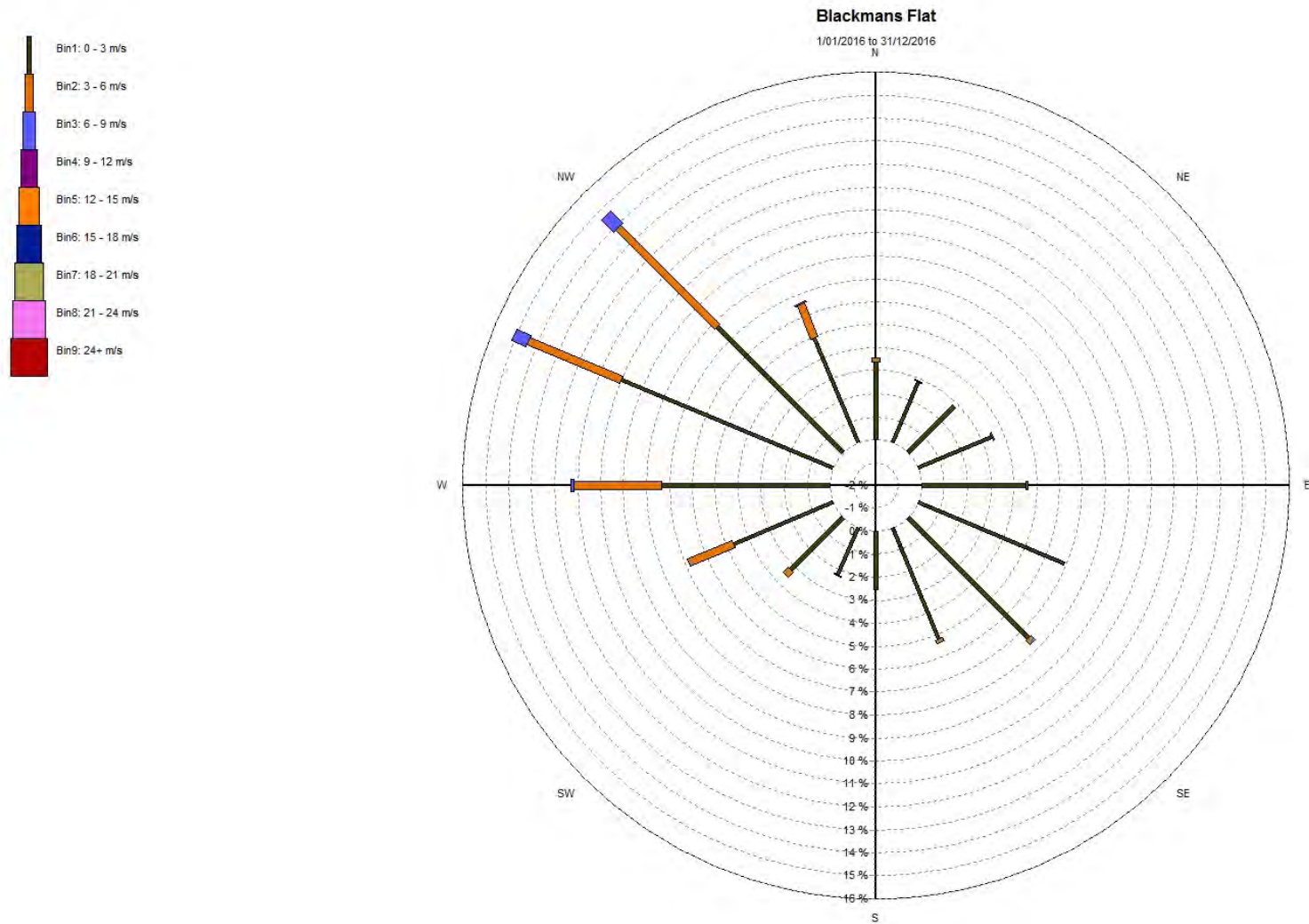


Figure 12 Pine Dale Mine Windrose Plot - 2016

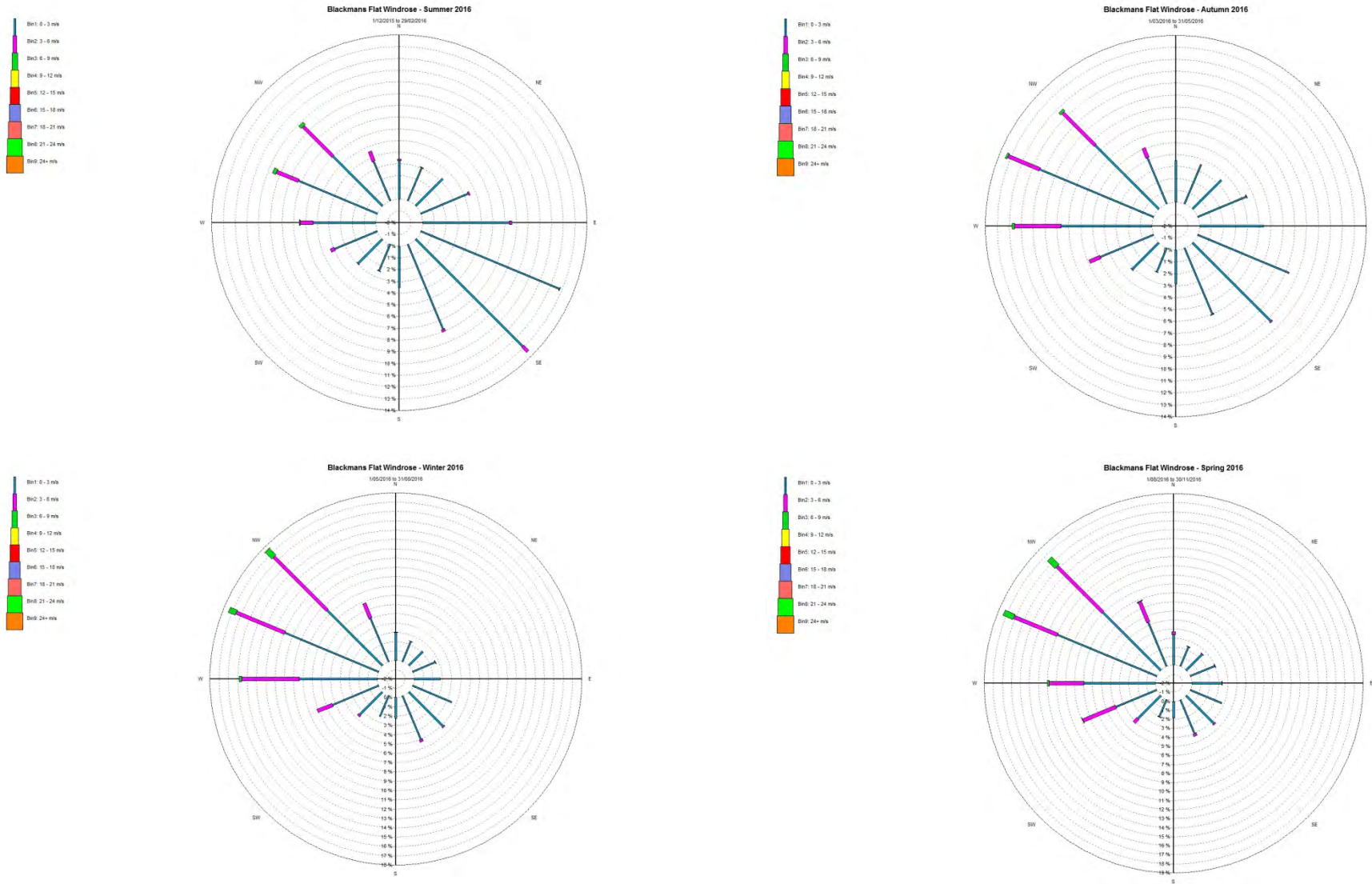


Figure 13 Pine Dale Mine Seasonal Windrose Plots - 2016

6.3 REVIEW OF METEOROLOGICAL MONITORING RESULTS

Pine Dale Mine received 1167.6mm of rainfall and experienced 147 rainfall days during the 2016 reporting period. Rainfall during this period was observed to be greater than rainfall recorded in 2015 (754.4mm and 144 rainfall days) and since 2010 at least. The maximum temperature recorded during the reporting period in January 2016 and was 37.3°C and 34.9°C at 2m and 10m respectively. The lowest temperature was observed during May and July with -7.1°C recorded at 2m and -7.0°C recorded at 10m. Predominant wind directions at the site during 2016 were observed to be from the south-east during summer and from the north-west and west-north-west during autumn, winter and spring. The maximum wind speed measured at the site was 20.7m/s on the 3 September from a west-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_004 1 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 2016 (refer RCA Reports 6880-1706, Feb 2016; and 6880-1721, Aug 2016 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:		09/02/16 & 09/08/16	
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, <5°
	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 2016 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 2016 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:		09/02/16 & 09/08/16	
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, 5-10°
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line August 2016 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 2016 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:		09/02/2016 09/02/2016	
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	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, 10-30°, permitting moderate to high velocity flows.
	Nature of Lateral Flow Regulation	4	Dense grassland. Low inflow rate, mostly diffuse.
Classification of Drainage Line August 2016 survey		Total Score 21/32 66%	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 2016 survey		66%	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:		09/02/2016 & 09/08/2016	
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, 10-30°, 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:		09/02/2016 & 09/02/2016	
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°
	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 2016 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 2016 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 stabilizing.

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 2016. 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 45**.

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 and 14		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 2016 period:

- Quarter 1 – January to March, monitoring conducted 11 January 2016
- Quarter 2 – April to June, monitoring conducted 5 April 2016
- Quarter 3 – July to September, monitoring conducted on 6 September 2016
- Quarter 4 – October to December, monitoring conducted on 6 and 7 October 2016

The aim of the attended noise survey is to record any impact of operational noise on the surrounding community. Two consecutive 15-minute surveys are conducted at each of the six monitoring locations. Results of attended noise surveys carried out during the 2016 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, January 2016*

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 January 2016	8:47:30	NM 2	49.5	53.4	39.7	NIL	42	48.8	41.1	Pine Dale Mine NIL* Road Traffic 38 to 59 Birds & Other 33 to 61
11 January 2016	9:02:30	NM 2	50.0	53.8	40.1	NIL	42	49.7	37.5	Pine Dale Mine NIL* Road Traffic 37 to 59 Birds & Other 36 to 54
11 January 2016	9:28:00	NM 1	54.0	57.5	45.6	NIL	42	53.9	37.1	Pine Dale Mine NIL* Road Traffic 42 to 70 Birds & Other 42 to 54
11 January 2016	9:43:00	NM 1	52.5	55.7	45.3	NIL	42	52.0	42.6	Pine Dale Mine NIL* Road Traffic 44 to 66 Birds & Other 42 to 70
11 January 2016	11:51:30	NM 3	46.5	49.3	40.0	NIL	42	43.5	43.5	Pine Dale Mine NIL* Road Traffic 37 to 60 Birds & Other 36 to 64
11 January 2016	12:06:30	NM 3	47.4	50.4	41.7	NIL	42	45.5	43.0	Pine Dale Mine NIL* Road Traffic 39 to 58 Birds & Other 37 to 63
11 January 2016	12:33:22	NM 4	43.6	46.2	38.6	NIL	35	33.5	43.2	Pine Dale Mine NIL* Road Traffic 34 to 48 Birds & Other 33 to 59
11 January 2016	12:48:22	NM 4	41.9	44.6	36.4	NIL	35	33.8	41.2	Pine Dale Mine NIL* Road Traffic 36 to 50 Birds & Other 32 to 51
11 January 2016	16:09:49	NM 6	42.4	35.1	27.9	NIL	35	25.7	42.3	Pine Dale Mine NIL* Road Traffic 27 to 48 Birds & Other 26 to 70
11 January 2016	16:24:49	NM 6	35.3	37.6	30.6	NIL	35	33.4	31	Pine Dale Mine NIL* Road Traffic 29 to 46 Birds & Other 27 to 51
11 January 2016	16:49:15	NM 5	37.4	39.6	32.4	NIL	35	33.6	35.1	Pine Dale Mine NIL* Road Traffic 30 to 56 Birds & Other 30 to 52
11 January 2016	17:04:15	NM 5	38	39.7	33.5	NIL	35	33.2	36.2	Pine Dale Mine NIL* Road Traffic 32 to 46 Birds & Other 31 to 56

* Nil – Noise source not audible during survey session

Table 47 *Attended Noise Survey – Quarter 2, April 2016*

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					
5 April 2016	09:49:20	NM 1	50.2	54.0	38.3	NIL	42	49.5	42.0	Pine Dale Mine NIL* Road Traffic 41 to 59 Birds & Other 34 to 63
5 April 2016	10:04:20	NM 1	50.3	53.2	38.7	NIL	42	50.5	40.0	Pine Dale Mine NIL* Road Traffic 40 to 63 Birds & Other 33 to 64
5 April 2016	10:40:43	NM 2	46.7	51.0	35.7	NIL	42	46.4	35.9	Pine Dale Mine NIL* Road Traffic 36 to 56 Birds & Other 31 to 60
5 April 2016	10:55:43	NM 2	47.9	52.1	34.6	NIL	42	47.6	35.9	Pine Dale Mine NIL* Road Traffic 37 to 58 Birds & Other 30 to 57
5 April 2016	12:40:28	NM 3	41.2	44.2	35.3	NIL	42	40.4	33.6	Pine Dale Mine NIL* Road Traffic 28 to 52 Birds & Other 32 to 56
5 April 2016	12:55:28	NM 3	40.0	43.1	32.1	NIL	42	38.8	33.8	Pine Dale Mine NIL* Road Traffic 31 to 49 Birds & Other 28 to 50
5 April 2016	13:21:58	NM 4	36.2	38.2	30.1	NIL	35	32.4	33.9	Pine Dale Mine NIL* Road Traffic 27 to 52 Birds & Other 27 to 59
5 April 2016	13:36:58	NM 4	36.5	39.0	30.7	NIL	35	32.0	34.7	Pine Dale Mine NIL* Road Traffic 31 to 53 Birds & Other 28 to 51
5 April 2016	15:07:43	NM 6	38.3	40.1	34.1	NIL	35	<30	37.9	Pine Dale Mine NIL* Road Traffic 33 to 52 Birds & Other 31 to 59
5 April 2016	15:22:43	NM 6	40.7	39.6	33.3	NIL	35	<30	40.3	Pine Dale Mine NIL* Road Traffic 33 to 50 Birds & Other 30 to 73
5 April 2016	15:48:50	NM 5	39.9	41.8	37.1	NIL	35	36.5	37.3	Pine Dale Mine NIL* Road Traffic 35 to 57 Birds & Other 34 to 48
5 April 2016	16:03:50	NM 5	40.6	41.0	36.6	NIL	35	32.1	40.0	Pine Dale Mine NIL* Road Traffic 34 to 44 Birds & Other 34 to 66

* Nil – Noise source not audible during survey session

Table 48 *Attended Noise Survey – Quarter 3, September 2016*

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 Sept. 2016	14:24:23	NM 1	51.8	55.2	38.9	NIL	42	51.6	43.6	Pine Dale Mine NIL* Road Traffic 39 to 63 Birds & Other 33 to 57
6 Sept. 2016	14:39:23	NM 1	51.7	55.9	34.1	NIL	42	54.7	44.2	Pine Dale Mine NIL* Road Traffic 40 to 64 Birds & Other 31 to 63
6 Sept. 2016	13:27:34	NM 2	47.5	50.5	37.2	NIL	42	47.0	37.4	Pine Dale Mine NIL* Road Traffic 38 to 59 Birds & Other 32 to 52
6 Sept. 2016	13:42:34	NM 2	46.1	50.0	35.6	NIL	42	45.7	35.9	Pine Dale Mine NIL* Road Traffic 36 to 54 Birds & Other 31 to 54
6 Sept. 2016	11:57:46	NM 3	41.7	44.6	36.8	NIL	42	39.5	37.7	Pine Dale Mine NIL* Road Traffic 34 to 53 Birds & Other 33 to 51
6 Sept. 2016	12:12:46	NM 3	43.3	46.5	35.7	NIL	42	40.8	39.6	Pine Dale Mine NIL* Road Traffic 37 to 54 Birds & Other 32 to 66
6 Sept. 2016	12:39:55	NM 4	36.7	37.7	31.4	NIL	35	31.2	35.3	Pine Dale Mine NIL* Road Traffic 36 to 57 Birds & Other 28 to 52
6 Sept. 2016	12:54:55	NM 4	36.2	36.9	30.0	NIL	35	<30	36.1	Pine Dale Mine NIL* Road Traffic 34 to 42 Birds & Other 28 to 55
6 Sept. 2016	15:21:56	NM 5	37.2	39.5	32.0	NIL	35	<30	36.8	Pine Dale Mine NIL* Road Traffic 33 to 50 Birds & Other 28 to 54
6 Sept. 2016	15:36:56	NM 5	43.5	41.7	31.8	NIL	35	NIL	43.5	Pine Dale Mine NIL* Road Traffic NIL* Birds & Other 28 to 67
6 Sept. 2016	16:08:32	NM 6	43.4	42.4	<30	NIL	35	42.8	34.2	Pine Dale Mine NIL* Road Traffic 29 to 63 Birds & Other 26 to 61
6 Sept. 2016	16:23:32	NM 6	40.2	44.5	<30	NIL	35	38.8	34.7	Pine Dale Mine NIL* Road Traffic 29 to 56 Birds & Other 27 to 52

* Nil – Noise source not audible during survey session

Table 49 *Attended Noise Survey – Quarter 4, October 2016*

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 October 2016	9:50	NM1	50.4	53.0	42.0	NIL	42	50.0	39.6	Pine Dale Mine NIL* Road Traffic 42 to 64 Birds & Other 39 to 52
6 October 2016	10:05	NM1	48.4	51.6	41.3	NIL	42	47.7	40.5	Pine Dale Mine NIL* Road Traffic 40 to 63 Birds & Other 38 to 53
6 October 2016	8:59	NM2	49.5	52.5	42.9	NIL	42	47.8	44.7	Pine Dale Mine NIL* Road Traffic 47 to 58 Birds & Other 44 to 60
6 October 2016	9:14	NM2	49.9	52.7	44.1	NIL	42	48.4	44.6	Pine Dale Mine NIL* Road Traffic 48 to 66 Birds & Other 44 to 59
6 October 2016	10:42	NM3	48.8	51.6	44.8	NIL	42	48.1	40.5	Pine Dale Mine NIL* Road Traffic 42 to 62 Birds & Other 42 to 52
6 October 2016	10:57	NM3	51.2	52.5	46.8	NIL	42	50.5	42.6	Pine Dale Mine NIL* Road Traffic 45 to 66 Birds & Other 44 to 67
7 October 2016	11:10	NM4	47.8	49.4	40.3	NIL	35	40.3	47.0	Pine Dale Mine NIL* Road Traffic 37 to 56 Birds & Other 37 to 68
7 October 2016	11:25	NM4	46.8	50.0	41.7	NIL	35	34.0	46.6	Pine Dale Mine NIL* Road Traffic 41 to 50 Birds & Other 39 to 58
7 October 2016	13:34	NM5	45.4	48.4	40.2	NIL	35	39.8	43.9	Pine Dale Mine NIL* Road Traffic 38 to 58 Birds & Other 36 to 57
7 October 2016	13:49	NM5	44.2	47.0	38.8	NIL	35	35.9	43.5	Pine Dale Mine NIL* Road Traffic 37 to 51 Birds & Other 36 to 60
7 October 2016	12:45	NM6	39.4	41.4	35.4	NIL	35	<30	38.8	Pine Dale Mine NIL* Road Traffic 35 to 54 Birds & Other 33 to 55
7 October 2016	13:00	NM6	41.5	40.3	35.1	NIL	35	39.5	37.2	Pine Dale Mine NIL* Road Traffic 34 to 65 Birds & Other 32 to 51

Table 50 Meteorological Conditions during Attended Noise Surveys

Survey Date (2016)	Start Time	Location	Cloud (octa)	Temp at 10m (°C)	Wind Speed At Microphone Position (m/s)	Wind Speed Range at Height of 10m (m/s)	Wind Direction
11 January, 2016	08:47 DST	NM 2	0	23	0 - 1.1	0.6 – 6.6	W
11 January, 2016	09:28 DST	NM 1	0	26	0 – 2.5	0.8 – 8.8	W
11 January, 2016	11:51 DST	NM 3	0	32	0 - 4	1.5 – 10.6	N
11 January, 2016	12:33 DST	NM 4	1	35	0 - 3	0.9 – 7.7	N
11 January, 2016	16:09 DST	NM 6	5	36	Nil	1.0 – 6.6	N/A
11 January, 2016	16:49 DST	NM 5	6	33	0 - 1	1.0 – 7.1	N
5 April 2016	09:49 EST	NM 1	0	27	0 - 2.6	0.4 – 6.8	N
5 April 2016	10:40 EST	NM 2	0	23	0 – 2	0.0 – 5.9	NE-E
5 April 2016	12:40 EST	NM 3	3	23	0 - 1.5	0.0 – 6.6	W
5 April 2016	13:21 EST	NM 4	6	23	Nil	0.2 – 6.1	N/A
5 April 2016	15:07 EST	NM 6	3	25	0 - 0.6	0.0 – 5.5	W - N
5 April 2016	15:48 EST	NM 5	3	25	0 - 2.2	0.2 – 3.9	W
6 September 2016	14:24 EST	NM 1	0	18	0 - 2.3	0.4 – 5.2	WSW
6 September 2016	13:27 EST	NM 2	0	17	0 – 2	0.0 – 6.0	WSW
6 September 2016	11:57 EST	NM 3	0	17	0 - 2.2	0.7 – 5.1	WSW
6 September 2016	12:39 EST	NM 4	0	18	0 - 2.3	0.4 – 4.7	WSW
6 September 2016	15:21 EST	NM 5	0	17	0 - 2.0	0.5 – 4.4	WSW
6 September 2016	16:08 EST	NM 6	0	16	0 - 0.8	0.5 – 3.5	WSW
6 October 2016	09:50 DST	NM 1	7	11	0 – 3.0	0.6 – 9.1	W
6 October 2016	08:59 DST	NM 2	7	10	0 – 2.9	0.8 – 7.9	WSW
6 October 2016	10:42 DST	NM 3	8	12	0 – 3.0	1.6 – 7.9	WSW
7 October 2016	11:10 DST	NM 4	1	16	0 – 2.7	0.9 – 9.2	W
7 October 2016	13:34 DST	NM 5	2	19	0 – 3.0	0.9 – 8.5	WSW
7 October 2016	12:45 DST	NM 6	2	19	0 – 2.9	0.9 – 9.1	W

Note: The Industrial Noise Policy states "Wind can also create extraneous noise on noise-monitoring equipment; an upper limit of 5 m/s at the microphone position is commonly applied during noise measurement to reduce this effect"

8.3 REVIEW & INTERPRETATION OF OPERATIONAL NOISE MONITORING RESULTS

Attended noise surveys of the Pine Dale mine for the 2016 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 2016

Attended noise surveys of the Pine Dale mine operations for the January to March 2016 quarter were undertaken on the 11th January 2016. 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.

Wind was blowing from Pine Dale Mine (Source to Receiver) at NM 3-6 which would have resulted in unchanged or slightly increased received Sound Pressure Levels from Pine Dale Mine workings at the respective survey locations, if present.

The surveys conducted at NM 1 and NM 2 showed that Road Traffic was the dominant noise source with bird calls intermittently contributing to the acoustic climate. The surveys conducted at NM 4 and NM 6 showed that bird calls were the dominant noise source with traffic intermittently contributing to the acoustic climate. The surveys conducted at NM 3 and NM 5 showed that road traffic and bird calls contributed evenly to the acoustic climate.

8.3.2 SECOND QUARTER 2016

Attended noise surveys of the Pine Dale mine operations for the April to June 2016 quarter were undertaken on the 5th April 2016. 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.

Wind was blowing from Pine Dale Mine (Source to Receiver) at NM 1, 2 and 6 which would have resulted in unchanged or slightly increased received Sound Pressure Levels from Pine Dale Mine workings at the respective survey locations, if present.

The surveys conducted at NM 1, NM 2 and NM 3 showed that Road Traffic was the dominant noise source with bird calls intermittently contributing to the acoustic climate. The surveys conducted at NM 6 showed that bird calls were the dominant noise source with traffic intermittently contributing to the acoustic climate. The surveys conducted at NM 4 and NM 5 showed that road traffic and bird calls contributed evenly to the acoustic climate with a slight dominance on bird calls at NM 5 due to direct overflight and higher peak levels.

8.3.3 THIRD QUARTER 2015

Attended noise surveys of the Pine Dale mine operations for the July to September 2016 quarter were undertaken on the 6th July 2016. 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.

Wind was blowing across and towards Pine Dale Mine (Source to Receiver) at NM 1, NM 2, NM 3 and NM 4 which would have resulted in unchanged or slightly decreased Sound Pressure Levels from Pine Dale Mine workings at the respective survey locations, if present.

Wind was blowing from Pine Dale Mine (Source to Receiver) at NM 5 and 6 which would have resulted in unchanged or slightly increased received Sound Pressure Levels from Pine Dale Mine workings at the respective survey locations, if present.

The surveys conducted at NM 1 and NM 2 showed that Road Traffic was the dominant noise source with bird calls intermittently contributing to the acoustic climate. The surveys conducted at NM 4, NM 5 and NM 6 showed that bird calls were the dominant noise source with traffic intermittently contributing to the acoustic climate. The surveys conducted at NM 3 showed that road traffic and bird calls contributed evenly to the acoustic climate with a slight dominance on bird calls at NM 5 due to direct overflight and higher peak levels.

8.3.4 FOURTH QUARTER 2016

Attended noise surveys of the Pine Dale mine operations for the October to December 2016 quarter were undertaken on the 6th & 7th of October 2016. 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 no 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 NM 4 and NM 5 showed that bird calls were the dominant noise source with traffic intermittently contributing to the acoustic climate. The surveys conducted at NM 6 showed that road traffic and bird calls contributed evenly to the acoustic climate with a slight dominance on road traffic due to fluctuations in vehicle numbers.

8.3.5 OVERALL ASSESSMENT FOR 2016

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 2016 period, traffic and natural sounds, which are represented by the "Overall" L_{Aeq} (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

Throughout the 2016 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



Katy Shaw
Environmental Scientist
Robert Carr and Associates trading as
RCA Laboratories – Environmental



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

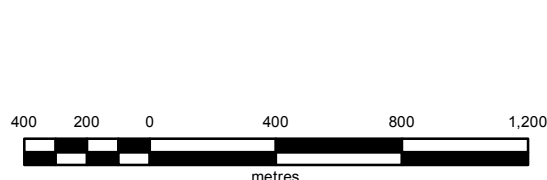
Appendix 1

Drawing 1 - Environmental Monitoring Locations

Drawing 2 - Stream Health & Channel Stability Monitoring Locations

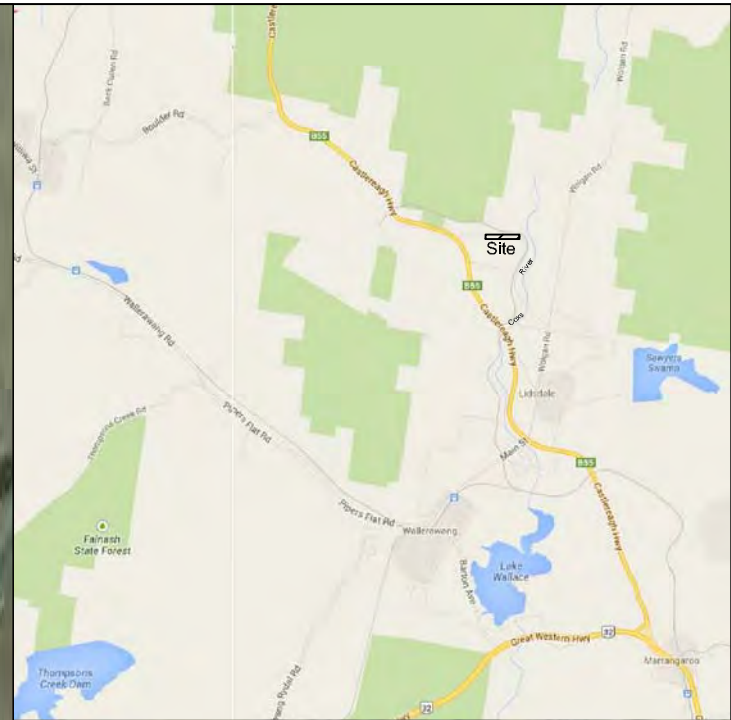


- Legend**
- Noise Monitoring Location
 - Depositional Dust Monitoring Location
 - Groundwater Monitoring Location
 - High Volume Air Sampling Location
 - Meteorological Monitoring Location
 - Surface Water Monitoring Location



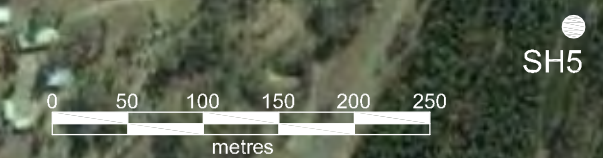
**PINE DALE MINE
CURRENT
ENVIRONMENTAL MONITORING LOCATIONS**

CLIENT	Pine Dale Mine	PROJECT No	6880-1729a
DRAWN BY	KS	SCALE	1:24,000 (A3)
APPROVED BY	KT	DATE	18/01/2017
		DRAWING No	1
		OFFICE	NEWCASTLE



Locality Plan
N.T.S.

- LEGEND**
- Monitoring location
 - Licence discharge point location
 - Clean water diversion location



Aerial image taken from Google Earth, 23 May 2006



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

CLIENT	Pine Dale Mine		RCA Ref	6880-1729a	
DRAWN BY	KS	SCALE	1 : 5000 (A3)	DRAWING No	2 REV 0
APPROVED BY	KT	DATE	9/12/2016	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1

APPENDIX C

2016 REHABILITATION MONITORING REPORT



Pine Dale Mine Rehabilitation Monitoring Report 2016

Report prepared by First Field Environmental
on behalf of EnergyAustralia

3 November 2016

Revision history

Version	Date	Author
Draft	31 October 2016	Michelle Evans
Final	3 November 2016	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 2016

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

First Field Environmental

PO Box 6318 Silverwater NSW 1811

T: 0468 708 520

E: michelle@firstfield.net.au

Contents

- 1. Introduction5
- 2. Performance indicators5
- 3. Weather conditions6
- 4. Survey methodology.....7
 - 4.1 Rehabilitation monitoring.....7
 - 4.2 Erosion and sedimentation7
 - 4.3 Soil loss.....9
 - 4.4 Vegetation assessment.....9
 - 4.5 Evidence of fauna and habitat features9
 - 4.6 Pest animal and weed survey9
 - 4.7 Fuel loads and fire-fighting access10
 - 4.8 Rural land capability assessment10
 - 4.9 Management input assessment.....10
- 5. Field survey results10
 - 5.1 Erosion and sedimentation10
 - 5.2 Soil loss.....11
 - 5.3 Vegetation assessment.....11
 - 5.4 Evidence of fauna and habitat features13
 - 5.5 Feral animals and weeds.....14
 - 5.6 Fuel loads and fire-fighting access15
 - 5.7 Rural land capability assessment16
 - 5.8 Management input assessment.....16
- 6. Rehabilitation status.....17
- 7. Key findings19
- 8. Recommendations.....20
- 9. References.....20

Appendices

Appendix A Survey data 2016	21
Appendix B Vegetation assessment of treed areas	30
Appendix C Estimation of annual soil loss in pastures	34
Appendix D Species list	36
Appendix E Photopoint monitoring to 2016.....	41

Figures

Figure 1 Pine Dale Mine	8
Figure 2 Exposed soils at transect 3	10
Figure 3 Typical pasture composition of transects 1, 2 and 3	11
Figure 4 Pasture composition representative of transect 4	11
Figure 5 Vegetation structure of treed analogue site (transect 7)	12
Figure 6 Transect 6 vegetation structure	12
Figure 7 Large logs are prominent fauna habitat features at transect 5	14
Figure 8 Recently sprayed African lovegrass at transect 4.....	15

Tables

Table 1 Performance indicators and completion criteria.....	5
Table 2 Rainfall (in mm) recorded at Lidsdale (Maddox Lane) January 2010 - September 2016.....	7
Table 3 Estimated soil loss due to erosion	11
Table 5 Percentage cover at transect 5 over time	12
Table 6 Feral animal and noxious weed presence	14
Table 7 Rural land capability assessment of pasture areas.....	16
Table 8 Status of completion criteria	17

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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Feral animals and noxious weeds are controlled in accordance with legislation.
Fuel loads	<ul style="list-style-type: none"> • Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan.
Access	<ul style="list-style-type: none"> • Adequate access for fire-fighting is maintained on rehabilitation areas.
Habitat features	<ul style="list-style-type: none"> • Habitat features are installed on native forest rehabilitation areas including: <ul style="list-style-type: none"> - Nesting boxes and salvaged hollows - Crushed timber spread over native forest rehabilitation areas - Rock pile clusters.
Vegetation health	<ul style="list-style-type: none"> • More than 75% of native forest indicator species are assessed to be healthy and growing at year 5.

Performance indicator	Completion criteria
	<ul style="list-style-type: none"> Native forest indicator species tree height and girth is within the range of analogue sites.
Soil loss	<ul style="list-style-type: none"> Net annual soil loss is comparable to analogue sites at year 10.
Erosion	<ul style="list-style-type: none"> There are no significant erosion features that compromise landform stability or public safety (including gulying or tunneling).
Woodland birds present	<ul style="list-style-type: none"> Evidence of woodland birds utilising rehabilitation areas.
Evidence of mammals	<ul style="list-style-type: none"> Evidence of target mammal species presence in rehabilitation areas.
Natural regeneration	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites.
Management inputs	<ul style="list-style-type: none"> Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.
Rural land capability	<ul style="list-style-type: none"> Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).
Species composition	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Weeds including African Lovegrass to comprise <10% of the pasture sward.
Ground cover	<ul style="list-style-type: none"> 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)

3. Weather conditions

The beginning of 2016 was characterised by sustained warmer weather and a lack of rainfall resulting in a late start to autumn. Average monthly rainfall for the leading up to the survey was variable, with April unusually dry receiving significantly lower rainfall than the statistical average for that month, followed by June being Australia's second-wettest June on record. Recorded rainfall in June, July and September were higher than the average statistical rainfall for those months, and August was slightly drier than the average.

Table 2 presents regional rainfall data for the period commencing 2010.

The area received light rain (between 0.2 and 7 mm per day) during the week leading up to the survey work on the 17th of September (Bureau of Meteorology 2016).

Table 2 Rainfall (in mm) recorded at Lidsdale (Maddox Lane) January 2010 - September 2016

Year	Average	2010	2011	2012	2013	2014	2015	2016
Month								
January	86.1	76.6	63	48.2	87.4	9.2	156.2	142.0
February	78.2	107	68.2	173.8	149	85	21.2	28.8
March	65.1	60.8	78	187	43.2	155	39.4	69.6
April	43.9	37.6	23.8	31.6	26.8	63	158.2	6.2
May	49	54	42.4	40.6	23.6	14	25.2	26.0
June	51.2	39.8	41.2	70.6	87	43.2	24.8	173.4
July	51.6	87.4	18.2	48.8	19.6	25.6	44.6	91.4
August	64	84.4	54.8	23.2	22.4	56.4	43.8	52.2
September	52.4	64	65.4	40.4	44	35.2	9.8	118.6
October	67.1	75.8	36.8	16.6	20.8	51.6	58.0	
November	72.5	101.6	158	39	68.6	36.8	63.6	
December	73.6	217	86	61.2	38.4	160.4	58.6	
Annual	762.1	1006	735.8	781	630.8	735.4	703.4	

Source: Bureau of Meteorology (2016)

4. Survey methodology

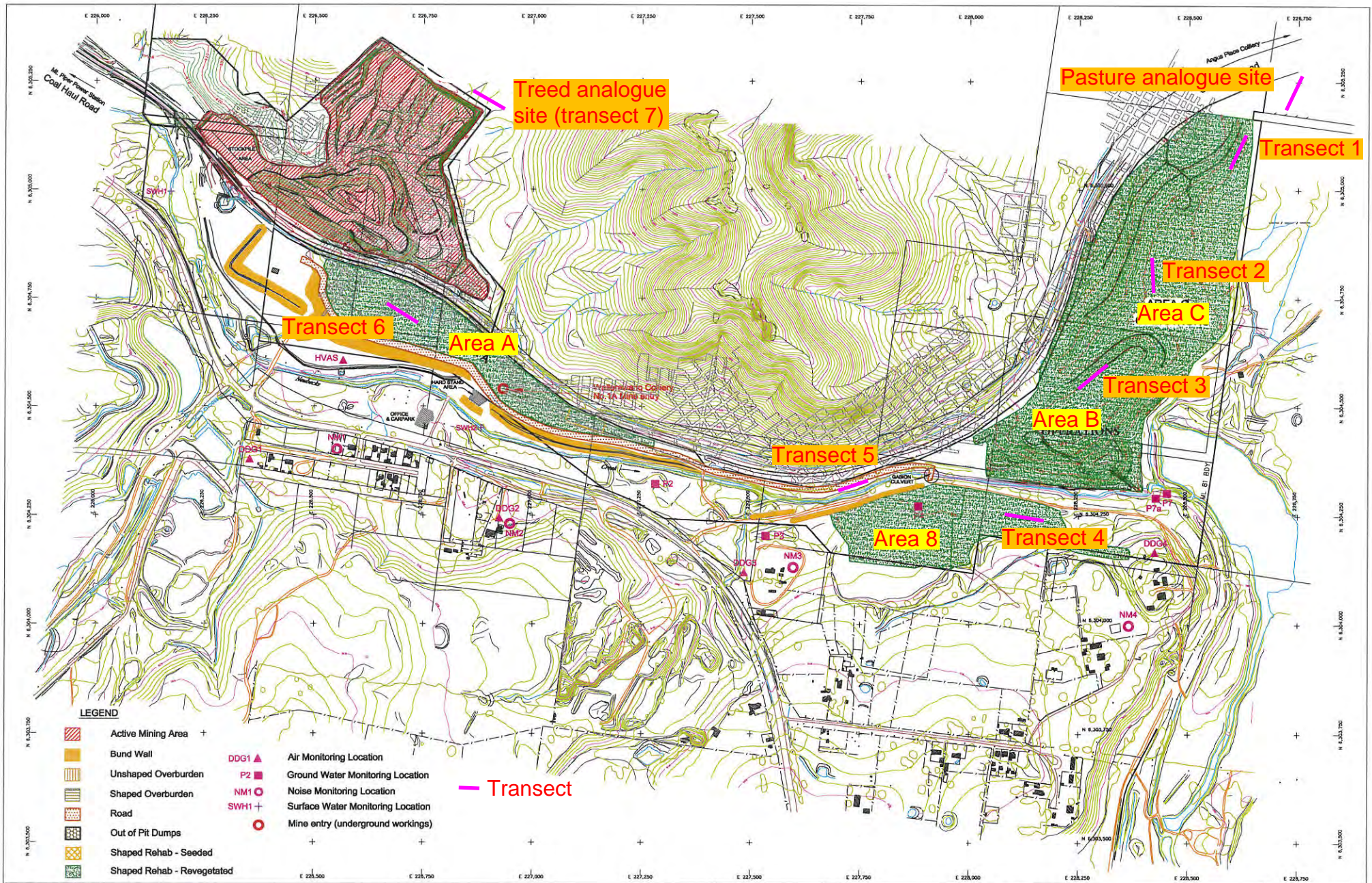
4.1 Rehabilitation monitoring

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.

4.2 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).



- Active Mining Area +
- Bund Wall
- Unshaped Overburden
- Shaped Overburden
- Road
- Out of Pit Dumps
- Shaped Rehab - Seeded
- Shaped Rehab - Revegetated
- DDG1 ▲ Air Monitoring Location
- P2 ■ Ground Water Monitoring Location
- NM1 ○ Noise Monitoring Location
- SWH1 + Surface Water Monitoring Location
- Mine entry (underground workings)

— Transect

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

4.3 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.

4.4 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 (*Festuca spp.*)
- 25% Cocksfoot (*Dactylis glomerata*)
- 20% Subterranean clover (*Trifolium subterranean*)
- 6% Perennial rye grass (*Lolium perene*)
- 5% White clover (*Trifolium repens*)
- 4% Phalaris (*Phalaris aquatica*)

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 have instead been determined in accordance with the *Australian Soil and Land Survey Field Handbook* (CSIRO 2009).

4.5 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.

4.6 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.

4.7 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).

4.8 Rural land capability assessment

Pasture rehabilitation areas have been assessed in accordance with the *Land and Soil Capability Assessment* (OEH 2007).

4.9 Management input assessment

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

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

5. Field survey results

Field survey was conducted on 17th September 2016 by a qualified ecologist. The survey revisited six transects representing rehabilitated pasture and treed areas as well as pasture and treed analogue sites.

5.1 Erosion and sedimentation

There are no significant erosion features that compromise landform stability or public safety (including gullying or tunneling) 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 minor wind erosion where groundcover is poorly established or absent. Figure 2 shows areas of exposed soils at transect 3.



Figure 2 Exposed soils at transect 3

Treed rehabilitation areas - Minor wind and rill erosion is occurring at treed rehabilitation areas.

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

5.2 Soil loss

Rehabilitation activities commenced less than 10 years ago, and it is not yet possible to determine whether net soil loss is comparable to analogue sites at year 10. Estimated annual soil loss at rehabilitated transects 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	0.00 t/ha	0.00 t/ha	0.00 t/ha	0.00 t/ha	0.36 t/ha	0.36 t/ha	0.0 t/ha

The soils of treed rehabilitation transects 5 and 6 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 of ground cover.

5.3 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 3 and

Figure 4.



Figure 3 Typical pasture composition of transects 1, 2 and 3



Figure 4 Pasture composition representative of transect 4

Groundcover at pasture rehabilitation areas – Rehabilitated pasture surfaces in the area of transect 1 support living groundcover of approximately 95%, and the areas of transects 2, 3 and 4 support living groundcover of approximately 90 %.

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

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.

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 5).



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



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 75%. The area of transect 6 supports total living groundcover of approximately 80%.

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 4 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)	September 2016 (transect 5)	
Total living cover	87.5%	<40%	50%	75%	12.5% decrease
Bare surface and litter	12.5%	>60%	50%	15%	2.5% increase

Table 4 shows that while the rehabilitation activities have not maintained initial rates of living cover at transect 5 living cover has increased significantly since the 2014 survey.

There has been significant change in percentage cover at transect 6, with 2014 data showing 30% living cover increasing to 80% living cover at 2016. Bare ground and litter has decreased from 70% in 2014 to 20% in 2015. See Appendix E for a visual comparison of cover at 2014 and 2016.

Vegetation health at treed rehabilitation areas – Native forest indicator species are those that occur both in treed rehabilitation areas and the treed analogue site and provide an opportunity for comparison of growth between natural and rehabilitation conditions. Indicator species include native trees, shrubs and groundcovers.

More than 20% of native species recorded at transect 7 are actively growing in the treed rehabilitation areas. These species are dominated by trees and shrubs and it is expected that groundcovers and herbaceous species will be able to colonise the treed rehabilitation areas once sufficient canopy cover is established.

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 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.

5.4 Evidence of fauna and habitat features

Field surveys recorded evidence of woodland birds utilising rehabilitation areas. Habitat features are installed on native forest rehabilitation areas including crushed timber rock pile clusters. Nesting boxes have not been installed in treed rehabilitation areas.

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 Large logs are prominent fauna habitat features at transect 5

5.5 Feral animals and weeds

Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use. Feral animals and noxious weeds are controlled in accordance with legislation. Weeds including African Lovegrass comprise <10% of the pasture sward. The presence or evidence of pests and weeds within and in the vicinity of each transect is recorded in Appendix A.

Pest animal presence – Rabbit and fox scats were observed across the property. Rabbit and fox numbers are considered low and do not require population reduction measures.

The European rabbit and European red fox are declared pests under the Local Land Services Act 2013. Rabbit and fox density is considered low, with some evidence of shallow soil scraping and scats across each of the monitoring locations. No holes, burrows or dens were observed. It was noted that juvenile native tree plantings along transects 5 and 6 were protected with stockings to prevent damage from rabbits.

Noxious and targeted weed species – Noxious weeds observed during field survey are listed in Table 5.

Table 5 Feral animal and noxious weed presence

Common name <i>Species name</i>	Location	Treatment
European Red Fox <i>Vulpes vulpes</i>	All locations	Landholders are obliged to control populations on their land.
European rabbit <i>Oryctolagus cuniculus</i>		
African Lovegrass <i>Eragrostis curvula</i>	Transects 1, 2, 3 and 4	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continually inhibits its reproduction.
Fireweed <i>Senecio madagascariensis</i>	Transect 6	
Wild Radish <i>Raphanus raphanistrum</i>	Transect 1	

The presence of African Lovegrass was noted at transects 1, 2, 3 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.

A single Fireweed and Wild Radish were observed within transects 6 and 1 respectively. It is possible that each occurs in unsurveyed areas of the property.



Figure 8 Recently sprayed African lovegrass at transect 4

5.6 Fuel loads and fire-fighting access

Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan, and adequate access for firefighting is maintained on rehabilitation areas.

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)).

5.7 Rural land capability assessment

Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing).

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			

5.8 Management input assessment

Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites.

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).

Recycled gypsum was applied to all rehabilitation areas in mid-2016. The use of gypsum is beneficial in improving soil structural properties such as texture, drainage and aeration.

6. 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	<ul style="list-style-type: none"> Feral animal and weed species presence and abundance is not considered to adversely impact the intended final land use. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Feral animal and noxious weed control	<ul style="list-style-type: none"> Feral animals and noxious weeds are controlled in accordance with legislation. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Fuel loads	<ul style="list-style-type: none"> Fuel loads and fire breaks in and surrounding rehabilitation areas are assessed and maintained in accordance with the Bushfire Management Plan. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Access	<ul style="list-style-type: none"> Adequate access for firefighting is maintained on rehabilitation areas. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Habitat features	<ul style="list-style-type: none"> Habitat features are installed on native forest rehabilitation areas including: <ul style="list-style-type: none"> - Nesting boxes and salvaged hollows - Crushed timber spread over native forest rehabilitation areas - Rock pile clusters. 	<ul style="list-style-type: none"> Ongoing - nesting boxes to be installed once trees are established
Vegetation health	<ul style="list-style-type: none"> More than 75% of native forest indicator species are assessed to be healthy and growing at year 5. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
	<ul style="list-style-type: none"> Native forest indicator species tree height and girth is within the range of analogue sites. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
Soil loss	<ul style="list-style-type: none"> Net annual soil loss is comparable to analogue sites at year 10. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
Erosion	<ul style="list-style-type: none"> There are no significant erosion features that compromise landform stability or public safety (including gullying or tunneling). 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Woodland birds present	<ul style="list-style-type: none"> Evidence of woodland birds utilising rehabilitation areas. 	<ul style="list-style-type: none"> Satisfactory
Evidence of mammals	<ul style="list-style-type: none"> Evidence of target mammal species presence in rehabilitation areas. 	<ul style="list-style-type: none"> Satisfactory
Natural regeneration	<ul style="list-style-type: none"> Evidence of second generation of native forest indicator species from desired vegetation community. 	<ul style="list-style-type: none"> Ongoing – continue to monitor

Performance indicator	Completion criteria	Status
	<ul style="list-style-type: none"> Evidence of natural regeneration of at least four pasture species at year 5. 	
Structure	<ul style="list-style-type: none"> Structural layers (canopy, mid-storey, understorey and ground cover) are comparable to analogue sites. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
Management inputs	<ul style="list-style-type: none"> Management inputs (ameliorants, fertilisers, weed treatments) are within the range of analogue sites. 	<ul style="list-style-type: none"> Ongoing – continue to monitor
Rural land capability	<ul style="list-style-type: none"> Pasture rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing). 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Species composition	<ul style="list-style-type: none"> 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. Approved pasture species mix is sown at the specified rate per hectare. 	<ul style="list-style-type: none"> Satisfactory
Weed presence	<ul style="list-style-type: none"> Weeds including African Lovegrass to comprise <10% of the pasture sward. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor
Ground cover	<ul style="list-style-type: none"> Ground cover (vegetation, leaf litter, mulch) >70% at year 5. 	<ul style="list-style-type: none"> Satisfactory – continue to monitor

7. Key findings

General

- Minor wind erosion associated with exposed soils was observed in all rehabilitated transects.
- Estimated soil loss in each of the transect areas has decreased since 2015.
- The property is 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.
- Levels of rabbit and fox activity at each of the rehabilitation and analogue sites are low and are not considered to adversely impact the intended final land use.

Pasture rehabilitation areas

- Estimated soil loss in rehabilitated pasture areas is considered consistent with the analogue pasture area.
- 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.
- 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%.

Treed rehabilitation areas

- Vegetation structure at the treed rehabilitation areas is not consistent with the analogue treed area.
- Transect 5 has seen a significant increase in groundcover from 50% in 2015 to 75% in 2016.
- Transect 6 has seen an increase in groundcover from 70% in 2015 to 80% in 2016.
- Isolated areas of minor rill erosion are occurring in the treed rehabilitation transects.
- 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.
- 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.

8. Recommendations

The following recommendations for mitigation and management are consistent with intervention and adaptive management measures contained within the *Pine Dale Mine Care and Maintenance Mining Operations Plan* (Enhance Place Pty Ltd 2014).

- Continue to monitor pest animal numbers.
- Continue to spot-spray outbreaks of African Lovegrass
- Install nesting boxes once the treed rehabilitation areas contain adequate structure to support nesting woodland birds.
- Place additional coarse woody debris along contours above rills to reduce the rate and volume of runoff at treed rehabilitation areas.

9. References

BFCC (2007) *Policy No. 2/2007 Fire Trails*, Bush Fire Coordinating Committee, Australia

Bureau of Meteorology (2016) *Weather data Lidsdale NSW*,
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=063132

CSIRO (2008) *Ecosystem Function Analysis*, CSIRO, Australia

CSIRO (2009) *Australian Soil and Land Survey Field Handbook*, CSIRO, Australia

Cunningham, G (2012) *Flora Monitoring Report: Pine Dale Mine – February 2010 to November 2010*, Geoff Cunningham Natural Resource Consultants Pty Ltd, Killara NSW

DSE (2010) *Overall Fuel Hazard Assessment Guide*, Department of Sustainability and Environment, VIC

Enhance Place Pty Ltd (2014) *Pine Dale Mine Care and Maintenance Mining Operations Plan*, Enhance Place Pty Ltd, NSW

First Field Environmental (2014) *Pine Dale Mine Rehabilitation Monitoring Report*, First Field Environmental, NSW

First Field Environmental (2015) *Pine Dale Mine Rehabilitation Monitoring Report*, First Field Environmental, NSW

IECA (2008) *Best Practice Erosion and Sediment Control*, International Erosion Control Association (Australasia)

NSW DPI (2016) *Noxious Weed Declarations for Upper Macquarie County Council*, New South Wales Department of Primary Industries, <http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed/>

NSW DPI (2016) *Rabbit Control*, New South Wales Department of Primary Industries, <http://www.dpi.nsw.gov.au/content/agriculture/pests-weeds/vertebrate-pests/pest-animals-in-nsw/rabbit-control>

OEH (2007) *Land and Soil Capability Assessment*, Office of Environment and Heritage, NSW

SLR (2014) *Soil Assessment and Recommendations for Rehabilitation Areas*, NSW

Appendix A

Survey data 2016

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 wind erosion observed on exposed soils.		
Cracking soils	Not observed.		
Surface drainage impediments	No significant drainage impediments.		
Vegetation			
Vegetation structure	Groundcover of mixed native exotic grasses and broadleaf herbs.		
Species richness	>30 herbs and grasses identified, dominated by exotic species.		
Cover classification	% cover at each observation		
	April 2014	September 2015	September 2016
Total living cover	90%	80%	95%
Annual living cover	-	40%	47.5%
Perennial living cover	-	50%	47.5%
Litter cover	10%	-	-
Bare surface	-	20%	5%
Target weed presence			
African Lovegrass (<i>Eragrostis curvula</i>)	<10%		
Wild radish (<i>Raphanus raphanistrum</i>)			

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 wind erosion observed on exposed soils.		
Cracking soils	Not observed.		
Surface drainage impediments	No significant drainage impediments.		
Vegetation			
Vegetation structure	Groundcover of mixed native exotic grasses and broadleaf herbs.		
Species richness	>32 herbs and grasses identified, dominated by exotic species.		
Cover classification	% cover at each observation		
	April 2014	September 2015	September 2016
Total living cover	90%	80%	90%
Annual living cover	-	40%	42%
Perennial living cover	-	50%	48%
Litter cover	10%	-	-
Bare surface	-	20%	10%
Target weed presence			
African Lovegrass (<i>Eragrostis curvula</i>)	<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 wind erosion observed on exposed soils.		
Cracking soils	Not observed.		
Surface drainage impediments	No significant drainage impediments.		
Vegetation			
Vegetation structure	Groundcover of mixed native and exotic grasses and broadleaf herbs.		
Species richness	>30 herbs and grasses recorded, dominated by exotic species.		
Cover classification	% cover at each observation		
	April 2014	September 2015	September 2016
Total living cover	90%	80%	90%
Annual living cover	-	40%	46%
Perennial living cover	-	50%	44%
Litter cover	10%	-	-
Bare surface	-	20%	10%
Target weed presence			
African Lovegrass (<i>Eragrostis curvula</i>)	<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 wind erosion observed on exposed soils.		
Cracking soils	Not observed.		
Surface drainage impediments	No significant drainage impediments.		
Vegetation			
Vegetation structure	Groundcover of mixed native exotic grasses and broadleaf herbs.		
Species richness	Diverse groundcover with >30 exotic herb and grass species recorded.		
Cover classification	% cover at each observation		
	April 2014	September 2015	September 2016
Total living cover	90%	80%	90%
Annual living cover	-	40%	42%
Perennial living cover	-	50%	48%
Litter cover	10%	-	-
Bare surface	-	20%	10%
Target weed presence			
African Lovegrass (<i>Eragrostis curvula</i>)	<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	Minor wind and rill erosion observed on exposed soils.
Cracking soils	Not present.
Surface drainage impediments	No significant drainage impediments.

Vegetation

Vegetation structure	Sparse tree layer to 3m height with scattered juvenile trees and sparse mixed native shrub species. Dense groundcover dominated by native and exotic grasses with scattered mixed native and exotic herbs.
Species richness	Shrub layer is dominated by native species and juvenile trees. Groundcover dominated by exotic broadleaf herbs and grasses, with >14 species recorded.

Cover classification	% cover at each observation		
	April 2014	September 2015	September 2016
Total living cover	90%	50%	75%
Annual living cover	-	20%	12%
Perennial living cover	-	30%	63%
Litter cover	10%	10%	10%
Bare surface	-	40%	15%

Target weed presence

None observed.

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		Minor wind and rill erosion observed on exposed soils.	
Cracking soils		Not observed.	
Surface drainage impediments		No significant drainage impediments.	
Vegetation			
Vegetation structure		Sparse tree layer to 3m height with scattered juvenile trees and sparse mixed native shrub species. Moderately dense groundcover dominated by native and exotic grasses with scattered mixed native and exotic herbs.	
Species richness		Shrub layer is dominated by native species and juvenile trees. Groundcover dominated by exotic broadleaf herbs and grasses, with >13 species recorded.	
Cover classification		% cover at each observation	
		April 2014	September 2015
		September 2016	
Total living cover		90%	70%
Annual living cover		-	10%
Perennial living cover		-	60%
Litter cover		10%	10%
Bare surface		-	20%
Target weed presence			
Fireweed (<i>Senecio madagascariensis</i>)			

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 observed.
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. >90% groundcover to 0.5m height, dominated by native grasses with mixed native herbs.
Species richness	More than 10 tree species, dominated by <i>Eucalyptus</i> spp. Shrub layer of >9 native species. Diverse groundcover dominated by <i>Poa</i> 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 2016

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	Sparse. To 3 m height.	Sparse. To 3 m height.	>10 species, 12-14 m height. 20% canopy cover.
Understorey	Sparse, to 2 m height. Juvenile Eucalyptus and Acacia species.	Sparse, to 3 m height. Juvenile Eucalyptus and Acacia species.	>9 species, 1-2 m height, 10% cover
Groundcover	75% cover. Mix of exotic grasses, native and exotic herbs.	Dominated by exotic grasses and herbs. Some native herbs present. 80% cover.	Dominated by <i>Poa</i> spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>15	>13, including <i>Senecio madagascariensis</i> .	<10
Recruitment	Not observed.	Not observed.	Present
Organic litter	Very sparse layer of mulch remaining.	Very sparse layer of mulch remaining.	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 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	Sparse. To 3 m height.	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. <i>Cassinia arcuata</i> .	Sparse, to 2 m height. Juvenile Eucalyptus and Acacia species. <i>Cassinia arcuata</i> .	>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 <i>Poa</i> spp. >95% cover. Mixed herbs and grasses also present.
Non-native species	>10, including <i>Rubus fruticosus</i> .	>10	<10
Recruitment	Not observed.	Not observed.	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	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	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 <i>Poa</i> spp. with mixed native herbs.
Non-native species	>10	>10	<10
Recruitment	Not observed.	Not observed.	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, 90-95% grassy groundcover				0.01 25% canopy cover of tall weeds or short brush, 80-85% grassy groundcover		0.00 Consistent with 75% canopy cover of trees and 95% grassy groundcover	
Erosion control practice factor (P)	1.3 Compacted				1.2 Consistent with trackwalking along contour		1.3 Compacted	
Annual soil loss due to erosion (A)	0.0 t/ha	0.00 t/ha	0.00 t/ha	0.00 t/ha	0.00 t/ha	0.36 t/ha	0.36 t/ha	0.0 t/ha

Appendix D

Species list

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Acacia dealbata</i> subsp. <i>dealbata</i>					X	X	X
<i>Acacia nana</i>					X	X	
<i>Acacia rubida</i>					X	X	X
<i>Acacia</i> sp.					X	X	X
<i>Acacia ulcifolia</i>							X
<i>Agrostis</i> sp.							
<i>Ajuga australis</i>							X
<i>Amaranthus</i> sp.	X	X	X	X	X	X	
<i>Austrostipa</i> sp.			X	X			
<i>Brassica juncea</i>	X	X	X	X	X	X	
<i>Brassica rapa</i>	X	X	X	X	X	X	
<i>Bursaria spinosa</i> subsp. <i>lasiophylla</i>					X	X	X
<i>Calandrinia calyptrata</i>							X
<i>Cirsium arvense</i>	X	X	X	X	X	X	
<i>Cirsium vulgare</i>	X	X	X	X	X	X	
<i>Conyza bonariensis</i>	X	X	X	X	X	X	
<i>Crassula</i> sp.					X		
<i>Dactylis glomerata</i>	X	X	X	X			
<i>Desmodium varians</i>							X
<i>Dillwynia phyllicoides</i>							X
<i>Eragrostis</i> sp.	X	X	X	X			
<i>Erodium cicutarium</i>				X			

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Eucalyptus dalrympleana</i> subsp. <i>dalrympleana</i>							X
<i>Eucalyptus dives</i>					X	X	X
<i>Eucalyptus macrorhyncha</i>							X
<i>Eucalyptus mannifera</i> subsp. <i>mannifera</i>							X
<i>Eucalyptus radiata</i> subsp. <i>radiata</i>						X	
<i>Eucalyptus rubida</i> subsp. <i>rubida</i>							X
<i>Festuca arundinacea</i>	X	X	X	X			
<i>Festuca</i> sp.	X	X	X	X			
<i>Gamochaeta</i> sp.	X	X	X	X			
<i>Geranium</i> sp.	X	X	X	X	X	X	X
<i>Gompholobium huegelii</i>							X
<i>Goodenia hederacea</i>							X
<i>Hibbertia aspera</i> subsp. <i>aspera</i>							X
<i>Hibbertia obtusifolia</i>							X
<i>Hypochaeris radicata</i>	X	X	X	X	X	X	
<i>Juncus</i> spp.		X					
<i>Leucopogon</i> sp.							X
<i>Lissanthe strigose</i> subsp. <i>subulata</i>							X
<i>Lomandra filiformis</i>							X
<i>Malva neglecta</i>				X			
<i>Medicago</i> sp.	X	X	X	X			
<i>Modiola caroliniana</i>				X			
<i>Oxalis corniculata</i>	X	X	X				

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Paspalum</i> sp.					X		
<i>Persicaria lapathifolia</i>		X					
<i>Persoonia laurina</i>							X
<i>Persoonia oblongata</i>							X
<i>Persoonia</i> sp.							X
<i>Phalaris aquatica</i>	X	X	X	X			
<i>Pinus</i> sp.							X
<i>Plantago lanceolata</i>	X	X	X	X	X	X	
<i>Poa annua</i>	X	X	X	X			X
<i>Poa labillardierei</i>							X
<i>Poa</i> spp.	X	X	X	X	X	X	X
<i>Ranunculus lappaceus</i>							X
<i>Ranunculus</i> sp.	X	X	X	X	X	X	
<i>Raphanus raphanistrum</i>	X						
<i>Rorippa</i> sp.			X				
<i>Rumex acetosella</i>	X	X			X	X	
<i>Senecio madagascariensis</i>						X	
<i>Senecio quadridentatus</i>		X					
<i>Sonchus asper</i>	X	X	X	X			
<i>Sonchus hydrophilus</i>	X	X	X	X			
<i>Sonchus oleraceus</i>	X	X	X	X			
<i>Taraxacum officinale</i>	X	X	X	X			
<i>Themeda australis</i>							X
<i>Trifolium arvense</i>	X	X	X	X			

Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Treed analogue site (Pine Dale Mine transect 7)
<i>Trifolium repens</i>	X	X	X	X			
<i>Trifolium subterraneum</i>	X	X	X	X			
<i>Veronica calycina</i>							X
<i>Vicia</i> sp.					X		
<i>Vulpia</i> sp.	X	X	X	X			

Appendix E

Photopoint monitoring to 2016



Transect 1 looking south 2014



Transect 1 looking south 2015



Transect 1 looking south 2016



Transect 2 looking southeast 2014



Transect 2 looking southeast 2015



Transect 2 looking southeast 2016