ESTABLISHED 1907

MUSWELLBROOK COAL COMPANY

2019
ANNUAL ENVIRONMENTAL MANAGEMENT REPORT

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Name of Leaseholder:	**Muswellbrook Coal Company Limited**
Name of Mine:	**Muswellbrook Coal**
Titles/Mining Leases:	**Consolidated Coal Lease 713** **Mining Lease 1304** **Mining Lease 1562**
MOP Commencement Date: MOP Completion Date:	**31 March 2017** **31 December 2023**
AEMR Commencement Date: AEMR End Date:	**1 January 2019** **31 December 2019**
Reporting Officer:	**Julie Thomas**
Title:	**Environmental Superintendent**
Signature:	*JThomas*
Date:	**26 March 2020**

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1.0 INTRODUCTION

Muswellbrook Coal Company (MCC) is a wholly owned subsidiary of the Idemitsu Kosan Company Ltd. Group. MCC has a long association with coal mining at Muswellbrook, with underground coal mining commencing in 1907 and open cut operations in 1944. The mine is located on Muscle Creek Road, approximately 3 kilometres to the north-east of Muswellbrook.

On 1 September 2003, Development Consent for DA 205/2002 was granted by Muswellbrook Shire Council (MSC) to extend the former MCC No.1 Open Cut. The No.1 Open Cut Extension commenced operations in March 2005 and has a capacity to produce up to 2,000,000 tonnes coal per annum. This approval has subsequently been modified on several occasions with the latest modification granted in 2017 to allow mining in an area known as the "Continuation Project" and to extend the life of the mining operations to 2022. Rehabilitation activities will continue past this date.

1.1 STRUCTURE OF THIS REPORT

The structure of this report is based on the document "*Guidelines and Format for Preparation of Annual Environmental Management Report*", Department of Mineral Resources, Document No. EDG03 MREMP Guide V3 dated January 2006 and incorporates the reporting requirements stipulated in the MCC Development Consent, specifically Condition 42. This report also incorporates the reporting requirements in MCC's water licences and mining leases.

This Annual Environmental Management Report (AEMR) provides a summary of activities, environmental management and performance at MCC from 1 January 2019 to 31 December 2019 (herein referred to as the 'reporting period').

In accordance with the Development Consent, copies of this AEMR will be made available to:

- Muswellbrook Shire Council (MSC);
- Department of Planning, Industry and Environment – Resources Regulator (RR);
- Environment Protection Authority (EPA);
- Office of Environment, Energy and Science (OEES);
- Natural Resources Access Regulator (NRAR); and
- MCC Community Consultative Committee (CCC).

A copy of the report is also available on MCC's website:
https://www.idemitsu.com.au/operations/muswellbrook-coal/approvals-plans-reports/

1.2 CONSENTS, LEASES AND LICENCES

MCC operates under many development consents issued by MSC. The primary consent is DA 205/2002, which was approved by MSC in 2003. This DA has been modified on several occasions with the latest modification being approved in 2016.

Mining activities at MCC are carried out wholly within Consolidated Coal Lease 713, Mining Lease 1562 and Mining Lease 1304.

In addition to the above approvals MCC operates under the following licences:

- Environmental Protection Licence (EPL) 656 issued under the Protection of the Environment Operations Act 1997.
- Water Licences WAL39806, WAL41503, and WAL41521, issued under the Water Management Act 2000.

Relevant consents, authorisations and licences are summarised in **Table 1**.

Table 1: Consents, Authorisations and Licences

Approval	Description	Consent Authority	Date Granted	Expiry/ Renewal Date
DA 205/2002 (MSC)	Approval for Extension of MCC Open Cut 1	Muswellbrook Shire Council	1 Sep 2003	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) – Amendment to Condition 1.1	Power line relocation and additions to Workshop	Muswellbrook Shire Council	19 Dec 2005	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) Amendment to 1.1 and 11.3	Relocate office buildings, workshop and bath-house	Muswellbrook Shire Council	13 July 2009	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) Amendment to 11.1	Extension of mining into Area C	Muswellbrook Shire Council	23 Dec 2010	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) Amendment to 1.1(a), 31, 33, 39, 45 and 58.	Revision to Mining Infrastructure Building Requirements and Rehabilitation Plan Revision to permit the continuation of mining operations for an additional 5 years.	Muswellbrook Shire Council	29 Oct 2013	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) Amendment to 1.1, 1.2 & 6.3.2 and additional conditions 59 & 60.	Modification to Permit the Continuation of Mining Operations at Muswellbrook Coal Mine for an Additional Five (5) Years- Multiple Allotments- Coal Road Muswellbrook.	Muswellbrook Shire Council	12 Dec 2013	Mining to 31 Dec 2022 No end date to approval
DA 205/2002 (MSC) General revision of consent conditions	Modification to allow mining operations to mine additional areas and to extend the mine life to 2022.	Muswellbrook Shire Council	26 Oct 2016	Mining to 31 Dec 2022 No end date to approval
Consolidated Coal Lease 713	Mining Lease	Department of Planning and Environment	5 May 1990	24 Nov 2024
Mining Lease 1304	Mining Lease	Department of Planning and Environment	12 Jan 1993	24 Nov 2024

Approval	Description	Consent Authority	Date Granted	Expiry/ Renewal Date
Mining Lease 1562	Mining Lease	Department of Planning and Environment	16 Feb 2005	16 Feb 2026
Environmental Protection Licence 656	Environmental Licence	Environmental Protection Authority	6 Dec 2000	Not applicable
WAL39806	Water Licence	WaterNSW	3 Nov 2016	Continuing
WAL41503	Water Licence	WaterNSW	25 Oct 2017	Continuing
WAL41521	Water Licence	WaterNSW	4 Nov 2019	Continuing

1.2.1 CHANGES TO APPROVALS

During the reporting period a change was made to the Mining Operations Plan (MOP). This change related to changing the physical locations of the areas to rehabilitate in 2019 and 2020. No changes were made to the total areas to be rehabilitated or any other aspect of the MOP.

There were no other changes to approvals during the reporting period.

1.3 MINE CONTACTS

The names and contacts of site personnel responsible for mining, rehabilitation and environmental management, planning and support functions are shown in **Table 2**.

Table 2: Mine Contacts

Name	Position	Contact Number
Grant Clouten	General Manager	(02) 6542 2300
Julie Thomas	Environmental Superintendent (appointed Environmental Officer)	(02) 6542 2300
Rod Gallagher	Production Superintendent Mine Manager	(02) 6542 2300
Leon Claassens	Technical Services Superintendent	(02) 6542 2300

1.4 EMPLOYEE LEVELS

The number of employees and full-time equivalent contractors at MCC for this reporting period is shown in **Table 3**, along with a comparison to the numbers from the last three reporting periods.

Table 3: Employee Levels

Year	Employees	Full-Time Equivalent Contractors
2019	65	93
2018	67	77
2017	69	85
2016	73	102
2015	75	88

1.5 ACTIONS REQUIRED FROM PREVIOUS AEMR REVIEW

Neither the RR or MSC conducted an AEMR inspection or provided feedback on the AEMR, so there are no actions arising from the previous AEMR.

1.6 COMPLIANCE STATUS

1.6.1 REPORTABLE INCIDENTS

During the reporting period, there were no reportable environmental incidents at MCC.

1.6.2 COMPLIANCE REVIEW

In accordance with the requirements of Condition 42 (a) of the development consent, a detailed compliance review of the performance of the project against conditions of this consent and statutory approvals was undertaken at the end of the reporting period. This review was against the conditions in place on 31 December 2018. MCC were compliant with the conditions of consent and statutory approvals during the reporting period, except for the following:

- Loss of wind data from the real-time metrological station. This is discussed further in **Section 3.2.**
- Loss of some data from the real-time PM10 monitoring units. This is discussed further in **Section 3.3.2.** The data capture rate is >90% and has been reported to the EPA. No correspondence has been received from the EPA regarding this loss of data.
- Monitoring of the biodiversity offsite site was due to be completed this monitoring period. Due to an oversight by MCC this monitoring wasn't conducted. The monitoring will be conducted during the next reporting period.

1.6.3 UNANNOUNCED SITE INSPECTION

On 21 June 2019, two inspectors from the Resources Regulator undertook an unannounced site inspection at MCC. The inspection focused on closure planning and commitments relating to the site's Mining Operations Plan (MOP). Following this unannounced inspection MCC received a section 240 notice under the *Mining Act 1992*. This notice required MCC to complete the following:

- Complete a Rehabilitation Risk Assessment to identify and evaluate all potential risks to achieving the final land use and the specific measures to be implemented to mitigate those risks – the Rehabilitation Risk Assessment has been completed and submitted to the Resources Regulator.
- Revise the Rehabilitation Cost Estimate for the site – work has commenced on revising this estimate and it will be submitted to the Resources Regulator early in the next reporting period.

2.0 ACTIVITIES DURING THE REPORTING PERIOD

2.1 EXPLORATION

During the reporting period MCC undertook an exploration program in the footprint of the approved mining area. The purpose of this exploration program was to confirm the coal quality in the future mining area. All planning and clearing activities were undertaken in accordance with the requirements of the MOP.

2.2 LAND PREPARATION

Land preparation is the process of preparing the land for open cut mining. Activities include vegetation clearing, topsoil stripping and topsoil stockpiling.

Prior to any vegetation clearance, a pre-clearance survey is undertaken to identify any potential habitat features located within proposed disturbance areas. The pre-clearance surveys also identify any weed infestations that may need treatment prior to clearing activities commencing. A Pre-Clearance Permit is approved by the Environmental Superintendent prior to any clearing commencing on site.

Trees containing features with the potential to provide habitat resources for birds, bats and/or arboreal mammals will be retained wherever practicable. Where practical and feasible, habitat features such as large hollows identified during the preclearance surveys will be salvaged and relocated to existing areas of rehabilitation or stockpiled for use in future rehabilitation areas.

During the reporting period there was a disturbance of 3.2ha of previously rehabilitated land to allow mining to continue. There was no salvageable topsoil in this area as the area that was cleared this reporting period is dominated by the Golden Wreath Wattle (*Acacia Saligna*). This species was historically used in the rehabilitation process at MCC but is now considered a potential threat to diversity on the rehabilitation areas and is no longer included in the seed mix. To reduce the risk of spreading the *Acacia Saligna* seed onto new rehabilitation areas the topsoil in this area is buried on site.

2.2.1 TOPSOIL MANAGEMENT

Previously stripped topsoil is stockpiled in locations around the site for use and will be used in future rehabilitation activities.

2.3 CONSTRUCTION

During the reporting period no construction activities occurred.

2.4 MINING

All mining activities this reporting period have occurred in Open Cut 1 with operations able to occur 24 hours a day, seven days a week. The status of mining activities at the end of the reporting period is shown in **Figure 1**.

The Open Cut 1 mining schedule will continue within the Eastern section of the approved area during the year, mining down through the seam sequences as they present from the Fleming through to the Loder seam.

Mining has continued in Strip 22. This area will be lowered to the Lower Lewis and Loder floor to remove all underground workings.

During the second quarter overburden stripping will extend into Strip 23 in Open Cut 1. At the end of mine life all UG workings will be mined out removing any fuel sources for spontaneous combustion. The mining waste will be dumped in Open Cut 1 and Open Cut 2.

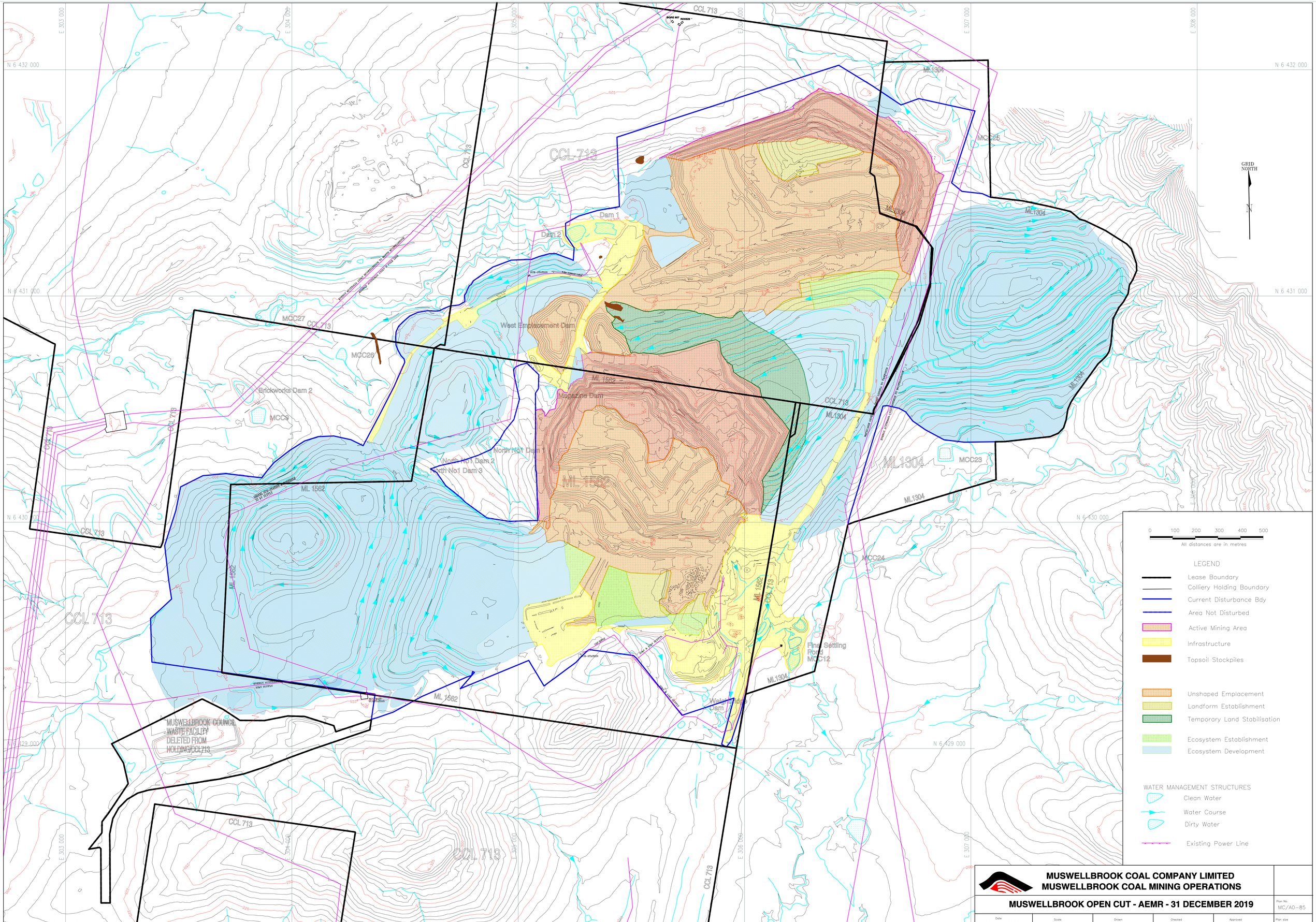
Open Cut 1 will continue to expose underground workings of the No. 2 Underground and St Heliers Collieries. Site based procedures have been developed to allow safe extraction of the remaining underground pillar coal. These procedures are reviewed to reflect the operating experience gained during mining progress. Open cut wall designs were undertaken following recommendations of a geotechnical study completed for MCC by Mining Operation Services.

Mining operations at MCC are undertaken in accordance with the MOP and relevant approvals, leases and licences.

Mining is achieved through open cut methods using excavators, front-end loaders and rear dump trucks. The current fleet used for mining at MCC is provided in **Table 4**.

Table 4: Mining Fleet Utilised at MCC

Equipment	Model	No	Work Area
Excavator	Hitachi EX3600 Hydraulic Excavator	2	Overburden, interburden and coal removal
	Hitachi EX2600 Hydraulic Excavator	1	Overburden, interburden and coal removal
Dump Truck	Hitachi 3500 (170 Ton)	9	Overburden, interburden and coal removal
	CAT 777C (85 Ton)	3	Overburden, coal and rejects
Front End Loader	CAT 990H	1	Coal stockpile management
Blast Hole Drill	SMW Drilltech 45	1	Drilling for blasting in overburden, interburden and coal
Grader	CAT 16H Grader	2	Surface preparation, road maintenance
Water Cart	Water Cart (CAT 777) 70,000 litre	2	Dust suppression, road maintenance
Dozer	CAT D10T	5	Dumps, roads, coal and overburden area preparation



MUSWELLBROOK COAL COMPANY LIMITED
MUSWELLBROOK COAL MINING OPERATIONS

MUSWELLBROOK OPEN CUT - AEMR - 31 DECEMBER 2019

Date	Scale	Drawn	Checked	Approved	Plan No.	Plan size
17-01-2020	1:5000	REJB	JT	JT	MC/A0-85	A0

2.5 MINERAL PROCESSING

MCC produces thermal coal for both export and domestic markets. High ash coal is mined, crushed and washed through the Coal Preparation Plant (CPP) while low ash coal is crushed and by-passes the CPP directly to the product stockpile.

Coal from Open Cut 1 requires washing by the CPP as a result of dilution associated with mining of the underground roadways. The CPP uses a jig as the main method of separation and has a capacity of approximately 240 tonnes per hour. The CPP is used on an 'as required' basis.

The CPP uses a belt press filter to treat the fines or tailings component of the coal feed. Both coarse and fine reject material will be trucked back to the open cuts for disposal. This material is quite dry and able to be handled in the same manner as overburden material. Disposal of carbonaceous material is undertaken in accordance with the Spontaneous Combustion Management Plan (SCMP).

2.6 WASTE MANAGEMENT

During the reporting period MCC continued to maintain a Total Integrated Waste Management Service to manage all waste streams generated on site. This includes general waste, cardboard and paper recycling, timber, waste oil, and steel. MCC continue to separate and recycle waste materials when possible, to assist in reducing the amount of waste going to the local landfill.

Table 5 shows the amount of waste that was removed from site during the reporting period. There has been a slight increase in the total waste removed from site during this reporting period, however, more waste was recycled compared to the previous reporting period.

Table 5: Waste Stream Generation

Month	Total Waste Removed (tonnes)	Total Waste to Landfill (tonnes)	Percentage Reused/ Recycled
January 2019	112.30	4.49	96.00
February 2019	102.64	5.37	94.77
March 2019	129.22	3.37	97.39
April 2019	117.14	3.17	97.29
May 2019	110.24	3.09	97.20
June 2019	100.35	2.30	97.71
July 2019	125.48	2.41	98.08
August 2019	116.10	2.18	98.12
September 2019	98.92	1.43	98.55
October 2019	138.14	3.81	97.24
November 2019	149.47	2.85	98.09
December 2019	134.68	1.96	98.54
Total	**1,434.68**	**36.42**	**97.46**

2.7 PRODUCT COAL AND TRANSPORT

Product coal is hauled from the product bin by truck to the stockpiles. Five product stockpiles have a total capacity of 250,000 tonnes. Product coal is trucked off site via Muscle Creek Road and the New England Highway to the Ravensworth Coal Terminal (RCT) for train loading. This coal is then transported to the Port of Newcastle.

2.8 PRODUCTION SUMMARY

The amount of production and associated waste generated by MCC is detailed in **Table 6**.

Table 6: Production and Waste Summary

	PRODUCTION		
	At End of This Reporting Period	**At End of Last Reporting Period**	**Estimate, End of Next Reporting Period**
Topsoil Stripped (m^3)	0	0	0
Topsoil used/spread (m^3)	0	0	0
Topsoil stockpiled (m^3)	3,450	3,450	3,450
Waste Rock (BCM)	8,119,374	7,870,331	8,664,664
Open Cut ROM Coal (t)	1,358,987	1,711,271	1,371,990
Underground ROM Coal (t)	0	0	0
Total Coal (t)	1,358,987	1,711,271	1,371,990
Processing Waste (t)	182,232	195,263	175,684
Open Cut Product Coal (t)	1,176,755	1,515,648	1,196,306
Underground Product Coal (t)	0	0	0
Total Product Coal (t)	1,176,755	1,515,648	1,196,306

2.9 HAZARDOUS MATERIALS MANAGEMENT

2.9.1 FUEL STORAGE

Diesel fuel is stored in three Class C1 above ground, self-bunded tanks, with a capacity of 105,000L each. The tanks are located 50m from any major buildings.

2.9.2 CHEMALERT SYSTEM

MCC use a web based ChemAlert system to manage chemical use at the mining operation and system users can access the database from the MCC intranet site. The ChemAlert system is a chemical hazard management tool that contains information on the storage, transportation, use and disposal of chemicals. A Dangerous Goods manifest and safe operating procedure for chemical selection and use can be readily accessed from the MCC intranet server.

2.9.3 EXPLOSIVES

MCC has a licence to supply and store explosives and explosive precursors in accordance with all relevant legislation under Licence Number XSPL100002. This storage consists of 2 external magazines and an above ground tank for raw materials with 30,000L capacity. Bulk explosive product can also be stored on the mobile processing unit with a capacity of 8,000L but it is not common practice to do so as this is only used on an as needs basis. All dangerous goods on the premises are listed under MCC's Notification of Hazardous Chemicals, Licence Number NDG021999. Blasting contractors are employed to carry out total loading service on site.

2.10 WATER MANAGEMENT

The primary objective of the Water Management Plan (WMP) is to enable the effective management of on-site water to minimise the impact of mining operations on surface and ground water resources, both on and adjacent to the mine site. No changes were made to the water management system during the reporting period.

The objectives of the WMP are to:

- Meet the water supply needs of the project;
- Separate clean water runoff produced by undisturbed catchments from dirty (sediment-laden) and contaminated runoff from disturbed catchments;
- Use appropriate sedimentation controls for dirty water;
- Where possible, recycle and reusing dirty and contaminated mine water for dust suppression and wash down activities;
- Allow clean water to flow through the catchment and using clean water for firefighting supplies (firefighting system uses raw mine water) and sensitive equipment where required and allowed by harvestable rights;
- Where possible, and where mine safety permits, use disused open cuts and underground mines as mine water storages;
- Have nil discharge of saline mine water by containing all saline mine water on site and minimising the risk of accidental off-site discharge; and
- Monitor surface and groundwater to determine significant impacts to water quality or beneficial use and undertaking remedial action where required.

2.10.1 WATER STORAGE

Volumes of stored water available at MCC are provided in **Table 7**.

Table 7: Stored Water

VOLUMES (m^3)	START REPORTING PERIOD	END REPORTING PERIOD	STORAGE CAPACITY
DIRTY WATER			
Blues Crusher Dam	145	0	8,500
Brickworks Dam 1	313	0	30,000
Brickworks Dam 2	200	0	20,000
Dam 3	3,206	500	8,000
SALINE OR MINE WATER			
Dam1	18,000	21,300	30,000
Dam 2	19,000	14,200	20,000
No.2 O/C Void	401,016	0	1,200,000
Final Settling Pond	6,032	6,100	10,100

2.10.2 GROUNDWATER EXTRACTION

MCC holds three licences to extract ground water. The volumes of groundwater extracted in this reporting period are shown **Table 8**. No new bores were constructed during the reporting period.

Table 8: Groundwater Extraction

Licence No.	Reporting Period Extraction Volume (ML)	Extraction Entitlement (ML per Annum Limit)
WAL39806 (small borehole)	191.8	1,000
WAL41503 (large borehole)	770.1	3,000
WAL41521 (open cut voids)	100.0	2,000

2.10.3 WATER BALANCE

The calculated water balance for the reporting period is provided in **Table 9**. The water balance indicates a water surplus for the year. Extra water has been stored in on-site water storages.

Table 9: Site Water Balance

INPUTS	ML/year
Ground Water Seepage	100.0
Surface Water Runoff and Dam Capture	92.7
Entrainment in Coal	101.9
Potable Water	3.4
Underground Workings – Dewatering Bores	690.4
TOTAL	**988.4**
OUTPUTS	**ML/year**
Entrainment in Coal	118.9
Discharge Off Site	0.0
Spontaneous Combustion Management – water infusion and sprays	384.9
Dust Suppression – water carts	314.6
Evaporation from Dams	113.3
Septic Pump Out	1.0
TOTAL	**931.9**
2019 Balance	**56.5**

2.11 OTHER INFRASTRUCTURE MANAGEMENT

MCC maintains Muscle Creek Road as per the requirements of the Development Consent.

3.0 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

3.1 ENVIRONMENTAL MANAGEMENT

To measure compliance with the management plans, the development consent and various licences, MCC undertakes a comprehensive monitoring program in the vicinity of the MCC mining areas. More details on the individual monitoring programs are provided in the following sections.

3.2 METEOROLOGICAL

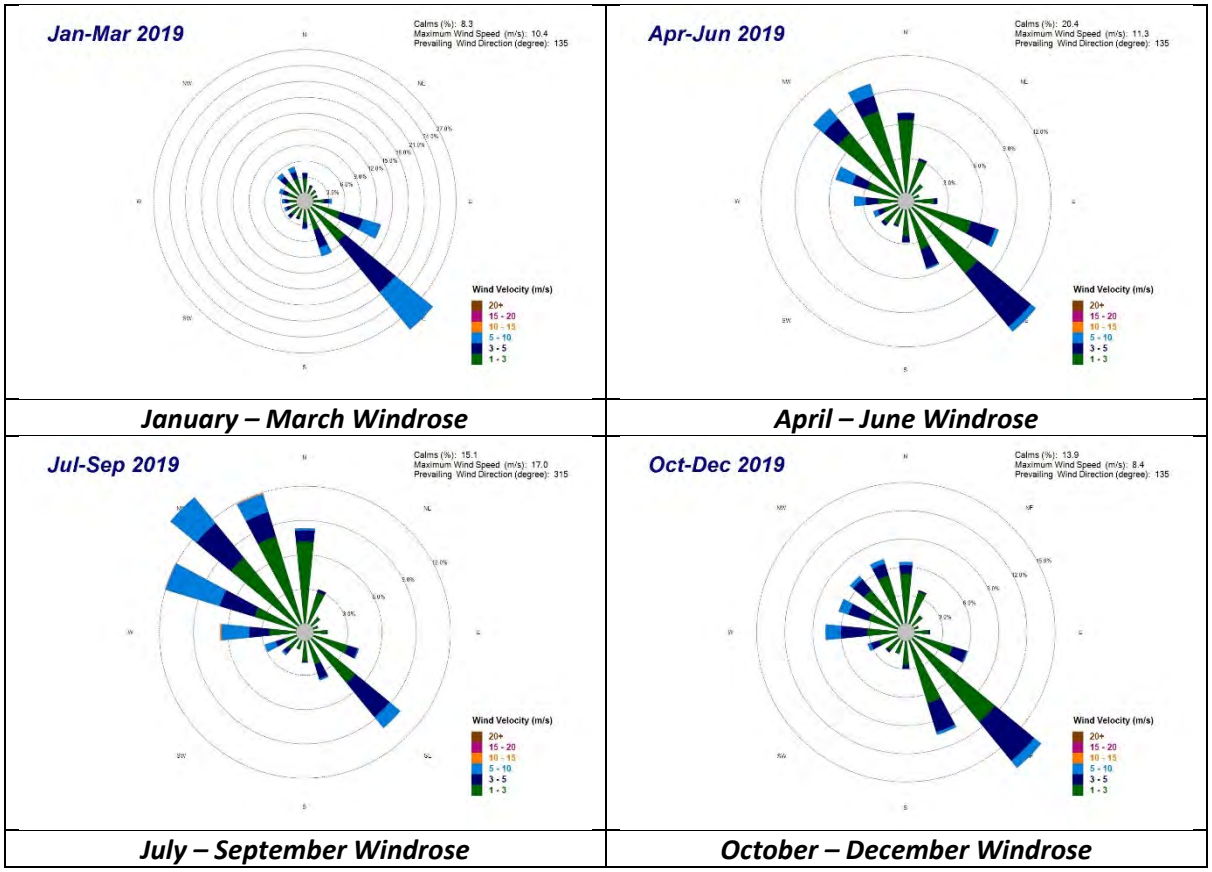
During the reporting period, MCC continued to maintain a Meteorological Monitoring Station (MMS) on rehabilitated land to the immediate west of Open Cut 1. This station is part of the Real Time Environmental Monitoring System (RTEMS).

The principal MMS provides 10m elevation wind speed and direction, 2m and 10m elevation air temperature, rainfall, humidity, barometric pressure, sigma theta and stability class. In addition, a calculation is performed to calculate temperature inversions.

Meteorological data provided in this report was sourced from the MMS. Wind data, rainfall and temperature results are summarised below. Data recovery for the monitoring period was 99.9%. The wind sensor stopped working during September resulting in minimal wind data for September. The wind sensor was replaced.

3.2.1 WIND SPEED AND DIRECTION

Quarterly wind roses are provided in **Figure 2**. These results are generally consistent with the predominant wind patterns in the Hunter Valley.



January – March Windrose	***April – June Windrose***
July – September Windrose	***October – December Windrose***

Figure 2: Quarterly Windroses

3.2.2 RAINFALL

Total rainfall recorded during the reporting period was 379.0mm, which is significantly below the long-term average of 620.8mm, recorded at the nearest Australian Bureau of Meteorology (BOM) site at Lower Hill Street in Muswellbrook. This is the third year of significantly low rainfall in a row. A summary of rainfall during the reporting period, compared to the historical rainfall at MCC and the closest BOM station in Muswellbrook, is provided in **Table 10** and **Figure 3**.

Table 10: Rainfall Data

Month	Muswellbrook Coal Actual (mm)	Muswellbrook Coal Average (mm)	Muswellbrook BOM Average (mm)
January	37.6	60.1	69.6
February	30.6	64.8	66.9
March	166.0	58.8	52.8
April	0.0	32.8	43.5
May	25.6	26.1	41.5
June	9.0	58.6	51.3
July	10.8	28.4	44.2
August	20.4	33.0	38.6
September	39.6	29.8	40.7
October	12.0	37.7	48.6
November	26.8	71.6	56.1
December	0.6	55.3	67.0
Total	**379.0**	**557.0**	**620.8**

3.2.3 TEMPERATURE

Maximum temperature recorded during the reporting period was 44.8°C and the minimum recorded was -2.6°C. This is consistent with the long term minimum and maximum recorded by the Australian Bureau of Meteorology site at Scone, -5.1°C and 46.5°C. A summary of minimum, maximum and average monthly temperatures during the reporting period is provided in **Table 11** and **Figure 4**.

Table 11: Temperature Data

Month	Minimum Temperature (°C)	Average Temperature (°C)	Maximum Temperature (°C)
January	18.0	28.1	41.8
February	15.6	22.5	29.0
March	8.7	22.4	35.0
April	5.1	17.8	30.5
May	2.5	13.4	23.8
June	-2.6	10.6	22.7
July	-0.3	10.9	21.5
August	-0.4	11.1	24.5
September	3.1	15.5	31.3
October	7.2	20.0	37.0
November	8.8	23.0	39.0
December	12.6	25.3	44.8
Summary	**-2.6**	**18.4**	**44.8**

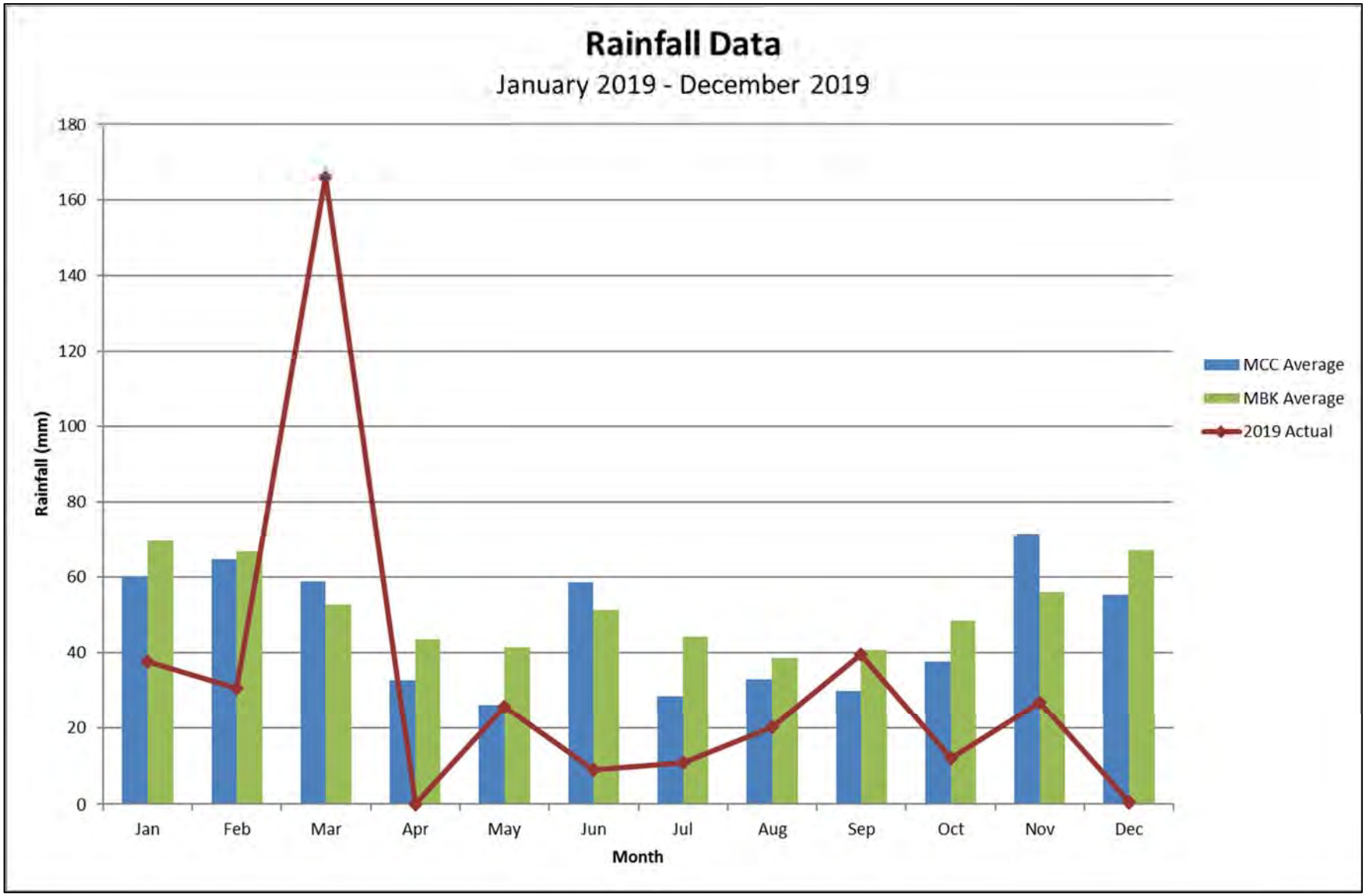


Figure 3: Rainfall Graph

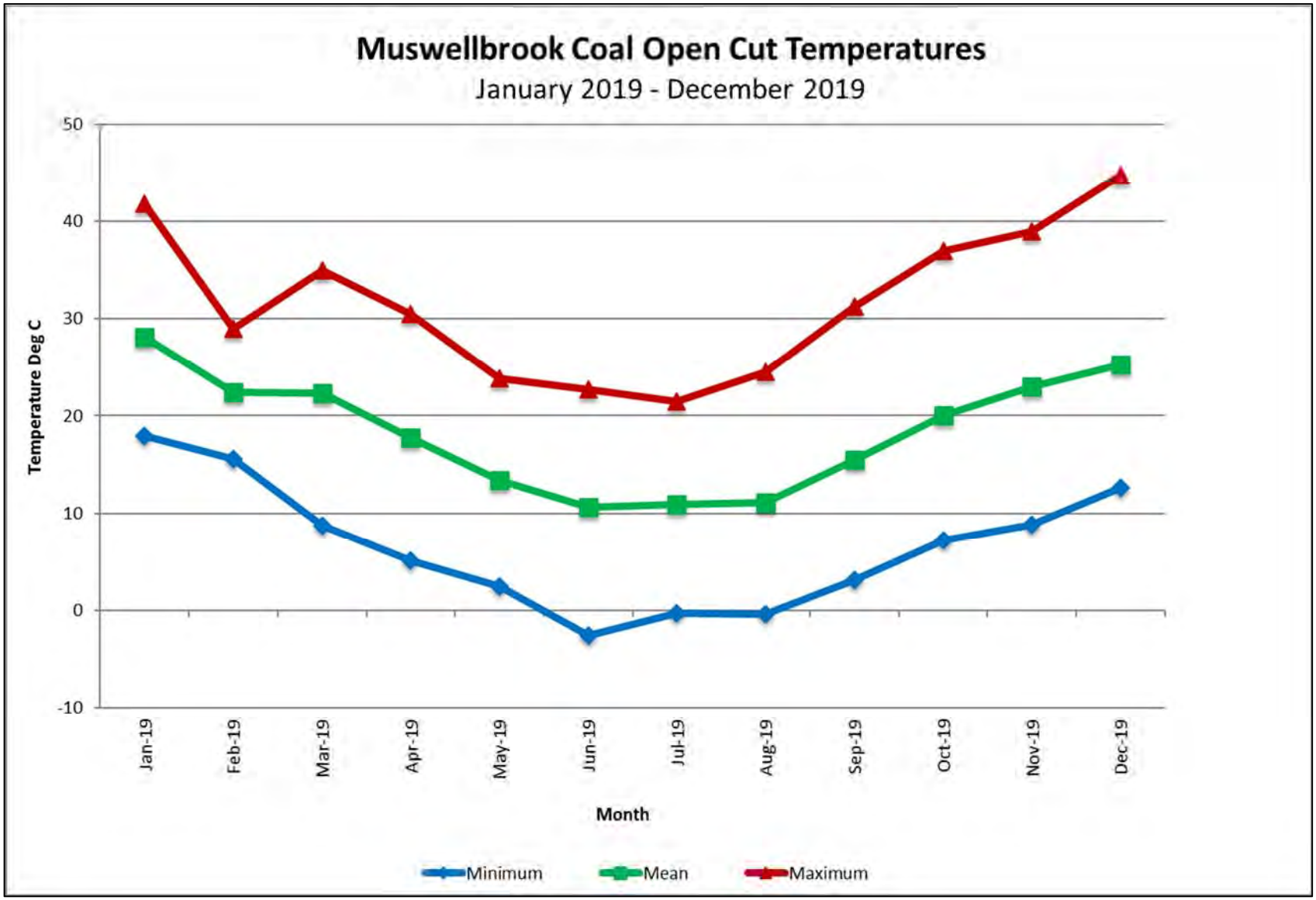


Figure 4: Temperature Graph

3.3 AIR QUALITY MANAGEMENT

3.3.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to operate in accordance with the approved Air Quality Management Plan.

The primary objective of air quality management at MCC is to manage and minimise the impact of dust from the operations on the environment and nearby residences. Dust mitigation measures have been divided into control procedures for wind-blown dust and mining generated dust sources.

Dust can be generated from two primary sources, either windblown dust from exposed areas, or dust generated by mining activities. The control procedures for these sources are outlined in **Table 12** and **Table 13**.

Table 12: Control Procedures for Wind Blown Dust

Source	Control Procedures
Areas disturbed by mining	• Disturb only the minimum area necessary for mining. • Reshape, topsoil and rehabilitate completed overburden emplacement areas after the completion of overburden tipping.
Coal Handling and Coal Stockpile Areas	• Maintain coal handling areas in a moist condition using water carts to minimise windblown and traffic generated dust. • Clean-up after any spillage event. • Water carts to operate around the coal stockpile area to suppress dust on roadways and the coal stockpiles.

Table 13: Control Procedures for Mining Generated Dust Sources

Source	Control Procedures
Haul road dust	• All roads and traffic areas will be watered using water carts to minimise the generation of dust. • Long term haul roads will be sheeted with hard wearing material where practicable.
Minor roads	• Development of minor roads will be limited to those roads as required by mining and rehabilitation activities. • Minor roads will be watered if used for extended periods.
Topsoil stockpiling	• All topsoil stockpiles will be located and shaped to minimise the area exposed to prevailing winds. • Long term topsoil stockpiles, not used for over 6 months will be vegetated.
Drilling	• Dust aprons will be lowered during drilling. • Drills will be equipped with dust extraction cyclones or water injection systems. • Water injection or suppression sprays will be used when high levels of dust are being generated.
Blasting	• Stemming will be used at all times. • Blasting will occur in accordance with the Blast-Vibration Management Plan relating to meteorological conditions.
Raw Coal Receival Bin	• Sprays are to be used when tipping raw coal into the receival bin during high wind events.

Source	Control Procedures
Coal Handling and Preparation Plant	• Sprays are fitted at transfer points.

Equipment used to control dust generation include: water cart (sprays on haul roads and coal stockpiles), sprays at the Raw Coal Receival Bin, sprays at conveyor transfer points, dust extraction cyclones or water injection systems on drill rigs.

Further control procedures are implemented during periods of high dust emissions and for short term episodic events. These include:

- Delaying blasting;
- Delaying rehabilitation activities;
- Delaying grading of non-essential roads;
- Operating water carts during crib breaks and between shifts;
- Working in protected areas; and
- Shutting down the operations.

MCC utilise a daily dust forecasting tool to assist with managing dust emissions from the site.

During the reporting period MCC completed a Spontaneous Combustion Emissions Study in accordance with the requirements of the EPL. A detailed report was prepared and submitted to the EPA in May 2019 for their acceptance. The EPA requested additional information, which has been provided to them. At the end of the reporting period MCC were waiting to hear from the EPA to confirm they have accepted this report. The findings from the study will be included in the AQMP and SCMP to capture the ongoing management requirements of spontaneous combustion emissions. Gas monitoring continuing throughout the monitoring period and the gas data is uploaded to MCC's website monthly.

3.3.2 AIR QUALITY MONITORING

The air quality criteria that apply to MCC are shown in **Table 14** to **Table 16**.

Table 14: Long Term Particulate Matter Criteria

Pollutant	Standard / Goal
Particulate Matter <10μg (PM_{10})	30μg/m^3 (annual mean)

Table 15: Short Term Particulate Matter Goal

Pollutant	Standard/Goal
Particulate Matter <10μm (PM_{10})	50μg/m^3 (24-hour average)

Table 16: Atmospheric Gas Content Criteria

Pollutant	Criterion	
Sulphur Dioxide (SO_2)	80ppb (24 hour average)	200ppb (1 hour average)
Hydrogen Sulphide (H_2S)	100ppb (24 hour average)	500ppb (1 hour average)

The air quality monitoring sites are displayed in **Figure 5**.

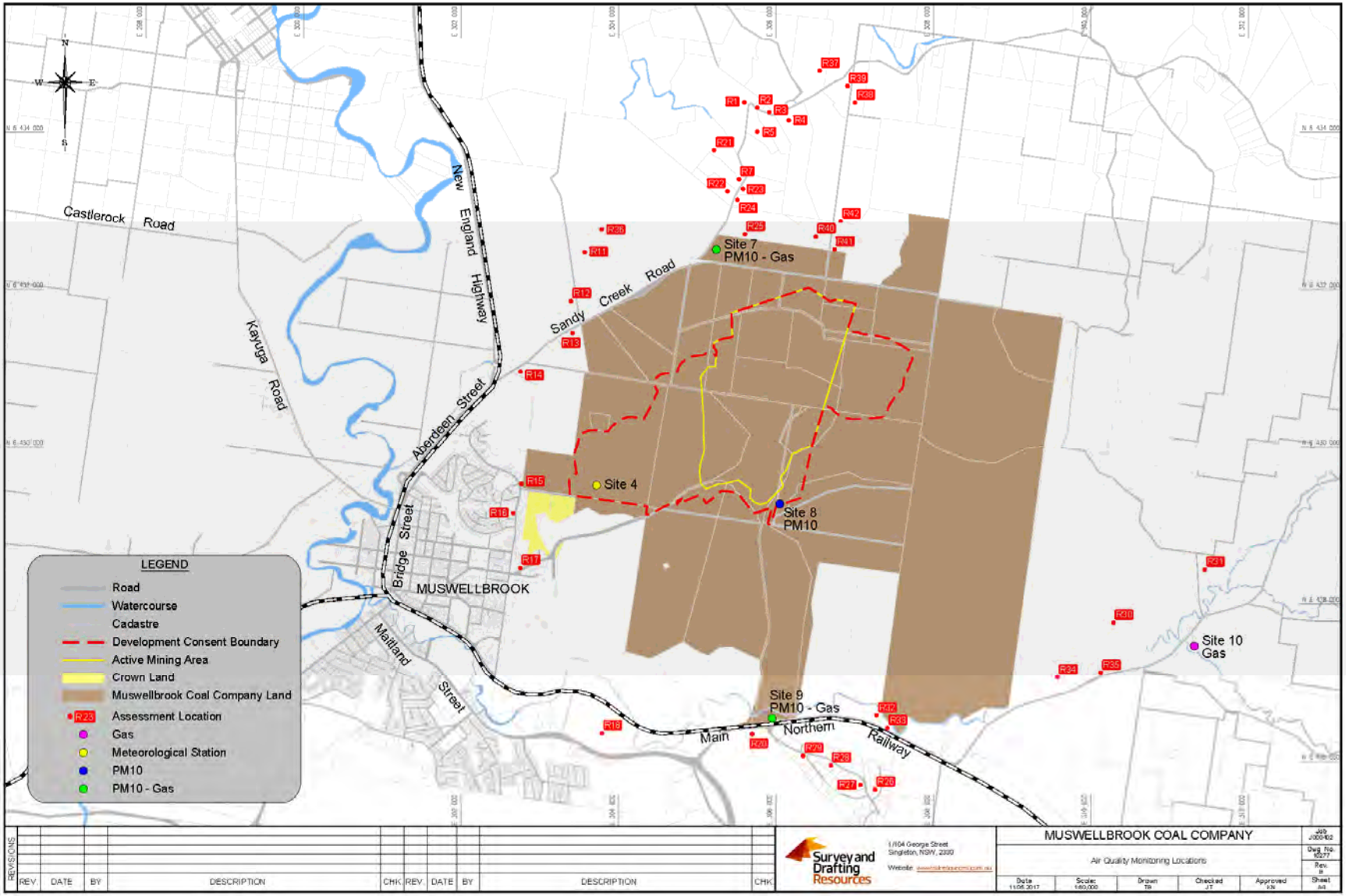


Figure 5: Air Quality Monitoring Locations

Particulate Matter <10µg (PM_{10})

MCC operate three real-time PM_{10} monitoring units with all three units continuously relaying data to a password protected website that is accessible by MCC personnel.

The PM_{10} units are continuous electronic monitoring systems that are subject to equipment faults, communication losses, power outages and maintenance downtime. High data recovery is considered essential and data recovery levels obtained during the reporting period were 94.9% across the three units. However, the data recovery was low at Site 9 due to ongoing issues with the equipment losing data. This unit was replaced in December 2019 with the aim to improve data capture rates.

The criteria in the development consent apply to PM_{10} levels at residential locations and as monitoring location Site 8 is used as a management tool, it is not subject to the criteria in the development consent. There were 45 days during the reporting period where the 24-hour PM_{10} results were above the 24-hour criteria of 50µg/m^3 at the compliance based monitoring locations. Each of these days has been investigated and they are all attributable to regional dust events or from bushfire smoke. The results are not directly attributable to MCC.

The annual average PM_{10} did not exceed the 30µg/m^3 annual criteria during the reporting period. **Table 17** displays the average PM_{10} value at each site during the reporting period with the results graphically presented in **Figure 6** to **Figure 8**. A table of comprehensive PM_{10} results is provided in **Appendix 1**.

Table 17: Real-Time PM_{10} Averages

Site Number	Annual Average PM_{10} Concentration (µg/m^3)	Annual Average Criteria (µg/m^3)	Data Recovery %
7	26.7	30	98.9
8	51.1	NA	96.7
9	24.2	30	89.0

Table 18 compares the results from Sites 7 and 9 for this reporting period, background results and predictions made in the 2016 Statement of Environmental Effects (SEE). The results this reporting period are generally higher with the background levels and the predicted results in the EA and SEE. This is attributable to the high days from regional dust events and bushfire smoke experienced throughout the region during the reporting period.

Table 18: Comparison of Real-Time PM_{10} Results (Sites 7 and 9)

Year	Monitoring Results (µg/m^3)		Background Results (µg/m^3)		SEE Predicted Results (µg/m^3)	
	Site 7	Site 9	Site 7	Site 9	Site 7	Site 9
2019	26.7	24.2	16.9	16.9	23.0	17.0
2018	20.2	17.8	16.9	16.9	23.0	17.0
2017	15.6	16.7	16.9	16.9	23.0	17.0

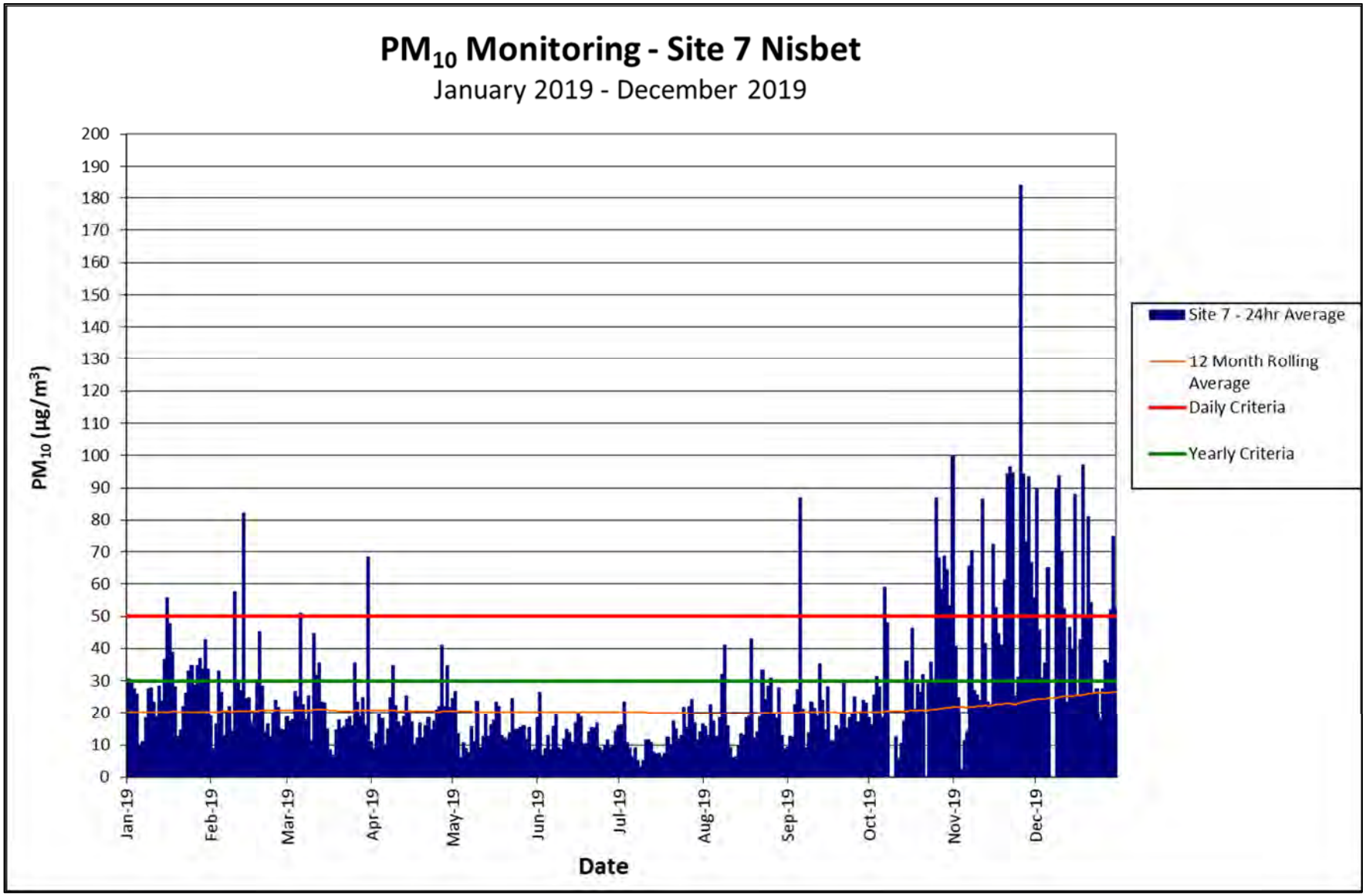


Figure 6: Site 7 PM_{10} Results

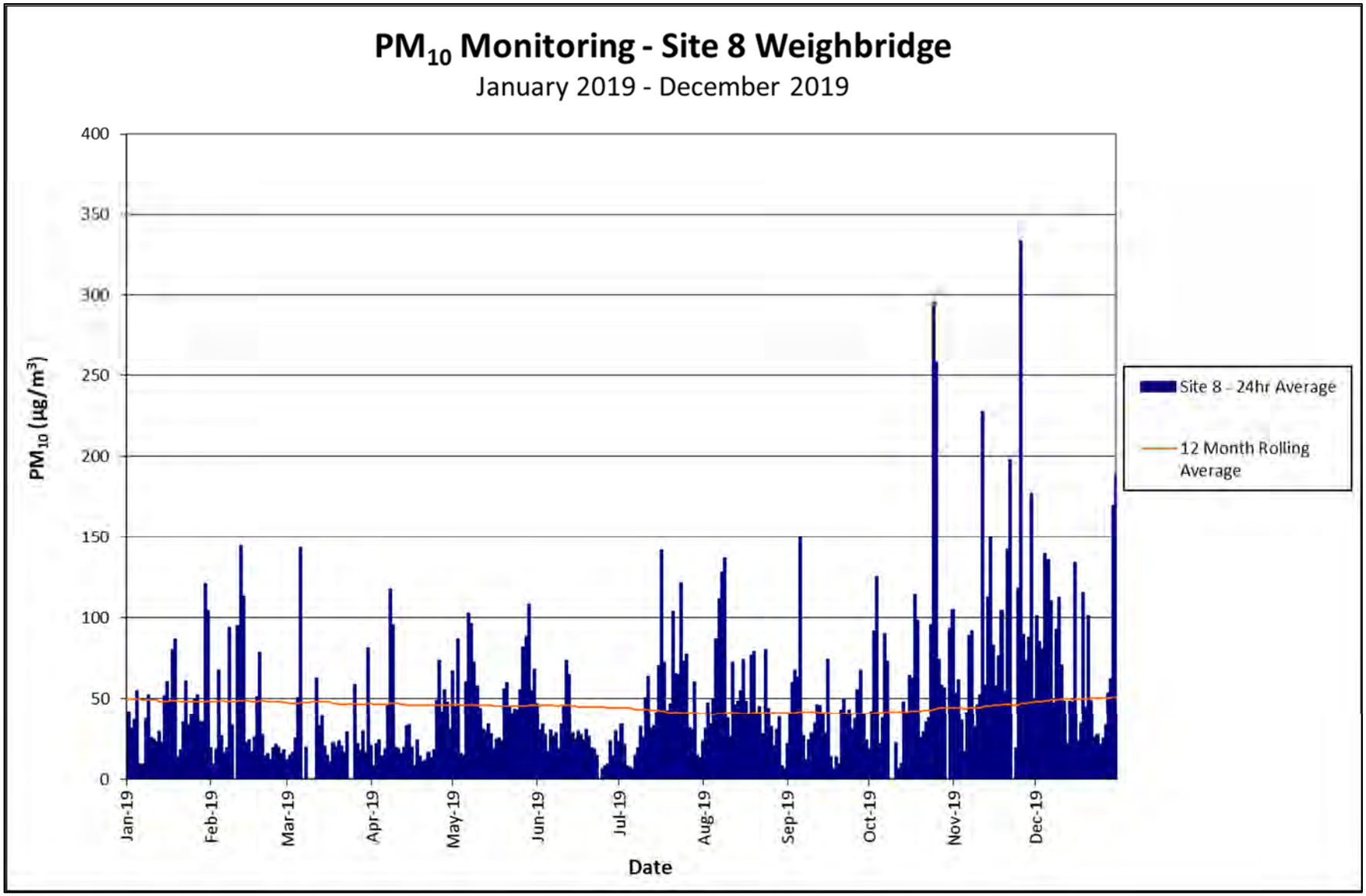


Figure 7: Site 8 PM_{10} Results

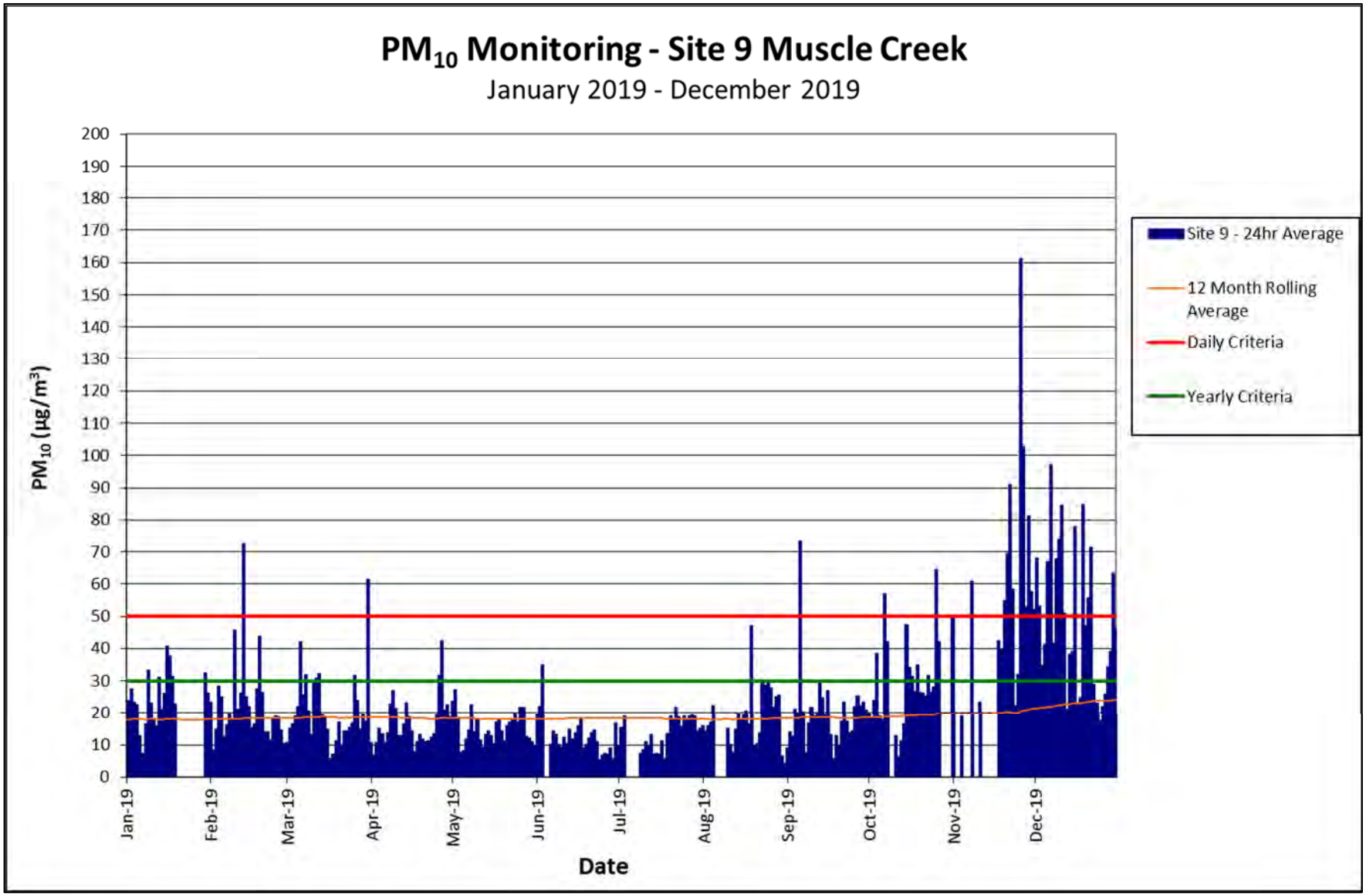


Figure 8: Site 9 PM_{10} Results

Gas Monitoring (Hydrogen Sulphide and Sulphur Dioxide)

MCC operate three real-time gas monitors that measure Hydrogen Sulphide (H_2S) and Sulphur Dioxide (SO_2). The locations of these monitors are shown in **Figure 5**. Monitoring at two of the sites (Site 7 and Site 9) is undertaken in accordance with the EPL requirements and monitoring at Site 10 is undertaken in accordance with MSC requirements. There are two types of monitor used:

- Site 7 and Site 9 – Ecotech monitor
- Site 10 – GrayWolf monitor

These monitors utilise different methodologies and have different limits of detection, which results in slightly different results being recorded. The criteria for H_2S and SO_2 are shown in **Table 16**. A summary of the monitoring results is shown in **Table 19** and this shows that there were no results above these criteria during the reporting period. The monitor at Site 10 was not working properly and failed to collect valid data during September and October. Attempts were made throughout these two months to fix the monitor; however, the monitor was not repaired until early November. Therefore, there is no data to report from this monitor for September and October.

Table 19: Summary of Gas Data Results

Month	Highest H_2S 1-hour result	Highest H_2S 24-hour result	Highest SO_2 1-hour result	Highest SO_2 24-hour result
Site 7 – Nisbet				
January 2019	5.0	2.2	97.0	8.9
February 2019	7.7	2.7	46.7	8.1
March 2019	16.0	2.0	50.0	9.0
April 2019	15.7	2.5	90.9	10.2
May 2019	5.0	2.0	38.0	5.0
June 2019	4.1	2.3	80.1	8.5
July 2019	7.4	1.2	17.2	4.7
August 2019	4.3	2.6	28.0	6.5
September 2019	5.8	2.5	45.0	5.3
October 2019	4.4	2.1	37.8	8.9
November 2019	5.4	1.6	56.2	7.1
December 2019	5.0	1.6	41.2	6.7
Site 9 – Muscle Creek (Railway)				
January 2019	97.0	2.3	100.5	10.6
February 2019	2.8	1.6	97.8	12.0
March 2019	10.0	2.0	67.0	12.0
April 2019	3.9	1.3	116.8	16.6
May 2019	38.0	2.0	70.0	7.0
June 2019	9.1	1.8	69.8	10.9
July 2019	5.4	1.4	39.7	6.1
August 2019	4.0	1.5	40.9	8.1
September 2019	4.5	1.1	117.8	8.0
October 2019	3.9	1.9	60.1	7.2
November 2019	8.3	1.6	66.1	10.4
December 2019	6.1	2.3	65.4	10.9
Site 10 – Muscle Creek (Fire Station)				
January 2019	111.7	23.7	37.5	6.6
February 2019	55.0	13.3	11.3	5.6
March 2019	91.7	15.1	22.1	5.9
April 2019	40.8	11.0	32.5	6.6

Month	Highest H_2S 1-hour result	Highest H_2S 24-hour result	Highest SO_2 1-hour result	Highest SO_2 24-hour result
May 2019	47.9	11.1	17.9	5.6
June 2019	96.3	12.6	34.2	8.4
July 2019	107.1	13.3	76.7	25.6
August 2019	34.2	9.2	97.5	23.6
September 2019	no data	no data	no data	no data
October 2019	no data	no data	no data	no data
November 2019	302.1	22.8	133.8	15.3
December 2019	7.9	5.3	156.7	21.2

3.3.3 ACTIVITIES NEXT REPORTING PERIOD

MCC will continue to manage and monitor air quality impacts in accordance with the AQMP.

The AQMP will be reviewed and updated during the next reporting period. This review will capture the outcomes of the Spontaneous Emissions Combustion Study.

3.4 GREENHOUSE GAS

No methane drainage or ventilation issues were associated with the Open Cut operations during this reporting period. A number of boreholes intersect the underground workings that are used for gas and water monitoring. These boreholes are capped and opened only for monitoring purposes.

MCC supply data to Idemitsu for their corporate reporting requirements for the National Greenhouse and Energy Reporting (NGER's) process.

3.5 EROSION AND SEDIMENT CONTROL

3.5.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage erosion and sediment control in accordance with the Water Management Plan (WMP).

The key considerations for erosion and sediment control at MCC include:

- restricting the extent of disturbance to the minimum that is practical and in accordance with the Mining Operations Plan/Rehabilitation Plan;
- progressive rehabilitation of disturbed land, where possible, and the construction of drainage controls to improve the stability of rehabilitated land;
- protection of natural drainage lines and watercourses by the construction of erosion control devices such as diversion banks and channels and sediment retention dams as necessary;
- restriction of access to rehabilitated areas;
- management of erosion and sediment control of affected surface watercourses/ water bodies, including creek lines within or adjacent to the development consent boundary;
- regular inspection of dams to monitor their efficiency and any required maintenance; and
- inspection and maintenance, if required, of sediment and erosion controls including dams and drainage lines following storm events.

Two main natural catchments exist in the area of mining, associated with Muscle and Sandy Creeks. The area contains undisturbed land surfaces that drain towards Sandy Creek. However, some of the

runoff is captured by dams. Water from undisturbed catchments is diverted around mining operations by diversion banks and channelled into adjacent watercourses.

Drainage from the coal crushing plant and stockpile area is collected in a dam and re-used for dust suppression. All disturbed or newly rehabilitated areas contain diversion banks (major and minor graded banks) to control the flow of water from catchment areas and to contain dirty runoff on the mine site.

During the reporting period MCC maintained water management structures to contain any potentially contaminated water on site. This work included desilting of dams to maintain capacity and drain cleanout to remove blockages.

3.5.2 EROSION AND SEDIMENT CONTROL MONITORING

Erosion and sediment control monitoring is conducted as part of the surface water monitoring program. Surface water monitoring is discussed in **Section 3.6.2**.

3.5.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period, MCC will continue to manage and monitor erosion and sediment impacts in accordance with the WMP.

3.6 SURFACE WATER MANAGEMENT

3.6.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage surface water impacts in accordance with the Water Management Plan (WMP).

The trigger values for water quality in Muscle Creek are presented in Table 20.

Table 20: Trigger Values for Muscle Creek Water Quality

Site	pH 20th/80th Percentile Trigger Values	EC (µS/cm) 80th Percentile Trigger Values	TSS (mg/L) 80th Percentile Trigger Values
SW07 – Muscle Creek – Upstream	7.7–8.0	4,048	13
SW08 – Muscle Creek – Downstream	7.8–8.0	5,136	10

If monitored conditions are outside the upper or lower trigger levels for 3 continuous monthly results MCC will conduct an investigation into the results.

3.6.2 SURFACE WATER MONITORING

MCC undertake a surface water monitoring program that consists of monthly, quarterly and annual monitoring. The locations of the surface water monitoring sites are shown in **Figure 9**.

The surface water pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS) results are shown graphically in **Figure 10** to **Figure 15**. The data and the annual comprehensive surface water monitoring results are provided in **Appendix 2**.

pH

The pH levels at surface water monitoring sites were generally within the recommended ecosystem pH levels of 6.5–9.5 throughout the reporting period. As shown in **Table 21** the results from this reporting period are consistent with the results from previous reporting periods. There are no background results or predictions to compare these results to.

Table 21: Comparison of pH Results to Historical Results

Location	pH Annual Average							
	2012-2013	2013-2014	2014	2015	2016	2017	2018	2019
Dam 1/2	7.8	7.8	7.7	7.7	7.9	8.0	7.9	7.9
MCC12 Final Settling Pond	8.1	8.3	8.3	8.3	8.4	8.4	8.7	8.5
No.2 Open Cut Void	7.9	8.0	8.1	7.9	8.0	8.0	8.1	no results
No.1 Open Cut Void	7.8	7.7	no results	no results	no results	no results	8.1	no results
MCC07	7.8	7.8	7.8	7.9	8.0	8.0	7.7	7.8
MCC08	7.9	7.8	7.9	7.9	7.9	8.0	8.0	7.9
MCC09	8.3	8.6	8.7	8.7	8.4	8.1	8.1	8.3
MCC23	8.8	8.6	9.3	9.2	8.8	8.1	8.3	8.9
MCC24	8.3	8.2	8.0	7.7	7.8	no results	8.3	8.3
MCC25	no results	7.5	no results	7.6	7.8	8.0	no results	no results
MCC26	8.4	8.7	8.9	8.3	8.4	8.8	8.7	8.9
MCC27	8.3	8.2	8.4	8.0	8.2	8.2	8.5	8.5

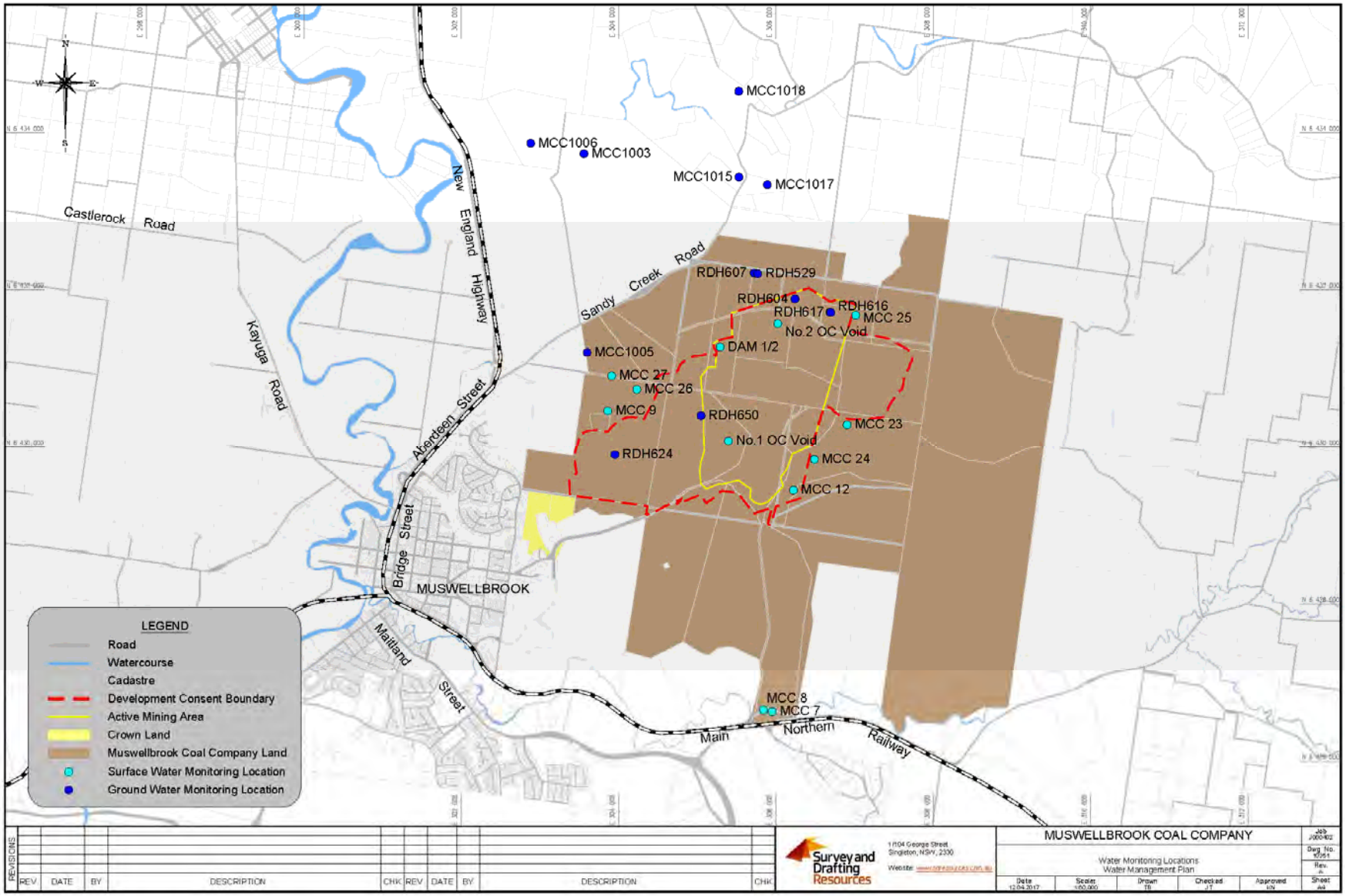


Figure 9: Water Monitoring Locations

Electrical Conductivity (EC)

Typically, EC levels for mine water are greater than 4,000µS/cm. The low rainfall during the reporting period is reflective in the elevated EC results in the dams, where the water levels have remained low and the salts have concentrated in the water.

EC results in Muscle Creek have been high during the reporting period. MCC has investigated these high results to confirm that they aren't being influenced by MCC operations. The highest results are upstream of the operations and decrease downstream of the operations. The investigation concluded that these results are being affected by the ongoing dry conditions and potential groundwater influences. MCC will continue to monitor the water quality in Muscle Creek to see if they return to normal following a significant rainfall event.

The sediment from MCC09 was removed during the previous reporting period and the EC continues to remain low. The EC at MCC23 continues to remain high as there has been no significant runoff into the dam this reporting period. MCC will continue to monitor the water in this dam to see if there is a drop in EC following significant runoff.

As shown in **Table 22** the results from this reporting period are consistent with the results from previous reporting periods for all other sites. There are no background results or predictions to compare these results to.

Table 22: Comparison of EC Results to Historical Results

Location	Electrical Conductivity Annual Average (µS/cm)							
	2012-2013	2013-2014	2014	2015	2016	2017	2018	2019
Dam 1/2	5,886	5,975	6,133	6,337	6,511	6,757	6,538	7,423
MCC12 Final Settling Pond	8,836	8,359	8,530	7,523	7,514	7,537	6,820	5,436
No.2 Open Cut Void	5,941	6,267	6,465	6,526	6,683	6,908	6,980	no results
No.1 Open Cut Void	5,030	5,533	no results	no results	no result	no result	5,520	no results
MCC07	2,064	2,843	4,780	2,887	2,594	4,723	12,925	14,389
MCC08	2,800	3,672	5,207	3,185	3,338	5,036	6,906	6,828
MCC09	4,718	4,043	3,900	4,985	12,400	5,220	475	396
MCC23	3,110	1,953	2,080	1,950	1,970	4,765	11,168	14,100
MCC24	5,278	3,933	3,840	3,940	2,740	no result	5,900	1,490
MCC25	no results	1,740	no results	1,533	3,413	5,470	no results	no results
MCC26	6,300	4,868	6,615	4,133	4,660	7,898	14,818	3,903
MCC27	10,175	9,588	9,405	8,273	8,623	12,735	11,033	11,733

Total Suspended Solids (TSS)

As shown in **Table 23** the results from this reporting period are consistent with the results from previous reporting periods, except for MCC09. The TSS in MCC09 was elevated during this monitoring period. There was only one sample collected from this site during the reporting period and the water level was very low and muddy, which would have resulted in the elevated TSS level. There are no background results or predictions to compare these results to.

Table 23: Comparison of TSS Results to Historical Results

Location	Total Suspended Solids Annual Average (mg/L)							
	2012-2013	2013-2014	2014	2015	2016	2017	2018	2019
Dam 1/2	13	14	7	11	9	13	7	13
MCC12 Final Settling Pond	18	22	16	18	31	19	15	21
No.2 Open Cut Void	18	20	12	12	9	12	24	no results
No.1 Open Cut Void	16	13	no results	no results	no results	no result	8	no results
MCC07	14	16	11	8	8	18	18	5
MCC08	12	13	10	8	7	9	8	8
MCC09	10	11	4	33	608	8	27	71
MCC23	15	20	18	7	22	25	20	14
MCC24	21	13	14	7	11	no results	16	11
MCC25	no results	13	no results	5	9	17	no results	no results
MCC26	16	15	42	5	7	30	44	20
MCC27	13	14	31	9	15	41	10	11

3.6.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period, MCC will continue to manage and monitor surface water quality impacts in accordance with the WMP.

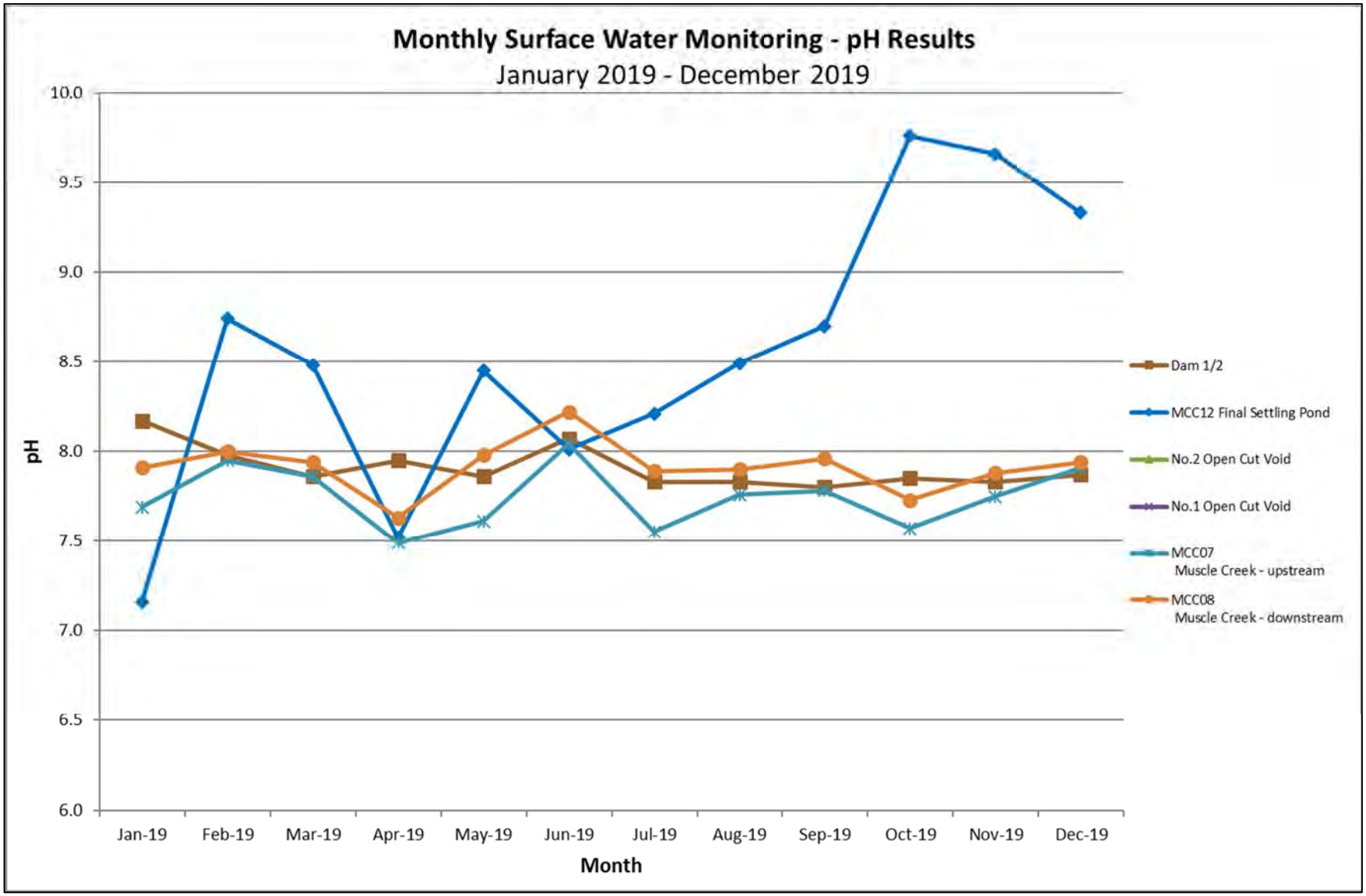


Figure 10: Monthly Surface Water Monitoring Results – pH

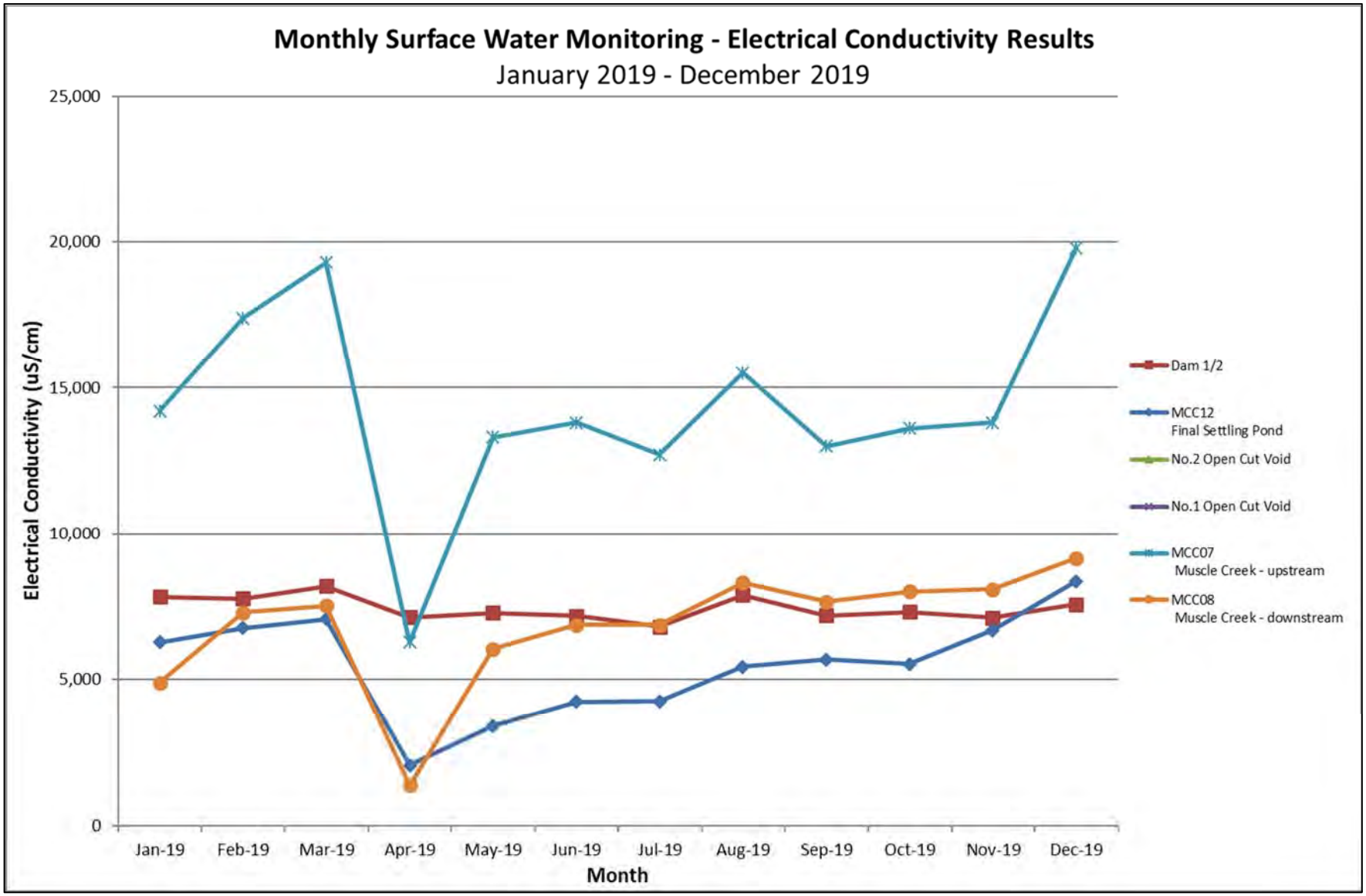


Figure 11: Monthly Surface Water Results – Electrical Conductivity

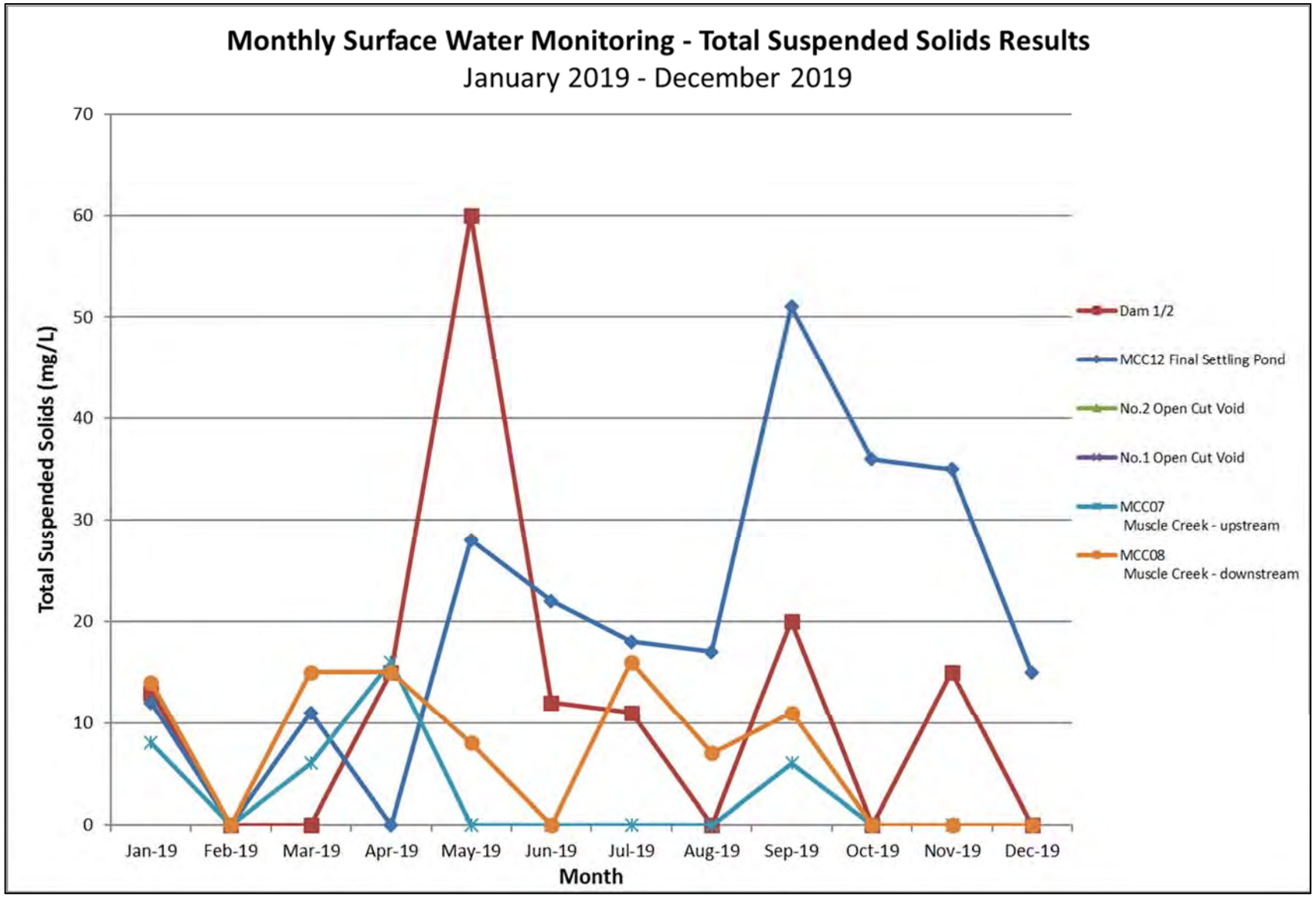


Figure 12: Monthly Surface Water Results – Total Suspended Solids

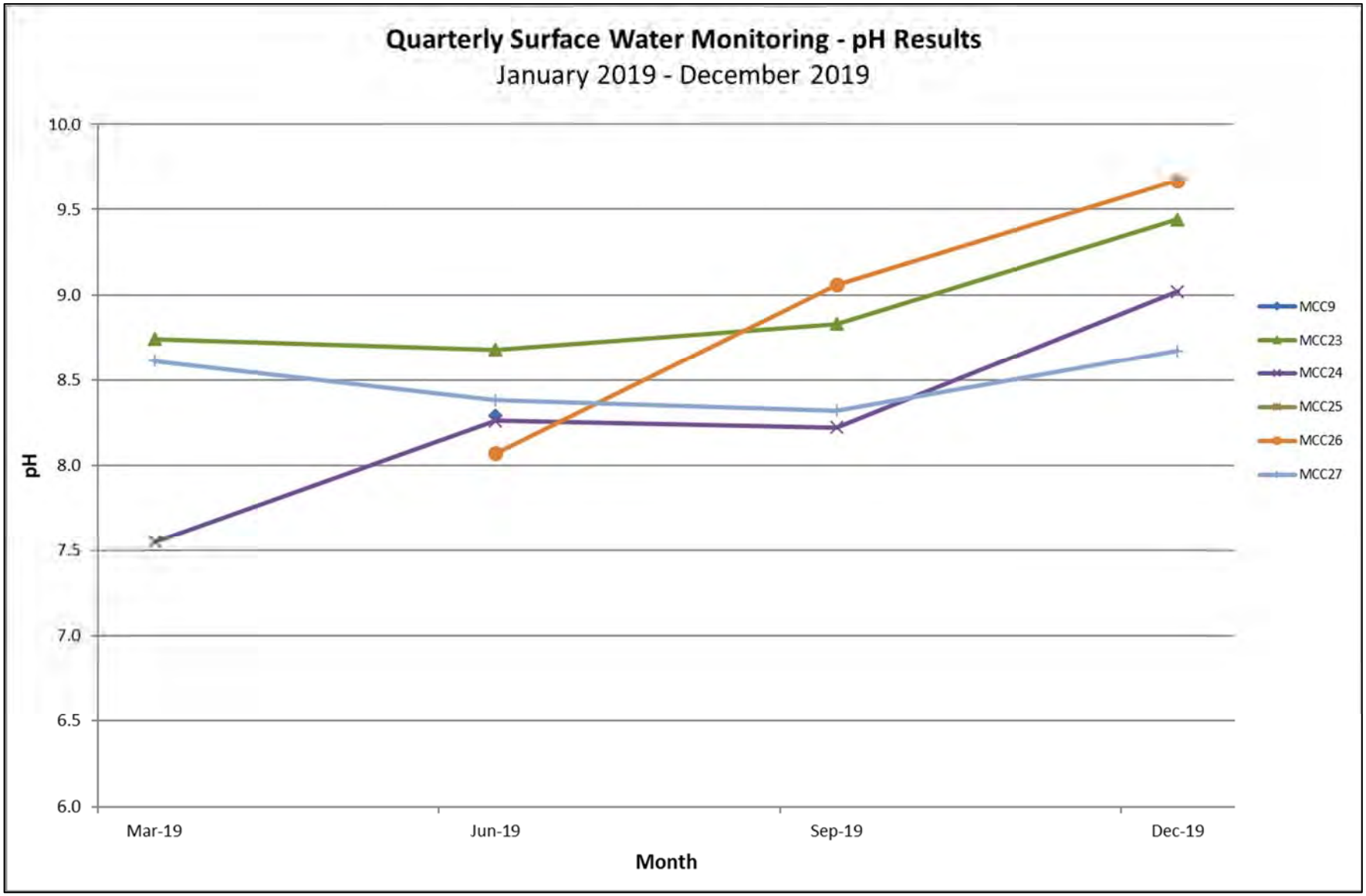


Figure 13: Quarterly Surface Water Results – pH

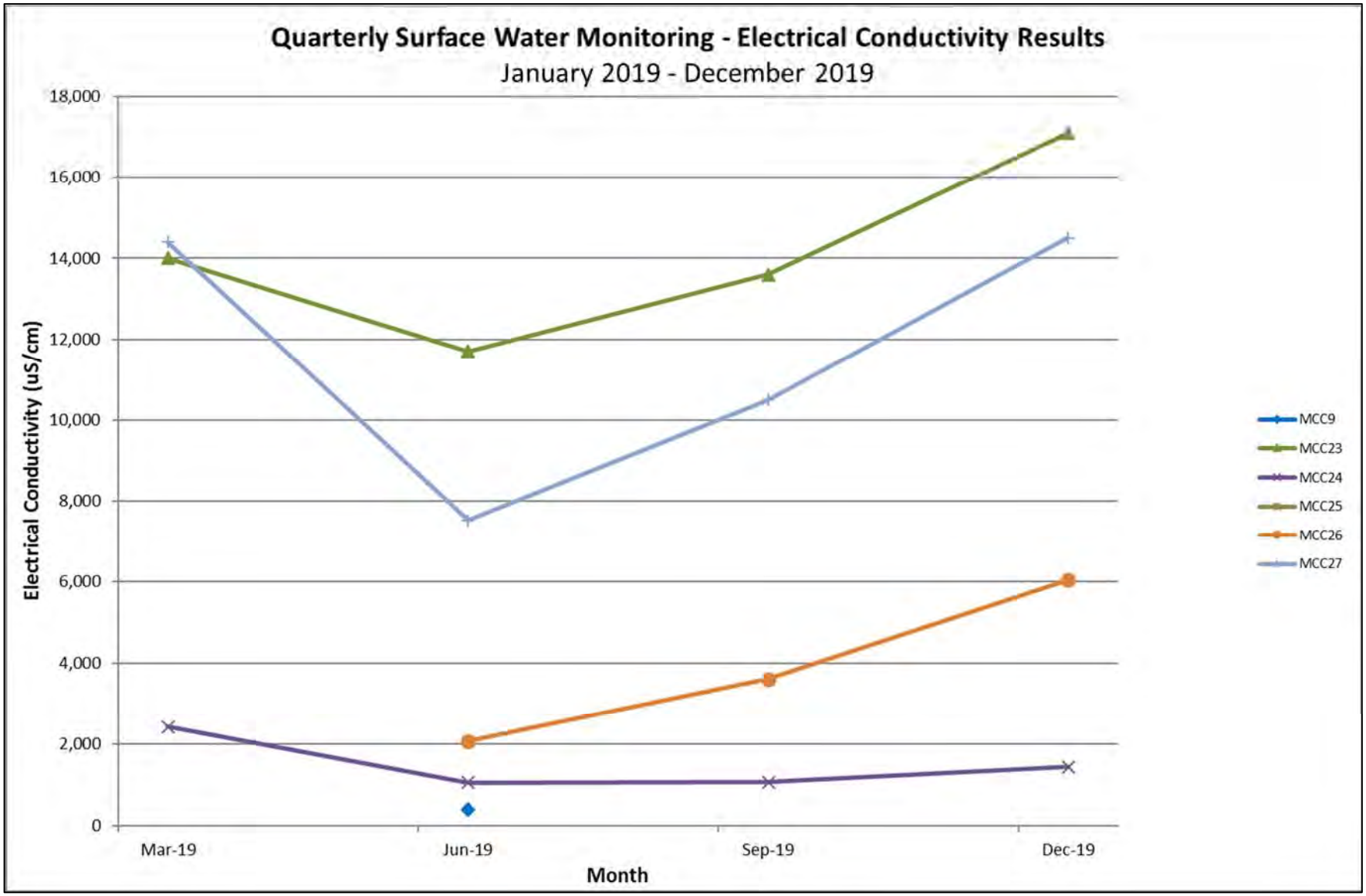


Figure 14: Quarterly Surface Water Monitoring Results – Electrical Conductivity

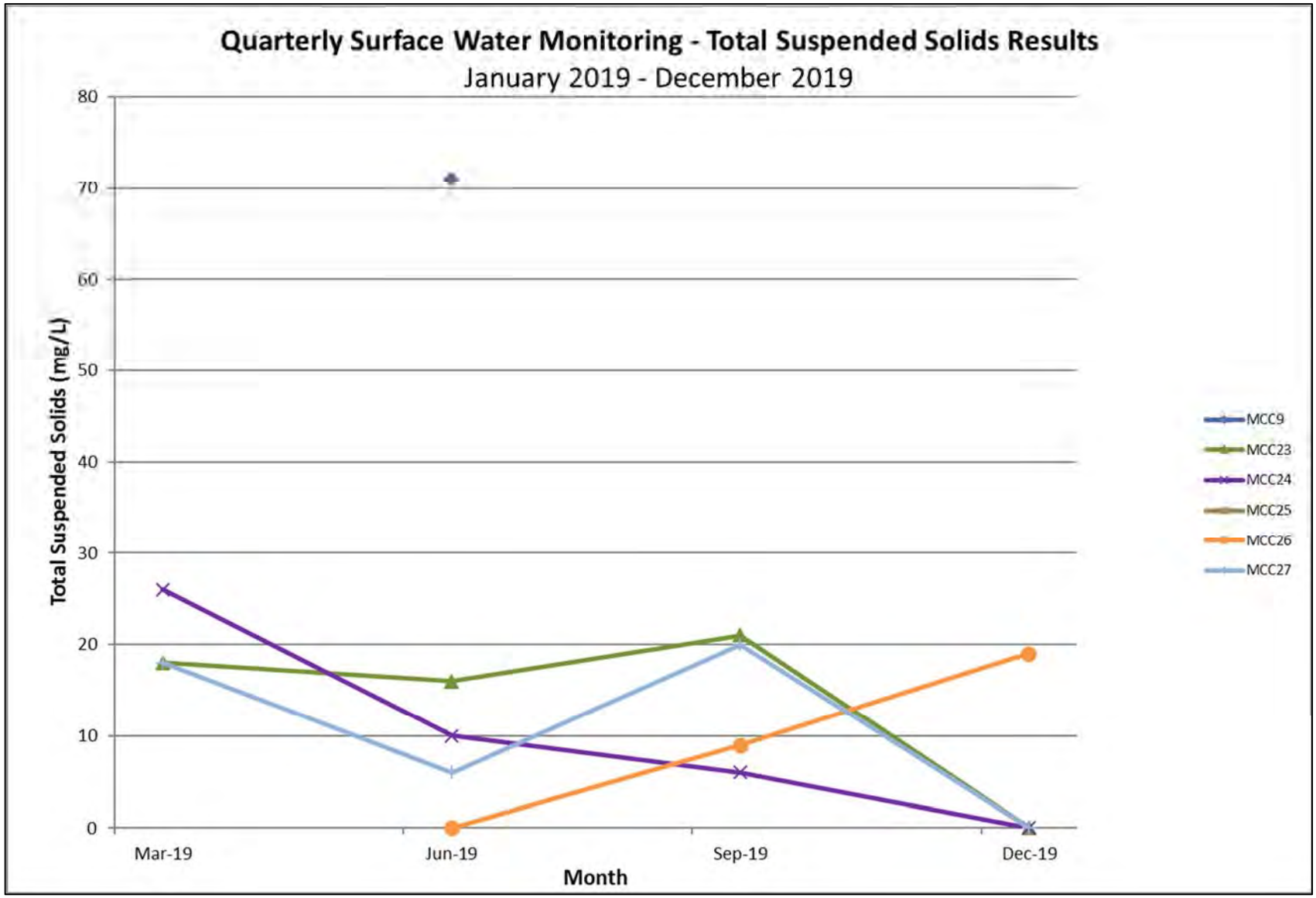


Figure 15: Quarterly Surface Water Monitoring Results – Total Suspended Solids

3.7 GROUNDWATER MANAGEMENT

3.7.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage groundwater impacts in accordance with the Water Management Plan (WMP).

Groundwater trigger levels have been established for selected sites with the trigger levels shown in **Table 24**.

Table 24: Groundwater Monitoring Trigger Levels

WATER LEVELS			
Bore/Well	**Aquifer**	**Lower Trigger Level (m) BTOC**	**Lower Trigger Level (m) AHD**
MCC1003	Alluvial	8.6	146.5
MCC1005	Alluvial	11.3	138.9
MCC1006	Alluvial	10.3	144.6
MCC1017	Hardrock	18.1	180.7
MCC1018	Hardrock	19.0	181.9
pH			
Bore/Well	**Aquifer**	**Lower Trigger pH**	**Upper Trigger pH**
MCC1003	Alluvial	7.1	7.3
MCC1005	Alluvial	6.9	7.2
MCC1006	Alluvial	7.1	7.4
ELECTRICAL CONDUCTIVITY			
Bore/Well	**Aquifer**	**Upper Trigger EC**	
MCC1003	Alluvial	1,666	
MCC1005	Alluvial	5,584	
MCC1006	Alluvial	1,152	

If monitored conditions are outside the upper or lower trigger levels for 3 continuous monthly results MCC will conduct an investigation into the results.

3.7.2 GROUNDWATER MONITORING

MCC undertake a groundwater monitoring program that consists of monthly and annual monitoring. The locations of the groundwater monitoring sites are shown in **Figure 9**.

Ground Water Monitoring Results – Mining Operations

The water level, pH and Electrical Conductivity of the underground working are shown in **Figure 16** and **Figure 17**. The water levels in groundwater monitoring wells located on site are shown in **Figure 18**. These results show there has been a drop in the water levels in the underground workings due to MCC pumping water from these workings. The regional monitoring has shown that there is no impact on alluvial water sources from this drop in water level in the underground workings. The data and the annual comprehensive groundwater monitoring results are provided in **Appendix 2**.

As shown in **Table 25** the pH and Electrical Conductivity results from this reporting period are consistent with previous results and the water levels are lower than previous reporting periods. There are no background results or predictions to compare these results to.

Table 25: Comparison of Underground Working Results

Year	Average pH	Average EC *(µS/cm)*	Relative Level (RL) *(AHD metres)*
2019	7.3	6,265	104
2018	7.0	5,965	107
2017	7.5	6,455	114
2016	7.5	6,482	114
2015	7.3	6,327	114
2014	7.3	5,468	116
2013-2014	7.2	5,375	125
2012-2013	7.6	5,711	123-146

Ground Water Monitoring Results – Sandy Creek Area

The alluvial and hard rock aquifers in the Sandy Creek area are a significant lateral distance from the open cut footprint and no impacts have been determined. Ground water depths and quality results are presented in **Figure 19** to **Figure 21**. The data and the annual comprehensive groundwater monitoring results are provided in **Appendix 2**.

As shown in **Table 26** to **Table 28** the results from this reporting period are generally consistent with the results from previous reporting periods with any variations being due to the ongoing dry conditions. There are no background results or predictions to compare these results to.

Table 26: Comparison of Depth to Historical Results

Location	Depth Annual Average (mbgl)							
	2012-2013	2013-2014	2014	2015	2016	2017	2018	2019
MCC1003	3.8	4.5	5.8	3.6	3.9	4.6	7.2	7.1
MCC1005	7.3	7.8	8.3	7.9	7.5	8.0	8.8	9.2
MCC1006	5.7	6.5	no results	no results	5.6	6.4	no results	no results
MCC1017	17.0	17.1	16.8	17.1	17.1	17.2	17.6	17.9
MCC1018	16.6	16.7	16.8	17.3	17.6	17.8	18.2	18.4

Table 27: Comparison of pH Results to Historical Results

Location	pH Annual Average							
	2012-2013	2013-2014	2014	2015	2016	2017	2018	2019
MCC1003	7.2	7.3	7.2	7.2	7.1	7.1	7.0	7.1
MCC1005	7.1	7.2	7.2	7.1	7.2	7.1	7.0	6.9
MCC1006	7.1	7.2	no results	no results	7.2	7.2	no results	no results

Table 28: Comparison of EC Results to Historical Results

Location	Electrical Conductivity Annual Average (µS/cm)							
	2012-2013	2013-2014	2014	2015	2016	2017	2018	**2019**
MCC1003	1,359	1,480	1,701	1,345	1,471	1,347	1,392	1,212
MCC1005	1,947	2,544	2,697	2,768	2,170	2,235	2,851	3,880
MCC1006	1,087	1,117	no results	no results	982	931	no results	no results

3.7.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period, MCC will continue to manage and monitor groundwater quality impacts in accordance with the WMP.

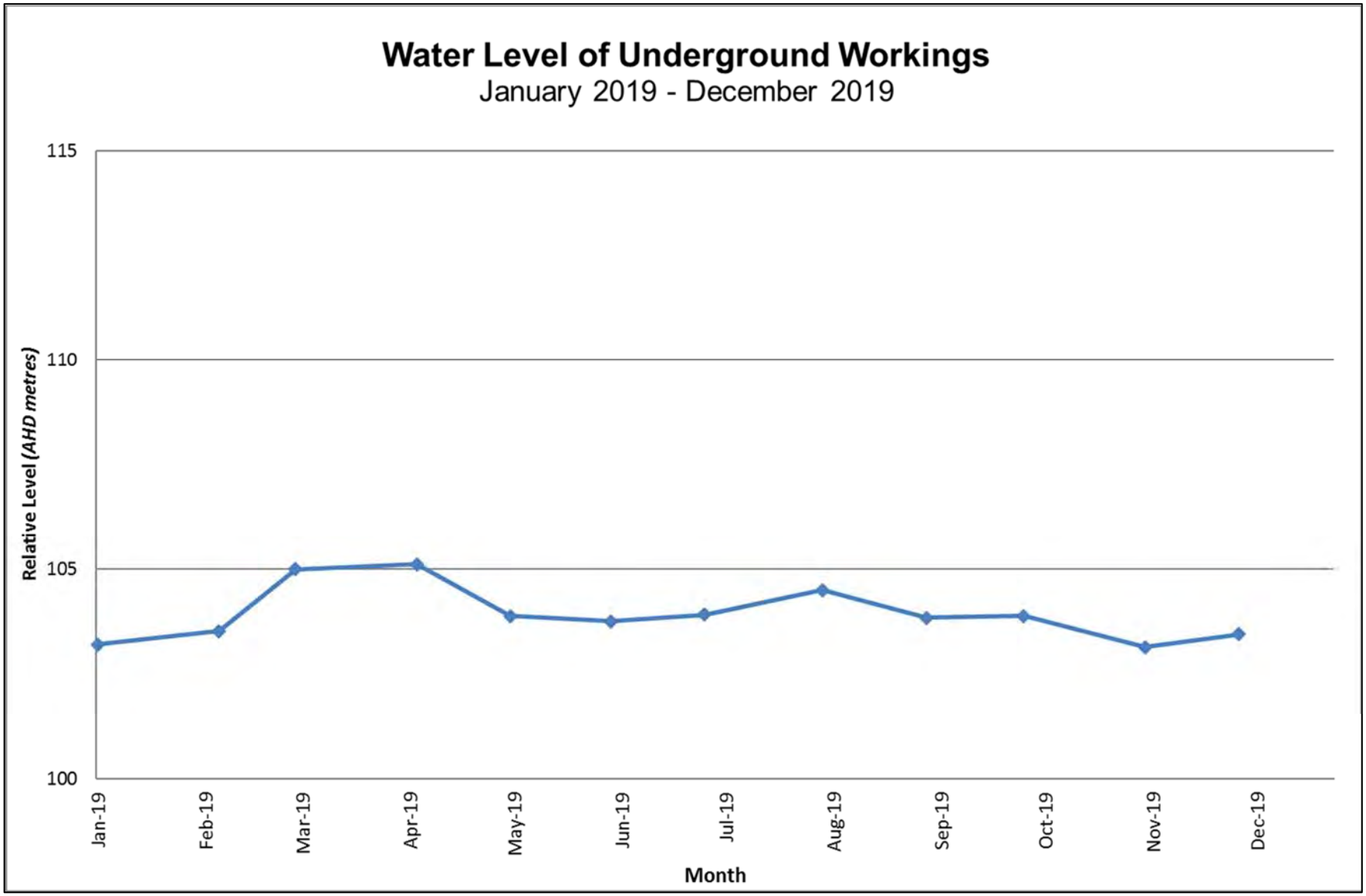


Figure 16: Water Level for Underground Workings

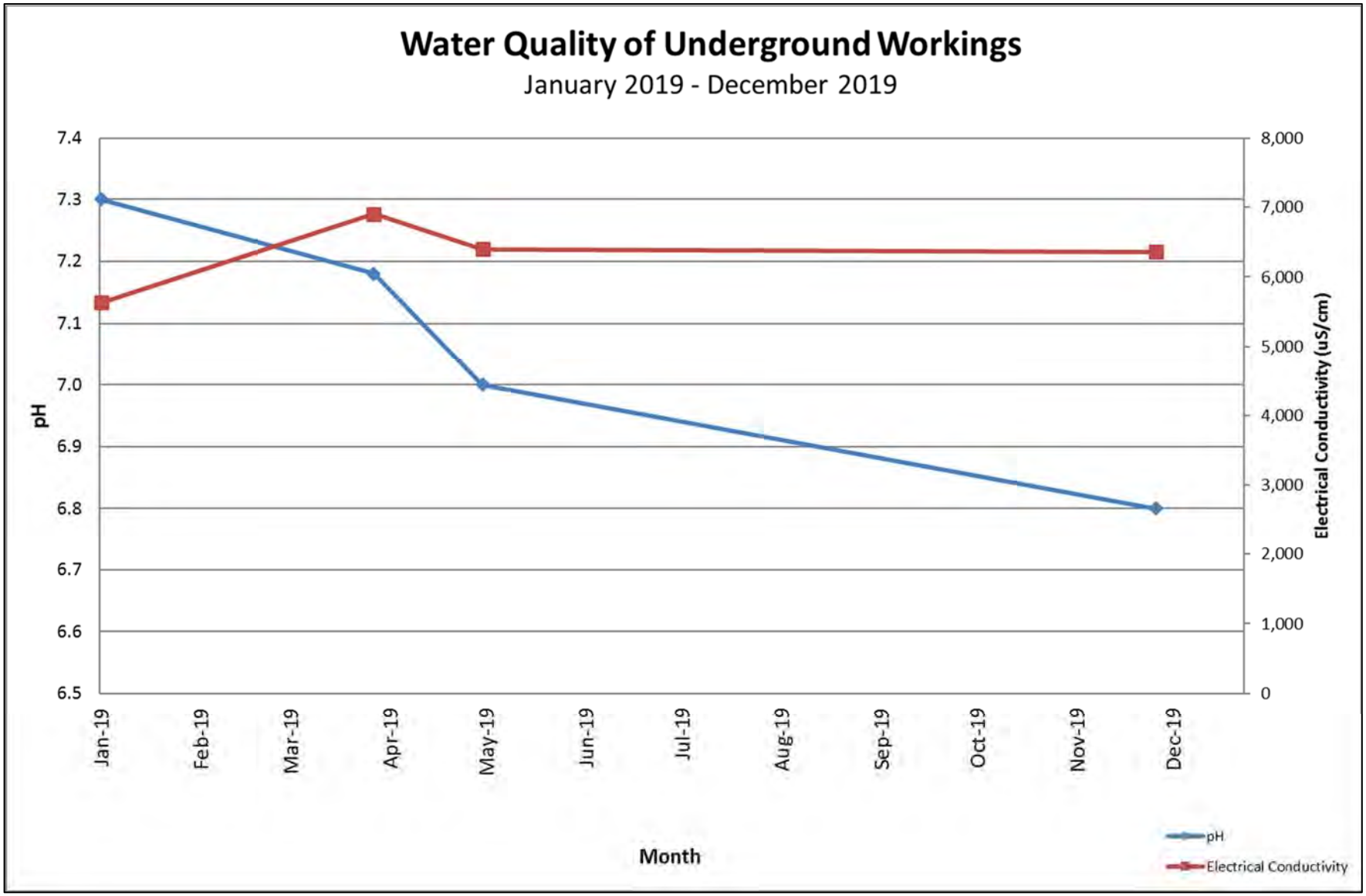


Figure 17: Water Quality Data in Underground Workings

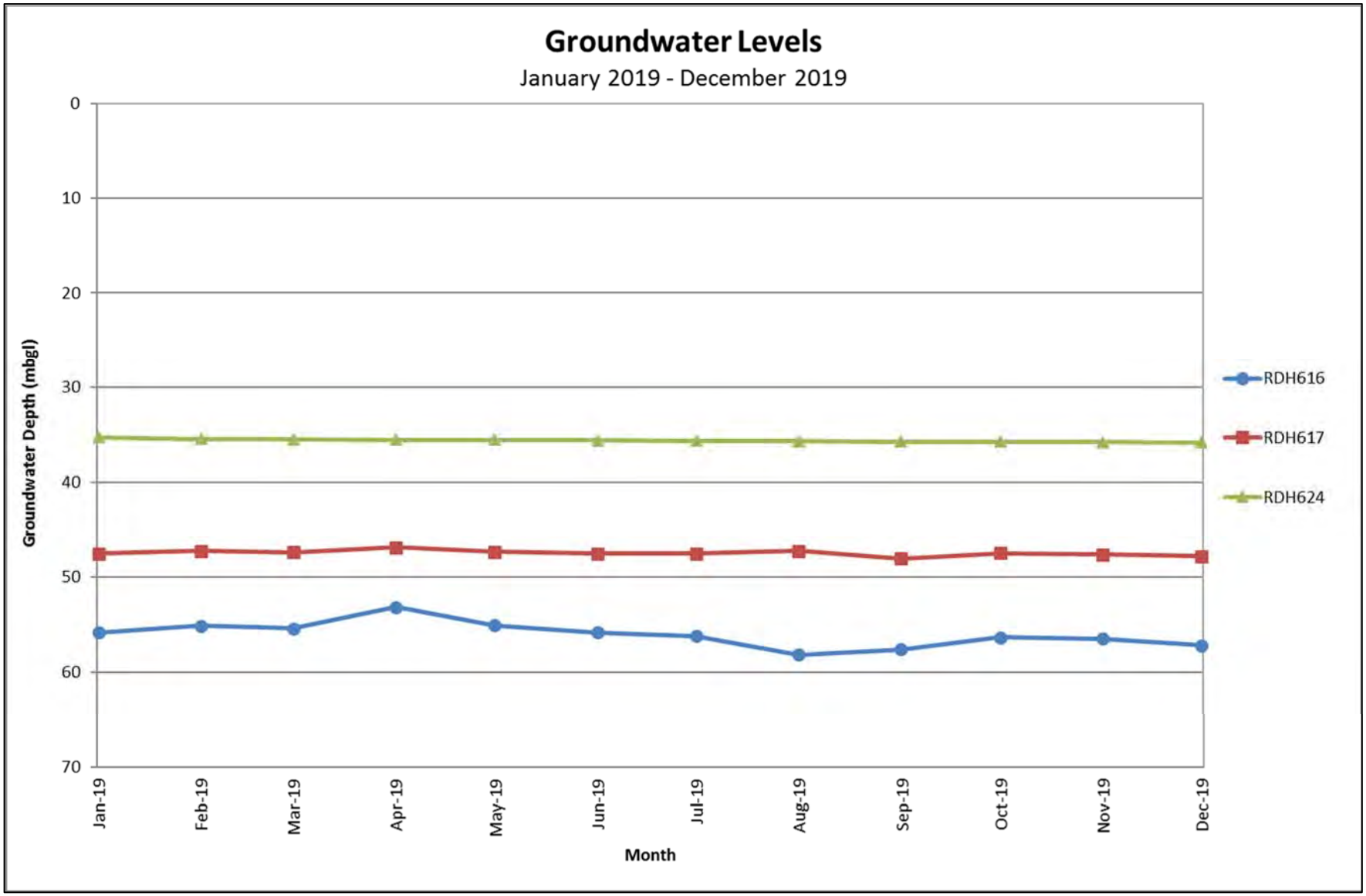


Figure 18: Water Level for On Site Groundwater Monitoring

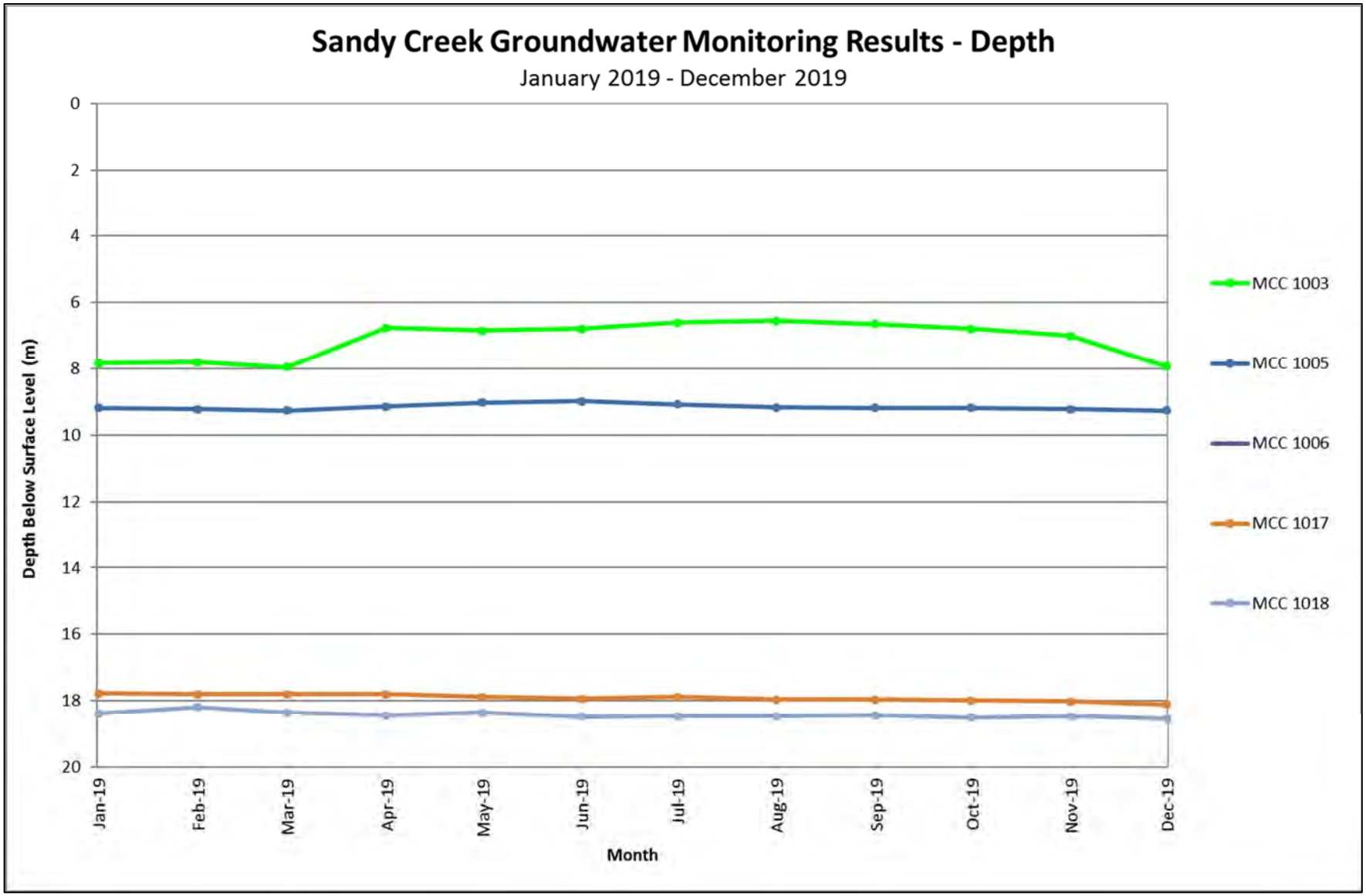


Figure 19: Sandy Creek Groundwater Depth

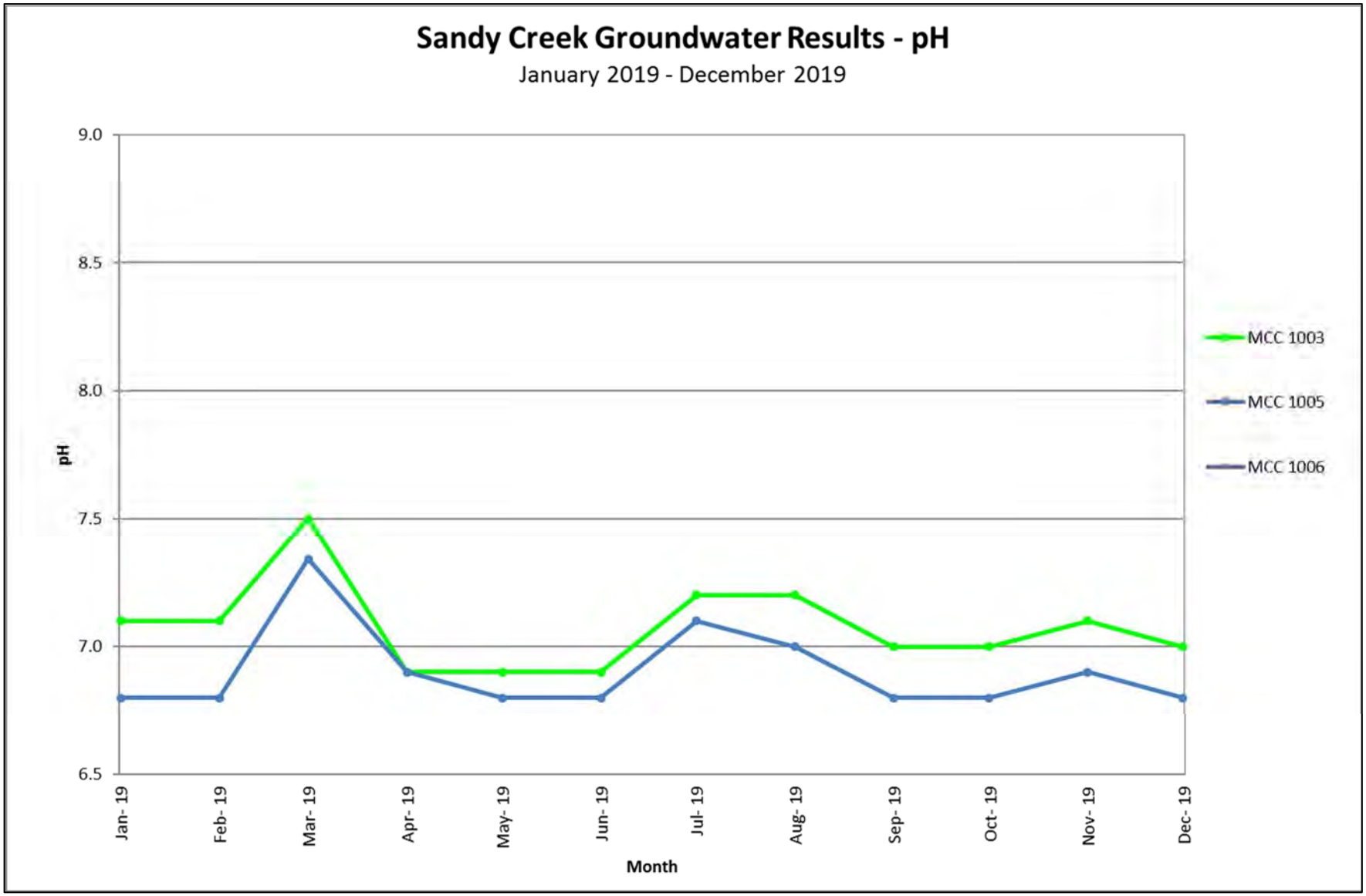


Figure 20: Sandy Creek Water Quality – pH

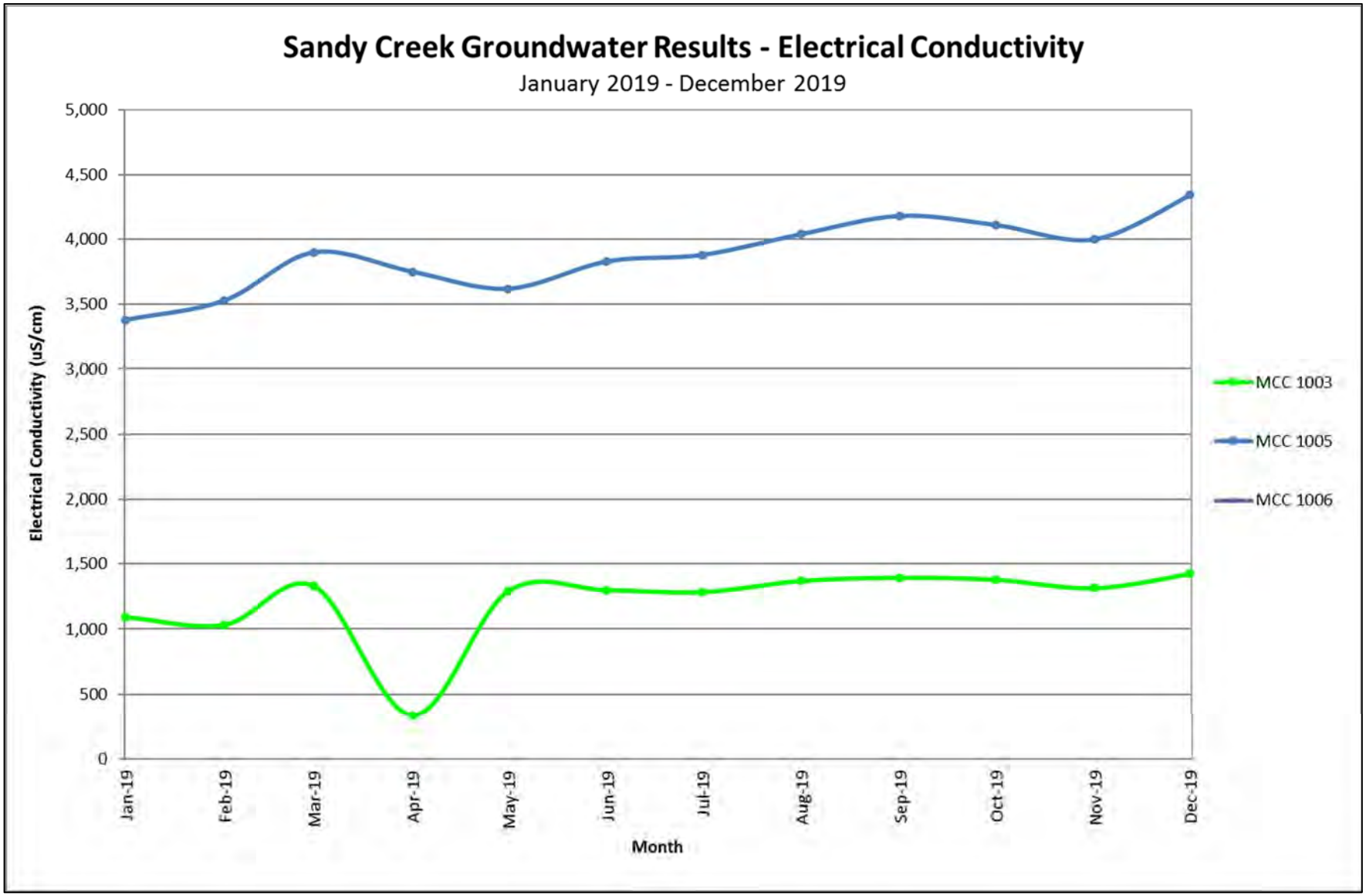


Figure 21: Sandy Creek Water Quality – Electrical Conductivity

3.8 CONTAMINATED LAND

MCC has a Bioremediation Area where material contaminated with hydrocarbons is managed and tested. When the test results indicate that the material is no longer contaminated it is removed and disposed of in the carbonaceous dump in the mining area.

3.9 FLORA AND FAUNA MANAGEMENT

3.9.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage impacts on flora and fauna in accordance with the Mining Operations Plan (MOP). The latest modification to the development consent removed the requirement for a Flora and Fauna Management Plan with the management of flora and fauna impacts to be discussed in the MOP.

MCC is set amongst an area of existing disturbed and mined land. The area to be mined is extensively altered from its natural state through current and past mining operations.

Five vegetation communities have been identified at MCC. These are:

- Hunter Floodplain Red Gum Woodland;
- Central Hunter Grey Box-Ironbark Woodland;
- Regenerating Central Hunter Grey Box-Ironbark Woodland;
- Aquatic Forbland; and
- Mine Rehabilitation.

No threatened flora species have been identified at MCC. The area to be disturbed is not considered important habitat for threatened fauna. The area is also not considered critical habitat.

To allow for continued mining operations, tree clearing on historical rehabilitation was undertaken during the reporting period. Prior to this clearing commencing, a pre-clearance survey was undertaken by an ecologist to identify any habitat features or threatened species that needed additional management. No issues were identified during the pre-clearance survey that required additional management.

3.9.2 FLORA AND FAUNA MONITORING

Inspections of nesting boxes are performed on a regular basis. Inspections were performed twice during this reporting period with the results of the inspections shown below.

- Sugar Glider (2) – not occupied at the time of inspection and no signs of activity were observed.
- Bat (4) – not occupied at the time of inspection and no signs of activity were observed.
- Brushtail Possum (2) – not occupied at the time of inspection and no signs of activity were observed.

3.9.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage impacts on flora and fauna in accordance with the Mining Operations Plan (MOP).

3.10 WEEDS, PEST AND FERAL ANIMALS

3.10.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage weeds, pest and feral animals on site.

Weed Control

Weed control and eradication techniques used at MCC include:

- Promotion of vigorous pasture growth to out-compete weeds;
- Minimisation of area available for weed infestation, through prompt revegetation of bare areas;
- Spraying with selective herbicides; and
- Physical removal by chipping/slashing.

During the reporting period MCC undertook weed control programs across the rehabilitation areas. Weed spraying was the main form of weed control this year and included a combination of ground and aerial spraying. The target species for the weed spraying control included:

- Galenia (153.3ha);
- Prickly Pears (Prickly Pear, Tiger Pear and Creeping Pear) (72.0ha);
- Paterson's Curse (4.5ha);
- Mother of Millions (1.4ha);
- Saffron Thistle (7.7ha);
- African Boxthorn (45.7ha);
- Mixed weeds (includes grasses, Tree Tobacco, Castor Oil, Cotton Bush and Acacia saligna) (12.1ha);
- Pampas Grass (approx. 20 plants);
- Bitou Bush (3 plants); and
- Acacia Saligna regrowth (0.4ha).

In addition, a stand of Acacia Saligna, 0.4ha in size, was removed via physical removal.

The areas that were targeted during the reporting period are shown in **Figure 22**.

Pest Animal Control

During the reporting period, MCC conducted a culling program targeting Eastern Grey Kangaroo, Red-necked Wallaby, and Wallaroo. This program was conducted in accordance with a Licence to Harm Kangaroos issued under Part 2 of the *Biodiversity Conservation Act* 2016, by the National Parks and Wildlife Service. MCC undertook this culling program to reduce the grazing pressure on the rehabilitated areas.

Feral Animal Control

During the reporting period, MCC undertook a dog and fox baiting program that was implemented in conjunction with surrounding landowners including the Hebden Wild Dog Association. This included aerial and ground baiting.

The ground baiting program consisted of using Canid Pest Ejectors (CPEs) at 20 locations around the mining area. These ejectors were checked weekly and replaced if they were taken. The baiting program was undertaken over 37 days in May and June 2019. There was a 42% take rate of the baits, which is considered a high take rate. Field cameras were used to assist with identifying what animals were taking the baits. From these cameras and other evidence around the baiting stations it was identified that cats, foxes and a cat took the baits. Some baits were taken by unknown animals.

3.10.2 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage weed and feral animal impacts in accordance with the Mining Operations Plan (MOP).

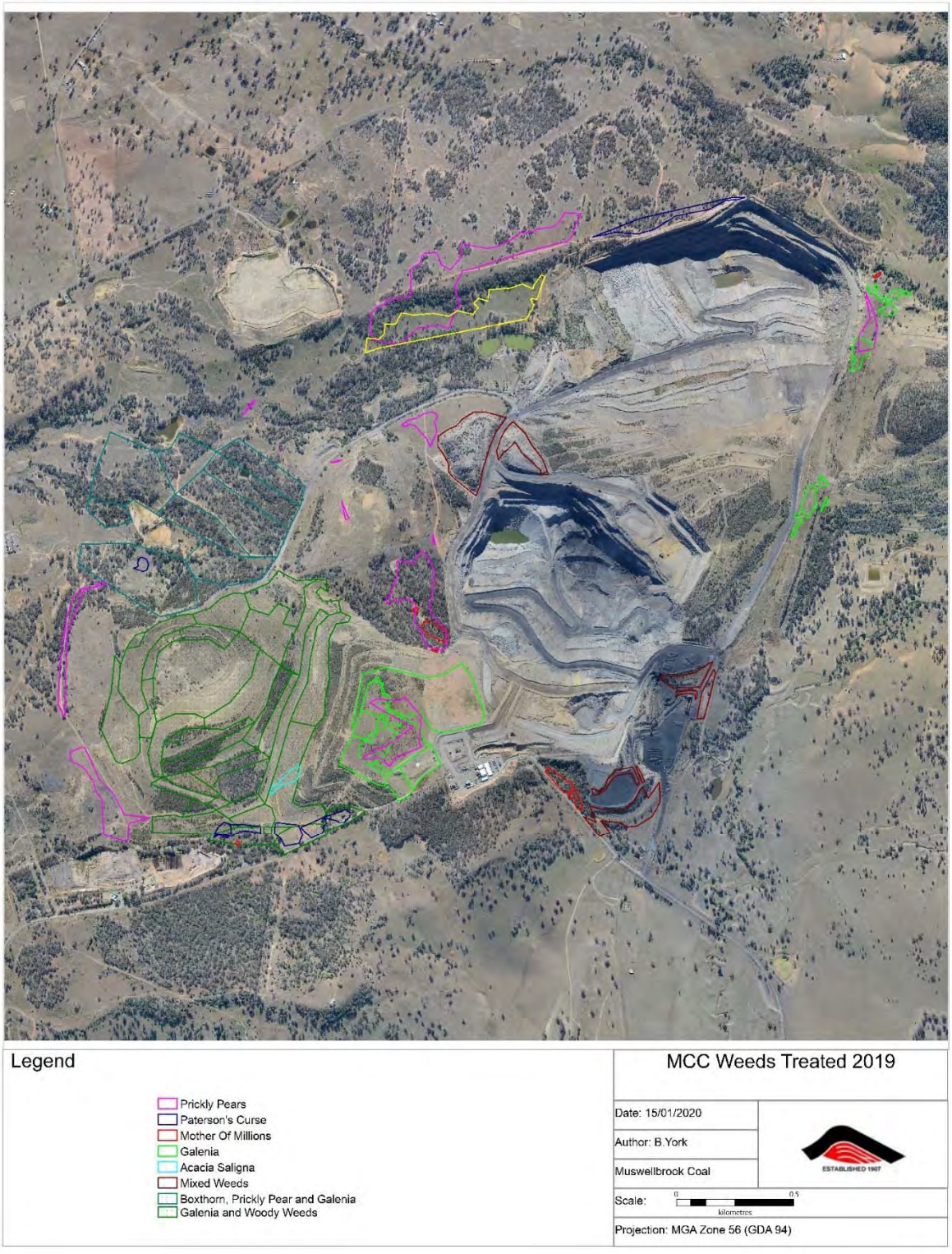


Figure 22: Weed Control Areas

3.11 BLASTING

3.11.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage blasting impacts in accordance with the Blast Management Plan.

Members of the public are notified of proposed blasting times by contacting the Blast Information Service Line where they hear a recorded message or by looking at the "Blasting Notices" page of the Muswellbrook Shire Council Website.

The intent of best practice goals in drill and blast activities is to comply with the fragmentation requirements for each blast. The use of best practice techniques will reduce air blast overpressure, ground vibration, fumes and odours from blasting activities.

Best practice drill and blast activities at MCC include:

- A high degree of accuracy in the placement of drill holes so that design spacing and burden is achieved using Automatic Positioning System (APS) or other survey control;
- Management of surface and groundwater in the drill holes (to reduce fume and odour issues);
- Blast design and delays are designed to avoid wavefront reinforcement;
- Regular inspections of ground and hole conditions to identify any geological abnormalities that may create a path for the uncontrolled release of gaseous products from explosive material;
- Loading of the explosive material so that holes are not loaded in excess of the design;
- Proper placement of decking charges if required;
- Effective placement of good quality stemming to design column height for containment of explosive product;
- Reduce the sleep time of the blast pattern to minimise the potential for deterioration of the explosive material;
- Take into account any adverse meteorological conditions at the time of the blast and defer or modify the blast to accommodate those conditions;
- Video recording of blasts to identify any causal factors contributing to any aberration from the predicted outcomes; and
- Vibration and overpressure monitoring for all blasting activities on site.

3.11.2 BLAST MONITORING

All blasts are monitored by four automatically triggered blast monitors. The monitors are maintained in accordance with the relevant standards and calibrated annually.

The blasting criteria that apply to MCC are shown in **Table 29**.

Table 29: Blast Criteria

Vibration (mm/s)	Allowable Exceedance
5	5% of total number of blasts over a 12 month period
10	0%
Overpressure (dB(L))	**Allowable Exceedance**
115	5% of total number of blasts over a 12 month period
120	0%

The blast monitoring network is provided in **Table 30** and locations are displayed in **Figure 23**.

Table 30: Blast Monitoring Network

Blast Monitor	Location
B1 (Queen St)	In the vicinity of the nearest non-company owned residence
B2 (School)	At the Muswellbrook Public School, Roger Street, North Muswellbrook
B3 (99 Queen St)	At the northern end of Queen Street, North Muswellbrook
B4 (Nisbet)	Sandy Creek Road, approximately 1.2km to the north of MCC

During the reporting period, 100 blast events occurred at MCC. All four blast monitors were operational throughout the reporting period, with 100% of data captured during the reporting period.

A summary of blast monitoring results is displayed in **Figure 24** to **Figure 27**. Blast data for all monitors is shown in **Appendix 3**.

Table 31 compares the average results from the blast monitoring sites during this reporting period, historical monitoring results, and predictions made in the 2010 Environmental Assessment (EA) (for 2016 and earlier) and the 2016 Statement of Environmental Effects (SEE) (for 2017 and later). When the SEE was prepared the predicted results were recalculated. The results this reporting period are generally consistent with historical monitoring results and below the predicted results in the EA and SEE.

Table 31: Comparison of Blasting Results

Year	Vibration (mm/s)		Overpressure (dBL)	
	Average Monitoring Results	EA Predicted Results	Average Monitoring Results	EA Predicted Results
2019	0.19	0.7	100.1	111.0
2018	0.20	0.7	101.3	111.0
2017	0.25	0.7	101.8	111.0
2016	0.22	2.2	101.0	114.0
2015	0.52	2.2	97.8	114.0
2014	0.11	2.2	98.0	114.0
2013-2014	0.15	2.2	99.1	114.0
2012-2013	0.16	2.2	98.6	114.0

3.11.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage and monitor blasting impacts in accordance with the BMP.

The BMP will be reviewed and updated during the next reporting period.

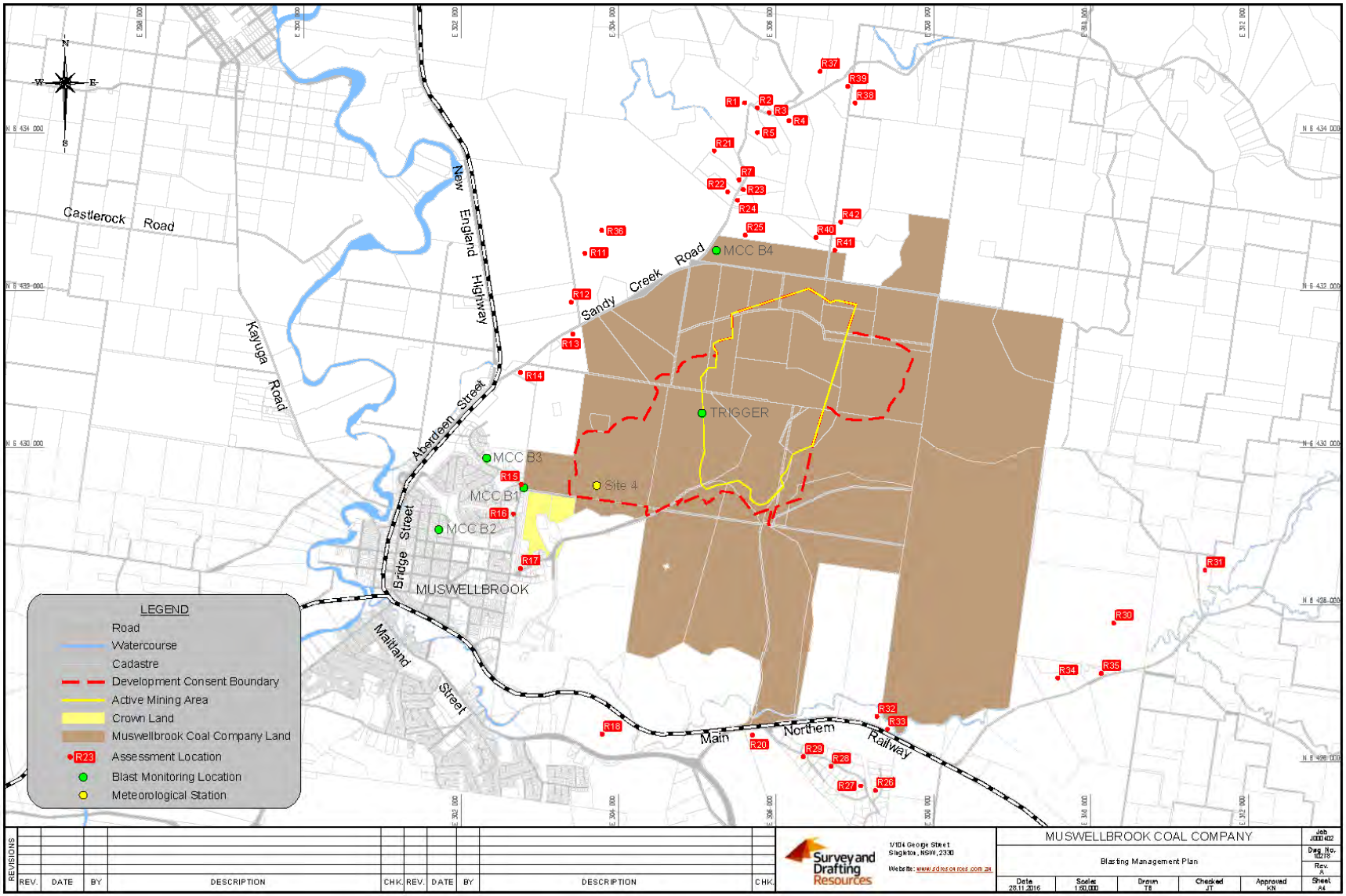


Figure 23: Blast Monitoring Locations

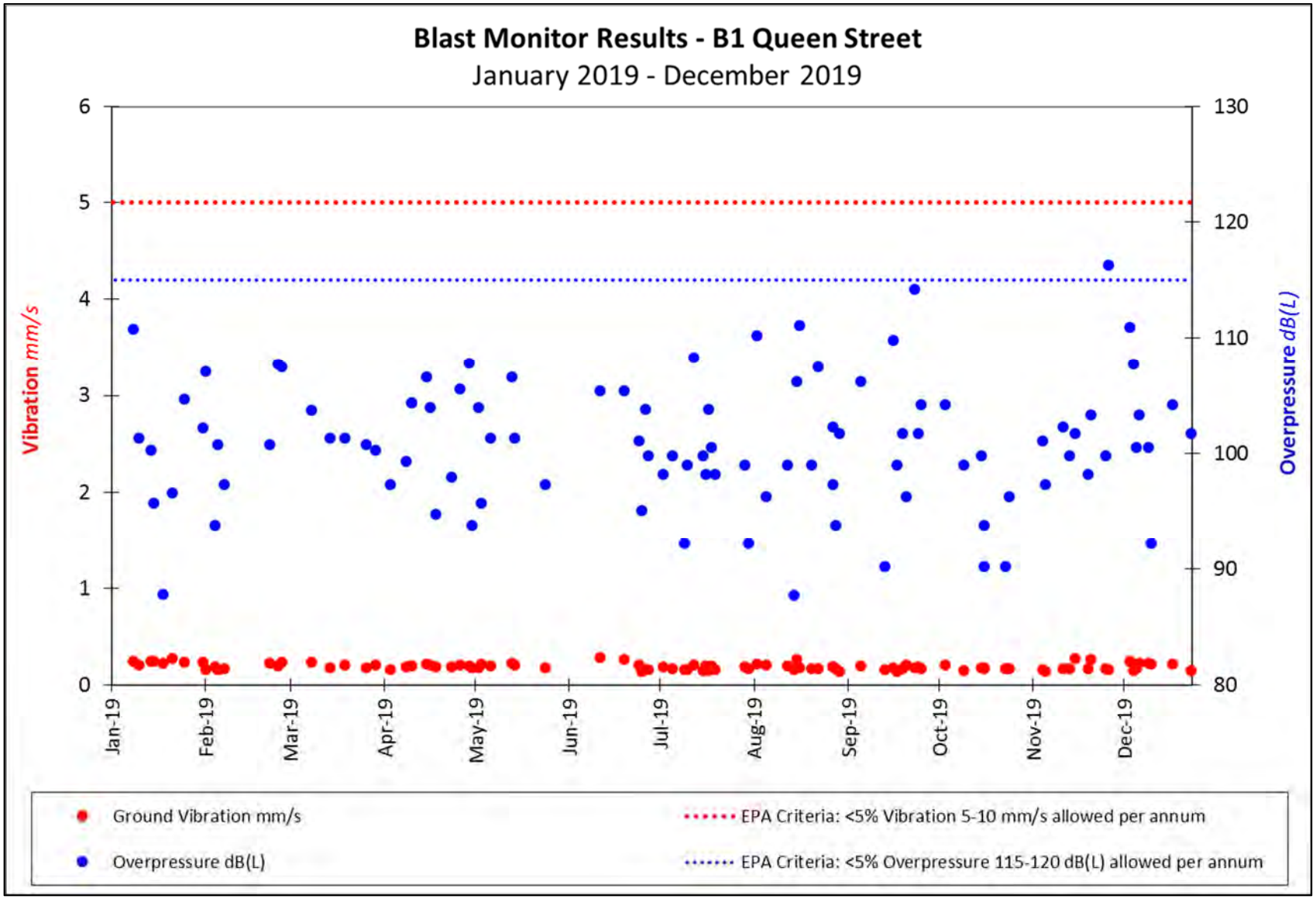


Figure 24: Queen Street Blast Monitoring Results

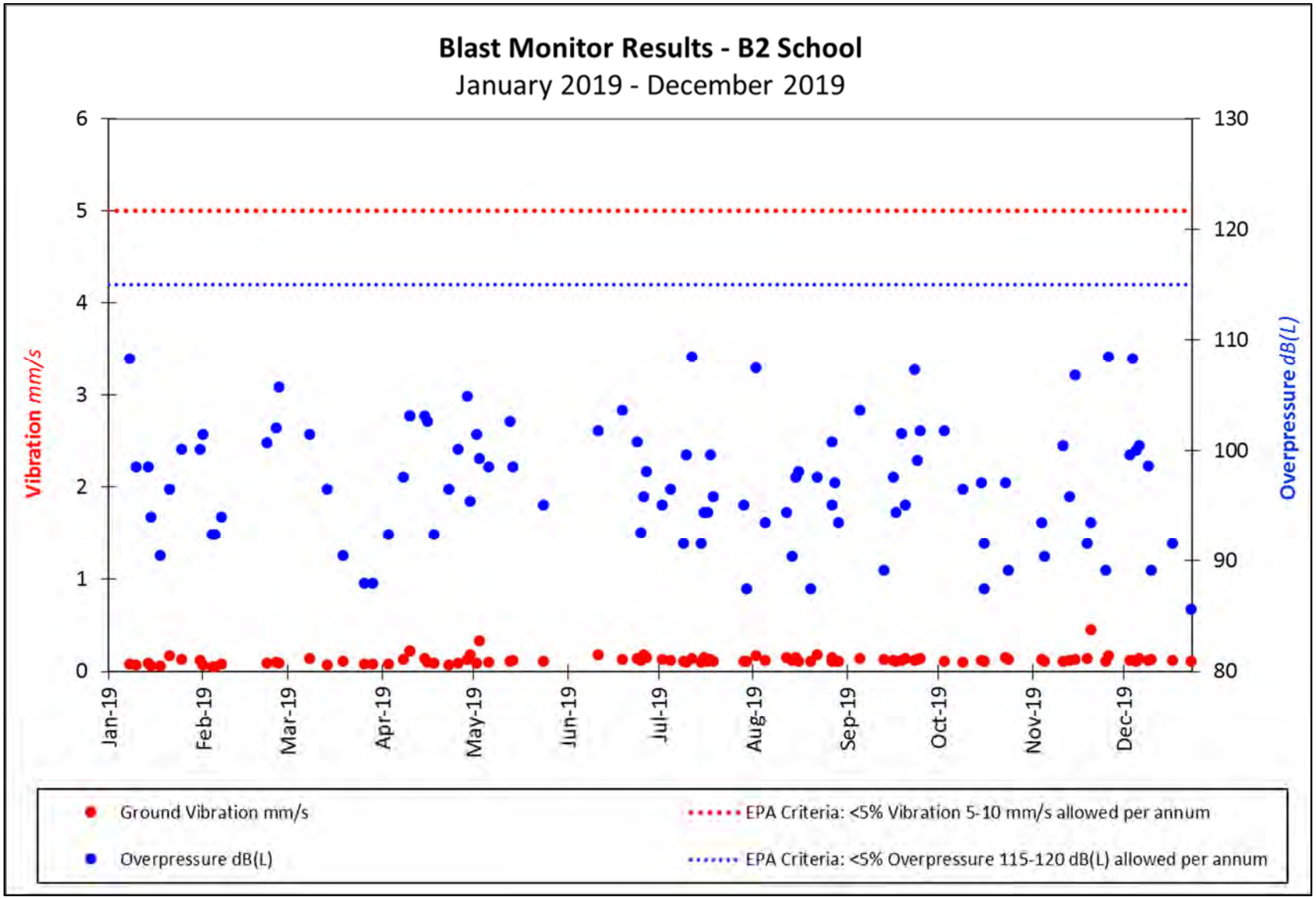


Figure 25: School Blast Monitoring Results

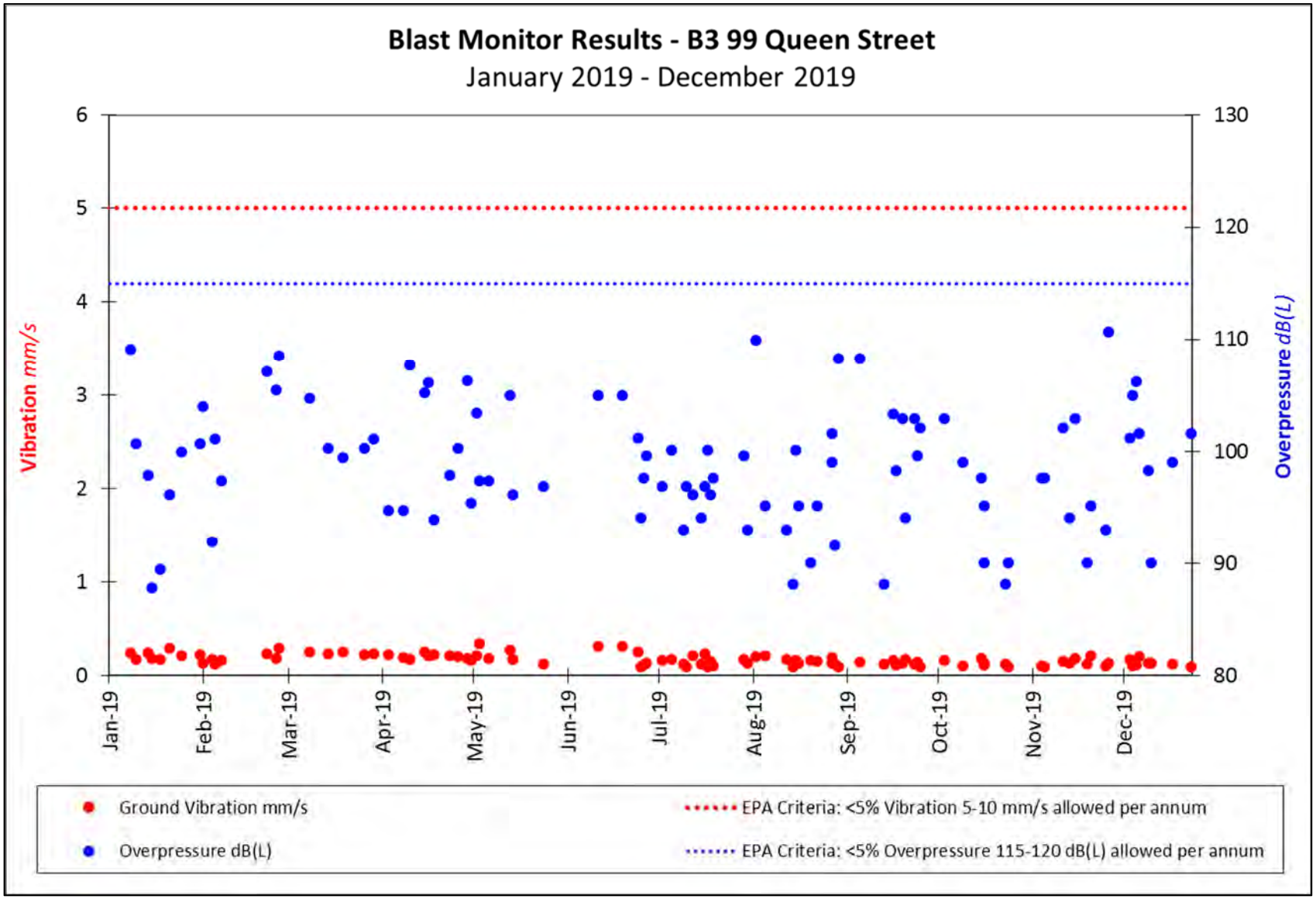


Figure 26: 99 Queen Street Blast Monitoring Results

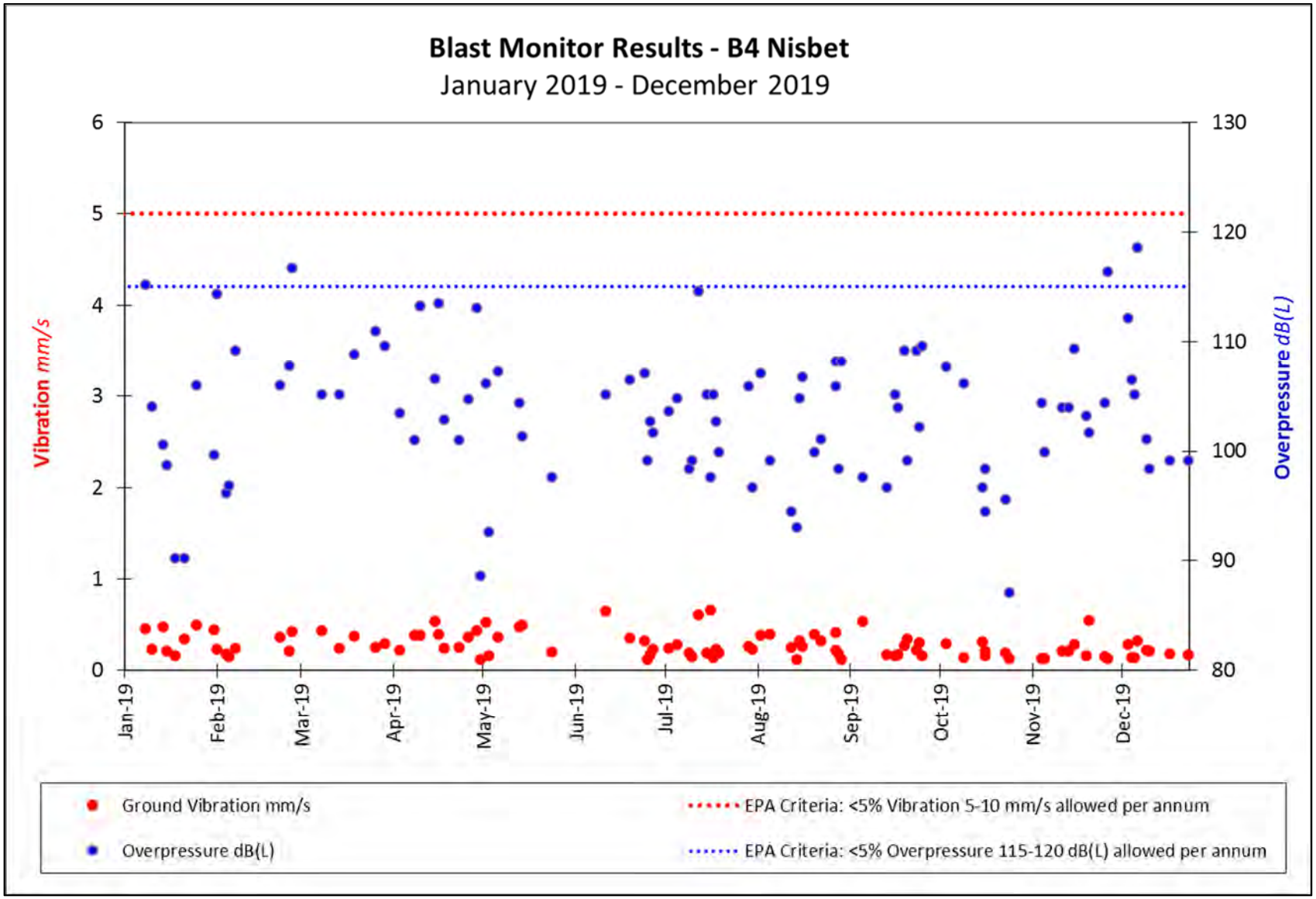


Figure 27: Nisbet Blast Monitoring Results

3.12 NOISE MANAGEMENT

3.12.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to operate in accordance with the Noise Management Plan (NMP).

The main objective of the NMP is to manage and minimise the impact of noise from mining operations on the environment and nearby residences. The following actions will be undertaken to achieve this objective:

- Outline the measures to be undertaken on site to mitigate noise emissions;
- Maintain a noise monitoring program;
- Identify the risk levels at which mine operations may need to be modified to manage compliance;
- Define the mechanisms for community consultation;
- Detail the management measures to be undertaken where the noise levels are demonstrated to exceed the criterion;
- Detail the specifications and procedures to be used for the purpose of Independent Noise Investigations; and
- Specify the regulatory reporting requirements.

3.12.2 NOISE MONITORING

The noise monitoring network is provided in **Table 32** and locations are displayed in **Figure 28**.

Table 32: Noise Monitoring Network

Location	Description
R13	Sandy Creek Road
R15	Queen St
R17	Queen St
R25	Sandy Creek Road
R32	Muscle Creek Road

MCC has a network of five attended noise survey locations. Monitoring is conducted at these sites monthly. Monthly attended monitoring allows for a variety of operating configurations, weather conditions and seasonal variations to be measured. The noise consultant schedules the monitoring to occur at times unknown to MCC and they determine the intervals between surveys and the time of measurement. Each attended noise survey is conducted during night periods only.

All noise surveys are performed in accordance with the EPA "NSW Noise Policy for Industry", the Periodic Noise Monitoring programme and Australian Standard 1055 "Acoustics, Description and Measurement of Environmental Noise" as specified in the NMP. Twelve attended noise surveys were undertaken during the reporting period.

Measurements were taken in third-octave bands with an instrument that has Type 1 characteristics as defined in AS1259-1990 "Acoustics – Sound Level Meters". The instrument has a current calibration as per manufacturer's instructions and calibration was also confirmed prior to and at the completion of measurements with a Sound Level Calibrator. The LA_{eq} (15-minute) noise emission levels, at each monitoring site, were determined.

The actual noise level received at individual residences may vary because of:

- The location of mining equipment;

- The elevation of mining equipment;
- Impacts from other noise sources; and
- Prevailing meteorological conditions.

A summary of the results are shown in **Table 35** and **Table 36**.

The mining related noise sources were from engine noise, dozer tracks and CHPP operations.

Table 33 and **Table 34** compare the average noise monitoring results for this reporting period, historical monitoring results, and predictions made in the 2010 Environmental Assessment (EA) (for 2016 and earlier) and the 2016 Statement of Environmental Effects (SEE) (from 2017). When the SEE was prepared the predicted results were recalculated due to the changes in mine plan. The results in 2017 are generally consistent with historical monitoring results and below the predicted results in the EA and SEE. Overall there has been a reduction in noise levels during this reporting period compared to the last reporting period.

Table 33: Comparison of Average LA_{eq} Noise Results

Year	R13 Sandy Creek Road		R15 Queen Street		R17 Queen Street		R25 Sandy Creek Road		R32 Muscle Creek Road	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
2019	29	40	25	37	24	34	29	41	20	32
2018	29	40	29	37	31	34	30	41	24	32
2017	28	40	27	37	24	34	27	41	25	32
2016	28	38	20	35	23	33	no data		no data	
2015	29	38	28	35	31	33	no data		no data	
2014	35	38	25	35	23	33	no data		no data	
2013-2014	33	38	29	35	27	33	no data		no data	
2012-2013	33	38	21	35	18	33	no data		no data	

Table 34: Comparison of Average $LA1_{1min}$ Noise Results

Year	R13 Sandy Creek Road		R15 Queen Street		R17 Queen Street		R25 Sandy Creek Road		R32 Muscle Creek Road	
	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
2019	33	37	29	33	28	31	33	40	23	32
2018	34	37	34	33	37	31	35	40	26	32
2017	33	37	32	33	28	31	32	40	29	32
2016	28	no data	24	no data	23	no data	no data		no data	
2015	32	no data	30	no data	37	no data	no data		no data	
2014	40	no data	29	no data	25	no data	no data		no data	
2013-2014	34	no data	32	no data	25	no data	no data		no data	
2012-2013	41	no data	28	no data	19	no data	no data		no data	

3.12.3 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage and monitor noise related impacts in accordance with the NMP. The NMP will be reviewed and updated during the next reporting period.

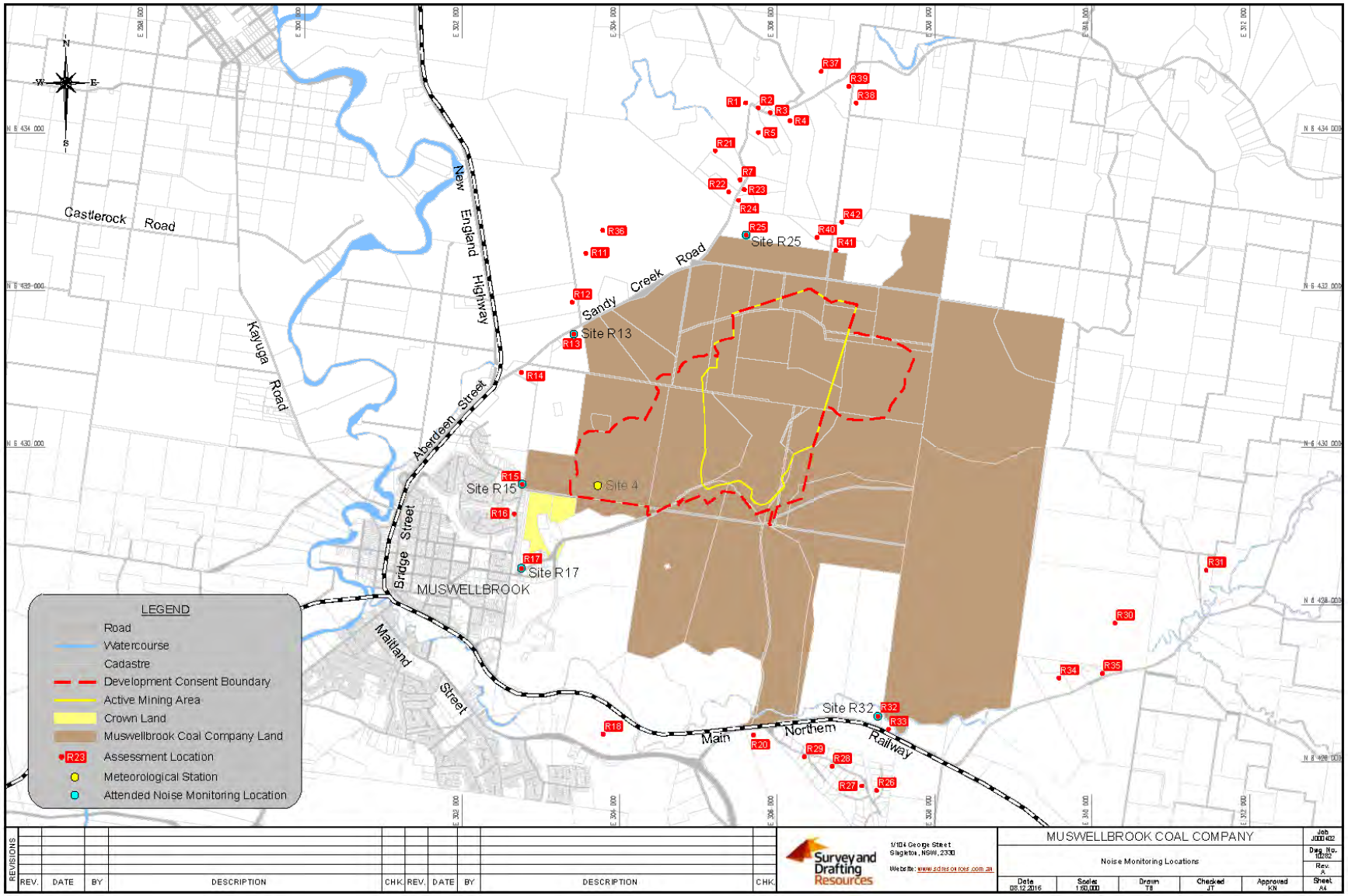


Figure 28: Noise Monitoring Locations

Table 35: Noise Monitoring Results – MCC Contribution LA_{eq}

Month	R13 Sandy Creek Rd	Criteria	R15 Queen St	Criteria	R17 Queen St	Criteria	R25 Sandy Creek Rd	Criteria	R32 Muscle Creek Rd	Criteria
Jan 19	38	41	Not audible	37	Not audible	35	33	42	Not audible	35
Feb 19	34	41	32	37	32	35	30	42	Not audible	35
Mar 19	40	41	36	37	33	35	40	42	Not audible	35
Apr 19	38	41	34	37	33	35	31	42	Not audible	35
May 19	Not audible	41	Not audible	37	Not audible	35	Not audible	42	34	35
Jun 19	Not audible	41	Not audible	37	Not audible	35	Not audible	42	29	35
Jul 19	31	41	30	37	28	35	Not audible	42	Not audible	35
Aug 19	25	41	32	37	33	35	35	42	26	35
Sep 19	36	41	30	37	22	35	38	42	Not audible	35
Oct 19	36	41	Not audible	37	Not audible	35	35	42	Not audible	35
Nov 19	Not audible	41	Not audible	37	Not audible	35	22	42	22	35
Dec 19	25	41	30	37	32	35	36	42	29	35

Table 36: Noise Monitoring Results – MCC Contribution $LA1_{1min}$

Month	R13 Sandy Creek Rd	R15 Queen St	R17 Queen St	R25 Sandy Creek Rd	R32 Muscle Creek Rd	Criteria
Jan 19	43	Not audible	Not audible	37	Not audible	45
Feb 19	42	40	40	34	Not audible	45
Mar 19	43	40	36	44	Not audible	45
Apr 19	42	42	40	39	Not audible	45
May 19	Not audible	Not audible	Not audible	Not audible	38	45
Jun 19	Not audible	Not audible	Not audible	Not audible	33	45
Jul 19	35	35	31	Not audible	Not audible	45
Aug 19	28	41	40	40	29	45
Sep 19	43	40	40	42	Not audible	45
Oct 19	41	Not audible	Not audible	39	Not audible	45
Nov 19	Not audible	Not audible	Not audible	32	36	45
Dec 19	29	34	37	42	33	45

3.13 VISUAL AMENITY, LIGHTING AND LANDSCAPING

During the reporting period MCC continued to operate in accordance with the Visual Amenity, Lighting and Landscaping Management Plan (VALLMP).

The primary objectives of the VALLMP are to implement visual reduction strategies in order to minimise the visual, lighting and landscape impact on the community and meet the development consent requirements. MCC will continue to employ measures to minimise the potential for visual related impacts on the nearest receptors by:

- Undertaking rehabilitation progressively where possible; and
- Orientating lights away from sensitive receptors where practical.

During the next reporting period MCC will continue to manage visual, lighting and landscaping in accordance with the VALLMP. The VALLMP will be reviewed during the next reporting period.

3.14 ABORIGINAL HERITAGE

MCC has successfully completed salvage operations and continues to maintain and protect one Aboriginal cultural site located within the mine lease boundary.

During the reporting period, no ground disturbance operations required consultation with Aboriginal groups. A member of the Wanaruah Local Aboriginal Lands Council presently sits on the MCC Community Consultative Committee (CCC).

3.15 EUROPEAN HERITAGE

There are no European Heritage sites located at MCC that require ongoing management.

3.16 SPONTANEOUS COMBUSTION

3.16.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to operate in accordance with the Spontaneous Combustion Management Plan (SCMP).

The main objective of the SCMP is to minimise the occurrence and manage the effect from spontaneous combustion in:

- The highwall and existing U/G mine workings in Open Cut 1;
- The overburden/interburden removal and coal removal in Open Cut 1;
- Active and recent emplacement areas within Open Cut 1;
- Open Cut 2;
- Coal emplacement and storage areas; and
- Elsewhere with the disturbance area.

The SCMP lists the preventative measures, control measures and trigger response action plans (TARP's) for each of these areas.

Regular spontaneous combustion reports are provided to both RR and EPA. These reports identify existing and new incidents of spontaneous combustion, mitigation procedures and improvements to these procedures, effectiveness of actions, areas capped, areas mined, areas under water infusion and complaints received. The report also includes a plan showing the extent and location of problem areas.

Four spontaneous combustion reports were submitted to RR and EPA during the reporting period. All affected areas were within the open cut and overburden emplacement areas. The areas that were treated each month are shown in **Table 37.** A historical comparison of affected areas without active control measures is provided in **Table 38**.

Table 37: Spontaneous Combustion Report Summary

Reporting Month	Spontaneous Combustion Areas Capped (m^2)	Spontaneous Combustion Areas Mined (m^2)	Area Under Water Infusion (m^2)
Jan-19	4	0	14,800
Feb-19	0	0	0
Mar-19	0	4	8,700
Apr-19	0	8	8,700
May-19	4	16	7,700
Jun-19	4	16	7,700
Jul-19	8	12	4,500
Aug-19	0	0	4,500
Sep-19	8	0	4,500
Oct-19	20	8	10,900
Nov-19	0	0	8,020
Dec-19	0	4	8,020

Note: Areas capped and areas mined are the total of the areas treated during that month. Area under water infusion is the area at the end of the month. This area may change during the month.

Table 38: Summary of Spontaneous Combustion Affected Areas Without Active Control

Total Area Affected by Spontaneous Combustion (m^2)											
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Jan-Mar	641	40	215	71	65	156	145	248	24	96	52
Apr-Jun	187	85	95	53	57		232	182	48	60	44
Jul-Sep	34	135	85	45	149	177	190	48	52	36	64
Oct-Dec	70	45	64	57	45	119	242	56	52	56	87
Yearly Average	**233**	**76**	**115**	**57**	**79**	**151**	**203**	**133**	**44**	**62**	**62**

Note: These values are the values at the end of the respective reporting period. These areas may change during the reporting period.

Planned Versus Actual Activities

One of the requirements of the SCMP is to prepare an annual plan in relation to spontaneous combustion management activities and then at the end of the reporting period to review the actual activities against the planned activities and identify any opportunities for improvement in relation to spontaneous combustion management. Below is a summary of the review of the action plan from this reporting period.

The planned fly ash and clay sealing activities for this reporting period are shown in **Figure 29** to **Figure 30**.

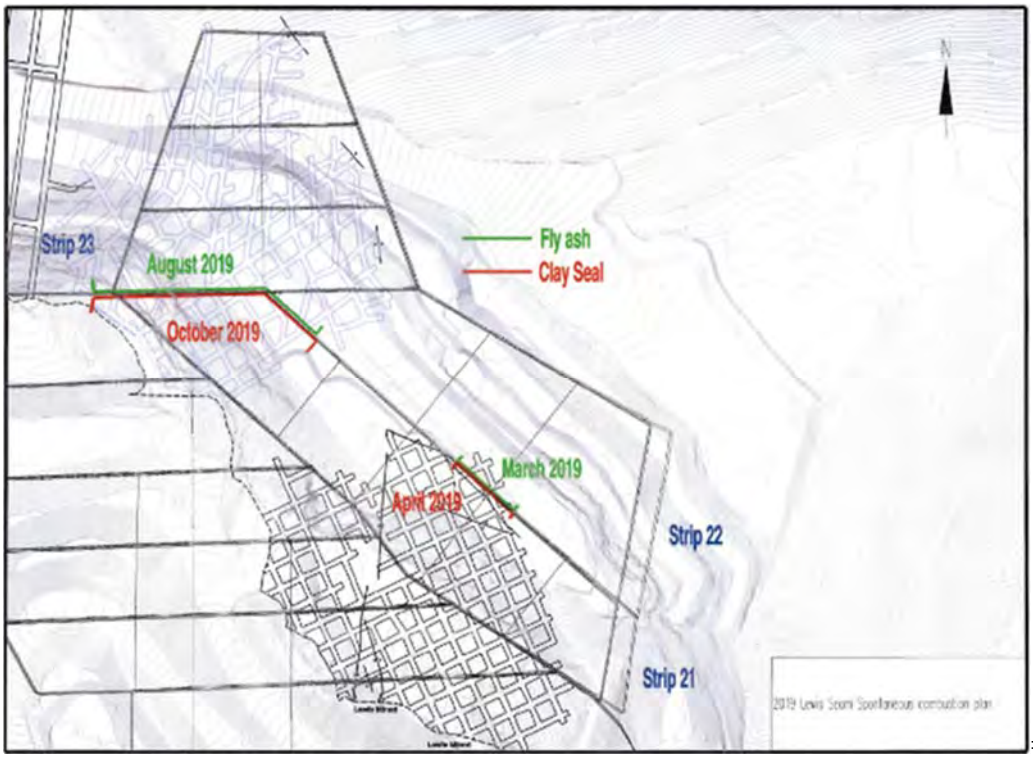


Figure 29: Proposed sealing in Lower Lewis Workings

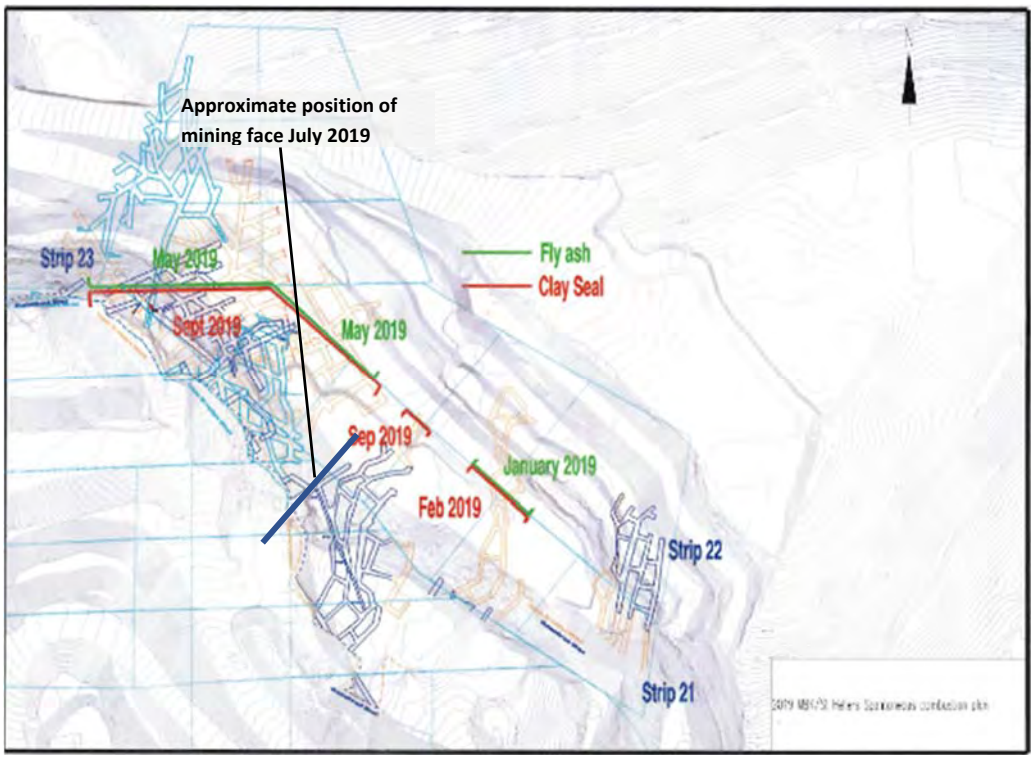


Figure 30: Proposed sealing in Muswellbrook and St Heliers Workings

The actual fly ash and clay sealing activities for this reporting period are shown in **Figure 31** to **Figure 32**.#

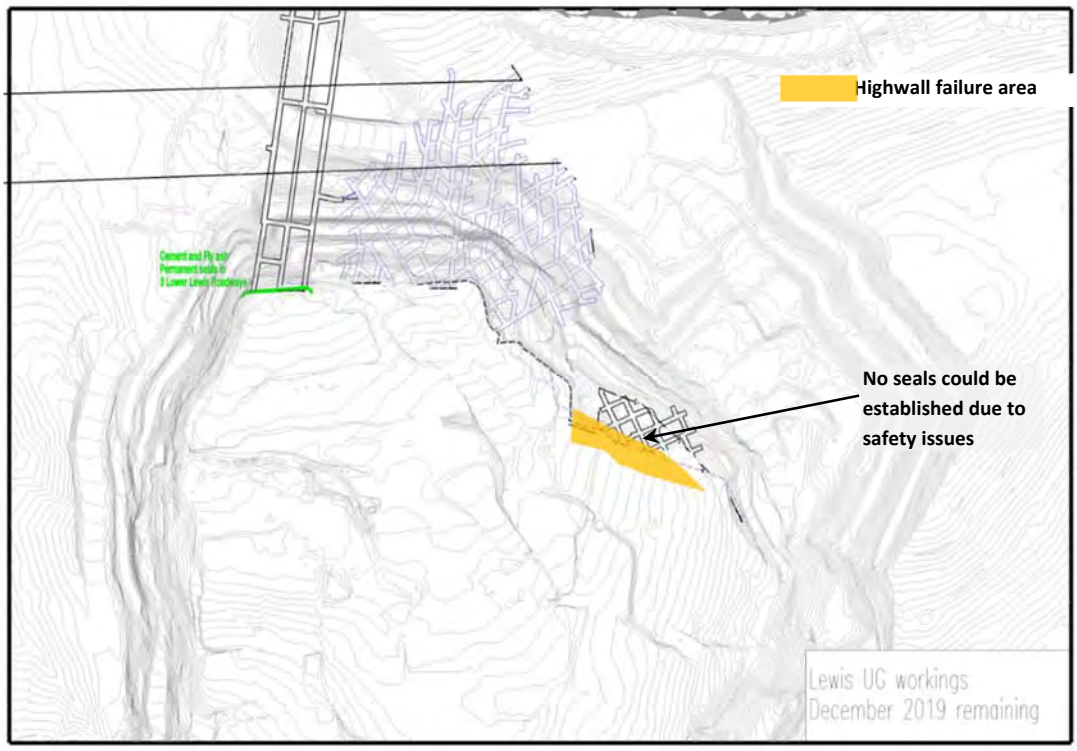


Figure 31: Actual sealing in Lower Lewis workings

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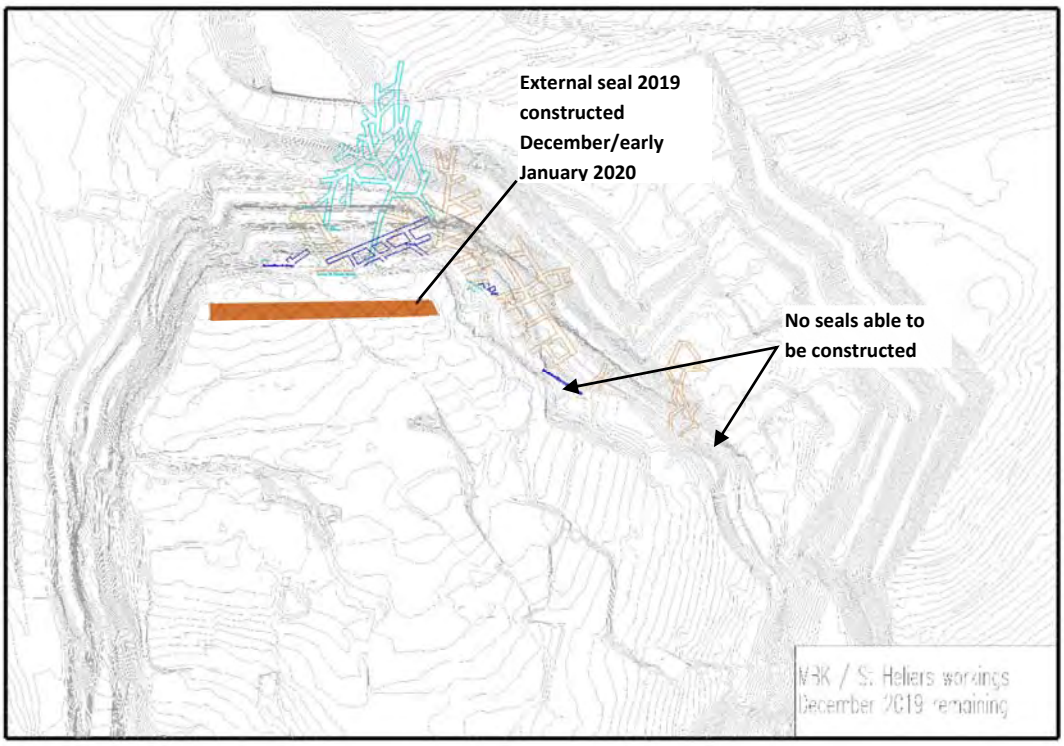


Figure 32: Actual sealing in Muswellbrook and St Heliers workings

The reasons why not all of the proposed activities were undertaken include:

- A highwall failure preventing access to parts of the Lower Lewis workings. This lack of access was due to serious safety concerns with working in this area.
- No sealing was able to be conducted on the eastern end of the Muswellbrook and St Heliers workings due to stability issues with the wall.

What Worked Well

The following spontaneous combustion management activities worked well during the reporting period:

- Good control and management of spontaneous combustion in dumps was achieved (see **Figure 33** and **Figure 34**).

Figure 33: Photo of Spontaneous Combustion Management on Western Side of OC1 dumps

Figure 34: Photo of Spontaneous Combustion Management on Eastern Side of OC1 dumps

- Given the generally higher coal temperature, all aspects of coal haulage, stockpiling processing and stockpile residence time was well managed.
- The effective use made of the limited water supply by operational personnel was very well done.
- Extended use of water carts in minimizing spontaneous combustion impacts, particularly during periods of low water availability for monitor sprays was excellent.
- Maintaining the airlock seals kept venting and odour to a minimum.

- Sprays, when able to be used, maintained control of spontaneous combustion.
- The redesigns of the eastern end-wall have allowed all of the Lower Lewis Seam coal, particularly in the underground workings to be mined. Redesign of the remaining strips shows that there will be no underground workings unmined in the Muswellbrook/St Heliers. There will be no underground workings unmined in the Upper Lewis and only the main headings of the Lower Lewis remaining. This removes the long-term spontaneous combustion risks; and
- Re-sequencing of mining so that the Lower Lewis was mined earlier in Strip 21 and the eastern end of Strip 22 mined in early 2020 has or will remove the potential high-risk spontaneous combustion coal.

Lessons Learnt

The following lessons regarding spontaneous combustion management were learnt during this reporting period.

- The development of the action plan in 2019 was invaluable and, given the level of difficulty for spontaneous combustion during the year, made a significant difference.
- Since the highwall failure blasting has significantly improved. This is expected to result in a major reduction in the spontaneous combustion issues associated with back-break and collapse of the coal into highwall roadways.
- The availability of monitoring holes was sub optimal. This was due to:
  - availability of equipment (the contractors drill) and personnel to drill sampling holes; and
  - the extremely congested work areas once operations moved into the Muswellbrook/St Heliers/Upper Lewis sequence, which made establishment of safely accessible monitoring holes impracticable.
- Issues with maintaining water pipelines to the east side of the mine.
- Maintaining immediately available pump and motor spares hampered supply of water for spontaneous combustion control. This is being corrected with the site to maintain a spare pump and motor for each of the large and small borehole pump sites.

3.16.2 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage spontaneous combustion in accordance with the SCMP. This will include:

- Control of collapse zones and digging back to presplit lines will continue to build on the excellent results to date.
- An extension of the borehole pumping system is being examined so that adequate water supply for spontaneous combustion control can be maintained to all areas of the mine when required.
- Because the seal currently being constructed along the Strip 23 low wall will need to retain its integrity for one to two years, additional engineering and water saturation systems will be installed. This will include a double spray system to allow an adequate level of redundancy to allow for continuity of operation.
- A system of monitoring hole establishment for 2020 will be developed.
- All underground workings in the Muswellbrook and St Heliers will be mined out in Strip 22. Similarly, all underground workings in the Lower Lewis will be mined out in Strips 21 and 22.

The SCMP will be reviewed and updated during the next reporting period.

3.17 BUSHFIRE

Management of bushfire risks are undertaken in accordance with the Bushfire Management Plan (BFMP).

The objectives of the Bushfire Management Plan are:

- To manage activities on site are to minimise the risk of outbreak of fire;
- Contain fuel loads to acceptable levels to moderate fire intensity;
- To put in place hazard mitigation measures to contain an outbreak of fire should one occur; and
- To put in place arrangements to liaise with and support the Rural Fire Service (RFS) should an outbreak of fire occur at MCC or threaten MCC's operations.

There were no bushfire outbreaks within the development consent area during the reporting period.

The Emergency Response Team undertake firefighting training on a regular basis. During the reporting period all staff and full-time equivalent contractors undertook firefighting training.

3.18 HYDROCARBON CONTAMINATION

Hydrocarbon storage facilities were constructed as part of the workshop, stores and blasting facilities. These storage facilities comply with the requirements of *AS1940 – The storage and handling of flammable and combustible liquids*. Activities undertaken on site to reduce the risk of hydrocarbon contamination include:

- Above ground fuel storage tanks are self-bunded to contain any spillage which may occur;
- Waste oil from the workshop is stored in a bunded waste oil tank and is removed as required;
- Oily water runoff from the re-fuelling bay drains into an above ground sump which is fully bunded; and
- Runoff from the hardstand wash-down bay passes through a three-staged silt trap and an oil/water separator. The collected silt is routinely cleaned out.

A Bioremediation Management Plan has been developed by MCC to provide guidance on how to manage material that is potentially contaminated with hydrocarbons. This Bioremediation Management Plan was developed at the request of RR and has been provided to them following this request. RR has not provided any comment on the Bioremediation Management Plan and the plan has been implemented by MCC.

Any material that is potentially contaminated is tested with the results being compared to the limits in the *NSW EPA Waste Classification Guidelines Part 1: Classifying Waste (2014)*. If the material is classified as solid waste it is disposed on site. If the material is classified as contaminated it is either treated on site prior to disposal or it is taken off site for disposal.

3.19 METHANE DRAINAGE/VENTILATION

As no underground mining occurred at MCC during the reporting period, no methane drainage or ventilation was required.

3.20 PUBLIC SAFETY

During the reporting period, public safety was managed in accordance with current MCC procedures. Fences surrounding the operational areas and along property boundaries were inspected and maintained.

A security patrol is conducted by a local security firm over weekends and other nominated periods (Christmas, shutdowns, etc.) when the site is not manned.

3.21 OTHER ISSUES AND RISKS

No incidents of damage to surface infrastructure were recorded during this reporting period.

4.0 COMMUNITY RELATIONS

MCC undertakes community consultation through the Community Consultative Committee, discussions with community members and operating a toll free 24-hour Environmental Contact Line (1800 600 205). MCC are an active member of the Upper Hunter Mining Dialogue – a forum for the mining industry and the community to discuss concerns relating to mining impacts.

4.1 ENVIRONMENTAL COMPLAINTS

MCC operates a toll free 24-hour Environmental Contact Line where community members can communicate their concerns to site personnel. On receiving a complaint, MCC staff investigate the complaint, take action to reduce impact as required and report back to the complainant with the findings. The recording of environmental complaints and the operation of the Environmental Contact Line is conducted in accordance with the MCC Development Consent and Environmental Protection Licence conditions.

32 complaints were received during the reporting period. More details on the complaints are provided in **Appendix 4**. **Table 39** and **Figure 35** provide a summary of the complaints received during the reporting period.

Table 39: Summary of Complaints

Type of Complaint	Number	Percentage
Odour	18	56.3%
Blast	0	0.0%
Dust	1	3.1%
Haulage	0	0.0%
Light	1	3.1%
Noise	5	15.6%
Visual	6	18.8%
Other	1	3.1%
Total	**32**	**100%**

In comparison, there has been a significant decrease in the number of complaints received during this reporting period compared to the last reporting period. The complaint history chart is shown in **Figure 36**. In comparison to the last reporting period, there has been a significant decrease in the number of odour complaints (18 for this reporting period compared to 37 for the previous reporting period).

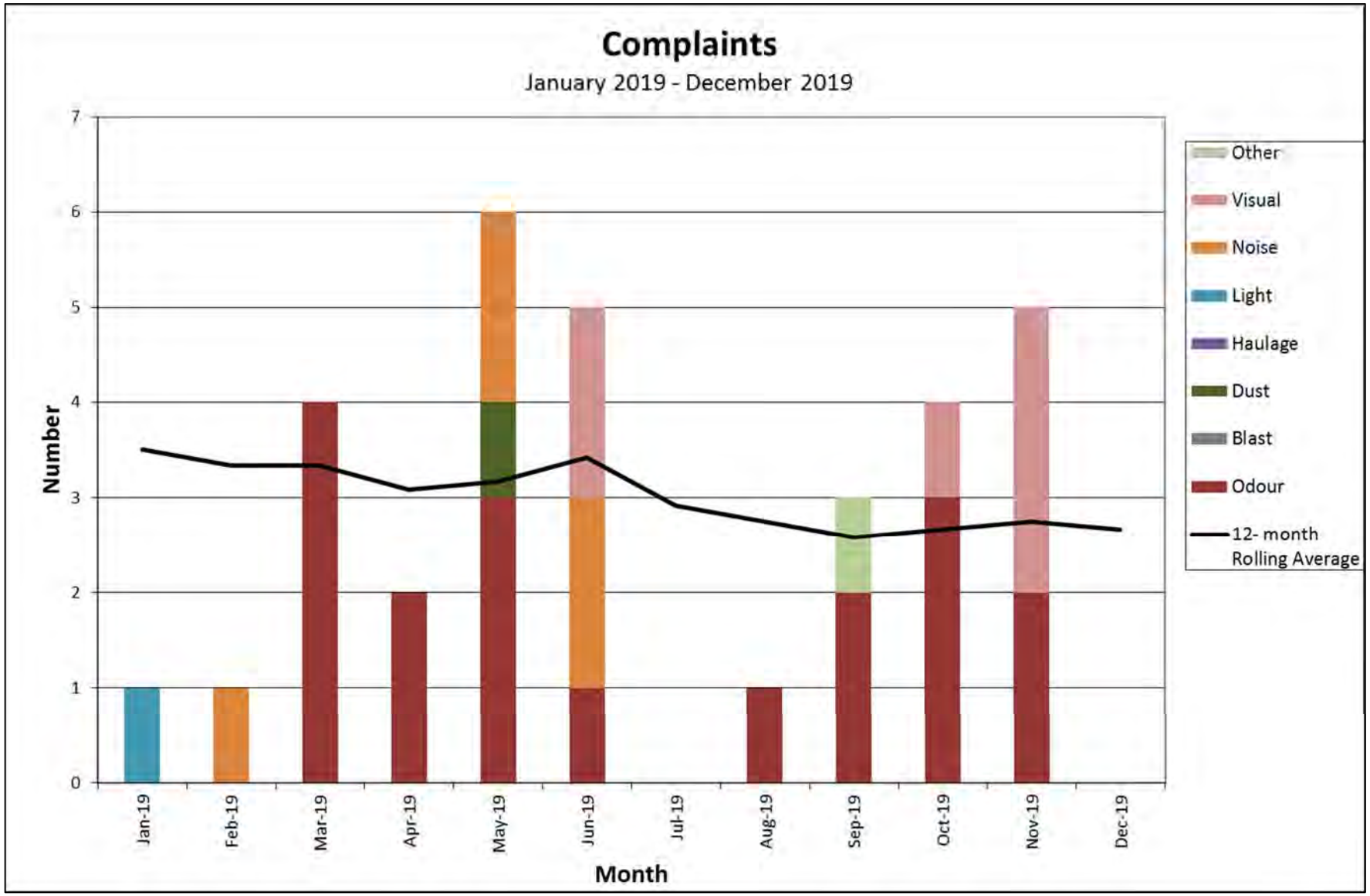


Figure 35: Complaint Summary

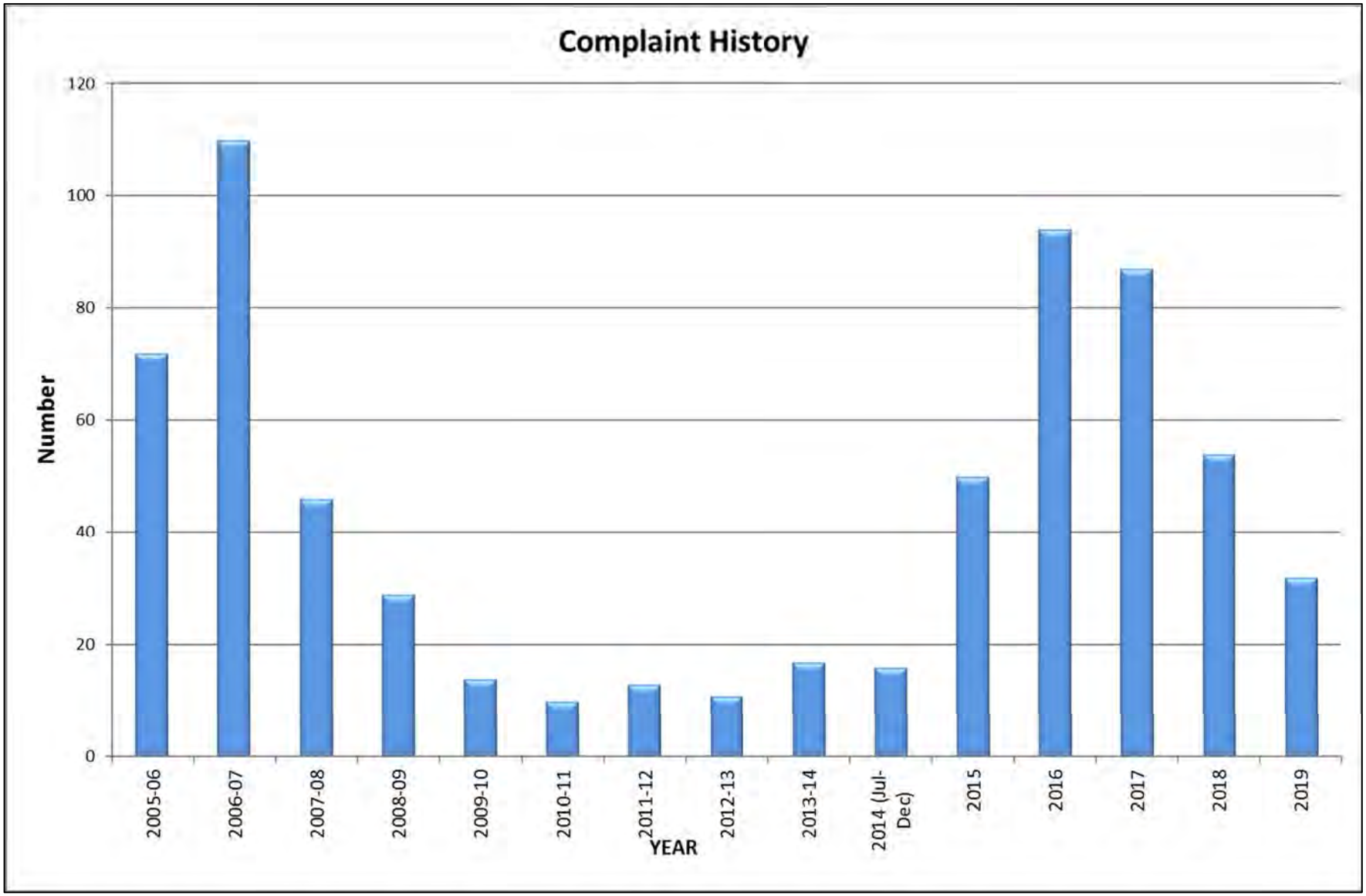


Figure 36: Complaint History

4.2 COMMUNITY LIAISON, SPONSORSHIPS AND DONATIONS

MCC personnel maintain contact with nearby residents and are committed to continually fostering and developing strong links with the community.

Community support throughout the reporting period included donations to the following organisations:

- St James' Primary School – Improve STEM resources at local primary school
- Wybong Wild Dog Association – assistance with regional dog baiting program
- Kurri Netball Association – water bottles for local team
- Muswellbrook Car Club – community fun day event
- Muswellbrook Race Club – annual sponsorship
- Aberdeen Public School – shade sail
- South Muswellbrook Primary School – local school's fete
- Muswellbrook Netball Association – colour run
- Singleton Swimming Club – major carnival
- Muswellbrook Girls Academy – support for academy

4.3 COMMUNITY CONSULTATIVE COMMITTEE

MCC's Community Consultative Committee (CCC) provides information regarding mine operations to the local community. The aim of the committee is to provide an effective communication mechanism so that members of the local community have adequate information on mining and environmental matters. CCC meetings are held twice per year at the MCC office and committee members are actively involved in the review of environmental monitoring data and are kept up to date on mining operations through presentations and site visits.

The CCC is comprised of one Councillor, one council staff representative, five community representatives (including one from the Wanaruah Local Aboriginal Lands Council) and two MCC representatives.

During the reporting period meetings were held on 4 June 2019 and 3 December 2019. Minutes of the meetings can be found on MCC's website.

5.0 REHABILITATION

During the reporting period MCC continued to operate in accordance with the Mining Operations Plan/Rehabilitation Plan (MOP). This MOP was approved in March 2017 and covers mining and rehabilitation activities until 2023.

5.1 BUILDINGS

No buildings were demolished or rehabilitated during the reporting period.

5.2 REHABILITATION OF DISTURBED LANDS

5.2.1 REHABILITATION PROCESS

The rehabilitation process at MCC includes:

- Shaping is conducted in accordance with the design requirements outlined in the MOP.
- Rock raking occurs to remove rocks from the surface.
- Contour banks are constructed.
- Growth medium is spread at the recommended application rate (this differs depending on what growth medium is being used).
- Other ameliorants as required are spread (the type of ameliorant and application rate is dependent on soil results).
- Prior to seeding, growth medium and/or other ameliorants are incorporated into the underlying soil.
- Seeding of the area with vegetation or pasture seed mix (as required).

MCC's rehabilitation program aims to link existing remnant vegetation in Bells Mountain and Skelletar Ridge areas north and south of the lease area by establishing habitat corridors across the lease area creating a viable wildlife corridor. Rehabilitation planning for MCC includes the incorporation of native vegetation areas to continue the corridor. There has been no change to the agricultural land suitability of the site during the reporting period.

5.2.2 REHABILITATION ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC completed 11.5ha of new rehabilitation in three locations in OC1 and one location in OC2. The following activities were undertaken on these new rehabilitation areas:

- The areas were bulk shaped to design.
- Soil sampling was conducted to identify if any ameliorants were required. DAP fertiliser was recommended based on the soil results. This fertiliser was mixed into the seed mix.
- Rock raking was undertaken to remove rocks from the surface.
- Contour drains were constructed where required.
- A mulch product consisting of three parts green waste and one-part biosolids were spread over the areas.
- The mulch was incorporated into the surface prior to the spreading of seed.
- Pasture seed and fertiliser were sown on the rehabilitation areas.

The pasture seed mix used in the rehabilitation this reporting period is shown in **Table 40**.

Table 40: Seed Mix Used in Rehabilitation

Seed Type or Fertiliser	Rate (kg/ha)
Millet – cover crop	20
Couch	2
Kikuyu	2
Lucerne	2
White Clover	2
Medic	2
DAP Fertiliser	80

In addition to the establishment of new rehabilitation areas, MCC maintained a focus on rehabilitation maintenance activities and mine closure activities during this reporting period. These activities included:

- Weed, pest and feral animal control (discussed further in **Section 3.10**).
- Thinning out a stand of trees that had been densely planted to encourage growth of ground species and mid-storey species.
- Establishment of a security fence around the OC2 highwall.
- Identifying the locations of fences, stockyards, tanks, water pipelines and water troughs as part of introducing cattle onto the rehabilitation areas.

Previous rehabilitation reviews have recommended the planting of tube stock in areas where there has been dieback of vegetation. Due to the ongoing drought experienced this reporting period, MCC did not progress any of this work but will look to undertake this planting when the drought breaks.

MCC were notified during the reporting period that the ban on using Organic Growth Medium (OGM) in rehabilitation will not be lifted by the EPA. MCC has been working with the EPA to identify how the stockpiles on site can be disposed of. This should be resolved during the next reporting period and MCC will follow the guidance of the EPA on this matter. To offset the loss of the use of the OGM, MCC has been working to identify alternate growth medium suppliers. One of these products was used on the rehabilitation areas this reporting period and MCC will evaluate the benefits of using this product in the long-term.

The rehabilitation and maintenance summary for the reporting period can be found in **Table 41** and **Table 42**.

Table 41: Rehabilitation Summary

AREA AFFECTED / REHABILITATED (hectares)					
			To Date	**Last Report**	**Next Report (Est.)**
A	**MINE LEASE AREA**				
	A1	**Mine Lease Area: CCL 713, ML 1304 and ML1562**	**1858**	**1788**	**1858**
B	**DISTURBED AREAS**				
	B1	**Infrastructure Area**	47.6	48.2	47.4
	B2	**Active Mining Area** (excluding items B3-B5 below)	66.2	71.3	71.1
	B3	**Waste Emplacements** (active/unshaped/in or out-of-pit)	122.3	127.6	117.4
	B4	**Tailing Emplacements** (active/unshaped/uncapped)	0.0	0.0	0.0
	B5	**Shaped Waste Emplacement** (awaits final vegetation)	9.5	6.8	7.2
	B6	**Temporary Stabilisation** (vegetation area for dust control)	21.6	24.8	14.1
	ALL DISTURBED AREAS		**267.2**	**278.7**	**257.2**
C	**REHABILITATION PROGRESS**				
	C1	**Total Rehabilitation Area** (except for maintenance)	**351.0**	**339.5**	**361.0**
D	**REHABILITATION ON SLOPES**				
	D1	**10 to 18 degrees**	53.7	45.7	56.5
	D2	**Greater than 18 degrees**	0.0	0.0	0.0
E	**SURFACE OF REHABILITATED LAND**				
	E1	**Pasture and grasses**	256.7	245.2	265.5
	E2	**Native forest/ecosystems**	94.3	94.3	95.5
	E3	**Plantation and crops**	0.0	0.0	0.0
	E4	**Other** (include non-vegetative outcomes)	0.0	0.0	0.0
F	**DE-HAB -** *disturbed areas previously rehabilitated, figures reflected in Section E*				
	F1	**Pasture and grasses**	0.0	4.5	0.0
	F2	**Native forest/ecosystems**	3.2	0.0	7.5
G	**SURFACE CONVERSION -** *previously reported pasture (cover crop) areas planted to trees, hectares reflected in Section E)*				
	G1	**Pasture/Cover Crop areas planted to Trees**	0.0	0.0	0.0

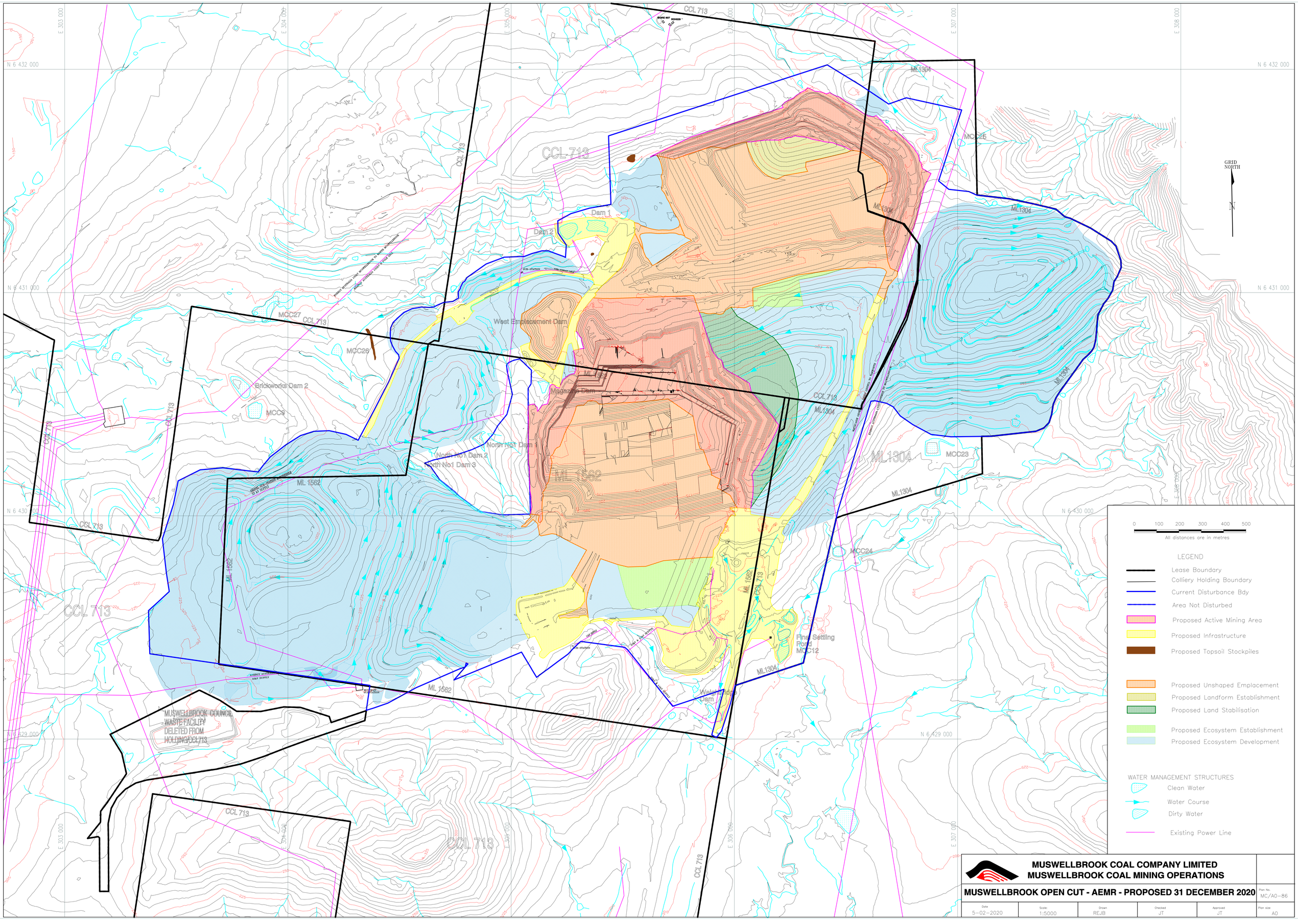
Table 42: Maintenance Activities on Rehabilitated Land

NATURE OF TREATMENT	AREA TREATED (Ha)		Comment / Control Strategies / Treatment Detail
	Report Period	Next Period	
Additional erosion control works (drains, re-contouring, rock protection)	0.0	0.0	
Re-covering (detail - further topsoil, subsoil sealing etc.)	0.0	0.0	
Soil Treatment (detail - fertiliser, lime gypsum etc.)	0.0	0.0	
Treatment / Management (detail - grazing, cropping, slashing)	0.0	0.0	
Re-seeding / Replanting (detail - species density, season etc.)	0.0	0.0	
Adversely Affected by Weeds (detail – type and treatment)	237.4	150.0	Spraying of weeds (see **Section 3.10.1**) for more details
Feral Animal Control (detail – additional fencing, trapping, shooting, baiting etc.)	Unknown	Unknown	Regional dog baiting program with areas of MCC land being included in the program Rabbit control program Kangaroo cull program See **Section 3.10.2** for more detail

5.2.3 REHABILITATION ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will complete 9.9ha of new rehabilitation as shown in **Figure 37**. This will be in OC1 and OC2 and will be a combination of pasture and trees. Contour drains and drop structures will be established as required.

Ongoing rehabilitation maintenance will continue during the next reporting period. The scope of this maintenance work will be dependent on the weather conditions experienced during the next reporting period.


E 303 000
E 304 000
E 305 000
E 306 000
E 307 000
E 308 000
N 6 432 000
N 6 431 000
N 6 430 000
N 6 429 000
CCL 713
ML1304
ML 1562
MCC27
MCC29
MCC9
MCC25
MCC23
MCC24
Dam 1
Dam 2
West Emplacement Dam
Magazine Dam
North No1 Dam 1
North No1 Dam 2
North No1 Dam 3
Brickworks Dam 2
Fine Settling Pond MCC12
Weighbridge Dam
MUSWELLBROOK COUNCIL WASTE FACILITY DELETED FROM HOLDING/CCL713
GRID NORTH
0 100 200 300 400 500
All distances are in metres
LEGEND
Lease Boundary
Colliery Holding Boundary
Current Disturbance Bdy
Area Not Disturbed
Proposed Active Mining Area
Proposed Infrastructure
Proposed Topsoil Stockpiles
Proposed Unshaped Emplacement
Proposed Landform Establishment
Proposed Land Stabilisation
Proposed Ecosystem Establishment
Proposed Ecosystem Development
WATER MANAGEMENT STRUCTURES
Clean Water
Water Course
Dirty Water
Existing Power Line
MUSWELLBROOK COAL COMPANY LIMITED
MUSWELLBROOK COAL MINING OPERATIONS
MUSWELLBROOK OPEN CUT - AEMR - PROPOSED 31 DECEMBER 2020
Plan No. MC/A0-86
Date 5-02-2020
Scale 1:5000
Drawn REJB
Checked JT
Approved JT
Plan size A0

5.3 REHABILITATION MONITORING

5.3.1 SITE SELECTION

A total of sixteen permanent sites, five rehabilitation and three analogue woodland sites, and five rehabilitation and three analogue pasture sites, were surveyed during the reporting period.

Within the woodland sites, three analogue sites were established within remnant patches of the Endangered Ecological Community (EEC) *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregion* listed under the *Threatened Species Conservation Act 1995* (TSC Act). The remaining five locations were established within each of the three Rehabilitations Blocks (A, B and C).

The pasture sites monitored included three within remnant pasture areas and the remaining five were established within each of the three Rehabilitations Blocks (A, B and C).

Figure 39 indicates the location of the monitoring sites and **Figure 40** indicates where fauna monitoring equipment has been set up.

5.4 FLORA MONITORING RESULTS – WOODLAND

To demonstrate compliance with the completion criteria indicated in the MOP for woodland sites, monitoring survey results was compared to benchmarks derived through the monitoring of analogue sites.

5.4.1 SPECIES RICHNESS AND FOLIAGE COVER

The species richness measured at each woodland monitoring site this reporting period is represented in **Figure 38** and is based on the average number of native species. The average number of native species present within the rehabilitation woodland sites is just over half (15) that of native species present across the remnant woodland sites (25).

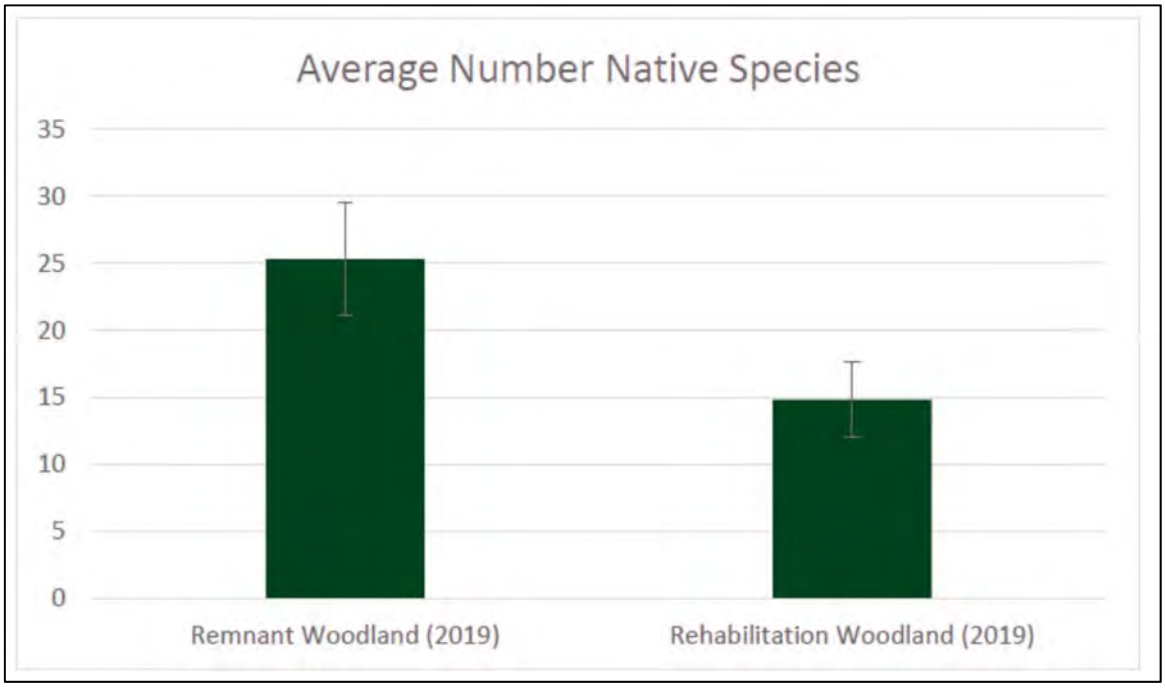


Figure 38: Comparison of Average Native Species Richness at Woodland Sites

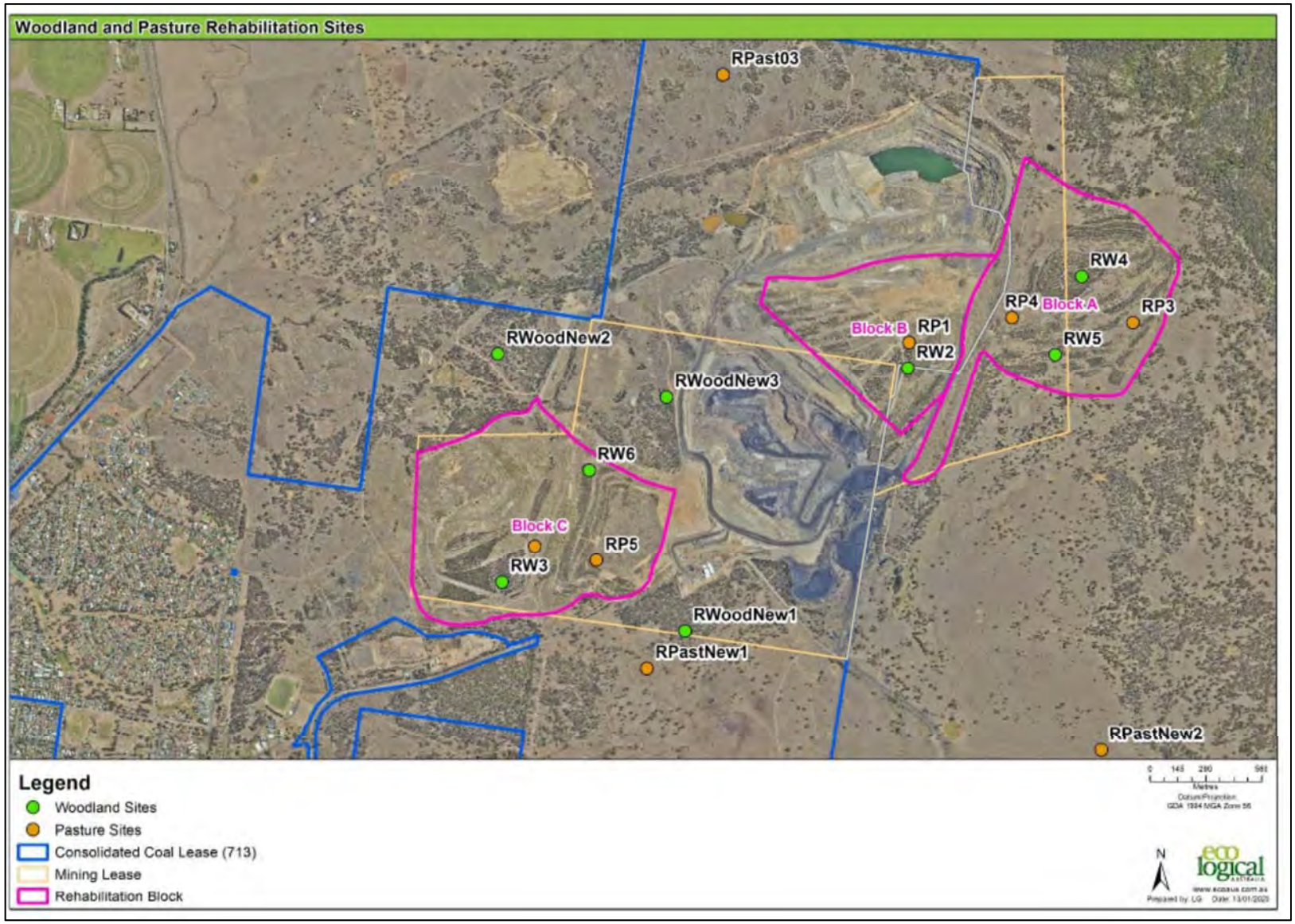


Figure 39: Rehabilitation Monitoring Program – Flora Sites

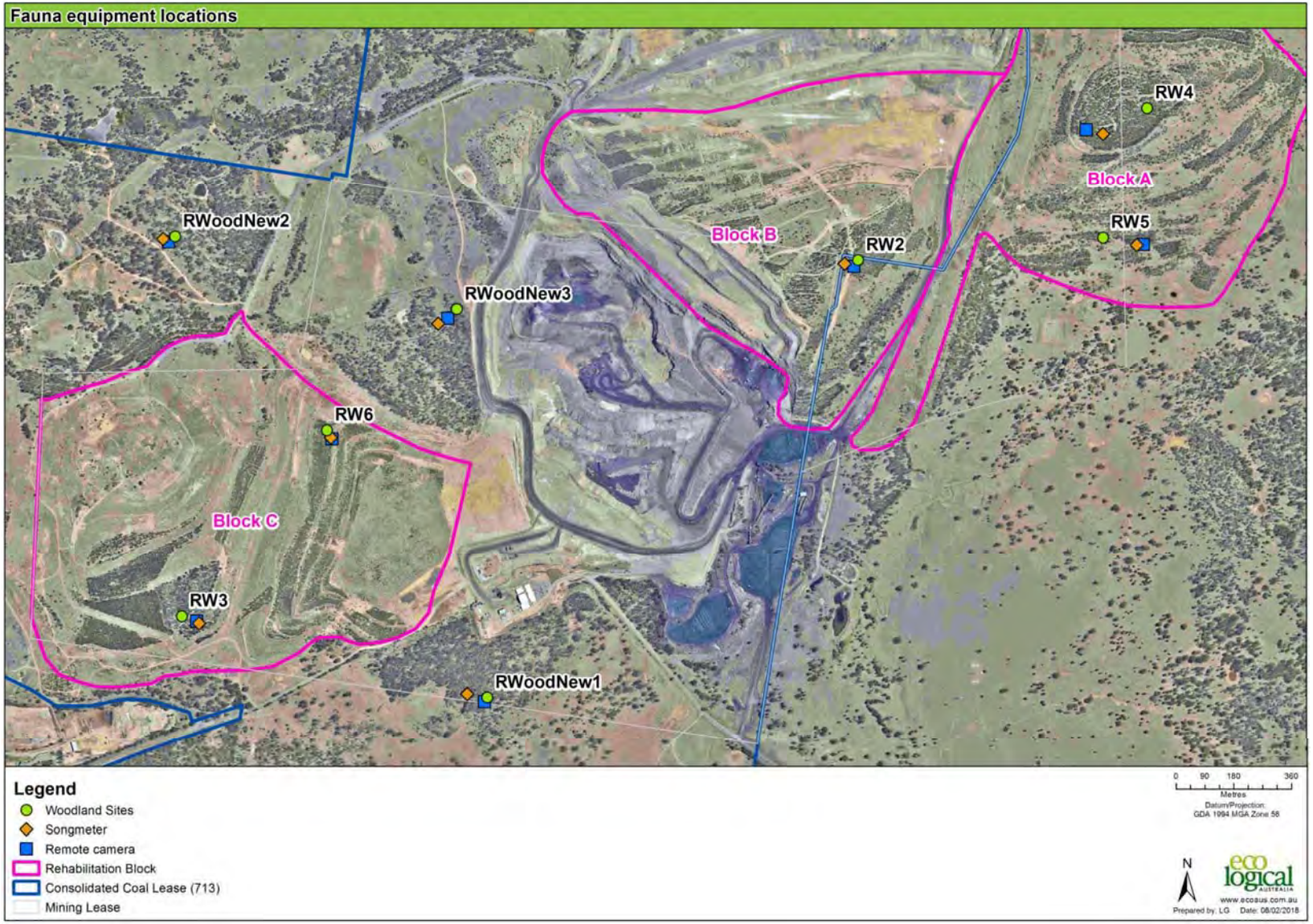


Figure 40: Rehabilitation Monitoring Program – Fauna Sites

Projected foliage cover (PFC) at each of the rehabilitation woodland sites across all strata has been calculated and is presented in **Figure 41.**

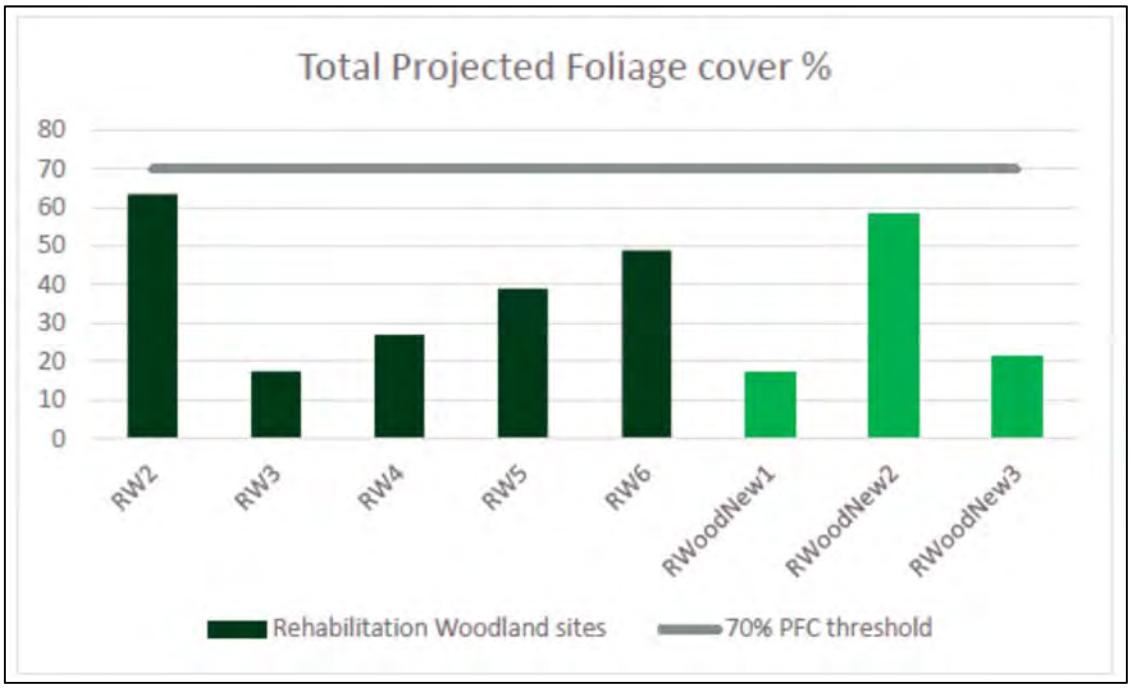


Figure 41: Total Projected Foliage Cover at Rehabilitation Woodland Sites

The average weed species present at rehabilitation woodland sites was just over double that found at remnant woodland sites. Rehabilitation woodland sites comprised and average of nine weed species and remnant woodland sites comprised and average of four weed species (**Figure 42**).

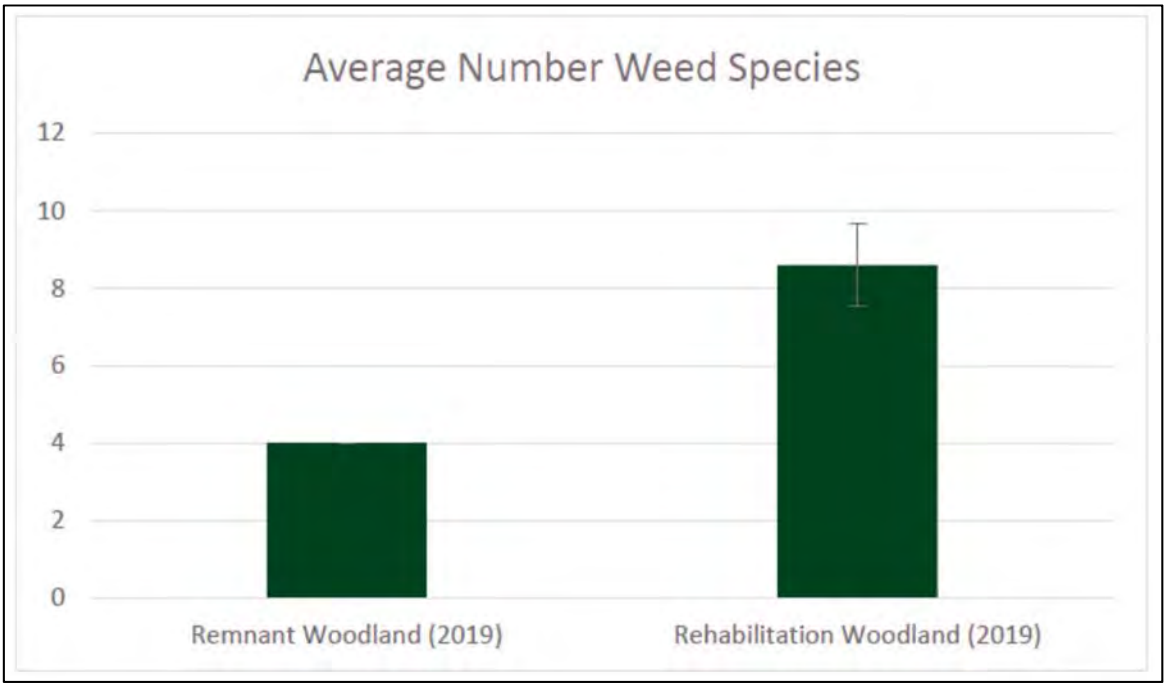


Figure 42: Comparison of Average Number of Weed Species at Woodland Sites

5.4.2 BIOMETRIC DATA

Average percentage of native over-storey, mid-storey cover, and native grass, shrub and native other cover was measured for rehabilitation and remnant woodland sites (**Figure 43**). Exotic plant cover, litter and bare ground was also recorded and provides a comparison between remnant and rehabilitation woodland sites.

The remnant woodland sites contained a greater proportion of native species in general, with a slightly higher proportion in over-storey and grass cover, equal amounts of native other cover and slightly less in native shrub cover. Foliage cover within the over-storey at rehabilitation woodland sites is comparable to remnant woodland sites with rehabilitation woodland sites being 14.4% and remnant woodland sites being 18.7%. Exotic ground cover at rehabilitation woodland sites was five times higher than that found at remnant woodland sites. Both litter cover and bare ground cover were comparable between rehabilitation and remnant woodland sites.

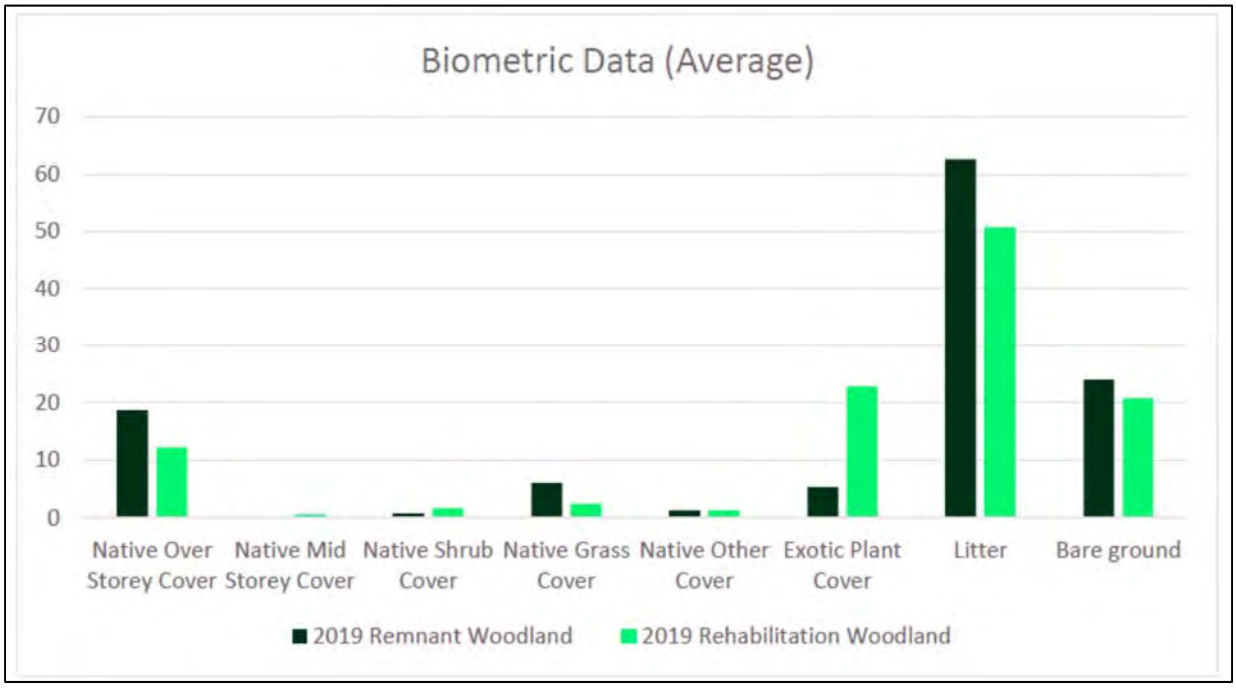


Figure 43: Biometric Data Averages

5.4.3 COMPARISON TO COMPLETION CRITERIA

In relation to the completion criteria, the results of the rehabilitation woodland sites established native species composition, projected foliage cover and for number of weeds listed as WoNS is presented in **Table 43**.

Table 43: Rehabilitation Site Completion Criteria Target – Woodland

Site	Completion criteria target (native species established)	2019 result	Target reached	Completion criteria target (projected foliage cover)	2019 result	Target reached	Completion criteria target (WoNS)	2019 result	Target exceeded
RW2	>50%	50%	No	≥70%	63.5%	No	<20%	8.3%	No
RW3	>50%	87%	Yes	≥70%	17.5%	No	<20%	0.0%	No
RW4	>50%	64%	Yes	≥70%	27.0%	No	<20%	0.0%	No
RW5	>50%	48%	No	≥70%	39.0%	No	<20%	7.7%	No
RW6	>50%	74%	Yes	≥70%	49.0%	No	<20%	12.5%	No

5.4.4 CONCLUSIONS

This reporting period, it was observed, at all rehabilitation woodland sites, that Acacia species, primarily *Acacia saligna*, are dying off. The dying off of these species is contributing to the lower overall foliage cover results obtained at the majority of rehabilitation sites. Consideration will be given to replanting of longer-lived eucalypt species at particular rehabilitation sites (particularly RW2 and RW5) currently comprising of a dying *Acacia saligna* canopy in order to meet the canopy foliage cover completion criteria in future years.

It is noted that this reporting period, and also the previous two reporting periods have been extremely dry, as compared with the wetter years of 2015 and 2016. It is considered that the dry conditions observed over the last three years has played a significant part in the die-back of Acacia species observed across rehabilitation sites, along with some species reaching the end of their lifespan.

All of the five rehabilitation woodland sites for this reporting period meet the criteria target for <20% WoNS weed presence.

5.5 FLORA MONITORING RESULTS – PASTURE

5.5.1 CARRYING CAPACITY

The MOP makes reference to estimated carrying capacities on MCC's rehabilitation areas. However, for the majority of rehabilitation pasture sites, the classification types listed only partially align with those encountered. Therefore, the best fit in terms of species composition and treatment type has been selected. Historically, the pasture types have been estimated to fall within the 'native unimproved – moderate fertility (no seed or fertiliser added)' and 'native unimproved – low fertility based on data collected at rehabilitation pasture sites and ecological interpretation of that data. In 2019 a local agronomist assessed the rehabilitation pasture areas and provided expert advice that allowed for a re-alignment of the estimated pasture types considered to be present. As such, this year's monitoring results show that four of the five rehabilitation pasture sites fall within the 'improved pasture – moderate fertility (tropical grasses, clover + fertiliser)' and RP5 falls within the 'native unimproved – low fertility (dominated by undesirable species including Galenia pubescens). As has occurred in previous monitoring years, a value judgement (as to the estimated value within the range of DSE/ha listed) has been selected.

Due to the prolonged drought conditions, there has been an approximately four-fold reduction in overall herbage mass available for consumption from 2015/2016 'wet years'. As a result, it was considered that a 'drought' factor of -4 be applied to the estimated (DSE/ha), in order to represent the reduction in overall herbage mass available.

Carrying capacity for each of the rehabilitation pasture sites has been calculated using the example of a 450 kg dry stock (non-lactating, non-pregnant cow) for typical DSE equivalents (Section 2.5.2). The results in **Table 44** show that all three remnant pasture sites have the ability to stock 0.6 cow per ha, as can RP6. RP1, RP3 and RP4 can all stock 0.5 cows per ha, and RP5, as it currently stands, cannot support any stock.

Table 44: Estimated Carrying Capacity for Remnant and Regrowth Pasture Sites

Sites	Pasture Type	Range (DSE/ha)	Estimated Value (DSE/ha)	Drought factor applied (-4)	Estimated carrying capacity (450kg dry stock)
RPastNew 1	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	4	0.6 cow per 1ha
RPastNew 2	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	4	0.6 cow per 1ha
RPast03	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	4	0.6 cow per 1ha
RP1	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	3	0.5 cow per 1ha
RP3	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	3	0.5 cow per 1ha
RP4	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	3	0.5 cow per 1ha
RP5	Native unimproved – low fertility (dominated by undesirable species including *Galenia pubescens*)	1.0-2.5	2	0	0.0 cow per 1 ha
RP6	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	8	4	0.6 cow per 1ha

5.5.2 HERBAGE MASS

Remnant pasture herbage mass for 2019 is presented in **Table 45**. Data collected for rehabilitation pasture sites is presented in **Table 46**. A comparison of the remnant and rehabilitation pasture sites is shown in **Figure 44**.

Table 45: Remnant Pasture Herbage Mass Sampling (2019 Data Average)

Component	RPastNew1	RPastNew2	RPast03
A: Cover (%) - percentage of total pasture cover (living and dead)	35.0	32.0	45.0
B: Percentage cover of live native plants	41.0	27.0	39.5
C: Percentage cover of live non-native plants	5.0	13.5	7.5
D: Pasture height (cm)	2.9	3.0	5.2
Estimate of herbage mass (kg DM/ha) (based on Meat and Livestock Australia Pasture Ruler)	920	1150	1,460

Table 46: Rehabilitation Pasture Herbage Mass Sampling

Component	RP1	RP3	RP4	RP5	RP6
A: Cover (%) - percentage of total pasture cover (living and dead)	60.0	52.0	48.0	18.6	39.5
B: Percentage cover of live native plants	27.0	22.0	30.0	21.6	56.0
C: Percentage cover of live non-native plants	18.0	31.0	14.0	6.0	19.0
D: Pasture height (cm)	1.2	1.5	3.0	1.0	3.1
Estimate of herbage mass (kg DM/ha) (based on Meat and Livestock Australia Pasture Ruler)	580	520	790	320	1,180

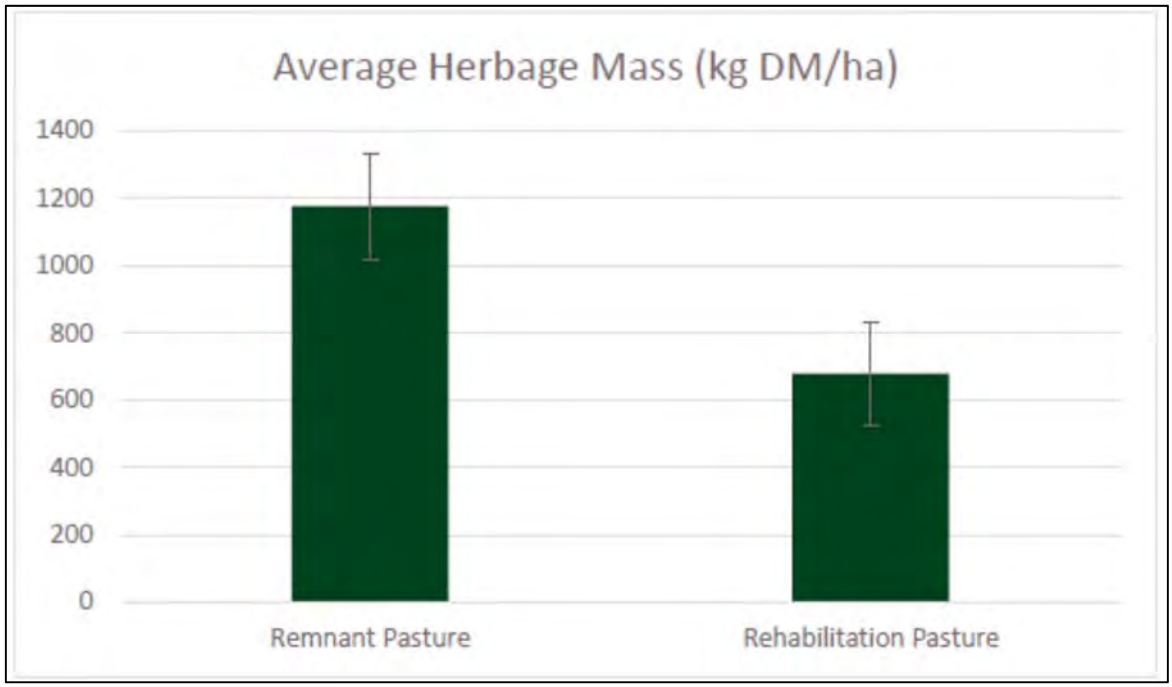


Figure 44: Average Herbage Mass (kg DM/ha) between Remnant and Rehabilitation Pasture Sites

5.5.3 PASTURE QUALITY

Pasture quality has been qualitatively assessed by estimating the digestible percentage using the graph shown in **Figure 45**. The three remnant pasture sites and rehabilitation pasture site RP6 fall within the 'Maintain Dry Stock' range. Rehabilitation pasture sites RP1, RP3 and RP4 are considered to fall within 'Weight loss of dry stock' range due to the minimal amount of fodder available and RP5 has considerable dead and dying *Galenia pubescens* (due to weed spraying) and other non-desirable species present, therefore this site also falls within 'Weight loss of dry stock' range.

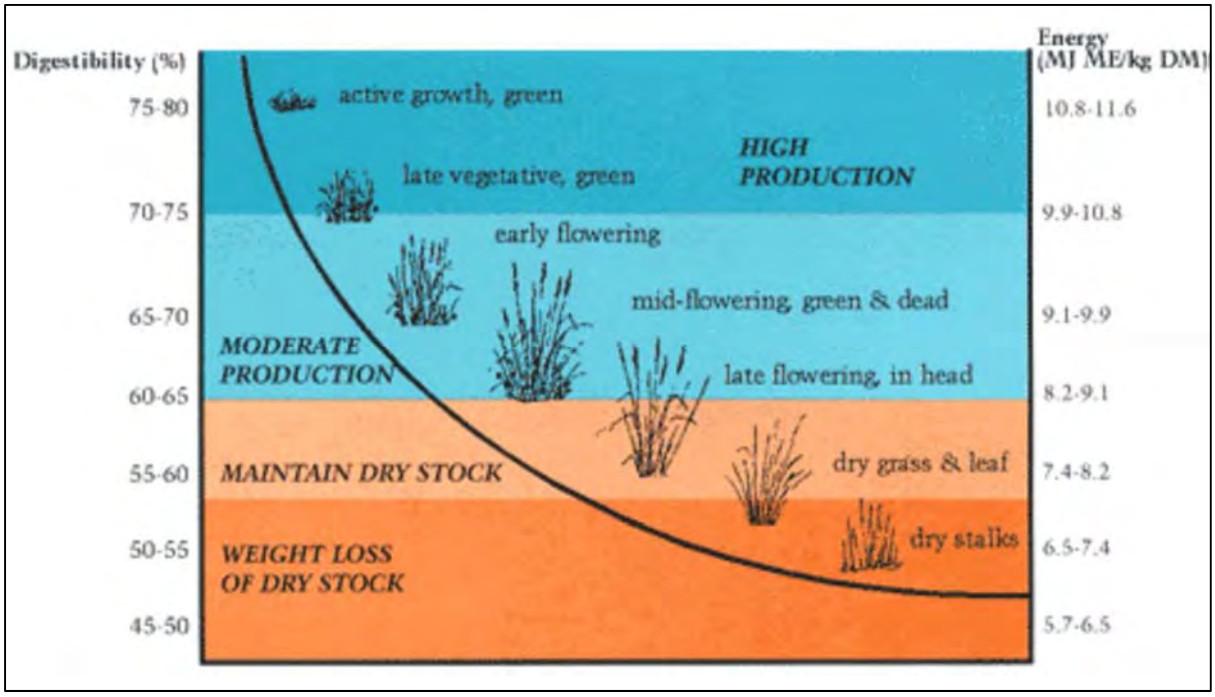


Figure 45: A Guide to Digestibility Percentage in Temperate Pasture Mixes

5.5.4 PASTURE SPECIES RICHNESS

The average number of native/desirable pasture species has been compared between remnant and rehabilitation pasture sites (**Figure 49**). The average number of native/desirable species present within the remnant pasture sites is just below double (17) that of native/desirable species present across the rehabilitation pasture sites (9).

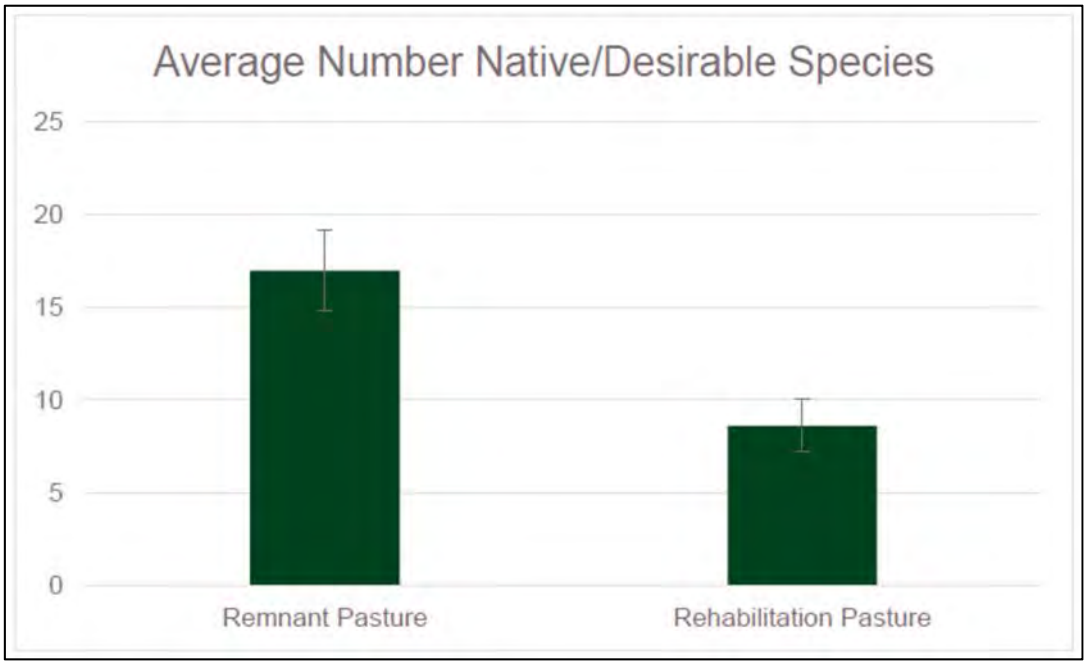


Figure 46: Comparison Between Remnant and Rehabilitation Pasture Sites for Average Native/Desirable Species

Percentage Foliage Cover (PFC) at each of the rehabilitation pasture sites has been calculated and is presented in **Figure 47**.

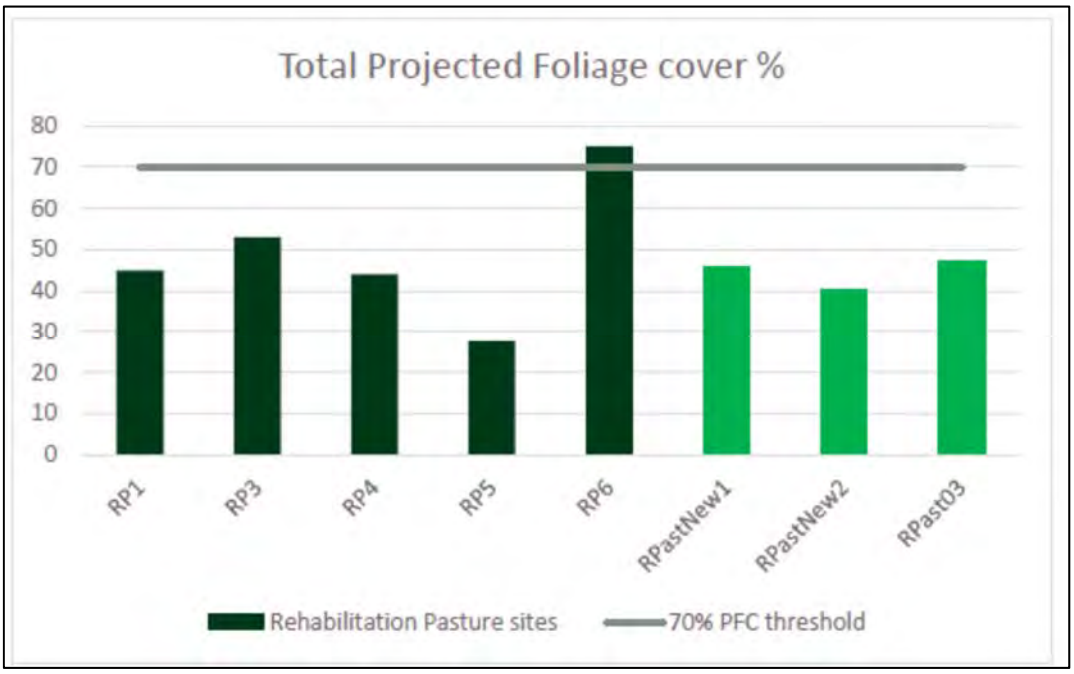


Figure 47: Total Projected Foliage Cover at Rehabilitation Pasture Sites

The average number of weed species has been compared between remnant and rehabilitation pasture sites (**Figure 48**). The average weed species present at both remnant and rehabilitation pasture sites was very similar with remnant pasture sites comprising 11 weed species and rehabilitation pasture sites comprising 12 species. This is a decrease in weed species when compared to the previous reporting period.

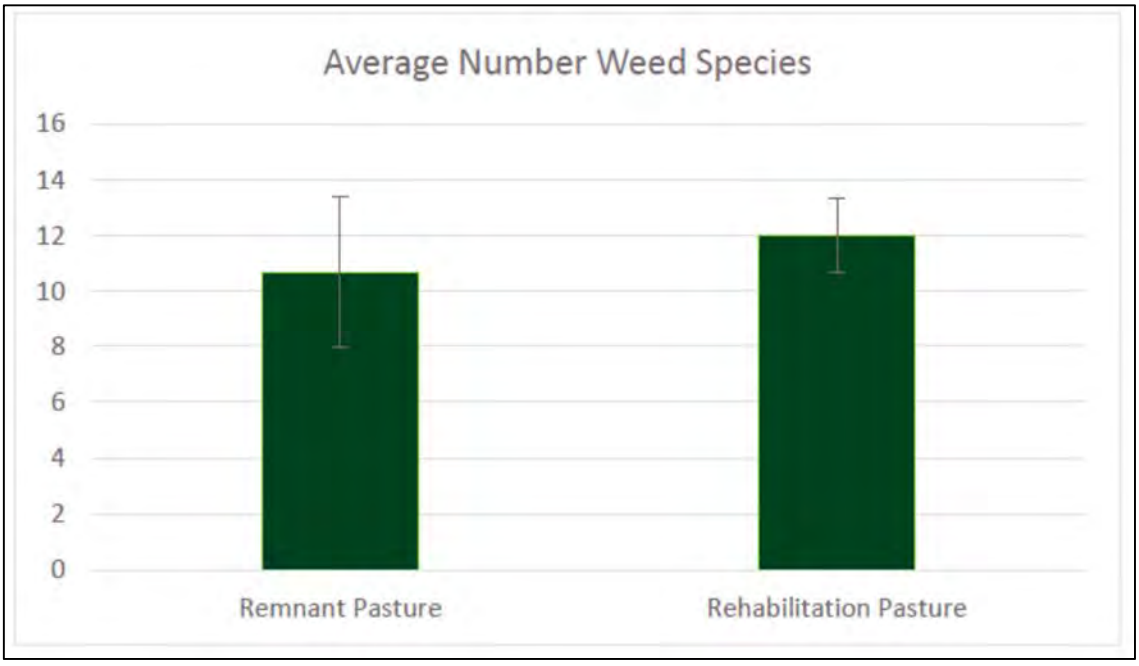


Figure 48: Comparison Between Remnant and Rehabilitation Pasture Sites for Average Weed Species Richness

5.5.5 COMPARISON TO CLOSURE CRITERIA

In relation to the completion criteria, the results of the rehabilitation pasture sites established native/desirable species composition, projected foliage cover and number of weeds listed as WoNS is presented in **Table 47**.

Table 47: Rehabilitation Site Completion Criteria Target – Pasture

Site	Completion criteria target (native/desirable species established)	2019 result	Target reached	Completion criteria target (projected foliage cover)	2019 result	Target reached	Completion criteria target (WoNS)	2019 result	Target exceeded
RP2	>50%	41%	No	≥70%	45%	No	<20%	10.0%	No
RP3	>50%	48%	No	≥70%	53%	No	<20%	5.9%	No
RP4	>50%	45%	No	≥70%	44%	No	<20%	8.3%	No
RP5	>50%	50%	No	≥70%	28%	No	<20%	14.3%	No
RP6	>50%	26%	No	≥70%	75%	Yes	<20%	14.3%	No

5.5.6 CONCLUSIONS

None of the rehabilitation pasture sites are currently meeting the MOP criteria for desirable species established, however, three sites, being RP3, RP4 and RP5 fall just below the target, RP2 is slightly lower and RP6 sits at just above half the target. It is considered with future re-work of the pasture sites that the rehabilitation pasture sites can accomplish the completion criteria targets. It should be noted though, that until the drought conditions ease, and regular rainfall is received, that any re-work of rehabilitation sites, to meet targets is unlikely to succeed.

All rehabilitation pasture sites comprise key pasture species including *C. gayana, L. rigidum, T. repens* and *M. repens* and all rehabilitation pasture sites currently show evidence of both short-lived and long-lived annual/perennial species. None of the rehabilitation pasture sites, excepting RP6, meet the criteria target for percent foliage cover. Considerable re-work of RP5 will be necessary to reduce and remove weed species present and establish species in line with the MOP. All of the rehabilitation pasture sites meet the criteria target for <20% WoNS weed presence.

5.6 FAUNA MONITORING RESULTS

5.6.1 REMOTE CAMERA SURVEY

The results of the remote camera data are presented in **Figure 49** and **Table 48** and provides an indication of fauna species richness at each woodland site surveyed from the 2015 to the 2019 monitoring periods. Results show that across the remnant woodland sites, mammals have increased from 2018, from one species in 2018 to 4 species during 2019. Birds have gone from one species in 2018 to two species during 2019 and reptiles were again identified during 2019 with two species recorded. Two pest species were identified at remnant woodland sites during 2019. Across the rehabilitation woodland sites, the number of mammals has increased from two in 2018 to three during 2019, birds have increased from one across years 2106, 2017 and 2018 to 3 species during 2019 and pest species have decreased to one species during 2019. Reptiles are absent at rehabilitation sites as they have been for all monitoring years.

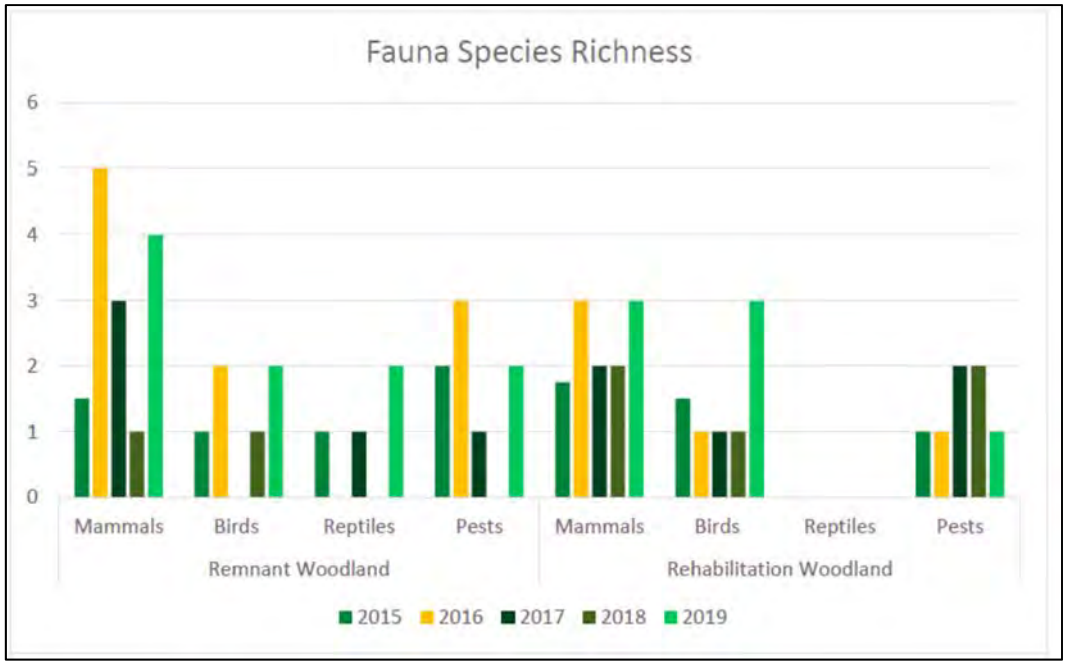


Figure 49: Comparison of Average Fauna Species Richness

Table 48: Remote Camera Results

Species	Remnant Woodland Sites			Rehabilitation Woodland Sites				
	RWoodNew1	RWoodNew2	RWoodNew3	RW2	RW3	RW4	RW5	RW6
Mammals								
Macropus rufogriseus (Red-neck Wallaby)	X	X						X
Macropus giganteus (Eastern grey kangaroo)	X	X		X			X	X
Macropus robustus robustus (Eastern Wallaroo)								X
Wallabia bicolor (Swamp Wallaby)	X							
Trichosurus vulpecula (Brushtail possum)		X						
Birds								
Gymnorhina tibicen (Australian Magpie)			X		X			X
Corvus coronoides (Australian Raven)					X			
Corcorax melanorhamphos (White wing Chough)					X			
Manorina melanocephala (Noisy Miner)		X						
Reptiles								
Egernia striolata (Tree skink)			X					

Species	Remnant Woodland Sites			Rehabilitation Woodland Sites				
	RWoodNew1	RWoodNew2	RWoodNew3	RW2	RW3	RW4	RW5	RW6
Pogona barbata (Eastern Bearded Dragon)			X					
Pest Species								
Oryctolagus cuniculus (Rabbit)				X				
Lepus europaeus (European hare)	X							
Vulpes vulpes (Fox)	X							

5.6.2 BIRD CENSUS

Bird species were identified with a comparison between remnant and rehabilitation woodland sites and across the 2015 to 2019 monitoring periods is shown in **Figure 50**. Across the remnant woodland sites, the average bird species remained consistent from the 2018 monitoring and during the 2019 monitoring (12 recorded). The rehabilitation woodland sites have decreased slightly in the average bird species present from 14 during 2018 monitoring to 13 during the 2019 monitoring. This is not a notable decrease and still significantly higher than that recorded in 2015 and similar to that recorded across remnant woodland sites.

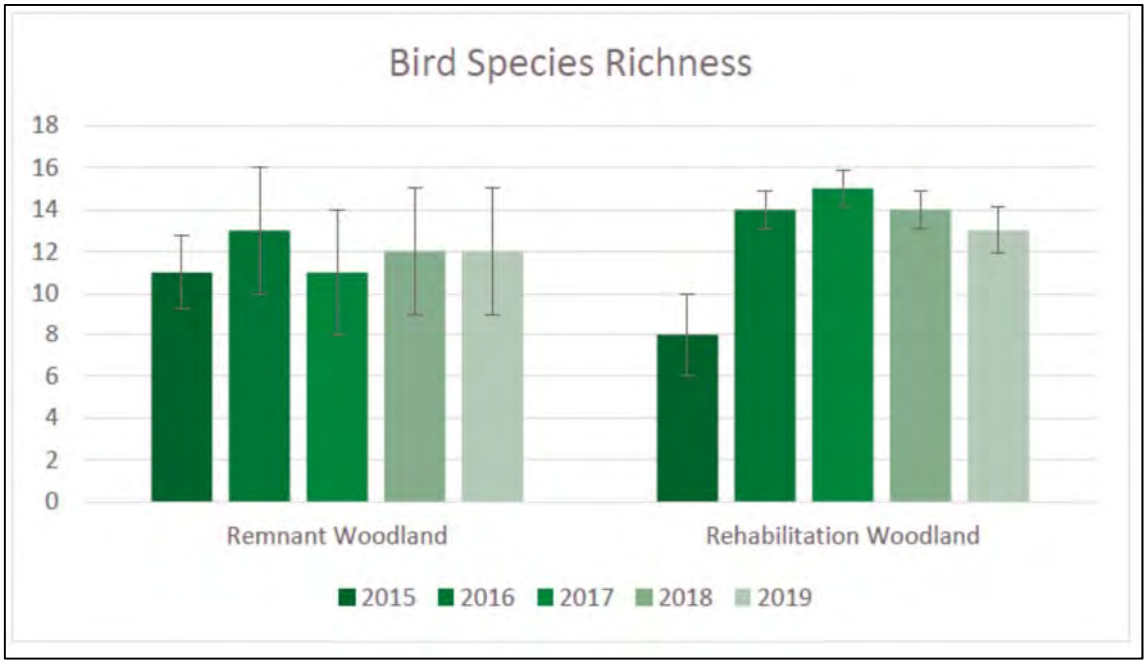


Figure 50: Bird Species Identified at Remnant and Rehabilitation Sites

5.6.3 MICROCHIROPTERAN BATS

The results of the Micro-bat census using songmeter data capture is presented in **Figure 51** indicating the presence of bat species utilising the woodland sites surveyed. Of the common microbat species, RWoodNew2 had the highest number of recorded being ten, RWoodNew1 was slightly lower at nine species and RWoodNew3, RW2 and RW5 all had eight species. Both RW3 and RW6 recorded seven species and RW4 recorded two species. Definite and potential call sequences for threatened microbat species were identified at all sites. RWoodNew2 recorded the highest number of threatened species being six, RWoodNew1 was slightly lower at five species, RW5 had four species, RWoodNew3 recorded three species, RW2 recorded two species and RW3 and RW4 and RW6 all recorded one threatened

microbat species each. These threatened microbats included *Mormopterus norfolkensis* (East-Coast Free-tailed Bat), *Myotis macropus* (Southern Myotis), *Nyctophilus sp, Vespadelus troughtoni* (Eastern Cave Bat), *Miniopterus schreibersii oceanensis* (Large Bent-winged Bat), *Chalinolobus dwyeri* (Large-eared Pied Bat), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) and *Scoteanax rueppellii* (Greater Broad-nosed Bat).

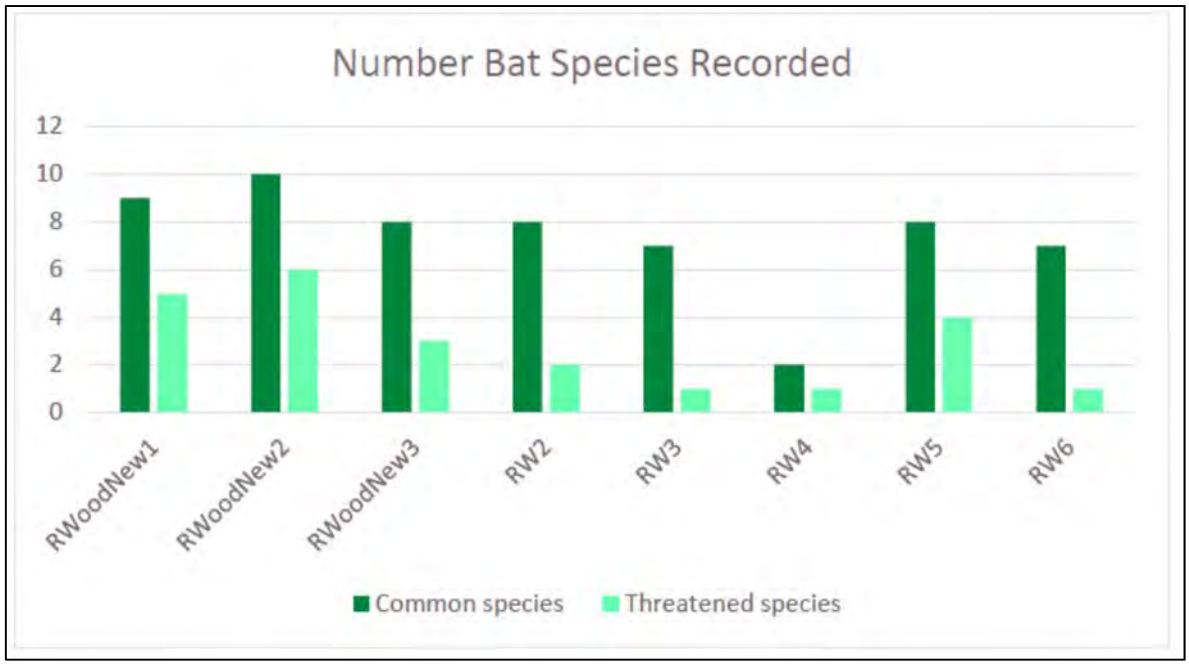


Figure 51: Number of Common and Threatened Bat Species Recorded at Woodland Sites

5.6.4 CONCLUSIONS

Based on the data collected this reporting period, generally it is considered that the rehabilitation woodland sites are functioning as wildlife corridors for those highly mobile fauna groups. There is considerable diversity and number of microbat species present across the rehabilitation woodland sites. The identification of eight threatened microbats is a positive result. For mammals, birds and microbats all are exceeding the target threshold in relation to the analogue woodland sites. One faunal group, being reptiles are yet to be identified as occurring within rehabilitation woodland sites, however, this faunal group can be difficult to survey for, and often require specific habitat features, such as hollow logs etc to be present.

5.7 SOIL MONITORING RESULTS

All rehabilitation sites fall within the neutral range of within 5.5 to 7.5 which is optimal for plant growth. Remnant sites RWoodNew1, RWoodNew3 and RPast03 are slightly more acidic falling just below 5.5. As all rehabilitation sites are within the acceptable range, pH is not considered a limiting factor.

EC is a measure of salinity. All rehabilitation sites fall within the acceptable range of <600µS/cm. Rehabilitation sites had a slightly higher salinity level as compared to the remnant (analogue) sites, however, was well below the threshold at 197µS/cm.

Based on the analysis of rehabilitation sites tested, the soils do not have a sodicity problem.

Potassium levels are not a limiting factor in soils across the rehabilitation sites. Adequate potassium is evident to support the growth of a wide range of pastures. All rehabilitation sites have levels above

the 0.5meq/100g parameter required to meet completion criteria and are in line with the remnant (analogue) sites.

Sulphur is a mobile element and can be removed by leaching through the soil, plant uptake and mineral breakdown. This is however a slow process and can be impacted by drought conditions where elevated levels occur due to lack of rain and percolation through the soil profile. High sulphur levels are common across the rehabilitation sites. These high levels across these rehabilitation sites will take some time to reduce.

Generally, for nitrate/nitrogen, the preferred level is between 1.20-1.80mg/kg. All rehabilitation sites are well above this preferred level, however, are in-line with the levels recorded at remnant (analogue) sites. These high levels are likely a result of the extreme drought conditions experienced in the Hunter region. It is considered that once adequate rainfall occurs, and plant growth increases the overall high nitrate levels will reduce to acceptable level through plant uptake.

Nitrogen levels should be within the 2,600–3,150mg/kg range. Of the rehabilitation woodland sites, only one, being RW3 (at 2,800mg/kg) is within the adequate nitrogen range. RW2, RW4 and RW6 are slightly below the acceptable range at 2,100, 2,000 and 2,000mg/kg respectively, whilst RW5 is well above this at 3,600mg/kg. Two of the remnant (analogue) sites are generally within the acceptable range, however, RWoodNew1 is slightly elevated at 3,600mg/kg. Of the rehabilitation pasture sites, none fall within the acceptable range, however, RP1, RP3 and RP4 are only slightly lower at 2,500, 2,500 and 2,100mg/kg respectively. Both RP5 and RP6 have elevated nitrogen levels at 3,900 and 6,500mg/kg respectively. In comparison, two of the remnant (analogue) pasture sites also have elevated nitrogen levels with RPastNew1 sitting at 4,800mg/kg and RPastNew2 at 3,500mg/kg. RPast03 is below the acceptable range being 1,800mg/kg. The extreme drought conditions currently being experienced are likely to be influencing the high nitrogen levels across both the remnant and rehabilitation woodland and pasture sites.

The average soil organic matter is lower across rehabilitation sites, however, all sites are within the preferred range of between 3-10%.

5.8 EROSION AND LANDFORM STABILITY

In conjunction with the rehabilitation monitoring, observations were made in the areas surrounding each of the rehabilitation monitoring sites for any signs of soil erosion or obvious landform instability.

Generally, there was little active erosion occurring within the rehabilitation sites. Vegetative cover is moderate to high in most areas and is likely to have assisted in stabilising rehabilitation areas. As noted in 2017, gully erosion has been identified along the northern boundary of Block C on the left-hand side of road heading towards RW6. The erosion gully seems to extend downslope for approximately 50 m. The severity of the gully erosion does not seem to have worsened since first observing in 2017. No action is required other than to monitor to determine whether conditions worsen.

5.9 BIODIVERSITY OFFSET AREA

In accordance with amendments to the MOP 2017-2023, monitoring of the biodiversity offset area will now be undertaken on a three-yearly cycle. This monitoring was due to be undertaken this reporting period but due to an oversight this monitoring did not occur. Monitoring of the offset areas will be undertaken during the next reporting period.

5.10 FIRE AFFECTED REHABILITATION SITE

An unplanned fire occurred on the 14 December 2015 within the western and south-western section of Block C. Two monitoring points have been set up to monitor the area in order to document the resilience of rehabilitation to impacts of fire (**Figure 52**).

At monitoring point 1, no canopy species are present in the locality. The drought conditions are impacting on vegetation present in the locality. Low shrub species consisted of *Acacia paradoxa* (Kangaroo Thorn). The ground layer consisted of a majority of exotic species such as *Chloris gayana* (Chloris grass), *Hypochaeris radicata* (Flatweed) and *Sida rhombifolia* (Paddy's Lucerne). A few native species, such as *Wahlenbergia communis* (Tufted bluebell) and *Erodium crinitum* (Blue Storks bill), were also present.

At monitoring point 2, no canopy species are present in the locality. The drought conditions are impacting on vegetation present in the locality. Shrub species consisted of *A. saligna* which were showing signs of drought stress. Ground layer species consisted of a majority of exotic species such as *Galenia pubescens* (Galenia), *C. gayana*, *H. radicata*, *V. bonariensis*, *S. rhombifolia* and *Cirsium. vulgare* (Scotch thistle). A few native species, such as *W. communis,* were also present.

This area has shown signs of recovering well across 2016, 2017 and 2018, however, is currently showing signs of drought stress. This however is impacting vegetation across all of the site, therefore, is not related directly to the fire. At monitoring point one, the shrub species *Acacia paradoxa* is present and in 2018 showed signs of older and newer growth, however this year parts of the plant are showing signs of browning off. Common ground-layer species including both exotic and native species are present and no longer show any signs of impacts from the fire. Shrub species at monitoring point two include *Acacia saligna*. This species showed signs of being drought affected, however, are likely to recover with regular rainfall. Common ground-layer species including both exotic and native species are present and impacts of fire are not apparent.

As the monitoring shows that these areas have recovered from the fire, specific monitoring of these sites will cease. Monitoring of this area will be part of the regular rehabilitation monitoring program.

5.11 REHABILITATION TRIALS AND RESEARCH

MCC are not currently undertaking any trials within the rehabilitation areas.

5.12 FURTHER DEVELOPMENT OF THE FINAL REHABILITATION PLAN

As part of the modification to the development consent the final landform was reviewed with improvements made to the final landform. The revised final landform has been modified such that all slopes, including final void batters, would be equal to or less than 14 degrees. One high wall will remain, in Open Cut 2, which will be appropriately treated with the installation of a safety fence and/or berms, as well as capping of exposed coal seams. There are no proposed changes to this final rehabilitation plan.

Figure 52: Fire Affected Monitoring Sites

6.0 ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

During the next reporting period, the following activities are planned:

- Continuing to implement the commitments in the Environmental Management Plans and the Mining Operations Plan.
- Place a caveat on the title for the Biodiversity Offset Area regarding restrictions on the use of this land.
- Bulk shape and seed 9.88ha of new rehabilitation.
- Maintenance activities on the rehabilitation areas will continue.
- Complete the three-yearly review of the Environmental Management Plans that are due for a review.

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Appendix 1: Air Quality Monitoring Results

REAL-TIME PM_{10} MONITORING RESULTS

January 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jan-19	21.5	27.5	15.7
02-Jan-19	30.5	41.6	23.9
03-Jan-19	30.4	31.1	27.7
04-Jan-19	27.7	37.1	23.4
05-Jan-19	25.9	54.9	22.6
06-Jan-19	9.8	9.2	12.9
07-Jan-19	11.1	9.4	7.3
08-Jan-19	18.4	37.6	16.4
09-Jan-19	27.5	52.2	33.3
10-Jan-19	27.9	26.0	23.0
11-Jan-19	23.3	24.8	18.1
12-Jan-19	18.8	23.3	15.9
13-Jan-19	28.4	29.8	31.0
14-Jan-19	23.6	22.6	21.2
15-Jan-19	36.7	51.7	26.0
16-Jan-19	55.5	60.5	40.8
17-Jan-19	47.6	48.5	37.8
18-Jan-19	38.8	80.2	31.4
19-Jan-19	28.2	87.1	22.8
20-Jan-19	12.7	13.8	no data
21-Jan-19	14.6	17.9	no data
22-Jan-19	22.0	35.0	no data
23-Jan-19	26.1	60.8	no data
24-Jan-19	33.1	33.6	no data
25-Jan-19	34.8	39.3	no data
26-Jan-19	28.7	49.2	no data
27-Jan-19	34.6	52.1	no data
28-Jan-19	37.0	35.9	no data
29-Jan-19	33.7	35.0	no data
30-Jan-19	42.7	120.8	32.4
31-Jan-19	33.7	104.2	26.2

February 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Feb-19	19.0	19.5	23.4
02-Feb-19	8.7	9.2	8.6
03-Feb-19	16.6	18.6	14.8
04-Feb-19	32.9	67.5	28.4
05-Feb-19	26.3	26.6	25.2
06-Feb-19	13.1	16.5	12.7
07-Feb-19	20.7	19.1	16.2
08-Feb-19	22.1	93.9	19.8
09-Feb-19	14.2	33.7	18.0
10-Feb-19	57.5	no data	45.8
11-Feb-19	29.4	95.1	21.3
12-Feb-19	26.9	144.7	26.2
13-Feb-19	82.2	113.4	72.5
14-Feb-19	24.6	22.4	25.1
15-Feb-19	24.8	24.1	22.1
16-Feb-19	16.9	16.8	15.3
17-Feb-19	20.0	26.0	16.6
18-Feb-19	29.3	51.3	27.5
19-Feb-19	45.3	78.7	43.9
20-Feb-19	28.3	27.3	26.5
21-Feb-19	14.1	14.3	14.0
22-Feb-19	16.6	15.6	14.1
23-Feb-19	12.5	12.1	11.5
24-Feb-19	20.1	19.1	18.4
25-Feb-19	23.9	21.2	19.0
26-Feb-19	21.7	19.7	18.6
27-Feb-19	14.8	15.8	14.5
28-Feb-19	14.6	18.3	10.4

March 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Mar-19	18.7	12.2	10.8
02-Mar-19	17.2	15.0	15.0
03-Mar-19	18.0	16.6	16.4
04-Mar-19	26.8	25.4	19.1
05-Mar-19	25.2	50.5	22.0
06-Mar-19	50.9	143.7	42.1
07-Mar-19	22.6	no data	25.6
08-Mar-19	17.8	19.7	31.9
09-Mar-19	25.4	no data	20.8
10-Mar-19	11.4	no data	13.2
11-Mar-19	44.6	no data	29.1
12-Mar-19	31.6	62.6	30.9
13-Mar-19	35.5	32.8	32.1
14-Mar-19	23.4	38.8	19.6
15-Mar-19	23.1	20.1	18.8
16-Mar-19	14.8	15.0	14.9
17-Mar-19	8.6	10.4	5.7
18-Mar-19	7.0	22.7	7.3
19-Mar-19	14.7	19.9	11.4
20-Mar-19	17.6	23.4	17.2
21-Mar-19	15.1	20.4	9.8
22-Mar-19	15.8	16.6	14.3
23-Mar-19	17.8	28.8	14.4
24-Mar-19	18.7	no data	15.4
25-Mar-19	16.0	no data	16.8
26-Mar-19	35.5	59.0	31.7
27-Mar-19	23.5	21.8	23.9
28-Mar-19	18.9	17.3	14.8
29-Mar-19	24.7	29.9	19.6
30-Mar-19	15.8	16.6	17.5
31-Mar-19	68.3	81.1	61.5

April 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Apr-19	11.1	20.6	10.6
01-Apr-19	8.8	7.9	6.7
01-Apr-19	13.4	21.8	10.8
01-Apr-19	19.6	24.4	15.2
01-Apr-19	18.1	14.3	13.4
01-Apr-19	10.2	18.9	10.8
01-Apr-19	14.8	45.8	13.7
01-Apr-19	24.9	117.6	22.9
01-Apr-19	34.7	95.9	27.0
01-Apr-19	22.4	19.8	21.5
01-Apr-19	17.2	18.5	12.8
01-Apr-19	15.8	15.7	12.9
01-Apr-19	18.7	19.6	16.4
01-Apr-19	25.3	32.8	23.0
01-Apr-19	20.1	33.7	18.7
01-Apr-19	17.1	19.6	14.4
01-Apr-19	10.1	8.4	7.9
01-Apr-19	12.0	24.0	11.1
01-Apr-19	16.9	14.2	13.2
01-Apr-19	12.0	10.9	11.7
01-Apr-19	16.0	11.6	11.0
01-Apr-19	18.4	16.6	11.4
01-Apr-19	14.6	13.0	12.3
01-Apr-19	17.4	18.2	13.5
01-Apr-19	20.8	49.1	19.2
01-Apr-19	21.9	73.6	31.8
01-Apr-19	41.1	41.6	42.6
01-Apr-19	22.1	55.6	20.9
01-Apr-19	34.7	48.1	22.6
01-Apr-19	21.7	30.7	18.8

May 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-May-19	24.4	67.3	23.6
02-May-19	26.8	45.1	27.3
03-May-19	13.3	86.8	18.1
04-May-19	5.9	15.8	7.6
05-May-19	10.7	15.0	8.3
06-May-19	8.7	60.6	11.9
07-May-19	7.8	102.7	14.6
08-May-19	15.8	96.2	22.5
09-May-19	11.1	72.6	14.1
10-May-19	23.7	57.9	18.1
11-May-19	9.2	43.9	11.6
12-May-19	12.7	30.7	9.2
13-May-19	19.3	29.9	13.2
14-May-19	12.7	33.9	14.4
15-May-19	16.3	27.8	13.1
16-May-19	17.6	18.8	10.5
17-May-19	23.5	25.0	17.0
18-May-19	22.0	25.0	17.5
19-May-19	13.0	23.4	14.3
20-May-19	12.1	56.3	11.2
21-May-19	11.7	60.1	16.0
22-May-19	13.7	44.9	17.2
23-May-19	24.4	40.9	17.6
24-May-19	14.9	43.3	19.9
25-May-19	14.7	42.8	17.1
26-May-19	15.4	55.3	21.8
27-May-19	16.0	81.6	21.8
28-May-19	11.9	88.4	12.6
29-May-19	15.5	108.5	12.0
30-May-19	8.4	55.1	11.1
31-May-19	8.7	67.9	9.9

June 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jun-19	18.4	46.6	19.7
02-Jun-19	26.3	30.3	21.9
03-Jun-19	7.0	34.3	35.0
04-Jun-19	8.9	27.4	no data
05-Jun-19	13.0	17.1	no data
06-Jun-19	8.6	29.9	10.1
07-Jun-19	15.5	26.2	14.2
08-Jun-19	19.2	28.8	13.1
09-Jun-19	9.0	18.6	10.0
10-Jun-19	8.4	34.0	9.4
11-Jun-19	11.8	45.0	12.2
12-Jun-19	14.9	73.7	10.4
13-Jun-19	13.7	65.0	14.7
14-Jun-19	10.7	28.7	11.9
15-Jun-19	16.9	25.0	13.8
16-Jun-19	19.7	29.7	15.9
17-Jun-19	18.7	27.4	18.0
18-Jun-19	10.2	24.3	8.9
19-Jun-19	10.4	30.8	10.0
20-Jun-19	14.0	26.5	12.2
21-Jun-19	15.3	19.1	13.8
22-Jun-19	15.0	18.9	14.5
23-Jun-19	16.7	14.8	11.1
24-Jun-19	9.0	no data	5.6
25-Jun-19	8.4	6.8	6.8
26-Jun-19	9.9	8.0	7.4
27-Jun-19	11.6	9.3	7.2
28-Jun-19	9.2	23.5	9.0
29-Jun-19	9.6	14.2	5.8
30-Jun-19	14.4	29.5	16.9

July 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jul-19	16.0	23.1	9.7
02-Jul-19	16.1	34.0	15.5
03-Jul-19	23.4	21.5	19.0
04-Jul-19	10.6	8.4	no data
05-Jul-19	9.1	7.9	no data
06-Jul-19	6.3	6.5	no data
07-Jul-19	9.0	14.6	no data
08-Jul-19	5.1	19.1	no data
09-Jul-19	3.3	32.2	7.3
10-Jul-19	5.1	25.6	8.6
11-Jul-19	11.5	50.7	10.9
12-Jul-19	11.5	63.5	9.7
13-Jul-19	10.7	31.5	13.1
14-Jul-19	7.6	32.8	7.2
15-Jul-19	7.2	41.5	7.4
16-Jul-19	7.3	70.6	7.1
17-Jul-19	6.2	141.8	11.3
18-Jul-19	7.4	72.7	5.8
19-Jul-19	12.4	42.4	13.4
20-Jul-19	10.1	46.7	19.0
21-Jul-19	17.3	103.9	18.1
22-Jul-19	14.9	65.3	21.9
23-Jul-19	11.8	64.8	18.8
24-Jul-19	12.8	121.3	15.8
25-Jul-19	21.8	73.2	19.0
26-Jul-19	15.5	77.5	17.7
27-Jul-19	22.1	32.0	19.1
28-Jul-19	24.1	30.9	19.4
29-Jul-19	16.8	60.2	18.9
30-Jul-19	11.6	14.6	14.2
31-Jul-19	14.0	13.3	15.2

August 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Aug-19	16.4	23.73	16.0
02-Aug-19	15.6	31.4	14.3
03-Aug-19	12.9	47.2	16.0
04-Aug-19	22.5	33.9	17.1
05-Aug-19	17.3	49.7	22.3
06-Aug-19	12.8	86.7	no data
07-Aug-19	18.6	111.5	no data
08-Aug-19	31.9	128.1	no data
09-Aug-19	41.1	136.9	no data
10-Aug-19	16.1	37.9	15.1
11-Aug-19	9.3	26.5	10.2
12-Aug-19	6.0	72.6	7.6
13-Aug-19	6.2	46.0	14.9
14-Aug-19	10.0	48.3	20.0
15-Aug-19	13.4	55.2	18.2
16-Aug-19	12.9	74.3	19.2
17-Aug-19	18.5	48.5	20.6
18-Aug-19	19.1	39.4	16.6
19-Aug-19	42.9	76.7	47.1
20-Aug-19	12.2	78.9	9.7
21-Aug-19	14.1	41.2	10.5
22-Aug-19	18.6	44.8	13.7
23-Aug-19	33.3	27.8	29.3
24-Aug-19	24.3	80.3	28.6
25-Aug-19	28.4	44.1	29.7
26-Aug-19	30.9	32.2	27.7
27-Aug-19	19.4	20.1	21.7
28-Aug-19	18.2	30.9	24.9
29-Aug-19	27.9	38.6	25.5
30-Aug-19	13.0	8.0	6.7
31-Aug-19	8.7	6.4	4.4

September 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Sep-19	9.5	21.9	9.0
02-Sep-19	12.8	41.0	14.0
03-Sep-19	12.4	60.1	12.7
04-Sep-19	22.5	67.9	21.3
05-Sep-19	27.2	63.4	20.2
06-Sep-19	86.8	149.9	73.2
07-Sep-19	21.3	26.8	20.4
08-Sep-19	9.0	12.3	7.7
09-Sep-19	13.9	24.1	16.7
10-Sep-19	23.4	28.4	21.7
11-Sep-19	21.6	34.5	18.9
12-Sep-19	19.0	46.4	20.2
13-Sep-19	35.2	45.4	30.2
14-Sep-19	23.9	40.9	24.7
15-Sep-19	14.5	28.7	19.3
16-Sep-19	28.0	74.0	27.0
17-Sep-19	11.3	13.8	13.1
18-Sep-19	11.4	6.6	5.8
19-Sep-19	15.9	13.5	12.8
20-Sep-19	14.7	9.4	9.6
21-Sep-19	20.1	42.6	17.3
22-Sep-19	29.6	50.2	23.5
23-Sep-19	15.0	40.7	17.4
24-Sep-19	18.4	43.0	13.7
25-Sep-19	19.6	30.8	14.2
26-Sep-19	25.0	37.4	22.1
27-Sep-19	17.1	55.6	25.3
28-Sep-19	20.3	67.5	22.2
29-Sep-19	24.0	39.6	23.3
30-Sep-19	23.2	24.1	21.0

October 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Oct-19	18.4	18.9	19.9
02-Oct-19	16.2	41.5	18.6
03-Oct-19	25.6	91.6	23.9
04-Oct-19	31.4	125.4	38.5
05-Oct-19	28.1	22.1	19.0
06-Oct-19	18.3	38.0	18.0
07-Oct-19	59.0	90.2	57.1
08-Oct-19	47.9	73.0	42.2
09-Oct-19	no data	no data	no data
10-Oct-19	no data	no data	no data
11-Oct-19	12.7	22.5	13.1
12-Oct-19	5.8	6.6	6.3
13-Oct-19	10.5	9.9	11.3
14-Oct-19	17.2	48.1	16.6
15-Oct-19	36.0	42.0	47.5
16-Oct-19	29.3	64.1	34.0
17-Oct-19	46.3	62.4	31.3
18-Oct-19	21.3	114.1	26.6
19-Oct-19	28.9	98.4	34.9
20-Oct-19	26.6	25.9	26.5
21-Oct-19	32.0	29.3	26.3
22-Oct-19	no data	35.3	25.4
23-Oct-19	29.4	37.6	31.8
24-Oct-19	35.7	95.9	26.5
25-Oct-19	29.6	295.8	28.1
26-Oct-19	86.9	258.2	64.5
27-Oct-19	68.1	74.2	42.2
28-Oct-19	58.3	58.0	no data
29-Oct-19	68.6	56.6	no data
30-Oct-19	64.5	no data	no data
31-Oct-19	53.3	93.7	no data

November 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Nov-19	99.9	105.0	50.6
02-Nov-19	40.7	53.1	no data
03-Nov-19	24.7	61.8	no data
04-Nov-19	2.4	36.3	19.0
05-Nov-19	11.4	16.9	no data
06-Nov-19	14.4	41.2	no data
07-Nov-19	65.5	89.3	no data
08-Nov-19	70.3	91.6	60.9
09-Nov-19	27.1	32.3	no data
10-Nov-19	25.7	46.2	no data
11-Nov-19	23.8	51.9	23.5
12-Nov-19	86.6	227.7	no data
13-Nov-19	41.7	58.0	no data
14-Nov-19	23.5	112.6	no data
15-Nov-19	22.7	150.3	no data
16-Nov-19	72.2	82.8	no data
17-Nov-19	52.7	57.7	no data
18-Nov-19	44.6	76.5	42.3
19-Nov-19	40.9	104.2	39.7
20-Nov-19	61.1	54.5	54.9
21-Nov-19	94.2	142.4	69.4
22-Nov-19	96.4	198.2	91.1
23-Nov-19	94.7	no data	58.5
24-Nov-19	25.3	19.1	22.4
25-Nov-19	31.1	118.5	32.0
26-Nov-19	183.9	333.8	161.2
27-Nov-19	94.2	89.4	102.8
28-Nov-19	72.9	73.8	52.8
29-Nov-19	93.5	88.2	81.3
30-Nov-19	66.6	176.9	57.6

December 2019			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Dec-19	55.5	53.9	52.1
02-Dec-19	90.0	100.9	68.1
03-Dec-19	45.9	85.0	53.1
04-Dec-19	30.8	80.8	34.6
05-Dec-19	33.3	139.9	41.4
06-Dec-19	65.1	135.8	67.1
07-Dec-19	no data	110.8	97.4
08-Dec-19	no data	47.5	41.7
09-Dec-19	91.4	93.2	67.8
10-Dec-19	108.7	112.5	73.8
11-Dec-19	69.9	70.6	84.5
12-Dec-19	52.2	48.1	50.9
13-Dec-19	23.3	21.9	21.2
14-Dec-19	46.5	48.3	38.3
15-Dec-19	40.1	47.7	39.0
16-Dec-19	88.0	134.4	78.1
17-Dec-19	25.7	23.4	22.5
18-Dec-19	42.7	34.4	24.8
19-Dec-19	96.9	115.4	84.8
20-Dec-19	50.6	44.5	47.0
21-Dec-19	81.1	104.6	55.6
22-Dec-19	54.3	no data	71.3
23-Dec-19	26.6	25.8	28.8
24-Dec-19	27.5	27.7	23.2
25-Dec-19	18.3	21.2	17.5
26-Dec-19	27.6	25.3	22.0
27-Dec-19	36.4	33.6	25.9
28-Dec-19	35.6	53.3	34.3
29-Dec-19	52.0	62.4	39.2
30-Dec-19	75.1	169.8	63.5
31-Dec-19	52.6	188.9	46.2

Appendix 2: Water Monitoring Results

MONTHLY SURFACE WATER MONITORING RESULTS - pH

DATE	Dam 1/2	MCC12 Final Settling Pond	No.2 Open Cut Void	No.1 Open Cut Void	MCC07	MCC08
9-Jan-19	8.17	7.16	no access	no access	7.69	7.91
13-Feb-19	7.98	8.74	no access	no access	7.95	8.00
7-Mar-19	7.86	8.48	no access	no access	7.86	7.94
4-Apr-19	7.95	7.52	no access	no access	7.49	7.63
8-May-19	7.86	8.45	no access	no access	7.61	7.98
6-Jun-19	8.07	8.01	no access	no access	8.04	8.22
3-Jul-19	7.83	8.21	no access	no access	7.55	7.89
6-Aug-19	7.83	8.49	no access	no access	7.76	7.90
5-Sep-19	7.80	8.70	no access	no access	7.78	7.96
3-Oct-19	7.85	9.76	no access	no access	7.57	7.73
7-Nov-19	7.83	9.66	no access	no access	7.75	7.88
4-Dec-19	7.87	9.33	no access	no access	7.91	7.94

MONTHLY SURFACE WATER MONITORING RESULTS – ELECTRICAL CONDUCTIVITY

DATE	Dam 1/2	MCC12 Final Settling Pond	No.2 Open Cut Void	No.1 Open Cut Void	MCC07	MCC08
9-Jan-19	7,810	6,260	no access	no access	14,200	4,880
13-Feb-19	7,750	6,750	no access	no access	17,400	7,280
7-Mar-19	8,180	7,060	no access	no access	19,300	7,510
4-Apr-19	7,110	2,050	no access	no access	6,270	1,360
8-May-19	7,270	3,390	no access	no access	13,300	6,030
6-Jun-19	7,160	4,230	no access	no access	13,800	6,850
3-Jul-19	6,790	4,240	no access	no access	12,700	6,860
6-Aug-19	7,880	5,420	no access	no access	15,500	8,300
5-Sep-19	7,170	5,670	no access	no access	13,000	7,650
3-Oct-19	7,300	5,520	no access	no access	13,600	8,000
7-Nov-19	7,100	6,680	no access	no access	13,800	8,080
4-Dec-19	7,560	8,350	no access	no access	19,800	9,140

MONTHLY SURFACE WATER MONITORING RESULTS – TOTAL SUSPENDED SOLIDS

DATE	Dam 1/2	MCC12 Final Settling Pond	No.2 Open Cut Void	No.1 Open Cut Void	MCC07 Muscle Creek - upstream	MCC08 Muscle Creek - downstream
9-Jan-19	13	12	no access	no access	8	14
13-Feb-19	<5	<5	no access	no access	<5	<5
7-Mar-19	<5	11	no access	no access	6	15
4-Apr-19	15	<5	no access	no access	16	15
8-May-19	60	28	no access	no access	<5	8
6-Jun-19	12	22	no access	no access	<5	<5
3-Jul-19	11	18	no access	no access	<5	16
6-Aug-19	<5	17	no access	no access	<5	7
5-Sep-19	20	51	no access	no access	6	11
3-Oct-19	<5	36	no access	no access	<5	<5
7-Nov-19	15	35	no access	no access	<5	<5
4-Dec-19	<5	15	no access	no access	<5	<5

QUARTERLY SURFACE WATER MONITORING RESULTS – pH

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
7-Mar-19	dry	8.74	7.55	dry	dry	8.61
6-Jun-19	8.29	8.68	8.26	dry	8.07	8.38
5-Sep-19	dry	8.83	8.22	dry	9.06	8.32
4-Dec-19	dry	9.44	9.02	dry	9.67	8.67

QUARTERLY SURFACE WATER MONITORING RESULTS – ELECTRICAL CONDUCTIVITY

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
7-Mar-19	dry	14,000	2420	dry	dry	14,400
6-Jun-19	396	11,700	1,050	dry	2,070	7,530
5-Sep-19	dry	13,600	1,060	dry	3,600	10,500
4-Dec-19	dry	17,100	1,430	dry	6,040	14,500

QUARTERLY SURFACE WATER MONITORING RESULTS – TOTAL SUSPENDED SOLIDS

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
7-Mar-19	dry	18	26	dry	dry	18
6-Jun-19	71	16	10	dry	<5	6
5-Sep-19	dry	21	6	dry	9	20
4-Dec-19	dry	<5	<5	dry	19	<5

ANNUAL SURFACE WATER MONITORING RESULTS

Sampled 7 March 2019

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC07	MCC08	MCC09	MCC23	MCC24	MCC25	MCC26	MCC27
pH	7.86	8.48	No access	No access	7.86	7.94	Dry	8.74	7.55	Dry	Dry	8.61
EC (*µS/cm*)	8,180	7,060			19,300	7,510		14,000	2,420			14,400
TSS *(mg/L)*	<5	11			6	15		18	26			18
Hardness - total (calculation - *mg/L*)	3,920	3,380			4,420	1,980		8,080	813			5,520
Alkalinity - Carbonate *(mg $CaCO_3$/L)*	<1	5			<1	<1		70	<1			16
Alkalinity - Bicarbonate *(mg $CaCO_3$/L)*	208	30			294	329		165	65			62
Sulphates *(mg/L)*	4,290	3,460			3,360	1,740		7,930	733			7,040
Chloride *(mg/L)*	733	703			5,880	1,540		1,210	301			1,670
Calcium *(mg/L)*	523	674			783	373		366	141			510
Magnesium *(mg/L)*	635	411			600	254		1,630	112			1,030
Sodium *(mg/L)*	742	594			3,090	957		1,390	183			2,020
Potassium *(mg/L)*	44	33			12	4		61	24			25
Iron- filterable *(mg/L)*	<0.05	<0.05			<0.05	<0.05		<0.05	<0.05			<0.05
Arsenic *(mg/L)*	<0.001	<0.001			0.002	0.004		0.005	0.001			0.001
Barium *(mg/L)*	0.03	0.058			0.112	0.023		0.076	0.118			0.071
Cadmium *(mg/L)*	<0.0001	<0.0001			<0.0001	<0.0001		<0.0001	<0.0001			<0.0001
Chromium *(mg/L)*	<0.001	<0.001			<0.001	<0.001		<0.001	<0.001			<0.001

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC07	MCC08	MCC09	MCC23	MCC24	MCC25	MCC26	MCC27
Copper (mg/L)	<0.001	<0.001			<0.001	<0.001		0.003	0.003			0.001
Nickel (mg/L)	0.094	0.004			<0.001	<0.001		0.008	0.008			0.002
Lead (mg/L)	<0.001	<0.001			<0.001	<0.001		<0.001	<0.001			<0.001
Zinc (mg/L)	0.007	<0.005			<0.005	<0.005		<0.005	<0.005			<0.005
Manganese (mg/L)	1.430	0.007			0.295	0.405		0.186	0.172			0.035
Selenium (mg/L)	<0.01	<0.01			<0.01	<0.01		<0.01	<0.01			<0.01
Boron (mg/L)	0.52	0.32			0.14	0.13		0.77	0.08			<0.05
Iron - total (mg/L)	0.06	<0.05			0.14	0.14		0.22	0.68			0.16
Mercury (mg/L)	<0.0001	<0.0001			<0.0001	<0.0001		<0.0001	<0.0001			<0.0001
Fluoride (mg/L)	1.0	1.3			0.3	0.5		1.0	0.8			0.6
Nitrogen Ammonia (mg N/L)	0.90	0.04			0.07	0.04		0.07	0.20			0.07
Nitrates (mg N/L)	1.12	0.07			0.02	0.02		<0.01	0.39			0.16
Oil & Grease (mg/L)	<5	<5			<5	<5		<5	<5			<5
PAH (mg/L)	<0.0005	<0.0005			<0.0005	<0.0005		<0.0005	<0.0005			<0.0005
Total Petroleum Hydrocarbons (mg/L)	<0.07	<0.07			<0.07	<0.07		<0.07	<0.07			<0.07

GROUND WATER MONITORING RESULTS – MINING AREAS

DATE	Relative Level (mAHD)	pH	Electrical Conductivity (µS/cm)	Depth to Water (mbgl)		
BORE RDH650				RDH616	RDH617	RDH624
Jan-19	103.21	7.3	5,630	55.81	47.52	35.25
Feb-19	103.53	no results	no results	55.14	47.28	35.41
Mar-19	105.01	no results	no results	55.42	47.40	35.45
Apr-19	105.12	7.2	6,900	53.14	46.90	35.51
May-19	103.89	7.0	6,400	55.08	47.36	35.53
Jun-19	103.77	no results	no results	55.84	47.53	35.58
Jul-19	103.92	no results	no results	56.19	47.55	35.61
Aug-19	104.51	no results	no results	58.15	47.28	35.65
Sep-19	103.85	no results	no results	57.61	48.04	35.70
Oct-19	103.89	no results	no results	56.32	47.50	35.68
Nov-19	103.15	no results	no results	56.48	47.64	35.77
Dec-19	103.46	6.8	6,360	57.17	47.80	35.81
AVERAGE	**103.94**	**7.1**	**6,323**	**56.03**	**47.48**	**35.58**

ANNUAL GROUNDWATER MONITORING RESULTS – MINING AREAS

Sampled 30 April 2019

ANALYTE	RDH529
pH	7.45
EC (µS/cm)	6,840
TSS (mg/L)	<5
Total Hardness (calculation - mg/L)	3,690
Alkalinity - Carbonate (mg CaCO3/L)	<1
Alkalinity - Bicarbonate (mg CaCO3/L)	208
Sulphates (mg/L)	3,560
Chloride (mg/L)	665
Calcium (mg/L)	604
Magnesium (mg/L)	530
Sodium (mg/L)	680
Potassium (mg/L)	49
Iron- filterable (mg/L)	<0.05
Arsenic (mg/L)	<0.001
Barium (mg/L)	0.037
Boron (mg/L)	0.59
Cadmium (mg/L)	<0.0001
Chromium (mg/L)	<0.001
Copper (mg/L)	<0.001
Nickel (mg/L)	0.132
Lead (mg/L)	<0.001
Zinc (mg/L)	0.109
Manganese (mg/L)	1.26
Selenium (mg/L)	<0.01
Iron - total (mg/L)	0.28
Mercury (mg/L)	<0.0001
Fluoride (mg/L)	1
Nitrogen Ammonia (mg N/L)	0.92
Nitrates (mg N/L)	0.03
Oil & Grease (mg/L)	<5
PAH (mg/L)	<0.0005
Total Petroleum Hydrocarbons (mg/L)	<0.07

GROUND WATER MONITORING RESULTS – SANDY CREEK

Date Sampled	MCC 1003			MCC 1005			MCC 1006			MCC 1017	MCC 1018
	Depth (mbgl)	pH	EC (µS/cm)	Depth (mbgl)	pH	EC (µS/cm)	Depth (mbgl)	pH	EC (µS/cm)	Depth (mbgl)	Depth (mbgl)
9-Jan-19	7.83	7.1	1,091	9.19	6.8	3,380	Dry			17.78	18.39
13-Feb-19	7.81	7.1	1,033	9.23	6.8	3,530				17.80	18.20
7-Mar-19	7.95	7.5	1,330	9.27	7.3	3,900				17.81	18.37
4-Apr-19	6.77	6.9	335	9.15	6.9	3,750				17.80	18.45
8-May-19	6.84	6.9	1,291	9.02	6.8	3,620				17.89	18.37
6-Jun-19	6.79	6.9	1,299	8.99	6.8	3,830				17.94	18.49
3-Jul-19	6.61	7.2	1,284	9.08	7.1	3,880				17.89	18.47
6-Aug-19	6.55	7.2	1,370	9.17	7.0	4,040				17.96	18.47
5-Sep-19	6.64	7.0	1,395	9.18	6.8	4,180				17.96	18.45
3-Oct-19	6.79	7.0	1,379	9.19	6.8	4,110				17.99	18.52
7-Nov-19	7.00	7.1	1,314	9.22	6.9	4,000				18.02	18.48
4-Dec-19	7.93	7.0	1,425	9.26	6.8	4,340				18.12	18.55

ANNUAL GROUNDWATER MONITORING RESULTS – SANDY CREEK

Sampled 7 March 2019

Analyte	MCC1003	MCC1005	MCC1006
pH	7.5	7.34	Dry
EC (µS/cm)	1,330	3,900	
TSS (mg/L)	<5	24	
Hardness - total (calculation - mg/L)	352	958	
Alkalinity - Carbonate (mg CaCO3/L)	<1	<1	
Alkalinity - Bicarbonate (mg CaCO3/L)	184	238	
Sulphates (mg/L)	109	144	
Chloride (mg/L)	237	1,050	
Calcium (mg/L)	85	184	
Magnesium (mg/L)	34	121	
Sodium (mg/L)	146	377	
Potassium (mg/L)	2	3	
Iron- filterable (mg/L)	<0.05	<0.05	
Arsenic (mg/L)	<0.001	0.001	
Barium (mg/L)	0.042	0.091	
Cadmium (mg/L)	0.0002	<0.0001	
Chromium (mg/L)	<0.001	0.006	
Copper (mg/L)	0.005	0.008	
Lead (mg/L)	<0.001	0.011	
Manganese (mg/L)	0.2	0.098	
Nickel (mg/L)	0.002	0.006	
Selenium (mg/L)	<0.01	<0.01	
Zinc (mg/L)	0.138	0.139	
Boron (mg/L)	0.08	0.08	
Iron - total (mg/L)	1.65	9.59	
Mercury (mg/L)	<0.0001	<0.0001	
Fluoride (mg/L)	0.3	0.2	
Ammonia (mg/L)	0.07	0.04	
Nitrite (mg N/L)	0.01	<0.01	
Nitrate (mg N/L)	2.91	1.1	
Oil & Grease (mg/L)	<5	<5	
PAH (mg/L)	<0.0005	<0.0005	
Total Petroleum Hydrocarbons *(mg/L)*	<0.07	<0.07	

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Appendix 3: Blast Monitoring Data

BLAST MONITORING RESULTS

Date	Time	Queen Street (B1)		School (B2)		99 Queen Street (B3)		Nisbet (B4)	
		Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s
08-Jan-19	14:14	110.8	0.25	108.3	0.08	109.1	0.24	115.2	0.45
10-Jan-19	12:44	101.3	0.21	98.5	0.07	100.7	0.17	104.1	0.23
14-Jan-19	15:49	100.3	0.25	98.5	0.09	97.9	0.24	100.6	0.48
15-Jan-19	14:17	95.7	0.25	94.0	0.06	87.8	0.18	98.7	0.21
18-Jan-19	12:53	87.8	0.23	90.5	0.06	89.4	0.17	90.2	0.16
21-Jan-19	12:53	96.6	0.27	96.5	0.17	96.1	0.29	90.2	0.34
25-Jan-19	12:52	104.7	0.24	100.1	0.13	99.9	0.21	106.0	0.50
31-Jan-19	09:08	102.2	0.24	100.1	0.12	100.7	0.22	99.7	0.44
01-Feb-19	13:52	107.1	0.16	101.4	0.07	104.0	0.13	114.4	0.23
04-Feb-19	15:41	93.8	0.19	92.4	0.05	91.9	0.17	96.2	0.18
05-Feb-19	12:48	100.8	0.16	92.4	0.05	101.1	0.12	96.9	0.15
07-Feb-19	15:45	97.3	0.17	94.0	0.08	97.4	0.16	109.2	0.24
22-Feb-19	09:11	100.8	0.23	100.7	0.09	107.1	0.23	106.0	0.36
25-Feb-19	12:47	107.7	0.20	102.0	0.10	105.5	0.18	107.8	0.21
26-Feb-19	14:47	107.5	0.24	105.7	0.09	108.5	0.29	116.7	0.42
08-Mar-19	13:02	103.7	0.24	101.4	0.14	104.7	0.25	105.2	0.43
14-Mar-19	12:45	101.3	0.18	96.5	0.07	100.3	0.23	105.2	0.24
19-Mar-19	12:49	101.3	0.21	90.5	0.11	99.4	0.25	108.9	0.37
26-Mar-19	12:51	100.8	0.18	88.0	0.08	100.3	0.22	111.0	0.25
29-Mar-19	10:15	100.3	0.21	88.0	0.08	101.1	0.23	109.6	0.29
03-Apr-19	12:51	97.3	0.16	92.4	0.08	94.7	0.22	103.5	0.22
08-Apr-19	13:01	99.3	0.19	97.6	0.13	94.7	0.19	101.0	0.38
10-Apr-19	12:55	104.4	0.20	103.1	0.22	107.7	0.17	113.3	0.38
10-Apr-19	12:55	104.4	0.20	103.1	0.22	107.7	0.17	113.3	0.38
15-Apr-19	12:44	106.6	0.22	103.1	0.14	105.2	0.25	106.6	0.54
16-Apr-19	13:18	104.0	0.21	102.6	0.10	106.1	0.21	113.5	0.39
18-Apr-19	11:27	94.8	0.19	92.4	0.09	93.9	0.22	102.9	0.24
23-Apr-19	14:17	98.0	0.19	96.5	0.07	97.9	0.21	101.0	0.25

Date	Time	Queen Street (B1)		School (B2)		99 Queen Street (B3)		Nisbet (B4)	
		Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s
26-Apr-19	12:57	105.6	0.21	100.1	0.09	100.3	0.20	104.7	0.36
29-Apr-19	13:51	107.8	0.20	104.9	0.13	106.3	0.18	113.1	0.43
30-Apr-19	13:02	93.8	0.18	95.4	0.18	95.4	0.16	88.6	0.12
02-May-19	13:32	104.0	0.18	101.4	0.09	103.4	0.21	106.2	0.53
03-May-19	11:05	95.7	0.22	99.3	0.33	97.4	0.34	92.7	0.16
06-May-19	13:43	101.3	0.20	98.5	0.10	97.4	0.18	107.3	0.36
13-May-19	12:59	106.6	0.23	102.6	0.11	105.0	0.27	104.4	0.48
14-May-19	12:54	101.3	0.21	98.5	0.12	96.1	0.17	101.4	0.50
24-May-19	12:54	97.3	0.18	95.1	0.11	96.9	0.12	97.6	0.20
11-Jun-19	12:51	105.4	0.28	101.8	0.18	105.0	0.31	105.2	0.65
19-Jun-19	12:48	105.4	0.26	103.6	0.13	105.0	0.31	106.5	0.35
24-Jun-19	13:09	101.1	0.21	100.8	0.14	101.2	0.25	107.1	0.32
25-Jun-19	13:52	95.1	0.14	92.6	0.12	94.1	0.09	99.2	0.12
26-Jun-19	14:01	103.8	0.16	95.8	0.18	97.6	0.11	102.7	0.17
27-Jun-19	12:09	99.8	0.16	98.1	0.15	99.6	0.13	101.7	0.23
02-Jul-19	13:15	98.2	0.19	95.1	0.13	96.9	0.16	103.6	0.24
05-Jul-19	14:54	99.8	0.17	96.5	0.12	100.1	0.17	104.8	0.28
09-Jul-19	13:41	92.2	0.16	91.6	0.11	93.0	0.12	98.4	0.19
10-Jul-19	13:02	99.0	0.16	99.6	0.10	96.9	0.09	99.2	0.15
12-Jul-19	14:26	108.3	0.21	108.5	0.14	96.1	0.21	114.6	0.61
15-Jul-19	13:23	99.8	0.15	91.6	0.10	94.1	0.12	105.2	0.19
16-Jul-19	13:15	98.2	0.20	94.4	0.15	96.9	0.23	97.6	0.66
17-Jul-19	15:10	103.8	0.15	94.4	0.11	100.1	0.09	105.2	0.14
18-Jul-19	13:08	100.5	0.20	99.6	0.13	96.1	0.15	102.7	0.23
19-Jul-19	13:13	98.2	0.16	95.8	0.11	97.6	0.10	99.9	0.19
29-Jul-19	13:16	99.0	0.19	95.1	0.11	99.6	0.17	105.9	0.26
30-Jul-19	13:10	92.2	0.17	87.5	0.11	93.0	0.13	96.7	0.23
02-Aug-19	13:25	110.2	0.22	107.5	0.17	109.9	0.20	107.1	0.38
05-Aug-19	13:15	96.3	0.21	93.5	0.12	95.1	0.21	99.2	0.39

Date	Time	Queen Street (B1)		School (B2)		99 Queen Street (B3)		Nisbet (B4)	
		Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s
12-Aug-19	13:11	99.0	0.20	94.4	0.15	93.0	0.17	94.5	0.25
14-Aug-19	13:16	87.7	0.16	90.4	0.12	88.1	0.09	93.1	0.12
15-Aug-19	14:50	106.2	0.26	97.6	0.15	100.1	0.16	104.8	0.32
16-Aug-19	14:09	111.1	0.18	98.1	0.11	95.1	0.13	106.8	0.26
20-Aug-19	09:37	99.0	0.17	87.5	0.11	90.0	0.16	99.9	0.39
22-Aug-19	15:08	107.5	0.17	97.6	0.18	95.1	0.15	101.1	0.32
27-Aug-19	15:35	97.3	0.19	95.1	0.11	99.0	0.13	105.9	0.22
27-Aug-19	15:49	102.3	0.19	100.8	0.15	101.6	0.19	108.2	0.41
28-Aug-19	16:34	93.8	0.17	97.1	0.11	91.6	0.12	98.4	0.18
29-Aug-19	16:46	101.7	0.14	93.5	0.11	108.3	0.09	108.2	0.12
05-Sep-19	13:16	106.2	0.20	103.6	0.14	108.3	0.14	97.6	0.54
13-Sep-19	13:46	90.2	0.16	89.1	0.13	88.1	0.12	96.7	0.17
16-Sep-19	14:14	109.8	0.18	97.6	0.12	103.3	0.16	105.2	0.16
17-Sep-19	10:11	99.0	0.14	94.4	0.11	98.3	0.11	104.0	0.17
19-Sep-19	13:34	101.7	0.17	101.5	0.12	102.9	0.13	109.2	0.27
20-Sep-19	13:54	96.3	0.21	95.1	0.14	94.1	0.17	99.2	0.34
23-Sep-19	13:21	114.2	0.18	107.3	0.12	102.9	0.12	109.2	0.22
24-Sep-19	13:14	101.7	0.19	99.1	0.13	99.6	0.14	102.2	0.30
25-Sep-19	13:20	104.2	0.17	101.8	0.14	102.1	0.09	109.6	0.16
03-Oct-19	13:41	104.2	0.21	101.8	0.11	102.9	0.16	107.7	0.29
09-Oct-19	09:55	99.0	0.15	96.5	0.10	99.0	0.10	106.2	0.14
15-Oct-19	15:07	99.8	0.18	97.1	0.12	97.6	0.18	96.7	0.31
16-Oct-19	10:40	90.2	0.17	87.5	0.11	90.0	0.11	94.5	0.16
16-Oct-19	13:09	93.8	0.18	91.6	0.11	95.1	0.13	98.4	0.21
23-Oct-19	15:23	90.2	0.17	97.1	0.15	88.1	0.12	95.6	0.19
24-Oct-19	13:34	96.3	0.17	89.1	0.13	90.0	0.09	87.1	0.13
04-Nov-19	15:24	101.1	0.16	93.5	0.13	97.6	0.10	104.4	0.13
05-Nov-19	13:15	97.3	0.14	90.4	0.11	97.6	0.09	99.9	0.13
11-Nov-19	09:43	102.3	0.17	100.4	0.11	102.1	0.15	104.0	0.21

Date	Time	Queen Street (B1)		School (B2)		99 Queen Street (B3)		Nisbet (B4)	
		Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s	Overpressure dB(L)	Ground Vibration mm/s
13-Nov-19	13:34	99.8	0.17	95.8	0.12	94.1	0.13	104.0	0.21
15-Nov-19	13:24	101.7	0.27	106.8	0.13	102.9	0.18	109.4	0.28
19-Nov-19	14:21	98.2	0.17	91.6	0.14	90.0	0.12	103.2	0.16
20-Nov-19	13:44	103.3	0.26	93.5	0.45	95.1	0.21	101.7	0.55
25-Nov-19	13:17	99.8	0.17	89.1	0.11	93.0	0.10	104.4	0.15
26-Nov-19	10:52	116.3	0.16	108.5	0.17	110.7	0.13	116.4	0.13
03-Dec-19	16:02	110.9	0.25	99.6	0.12	101.2	0.17	112.2	0.28
04-Dec-19	13:16	107.7	0.15	108.3	0.12	105.0	0.10	106.5	0.14
05-Dec-19	13:17	100.5	0.17	100.0	0.11	106.2	0.11	105.2	0.14
06-Dec-19	13:11	103.3	0.23	100.4	0.14	101.6	0.20	118.6	0.32
09-Dec-19	14:21	100.5	0.23	98.6	0.12	98.3	0.13	101.1	0.22
10-Dec-19	13:23	92.2	0.22	89.1	0.13	90.0	0.13	98.4	0.21
17-Dec-19	13:16	104.2	0.22	91.6	0.12	99.0	0.12	99.2	0.18
23-Dec-19	13:21	101.7	0.15	85.6	0.11	101.6	0.09	99.2	0.17

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Appendix 4: Complaints Summary

SUMMARY OF COMPLAINTS

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
14-Jan-19	8:46 PM	14-Jan-19	8:45 PM	McCully's Gap	LIGHT	Environmental Hotline - OCE responded.	Light pointing at property	The OCE adjusted the lighting plant on the maintenance service pad and contacted the complainant. The complainant was comfortable that the light was no longer facing their property.
17-Feb-19	6:41 AM	17-Feb-19	6:41 AM	McCully's Gap	NOISE	Direct call to OCE phone and Environmental hotline	Excessive dozer noise	OCE conducted a review of the operations and all activities were being undertaken in accordance with the Noise Management Plan, Development Consent conditions and Environmental Protection Licence.
05-Mar-19	9:39 AM	03-Mar-19	8:00 AM	McCully's Gap	ODOUR	Email from EPA	Burning coal air pollution from mine possibly Muswellbrook Coal	Mining operations were in progress. Spontaneous combustion management activities were occurring on site in accordance with the Spontaneous Combustion Management Plan. Elevated SO_2 levels were seen on the gas monitors. Upwind monitor at Muscle Creek had higher readings then the downwind monitor at Nisbet. The Environmental Superintendent provided a response to the EPA.
11-Mar-19	4:03 PM	10-Mar-19	7:30 PM	Woodlands Ridge	ODOUR	Email from EPA	Annoying sulphur smell	Spontaneous combustion management activities were occurring on site in accordance with the Spontaneous Combustion Management Plan. At the time of the complaint gas monitoring at Muscle Creek H_2S readings <= 3.2ppb and SO_2 reading <10ppb. The Environmental Superintendent provide a response to the EPA.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
27-Mar-19	9:20 PM	27-Mar-19	8:20 PM	Scone	ODOUR	Direct call to OCE's phone - OCE responded	Had to close house up due to spon com odour	Mining operations were in progress with infusion sprays running. The OCE discussed the spontaneous combustion management with the complainant. At the time of the complaint gas monitoring readings at Nisbet <2ppb for both SO_2 and H_2S.
30-Mar-19	11:00 AM	31-Mar-19	11:00 AM	Muswellbrook	ODOUR	Environmental Hotline - OCE responded	Can smell spontaneous combustion strongly and see smoke	No operational activities at the time of the complaint due to recent heavy rainfall. Spontaneous combustion control measures on site were in accordance with the Spontaneous Combustion Management Plan. The OCE discussed the spontaneous combustion management with the complainant.
07-Apr-19	6:49 AM	07-Apr-19	6:49 AM	Woodlands Ridge	ODOUR	Environmental Hotline - OCE responded	Very bad odour	Mining operations were in progress with infusion sprays running. Odour observation at Topknot Place at approximately 7:30am detected a very weak odour. Gas monitoring sites 13 and 16 (Muscle Creek) 30-minute H_2S readings <2.5ppb and 1 hour SO_2 readings <1.0ppb. Complainant contacted the EPA as well and the Environmental Superintendent provided a response to the EPA. Attempts to contact the complainant have been unsuccessful.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
24-Apr-19	8:37 AM	24-Apr-19	8:37 AM	Woodlands Ridge	ODOUR	Environmental Hotline - OCE responded	Strong Sulphur Smell	Mining operations were in progress. Spontaneous combustion management activities were occurring on site in accordance with the Spontaneous Combustion Management Plan. Odour observations at Topknot Place at approximately 8:00am and 8:50am detected no odour. At the time of the complaint gas monitor readings at Muscle Creek were <2ppb for both SO_2 and H_2S. Attempts to contact the complainant have been unsuccessful.
02-May-19	10:45 AM	01-May-19	2:20 PM	Woodlands Ridge	ODOUR	Email from EPA	Sulphurous, acrid odour and can see visible smoke plume	Mining operations were in progress. Spontaneous combustion management activities were occurring on site in accordance with the Spontaneous Combustion Management Plan. At the time of the complaint 30-minute H_2S readings were 1.3 to 1.6 ppb while 30 minute SO_2 readings were 1.8 to 2.2 ppb. The Environmental Superintendent provide a response to the EPA.
03-May-19	9:58 AM	03-May-19	9:58 AM	Woodlands Ridge	DUST	Environmental Hotline - OCE responded	Dust visible	Mining operations had commenced. Hot material was being uncovered in Strip 21 Goaf. The Mine Manager and Environmental Superintendent inspected the area where the complaint originated and dust from MCC was visible. The OCE stopped operations in Strip 21 Goaf and operations were changed to manage the dust. The Environmental Superintendent spoke to the complainant and thanked them for their feedback. The complainant had also contacted the EPA and a response was provided to the EPA.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
20-May-19	1:25 PM	20-May-19	1:24 PM	Woodlands Ridge	ODOUR	Direct message to General Manager's phone - General Manager responded	Air quality at house today is putrid with smell of sulphur	Mining operations were occurring in Strip 21 goaf. Hot material was being cooled by water carts. Odour observation at Topknot Place at 2:37pm detected no odour. At the time of the complaint 30-minute gas reading for H_2S was 1.3ppb and SO_2 was 1.1ppb from the Muscle Creek monitoring site. The General Manager attempted to contact the complainant but did not receive a response.
22-May-19	8:42 PM	22-May-19	8:42 PM	McCully's Gap	ODOUR	Environmental Hotline - OCE responded	Odour complaint	Spontaneous combustion was being manage as per our Spontaneous Combustion Management Plan. The Nisbet monitoring station returned 30-minute H_2S and hourly SO_2 gas reading of 0.7 ppb and 0.4 ppb respectively. The OCE contacted the complainant and discussed the complainant's concerns with them.
22-May-19	8:53 PM	22-May-19	8:53 PM	McCully's Gap	NOISE	Environmental Hotline - OCE responded	Can hear digger loading trucks	Mining operations had moved into a new area. The OCE reviewed operations and made adjustments to mitigate any noise impacts. The OCE contacted the complainant and discussed the complainant's concerns with them. Actions were put in place to reduce noise impacts on subsequent night shifts.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
22-May-19	9:00 PM	22-May-19	9:00 PM	McCully's Gap	NOISE	Environmental Hotline - OCE responded	Noise and Smell	Mining operations had moved into a new area. The OCE reviewed operations and made adjustments to mitigate any noise impacts. Actions were put in place to reduce noise impacts on subsequent night shifts. Spontaneous combustion was being managed as per our Spontaneous Combustion Management Plan. The Nisbet monitoring station returned 30-minute H_2S and hourly SO_2 gas reading of 0.7 ppb and 0.4 ppb respectively. The OCE contacted the complainant and discussed the complainant's concerns with them.
11-Jun-19	10:30 AM	11-Jun-19	10:30 AM	South Muswellbrook	VISUAL	Environmental Hotline - OCE responded	Visible Smoke	Mining and spontaneous combustion management activities were underway. The OCE contacted the complainant and explained the current situation with spontaneous combustion and the processes used to mitigate its effects. The complainant confirmed that they noticed the smoke while they were driving along the New England Highway towards Muswellbrook. The smoke was not visible from the complainant's residence.
12-Jun-19	10:40 PM	12-Jun-19	10:40 PM	Muswellbrook	NOISE	Environmental Hotline - OCE responded	Noise from Muswellbrook Coal Extreme	The OCE reviewed operations and made adjustments to mitigate any noise impacts. The OCE contacted the complainant and discussed the complainant's concerns with them. The Environmental Superintendent spoke with the complainant the next day who confirmed that the noise had cleared after approximately 15 minutes.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
14-Jun-19	9:35 AM	14-Jun-19	9:35 AM	Muscle Creek	VISUAL	Environmental Hotline - Production Superintendent responded.	Excessive Stream/Smoke coming from that hole up there	Mining operations were occurring. Hot material was been cooled by water sprays. The Production Superintendent contacted the complainant and explained the current situation with spontaneous combustion and the processes used to mitigate its effect. The complainant also contacted the EPA and the Environmental Superintendent provided a response to the EPA.
14-Jun-19	9:42 AM	14-Jun-19	9:42 AM	Muscle Creek	ODOUR	Environmental Hotline - Production Superintendent responded.	Smell of sulphur being high	Mining operations were occurring. Hot material was been cooled by water sprays. The Production Superintendent contacted the complainant and explained the current situation with spontaneous combustion and discussed the complainant's concerns with them. At the time of the complaint the 30-minute H_2S and 1 hour SO_2 results at Muscle Creek were between 0.2 to 0.5 ppb and 0.1 to 0.3 ppb respectively. The complainant also contacted the EPA and the Environmental Superintendent provided a response to the EPA.
23-Jun-19	5:15 AM	23-Jun-19	5:15 AM	McCully's Gap	NOISE	Environmental Hotline - OCE responded	Noise emissions from the mine	Mining operations were being carried out in accordance with Noise Management Plan. The OCE contacted the complainant and discussed the complainant's concerns with them. The Environmental Superintendent attempted to contact the complainant but was unsuccessful.
08-Aug-19	3:35 PM	07-Aug-19	4:15 PM	Woodlands Ridge	ODOUR	Email from the EPA	Strong odours and dust pollution	Mining operations were occurring in Strip 21 and Strip 22. Hot material was being cooled by water carts. The Environmental Superintendent provided a response to the EPA.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
09-Sep-19	8:32 AM	05-Sep-19	9:22 AM	Woodlands Ridge	ODOUR	Email from the EPA	Burning coal creating a lot of smoke. Sulphur odour in the air.	Mining operations were occurring in Strip 21 and Strip 22. Hot material was being cooled by sprays and water carts. A response was provided to the EPA by the Environmental Superintendent.
11-Sep-19	10:23 AM	11-Sep-19	7:19 AM	Woodlands Ridge	ODOUR	Email from the EPA	Very strong odour coming from Muswellbrook Coal.	Mining and spontaneous combustion management activities were underway. Odour observation at Topknot Place at 7:21am detected no odour. The Environmental Superintendent provided a response to the EPA.
23-Sep-19	8:03 AM	23-Sep-19	8:03 AM	Muscle Creek	OTHER	Direct call to MCC office - Mine Manager Responded	Hazard with a low loader truck taking up all the bridge	The Mine Manager investigated the incident and obtained statements for the float driver and a witness. The Mine Manager contacted the complaint and float owner and relayed the results of the investigation. Actions were put in place to prevent a reoccurrence.
19-Oct-19	9:50 AM	19-Oct-19	9:50 AM	Muswellbrook	VISUAL	Direct call to MCC office - OCE responded	Report of emissions above MCC site	OCE inspected mining operation and noted smoke haze above site. OCE suspended processing coal and loading coal from pit. Water cart cooling spontaneous combustion in Strip 21. OCE reviewed re-starting operations and monitored conditions. Emissions from spontaneous combustion were what was seen. OCE discussed the complaint with the complainant.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
22-Oct-19	2:42 PM	19-Oct-19	7:30 AM	Woodlands Ridge	ODOUR	Email from the EPA	Very strong odour coming from Muswellbrook Coal.	A response was provided to the EPA on 29 October 2019. Data supplied to the EPA as requested. Upwind monitors had higher gas levels than the downwind monitors. Gas levels at the time of the complaint were: 30-minute average H_2S readings - upwind monitor = 0.995 ppb, downwind monitor = 0.097 ppb 1-hour average SO_2 readings - upwind monitor = 1.2 ppb, downwind monitor = <0.1 ppb"
24-Oct-19	6:00 AM	24-Oct-19	6:00 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded	Sulphur odour	OCE contacted the complaint. OCE review the operations and drove around site. No odour was detected.
25-Oct-19	3:18 PM	25-Oct-19	8:30 AM	Woodlands Ridge	ODOUR	Email from the EPA	Large amount of dust and sulphur produced from Coal Mine.	A response was provided to the EPA on 30 October 2019. Requested data was also supplied to the EPA. At the time of the complaint gas monitor readings were higher at the upwind monitor for the 30-minute average H_2S - upwind monitor 1.594ppb downwind monitor 0.984. 1 hourly SO_2 readings at both up and down wind monitors were equal at 1.8ppb
02-Nov-19	1:35 PM	02-Nov-19	1:35 PM	Muswellbrook	VISUAL	Direct call to MCC office - OCE responded	Dust cloud heading towards Queen Street.	OCE inspected the mining operations and phoned the complainant back and let them know the dust was not coming from Muswellbrook Coal, we did not have dozers bulk shaping and we had not let a shot off. Complainant was happy we had looked into the issue and that it was not Muswellbrook Coal, he was also happy with our approach to this issue. Emissions from the spontaneous combustion were visible.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
12-Nov-19	11:43 AM	12-Nov-19	8:17 AM	Woodlands Ridge	VISUAL	Email from the EPA	Heavy dust smelling of sulphur blowing across Muscle Creek	Mining operations were occurring in Strip 22. Hot material was being cooled by water carts. A response was not required by the EPA. Emissions from the spontaneous combustion were visible.
19-Nov-19	1:47 PM	15-Nov-19	8:18 AM	Woodlands Ridge	ODOUR	Email from the EPA	Dust and sulphur since 7:00am	Mining operations were underway. Water carts were assisting with the management of spontaneous combustion. Muscle Creek gas monitor recorded <1ppb of H_2S and SO_2. The EPA did not require any information in relation to this complaint.
19-Nov-19	1:47 PM	15-Nov-19	11:45 AM	Unknown	VISUAL	Email from the EPA	Noticed dust (actually spon com emissions) when driving past.	Mining operations were occurring with water carts assisting with spontaneous combustion management. The EPA did not require a response to this complaint. Emissions from the spontaneous combustion were visible.
22-Nov-19	7:30 PM	22-Nov-19	7:00 PM	Scone	ODOUR	Direct call to MCC office - OCE responded	Had to close windows, issue with odour.	Spontaneous combustion management activities were occurring on site in accordance with the Spontaneous Combustion Management Plan. OCE discussed the complainant's concerns with them.