Rix’s Creek Mine 2017 Annual Review

Brush Tail Phascogale photo taken in October 2017 from a nest box located in the Rix’s Creek Northern Biodiversity Offset Area.

Name of Operation	**Rix's Creek Mine**
Name of operator	**Bloomfield Collieries Pty Ltd**
Development consent / project approval # **Rixs Creek North** **Rixs Creek South**	 **PA 08_0102** **DA 49/94**
Name of holder of development consent / project approvals	**Bloomfield Collieries Pty Ltd**
Mining Lease #	**CL357, ML1630, ML1648, ML1649, ML1650, ML1651,CL352, ML1432 & ML1725**
	Bloomfield Collieries Pty Ltd
Water License #	**20WA219698, 20BL172249, 20BL170863, 20BL170864**
Name of holder of water license	**Bloomfield Collieries Pty Ltd**
MOP / RMP start date **Rixs Creek North** **Rixs Creek South**	 **18/01/2016** **8/3/2013**
MOP / RMP end date **Rixs Creek North** **Rixs Creek South**	 **30/11/2018** **8/3/2020**
Annual Review start date	**1/1/2017**
Annual Review end date	**31/12/2017**
I, Chris Quinn, certify that this audit report is a true and accurate record of the compliance status of Rix's Creek Mine for the period 1/1/2017 – 31/12/2017 and that I am authorised to make this statement on behalf of Bloomfield Collieries Pty Ltd.	
Name of authorised reporting officer	**Chris Quinn**
Title of authorised reporting officer	**Environmental Advisor**
Signature of authorised reporting officer	
Date	**29/3/2018**

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AHD	Australian Height Datum
AR	Annual Review
bcm	Bank cubic metre
CHPP	Coal Handling and Preparation Plant
CCC	Community Consultative Committee
DA	Development Application
dBL	Noise decibels (linear)
dBA	Noise decibels (A-weighted)
DPE	Department of Planning and Environment
DRE	Division of Resources and Energy
EA	Environmental Assessment
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EL	Exploration Licence
EMP	Environmental Management Plan
EPA	Environment Protection Authority
ESU	Environmental sustainability Unit
GHG	Greenhouse Gas
EPL	Environment Protection Licence
$g/m^2/mth$	Grams per square metre per month
HRSTS	Hunter River Salinity Trading Scheme
IEA	Independent Environmental Audit
ISO	International Standard
l/s	Litres per second
LHPA	Livestock Health and Pest Association
MCM	Monthly Communication Meetings
MIC	Maximum Instantaneous Charge
mm/s	Millimetres per second
MOP	Mining Operations Plan
Ml	Megalitre
ML, MPL, CCL & CL	Mining Leases
Mt	Million tonnes
NAG	Noise Assessment Group
DPIW	Department of Primary Industires Water
OC	Open Cut
PIRMP	Pollution Incident Response Management Plan
PM_{10}	Particulate matter (dust) with a diameter of less than 10 microns
PPV	Peak Particle Velocity
RCS	Rix's Creek South
RCN	Rixs Creek North
ROM	Run-of-mine
SEPP	State Environmental Planning Policy
STP	Sewage Treatment Plant
TBT	Toolbox Talk
TBG	The Bloomfield Group
TEOM	Tapered Element Oscillating Microbalance
TPH	Total Petroleum Hydrocarbons
µS/cm	Micro Siemens per centimetre
$µg/m^3$	Micrograms per cubic metre

SECTION 1 STATEMENT OF COMPLIANCE

Table 1 Summary Statement of Compliance for Major Approvals

Were all conditions of the relevant approval(s) complied with?	
DC # DA 49/94 Mod 6	NO
PA 08_0102	NO
ML # 1432, CL342	YES
ML # CL 357, ML 1630, ML 1648-1651	YES

The non-compliances identified with PA 08_0102 are detailed in **Table 2 below.**

Table 2 Non Compliances with Rix's Creek North PA 08_0102

Condition	Non-Compliance	Risk Level	Addressed in 2017 AR/ comments
Schedule 3 , Condition 2 **Schedule 3, Condition 3** **Schedule 3, Condition 4** **Schedule 3, Condition 5**	Noise monitoring does not assess the proportion of privately owned land for which exceedances may occur.	**Administrative**	Section 6.2 and Appendix 1
Schedule 3, Condition 9(f)	Evidence of coordination of noise management with Integra Underground and Ashton was not able to be provided.	**Administrative**	Section 6.2.1
Schedule 3, Condition 10(e)	A cumulative protocol has not been developed in coordination with the nearby mines and included in the noise management plan as required.	**Low**	Section 6.2.1
Schedule 3, Condition 19(f)	A cumulative protocol has not been developed in coordination with the nearby mines and included in the blast management plan as required.	**Low**	Section 6.3.1
Schedule 3, Condition 22 **Schedule 3, Condition 23**	Air quality monitoring does not assess the proportion of privately owned land for which exceedances of the cumulative criteria may occur.	**Administrative**	Section 6.4
Schedule 3, Condition 27(c)	A cumulative protocol has not been developed in coordination with the nearby mines and included in the air quality and greenhouse gas management plan as required.	**Low**	Section 6.4.1
Schedule 3, Condition 36(a)	No evidence of consultation with OEH, EPA, DRG or Council and no evidence that the WMP has been endorsed by DPI-Water.	**Low**	Combined WMP to be submitted to DPI water for review. Time frame 19 April 2018

Condition	Non-Compliance	Risk Level	Addressed in 2017 AR/ comments
Schedule 3, Condition 36(d)	Section 5.1.2.2 outlines Erosion and Sediment Control measures for Rix's Creek North, however does not cover all requirements listed under this condition.	**Low**	To be included in combined RCM WMP and submitted to DPE and DPI Water for review.
Schedule 3, Condition 36(e)	Surface water management plan does not include specific water quality trigger levels.	**Low**	To be included in combined RCM WMP and submitted to DPE and DPI Water for review.
Schedule 3, Condition 40 (c)	No mention of measures to conserve and/or reuse topsoil in the biodiversity management plan. Further while measures are taken to ensure revegetation reflects that of a native ecosystem, there is no specific section that details how landscaping activities will be carried out to ensure visual impacts are minimised.	**Low**	To be included in revision of Biodiversity Management Plan 19 April 2018.
Schedule 3, Condition 46(c)	No evidence to support that lighting equipment considers AS 4282 (Int) 1995.	**Administrative**	Lighting SOP to be developed by 30 June 2018
Schedule 3, Condition 52(a)	No evidence of the rehabilitation management plan being prepared in consultation with relevant agencies or the CCC prior to submission and approval.	**Low**	RCN is required to submit a new MOP within 2018. Consultation will occur prior to submission of new MOP.
Schedule 3, Condition 52(c) & (e)	Section 5.2 of the rehabilitation management plan lists Rehabilitation Objectives, however not all of the objectives listed in Table 15 are addressed in the MOP including: - Final landforms designed to incorporate micro-relief and integrate with surrounding natural landforms. - Ensure public safety. Minimise the risk of flood interaction for all flood events up to and including the Probable Maximum Flood.	**Low**	To be included in new RCN MOP time frame 31 December 2018.
Schedule 5, Condition 10(c)	No formal or methodical review of compliance under this project approval presented for each reporting year in the annual reviews	**Low**	This table addresses compliance review.

Condition	Non-Compliance	Risk Level	Addressed in 2017 AR/ comments
Schedule 5, Condition 13(a)	- Latest CCC minutes published on the Rix's Creek North website are dated February 2016, however the CCC has combined with Rix's Creek and the minutes from the latest meetings (including 20 September 2016 and 1 June 2017) which were for the combined sites are only published on the Rix's Creek website and are not on the Rix's Creek North website. - 2016 Annual Review has not been published on the Rix's Creek North website, however is located on the Rix's Creek website. 2014 Independent Audit of Rix's Creek North response to recommendations is not located on the website (sighted 24 October 2017). It was noted during the audit that this report was uploaded to the Vale website and had not yet been copied across following change of ownership.	**Administrative**	Website updated to include relevant information.
SoC B2	- No evidence provided to confirm that material will not be stripped in either extremely wet or dry conditions occurs and is not addressed in MOP.	**Administrative**	To be updated in new RCN MOP. Timeframe 31 Dec 2018.
SoC B4	No evidence provided to confirm that tracking over previously laid soil will be avoided to minimise compression effects occurs and is not addressed in MOP.	**Administrative**	To be updated in new RCN MOP. Timeframe 31 Dec 2018.
SoC B11	No inventory was able to be provided during the audit and not addressed in MOP.	**Low**	To be updated in new RCN MOP. Timeframe 31 Dec 2018.
SoC C5	There is no mention of Groundwater Dependent Ecosystems in the biodiversity offset strategy or rehabilitation management plan in the MOP.	**Low**	BMP to be updated to include this condition. 19 April 2018.

The non-compliances identified with DA49/94 are detailed in **Table 3 below.**

Table 3 Non Compliances with Rix's Creek South DA49/94

Condition	Non-Compliance	Risk Level	Addressed in 2017 AR/ comments
Schedule 2, Condition 6(c)	A revised Landscape Management Plan has been developed for Rix's Creek South dated 10 January 2017; however it has not been submitted to DPE for approval. It is noted that the previous audit included a recommendation to develop a formal building maintenance program, however the revised Landscape Management Plan does not include this.	**Low**	To be updated to include building maintenance plan and sent to DPE for review.
Schedule 2, Condition 7	No evidence to support that lighting equipment considers AS 4282 (Int) 1995. It was also noted that there is no formal documentation of the standards used regarding lighting at Rix's Creek Mine.	**Administrative**	Lighting SOP to be developed by 30 June 2018
Schedule 2, Condition 11 (v)	The noise management plan does not include a protocol that has been developed in consultation with the surrounding mines	**Low**	Section 6.2.1
Schedule 2, Condition 12D	The blast management plan does not include a protocol that has been developed in consultation with the surrounding mines	**Low**	Section 6.3.1
Schedule 2, Condition 14A	Section 6.1.3 of the air quality and greenhouse gas management plan addresses a cooperation protocol to be used with other mines however there is no evidence of consultation with other mines to develop a protocol.	**Low**	Section 6.4.1
Schedule 2, Condition 14B	The meteorological station is not capable of continuous real-time measurement of temperature lapse rate and there was no evidence available to confirm that the EPA has approved an alternate way to measure this.	**Low**	Met Station at Rix's Creek North has temperature lapse rate (sigma theta). This is to be used in conjunction with RCS Met station. Section 6.1

Condition	Non-Compliance	Risk Level	Addressed in 2017 AR/ comments
Schedule 2, Condition 16B	The following is not included in the RMP as required by this condition: – protecting vegetation and soil outside the disturbance areas; – there is no detailed description as to how the impacts on fauna will be managed – There is no description of collecting and propagating seed for rehabilitation works – there is no description as to how controlling access to rehabilitated areas would be undertaken	**Low**	To be included in revised RCS MOP.
Schedule 2, Condition 16D	Completion criteria for Sub Domain A (Pasture) and Sub Domain B (Tree Areas) is referenced to be outlined in the RMP. However completion criteria for each domain have not been covered in the RMP. No completion criteria for Sub Domain C (Plantation Forest Areas) and Sub Domain D (Undisturbed Native Grassland) has been included within the Mine Closure Plan or RMP.	**Low**	To be included in revised RCS MOP.
Schedule 2, Condition 27	During the site inspection, oil rags were found in general waste bins outside the workshop. Dedicated waste bins were located on site, however were not being appropriately used.	**Low**	Increased waste segregation with additional oil rag bins placed at both workshops. Section 4.6
Schedule 2, Condition 28	There is no evidence to suggest a review of all management plans occurred following the 2016 Audit or submission of the annual review. Further the following management plans were not revised within 3 months of the approval of the Mod 8 in December 2016: – The Landscape Management Plan has not been revised since 18.03.10. – The Rehabilitation Management Plan has not been revised since 09.11.11. – The Final Void Management Plan has not been revised since 19.01.12. – The Mine Closure Plan has not been revised since 22.02.12. – The Water Management Plan has not been revised since 20.01.14	**Low**	Management Plan review to be conducted by 19 April 2018. Within 3 months of Consent Order independent Audit.

During the assessment of the EIS for the Rix's Creek (South) Continuation Project, DP&E identified a potential discrepancy between the permitted mining area identified in the original modified Project EIS and the permitted mining area identified in the environmental assessment that accompanied the development application for DA 49/94.

Subsequent action was undertaken by DP&E to define the "Permitted Mining Area" and therefore enable the impacts of the Project to be accurately defined and assessed. DP&E formed the view that various mining operations at Rix's Creek were not carried out in accordance with the Development Consent. Rix's Creek had at all times reported the carrying out of such mining operations to DP&E but in the interests of reaching a resolution on the issue that would not delay this application, agreed to consent orders under the EP&A Act and an enforceable undertaking under the Mining Act 1992 to rectify the issue.

It was resolved that the area of permitted mining within DA 49/94, now known as the Existing Permitted Mining Area, provided approval for all elements of the Mine and ancillary activities.

A consent order before the Land and Environment Court as well as the Enforceable Undertaking (EU) with the Department of Planning and Environment has been finalised due to interpretation differences in the Rix's Creek Consent Area. There are a number of commitments as part of this EU which are currently being progressed and reported to DRG on an ongoing basis, which include:

- Within 6 Months of the enforceable undertaking taking effect, an Independent audit of the development consent commitments for Rix's Creek DA 49/94 and PA 08_0102 and applicable mining tenements was completed.
- Training to promote the compliance of development consent commitments and mining lease conditions throughout the organisation. This also involved updating the Land Disturbance Management Procedure and permit to disturb process.
- Bloomfield provided $25 000 to Singleton Council/ or a local land care group for the Hunter River improvement works
- Bloomfield provided $25,000 to Associate Professor Kym Rae for the testing kidney health in Gomeroi Gaaynggal Indigenous mothers and babies for early intervention.

Currently all works for Rix's Creek South are defined as approved by the consent order.

SECTION 2 INTRODUCTION

The Annual Environmental Management Report for 2017 is compiled pursuant to Condition 19 of the development consent for DA49/94 and Schedule 5, Condition 10 of PA08_0102. The report is also presented to satisfy the environmental reporting requirements of the Department of Industry – Division of Resources and Geosciences and the Resource Regulators,The NSW Office of Environment and Heritage (OEH), and the Department of Planning and Environment (DPE). This reporting period extends from 1 January 2017 to 31 December 2017.

Rix's Creek Mine is wholly owned by The Bloomfield Group Ltd. an Australian owned family company. The Bloomfield Group also operates an open cut coal mine at East Maitland, *Bloomfield Collieries Pty. Ltd*, exploration license (EL) 7435 "*Goonbri*", EL5888 and EL5306 "*Bickham*", EL6604, EL7365 and CCL711 "*Curlewis*", engineering businesses *Four Mile Engineering* and *King's Engineering* as well as equity positions in companies specialising in renewable energies, recycling and biofuel production.

Rix's Creek Mine commenced operations in July 1990 following the granting of Development Consent and Coal Lease No. 352 on 20 October 1989. This followed the submission of Coal Lease Application No. 185, an Environmental Impact Statement (EIS) and a public inquiry into the development application.

Construction began in late November 1989 establishing access roads, dams, facilities and screening bunds adjacent to the New England Highway. The Mining Operations Plan (MOP) was approved covering a five-year period, which corresponded, to Stage 1 of the mining proposal set out in the EIS.

The initial area was located adjacent to and on the northern side of the New England Highway and utilised bulldozer and scrapers to remove overburden. As mining progressed to greater depths, massive sandstone was encountered, requiring the introduction of overburden blasting. The scraper fleet was substituted with front end loader and trucks as the primary means of overburden removal. The Hebden and Barrett coal seams were mined at the rate of 300,000 tonnes of raw coal per annum.

The mining area was within old underground workings of the New Park Colliery, which dated back to the late 1800's. The underground workings were far more extensive than documented and resulted in poor coal recoveries and quality. This led to the relocation of operations to the north of the mining lease, an area termed the Arties Pit.

A bridge over the New England Highway was constructed to enable access to coal reserves in the southern area of the coal lease or South Pit. Since the completion of the bridge in June 1994 mining operations concentrated in this area. The production rate was then increased to 800,000 tonnes of raw coal per annum.

A coal preparation plant and rail loading facility were commissioned in April 1993, with all product coal being transported by rail to the port of Newcastle, where it is blended with coal from Bloomfield open cut. All product coal is sold on the export market. Prior to the commissioning of Rix's Creek washing and railing facilities, all raw coal was transported to Bloomfield Colliery for washing and blending.

During 1997 the operation expanded following the 1995 Development Consent approval allowing production to increase to current levels.

Along with the continuing operation in the Arties Pit (Pit 1), operations commenced on the extension of South Pit (Pit 2) in January 1997. Production increased to 1.7 million tonnes of raw coal. Since 1997 mining operations continued in South Pit and Arties Pit. During 2002 operations commenced in West Pit (Pit 3) on the western side of Rix's Creek adjacent to South Pit. The last coal was extracted from South Pit on 23rd June 2003. The emplacement of tailings into the South Pit void commenced in July 2005 with capacity reached during May 2014. Operations have continued in the West Pit with approximate production of 1,400,000 tonnes of product coal per annum. Mining in Arties Pit via open-cut finalised in 2014 with the focus of the operations continuing in West Pit.

On the 18th December 2015, HV Coking Coal Pty Limited (Glencore) completed the purchase of 100% of the Integra Mining Operations Complex. Bloomfield Collieries Pty Limited (BCL) subsequently purchased, from Glencore, the previous Integra Open Cut Operations, Coal Handling Preparation Plant, Train Loading Infrastructure and the Rail Loop. Under the "Operating, Infrastructure Access and Services Agreement", entered into by Glencore and BCL, all current mining operations covered by the 2010 Integra Complex Consent, Project 08_0101 Integra Underground Project and Project 08_0102 Integra Open Cut Project, can continue. Bloomfield Collieries Pty Limited operate the Open Cut Operations as Rix's Creek Northern Operations (RCN). This will control open cut mining in the Camberwell Pit area. Delivery of Project 08_0101 Run of Mine (ROM) coal from the Underground Mine, Coal Preparation and Train Loading Operations will all be operated and managed by RCN.

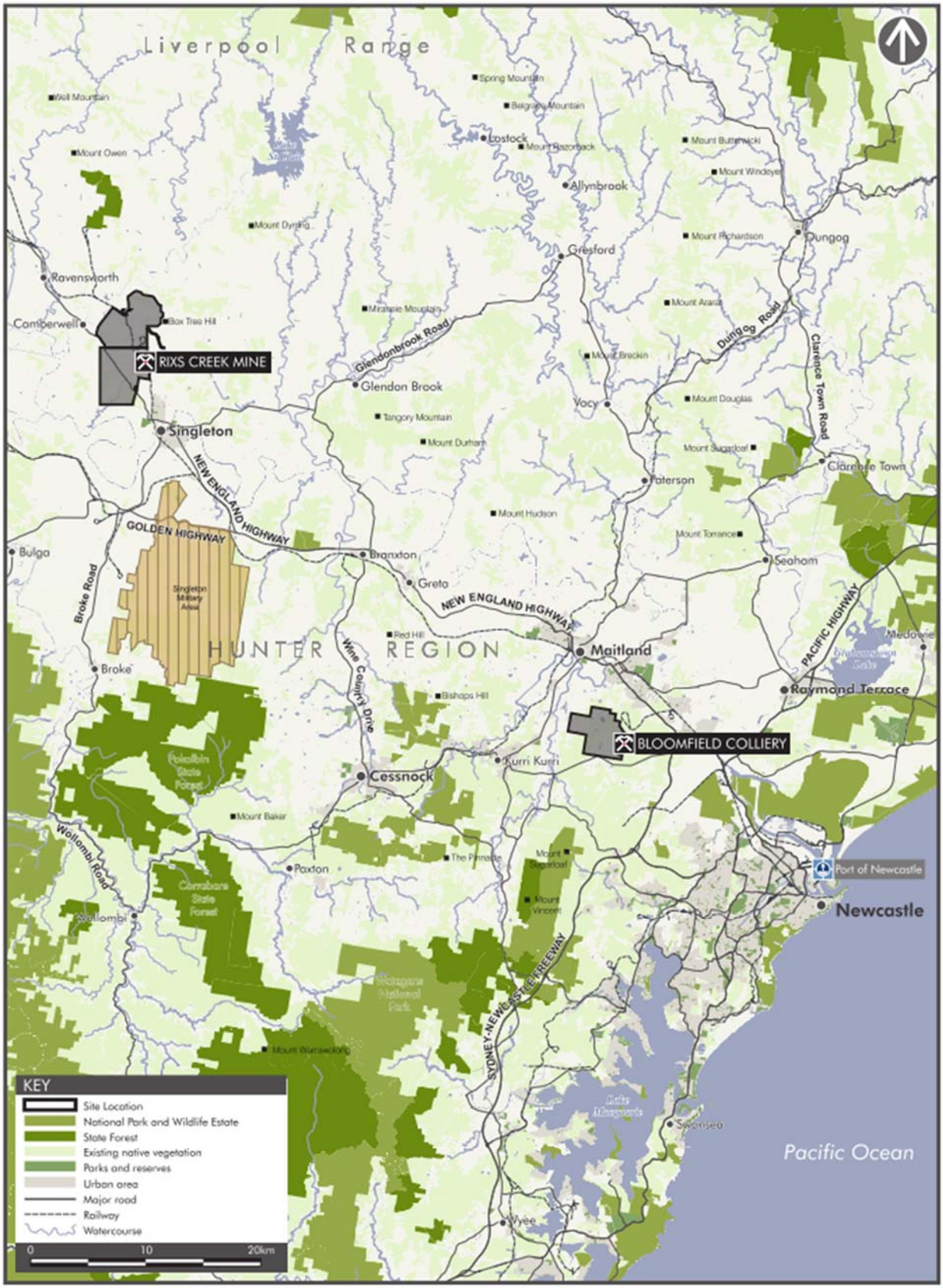


Figure 1 Regional Context Plan

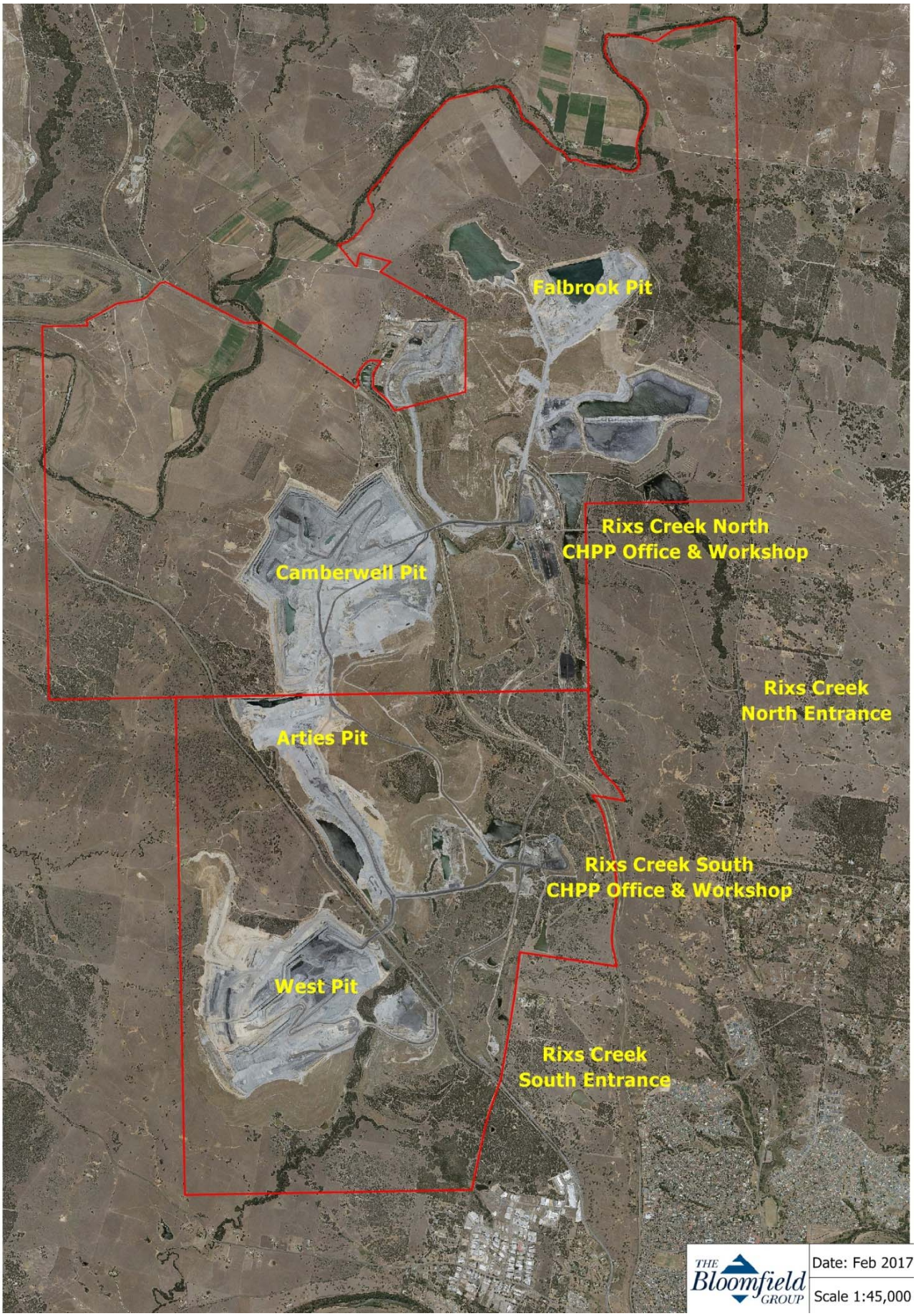


Figure 2 Site Layout and Locality Plan

2.1 Consents, Leases and Licences

A full list of consents, leases and licences held by Rix's Creek Mine is contained in Table 5.

Coal Lease No. 352 was renewed on 20/10/2011 allowing mining operations to continue on the site. Mineral Lease Application No. 17 to remove the surface exclusion from the remaining areas within the lease was submitted in 1995 and access agreements reached with landholders. Mining lease No. 1432 was granted by the Minister on 24/6/1998.

The development application to expand the operation submitted to the Department of Urban Affairs & Planning in November 1994 under the provisions of State Environmental Planning Policy (SEPP) No. 34 was determined by the Minister in October 1995. The development consent came into effect in December 1995, and implementation progressed during 1996.

The Company holds Environmental Protection Licence No. 003391 under the Protection of the Environment Operations Act, 1997. This EPL has been varied to accept wastes on site such as biosolids (rehabilitation). The license has also had variations for PRPs (Pollution Reduction Programs) in regard to *Coal Mine Particulate Matter Control Best Practise* as well as a noise assessment in accordance with the document, 'NSW Industrial Noise Policy', (EPA 2000). The prescribed use classification is Coal Industry Works Class I, and operational scale is more than 500 to 2,000 kilotonnes per annum. On the 18th December 2015 Environmental Protection 003391 was varied to include Rix's Creek Northern operations.

Rix's Creek P/L is a non-discharging participant in the Hunter River Salinity Trading Scheme holding 5 credits.

An application was made in November 2003 to vary the Development Consent to receive and process coal from Glennies Creek Coal Mine. The Notice of a Modification to a Development Consent under Section 96(2) of the Environmental Planning and Assessment Act 1979 was signed by the Minister on 23rd December 2003, modifying the Rix's Creek Development Consent to allow this activity. No coal was received during 2014.

An application was made in April 2004 to vary the Development Consent to receive coal from Bickham Bulk Sample Exploration Licence operation. The Minister signed the Notification of a Modification to Development Consent under Section 96(2) of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979) on 24th June 2004, modifying the Rix's Creek Development Consent to allow this activity. This activity was completed and the last coal railed in March 2005.

An application for a second crossing of the New England Highway to improve the efficiency of the mining operation was submitted to Department of Planning in March 2009. The Minister approved the modification under Section 96(2) of EP&A Act 1979, on 27 August 2009, for a Cut and Cover Tunnel crossing on the New England Highway. Following final approval of the design by the RTA in October 2010 construction began in November 2010 with completion of the project during June 2012. The first haul truck officially passing under the tunnel on 5 June 2012.

An application for the construction of a rail-loop off the main northern rail-way line onto Rix's Creek owned land was approved in 2013 resulting in modification number 5. No construction has commenced on this project since approval was granted.

On Friday 4th October 2013 Rix's Creek took ownership of land ahead of the West Pit operations to secure the future of mining within the lease. The three properties purchased include Lot A, D.P.404824 (previously owned by A.Bowman); Lot 122, D.P.1170863 (previously owned by E.S.Bowman); and Lot 55, D.P.252692 (previously owned by Canravo Pty Ltd).

A detailed map of Rix's Creek property ownership is shown on Figure 3.

During 2014 an application to increase total material movement from 15 million BCM to 16.1 million BCM was approved resulting in Mod No.6 DA49/94. During 2014 Rix's Creek commenced the Rix's Creek Continuation Project (SSD# 6300) in order for the mine to continue another 21 years pending

the approval of a new development consent. The draft Environmental Impact Statement (EIS) was completed and submitted for adequacy November 2015.

Mod No. 7 DA49/94 was submitted until February 2016 to improve the efficiency of the Rix's Creek and Rix's Creek North operations. The purpose of the modifications was to enable coal mined at one site to be processed and handled at the other site's CHPP, stockpiles and rail loading facilities.

The proposal involved:

- Allowing ROM coal from Integra's Open Cut Project to be transported to Rix's Creek CHPP for processing; and
- Allowing ROM coal from Rix's Creek to be transported to Integra's CHPP for processing

Mod No.8 DA49/94 was to submitted to allow ROM coal to be stockpiled on 2 satellite pads near the Rixs Creek South CHPP prior to the ROM stockpile pad to reduce congestion on the ROM pad, was approved in December 2016.

On December 18th 2015 Bloomfield Collieries Pty Ltd took ownership of the Vale Integra open-cut mine which has been renamed 'Rix's Creek North' (RCN). Rix's Creek Northern operations recommenced extraction of coal in May 2016.

RCN was given Project Approval under Section 75W of the *Environmental Planning and Assessment Act 1979* by the Minister for Planning on 23 August 2016 for Project 08_0102 Mod 6. This Mod 6 separated the former Integra Mine Complex approval, which was a combination of the Integra Underground Project 08_0101 and Integra Open Cut Project 08_0102 (Integra Mine Complex) as it was known then.

The former Integra Mine Complex approval consolidated the following pre-existing approvals:

- Glennies Creek Colliery (105/90);
- Camberwell Coal Project (86/2889);
- Glennies Creek Colliery Surface Facilities (06_0057);
- Glennies Creek Underground Coal Project (06_0213); and
- Glennies Creek Open Cut Coal Project (06_0073).

The Rixs Creek North Project Approval 08_0102 Mod 6 includes:

- The Camberwell Pit (old South Pit/Western Extension);
- The Fallbrook Pit (old North Open Cut Pit);
- Coal Handling and Processing Plant (CHPP);
- Clean coal stockpile and rail loading facility; and
- Associated industrial areas and offices.

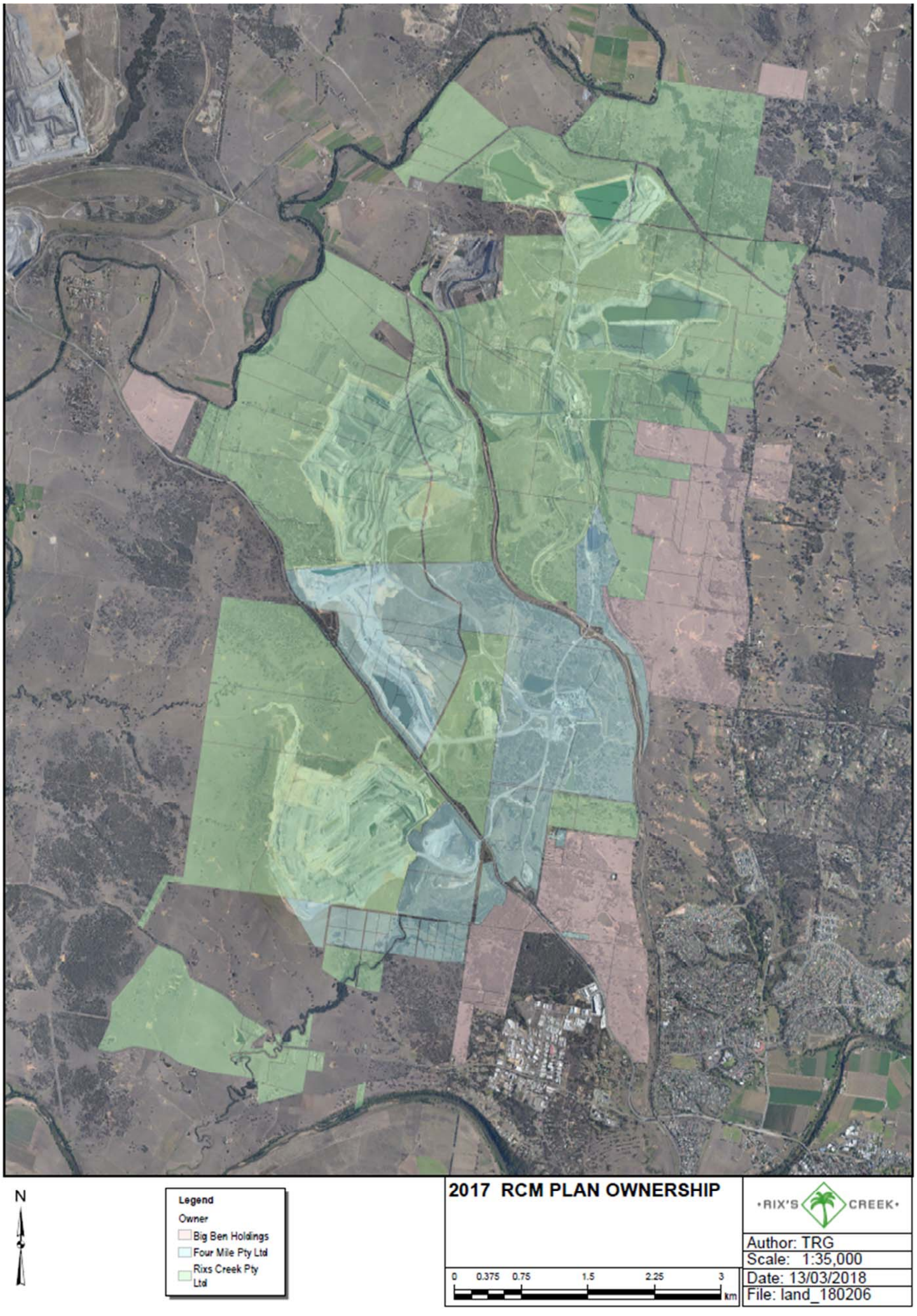


Figure 3 Land Ownership December 2017

2.2 Mine Contacts

Rix's Creek Pty Limited

Site:-	Rix's Creek Lane Singleton NSW 2330	Postal Address:-	P O Box 4 EAST MAITLAND NSW 2323.
Telephone:-	02 65788800		
Fax:-	02 65711066		

Rix's Creek Community & Blasting Hotline:-
02 49302665 (24hr)

Mine Manager:- Luke Murray
Responsible for overseeing all operations on site.
Telephone No:- 02 65788802
E-mail:- lmurray@rixs.com.au

Technical Services Manager:- Tim Gentle
Responsible for survey and mine planning.
Telephone No:- 02 65788808
E-mail:- tgentle@rixs.com.au

Environment Manager :- Chris Knight
Responsible for consulting with regulatory authorities as required, provide measures for continual improvement to site procedures and ensuring all personnel are trained and competent in relation to environmental aspects of the mine site.
Telephone No:- 02 65788824
E-mail:- cknight@rixs.com.au

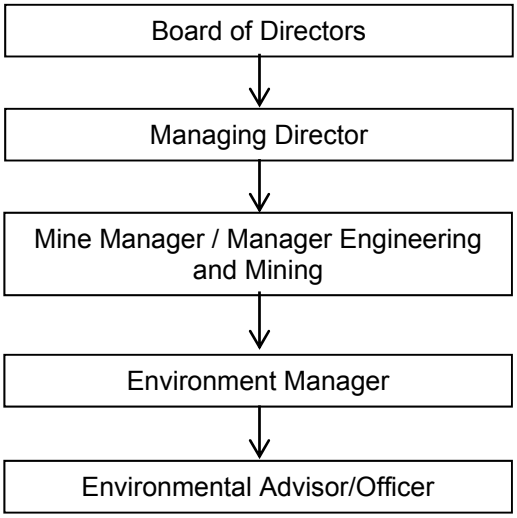
Environmental Advisor:- Chris Quinn
Responsible for assisting monitoring and reporting on the environmental performance of the operation and co-ordinating the rehabilitation on the mine site.
Telephone No:- 02 65788806
E-mail:- cquinn@rixs.com.au

Environmental Officer:- Hannah Bowe
Responsible for assisting monitoring and reporting on the environmental performance of the operation.
Telephone No: - 02 65788826
E-mail:- hbowe@rixs.com.au

Bloomfield / Rix's Creek Website:-
www.bloomcoll.com.au

2.3 Organisational Chart (Environment)

As per *Rix's Creek Mine Management Structure Register* document:



2.4 Employment Demography

Rix's Creek currently has 276 employees comprising of staff and operators. This is a significant increase from the 236 employees in the 2016 reporting period and 140 employees recorded in the 2015 Annual Review. The increased employment was mainly due to the ramping up of operations in the Camberwell Pit. The areas which include the largest number of employees are Singleton Council (31%), Maitland City Council (24%) and Cessnock City Council (18%). Rix's Creek mine endeavour to employ local personnel and local contractors are preferentially engaged as required.

Table 4 Demographic Breakdown at Rix's 2017

Council Area	Employees
Cessnock City Council	50
Dungog Shire Council	6
Lake Macquarie City Council	13
Maitland City Council	66
Mid-Coast Council	1
Muswellbrook Shire Council	13
Newcastle City Council	18
Port Stephens Council	11
Singleton Council	86
Upper Hunter Shire Council	12
TOTAL	**276**

SECTION 3 – APPROVALS

Table 5 RCM Approvals, Leases and Licences.

APPROVAL	ORGANISATION	VALIDITY PERIODS
Project Approval 08_0102	Planning NSW	26/11/2010 -31/12/2035
Project Approval 08_0102 Modification 7 as modified	Planning NSW	1/09/2017
Development Consent DA 49/94	Planning NSW	October 2019
Development Consent DA 49/94 Modification 9, as modified	Planning NSW	1/9/2017
Coal Lease 357	Division of Resources & Geosciences (DRG)	18/06/2013 – 27/03/2032
Coal Lease 382	DRG	10/10/2014 (renewed) – 11/11/2033
Coal Lease 352	DRG	October 2031
Mining Operations Plan Rix's Creek Northern Operations	DRG	8/1/2016 – 30/11/2018
Mining Lease 1437	DRG	28/04/1999-27/03/2032
Mining Lease 1518	DRG	14/06/2004-27/03/2032
Mining Lease 1630	DRG	16/03/2009-13/03/2030
Mining Lease 1648	DRG	04/01/2011-04/01/2032
Mining Lease 1649	DRG	04/01/2011-04/01/2032
Mining Lease 1650	DRG	04/01/2011-04/01/2032
Mining Lease 1651	DRG	04/01/2011-04/01/2032
Mining Lease 1725	DRG	16/12/2016-30/12/2018
Mining Lease 1432	DRG	July 2019
Notification of Dangerous Goods NDG028098	Work Cover	16/12/2018
New England Highway Closure Approval. ROL 521873	RMS	Renewed 6 monthly. Current ROL until 30/6/2018
WAL874 (240 GS)	NSW DPI - Water	Issued 31/3/2005
WAL672 (102 GS)	NSW DPI - Water	Issued 23/3/2005
WAL833 (54 GS)	NSW DPI - Water	Issued 31/3/2005
WAL797 (12 GS)	NSW DPI - Water	Issued 1/11/2006
WAL1273 (1.2 SS)	NSW DPI - Water	Issued 1/11/2006
WAL 10095 (230HS)	NSW DPI - Water	Issued 11/09/2006
Licence No 20SL050160	NSW DPI - Water	January 2018
Licence No 20SL049786	NSW DPI - Water	October 2017
Licence No 20SL060625 Converted to:- Water Access Licence 20AL201498 WAL 11084, Works Approval 20WA201499	NSW DPI - Water	June 2017
Licence No 20WA209900	NSW DPI - Water	Renewed December 2016
Bore Licence 20AL 200940	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 201041	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 201231	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20BL 167917	NSW DPI - Water	Issued 15/08/2000
Bore Licence 20BL 169571	NSW DPI - Water	Issued 07/03/2005

APPROVAL	ORGANISATION	VALIDITY PERIODS
Bore Licence 20BL 169573	NSW DPI - Water	Issued 07/03/2005
Bore Licence 20BL 169574	NSW DPI - Water	Issued 07/03/2005
Bore Licence 20BL 169628	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169629	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169630	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169631	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169632	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 169862	NSW DPI - Water	Issued 26/09/2005
Bore Licence 20BL 169864	NSW DPI - Water	Issued 26/09/2005
Bore Licence 20BL 171507	NSW DPI - Water	03/09/2007-Perpetuity
Bore Licence 20BL 171705	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 171707	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 171708	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 171710	NSW DPI - Water	17/08/2007-Perpetuity
Bore Licence 20BL 171720	NSW DPI - Water	16/02/2008-Perpetuity
Bore Licence 20BL 171721	NSW DPI - Water	16/02/2008-Perpetuity
Bore Licence 20BL 171722	NSW DPI - Water	16/02/2008-Perpetuity
Bore Licence 20BL 171813	NSW DPI - Water	03/04/2008-Perpetuity
Bore Licence 20BL 171814	NSW DPI - Water	03/04/2008-Perpetuity
Bore Licence 20BL 172277	NSW DPI - Water	15/09/2009-Perpetuity
Bore Licence 20BL 172278	NSW DPI - Water	15/09/2009-Perpetuity
Bore Licence 20BL 172289	NSW DPI - Water	15/09/2009-Perpetuity
Bore Licence 20BL 009051	NSW DPI - Water	Issued 20/04/1959
Bore Licence 20BL 012970	NSW DPI - Water	Issued 10/12/1962
Bore Licence 20WA219698	NSW DPI - Water	Renewed 28/02/2015
Bore Licence 20BL 171814	NSW DPI - Water	Issued 03/04/2008
Bore Licence 20AL 200530	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 200940	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 201041	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20AL 201231	NSW DPI - Water	Issued 01/07/2004
Bore Licence 20CA 200531	NSW DPI - Water	01/07/2004-25/02/2018
Bore Licence 20CA 201042	NSW DPI - Water	01/07/2004-30/06/2018
Bore Licence 20CA 201232	NSW DPI - Water	04/07/2004-30/06/2018
Licence No. 20BL170863	NSW DPI - Water	Renewed December 2016
Licence No. 20BL170864	NSW DPI - Water	Renewed December 2016
License No. 20BL172457	NSW DPI - Water	Perpetuity
License No. 20BL172458	NSW DPI - Water	Perpetuity
License No. 20BL172459	NSW DPI - Water	Perpetuity
License No. 20BL172460	NSW DPI - Water	Perpetuity
License No. 20BL172461	NSW DPI - Water	Perpetuity
License No. 20BL173812	NSW DPI - Water	Perpetuity
License No. 20BL173733	NSW DPI - Water	Perpetuity
License No. 20BL173734	NSW DPI - Water	Perpetuity

Table 6 Rix's Creek North Mine Project Approval History

Year	Description	Approval Reference
1990	Original application for open cut mining at Camberwell Coal Mine for the North Open Cut (NOC) and South Open Cut (SOC), development and operation of a coal handling and preparation plant, train loader and associated facilities submitted in 1990.	DA 86/2889 (and subsequently modified) Approved open cut activities were incorporated into the Integra Open Cut Project (MP 08_0102) with DA 86/2889 subsequently surrendered.
2007	Construction of surface facilities at the Complex. This application was submitted in 2006.	Approved under MP 06_0057 in 2007. Approved open cut activities were incorporated into the Integra Open Cut Project (MP 08_0102)
2008	Northern open cut was assessed in the Glennies Creek Open Cut Coal Mine EA prepared by R.W. Crockery & Co. Pty Limited in 200 (referred to as the NOC EA).	Approved under MP 06_0073 in 2008 (and subsequently modified)
2010	Western extension of the existing SOC (the western mining area) and incorporation of the approved NOC operations. An application and accompanying EA (URS 2009) (Open Cut Project EA) was lodged in 2009. This was supported by the Environmental Assessment titled *Integra Open Cut Project*, dated June 2009.	The combined project approval (08_0102) was granted in 2010 for the Integra Open Cut Project which incorporated the NOC Project (MP 06_003) and surface Facilities Project (MP 06_0057)
2012	Mod 1 – extension of the NOC out of-pit emplacement area. This was supported by the *Integra Mine Complex Modification 1 Environmental Assessment,* prepared by EMGA Mitchell McLennan, dated 2 December 2011	PA 08_0102 MOD 1
2013	Mod 2 – amendment to overland conveyor and extension of timeframes to secure biodiversity offsets. This was supported by the *Integra Mine Complex Modification 2 Environmental Assessment,* prepared by EMGA Mitchell McLennan, dated September 2012	PA 08_0102 MOD 2
2012	Mod 3 – interim modification to timeframes in project approval.	PA 08_0102 MOD 3
2016	Mod 4 – in relation to altering the approved biodiversity offsets strategy. This was supported by the *Integra Mine Complex Modification 4 Environmental Assessment*, prepared by EMGA Mitchell McLennan and dated 16 May 2014.	PA 08_0102 MOD 4
2016	Mod 5 – allow ROM coal from Rix's Creek to be processed at the Rix's Creek North CHPP. This was supported by the *Environmental Assessment for Proposed Modifications to Rix's Creek DA 49/94 N90/00356 (Mod 7) and Integra Open Cut Project 08_0102 (Mod 5),* prepared by Bloomfield Collieries Pty Ltd, dated 4 February 2016	PA 08_0102 MOD 5

Year	Description	Approval Reference
2016	Mod 6 – separate the combined Project Approval for the former Integra Mine Complex into two separate approvals for the underground (Glencore) and open cut operations (Bloomfield). This was supported by the *Application to Modify Project Approval for Integra Underground Project (MP 08_0101) and Integra Open Cut Project (MP 08_0102),* prepared by HV Coking Coal Pty Limited and Bloomfield Collieries Pty Limited, dated February 2016	PA 08_0102 MOD 6
2017	Mod 7 – allow for overburden and dry tailings from Rix's Creek South Mine to be transported to Rix's Creek North Mine. This was supported by the *Environmental Assessment for Proposed Modifications to Rix's Creek DA 49/94 N90/00356 (Mod 9) and Rix's Creek North Open Cut Project 08_0102 (Mod 7)*. Modification to allow exploration drilling to be conducted in an approved undisturbed area.	PA 08_0102 MOD 7

Table 7 Rix's Creek South Development Consent History

Year	Description	Approval Reference
1995	Coal Mining within CL 352 and on land subject to Coal Lease Application No 17 Singleton, construction and operation of surface coal mine and infrastructure and equipment upgrades. Total mine production capped at 15 million bank cubic metres of material movement.	DA 49/94 – Minister for Urban Affairs and Planning
1999	Mod 1 - Modification to amend applicable potentially affected lands monitoring requirements.	DA 49/94 Modification 1 – Minister for Infrastructure and Planning
2003	Mod 2 - Modification to receive ROM coal from Glennies Creek underground mine, process the coal and transport by rail.	DA 49/94 Modification 2 – Minister for Infrastructure and Planning
2004	Mod 3 - Modification to receive process and transport bulk coal samples from the Bickham exploration project.	DA 49/94 Modification 3 – Minister assisting the Minister for Infrastructure and Planning
2009	Mod 4 - Modification to allow a cut and cover tunnel under the New England Highway.	DA 49/94 Modification 4 – Minister for Planning
2013	Mod 5 - Modification to enable the construction and operation of a rail loop and associated clean coal stockpile and rail loading facility on the Rix's Creek mine site.	DA 49/94 Modification 5 – Minister for Planning and Infrastructure
2014	Mod 6 - Modification of the total volume of material that can be moved annually from 15 million bank cubic metres to 16.1 million bank cubic metres.	DA 49/94 Modification 6 – Minister for Planning
2016	Mod 7 - Modification to allow ROM coal from Rix's Creek North (former Integra Open Cut) to be transported to the Rix's Creek CHPP for processing.	DA 49/94 Modification 7- Minister for Planning

Year	Description	Approval Reference
2016	Mod 8 – Modification to construct and utilise two temporary ROM stockpile pads.	DA 49/94 Modification 8- Minister for Planning
2017	Mod 9 – up to 5 Million BCM of RCS overburden and 0.5 Million BCM of dried tailings from RCS CHPP per annum to be emplaced within the RCN overburden dumps.	DA 49/94 Modification 9- Minister for Planning

SECTION 4 – OPERATIONS SUMMARY

Table 8. Rix's Creek North PA08_0102 Production Summary

Material	Approved limit	Previous Reporting Period	This Reporting Period	Next Reporting Period
Waste Rock / Overburden	N/A	4,825,050 BCM	11,564,760 BCM	10,520,000 BCM
ROM Coal / Ore	4.5 Million Tonne per annum (western OC)	915,010 t	1,804,652 t	2,290,000 t
Coarse reject / Fine reject (Tailings)	N/A	0 t*	118,964 t*	500,000 BCM's from RCS
Saleable product	N/A	462,393 t	953,646 t	1,078,000 t

** RCN CHPP washed Integra UG Coal with Tailings deposited in Tailings Dam 2.*

Table 9. Rix's Creek South DA49/94 Production Summary

Material	Approved limit	Previous Reporting Period	This Reporting Period	Next Reporting Period
Waste Rock / Overburden	16.1 Million BCM total material movement as per DA 49/94 Mod 6	13,534,982 BCM	9,266,678 BCM	10,220,000 BCM
ROM Coal / Ore	N/A	2,662,223 t	2,013,486 t	2,292,000 t
Total Material Movement on Site – Overburden + Coal	16.1 Million BCM total material movement as per DA 49/94 Mod 6	15,309,797 BCM	10,609,002 BCM	11,748,000 BCM
Coarse reject / Fine reject (Tailings)	N/A	1,732,359 t *	1,938,869 t *	1,580,000 t
Saleable product	N/A	1,377,148 t	999,519 t	1,024,000 t

**Combined tailings from RCN and RCS operations*

4.1 Exploration

During 2017 no exploration was undertaken ahead of mining in the Rix's Creek South West Pit.

Exploration drilling was conducted in 2017 at RCN with 10 exploration holes being drilled to better determine the mining resources within the approved area. More exploration is planned to be undertaken commencing in early 2018 to better define the resource within the current mining tenements.

4.2 Land Preparation

Pre mining land preparation took place during the reporting period covering an area of 13.1 ha. The area cleared was located to the South West of the Camberwell Pit operations in Rix's Creek North.

4.3 Construction

The Coal Handling Preparation Plant (CHPP) has undergone modifications to further enhance coal recovery and reduce water usage to maximise washing efficiency. The new design was thoroughly tested throughout 2013 with modifications undertaken where necessary. Stage 1 of a small-scale tailing's drying process was commissioned during November 2013 with early results proving very successful. This process led to Rix's Creek receiving two more solid-bowl centrifuge (SBC) tailing's drying units and commissioning during November 2014 to minimise the need for tailing's dams and maximise in-pit dumping of washing plant waste product. During 2017 Rix's Creek used a combination of solid-bowl units to dispose of solid bowl water in pit as well as depositing fine reject within the active tailings facility onsite.

No other new infrastructure construction took place during 2017 at the RCS CHPP.

4.4 Mining

Rix's Creek Mine, which includes both Southern and Northern operations operated three shifts a day, 15 shifts a week for 48 weeks during 2017. Day shift operated between 06:20 and 14:20, afternoon shift operated between the hours of 14:20 and 22:20 hours and night shift 22:20 and 06:20.

The major operation took place in the Camberwell Pit at Rix's Creek Northern operations. The Liebherr R9800 excavator (EX9800) was relocated from the West Pit to the Camberwell Pit in July 2017. The Caterpillar 6040 (EX6040) was sold in October 2017 and transported from site. Hitachi 3600 (Exc3600–3) was recommissioned in November 2017 and transported to the Camberwell Pit to resume operations in the absence of the EX6040.

Operations also took place in West Pit western side of Rix's Creek South with the Hitachi 5500 excavator (EX5500) and the Hitachi EX3600 excavator (EX3600-1) in operation at West Pit.

There has been no major change to mining methods on site during the reporting period. Overburden and inter-burden were removed utilising the Liebherr R9800 excavator, Catepillar 6060 (EX6060) Hitachi EX5500 excavator, Hitachi EX3600 excavator, and large front end loaders (Caterpillar 994 & 992). These machines load 220 (Caterpillar 793) and 180 (Caterpillar 789) tonne rear dump trucks. Associated with this machinery is the normal suite of ancillary equipment (bulldozers, graders, water carts and drills) used in the overburden and coal removal process.

During 2018 the main pit expansion areas includes mining of the Rix's Creek North Camberwell Pit. Rix's Creek West Pit will continue to progress in a north-west direction aligned with the current MOP in place (I.e. between the out of pit dump and the New England Highway).

Table 10 is a list and number of the major pieces of equipment utilised on site for the mining operation.

Table 10. Equipment List 2017

Equipment List 2017	
Caterpillar 789 Truck	22
Caterpillar 793 Truck	11
Caterpillar 994 Front-End Loader	2
Caterpillar 992 Front-End Loader	2
Caterpillar 988 Front-End Loader	1
Caterpillar 950 Front-End Loader	1
Liebherr R9800 Excavator	1
Hitachi EX5500 Excavator	1
Hitachi EX3600 Excavator	3
Caterpillar 6060 Excavator	1
Caterpillar D 11 Bulldozer	8
Caterpillar D 10 Bulldozer	6
Caterpillar Tiger R690B Bulldozer	1
Caterpillar 16G Grader	1
Caterpillar 16H Grader	1
Caterpillar 24H Grader	2
Redrill SK75	1
Redrill SK50	1
Sandvik Drill D75K	1
Sandvik Drill D50-i	1
Volvo Stemming Truck	1
Volvo Lube Truck	2
Caterpillar 773 Lube truck	2
Caterpillar 785 Water Cart (114,000 l)	2
Caterpillar 777 Water Cart (80,000 l)	4
ACCO Water Cart (10,000 l)	1

4.5 Mineral Processing

Table 11 Production and Waste Summary for Rix's Creek Mine

Figures in () are for the current year	Cumulative Production (cubic metres)		
	Start of Reporting Period	**At end of Reporting Period**	**End of next reporting (estimated)**
Topsoil stripped (bcm)*	447,874	467,524 RCN – 19,650 RCS – 0	497,524 (30,000)
Topsoil used/spread (bcm)*	287,453	310 053 RCN –17,200 RCS – 5,400	340053
Waste Rock (bcm)	227,071,317	247,902,755 (20,831,438) RCN – 11,564,760 RCS – 9,266,678	270,802,755 (22.9 million) RCN – 10,520,000 RCS – 10,220,000
Run Of Mine Coal (tonne)**	48,152,369	51,970,507 (3,818,138) RCN – 1,804,652 RCS – 2,013,486	55,770,507 (3.8 million) RCN – 1.1 million RCS – 2.7 million
Processing Waste Tailings / Chitter (tonne)	19,997,601	22,055,434 (2,057,833) RCN - 118,964 RCS - 1,938,869	24.855,434 (2.8 million)
Coal (tonne)	28,107,434	30,060,599 (1,953,165) RCN – 953,646 RCS – 999,519	32,570,599 (2,51 million) RCN – 1,011,663 RCS – 1,500,000

** Topsoil figures are not from the commencement of the mining operations.*

*** Waste Rock includes both RCN and RCS combined volumes for 2017 period.*

The recovery of saleable to run of mine coal for the year was 51.1%. This is lower than the long-term average to date of 60%. This may be due to different coal quantities washed from the West Pit and Camberwell Pit area (i.e. high ash, sulphur, moisture).

During 2017, the Rix's Creek North CHPP washed Glencore's Integra Underground ROM Coal, with fine tailings from the coal washing process being deposited in Rix's Creek North prescribed emplacement facility Tailings Dam 2. Dry Tailings from the processing of Integra UG's coal was disposed of within the Rix's Creek North open cut area.

Coal that was extracted from both the Rix's Creek North and Rix's Creek Southern open cut areas was processed at the Rix's Creek South CHPP. The fine tailings from coal washing process was stored in Rix's Creek South's Emplacement Area 4, which is referred to as MB19. Dry tailings was disposed of within Rix's Creek South open cut area.

In October 2017, approval was sought for Rix's Creek Southern operations to emplace up to 5 Million BCM of RCS overburden and 0.5 Million BCM of dried tailings from RCS CHPP per annum to be emplaced within the RCN overburden dumps.

Table 12. Rix's Creek North Production

YEAR	RON-of-MINE COAL PRODUCTION (tonnes)	OVERBURDEN REMOVAL (bank cubic metres)	APPROVAL LIMIT ROM Coal (Tonnes)
2016	915,011	4,825,050	4,500,000*
2017	1,804,652	11,564,760	4,500,000*

* Project Approval 08_0102 Sch 2, Con.7.

Table 13. Rix's Creek South Production History

YEAR	RON-of-MINE COAL PRODUCTION (tonnes)	OVERBURDEN REMOVAL (bank cubic metres)	Total Movement of Material on site (bank cubic metres)	APPROVAL LIMIT (bank cubic metres)
1990	300,000			
1994	800,000			
1997	1,700,000	7,198,000		15,000,000
1998	1,800,000	7,052,000		15,000,000
1999	1,888,900	7,635,000		15,000,000
2000	2,288,900	7,635,000		15,000,000
2001	1,679,400	7,460,000		15,000,000
2002	1,754,001	7,787,685		15,000,000
2003	1,943,095	8,768,068		15,000,000
2004	1,931,383	8,511,771		15,000,000
2005	1,628,753	9,567,000		15,000,000
2006	2,015,042	11,547,989		15,000,000
2007	2,096,320	11,150,416		15,000,000
2008	2,096,697	11,020,152		15,000,000
2009	2,338,424	10,698,123		15,000,000
2010	2,367,229	10,267,881		15,000,000
2011	2,212,703	10,589,386		15,000,000
2012	2,689,935	10,341,895		15,000,000
2013	2,747,880	11,502,321		15,000,000
2014	2,760,693	13,234,085		16,100,000*
2015	2,847,899	13,364,730	15,073,469	16,100,000
2016	2,662,223	13,534,982	15,132,316	16,100,000
2017	2,013,486	9,266,678	10,609,002	16,100,000

*Development Consent 49/94 - Mod 6 approval granted November 2014.

The tailings is transported by pipeline and safeguarded by:-

- use of welded poly pipe;
- containment dams located along the length of the pipeline;
- regular pipeline inspections; and
- sequential flow meters.

The solid-bowl centrifuge system located at the RCS CHPP enables a lower amount of tailing's to be transported by pipeline as the water removed during the tailing's 'drying' process allows for co-disposal of the 'dried' tailing's within the open cut emplacement area in a similar fashion to overburden. Early testing of dump areas has shown minimal surface slumping / cracking when this

dried tailing's material is capped with sufficient overburden material from the mining process.

Return water is decanted from the emplacement area and pumped back to the containment water system that feeds the coal preparation plants. This maximises the recycling of mine water across site.

At Rix's Creek Norths CHPP, fine tailngs is pumped to prescribed emplacement facility Tailings Dam 2. A sloping decant structure was built in 2011 when the Tailings Dam was augmented. This allows the tailings return water to be transported to D1 for water to be reused for coal washing and dust supression at Rix's Creek North.

4.6 Waste Management

Waste Water: Grey water generated on site consisting of domestic waste water from the bathhouse, associated amenity areas and administration area pass through a septic system approved by the local authorities (OSSM Approval No: 2820/2002 expiry 1/3/2019). The septic tank provides a primary and secondary treatment process with solid waste processed by anaerobic bacteria. Effluent then passes to a maturation pond prior to disposal by evaporation and land irrigation. The Septic system is cleaned out 6-monthly by a suitably qualified waste contractor and the resulting waste is removed from site.

Waste Oil: Waste oil from mining equipment as a result of scheduled maintenance operations, breakdown repairs and the oil arrestor is collected in a storage tank and there after removed for recycling by a licenced waste oil contractor.

Most mining machinery is greased automatically by an on board system. The system is refilled from a bulk bin on the mobile service cart. Alternatively, this is carried out in the main workshop.

Any oily water from spills or contained within bunded storage areas are also collected by a licenced waste oil contractor.

Waste Metal: Scrap metal is collected for recycling on a regular basis as required. The metal recycler sorts into hard and soft metal for further economic benefit to the company. A tidy up initiative was carried out in 2017, which saw a large portion of disused scrap metal be recycled to improve the cleanliness of areas around RCM.

Copper Bin: Assorted copper on site, mostly from electrical wiring, is recycled by a metal contractor and collected on a regular basis as required. Most wiring remains with the protective layer attached but where economical a contractor strips assorted wire on-site for further economic benefit to the company. A copper waste bin is located in the electrical workshop to further minimise waste.

General Waste: General garbage is placed in large bins and taken off site by a licenced waste contractor for disposal in the Council landfill site.

Paper/Cardboard Recycling: Paper and Cardboard is placed in large bins and taken off site by contractor for further recycling. Small paper/recycling bins are placed within the main office, workshops and CHPP's to enhance recycling.

Plastic wrapping: Plastic wrapping recycling was introduced during 2015 to site. Plastic used in the wrapping of parts and other assorted uses across site is placed in tied-off bags within the store and collected with the paper/cardboard recycling for further recycling off-site by the waste contractor.

Batteries: Small general use batteries (AA, AAA, C, D, etc) recycling was introduced during 2015 to site. Sealed battery tubs are located within the offices, electrical workshop and RCN workshop for further recycling off site by the waste contractor. Large batteries are also stored on pallets within designated battery bays and taken off site by a licenced waste contractor.

Oil Filter Bin: Used oil filters from heavy vehicles are placed in a large filter bin near located at both the Southern and Northern workshops and taken off site by contractor for cleaning and recycling at the waste contractor's facility. In 2017 the large bins were changed out with bins with lids to reduce the inundation of water into the bins.

Hydraulic Hose Bins: Two hydraulic hose bins are located at the RCS and RCN workshops and

regularly serviced by a licenced waste contractor.

Oil Rag Bins: Oil rag bins were introduced to site in December 2017 after it was determined in an independent audit that oil rags were not being adequately segregated from other waste streams. There are two bins located at the RCS and RCN workshops and they are regularly serviced by a licenced waste contractor.

Used printer cartridges: These are placed in a large bin within the main office and taken off site by contractor for recycling at the waste contractor's facility as required.

Poly Pipe recycling: The RCS CHPP recycled 3000kg polyline in December 2017 which was sent offsite by a licenced waste contractor during the 2017 reporting period.

Electronic Waste: This waste is segregated and transported offsite to a local recycler by the primary waste contractor. E-waste can include, printer cartridges, old computers and outdated electronic componenents from operational machinery.

Table 14. 2017 Waste Volumes

Description	Q1	Q2	Q3	Q4	Total
Waste Oil (L)	107,400	36,200	142,400	102,300	**388,300**
Waste Metal (kg)	22,694	232,020	65,350	53,300	**373,364**
General Waste (kg)	34,191	36,094	33,753	30,771	**134,809**
Paper/Cardboard Recycling (kg)	3,044	2,434	5,813	3,880	**15,171**
Oil Filters (kg)	4500	5500	5604	4626	**20,230**
Batteries recycling (kg)	0	1000	0	1428	**2,428**
Fluro recycling (kg)	0	180	0	0	**180**
E- Waste (kg)	0	0	0	641	**641**
Hydraulic hoses (kg)	500	1151	3028	2643	**6,822**
Poly Pipe (Kg)	0	0	0	3000	**3,000**

4.7 Product Stockpiles

Raw coal is transported from the active mining areas in 180 and 220 tonne and rear dump trucks (Caterpillar 789 and 793) to the 30,000 tonne capacity run of mine (ROM) stockpile at the coal preparation plant prior to washing.

Product coal (clean coal) is conveyed to a 1,000 tonne bin and then transported by road vehicles 2.0 kilometres to the rail loading facilities. Each coal transportation semi-trailer holds approximately 48 tonnes of clean coal.
The capacity of the clean coal stockpile at the rail loading facility is 185,000 tonnes. During 2002 sections of the stockpile area were resurfaced and additional drainage installed. This work was completed in May 2004. The completion was delayed due to stockpile levels.

4.8 Hazardous Material Management

Under Schedule 11 of the Work Health and Safety Regulation notification of hazardous substances occurred during 2017. The listing of dangerous goods stored on site is listed below:-

Depot 1	Above ground tank for Class C1, UN 00C1 Diesel.	110,000 litres
Depot 2	Above ground tank for Class C1, UN 00C1 Diesel.	90,000 litres
Depot 3	Above ground tank for Class C1, UN 00C1 Diesel.	90,000 Litres
Depot 5	Above ground tank for Class C1, UN 00C1 Diesel.	90,000 litres
Depot 6	Above ground tank for Class 3, UN 1989 Aldehydes, N.O.S.	15,000 litres
Depot 8	Above ground tank for Class C1, UN 00C1 Combustible liquids	60,000 litres
GAS1	Cylinder store for Class 2.1, UN1001 Acetylene, dissolved	1,000 litres
GAS2	Cylinder store for Class 2.2, UN1072 Oxygen, compressed	1,000 litres
GAS2	Cylinder store for Class 2.2, UN1006 Argon, compressed	1,000 litres

RCN1	Above ground tank for Class 5.1, Ammonium Nitrate	50,000 kg
TKN1	Above ground tank for Class 5.1, Ammonium Nitrate Emulsion	60,000 kg
TKN2	Above ground tank for Class 5.1, Ammonium Nitrate Emulsion	30,000 kg

A separate licence for the storage and handling of explosives on the site has also been made to WorkCover. License number:- XSTR100131 was renewed in June 2012 until 5/7/2017. The listing of explosives stored on site is listed below:-

MAG1	Magazine Class 1.1B, UN 360, Detonator Assemblies non-electric	10,000 units
MAG1	Magazine Class 1.4S, UN 349, Articles, Explosives, N.O.S.	10,000 metres
MAG1	Magazine Class 1.4B, UN 255, Detonators, Electric for blasting	10,000 units
MAG2	Magazine Class 1.1D, UN 65, Cord, detonating, flexible	3,000 metres
RCN1	Explosives Receptacle Class 5.1, Ammonium Nitrate (ANFO)	50,000 kg
TNK1	Above ground tank Class 5.1, UN 3375, ANFO Emulsion	80,000 litres
TNK2	Above ground tank Class 5.1, UN 3375, ANFO Emulsion	36,000 litres

Access to Material Safety Data Sheets is through the ChemAlert web site. The register is continually updated as new products are brought onsite.

Explosives are stored in explosive magazines located on site.

4.9 Other Infrastructure Management

There has been an ongoing maintenance program on infrastructure associated with the Rix's Creek mining operation. This has included painting of assorted buildings and substations sheds across site.

Rix's Creek has ownership of the former Vale owned rail loop to transport product coal to the port of Newcastle for export. The rail loading facility and clean coal stockpile is located within the RCN lease area. In 2017 maintenance and access of the rail loop areas was improved and vegetation was removed off the ballast section of the rail loop.

During 2017, recommissioning work was completed on the Rix's Creek North CHPP in preparation for washing of Integra UG ROM coal in 2017.

SECTION 5 – ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

5.1 Actions Required at Previous Annual Review

The Rix's Creek South (DA: 49/94) and Rix's Creek North (PA 08_0102) annual environmental inspection took place on the 18 August 2017 and was undertaken by DRG – Environmental Sustainability Unit (ESU). Generally the Annual Review was accepted subject to the following items:

Table 15 Actions Required at Previous Annual Review

Description of Items	Addressed in 2017 AR
Results of rehabilitation monitoring undertaken against the rehabilitation completion criteria as presented in the Mining Operations Plans for Rix's Creek North and Rix's Creek South is to be reported in the rehabilitation section and used to justify achievement / progress towards achievement of rehabilitation objectives and completion criteria in future Annual Reviews.	Section 8.6
The Department notes as per Section 8.5 – Rehabilitation Monitoring within the 2016 Annual Review that rehabilitation monitoring was not undertaken during the reporting period. Section 8.1 Rehabilitation Monitoring Research and Reporting, 8.1.1 Post Mined Lands of the Rix's Creek South Mining Operations Plan and Rix's Creek North Mining Operations Plan 'representative monitoring sites will be established in newly rehabilitated areas at an average of one site per 20-50ha of newly rehabilitated land. Each site will be monitored within 12 months of establishment and then every two years after.' Further, 21.7ha of lands was reported as rehabilitated at Rix's Creek South operations within the 2015 Annual Review. The Department reminds Bloomfield Collieries Pty Ltd of the commitments within the Mining Operations Plan for both operations	Section 8.6
The Department requests that data relating to rehabilitation and disturbance areas, rehabilitation summary and maintenance on rehabilitated lands (as reported in the 2016 Annual Review in Tables 47, 48 and 49) is reported separately for the Rix's Creek North and Rix's Creek South in future Annual Reviews.	Section 8
The Department notes that the 2016 Annual Report submitted for Rix's Creek North and Rix's Creek South operations reports significant variances between actual disturbance and that approved by the Mining Operations Plans for both operations. It is noted that this matter has been investigated by the Resource Regulator. Justification of variances between disturbances approved by the Mining Operations Plan and actual disturbances is required to be reported in future Annual Reviews. Additionally, Bloomfield Collieries Pty Ltd should include an overview of the investigation (including outcomes) and report on control measures adopted to prevent future recurrences of exceeding approved disturbance areas in the 2017 Annual Review.	Section 8 Section 11
During the site inspection performed on 18 August 2017, Department representatives noted that a stockpile of substrate material was located along the northern batter of the West Pit Out of Dump Area (Plate 1). The Department requests that should this material be proposed to remain in situ for an extended period, stabilisation and control measures including (but not limited to) cover crop seeding and installation of appropriate sediment and erosion controls is undertaken.	Section 8

The Department of Planning and Environment (DPE) conducted a desk top audit for both the Rix's Creek South and the Rix's Creek North 2016 annual review. DPE requested an amended Annual Review that covered the following details by October 13 2017:

Table 16 Actions Required at Previous Annual Review

Description of Action	Addressed in 2017 AR
Noise – Both approvals require the AR to include a review of the Projects environmental performance against predictions made in the environmental assessment documents. Please include an assessment of the noise performance against the predictions made in the environmental assessments	Section 6.3, Appendix 1
Groundwater – Please include a comparison of the groundwater monitor results with the predictions in the relevant environmental assessments	Section 7.2
Rehabilitation – As per the Departments Annual Review Guideline, please include a discussion that addressed the key issues that may affect the ability to successfully rehabilitate the site, including but not limited to soil/spoil physical and chemical constraints such as excess soil magnesium, dispersion and salinity.	Section 8
Please provide a discussion of the coordination of blasting with other mines and any outcomes from this process.	Section 6.4.1
Environmental performance activities – please include a target date for the surrender of DA 49/94 in the environmental performance improvement activities table.	Section 12

SECTION 6 ENVIRONMENTAL PERFORMANCE

An extensive environmental monitoring program is conducted throughout the site and surrounding areas to monitor the impacts of the operation. Environmental parameters monitored include local meteorology, air quality, water quality, vibration and noise.

6.1 Meteorological

The RCS and RCN mine operates a meteorological station on the site. The RCS meteorological station is located on the Western extent of RCS west Pit operations and has real-time capabilities for all personnel to access via computer or phone. There is also a meteorological station at the RCN mine located near the entry lane / main administration office. This station has real-time capabilities and is accessed via the site Environmental Monitoring system (SCADA network). Both meteorological stations record the following environmental parameters:-

- wind speed and direction;
- temperature (2m and 10m);
- relative humidity;
- solar radiation; and
- rainfall.

In the Rix's Creek South DA 49/94 independent audit it was found that the real time temperature lapse rate (sigma theta) wasn't calculated at the RCS meteorological station. Rix's Creek Mine uses the Rix's Creek North Met station that calculates the real time temperature lapse rate across Rix's Creek Mine.

These parameters are recorded at 10-minute intervals and downloaded on a monthly basis. To complement this, Rix's Creek Mine is a member of the Upper Hunter Sounding Group Joint Venture (UHSGJV) which provides access to an atmospheric prediction model providing more accurate weather parameter predictions for the Rix's Creek operation. This information is used by management to access environmental conditions for blast scheduling, and determine when adverse conditions exist to cease dumping to exposed locations. This model also forecasts meteorological data for the following day so operational activities can be scheduled for the predicted conditions.

6.1.1 Rainfall

Total rainfall for the period was 560 mm over 66 days, which was 138 mm below average for the year - compared to 2016 where total rainfall was 705.75 mm and 7.75 mm above average. The yearly average for Singleton is 698 mm. The monthly rainfall data is provided in Table 17 and Figure 4 shows the results graphically.

March and October were the only months to receive above average rainfall. March received extensive rainfall with more than two times the average amount whilst October also received slightly increased rainfall. January, February and April through to September was a very dry period with 10 months receiving less than the monthly average rainfall.

Table 17. Annual Rainfall

RIX'S CREEK ANNUAL RAINFALL 2017													
Month	January	February	March	April	May	June	July	August	September	October	November	December	**TOTAL**
Total Rainfall	33.75	41	193.75	42.5	19.75	42.75	1	11	6	83.25	20.75	64.5	**560**
Average Rainfall	75	72	71	56	46	57	51	42	45	51	58	74	**698**
Wet days (>0.5 mm rainfall)	4	6	12	8	2	9	1	2	1	7	6	8	**66**

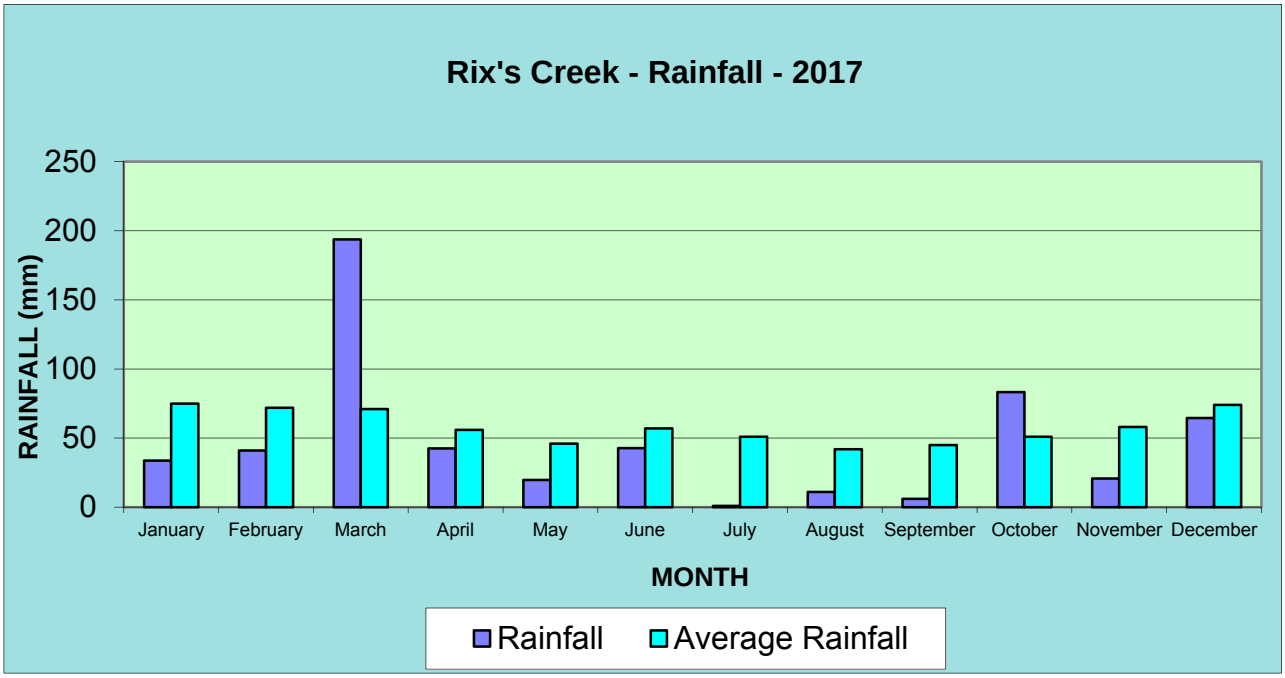


Figure 4 Annual Rainfall 2017

6.1.2 Temperature

The maximum temperature of 40.3 °C occurred on 20th December and the minimum temperature of 2.4 °C was recorded on 2nd July. Figure 5 shows the monthly average maximum and minimum temperatures for the site.

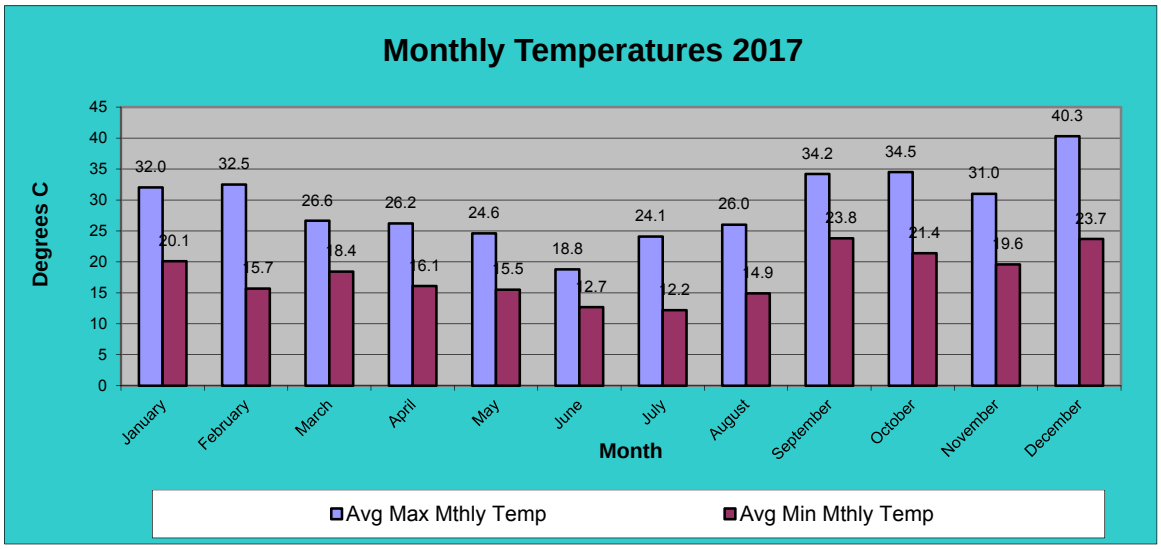


Figure 5 Average Monthly Maximum & Minimum Temperature 2017

6.1.3 Wind Speed and Direction

The results of wind speed and direction monitoring shows similar trends to previous years. During summer the winds predominate from the south east and winter the northwest. Autumn and spring are typically transitional seasons with winds distributed between both northwest and south-easterly directions. From all of the windroses it is evident the dominant wind direction for the calendar year was from the north-west.

Figure 6 shows the seasonal windroses generated for the site on a seasonal basis.

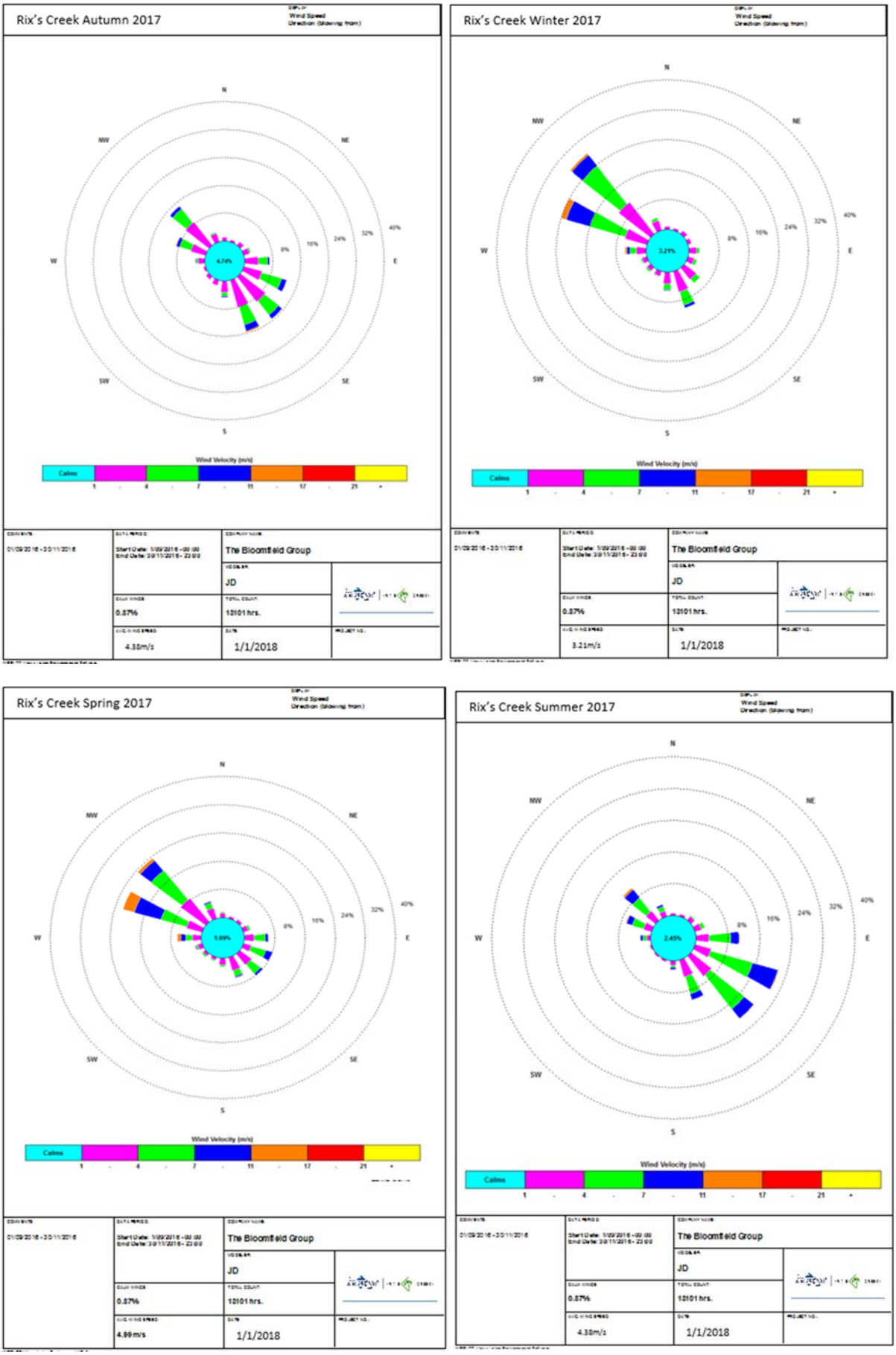


Figure 6 Windrows for Rix's Creek 2017

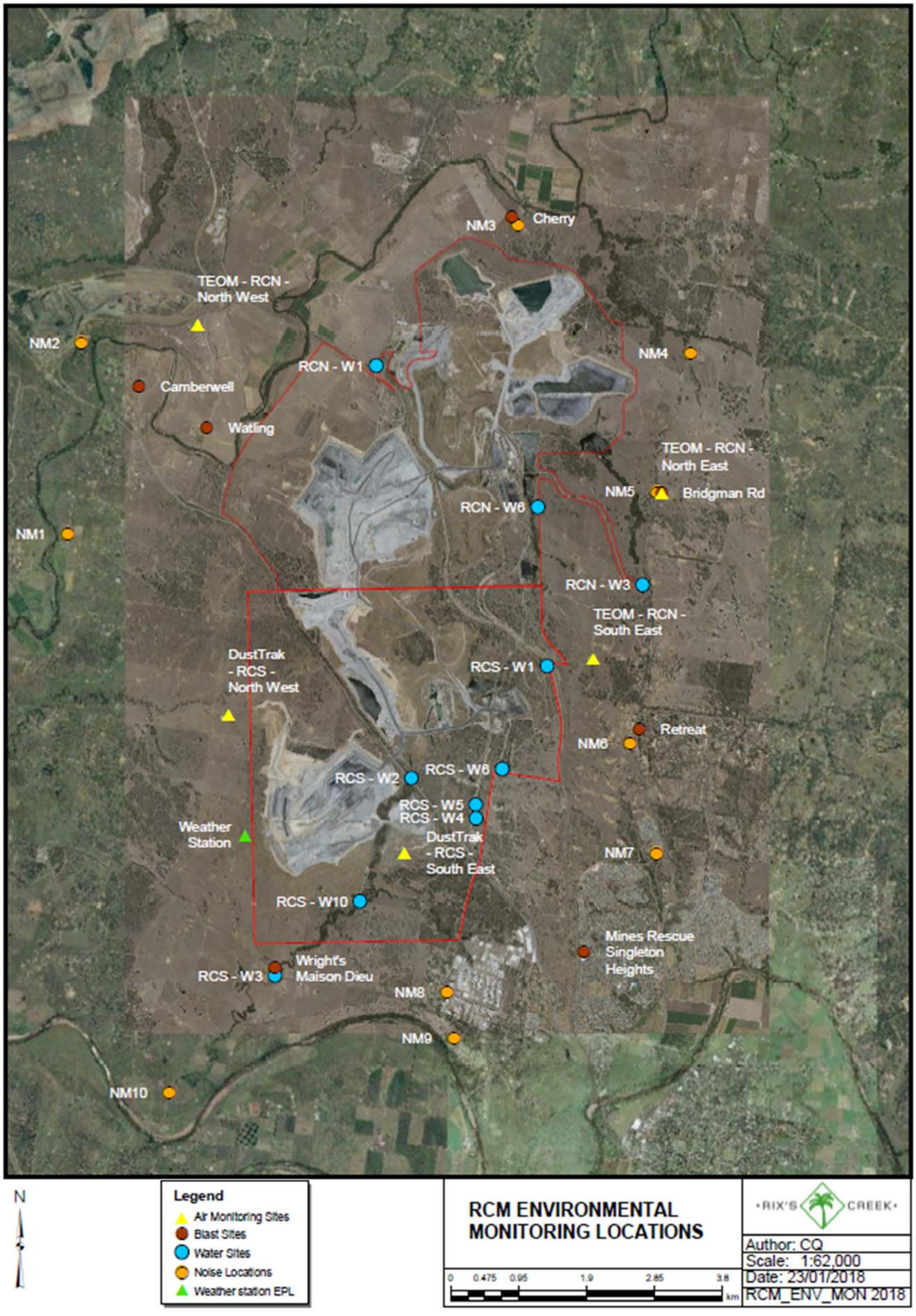


Figure 7 Rix's Creek Mine Environmental Monitoring Locations

6.2 Operational Noise

6.2.1 Environmental Management

Rix's Creek has changed the monitoring and reporting of noise during 2017. Modification 8 was also used as an opportunity to update some of the conditions within the Development Application 49/94. This allowed the management plans to be written across both RCN and RCS operations to create the Rix's Creek Mine Management Plans, an amalgamation of the Rix's Creek North and Rix's South Operations. Modification 8 changed the compliance assessment method from the 72 hour design goal monitoring proposed in the original 1989 EIS for Rix's Creek South DA 49/94, to a LAeq 15 min average compliance method for RCS operations.

A variation of EPL 3391 was approved on the 31 August 2017. The variation updated the noise monitoring toward industry best practice of LAeq 15min average for both Rix's Creek Southern and Rix's Creek Northern operations.

The Rix's Creek Mine Noise Management Plan, which includes both Rix's Creek Southern and Rix's Creek Northern mining operations was approved by Department of Planning & Environment on the 19 December 2017. The approved Noise Management Plan included a noise protocol that was developed in consultation with nearby mines and updated in the Noise Management Plan.

The primary objectives of the RCM Noise Management Plan, which was approved by DPE on the 19 December 2017, is to ensure compliance with legislative requirements, support procedures to manage and monitor noise emissions from the mine and provide management mechanisms to minimise the potential for noise from the mine to cause off site impacts were possible.

Residences surrounding the Mine have been grouped generally according to the locality and local acoustic environment. These groupings are referenced in the relevant EAs as Noise Assessment Groups (NAG).

6.2.2 Environmental Performance

Noise levels from RCN and RCS complied with the relevant criteria as detailed in the current Noise Management Plan at all monitoring location during 2017**.** A review of the projects environmental performance against predictions made in the environmental assessment is described in the Annual Noise Report in **Appendix 1.**

6.2.3 Incidents and Complaints

No reportable incidents were recorded relating to noise during the 2017 reporting period as a result of monthly independent compliance monitoring. Thirty Four (34) complaints were recorded for noise during 2017 compared to 38 complaints received in the 2016 calendar year. Rix's Creek Mine investigate all complaints. Rix's Creek Mine employee an Environmental Technician that conducts noise monitoring during afternoon and night shifts when Rix's Creek Mine is operational. If the operational noise from the mine is recorded within 2dB of the noise compliance limits, the Open Cut Examiner (OCE) is notified and operations are changed to reduce operational noise.

6.2.4 Further Improvements.

All equipment is checked and maintained on a regular basis to ensure noise attenuation equipment silencers – mufflers are operational. All new equipment is fitted with broad band reversing alarms to minimise offsite noise impacts. Sound suppression will continue for any new pieces of equipment prior to commencing work/s on-site.

Further noise attenuation work is also anticipated for the CHPP (eastern and southern walls) and ROM Pad receival hopper to minimise noise travelling south-east from this area. This work is dependent on the approval of the Rix's Creek Continuation project.

In 2018, four Caterpillar 793 Haul Trucks will be fitted with sound suppression package which include sound attenuated mufflers, radiator sound attenuated louvres and engine closures. Two water carts are also planned to be retrofitted with sound attenuated mufflers.

During 2014 Rix's Creek worked with Todoroski Air Sciences (TAS) and Nigel Holmes to develop a 3-D predictive noise model for the Mine. The meteorological data from the Hunter Valley Meteorological Sounding Group Joint Venture (HVMSGJV), meteorological forecasts for the Rix's Creek mine site is used to develop half hourly predictions, of noise enhancement conditions, for each twenty four hours of Mine production. To date noise enhancement has been in predicted area's shown on model. The model was upgraded during 2015 to include all offsite receptors (residences) as follows:

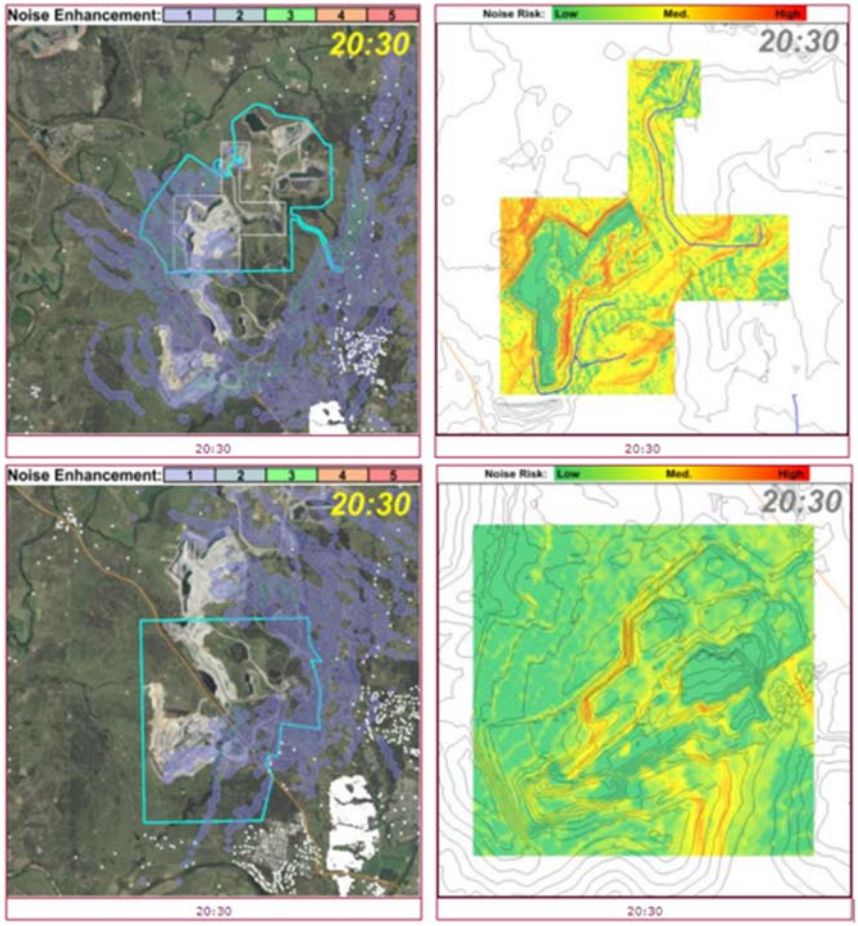


Figure 8 Updated noise model 2017 to reflect enhancement from operational areas within open cut area.

*White dots indicate off-site receptors / residences closest to mining operation.

The use of the Todoroski 3-D noise model to predict areas of possible meteorological enhancement of Rixs Creek open cut noise, to plan mine working faces has been successful in controlling it's noise impact to current Environment Protection License (EPL 3391) Project Specific Noise Criteria as per Noise Pollution Production Program (U1 Premises Noise Limits: 12323_PRP_R02 as submitted by Global Acoustics). An integral part of the Noise Management Plan is using real time attended monitoring. The monitoring results assist in calibration of the noise model and production shift supervisor placement of the mines production units to keep mine noise levels to license conditions.

During 2017 further advancements to the Todoroski 3-D noise model has occurred (Figure 8), with areas of operational noise enhancement being highlighted in yellow within the open cut area. This provides Rix's Creek Mine with additional proactive tools to manage noise when enhancement is predicted by ensuring that the allocation of sound attenuated equipment is utilised in the yellow/orange highlighted areas.

6.3 Blasting

6.3.1 Environmental Management

Blasting criteria for mining at Rix's Creek is specified in the Development Consent conditions and Environmental Protection License. The conditions state that blasting is to be carried out in accordance with the recommendations of Australian Standard 2187-1993 and in terms of ANZECC Guidelines and to the satisfaction of the EPA.

Blasting is not to be carried out within 500 m of the New England Highway or an approved deviation of the highway while open to traffic. During the year blasting in the West Pit has taken place within the 500 m exclusion zone under an approved procedure to close the Highway to traffic during blasting. The Company has approval from the Roads and Maritime Services (RMS) to conduct closures of the Highway for blasting under a Road Occupancy License (currently ROL 695092) – This approval is renewed every six months.

The Rix's Creek Mine Blast Management Plan was approved by the Department of Planning and Environment on the 19 December 2017. The blast management plan combines Rix's Creek Southern and Rix's Creek Northern operations. A cumulative protocol has been developed in coordination with the nearby mines and included in the approved Blast Management Plan as required.

The conditions specified in the Development Consents and Environmental Protection License require blasts to be designed to minimise air blast overpressure and ground vibration. Blasts are designed to ensure that there is less than 5 % probability of exceeding an air blast overpressure of 115 $dB_{(Linear)}$ to a maximum of 120 $dB_{(Linear)}$ and vibration with peak particle velocity of 5 mm/sec to a maximum of 10 mm/sec at the closest residence (not owned by the applicant outside the mining lease). Blasting frequency is also limited to one blast a day in the Camberwell Pit, this was maintained during the reporting period.

Instantaneous wind speed and direction information is available to management to be used in scheduling blasting operations to minimise offsite effects of air blast overpressure and dust. The Company is one of the joint venture partners in the Meteorological Sounding Group. This group has purchased equipment to measure wind speed, direction and temperature in the atmosphere. This data is then used to better predict the impacts of atmospheric conditions that can result in overpressure enhancement off site. The on-site weather station also has real-time data that can be viewed at any time by relevant site personnel. This weather station has the ability to alarm when conditions are not suitable for blasting i.e. wind speed currently greater than 10 m/s.

All blasts are monitored to record air blast overpressure and peak particle velocity at residences most likely to be effected. The modelling of dust and fume associated with blasting commenced during March 2012 and is constantly validated using DustTrak monitors, TEOM dust monitors and App-Tek OdaStat gas monitors. The monitoring was in conjunction with Rix's Creek daily EnvMet and NOx emissions predictive modelling. The NOx modelling shows various predicted outcomes and has continued provide an integral part of Rix's Blast regime during 2017 and can be seen in Figure 9. The pink dots on the model are the closest residences/receptor's that can potentially be impacted via blasting. During 2017 App-Tek OdaStat gas monitors were utilised during every blast to measure any potential fume emanating from a blast in conjunction with the dust / fume model.

Schedule 2, Condition 12(BII) of DA 49/94 and Schedule 3 Condition 16(c) of PA 08_0102 requires coordination of blasting onsite with nearby mines to minimise cumulative blasting impacts. Rix's Creek send out an email blast notification to nearby mines prior to all blasts that provides a figure of the location of the blast and the intended time of firing. Rix's Creek Mine also receives blast notifications from nearby mines which identifies the intended time and position of the blast so that coordination of blasts times can occur between mine sites. Rix's Creek Mine generally fires within the operator crib window (11:00am – 11:30am) and shift change out (2:00pm – 2:30pm). This bast protocol forms part of the Rix's Creek Mine Blast Management Plan that was approved by DPE on the 19 Decebmer 2017.

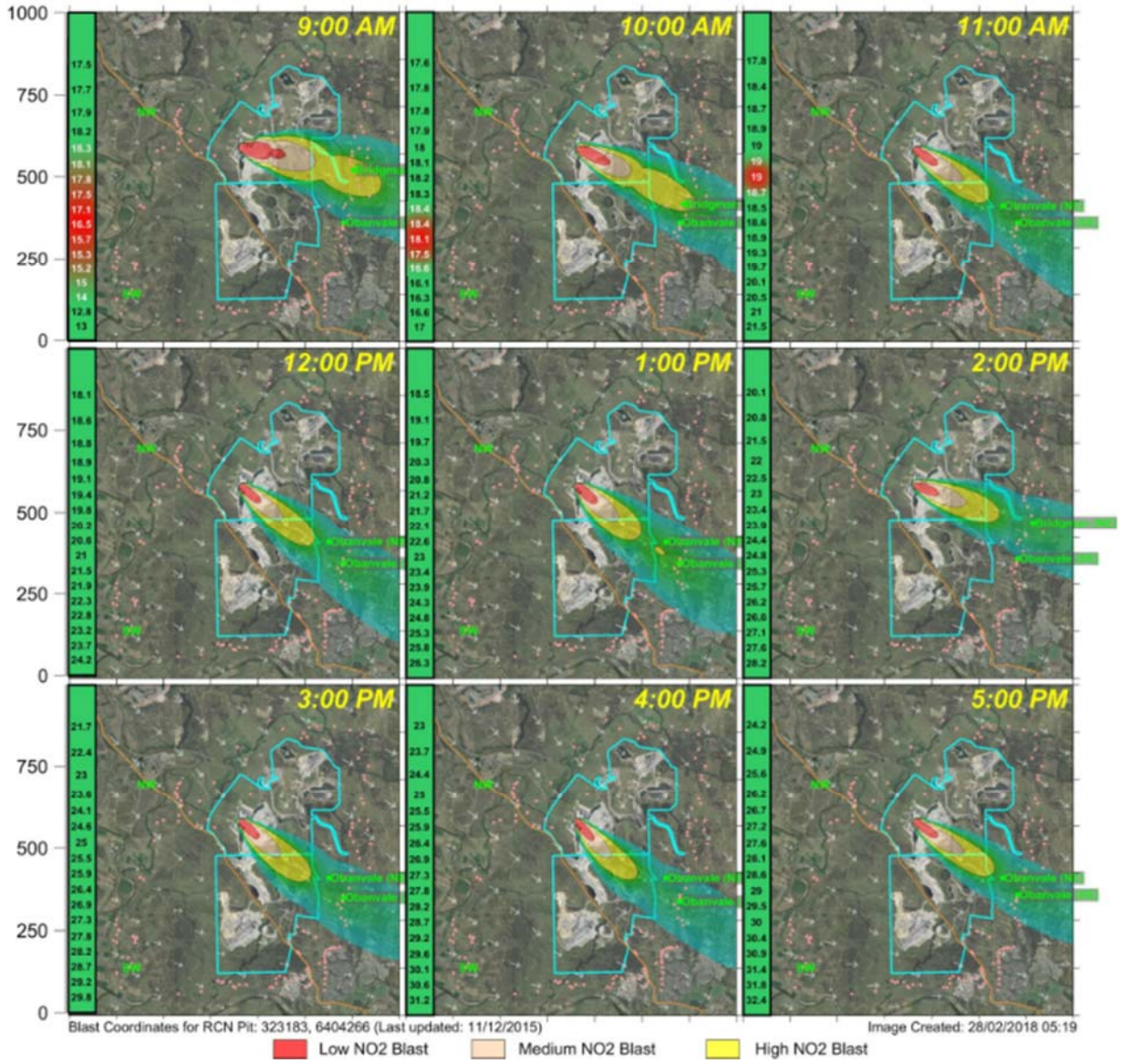


Figure 9 Blast Dust / Fume 'Plume' Model incorporated into the RCN site in 2017.

6.3.2 Environmental Performance

During 2017 a total of 127 production blasts were initiated into overburden. 63 blasts were fired in the Camberwell Pit at Rixs Creek Northern operations and 64 shots were fired in the West Pit at Rix's Creek Southern operations.

Rix's Creek North PA 08_0102 allows one blast a day in the Camberwell Pit, unless an additional blast is required following a blast misfire. This was complied with during the 2017 reporting period. All blasts fired at Rix's Creek Mine were carried out between 9am and 5pm Monday to Saturday. No blasts were fired on Sundays or public holidays.

Individual blast results for 2017 are shown on the Bloomfield website:
http://www.bloomcoll.com.au/Environment/RixsCreek/EnvironmentalReports/tabid/251/Default.aspx

Of the 127 blasts the fume ratings recorded were as follows:

Rating		A	B	C
0	84	-	-	-
1	-	24	5	-
2	-	8	6	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-

6.3.3 Incidents and Complaints

Of the 127 blasts, no blasting receptors within EPL 3391 recorded vibration over 5 mm/sec and 2 blasts at the Watling blast monitor recorded overpressure above 115 dB_{Linear}. Rix's Creek Mine remained below the 5% of total blasts over a period of 12 months. Blasts were cancelled and rescheduled due to unfavourable weather conditions, this included rainfall, windspeed, wind direction, dust potential, fume potential and overpressure potential.

During 2017, ten (10) complaints were received by nearby community residences in relation to blasting at Rix's Creek Mine.

6.3.4 Further Improvements

The Company is part of the Terrock EnvMet Research Project. This allows access to the prediction model for atmospheric enhancement for overpressure. This information is used to access the potential for overpressure enhancement due to the predicted atmospheric conditions throughout the day. This information can then be used to schedule blasting operations to minimise off site environmental impacts resulting from blast overpressure. The models (overpressure, fume and dust) are now capable to have predictive forecasting for atmospheric conditions two days ahead to further enhance undertaking blasting during ideal weather conditions. The models have also been updated to include nearest receptors which are likely to be affected by blasting activities.

Rix's Creek have access to several predictive weather models in which products are selected for blasting based on possible weather conditions prior to blasting. Blast products will continually be reviewed and trialled where thought beneficial throughout 2017 to minimise fume emitted from blasting. Fume will continually be monitored on site to manage any onsite and offsite impacts in the case of a fume event resultant from a blast. Two gas analysers are also set-up downstream of all blasts to monitor any potential gasses released from blasts on the site boundary.

Rix's Creek blast fume model was updated again in 2017 to progress from the previous 2D ground level model to one displaying the modelling of altitude (up to 1000m) as well as wind speed and direction to further assist the scheduling of blasting activities.

Since the acquisition of the Rix's Creek North site, the predictive model has been updated to accommodate for this operational expansion and maintain a consistent standard of blast monitoring. Further analysis will continually be done regarding any blast vibration impacts resultant from Camberwell Pit blasts, in particular on the Dulwich residence.

Due to the acquisition of the Rix's Creek North site, a decision was made in consultation with DPE to relocate the Ernst Blast Monitor to the Watling residence. Also, an additional blast monitor was installed at Camberwell UHAQMN site to further measure any potential blast impacts on the village of Camberwell.

The ACCO 10,000L water cart was continually used for crusting drill cuttings from the drill and blast process. The watering of drill cuttings generally follows the path of the drill on the shot and also when unfavourable wind conditions are predicted.

6.4 Air Quality

6.4.1 Environmental Management

The Rix's Creek Mine Air Quality and Greenhouse Gas Management Plan (AQGGMP) was approved by DPE on the 19th December 2017 and addresses dust management practices and the air quality monitoring network at both Rix's Creek South and Rix's Creek North operations. This program involves monitoring air quality for dust particulates. A cumulative protocol has been developed in coordination with the nearby mines and included in the approved RCM AQGGMP.

The air quality assessment criteria are listed in Table 18.

In April 2017 Rix's Creek Mine received from the EPA a Licence Variation Notice 1550914 to EPL3391 'Optimisation of Air Quality Monitoring' issued under section 58(5) of the *Protection of the Environment Operations Act 1997* to improve the air quality monitoring methodologies utilised. Rix's Creek Mine shifted from the primary use of HVAS and DDG methods of air quality analysis and instead aligning with the EPA's requirements for optimised real time air quality monitoring at both upstream and downstream receptors of the Rix's Creek Mine, to determine Rix's Creek Mines cumulative air quality contribution.

TEOM and Dusk Track systems offer the vital advantage of real-time access to continuous air quality data as well as the upstream and downstream differentials across the site.

As such, all future air quality monitoring and associated reporting will utilise:-

- 2 dust deposition gauges (DDG28 and DDG32);
- 3 TEOM's equipped to sample particulates less than 10 microns (PM10) in diameter via real-time / continuous monitoring (RCN NW, RCN SE and RCN NE);
- 2 Dust Trak units which sample particulates less than 10 microns (PM10) in diameter via real-time continuous monitoring (RCS NW and RCS SE).

Table 18 Air Quality Assessment Criteria

POLLUTANT	STANDARD	PERIOD	AGENCY
TSP	90µg/m3	Annual average	EPA/DPE/ National Health & Medical Research Council
PM10	50µg/m3	24 hour maximum	EPA/ DPE
	30µg/m3	Annual average	EPA/ DPE
	50µg/m3	24 hour average; 5 exceedances permitted a year	National Environment Protection Measure (NEPM)
Depositional Dust	4g/m2/month	Annual maximum total deposited dust level	EPA/ DPE
	2g/m2/month	Annual maximum increase in deposited dust level	EPA/ DPE

Dust Deposition Gauges

Thirty (30) Depositional Dust Gauges were sampled from January 2017 to April 2017. After the EPL 3391 variation to improve the optimisation of air quality monitoring, there has been a significant reduction in the sampling of DDG's. Two (2) DDG's have remained within the Rix's Creek Mine monitoring suite and are sampled on a monthly basis. The location of the DDG's are referred to in Figure 7.

The dust deposition gauges conform to Australian Standard 2724.1- 1984 Ambient Air - Particulate Matter, Part 1 - Determination of Deposited Matter expressed as insoluble solids and ash residue. Gauges have 150 mm funnels located 2 metres above the ground.

High Volume Air Samplers

Rix's Creek Mine monitored the High volume air samplers from January until the end of December 2017. High volume air samplers which are located at three sites on the eastern side of the lease i.e. between the operation and the populated area of Singleton. These samplers run for 24 hours on a six day cycle and provide information on total suspended particulates (TSP) and particulates less than 10 micron (PM_{10}) in diameter and operate in accordance with Australian Standard 2724.3 and AS3580.9.3:2003

These units are located at:-

1) Rix's Creek Lane;
2) Singleton Heights - Mines Rescue Station; and
3) Off Bridgman Road - Lot 2, The Retreat.

Tapered Element Oscillating Microbalance (TEOM)

The approved AQGGMP has 3 TEOMS which were reinstated at Rix's Creek North site during February 2016. PM10 is assessed for the purpose of real-time environmental management as defined by Standards Australia AS/NZS 3580.9.8.2008: Methods for sampling and analysis of ambient air – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser.

During 2017, there has been a relocation of the RCN TEOM dust monitors at the upstream and downstream receptors to better align with the predominant wind directions in the Upper Hunter. Due to the relocation of TEOM's there was a transitional arrangement where TEOM units were swapped during February and March 2017. Rix's Creek Mine had an information access arrangement with Ashton Mine to share data from the Richards TEOM located toward the North West of the operations on Glennies Creek Road. Due to the transitional arrangements, Ashton Mine removed the Richards monitor in January 2017. The Western Extension Monitor was still in operation, located at the North West of RCN until March 29th, where it was relocated to Obanvale, located toward the South East of RCN operations and renamed RCN SE TEOM. The RCN SE TEOM was commissioned on the 30th March 2017. The Bridgman Road TEOM remained in the same position and was renamed RCN NE TEOM.

A TEOM was commissioned at the North West of RCN operations on the 29th May 2017. The reason for the extended time frame was that Rix's Creek had to enter into an arrangement with Mount Owen Mine to place a TEOM on their property located on 248 Glennies Creek Road. Sourcing power and site access to install and commission the RCN NW TEOM took time. The EPA varied the RCN EPL 3391 to extend the timeframe for commissioning on the RCN NW TEOM to the 31st May 2017.

The location of the TEOMS are shown in Figure 7.

Dust Trak Monitors

Two Dust Trak units which sample particulates less than 10 microns (PM10) in diameter via real-time continuous monitoring. Dust Trak monitors are located at the Rix's Creek Southern operations and are located toward the North West of the mining operations in West Pit (Dust Trak RCS NW). the other Dust Trak unit is located on the South Pit rehabilitation (Dust Trak RCS SE).

The location of the Dust Trak monitor are shown in Figure 7.

Environmental controls employed to minimise dust generation includes the application of recycled mine water to haulage roads and areas with heavy use by machinery, application of recycled mine water to drill pads (i.e. fine cuttings) and sprinkler systems on coal stockpile areas and the surrounds of the washing plant.

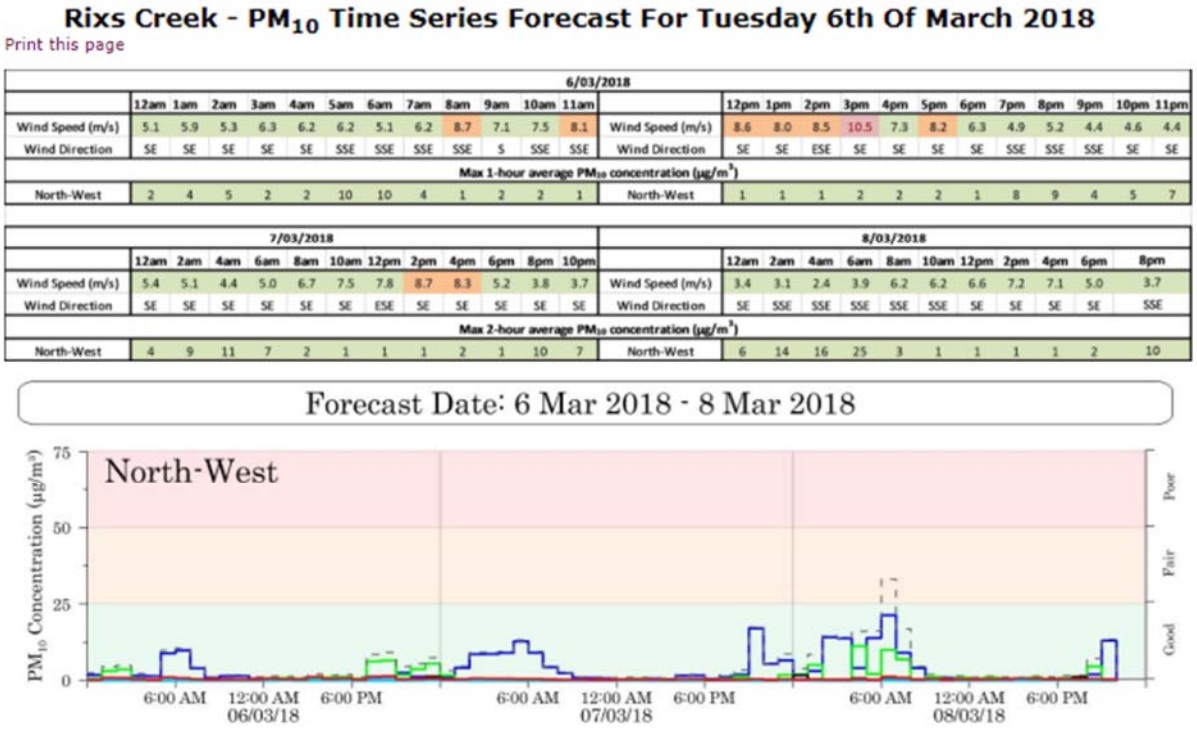
Conveyor systems at the washing plant and rail loader are enclosed on at least two sides to control dust.

Operational procedures for blasting include not blasting under adverse weather conditions i.e. high wind and direction conditions; when there is a likelihood that dust generated from the blast will reduce visibility at the lease boundary or New England Highway. Wind speed and direction information is available at the office for staff to make informed decisions regarding the prevailing weather conditions when scheduling blasts. This data is available real time from Rix's Creek weather station as well as the Hunter Valley Meteorological Sounding Group Joint Venture - Lemington site and through improved localised meteorologic daily forecasts.

This information is used to schedule operations so as to minimise the potential for dust emissions. Under adverse weather conditions overburden is not dumped to exposed locations. When these conditions exist the overburden removal and dumping operation is modified with dumping occurring either in pit or to areas not exposed to the prevailing winds, alternatively operations may be ceased until conditions are suitable. For blasting, information is used in a model to predict the potential for meteorological reinforcement of overpressure as well as directional travel of dust/fume from a blast. The model shows the likelihood and receptors that may be affected by the blast which in turn can alter the timing of the blast being initiated.

Rix's Creek is an active participant of the Upper Hunter Air Quality Monitoring Network. The network consists of Industry and Government. The aim is to establish a network of air quality monitors located throughout the valley from Singleton to Muswellbrook to monitor air quality. There are currently 14 monitoring sites operational. One of the monitoring sites is located between the Rix's Creek mine and Singleton town ship on land owned by the Company. This monitoring site was commissioned in August 2011 and is currently displayed on the OEH website known as 'Singleton NW' and displays wind speed, wind direction and PM10 data on a continuous basis. Rix's Creek has an annual data agreement to access data from this station for a fee.

During 2017 a site-specific dust forecasting tool was used to predict the potential for dust emissions being created on site and affecting air quality. This forecasting tool uses predictive met-data to highlight times throughout the day the operation may be affected. Based on this, the operation can be modified before the high potential of dust to occur. This includes utilising increased supervisor inspections, additional water carts, re-schedule servicing of equipment, work lower in the pit, shut-down equipment, activate water sprays on stockpiles to name a few.



Rixs Creek - PM_{10} Time Series Forecast For Tuesday 6th Of March 2018

Print this page

6/03/2018																								
	12am	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am		12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
Wind Speed (m/s)	5.1	5.9	5.3	6.3	6.2	6.2	5.1	6.2	8.7	7.1	7.5	8.1	Wind Speed (m/s)	8.6	8.0	8.5	10.5	7.3	8.2	6.3	4.9	5.2	4.4	4.6	4.4
Wind Direction	SE	SE	SE	SE	SE	SSE	SSE	SSE	SSE	S	SSE	SSE	Wind Direction	SE	SE	ESE	SE	SE	SE	SE	SSE	SSE	SSE	SE	SE
Max 1-hour average PM_{10} concentration ($\mu g/m^3$)																								
North-West	2	4	5	2	2	10	10	4	1	2	2	1	North-West	1	1	1	2	2	2	1	8	9	4	5	7

7/03/2018														8/03/2018											
	12am	2am	4am	6am	8am	10am	12pm	2pm	4pm	6pm	8pm	10pm		12am	2am	4am	6am	8am	10am	12pm	2pm	4pm	6pm	8pm	
Wind Speed (m/s)	5.4	5.1	4.4	5.0	6.7	7.5	7.8	8.7	8.3	5.2	3.8	3.7	Wind Speed (m/s)	3.4	3.1	2.4	3.9	6.2	6.2	6.6	7.2	7.1	5.0	3.7	
Wind Direction	SE	SE	SE	SE	SE	SE	ESE	SE	SE	SE	SE	SE	Wind Direction	SE	SSE	SSE	SSE	SSE	SSE	SE	SE	SE	SE	SSE		
Max 2-hour average PM_{10} concentration ($\mu g/m^3$)																									
North-West	4	9	11	7	2	1	1	1	2	1	10	7	North-West	6	14	16	25	3	1	1	1	1	2	10	

Figure 10 Example of dust forecasting tool to assist operations during 2017

Table 19 Dust Monitoring Sites

SITE	LOCATION
1	Adjacent to railway line on East Boundary
2	Adjacent to railway line on East Boundary
3	Near old railway cutting
~~4~~	Near Middle Falbrook Road, North boundary (discontinued - area now active mine)
5	Rix's Creek Lane East Boundary
6	Near New England Highway
7	Paddock opposite middle Falbrook Road intersection – moved to Bowman boundary fence during July 2012
8	Off Maison Dieu Road
9	Off Maison Dieu Road near Dight's Crossing intersection
10	Off Maison Dieu Road
11	Wattle Ponds Road
~~12~~	Oval near Singleton Civic Centre (discontinued due to constant vandalism)
13	Lawson Avenue, Singleton Heights
14	Mines Rescue Station, Singleton Heights
15	Gardner Circuit, Singleton Heights
16	46 D'Arbon Crescent, Singleton Heights
17	The Retreat
18	Bridgman Road
19	Main Northern Railway
20	Bridgeman Road
21	Bridgeman Road
22	Bridgeman Road
23	Main Northern Railway
~~24~~	Off Middle Falbrook Road (discontinued - now active mining area)
25	Off New England Highway
26	Granbalang – Off New England Highway
27	Off Wattle Ponds Road adjacent to Hunter River
28*	Off New England Highway north-west of lease. Relocated August 2011
29	South of Maison Dieu Road
30	West of lease
31	West of lease
32*	Pre-School Gardner Circuit
33	Wright Property Maison Dieu

*Note – Deposition Dust Gauge 28 and 32 will continue to be sampled. The other DDG's have been decommissioned.

6.4.2 Environmental Performance

Insoluble Solids

During January to April 2017 all 30 gauges comply with the DECC Insoluble Solids Dust Deposition assessment criteria of an annual average result of less than 4 gm/m^2/month. Location of the depositional dust gauges are referred to in Table 19.
In 2017 seven (7) of the dust deposition gauges (23%) exceeded the arbitrary annual average result of 2 g/m^2/month when compared to eight (8) or 27% in 2016. It must be noted that 30 DDG's were sampled from January to April 2017. The monitoring of DDG's were significantly reduced with only DDG 28 and DDG32 being sampled for the remainder of 2017.

The results from previous years are listed below:-

- 4 gauges or 13% exceeded 2 g/m^2/month 2017 January to April 2017 sampling
- 8 gauges or 27% exceeded 2 g/m^2/month 2016
- 8 gauges or 27% exceeded 2 g/m^2/month 2015
- 8 gauges or 27% exceeded 2 g/m^2/month 2014
- 11 gauges or 37% exceeded 2 g/m^2/month 2013

- 17 gauges or 57% exceeded 2 g/m^2/month 2012
- 15 gauges or 50% exceeded 2 g/m^2/month 2011
- 4 gauges or 13% exceeded 2 g/m^2/month 2010
- 17 gauges or 57% exceeded 2 g/m^2/month 2009
- 6 gauges or 20% exceeded 2 g/m^2/month 2008
- 5 gauges or 17% exceeded 2 g/m^2/month 2007
- 10 gauges or 33% exceeded 2 g/m^2/month 2006
- 5 gauges or 17% exceeded 2 g/m^2/month 2005
- 7 gauges or 23% exceeded 2 g/m^2/month 2004
- 4 gauges or 13% exceeded 2 g/m^2/month 2003
- 12 gauges or 40% exceeded 2 g/m^2/month 2002
- 11 gauges or 37% exceeded 2 g/m^2/month 2001
- 9 gauges or 32% exceeded 2 g/m^2/month 2000
- 10 gauges or 35% exceeded 2 g/m^2/month 1999
- 11 gauges or 39% exceeded 2 g/m^2/month 1998
- 12 gauges or 35% exceeded 2 g/m^2/month 1997
- 13 gauges or 35% exceeded 2 g/m^2/month 1996
- 4 gauges or 15% exceeded 2 g/m^2/month 1995

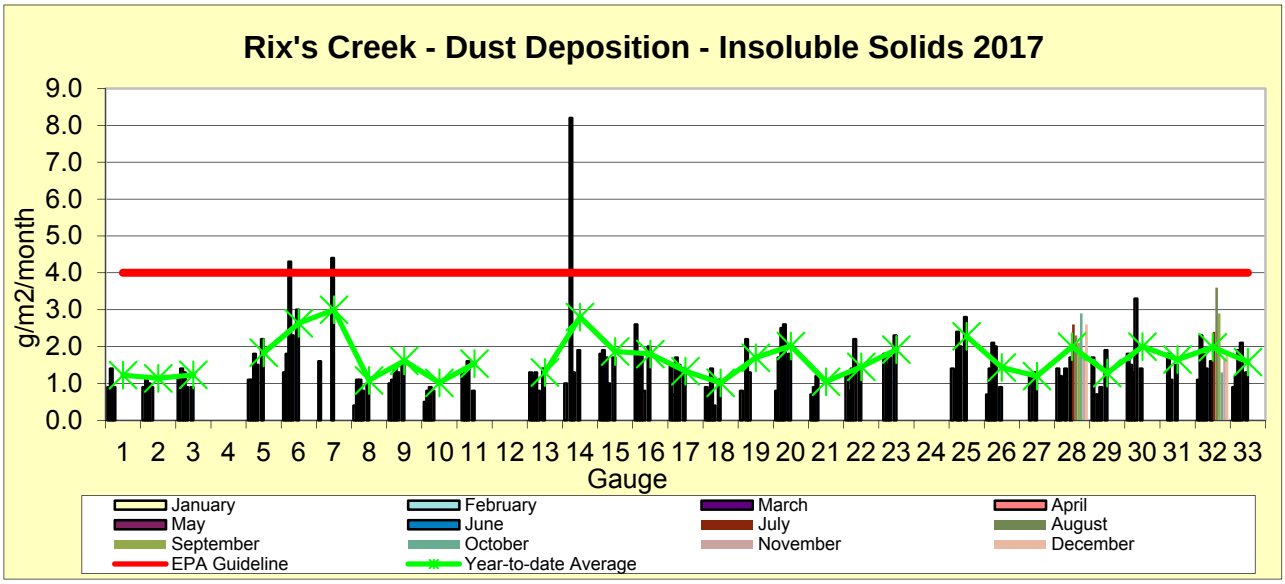


Figure 11 Rix's Creek Insoluble Solids Dust Deposition 2017

Figure 11 displays the individual monthly insoluble solids deposition rates for each gauge and annual average deposition result in gm/m^2/month. The graph does not contain any contaminated results nor have they been included in the annual averages. There were 21 contaminated samples recorded in 2017.

Some sites individual monthly result exceeded the annual limit of 4.0 gm/m^2/month and these results are most likely as a result of localised episodic events. The maximum result was in March at Site 14 measuring 8.1gm/m^2/month. This DDG site is located at Mines Rescue Station in singleton Heights, south of the operations.

Figure 12 shows the running 12 month averages for dust deposition and gives a good indication of any trends that may be emerging around the site. From the graph the gauges with the higher results; gauges 6, 7 and 27 are located in close proximity to South Pit and West Pit mining operations. These same gauges recorded similar trends 2015 and 2016 in comparison to the 2017 dust deposition results.

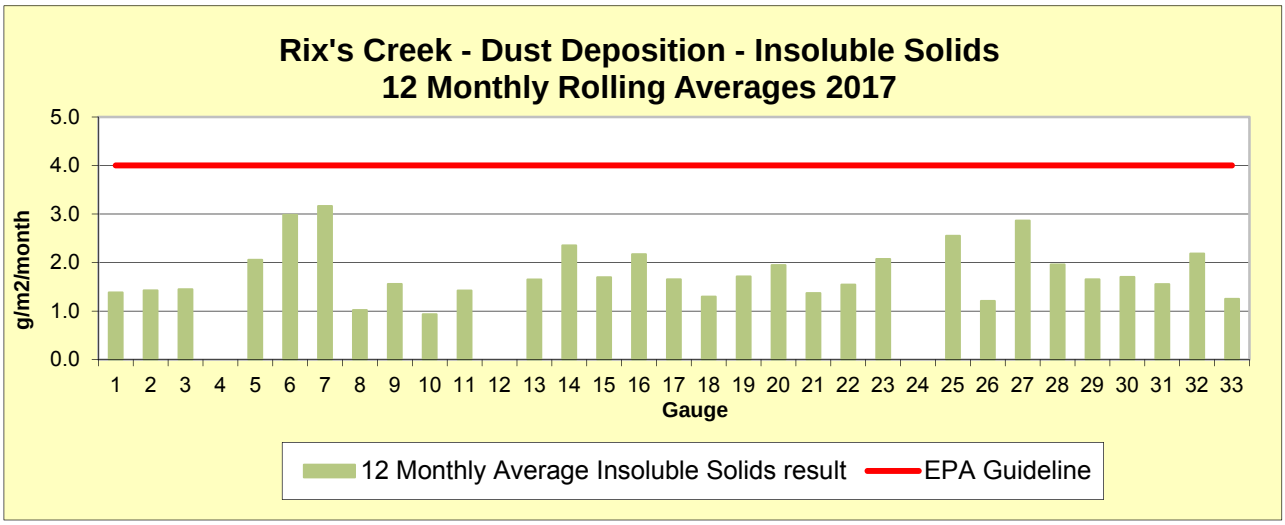


Figure 12 Insoluble Solids Dust Deposition 12 Monthly Average 2017

Total Suspended Particulates

All sites are below the limit set by the National health & Medical Research Council (NHMRC) air quality guideline annual average of 90 *u*g/m^3. The maximum, minimum and average results summarised in Table 21 and Figure 13 show the individual results for each site throughout the year and monthly averages. There was 30 out of a possible 183 results (16%) that exceeded the annual average limit of 90 *u*g/m^3. Mines Rescue 6 results, Retreat 13, and Rix's Creek 12 results.

The last 10 years individual results that exceeded the Annual Average level of 90 *u*g/m^3 are:-

- 34 results – 19% in 2017
- 20 results - 11% in 2016
- 33 results – 18% in 2015
- 39 results – 21% in 2014
- 60 results – 33% in 2013
- 32 results – 17% in 2012
- 34 results – 19% in 2011
- 35 results – 19% in 2010
- 44 results – 24% in 2009
- 36 results – 20% in 2008
- 18 results – 10% in 2007
- 40 results – 22% in 2006

Table 21 Total Suspended Particulates (ug/m3) 2017

GAUGE	MINIMUM		MAXIMUM		AVERAGE		No. of RECORDINGS
	2017	2016	2017	2016	2017	2016	
Mines Rescue Station	12	9	139	125	51.2	48.6	100 (%)
Rix's Creek	13	10	249	159	61.9	59.6	100 (%)
The Retreat	11	9	268	131	63.2	55.8	100 (%)

The average TSP results for 2017 increased at all of the three sites – Mines Rescue by 2.6 *u*g/m^3, Rix's Creek by 2.3 *u*g/m^3 and The Retreat by 7.4 *u*g/m^3 when compared to the 2016 average TSP

results. Refer to Table 21 above. Rainfall was 138mm below the annual average for the 2017 period, which coincided with elevated TSP levels when compared to the 2016 reporting period results.

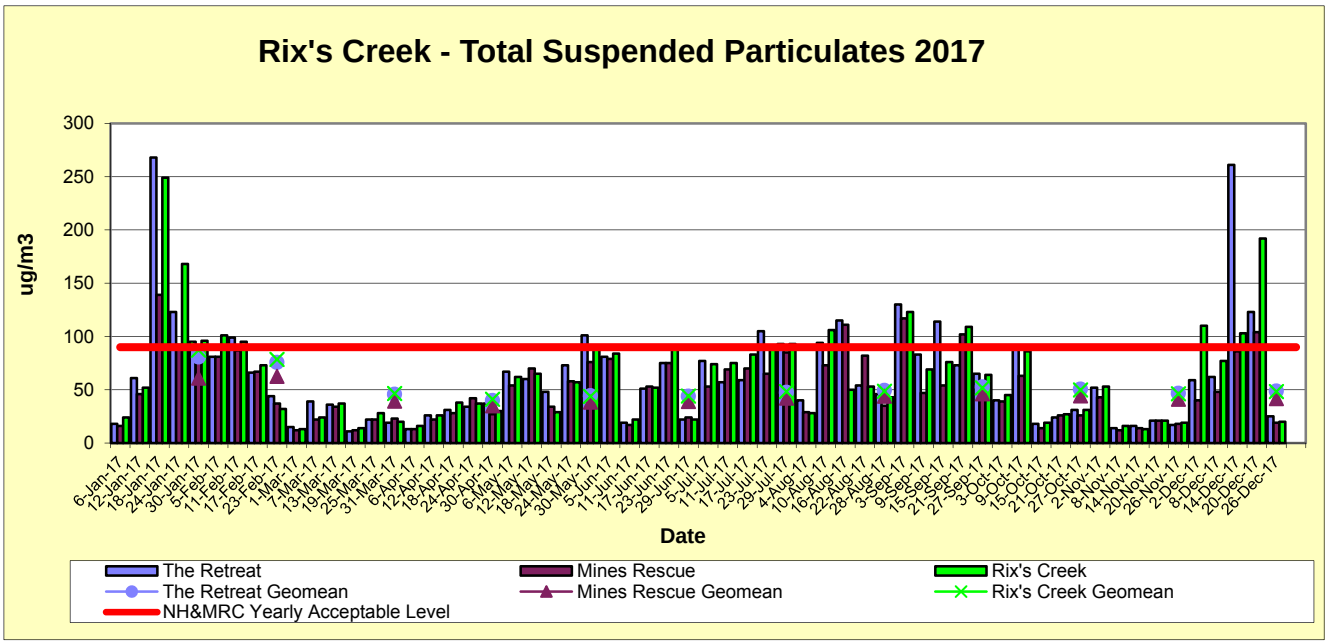


Figure 13 Total Suspended Particulates 2017

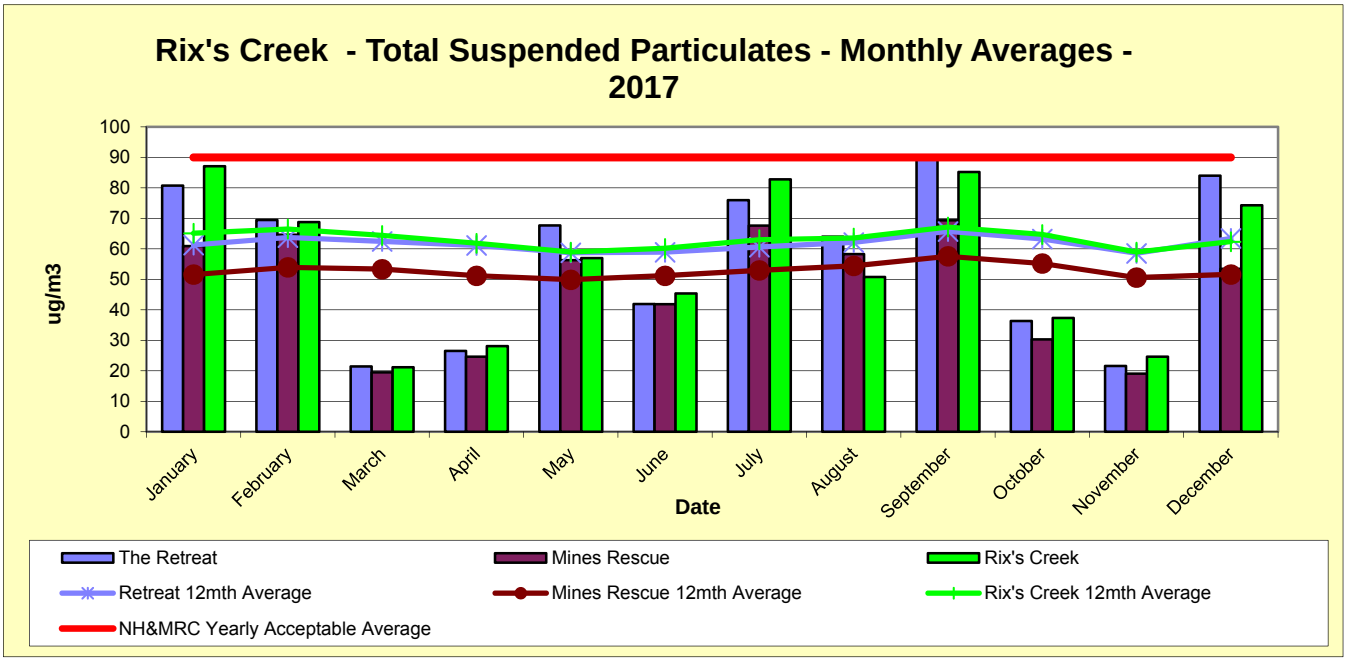


Figure 14 Total Suspended Particulates Monthly Averages & 12 Monthly Rolling Averages

Figure 14 shows the monthly average results for each site during the year along with the running 12 monthly averages. The monthly results were elevated at the Retreat and Rix's Creek sites for January, February, July, August, September and December. January, February and May through to September were all subsequently dry months of the year regarding very low rainfall. In September the retreat recorded at TSP average of 90 *u*g/m^3 and Rix's Creek receptor recorded 85 *u*g/m^3. The elevated levels in TSP correlate with the below average rainfall during the July to September period. December 2017 also recorded below average rainfall which coincided with elevated regional levels of TSP.

Particulates Less Than 10 Micron

The daily level of 50 *u*g/m^3 was exceeded at the Rix's Creek site on 5 occasions, Mines rescue on 1 occasion and Retreat on 1 occasion during the 2017 period. On the 18 January 2017 PM10 was above 50ug/m3 at all three monitors. This coincided with low rainfall and elevated wind conditions on the 18 January.

Throughout the reporting period no problems were experienced with 100% of the data collected from the Hi - Volume Samplers.

The annual averages for Mines Rescue and the Retreat receptors increased by 2ug/m3 when compared to the 2016 annual average results. The Rixs Creek receptor recorded an increase (4 *u*g/m^3) compared to last year's results. All sites are under the 30 *u*g/m^3 annual average limit. 2016 recorded significantly higher rainfall than the 2017 reporting period and this can be attributed to elevated averages for the 2017 reporting period.

Table 21 Hi Vol Results – particulates less than 10 Micron

GAUGE	MINIMUM		MAXIMUM		Average		No. of RECORDINGS
	2017	2016	2017	2016	2017	2016	
Mines Rescue Station	3	4	53	46	20	18	100 (%)
Rix's Creek	6	6	157	57	27	23	100 (%)
The Retreat	3	4	80	42	20	18	100 (%)

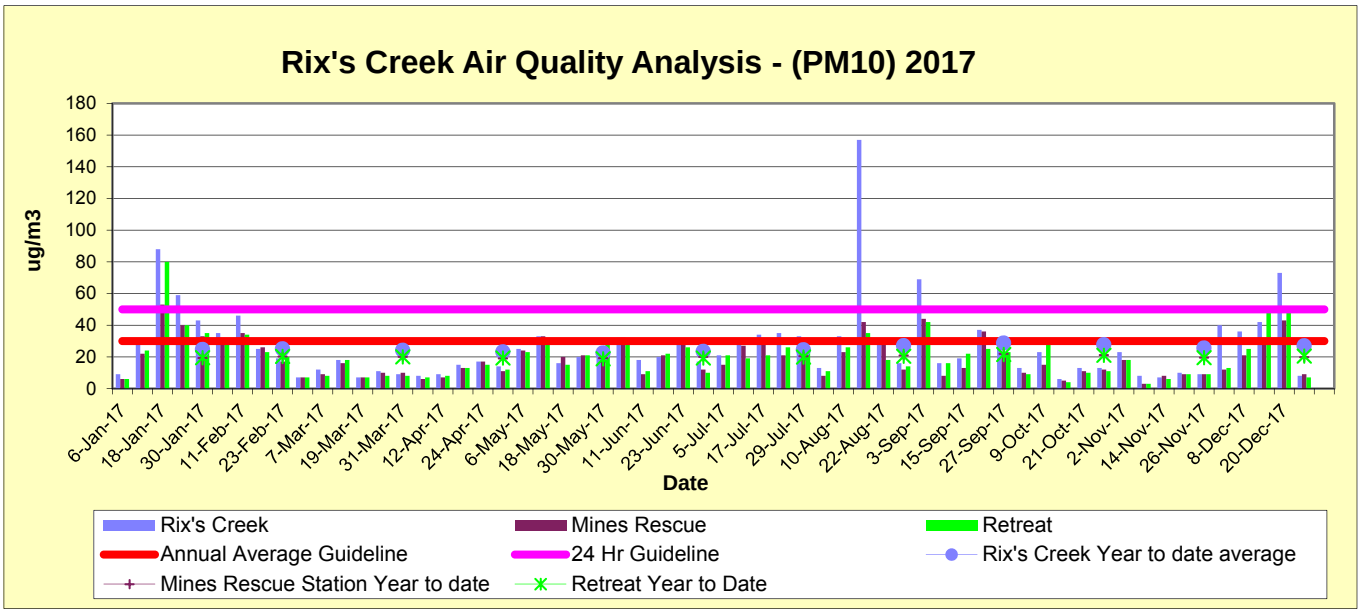


Figure 15. Particulate Matter <10 Micron 2017

Individual run results are depicted in Figure 15 with the monthly results and 12 monthly rolling averages shown in Figure 16. Figure 16 also includes a snapshot of monthly rainfall over the 2017 reporting period. The trend shows that periods of high rainfall coincided with reduced PM10 results and periods of low rainfall (August and September) coincided with elevated PM10 results.

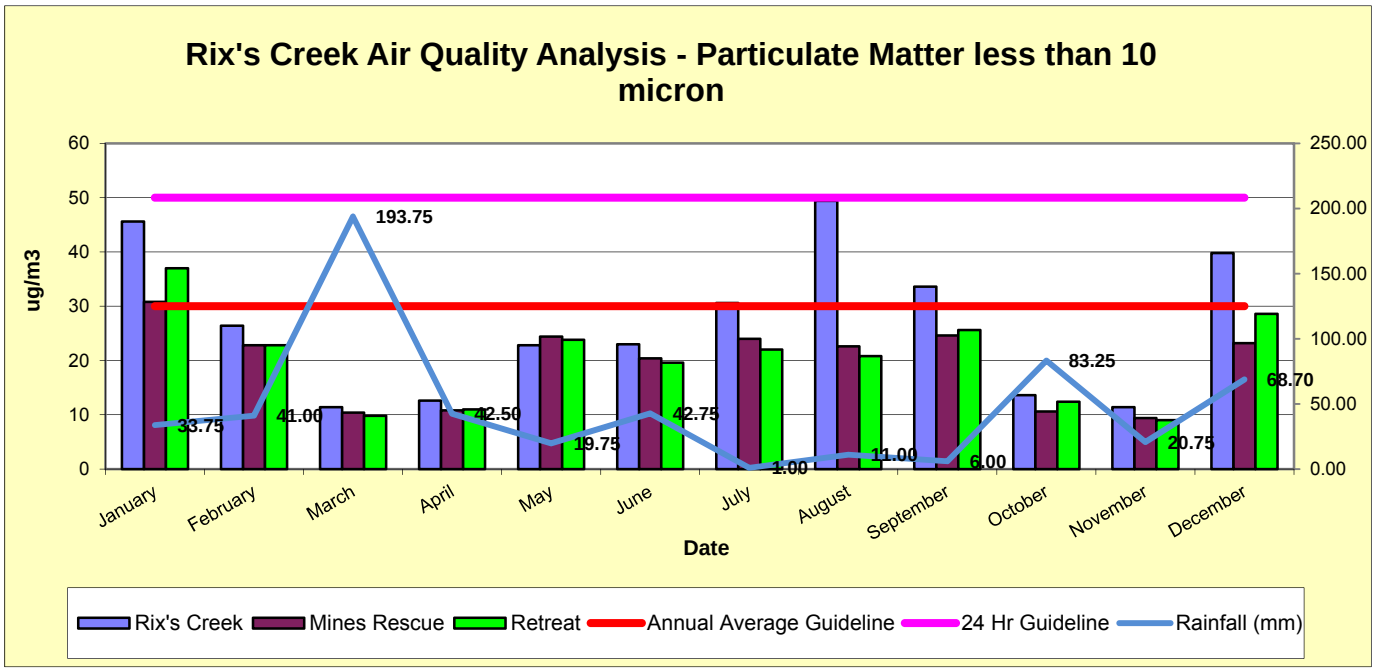


Figure 16 Particulate Matter less than 10 Micron Monthly Averages & 12 Monthly Rolling Averages 2017

During 2017, there has been a relocation of the RCN TEOM dust monitors at the upstream and downstream receptors to better align with the predominant wind directions in the Upper Hunter. Due to the relocation of TEOM's there was a transitional arrangement where TEOM units were swapped during February and March 2017. Rix's Creek Mine had an information access arrangement with Ashton Mine to share data from the Richards TEOM located toward the North West of the operations on Glennies Creek Road. Due to the transitional arrangements, Ashton Mine removed the Richards monitor in January 2017. The Western Extension Monitor was still in operation, located at the North West of RCN until March 29th, where it was relocated to Obanvale, located toward the South East of RCN operations and renamed RCN SE TEOM. The RCN SE TEOM was commissioned on the 30th March 2017. The Bridgman Road TEOM remained in the same position and was renamed RCN NE TEOM.

Due to the close proximity of Rix's Creek Mine to the community of Camberwell Village, the Camberwell UHAQMN TEOM was also used by RCM during the transitional arrangement to determine the upstream air quality contribution while the RCN NW TEOM was being commissioned. A TEOM was commissioned at the North West of RCN operations on the 29th May 2017. The reason for the extended time frame was that Rix's Creek had to enter into an arrangement with Mount Owen Mine to place a TEOM on their property located on 248 Glennies Creek Road. Sourcing power and site access to install and commission the RCN NW TEOM took time. The EPA varied the RCN EPL 3391 to extend the timeframe for commissioning on the RCN NW TEOM to the 31st May 2017.

During the 2017, the NW RCN TEOM exceeded the 24hour PM10 contribution on 40 occasions, the NE RCN TEOM exceeded the 24 hour PM10 contribution on 2 occasions and the SE RCN TEOM exceeded the 24 hour PM10 contribution on 16 occasions. On days when the 24 hour PM10 exceeded 50ug/m3 the analysis of upstream contribution compared to the downstream contribution identified no exceedances of Rix's Creek Mines cumulative contribution occured.

Table 22 provides analysis of the upstream and downstream TEOM monitors in conjunction with the prevailing wind direction and shows that the upstream receptor (NW RCN TEOM) has elevated readings when compared to the downstream (SE RCN TEOM) receptor. This trend indicates that the elevated air quality readings are coming from upstream sources in a North Westerly direction from Rix's Creek Mine.

The monthly averages and 12 month rolling averages are shown in Figure 17. The RCN TEOM recorded elevated monthly average PM10 samples for July (56.26 ug/m3), August (37.44ug/m3) and

September (54.09ug/m3). In comparison the SE RCN TEOM recorded monthly averages of 35.5ug/m3 in July, 29.2ug/m3 in August and 42.77 ug/m3 in September. July to September period recorded higher monthly averages due to significantly lower than average rainfall and elevated NW winds. The NE RCN TEOM recorded 23.9ug/m3 in July, 21.6ug/m3 in August and 30.96ug/m3 in September 2017.

When the Rix's Creek North air quality results for 2017 are compared to the 2009 Environmental Assessment modelled results for year 6 part pit extent of the operations, it was determined that the annual average at the RCN NW TEOM (35ug/m3) was significantly higher than the EA prediction at the mine owned residence ID 85 (24ug/m3), which is where the location of the RCN NW TEOM is located. This was due to significantly low rainfall over the July, August and September period, which coincided with elevated regional air quality levels. Please note that the RCN NW TEOM was the upstream air quality receptor over the July, August and September periods. Comparatively, the Camberwell Upper Hunter Air Monitoring Network (UHAQMN) upstream monitor recorded an annual average of 27ugm/3 for the 2017 reporting period. The South East TEOM and North East TEOM PM10 averages were consistent with 2009 EA predictions for year 6 part pit extent operations.

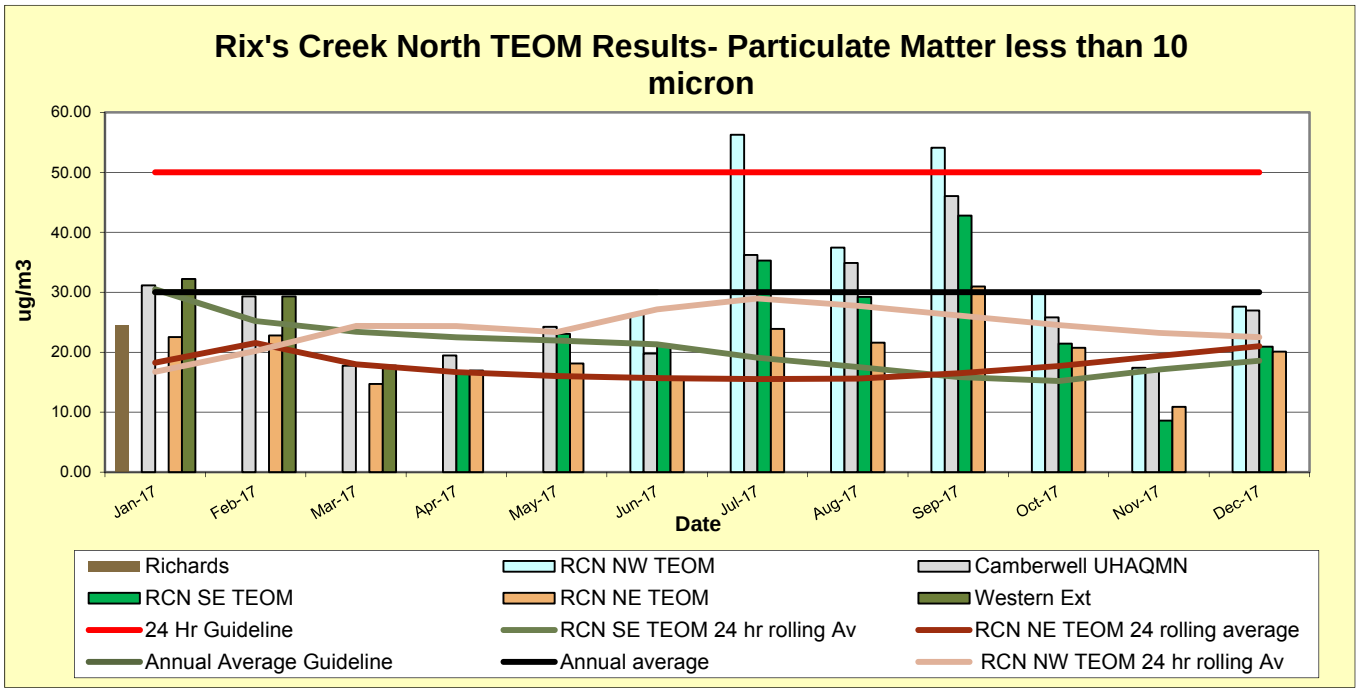


Figure 17 Particulate Matter less than 10 Micron Monthly Average and 12 Month Rolling Averages 2017

Table 22 Analysis of Air Quality under adverse weather conditions upstream, downstream air quality difference

Date	RCN NW TEOM 24 hr Av (ug/m3)	RCN SE TEOM 24 hr Av (ug/m3)	Upstream downstream Differential (RCM Contribution)	Predominant Wind Direction	Max Wind Speed (m/s)
27/07/2017	80.06	58.32	-21.74	North Westerly	4
28/07/2017	55.15	43.18	-11.97	North Westerly	10.5
29/07/2017	66.77	45.27	-21.51	North Westerly	8.8
30/07/2017	56.10	33.63	-22.46	North Westerly	10.8
31/07/2017	74.43	32.20	-42.23	North Westerly	11.5
1/08/2017	41.11	24.68	-16.43	North Westerly	4.5

6.4.3 Reportable Incidents

There were no reportable incidents occurring during the 2017 period.

6.4.4 Further Improvements

Further improvements to the Rix's Creek Real time SCADA system will be completed in 2018 to assist mining operation to make informed decisions under adverse weather conditions. This will involve the integration of existing real-time dust trak monitors situated around the Rix's Creek South operations into the SCADA network, as well as the integration of both met stations onto one real time system to form a complex wide real time monitoring system.

6.5 Contaminated Polluted Land

6.5.1 Environmental Management

No contaminated or polluted land has been identified at Rix's Creek. No significant hydrocarbon or chemical spills occurred requiring special response, clean-up or ongoing management.

6.5.2 Environmental Performance

Regular inspections of hydrocarbon storage facilities are completed as part of the site EMS, and no land contamination or significant pollution incidents were reported during these inspections.

6.5.3 Reportable Incidents

No reportable incidents relating to land contamination occurred during the 2017 reporting period.

6.5.4 Further Improvements

The inspection regime is ongoing and management practises are in place to identify and control leaks or spills before they become contamination issues. The Hydrocarbon Management Procedure was updated in 2017 and will be regularly monitored and reviewed as necessary.

6.6 Threatened Flora and Fauna

6.6.1 Environmental Management

The Rix's Creek North Biodiversity Management Plan (BMP) was to approved by DPE on the 21 December 2017. The objectives of the Biodiversity Management Plan are to rehabilitate, revegetate and manage land for biodiversity within the biodiversity offset areas and the mine site during and post mining.

For Rix's Creek Southern operations (DA49/94), no threatened species have been identified on site in the EIS prepared for the operation or since then as the operation has progressed. No area of significant habitat exists on the site. "*The site has been extensively disturbed as a result of previous land uses and similar species and habitats exist in surrounding areas. No rare or endangered plant or animal species were observed during the study or are likely to occur on the site.*" Environmental Impact Statement for Proposed Modification of Mining Operations – Rix's Creek Coal Mine, November 1994.

6.6.2 Environmental Performance

The ecological monitoring of Rix's Creek North biodiversity offset areas is prescribed in Section 2.7 – Flora and Fauna Monitoring of the Biodiversity Management Plan 2018 – 2020 (AECOM, 2017). Components relevant to annual monitoring at Rix's Creek North include

- inspection of 76 installed nest and roost boxes for a variety of tree hollow dependent fauna, including the threatened Brush-tailed Phascogale, Squirrel Glider and honeybees;
- diurnal and nocturnal surveys along 7 designated transects for the threatened and protected species;
- monitoring of feral predators by use of remote infra-red cameras, presence of impact / damage, sightings and scats, and
- comprehensive surveys for all fauna groups conducted in 2018 and 2020, then every 3 years.

In 2017, fauna monitoring prescriptions include components of the then draft BMP, but also included new monitoring sites within biodiversity offset areas. Nest box usage, as determined by either presence of individual species, or nest material, increased significantly in some offset areas in the 2017 monitoring period. Whilst several nest boxes require maintenance or repair, the threatened Brush-tailed Phascogale was recorded utilising 17 of the boxes in 2017. The terrestrial trapping surveys also resulted in captures of 7 individual Brush-tailed Phascogale. This is the highest recorded occurrence of the species since a number of individuals were trapped during the EIS. No individual Squirrel Gliders were detected in boxes during the inspections, however, many boxes exhibited evidence of use based on the presence of their characteristic leaf nest.

In contrast, the microbat boxes have yet to be utilised in significant numbers. No evidence of roosting individuals was observed in nest boxes in 2017. An issue with the microbat boxes is the ongoing maintenance required for these boxes, with many lids falling off, or hanging upside down. Since commencement of monitoring in 2009, only 1 box in 2012 recorded 4 individual Gould's Wattled Bat. Occupation rates are very low for the Rix's Creek North offsets, which contrasts markedly with the nearby Mt Owen Complex, in which microbat occupation rates in nest boxes are high. The absence of occupation of nest boxes at Rix's Creek is attributed to the design, and also the quality of the construction. It is recommended that any replacement bat roost boxes utilise a different manufacturer.

The comprehensive fauna survey recorded 46 native and 2 introduced birds, 10 mammals, 3 reptiles and 1 frog species. Bird census recorded presence of 2 threatened birds, including Grey-crowned Babbler and Speckled Warbler, which were both widespread across the offsets.

Small mammal trapping captured 5 individual Yellow-footed Antechinus *flavipes* at one offset site, RCN_10. This site is replanted trees along Blackwattle Creek (near Martins Creek BOA), which is significant as this species is tree hollow dependent. This regrowth creek line has suitable microhabitat in the form of tree hollows, ground litter and logs. In contrast, in nearby Mt Owen Complex, this species is dependent on remnant forest, and rarely captured in regrowth or rehabilitation areas due to absence of suitable habitat.

Microbat surveys resulted in 530 calls recorded that were suitable for analysis. A total of 11 microbat species were recorded, including 4 threatened microbat species, the Eastern Freetail-bat, Eastern Bentwing-bat, Little Bentwing-bat and Large-footed Myotis. Harp trapping resulted in the capture of 4 individuals of 3 species, including the threatened Large-footed Myotis *macropus.* This species is associated with water bodies such as the nearby Glennies Creek, but will utilise tree hollows in adjacent forests for roost sites. No evidence of larger flying-foxes was detected during spotlight searches.

Monitoring of feral predators by field cameras detected only one introduced species in 2017, the Red Fox. No evidence of other feral predators, such as Cat and Dingo / wild dog were detected during camera monitoring (a total of 88 consecutive days).

During 2017, weed management, outlined in section 6.7 and fence repairs to the Martins Creek BOA area were conducted. More detailed vegetation enhancement in accordance with the timelines in the RCN BMP will be carried out in 2018 in accordance with the approved Biodiversity Management Plan.

Schedule 3, Condition 39 of PA 08_0102 requires suitable arrangements be made to provide appropriate long-term security for all areas in the biodiversity offset strategy by October 31st 2016. Correspondence was received from the Department on the 26th October 2016 confirming an extension of time to secure the long term security of the Rix's Creek North Biodiversity Areas until the 31st October 2018.

Areas of timber clearing were undertaken in South West of the Camberwell Pit. No threatened flora and fauna issues were encountered during approved clearing operations.

6.6.3 Reportable Incidents

No reportable incidents relating to flora and fauna management occurred during the 2017 reporting period.

6.6.4 Further Improvements

Enhancement of the Martins Creek Biodiversity Area is planned for the 2018 period. This will involve the preparation and seeding of six, half hectare plots within Martins Creek BOA with the Narrow-Leaved Ironbark, Spotted Gum, Grey Box open forest community. Flora and Fauna monitoring in line with the Biodiversity Management Plans performance indicators is also planned to be conducted in the 3rd Quarter of 2018.

6.7 Weeds & Pests

6.7.1 Environmental Management

A weed control program is undertaken on site each year. During the year areas were targeted to control African Boxthorn, Mother of Millions, Prickly/Creeping/Tiger Pear, Blue Heliotrope, Galenia, St. John's wart, Scotch/Safron thistle, Cotton bush, Lantana, Castor Oil, Green Cestrum, Bitou bush, Pampas grass,African Olive and Western Australian Wattle (Acacia Saligna). During November and December extensive Pear control was carried out at western edge of Falbrook operations and undisturbed land ahead of the West Pit operations. The Western Australia Wattle (Acacia Saligna) was sprayed from February to March and from April to December 2017, to control spread at Rix's Creek North operations.

The first quarter of 2017 was focussed on African Olive works and prickly pear on the entire site with focus on the O'Haras paddock south of the Rix's Creek South operations. The second quarter of 2017 was focussed on Acacia Saligna located at the RL141 Falbrook Pit area and reshoot areas around the tailings dam 2 and old south pit rehab in Rix's Creek North. The third quarter of 2017 focussed on Galenia across all rehabilitation areas on site and grasses were sprayed around hard stand and electrical substations. The last quarter of 2017 was focused on Western Australian Wattle to the South of the rail loop and Assorted Pear to the west of the Falbrook Pit. African Boxthorn was also targeted near the south pit rehabilitation areas at Rix's Creek South. Assorted weeds and grasses surrounding site infrastructure and topsoil stockpiles were also controlled as required.

Throughout May, 1080 Wild Dog Baiting was undertaken across site in consultation with Livestock Health and Pest Associations (LHPA) aerial baiting in surrounding areas. During October and December a qualified pest control contractor sprayed the entire site with odourless chemical.

6.7.2 Environmental Performance

The following weed species have been identified and treated on-site during 2017:-

- Mother-of-millions, *Bryophyllum* spp. (class 3);
- Galenia, *Galenia pubescens* (non noxious – class 4 Tamworth);
- Pampas grass, *Cortaderia* spp. (class 4);
- Prickly pear, *Cylindropuntia* spp. (class 4);
- Creeping pear, *Cylindropuntia* spp. (class 4);
- Tiger pear, *Cylindropuntia* spp. (class 4);
- African boxthorn, *Lycium ferocissimum* (class 4);
- St John's wort, *Hypericum perforatum* (class 4);
- Paterson's curse, *Echium plantaginuem* (class 4);
- Coolatai Grass, *Hyparrhenia hirta*, (class 4);
- Castor Oil, *Ricinus communis* (non noxious – class 4 Sydney area);
- Blue Heliotrope, *Heliotropium amplexicaule* (non noxious - class 4 outside of Singleton

LGA);
- Cotton bush, *Gomphocarpus fruticosus* (non noxious);
- Green Cestrum, *Cestrum parqui* (class 3);
- Bitou bush, *Chrysanthemoides monilifera* (non-noxious – class 3/4 out of Singleton LGA);
- Lantana, *Lantana* spp. (class 4);
- Noogoora burr, *Xanthium occidentale* (class 4); and
- African Olive, *Olea europaea subspecies Africana* (class 4).

The following 1080 baits have been laid on site during 2017:
- 40 ground meat baits (targeting wild dogs) during Autumn.

The Autumn 1080 baiting program was aligned with the Upper Hunter 1080 Wild Dog Aerial baiting program.

From February to November 2017, qualified open range shooters conducted a Kangaroo culling program across site. The shooting was undertaken across five nights (across several weeks) with Eastern Grey Kangaroo's (*Macropus giganteus*) culled and tagged with tags supplied by National Parks and Wildlife Service (NPWS).

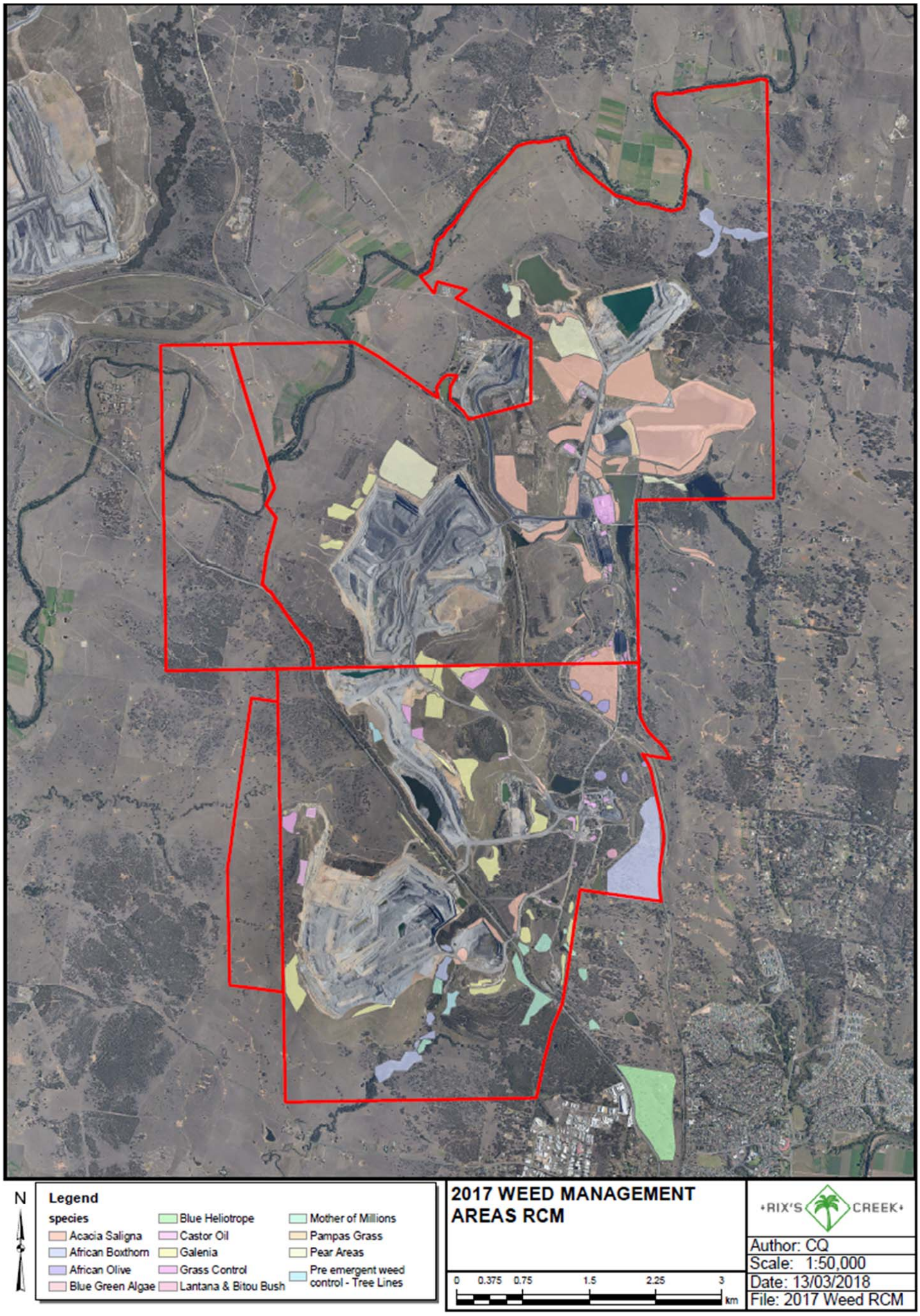


Figure 18. Weed Management Plan

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6.7.3 Reportable Incidents

No reportable incidents relating to weed and/or pest management occurred during the 2017 reporting period.

6.7.4 Further Improvements

An annual weed spraying program is undertaken to control the weeds listed in section 6.6.2. The following weed species have been identified on-site and will be managed as practicable in 2018:-

- Prickly pear, *Cylindropuntia* spp. (class 4);
- Coolatai Grass, *Hyparrhenia hirta*, (class 4);
- Galenia, *Galenia pubescens* (non noxious – class 4 Tamworth); and
- African Olive, *Olea europaea subspecies Africana* (class 4).

Continuation of Kangaroo culling program aligned with the annual wild dog aerial baiting program for Upper Hunter and Wild Dog Associaitons (WDA) requirements will also continue during 2018. Due to recent wild dog sightings, Rix's Creek Mine is also investigating opportunities to complete dog trapping exercises in conjunction with 1080 dog baiting to reduce the number of wild dogs coming into the Rix's Creek Mine land holdings.

6.8 Visual, Stray Light

6.8.1 Environmental Management

It is a Development Consent requirement to implement all reasonable and feasible measures to mitigate visual and off-site lighting impacts of the project.

Progressive rehabilitation of mining disturbed land is the main strategy for minimising visual impacts from Rix's Creek. As well as providing a safe and stable landform, one of the key objectives of rehabilitation planning is to provide vegetated landforms that blend with the surrounding landscape.

A number of management techniques are used to minimise the impacts of stray lighting and are employed across both sites which include:

- Visual bunds established to improve visual amenity and block light;
- Light positioning and orientation for mobile lighting plant;
- Positioning mine entrance and exit roads to prevent headlights shining towards adjacent residences; and
- Awareness training to educate employees regarding the sensitivity of the operations proximity to local residents.
- Routine offsite visual light inspection undertaken by trained personnel when mine is operational.

6.8.2 Environmental Performance

There is a standard operational procedure for lights not to be directed towards the New England Highway, main northern railway line or towards local residences. The Environmental Technician that conducts operational noise testing on afternoon and night shift also undertakes lighting inspections from various locations around the mine site. If visual lighting is deemed intrusive, the Environmental Technician contacts the Shift Supervisor and gets the light adjusted to eliminate the lighting issue.

6.8.3 Reportable Incidents

There were no complaints received relating to stray light during the 2017 reporting period.

6.8.4 Further Improvements.

There has been an ongoing maintenance program replacing existing older lights with new modern LED lighting that shields and directs light more towards the ground surface rather than outwards.

6.9 Aboriginal Heritage

6.9.1 Environmental Management

Aboriginal heritage issues identified in the EIS have been addressed. Application was made and Consent No:- SZ 163 granted on 25/5/97 under Section 90 of National Parks and Wildlife Act , 1974 to Carry out the Destruction of an Aboriginal Relic/Place. The Consent was issued in relation to Aboriginal sites NWP #37-6-244 and #37-6-245.

In accordance with the Rix's Creek North Project Approval (08_0102) an Aboriginal Heritage Management Plan sets out the procedures for the protection of Aboriginal sites as well as the salvage and care of Aboriginal objects found within the operational activities. Additional objectives of the Aboriginal Heritage Management Plan are:

- To establish an ongoing Aboriginal stakeholder consultation process;
- To describe the manner in which certain Aboriginal sites will be salvaged;
- To provide a summary research design and work plan for the sub surface excavation of select sites and areas; and
- To describe a program for Aboriginal site survey and assessment in areas not addressed by the original EA.

The Aboriginal Heritage Management Plan also outlines the importance of ongoing consultation with Aboriginal stakeholders during mining. All staff and contractors as part of a site induction are provided with information on what constitutes an artefact and what to do if an item of Aboriginal heritage is located.

6.9.2 Environmental Performance

Prior to commencement of mining in West Pit, four known Archaeological sites, listed as R1, R2, R12 and R15 were fenced to prevent damage. During 2017 fencing of these areas was maintained

During 2017, Aboriginal surveys were conducted at Martins Creek Biodiversity Offset Area prior to any replanting to determine low sensitivity areas for regeneration planting and tree seeding within the BOA.

6.9.3 Reportable Incidents

No artefacts were identified during operations during the 2017 reporting period.

6.9.4 Further Improvements.

It was decided to replace the collected artefacts under the Section 90 Consent to Destroy to an area protected from mining adjacent to Rix's Creek. This area was initially identified as a potential artefact site. The area is in the bend of the Creek and has been fenced to exclude access. When the study of the artefacts has concluded then they will be placed in this area.

6.10 Natural Heritage

6.10.1 Environmental Management

The Rix's Creek Coke Ovens and associated works adjacent to Rix's Creek Lane are the subject of an Order made under Section 130 (1) of the Heritage Act, 1997. The order was made on 23/7/82.

The Rix's Creek Coke Ovens are also classified by the Natural Trust of Australia and are included in the Trust Register.

As such the Company prepared in 1989 a Rix's Creek Coke Ovens Conservation Plan. The Plan outlines the measures the Company has put in place and operational controls to conserve the area.

The Plan was reviewed during 2004 by Peter Lonergan of Cracknell & Lonergan a heritage architect. The following recommendations were made:-

> *17. It is my opinion that any active conservation to the fabric is unwarranted and inappropriate. The ovens ceased operation some 60 years prior to the conservation plan and now 15 years later little further deterioration has occurred, or is evident.*

Rix's Creek North operations has a Non Aboriginal Management Plan which addresses management of non –aboriginal heritage.

If during the course of works any previously unknown historical archaeological material or heritage sites/items are uncovered or identified, all work in the area of the item(s) shall cease immediately and a suitably qualified and experienced archaeologist will be consulted. If the archaeologist considers the archaeological material uncovered constitutes an archaeological 'relic', the Heritage Branch, OEH will be consulted, in accordance with Section 146 of the Heritage Act 1977 (NSW), to determine an appropriate course of action prior to the recommencement of work in the area of the item.

6.10.2 Environmental Performance

A program of cutting and cleaning the dead wood around the area was undertaken during 2006 and weed control over the area is undertaken as necessary. Mother-of-Millions weeds around the area were sprayed again this year as well as assorted Pear (*Opuntia spp.*) species. Some scattered African Boxthorn weed species were also found and sprayed as necessary. Galenia was sprayed across several old spoil heaps. Restricted access and security of the area has been maintained throughout 2017.

6.10.3 Reportable Incidents

There were no reportable incidents in relation to natural heritage during the 2017 reporting period.

6.10.4 Further Improvements.

The program of protection of the Coke oven area and other known natural heritage sites will continue. Annual inspections are undertaken of the areas with known heritage. Any weeds identified will be sprayed. Vegetation maintenance may be required as necessary and fencing and signage are checked for adequacy.

6.11 Spontaneous Combustion

6.11.1 Environmental Management

The coal seams mined at the site are not susceptible to spontaneous combustion. All stockpiles are however inspected regularly to check for heating of the material. Any coal mined and not able to be washed is stockpiled at deisginated stockpile areas where no combustible materials surround it.

6.11.2 Environmental Performance

N/A

6.11.3 Reportable Incidents

There were no reportable incidents relating to spontaneous combustion during the 2017 reporting period.

6.11.4 Further Improvements.

Monitoring of stockpiles will continue as an ongoing operational procedure.

6.12 Bushfire

6.12.1 Environmental Management

Fuel reduction programs are undertaken on an as needed basis and done in conjunction with the local Rural Fire Service (RFS).

6.12.2 Environmental Performance

A slashing program was undertaken regularly to reduce fuel loads. As well as reducing fuel loads mulching this material into the surface will enhance the rehabilitation through improved nutrient recycling as the material decomposes over time. Excessive grass and weeds were sprayed around site infrastructure to further reduce fuel loads. Rix's Creek and AustGrid also conducted spraying and mulching of power line easements across site throughout the year.
Proactive management was undertaken which included clearing trees that could potentially come in contact with overhead power lines and implementing an inspection program for tree trimming near the overhead power lines to reduce the occurrence of grass fires.

Grazing of cattle was undertaken around mining activities to apply grazing pressure to land ahead of the West Pit during 2017 and on the rehabiltation area adjacent the RCN CHPP. This will continue in 2018.

During 2014 Rix's Creek purchased a property and existing four-bay shed in Maison Dieu in which the shed is provided to the Rural Fire Service – Darlington brigade in sponsorship by the Bloomfield Group at no cost. This sponsorship continued in 2017.

6.12.3 Further Improvements.

Fuel reduction programs are undertaken on an as needed basis and done in conjunction with the local Rural Fire Service and local landholders. Areas of land owned within the lease and outside of the active mining area and rehabilitated areas will continually be leased to lessee's to graze cattle in a bid to minimise fuel loads across site.

6.13 Mine Subsidence

6.13.1 Environmental Management

Areas of the Rix's Creek mine site are undermined by historic underground workings. Sink holes associated with shallow workings are infrequent. If identified, the standard management procedure is to flag off and isolate the sink holes from access, back fill the holes and monitor for further subsidence. Once deemed stable, the area will then be rehabilitated and periodic inspections will continue.

6.13.2 Environmental Performance

There were no reportable incidents in relation to mine subsidence during the 2017 reporting period.

6.13.3 Reportable Incidents

Nil.

6.13.4 Further Improvements

Identified sink holes will be remediated and the heritage areas will be protected. No other improvements to subsidence management are planned.

6.14 Hydrocarbon Contamination

6.14.1 Environmental Management

Hydrocarbon storages at Rix's Creek southern operations consist of 3 bulk storage areas. The main fuel farm for distillate and lubrication oils for machinery.

At Rix's Creek Northern operations, the open cut wash down area has a sump to collect the oil/water mix. Drains at the workshop are directed to the wash down bay area sump where a loop tube surface skimmer removes the majority of hydrocarbons before the remaining water is passed through a plate separator. Recovered oil is transferred to a storage tank and a licensed waste transport contractor collects the separated waste oil from the storage tank. Water post hydrocarbon recovery then flows to mine water dam D1. At Rix's Creek Northern operations, concrete bunds have been constructed around major hydrocarbon infrastructure.

At Rix's Creek South hydrocarbon storage areas have the storage tanks located within a bunded area capable of containing greater than 110 % of the largest storage tank. The bunded area is lined with a 'Claymax' product barrier at Rix's Creek South operations. Any fluids including water and hydrocarbons drain to a sump where the water is decanted and processed through an oil arrestor to remove any hydrocarbons. The hydrocarbons are directed to a waste oil tank for recycling. The water goes into the contaminated water system for recycling through the CHPP.

All machinery is fitted with quick fill mechanisms. The inlets and outlets, at the refuelling bay and mobile tanker are positively closed with an automatic cut off when full. This refuelling method is quick and minimises any potential for spillage during the refuelling operation.

The hydrocarbon management procedure was updated to include Rix's Creek Northern operations during the reporting period.

6.14.2 Environmental Performance

There were no major hydrocarbon spills during the year. Rix's Creek developed a Hydrocarbon Management procedure to align both sites with a standardised process for minimising hydrocarbon and chemical spills or management and reporting requirements if a spill occurs.

6.14.3 Reportable Incidents

There were no external reportable incidents related to hydrocarbon management during the reporting period. The hydrocarbon spills that occurred during 2017 were contained using spill kits, or earth moving equipment was used to form a temporary bund. Material contaminated from hydrocarbon spills was relocated via a small front end loader to the bioremediation areas at Rix's Creek North or Rix's Creek South.

6.14.4 Further Improvements

The use of S200 / Micro-blaze for minor hydrocarbon spills to assist in the breaking down of hydrocarbons via bacteria will continue during 2017. This technique has proven effective and was used several times throughout the year to clean up minor spot stains around the fuel farm, oil/water sumps, and equipment.

The site remediation area is regularly turned over via backhoe within each cell. Soil material from the bioremediation area is tested and if below required levels is placed back into the Open Cut. Once results are below this criteria it can be placed back into the open cut pit. Generally after the soil has been stored for a long period and has grassed over it is a good indication to conduct soil sampling.

6.15 Public Safety.

6.15.1 Environmental Management

Fences along the New England Highway, Bridgman Road, Stoney Creek Road and Falbrook Road were checked during the year and repaired as necessary with 'No Trespassing' signs replaced every 100 m along the fences on both sides of the New England Highway in which the lease intersects. Gates along the New England Highway as well as bordering rehabilitation areas were chained secure during the 2017 period to prevent unauthorised access.

6.15.2 Environmental Performance

There we no external reported incidents reported to Police in the 2017 period, whereby illegal entry from unauthorised people was gained on site. Fences and gates were inspected on Bridgman Road, Stoney Creek Road, Falbrook Road and the New England Highway during 2017 and repaired where required.

6.15.3 Reportable Incidents

There were no external reportable incidents relating to public safety in 2017.

6.15.4 Further Improvements

No other overall improvements are planned to manage public safety, however Rix's Creek will continue to maintain and improve existing fencing, gates, barriers and signage.

SECTION 7 WATER MANAGEMENT

7.1 Rix's Creek Setting and Context

7.1.1 Geology

Regional Geology

The Project is located within the Hunter Coalfields of the Sydney Basin. The coal reserves occur within the Permian age Foybrook Formation of the Vane Sub-group, which comprises the Lemington to Hebden coal seams. The target coal seams are separated by interburden sediments, which comprise sandstone, siltstone, conglomerate, mudstone, and shale, as well as occasional minor coal seams.

The main regional geological structures in the area are two approximately parallel thrust faults, these being the continental scale Hunter Thrust Fault to the north of the Project and the Hebden Thrust Fault to the south. There are many anticlines and synclines that are significant to the Project. The axes of the anticlines and synclines are orientated approximately north–south. No major faults or other significant structures or igneous intrusions (dykes or sills) are known to occur in the mining area.

Local Geology

The Project is confined within a geological basin-like north–south trending syncline that hosts the Permian coal reserves that are part of the Whittingham Coal Measures. The syncline is approximately 8 km long by 3 km wide and is bounded by the Camberwell and Darlington Anticlines. The syncline is asymmetrical, the western limb generally dipping at a steeper angle than the eastern limb. The syncline is also locally double-plunging forming the synclinal basin structure centred on the Rix's Creek operations. North of the Rix's Creek mining lease, the syncline plunges to the north.
The major coal seams identified in the Rix's Creek syncline are (in descending stratigraphic order):

- Lemmington Seam
- Pikes Gully Seam
- Arties Seam
- Liddell Seam
- Barrett Seam
- Hebden Seam.

The seams typically out-crop within the syncline, with the outcrop of Barrett and Hebden seams to the east, west, and south, marking the limit of the mineable seams. The target coal seams vary widely throughout the area and often occur as several dispersed splits, separated by interburden sediments that comprise alternating sandstone, siltstone, conglomerate, mudstone and shale, as well as occasional minor coal seams. The Interburden between the Barrett and Upper Hebden seams increases to more than 20 m in the northern and western regions, rendering the Upper Hebden seam uneconomical to mine.

7.1.2 Hydrogeological Setting

The hydrogeology of the Upper Hunter Valley is dominated by two aquifer groups; alluvial deposits of quaternary age and consolidated sedimentary rocks of Permian age.

Alluvial Aquifer

The unconsolidated alluvium is associated with drainage lines and creeks and the regolith comprises clay-bound and silt-bound sands and gravels. Within the project area only minor alluvium, associated with Rix's Creek exists to the south of the mine lease, these deposits generally consist of low permeability clay underlain by marginally higher permeability clayey gravel and clayey sand. At Rix's Creek, alluvial aquifers are typically thin and poorly developed, while being more extensively developed in the north around Glennie's Creek to the west of Rix's Creek Northern operations; and along the Hunter River to the south.

Permian Coal Measures Aquifer

The Permian Coal Measures consist of a variable sequence of aquitards (predominantly siltstone and sandstone) and low permeability aquifers (coal seams). The permeability of the coal seams is typically 1 to 2 orders of magnitude greater than that of the associated interburden and overburden units, with groundwater flow within the Coal Measures predominantly confined to the cleat fractures in the coal seams. This means the coal seams themselves form the main aquifer within the hard rock system.

Within the Coal Measures, the higher permeability coal seams are the main influence of the bulk horizontal hydraulic conductivity, while the lower permeability interburden sandstones, siltstones and shales influence the overall vertical hydraulic conductivity – meaning groundwater prefers to flow along the coal seam beds rather than moving vertically through the lower permeability siltstone/shale units.

Increased permeability can be associated with the crests and limbs of the major folds like the Camberwell and Muswellbrook anticlines and Rix's Creek Syncline, and areas of localised bedding flexure. Such deformation may result in enhanced cleating within the coal seams or enhanced fracturing and jointing within adjacent strata. Although it is noted from mining to date at Rix's Creek Mine Complex, enhanced permeability and associated groundwater inflows have not been encountered in the operational areas.

The hydrogeological basement lithologies on site are comprised of low permeability siltstones of the basal Saltwater Creek Formation of the Whittingham Coal Measures, and the underlying Mulbring Siltstone of the Maitland Group.

Regional Groundwater Flow

Regional groundwater flow within the Coal Measures is sustained by rainfall recharge to generally elevated areas of regolith and outcropping strata on the fringes of the basin structure. Downward recharge to deeper strata is aided in areas of enhanced jointing and fracturing, particularly dilated joints and bedding planes in the upper weathered horizons. Downwards recharge will typically be limited by reduced fracture connectivity with depth.

Mackie (2009) compiled a regional piezometric surface from reports submitted in support of mining approvals over the period 1993 to 2004. The map typically shows groundwater flow from areas of high ground towards the Hunter River and associated alluvium, and towards major tributary drainages such as Glennie's Creek and Wollombi Brook. In the vicinity of Rix's Creek this flow is generally to the west in the vicinity of Deadman's Gully and south to southwest in the vicinity of Rix's Creek. The regional flow regimes are altered around major below water table mining operations where drawdown influences prevail.

It is noted that in areas where mining has not impacted upon the Coal Measures strata, the deep pore pressure regime is observed to be generally stable in time with seasonal movements being commonly less than one metre, even during periods of sustained drought – suggesting that the shallow groundwater and basement groundwater systems are hydraulically isolated from each other for the most part.

Groundwater discharge is typically to the regional drainage and overlying alluvial aquifers of the Hunter River and its tributaries with upwards leakage associated with the sub-cropping of Coal Measures in specific areas. In areas not influenced by mining operations, upwards hydraulic gradients are often identified, and reduced water quality is often associated with areas of leakage of more saline groundwater from the Coal Measures into the overlying alluvial system.

Groundwater levels within the Rix's Creek Syncline are dominated by the groundwater sinks presented by the current Rix's Creek open cut mining operation at West Pit Camberwell Pit to the north, along with the Glencore Integra underground operations further to the northwest.

Conceptual Hydrogeological Model

The conceptual hydrogeological model for Rix's Creek is relatively simple in that the basin-like structure of the Rix's Creek Syncline acts to isolate the Coal Measures from the broader regional hydrogeological regime, with little groundwater interaction through the bounding low permeability siltstones.

The basin-like structure as defined by the base of the Hebden Seam (and upper surface of the underlying siltstone basement rock of the Saltwater Creek Formation) is depicted on Figures 19 and 20 (below).

The limbs of the anticline have a relatively shallow dip on the eastern limb with the western limb dipping at a much steeper angle. The syncline axis also plunges from the north and south. The lowest point the Coal Measures in the synclinal basin is approximately -130mAHD.

Although geologically more complex on the local scale due to the splitting and merging of multiple minor seams, the aquifer system at Rix's Creek has been simplified and represented by a layer cake style system, with the layer geometry reflecting the synclinal basin structure. Within the layer cake, the major coal seams represent the main aquifers, with the interburden units acting as low permeability aquitards between the aquifers. Within the coal seam aquifers, preferential groundwater flow is along the bedding. Large scale groundwater flow vertically between bedded units is impeded by the low permeability interburden units.

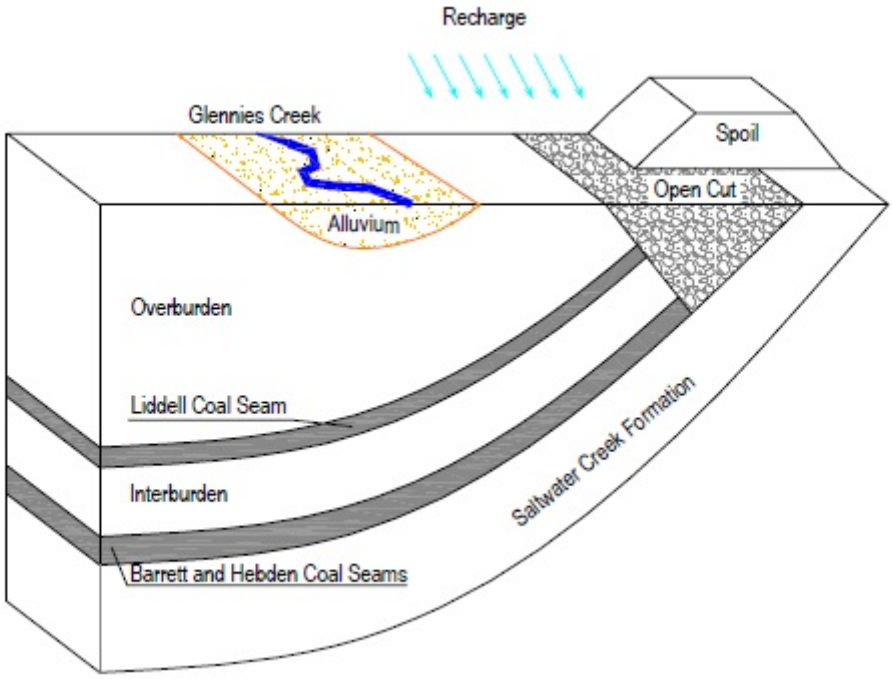

Figure 19 Conceptual Hydrogeological Model of the Rix's Creek Syncline area

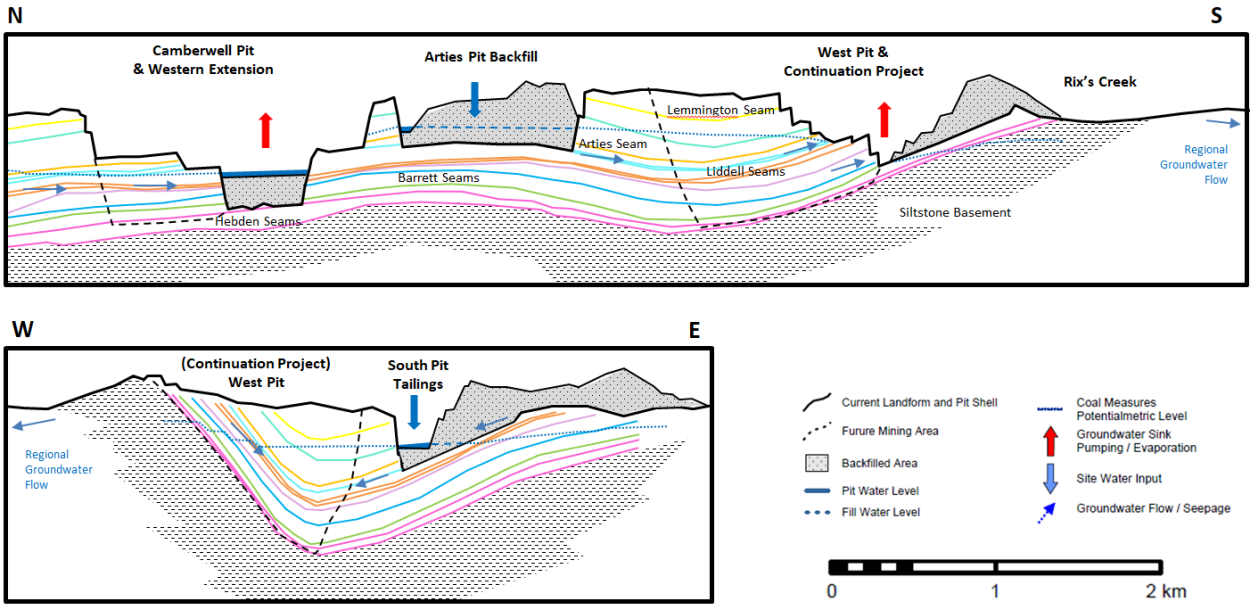

Figure 20 Conceptual Hydrogeological Cross Section

Aquifer Recharge

Rainfall recharge and infiltration will occur on remnant regolith areas, as well as rehabilitated mine areas, and direct rainfall to open cut areas. A degree of enhanced recharge and infiltration will also occur from the Old

North Pit water to storage and the deposition of tailings slurry in South Pit (although tailings seepage is anticipated to be a minor contributor to the overall water balance).

The lack of water level response observed at shallow monitoring bores in the creek alluvial system, located within the limit of Coal Measures outcrop, demonstrates the disconnection of the shallow regolith and alluvial aquifers from the deeper groundwater regime. It also shows that the shallow aquifers in these locations are locally reliant on direct rainfall recharge, and that this has not been diminished by the ongoing mining operations

Hydrological Setting

Figures 24 and 25 gives an indication of the approximate extent of the surface water catchments draining to the various storages within the Rix's Creek sites. In the RCN area, the eastern portion of the Falbrook Pit area intercepts runoff from the Reedy Creek catchment. Several diversion banks with excavated channels are used to divert clean catchment runoff around or through areas disturbed by mining operations.

In the RCS area, the Arties Pit, West & South Pit are surrounded by natural landforms that slope inwards towards the active mining area which directs any runoff over disturbed areas to flow back towards the pits. Clean water diversion structures have been installed to divert clean water away from active pits in average rainfall conditions.

In the vicinity of the mine footprint, all clean water flowing through or around the mine site area finds its way into either Glennie's Creek or Rix's Creek and ultimately into the Hunter River.

The catchment areas and diversion structures are progressively changing with the ongoing excavation of approved mining areas – and are adapted and maintained to enable the outcomes described above.

Groundwater Dependent Ecosystems

The proximity of GDEs to the Project area has been assessed by reviewing the Water Sharing Plan (WSP) and the Groundwater Dependent Ecosystem Atlas (Bureau of Meteorology, 2012). The findings have confirmed that there are no identified GDEs in the vicinity of the Project (RCS and RCN).

Most of the existing mine footprint is situated up hydraulic gradient of Rix's Creek and there are no alluvium deposits associated with the creek in the immediate vicinity of the mine. Surface water monitoring data (EC and flow observations) obtained from the creek shows the water to be relatively fresh (EC <200 µS/cm) and flows to be occasional, which suggests that the flow within the Creek is almost entirely derived from surface water run-off.

As there is no alluvium in the mining area and no apparent base flow contributions, the pumping or interception of groundwater with the Permian Coal Measure aquifer from current or future mining activities is unlikely to impact upon on creek flow volumes in the regolith/alluvial aquifer system. The only risks to the creek therefore relate to water quality impacts associated with dirty water runoff.

7.2 Water Licences

Rix's Creek has the following active groundwater licences:

Table 23 Rix's Creek Water Licences

Water License #	Water sharing plan, sources and management zone (as applicable)	Entitlement
Rix's Creek North - Water Licences		
20AL201231	Hunter Regulated River – Zone 3A Glennie's Ck - High Security	230 ML
20AL200940	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	54 ML

20AL200530	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	102 ML
20AL200818	Hunter Regulated River – Zone 3A Glennie's Ck	23 ML
20CA200847	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	14 ML
20AL201041	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	240 ML
20AL200846	Hunter Regulated River – Zone 3A Glennie's Ck - Supplementary Water	1.2 ML
20WA207397	Hunter Unregulated and Alluvial Water Sources - Unregulated River	6 ML
20CA207373	Hunter Unregulated and Alluvial Water Sources - Aquifer	5 ML
20CA200041	Hunter Regulated River Water Source	-
20CA200041	Hunter Regulated River – Zone 3A Glennie's Ck - General Security	51 ML
20BL169513 WAL 41500	Mining	100 ML
20BL172249	Mining	100 ML
20BL169513	Irrigation	5 ML
Rix's Creek South - Water Licences		
20AL203407	Regulated River (General Security)	159 Units
20AL203406	Regulated River (General Security)	49.5 Units
20AL203405	Regulated River (General Security)	49.5 Units
20AL203405	Domestic & Stock	24 Units
20AL209899	Water sharing plan – Hunter unregulated and alluvial water sources 2009	150 Units
20AL207389	Water sharing plan – Hunter unregulated and alluvial water sources 2009	5 Units
20WA209901	Water sharing plan – Hunter unregulated and alluvial water sources 2009	300 Units
20BL170863	Open Cut (dewatering groundwater) Hard Rock	100 ML
20BL170864	1 x Bore (dewatering groundwater)	100 ML
20BL168734	1 x Bore (monitoring bore)	1 ML
20AL209919	Water sharing plan – Hunter unregulated and alluvial water sources 2009	91 Units
20WA201499	Water sharing plan – Hunter unregulated and alluvial water sources 2009	1 Units

7.21 Water Management

Rix's Creek mine currently has two Water Management plans that outline surface water and ground water management practices including monitoring requirements, performance indicators and response plans. The Rix's Creek South Water Management Plan was developed for the site during the year (2010) as part of the development consent (DA 49/94) modification approval requirements for the cut and cover tunnel. Rix's Creek North Water Management Plan was approved by The DPE on the 16th February 2016 covering conditions of Schedule 3, Condition 36 of Project Approval 08_0102.

In January 2018 a new WMP combining both RCN and RCS was developed to rationalise and combine the monitoring programme, this WMP as of March 2018 is undergoing final reviews ahead of submission to the regulator. This 2017 water review uses the monitoring programme outlined in RCN: 08_0102 and RCS: DA 49/94

A static water balance was calculated for 2017 providing information on inputs and outputs for both the Northern and Southern operations and the results are shown in Table 24 and Table 25.

Table 24 shows that in 2017 the strategy was to manage water levels in the open cut at Rix's Creek South operations by pumping water to the CHPP for re-use, to surface dams and disused voids to maximise evaporation. Water is pumped to the CHPP Dams and to the Arties Pit void from west pit open cut operations.

Evaporation from Rix's Creek South process water dams and pit storages totalled 427 ML in 2017. Evaporation volumes from the various storages are linked to the extent of their surface area exposed to evaporative processes.

There was an estimated 50 ML of groundwater inflow into the open cut voids at Rix's Creek South during the reporting period.

Overall, the RCS area was close to water neutral, with a small (16 ML) accumulation of water in the main storage dam.

Table 25 shows that in 2017 Evaporation from site process water dams at Rix's Creek North totalled 1,350 ML in 2017. The major evaporation occurred at the Tailings Dam facilities and Possum Skin Dam, with the in-pit voids and Dirty Water Dams also contributing based on their surface area.

There was an estimated 100 ML of groundwater inflow into the open cut voids during the reporting period.

The groundwater inflow and seepage from rehabilitated emplacements and spoil dumps into the Underground Portal Storage was estimated at 805 ML. The estimate is based on water balance assessment work undertaken jointly by Rix's Creek and Integra throughout 2017 is resolving key water balance drivers and contributions.

The Rix's Creek North CHPP returned to operational mode in May 2017 and has been processing coal since that time.

Approximately 17 ML of potable water was sourced from the Singleton town water supply in 2017 for Rix's Creek South and Rix's Creek North operations.

Overall, the RCN area accumulated 932 ML, mostly in the Falbrook pit, through a combination of water directed from the Portal and the Camberwell Pit.

Table 24 Sample Static Water Balance Rix's Creek South (2017)

Water Stream	2017 (ML)
Inputs	
Imported Fresh Water	0
Imported Potable	10
Groundwater Seepage To Open Cuts	50
Underground Dewatering	0
Rainfall Runoff – Into Dirty Water System	1,586
Recycled to CHPP from Tails & Storage (not included in total)	(470)
Water from ROM Coal	292
Total Inputs	**1,938**
Outputs	
Groundwater Seepage Out	0
Dust Suppression – Water Carts	410
Exported to Other Mines – Dirty Water	0
Evaporation Fans & Sprays	0
Evaporation - Mine Water & Tailings Dams	427
Entrained in Process Waste	928
Water in Product Coal	147
Potable Usage	10
Total Outputs	**1,922**
Estimated Change in Pit Storage (increased)	**16**

Table 25 Sample Static Water Balance Rix's Creek North 2017

Water Stream	2017 (ML)
Inputs	
Imported Fresh Water	0
Imported Potable	7
Groundwater & Spoil Seepage To Portal	805
Groundwater Seepage To Open Cuts	100
Underground Dewatering	0
Rainfall Runoff – Into Dirty Water System	1,963
Recycled to CHPP from Tails & Storage (not included in total)	(220)
Water from ROM Coal	92
Total Inputs	**2,967**
Outputs	
Groundwater Seepage Out	0
Dust Suppression – Water Carts	198
Exported to Other Mines – Dirty Water	0
Evaporation Fans & Sprays (Operated Jan – Oct)	0
Evaporation - Mine Water & Tailings Dams	1,350
Entrained in Process Waste	389
Water in Product Coal	91
Potable Usage	7
Total Outputs	**2,035**
Estimated Change in Pit Storage (increased)	**932**

7.2.1 Climate/Rainfall

Daily rainfall is measured at Rix's Creek West Pit weather station at the site-specific rain gauge. Rainfall data is summarised in Table 26 and Figure 21.

Table 26 2017 Monthly Rainfall Data and Long-Term Average

Date	Rix's Creek Site Specific Rain Gauge (mm)	Long Term Average (mm) 1999-2017
January 2017	33.75	75
February 2017	41	72
March 2017	193.75	71
April 2017	42.5	56
May 2017	19.75	46
June 2017	42.75	57

July 2017	1	51
August 2017	11	42
September 2017	6	45
October 2017	83.25	51
November 2017	20.75	58
December 2017	64.5	74
Total	**560**	**698**

In general, the rainfall for 2017 was below average except for March and October 2017.

Specific climate data from 2017 are as follows:

- Over the review period, the highest rainfall events at all stations occurred in March and October 2017 which were the result of storm events.
- 2017 annual rainfall at Rix's Creek was 560mm, which is significantly lower than the long-term average of 698mm.

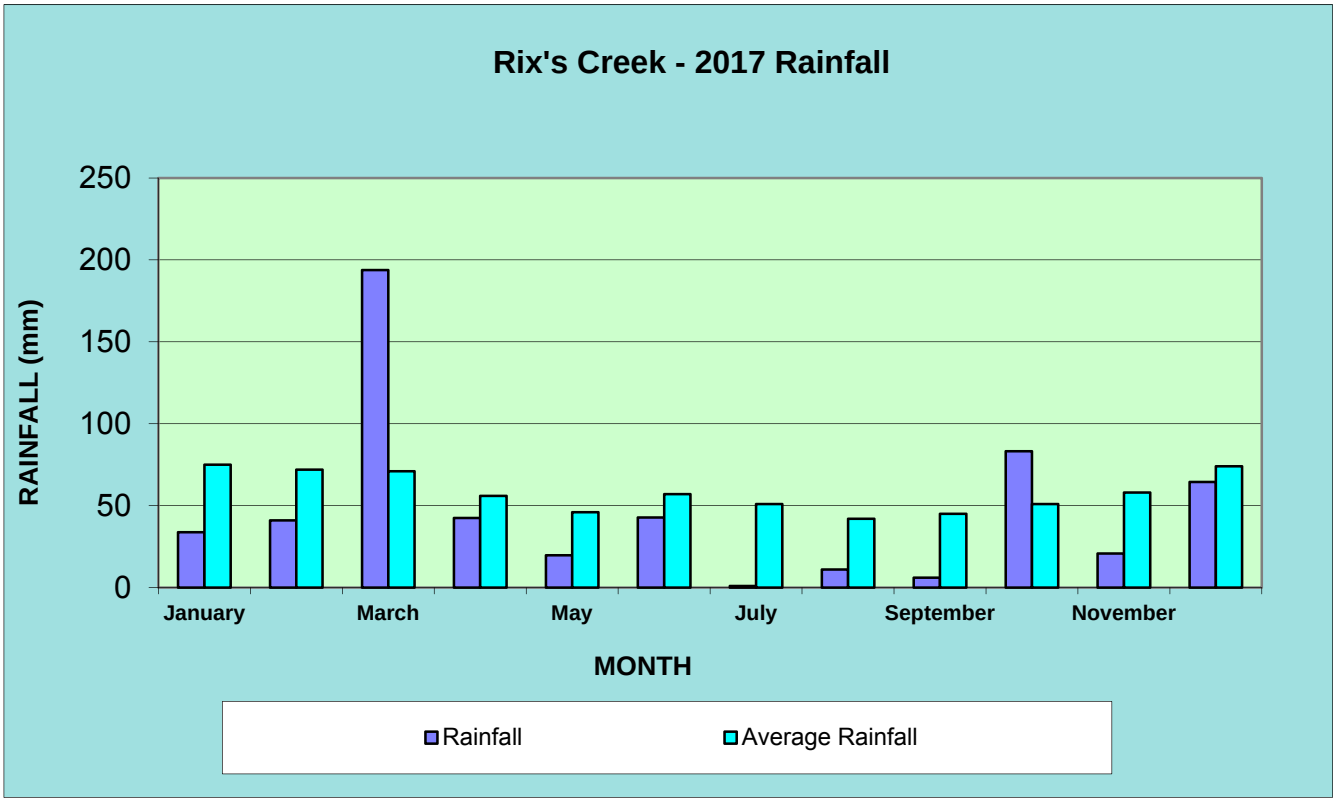

Figure 21 Annual Rainfall at Rix's Creek 2017

Annual rainfall results are plotted for the last 18 years and are presented in Figure 22.

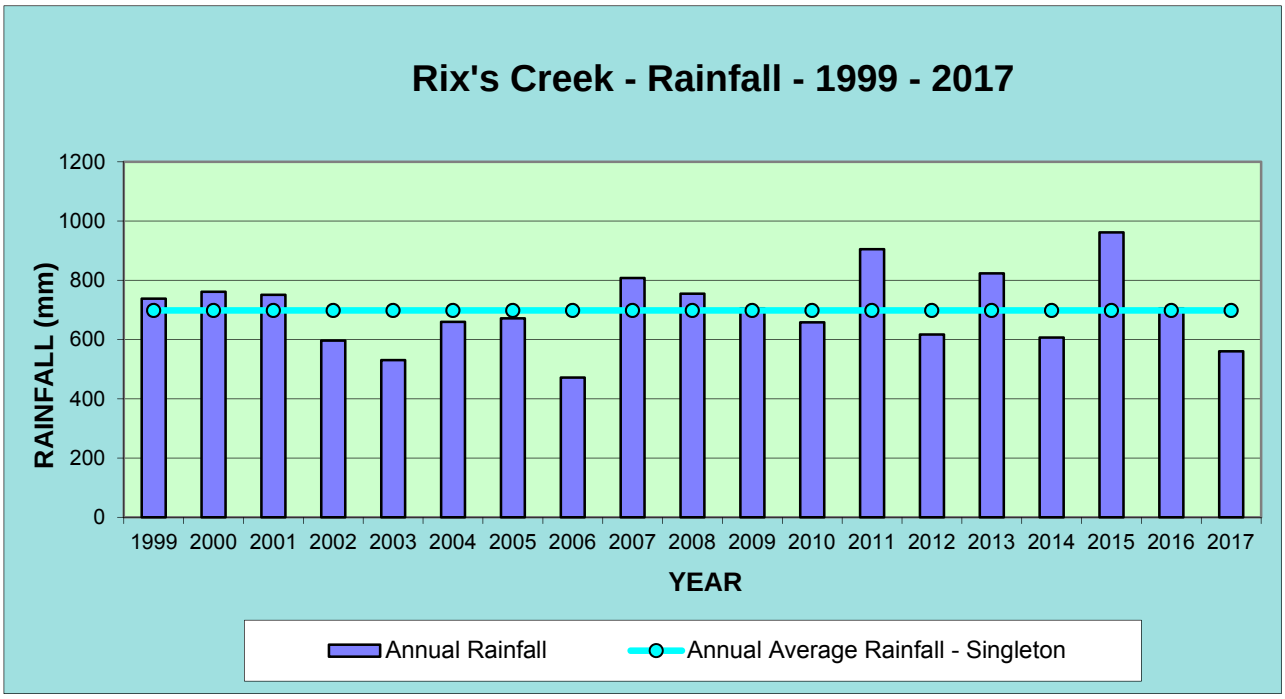

Figure 22 Annual rainfall at Rix's Creek 1999-2017

7.3 Surface Water

7.3.1 Environmental Management

The water management system at Rix's Creek mine has been designed with the primary objectives of:

- Segregation of uncontaminated, clean water runoff, from contaminated-mine water on site; and
- Priority use of, and safe disposal on site of contaminated water.

Clean Water

Runoff from undisturbed areas is directed away from mining operations through diversion banks and channels. The clean water is directed into Rix's Creek, which flows through the lease. North of the New England Highway the Creek consists of a number of flow lines in smaller catchments. South of the Highway Rix's Creek is a defined flow line amongst a belt of riparian vegetation.

Water quality is monitored in the Creek on a monthly basis when there is sufficient water to sample as Rix's Creek is an ephemeral stream. Water quality is also monitored in a smaller creek north of the operation labelled Deadman's Creek.

For Rix's Creek Northern operations, in the open cut mining lease area east of the main Northern Railway Line, rainwater runoff from non-mined or rehabilitation areas, as well as from the diversion of the Martins Creek and Blackwattle Creek catchments, is collected in a series of four dams (C1, C2, C3 and C4). A vegetated clean water channel connects these dams. C3 and C4 are maintained with sufficient freeboard to ensure adequate surge capacity during storm events. Three further dams, C5, C6 and C6a are sediment laden water dams in the south of the mining lease and these dams bywash to Dam C3.

The area west of the Main Northern Railway Line had several dams constructed in 2000 due to the increase in South Pit operations and the need to separate clean and mine water. The water management system comprises clean water dams C7 to C11. The dams and diversion banks divert clean runoff water from entering mine workings. Dams C7, C8 and C11 bywash and flow into C4 via the vegetated channel, while dam C9 (west of the south pit) bywashes into Station Creek. Dam C10 was located in the active mining area and was 'mined-through' in 2001.

Contaminated Water

Runoff from disturbed areas is contained within a system of detention dams designed to allow settlement of the suspended solids. Runoff from active mining areas is pumped to the dirty water storages.

Tailings from the coal beneficiation process are directed to the emplacement area and water decanted off the tailing's dam surface is recycled through the coal handling and preparation plant.

First priority is given to the use of contaminated water in mine operations. Contaminated water is used in the coal beneficiation process and for dust suppression via water carts for haul road watering and spraying coal stockpiles.

Hunter River Salinity Trading Scheme

Rix's Creek is a member of the Hunter River Trading Scheme holding 5 salt credits. Rix's Creek is classified as a non-discharging credit holder. Although Rix's Creek is a member of the scheme there has been no need to discharge saline water and the instrumentation necessary to participate in the scheme was not installed. As a consequence, Rix's Creek is unable to discharge and EPA has subsequently revoked the discharge component of the Environmental Protection Licence.
Credits are traded to other operations when required. Previously, Rix's Creek has traded credits to Glencore (formally Xstrata).

Rix's Creek runs the length of the Rix's Creek South mining lease area. A small portion on the east

side of the site adjacent to Rix's Creek Lane is drained by a tributary of Rix's Creek, known as 'Stone Quarry Gully'.
Grab samples are taken from Rix's Creek Southern site in four locations. They are:-

- Site 1 - Railway Underpass, as the Creek enters the site;
- Site 2 - New England Highway Bridge, at the mid-point through the mine site;
- Site 10 – Below Operation, on Rix's Creek below the operation; and
- Site 3 - Maison Dieu Road Bridge, after the Creek has left the site.

Water storage dams 1, 2, and 6 are sampled and analysed monthly. The locations of these dams are shown on Figure 23 with the relationship being:-

- Site 4-Clean Water Dam 1 - (CWD 1)
- Site 5-Clean Water Dam 2 - (CWD 2)
- Site 7-Clean Water Dam 6 - (CWD 6)

For Rix's Creek Northern operations, Environmental Protection Licence (EPL 3391) requires the monitoring of surface waters for pH, EC, TSS and TDS at the following sites on a monthly basis:

- W3 - Martins Creek, where it enters the site;
- W6 - Blackwattle Creek, where it enters the site; and
- W1 - Station Creek, where it leaves the mine site.

EPL Samples are taken on a monthly basis. Sampling site locations are indicated on Figure 23.

In addition to the EPL water sampling, the Rix's Creek North Water Management Plan was approved on the 16 February 2016. Surface water monitoring sites in Rix's Creek North Water Management Plan are listed in Table 27 and identified in Figure 24. Surface water sampling results are presented in **Appendix 2.**

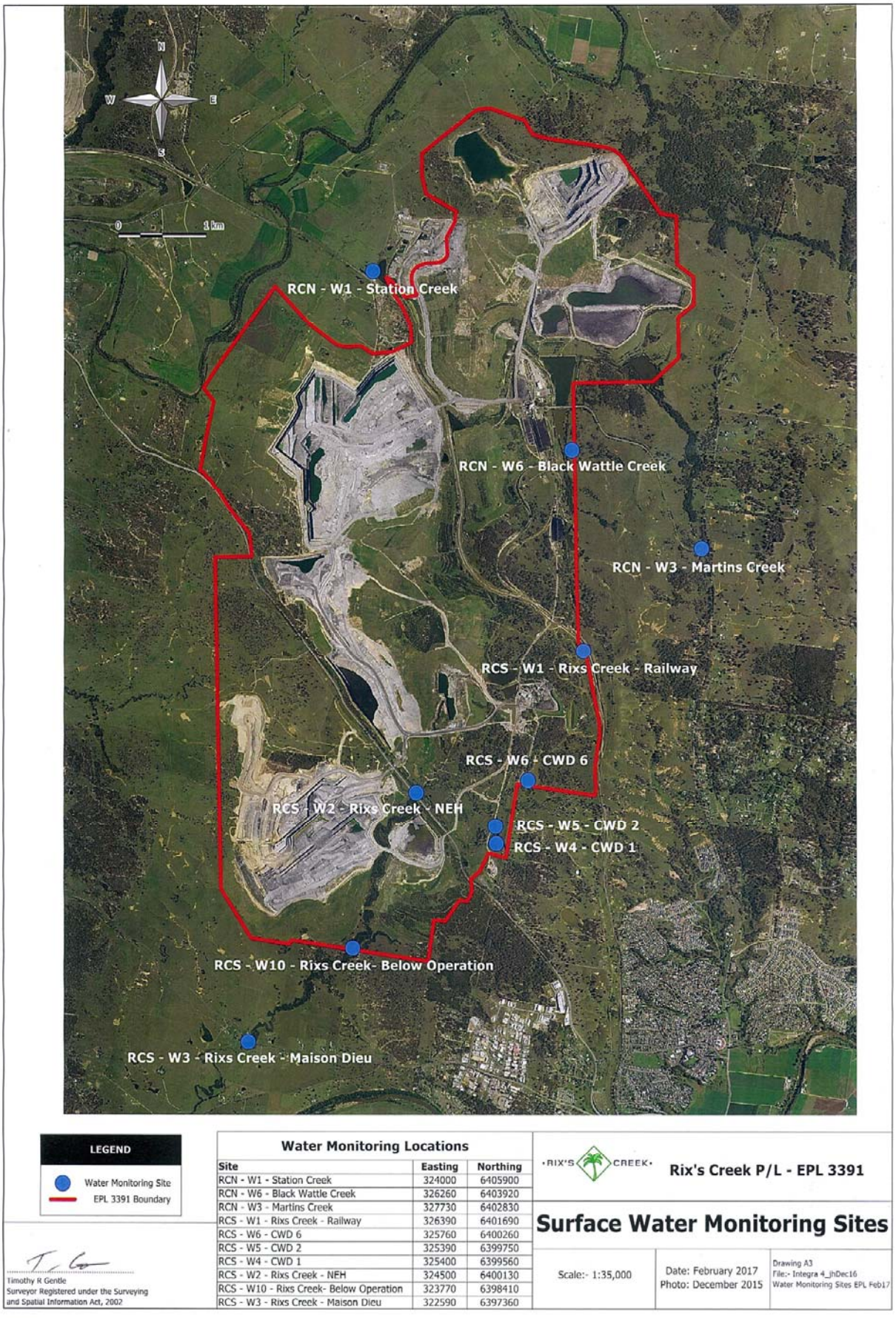

Figure 23 EPL 3391 water monitoring sites

Table 27 RCN Surface Water Monitoring Sites

Monitoring Point	Location
W1	Station Creek
W3	Martins Creek
W4	Glennies Creek upstream of the Station Creek confluence
W5	Glennies Creek downstream of the Station Creek confluence
W6	Blackwattle Creek
W7	Stony Creek where it crosses Stony Creek Road
W10	Clean Water Dam – C4
W11	Glennies Creek downstream at Camberwell where it crosses the New England Highway
W12	Clean Water Dam – C1
W13	Clean Water Dam – C6
W14	Clean Water Dam – C3
W15	Clean Water Dam – C6A (after C5 spillway channel before clean water channel)
W16	Sediment Control Dam – C7
W17	Clean Water Dam – C2
W18	Clean Water Dam – C5
W19	Mine Water Dam D1
W20	Northern Stock Water Dam No. 1
W21	Northern Stock Water Dam No. 2
W22	Station Creek Up
W23	Station Creek Down
GCS003	Possum Skin Dam
GCS004	PS Dam Seepage Collector
GCS005	PS Dam Clean Water diversion Sediment Pond
SD1	South Sediment Dam
SD2	Central Sediment Dam
SD3	North Sediment Dam
GC1	Middle Falbrook Rd Bridge
GC2	Glennies Creek Nobles Crossing
Nobles Crossing	Nobles Crossing

Figure 24. Rix's Creek North Ground and Surface Water Monitoring sites

7.3.2 Environmental Performance

Grab samples are analysed for water quality parameters of pH, electrical conductivity, total dissolved solids and total suspended solids. The water samples are analysed by Steel River Testing Mayfield as well as ALS Laboratory Group at Warabrook. Both laboratories are registered by the National Association of Testing Authorities, Australia (NATA).

Rix's Creek South results

During the 2017 surface water assessment the January period coincided with relatively higher pH levels due to below average rainfall during the month. March and October were the only months with above average rainfall which correlated with decreased pH levels and salinity levels across monitoring locations.

pH

The general pH trend in the Creeks and site dams is to decrease under flow conditions and increase in times of stagnant conditions or limited flow. The decrease in pH under flow conditions reflects the slightly acidic nature of rainfall. The pH ranged from 7.15 to 9.83 throughout 2017. The trends and results are generally consistent with 2016 results.

Electrical Conductivity (Salinity)

Salinity levels at RCS generally fluctuated in correlation with variations in rainfall and flowing vs non-flowing conditions, ranging from 156uS/cm to 10,400uS/cm during the 2017 reporting period.

Results ranged from 156 uS/cm at the Clean Water Dam #1 to 10,400 uS/cm at the Turkey's Nest Dam. The high November result at the Turkey's Dam Site occurred due to the dry conditions/evaporation and minimal to no creek flow in the November period.

Total Dissolved Solids

The Total Dissolved Solids (TDS) results for Rix's Creek South are presented in **Appendix 2**. TDS ranged from 160 mg/l – Site 3 Maison Dieu to 6,600 mg/L – Turkey's Nest Dam. The higher TDS levels reflect dryer than average conditions in Rix's Creek.

Total Suspended Solids

Total Suspended Solids (TSS) results are presented in **Appendix 2**. TSS ranged from 5 mg/l at the Industrial Catchment Site under no flow conditions to 37 mg/l at the Sediment Dam 20. The general trend is for levels to increase down the catchment under flow conditions. This historic trend is an indication that the water flowing in the Creeks picks up sediment and increases the sediment load down the catchment.

Rix's Creek North Results

pH

During the 2017 surface water assessment the pH of upstream ephemerals W6 (Black Wattle Creek) ranged between 7.4 and 8.1 and W3 (Martins Creek) ranging between 5.9 and 7.3. W1 (Station Creek) monitoring site is located downstream of mining operations and recorded slightly acidic to neutral pH during the reporting period ranging between 4.6 and 7.5. W10 (Dam C4) recorded pH levels ranging between 8.4 (July) to 9.7 (January) and W16 (Dam C8) recorded pH ranging between 8.5 (August) to 9.0 (September). The pH levels at dam sites in the series W12 - W21 remained slightly alkaline historically.

The general pH trend in the Creeks and site dams decreases under flow conditions and increases in

times of limited to no flow. The decrease in pH under flow conditions reflects the slightly acidic nature of rainfall. The trends and results are generally consistent with the 2016 results.

Electrical Conductivity (Salinity)

The EC results under flow conditions typically decrease down the catchment reflecting a flushing of the Creeks with clean runoff water. During times of no flow as the water becomes stagnant and concentrated by evaporation the salinity levels generally rise. This is evident from May (2,250) to November (11,170) at W6 (Black Wattle Creek) which is consistent with previous year's results as Black Wattle Creek's water flow is usually stagnant in drier periods with lower to no rainfall.

The EC of upstream ephemerals W6 (Black Wattle Creek) ranged between 475 and 11,170 and W3 (Martins Creek) ranging between 109 and 557. W1 (Station Creek) monitoring site is located downstream of mining operations and recorded range from fresh to slightly brackish during the reporting period ranging between 179 and 1,308. W10 (Dam C4) recorded EC levels ranging between 2,690 to 3,410 and W16 (Dam C8) recorded EC ranging between 4,070 to 6,130.

Total Dissolved Solids

The TDS results for RCN are presented in **Appendix 2**. TDS ranged from 138 mg/l (June) – W7 Stony Creek to 8,000 mg/l (November) – W6 Blackwattle Creek. The higher results during June to November reflect typically dryer conditions in Rix's Creek. Total dissolved solids at monitoring site W6 (Black Wattle Creek) ranged between 409 mg/l in April and 8,000mg/l in November. W6 (Black Wattle Creek) water flow is usually stagnant in drier periods with low rainfall.

Total Suspended Solids

TSS results are presented in **Appendix 2**. TSS results ranged from 2 mg/l (September) at the W12 Dam C1 site under no flow conditions to 362 mg/l (February) at the W16 Dam C8 with flow following sampling undertaken after a rain event. The general trend is for levels to increase down the catchment under flow conditions. This historical trend is an indication that the water flowing in the Creeks picks up sediment and increases the sediment load down the catchment.

7.3.3 Reportable Incidents

There were no external reportable incidents that occurred in the reporting period.

7.3.4 Further Improvements

During 2017 Rix's Creek additionally monitored several sites before (dams) and along Dead Man's Creek as per the monthly surface water regime for internal reference. This will continue during 2018.

A Rix's Creek Complex Water Management Plan will be written and implemented in 2018 to integrate water management across both the Rix's Creek South and Rix's Creek North mining operations. The integration to a complex Water Management Plan will standardise water management across the Rix's Creek Mine.

7.4 Groundwater

The groundwater monitoring sites across the Rix's Creek mine sites have been combined in Table 28 and are provided as a reference to compare Rix's Creek South and Rix's Creek North (formerly Integra).

Table 28 Rix's Creek Ground Water Monitoring Sites

Bore ID	License	Easting	Northing	Screened Interval	Stick Up (m)	Surface Elevation (mAHD)	Total Depth (mbgl)
Rix's Creek North							
Open Cut Piezometers and Wells							
Glennies Creek Alluvium							
GCP9	(20BL171708)	323259	6407315	Unknown	1.5	69.885	9
GCP10	(20BL171708)	324414	6408030	Unknown	0.7	74.891	11.5
GCP19	(20BL171708)	325086	6408333	8.5 - 12	0.63	77.5	12
GCP20	(20BL171708)	325201	6408179	5.2 - 8.2	0.67	82	8.2
GCP21	(20BL171721)	324466	6407916	6 to 11	0.82	76	11
GCP22	(20BL171721)	324558	6407814	8.5 - 12	0.7	75	12
GCP23	(20BL171721)	324535	6407659	4.6 - 8	1.01	75	8
GW67291	(stock well)	326264	6408139	Unknown	Unknown	Unknown	90
Coal Measure							
GCP1	(20BL169631)	325124	6406664	Unknown	0.34	96.013	108
GCP2	(20BL169631)	325160	6406490	Unknown	0.61	105.495	105
GCP5	(20BL169631)	324337	6406203	Unknown	0.54	80.334	108
GCP6	(20BL169631)	324941	6406784	Unknown	0.38	102.931	126
GCP7	(20BL169628)	325864	6407071	60 - 72 and 96 - 102	0.1	93.034	120
GCP8	(20BL169630)	326332	6407214	Unknown	0.44	105.095	120
GCP13	(20BL169628)	326169	6406745	Unknown	0.15	105.356	66
GCP14	(20BL169628)	325774	6407042	Unknown	0.66	90.99	123
GCP15	(20BL169628)	325912	6406961	Unknown	0.42	95.035	114
GCP16	(20BL169628)	326029	6407077	Unknown	0.7	98.853	120
GCTB	(20BL169631)	325149	6406572	Unknown	0.2	102.564	90
Extended Southern Pit							
Glennies Creek Alluvium							
GCP28	(20BL171722)	322651	6405459	6.7 -12.0	0.8	69.5	12
GCP29	(20BL171722)	323191	6405356	4.5 - 10.0	0.9	71	10
GCP30	(20BL171720)	322438	6404649	5.5 -12.0	0.94	67.5	12
GCP31	(20BL171720)	322930	6404424	8.5 -14.0	0.77	70	14
GCP33	(no piezo)	322586	6404181	5m total depth	n/a	n/a	n/a
Coal Measure							
GCP27	(20BL171881)	323197	6406037	36.5-37.5	1.11	70	27.5
GCP32	(20BL171880)	322491	6404250	49.0-55.0	0.66	70.5	55.55
GCP34	(20BL171879)	322800	6403235	47.0-56.25	0.61	101	56.25
GCP35	(VWP)	323149	6404757	72, 147, 195	n/a	71	197
GCP36	(20BL171722)	322915	6405320	14.5-16.0	0.85	70.5	16
GCP37	(VWP)	324156	6405612	70, 125	n/a	80	127.5
GCP38	(20BL171878)	323468	6405626	17.0-24.3	0.98	71	24.3
Richards Bore		321110	6405184	18-24	0.4	47.87	30
SGD644 (VWP)		325143	6406526	77.6, 83.6, 94.4	n/a	104.6	104
SGD645 (VWP)		325815	6406509	57.6, 66.6, 75.2	n/a	96.6	96
GCP17		323803	6409986	5.5-7.5			7.5
GCP24		323421	6407105	46-48			48
GCP40		321112	6409047	5-6			6

Bore ID	License	Easting	Northing	Screened Interval	Stick Up (m)	Surface Elevation (mAHD)	Total Depth (mbgl)
Rix's Creek South							
Regolith (Upper weathered zone)							
BH3		325457	6401923	5-8	0.97	100	11
BH4		323982	6398666	7-10	0.74	63	10
BH8		321803	6401175	5-14	0.8	85.446	20
Coal Measure							
BH1		323190	6400562	115-121, 127-130	0.85	113	130
BH2		322936	6401923	84-87	0.98	136	90
BH5		324562	6399924	63-66	1.04	76.469	66.5
BH7		323345	6401709	150.5-198.5	0.72	100.86	200.5
20BL170864		324633	6400335		0.3	80.5	~70

7.4.1 Monitoring Background

As part of the Water Management Plan for Rix's Creek Mine, a monitoring programme has been implemented to detect any impacts from mining on the groundwater regime, and from neighbouring groundwater users. The monitoring programme incorporates both shallow and deep groundwater monitoring locations monitoring the water levels in the Glennie's Creek Alluvial deposits and the Permian Coal Measures around both Rix's Creek South Colliery and the Rix's Creek North Colliery.

Mining activities that have the potential to impact groundwater levels and quality are:

- Tailings emplacement area - groundwater pollution;
- Spoils and emplacement – contribution of salt to surface water and groundwater;
- Surface water bodies – these may locally control groundwater levels in surrounding spoil and Permian strata; and
- Waste dumps & Coal Handling plant – surface water runoff and associated water quality issues.

7.4.2 2017 Groundwater Monitoring Performance

Groundwater Levels were monitored on a bi-monthly to quarterly basis during the review period, with the results tabulated in Appendix 3. The exceptions are BH1 which was damaged in the second half of 2017, GCP32 – GCP37 which recorded partial data and monitoring bore Richards Bore, which had no water levels collected during 2017 as this bore has shifted to the underground operations, GCP20 which was dry throughout 2017 and BH2 which was destroyed.

Rix's Creek South Groundwater Monitoring Results

In accordance with Modification 4 of the Rix's Creek South development consent (DA 49/94) the DPI Water required a groundwater monitoring programme to be developed for Rix's Creek south operations that:

- Detailed baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores, which could be affected by the development;
- Groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts of the development;

- A program to monitor groundwater inflows to the open cut mining operations, and impacts of the development on the regions aquifers, any groundwater bores, and surrounding watercourses.

Groundwater level monitoring has been undertaken since 2010 and on a quarterly basis from 2012 to 2017 in accordance with the Rix's Creek Water Management Plan 2011 (WMP) approved by DPI Water.

The potential proposed groundwater inflows are licenced at 100ML/year at Rix's Creek South mine (20BL170863). The 2017 static water balance calculated ground water seepage from Rix's Creek South mine at 50 ML during 2017.

For Rix's Creek South operations, three piezometers are installed into the Permian coal measures and three into overlying regolith zone. Bore details are in Table 29 and shown on Figure 25. Piezometers BH1, BH5 and BH7 are the deeper bore holes into the coal measures while Piezometers BH3, BH4 and BH8 are shallow into the overlying regolith. The monitoring network also included the existing production bore 20BL170864. BH2 was installed in the Permian coal measures but this bore was destroyed in 2011.

Piezometer BH6 was proposed but not completed due to several problems when drilling during 2015, with BH8 being completed in its place.

Table 29 Rix's Creek South 2017 Groundwater Monitoring Network

Bore ID	Type	Depth (mbgl)	Location	Change in Water Levels during 2017 (m)
BH1	Standpipe Piezometer	130	Middle of basin - Upper / Lower Arties	0.25 (Bore Damaged in August, 2017)
BH2	Standpipe Piezometer	90	West of basin, close to outcrop- Lower Barrett	Bore Destroyed
BH3	Standpipe Piezometer	11	East of waste dump / backfill area- Regolith and shallow coal seams	-1.06
BH4	Standpipe Piezometer	10	Rix's Creek south of Pit 3- Regolith	-0.26
BH5	Standpipe Piezometer	66.5	East of Rix's Creek / tailings emplacement area- Lower Barrett	9.95
20BL170864	Production bore	~70	Above underground Workings- All coal seams	14.18
BH7	Standpipe Piezometer	200.5	Bottom of basin- Hebden	-2.4
BH8	Standpipe Piezometer	20	Dead Man's Creek wet of coal outcrop – regolith	0.22

Figure 25. Rix's Creek South Groundwater Monitoring sites

The groundwater levels are presented in **Appendix 3**. Rix's Creek South data collected to date show that:

Groundwater levels for Rix's Creek South groundwater bores have remained fairly consistent since the commencement of monitoring ground water levels (2010) and the results continue to confirm the hydrogeological conceptualisation outlined above, with the Coal Measures acting in hydraulic isolation from the shallow regolith and alluvium aquifer systems. This can be seen in the hydrograph responses from BH1 (screened in Arties seam), which shows a water level response correlating with mine water management activities in the Arties Pit. In more recent times, a depressurisation response can be observed in BH1, BH5, BH7 and 20BL170864 – which is expected to be in response to ongoing Coal Measures dewatering in the broader Rix's Creek area, with BH5 recovering when pumping at 20BL170864 ceases. Within the last 12 months, a recovery trend has been observed for BH5 and 20BL170864, returning to levels observed in 2014.

In direct contrast to these trends, the bores screened in the regolith aquifer system BH4 and BH8 have remained stable throughout the local mining activities, showing that the deeper coal measures aquifer is not hydraulically connected to the shallow regolith and alluvium system in this region. BH3 has shown a slight decline in water levels when compared to other regolith bores (BH4 and BH8), this decline was thought to be tied to the decrease in rainfall but the bore log notes that the screened interval is within a small coal seam and may be connected to the deeper coal measures than the shallow regolith unit.

During 2017 BH4 ranged from 2.15 – 2.41mgbl and BH8 level ranged between 2.76 - 2.98mbgl. Overall the water levels in the regolith aquifer system appeared to be a relatively stable shallow water table with fluctuating responses to seasonal rainfall trends (and no observable correlation to water level trends in the bores screened in the Coal Measures). BH3 ranged between 5.17 – 6.23mbgl, but this bore as noted above is assumed to have some connection to the coal measures.

Groundwater EC (mS) throughout the period of monitoring have also returned consistent results. This is all consistent with the historical groundwater EC ranges.

The average salinity values of the groundwater sampled from the screened bore in the coal seam (BH5) ranged between 4,680 to 6,140 mg/L showing high levels of salinity. BH2 is also within the coal seam but was unable to be sampled during 2016 as this bore has been recorded as being destroyed in 2012 with the last time it was successfully sampled being in February, 2012. A replacement bore for BH2 was installed during July 2015 named BH7 which recorded 7,250 mg/L in May 2016, the bore appeared to be dry during other sampling events during 2016. The salinity values within the regolith (BH3 and BH4) is also high ranging from 5,720 to 20,400 mg/L. These salinity ranges are all consistent with field water quality parameters outlined in the Rix's Creek South Water Management Plan.

Over the monitoring period salinity levels are shown to remain consistent in the coal seams and the regolith. This indicates limited connectivity (and mixing) between the two aquifer zones, and no negative water quality trends are being driven from mining operations in the area. This is consistent with the hydrogeological conceptualisation which underpins the groundwater baseline study and impact assessment work, and continues to be validated by the ongoing monitoring analysis.

Comparison of the analysis results for dissolved metals against the ANZECC guideline values for the protection of Freshwater Ecosystems (ANZECC, 2000) shows a number of exceedances of the guideline values, as follows:

- Copper was detected above the freshwater ecosystem value limit of 0.0014 mg/L in BH3 at concentrations of 0.023
- Nickel was detected above the freshwater ecosystem value limit of 0.011 mg/L in BH3 at concentrations of 0.018; and
- Zinc was detected in piezometers BH3, production bore 20BL170864 and BH8 at concentrations of 0.050, 0.015 and 0.016 mg/L respectively, which exceeded the freshwater ecosystem guideline of 0.008 mg/L.

This is consistent with baseline studies showing in the Rix's Creek WMP that there is a number of exceedances of the guidelines values with arsenic, chromium, cadmium, copper, nickel and zinc – so can be considered as background trends.

Rix's Creek North Groundwater Monitoring Results

The current Rix's Creek North Water Management Plan approved by DPE on the 16th February 2016.

Piezometers, bores and private wells included in the Rix's Creek North groundwater monitoring program include the Foybrook Formation basement coal measures as well as the Glennie's Creek and Station Creek alluvium groups.

Due to the complex interactive depressurisation effects of numerous coal mines on steady state groundwater levels within the model area, calibration of the 2009 groundwater assessment model was more focused on obtaining correlation between known and modelled mine inflow rates, as opposed to matching observed and modelled groundwater levels.

From the 2009 Environmental Assessment, the model indicated that the groundwater within alluvial aquifers associated with Glennie's Creek and Station Creek had the potential to be marginally to negligibly affected by the proposed pit during its active mining phase, with drawdowns ranging up to 1.2m (based on the Case 1 groundwater model hydraulic conductivity of 7.9 x 10-2m/day) near the Mine Area until mining of the pit is completed.

Results from 2017 reporting period compared to the 2009 Ground Water Environmental Assessment show alluvium water levels have maintained pre-mining water levels (with variations in water levels are induced by natural creek flow process), and that dewatering of the neighboring/underlying coal seams and broad depressurisation of the Permian basement does not result in water level impacts within the creek alluvium system. The hydrogeological conceptualization outlined earlier in this chapter shows the basis of this relationship.

The potential proposed pit groundwater inflows from the 2009 ground water environmental assessment predicted that full pit ground water inflows of 73 ML/year in 2014 and 117ML/year from 2018. Table 25 refers to the 2017 static water balance, which estimated groundwater seepage from RCN mine at 100ML for 2017, close to the model predicted volumes based on timing and range.

The Rix's Creek North Groundwater monitoring program is referred to in Table 29 and shown on Figure 24. The results are presented in **Appendix 3**.

Table 5 Rix's Creek North Ground Water Monitoring Network

Bore ID	Type	Total Depth (mbgl)	Formation	Change in Water Levels during 2017 (m)
GCP09	Standpipe Piezometer	9	Glennie's Creek Alluvium	-0.39
GCP10	Standpipe Piezometer	11.5	Glennie's Creek Alluvium	-0.21
GCP 19	Standpipe Piezometer	12	Glennie's Creek Alluvium	0.12
GCP20	Standpipe Piezometer	8.2	Glennie's Creek Alluvium	Dry
GCP21	Standpipe Piezometer	8.2	Glennie's Creek Alluvium	-0.31
GCP22	Standpipe Piezometer	12	Glennie's Creek Alluvium	-0.07
GCP23	Standpipe Piezometer	8	Glennie's Creek Alluvium	0.6
GCP28	Standpipe Piezometer	12	Glennie's Creek Alluvium	0.31
GCP29	Standpipe	10	Glennie's Creek Alluvium	0.28

Bore ID	Type	Total Depth (mbgl)	Formation	Change in Water Levels during 2017 (m)
	Piezometer			
GCP30	Standpipe Piezometer	12	Glennie's Creek Alluvium	-0.19
GCP32	Standpipe Piezometer	55.56	Camberwell Pit Basement	Incomplete Data
GCP34	Standpipe Piezometer	56.26	Camberwell Pit Basement	No Data
GCP35	Vibrating Wire Piezometer multi depth	195	Camberwell Pit Basement	No Data
GCP36	Standpipe Piezometer	15.98	Camberwell Pit Basement	-0.18
GCP37	Vibrating Wire Piezometer multi depth	127.50	Camberwell Pit Basement	Incomplete Data
SGD644	Vibrating Wire Piezometer multi depth	104	Camberwell Pit Basement	Incomplete Data
SGD645	Vibrating Wire Piezometer multi depth	96	Camberwell Pit Basement	Incomplete Data
GCP38	Standpipe Piezometer	24.31	Camberwell Pit Basement	0.27
GCP02	Standpipe Piezometer	105	Falbrook pit Basement	0.55
GCP05	Standpipe Piezometer	108	Falbrook pit Basement	1.2
GCP06	Standpipe Piezometer	126	Falbrook pit Basement	0.1
GCP07	Standpipe Piezometer	120	Falbrook pit Basement	6.8
GCP08	Standpipe Piezometer	120	Falbrook pit Basement	6.04
GCP13	Standpipe Piezometer	66	Falbrook pit Basement	2.42
GCP14	Standpipe Piezometer	123	Falbrook pit Basement	6.82
GCTB	Standpipe Piezometer	90	Falbrook pit Basement	0.79

The results for groundwater analysis, including range, mean and standard deviation are presented in **Appendix 3**.

The field pH levels remained at relatively constant levels throughout the reporting period at reported GC series groundwater monitoring wells (neutral to slightly alkaline range). EC is consistently low at the Glennie's Creek alluvial bore GC09 (397-462 μS/cm) when compared to other GC bores at RCN.

Monitoring wells B1 to B5 have been installed in order to evaluate hydrological impacts on TD2 dam wall. As such, results from these bores do not reflect groundwater impacts generally. The results recorded in each piezometer installed on TD2 were stable throughout the reporting period and similar to results recorded in previous years. Bore s 4 and 5 was recorded as being dry for the entire reporting period.

Based on the data during the 2017 reporting period, alluvial groundwater level monitoring indicated no response to mining outside of the influences of normal climatic variability in proximity to drawdown associated with the Falbrook Open Cut in the Glennie's Creek catchment, or the Camberwell Open Cut in the Glennie's Creek and Station Creek catchments.

The available basement groundwater monitoring data in the 2017 reporting period indicated;

- Recovery of GCP7, 8, 13 and 14 associated with water storage in the Falbrook Pit, along with normal climatic variability with the remaining piezometers within the Falbrook Open Cut; and
- All other basement bores at RCN continued to follow historical trends associated with regional depressurisation influences.

Piezometer array SGD644 in the Falbrook Open Cut area showed no mining induced depressurisation in the data provided up to May 2017, with pressures remaining stable, even slightly recovering.

In the sensor at 53.75m below surface in SGD645 indicates an ongoing steady recovery of several metres during 2017, a lesser recovery on the middle sensor, while the deep sensor continues an ongoing depressurisation trend, likely in response to ongoing dewatering in the Integra underground workings to the northwest.

GCP37 showed no mining induced depressurisation during 2017 outside of its historic range, with a highly stable pore pressure profile continuing to be recorded at this location.

The pH and salinity in the Glennie's Creek alluvial open standpipe piezometers has not shown any significant trends since they were installed in 2007, except for a reducing salinity profile in GCP29 and GCP30 between mid-2009 and early 2011.

The pH and salinity in the Camberwell basement open standpipe piezometers has not shown any significant trends since they were installed after mid-2007.

The pH and salinity in the Falbrook Open Cut alluvial open standpipe piezometers has not shown any significant trends since they were installed in 2012.

The pH and salinity in the Falbrook Open Cut basement open standpipe piezometers has not shown any significant trends since they were installed in 2012 except for a fall in salinity in GCP14 and GCP08 – both north of the Falbrook Pit, and likely being influenced by the fresher quality stored water within the Falbrook pit void.

7.5 Erosion and Sediment

7.5.1 Environmental Management

Erosion and sedimentation control is an integral part of the water management across the entire site. Erosion control on reshaped and rehabilitation areas is achieved by having the minimum delay in time and area between the active mining operation and establishing rehabilitation. Revegetation of rehabilitation areas is undertaken as soon as an area becomes available with the aim to establishing a minimum of 70% ground cover, the level required to adequately control soil erosion. Accompanied with this is the use of sediment detention basins in front of the operation, along haulage roads and on drainage lines flowing from establishing rehabilitation areas.

Throughout April 2017 sediment dams across site were de-silted whilst climatic conditions were dry allowing adequate access and works to take place. This required the use of a 22 tonne excavator. Several other smaller sediment dams and drainage lines were also cleaned via an on-site backhoe as required throughout the year. These sediment dams contain the same material as that excavated from the open cut operation as well as clays, soil and silt from the natural environment.

Clean water drainage repairs were also conducted around the rail loop at Rix's Creek Mine. The works conducted in March and April 2017 have minimised the amount of water that may pool against the rail infrastructure. Monthly sediment and erosion checklists were completed at Rix's Creek South and Rix's Creek North mine, with routine repairs to sediment fences being completed during the reporting period.

7.5.2 Environmental Performance

Total Suspended Solids (TSS) results from water sampling is used as a key indicator of sediment control. TSS results are discussed in Section 7.3 Surface Water environmental performance section.

7.5.3 Reportable Incidents

No reportable incidents relating to erosion and sediment occurred during the 2017 reporting period.

7.5.4 Further Improvements

Any sediment collected within the light-vehicle wash-down pad, heavy-vehicle wash-down pad, diesel fill-point sump, electrical workshop sump, mechanical workshop sump are all cleaned regularly with the sediment particles relocated to the site bioremediation area.

SECTION 8 REHABILITATION

8.1 Buildings

Maintenance of structures is undertaken on as needs basis throughout the year. Throughout 2017 infrastructure sheds and structures were painted as necessary. The preferred colour scheme is light green (known as rivergum green) with this same colour utilised on the colorbond fencing installed adjacent to the bridge of the cut and cover tunnel as well as major infrastructure across the site. Previous Vale Integra (now RCN) infrastructure will remain the non intrusive beige colour at present.

8.2 Post Landform Land Use

Land capability at Rix's Creek Mine is predominantly Class IV and Class V which is suitable for grazing. The primary post mining landuse goal is to provide improved pasture species with scattered tree lots and tree corridors linking surrounding rehabilitated areas, proposed tree planting corridors and surrounding existing native vegetation. The overburden emplacement areas are designed to be sympathetic to the surrounding landscape.

For Rix's Creek Northern operations, tree corridors will be established over the Falbrook Pit (formerly referred to as Old North Pit) waste emplacement to link the rehabilitation of the Falbrook Pit with the rehabilitation of the Camberwell Pit (formerly referred to as extended South Pit) final landform. It is anticipated that this will provide a north-south link across the RCN project Area, which will link the Biodiversity Offset Areas that join the Falbrook Pit.

The progressive rehabilitation when compared to the respective Mining Operations Plans is referred in Tables 31 and 32 and demonstrated in plates 1 -6 in section 8.3.

8.3 Rehabilitation of Disturbed Land

Re-contouring, topsoil handling and revegetation techniques are generally well established at Rix's Creek and undertaken in accordance with the Bloomfield Mining Operations Land Rehabilitation Management System (LRMS).

The key elements of the LRMS include:-

- setting overall rehabilitation aim and objectives;
- developing appropriate rehabilitation indicators and completion criteria;
- undertaking land rehabilitation;
- developing and implementing a rehabilitation assessment program;
- continuing rehabilitation management and maintenance; and
- presenting a request for rehabilitation sign-off to regulators, supported by results from the assessment program.

The aim of rehabilitation at Rix's Creek Colliery is to reinstate the pre-mining land capability of grazing land, with stable landforms, compatible with the surrounding landscape, and allow for a range of possible post-mining land-uses such as agricultural lots. As of 2015 Rix's Creek is beginning to achieve large parcels of grazing land which when the areas suit the operation will be grazed to assess if the pasture rehabilitation is sustainable long-term prior to sign-off. Pasture sampling for feed quality analysis has also been monitored since 2013 through a 4 ha trial on the North Pit rehabilitation to monitor the effectiveness of bio solids used in rehabilitation areas to gain a better understanding if the pasture rehabilitation will be sustainable long-term.

The rehabilitation is undertaken to meet the following objectives.

General

- Land will be rehabilitated in accordance with relevant NSW Department of Industry – DRG – DPE standards applicable at the time of rehabilitation i.e. Mining Operations Plan (MOP) guidelines, September 2013.
- Rehabilitated land will represent a minimal source of offsite environmental impacts, such as dust, water pollution, visual amenity and weeds.
- Rehabilitated land will require ongoing management inputs no greater than similar adjacent land.
- Rehabilitation will be compatible with the proposed post-mining land-use.

Landform

- Rehabilitated land will be safe and stable.
- Land capability will be returned to a class similar to that existing prior to the commencement of mining.
- Mined land will be re-contoured to a landform compatible with the surrounding natural landscape.
- Reinstate a stable drainage network.

Vegetation

- Rehabilitated land will be topsoiled, fertilised and sown with grass and/or native vegetation species.
- A sustainable vegetation cover will be established on rehabilitated land.
- Grazing areas will be established with a range of species suitable for pasture production in the area.
    - An example of a species mix that may be used as per Rix's Creek MOP is:-
    - **Pasture mix #1** - Rhodes Grass, Couch, Rye, Sub. Clover, Wolly Pod Vetch, Green Panic, Sirosa Phalaris, Sephi Barrel Medic, Lucerne, and Kikuyu. All summer / winter active.

Pasture mix #1 was amended in the 2013 Rix's Creek MOP with Rhodes grass being restricted from previously used rates of 5 kg/ha back to 1 kg/ha to minimise potential for 'monocultures' of Rhodes grass being dominant in the pasture rehabilitation area.

- Tree areas will be established with native species by either direct seeding or tubestock planting techniques.
    - An example of a native species mix that may be used as per Rix's Creek MOP:-
    - **Tree mix #1** - *Eucalyptus crebra, E. fibrosa, , E. mollucana, E. melliodora, Corymbia maculate, Acacia decora, A. falcata, A. implexa, A. paradoxa, A. salicina, Casuarina luehmannii, Hardenbergia violacea*, and hybrid *Eucalyptus* spp. suitable for plantations.

Rehabilitation is generally carried out on a seasonal basis in spring and autumn. Cover crops used in pasture rehabilitation may be adjusted to suit the climatic conditions at time of sowing. Preferred species may also require adjustment due to availability.

During the reporting period a total of 22.6 ha was rehabilitated across Rix's Creek Mine. A further breakdown of this can be seen in Table 31 and 32.

Table 31 2017 Rehabilitation Summary RCN

Locator	Site Name	Type	Date Sown	Species mix	Area (ha)
Camberwell Pit	RL150 Area	Pasture	August	Pasture #2	12.3
Camberwell Pit	RL150 Area	Pasture	September	Pasture 1	0.5
Falbrook Pit	Near Falbrook Pit HV park up area	Pasture		Pasture #1	4.4
Falbrook Pit	Stoney Creek Road batter	Trees		Trees#1	3
TOTAL 2017 @ RCN					**17.2**
CUMULATIVE TOTAL INCLUDING 2017 @ RCN					**409.2**

Table 32 Rehabilitation Summary RCS

Locator	Site Name	Type	Date Sown	Species mix	Area (ha)
Arties Pit	RL 140	Trees	March	Trees#1	1.5
West Pit	Out of Pit Dump	Pasture	June	Pasture #2	0.9
Arties Pit	Pin dump 1	Pasture	September	Pasture #1	4.6
TOTAL 2017 @ RCS					5.4
CUMULATIVE TOTAL INCLUDING 2017 @ RCS					**428.1**

Arties RL140 (Tree's)

The RL140 dump north of tree stand area was rehabilitated in March 2017 totalling 2 ha. These area was prepared in 2016 and tree seeded in 2017 with a light cover crop and starter fertiliser. This area was direct seeded via a tractor using tree species (Tree mix #1).

The area was created using overburden from the Arties Pit operation then clay and subsoil from the West Pit pre-strip was shaped onto a 1-2 degree slope. This area was overlaid with approximately 100-200 mm of topsoil using a D10 dozer. The topsoil was from the West Pit pre-strip area. Prior to seeding the area was spread with biosolids at a rate of 50 tonnes / hectare and ripped into the soil with a tractor with rip lines running across the contour to minimise erosion from surface run-off.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 100 kg/ha. A cover crop was also applied to minimise the erosion and weed potential. Early indications also show some weed (galenia and scotch thistle) which will be monitored and managed accordingly. To date a low amount of seedlings are emerging due to below average rainfall conditions.

Plate. 1 Arties Pit – pin dump batter (visible from New England Highway) and RL140 dump – tree seeded areas

West Pit Out of Pit Dump

The West Pit Out of Pit Dump (top batter) site was rehabilitated throughout March 2017 totalling 0.9 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #1).

The area was created using overburden from the West Pit operation then shaped into a 2 degree slope with a D10 dozer. The whole area was overlaid with approximately 100-200 mm of topsoil from the West Pit Out of Pit Dump stripped area. Prior to seeding the area was spread with biosolids at a rate of 80 tonnes / hectare and ripped into the soil with a tractor.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. A cover crop was also applied to stabilise the slope and minimise the weed potential. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures. This West Pit area was sprayed for weeds during the reporting period to minimise the invasive species of Galenia.

Plate. 2 West Pit out of pit dump

Arties Pit Pin Dump

The North Pit RL140 dump site was rehabilitated in June 2017 totalling 1.4 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #2).

The area was created using overburden from the West Pit operation then clay and subsoil (300-500 mm thick) from the West Pit pre-strip was shaped onto a 6-8 degree slope. This slope was overlaid with approximately 100 mm of topsoil from the West Pit pre-strip area. Prior to seeding the area was spread with biosolids at a rate of 80 tonnes / hectare and ripped into the soil with a tractor. The rip lines were created across the contour to minimise erosion from surface run-off. This area creates good undulation to

the Arties Pit dump which has a more natural aesthetic for passing road-users.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. Early indications also show some weed (galenia) which will be monitored and managed accordingly. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 3 Arties Pit Pin Dump Area

Camberwell Pit RL150 Dump

The Camberwell Pit RL150 Drainage Line site was rehabilitated in September 2017 totalling 12.5 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #2).

The area was created using overburden from the Camberwell Pit operation previously dumped by Vale. It was shaped onto the 2 degree undulating landform. This undulating landform was overlaid with clay and subsoil approximately 300-500mm capping material and covered with approximately 100-200 mm of topsoil stockpiled within the rehabilitation area using a D10 dozer. The topsoil came from the 13ha cleared area from the South West of the Camberwell Pit. Prior to seeding the area was spread with biosolids at a rate of 100 tonnes / hectare and ripped into the soil with a tractor with rip lines running across the contour to minimise erosion from surface run-off.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. A cover crop was also applied to stabilise the landform and minimise the weed potential. Early indications also show some weed (galenia) which will be monitored and managed accordingly. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 5 Camberwell Pit RL150 Dump

Falbrook Pit near old North Park up area

The Falbrook Pit Stoney Creek Road site was rehabilitated in July 2017 totalling 4.4 ha. This area was direct seeded via a tractor using pasture species (Pasture mix #2).

The area was created using overburden from the Falbrook Pit operation previously dumped by Vale. It was shaped from a free-fall 0 -2 degree landform. This landform was overlaid with approximately 100-200 mm of topsoil stockpiled within the rehabilitation area using a D10 dozer and 994 front-end loader. Prior to seeding the area was spread with biosolids at a rate of 100 tonnes / hectare and ripped into the soil with a tractor with rip lines running across the contour to minimise erosion from surface run-off.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. A cover crop was also applied to stabilise the slope and minimise the weed potential. Early indications also show some weed (galenia) which will be monitored and managed accordingly. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 6 Falbrook Pit – RL141 near old North park up area

Falbrook Pit Stoney Creek Batter - Tree Area

The Falbrook Pit Stoney Creek Road site was rehabilitated in October-November 2016. In March 2017 3 ha of the area was direct tree seeded using a tractor using Tree Seed #1 species. The tractor

The area was created using overburden from the Falbrook Pit operation previously dumped by Vale. It was shaped from a free-fall (~37 degree slope) into a 10 degree slope. This slope was overlaid with approximately 100-200 mm of topsoil stockpiled within the rehabilitation area using a D10 dozer and 994 front-end loader. Prior to seeding the area was spread with biosolids at a rate of 100 tonnes / hectare and ripped into the soil with a tractor with rip lines running across the contour to minimise erosion from surface run-off.

The material used in the construction has no relevant chemical characteristics, acid forming or spontaneous combustion potential. During the seeding process a starter fertiliser was spread at a rate of 200 kg/ha. A cover crop was also applied to stabilise the slope and minimise the weed potential. Early indications also show some weed (galenia) which will be monitored and managed accordingly. Some rock and timber structures were also created throughout the area as habitat for ground-dwelling creatures.

Plate. 7 Falbrook Pit – Stoney Creek batter rehabilitation facing west

A total of 4730 tubestock plants were planted during May and June 2017. 1530 Tubestock were planted during May along the Rix's Creek South entry lane visual bunds, clean water diversion behind ROM pad noise bund, Wet Pit Out-Of-Pit-Dump and the Ernst Property located on the New England Highway for visual amenity. Glennies Creek Riparian enhancement also sore and additional 3200 tubestock planted along Glennies Creek during May and June 2017.

As shown in Table 33, 5.4 ha was rehabilitated in 2017 at RCS giving RCS a cumulative area rehabilitated of 427.5 ha since 1990. This cumulative area is 29 ha behind the MOP cumulative total of 456.9 ha. In the 2017 reporting period Rix's Creek Mine concentrated the majority of operational efforts at the Rix's Creek Northern operations and subsequently reduced operations at Rix's Creek South. Of note, Rix's Creek South were well below the maximum production rate 16.1 million BCM (Bank Cubic Metres) moving 10.6 Million BCM in 2017 compared to that of 15.1 Million BCM during 2016. This significant reduction in material moved resulted in the reduced availability of completed overburden dumps being shaped to final landform designs and consequently reduced the opportunity for rehabilitation progression. There is a concerted effort to shape overburden dumps as soon as they reach final landform height and this will continue across Rix's Creek Mine in 2018.

Table 34 shows 17.2 ha was rehabilitated in 2017 at RCN giving RCN a cumulative area rehabilitated of 415.9 ha. This cumulative area is 14.5 ha behind the revised cumulative total of 430.4 ha in 2017 as seen in Table 34. It must be noted that in Table 21 of the approved Rix's Creek North MOP, the total rehabilitation column was well below the actual total rehabilitation completed at Rix's Creek North operations. Upon internal investigation it was identified that Table 21 Total Rehabilitation Column in the approved 2015 RCN MOP didn't include the existing Northern rehabilitation area that was completed by previous owners Vale. The Northern rehabilitation area comprised of 148ha that wasn't included in the total rehabilitation column in Table 21 of the 2015 RCN MOP. Table 34 highlights the total rehabilitation area stated in the MOP and the actual figure re-calculated to include the 148 ha Northern rehabilitation completed by previous owners Vale.

Rix's Creek Mine has concentrated efforts at Rix's Creek North during the 2017 reporting period. Areas to be rehabilitated in 2018 are shown in figure 27. In 2016, the rehabilitation requirement was 42.7ha. Mining operations at Rix's Creek North didn't resume until March 2016 with only day shift operations occurring until May where there was the inclusion of an afternoon shift and soon after a night shift crew. In 2017 17.2 ha was completed as operations increased during 2017 when an addendum to the 2015 RCN MOP was approved to increase production rate at Rix's Creek North operations.

Mining operations are actively progressing in Rix's Creek North with material moved now progressing towards final landform designs which will make available significant areas for reshaping and rehabilitation from 2018 onwards.

Table 33 RCS Rehabilitation and Disturbance Areas (ha) compared to MOP

Domain / Phase	2016 Actual	2017 MOP	2017 Actual	2018 MOP
Infrastructure Area	RCS 72.9	RCS 59.7	60.7	RCS 62.5
Tailing's Emplacement Area –RCS	RCS 22.7	RCS 17.6	20.6	RCS 19.3
Active Mining Area RCS	RCS 157.5	RCS 82	153.6	RCS 84.4
Overburden Emplacement Area -RCS	RCS 300.3	RCS 260.5	308.6	RCS 260.5
Rehabilitated Lands – Pasture phase – Ecosystem and landuse establishment	RCS 27.0	RCS 7.2	5.4	RCS 45.9
Rehabilitated Lands – Pasture; Ecosystem and Landuse Sustainability	RCS 98.7	RCS 136.7	113	RCS 143.8
Total Rehabilitation – Ecosystem and Landuse Sustainability (incl. pre MOP rehabilitation)	RCS 421.1	RCS 456.9	426.5	RCS 464

Table 34 RCN Rehabilitation and Disturbance Areas (ha) compared to MOP

Domain / Phase	2016 Actual	2017 MOP	2017 Actual	2018 MOP
Infrastructure Area	109.3	108.3	109.8	108.3
Tailing's Emplacement Area – RCN RCS	67.7	100.2	67.7	100.2
Active Mining Area RCN	92.1	71.4	98.8	73.1
Overburden Emplacement Area _RCN	380.1	257.3	369.0	255.5
Rehabilitated Lands – Pasture; Ecosystem and Landuse Establishment	18.7	4.2	17.2	7.5
Rehabilitated Lands – Pasture; Ecosystem and Landuse Sustainability	66.3	9.3	66.3	11.3
Total Rehabilitation – Ecosystem and Landuse Sustainability (incl. pre MOP rehabilitation)	239.7* 398.7**	282.4* 430.4**	415.9**	286.6* 434.6**

** Total rehabilitation calculated in approved 2015 RCN MOP from Table 21.*
*** Revised total to include the 148ha Northern rehabilitation area completed by previous owners Vale.*

Figure 26 outlines the progression of rehabilitation during the 2017 reporting period. All areas rehabilitated during 2017 across Rix's Creek Mine were treated with biosolids. The application of biosolids greatly enhances revegetation onsite given the poor quality of available topsoil. Biosolids organic properties also aid in water infiltration which leads to an improvement in soil composition and long-term vegetative growth. The rehabilitation monitoring conducted in 2017 shows good landscape function performance across the Rix's Creek Mine. It must be noted that the rehabilitation transect areas performing below the completion criteria outlined in Section 8.6 Rehabilitation Monitoring, have not been treated with biosolids and were treated with Organic Growth Matter (OGM) and ameliorated with gypsum. These products were applied

during a pasture trial conducted in 2013. Areas performing below the respective MOP completion criteria are planned to be improved during 2018.

Weed infestation remains the major challenge that has the potential to affect rehabilitation performance across the site, particularly with widespread occurrence and locally severe infestations of Galenia (*Galenia pubescens*), and more localised incursions of Prickly Pear (*Opuntia spp.*), Coolatai grass (*Hyperhenia hirta*) and Western Australian Wattle (*Acacia Saligna)*. Efforts have been increased to remove *Acaica Saligna* from previously rehabilitated areas during the 2017 period, with approximately 52 hectares of Acacia Saligna trees being removed from Rix's Creek Northern rehabilitation areas.

The previous owners Vale placed the Acacia Saligna species within their rehabilitation tree seed mix. Due to the aggressive growth and ability to deposit a large seed bank within the soil, the Acacia Saligna species quickly became dominant on rehabilitated areas where it was direct seeded. The Acacia Saligna species creates a monoculture that inhibits native providence acacia and eucalypts species from re-populating rehabilitated areas designated for tree seed over pasture. Under the direction of DRG, Rix's Creek Mine have increased efforts to remove the Acacia Saligna species from rehabilitated areas at Rix's Creek North from 2016.

Weed management will be a priority in 2018 to ensure that we reduce the amount of invasive species that have the ability to affect rehabilitation at Rix's Creek Mine.

Rixs Creek North & Rixs Creek South

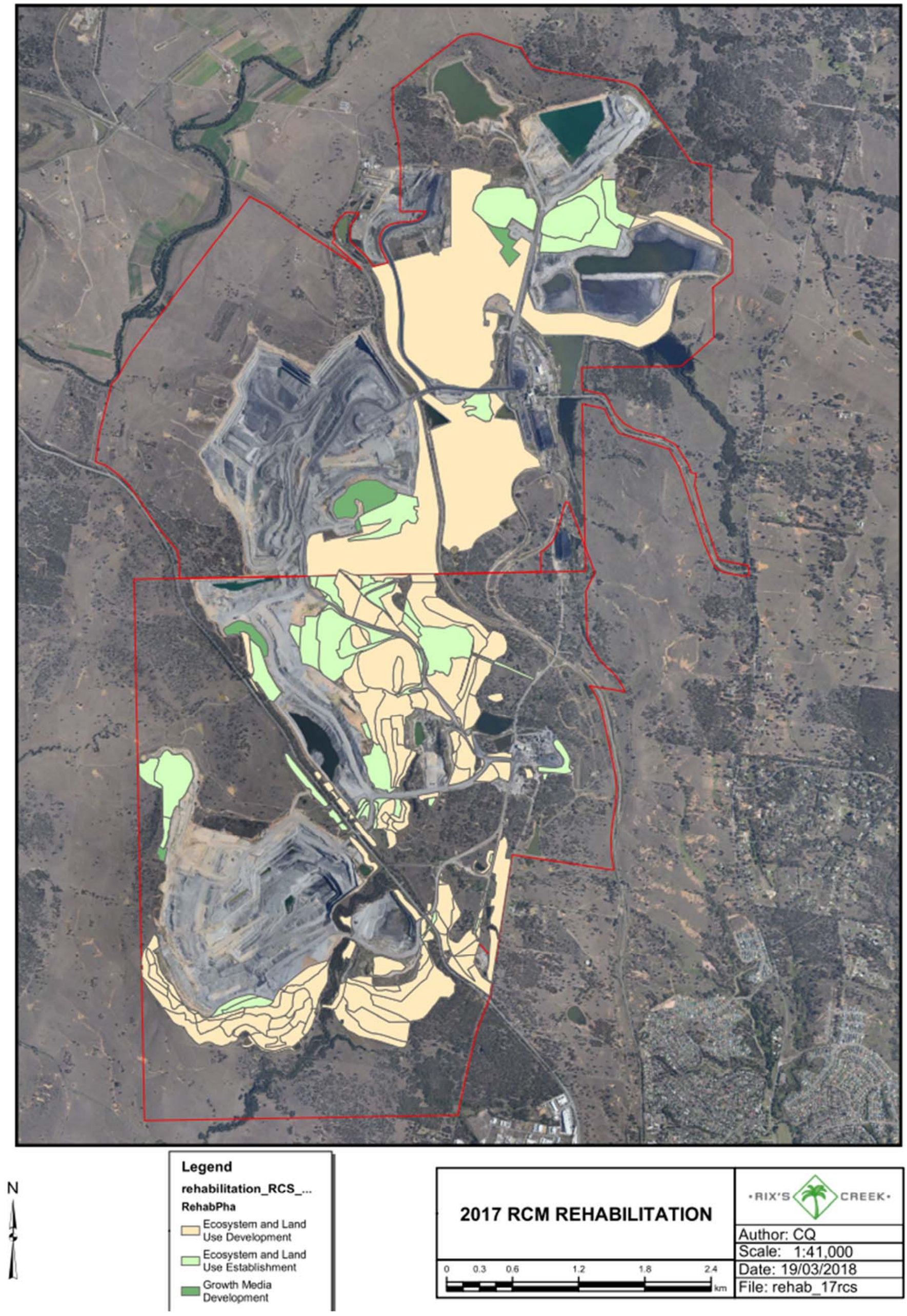

Figure 26 2017 Rix's Creek Mine Rehabilitation

Rixs Creek North & Rixs Creek South

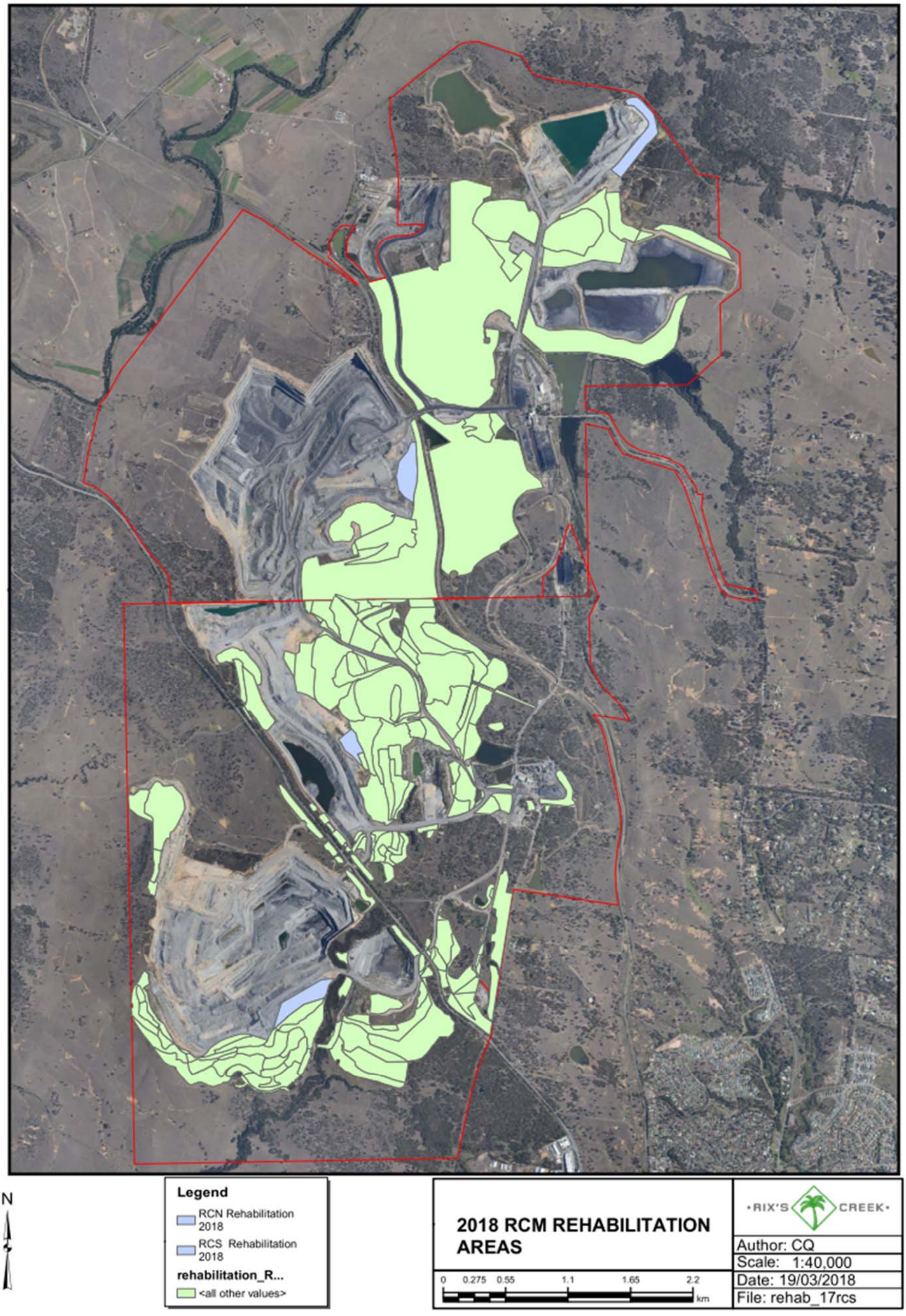

Figure 27 2018 Rehabilitation Areas

8.4 Other Infrastructure

No major infrastructure was installed during 2017.

8.5 Rehabilitation Trials and Research

A 4 ha rehabilitation trial comprising of four 1 ha quadrats was conducted on site during August 2013. During 2014 this trial was monitored in February (six months after sowing) and August (12 months after sowing). During 2015 this trial was monitored during August (24 months after sowing) as well as during 2016 (36 months after sowing). Rix's Creek set up this trial to compare the conventionally used biosolids with compost (reuse of garden green waste) to evaluate the effectiveness of both products in contributing to long-term sustainability for the site. The four 1 ha quadrats were sown with conventional methods using pasture species already used on site with soil treatment as follows:

- Quadrat 1: Control with 200 kg starter fertiliser applied
- Quadrat 2: Compost at 80 t / ha
- Quadrat 3: Compost at 140 t /ha
- Quadrat 4: Biosolids at 140 t / ha (maximum allowable rate).

The six, 12, 24 and 36 monthly results to date can be seen in Figure 28. To date all sites are similar in terms of pasture composition and species diversity but dry conditions in 2016 and 2017 have seen the rehabilitation growth rates lower than average annual growth rates across the site. Physically looking at the area's during August 2016 the control plot is much lower in quality then the three other plots, whilst the biosolids plot is slightly higher in quality (available green feed) then the other plots. These plots will be monitored again in August 2017 to see any seasonal influences and further rehabilitation progression (after 48 months) on the four trial plots. All four sites over the timeline of the trial have increased in stability and nutrition. In terms of soil infiltration all the sites have increased and then plateau from the 12 to 24 months results.

The 48 months results completed in October 2017 revealed the following trends:

- Pasture productivity and dry matter production increased significantly in the Control and Biosolids treatments in the last 6 months, but was markedly lower in the compost treatments. Plant mortality due to shading in the Biosolids treatment is expected to underestimate pasture and leaf mass in this treatment.
- Weeds were suppressed on all treatments by subtropical grasses, but remained substantially higher in the Control. The weed content was inversely proportional to nutrient inputs, and the productivity of subtropical grasses.
- The Control treatment showed significant improvement over the last 6 months, producing similar herbage mass due to an increase of kikuyu and panic.
- The biosolids treatment continues to show higher forage quality and higher potential stocking rates than the other treatments. Indicative pasture productivity and stocking rates are approximately 2 to 3 times higher than native pasture of equivalent land class.
- The compost treatments had significantly lower digestibility and protein levels, and reflect the lower pasture productivity observed in these treatments. Reasons for this result are unclear and further soil testing is required.
- Grazing is likely to complement long term objectives of improving pasture species diversity and forage quality.

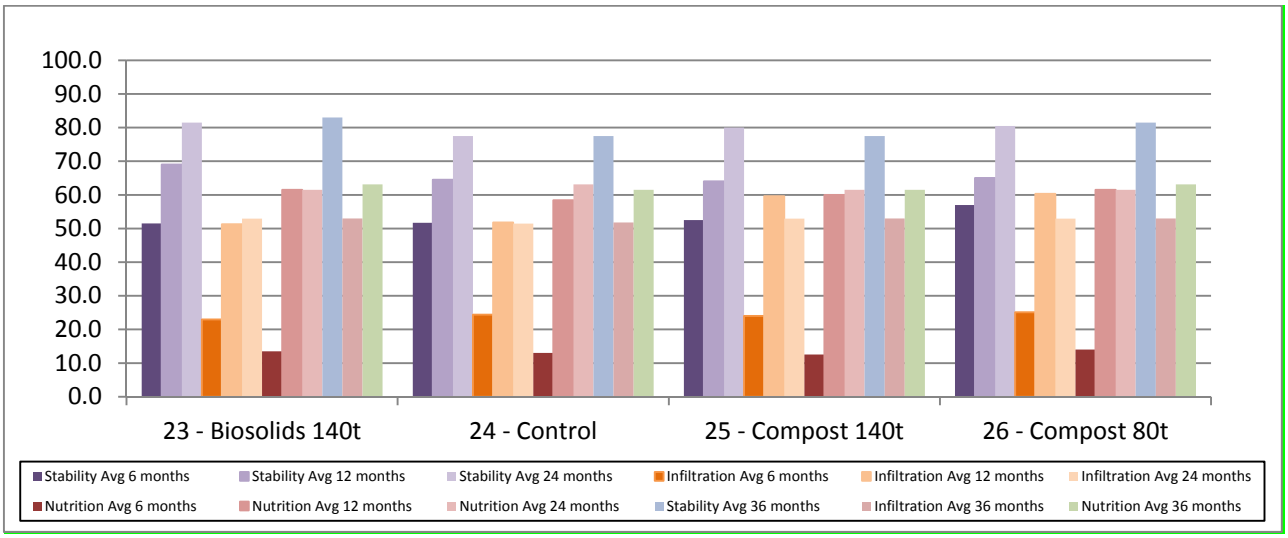

Figure 28 Summary of Rix's Creek 4 ha trial on North Pit Dump.

8.6 Rehabilitation Monitoring

Rehabilitation monitoring was undertaken independently by Aecom for Rix's Creek Mine during the 2017 reporting period.

The 2017 Rehabilitation Monitoring Report identified weed incursion as the main issue currently impeding rehabilitation performance across the site, particularly with widespread occurrence and locally severe infestations of Galenia (*Galenia pubescens*), and more localised incursions of Prickly Pear (*Opuntia spp.*), Coolatai grass (*Hyperhenia hirta*) and *Acacia Saligna*. In total, 12 of the 35 monitoring sites supported weed infestation levels exceeding the target benchmark of 15% weed cover and will require control works to be implemented during 2018.
However and assuming successful management and control of the site's weed population, the monitoring results obtained in 2017 showed that rehabilitation condition was very satisfactory across the site and, when compared to previous years monitoring results, generally trajecting towards achieving the ultimate rehabilitation objective of re-establishing safe and stable landforms compatible with the surrounding landscape and with a land capability suitable for grazing (i.e. class IV-V).
The key findings of the 2017 monitoring are summarised below.

Ground cover

Ground cover protection was generally excellent and the benchmark of 70% cover was met at 33 of the 35 rehabilitation monitoring sites, with 27 sites achieving >90% ground cover. Of the two monitoring sites not meeting the benchmark in 2017, one consisted of young rehabilitation (i.e. still in the vegetation establishment phase) while the other showed deficiencies in the soil/growing media which likely hindered the successful establishment of vegetation.

Ground cover was provided in the form of vegetative grass cover and organic litter, with grass cover typically dominating in pasture areas and litter cover dominating in tree areas.

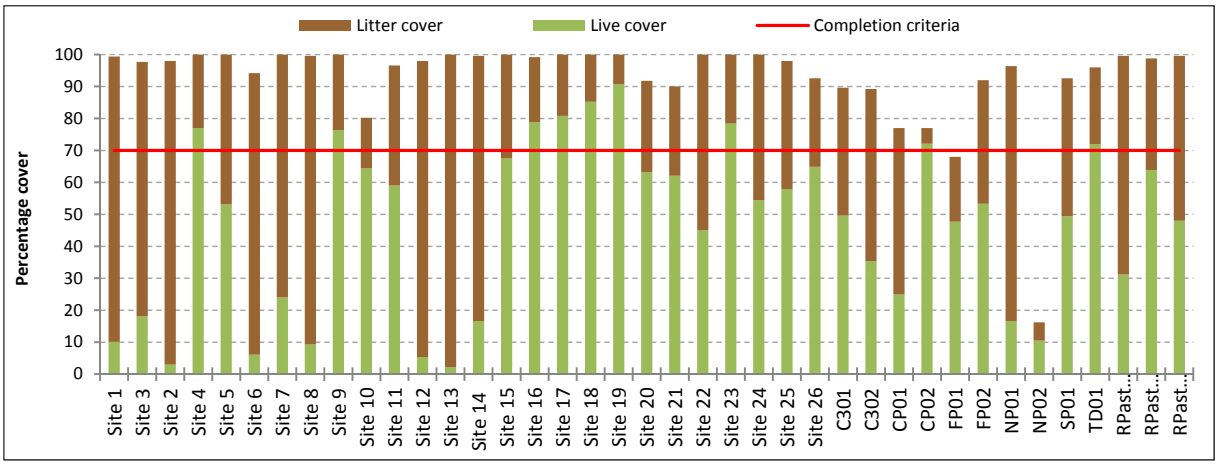

Figure 29 Litter Cover on rehabilitation transects

Landscape function

Landscape function was assessed using the Landscape Function Analysis (LFA) tool developed by the CSIRO, which relies on visually assessed indicators of soil surface processes to gauge how effectively a hillslope is operating as a biophysical system. It is mainly based on processes involved in surface hydrology: rainfall, infiltration, runoff, erosion, plant growth and nutrient cycling.

Consistent with previous monitoring years, the 2017 results highlighted good landscape function performance across most of the rehabilitation monitoring sites, as follows:

- The soil stability benchmark was met at 34 of the 35 monitoring sites;
- The soil infiltration benchmark was met at 33 of the 35 monitoring sites; and
- The soil nutrient cycling benchmark was met at 32 of the 35 monitoring sites.

Generally, lower landscape function index scores (i.e. not achieving the benchmarks) were recorded for those sites which showed poorer ground cover protection performance.

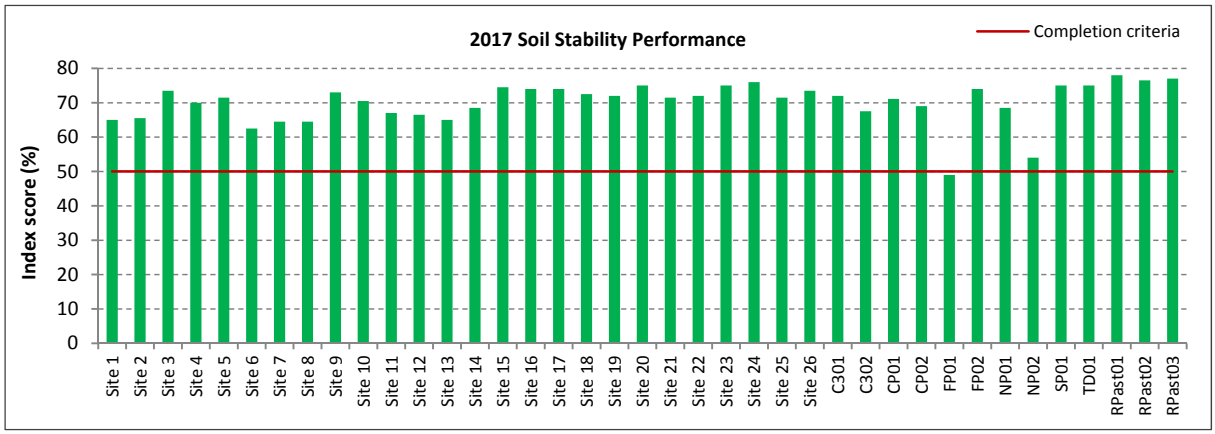

Figure 30 2017 Soil Stability Performance

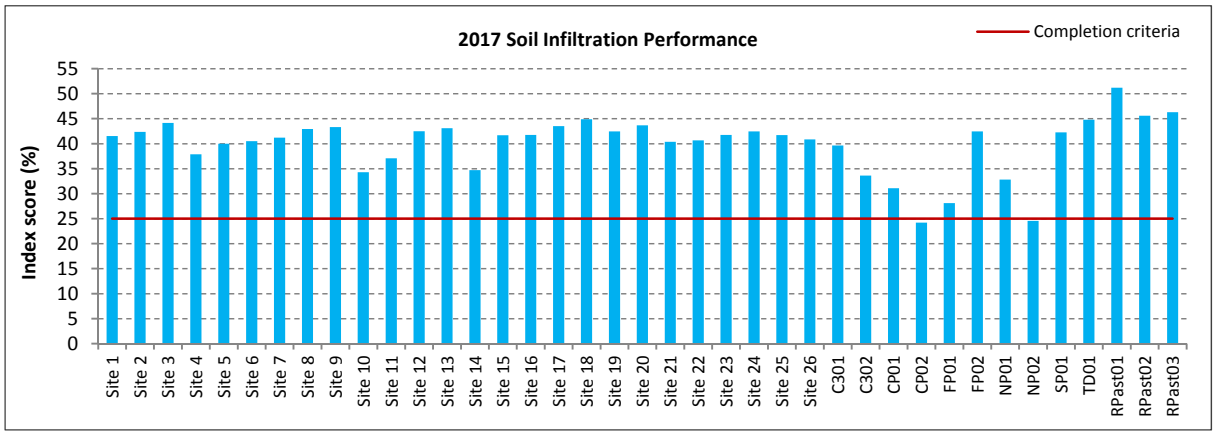

Figure 31 2017 Soil Infiltration Performance

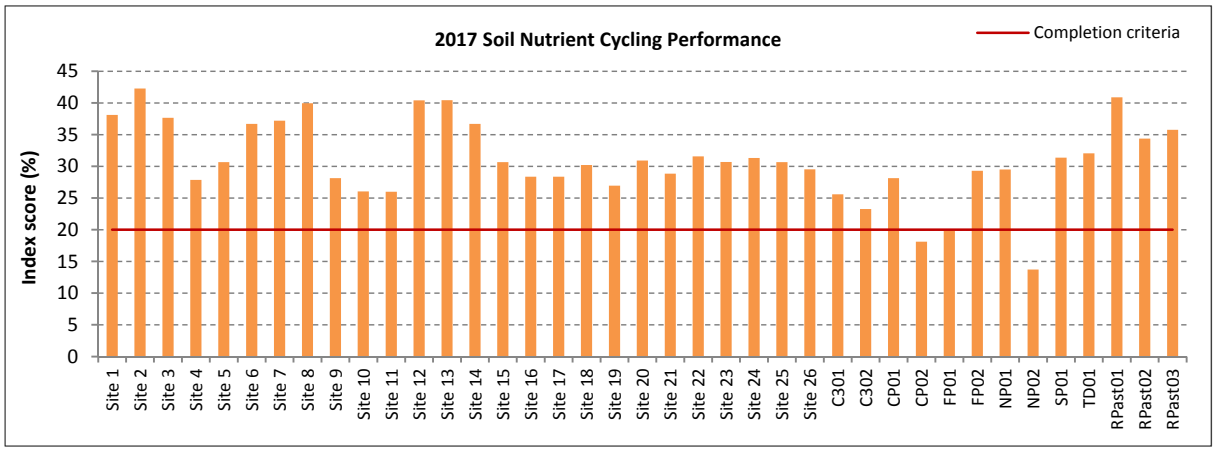

Figure 32 2017 Soil Nutrient Cycling Performance

Landforms stability

As a function of the high vegetative cover achieved throughout, excellent soil and slope stability were observed across all monitored areas, with no severe erosion processes recorded that had the potential to compromise the overall landform stability and integrity.

Pasture performance

Rehabilitated pastures were typically dominated by exotic grasses aligned to the MOPs revegetation seeding mixes and comprising species suitable for the district which are known to produce productive pastures across the Hunter region. Dominant pasture species across the site typically consisted of *Chloris gayana* (Rhodes grass), *Cenchrus clandestinus* (Kikuyu), *Setaria sphacelata* (Setaria) and *Megathyrsus maximus* (guinea grass). Leguminous species were also recorded at a majority of the pasture monitoring sites, however they consistently occurred at low abundance.

With the exception of areas of pasture rehabilitation across RCN which were actively grazed, herbage biomass (i.e. amount of feed available to cattle) was generally high across all areas with a recorded average pasture yield of 2,800 kg DM/ha.

Sampling and analysis of grass foliage was undertaken at a subset of monitoring sites across RCS to determine feed quality and enable calculations of indicative carrying capacities. These indicated that in their current condition, the rehabilitated pastures could support satisfactory dry stock stocking rates of between ~1.9 and 8.1 animals per hectare.

Tree rehabilitation performance

Rehabilitated tree areas typically showed excellent surface accumulation of deposited leaf litter, and good woody vegetation establishment, growth and health condition across the site.
Vegetative ground cover was generally sparse with highly variable species composition between the monitoring sites including either or a combination of exotic grasses, native grasses and/or weeds.
Most areas of tree rehabilitation across RCS consisted of *Corymbia maculata* (Spotted Gum) forestry plantation trials and consequently showed relatively poor species diversity, although in several locations some natural recruitment of acacia shrubs was noted to occur in the mid-storey. Other areas of tree rehabilitation (i.e. other than forestry plantations) at RCS and across RCN showed a greater species diversity and contained a range of local endemic eucalypt and acacia species.
Stem densities across the rehabilitated tree sites ranged from 100 stems/ha to 1,050 stems/ha with an average of ~540 stems/ha. Foliage projective cover ranged from 5.0% to 40.0% with an average of ~22%.
Finally, most areas of older tree rehabilitation showed signs of active natural regeneration in the form of flowering/fruiting species or presence of second generation seedlings.

Soils

The soil profile assessments undertaken in 2017 showed that a satisfactory topsoil layer had been spread, with an average cover depth of ~180mm across all rehabilitated areas. Topsoil texture generally consisted of sandy clay loams or silty clays, which are typically associated with slow to moderate infiltration rates.
Soil testing results highlighted highly variable pH levels ranging from strongly acidic to strongly alkaline, however soil pH levels were within the benchmarks (i.e. comprised between 4.5 and 9.0) at most locations (34 of 35 monitoring sites, with only one sample returning a pH of 9.1). In addition, soils were consistently non-saline and generally non-sodic, with only 5 of 35 samples returning elevated levels of sodicity.
Overall, soils across the rehabilitated areas generally showed properties that were conducive to the successful establishment and growth of vegetation.

8.8 Rehabilitation Status

RCN as follows:

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	Year 2016 (ha)	Year 2017 (ha)	Year 2018 (ha)
Total mine footprint	1917	1917	1917
Total active disturbance	651.4	645.3	504.9
Land being prepared for rehabilitation	0	5	10
Land under active rehabilitation	18.7	17.2	15
Completed rehabilitation	392	415.9	430.9

RCS as follows:

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	Year 2016 (ha)	Year 2017 (ha)	Year 2018 (ha)
Total mine footprint	1823.3	1823.3	1823.3
Total active disturbance	569.6	569.6	580.2
Land being prepared for rehabilitation	9.0	9.0	6.8
Land under active rehabilitation	27	5.4	15.8
Completed rehabilitation	423.1	427.5	443.3

SECTION 9 COMMUNITY

9.1 Community Engagement.

Rix's Creek is required under the development consent to participate and co-operate with a Community Consultative Committee (CCC). The committee consists of community representatives and is chaired by Council and other Government representatives are invited to participate on the committee. Rix's Creek was the first mine in the Hunter Valley to have a CCC which has operated for 24 years. During 2017 there were changes with the RCM CCC with Sarah Lukeman replacing Councillor Val Scott as Chairperson.

The Committee representatives are:-

Chairperson:-	Councillor Sarah Lukeman
Community representatives:-	Patricia Bestic
	Reg Eveleigh
	Michelle Higgins
	Deidre Olofsson
	Lyn McBain
	David Moran
	Greg Hall
DPE representative:-	Michael Frankcombe
Company representatives:-	Mine Manager – Luke Murray
	Environment Manager – Chris Knight
	Environmental Advisor – Chris Quinn
	Environmental Officer – Hannah Bowe

The Committee met two times during the year. Once on 1st June 2017 to present the Annual Review (AR) for 2016, and again on 19th October 2017 for the presentation of 6 monthly environmental monitoring results for the January to June 2017 monitoring period.

Additional community consultation that was conducted during the reporting period included company newsletters which informed community members on updates to Rix's Creek operations, which included:

- Rix's Creek South Continuation of Mining Update News Letter sent out in November 2017

Notifications on kangaroo culling and 1080 wild dog and fox baiting were also distributed throughout the community during the reporting period.

Monthly internal employee newsletters were also distributed throughout the workforce that provided updates for environmental initiatives occurring onsite.

The Environmental Department and Land Manager also had an active presence within the local community providing updates and information on Rix's Creek operations to community members.

The Company is a financial member of the Hunter Coal Environmental Group (HCEG).

The company is a financial member of the Hunter Valley Combined Wild Dog Association (HVCWDA) Incorporation.

The company is also part of the Upper Hunter Mining Dialogue (UHMD) in association with the NSW Minerals Council (NSWMC) which brings industry, community, and key stakeholder groups together across various projects and goals relating to:-

- Land Management
- Social Impacts and Infrastructure
- Water
- Emissions and Health

The Bloomfield Group UHMD representatives are:-

Executive Oversight Committee (Chair):-	Managing Director / CEO – John Richards
Steering Committee:-	General Manager Mining Development – Garry Bailey
UHMD Industry Working Group	Environment Manager – Chris Knight Environmental Advisor – Chris Quinn

9.2 Community Contributions.

The company provides annual donations to approximately 30 charitable groups as well as annual sponsorship to around 50 local community groups. In particular in the Singleton Community over the last five years:

- Samaritans and the Singleton Christmas Lunch
- Singleton Legacy
- Cancer Council Singleton Office – patient support and carer transport
- Rose Point Park Tree Planting
- Many Local Junior Sporting groups
- Singleton Show
- Singleton High School, Singleton Public School, Singleton Pre-School
- Singleton Hospital and Hunter New England Health
- Uniting Care Disability Services
- SES, Salvation Army, Red Cross
- Westpac Helicopter Services
- Darlington Bush Fire Services
- Scouts and Girl Guides

Rix's Creek has had collaboration with Newcastle University and Australian Coal Association Research Program (ACARP) to support effective innovation and development for the improvement of mine operations and environmental practices.

9.3 Community Complaints.

All complaints are dealt with under the '*Complaints Protocol for Rix's Creek Coal Mine'* as set up in response to the Rix's Creek Environmental Monitoring Committee under the original development Consent. The protocol is used to register and investigate all complaints. All complaints are referred to the Mine Manager, Mr. Luke Murray and are dealt with on an individual basis.

The Company policy is to personally deal with every complainant to find a resolution to the stakeholders concerns.

Table 35 Complaints 2017

No	Date Received	Site	How received	Complaints breakdown					
				Blast	Noise	Dust	Water	Lights	Odour
1	20/1/2017	RCS	Direct to mine		X				
2	20/1/2017	RCS	EPA		X				
3	24/1/2017	RCS	Direct to mine		X				
4	31/1/2017	RCN	Direct to mine	X					
5	1/2/2017	RCN	DPE	X					
6	1/2/2017	RCS	Direct to mine		X				
7	5/2/2017	RCS	Direct to mine		X				
8	6/2/2017	RCS	Direct to mine		X				
9	9/2/2017	RCS	Direct to mine		X				
10	15/02/2017	RCS	Direct to mine		X				
11	15/02/2017	RCS	DPE		X				
12	16/02/2017	RCS	DPE		X				
13	17/02/2017	RCS	Direct to mine		X				
14	17/02/2017	RCS	Direct to mine		X				
15	22/02/2017	RCS	Direct to mine		X				
16	23/02/2017	RCS	Direct to mine		X				
17	23/02/2017	RCS	In person to staff		X				
18	24/02/2017	RCS	Direct to mine		X				
19	12/03/2017	RCS	DPE		X				
20	27/03/2017	RCS	Direct to mine		X				
21	28/03/2017	RCS	Direct to mine		X				
22	28/03/2017	RCS	Direct to mine		X				
23	28/03/2017	RCS	EPA		X				
24	28/03/2017	RCS	EPA		X				
E	29/03/2017	RCs	Direct to mine		X				
E	29/03/2017	RCS	Direct to mine		X				
25	31/03/2017	RCS	DPE		X				
26	11/04/2017	RCS	Direct to mine		X				
27	24/05/2017	RCN	Direct to mine	X					
E	26/05/2017	RCS	Direct to mine		X				
28	29/05/2017	RCS	EPA		X				
29	8/06/2017	RCS	DPE		X				
30	8/06/2017	RCS	Direct to mine		X				
E	16/06/2017	RCS	Direct to mine		X				
31	05/07/2017	RCN	Direct to mine	X					
32	10/07/2017	RCS	Direct to mine		X				
33	13/07/2017	RCN	Direct to mine	X					
34	14/07/2017	RCS	Direct to mine		X				
E	14/07/2017	RCN	Direct to mine	X					
35	18/07/2017	RCS	Direct to mine		X				
36	25/07/2017	RCN	Direct to mine	X					
37	14/08/2017	RCS	Direct to mine		X				
38	21/08/2017	RCS	Direct to mine	X					
39	23/08/2017	RCS	EPA	X					
E	07/09/2017	RCS	Direct to mine		X	X			
40	20/09/2017	RCS	Direct to mine	X					

E	25/09/2017	RCS	Direct to mine		X				
E	26/09/2017	RCS	Direct to mine		X				
E	28/09/2017	RCS	Direct to mine		X				
41	11/10/2017	RCN	Direct to mine	X					
42	16/10/2017	RCS	Direct to mine		X				
43	17/10/2017	RCN	Direct to mine			X			
E	25/10/2017	RCS	Direct to mine		X				
44	26/10/2017	RCN	Direct to mine	X					
45	9/11/2017	RCN	Direct to mine	X					
46	10/11/2017	RCN	Direct to mine		X				
47	14/11/2017	RCN	Direct to mine	X					
E	16/11/2017	RCN	Direct to mine	X					
48	13/12/2017	RCS	Direct to mine		X				
E	18/12/2017	RCS	Direct to mine		X				

* Enquiry to Company regarding operations.

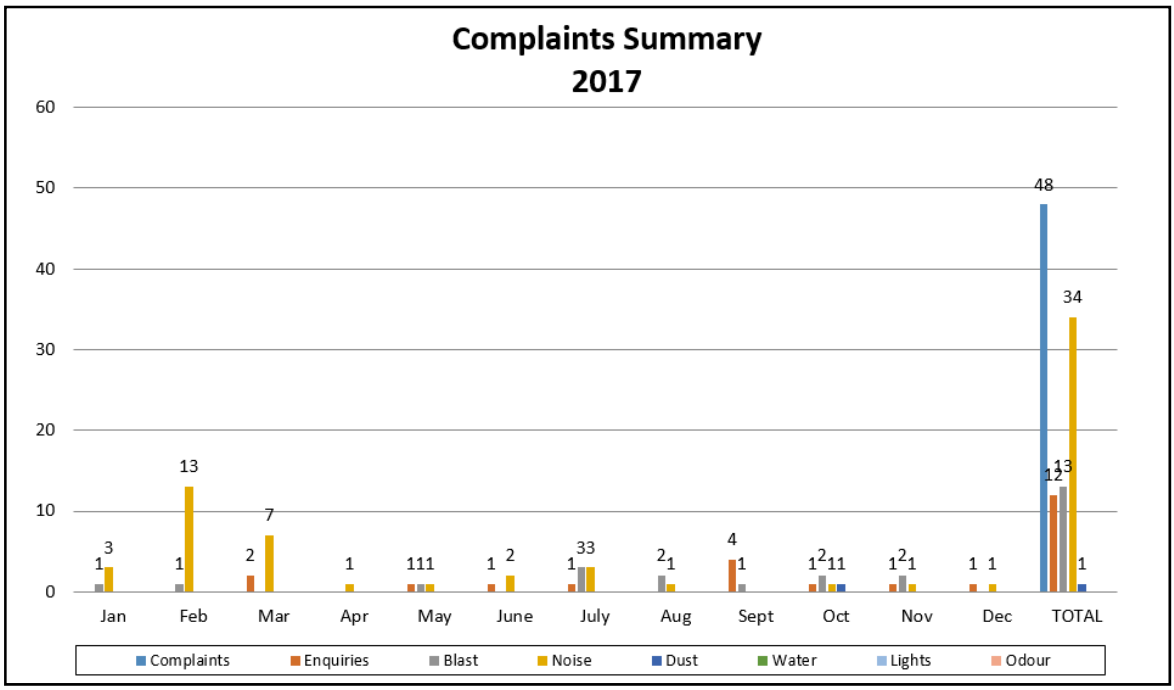

Figure 33 2017 RCM Complaints Summary

Forty-eight (48) complaints were received by the Company in 2017. 37 were made via direct contact/calls to the mine, 5 were direct from Environmental Protection Authority (EPA) and 6 were direct from Planning and Environment (DPE). Ten (10) operational enquiries were made directly to the mine in 2017.

Table 36 Complaints 2001-2017

Year	Complaints	Enquiries	Complaints					
			Blast	Noise	Dust	Water	Lights	Odour
2001	7		2	1	3	1		
2002	29		11	9	8	1		
2003	16		5	10	1			
2004	10		7	1	1		1	
2005	12	2	4	6	1		1	
2006	27	1	4	21	1			1
2007	14		7	4			1	2
2008	4		4					
2009	7		2		5			
2010	11		2	3	3	1	2	
2011	11	5	6	2	2			1
2012	20	2	9	4	7			
2013	19	5	8	10				1
2014	20	4	2	15	3			
2015	20	3	4	16				
2016	55	8	10	38	6		1	
2017	48	10	13	7.0	3.4	1.0	1.2	1.3

Rix's Creek received 48 complaints in 2017 which is above average, however it was 7 complaints less than 2016. It is preferential no complaints are received and Rix's Creek endeavour to work with the community to minimise the sites environmental impacts.

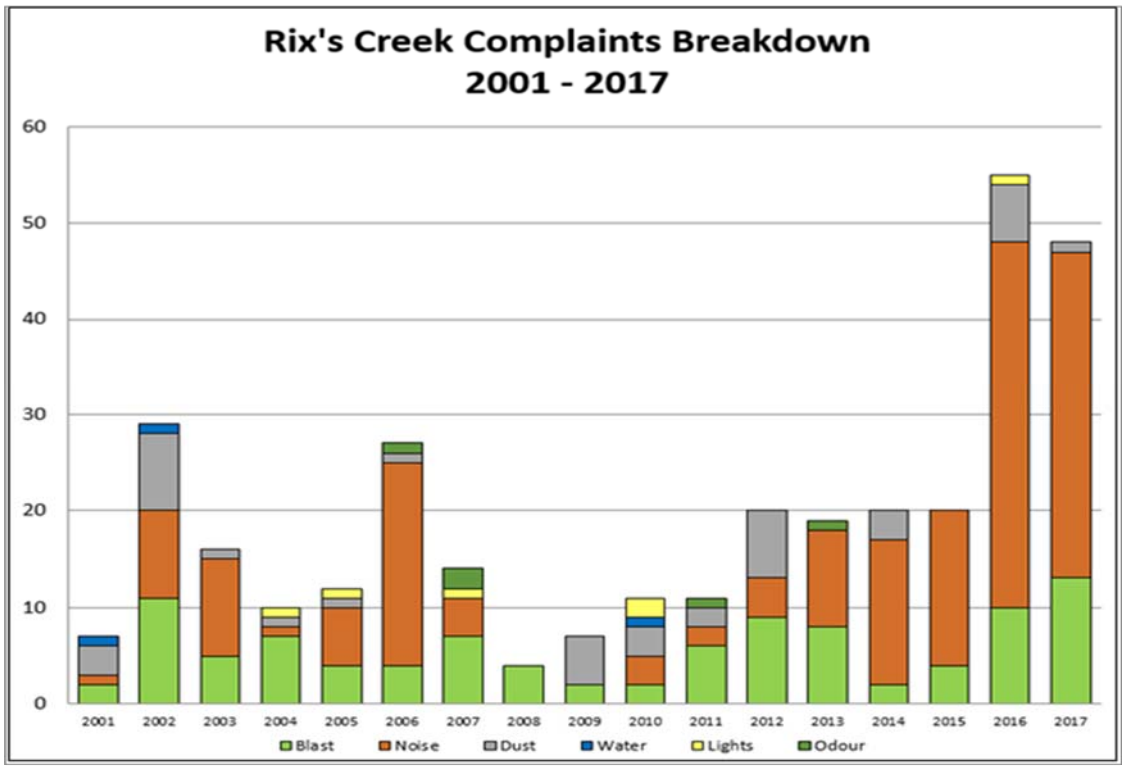

Figure 34 Summary of Rix's Creek Complaints 2001-2017

SECTION 10 – INDEPENDENT AUDIT

There was an independent audit undertaken of the Rix's Creek North project approval PA 08_0102 during the reporting period in 2017. This independent audit was completed in October 2017 by Umwelt. The last independent audit of the Rixs Creek South approval was carried out in 2016 by Umwelt required under the approval.

The outcomes of Independent Audit carried out in 2017 with the summary of non-compliances/action plan of development consent is shown in Tables 37 and 38.

Rix's Creek North (PA 08_0102) Independent Environmental audit 2017

The following extracts area from the Audit report:

Umwelt (Australia) Pty Limited (Umwelt) was commissioned by Bloomfield Collieries Pty Ltd (Bloomfield) to conduct an independent environmental compliance audit against Project Approval 08_0102 (as modified) for Rix's Creek North Coal Mine. This audit was undertaken for the Department of Planning and Environment (DPE) for the period 5 December 2014 to 27 October 2017. The audit also assessed compliance with the conditions of the sites Environment Protection Licence (EPL), key mining authorities and other licence documents.

This audit was conducted by Daniel Sullivan (Exemplar Global International Certified Auditor 113202) and Bridie McWhirter from Umwelt. The field visit component was completed over the period 26 – 27 October 2017.

The audit consisted of a detailed desktop review of documentation, interviews with key Rix's Creek North staff and a field inspection of the mining and rehabilitation areas. The audit was conducted generally consistent with 'ISO 14010 - Guidelines and General Principles for Environmental Auditing', 'ISO 14011 - Procedures for Environmental Auditing' and the 'Independent Audit Guideline. Post-approval requirements for State significant developments (NSW Government, 2015)'.

This audit has concluded that the on the ground environmental management practices being applied at the Rix's Creek North Coal Mine are appropriate. The open cut pit areas assessed during the field inspection were observed to be well managed, with equipment operators and supervisory personnel demonstrating a good understanding of management actions required to minimise amenity impacts from mining activities. This observation is supported by the results from noise and dust monitoring programs and the relatively small number of community complaints received during the audit period.
Implementation of site rehabilitation during the audit period was found to have fallen behind the targets as per the Mining Operations Plan in 2016. However, this was considered to be partly due to the operation being in care and maintenance until March 2016 and change of ownership. A review of rehabilitation during the field inspection completed for this audit found that rehabilitation areas were being developed and maintained to a good standard with restorative actions being undertaken as necessary to improve previous rehabilitated areas.

A review of management plans for Rix's Creek North found that a number of plans had been developed and submitted to the Department (DPE); however have not been approved. A recommendation has been included to follow up the status of these management plans with DPE.

A review of incidents that occurred at Rix's Creek North Mine since the previous audit indicated that they were classified as low risk and were related to water management, with all being documented and reported to regulatory agencies as required.

Development Consent

A summary of the compliance assessment against Rix's Creek Mine Development Consent is included below.

Rix's Creek North Project Approval (PA 08_0102)

Table 37 refers to the Companies reply to the Audit report with action plan to address issues identified.

Rix's Creek South Development Application (DA49/94)

Table 38 refers to the Companies reply to the Audit report for DA49/94 with action plan to address issues identified.

Table 37 RCN Audit Response to Auditors Recommendations

Condition / Issue	Identified Non- Compliance	Non Compliance	Recommendation	Rix's Creek's Response	By Date
PA08_0102					
Schedule 3, Condition 2 Schedule 3, Condition 3 Schedule 3, Condition 4 Schedule 3, Condition 5	Noise monitoring does not assess the proportion of privately owned land for which exceedances may occur.	Administrative	Bloomfield either seek to modify the consent to remove the requirement to assess compliance of noise limits over vacant land or approval to complete noise modelling annually to validate noise monitoring results in this regard and report in the annual review or complete modelling as required in response to any complaints received in this regard.	Assessment of the condition will be undertaken annually and a report will be included in the Annual Review. Assessment will utilise the results of the monthly compliance attended noise monitoring and the predictive noise model for the same perios to determine compliance. Bloomfield will seek removal of the condition at the next consent modification.	Annually by 31 March
Schedule 3, Condition 8			Bloomfield should seek to formalise the request of compliance reports from train operators to demonstrate that all locomotives are approved to operate on the NSW rail networks. Bloomfield should confirm with the Department appropriate conditions of RailCorp and ARTC EPL's that should be referenced here and that need to be complied with.	Bloomfield will request locomotive class information from Pacific National, Aurizon and Genesee & Wyoming rail providers to determine compliance with Condition E2 of EPL 3142 held by ARTC. This information will be provided in the Annual Review Report.	Annually by 31 March
Schedule 3, Condition 10 ('e)	A cumulative protocol has not been developed in coordination with the nearby mines and included in the noise management plan as required.	Low	A formal protocol should be developed in consultation with the owners of the nearby mines as required and that it be included in the noise management plan for the Departments approval.	A draft protocol will be developed and sent to Integra Underground, Ashton and the Mount Owen Complex for consultation. Comments recieved from other mines during the consultation period will be used to prepare a protocol to minimise cumulative noise impacts from the mines.The requirements of the protocol will be included in the Rix's Creek Mine Noise Management Plan.	30 June 2018
Schedule 3, Condition 16 Schedule 3, Condition 27 Schedule 3, Condition 40			Bloomfield should follow up with the Department the status of the management plans that have been submitted for approval under these conditions.	All outstanding Management Plans have been approved as at end of December 2017.	Complete
Schedule 3, Condition 19 (f)	A cumulative protocol has not been developed in coordination with the nearby mines and included in the blast management plan as required.	Low	A formal protocol should be developed in consultation with the owners of the nearby mines as required and that it be included in the blast management plan for the Departments approval.	A draft protocol will be developed and sent to Ashton and the Mount Owen Complex for consultation. Comments recieved from other mines during the consultation period will be used to prepare a protocol to minimise and manage the cumulative blast impacts of the mines.The requirements of the protocol will be included in the Rix's Creek Mine Blast Management Plan.	30 June 2018
Schedule 3, Condition 22 Schedule 3, Condition 23	Air quality monitoring does not assess the proportion of privately owned land for which exceedances of the cumulative criteria may occur.	Administrative	Bloomfield either seek to modify the consent to remove the requirement to assess compliance of air quality criteria over vacant land or seek approval from the Department to complete air modelling annually to validate monitoring results in this regard and report in the annual review or complete modelling as required in response to any complaints received in this regard.	Assessment of the condition will be undertaken annually and a report will be included in the Annual Review. Assessment will model the results of the PM10 real time monitoring from the Rix's Creek Mine and the Upper Hunter Air Quality Monitioring Network to determine compliance. Bloomfield will seek removal of the condition at the next consent modification.	Annually by 31 March
Schedule 3, Condition 27 ('c)	A cumulative protocol has not been developed in coordination with the nearby mines and included in the air quality and greenhouse gas management plan as required.	Low	A formal protocol should be developed in consultation with the owners of the nearby mines as required and that it be included in the AQGGMP management plan for the Departments approval.	A draft protocol will be developed and sent to Integra Underground, Ashton and the Mount Owen Complex for consultation. Comments recieved from other mines during the consultation period will be used to prepare a protocol to minimise and manage the cumulative air quality impacts of the mines.The requirements of the protocol will be included in the Rix's Creek Mine Air Quality and Greenhouse Gas Management Plan.	30 June 2018
Schedule 3, Condition 33	During the audit period three unplanned discharges occurred that were in exceedance of the EPL discharge limits.	Low	A review of the water management system, monitoring requirements and procedures should be completed with key findings used to update the water management plan for the Departments approval.	The Water Management Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018
Schedule 3, Condition 36 (d)	Section 5.1.2.2 outlines Erosion and Sediment Control measures for Rix's Creek North, however does not cover all requirements listed under this condition.	Low	Detailed erosion and sediment control plans should be reviewed and updated to provide a consistent and coordinated approach and that these are included in the water management plan.	The Erosion and Sediment Control Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018
Schedule 3, Condition 36 (e)	Surface water management plan does not include specific water quality trigger levels.	Low	The water management plan should be updated to include specific trigger levels for water quality as required by this condition.	The Water Management Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018
Schedule 3, Condition 37			It is recommended that the Martins Creek Biodiversity Offset Area be confirmed by a surveyor and if it is below the minimum size advice should be sought from the Department as to whether the area needs to be increased or if any further offsetting arrangements are required to address this condition.	Area to be determined and advice to be sought from DPE.	31 December 2018
Schedule 3, Condition 40 ('c)	No mention of measures to conserve and/or reuse topsoil in the biodiversity management plan. Further while measures are taken to ensure revegetation reflects that of a native ecosystem, there is no specific section that details how landscaping activities will be carried out to ensure visual impacts are minimised.	Low	Update the BDMP to include the following: - specific mention of introducing naturally scarce elements - specific reference in Section 2.6.8 as to how the measure included will manage salinity - measures to specifically address the reuse of topsoil - a section on pre-clearance surveys and the method - a section on how visual impacts will be minimised	The Biodiversity Management Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018
Schedule 3, Condition 44			Incorrect reference to Project Approval Condition – Management Plan states this as Schedule 3, Condition 47 (actually 44) During the next revision of the HMP that this error should be corrected	The Heritage Management Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018
Schedule 3, Condition 46 ('c)	No evidence to support that lighting equipment considers AS 4282 (Int) 1995.	Administrative	Include a lighting component in an appropriate site management plan and ensure that procurement of all lighting for site complies with this standard.	The Heritage Management Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018

Schedule 3, Condition 52 (a), ('c) & ('e)	No evidence of the rehabilitation management plan being prepared in consultation with relevant agencies or the CCC prior to submission and approval. Section 5.2 of the rehabilitation management plan lists Rehabilitation Objectives, however not all of the objectives listed in Table 15 are addressed in the MOP including: - Final landforms designed to incorporate micro-relief and integrate with surrounding natural landforms - Ensure public safety - Minimise the risk of flood interaction for all flood events up to and including the Probable Maximum Flood.	Low	Include all Rehabilitation Objectives from Table 15 in the rehabilitation management plan as required by this condition.	The Rehabilitation Management Plan has been superseeded by the Rix's Creek North Mining Operations Plan and was approved by the Division of Resources and Geosciences (DRG) on 28 November 2017. Rix's Creek Mine is required to submit a new MOP on the grant of ML1725, our portion of CL382. This is expected to occur during 2018. The new MOP including ML1725 will include the noted deficiencies.	31 December 2018
Schedule 5, Condition 5	Three incident reports were prepared and submitted to the Department during the audit period for uncontrolled water discharges from site. No evidence of a review or update of the WMP within 3 months of two of these incidents. Also no evidence of review and updates to management plans following the annual reviews during the audit period.	Low	A process of regular review and revision of management plans should be established to confirm compliance with this condition.	Compliance database utilising either M-Files or Pulse to be implemented.	30-Jun-18
Schedule 5, Condition 10 ('c)	No formal or methodical review of compliance under this project approval presented for each reporting year in the annual reviews.	Low	A formal or methodical review of compliance under this project approval should be completed each year in the Annual Reviews.	Review of compliance under the project approval to be completed and reported in each Annual review	Annually by 31 March
Schedule 5, Condition 13	- Latest CCC minutes published on the Rix's Creek North website are dated February 2016, however the CCC has combined with Rix's Creek and the minutes from the latest meetings (including 20 September 2016 and 1 June 2017) which were for the combined sites are only published on the Rix's Creek website and are not on the Rix's Creek North website. - 2016 Annual Review has not been published on the Rix's Creek North website, however is located on the Rix's Creek website.	Administrative	Provide a link to CCC meeting minutes and Annual Reviews on the Rix's Creek North website and update website to explain that the two sites are operated together but under separate consents.	Website to be revised and updated to explain current operations	31 March 2018
Schedule 5, Condition 13	- 2014 Independent Audit of Rix's Creek North response to recommendations is not located on the website (sighted 24 October 2017). It was noted during the audit that this report was uploaded to the Vale website and had not yet been copied across following change of ownership.	Administrative	The 2014 Independent Audit of Rix's Creek North and response to recommendations should be uploaded to the Rix's Creek North website.	Completed	Completed
SoC B2, SoC B4	-No evidence provided to confirm that material will not be stripped in either extremely wet or dry conditions occurs and is not addressed in MOP. - No evidence provided to confirm that tracking over previously laid soil will be avoided to minimise compression effects occurs and is not addressed in MOP.	Administrative	Update the rehabilitation management plan in the MOP to include discussion on: □ Material will not be stripped in either extremely wet or dry conditions □ Tracking over previously laid soil will be avoided to minimise compression effects	The Rehabilitation Management Plan has been superseeded by the Rix's Creek North Mining Operations Plan and was approved by the Division of Resources and Geosciences (DRG) on 28 November 2017. Rix's Creek Mine is required to submit a new MOP on the grant of ML1725, our portion of CL382. This is expected to occur during 2018. The new MOP including ML1725 will include the noted deficiencies.	31 December 2018
SoC B11	No inventory was able to be provided during the audit and not addressed in MOP.	Low	Update the rehabilitation management plan in the MOP to include discussion on: □ An inventory of available soil will be maintained to ensure adequate topsoil materials are available for planned rehabilitation activities.	The Rehabilitation Management Plan has been superseeded by the Rix's Creek North Mining Operations Plan and was approved by the Division of Resources and Geosciences (DRG) on 28 November 2017. Rix's Creek Mine is required to submit a new MOP on the grant of ML1725, our portion of CL382. This is expected to occur during 2018. The new MOP including ML1725 will include the noted deficiencies.	31 December 2018
SoC C5	There is no mention of Groundwater Dependent Ecosystems in the biodiversity offset strategy or rehabilitation management plan in the MOP.	Low	The rehabilitation management plan and or biodiversity management plan should be updated to detail how rehabilitation of groundwater dependent ecosystems will be undertaken. This update should include trigger thresholds for the groundwater management response	The Biodiversity Management Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018
SoC C11			At next opportunity change commitment to 'Bloomfield' instead of 'ICO' in condition	Item to be addressed with DPE at the next Project Modification	
SoC D5			At next opportunity liaise with the Department to remove portal sump from commitment as this is located at Integra Underground	Item to be addressed with DPE at the next Project Modification	
SoC D7			Update the Erosion Sediment Control Plans to capture the commitment that If the weather outlook indicates future significant rainfall, water will be pumped out of any dirty water storage (with the potential to discharge offsite) that is within 100 mm of spilling, provided that a suitable alternative storage location is available elsewhere on the site	The Erosion and Sediment Control Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018
SoC H13 SoC H14			Include locations of new TEOMs (including the NW TEOM) in regards to the vicinity of residences listed under these SOCs in the AQGGMP	The Air Quality and Green House Gas Management Plan will be updated and submitted to the Department for review in accordance with Sch. 5 Cond. 5 of PA 08_0102. (by 19 April 2018).	19 April 2018

Table 38 RCS Audit Response to Auditors Recommendations

Condition	Non-Compliance	Risk Level	Action Plan
Schedule 2, Condition 1A	Not all of the conditions of the Project Approval have been complied with. See risk ratings for each individual condition.	**Low**	Addressed through the implementation of this Action Plan
Schedule 2, Condition 3	Non-compliances have been recorded during the audit period for legislative acts and agencies as detailed within this condition and these are discussed in Section 4 of the report.	**Low**	Addressed through the implementation of this Action Plan
Schedule 2, Condition 6(c)	No formal building maintenance program was implemented to specifically review the maintenance of buildings.	**Administrative**	Addressed through the updating of the Landscaping Plan
Schedule 2, Condition 7	Site lighting has not been confirmed with Singleton Council that it is managed to their satisfaction.	**Administrative**	Condition updated in MOD 8 and will be included in Annual Review.
Schedule 2, Condition 9	The Traffic Management Plan was not approved by the Secretary prior to the commencement of the tunnel construction activities.	**Administrative**	No Action Necessary
Schedule 2, Condition 11	Noise monitoring is not undertaken in accordance with the requirements of this condition as noise monitoring is not undertaken on a quarterly basis, monitoring is undertaken on a 6 monthly basis.	**Low**	Condition updated in MOD 8 and will be addressed with the review of the Noise Management Plan to be submitted by 30th April 2017.
Schedule 2, Condition 14	• The area of disturbance onsite reflected the extent of disturbance as approved at the end of the MOP term (2020) and therefore ground disturbance was ahead of the schedule within the MOP; and • Not all sprays on site, including the coal stockpile, are automatic.	**Medium**	Condition updated in MOD 8 and will be addressed with the review of the Air Quality & Green House Gas Management Plan to be submitted by 30th April 2017. A consent order before the Land and Environment Court as well as the Enforceable Undertaking (EU) with the Department of Planning and Environment has been finalised due to interpretation differences in the Rix's Creek Consent Area. Coal Stockpile sprays onsite are automatic and currently operational.
Schedule 2, Condition 14A	No evidence was available to confirmation that the NGERS Report had been undertaken to the satisfaction of the Secretary.	**Administrative**	Condition updated in MOD 8 and will be addressed with the review of the Air Quality & Green House Gas Management Plan to be submitted by 30th April 2017.
Schedule 2, Condition 15	• Sections of the Water Management Plan did not include the information required below: - Describe measures to minimise water use by the development. - detail that visual monitoring of flow volume will be undertaken. - process for monitoring yield into the open cut. - process for monitoring impacts to baseflow and offsetting as required any loss of base flow, impacts to private land owners caused by Rix's Creek Operations.	**Low**	Water Management Plans to be updated to address these issues and submitted for approval following MOD 8
Schedule 2, Condition 16A	• A copy of the Landscape Management Plan marked 'final' was not forwarded to the Singleton office as requested by the DP&E. • The Final Void Management Plan was not submitted to the DP&E by the due date. • The Mine Closure Plan was not submitted to the DP&E by the due date.	**Administrative**	Landscape Management Plan to be updated following MOD 8 and submitted for approval.

Condition	Non-Compliance	Risk Level	Action Plan
Schedule 2, Condition 16B	• Sections of the Rehabilitation Management Plan did not include the information required below: - procedure to protect vegetation and soil outside the disturbance areas. - procedure to manage impacts on fauna. - procedure to landscape the site to minimise visual impacts. - procedure to conserve and reuse topsoil. - information regarding the salvage and re-use of material. - monitoring program to include all measures in 16B(v) and effectiveness of these measures. - clearly state who is responsible for monitoring and reviewing the plan.	**Low**	Rehabilitation Management Plan to be updated following MOD 8 and submitted for approval as component of Landscape Management Plan.
Schedule 2, Condition 16D	• Sections of the Mine Closure Plan did not include the information required below: - objectives and criteria for mine closure for ML 1432 and completion criteria for each domain. -	**Low**	Mine Closure Plan to be updated following MOD 8 and submitted for approval as component of Landscape Management Plan.
Schedule 2, Condition 19	• Sections of the Annual Environmental Management Reports/Annual Review did not include the information required below: - updated water balance for the reporting year not included each year as required *Note it was included in 2015 Annual Review.* - not all reports were submitted by the due date. - Specific targets for the next year have not been included in the 2011 2015 reports.	**Low**	To be updated and submitted 31st March 2017
Schedule 2, Condition 28	Not all management plans / programs were revised following the submission of an incident report under Condition 19 or modifications of the Development Consent to the satisfaction of the Secretary.	**Low**	Procedure to be developed to address this requirement to revise strategies, plans and programs.
Schedule 2, Condition 29	• Management plans have not been updated as required by Condition 28 of the Development Consent. • Some management plans have been updated without consultation being undertaken with all parties nominated by the Development Consent. No agreement with the Secretary was sought to revise the management plans without consultation with relevant parties.	**Low**	Procedure to be developed to address this requirement to revise strategies, plans and programs.

SECTION 11 – INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

There were no reportable incidents that occurred at Rix's Creek North during the 2017 reporting period.

Non-compliances from the audit report are described in Section 10.

A consent order before the Land and Environment Court as well as the Enforceable Undertaking (EU) with the Department of Planning and Environment has been finalised due to interpretation differences in the Rix's Creek DA49/94 Consent Area. There are a number of commitments as part of this EU which are currently being progressed and reported to DPE and NSW Resource Regulator on an ongoing basis, which include:

- Within 6 Months of the enforceable undertaking taking effect, an Annual Independent audit of the development consent commitments for Rix's Creek DA 49/94 and PA 08_0102 and applicable mining tenements was completed.
- Training to promote the compliance of development consent commitments and mining lease conditions throughout the organisation. This also involved updating the Land Disturbance Management Procedure and permit to disturb process.
- Bloomfield provided $25 000 to Singleton Council/ or a local land care group for the Hunter River improvement works
- Bloomfield provided $25,000 to Associate Professor Kym Rae for the testing kidney health in Gomeroi Gaaynggal Indigenous mothers and babies for early intervention.

Currently all works for Rix's Creek South are defined as approved by the consent order.

SECTION 12 – ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

The operations for the coming year will be similar to 2017. Mining will be focussed in the West Pit (Pit 3) at Rix's Creek South and Camberwell Pit operations at Rix's Creek North. Due to coal advances in the West Pit a majority of overburden from the West Pit will be placed in the Arties Pit until coal reserves move in a northward fashion. Camberwell Pit mining will process in a southerly manner with pre stripping to the south west of Camberwell Pit to be completed. The overburden placement will be dumped from the eastern section of Camberwell pit and transition to the west in 2017 as per the Mining Operation Plan.

Further improvements to the Rix's Creek Real time SCADA system will be completed in 2018. Flowmeter upgrades on pipe infrastructure will be completed during 2018 to improve the water balance across Rix's Creek Mine.

Environmental management is an ongoing process at Rix's Creek with continual improvement being made to the existing systems already in place. Management plans will require updating in 2018 to standardise processes across both Rix's Creek North and Rix's Creek South operations. Table 39 refers to the Environmental Performance Improvement Activities for the 2018 period.

Table 39 Environmental Performance Improvement Activities

Environmental Performance Improvement Activities	Target Date
Rix's Creek Mine Combined Water Management Plan	Q2 2018
Rix's Creek Mine Rehabilitation Progression	Q1-Q4 2018
Continued upgrades/ validation to the Environmental Forecasting Tools used at Rix's Creek Mine.	Q4 2018
Flowmeter upgrades around Rix's Creek Mine. Flowmeter data to be integrated into SCADA network.	Q4 2018
The Target date for the Surrender of DA49/94 is October 2019 or sooner depending if SSD_6300 Rix's Creek Mine Continuation Project is approved.	October 2019

SECTION 13 MANAGEMENT PLAN REVIEW

Management Plans are required to be updated when a review is triggered. An update can be triggered by any of the following:-

- Action from independent environmental audit;
- Submission of Annual Review;
- Approval modification;
- Result of an environmental incident; and
- Changes to the operation.

The management plans for both RCN and RCS as required under their relevant approvals are listed in Table 40 along with their relevant status.

Table 40 Environmental Management Plans

Approval Authority	Approval Date	Title
Rixs Creek North		
DPE	19/2/2016	Water Management Plan
DPE	21/12/2017	Biodiversity Management Plan to be updated following the determination Mod 4 by the PAC- Feb 2016
DPE	19/2/2016	Heritage Management Plan
DPE	19/2/2016	Waste Management Plan
DRE	16/1/2016	Mining Operations Plan (MOP) which becomes the Rehabilitation Management Plan
Rixs Creek South		
DPE	Submitted 1996	Landscaping Plan
DPE	2011	Transport Management Plan – Cut & Cover Tunnel
DPE	Not Triggered	Construction Noise Management Plan for Rail Loop
DPE	22/1/2014	Water Management Plan
DPE	22/1/2014	Landscape Management Plan
	"	- Rehabilitation Management Plan
	"	- Final Void Management Plan
	"	- Mine Closure Plan
DPE	Not Triggered	Biodiversity Management Plan – Rail Loop
DPE	Not Triggered	Heritage Management Plan – Rail Loop
DRE	8/3/2013	Mining Operations Plan (MOP) which becomes the Rehabilitation Management Plan
RCM Integrated Management Plan to cover Rixs Creek North & Rixs Creek South Operation		

DPE	Approved 19/12//2017	Noise Management Plan
DPE	Approved 19/12/2017	Blast Management Plan
DPE	Approved 19/12/2017	Air Quality & Greenhouse Gas Management Plan
DPE	Being Developed to be submitted by 19 April 2018.	Water Management Plan

Appendix 1 2017 Noise Monitoring Report


Rix's Creek Coal Mine
Environmental Noise Monitoring
Annual Report - 2017
Prepared for
Rix's Creek Pty Limited
Global Acoustics
Noise and Vibration Analysis and Solutions
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Rix's Creek Coal Mine

Environmental Noise Monitoring
Annual Report – 2017

Reference: 18041_R01
Report date: 19 March 2018

Prepared for

Rix's Creek Pty Limited
PO Box 4
East Maitland NSW 2323

Prepared by

Global Acoustics Pty Ltd
PO Box 3115
Thornton NSW 2322

Prepared: Joel Curran
Acoustics Consultant

QA Review: Amanda Borserio
Acoustics Consultant

Global Acoustics Pty Ltd ~ Environmental noise modelling and impact assessment ~ Sound power testing ~ Noise control advice ~ Noise and vibration monitoring ~ OHS noise monitoring and advice ~ Expert evidence in Land and Environment and Compensation Courts ~ Architectural acoustics ~ Blasting assessments and monitoring ~ Noise management plans (NMP) ~ Sound level meter and noise logger sales and hire

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Appendices

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Rix's Creek Pty Ltd (RCM) to provide a review of the their operations performance against predictions made in the environmental assessment documents for both Rix's Creek South (RCS), and the former Integra Open Cut Project Mine, now known as Rix's Creek North (RCN) for the annual review period between 1 January and 31 December 2017.

RCM is located less than 10 kilometres north-west of Singleton, NSW. A Noise and Blasting Impact Assessment was conducted in 2009 to assess noise impacts as part of the Environmental Assessment (EA) for consolidation of the development consent for RCN (formerly Integra Mine). An acoustic assessment was also conducted as part of the Environmental Impact Statement (EIS) for a modification to the RCS development consent in 1995.

As part of project approval requirements and the Noise Management Plan (NMP), noise compliance monitoring is conducted at locations surrounding RCM. Quarterly attended noise monitoring, conducted during the 2017 reporting period has been described in this report.

The survey purpose of attended monitoring is to quantify and describe the existing acoustic environment around the site and compare results with relevant limits. Comparisons were also made between environmental noise monitoring results and model predictions from the RCN (formerly Integra Mine) 2009 Environmental Assessment and the RCS 2015 Environmental Assessment for RCN and RCS respectively.

1.2 Monitoring Locations

In accordance with the NMP, there are a total of ten monitoring locations as detailed in Table 2.1 and shown on Figure 1. Monitoring is not undertaken at all locations during each month, due to the number and distance between each location. As a result, a risk-based assessment has been adopted where attended noise monitoring targets locations where operational noise from RCM is likely, with a minimum of six locations to be monitored per night. This procedure is detailed in Section 5 of the NMP, and reproduced in Appendix A.

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Table 1.1: RCM ATTENDED NOISE MONITORING LOCATIONS

Location Descriptor ID	EA Reference (RCN/RCS)[1]	Monitoring Location
NM1	132/171	End of Glennie Street, Camberwell
NM2	91/NA	Glennies Creek Road, Camberwell
NM3	47/NA	893 Middle Falbrook Road, Middle Falbrook
NM4	19/12	997 Bridgman Road, Bridgman
NM5	11/8	788 Bridgman Road, Obanvale
NM6	145/19	427 Bridgman Road, Obanvale
NM7	NA/61	McMahon Way, Singleton Heights
NM8	NA/152	Cnr Belmadar Way and Maison Dieu Road, Maison Dieu
NM9	NA/121	Llanrian Drive, Gowrie
NM10[2]	NA/135	End of Dights Crossing Road, Maison Dieu

Notes:

1. *NA indicates location was not included in the EA for that project; and*
2. *An offset correction has been applied to this measurement as the actual monitoring location is closer to RCM than the area it represents.*

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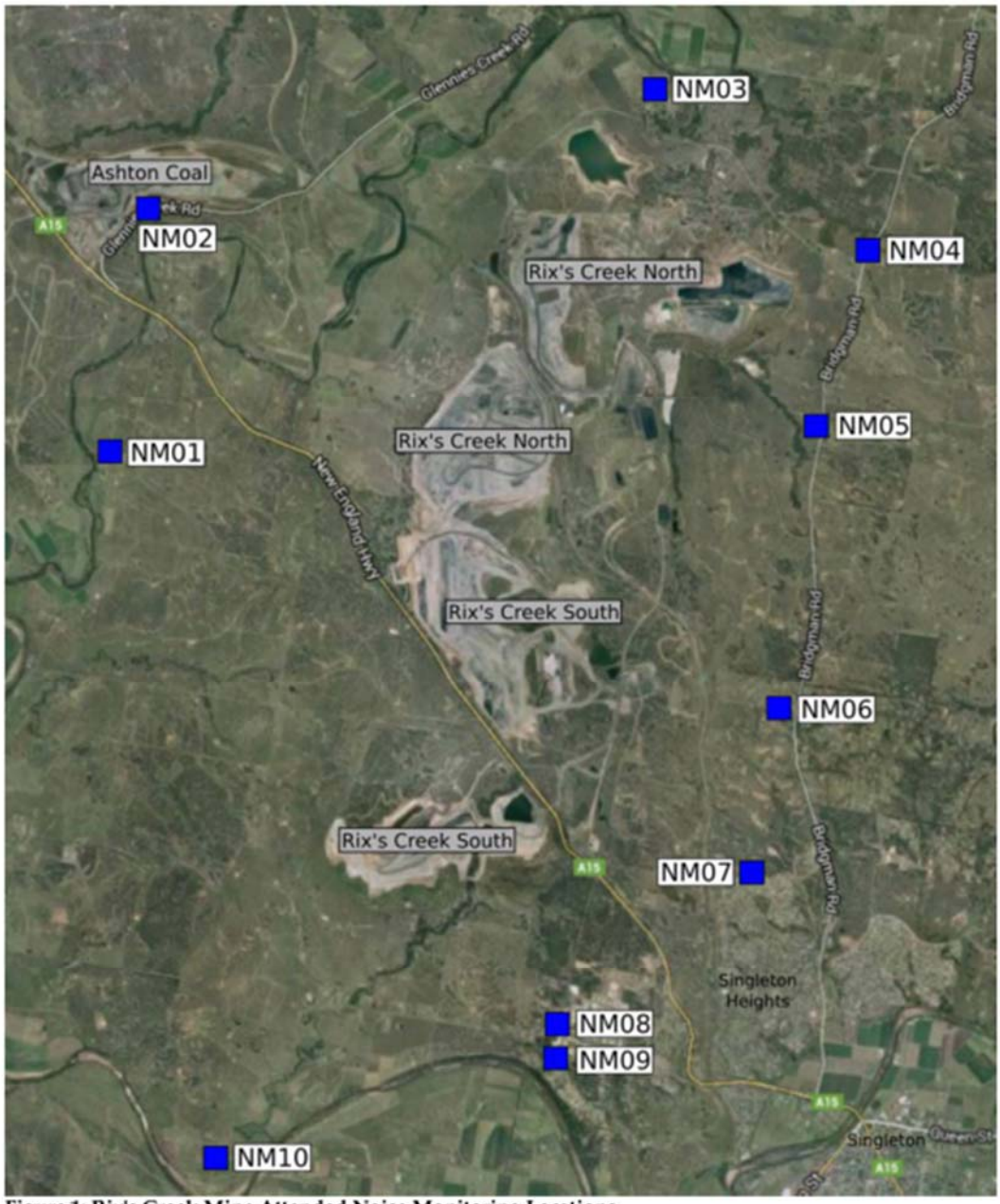

Figure 1: Rix's Creek Mine Attended Noise Monitoring Locations

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1.3 Terminology & Abbreviations

Some definitions of terms and abbreviations, which may be used in this report, are provided in Table 1.2.

Table 1.2: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
L_A	The A-weighted root mean squared (RMS) noise level at any instant
L_{Amax}	The maximum A-weighted noise level over a time period or for an event
L_{A1}	The noise level which is exceeded for 1 per cent of the time
L_{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels
L_{A50}	The noise level which is exceeded for 50 per cent of the time
L_{A90}	The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The L_{A90} level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes
L_{Amin}	The minimum A-weighted noise level over a time period or for an event
L_{Aeq}	The average noise energy during a measurement period
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise
SPL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals
Hertz (Hz)	Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude. Estimated from wind speed and sigma theta data
IA	Inaudible. When site only noise is noted as IA, there was no noise from the source of interest audible at the monitoring location
NM	Not Measurable. If site only noise is noted as NM, this means some noise from the source of interest was audible at low-levels, but could not be quantified
Day	This is the period 7:00am to 6:00pm
Evening	This is the period 6:00pm to 10:00pm
Night	This is the period 10:00pm to 7:00am

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2 CONSENT AND CRITERIA

2.1 Project Approvals

The operations at Rix's Creek North are subject to the conditions contained in the Project Approval 08_0102 (MOD 6) last modified August 2016. Noise conditions are detailed in Schedule 3 Conditions 1-10 and Appendix 5 of the consent and are reproduced in Appendix A .

The operations at Rix's Creek South are subject to conditions contained in the Project Approval N90/00356 (MOD 8) last modified in December 2016. Noise conditions are detailed in Conditions 10 and 11, and Appendix 4 and are reproduced in Appendix A. Rix's Creek is currently going through a transition period as it moves from the existing 1995 development consent (N90/00356) into the proposed new consent (from 2017 for a period of 21 years).

2.2 Environmental Protection Licence

RCM holds Environmental Protection Licence (EPL) No. 3390. Section L2 of the most recent licence outlines noise limits and meteorological exclusions.

2.3 Noise Management Plan

The most recent version of the NMP was approved on 19 December 2017, to address noise impacts associated with the operation of RCM. Section 5 of the NMP details the noise compliance monitoring program, including monitoring locations and methodology.

2.4 Noise Impact Criteria

The current NMP, which includes noise management requirements for both RCN and RCS includes the project specific noise criteria. Table 5.7 of the NMP outlines compliance criteria for the project, which are reproduced in Table 2.1. Results from quarterly noise monitoring have been compared to these criteria.

2 CONSENT AND CRITERIA

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The operations at Rix's Creek South are subject to conditions contained in the Project Approval N90/00356 (MOD 8) last modified in December 2016. Noise conditions are detailed in Conditions 10 and 11, and Appendix 4 and are reproduced in Appendix A. Rix's Creek is currently going through a transition period as it moves from the existing 1995 development consent (N90/00356) into the proposed new consent (from 2017 for a period of 21 years).

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The current NMP, which includes noise management requirements for both RCN and RCS includes the project specific noise criteria. Table 5.7 of the NMP outlines compliance criteria for the project, which are reproduced in Table 2.1. Results from quarterly noise monitoring have been compared to these criteria.

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Table 2.1: RCM PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA[2]

Descriptor	Rix's Creek North		Rix's Creek South	
	Impact Assessment Criterion $L_{Aeq,15minute}$ dB[1]	Impact Assessment Criterion $L_{A1,1minute}$ dB[1]	Impact Assessment Criterion $L_{Aeq,15minute}$ dB[1]	Impact Assessment Criterion $L_{A1,1minute}$ dB[1]
NM1	38	48	40	48
NM2	40	47	40	47[1]
NM3	39	45	NA	NA
NM4	37	49	42	48
NM5	41	47	42	48
NM6	36	48	42	47
NM7	NA	NA	40	45
NM8	NA	NA	40	47
NM9	NA	NA	40	47
NM10[2]	NA	NA	40	47

Note:

1. *Criterion set as for Rix's Creek North in the absence of data in the EIS; and*
2. *NA indicates criteria not applicable at that location, as it was not included in the relevant EA, EIS or Project Approval.*

The RCM NMP and Environment Protection License (EPL 3391, Dec 2015) outline required meteorological conditions for criteria to be applicable during attended noise monitoring, which are as follows:

Noise emission limits apply under all meteorological conditions of:

- wind speeds up to 3m/s at 10 metres above ground level; or
- temperature inversion conditions of up to 3°C/100m and wind speed up to 2m/s at 10 metres above the ground.

2.5 RCS Noise Level Design Goals

As detailed in Section 2.1, RCS is subject to conditions in Project Approval N90/00356 (MOD 8). While quarterly noise results have been compared to impact assessment criteria in the approved NMP, RCS is still subject to the noise level design goals set out in the current Project Approval while it transitions to the new consolidated approval, relevant to both RCS and RCN.

According to the latest version of N90/00356, RCS must comply with L_{A10} night time noise level design goals as follows:

- The Retreat – 40 dB
- Singleton Heights – 40 dB
- Maison Dieu Road – 38 dB

As detailed in Appendix 4 of the Project Approval, noise limits do not apply under the following meteorological conditions:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10m above ground level; and
- temperature inversion conditions greater than 3°C/100m.

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3 METHODOLOGY

3.1 Attended Noise Monitoring

Noise monitoring during Quarters 1, 2 and 3 was conducted in accordance with the Environment Protection Authority 'Industrial Noise Policy' guidelines and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise' and the latest compliance monitoring procedure detailed in the NMP.

Noise monitoring during Quarter 4 was conducted in accordance with the EPA 'Noise Policy for Industry' (NPfI, 2017) and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'.

If the exact contribution of the source of interest cannot be established, due to masking by other noise sources in a similar frequency range, but site noise levels are observed to be well below (more than 5 dB lower than) any relevant criterion, a maximum estimate of the potential contribution of the site might be made based on other measured site-only noise levels, for example, L_{A10}, L_{A50} or L_{A90}. This is generally expressed as a 'less than' quantity, such as <20 dB or <30 dB.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may also be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. When site noise is noted as NM, this means some noise was audible but could not be quantified. If site noise was NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods as per section 7.1 of the NPfI (e.g. measuring at an intermediate location and using relevant calculation) to determine a value for reporting.

All sites noted as NM in this report are due to one or more of the following reasons:

- site noise levels were extremely low and unlikely, in many cases, to be even noticed;
- site noise levels were masked by another relatively loud noise source that is characteristic of the environment (e.g. breeze in foliage or continuous road traffic noise) that cannot be eliminated by moving closer; and/or
- it was not feasible or reasonable to employ NPfI methods such as using an intermediate location. Cases may include, but are not limited to, rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

A measurement of $L_{A1,1minute}$ corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms this is the highest noise level, or L_{Amax}, received from the site during the entire measurement period (i.e. the highest level of the worst minute during the 15-minute measurement).

3.2 Meteorological Conditions

One on-site Automatic Weather Station (AWS) is currently located within each of the RCS and RCN mining lease areas. Data obtained from these stations allowed correlation of atmospheric parameters and measured noise levels.

For the purpose of determining valid meteorological conditions for which noise criteria apply:

- the Rix's Creek South AWS will be used for assessment of Rix's Creek South; and
- the Rix's Creek North AWS will be used for assessment of Rix's Creek North.

All monitoring and meteorological results have been reproduced as they were originally reported at the time of monitoring.

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3.3 Integra Open Cut Environmental Assessment 2009

As part of the project to extend the South Pit at the former Integra Open Cut and to gain approval of a consolidated project approval, a Noise and Blasting Impact Assessment (URS, June 2009) was commissioned in order to assess noise impacts as part of the Environmental Assessment (EA). As part of the modelling assessment, noise levels from the Project were predicted for representative operating scenarios, time periods and weather conditions. Year 6 part pit predictions for specific meteorological conditions identified within the Acoustic Impact Assessment as 'prevailing' in accordance with the INP were compared with measured levels from attended compliance monitoring for corresponding meteorological conditions, as these are deemed to best represent the 2017 operations.

Table 19 of the Noise and Blasting Assessment lists modelled meteorological conditions; this table is reproduced below.

Table 19 Noise Modelling Meteorological Parameters

Period	Meteorological Condition	Air Temp	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	18°C	60%	0m/s	0°C/100m
Evening	Calm	12°C	75%	0m/s	0°C/100m
Night-time	Calm	6°C	90%	0m/s	0°C/100m
Night-time	Adverse	6°C	90%	0m/s	3°C/100m

The following rules were used to allocate meteorological parameter bounds for each condition:

1. For calm meteorological conditions, wind speeds less than or equal to 0.5 metres per second (m/s), all wind directions, and temperature gradients up to and including 0.5 °C/100m were included; and

2. For night adverse meteorological conditions, wind speeds less than or equal to 0.5 m/s and vertical temperature gradients in the range 1.5 to 4.0 °C/100m were included. This vertical temperature gradient range is in accordance with Table E1 of the INP for stability class F.

3.4 Rix's Creek South Noise Assessment 2015

As part of modifications to the Rix's Creek Coal Mine Development Consent originally granted in October, 1989, an Environmental impact Statement was then completed. A further Environmental Impact Statement was completed as part of changes to the Development Consent which resulted in the approval of the 1995 consent, under which RCS still currently operates.

The assessment of noise at RCS has been compared to the L_{A10} design goals contained within the most current approval for RCS as these were the result of the relevant EIS and are representative of phase 4 (mining operations years 16-21) of the Rix's Creek mine. These noise goals are based on the L_{A10} (a former method of assessing noise impacts), therefore as direct comparison is not possible, the site only L_{Aeq}

measured at relevant equivalent locations during 2017 has been compared to these design noise goals for information purposes only.

The most recent Environmental Assessment for RCS was the Rix's Creek Extension project EA for which a Noise Impact Assessment was completed in 2015 to assess noise impacts associated with the continuation of operations. As part of the modelling assessment, noise levels from the Project were predicted for representative operating scenarios, time periods and weather conditions. There were two scenarios modelled for each mining year evaluated, one being full operations (scenario 1) and the other being reduced operations (scenario 2).

The year 2017 predictions as identified in the assessment, representing the early stages of the project were compared with measured levels from attended compliance monitoring, as these are deemed to best represent 2016 operations.

As detailed in the assessment, predicted results were determined using the cumulative distribution of results methodology to produce a single 90th percentile L_{Aeq} for which monitoring results may be compared. This method involves calculating a range of L_{Aeq} results based on a large number of different meteorological conditions for each receptor and then determining the 90th percentile L_{Aeq} based on the percentage distribution of meteorological conditions. Therefore, all measured noise results for which criteria were applicable according to the impact assessment criteria meteorological exclusions, as detailed in the NMP, were compared to predictions without any further exclusion based on modelled conditions (as is required for a prevailing meteorological condition based assessment).

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4 SUMMARY OF ATTENDED MONITORING RESULTS

4.1 March 2017

Monitoring was conducted during the night period of 16/17 March 2017. A summary of RCN and RCS operational noise results from March 2017 (Quarter 1) are presented in Tables 4.1 and 4.2. Noise levels from both RCN and RCS complied with relevant criteria at all monitoring locations during March 2017.

Table 4.1: NOISE LEVELS GENERATED BY RCN AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – MARCH 2017

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCN $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCN $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	16/03/2017 23:34	36	1.4	0.5	38	IA	Yes	Nil	48	IA	Yes	Nil
NM02	16/03/2017 23:57	42	0.6	3.0	40	IA	No	NA	47	IA	No	NA
NM03	16/03/2017 21:09	41	0.4	3.0	39	IA	No	NA	45	IA	No	NA
NM06	16/03/2017 21:34	53	1.8	-1.0	36	IA	Yes	Nil	48	IA	Yes	Nil
NM07	16/03/2017 21:57	45	0.7	3.0	NA	IA	NA	NA	NA	IA	NA	NA
NM08	16/03/2017 22:44	36	1.2	-1.0	NA	IA	NA	NA	NA	IA	NA	NA
NM09	16/03/2017 23:04	35	1.4	0.5	NA	IA	NA	NA	NA	IA	NA	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCN;*
5. *Bold results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

Table 4.2: NOISE LEVELS GENERATED BY RCS AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – MARCH 2017

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCS $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	16/03/2017 23:34	36	3.5	0.5	40	NM	No	NA	48	28	No	NA
NM02	16/03/2017 23:57	42	3.0	0.5	40	NM	No	NA	47	NM	No	NA
NM03	16/03/2017 21:09	41	2.2	-1.0	NA	IA	NA	NA	NA	IA	NA	NA
NM06	16/03/2017 21:34	53	2.5	-1.0	42	IA	Yes	Nil	47	IA	Yes	Nil
NM07	16/03/2017 21:57	45	3.2	-1.0	40	IA	No	NA	45	IA	No	NA
NM08	16/03/2017 22:44	36	3.0	0.5	40	IA	No	NA	47	IA	No	NA
NM09	16/03/2017 23:04	35	3.5	0.5	40	IA	No	NA	47	IA	No	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS;*
5. *Bold results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

4.2 June 2017

Monitoring was conducted during the night period of 1/2 June 2017. A summary of RCN and RCS operational noise results from June 2017 (Quarter 2) are presented in Tables 4.3 and 4.4. Noise levels from both RCN and RCS complied with relevant criteria at all monitoring locations during June 2017.

Table 4.3: NOISE LEVELS GENERATED BY RCN AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – JUNE 2016

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCN $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCN $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	01/06/2017 21:00	43	0.6	-1.0	38	IA	Yes	Nil	48	IA	Yes	Nil
NM03	01/06/2017 21:33	43	1.0	0.5	39	<35	Yes	Nil	45	<35	Yes	Nil
NM04	01/06/2017 21:59	35	0.9	-1.0	37	IA	Yes	Nil	49	IA	Yes	Nil
NM05	01/06/2017 22:22	36	1.2	0.5	41	IA	Yes	Nil	47	IA	Yes	Nil
NM06	01/06/2017 22:46	39	0.8	0.5	36	IA	Yes	Nil	48	IA	Yes	Nil
NM07	01/06/2017 23:20	47	0.5	0.5	NA	IA	NA	NA	NA	IA	NA	NA
NM08	02/06/2017 00:08	38	0.9	-1.0	NA	IA	NA	NA	NA	IA	NA	NA
NM09	01/06/2017 23:47	34	0.7	-1.0	NA	IA	NA	NA	NA	IA	NA	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCN;*
5. *Bold results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

Table 4.4: NOISE LEVELS GENERATED BY RCS AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – JUNE 2017

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCS $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	01/06/2017 21:00	43	2.2	-1.0	40	<35	Yes	Nil	48	35	Yes	Nil
NM03	01/06/2017 21:33	43	2.5	3.0	NA	IA	NA	NA	NA	IA	No	NA
NM04	01/06/2017 21:59	35	2.8	0.5	42	34	No	NA	48	42	No	NA
NM05	01/06/2017 22:22	36	2.5	0.5	42	33	No	NA	48	36	No	NA
NM06	01/06/2017 22:46	39	3.2	-1.0	42	39	No	NA	47	47	No	NA
NM07	01/06/2017 23:20	47	3.2	0.5	40	<35	No	NA	45	<35	No	NA
NM08	02/06/2017 00:08	38	3.8	0.5	40	28	No	NA	47	40	No	NA
NM09	01/06/2017 23:47	34	3.5	-1.0	40	IA	No	NA	47	IA	No	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS;*
5. *Bold results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

4.3 September 2017

Monitoring was conducted during the night period of 7/8 September 2017. A summary of RCN and RCS operational noise results from September 2017 (Quarter 3) are presented in Tables 4.5 and 4.6. Noise levels from both RCN and RCS complied with relevant criteria at all monitoring locations during September 2017.

Table 4.5: NOISE LEVELS GENERATED BY RCN AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – SEPTEMBER 2017

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCN $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCN $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	07/09/2017 21:00	35	2.0	-1.0	38	IA	Yes	Nil	48	IA	Yes	Nil
NM03	07/09/2017 22:49	38	2.2	-1.0	39	IA	Yes	Nil	45	IA	Yes	Nil
NM04	07/09/2017 23:12	35	1.6	-1.0	37	33	Yes	Nil	49	45	Yes	Nil
NM05	07/09/2017 23:44	39	1.6	-1.0	41	35	Yes	Nil	47	38	Yes	Nil
NM06	08/09/2017 00:17	44	1.5	-1.0	36	IA	Yes	Nil	48	IA	Yes	Nil
NM07	08/09/2017 00:44	38	1.4	-1.0	NA	IA	NA	NA	NA	IA	NA	NA
NM08	08/09/2017 01:31	37	1.5	0.5	NA	IA	NA	NA	NA	IA	NA	NA
NM09	08/09/2017 01:11	42	1.4	-1.0	NA	IA	NA	NA	NA	IA	NA	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCN;*
5. *Bold results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

Table 4.6: NOISE LEVELS GENERATED BY RCS AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – SEPTEMBER 2017

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCS $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	07/09/2017 21:00	35	6.0	-1.0	40	IA	No	NA	48	IA	No	NA
NM03	07/09/2017 22:49	38	5.0	0.5	NA	IA	NA	NA	NA	IA	NA	NA
NM04	07/09/2017 23:12	35	4.5	0.5	42	31	No	NA	48	33	No	NA
NM05	07/09/2017 23:44	39	4.0	-1.0	42	35	No	NA	48	46	No	NA
NM06	08/09/2017 00:17	44	4.8	0.5	42	40	No	NA	47	43	No	NA
NM07	08/09/2017 00:44	38	4.8	0.5	40	36	No	NA	45	39	No	NA
NM08	08/09/2017 01:31	37	5.5	-1.0	40	<35	No	NA	47	37	No	NA
NM09	08/09/2017 01:11	42	3.8	0.5	40	IA	No	NA	47	IA	No	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS;*
5. *Bold results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

4.4 December 2017

Monitoring was conducted during the night period of 5/6 December 2017. A summary of RCN and RCS operational noise results from December 2017 (Quarter 4) are presented in Tables 4.7 and 4.8. Noise levels from both RCN and RCS complied with relevant criteria at all monitoring locations during December 2017.

Table 4.7: NOISE LEVELS GENERATED BY RCN AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – DECEMBER 2017

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[3]	RCN $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[3]	RCN $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	5/12/2017 21:18	38	3.8	-1.0	38	IA	No	NA	48	IA	No	NA
NM02	5/12/2017 21:48	48	2.1	0.5	40	IA	No	NA	47	IA	No	NA
NM03	5/12/2017 23:40	40	1.4	-1.0	39	<30	Yes	Nil	45	33	Yes	Nil
NM04	5/12/2017 23:15	35	2.5	-1.0	37	<30	Yes	Nil	49	30	Yes	Nil
NM05	5/12/2017 22:38	41	2.0	3.0	41	<30	No	NA	47	<30	No	NA
NM06	5/12/2017 22:07	47	1.9	0.5	36	NM	Yes	Nil	48	NM	Yes	Nil
NM08	5/12/2017 21:37	40	3.1	-1.0	NA	IA	No	NA	NA	IA	No	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCN;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

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Table 4.8: NOISE LEVELS GENERATED BY RCS AGAINST PROJECT APPROVAL IMPACT ASSESSMENT CRITERIA – DECEMBER 2017

Location	Start Date and Time	Total L_{Aeq} dB	Wind Speed m/s	VTG °C/100m	L_{Aeq} Criterion dB[5]	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of L_{Aeq} Criterion[3,5,6]	$L_{A1,1min}$ Criterion dB[5]	RCS $L_{A1,1min}$ dB[4]	Criterion Applies?[1,2,3]	Exceedance of $L_{A1,1min}$ Criterion[3,5,6]
NM01	5/12/2017 21:18	38	4.2	0.5	40	IA	No	NA	48	IA	No	NA
NM02	5/12/2017 21:48	48	2.8	0.5	40	IA	No	NA	47	IA	No	NA
NM03	5/12/2017 23:40	40	4.5	-1.0	Nil	IA	No	NA	NA	IA	No	NA
NM04	5/12/2017 23:15	35	3.5	-1.0	42	IA	No	NA	48	IA	No	NA
NM05	5/12/2017 22:38	41	2.0	0.5	42	<30	No	NA	48	39	No	NA
NM06	5/12/2017 22:07	47	1.5	0.5	42	<30	Yes	Nil	47	<30	Yes	Nil
NM08	5/12/2017 21:37	40	3.5	0.5	40	IA	No	NA	47	IA	No	NA

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits apply for winds up to 3 metres per second (at a height of 10 metres); or temperature inversion conditions up to 3°C/100m and wind speeds up to 2 metres per second;*
3. *NA in criterion, criterion applies and exceedance columns indicates this location has no criterion;*
4. *Estimated or measured $L_{Aeq,15minute}$ or $L_{A1,1minute}$ attributed to RCS;*
5. *Bolded results in red are possible exceedances of relevant criteria (if applicable); and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.*

4.5 RCS Comparison to Consent Design Noise Goals

As detailed in Section 3.4, the most current consent for RCS contains L_{A10} design goals. While direct comparison between measured L_{Aeq} and these L_{A10} design goals is not accurately possible, the 2017 measured results for those monitoring locations deemed to most closely represent the former locations detailed in the consent are shown in Table 4.9.

Table 4.9: NOISE LEVELS GENERATED BY RCS AGAINST CONSENT L_{A10} NOISE DESIGN GOALS – 2017

	Location	Consent Location	L_{A10} Design Goal dB	RCS $L_{Aeq,15min}$ dB[4]	Criterion Applies[1]	Difference dB[2,3]
Quarter 1 2017	NM06	The Retreat	40	IA	Yes	NA
	NM07	Singleton Heights	40	IA	No	NA
	NM08	Maison Dieu Road	38	IA	No	NA
Quarter 2 2017	NM06	The Retreat	40	39	No	NA
	NM07	Singleton Heights	40	<35	No	NA
	NM08	Maison Dieu Road	38	28	No	NA
Quarter 3 2017	NM06	The Retreat	40	40	No	NA
	NM07	Singleton Heights	40	36	No	NA
	NM08	Maison Dieu Road	38	<35	No	NA
Quarter 4 2017	NM06	The Retreat	40	<30	Yes	>-10
	NM07[5]	Singleton Heights	40	-	NA	NA
	NM08	Maison Dieu Road	38	IA	No	NA

Notes:

1. *Noise emission limits do not apply for wind speeds greater than 3 m/s at 10m above ground level, or temperature inversion conditions greater than 3°C/100m;*
2. *NA indicates that either criteria do not apply due to meteorological conditions, or RCS inaudible or not directly measurable;*
3. *A positive difference indicates that the measured L_{Aeq} is greater than the L_{A10} design goal;*
4. *Estimated or measured $L_{Aeq,15minute}$ attributed to RCS; and*
5. *Noise monitoring not carried out at this location during Quarter 4 due to non-enhancing conditions in that area.*

5 COMPARISON WITH EA MODELLED PREDICTIONS

5.1 Comparison Between Attended and Modelled Results – Rix's Creek North

As detailed in Section 3.3, an acoustic impact assessment, including modelling of predicted noise levels for different operational years was conducted in order to assess noise and blasting impacts of RCN as part of the EA for a consolidated project approval. The modelled Year 6 part pit predictions presented in the assessment have been used for comparison in this report as that stage is most closely aligned to the 2016 reporting year.

Predicted Year 6 part pit operational noise levels for each non mine-owned residence are found in Appendix F6 of the Integra Open Cut Noise and Blasting Impact Assessment (June 2009), which is reproduced in Appendix A.

Measured operational levels have been compared to the predicted levels for Year 6 part pit in the Noise and Blasting Assessment for the relevant meteorological conditions. In the tables below, a positive difference is where the measured level is greater than the predicted level and a negative difference is where the measured levels are less than the predicted level. Notation used in the tables to denote differences is irrespective of the integer value sign. For example, the notation >-5 means the values are more than 5 dB less than the predicted level.

A summary of predicted noise levels for monitoring locations have been reproduced in Table 5.1.

Table 5.1: MONITORING LOCATION MODEL PREDICTIONS – $L_{Aeq,15minute}$ dB[1]

Monitoring Location ID	EA Reference	Predicted Night – Calm	Predicted Night – Adverse
NM1	132	23	33
NM2	91	27	34
NM3	47	22	27
NM4	19	20	35
NM5	11	30	40
NM6	145	21	34
NM7[1]	NA	<30	30-35 (33 used in comparison)
NM8[1]	NA	<30	<30
NM9[1]	NA	<30	<30
NM10[1]	NA	<30	<30

Notes:

1. *Predictions assumed based on contour maps (residence not included in EA).*

Table 5.2 provides the difference between measured and predicted levels with calm conditions during the night period.

Table 5.2: 2017 RCN OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST PREDICTED CALM CONDITIONS - NIGHT, YEAR 6 PART PIT[1,2]

Location	March	June	September	December
NM1	NA	NA	NA	NR
NM2	NR	-	-	NR
NM3	NR	NA	NA	NA
NM4	-	NA	+13	NA
NM5	-	NA	+5	NR
NM6	NA	NA	NA	NA
NM7	NR	NA	NA	-
NM8	NA	NA	NA	NR
NM9	NA	NA	NA	-
NM10	-	-	-	-

Notes:

1. *NR denotes meteorological conditions not relevant, NA denotes meteorological conditions relevant, however RCN inaudible or not directly measurable, "-" indicates no measurement was taken at this location during the relevant monitoring period; and*
2. *See Section 3.3 for applicable meteorological bounds.*

Table 5.3 provides the difference between measured and predicted levels with adverse conditions during the night period.

Table 5.3: 2017 RCN OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST PREDICTED ADVERSE CONDITIONS - NIGHT, YEAR 6 PART PIT[1,2]

Location	March	June	September	December
NM1	NA	NA	NA	NR
NM2	NR	-	-	NR
NM3	NR	NA	NA	NA
NM4	-	NA	-2	NA
NM5	-	NA	-5	NR
NM6	NA	NA	NA	NA
NM7	NR	NA	NA	-
NM8	NA	NA	NA	NR
NM9	NA	NA	NA	-
NM10	-	-	-	-

Notes:

1. *NR denotes meteorological conditions not relevant, NA denotes meteorological conditions relevant, however RCN inaudible or not measurable, "-" indicates no measurement was taken at this location during the relevant monitoring period; and*
2. *See Section 3.3 for applicable meteorological bounds.*

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5.2 Comparison Between Attended and Modelled Results – Rix's Creek South

As detailed in Section 3.3, an acoustic impact assessment, including modelling of predicted noise levels for different operational years was conducted in order to assess noise impacts of RCS as part of the EA for a continued operations. The modelled Year 2017 pit predictions for scenarios 1 and 2 presented in the assessment have been used for comparison in this report as that stage most closely aligns to the 2017 reporting year.

Predicted 90th percentile L_{Aeq} operational noise levels for each non noise sensitive receptor are found in Appendix A of the Rix's Creek Coal Mine – Continuation of Mining Project Environmental Noise Assessment (AECOM, October 2015), which is reproduced in Appendix A.

Measured operational levels have been compared to the predicted levels for Year 2017 in the Noise Assessment. In the tables below, a positive difference is where the measured level is greater than the predicted level and a negative difference is where the measured levels are less than the predicted level. Notation used in the tables to denote differences is irrespective of the integer value sign. For example, the notation >-5 means the values are more than 5 dB less than the predicted level.

A summary of predicted noise levels for monitoring locations have been reproduced in Table 5.4.

Table 5.4: MONITORING LOCATION MODEL PREDICTIONS – 90th Percentile $L_{Aeq,15minute}$ dB[1]

Monitoring Location ID	EA Reference	Predicted Night Scenario 1[1]	Predicted Night Scenario 2[2]
NM1	171	40	30
NM2[3,4]	NA	38	26
NM3[3,5]	NA	39	31
NM4	12	33	28
NM5	8	39	34
NM6	19	45	40
NM7	61	42	31
NM8	152	46	39
NM9	121	43	36
NM10	135	38	28

Notes:

1. *Night Scenario 1 represents normal night operations with all proposed night plant operational;*
2. *Night scenario 2 represents a modified night period scenario, where coaling equipment, reject haulage and an additional overburden excavator (and associated trucks) is also excluded;*
3. *NA indicates location not included in EA;*
4. *This monitoring location was not included in the EA as a NSR, however falls within the N Noise Assessment Group. The most minimum prediction for this NAG has been used for comparison, as NM2 is located further from the mine than any other receptor in the group; and*
5. *This specific monitoring location was not included in the EA. Predictions modelled for NSR 181, which is located on the same street were used for comparison.*

Table 5.5 provides the difference between measured and predicted levels with a full operations scenario.

Table 5.5: 2017 RCS OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST NIGHT SCENARIO 1 (FULL OPERATIONS) - NIGHT, YEAR 2017[1,2]

Location	March	June	September	December
NM1	NR	NA	NR	NR
NM2	NR	-	-	NR
NM3	NA	NR	NR	NR
NM4	-	NR	NR	NR
NM5	-	NR	NR	NR
NM6	NA	NR	NR	NA
NM7	NR	NR	NR	-
NM8	NR	NR	NR	NR
NM9	NR	NR	NR	-
NM10	-	-	-	-

Notes:

1. *NR denotes meteorological conditions not relevant, NA denotes meteorological conditions relevant, however RCS inaudible or not measurable, "-" indicates no measurement was taken at this location during the relevant monitoring period; and*
2. *See Section 3.4 for details regarding meteorological conditions.*

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Table 5.6 provides the difference between measured and predicted levels associated with a reduced operations scenario.

Table 5.6: 2017 RCS OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST NIGHT SCENARIO 2 (REDUCED OPERATIONS) - NIGHT, YEAR 2017[1,2]

Location	March	June	September	December
NM1	NR	NA	NR	NR
NM2	NR	-	-	NR
NM3	NA	NR	NR	NR
NM4	-	NR	NR	NR
NM5	-	NR	NR	NR
NM6	NA	NR	NR	NA
NM7	NR	NR	NR	-
NM8	NR	NR	NR	NR
NM9	NR	NR	NR	-
NM10	-	-	-	-

Notes:

1. *NR denotes meteorological conditions not relevant, NA denotes meteorological conditions relevant, however RCS inaudible or not directly measurable, "-" indicates no measurement was taken at this location during the relevant monitoring period; and*
2. *See Section 3.4 for details regarding meteorological conditions.*

6 SUMMARY

Global Acoustics was engaged by RCM to provide a summary of operational environmental noise surveys for the 2017 annual reporting year, and to compare environmental noise monitoring results with model predictions from the relevant Environmental Assessments for RCN and RCS.

6.1 Operational Noise Results

Noise levels from both RCN and RCS complied with relevant criteria as detailed in the current NMP at all monitoring locations during 2017.

6.2 Comparison to modelled predictions

Attended monitoring results were filtered to extract those that were taken during meteorological conditions that were similar to meteorological conditions included in the most relevant environmental assessments for both of RCN and RCS. These results were compared with model predictions to provide an indication of relative difference between measured and predicted levels.

6.2.1 Rix's Creek North

Results of this assessment indicate that meteorological conditions included in the Noise and Blasting Impact Assessment report (2009) did not regularly occur during attended monitoring. A total of 23 of the 30 attended compliance measurements during 2017 occurred during meteorological conditions where criteria applied (and that were similar to modelled meteorological conditions). Of the 23 instances where meteorological conditions were relevant, there were only two instances where RCN was directly measurable, not IA or NM or less than a maximum cut-off value. These two measurement occurred during September 2017. During calm conditions, measured levels from RCN were 13 and 5 dB above the modelled levels. During adverse conditions, measured levels from RCN were 2 and 5 dB less than the modelled levels.

6.2.2 Rix's Creek South

Results of this assessment indicate that a total of 4 of the 30 attended compliance measurements in 2017 occurred during meteorological conditions where RCS criteria applied. RCS levels were not directly measurable in these four measurements so a comparison to modelled levels could not be made.

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APPENDIX

A STATUTORY REQUIREMENTS

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Rix's Creek North Project Approval

NOISE

Noise Criteria

2. Except for the land referred to in Table 1 for which the acquisition basis is noise, the Proponent must ensure that the noise generated by the project does not exceed the criteria in Table 2 at any residence on privately-owned land or on more than 25 percent of any privately-owned land.

Table 2: Noise criteria dB(A)

Location		Day	Evening	Night	
		$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
NAG 1	All privately-owned land	38	38	36	46
NAG 2	All privately-owned land	39	39	37	47
NAG 3	All privately-owned land	40	40	39	49
NAG 4	99, 100	39	39	39	47
	88, 91, 95	40	40	40	47
	105, 161	41	41	41	47
	All other privately-owned land	42	42	37	47
NAG 5	104	35	35	35	52
	139	36	36	36	52
	103	37	37	37	52
	121	40	40	40	52
	118, 154	43	43	43	52
	Deleted	45	45	45	52
	Deleted	47	47	47	52
	All other privately-owned land	50	46	42	52
NAG 6	137	35	35	35	48
	133	37	37	37	48
	132	38	38	38	48
	All other privately-owned land	41	41	38	48
NAG 7	All privately-owned land	45	42	39	49
NAG 8	142	35	35	35	45
	All other privately-owned land	42	42	35	45
NAG 9	146, 148, 149	35	35	35	48
	143, 144, 145, 147, 150, 151, 152	36	36	36	48
	2	37	37	37	48
	3, 4	39	39	39	48
	All other privately-owned land	40	40	38	48
NAG 10	5	40	40	40	47
	6, 11	41	41	41	47
	8	42	42	42	47
	All other privately-owned land	39	39	37	47

NAG 11	20, 21	37	37	36	49
	19	37	37	37	49
	17	38	38	38	49
	7	39	39	39	49
	12, 15	40	40	40	49
	14, 16	42	42	42	49
	All other privately-owned land	41	41	39	49
NAG 12	52, 55	35	35	35	45
	51, 56	37	37	37	45
	53, 57	38	38	38	45
	50, 54	39	39	39	45
	62	40	40	40	45
	All other privately-owned land	38	38	35	45
NAG A	24, 25, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 41	35	35	35	46
	31	36	36	35	46
	42, 43	36	36	36	46
	32	37	37	35	46
	22, 23	37	37	37	46
	34	39	39	36	46
	35	39	39	35	46
	All other privately-owned land	39	39	36	46
NAG B	All privately-owned land	37	37	35	45
NAG C	47	39	39	39	45
	63	40	40	40	45
	All other privately-owned land	37	37	35	45
NAG D	44, 48	36	36	36	48
	49	39	39	39	48
	All other privately-owned land	40	40	38	48
NAG F	65, 66	39	39	39	50
	67	40	40	40	50
	68	42	42	42	50
	All other privately-owned land	40	40	40	50
NAG G	All privately-owned land	41	41	39	50
All other privately-owned land		35	35	35	45

However, these criteria do not apply if the Proponent, or another mining company, has acquired the land or if the Proponent has a written agreement with the relevant landowner to exceed the criteria, and the Proponent has advised the Department in writing of the terms of this agreement.

Noise generated by the project is to be measured in accordance with the relevant requirements of the INP. Appendix 5 sets out the requirements for evaluating compliance with these criteria.

APPENDIX 5: NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the *NSW Industrial Noise Policy* and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located on the site (as required by condition 28 of Schedule 3).

Rix's Creek South Project Approval

10. The Applicant must
    (i) comply with L_A 10 daytime noise level design goals set out below:

The Retreat	42dB(A)
Singleton Heights	42dB(A)
Maison Dieu Road	38dB(A)

    (ii) comply with L_A I0 night time noise level design goals set out below:

The Retreat	40dB(A)
Singleton Heights	40dB(A)
Maison Dieu Road	38dB(A)

Appendix 4 sets out the requirements for evaluating compliance with these criteria.

APPENDIX 4: NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the *NSW Industrial Noise Policy* and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located on the site (as required by condition 14B of Schedule 2).

Rix's Creek Noise Management Plan

5. Attended Noise Compliance Monitoring

5.1.1 INTRODUCTION

Attended monitoring is required to assess compliance with regulatory limits. Note: As described in this document it does not address the 25% of privately owned land aspect of Schedule 3, Condition 2 of the Rixs Creek North Cut Project Approval. As recommended in the 2011 Independent Environmental Audit, the requirement to assess affectation of 25% of privately owned land should be removed as a requirement (for all criteria); it is not practical to determine and has no relevance to resident amenity.

Attended monitoring at all receptor locations will be at night only commencing from 9pm, with results compared to all criteria (day, evening and night). Atmospheric conditions and noise propagation are usually the same on the evening/night and night/day time boundaries. Note also that receptors near to, or exposed to, the New England Highway have a completely different noise environment in the day due to traffic such that mining noise is unlikely to be a problem. This is consistent with the Independent Review Of Cumulative Noise Impacts -Camberwell Village (WMPL, May 2010), which states:

> *The L_{Aeq} levels near the New England Highway are predominately due to road traffic and associated heavy vehicles, rather than mining or other industrial noise, and is unlikely to decrease in the future.*

5.1.2 FREQUENCY

Attended compliance monitoring is to be undertaken one night per calendar month.

5.1.3 LOCATIONS

Compliance cannot be determined at each individual resident so on the monitoring night monitoring is targeted to locations where operational noise is likely to be the highest. These monitoring locations are selected by the following procedure.

Residences surrounding the Mine have been grouped generally according to the locality and local acoustic environment. These groupings are referenced in the relevant EAs as Noise Assessment Groups (NAG). Monitoring locations, including the receptor reference numbers from the relevant EAs and the NAG each represents, are listed in Table 5-6.

Compliance monitoring is to be conducted at locations indicated as being in the zone of meteorological enhancement by the predictive noise model. The procedure for determining which locations to monitor is as follows:

1. The acoustic consultant undertaking the monitoring will access the predictive model website for the site for the upcoming night shift. The model results will indicate graphically the predicted zone of meteorological enhancement;
2. A monitoring plan will be developed by the consultant for the upcoming night period. Locations are to include:
    a. If a clear zone of meteorological enhancement is indicated, one location in the opposite direction to the zone of predicted enhancement, and, all locations located within the predicted zone of enhancement; and

b. If relatively neutral conditions are predicted with no clear zone of meteorological enhancement, the eight locations nearest the mine will be monitored. NM01, NM03 and NM10 would be excluded, as non-compliance at those locations in the absence of meteorological enhancement is unlikely due to distance from the Mine.

3. A minimum of six locations are to be monitored per night.

Once monitoring commences, the consultant will apply best judgment to either proceed with the original monitoring plan, or a modified plan if monitoring results justify a change.

The procedure for monitoring when a clear zone of meteorological enhancement is predicted is:

1. The first monitoring location will be the potentially most affected location in the opposite direction to the zone of predicted enhancement to confirm noise emission in that direction is well below compliance criteria;
2. If the Mine L_{Aeq} is more than 2 dB below the relevant criterion at the first location (L_{Aeq} < criterion minus 2 dB), the consultant will proceed with the original plan and move to the locations within the predicted zone of enhancement;
3. If the Mine L_{Aeq} is within 2 dB of the relevant criterion (L_{Aeq} >= criterion minus 2 dB), the consultant will monitor at the next most potentially affected location in the same general direction from the Mine. This procedure will be repeated until the Mine L_{Aeq} is more than 2 dB below the relevant criterion. Result acceptance procedures in Section 5.1.7 will be applied;
4. The consultant will then proceed with the original plan; and
5. If fatigue management rules result in insufficient time to monitor all locations, the consultant will apply best judgement to determine which locations will provide the best indication of compliance with the time available.

The procedure for monitoring when no clear zone of meteorological enhancement is predicted is:

1. The first monitoring location will be the potentially most affected location based on forecast and prevailing meteorological conditions;
2. If compliance is demonstrated, the consultant will proceed with the original plan;
3. If non-compliance is measured at any location, result acceptance procedures in Section 5.1.7 will be applied. Any locations in the same general direction from the Mine that were omitted in the original plan will be included; and
4. If fatigue management rules result in insufficient time to monitor all locations, the consultant will apply best judgement to determine which locations will provide the best indication of compliance with the time available.

The consultant shall maintain a fatigue management policy, which will be provided to the Mine and/or regulators on request.

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Table 5-6 Attended Monitoring Locations

NMP ID	EA Ref. (ICO/RCM) [1]	Owner or Area	NAG [2]
NM01	132/171	Bowman	6 (ICO) / M (RCM)
NM02	91/NA	Olofsson	4 (ICO)
NM03	47/NA	Cherry	B, C, F, 1, 6 and 12 (ICO)
NM04	19/12	Andrews	11 and A (ICO) / A (RCM)
NM05	11/8	Ferraro	10 and 11 (ICO) / A (RCM)
NM06	145/19	Murray	9 (ICO) / B and C (RCM)
NM07	NA/61	Gardiner Circuit	8 (ICO) / D and E (RCM)
NM08	NA/152	Belmadar Way	NA / J, G and F (RCM)
NM09	NA/121	Llanrian Drive	NA / H (RCM)
NM10	NA/135	Long Point	NA / K and I (RCM)

Notes: 1. NA indicates location was not included in the EA for that project; and

2. Indicates the NAG reference the location represents from the relevant EAs.

Figure 5-1 illustrates attended monitoring locations.

5.1.4 METHODS

Attended monitoring is to be conducted in accordance with the *'Industrial Noise Policy' (INP)* guidelines and *Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'*. The duration of each measurement is to be 15 minutes.

As indicated in L3.3, L3.4 & L3.5 of EPL 3391:

L3.3 Noise from the premises is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise level limits in this licence unless otherwise stated.

Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy.

The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.

L3.4 Noise from the premises is to be measured at 1 m from the dwelling facade to determine compliance with the LA1(1minute) noise limits in this licence.

L3.5 The noise emission limits identified in this licence apply under all meteorological conditions of: a) Wind speeds up to 3m/s at 10 metres above the ground level; or

b) Temperature inversion conditions of up to 3oC/100m and wind speed up to 2m/s at 10 metres above the ground.

5.1.8 COMPLIANCE CRITERIA

Table 5-7 sets out night period noise compliance criteria. Rixs Creek North criteria are sourced from the Project Approval. Rixs Creek South $L_{Aeq,15minute}$ intrusive noise criteria are based on proposed criteria nominated in the EIS. $L_{A1,1minute}$ criteria are based on sleep disturbance criteria for the relevant NAG derived in the EIS.

$L_{Aeq,15minute}$ criteria are applicable for the day (07:00 to 18:00), evening (18:00 to 22:00) and night (22:00 to 07:00) periods. $L_{A1,1minute}$ criteria are applicable for the night period only.

Table 5-7 Compliance Criteria

NMP ID	EA Ref. (ICO/RCM) [1]	Rix's Creek North		Rixs Creek South	
		$L_{Aeq,15minute}$ dB	$L_{A1,1minute}$ dB	$L_{Aeq,15minute}$ dB	$L_{A1,1minute}$ dB
NM01	132/171	38	48	40	48
NM02	91/NA	40	47	40	47 [1]
NM03	47/NA	39	45	NA	NA
NM04	19/12	37	49	42	48
NM05	11/8	41	47	42	48
NM06	145/19	36	48	42	47
NM07	NA/61	NA	NA	40	45
NM08	NA/152	NA	NA	40	47
NM09	NA/121	NA	NA	40	47
NM10	NA/135	NA	NA	40	47

Notes: 1. Criterion set as for Rixs Creek North in the absence of data in the EIS; and

2. NA indicates criteria not applicable at that location, as it was not included in the relevant EA, EIS or Project Approval.

Integra Open Cut (RCN) Operational Noise and Blasting Assessment – Modelled Predictions

YEAR 6 - PART PIT OPERATION INTRUSIVE NOISE EMISSIONS - NON-MINE OWNED RESIDENCES

Part Pit Operation - Year 6 $L_{Aeq(15minute)}$ Intrusive Noise Emissions (dBA re 20μPa)

Noise Assessment Group	Residence Reference	Daytime (Non-Adverse)			Project Specific Criteria	Evening (Non-Adverse)			Project Specific Criteria	Night-time (Non-Adverse)			Night-time (Adverse Winter)			Project Specific Criteria
		IOC	NOC	Project Total		IOC	NOC	Project Total		IOC	NOC	Project Total	IOC	NOC	Project Total	
1	80	23	30	31	35	24	30	31	38	24	12	24	36	13	36	39
3	87	33	26	34	38	34	26	34	40	34	8	34	41	9	**41**[1]	40
	106	34	20	34	38	35	20	35	40	35	3	35	42	5	**42**[1]	40
4	88	25	13	25	39	25	13	25	48	26	3	26	34	4	34	37
	91	26	14	26	39	27	14	27	48	27	3	27	34	4	34	37
	94	25	13	25	39	25	14	25	48	25	2	25	32	4	32	37
	95	26	14	26	39	26	14	27	48	27	3	27	33	4	33	37
	96	27	15	27	39	27	15	28	48	28	3	28	35	4	35	37
	99	24	13	24	39	24	13	25	48	25	2	25	32	3	32	37
	100	23	13	24	39	24	13	24	48	24	2	24	32	3	32	37
	105	27	14	27	39	27	14	27	48	27	4	27	35	5	35	37
	161	27	15	27	39	27	15	28	48	28	3	28	35	4	35	37
5	103	22	13	22	50	22	14	23	46	23	-7	23	31	-5	31	42
	104	22	13	22	50	22	13	23	46	23	1	23	31	2	31	42
	111	34	19	34	50	35	20	35	46	35	2	35	40	3	40	42
	112	30	20	30	50	30	21	31	46	31	4	31	38	4	38	42
	118	28	17	28	50	28	18	29	46	29	2	29	35	3	35	42
	120	28	18	29	50	29	18	29	46	30	2	30	36	3	36	42
	121	26	14	26	50	26	15	26	46	26	1	27	33	2	33	42
	123	24	12	24	50	24	12	24	46	24	0	24	32	2	32	42
	125	26	14	27	50	27	15	27	46	27	0	27	33	1	33	42
	126	24	12	24	50	24	13	25	46	25	1	25	32	2	32	42
	129	24	15	25	50	25	16	25	46	25	0	25	34	2	34	42
	139	22	6	22	50	22	7	23	46	23	-14	23	33	-12	33	42
	154	31	17	31	50	31	18	31	46	32	2	32	31	17	31	42
	156	30	17	30	50	31	17	31	46	31	2	31	37	3	30	42
	157	28	18	29	50	29	18	29	46	30	2	30	36	3	28	42
	159	28	17	28	50	28	18	29	46	29	2	29	35	3	28	42
6	132	22	10	22	39	22	10	23	41	23	-2	23	33	-1	33	38
	133	22	12	23	39	23	12	23	41	24	-3	24	33	-2	33	38

YEAR 6 - PART PIT OPERATION INTRUSIVE NOISE EMISSIONS - NON-MINE OWNED RESIDENCES

Noise Assessment Group	Residence Reference	Daytime (Non-Adverse)			Project Specific Criteria	Evening (Non-Adverse)			Project Specific Criteria	Night-time (Non-Adverse)			Night-time (Adverse Winter)			Project Specific Criteria
		IOC	NOC	Project Total		IOC	NOC	Project Total		IOC	NOC	Project Total	IOC	NOC	Project Total	
6	137	17	7	17	39	17	8	18	41	18	-3	18	31	-3	31	38
7	108	40	20	40	45	40	21	40	42	41	5	**41[1]**	45	6	**45[3]**	39
	109	41	19	41	45	41	20	41	42	41	4	**41[1]**	45	5	**45[3]**	39
	110	39	22	39	45	39	22	39	42	40	4	**40[1]**	44	5	**44[2]**	39
	Dulwich	32	20	32	45	32	21	32	42	33	4	33	39	6	39	39
8	142	13	1	14	42	14	2	14	42	15	-7	15	27	-6	27	35
9	2	28	17	29	37	29	13	29	41	30	-11	30	36	-9	36	39
	3	26	18	27	37	27	12	27	41	28	0	28	37	1	37	39
	4	27	18	28	37	28	12	28	41	29	-1	29	37	1	37	39
	143	17	5	17	37	17	5	17	41	18	-4	18	32	-3	32	39
	144	20	6	20	37	20	7	20	41	21	-1	21	34	0	34	39
	145	20	6	20	37	20	7	20	41	21	-1	21	34	0	34	39
	146	18	5	18	37	18	6	19	41	19	-3	19	33	-2	33	39
	147	19	6	19	37	20	7	20	41	20	-2	20	34	-1	34	39
	148	20	6	20	37	20	7	21	41	21	-10	21	34	-8	34	39
	149	20	5	21	37	21	6	21	41	22	-13	22	32	-11	32	39
	150	21	6	21	37	21	7	21	41	22	-12	22	34	-10	34	39
	151	20	6	20	37	21	7	21	41	22	-15	22	35	-13	35	39
	152	22	8	22	37	23	9	23	41	23	-7	23	34	-5	34	39
10	5	28	21	29	36	29	15	29	41	30	2	30	38	3	**38[1]**	37
	6	29	21	29	36	29	16	30	41	30	2	30	39	3	**39[1]**	37
	8	29	22	30	36	30	9	30	41	31	4	31	40	5	**40[2]**	37
	9	29	22	29	36	29	13	29	41	30	5	30	41	6	**41[2]**	37
	10	28	22	29	36	29	10	29	41	29	5	29	40	6	**40[2]**	37
	11	28	23	29	36	29	13	29	41	30	5	30	40	6	**40[2]**	37
	13	30	23	31	36	31	11	31	41	31	6	31	41	7	**41[2]**	37
11	7	28	20	29	38	29	15	29	43	30	1	30	37	2	37	40
	12	28	21	29	38	29	16	29	43	30	3	30	39	4	39	40
	14	30	23	31	38	31	17	31	43	32	5	32	40	6	40	40
	15	29	23	30	38	30	17	30	43	31	4	31	38	5	38	40

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YEAR 6 - PART PIT OPERATION INTRUSIVE NOISE EMISSIONS - NON-MINE OWNED RESIDENCES

Noise Assessment Group	Residence Reference	Daytime (Non-Adverse)			Project Specific Criteria	Evening (Non-Adverse)			Project Specific Criteria	Night-time (Non-Adverse)			Night-time (Adverse Winter)			Project Specific Criteria
		IOC	NOC	Project Total		IOC	NOC	Project Total		IOC	NOC	Project Total	IOC	NOC	Project Total	
11	16	30	24	31	38	31	19	31	43	31	6	31	40	7	40	40
	17	23	20	25	38	24	15	24	43	24	-4	24	34	-2	34	40
	18	22	19	24	38	22	14	23	43	23	-7	23	31	-5	31	40
	19	19	21	23	38	19	18	22	43	20	1	20	35	3	35	40
	20	20	22	24	38	20	21	23	43	21	4	21	35	6	35	40
	21	19	22	24	38	20	21	23	43	20	3	21	35	5	35	40
12	50	19	30	30	34	19	28	29	39	20	10	20	32	12	32	35
	51	19	29	29	34	19	27	28	39	20	10	20	32	11	32	35
	52	18	26	26	34	18	24	25	39	19	8	19	24	10	24	35
	53	19	28	29	34	20	26	27	39	20	8	21	32	10	32	35
	54	19	30	31	34	20	27	28	39	20	8	21	32	10	32	35
	55	19	26	26	34	19	24	25	39	20	7	20	28	8	28	35
	56	20	27	28	34	20	25	26	39	21	8	21	29	9	30	35
	57	19	26	27	34	20	24	26	39	20	7	21	31	8	31	35
	62	19	32	32	34	20	28	29	39	20	11	21	33	13	33	35
A	22	23	22	25	36	23	25	27	39	24	6	24	33	8	33	36
	23	23	23	26	36	23	25	27	39	24	5	24	34	8	34	36
	24	19	20	22	36	20	20	23	39	21	3	21	30	5	30	36
	25	19	19	22	36	20	21	24	39	20	5	20	30	6	30	36
	26	18	18	21	36	19	21	23	39	20	3	20	29	4	29	36
	27	19	18	21	36	19	21	23	39	20	2	20	29	3	29	36
	28	17	16	20	36	18	17	20	39	18	-7	18	28	-5	28	36
	29	19	20	23	36	20	22	24	39	21	4	21	30	5	30	36
	30	19	20	23	36	20	23	25	39	21	3	21	30	5	30	36
	31	20	21	24	36	20	25	26	39	21	5	21	30	7	30	36
	32	19	21	24	36	20	24	26	39	21	7	21	31	8	31	36
	34	20	24	25	36	20	27	28	39	21	8	21	31	10	31	36
	35	18	27	27	36	18	23	24	39	19	10	19	31	11	31	36
	36	19	24	25	36	19	20	23	39	20	6	20	29	7	29	36

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YEAR 6 - PART PIT OPERATION INTRUSIVE NOISE EMISSIONS - NON-MINE OWNED RESIDENCES

Noise Assessment Group	Residence Reference	Daytime (Non-Adverse)			Project Specific Criteria	Evening (Non-Adverse)			Project Specific Criteria	Night-time (Non-Adverse)			Night-time (Adverse Winter)			Project Specific Criteria
		IOC	NOC	Project Total		IOC	NOC	Project Total		IOC	NOC	Project Total	IOC	NOC	Project Total	
A	37	15	19	21	36	16	17	19	39	16	7	17	21	8	21	36
	38	18	23	24	36	18	22	23	39	19	6	19	30	7	30	36
	39	16	20	22	36	16	18	20	39	17	2	17	21	4	22	36
	40	15	18	19	36	15	15	18	39	16	5	16	20	6	20	36
	41	12	13	16	36	12	11	15	39	13	4	13	18	5	18	36
	42	17	23	24	36	17	24	25	39	17	6	18	30	7	30	36
	43	18	24	25	36	18	24	25	39	19	9	19	31	10	31	36
C	47	20	34	34	35	21	33	33	37	21	16	22	27	18	27	35
	63	19	31	31	35	20	29	29	37	20	14	21	31	16	31	35
	64	20	32	32	35	21	31	32	37	21	17	23	31	19	31	35
D	44	17	26	27	37	18	25	26	41	18	13	19	30	15	30	38
	48	18	29	29	37	19	28	29	41	19	13	20	25	16	25	38
	49	19	30	31	37	19	29	30	41	20	14	21	29	16	29	38
F	65	20	32	33	39	20	31	31	40	21	10	21	32	11	32	40
	66	19	33	33	39	20	30	31	40	20	11	21	30	12	31	40
	67	21	32	32	39	21	30	31	40	22	12	22	30	13	30	40
	68	21	35	35	39	22	34	34	40	22	13	23	34	14	34	40
	71	24	37	37	39	24	37	37	40	25	14	25	35	16	35	40
	72	24	37	37	39	24	37	37	40	25	14	25	35	16	35	40
	73	24	37	37	39	24	37	38	40	25	14	25	36	16	36	40
	76	24	35	37	36	24	33	33	40	25	14	25	36	16	36	40

Note 1: Marginal Noise Management Zone 1 to 2 dBA above project specific criteria (bold text)
Note 2: Moderate Noise Management Zone 3 to 5 dBA above project specific criteria (bold text)
Note 3: Noise Affection Zone >5 dBA above project specific criteria (bold text and shaded cell)

Rix's Creek Mine (RCS) Operational Noise Assessment – Modelled Predictions

Table A.1: 90th PERCENTILE OPERATIONAL PREDICTIONS- $L_{Aeq,15minute}$ dB

NSR ID	NAG	PSNL			2017				2020		
		Day	Eve	Night	Day	Eve	Night 1	Night 2	Day	Eve	N
1	NONE	NA	NA	NA	52	54	54	45	50	58	
2	A	38	38	38	**39**	40	**41**	36	38	36	
3	A	38	38	38	33	34	35	30	32	28	
4	A	38	38	38	**40**	41	**42**	37	38	39	
5	A	38	38	38	**40**	41	**42**	38	**39**	39	
6	A	38	38	38	**39**	40	**41**	36	37	37	
7	A	38	38	38	**39**	40	**41**	36	38	39	
8	A	38	38	38	36	38	**39**	34	34	36	
9	A	38	38	38	36	38	**39**	34	35	36	
10	A	38	38	38	35	37	38	33	34	34	
11	A	38	38	38	25	27	28	25	26	23	
12	A	38	38	38	26	28	33	28	27	25	
13	A	38	38	38	36	38	**39**	34	36	36	
14	A	38	38	38	37	38	**39**	34	35	36	
24	A	38	38	38	**40**	40	**42**	34	37	36	
15	B	43	42	37	42	42	**44**	37	40	41	
16	B	43	42	37	42	42	**44**	37	41	41	
17	B	43	42	37	43	43	**44**	**38**	41	41	
18	B	43	42	37	43	42	**44**	**39**	40	41	
19	B	43	42	37	43	43	**45**	**40**	41	41	
20	B	43	42	37	43	42	**44**	**39**	41	40	
21	B	43	42	37	42	43	**44**	**40**	41	41	

NSR ID	NAG	PSNL			2017			
		Day	Eve	Night	Day	Eve	Night 1	Night 2
22	B	43	42	37	42	43	**44**	**40**
23	B	43	42	37	43	43	**45**	**40**
25	C	43	42	37	34	32	34	26
26	C	43	42	37	36	35	36	27
27	C	43	42	37	**44**	44	**46**	**40**
28	C	43	42	37	36	35	36	29
29	C	43	42	37	33	31	33	26
30	C	43	42	37	36	35	37	28
31	C	43	42	37	43	43	**45**	**39**
32	C	43	42	37	42	42	**44**	37
33	C	43	42	37	42	42	**44**	**38**
34	C	43	42	37	43	44	**45**	**40**
35	C	43	42	37	41	42	**43**	35
36	C	43	42	37	39	38	**39**	34
37	C	43	42	37	43	43	**45**	**39**
38	C	43	42	37	37	36	37	33
39	C	43	42	37	37	36	37	30
57	D	36	36	35	**39**	40	**41**	31
58	D	36	36	35	**38**	39	**40**	29
59	D	36	36	35	**41**	43	**43**	35
60	D	36	36	35	**37**	35	**37**	28
61	D	36	36	35	**41**	41	**42**	31
62	D	36	36	35	**38**	39	**40**	32

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NSR ID	NAG	PSNL			2017			
		Day	Eve	Night	Day	Eve	Night 1	Night 2
64	D	36	36	35	36	34	35	26
65	D	36	36	35	**39**	41	**42**	32
71	D	36	36	35	**40**	41	**41**	33
72	D	36	36	35	**40**	41	**42**	34
74	D	36	36	35	**39**	40	**41**	31
75	D	36	36	35	**38**	37	**39**	30
76	D	36	36	35	**42**	42	**43**	35
77	D	36	36	35	36	35	**36**	28
78	D	36	36	35	**40**	41	**42**	32
79	D	36	36	35	**41**	41	**43**	34
80	D	36	36	35	**37**	36	**37**	27
85	E	36	36	35	**39**	39	**40**	32
86	E	36	36	35	**37**	37	**38**	31
87	E	36	36	35	**39**	39	**40**	32
88	E	36	36	35	**37**	36	**38**	30
89	E	36	36	35	**39**	40	**41**	33
90	E	36	36	35	**39**	40	**41**	33
91	E	36	36	35	**39**	39	**40**	33
92	E	36	36	35	36	35	**36**	26
93	E	36	36	35	36	37	**38**	28
94	E	36	36	35	24	25	29	16
95	E	36	36	35	**39**	40	**41**	32
56	F	36	36	35	36	37	**37**	25

NSR ID	NAG	PSNL			2017			
		Day	Eve	Night	Day	Eve	Night 1	Night 2
63	F	36	36	35	**38**	39	**39**	28
66	F	36	36	35	36	38	**39**	26
67	F	36	36	35	36	37	**38**	23
68	F	36	36	35	**37**	39	**39**	27
69	F	36	36	35	**37**	38	**39**	24
70	F	36	36	35	**37**	38	**39**	29
73	F	36	36	35	34	36	**37**	25
81	F	36	36	35	36	38	**38**	29
82	F	36	36	35	35	36	**37**	27
83	F	36	36	35	36	37	**38**	29
84	F	36	36	35	**37**	37	**38**	29
40	G	39	39	37	32	36	**38**	27
41	G	39	39	37	34	37	**38**	28
42	G	39	39	37	36	39	**40**	29
43	G	39	39	37	35	37	**38**	28
44	G	39	39	37	**44**	45	**45**	**39**
45	G	39	39	37	34	37	**38**	27
46	G	39	39	37	34	37	**38**	28
47	G	39	39	37	**44**	45	**45**	**39**
48	G	39	39	37	**43**	44	**44**	**39**
49	G	39	39	37	33	36	37	22
50	G	39	39	37	33	36	36	26
51	G	39	39	37	37	38	**39**	29

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NSR ID	NAG	PSNL			2017			
		Day	Eve	Night	Day	Eve	Night 1	Night 2
138	J	39	39	37	**46**	47	**48**	**41**
139	J	39	39	37	**46**	46	**47**	**39**
140	J	39	39	37	**47**	48	**49**	**42**
152	J	39	39	37	**46**	46	**46**	**39**
153	J	39	39	37	39	42	**42**	37
154	J	39	39	37	39	42	**42**	36
155	J	39	39	37	**46**	47	**47**	**40**
156	J	39	39	37	**41**	42	**42**	36
157	J	39	39	37	38	42	**42**	37
158	J	39	39	37	**44**	44	**44**	**38**
159	J	39	39	37	39	42	**42**	36
166	J	39	39	37	**44**	45	**45**	37
141	K	35	35	35	**43**	45	**45**	**37**
142	K	35	35	35	**40**	42	**42**	33
143	K	35	35	35	**40**	43	**42**	33
144	K	35	35	35	**40**	43	**42**	33
145	K	35	35	35	**39**	42	**41**	32
146	K	35	35	35	**38**	43	**42**	31
147	K	35	35	35	**37**	42	**41**	31
148	K	35	35	35	**40**	41	**41**	31
160	K	35	35	35	**45**	47	**47**	**40**
161	K	35	35	35	**45**	47	**46**	**40**
162	K	35	35	35	**44**	45	**45**	**37**

NSR ID	NAG	PSNL			2017			
		Day	Eve	Night	Day	Eve	Night 1	Night 2
163	K	35	35	35	**39**	44	**43**	32
149	L	37	37	37	**39**	38	36	26
150	L	37	37	37	36	36	33	20
151	L	37	37	37	37	37	35	20
164	L	37	37	37	**39**	39	37	26
165	L	37	37	37	35	36	33	25
167	L	37	37	37	**39**	41	**38**	32
168	L	37	37	37	**40**	41	**39**	33
169	L	37	37	37	**39**	40	**38**	31
171	M	39	39	38	37	41	**40**	30
174	M	39	39	38	38	40	**39**	27
170	N	45	42	39	33	39	38	26
172	N	45	42	39	36	39	39	30
173	N	45	42	39	36	40	**40**	31
175	N	45	42	39	40	46	**46**	35
176	N	45	42	39	40	45	**45**	34
177	N	45	42	39	36	42	**42**	27
178	N	45	42	39	37	41	**41**	31
179	N	45	42	39	38	42	**42**	32
180	O	35	35	35	**38**	42	**43**	34
181	O	35	35	35	35	38	**39**	31

Notes:

1. Results in bold type exceed PSNL.

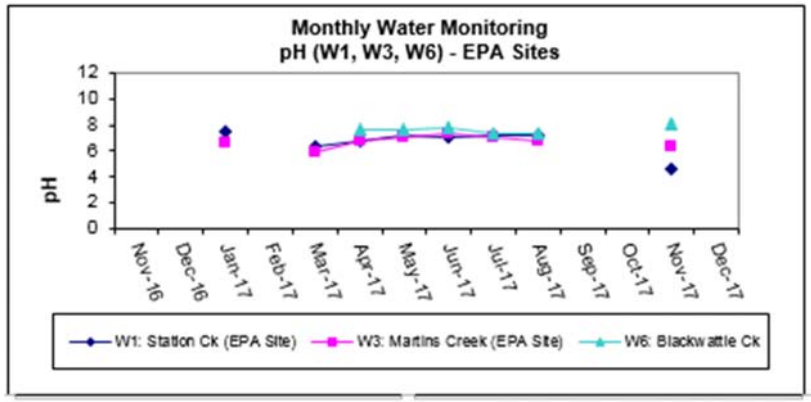
Appendix 2 Rix's Creek Complex Surface Water Sampling Results

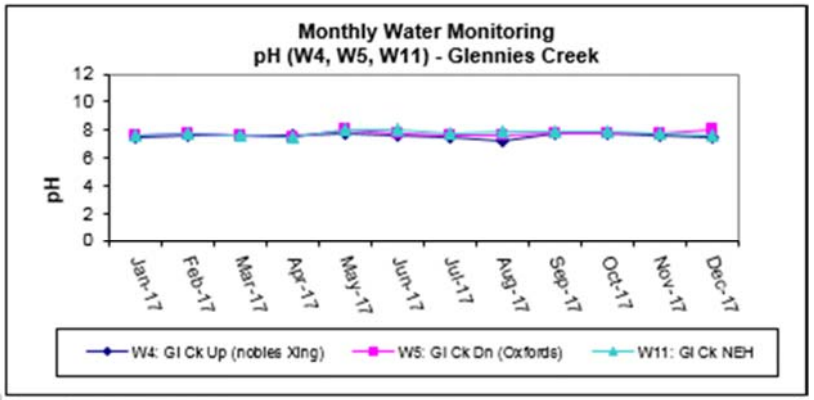
Date Sampled	Month Sampled	W1: Station Ck (EPA Site)				W3: Martins Creek (EPA Site)				W4: Gl Ck Up (nobles Xing)				W5: Gl Ck Dn (Oxfords)				W6: Blackwattle Ck			
		pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
10/01/2017	Jan-17	7.5	743	67	603	6.6	183	131	1250	7.5	246	13	162	7.6	255	11	182				
8/02/2017	Feb-17									7.7	237	6	220	7.8	211	6	149				
8/03/2017	Mar-17	6.3	727	75	536	5.9	557	116	469	7.6	293	14	149	7.6	346	22	199				
6/04/2017	Apr-17	6.8	179	79	242	6.8	109	47	211	7.6	369	29	285	7.5	335	38	273	7.6	475	62	409
15/05/2017	May-17	7.2	422	51	303	7.1	293	15	272	7.8	415	5	224	8	464	7	270	7.6	2050	4	2480
15/06/2017	Jun-17	7.1	666	59	463	7.3	182	39	559	7.7	670	10	362	7.8	705	6	388	7.8	2370	9	1290
19/07/2017	Jul-17	7.2	658	118	516	7.1	256	23	677	7.5	698	3	394	7.7	747	3	458	7.4	4840	19	2960
17/08/2017	Aug-17	7.2	751	73	619	6.8	295	28	963	7.3	278	6	195	7.6	290	5	224	7.4	7480	117	5010
21/09/2017	Sep-17									7.8	268	6	190	7.8	261	5	187				
20/10/2017	Oct-17									7.75	263	11	168	7.8	266	24	179				
16/11/2017	Nov-17	4.6	1308	27	1150	6.4	348	225	676	7.6	217	10	171	7.8	221	12	161	8.1	11170	142	8000
13/12/2017	Dec-17									7.5	207	14	158	8	215	12	152				
HISTORICAL AVERA		6.7	682	69	554	6.8	278	78	635	7.6	347	11	223	7.8	360	13	235	7.7	4730.8	58.8	3358.2
	MIN	4.6	179.0	27.0	242.0	5.9	109.0	15.0	211.0	7.3	207.0	3.0	149.0	7.5	211.0	3.0	149.0	7.4	475.0	4.0	409.0
	MAX	7.5	1308.0	118.0	1150.0	7.3	557.0	225.0	1250.0	7.8	698.0	29.0	394.0	8.0	747.0	38.0	458.0	8.1	11170.0	142.0	8000.0
	SD	0.9	321.6	26.0	275.7	0.5	136.6	73.5	345.2	0.1	168.5	6.9	81.7	0.2	185.3	10.4	97.8	0.3	3997.6	59.0	2763.3

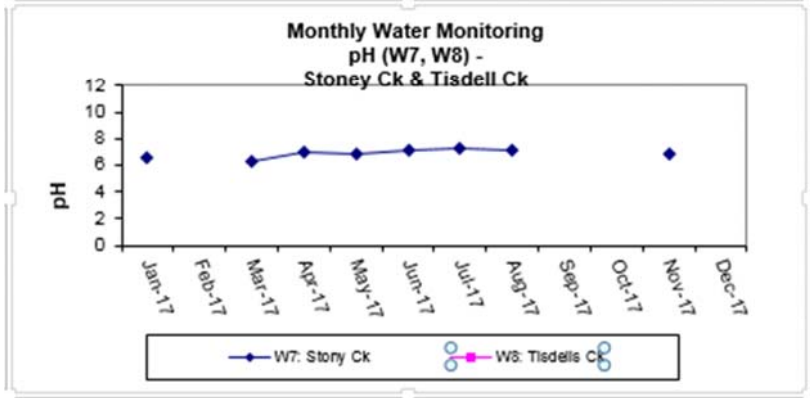
Date Sampled	Month Sampled	W7: Stony Ck				W10: Dam C4 (EPA Site)					W11: Gl Ck NEH				W12: Dam C1				W13: Dam C6			
		pH	EC uS/cm	TSS mg/l	TDS mg/l	Disch. Flow	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
10/01/2017	Jan-17	6.6	150	18	144		9.7	3120	7	1830	7.7	272	10	152	9	2360	15	1320	7.7	288	23	197
8/02/2017	Feb-17						9.5	3340	4	1960	7.8	215	11	142	8.9	2680	<1	1540	7.3	388	80	245
8/03/2017	Mar-17	6.3	237	134	358		9.4	3410	6	2060	7.7	399	14	243	9	2880	3	1680	7.2	399	78	258
6/04/2017	Apr-17	7	126	38	173		9.3	2970	14	1740	7.5	353	48	289	7.6	1466	12	939	7.1	176	36	169
15/05/2017	May-17	6.8	192	9	179		9.1	2740	10	1560	8	465	4	254	7.4	1496	9	849	7.2	196	11	192
15/06/2017	Jun-17	7.1	137	8	138		9.2	2700	6	1490	8.1	671	10	424	7.7	1523	11	878	7.5	227	8	180
19/07/2017	Jul-17	7.2	171	4	143		8.4	2700	3	1610	7.8	741	3	437	7.5	1582	5	938	7.6	226	7	167
17/08/2017	Aug-17	7.1	183	6	204		8.5	2750	12	1720	7.9	296	4	206	7.8	1768	4	1040	7.8	247	14	248
21/09/2017	Sep-17						9.2	2690	6	1640	7.9	270	3	186	8.1	1857	2	1000	7.9	281	24	204
20/10/2017	Oct-17						9.01	2990	36	1870	7.98	272	<5	175	8.39	2020	<5	1160	7.78	326	8	278
16/11/2017	Nov-17	6.8	307	11	331		9.4	2950	13	1870	7.8	230	8	196	9	1745	4	1200	9.4	282	19	202
13/12/2017	Dec-17						9.3	3140	16	1930	7.6	215	13	153	8.9	2240	7	1330	7.4	347	76	294
HISTORICAL AVERA		6.9	187.9	28.5	0.0	0.0	9.2	2958.3	11.1	1773.3	7.8	366.6	11.6	238.1	8.3	1968.1	7.2	1156.2	7.7	281.9	32.0	219.5
	MIN	6.3	126.0	4.0	138.0	0.0	8.4	2690.0	3.0	1490.0	7.5	215.0	3.0	142.0	7.4	1466.0	2.0	849.0	7.1	176.0	7.0	167.0
	MAX	7.2	307.0	134.0	358.0	0.0	9.7	3410.0	36.0	2060.0	8.1	741.0	48.0	437.0	9.0	2880.0	15.0	1680.0	9.4	399.0	80.0	294.0
	SD	0.3	59.5	44.0	87.0	0.0	0.4	253.4	8.9	175.2	0.2	176.0	12.7	100.2	0.7	476.1	4.4	267.2	0.6	72.1	29.0	43.3

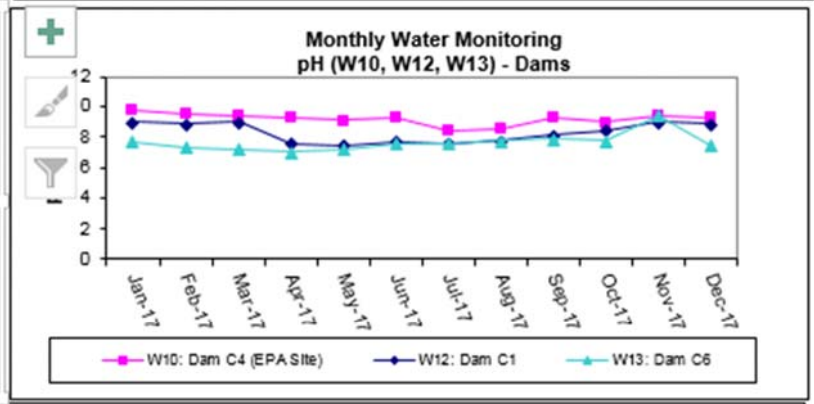
Date Sampled	Month Sampled	W14: Dam C3			W15: Dam C6A				W16: Dam C8				W17: Dam C2				W18: Dam C5				W19: Dam D1			
		EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
10/01/2017	Jan-17	2530	12	1510	7.7	387	12	281	8.7	5610	7	3820	8.6	950	3	572	7.6	291	6	210	9	8750	2	6100
8/02/2017	Feb-17	2720	16	1650	7.2	461	26	323	9	6130	362	4220	8.9	922	4	591	7.4	319	<1	205	8.8	9080	<1	6060
8/03/2017	Mar-17	2460	4	1430	7.1	405	81	305	8.9	5080	5	3410	8.8	1040	4	610	7.5	365	27	253	8.9	8890	3	6070
6/04/2017	Apr-17	1982	5	1170	6.8	156	101	231	8.7	4070	11	2690	7.7	866	12	547	6.9	153	38	185	9	7650	3	5040
15/05/2017	May-17	2160	6	1450	7.1	257	40	235	8.8	4230	28	3000	7.4	1017	5	547	7.3	197	8	193	8.9	8070	11	5370
15/06/2017	Jun-17	2300	6	1350	7.3	260	12	228	8.9	4290	18	2940	7.4	1034	6	619	7.4	240	5	193	8.7	7290	6	5540
19/07/2017	Jul-17	2280	6	1350	7.5	264	10	210	8.9	4320	47	2960	7.4	1079	4	621	7.6	243	7	153	7.9	8580	4	5910
17/08/2017	Aug-17	2460	5	1550	7.7	296	10	239	8.5	4490	22	3120	7.7	1180	9	714	7.7	269	8	238	8.2	8910	9	6230
21/09/2017	Sep-17	2620	9	1670	7.6	331	14	211	9	4850	8	3460	8.2	1211	2	715	8.1	294	8	165	8.6	9000	2	6170
20/10/2017	Oct-17	2570	6	1610	8.38	351	5	256	8.9	4520	16	3250	8.19	1290	<5	732	7.84	343	5	254	8.61	9740	24	6520
16/11/2017	Nov-17	2710	6	1790	9.3	258	12	168	8.7	4950	6	3450	8.4	1113	13	750	7.7	277	7	185	9.2	9080	36	6590
13/12/2017	Dec-17	2940	4	1880	7.2	327	11	253	8.9	5190	7	3640	8.3	1136	2	797	7.5	337	9	220	8.8	9530	11	6760
HISTORICAL AVERA		2477.7	7.1	1534.2	7.6	312.8	27.8	245.0	8.8	4810.8	44.8	3330.0	8.1	1069.8	5.8	651.3	7.5	277.3	11.6	204.5	8.7	8714.2	10.1	6030.0
	MIN	1982.0	4.0	1170.0	6.8	156.0	5.0	168.0	8.5	4070.0	5.0	2690.0	7.4	866.0	2.0	547.0	6.9	153.0	5.0	153.0	7.9	7290.0	2.0	5040.0
	MAX	2940.0	16.0	1880.0	9.3	461.0	101.0	323.0	9.0	6130.0	362.0	4220.0	8.9	1290.0	13.0	797.0	8.1	365.0	38.0	254.0	9.2	9740.0	36.0	6760.0
	SD	265.6	3.6	200.4	0.7	82.1	31.2	42.7	0.1	618.1	100.6	429.0	0.5	124.2	3.8	85.7	0.3	62.0	10.7	32.2	0.4	721.8	10.7	506.7

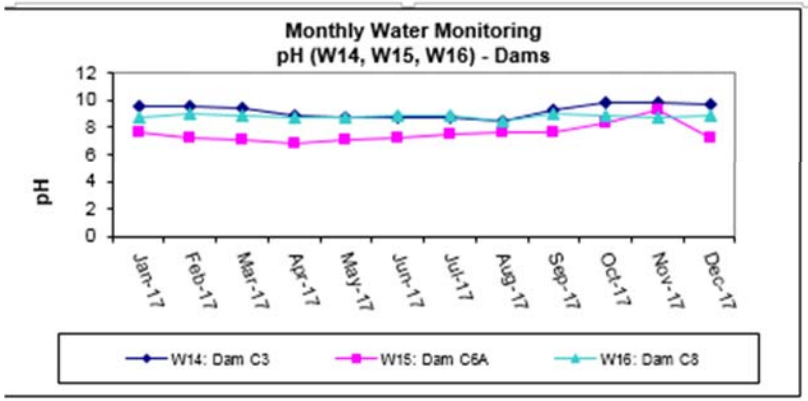
Date Sampled	Month Sampled	W20: North Dam 1				W21: North Dam 2			
		pH	EC uS/cm	TSS mg/l	TDS mg/l	pH	EC uS/cm	TSS mg/l	TDS mg/l
10/01/2017	Jan-17	9.1	10270	10	6760	8.6	1613	52	961
8/02/2017	Feb-17	9.4	7940	17	5120	9.1	2530	40	1520
8/03/2017	Mar-17	9.1	5160	12	3220	8.4	3050	15	1790
6/04/2017	Apr-17	8.8	5480	8	3250	8.3	2510	8	1470
15/05/2017	May-17	8.9	8240	16	5590	8.4	2870	4	1800
15/06/2017	Jun-17	8.8	8990	22	6010	8.7	2860	7	1690
19/07/2017	Jul-17	8.8	9470	15	6080	8.9	2860	10	1690
17/08/2017	Aug-17	8.7	9680	10	6890	8.5	3100	7	1940
21/09/2017	Sep-17	9.1	10020	11	7290	8.6	3510	7	2210
20/10/2017	Oct-17	9.6	5160	11	3160	8.8	3290	7	2020
16/11/2017	Nov-17	9.1	9830	28	6770	9.1	3810	24	2370
13/12/2017	Dec-17	8.9	9060	11	6120	9.4	3860	24	2440
HISTORICAL AVERA		9.0	8275.0	14.3	5521.7	8.7	2988.6	17.1	1825.1
	MIN	8.7	5160.0	8.0	3160.0	8.3	1613.0	4.0	961.0
	MAX	9.6	10270.0	28.0	7290.0	9.4	3860.0	52.0	2440.0
	SD	0.3	1937.8	5.8	1513.6	0.3	617.3	15.2	413.3

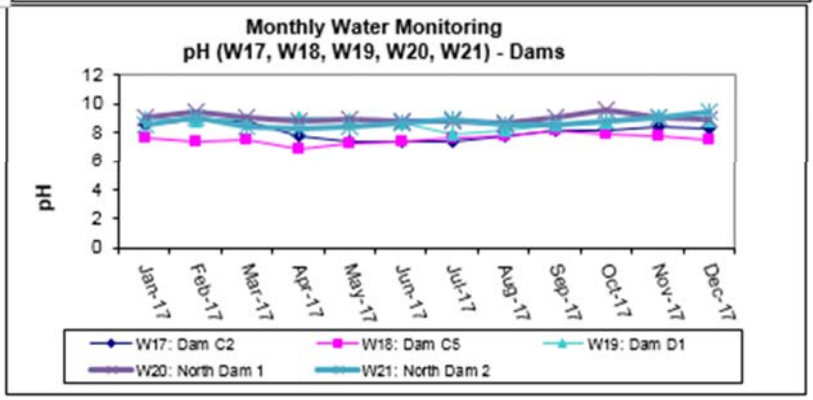

Monthly Water Monitoring
pH (W1, W3, W6) - EPA Sites
pH
W1: Station Ck (EPA Site)
W3: Martins Creek (EPA Site)
W6: Blackwattle Ck

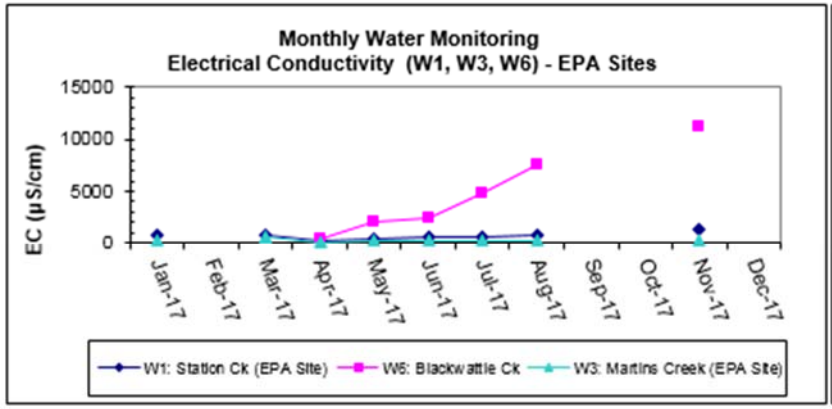

Monthly Water Monitoring
pH (W4, W5, W11) - Glennies Creek
pH
W4: Gl Ck Up (nobles Xing)
W5: Gl Ck Dn (Oxfords)
W11: Gl Ck NEH

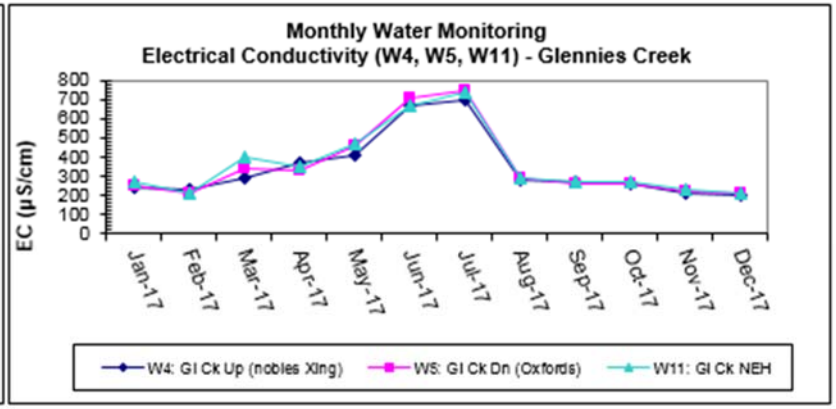

Monthly Water Monitoring
pH (W7, W8) -
Stoney Ck & Tisdell Ck
pH
W7: Stony Ck
W8: Tisdells Ck

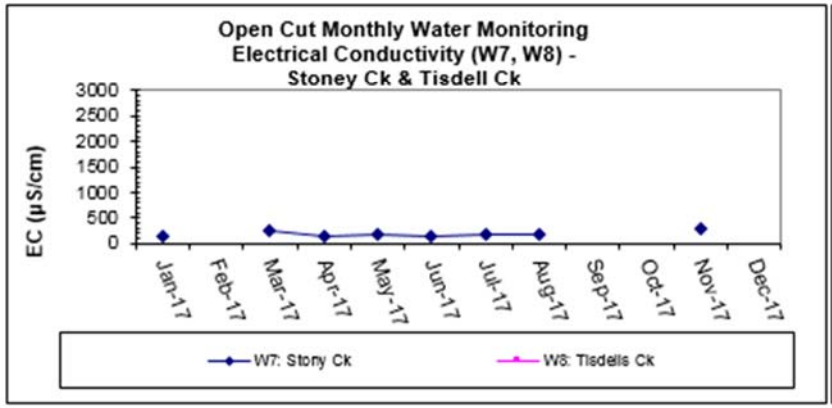

Monthly Water Monitoring
pH (W10, W12, W13) - Dams
W10: Dam C4 (EPA Site)
W12: Dam C1
W13: Dam C6

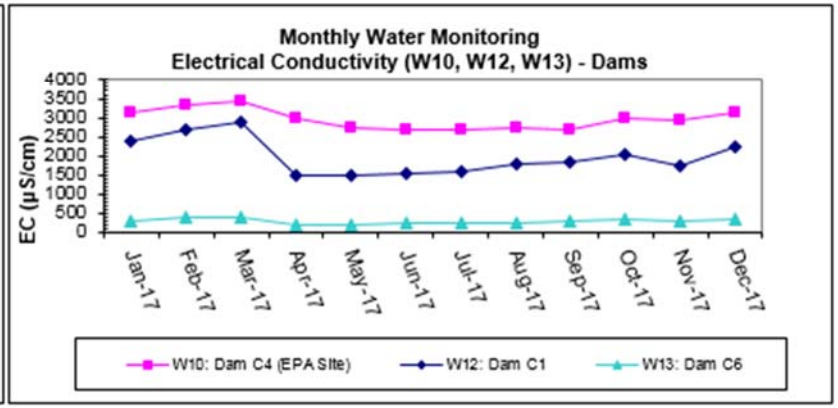

Monthly Water Monitoring
pH (W14, W15, W16) - Dams
pH
W14: Dam C3
W15: Dam C6A
W16: Dam C8

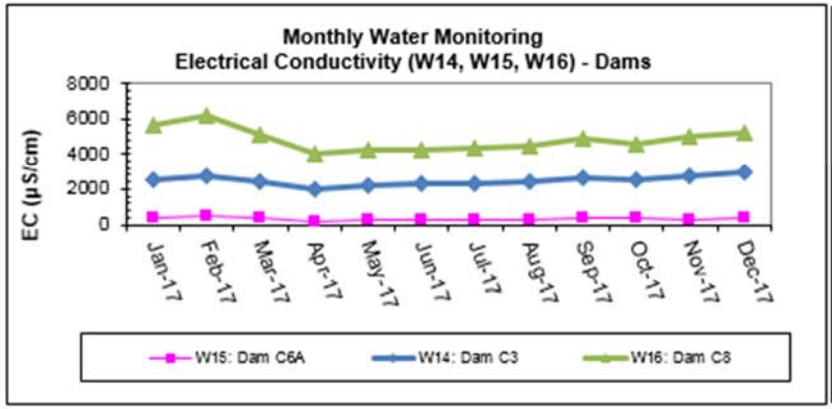

Monthly Water Monitoring
pH (W17, W18, W19, W20, W21) - Dams
pH
W17: Dam C2
W18: Dam C5
W19: Dam D1
W20: North Dam 1
W21: North Dam 2

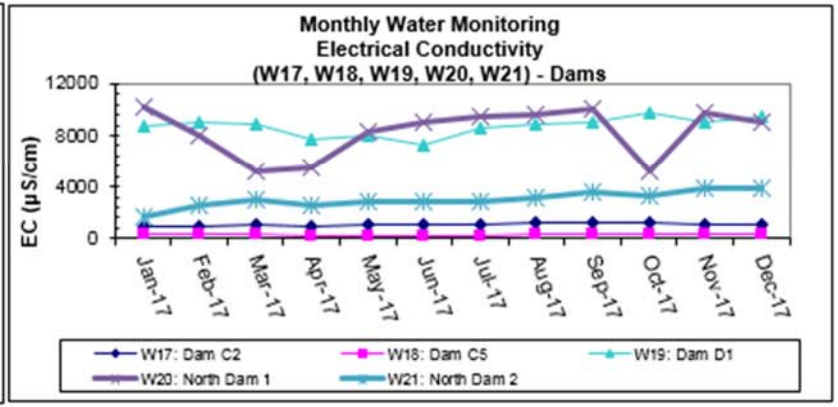

Monthly Water Monitoring
Electrical Conductivity (W1, W3, W6) - EPA Sites
EC (µS/cm)
15000
10000
5000
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W1: Station Ck (EPA Site)
W6: Blackwattle Ck
W3: Martins Creek (EPA Site)

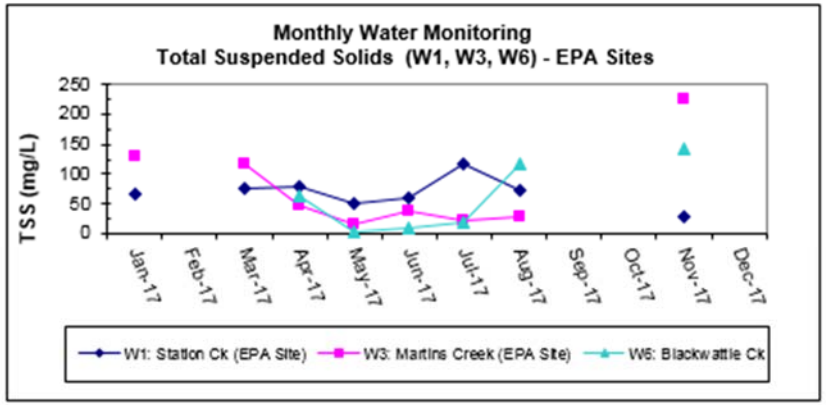

Monthly Water Monitoring
Electrical Conductivity (W4, W5, W11) - Glennies Creek
EC (µS/cm)
800
700
600
500
400
300
200
100
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W4: Gl Ck Up (nobles Xing)
W5: Gl Ck Dn (Oxfords)
W11: Gl Ck NEH

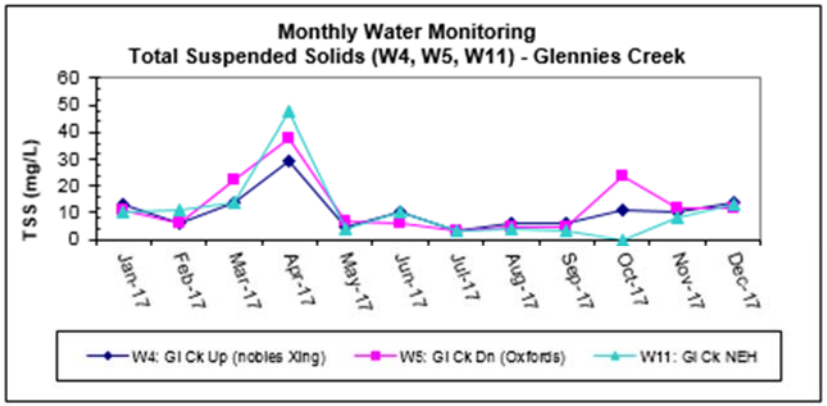

Open Cut Monthly Water Monitoring
Electrical Conductivity (W7, W8) -
Stoney Ck & Tisdell Ck
EC (µS/cm)
3000
2500
2000
1500
1000
500
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W7: Stony Ck
W8: Tisdells Ck

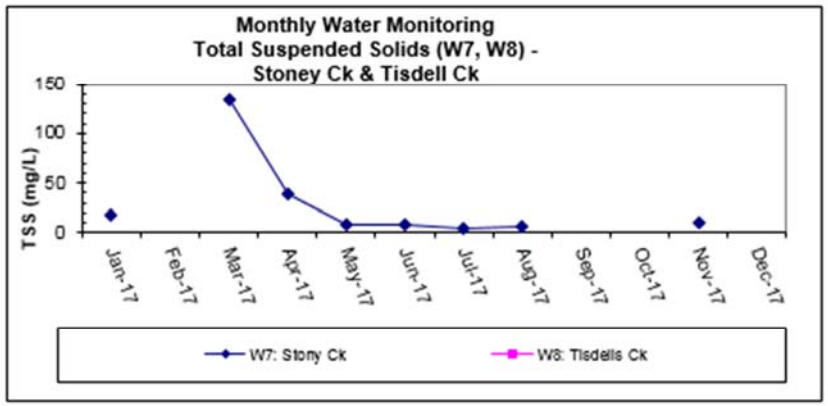

Monthly Water Monitoring
Electrical Conductivity (W10, W12, W13) - Dams
EC (µS/cm)
4000
3500
3000
2500
2000
1500
1000
500
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W10: Dam C4 (EPA Site)
W12: Dam C1
W13: Dam C6

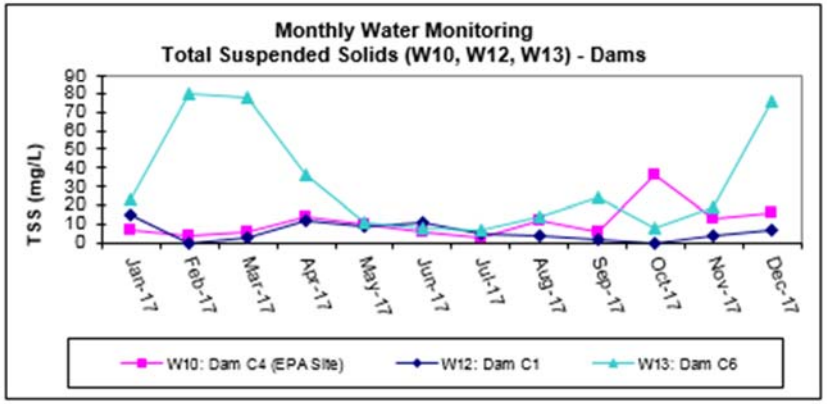

Monthly Water Monitoring
Electrical Conductivity (W14, W15, W16) - Dams
EC (µS/cm)
8000
6000
4000
2000
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W15: Dam C6A
W14: Dam C3
W16: Dam C8

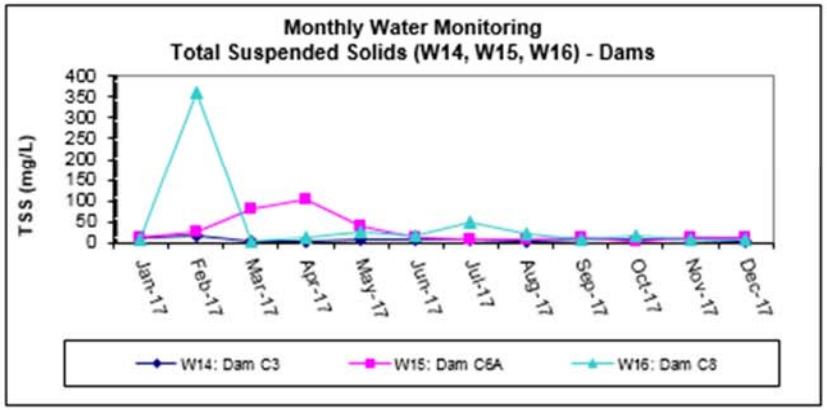

Monthly Water Monitoring
Electrical Conductivity
(W17, W18, W19, W20, W21) - Dams
EC (µS/cm)
12000
8000
4000
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W17: Dam C2
W18: Dam C5
W19: Dam D1
W20: North Dam 1
W21: North Dam 2

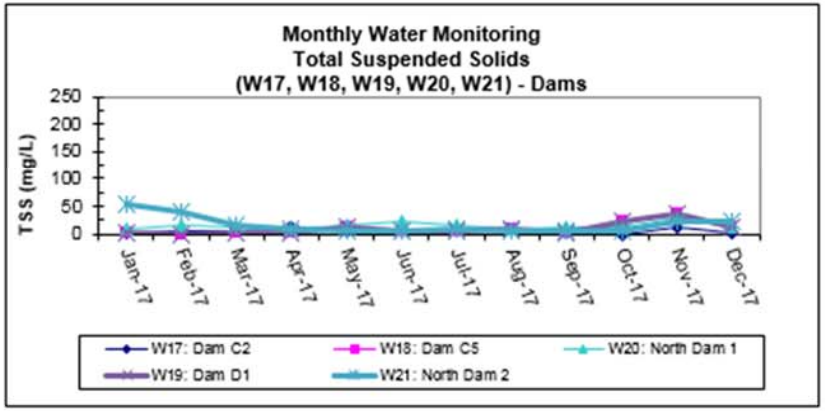

Monthly Water Monitoring
Total Suspended Solids (W1, W3, W6) - EPA Sites
TSS (mg/L)
250
200
150
100
50
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W1: Station Ck (EPA Site)
W3: Martins Creek (EPA Site)
W6: Blackwattle Ck

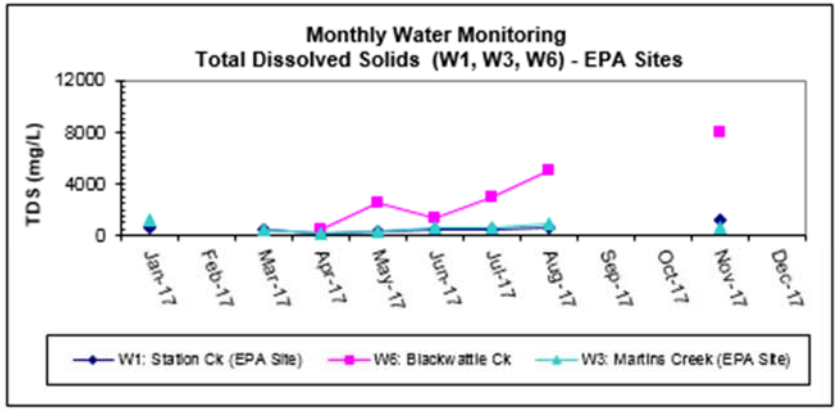

Monthly Water Monitoring
Total Suspended Solids (W4, W5, W11) - Glennies Creek
TSS (mg/L)
60
50
40
30
20
10
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W4: Gl Ck Up (nobles Xing)
W5: Gl Ck Dn (Oxfords)
W11: Gl Ck NEH

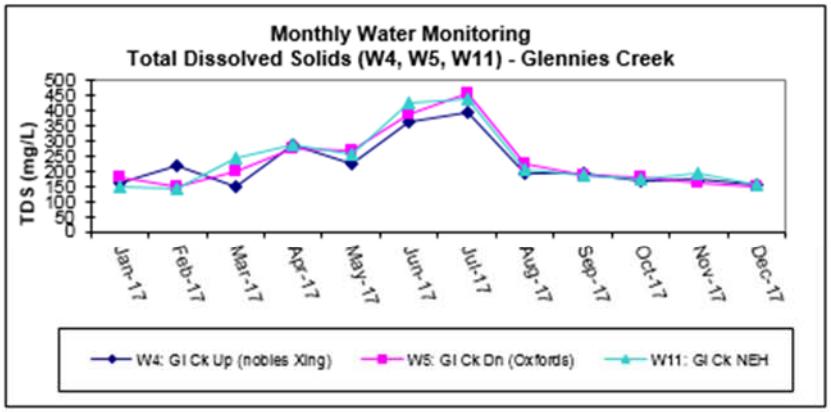

Monthly Water Monitoring
Total Suspended Solids (W7, W8) -
Stoney Ck & Tisdell Ck
TSS (mg/L)
150
100
50
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W7: Stony Ck
W8: Tisdells Ck

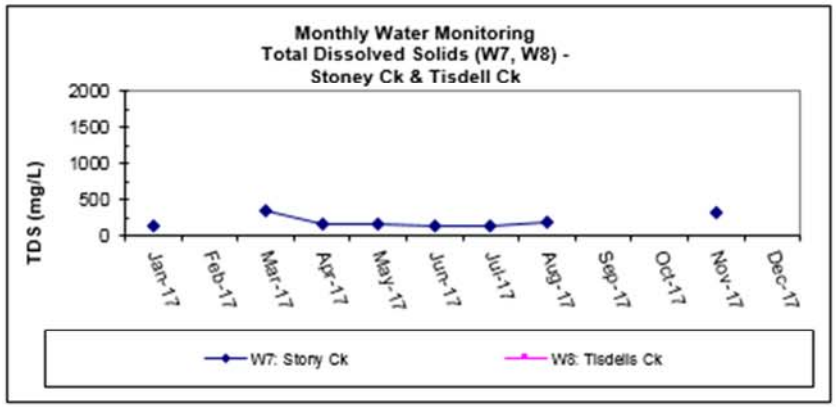

Monthly Water Monitoring
Total Suspended Solids (W10, W12, W13) - Dams
TSS (mg/L)
90
80
70
60
50
40
30
20
10
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W10: Dam C4 (EPA Site)
W12: Dam C1
W13: Dam C6

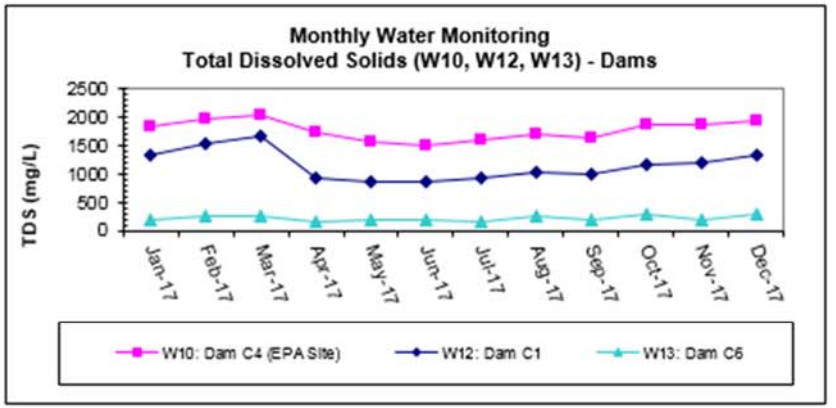

Monthly Water Monitoring
Total Suspended Solids (W14, W15, W16) - Dams
TSS (mg/L)
400
350
300
250
200
150
100
50
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W14: Dam C3
W15: Dam C6A
W16: Dam C8

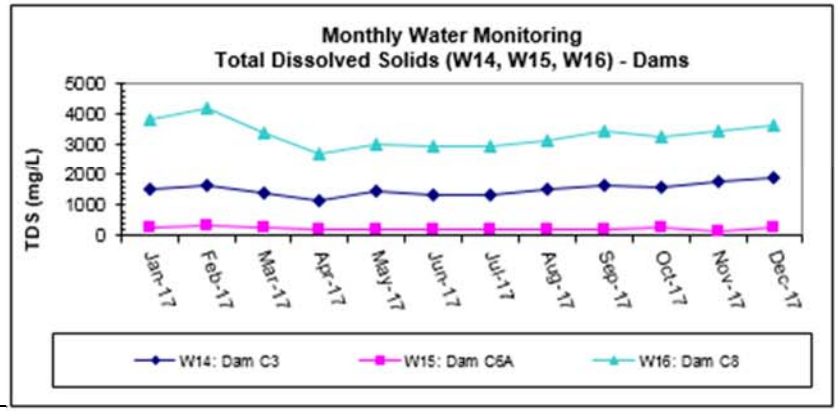

Monthly Water Monitoring
Total Suspended Solids
(W17, W18, W19, W20, W21) - Dams
TSS (mg/L)
250
200
150
100
50
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W17: Dam C2
W18: Dam C5
W20: North Dam 1
W19: Dam D1
W21: North Dam 2

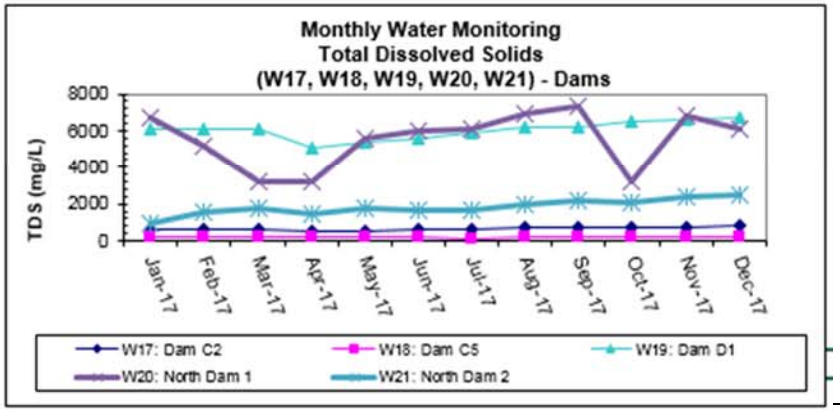

Monthly Water Monitoring
Total Dissolved Solids (W1, W3, W6) - EPA Sites
TDS (mg/L)
12000
8000
4000
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W1: Station Ck (EPA Site)
W6: Blackwattle Ck
W3: Martins Creek (EPA Site)

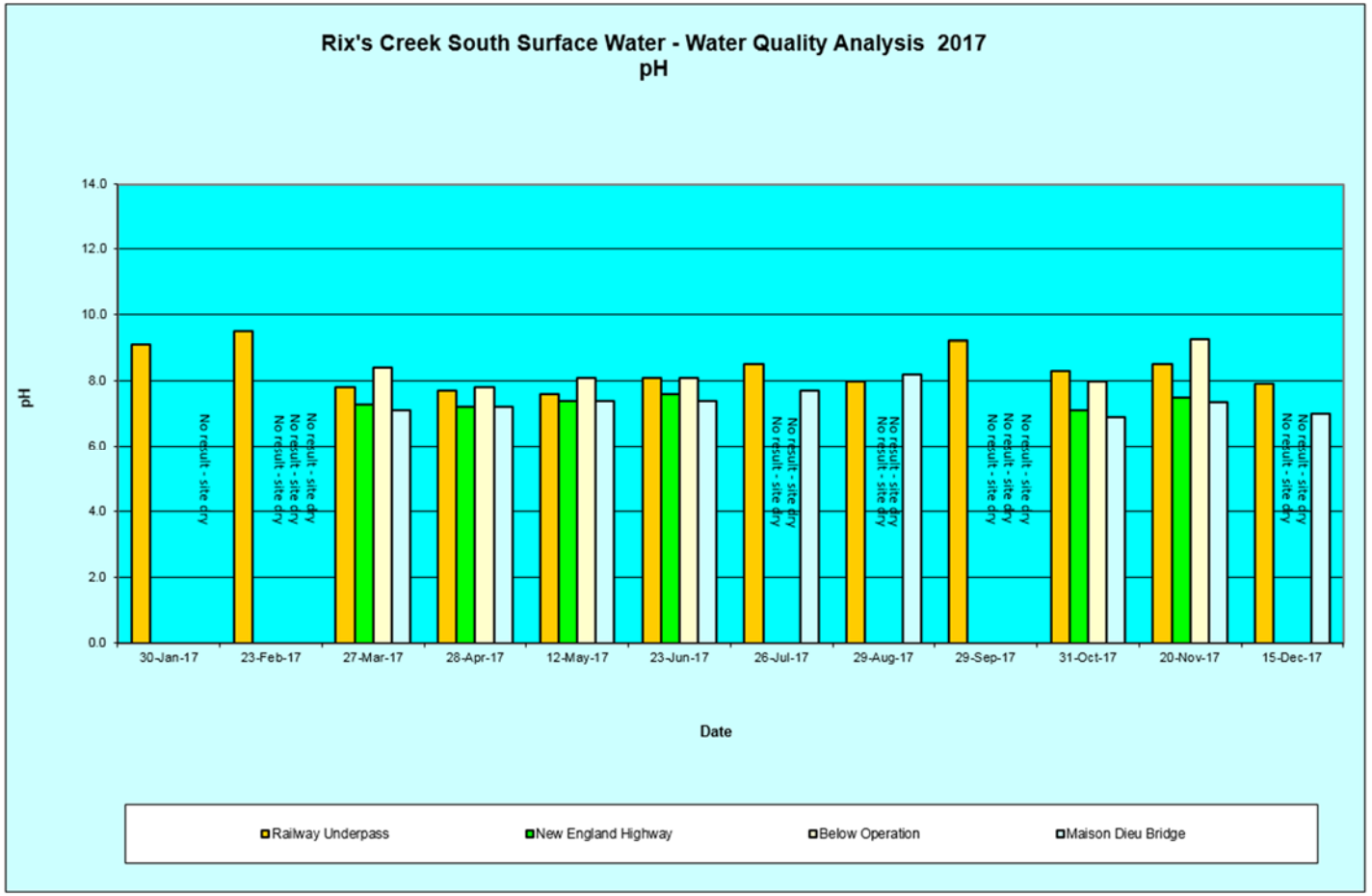

Monthly Water Monitoring
Total Dissolved Solids (W4, W5, W11) - Glennies Creek
TDS (mg/L)
500
450
400
350
300
250
200
150
100
50
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W4: Gl Ck Up (nobles Xing)
W5: Gl Ck Dn (Oxfords)
W11: Gl Ck NEH

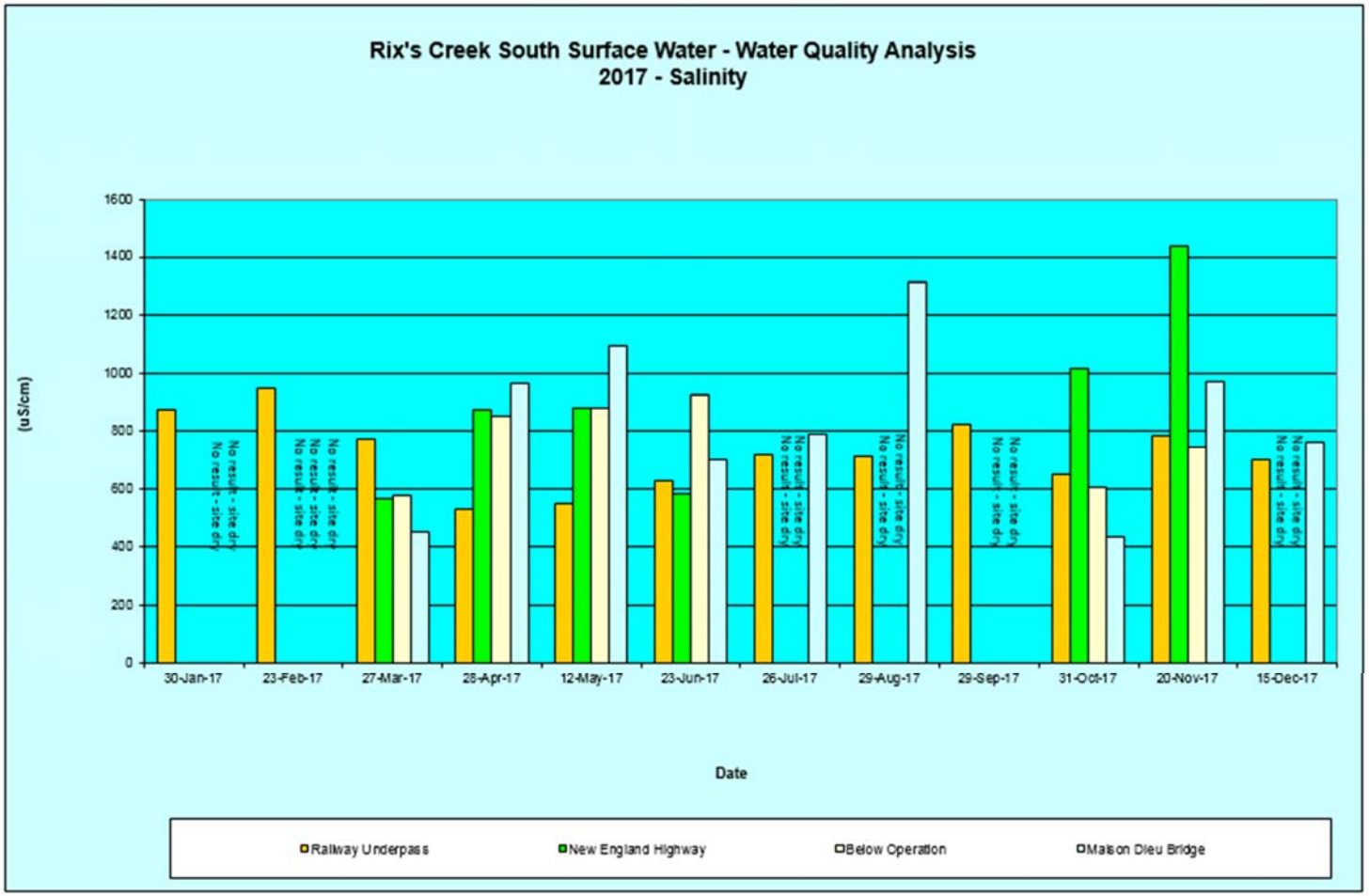

Monthly Water Monitoring
Total Dissolved Solids (W7, W8) -
Stoney Ck & Tisdell Ck
TDS (mg/L)
2000
1500
1000
500
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W7: Stony Ck
W8: Tisdells Ck

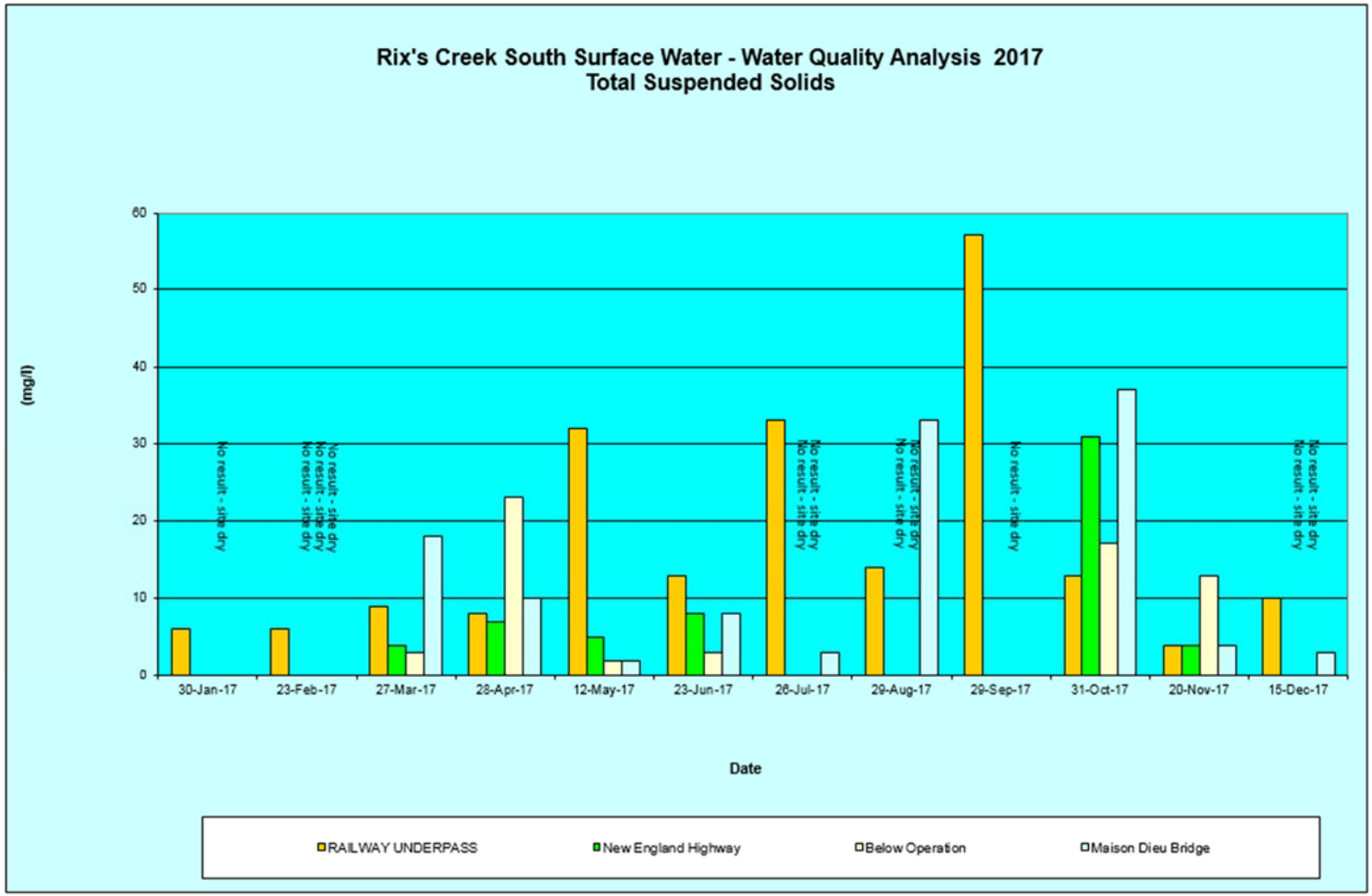

Monthly Water Monitoring
Total Dissolved Solids (W10, W12, W13) - Dams
TDS (mg/L)
2500
2000
1500
1000
500
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W10: Dam C4 (EPA Site)
W12: Dam C1
W13: Dam C6

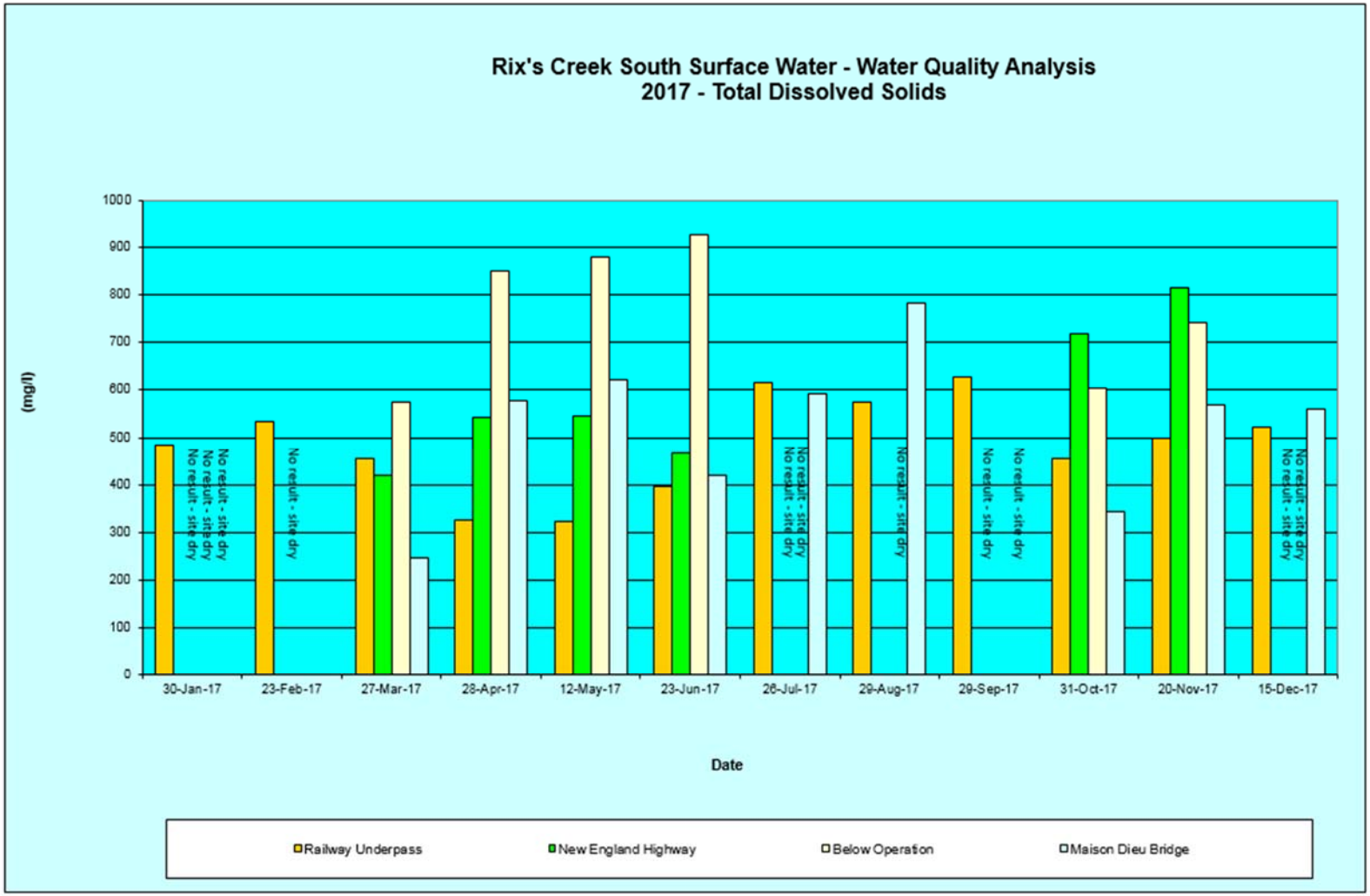

Monthly Water Monitoring
Total Dissolved Solids (W14, W15, W16) - Dams
TDS (mg/L)
5000
4000
3000
2000
1000
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W14: Dam C3
W15: Dam C6A
W16: Dam C8

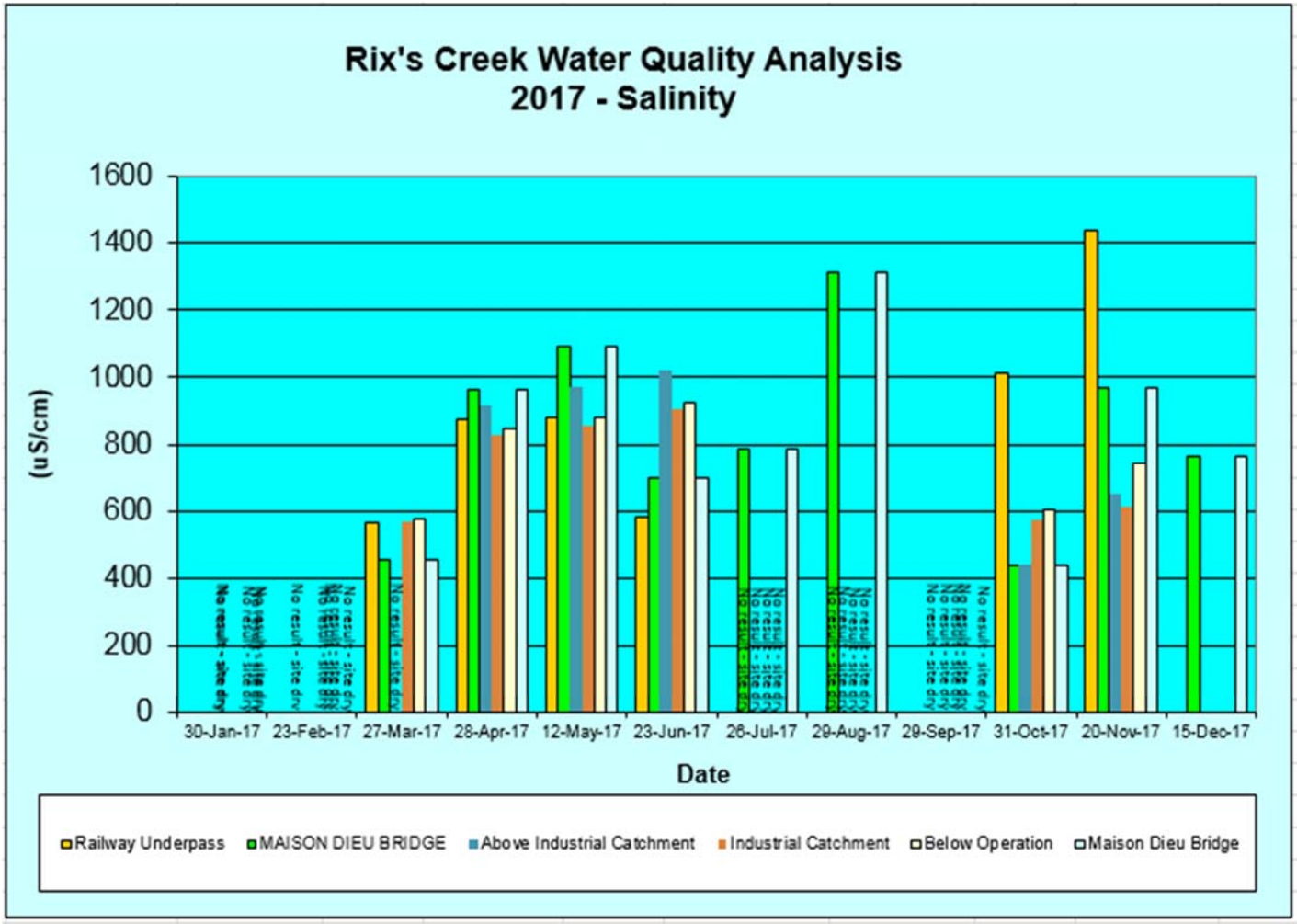

Monthly Water Monitoring
Total Dissolved Solids
(W17, W18, W19, W20, W21) - Dams
TDS (mg/L)
8000
6000
4000
2000
0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
W17: Dam C2
W18: Dam C5
W19: Dam D1
W20: North Dam 1
W21: North Dam 2


Rix's Creek South Surface Water - Water Quality Analysis 2017
pH
pH
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
No result - site dry
30-Jan-17
23-Feb-17
27-Mar-17
28-Apr-17
12-May-17
23-Jun-17
26-Jul-17
29-Aug-17
29-Sep-17
31-Oct-17
20-Nov-17
15-Dec-17
Date
Railway Underpass
New England Highway
Below Operation
Maison Dieu Bridge


Rix's Creek South Surface Water - Water Quality Analysis
2017 - Salinity
(uS/cm)
1600
1400
1200
1000
800
600
400
200
0
No result - site dry
30-Jan-17
23-Feb-17
27-Mar-17
28-Apr-17
12-May-17
23-Jun-17
26-Jul-17
29-Aug-17
29-Sep-17
31-Oct-17
20-Nov-17
15-Dec-17
Date
Railway Underpass
New England Highway
Below Operation
Maison Dieu Bridge

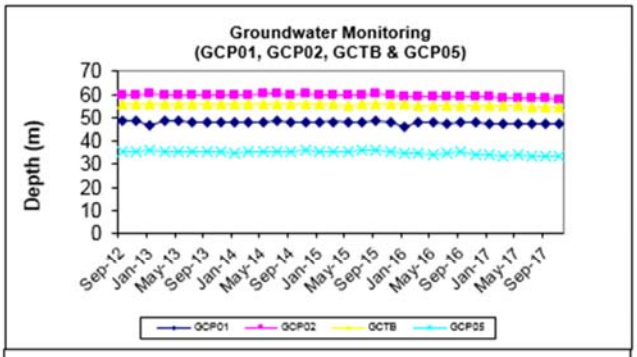

Rix's Creek South Surface Water - Water Quality Analysis 2017
Total Suspended Solids
(mg/l)
60
50
40
30
20
10
0
No result - site dry
30-Jan-17
23-Feb-17
27-Mar-17
28-Apr-17
12-May-17
23-Jun-17
26-Jul-17
29-Aug-17
29-Sep-17
31-Oct-17
20-Nov-17
15-Dec-17
Date
RAILWAY UNDERPASS
New England Highway
Below Operation
Maison Dieu Bridge

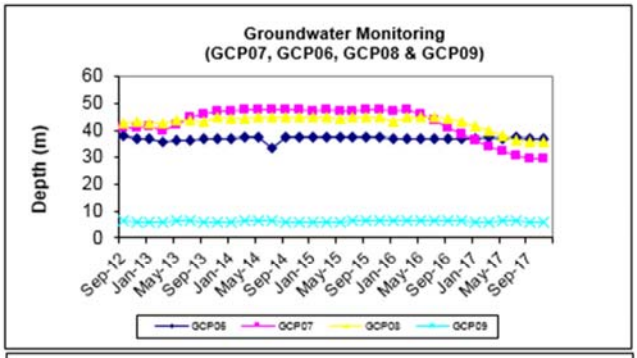

Rix's Creek South Surface Water - Water Quality Analysis
2017 - Total Dissolved Solids
(mg/l)
1000
900
800
700
600
500
400
300
200
100
0
No result - site dry
30-Jan-17
23-Feb-17
27-Mar-17
28-Apr-17
12-May-17
23-Jun-17
26-Jul-17
29-Aug-17
29-Sep-17
31-Oct-17
20-Nov-17
15-Dec-17
Date
Railway Underpass
New England Highway
Below Operation
Maison Dieu Bridge

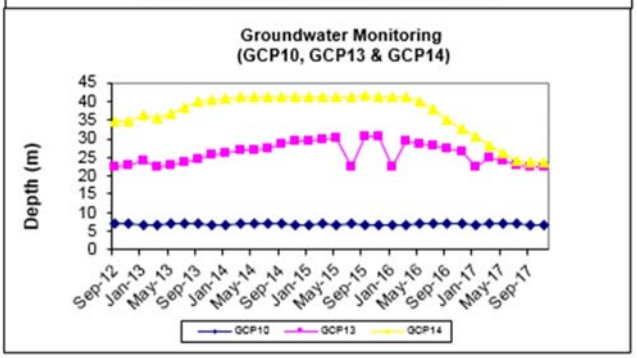

Rix's Creek Water Quality Analysis
2017 - Salinity
(uS/cm)
1600
1400
1200
1000
800
600
400
200
0
30-Jan-17
23-Feb-17
27-Mar-17
28-Apr-17
12-May-17
23-Jun-17
26-Jul-17
29-Aug-17
29-Sep-17
31-Oct-17
20-Nov-17
15-Dec-17
Date
Railway Underpass
MAISON DIEU BRIDGE
Above Industrial Catchment
Industrial Catchment
Below Operation
Maison Dieu Bridge

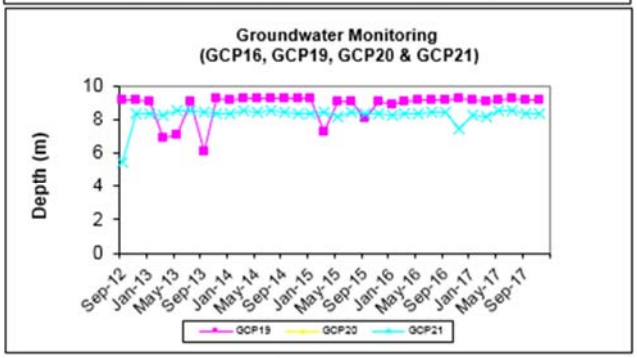
Appendix 3 Rix's Creek Mine Ground Water Sampling Results

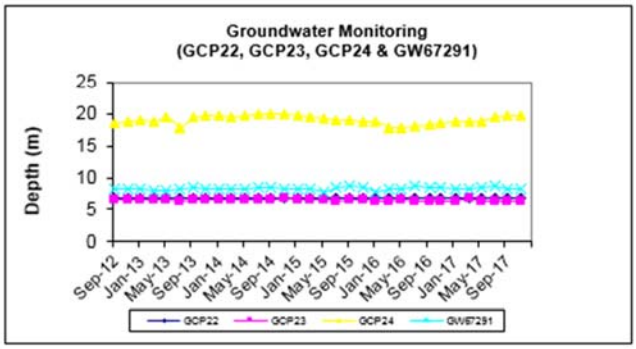
RCN Ground Waters

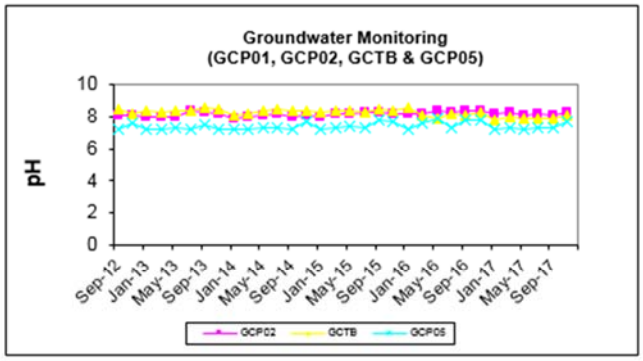


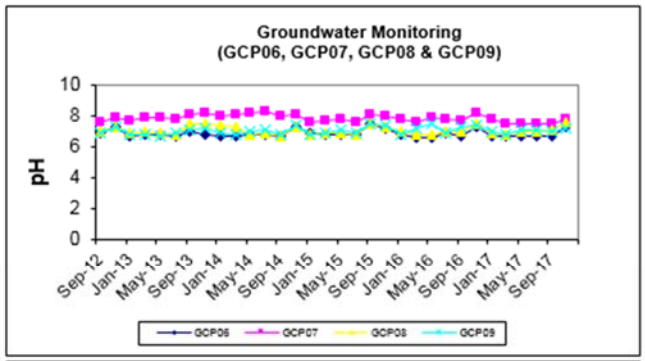


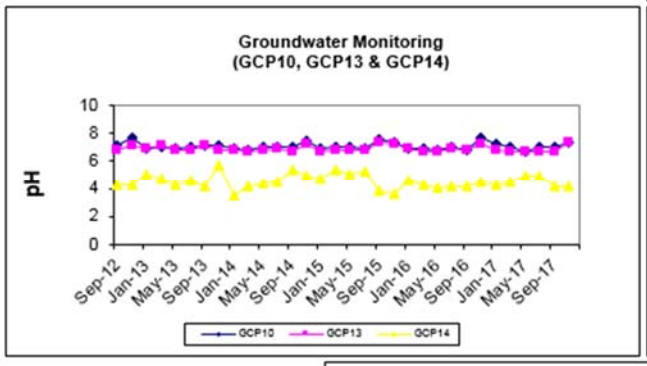


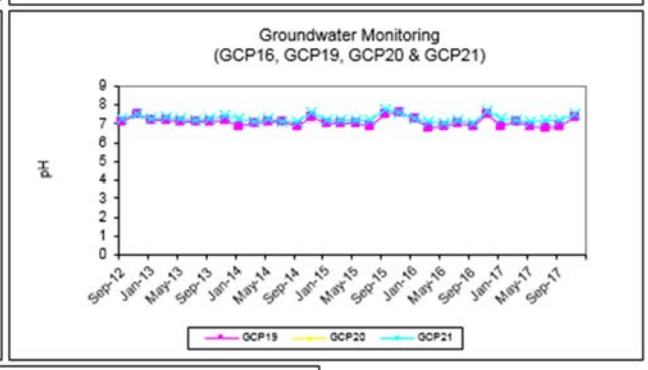


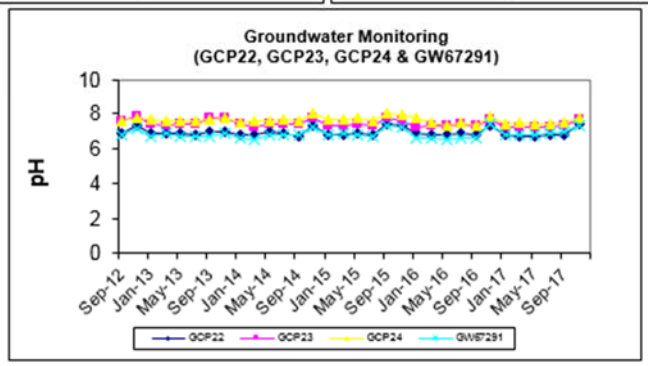


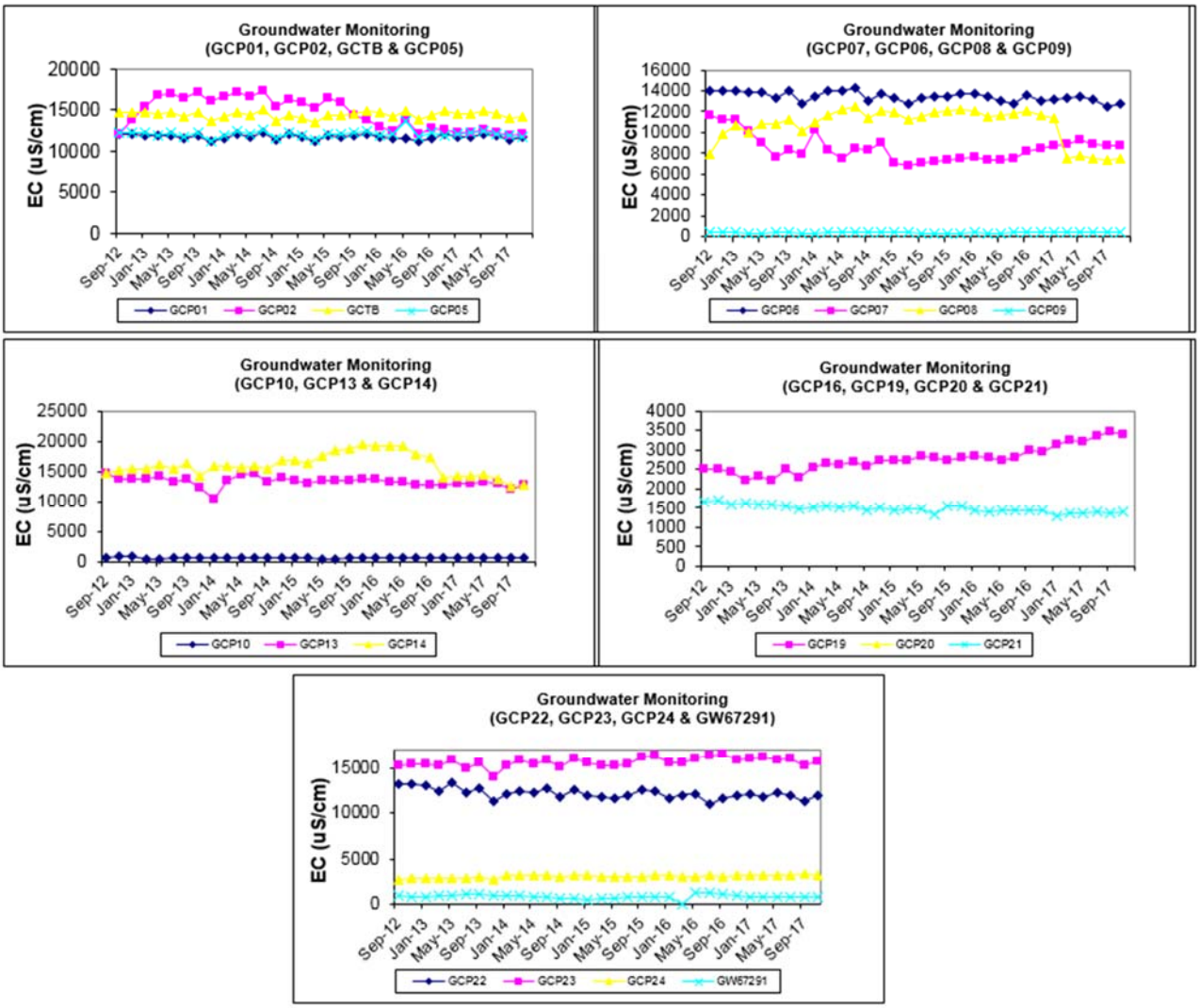

Groundwater Monitoring
(GCP01, GCP02, GCTB & GCP05)
pH
GCP02
GCTB
GCP05

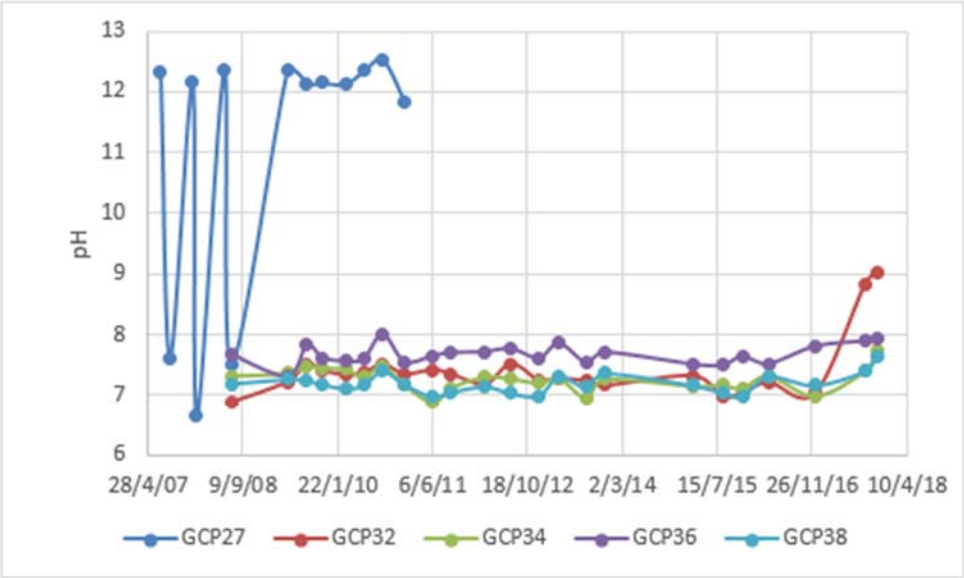

Groundwater Monitoring
(GCP06, GCP07, GCP08 & GCP09)
pH
GCP06
GCP07
GCP08
GCP09

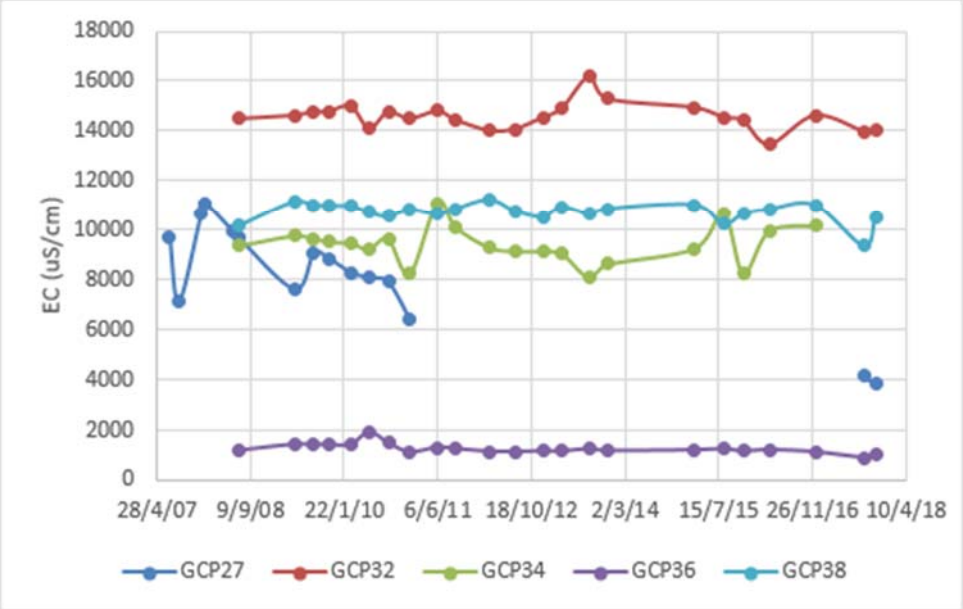

Groundwater Monitoring
(GCP10, GCP13 & GCP14)
pH
GCP10
GCP13
GCP14

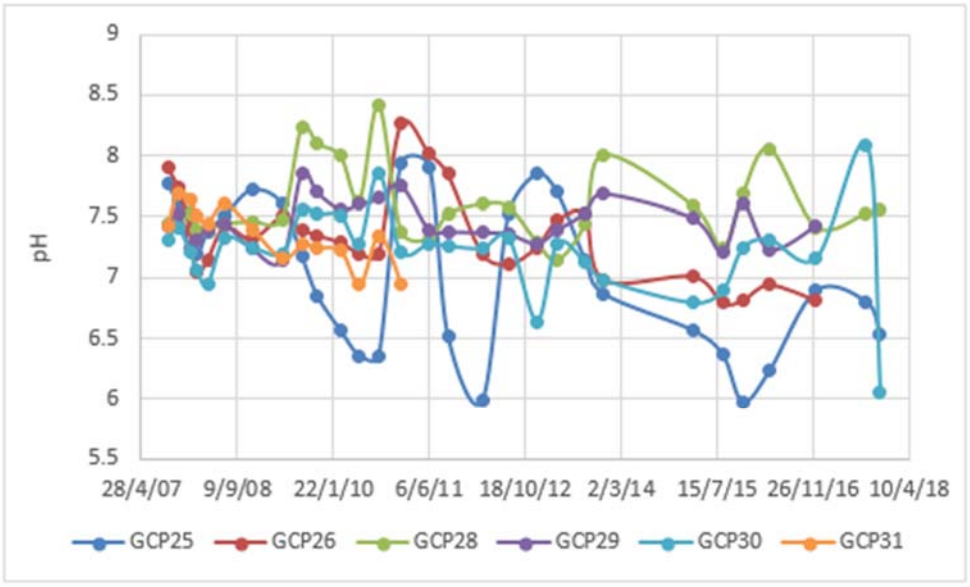

Groundwater Monitoring
(GCP16, GCP19, GCP20 & GCP21)
pH
GCP19
GCP20
GCP21

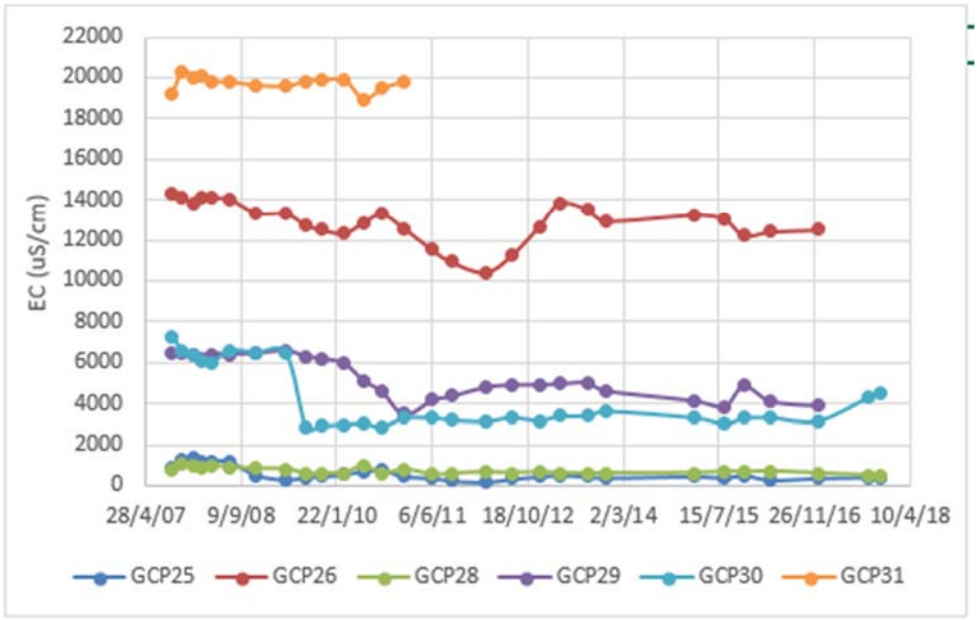

Groundwater Monitoring
(GCP22, GCP23, GCP24 & GW67291)
pH
GCP22
GCP23
GCP24
GW67291

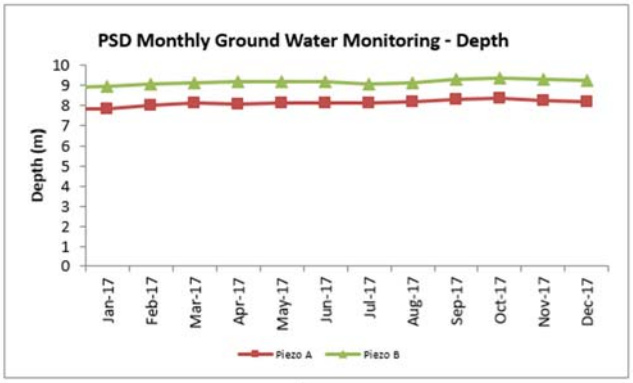

Groundwater Monitoring
(GCP01, GCP02, GCTB & GCP05)
EC (uS/cm)
GCP01
GCP02
GCTB
GCP05
Groundwater Monitoring
(GCP07, GCP06, GCP08 & GCP09)
EC (uS/cm)
GCP06
GCP07
GCP08
GCP09
Groundwater Monitoring
(GCP10, GCP13 & GCP14)
EC (uS/cm)
GCP10
GCP13
GCP14
Groundwater Monitoring
(GCP16, GCP19, GCP20 & GCP21)
EC (uS/cm)
GCP19
GCP20
GCP21
Groundwater Monitoring
(GCP22, GCP23, GCP24 & GW67291)
EC (uS/cm)
GCP22
GCP23
GCP24
GW67291

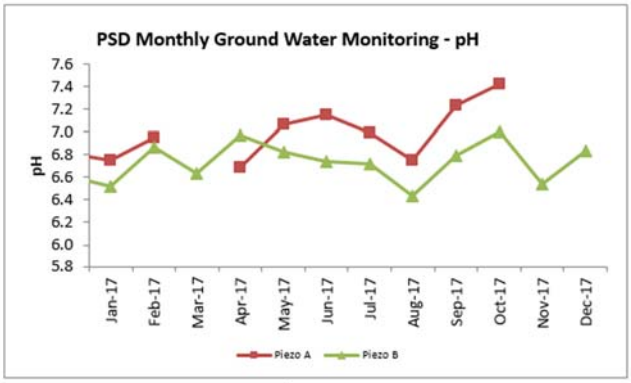

pH
13
12
11
10
9
8
7
6
28/4/07
9/9/08
22/1/10
6/6/11
18/10/12
2/3/14
15/7/15
26/11/16
10/4/18
GCP27
GCP32
GCP34
GCP36
GCP38

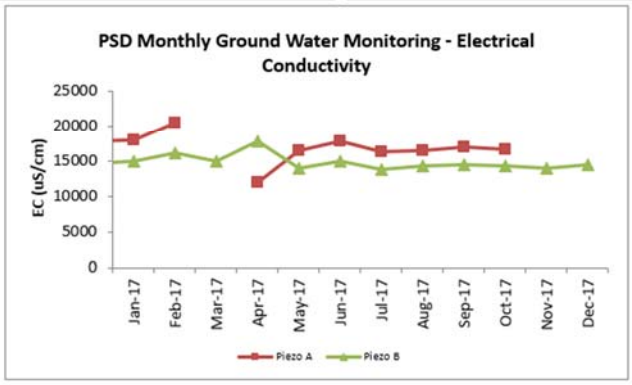

EC (uS/cm)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
28/4/07
9/9/08
22/1/10
6/6/11
18/10/12
2/3/14
15/7/15
26/11/16
10/4/18
GCP27
GCP32
GCP34
GCP36
GCP38


pH
9
8.5
8
7.5
7
6.5
6
5.5
28/4/07
9/9/08
22/1/10
6/6/11
18/10/12
2/3/14
15/7/15
26/11/16
10/4/18
GCP25
GCP26
GCP28
GCP29
GCP30
GCP31

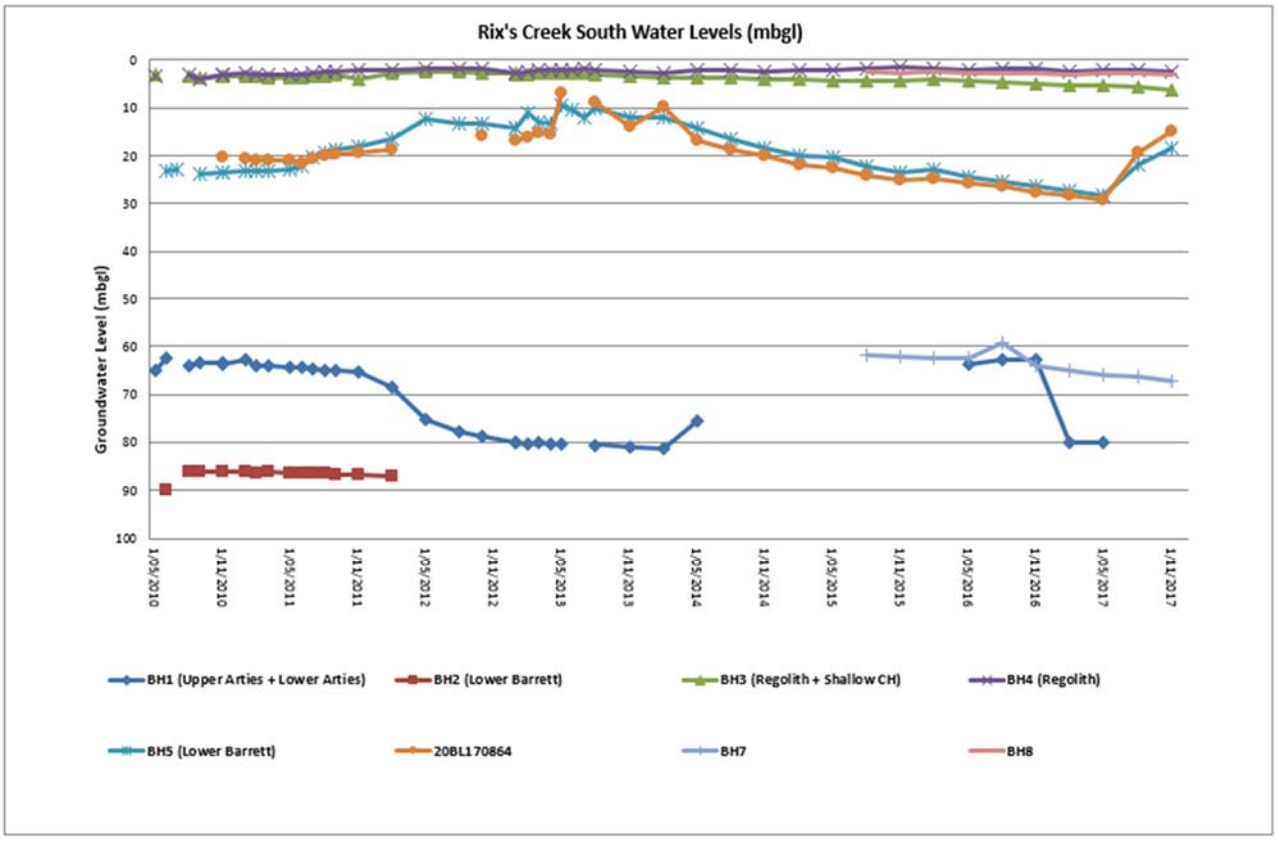

EC (uS/cm)
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
28/4/07
9/9/08
22/1/10
6/6/11
18/10/12
2/3/14
15/7/15
26/11/16
10/4/18
GCP25
GCP26
GCP28
GCP29
GCP30
GCP31

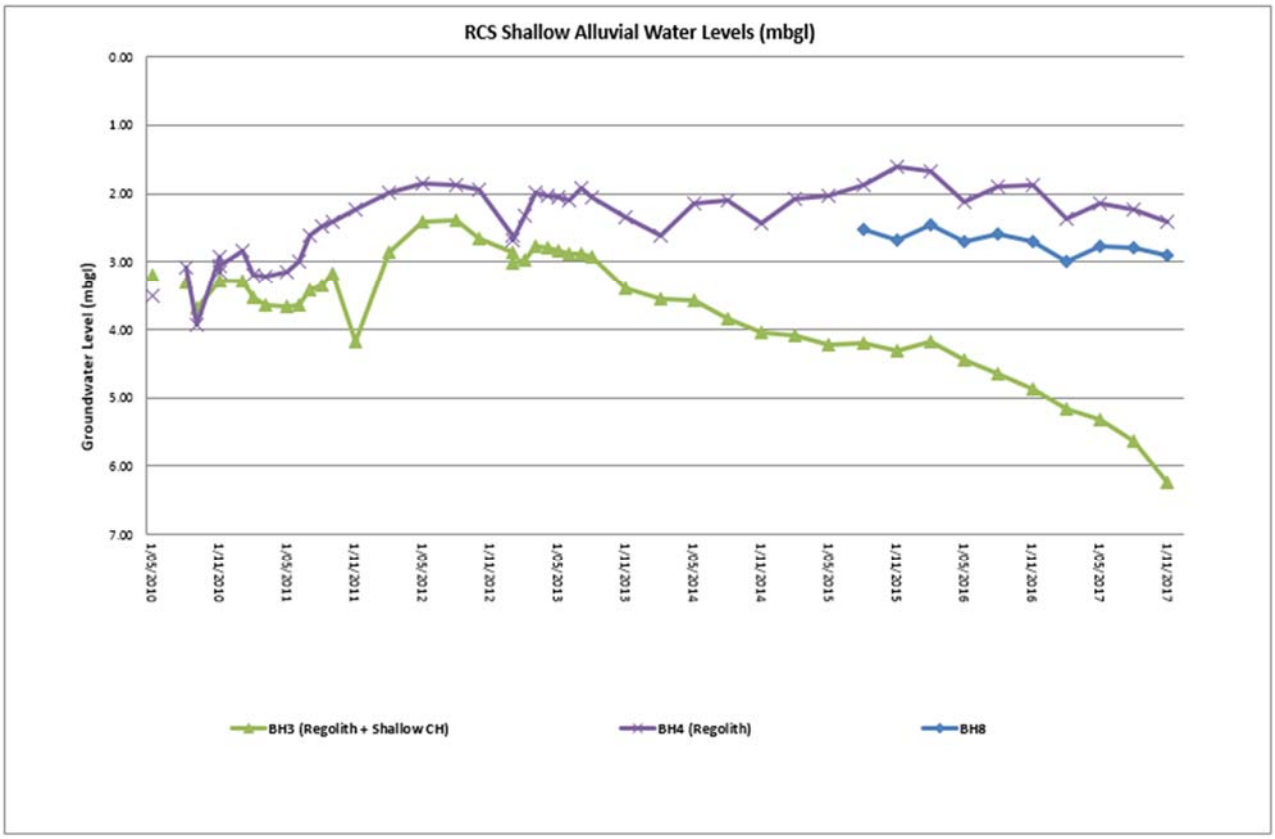


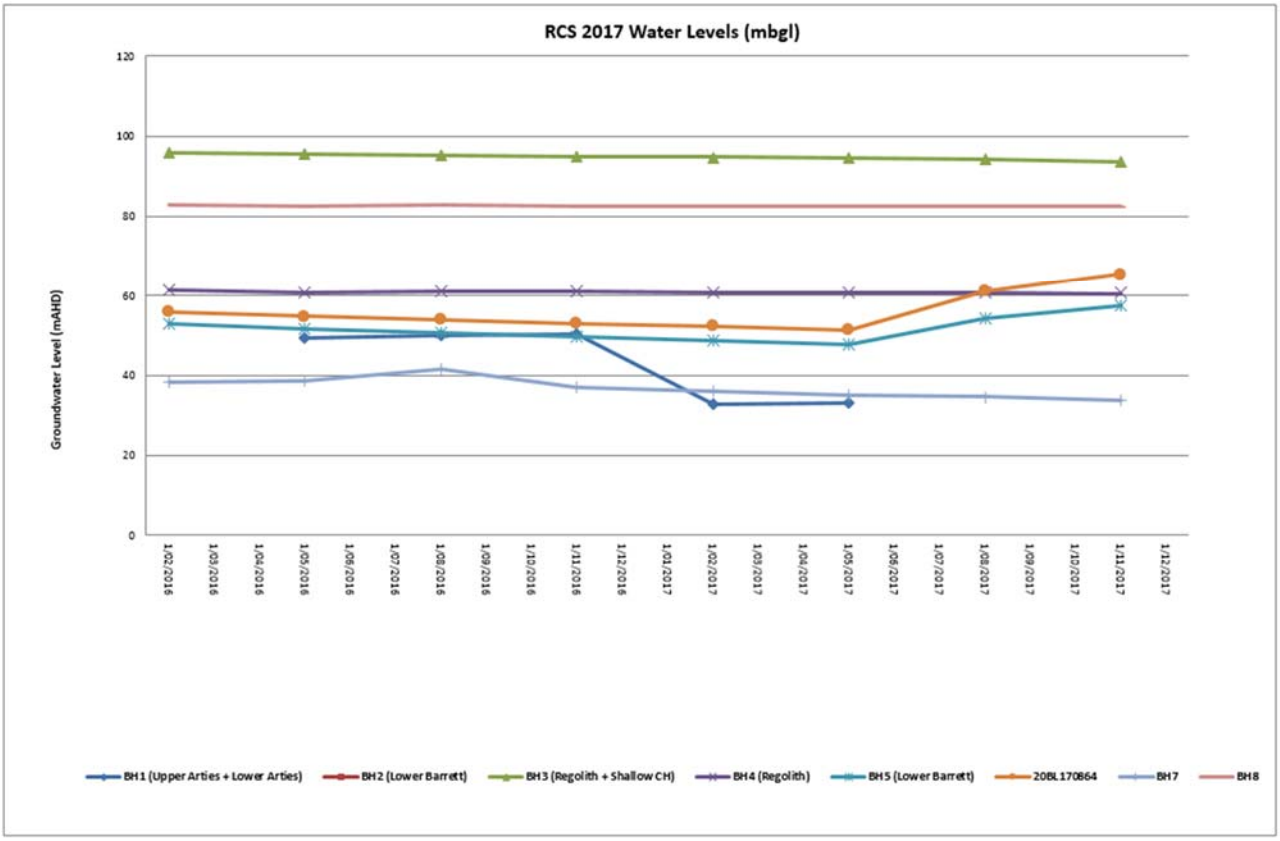


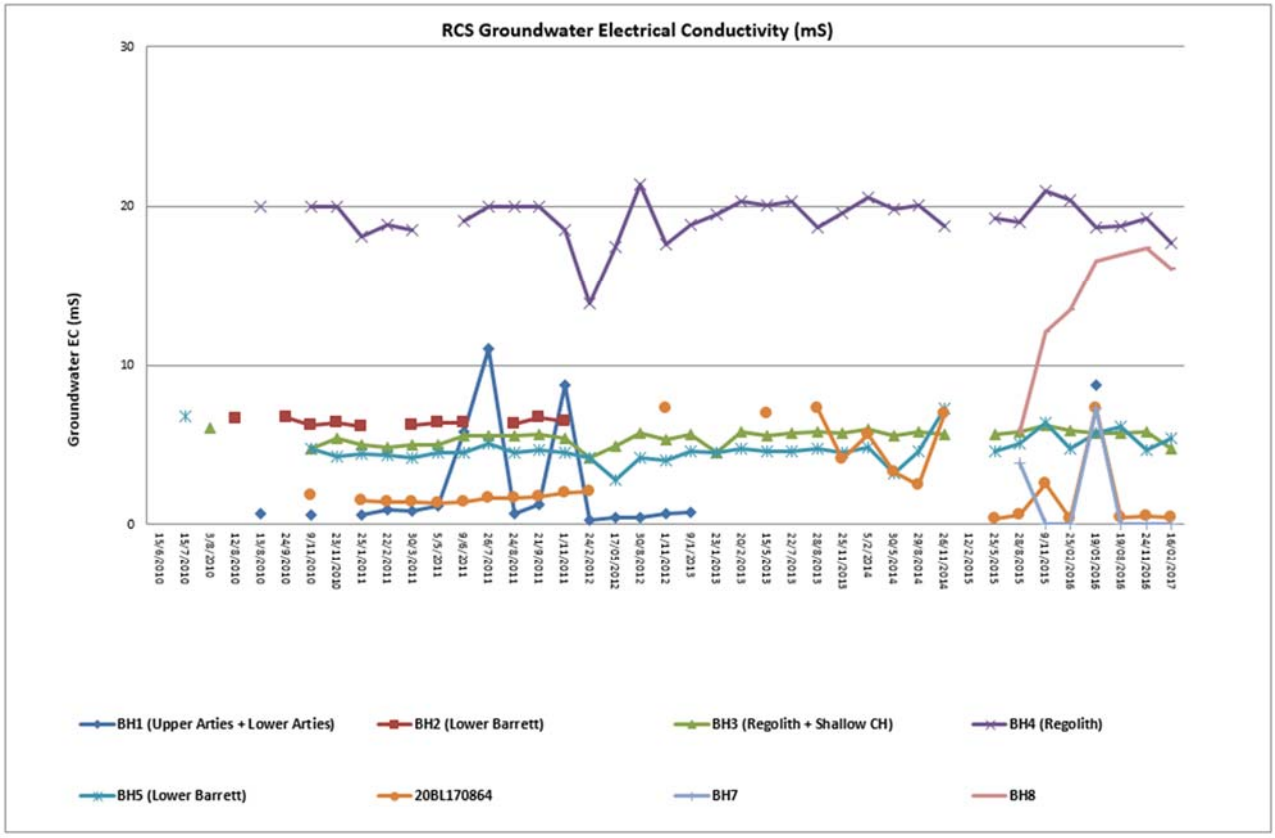


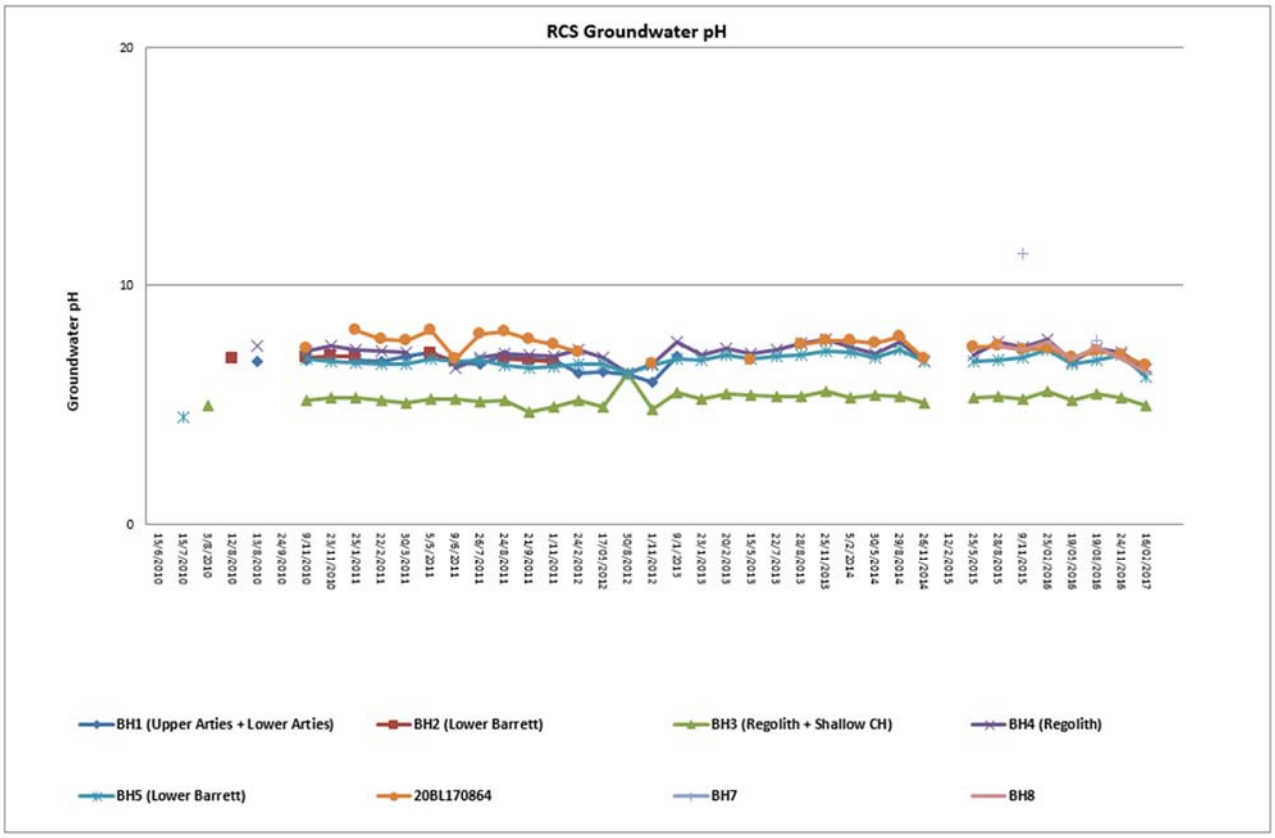
RCS Ground Water Results




RCS Shallow Alluvial Water Levels (mbgl)
Groundwater Level (mbgl)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
1/05/2010
1/11/2010
1/05/2011
1/11/2011
1/05/2012
1/11/2012
1/05/2013
1/11/2013
1/05/2014
1/11/2014
1/05/2015
1/11/2015
1/05/2016
1/11/2016
1/05/2017
1/11/2017
BH3 (Regolith + Shallow CH)
BH4 (Regolith)
BH8


RCS 2017 Water Levels (mbgl)
Groundwater Level (mAHD)
120
100
80
60
40
20
0
1/02/2016
1/03/2016
1/04/2016
1/05/2016
1/06/2016
1/07/2016
1/08/2016
1/09/2016
1/10/2016
1/11/2016
1/12/2016
1/01/2017
1/02/2017
1/03/2017
1/04/2017
1/05/2017
1/06/2017
1/07/2017
1/08/2017
1/09/2017
1/10/2017
1/11/2017
1/12/2017
BH1 (Upper Arties + Lower Arties)
BH2 (Lower Barrett)
BH3 (Regolith + Shallow CH)
BH4 (Regolith)
BH5 (Lower Barrett)
20BL170864
BH7
BH8


RCS Groundwater Electrical Conductivity (mS)
Groundwater EC (mS)
30
20
10
0
BH1 (Upper Arties + Lower Arties)
BH2 (Lower Barrett)
BH3 (Regolith + Shallow CH)
BH4 (Regolith)
BH5 (Lower Barrett)
20BL170864
BH7
BH8


RCS Groundwater pH
Groundwater pH
20
10
0
BH1 (Upper Arties + Lower Arties)
BH2 (Lower Barrett)
BH3 (Regolith + Shallow CH)
BH4 (Regolith)
BH5 (Lower Barrett)
20BL170864
BH7
BH8