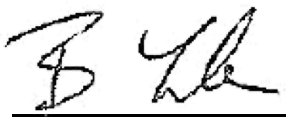
ESTABLISHED 1907

MUSWELLBROOK COAL COMPANY

2021
ANNUAL ENVIRONMENTAL MANAGEMENT REPORT

This page has been left blank intentionally.

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 2021** **31 December 2021**
Reporting Officer:	**Brooke York**
Title:	**Environmental Superintendent**
Signature:	
Date:	31/03/2022

This page has been left blank intentionally.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

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 2016 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 2021 to 31 December 2021 (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 (DPIE) – Resources Regulator (RR);
- DPIE – Office of Environment, Energy and Science (formerly OEH);
- DPIE – Water;
- Environment Protection Authority (EPA);
- 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

There were no 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	(02) 6542 2300
Rod Gallagher	Production Manager Mine Manager	(02) 6542 2300
Leon Claassens	Technical Services Manager	(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 five reporting periods.

Table 3: Employee Levels

Year	Employees	Full-Time Equivalent Contractors
2021	55	71
2020	62	82
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 INDEPENDENT ENVIRONMENTAL AUDIT

Condition 41 of the DA requires MCC to coordinate an Independent Environmental Audit (IEA) of the mining and infrastructure areas of the development every three years. This audit was conducted in November 2021. The audit found:

> *This audit has concluded that the on the ground environmental management practices being applied at the MCM (Muswellbrook Coal Mine) are appropriate. The open cut pit areas assessed during the field inspection were observed to be well managed, with equipment operators and supervisory personnel demonstrating a good understanding of management actions required to minimise amenity impacts from mining activities.*
> *A review of incidents that occurred at MCM since the previous audit indicated that they were classified as low risk and were related to equipment error and malfunction resulting in missed data capture, with all being documented and reported to regulatory agencies as required.*
> *A number of community complaints were received during the audit period, relating to odour, dust, blasting and noise. The number of community complaints in 2021 is lower than previous years indicating that the environmental management of the key risks at the site has improved during this audit period.*

A summary of non-compliances against the DA, EPL and Water Licences along with MCC's comments are shown in **Table 4**, **Table 5** and **Table 6** respectively.

Table 4: Non-Compliances with Development Consent DA 205/2002

Condition	Non-Compliance	Risk Level	MCC Comment
2	Non-compliances against some of the conditions in this Development Consent have been identified during the audit period. None of the non-compliances identified by this audit are considered to have resulted in material harm to the environment.	**Low**	This is an overarching condition and a non-compliance with any consent condition will also result in a non-compliance with this condition. No further action is required.
13(b)	There is no evidence of notification of appointment being sent through to MSB, OEH, DPI-Water and the CCC of Brooke York's temporary appointment to Environmental Officer.	**Administrative**	Julie Thomas held the appointment of Environmental Officer while on leave and she has returned to work. No further action is required.
14(c)	The revised Environmental Management Strategy was not sent to MSB following the revision of the plan.	**Administrative**	This was an oversight on behalf of MCC. A copy of the Environmental Management Strategy will be provided to MSB (now Subsidence Advisory)

Condition	Non-Compliance	Risk Level	MCC Comment
17	The Rehabilitation Plan is not consistent with the Rehabilitation Strategy (and as noted in Condition 18 the Rehabilitation Strategy has not been approved).	**Low**	MCC has been liaising with MSC regarding approval of the Rehabilitation Strategy since April 2017. MCC are seeking a modification to the consent, which may affect the requirements of the Rehabilitation Strategy.
18	The Rehabilitation Strategy has not been approved by MSC and as such it is not able to be verified if the draft strategy as developed is to the satisfaction of MSC.	**Low**	MCC has been liaising with MSC regarding approval of the Rehabilitation Strategy since April 2017. MCC are seeking a modification to the consent, which may affect the requirements of the Rehabilitation Strategy.
19	The Mine Closure Plan has not been approved by MSC and as such it is not able to be verified if the draft mine closure plan as developed is to the satisfaction of MSC. This is considered a medium risk as planned mine closure is in less than 12 months.	**Medium**	MCC has been liaising with MSC on the Mine Closure Plan since October 2017 and will continue to do so until this matter is resolved.
20	A positive caveat was registered outside the nominated timeframe as required by this condition. The vegetation offset area has also not been appropriately fenced as required in this condition and the conditions outlined in the Plan of Positive Covenant and Restriction on use of land within lot 62 DP752484.	**Low**	The delay to the registration of the positive caveat was to allow MCC and MSC to investigate an alternate final land use in the area. The requirement to fence the area is to restrict livestock grazing in the Offset Area. Fencing and natural terrain in the area restrict livestock access to the area. While this is not on the exact boundary of the Offset Area, the intent of the conditions has been met. Steep terrain prevents the complete fencing of the area. This terrain is too steep for livestock to negotiate. No further action is required.

Condition	Non-Compliance	Risk Level	MCC Comment
25	The current version of the Water Management Plan (V6) has not been approved and is overdue for further review	**Low**	MCC were of the understanding that V6 of the WMP had been approved, however, it hasn't been approved. MCC are currently updating the WMP, and it will be submitted to MSC for approval.
42	MCC have not submitted the 2018 AEMR, 2019 AEMR and 2020 AEMR to all the relevant agencies and CCC as required by this condition.	**Administrative**	The 2018, 2019 and 2020 AEMR's have been submitted as required, however, the evidence demonstrating this was not provided to the auditor during the audit. No further action is required.

Table 5: Non-compliances with EPL 656

Condition	Non-Compliance	Risk Level	Context
M2.2	2018-2019. Missing data from air quality monitoring Points 7,8, 9, 10, 13, 15, 16. periodically throughout the reporting period due to equipment calibration or equipment malfunction. Broken equipment has since been replaced while a contractor is engaged to maintain equipment. A licence variation has been submitted to vary the type of equipment being used at Point 13 and to improve the data capture rates 2019-2020 Missing data from monitoring points 7,8,9, 10, 13, 15, 16 periodically throughout the reporting period due to equipment calibration or equipment malfunction. Broken equipment has since been replaced while a contractor is engaged to maintain equipment.	**Low**	This has been reported to the EPA in the Annual Return. No further action is required.

Condition	Non-Compliance	Risk Level	Context
M4.1	2018-2019 Data recovery for the monitoring period was 99.9% for the weather station. The wind sensor stopped working during September 2019 resulting in minimal wind data for September. The wind sensor was replaced 2019-2020 Data recovery for the monitoring period was 97.2% for the weather station. The batteries stopped holding their charge during May resulting in minimal weather data for May. The batteries were replaced.	**Low**	This has been reported to the EPA in the Annual Return. No further action is required.
M7.1	2019-2020 The four blast monitors were operational throughout the reporting period, with 99.5% of data captured during the reporting period. Results were not collected at 99 Queen St on the 24th of February 2020 and at Queen St on 25th September 2020 due to the trigger monitor causing a reset of the blast monitor at the time of the blast and an automated retrieve all data process occurring at the time of the blast.	**Low**	This has been reported to the EPA in the Annual Return. No further action is required.

Table 6: Non-compliances with Water Licences

Condition	Non-Compliance	Risk Level	Context
WAL 41521			The data required to be collected is recorded in an electronic format, however, it does not include all the information required in the licence. As the water make is due to natural groundwater inflow there is no pump associated with this licence, so the pumping capacity isn't recorded. MCC will liaise with Water NSW about the missing information and identify a way to resolve the issue.
MW2338-00001 MW0606-00001 MW2337-00001 MW2339-00001	A logbook is currently not maintained for WAL 41521(Open Cut Voids).	**Low**	

1.6.2 REPORTABLE INCIDENTS

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

1.6.3 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 2021. MCC were compliant with the conditions of consent and statutory approvals during the reporting period, except for the following:

- Non-compliances against the DA noted in the findings of the IEA outlined in **Table 4.**
- 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 >98% and has been reported to the EPA. No correspondence has been received from the EPA regarding this loss of data.
- Loss of monitoring data from a blast monitor on two occasions during the reporting period. This is discussed further is **Section 3.11.2**.
- A non-compliance against Water Access Licence (WAL) 41521 outlined in **Table 6.**

All non-compliances are detailed in the IEA report which has been sent to the regulatory authorities and the CCC in accordance with condition 41 of the DA. Loss of data has been reported to the EPA in the Annual Return in accordance with the EPL. The IEA report is also available on the MCC website.

1.6.4 SITE INSPECTIONS

The Resources Regulator (RR) and Muswellbrook Shire Council (MSC) conducted a joint inspection at MCC on 21 April 2021. The inspection focused on erosion issues that were identified by MSC. Observations recorded by RR included:

- Erosion and rehabilitation failure within the Void 3 area.
- Erosion outside the Void 3 in the direction of the former brickworks area.
- Gully erosion into undisturbed remnant vegetation area adjacent to Open Cut No 1 requiring remediation works.

Recommendations from RR were:

1. Void 3 – Remediation of erosion and rehabilitation failure areas to be incorporated into planned remediation works.

2. Area of erosion outside of Void 3 – Actively monitor this area and incorporate event triggers into the monitoring – e.g. following intense or prolonged rainfall events.
3. Gully erosion into undisturbed remnant vegetation adjacent to Open Cut No 1 – the mine is to undertake an assessment of this area to determine the appropriate remediation options for the site. Additionally, it is the expectation of the Regulator that the mine develops an action plan and a timeframe of works to address the likelihood of further erosion occurring and impacting the remnant vegetation area.
4. The mine should ensure that control measures are evaluated and validated via monitoring and inspections.

A response was required by 28 May 2021. MCC provided a response on 18 May 2021 outlining the actions to be undertaken in response to the recommendations. The actions were:

- Response to Recommendation 1 – Remediation of erosion noted in the contour bank structure has been added to the works program for 2021. This work will include minor earthworks and will be scheduled in conjunction with other minor earthworks planned for the area to maximise efficiency. Investigation and remediation of the areas where vegetation has failed to establish has been added to the works program for 2021. The work will include soil testing, amelioration based on the results of analysis and reseeding. The work may also include minor earthworks which, if required, will be scheduled to coincide with the contour bank maintenance work.
- Response to Recommendation 2 – The area is monitored on an annual basis as part of the rehabilitation monitoring program. The 2020 report noted that *"the gully is well vegetated and partially stabilised and does not appear to have increased in size since first observing in 2017. No action required other than to monitor to determine whether conditions worsen."* Given the severe drought of 2017 to 2019 and the above average rainfall in 2020 and Q1 2021, it is noted that this gully has not significantly changed over the past four years of monitoring, despite extreme conditions. The inspection on 21 April with MSC confirmed that the gully contains vegetation, including seedlings, and appears stable. MCC believes this area is well established and adequately monitored. Ongoing monitoring will continue on an annual basis. Additionally, MCC will monitor the gully after (within 1 week of) the next significant rainfall event (i.e.>20mm in 24 hours) to determine if there is evidence of further instability. MCC will record the results of the inspection.
- Response to Recommendation 3 – Earthworks have been completed at the head of the gully to prevent future erosion by improving the windrow width and redirecting water onto Open Cut 1 (**Figure 1** below). The area where water was pooling at the side of the mine access road has been built up to prevent pooling and facilitate drainage towards the pit. This work will be inspected after the next significant rainfall event to confirm that water is no longer pooling against the windrow at the head of the gully.

Figure 1: Photos showing improved drainage

As noted during the inspection 21 April 2021, remediation works to retrieve the sediment deposited in the drainage line of the non-disturbance area would be likely to cause more damage. The focus will therefore be on preventing reoccurrence. The sediment deposited in the gully is showing signs of stability, with much of the drainage line exhibiting groundcover vegetation except for a short section above the dam at the bottom of the drainage line. MCC will desilt the dam at the bottom of the drainage line in the non-disturbance area to provide capacity for future rainfall runoff flows.

- Response to Recommendation 4 - Areas noted during the inspection 21 April 2021 will be included in the rehabilitation monitoring and inspection program. All works described will be completed prior to the end of 2021.

All works described were undertaken during the 2021 reporting period.

2.0 ACTIVITIES DURING THE REPORTING PERIOD

2.1 EXPLORATION

Previous exploration has provided a good understanding of the resources in the area. For this reason, no additional drilling or other exploration activities were done during the reporting period.

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.

No further disturbance for mining was undertaken during the reporting period.

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. Topsoil stockpiles were sampled by an agronomist during the reporting period and analysed to determine suitability for use in rehabilitation. The stockpiled topsoil was found to have suitable chemical properties for use. The volume of topsoil remaining is very limited.

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 2**.

The Open Cut 1 mining schedule will continue within the Northern 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 23. This area will be lowered to the Lower Lewis and Loder floor to remove all underground workings.

Mining extended into Strip 24 and Strip 25 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 is dumped in Open Cut 1 and Open Cut 2.

Open Cut 1 continues 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 7**.

Table 7: 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	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

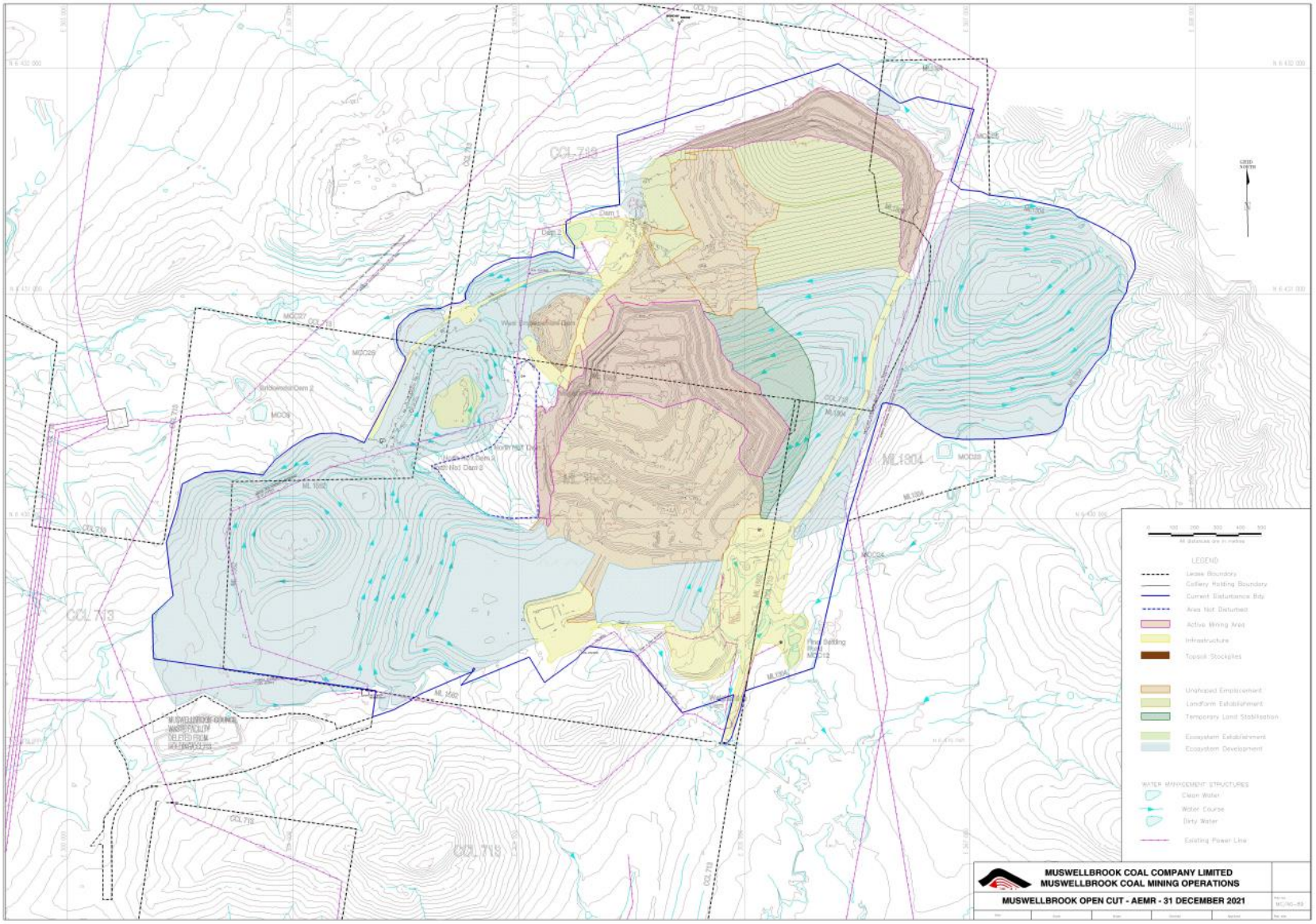


Figure 2: Mining Activities This Reporting Period

2.5 MINERAL PROCESSING

MCC produces thermal coal for the export market. 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 8 shows the amount of waste that was removed from site during the reporting period. There has been an increase in the total waste removed from site during this reporting period due to an increased focus on cleaning up storage and infrastructure areas, however, MCC has maintained a high percentage of waste recycled during the period.

Table 8: Waste Stream Generation

Month	Total Waste Removed (tonnes)	Total Waste to Landfill (tonnes)	Percentage Reused/ Recycled
January 2021	103.95	2.94	97.17
February 2021	96.47	2.45	97.46
March 2021	125.95	7.98	93.66
April 2021	99.51	3.43	96.56
May 2021	116.50	3.24	97.22
June 2021	96.95	2.64	97.28
July 2021	119.88	10.48	91.26
August 2021	126.66	2.37	98.13
September 2021	99.87	6.64	93.35
October 2021	114.57	4.39	96.17
November 2021	102.86	5.36	94.79
December 2021	104.94	16.85	83.94
Total	**1,291.45**	**68.76**	**94.75**

Figure 3 shows the monthly total waste to landfill in tonnes between 2016 and 2021.

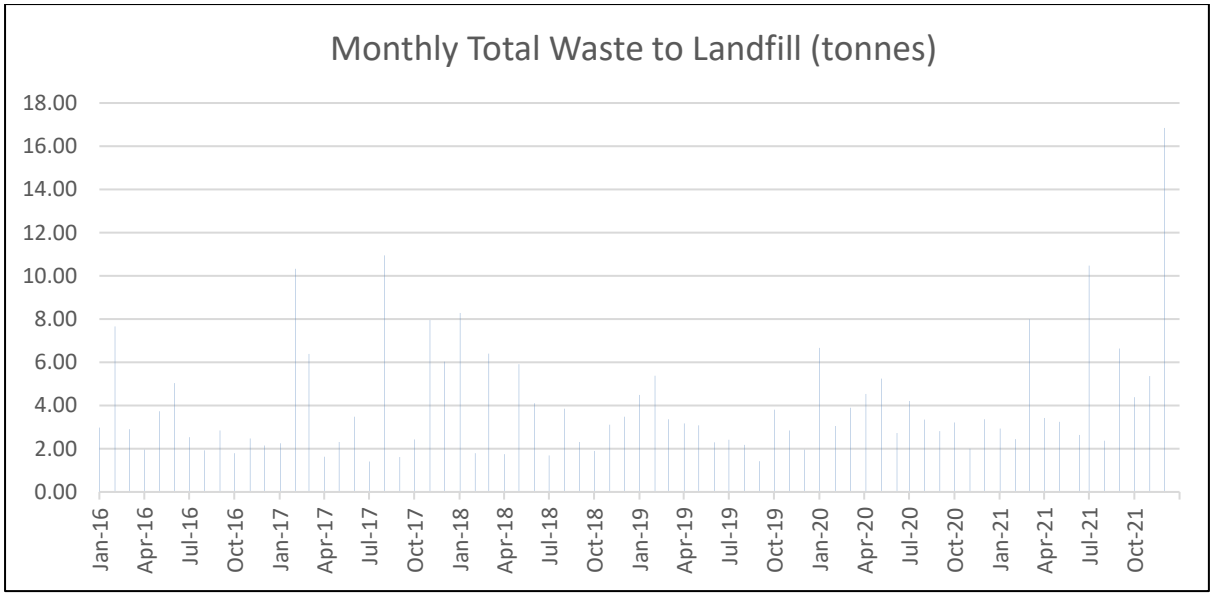


Figure 3: Monthly Total Waste to Landfill (tonnes) 2016-2021

Figure 4 shows the percentage of total waste recycled from 2016 to 2021. This percentage dropped during the reporting period due to increased general waste from site clean ups but remains high at over 94% of the total waste produced.

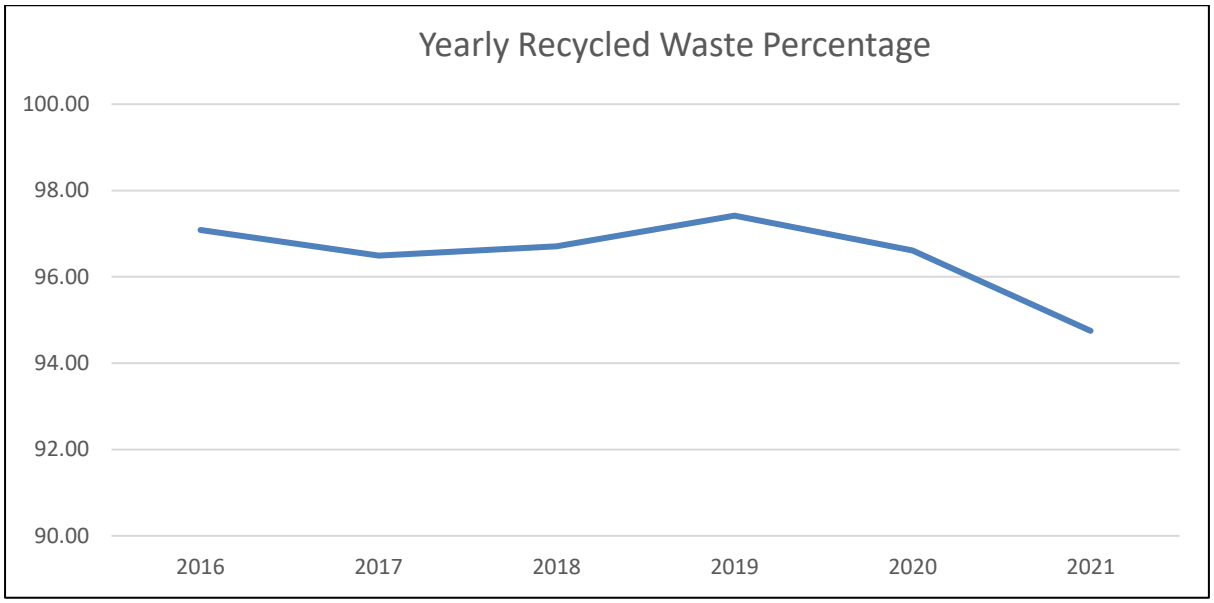


Figure 4: Waste Percentage Recycled 2016-2021

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 100,000 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 9**.

Table 9: Production and Waste Summary

	Limit	PRODUCTION		
		At End of This Reporting Period	At End of Last Reporting Period	Estimate, End of Next Reporting Period
Topsoil Stripped (m^3)	N/A	0	0	0
Topsoil used/spread (m^3)	N/A	0	0	0
Topsoil stockpiled (m^3)	N/A	3,450	3,450	3,450
Waste Rock (BCM)	N/A	6,883,344	9,547,446	1,445,038
Open Cut ROM Coal (t)	N/A	1,302,040	1,148,962	960,922
Underground ROM Coal (t)	N/A	0	0	0
Total Coal (t)	N/A	1,302,040	1,148,962	960,922
Processing Waste (t)	N/A	211,815	171,634	202,182
Open Cut Product Coal (t)	2,000,000	1,090,225	985,008	758,740
Underground Product Coal (t)	N/A	0	0	0
Total Product Coal (t)	2,000,000	1,090,225	958,008	758,740

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

Following an inspection in November 2020, MCC was issued an Improvement Notice (NTCE0007018) under section 191 of the *Work Health and Safety Act 2011* on 20 January 2021. MCC provided a response on 26 February 2021. The Improvement Notice included a direction to replace the licence to supply and store explosives with a licence to store explosives/explosives precursors. As a result, a new

licence to store was issued 26 April 2021 with updated types and quantities. The new licence number is XSTR200115 and the expiry date is 20 April 2026.

Storage still 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. Blasting contractors are employed to carry out total loading service on site.

All dangerous goods on the premises are listed under MCC's Notification of Hazardous Chemicals which was last updated 4 August 2021 (HazNot0001071).

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.

A review of the Water Management Plan was due during the 2021 period but has been delayed pending further data. MCC has flown a LiDAR capture of the site to facilitate a review of the wider catchments within the DA boundary and will need to consult with DPIE Water on the review of the plan before it is submitted to MSC for approval. The review is expected to be completed within the 2022 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 reuse dirty and contaminated mine water for dust suppression and wash down activities;
- Allow clean water to flow through the catchment and use 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 10**.

Table 10: Stored Water

VOLUMES (m^3)	START REPORTING PERIOD	END REPORTING PERIOD	STORAGE CAPACITY
DIRTY WATER			
Brickworks Dam 1	600	4,300	30,000
Brickworks Dam 2	400	2,300	20,000
Dam 3	6,800	18,900	19,740
SALINE OR MINE WATER			
Dam1	19,700	27,500	30,000
Dam 2	15,900	15,800	20,000
No.2 O/C Void	5,240	4,955	1,200,000
Final Settling Pond	5,500	7,300	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 11**. No new bores were constructed during the reporting period. No changes were made to groundwater extraction entitlements during the reporting period.

In December 2020, MCC applied for a variation to the works approval 20WA218978 which relates to WAL41521. This licence allows MCC to extract groundwater intercepted by the open cut voids. The variation was approved by NRAR 7 April 2021 and allows MCC to install two new bores in the western area of the operation. The purpose of the bores was to provide improved access to the water allocation which MCC is entitled to access under the Water Access Licence. The bores were expected to be required to provide water security for the remaining operations in the event of prolonged drought. The rainfall received during the past two reporting periods has made the installation of these bores unnecessary at this time. The bores must be constructed within three years of the date the approval was granted for the works approval to remain valid for those bores.

Table 11: Groundwater Extraction

Licence No.	Source	Water Sharing Plan	Reporting Period Extraction Volume (ML)	Extraction Entitlement (ML per Annum Limit)
WAL39806 (small borehole)	Sydney Basin-North Coast Groundwater Source	North Coast Fractured and Porous Rock Groundwater Sources 2016	185.1	1,000
WAL41503 (large borehole)	Sydney Basin-North Coast Groundwater Source	North Coast Fractured and Porous Rock Groundwater Sources 2016	165.5	2,200
WAL41521 (open cut voids)	Sydney Basin-North Coast Groundwater Source	North Coast Fractured and Porous Rock Groundwater Sources 2016	100.0	1,400

2.10.3 WATER BALANCE

The calculated water balance for the reporting period is provided in **Table 12**. The water balance indicates a water surplus for the year. Extra water has been stored in on-site water storages.

The water balance model was last updated in 2015 as part of the most recent DA modification. Each year inputs and outputs are measured or estimated based on the water balance developed for the site.

There are no predictions from the 2016 SEE to compare the water balance data to, however the SEE notes that the site generally operated in water deficit up until the 2014 water balance. The water balance is now generally in surplus due to lower volumes of water being used for dust suppression and spontaneous combustion management. This is consistent with the smaller operational mining area.

Table 12: Site Water Balance

INPUTS	**ML/year**
Ground Water Seepage	100.0
Surface Water Runoff and Dam Capture	244.73
Entrainment in Coal	97.65
Potable Water	5.11
Underground Workings – Dewatering Bores	350.6
TOTAL	**798.09**
OUTPUTS	**ML/year**
Entrainment in Coal	93.94
Discharge Off Site	0.0
Spontaneous Combustion Management – water infusion and sprays	297.99
Dust Suppression – water carts	167.57
Evaporation from Dams	113.3
Septic Pump Out	1.0
TOTAL	**673.85**
2021 Balance	**124.24**

2.11 OTHER INFRASTRUCTURE MANAGEMENT

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

The maintenance of Muscle Creek Road requires MCC to apply for a Section 138 approval from MSC which is accompanied by a Routine Maintenance Annual Plan (RMAP). The current Section 138 approval is valid until 30 June 2022. This approval references the 2020 RMAP and MCC Specific M3 2020 which were approved by MSC in 2021.

A separate Section 138 approval was granted by MSC for minor pavement maintenance work conducted over 2 days in March 2021.

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 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 99.8%. The losses of data occurred during equipment calibration and minor malfunctions.

3.2.1 WIND SPEED AND DIRECTION

Quarterly wind roses are provided in **Figure 5**. These results are generally consistent with the predominant wind patterns in the Hunter Valley.

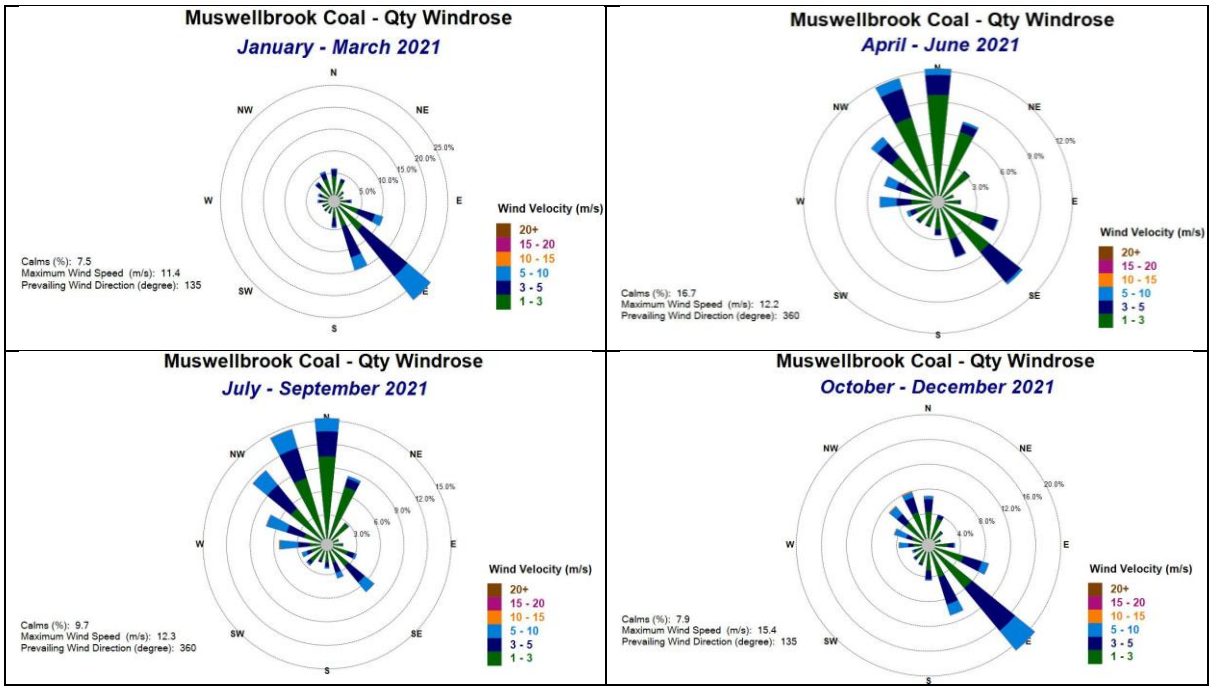


Figure 5: Quarterly Windroses

3.2.2 RAINFALL

Total rainfall recorded during the reporting period was 1000.8mm, which is significantly above the long-term average recorded onsite since 2005 of 602.2mm. This year has been the second in a row of

significantly above average rainfall. A summary of rainfall during the reporting period, compared to the long-term average recorded onsite since 2005, is provided in **Table 13** and **Figure 6**.

Table 13: Rainfall Data

Month	Muswellbrook Coal Actual (mm)	Muswellbrook Coal Average (mm)
January	72.4	60.7
February	101.8	71.7
March	147.8	63.6
April	18.8	36.4
May	23.2	26.1
June	71.8	58.2
July	25.2	32.4
August	29.2	32.6
September	39.6	30.7
October	71.8	44.4
November	264.2	80.4
December	135.0	65.1
Total	**1000.8**	**602.2**

3.2.3 TEMPERATURE

Maximum temperature recorded during the reporting period was 39.7°C and the minimum recorded was -1.6°C. A summary of minimum, maximum and average monthly temperatures during the reporting period is provided in **Table 14** and **Figure 7**.

Table 14: Temperature Data

Month	Minimum Temperature (°C)	Average Temperature (°C)	Maximum Temperature (°C)
January	9.7	22.6	39.7
February	12.0	21.7	34.8
March	10.6	20.0	36.2
April	2.7	15.8	29.2
May	0.2	13.3	26.1
June	0.0	10.8	23.2
July	-1.6	10.6	23.8
August	0.7	12.5	27.0
September	1.2	14.8	28.2
October	7.6	17.5	34.2
November	8.2	18.5	30.8
December	11.2	21.5	36.1
Summary	**-1.6**	**16.6**	**39.7**

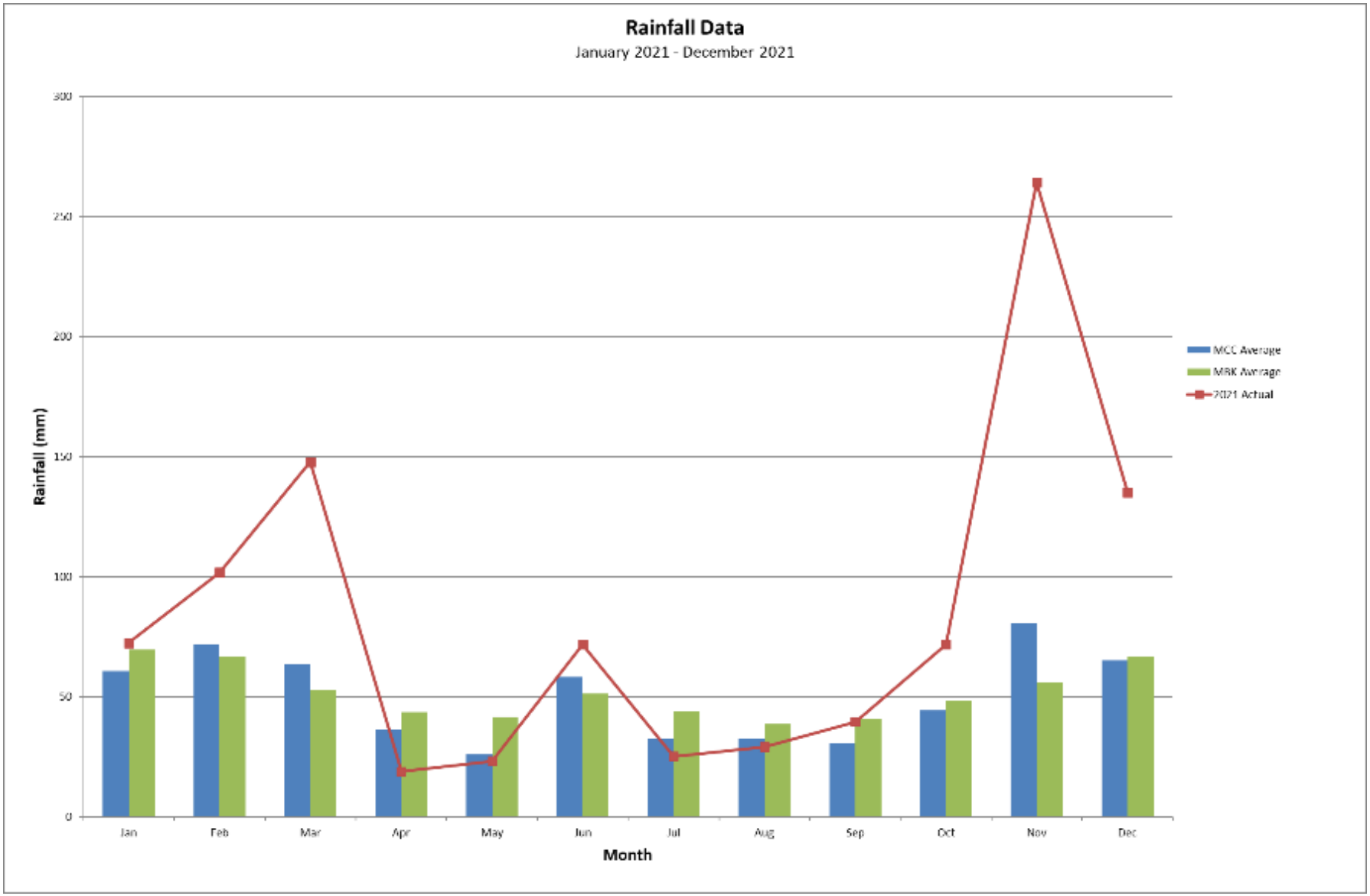


Figure 6: Rainfall Graph

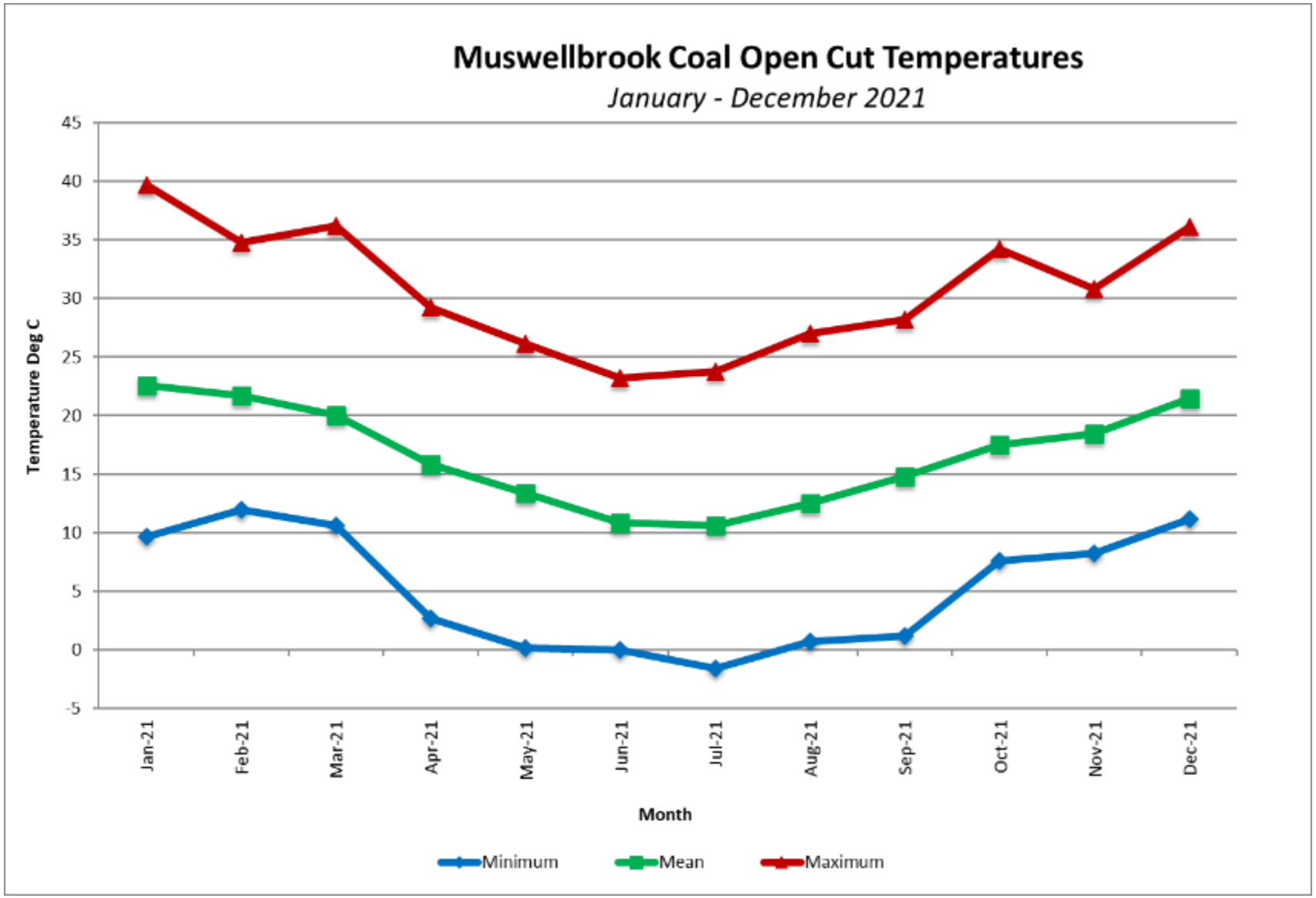


Figure 7: Temperature Graph

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 (AQMP) prepared in accordance with condition 29 of the DA. The current AQMP was approved by MSC on 1 December 2020 and is available on the MCC website.

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 15** and **Table 16**.

Table 15: 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 16: Control Procedures for Mining Generated Dust Sources

Source	Control Procedures
Haul roads	• 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.

3.3.2 AIR QUALITY MONITORING

The air quality criteria that apply to MCC are shown in **Table 17** to **Table 19**.

Table 17: Long Term Particulate Matter Criteria

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

Table 18: Short Term Particulate Matter Goal

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

Table 17 and 18 Note: • Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources); • Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, (but not Spontaneous Combustion within the mine) or any other activity agreed by Council.

Table 19: 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)

Note: • Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources); • Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, (but not Spontaneous Combustion within the mine) or any other activity agreed by Council • The need for the applicant to monitor its compliance with the requirements in Table 19, pursuant to the Air Quality Management Plan and condition 30A of the development consent be waived in the future depending on Council's consideration of the outcomes of the EPA's Environmental Study and any changes would be by agreement with Council.

The air quality monitoring sites are displayed in **Figure 8**.

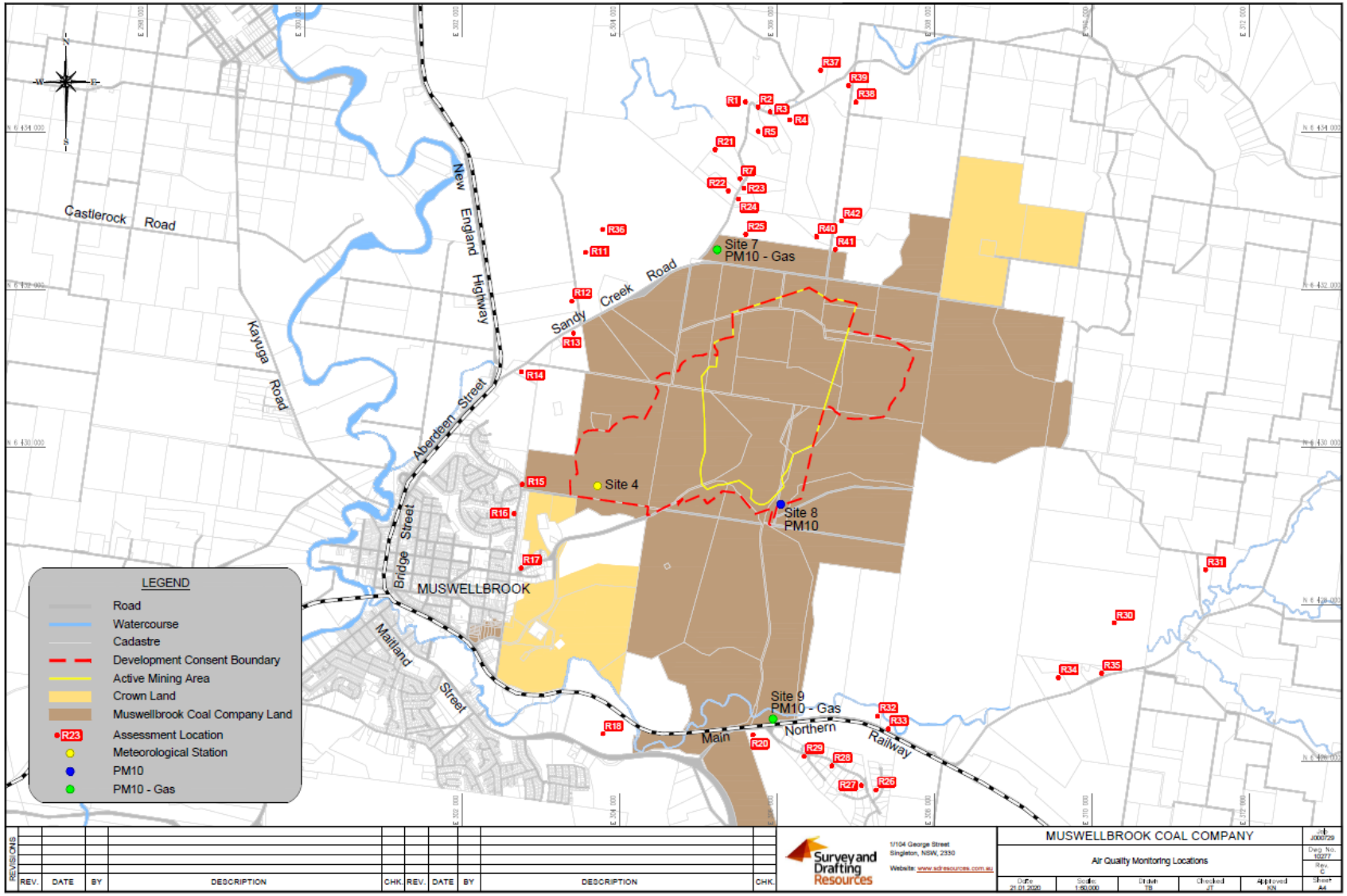


Figure 8: Air Quality Monitoring Locations

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 98.2% across the three units. The losses of data were due to equipment calibrations and minor malfunctions.

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 no days during the reporting period where the 24-hour PM_{10} results were exceeded above the 24-hour criteria of 50µg/m^3 at the compliance based monitoring locations.

The annual average PM10 did not exceed the 30µg/m3 annual criteria during the reporting period. **Table 20** displays the average PM10 value at each site during the reporting period with the results graphically presented in **Figure 9** to **Figure 11**. A table of comprehensive PM10 results is provided in **Appendix 1**.

Table 20: Real-Time PM_{10} Averages

Site Number	Annual Average PM_{10} Concentration (µg/m^3)	Annual Average Criteria (µg/m^3)	Data Recovery %
7	13.1	30	97.8
8	34.2	NA	97.3
9	14.1	30	99.5

Table 21 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 lower than the background levels and the predicted results in the SEE.

Table 21: 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
2021	13.1	14.1	16.9	16.9	23.0	17.0
2020	17.1	18.1	16.9	16.9	23.0	17.0
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

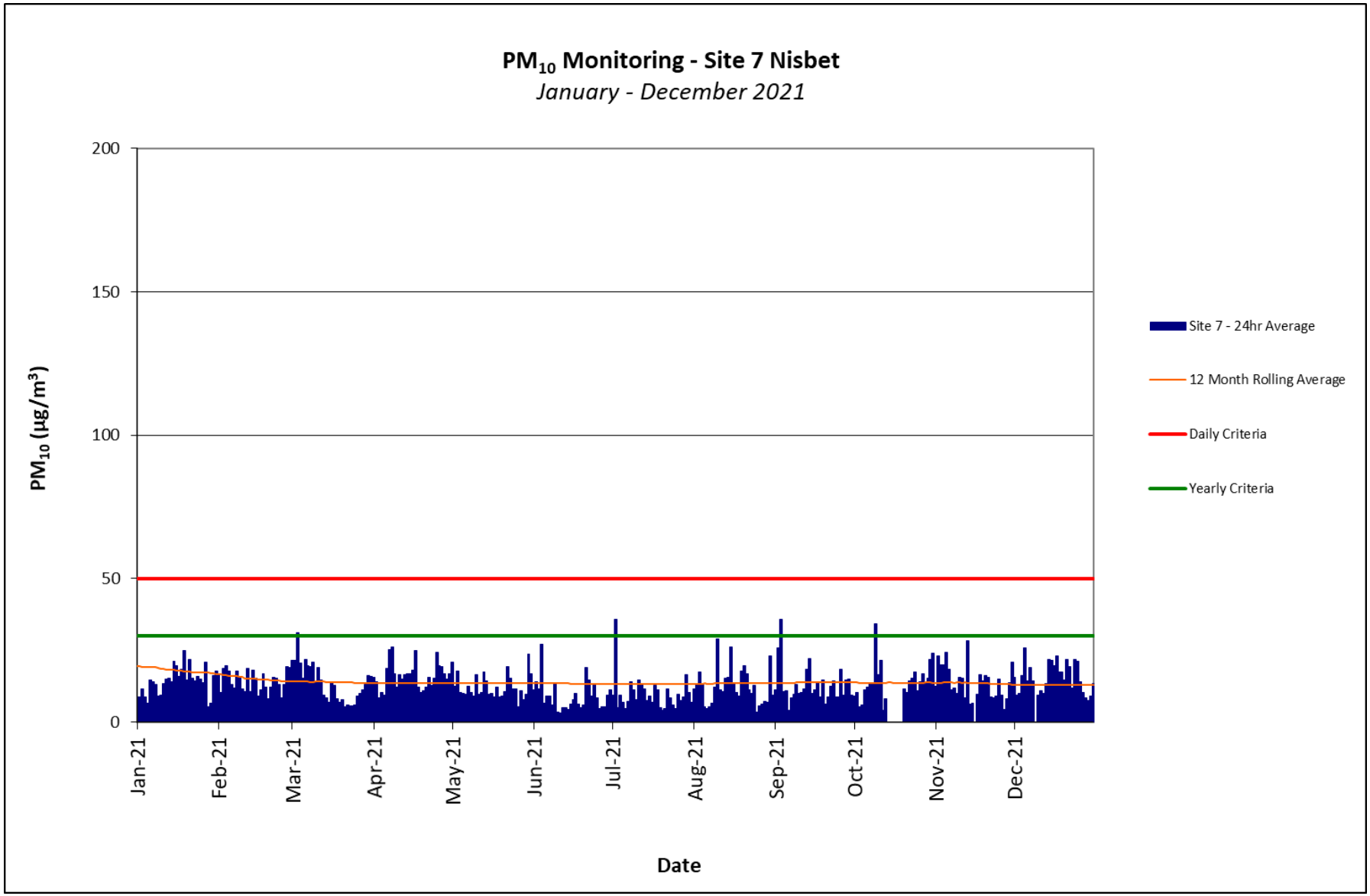


Figure 9: Site 7 PM_{10} Results

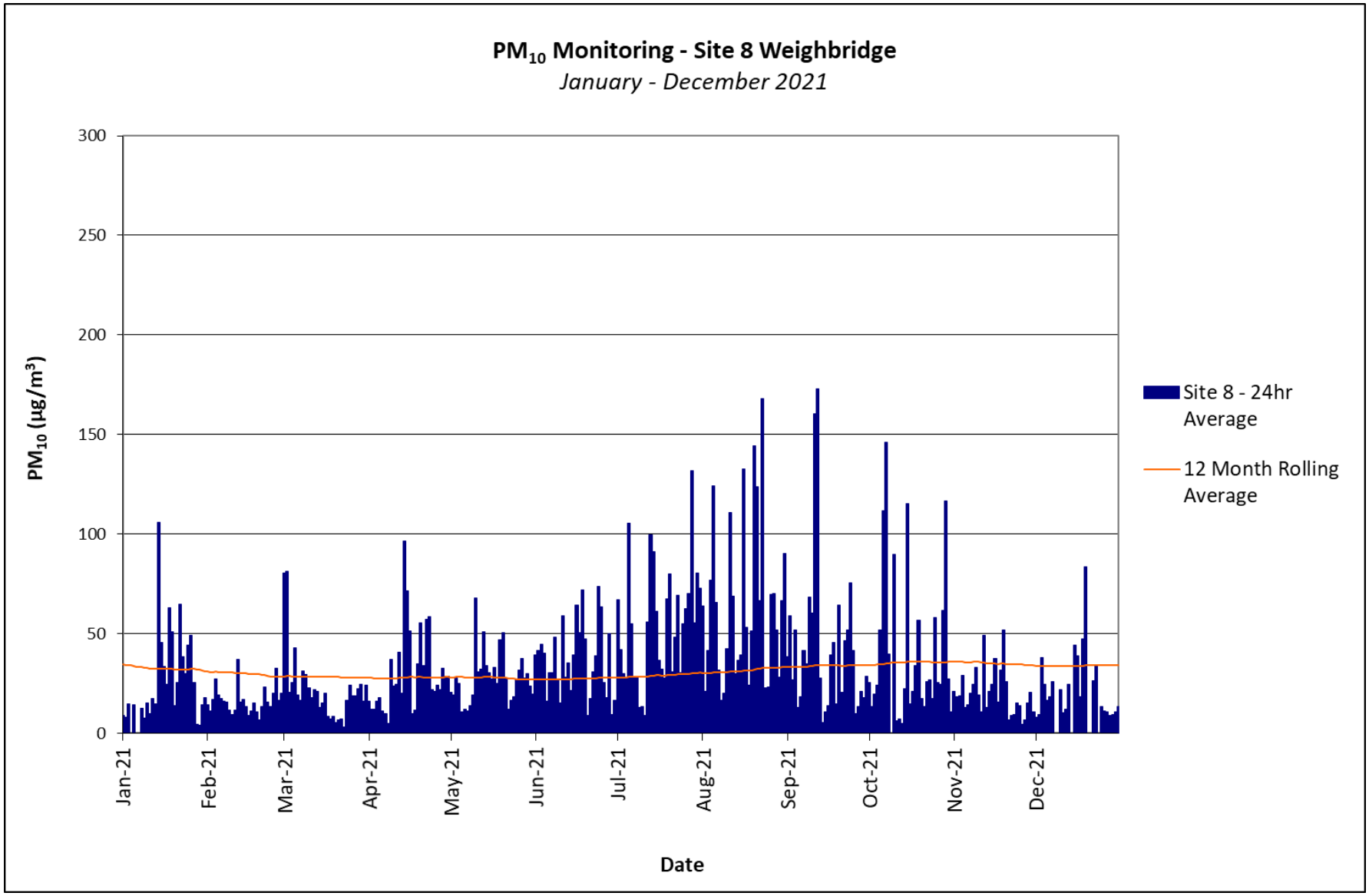


Figure 10: Site 8 PM_{10} Results

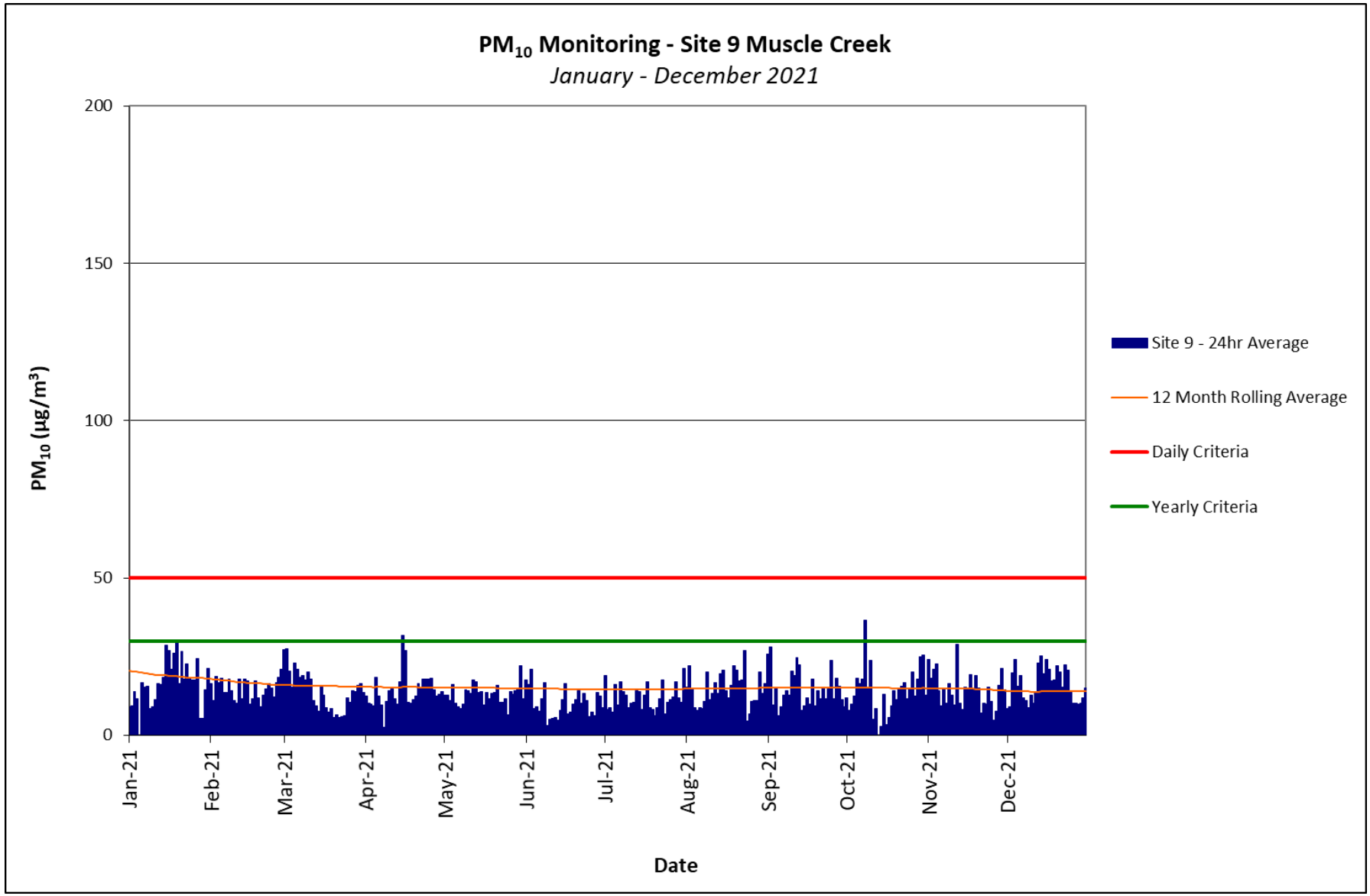


Figure 11: Site 9 PM_{10} Results

Gas Monitoring (Hydrogen Sulphide and Sulphur Dioxide)

MCC operate two real-time gas monitors that measure Hydrogen Sulphide (H_2S) and Sulphur Dioxide (SO_2). The locations of these monitors are shown in **Figure 8**. Monitoring the two sites (Site 7 and Site 9) is undertaken in accordance with the EPL requirements. Ecotech monitors are used to undertake monitoring at Site 7 and Site 9.

The criteria for H_2S and SO_2 are shown in **Table 19**. A summary of the monitoring results is shown in **Table 22** and this shows that there were no results above these criteria during the reporting period.

Table 22: Summary of Gas Data Results

Month	Highest H_2S 1-hour result (ppb)	Highest H_2S 24-hour result (ppb)	Highest SO_2 1-hour result (ppb)	Highest SO_2 24-hour result (ppb)
Site 7 – Nisbet				
January 2021	4	1	23	3
February 2021	4	1	15	4
March 2021	3	1	23	2
April 2021	3	1	47	6
May 2021	3	2	153	17
June 2021	9	3	13	4
July 2021	8	2	37	6
August 2021	6	2	15	4
September 2021	5	2	71	9
October 2021	5	2	10	3
November 2021	5	2	65	10
December 2021	6	3	125	15
Site 9 – Muscle Creek				
January 2021	6	2	17	5
February 2021	4	1	33	5
March 2021	2	1	41	4
April 2021	2	1	85	11
May 2021	4	1	168	18
June 2021	3	1	31	3
July 2021	9	2	58	8
August 2021	6	2	16	3
September 2021	5	2	191	14
October 2021	3	2	12	2
November 2021	6	3	98	13
December 2021	6	3	127	15

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 updated following the end of mining activities to confirm the management and monitoring requirements associated with the rehabilitation of the site.

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 in accordance with the approved Water Management Plan (WMP) prepared in accordance with condition 25 of the DA. The current WMP was approved by MSC October 2018 and is available on the MCC website.

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**.

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.

The WMP will be updated following the end of mining activities to confirm the management and monitoring requirements associated with the rehabilitation of the site.

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 approved Water Management Plan (WMP) prepared in accordance with condition 25 of the DA. The current WMP was approved by MSC October 2018 and is available on the MCC website.

The trigger values for water quality in Muscle Creek are presented in **Table 23**.

Table 23: 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 investigate the results. There are no surface water quality limits defined in the EPL.

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 12**.

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 (**Figure 13** and **Figure 14**). As shown in **Figure 15,** the results from this reporting period are consistent with the results from previous reporting periods. There are no predictions to compare these results to.

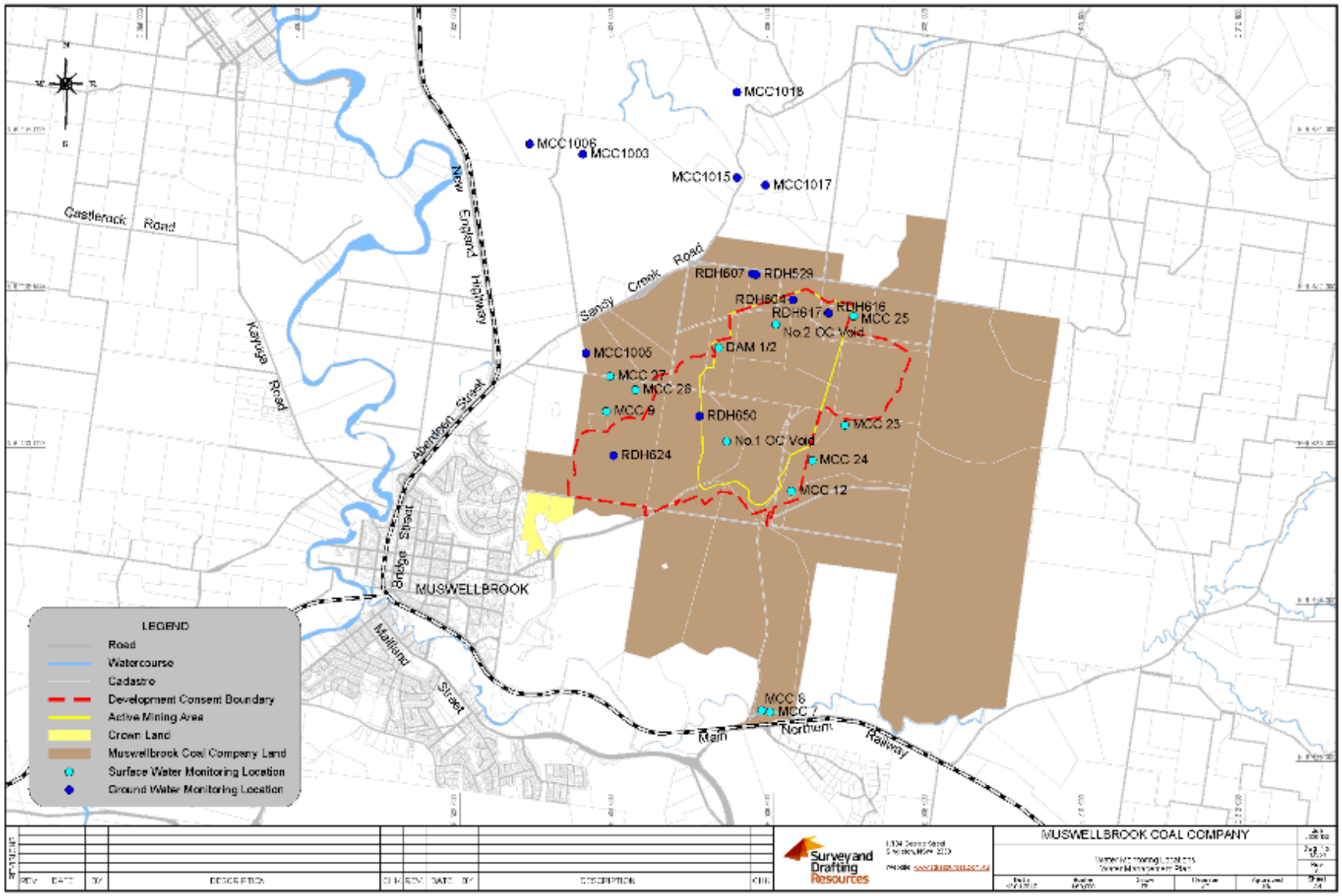


Figure 12: Water Monitoring Locations

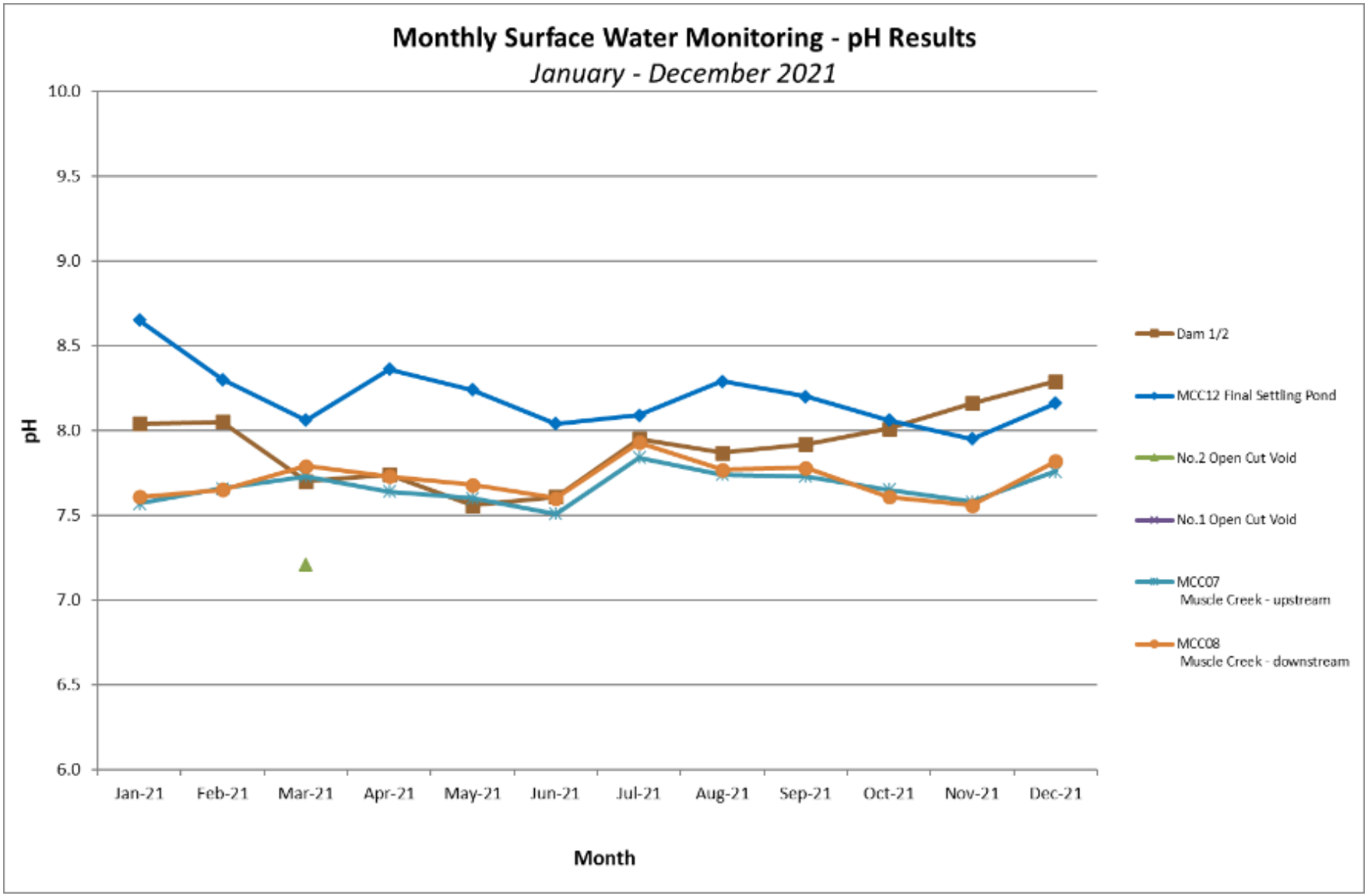


Figure 13: Monthly Surface Water Monitoring Results – pH

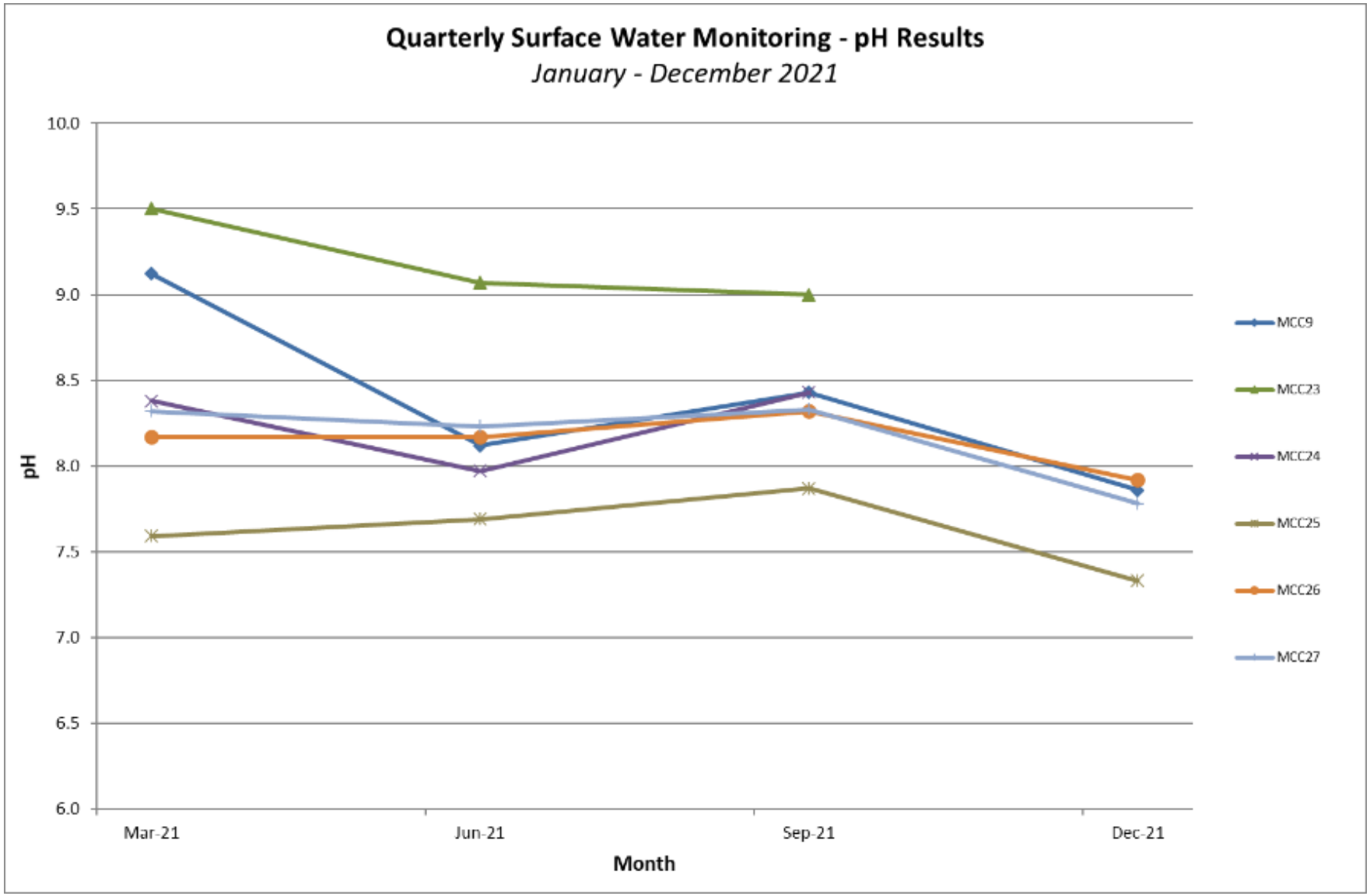


Figure 14: Quarterly Surface Water Results – pH

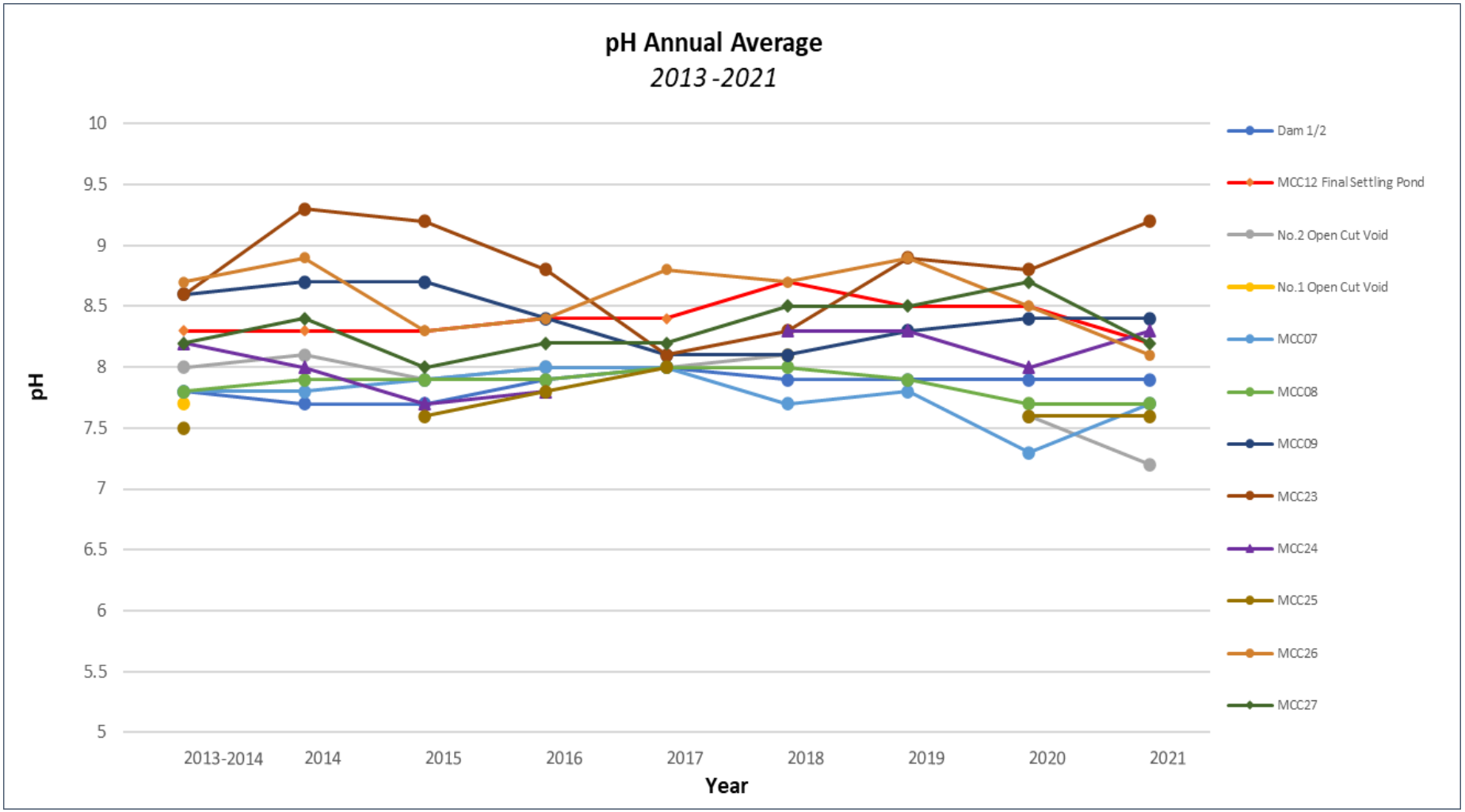


Figure 15: Comparison of pH results to Historical Results

Electrical Conductivity (EC)

Typically, EC levels for mine water are greater than 4,000µS/cm (**Figure 16** and **Figure 17**). The high rainfall during the reporting period has slightly reduced the elevated EC results since the end of the most recent drought in 2019 in the dams and Muscle Creek. Continued rainfall has reduced EC in Muscle Creek to below pre drought levels.

EC at MCC09 remains very low. The EC at MCC23 has reduced, coinciding with elevated runoff from increased rainfall. Despite the increased runoff, this dam has not yet returned to pre-drought EC levels.

MCC24 and MCC27 have returned significantly lower EC results during the reporting period compared to pre-drought levels.

The main mine water dams (Dams 1 and 2) and the Final Settling Pond have returned results consistent with or lower than previous reporting periods. Dams 1 and 2 have very little catchment area and have therefore shown a limited reduction compared to the Final Settling Pond where EC levels have declined compared to the previous reporting period.

A comparison of EC results from the reporting period to previous reporting periods is shown in **Figure 18**. There are no predictions to compare these results to.

Total Suspended Solids (TSS)

The results from this reporting period are shown in **Figure 19** and **Figure 20.** As shown in **Figure 21** the results from this reporting period are consistent with the results from previous reporting periods. TSS results can be highly variable with disturbance from desilting works and runoff from heavy rainfall causing short-term increases before conditions return to normal. There are no predictions to compare these results to.

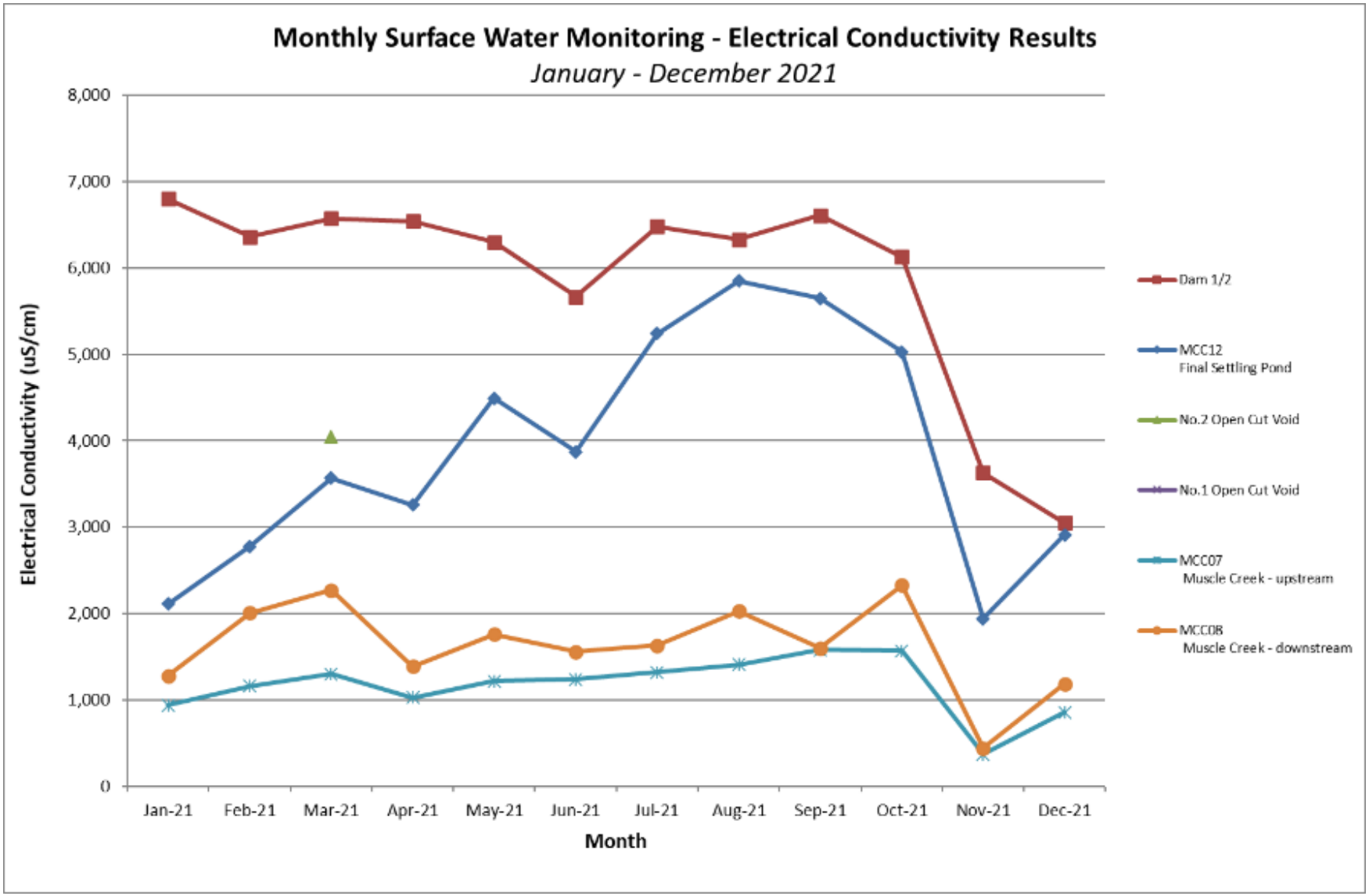


Figure 16: Monthly Surface Water Results – Electrical Conductivity

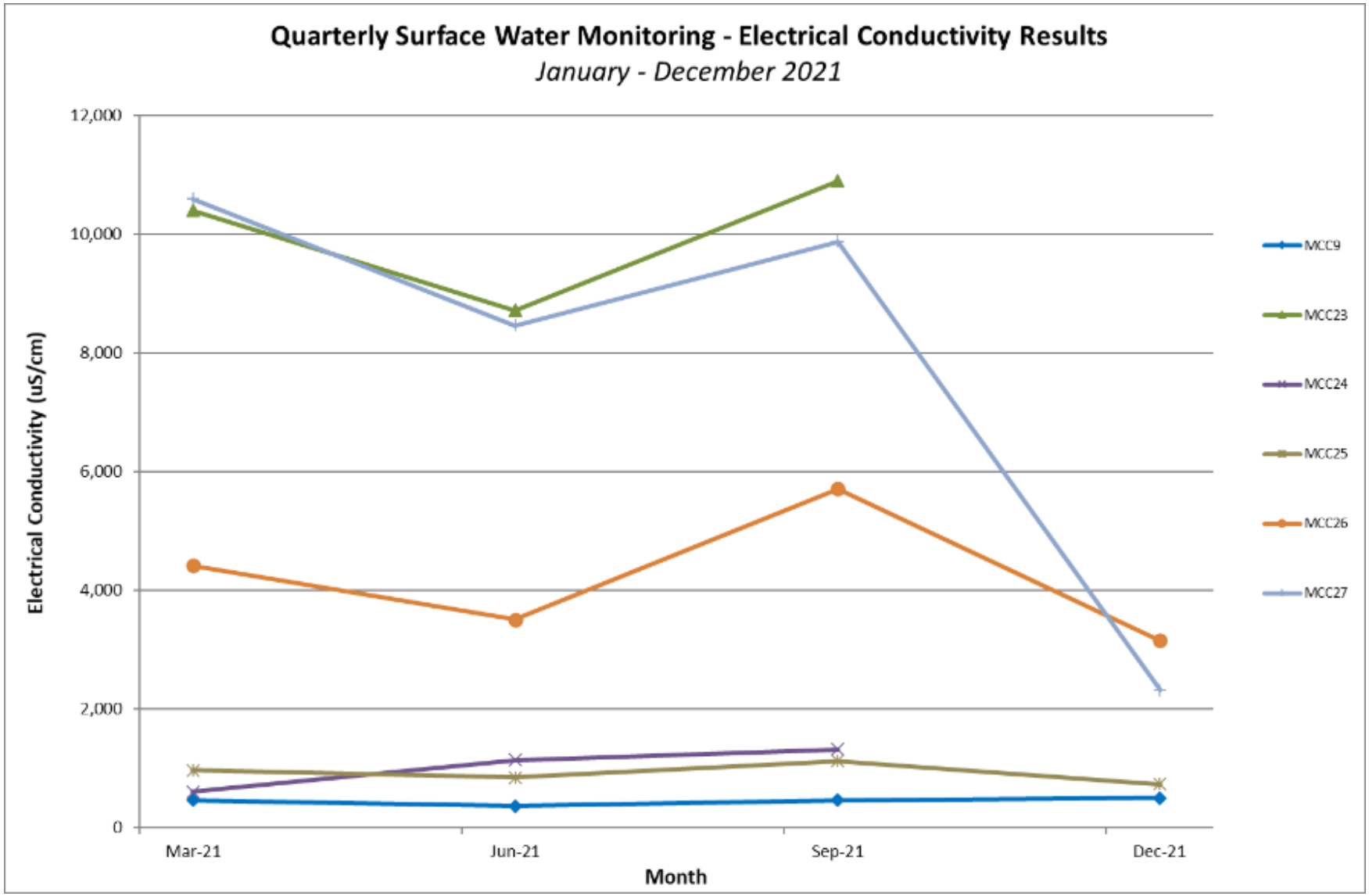


Figure 17: Quarterly Surface Water Monitoring Results – Electrical Conductivity

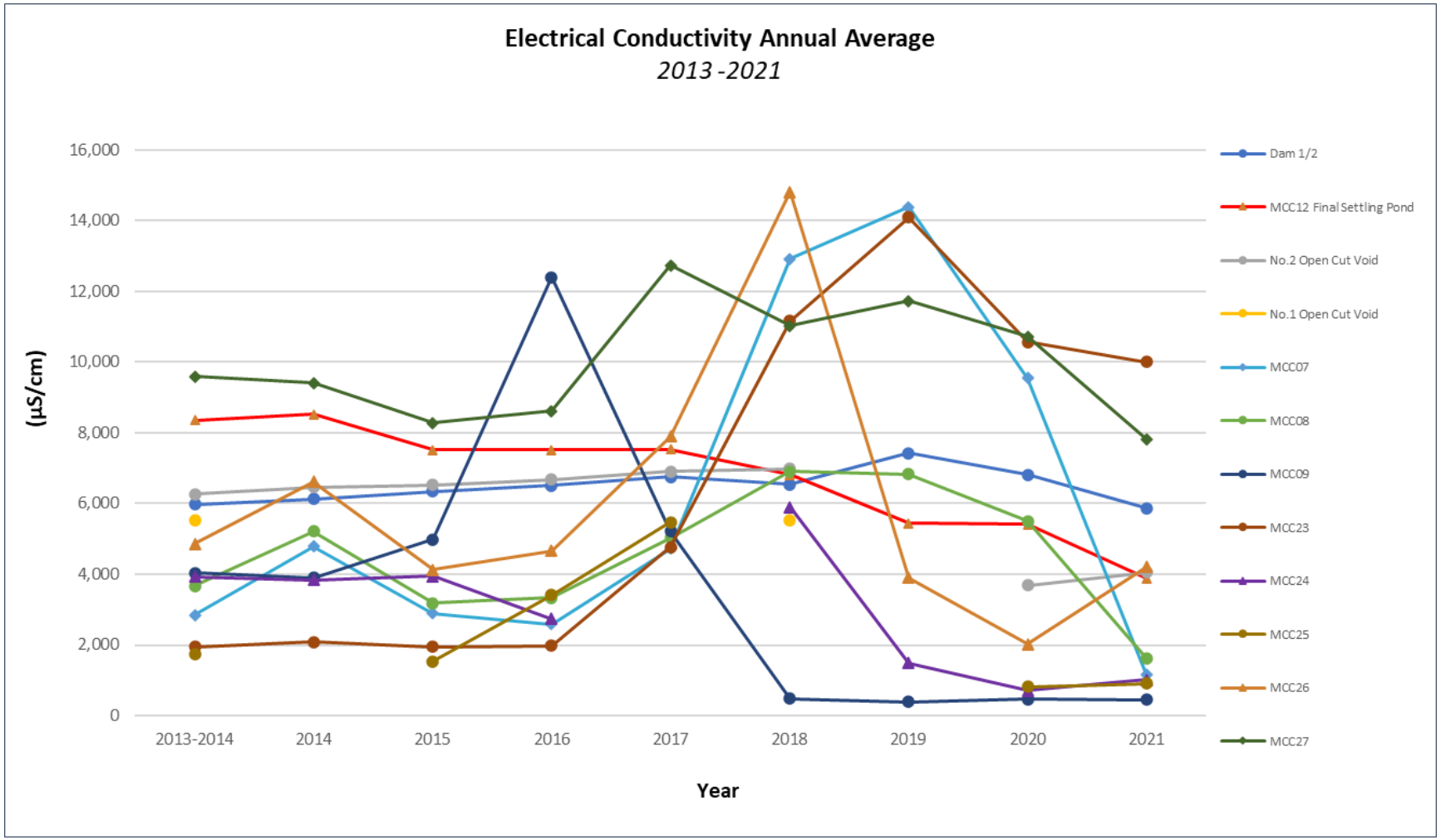


Figure 18: Comparison of EC results to Historical Results

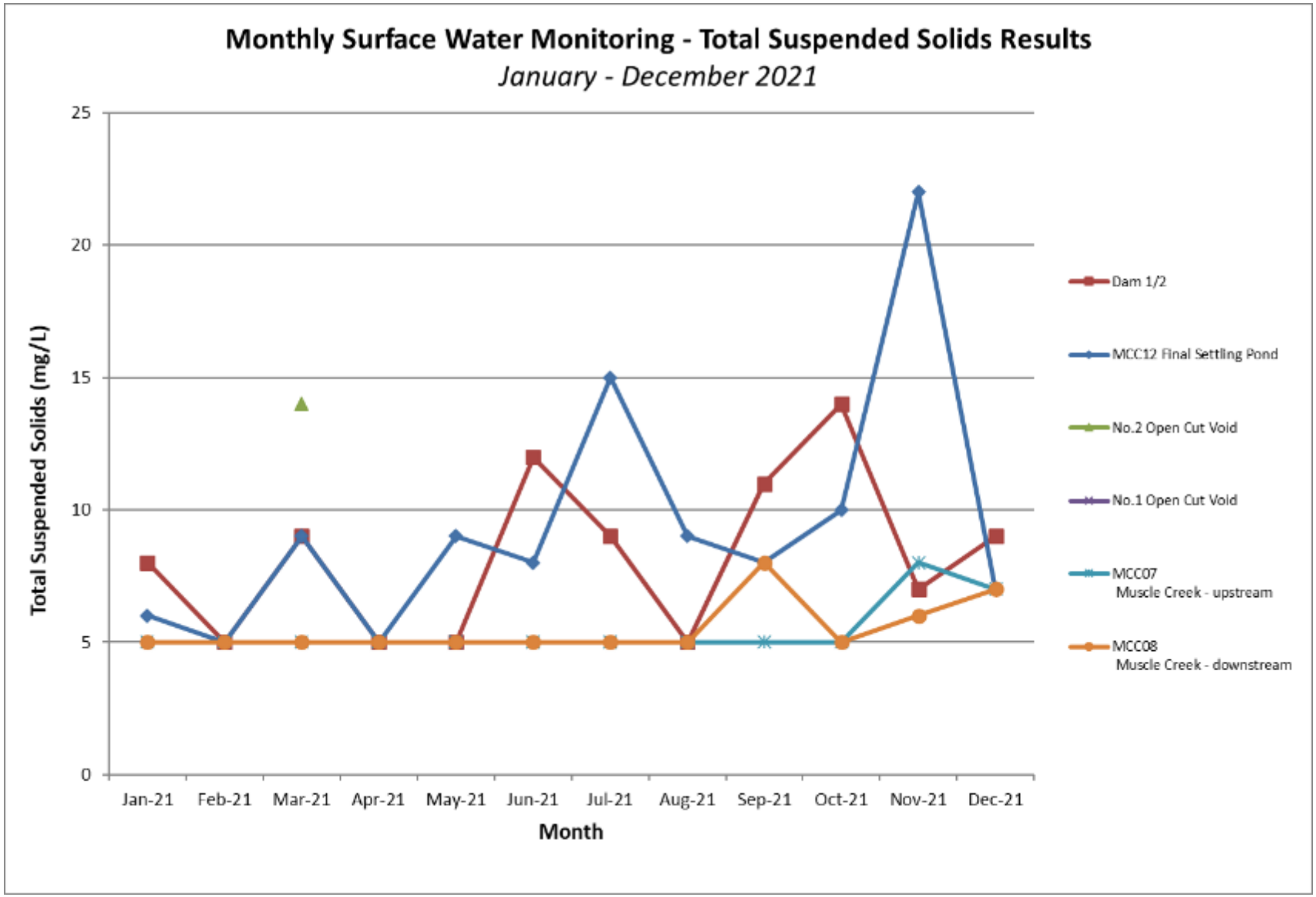


Figure 19: Monthly Surface Water Results – Total Suspended Solids

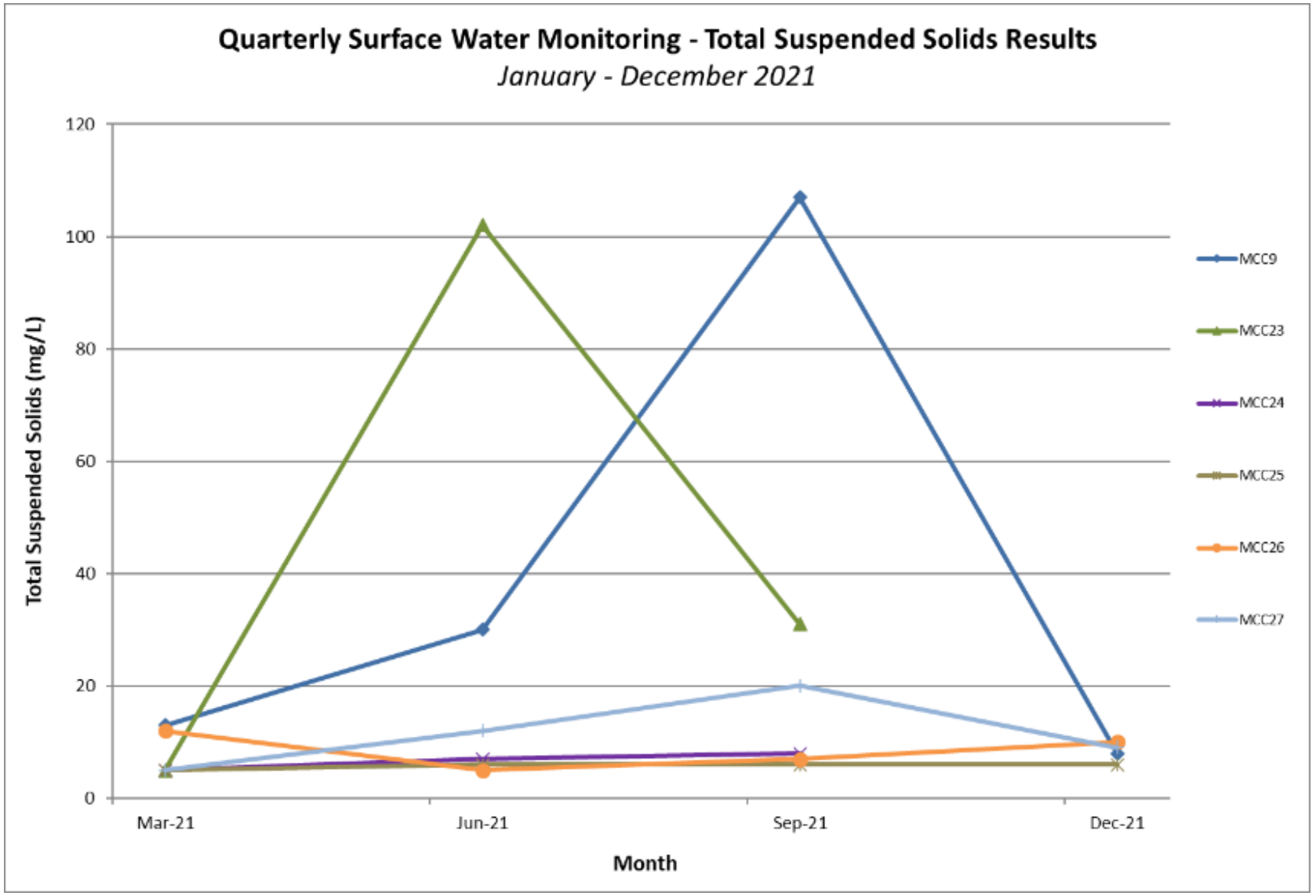


Figure 20: Quarterly Surface Water Monitoring Results – Total Suspended Solids

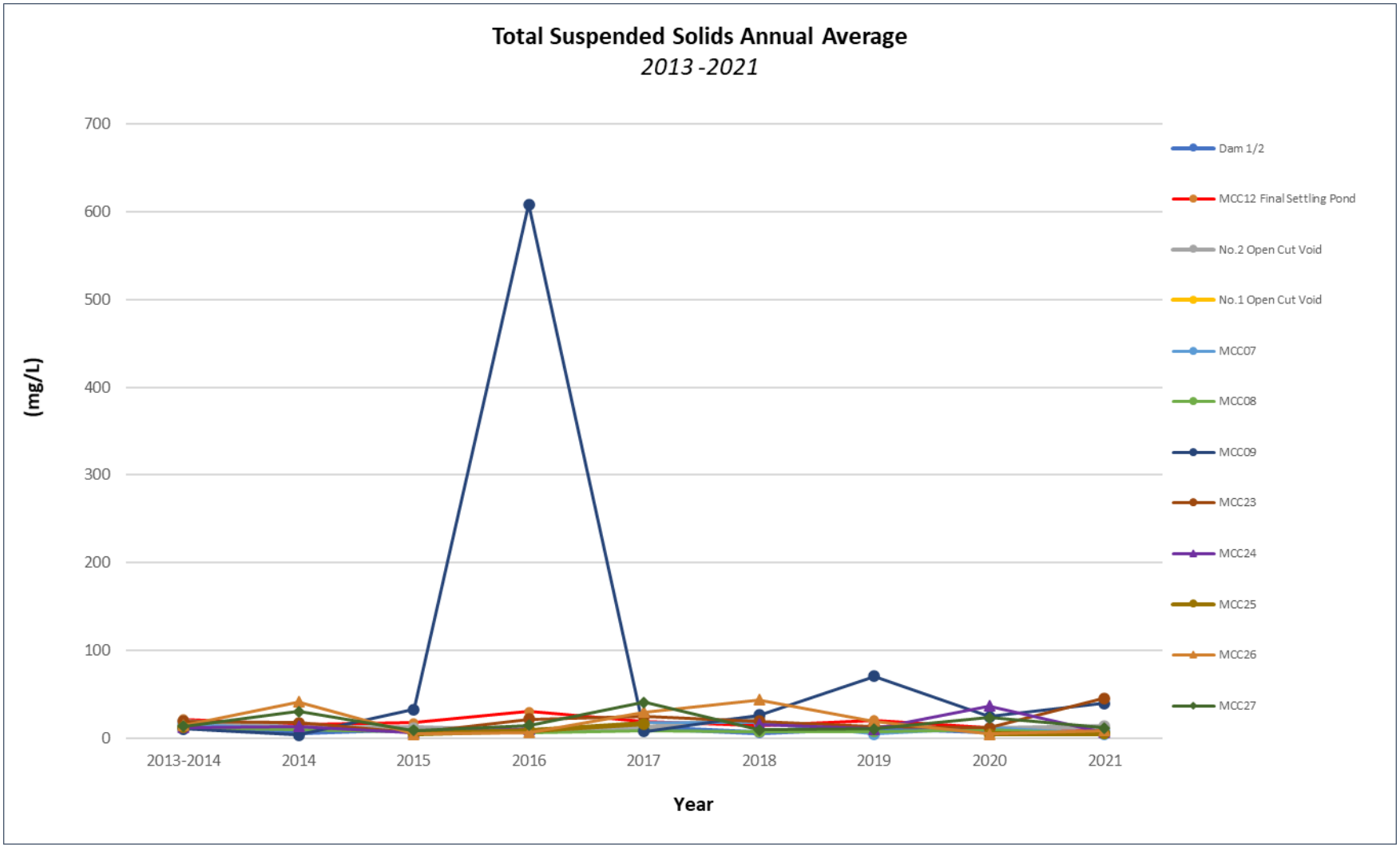


Figure 21: Comparison of TSS results to Historical Results

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. A review of the WMP was commenced in 2021 in the regular 3-yearly review cycle. The review will be completed during the next reporting period after being delayed by gathering data for the update. The updated WMP will be based on LiDAR data collected in January 2022 which will be used to improve the catchment mapping. The WMP is required to be developed in consultation with DPI Water in accordance with condition 25 of the DA. This consultation will be completed in 2022 when the data in the report has been updated and prior to the report being sent to MSC for approval.

The WMP will also be updated following the end of mining activities to confirm the management and monitoring requirements associated with the rehabilitation of the site.

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 approved Water Management Plan (WMP) prepared in accordance with condition 25 of the DA. The current WMP was approved by MSC October 2018 and is available on the MCC website.

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 investigate 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 12**.

Ground Water Monitoring Results – Mining Operations

The water level, pH and Electrical Conductivity of the underground working for this reporting period are shown in **Figure 22** and **Figure 23**. The water levels in groundwater monitoring wells located on site are shown in **Figure 24**. These results show that water levels in the underground workings have stayed relatively consistent during the reporting period. The regional monitoring has shown that there is no impact on alluvial water sources from the 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 years. There are no predictions to compare these results to.

Table 25: Comparison of Underground Working Results (Bore RDH650)

Year	Average pH	Average EC *(µS/cm)*	Relative Level (RL) *(AHD metres)*
2021	7.0	6,306	106
2020	7.1	6,098	106
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

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 for the reporting period are presented in **Figure 25** to **Figure 27**. The data and the annual comprehensive groundwater monitoring results are provided in **Appendix 2**.

As shown in **Figure 28** to **Figure 30**, the results from this reporting period are generally consistent with the results from previous reporting periods. There are no predictions to compare these results to.

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. A review of the WMP was commenced in 2021 in the regular 3-yearly review cycle. The review will be completed during the next reporting period after being delayed by gathering data for the update. The updated WMP will be based on LiDAR data collected in January 2022 which will be used to improve the catchment mapping. The WMP is required to be developed in consultation with DPI Water in accordance with condition 25 of the DA. This consultation will be completed in 2022 when the data in the report has been updated and prior to the report being sent to MSC for approval.

The WMP will also be updated following the end of mining activities to confirm the management and monitoring requirements associated with the rehabilitation of the site.

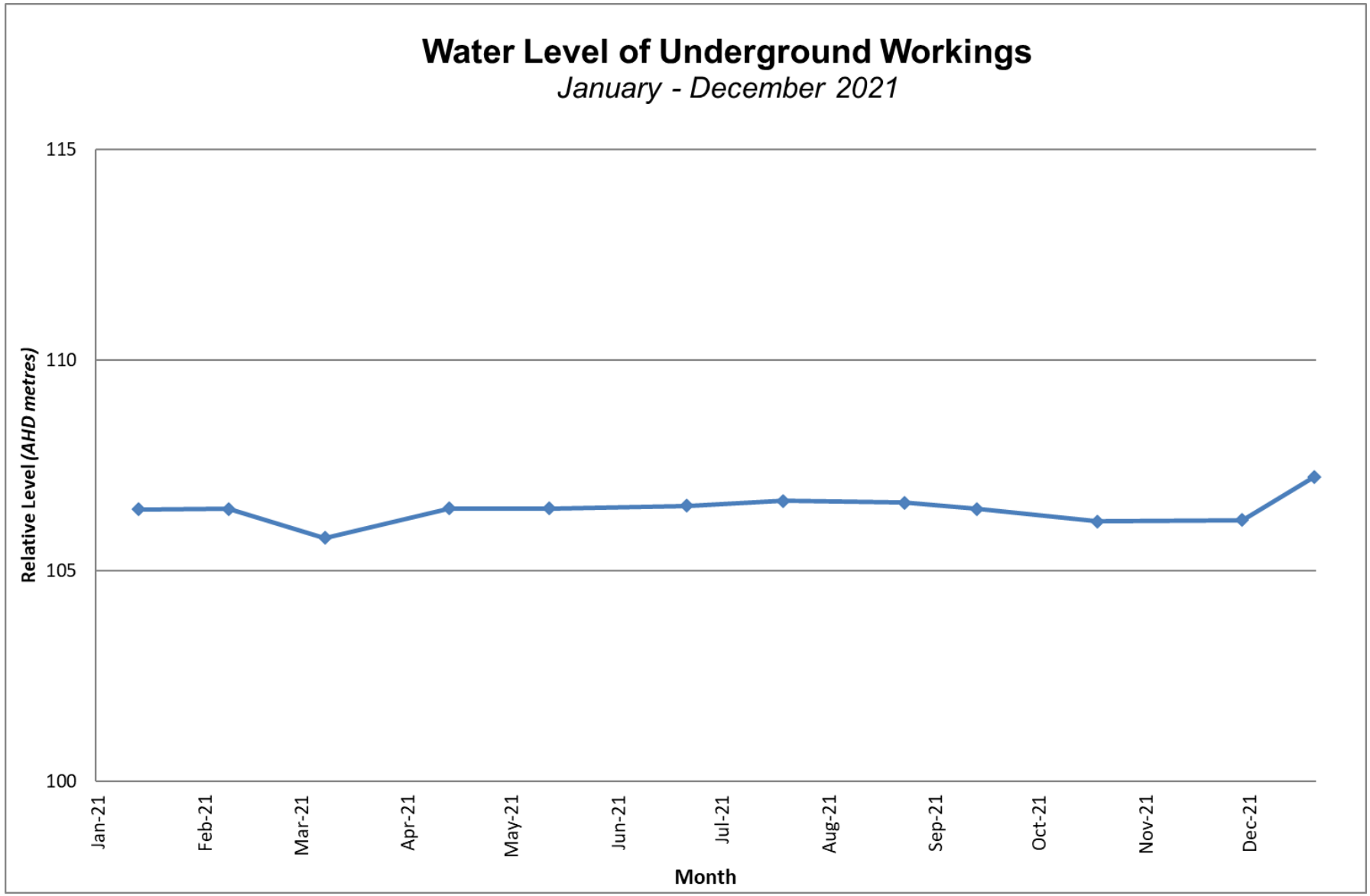


Figure 22: Water Level for Underground Workings

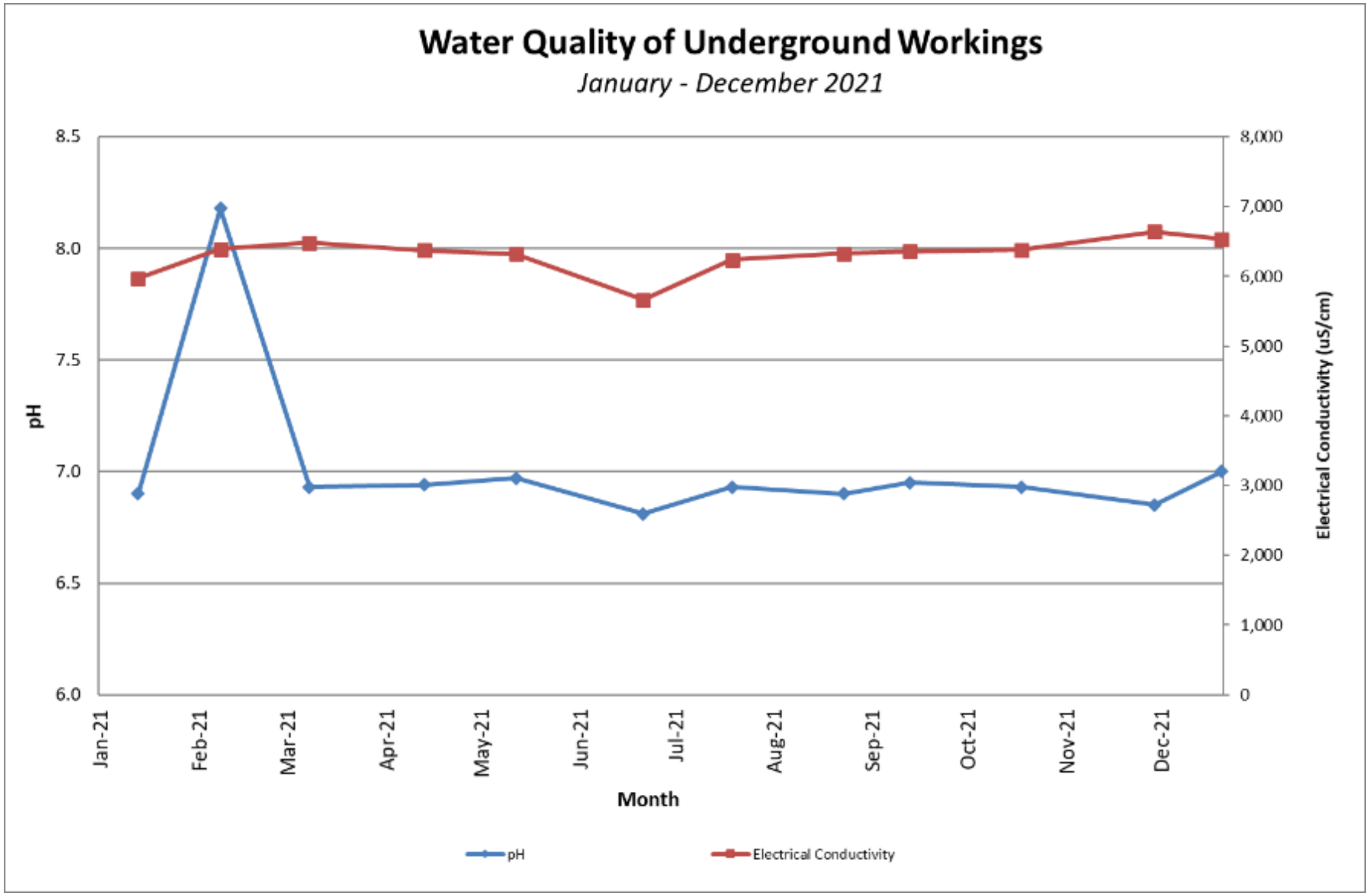


Figure 23: Water Quality Data in Underground Workings

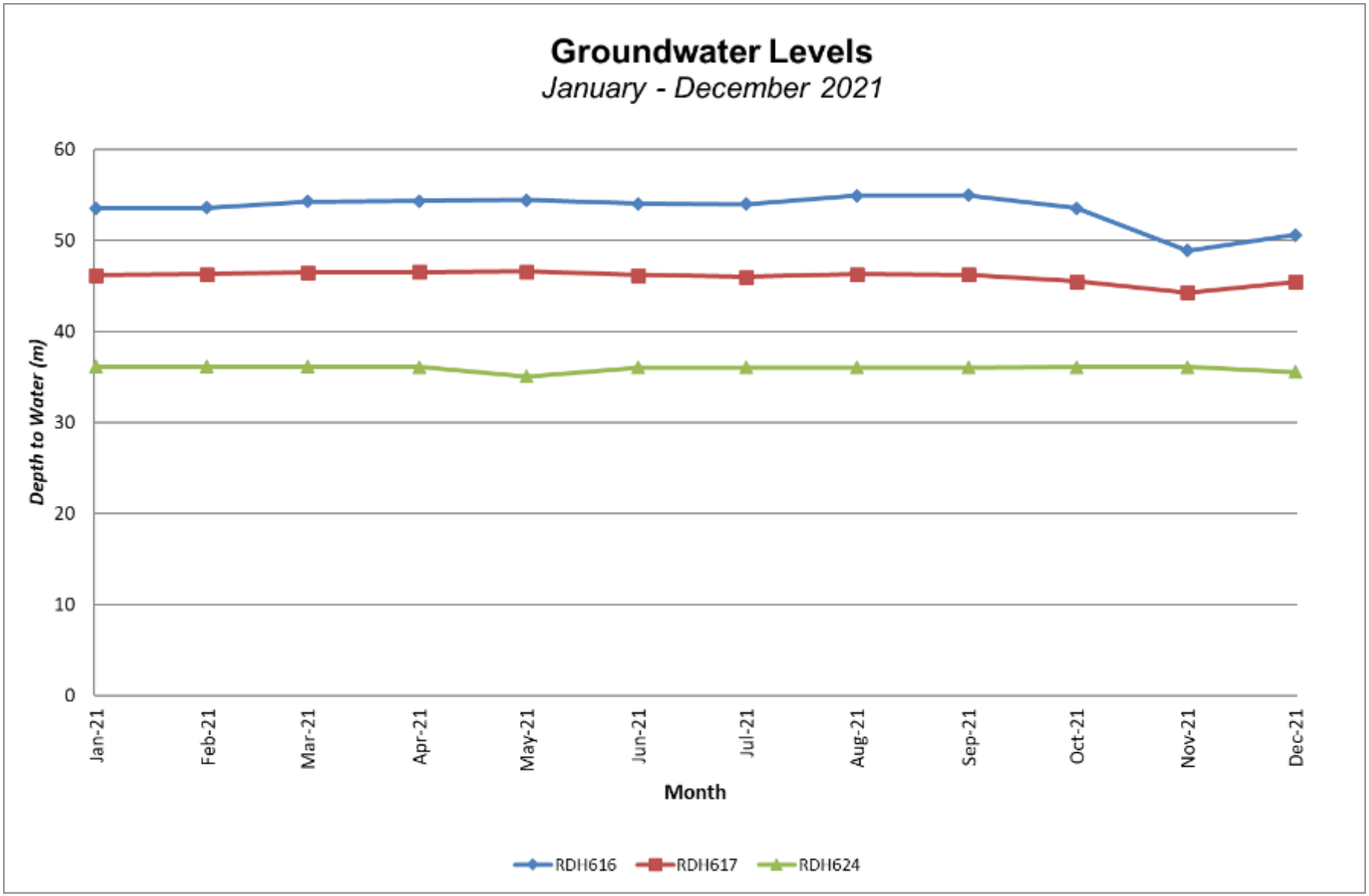


Figure 24: Water Level for Onsite Groundwater Monitoring

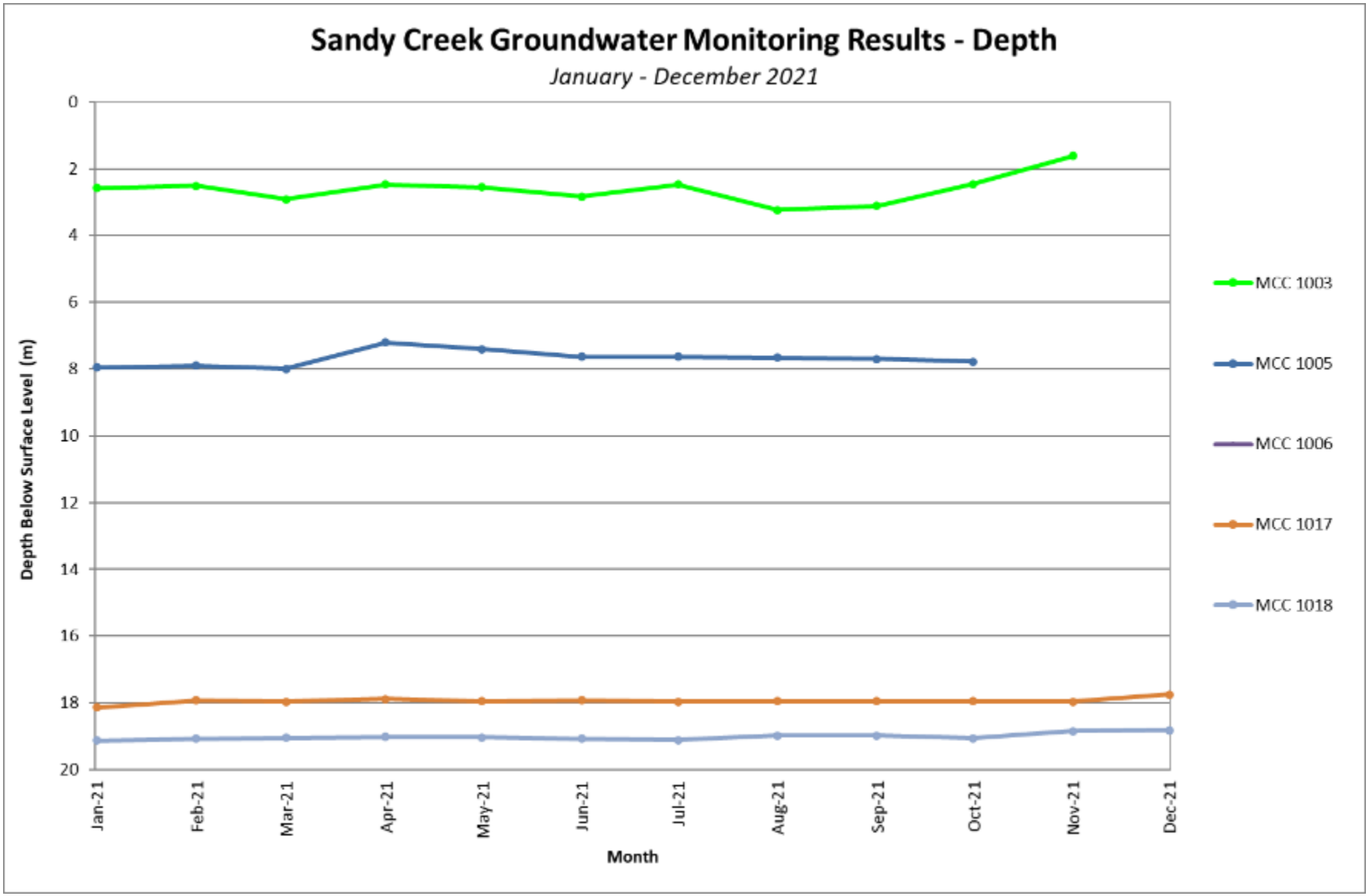


Figure 25: Sandy Creek Groundwater Depth

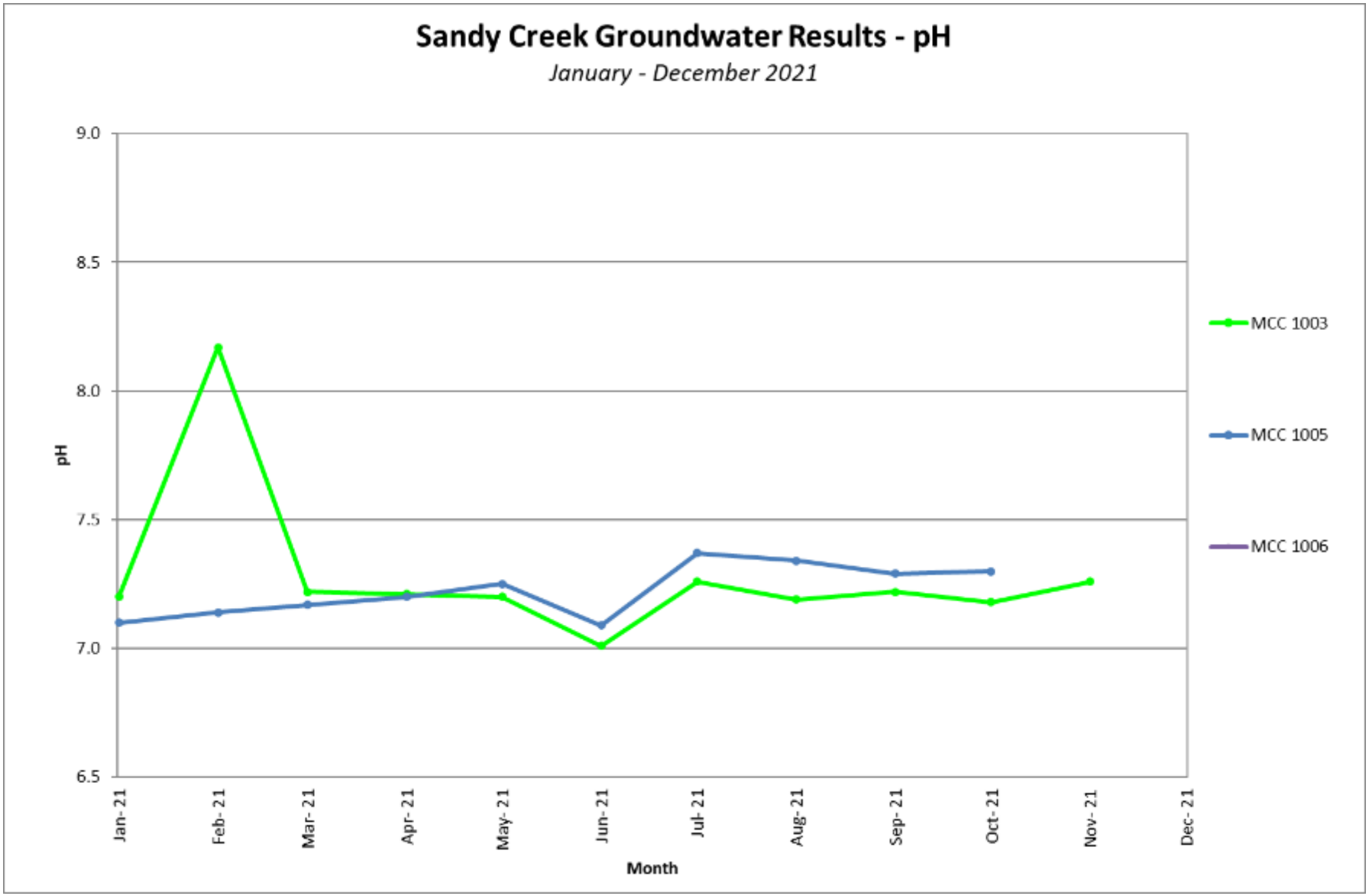


Figure 26: Sandy Creek Water Quality – pH

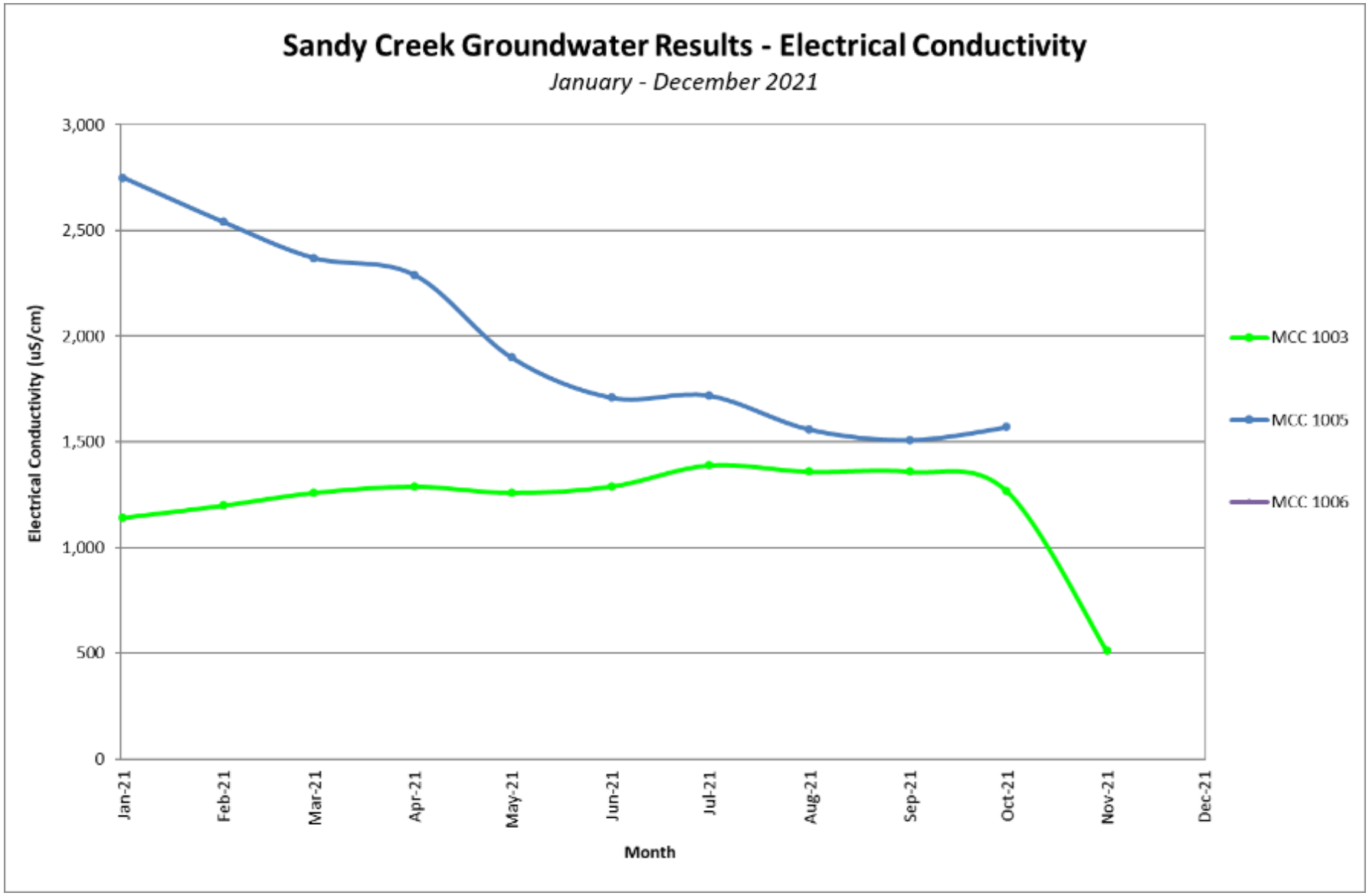


Figure 27: Sandy Creek Water Quality – Electrical Conductivity

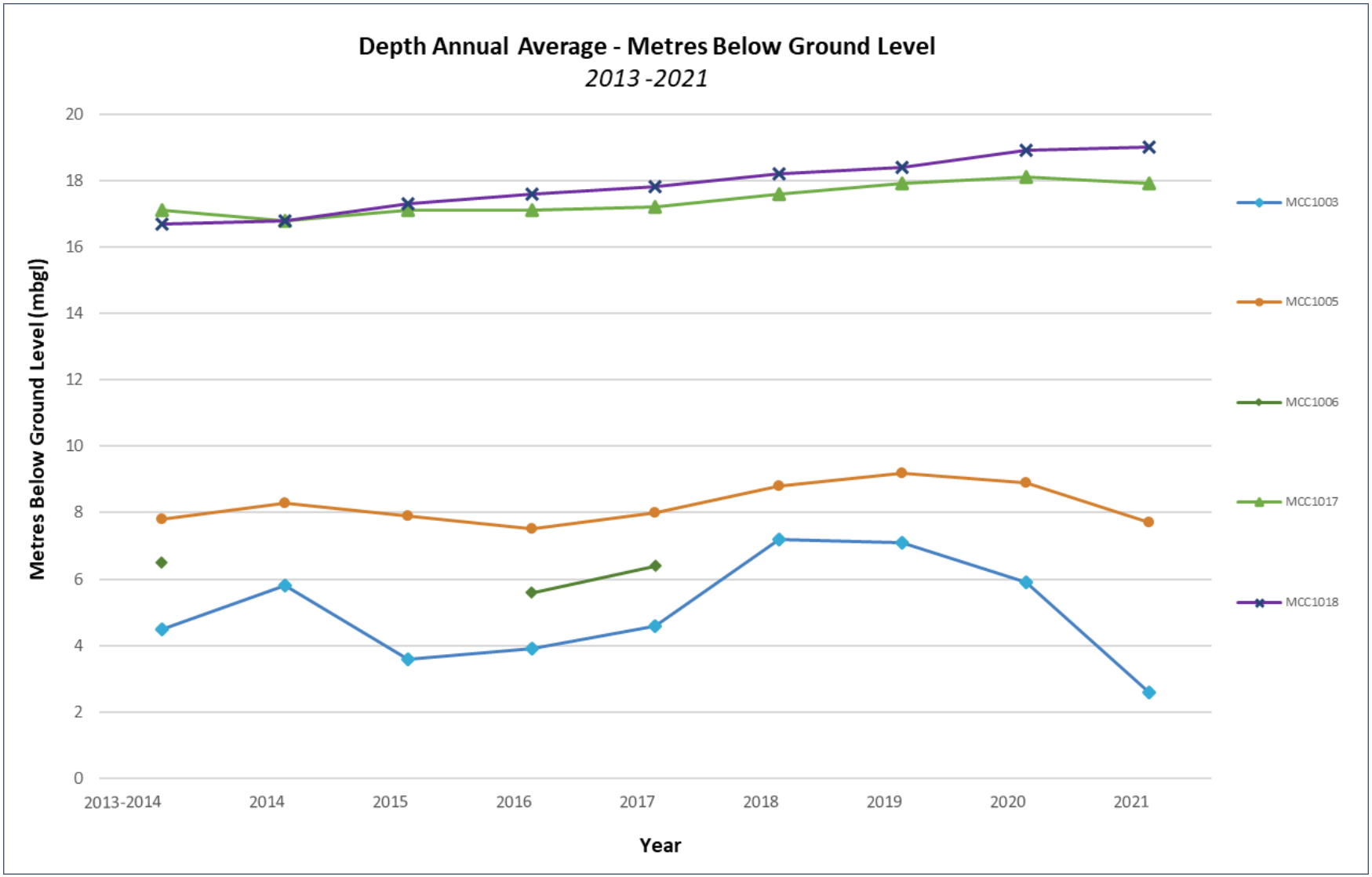


Figure 28: Comparison of Depth to Historical Results – Sandy Creek

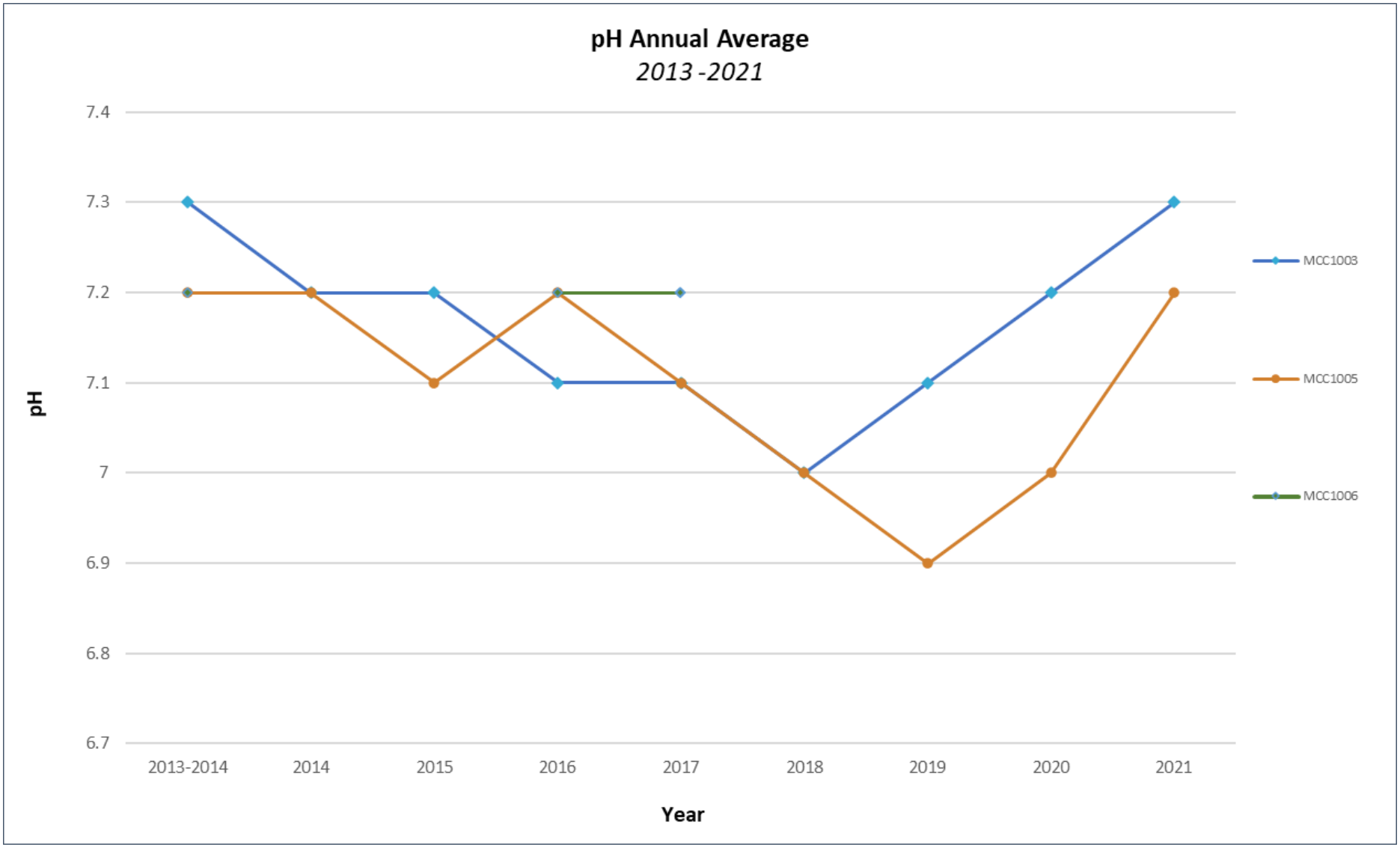


Figure 29: Comparison of pH Results to Historical Results – Sandy Creek

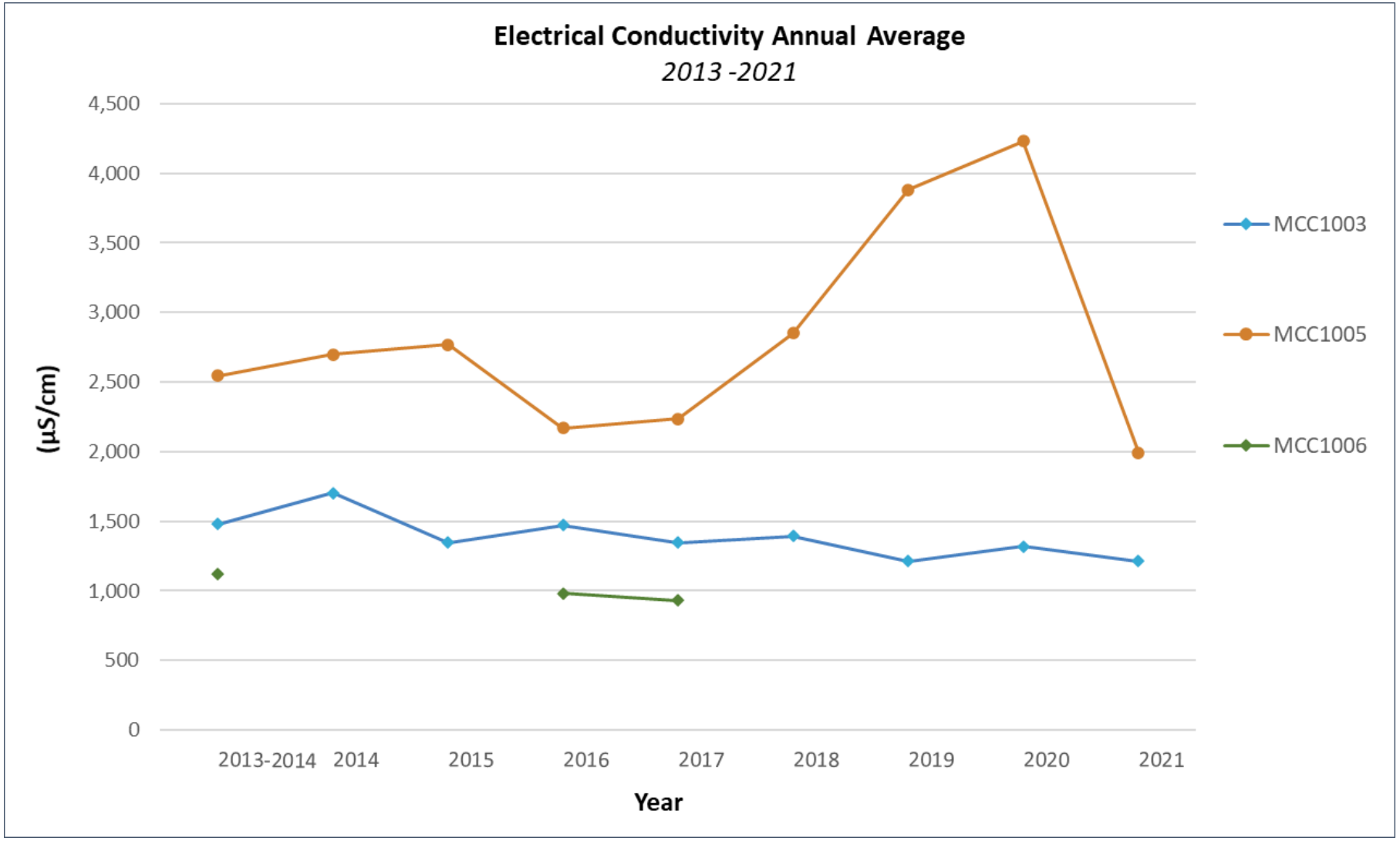


Figure 30: Comparison of EC Results to Historical Results – Sandy Creek

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.

During the reporting period, the Bioremediation Area in OC2 was decommissioned, and a new Bioremediation Area was set up in OC1. This was to make way for the area to be shaped as part of the rehabilitation of OC2. The material in the old Bioremediation Area was tested and cleared before being disposed of in the pit. The surface material in the old Bioremediation Area was then tested against the same criteria set out in the Bioremediation Management Plan and was also confirmed to meet the criteria before the area was covered and reshaped to meet the target for the next reporting period.

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 within the DA boundary 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.

No tree clearing was undertaken during the reporting period.

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. Management of impacts on flora and fauna have been managed in accordance with the Mining Operations Plan (MOP), but these requirements will be transferred to the Rehabilitation Management Plan (RMP) during the next reporting period. The MOP will be superseded by the RMP. This is discussed further in **Section 5.10**.

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, operational and non-operational areas. Weed spraying and cut and paint were the main forms of weed control during this reporting period. The target species for the weed control included:

- Prickly Pears (Prickly Pear, Tiger Pear and Creeping Pear)
- Mother of Millions
- St John's Wort
- African Boxthorn
- Castor Oil
- Tree Tobacco
- Acacia saligna
- Fleabane

The areas that were targeted during the reporting period are shown in **Figure 31**.

Feral Animal Control

During the reporting period, MCC undertook a wild dog and fox baiting and trapping program timed in accordance with the wild dog baiting program conducted by Hunter Local Land Services.

The wild dog and fox baiting program was undertaken during May and June 2021. The program consisted of a combination of mound baits using fresh meat 1080 baits and Canid Pest Ejectors (CPE) and were monitored using 4G field cameras. Over the program there were 15 dog takes (12 fresh meat baits and 3 CPE) and 9 fox takes (6 fresh meat baits and 3 CPE).

The wild dog and fox trapping program was undertaken in October to December 2021 as a follow-up to the baiting program. A total of 8 soft-jaw traps were set and monitored using 4G field cameras over the two-month period. The trapping effort was hampered by wet weather with the traps not set for several weeks within the trapping program due to difficult access conditions. One dog and one fox were trapped during the program.

Pest Animal Control

It was planned for a kangaroo cull program to be conducted onsite, with a Licence to Harm Kangaroos obtained from NSW National Parks and Wildlife Service for the program to be undertaken during late spring/early summer onsite. Due to the wet weather during this time most of the scheduled kangaroo cull nights had to be rescheduled and then later cancelled. One night's program did go ahead with 21 Eastern Grey kangaroos, one Common Wallaroo and eight Red-necked Wallabies euthanised.

3.10.2 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage weed and feral animal impacts. Management of weed and feral animal impacts have been managed in accordance with the Mining Operations Plan (MOP), but these requirements will be transferred to the Rehabilitation Management Plan (RMP) during the next reporting period. The MOP will be superseded by the RMP. This is discussed further in **Section 5.10**.

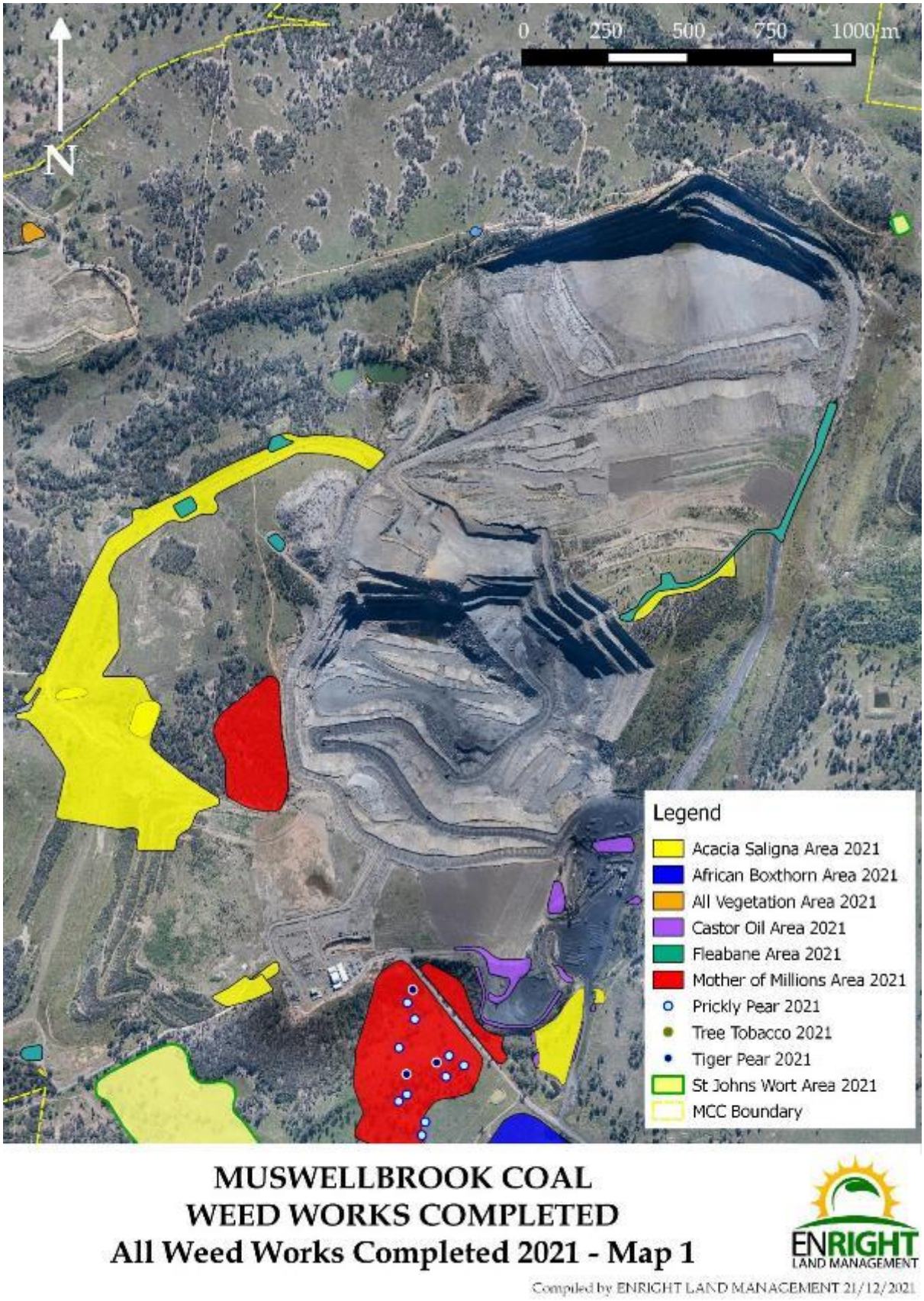


Figure 31: Weed Control Areas

3.11 BLASTING

3.11.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to manage blasting impacts in accordance with the approved Blast Management Plan (BMP) prepared in accordance with condition 33 of the DA. The current BMP was approved by MSC on 26 May 2020 and is available on the MCC website.

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 26**.

Table 26: 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 27** and locations are displayed in **Figure 32**.

Table 27: 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, 95 blast events occurred at MCC. The four blast monitors were operational throughout the reporting period, with 99.5% of data captured during the reporting period. Results were not collected at 99 Queen St on the 22 January 2021 and 18 March 2021 due to system faults which resulted in the unit not recording a result. Based on results from other units there were no adverse environmental impacts from the loss of data. The system fault identified by the supplier has been rectified.

A summary of blast monitoring results is displayed in **Figure 33** to **Figure 36**. Blast data for all monitors is shown in **Appendix 3**.

Table 28 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 28: Comparison of Blasting Results

Year	Vibration (mm/s)		Overpressure (dBL)	
	Average Monitoring Results	EA Predicted Results	Average Monitoring Results	EA Predicted Results
2021	0.25	0.7	97.1	111.0
2020	0.20	0.7	98.0	111.0
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

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 updated following the end of mining activities to confirm the management and monitoring requirements associated with the rehabilitation of the site.

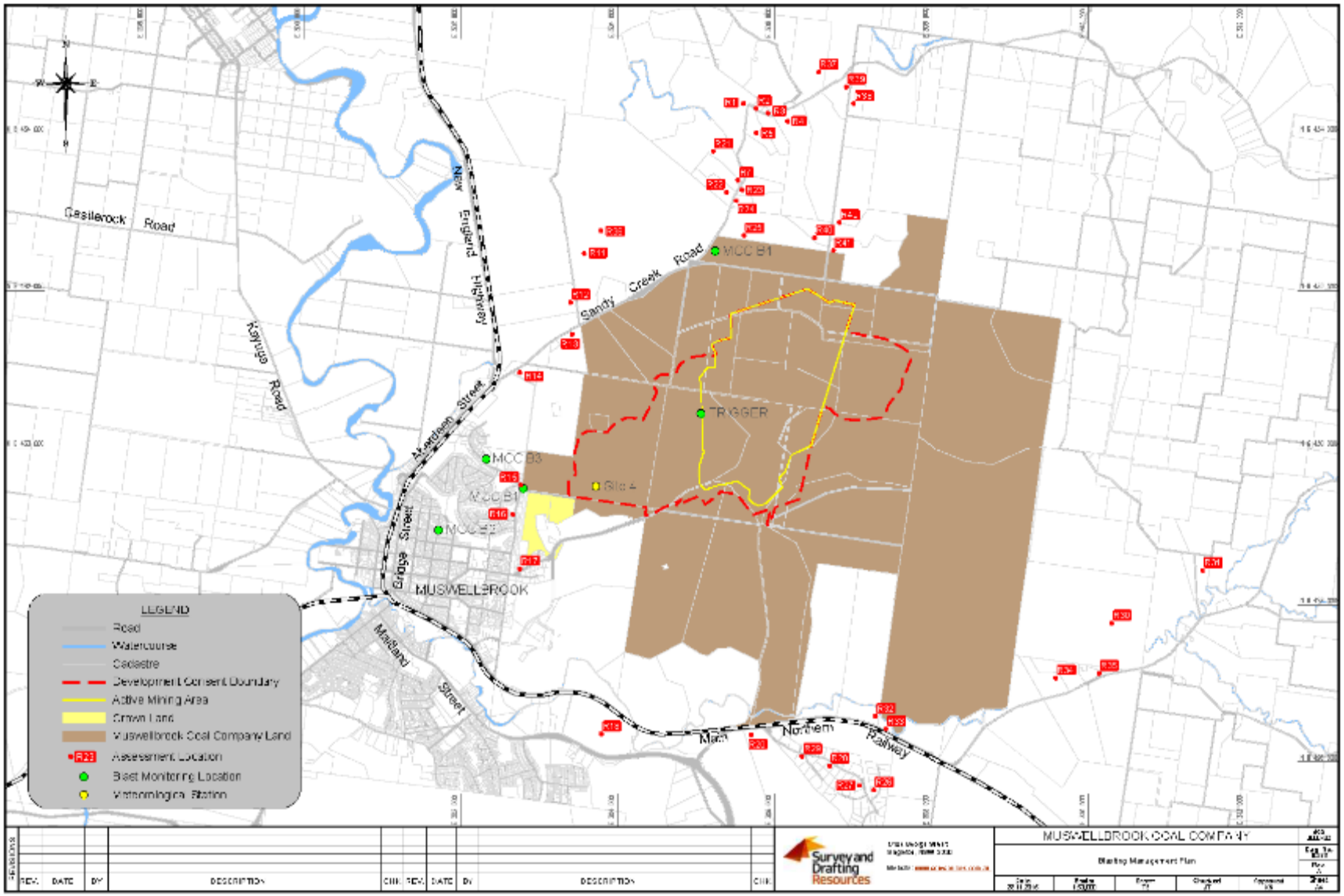


Figure 32: Blast Monitoring Locations

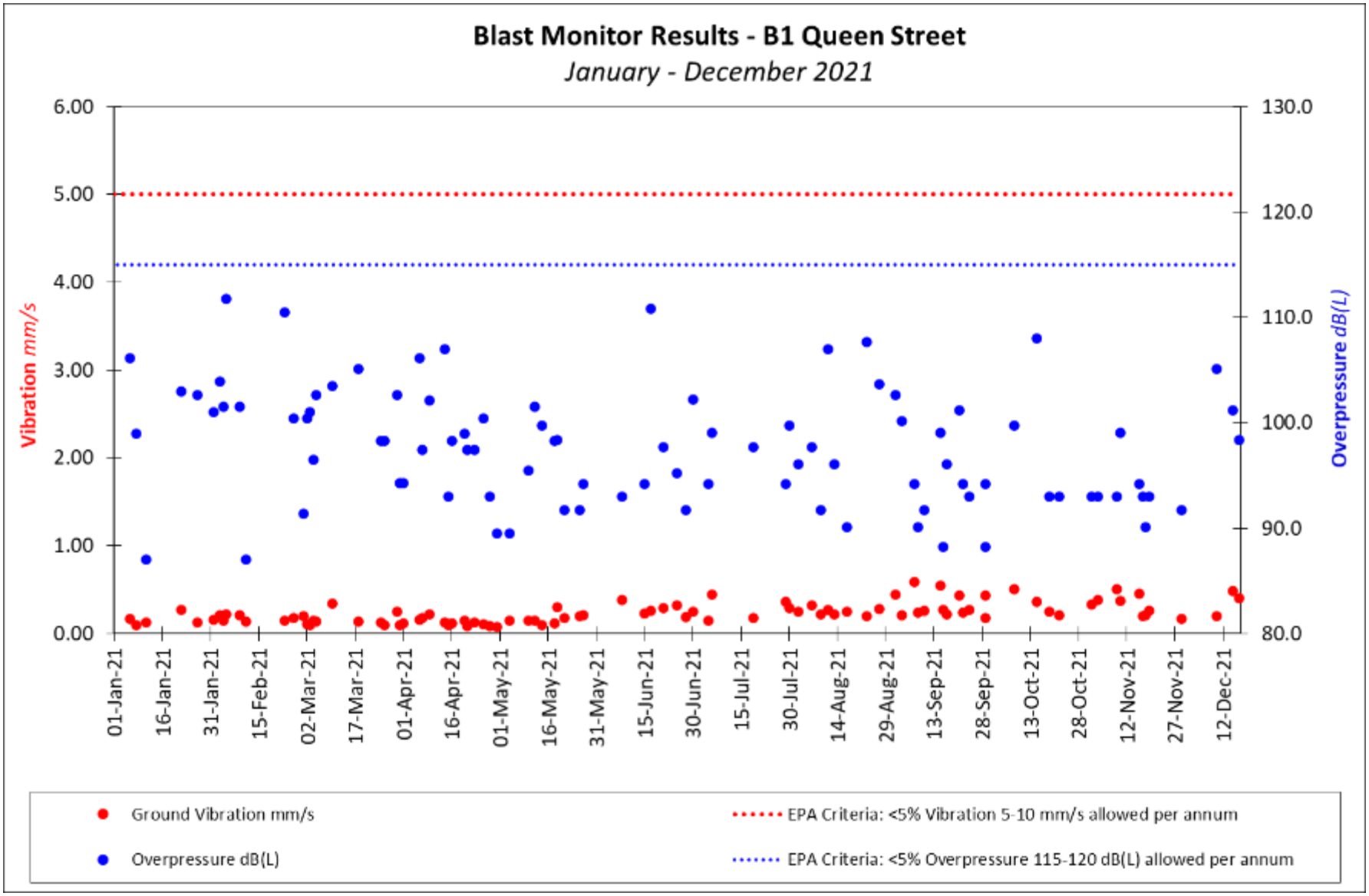


Figure 33: Queen Street Blast Monitoring Results

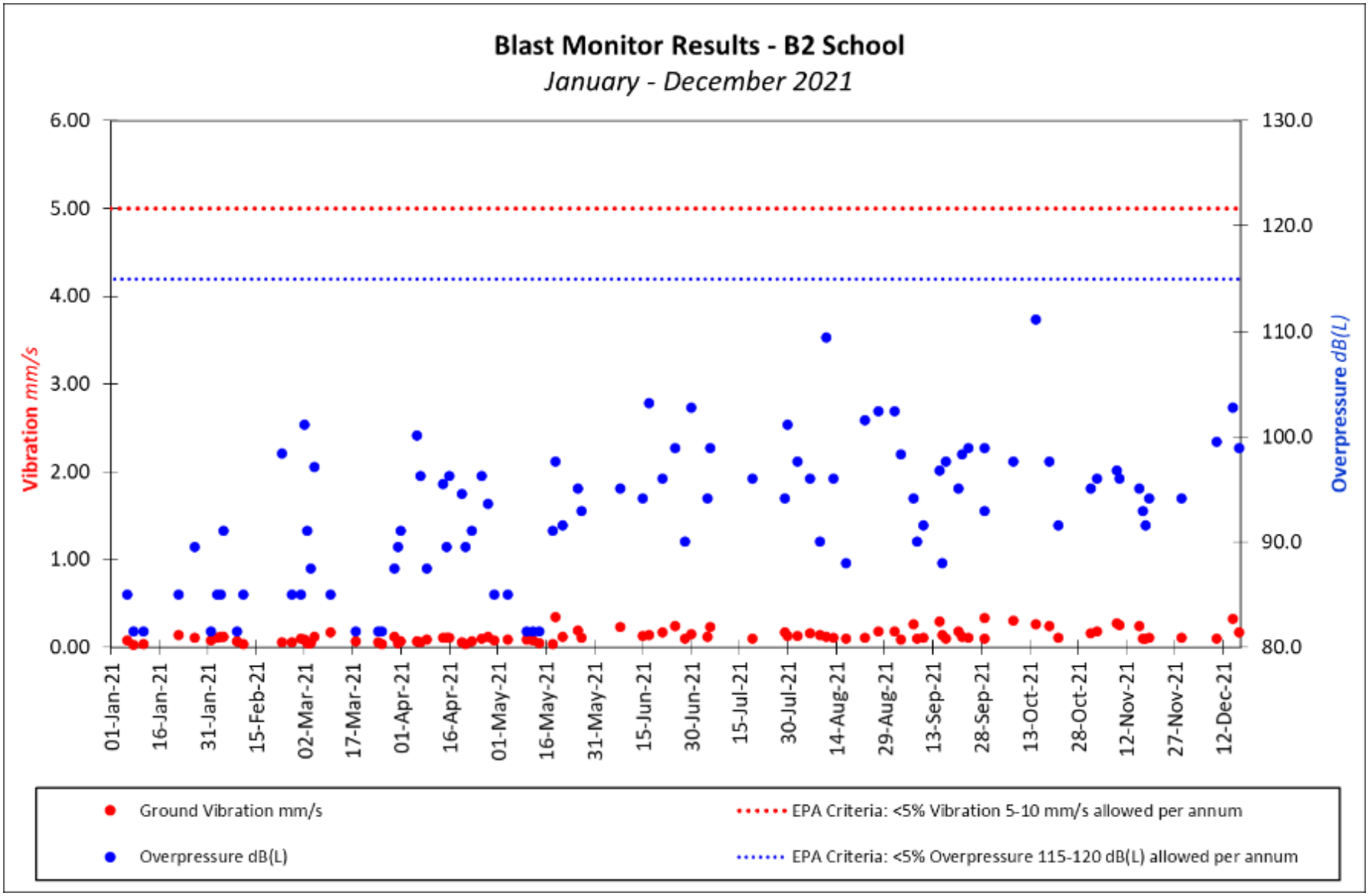


Figure 34: School Blast Monitoring Results

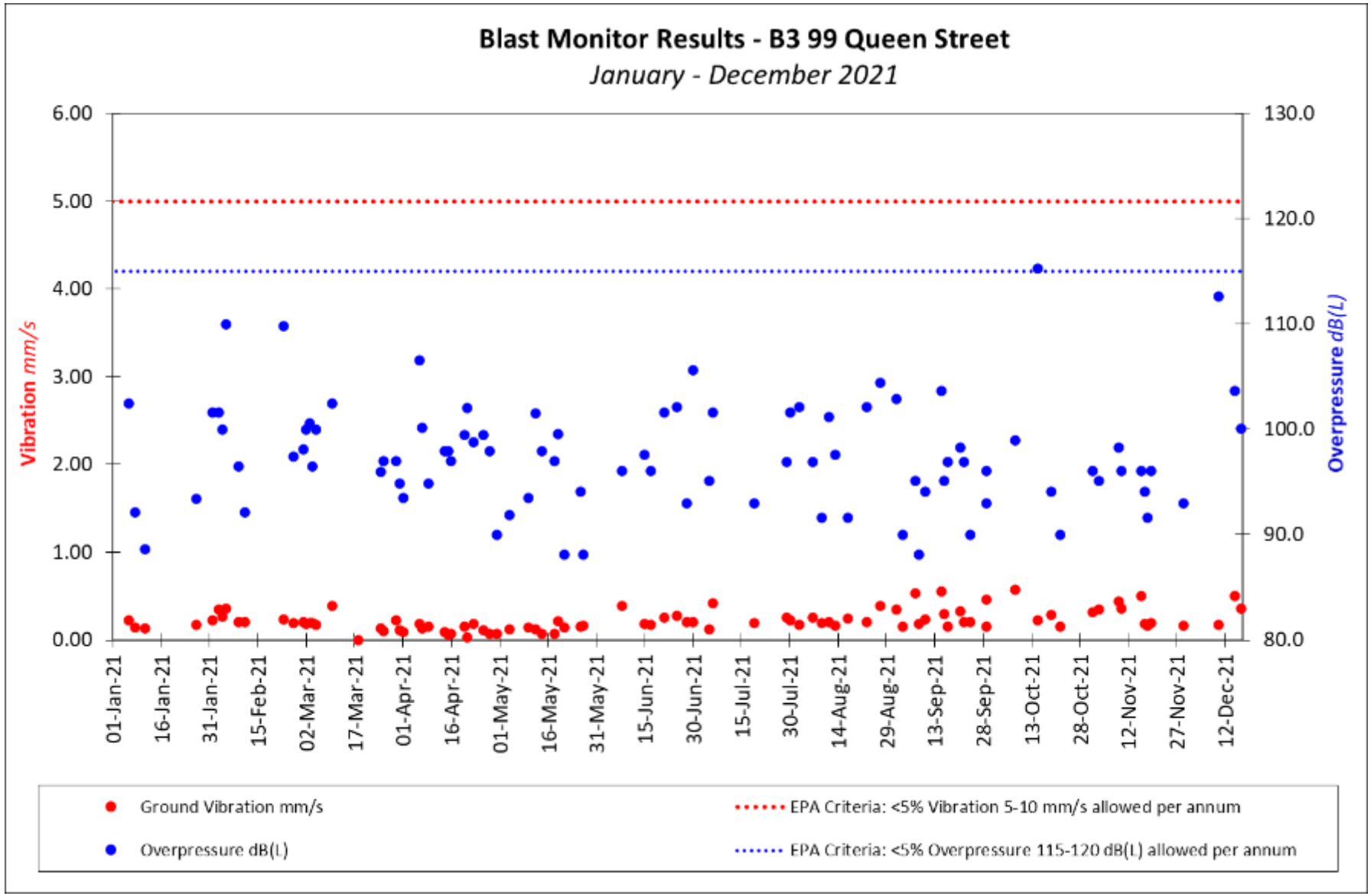


Figure 35: 99 Queen Street Blast Monitoring Results

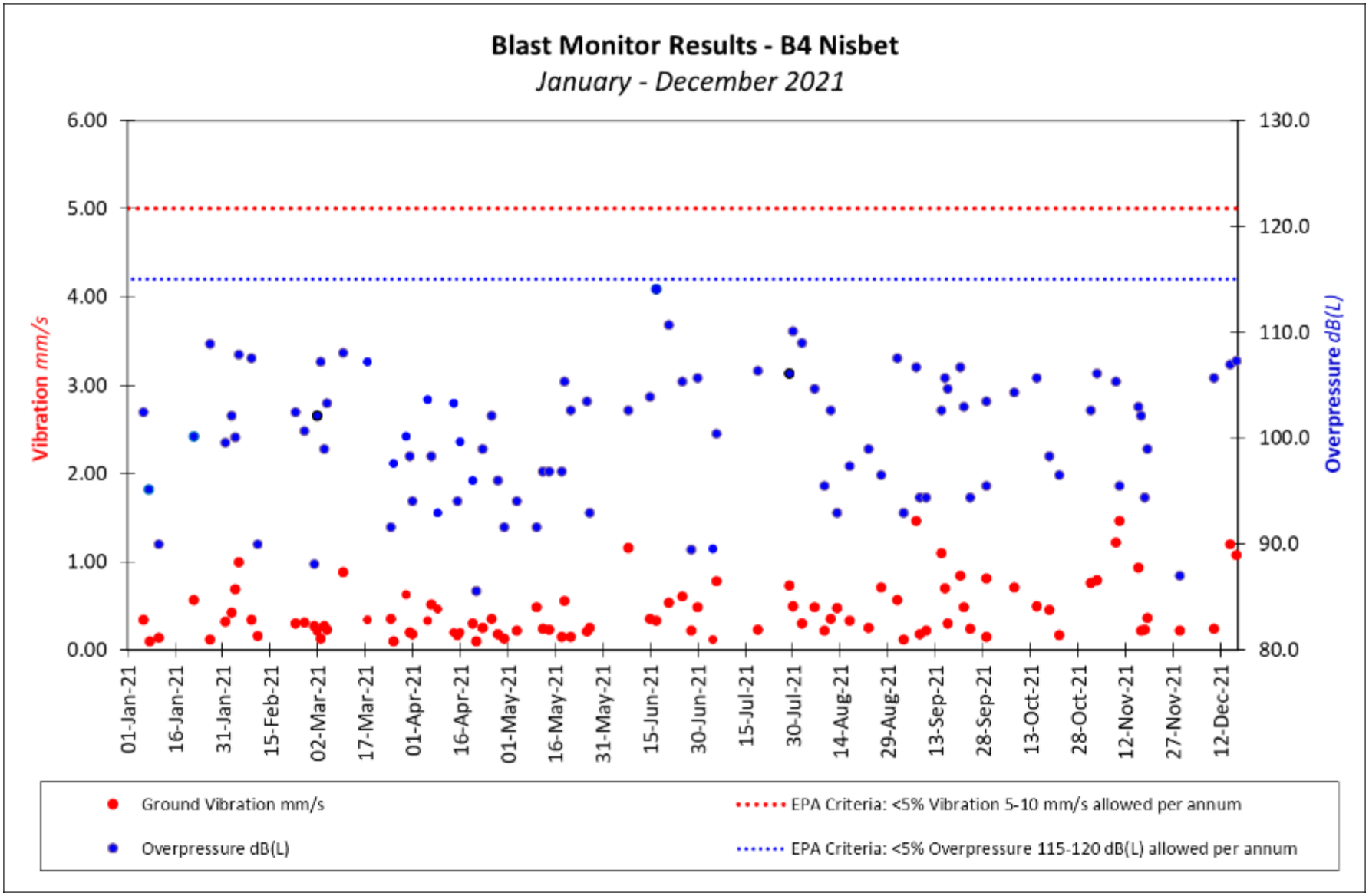


Figure 36: Nisbet Blast Monitoring Results

3.12 NOISE MANAGEMENT

3.12.1 ACTIVITIES THIS REPORTING PERIOD

During the reporting period MCC continued to operate in accordance with the approved Noise Management Plan (NMP) prepared in accordance with condition 39 of the DA. The current NMP was approved by MSC on 30 November 2020 and is available on the MCC website.

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 29** and locations are displayed in **Figure 37**.

Table 29: 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 due to:

- 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 32** and **Table 33.** The mining related noise sources were from engine noise, dozer tracks, horns, and reverse alarms.

Table 30 and **Table 31** 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 an increase in noise levels during this reporting period compared to the last reporting period.

Table 30: 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
2021	24	40	22	37	18	34	27	41	25	32
2020	27	40	24	37	22	34	25	41	26	32
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	

Table 31: 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
2021	28	37	28	33	22	31	33	40	29	32
2020	31	37	28	33	26	31	28	40	29	32
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	

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 updated following the end of mining activities to confirm the management and monitoring requirements associated with the rehabilitation of the site.

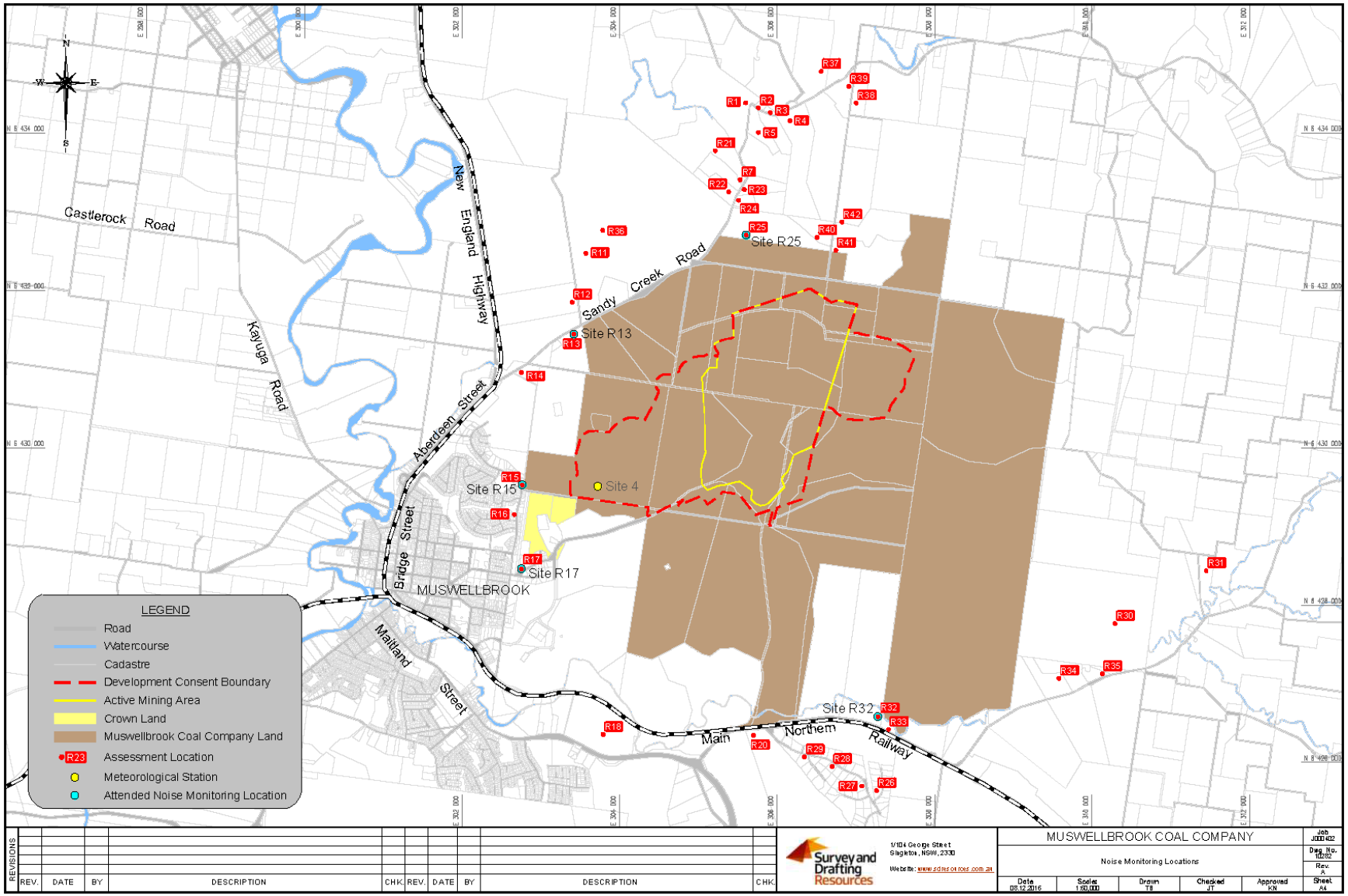


Figure 37: Noise Monitoring Locations

Table 32: 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 21	Not audible	41	<20	37	Not audible	35	<20	42	27	35
Feb 21	30	41	22	37	Not audible	35	35	42	Not audible	35
Mar 21	Not audible	41	Not audible	37	Not audible	35	25	42	33	35
Apr 21	31	41	33	37	<20	35	35	42	<20	35
May 21	37	41	33	37	<20	35	27	42	<20	35
Jun 21	<20	41	<20	37	30	35	32	42	31	35
Jul 21	<20	41	<20	37	<20	35	31	42	35	35
Aug 21	31	41	<20	37	23	35	32	42	<20	35
Sep 21	31	41	27	37	<20	35	32	42	Not audible	35
Oct 21	<20	41	Not audible	37	<20	35	Not audible	42	27	35
Nov 21	Not audible	41	<20	37	Not audible	35	<20	42	20	35
Dec 21	30	41	<20	37	Not audible	35	<20	42	<20	35

Table 33: 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 21	Not audible	25	Not audible	23	37	45
Feb 21	35	28	Not audible	43	Not audible	45
Mar 21	Not audible	Not audible	Not audible	30	39	45
Apr 21	40	38	25	41	27	45
May 21	42	41	27	36	<25	45
Jun 21	26	<25	37	38	36	45
Jul 21	28	30	25	40	41	45
Aug 21	41	30	38	40	25	45
Sep 21	41	37	26	38	Not audible	45
Oct 21	25	Not audible	27	Not audible	35	45
Nov 21	Not audible	<25	Not audible	<25	25	45
Dec 21	35	<25	Not audible	<25	<25	45

3.13 VISUAL AMENITY, LIGHTING AND LANDSCAPING

During the reporting period MCC continued to operate in accordance with the approved Visual Amenity, Lighting and Landscaping Management Plan (VALLMP) prepared in accordance with condition 22 of the DA. The current VALLMP was approved by MSC on 2 October 2020 and is available on the MCC website.

The primary objectives of the VALLMP are to implement visual reduction strategies to minimise the visual amenity, 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 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 amenity, lighting and landscaping in accordance with the VALLMP.

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. The site is fenced, and sign posted to prevent disturbance by mine personnel but is outside the area to be disturbed for mining. MCC has no ongoing requirement to protect the site post-mining. Once rehabilitation has been completed, the fencing and signage will be removed.

During the reporting period, no ground disturbance operations required consultation with Aboriginal groups.

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 approved Spontaneous Combustion Management Plan (SCMP) prepared in accordance with condition 31 of the DA. The current SCMP was approved by MSC on 30 November 2020 and is available on the MCC website.

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 action response 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.

Twelve 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 34.** A historical comparison of affected areas without active control measures is provided in **Table 35**.

Table 34: 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-21	7,652	1,032	0
Feb-21	0	360	0
Mar-21	0	360	0
Apr-21	24	3,600	8,600
May-21	728	1,800	4,900
Jun-21	1,350	5,800	22,000
Jul-21	204	5,300	6,800
Aug-21	3,500	5,600	8,700
Sep-21	50	600	700
Oct-21	240	770	2,500
Nov-21	0	4,330	4,600
Dec-21	0	1,220	2,205

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 35: Summary of Spontaneous Combustion Affected Areas Without Active Control

Total Area Affected by Spontaneous Combustion Without Active Control (m^2)											
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Jan-Mar	215	71	65	156	145	248	24	96	52	114	250
Apr-Jun	95	53	57	-	232	182	48	60	44	166	356
Jul-Sep	85	45	149	177	190	48	52	36	64	258	424
Oct-Dec	64	57	45	119	242	56	52	56	87	286	597
Yearly Average	**115**	**57**	**79**	**151**	**203**	**133**	**44**	**62**	**62**	**206**	**149**

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 sealing activities for this reporting period are shown in **Figure 38** to **Figure 39**.

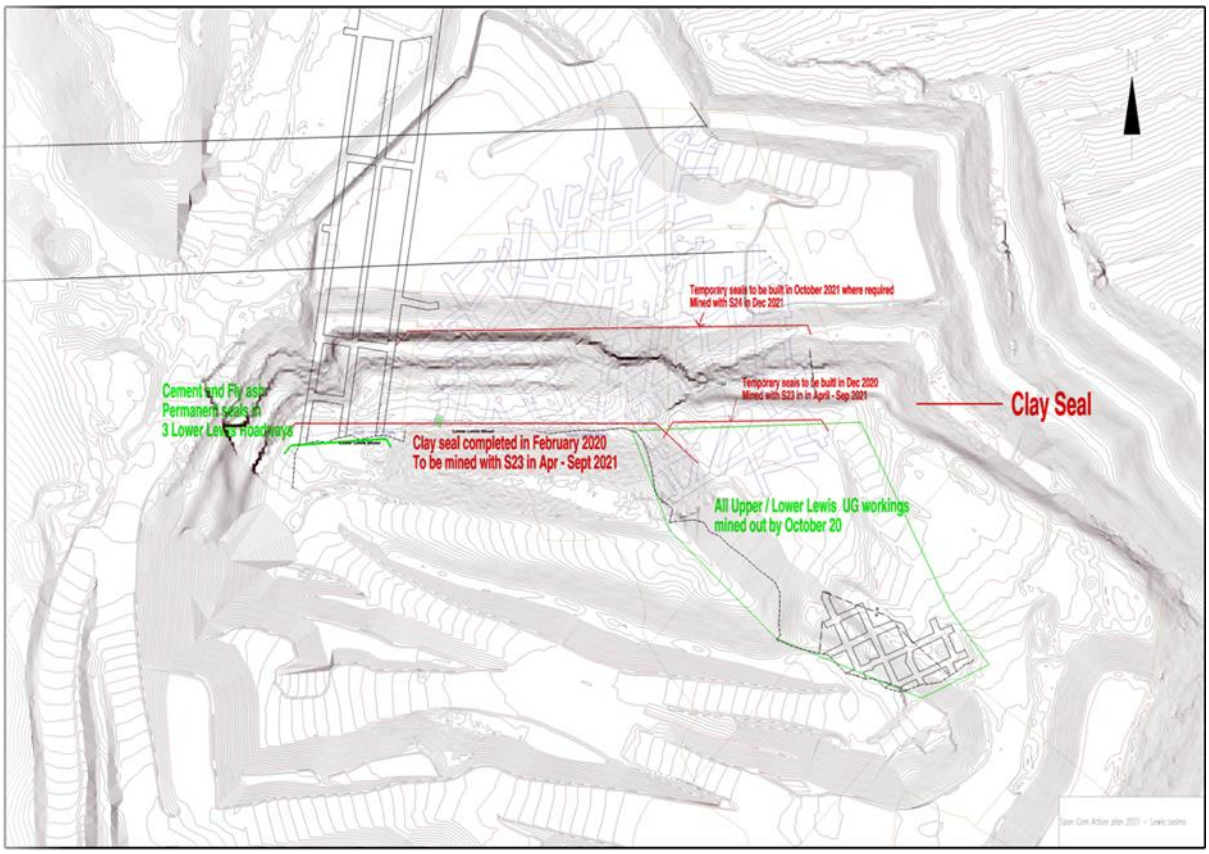


Figure 38: Proposed and Actual sealing in Lewis Workings

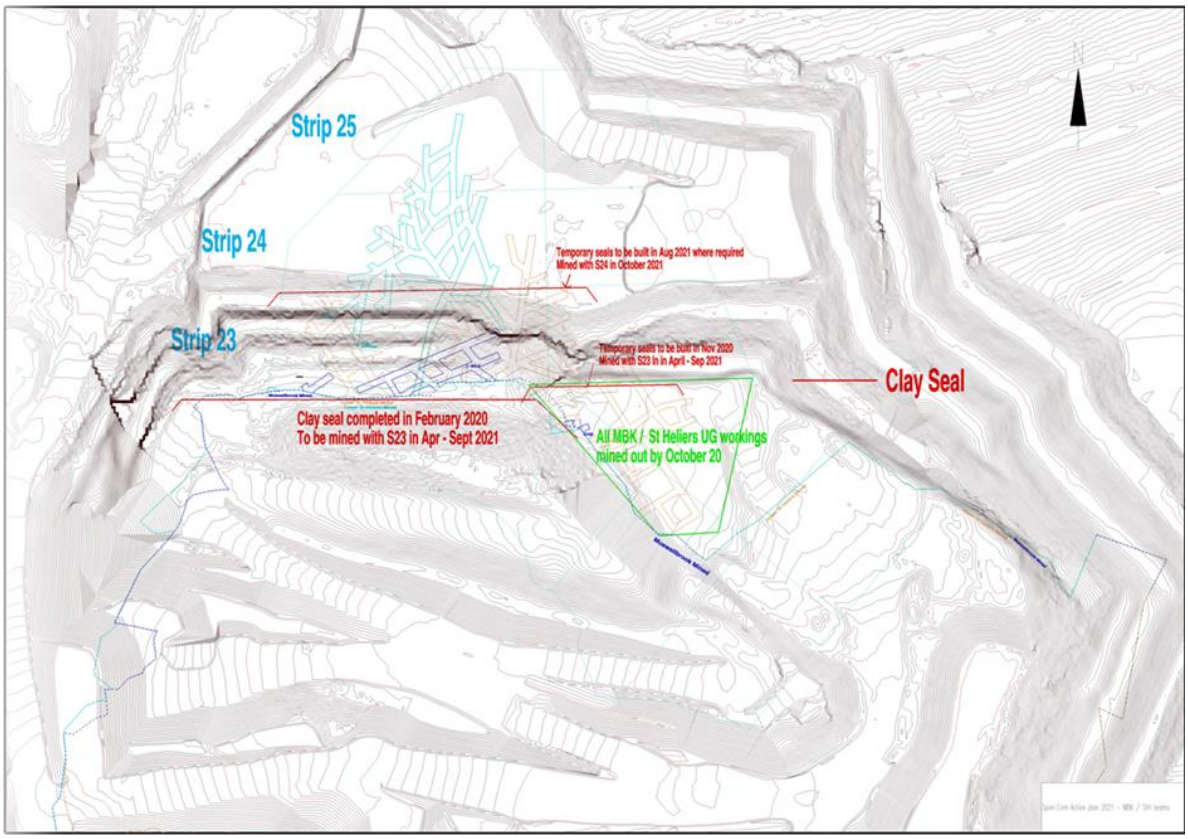


Figure 39: Proposed and Actual sealing in Muswellbrook and St Heliers Workings

The sealing activities for the reporting period happened as per the plan.

All underground workings in Strip 23 were mined out.

What Worked Well

Despite a number of impediments to best practice control, the following activity areas were managed well during the reporting period:

- Spontaneous combustion control and, where it was present, management of spontaneous combustion in overburden dumps was excellent. While this was assisted at times by higher rainfall, the control "on the ground" provided excellent results.
- The control and management of higher temperature coal was also very well managed with stockpile residence time kept very low to minimise spontaneous combustion.
- The use of fragmented rill material, together with additional water kept spontaneous combustion to a minimum even during the mining of the coal seams.
- The detailed planning, rescheduling and execution of mining to ensure that all underground workings in the old St Heliers Colliery are mined has shown the commitment of all personnel.

Figure 40: Photo of Open Cut 1 showing effective Spontaneous Combustion Management

Lessons Learnt

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

- Monitoring hole availability has continued to be an issue. Because of the ever-decreasing mining area footprint, a trade-off between mining scheduling and minimizing hot area exposure periods and providing areas and time for sampling has occurred. The positive results of this trade-off are evident in the general level of spontaneous combustion visible.
- With rapid changes in the mining plans and scheduling, quarterly updates on the annual action plan and external advice has been implemented. This has proven to be effective and proactive.

3.16.2 ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will continue to manage spontaneous combustion in accordance with the SCMP. During the next reporting period, activities will be centred around long-term spontaneous combustion management. To this end the following are planned or in place:

- Ample water reserves are in place with spare capacity.

- A continuation of external advice will occur.
- With much smaller work areas and few underground mining horizons, exposure and mining of some coal seams within the incubation period of the coal is a viable option.
- Mining of all underground workings present in Open Cut 1 except for the No.2 Underground Lower Lewis Seam workings, will be the main focus of coal recovery. This will include the sealing of any exposed Lower Lewis Seam roadways.

The SCMP will be updated following the end of mining activities to confirm the management and monitoring requirements associated with the rehabilitation of the site.

3.17 BUSHFIRE

Management of bushfire risks are undertaken in accordance with the approved Bushfire Management Plan (BFMP) prepared in accordance with condition 23 of the DA. The current BFMP was approved by MSC on 30 November 2020 and is available on the MCC website.

The objectives of the Bushfire Management Plan are:

- To manage activities on site 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. Annual inspections are conducted of the access tracks and powerline easements. These are slashed regularly to maintain access and reduce fuel loads. Weeds are sprayed in asset protection zones around all infrastructure, including buildings, electrical infrastructure and explosives storage facilities.

The Emergency Response Team undertake firefighting training on a regular basis.

During the next reporting period the BFMP will be updated following the end of mining activities to confirm the management requirements associated with the rehabilitation of the site.

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.
- Hydrocarbon spills are internally reported and recorded.

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 a 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.

14 complaints were received during the reporting period. More details on the complaints are provided in **Appendix 4**. **Table 36** and **Figure 41** provide a summary of the complaints received during the reporting period.

Table 36: Summary of Complaints

Type of Complaint	Number	Percentage
Odour	7	50.0%
Dust	1	7.1%
Blast	5	35.8%
Visual	1	7.1%
Total	**14**	**100%**

In comparison to 2020, there has been a decrease in the number of complaints received during this reporting period. The complaint history chart is shown in **Figure 42**. In comparison to the last reporting period, there has been a significant decrease in the number of odour related complaints (7 for this reporting period compared to 13 for the previous reporting period).

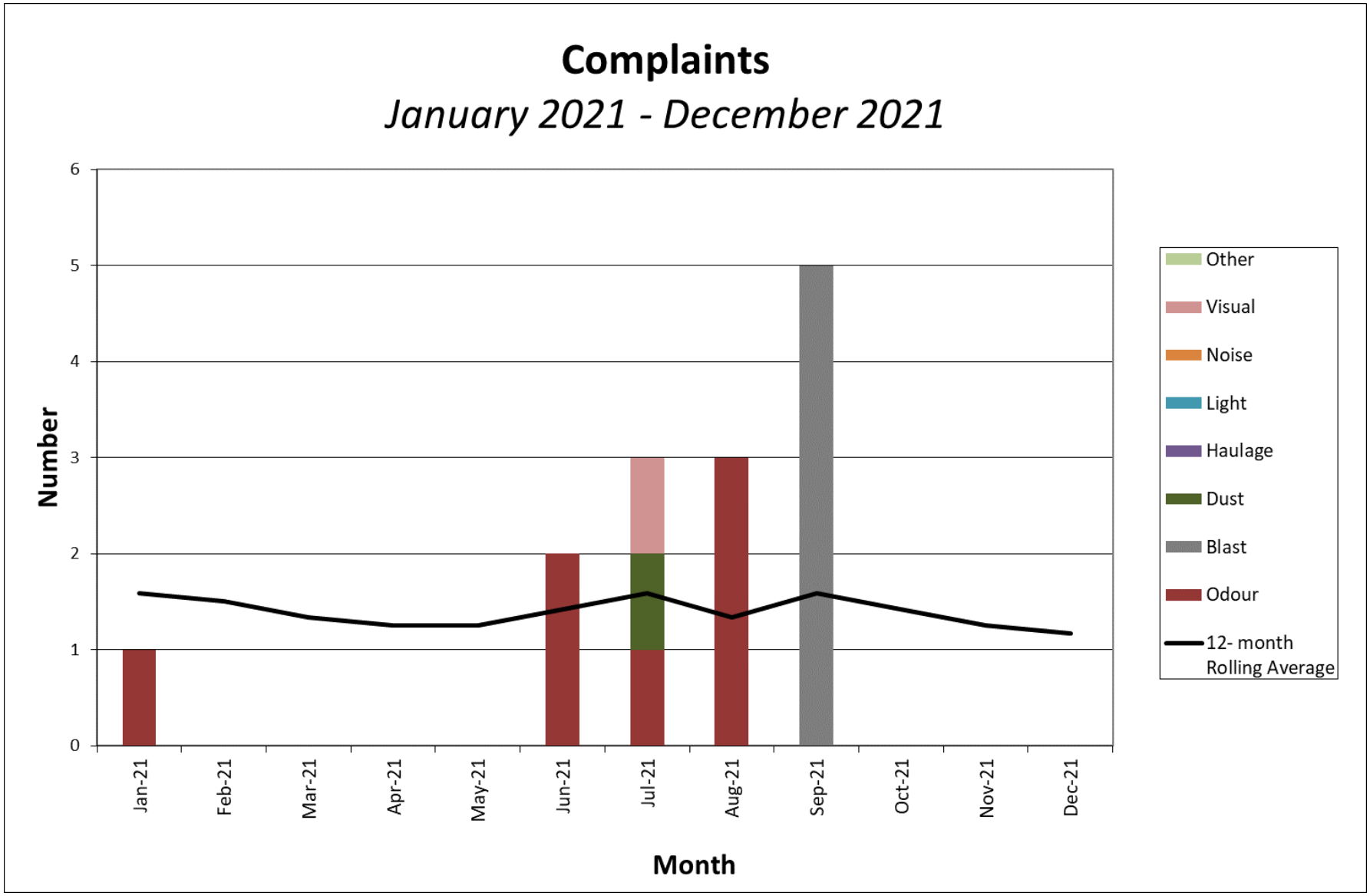


Figure 41: Complaint Summary

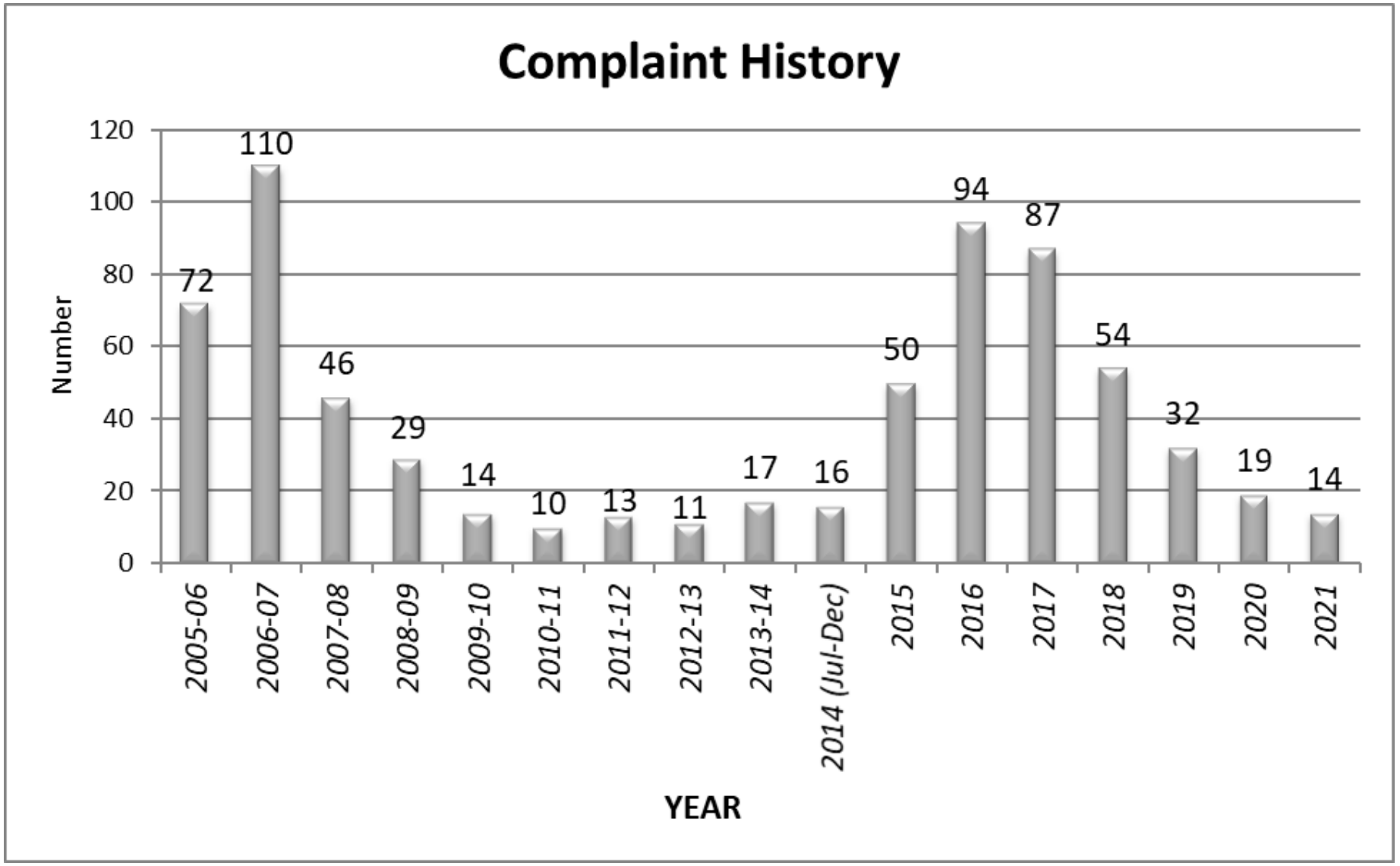


Figure 42: Complaint History

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:

- Wybong Wild Dog Association – assistance with regional dog baiting program
- Special Children's Christmas Party – supporting local children
- Upper Hunter Regional Museum – Regional Museum Project sponsorship
- Muswellbrook Race Club – annual sponsorship
- Weston Workers Bears Football Club – sponsorship local sports club

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 and two MCC representatives. The member from the Wanaruah Local Aboriginal Lands Council has not attended a meeting during the reporting period. MCC have attempted to make contact to determine the status of this member.

During the reporting period meetings were held on 8 June 2021 and 7 December 2021 in the MCC board room. 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 conducted in accordance with the design requirements outlined in the MOP.
- Rock raking to remove large 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 native 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. Rehabilitation planning for MCC includes the incorporation of native vegetation areas to develop the habitat 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 did not complete any new rehabilitation. This was in accordance with the approved MOP. The focus for the period was on shaping of rehabilitation areas in Open Cut 2 (OC2) in preparation for installation of water management structures and rehabilitation completion during the next reporting period. Several rehabilitation areas were also identified and targeted for maintenance during the reporting period.

These activities included:

- Planting 250 trees on approximately 8Ha adjacent to the heavy vehicle park-up area.
- Stripping of *Acacia saligna* from approximately 6.5Ha in OC2.
- Stripping of African Lovegrass from approximately 3.8Ha on Orica Dump.
- Digging test pits in an area subject to spontaneous combustion of approximately 1.3Ha on Orica Dump.
- Spreading clay on 3.8Ha of Orica Dump.
- Ripping of bare patches approximately 2.8Ha in western rehabilitation areas.
- Repair of contour banks and erosion rill in Void 3 (Council Void).
- MWOO (OGM) stockpile locations were ripped and seeded with pasture (approximately 1.4Ha).
- Weed and feral animal control (discussed further in **Section 3.10**).

The pasture seed mix used in the rehabilitation is shown in **Table 37**. Species sowing rates and cover crops are adjusted based on sowing in warm or cool months. Diammonium phosphate (DAP) fertiliser is spread with pasture seed at a rate of approximately 100 kg/ha. This rate may be varied depending on the results of soil testing or based on the availability of nutrients from other sources (e.g. organic matter).

Table 37: Pasture Seed Mix Used in Rehabilitation

Species	Autumn/Winter Sowing	Spring/Summer Sowing
	Rate (kg/ha)	Rate (kg/ha)
Megathyrsus maximus (Green Panic)	1	3
Digitaria eriantha (Digit Grass)	0	3
Setaria sphacelata (Setaria)	1	2
Cynodon dactylon (Couch)	2	2
Cenchrus clandestinus (Kikuyu)	1	3
Medicago sativa (Lucerne)	5	3
Trifolium repens (White Clover)	3	2
Medic sp.	4	2
Trifolium subterraneum (Subterranean Clover)	3	0
Festuca arundinacea (Tall Fescue)	4	0
Phalaris aquatic (Phalaris)	3	0
Dactylis glomerata (Cocksfoot)	4	2 (Spring only)
Vicia villosa (Woolly Pod vetch)	5	0
Cover Crops		
Avena sativa (Oats)	20	0
Echinochloa esculenta (Japanese Millet)	0	6

No native seed was spread during the reporting period.

The native seed mix was expanded considerably during the previous reporting period, in consultation with a new seed supplier. The purpose of this expansion is to increase diversity on the rehabilitation areas by seeding a broader range of species. Representatives of groundcover, mid-storey and canopy species were chosen based on presence in the area (based on monitoring records including Biodiversity Offset monitoring), subjective success on rehabilitation and availability of seed. Key species from Central Hunter Grey Box Ironbark Woodland and Central Hunter Ironbark Spotted Gum Grey Box Woodland were selected for the broadest mix of representative species consistent with MOP objectives and including the specific species listed in the DA. The species mix may be further refined, based on successful species establishment on MCC rehabilitation areas over the next 3-5 years. This process is intended to increase germination and establishment of native species on rehabilitation areas by selecting endemic species that are suited to conditions onsite.

Previous rehabilitation reviews have recommended the planting of tube stock in areas where there has been dieback of vegetation. MCC planted 250 trees on the rehabilitation area adjacent to the heavy vehicle park-up area during this reporting period (as reported in the 2020 AEMR). Monitoring of these trees has indicated a high mortality rate despite the favourable (high rainfall) climatic conditions since planting. The relatively high cost of planting compared to direct seeding and the increased diversity in seeded areas compared to planted has resulted in MCC favouring direct seeding over tree planting for establishment of native trees on rehabilitation.

Table 38: 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**	**1858**	**1858**
B	**DISTURBED AREAS**				
	B1	**Infrastructure Area**	48.2	47.6	48.2
	B2	**Active Mining Area** (excluding items B3-B5 below)	58.5	71.0	0.0
	B3	**Waste Emplacements** (active/unshaped/in or out-of-pit)	96.8	118.9	111.9
	B4	**Tailing Emplacements** (active/unshaped/uncapped)	0.0	0.0	0.0
	B5	**Shaped Waste Emplacement** (awaits final vegetation)	38.6	3.8	82.0
	B6	**Temporary Stabilisation** (vegetation area for dust control)	18.0	15.9	18.0
	ALL DISTURBED AREAS		**260.1**	**257.2**	**260.1**
C	**REHABILITATION PROGRESS**				
	C1	**Total Rehabilitation Area** (except for maintenance)	**340.7**	**351.0**	**440.0**
D	**REHABILITATION ON SLOPES**				
	D1	**10 to 18 degrees**	123.3	55.4	159.6
	D2	**Greater than 18 degrees**	7.0	0.0	21.0
E	**SURFACE OF REHABILITATED LAND**				
	E1	**Pasture and grasses**	227.6	264.2	231.6
	E2	**Native forest/ecosystems**	112.4	96.8	170.4
	E3	**Plantation and crops**	0.0	0.0	0.0
	E4	**Other** (include non-vegetative outcomes)	0.0	0.0	38.0
F	**DE-HAB -** *disturbed areas previously rehabilitated, figures reflected in Section E*				
	F1	**Pasture and grasses**	3.8	0.0	0.0
	F2	**Native forest/ecosystems**	6.5	3.2	0.0
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

The rehabilitation and maintenance summary for the reporting period can be found in **Table 38** and **Table 39**. The figures in **Table 38** were reviewed this year, resulting in a change to the classification of some areas. The increase in the infrastructure area resulted from the addition of a section of the east haul road to this category. Not from an increase in the actual footprint of the site infrastructure. Disturbed and rehabilitated areas are shown in **Figure 2**.

Rehabilitation on slopes categories have also been recalculated using recent LIDAR data. This change to the methodology resulted in approximately 7Ha of historical rehab being identified as greater than 18 degrees. Most areas in this category are associated with water management structures. The 10 to 18 degrees category also increased significantly due to the updated methodology. These changes are administrative and do not impact rehabilitation outcomes.

Surface of rehabilitated land categories have been updated to reflect changes made to the MOP during the development of the RMP. Whilst the overall objective of 50/50 pasture to woodland remains, the location of these areas on the ground have been reviewed to make them more cohesive and less fragmented across the landscape. This is expected to improve outcomes for pasture accessibility and habitat connectivity. Further work is underway to account for future infrastructure including the Muswellbrook Bypass. This will be outlined in the RMP when it is released during the next reporting period.

Table 39: 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)	0.1	0.0	Repair erosion and remove sediment build-up in contour banks – approx. 60m
Re-covering (detail - further topsoil, subsoil sealing etc.)	3.8	0.0	Clay was added to a 3.8Ha area.
Soil Treatment (detail - fertiliser, lime gypsum etc.)	1.4	0.0	Fertiliser added 1.4Ha (re-seeded pasture area)
Treatment / Management (detail - grazing, cropping, slashing)	6.5	0.0	Stripping Acacia saligna
Re-seeding / Replanting (detail - species density, season etc.)	1.4	0.0	1.4Ha re-seeded pasture mix
Adversely Affected by Weeds (detail – type and treatment)	Unknown	Unknown	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 Trapping program

5.2.3 REHABILITATION ACTIVITIES NEXT REPORTING PERIOD

During the next reporting period MCC will complete 89Ha of new rehabilitation in accordance with the approved MOP. The focus for 2022 will be to complete shaping all of the area in OC2 and install surface water management structures (drop structure and contour banks) as shown in **Figure 43**. The rehabilitation of OC2 will be completed in 2022 with a combination of pasture and trees. Contour drains and drop structures will be established to design.

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. The work will include weed control, pest and feral animal control, and reseeding in areas where vegetation is not meeting or progressing towards completion criteria.

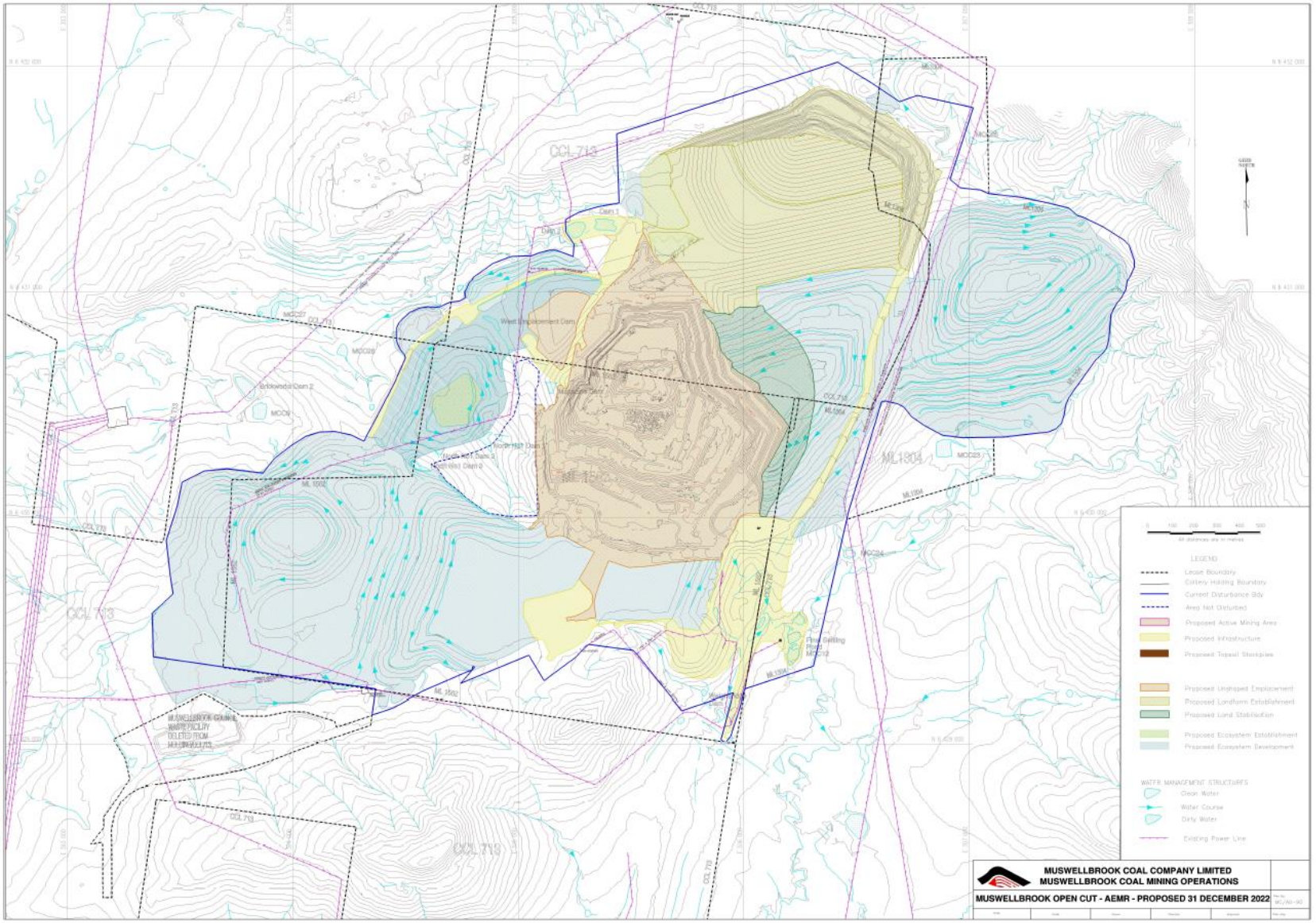


Figure 43: Proposed Activities Next Reporting Period

5.3 REHABILITATION MONITORING

5.3.1 SITE SELECTION

Eco Logical Australia were engaged to undertake rehabilitation monitoring for the 2021 reporting period. The below data is presented in their report Muswellbrook Coal 2021 Rehabilitation Monitoring Report (ELA, 2022).

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. Monitoring was undertaken between 20-24 September 2021.

Within the woodland sites, three analogue sites are 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 are 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 46 indicates the location of the flora monitoring sites and **Figure 47** indicates where fauna monitoring equipment has been set up.

5.4 FLORA MONITORING RESULTS

To demonstrate compliance with the completion criteria indicated in the MOP for, monitoring survey results were 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 44**. The average number of native species present within the rehabilitation woodland sites is just above half (18) that of native species present across the analogue woodland sites (35).

Figure 44: Comparison of Average Native Species Richness at Woodland Sites

The total Projected Foliage Cover (PFC) at each of the rehabilitation woodland sites has been calculated and compared against the Ecosystem and Land Use Establishment Phase completion criteria (>70%) presented in **Figure 45.** Only RW4 was below the completion criteria requirement in 2021. The total PFC recorded at rehabilitation sites ranged from 98% (at RW6) to 63% (at RW4). In comparison the total PFC recorded at analogue woodland sites ranged from 97% (at RWoodNew2) to 92.5% (at RWoodNew1).

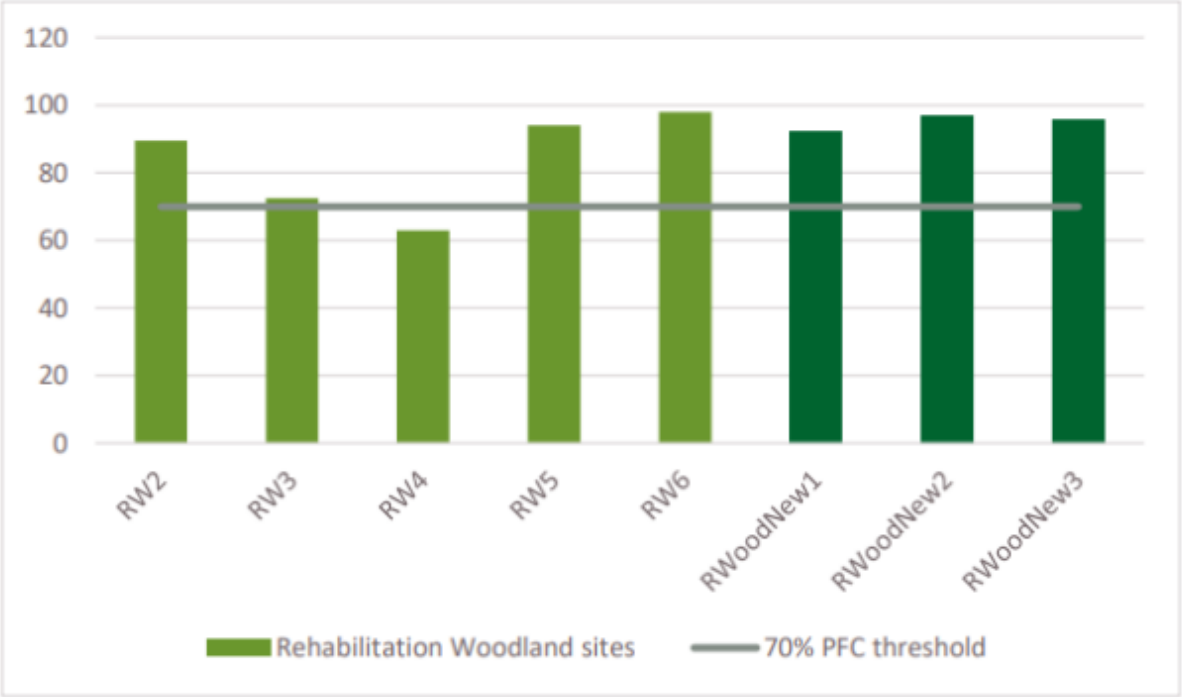


Figure 45: Total Projected Foliage Cover at Rehabilitation Woodland Sites

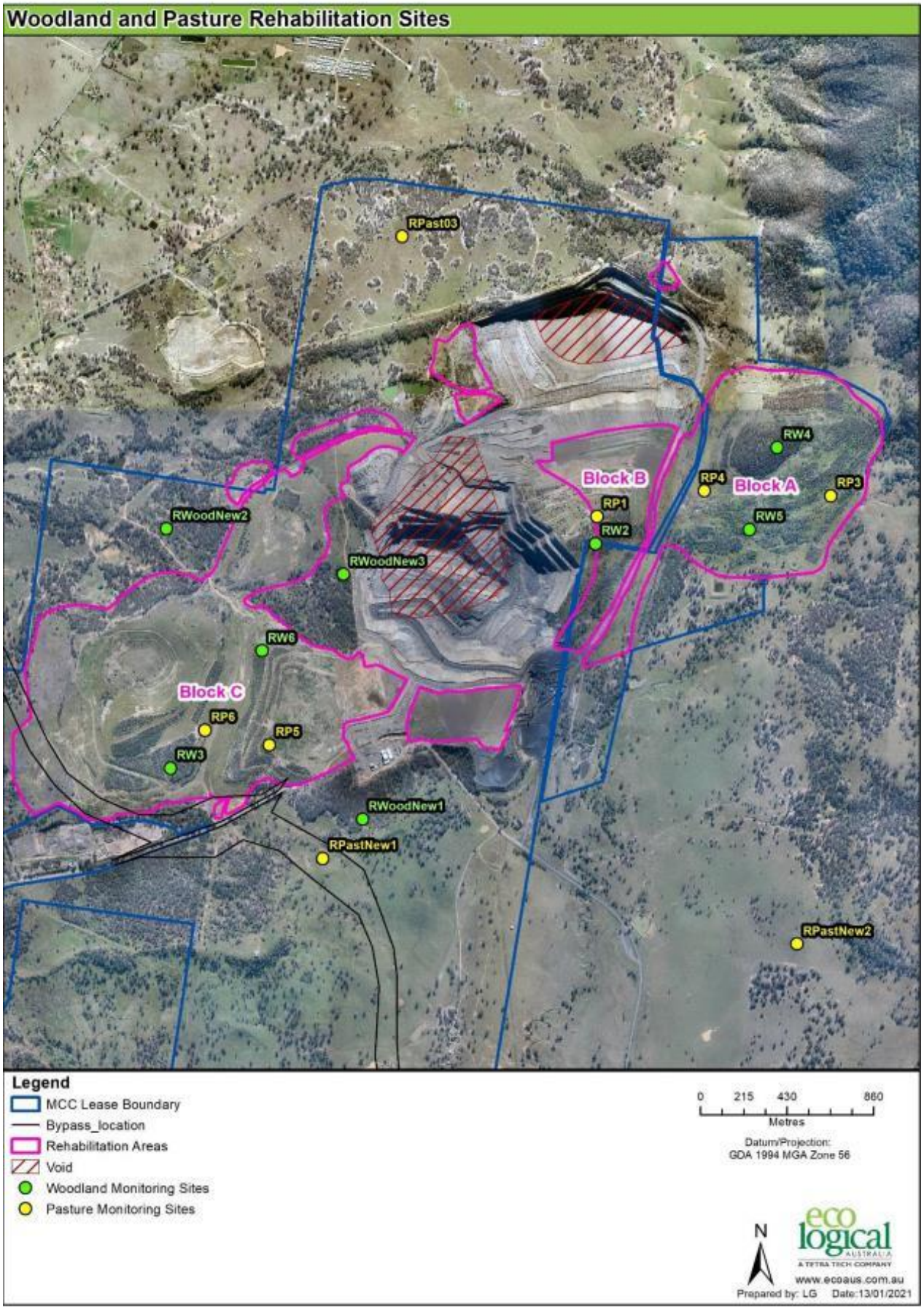


Figure 46: Rehabilitation Monitoring Program – Flora Sites

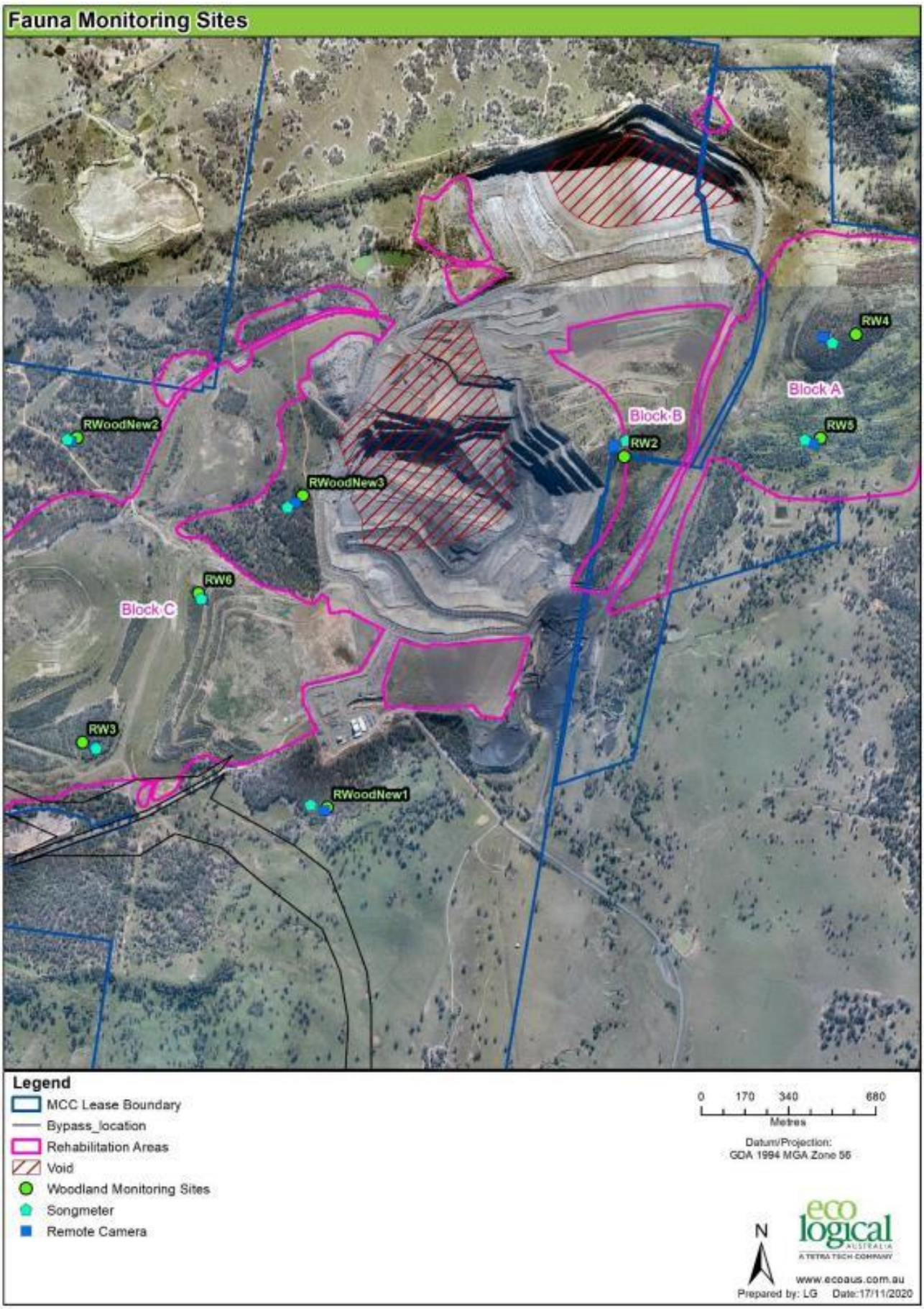


Figure 47: Rehabilitation Monitoring Program – Fauna Sites

The average weed species present at rehabilitation woodland sites was three times higher than at analogue woodland sites. Rehabilitation woodland sites comprised an average of 13 weed species and analogue woodland sites comprised and average of four weed species. (**Figure 48**).

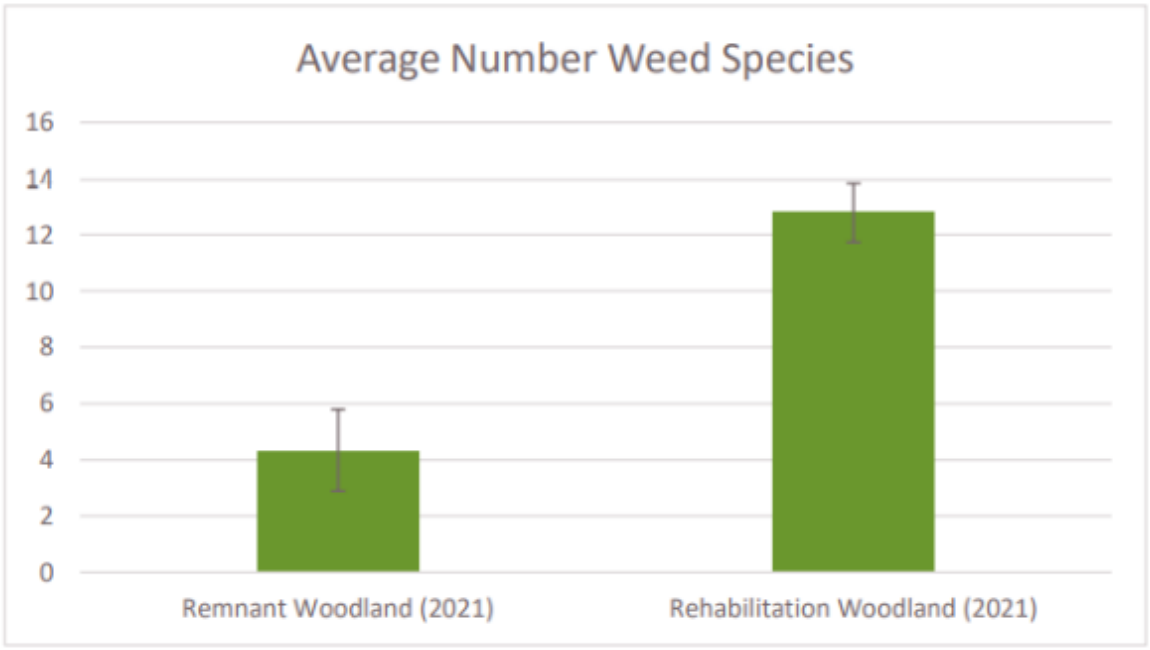


Figure 48: Comparison of Average Number of Weed Species at Woodland Sites

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 analogue woodland sites (**Figure 49**). Exotic plant cover, litter and bare ground was also recorded and provides a comparison between analogue and rehabilitation woodland sites.

The analogue and rehabilitation woodland sites had comparable average over-storey cover, shrub cover and native 'other' cover, and rehabilitation woodland sites had almost double the amount of litter cover and slightly less bare ground than analogue Woodland sites. The high ground cover is valuable for erosion protection. However, the native grass cover percentages at analogue sites was double that of Rehabilitation sites and analogue woodland sites also had considerably less exotic cover at almost four times less than rehabilitation sites.

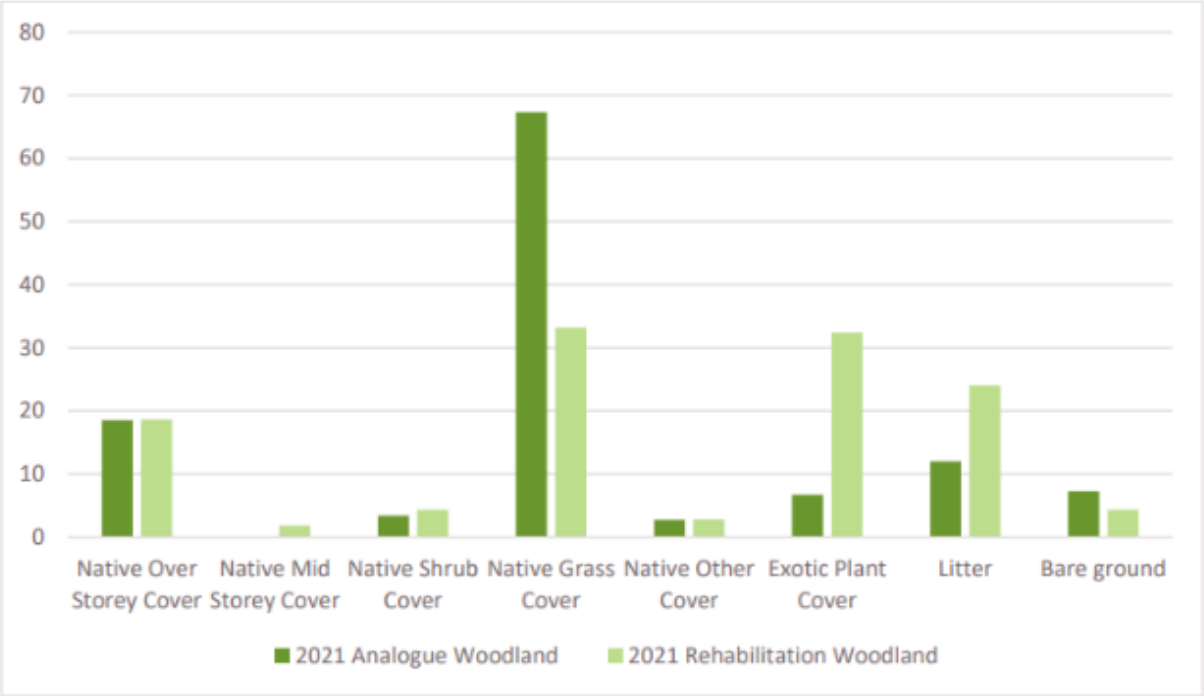


Figure 49: Biometric Data Averages

5.4.3 CARRYING CAPACITY

The MOP refers to estimated carrying capacities on MCC's rehabilitation areas. However, for the majority of rehabilitation pasture sites, the pasture types listed only partially align with those encountered. Therefore, the best fit in terms of species composition and treatment type has been selected to estimate the carrying capacity in rehabilitated areas. 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. The 2021 monitoring results indicate 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 – moderate fertility.

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. The results in **Table 40** show that using pasture type as a guide, all three analogue pasture sites and RP6 have an estimated carrying capacity of 1.3 head per hectare; RP1, RP3 and RP4 have a carrying capacity of 1.1 head per hectare; and RP5 has a carrying capacity of 0.5 head per hectare.

Table 40: Estimated Carrying Capacity for Analogue and Rehabilitation Pasture Sites

Sites	Pasture Type	Range (DSE/ha)	Estimated Value (DSE/ha)	Estimated carrying capacity (450kg dry stock)
RPastNew1	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	1.3 cow per 1 ha
RPastNew2	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	1.3 cow per 1 ha
RPast03	Native semi-improved - high fertility (clover + fertiliser added)	3.8-8.0	8	1.3 cow per 1 ha
RP1	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	1.1 cow per 1 ha
RP3	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	1.1 cow per 1 ha
RP4	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	7	1.1 cow per 1 ha
RP5	Native unimproved – moderate fertility (dominated by undesirable pasture yet native species *Erodium crinitum*)	1.5-4.0	3	0.5 cow per 1 ha
RP6	Improved pasture – moderate fertility (tropical grasses, clover + fertiliser)	7.0-10.0	8	1.3 cow per 1 ha

5.4.4 HERBAGE MASS

Data collected for the analogue pasture sites is presented in **Table 41**. Data collected for rehabilitation pasture sites is presented in **Table 42**. The collection of this data will enable future comparative analysis into the standing biomass of the analogue and rehabilitation pasture sites.

Table 41: Analogue Pasture Herbage Mass Sampling (2021 Data Average)

Component	RPastNew1	RPastNew2	RPast03
A: Cover (%) - percentage of total pasture cover (living and dead)	100%	100%	95.5%
B: Percentage cover of live native plants	68%	84.5%	66%
C: Percentage cover of live non-native plants	32%	15%	30%
D: Pasture height (cm)	12.5	10	7.5
Estimate of herbage mass (kg DM/ha) (based on Meat and Livestock Australia Pasture Ruler)	2650	2290	1810

Table 42: Rehabilitation Pasture Herbage Mass (2021 Data Average)

Component	RP1	RP3	RP4	RP5	RP6
A: Cover (%) - percentage of total pasture cover (living and dead)	92%	100%	71%	82%	89%
B: Percentage cover of live native (desirable*)plants	76%	77%	50%	67%	60%
C: Percentage cover of live non-native plants	20%	23%	21%	13%	25%
D: Pasture height (cm)	6	9	5.5	6	10
Estimate of herbage mass (kg DM/ha) (based on Meat and Livestock Australia Pasture Ruler)	1610	2145	1480	1600	2260

**Desirable encompasses native and desirable 'pasture species' as not all pasture species are native. This includes those species planted at the time of seeding e.g. Chloris gayana*

Herbage mass was generally high across both the analogue and rehabilitation pasture sites for this reporting period. Herbage mass at analogue pasture sites ranged from 1810 to 2350 kg DM/ha with a median of 2250 kg DM/ha. The herbage mass across rehabilitation sites showed wider range with 1480 kg DM/ha at RP4 to 2260 kg DM/ha at RP6, with the average at 1820 kg DM/ha. This data is considered to be a better reflection of potential productivity on rehabilitation areas than suggested by the estimates in **Table 40**.

The herbage mass for each of the analogue and rehabilitation sites is presented in **Figure 50** below and shows that all analogue and rehabilitation sites are above the minimum required for sustainable grazing.

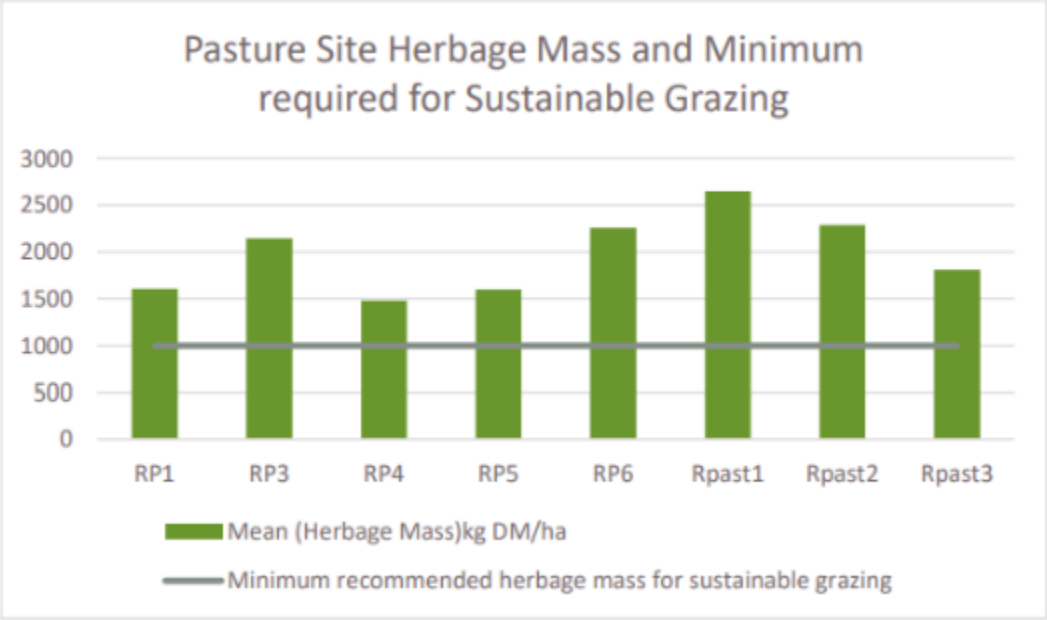


Figure 50: Pasture Site Herbage Mass (kg DM/ha) and Minimum Required for Sustainable Grazing

5.4.5 PASTURE QUALITY

Pasture quality has been qualitatively assessed by estimating the digestible percentage using the graph shown in **Figure 51** (sourced from the MOP (MCC, 2017)). The three analogue pasture sites and rehabilitation pasture sites RP1, RP3, RP4 and RP6 fall within the 'Moderate Production' range.

Rehabilitation pasture site RP5 is considered to fall within 'Maintain dry stock' range due to the lesser amount of suitable forage species present.

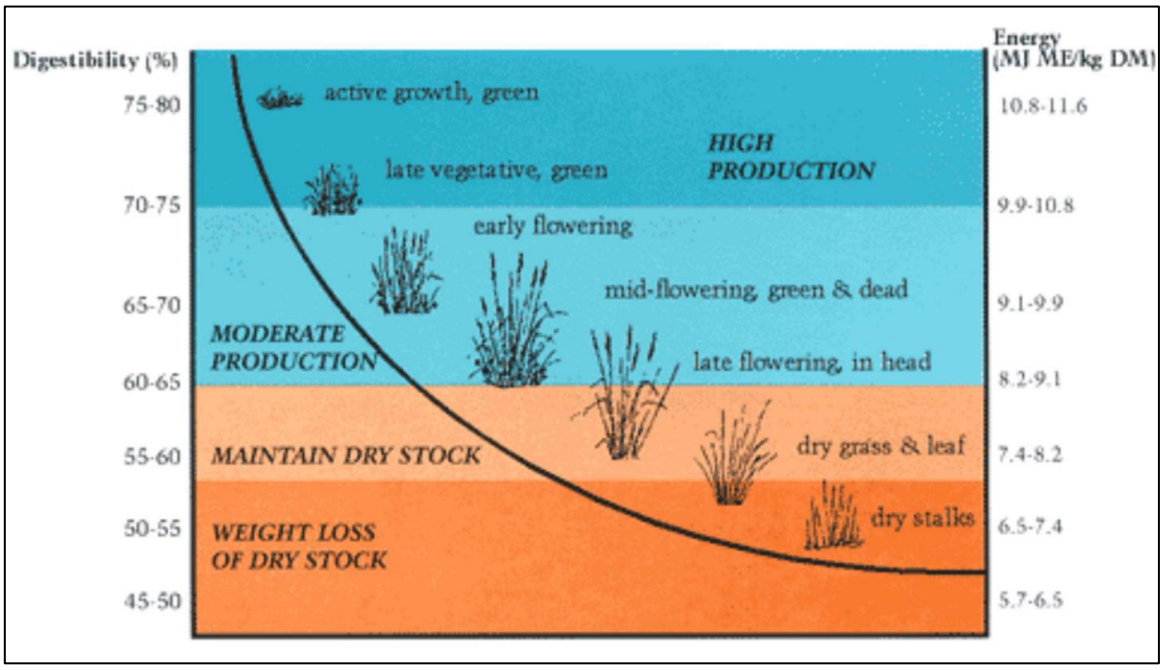


Figure 51: A Guide to Digestibility Percentage in Temperate Pasture Mixes

5.4.6 PASTURE SPECIES RICHNESS

The average number of native/desirable pasture species has been compared between analogue and rehabilitation pasture sites (**Figure 52**). The average number of native/desirable species present within the rehabilitation pasture sites for this reporting period is just under half (7) that of native/desirable species present across the analogue pasture sites (16).

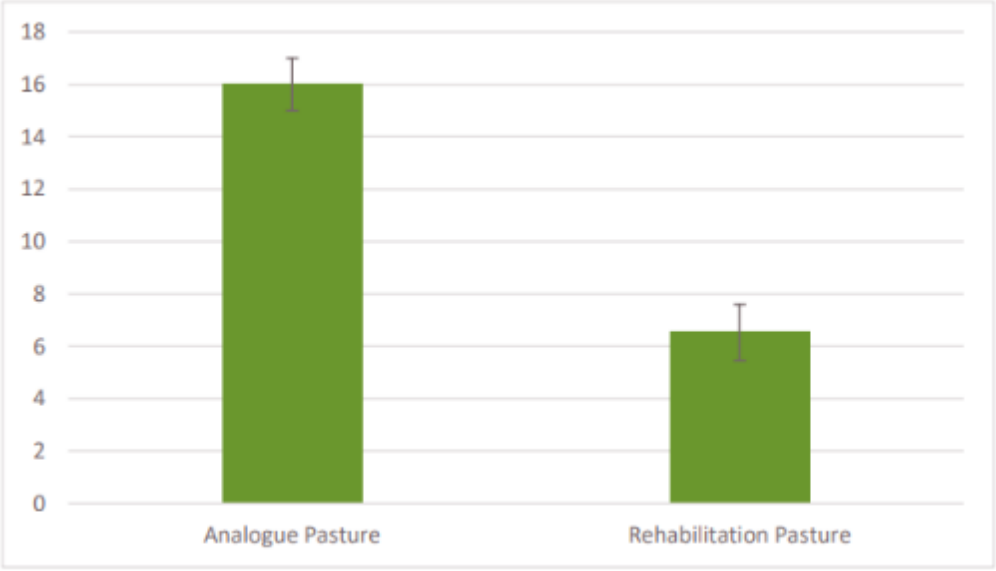


Figure 52: Comparison Between Analogue and Rehabilitation Pasture Sites for Average Native/Desirable Species

The total Projected Foliage Cover (PFC) at each of the rehabilitation pasture sites has been calculated and compared against the Ecosystem and Land Use Establishment Phase completion criteria from the MOP (>70%) **Figure 53**. The data shows that PFC was comparable between rehabilitation sites RP1,

RP3, RP5 and RP6 and the analogue pasture sites. The results from RP4 were below the average, however they met the 70% PFC completion criterion.

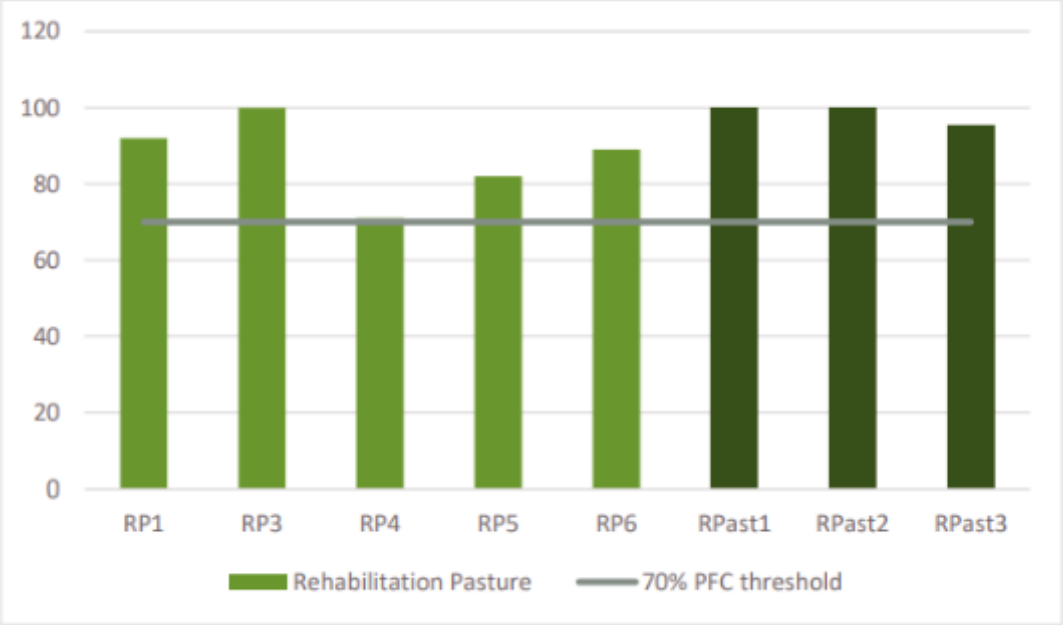


Figure 53: Total Projected Foliage Cover at Analogue and Rehabilitation Pasture Sites in 2021

The average number of weed species has been compared between analogue and rehabilitation pasture sites (**Figure 54**). The average weed species present at both analogue and rehabilitation pasture sites was similar with analogue pasture sites comprising 12 weed species and rehabilitation pasture sites comprising 10 species.

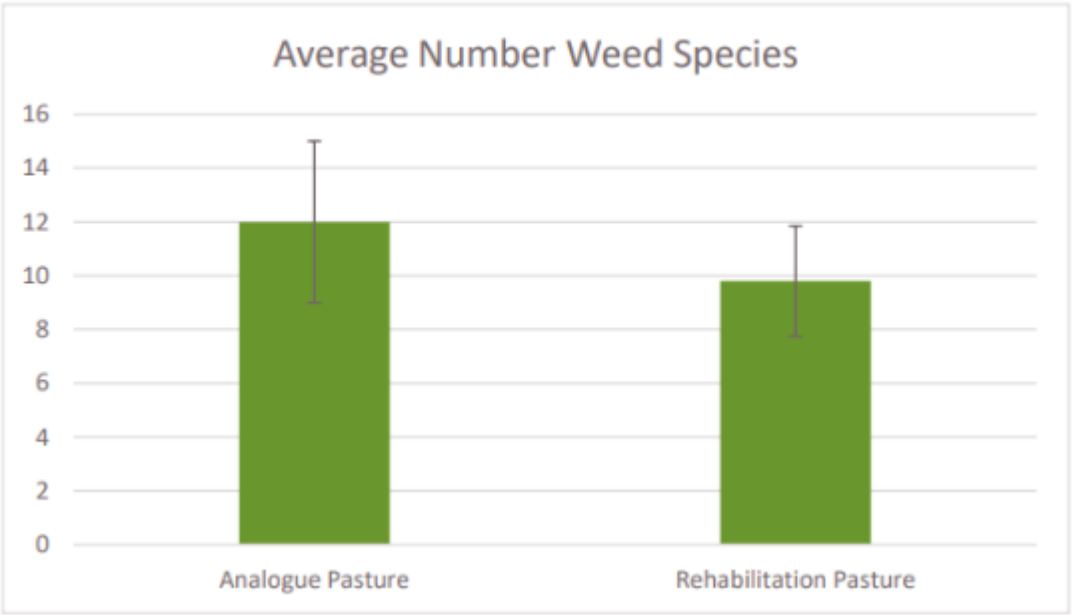


Figure 54: Comparison Between Analogue and Rehabilitation Pasture Sites for Average Weed Species Richness

5.4.7 COMPARISON TO COMPLETION CRITERIA

In relation to the MOP completion criteria for the Land Use Establishment Phase, the results of the rehabilitation woodland and pasture sites established native species composition, projected foliage cover, number of weeds listed as WoNS and key eucalypt species is presented in **Table 43** and **Table 44**. Rehabilitation monitoring results against MOP completion criteria for the Land Use Sustainability Phase are presented in **Table 45.**

Table 43: Rehabilitation Site Completion Criteria Target – Woodland (Land Use Establishment Phase)

Site	Completion Criteria Target (native species established)	2021 Result	Target Reached	Completion Criteria Target (total projected foliage cover ≥70%)	2021 Result	Target Reached	Completion Criteria Target ((WoNS) weeds <20%)	2021 Result	Target Exceedance	Completion Criteria Target (key eucalypt species present) Y/N	Target Reached
RW2	>50%	52%	Yes	≥70%	89%	Yes	<20%	7.1%	No	Y	Yes
RW3	>50%	59%	Yes	≥70%	72%	Yes	<20%	8.3%	No	Y	Yes
RW4	>50%	64%	Yes	≥70%	63%	No	<20%	8.3%	No	Y	Yes
RW5	>50%	50%	No	≥70%	94%	Yes	<20%	6.7%	No	Y	Yes
RW6	>50%	69%	Yes	≥70%	98%	Yes	<20%	9.1%	No	Y	Yes

Table 44: Rehabilitation Site Completion Criteria Target – Pasture

Site	Completion Criteria target (native\desirable) species established	2021 Result	Target Reached	Completion Criteria Target (total projected foliage cover ≥70%)	2021 Result	Target Reached	Completion Criteria Target ((WoNS) weeds <20%)	2021 Result	Target Exceeded	Completion Criteria Target (key pasture species) Y/N	Target Reached
RP1	>50%	47%	No	≥70%	92%	Yes	<20%	25%	Yes	Y	Yes
RP3	>50%	38%	No	≥70%	100%	Yes	<20%	7.7%	No	Y	Yes
RP4	>50%	41%	No	≥70%	71%	Yes	<20%	20%	Yes	Y	Yes
RP5	>50%	43%	No	≥70%	82%	Yes	<20%	0%	No	Y	Yes
RP6	>50%	33%	No	≥70%	89%	Yes	<20%	10%	No	Y	Yes

Table 45: Woodland and Pasture rehabilitation site completion criteria target (Land Use Sustainability Phase)

Site	Completion Criteria Target (regrowth evidence) Y/N	Target Reached	Completion Criteria Target (erosion present) Y/N	Target Reached
RW2	Y	Yes	N	Yes
RW3	Y	Yes	N	Yes
RW4	Y	Yes	N	Yes
RW5	Y	Yes	N	Yes
RW6	Y	Yes	N	Yes
RP1	Y	Yes	N	Yes
RP3	Y	Yes	N	Yes
RP4	Y	Yes	N	Yes
RP5	Y	Yes	N	Yes
RP6	Y	Yes	N	Yes

5.5 FAUNA MONITORING RESULTS

5.5.1 REMOTE CAMERA SURVEY

The results of the remote camera data are presented in **Figure 55** and **Table 46** and provides an indication of fauna species richness at each woodland site surveyed from 2015 to 2021 monitoring period.

The results show that mammals species numbers recorded at rehabilitation sites have been similar to (a difference of one or less) or greater than at analogue woodland sites in five out of the seven years of monitoring.

The results show that bird species numbers recorded at rehabilitation sites have been similar to (a difference of one or less) or greater than at analogue woodland sites in all years seven years of monitoring and have been consistently higher for the last three years.

Reptiles have only been recorded in the last two years at rehabilitation sites in contrast to four out of seven years at analogue sites. Numbers have been low across all sites and it is hard to draw conclusions about habitat quality from the data collected to date.

The results show that pest species numbers recorded at rehabilitation sites have been similar to (a difference of one or less) or less than at analogue woodland sites in six out of the seven years of monitoring.

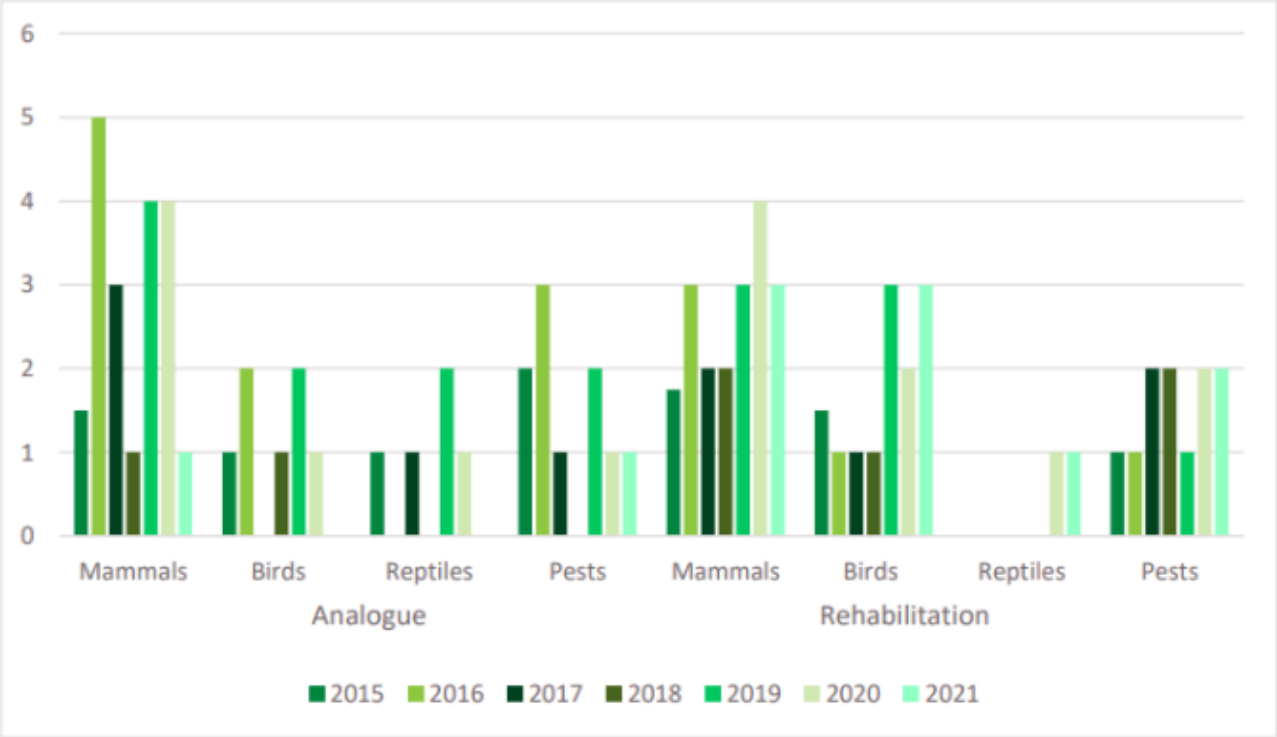


Figure 55: Comparison of Average Fauna Species Richness

Table 46: Remote Camera Results

Species	Analogue Woodland Sites			Rehabilitation Woodland Sites				
	RWNew1	RWnew2	RWNew3	RW2	RW3	RW4	RW5	RW6
Mammals								
Macropus rufogriseus (Red-necked Wallaby)					x			
Macropus giganteus (Easter Grey kangaroo)				x		x	x	
Macropus robustus robustus (Eastern Wallaroo)						x		
Trichosurus vulpecula (Brushed-tailed possum)	x	x	x					
Birds								
Gymnorhina tibicen (Australian magpie)				x	x			
Phaps Chalcoptera (Common Bronzeing)				x				
Aquila audax (Wedge-tailed Eagle)*						x		
Reptiles								
Ponga barbata (Bearded Dragon)								x
Pest Species								
Oryctolagus cuniculus (Rabbit)			x					x

*fauna species observed at site

5.5.2 BIRD CENSUS

Bird species were identified with a comparison between analogue and rehabilitation woodland sites and across the 2015 to 2021 monitoring periods is shown in **Figure 56**. The results show that average bird species numbers recorded at rehabilitation sites have been greater than at analogue woodland sites in the last six years of monitoring. Fifteen or more species have been recorded in three of the seven years at the rehabilitation woodland sites, whereas no more than 14 species have been recorded in any year at the analogue woodland sites.

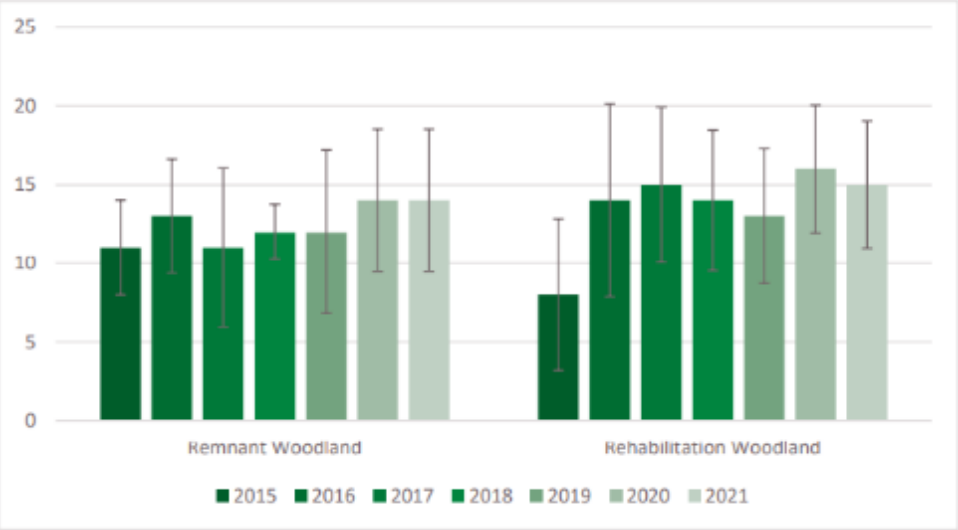


Figure 56: Bird Species Identified at Analogue and Rehabilitation Sites from 2015-2021

5.5.3 MICROCHIROPTERAN BATS

The results of the microbat census using songmeter data capture is presented in **Figure 57** indicating the presence (and number of calls) of microbat species. Results have been interpreted utilising both Definite and Potential call sequences for common species. Of the common microbat species, RW2 had the highest number of recorded bats being twelve, RW4 was slightly lower at 11 species, RW6 recorded seven species and both RW3 and RW5 recorded four species. Of the analogue sites, RWoodNew1 recorded seven species, RWoodNew2 recorded six and RWoodNew3 recorded four species.

Definite and potential call sequences for threatened microbat species were identified at all sites. Where a definite and potential call has been recorded at a site for a species within a 'species complex' i.e. *Vespadelus* species complex being either a threatened or common species, it is assumed that the call is the common species. RW2 recorded the highest number of threatened species being three, RWoodNew2 recorded two species and RWoodNew1, RWoodNew3, RW6 all recorded one threatened species. RW3, RW4 and RW5 did not record any threatened species. Threatened microbats recorded included Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*) and Greater Broad-nosed Bat (*Scotorepens balstoni*).

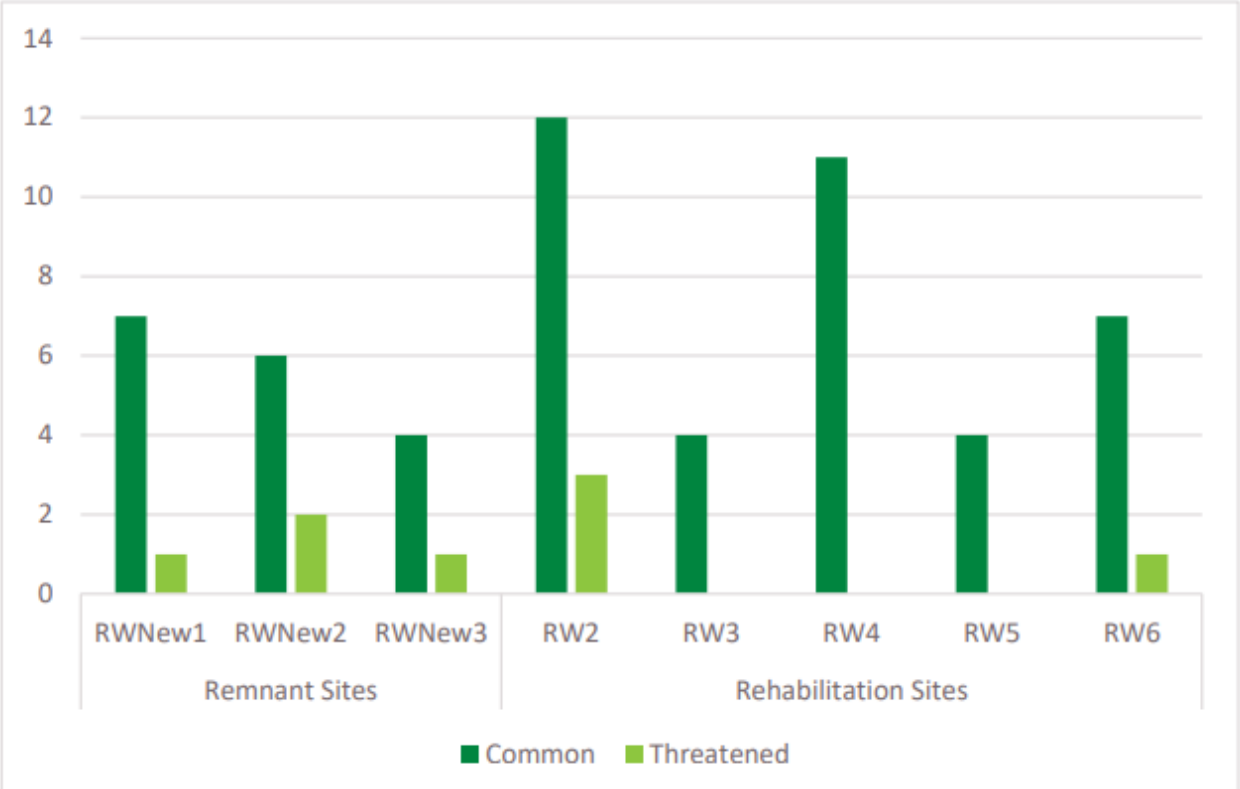


Figure 57: Number of Common and Threatened Microbat Species Recorded in 2021 at Woodland Sites

5.5.4 CONCLUSIONS

The completion criteria in the MOP states that 'Monitoring confirms that fauna diversity at rehabilitation sites >40% of fauna diversity at analogue sites'.

From the data gathered using the remote camera surveys, the monitoring during this reporting period confirms that fauna diversity for mammals at rehabilitation woodland sites exceeded the diversity at analogue woodland sites with one species recorded at analogue sites and three species recorded at rehabilitation sites, therefore the >40% fauna diversity target has been met. One reptile species was recorded at rehabilitation woodland sites during this reporting period.

From the data gathered using songmeters for bird surveys, the monitoring during this reporting period confirms that fauna diversity for bird species at rehabilitation woodland sites is >40% of fauna diversity at analogue woodland sites. On average across rehabilitation woodland sites, bird species diversity was greater (average 15 species) than that of analogue woodland sites (average 14 species), therefore the >40% targeted is achieved.

From the data gathered using songmeters for bats surveys, the monitoring during this reporting period confirms that the average fauna diversity for Microchiropteran bats at rehabilitation woodland sites is >40% of average fauna diversity at analogue woodland sites. On average across rehabilitation woodland sites, bat species diversity was greater (average eight species) than that of analogue woodland sites (average seven species), therefore the >40% targeted is achieved.

5.6 SOIL MONITORING RESULTS

None of the soils met more than five of the seven soil quality completion criteria. In particular, sites consistently did not meet either total nitrogen, nitrate nitrogen, sulfate or organic matter completion criteria. In some cases, the soil analysis results indicate rehabilitated soils have higher values for some indicators that indicate better quality than the analogues. However, because the values are outside the analogue range this is regarded as a negative result if the completion criteria are strictly interpreted.

Table 47: Comparison of Soil Data from Woodland and Pasture Rehabilitation sites compared to MOP soil completion Criteria target (Growth Medium Development Stage) and Analogue Sites

Site	Completion criteria targets (soils)						
	pH 5.5-7.5	EC-<600µs/cm	Potassium –>0.5 meq/100g	Sulphur –10-20 mg/kg	Nitrite+Nitrate –1.20-1.80 mg/kg	Nitrogen –2600-3150 mg/kg	Organic Matter - 3-10%
RwoodNew1	5.46	89	0.67	20	8.4	4300	9.1
RwoodNew2	6.04	101	1	4.4	18	3300	5
RwoodNew3	5.78	104	0.72	7.2	21	2500	5.1
RW2	4.75	447	0.82	299	21	3300	2.9
RW3	5.73	83	0.75	11	8.1	4800	5.2
RW4	4.93	1,161	0.43	817	2.2	6500	9.5
RW5	5.92	170	0.82	30	44	2800	9.6
RW6	5.69	245	0.94	100	4.6	4000	5.4
RPastNew1	5.9	92	1.3	10	19	4000	5.6
RPastNew2	6.47	84	1.4	5.5	6.2	3400	3.8
RPast03	5.53	49	0.66	2.2	4.8	1600	1.6
RP1	6.62	96	0.9	15	6.0	2400	2.8
RP3	6.74	115	1.2	4.8	17	1800	1.8
RP4	7.07	54	0.7	9.7	3.2	900	1.0
RP5	7.22	210	2	6.7	56	3300	3.1
RP6	5.24	561	0.46	266	5.7	3500	4.9

Within target range | Just outside range | Exceeds target range | Greatly exceeds target range

The results of the soil and vegetation monitoring do not indicate that that soil quality is a limitation to achieving successful rehabilitation outcomes. The inability of rehabilitation areas to meet the soil criteria is not due to poor quality soil material but almost entirely due to the nature of the criteria and the assumption that historic analogue conditions provide a suitable target soil quality for rehabilitation establishment. Soil analysis can be used as a tool to investigate poor performance, but in this case, because of the nature of soil criteria the provision of good soil quality is not being recognised.

5.7 EROSION AND LANDFORM STABILITY

Rehabilitation monitoring during the reporting period found that generally, there was little active erosion occurring within the rehabilitation sites. Vegetative cover is moderate to high in most areas and provides adequate resistance to erosion. No immediate action is required, but monitoring, particularly of existing features, should continue.

Erosion issues at MCC were the subject of a regulatory visit during the reporting period and are further discussed in **Section 1.6.4**.

5.8 BIODIVERSITY OFFSET AREA

During the reporting period, MCC registered a positive covenant and restriction on the use of land on the parcel in consultation with, and as directed by, MSC.

The Biodiversity Offset Area is a diverse parcel of land comprising a variety of vegetation types. The parcel is approximately 20Ha located to the north of the mine site on MCC owned land. The vegetation present in the Biodiversity Offset Area includes pockets of Grey-Myrtle Rusty Fig dry rainforest in the deeper gullies and two communities which are considered equivalent to the Threatened Ecological Community *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* (PCT1603 *Narrow-leaved Ironbark – Bulloak – Grey Box shrub – grass open forest* and PCT1605 *Narrow-leaved Ironbark – Native Olive shrubby open forest*).

5.9 REHABILITATION TRIALS AND RESEARCH

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

5.10 FURTHER DEVELOPMENT OF THE FINAL REHABILITATION PLAN

On 2 July 2021, an amendment to the *Mining Act 1992* took effect. As MCC is considered a "large mine" under the act, the changes will apply from 2 July 2022. From this date, the approved MOP will be replaced with a Rehabilitation Management Plan (RMP) and new documents and data will be required to be submitted to the Resources Regulator (RR) online portal. Under the new regulation, lease holders will be required to prepare and provide documents and data consistent with the Form and Way documents provided by RR. The new requirements include provision of:

- A Rehabilitation Objectives Statement (ROS).
- A Rehabilitation Completion Criteria Statement (RCCS).
- A Final Landform and Rehabilitation Spatial Plan (RSP).

For compliance with the amended conditions, MCC will be required to:

- Prevent or minimise harm to the environment.
- Rehabilitate land and water as soon as reasonably practicable after disturbance occurs.
- Achieve the approved final land use for the mining area as set out in the above ROS, RCCS and RSP.
- Undertake a Rehabilitation Risk Assessment and implement measure to eliminate, minimise or mitigate risks to achieving the final land use.
- Prepare and implement a Rehabilitation Management Plan (RMP).
- Prepare an annual Rehabilitation Report which describes the progress of rehabilitation over the annual reporting period.
- Prepare a Forward Program which includes the schedule of mining and rehabilitation activities for the next three years demonstrating how rehabilitation will occur as soon as reasonably practicable after disturbance.

MCC commenced preparations for the implementation of these rehabilitation reforms during the reporting period. The existing Rehabilitation Risk Assessment for will be updated as required. All other required documents and data are in the process of being prepared in accordance with the applicable Form and Way.

The rehabilitation objectives remain unchanged since the 2016 modification to the DA and the approval of the current MOP. The ROS being prepared will reflect this. The rehabilitation completion criteria and final landform will be subject to minor changes reflective of improved data and recommendations from subject matter experts. The revised final landform has changed slightly, however the overall slopes in OC1 and OC2 remain equal to or less than 14 degrees. One high wall will remain in OC2, which will be appropriately treated with the installation of a safety fence and/or berms, as well as capping of exposed coal seams. Proposed changes to this final rehabilitation plan will be minimal.

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.
- Develop a Rehabilitation Management Plan (RMP) that will supersede the Mining Operations Plan.
- Complete 89Ha of rehabilitation in OC2 in accordance with the currently approved MOP.
- Maintenance activities on the rehabilitation areas will continue.
- Complete the three-yearly review of the Water Management Plan.
- Continue working with MSC to gain approval for the Mine Closure Plan.
- Gain approval for a minor modification to the Development Consent to provide consistency with the Rehabilitation Reform requirements and to clarify closure related issues.
- Review the Environmental Management Plans following the end of coal mining operations on site.
- Commence detailed environmental studies associated with the closure of the site.

This page has been left blank intentionally

Appendix 1: Air Quality Monitoring Results

REAL-TIME PM_{10} MONITORING RESULTS

January 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jan-21	8.9	8.7	9.0
02-Jan-21	8.7	7.8	9.2
03-Jan-21	11.7	14.9	13.8
04-Jan-21	8.7	No Data	11.7
05-Jan-21	6.6	14.4	No Data
06-Jan-21	14.5	No Data	16.7
07-Jan-21	14.2	No Data	15.3
08-Jan-21	13.2	12.4	15.5
09-Jan-21	9.0	7.5	8.4
10-Jan-21	9.4	15.2	9.1
11-Jan-21	13.6	9.9	11.3
12-Jan-21	14.9	17.5	16.4
13-Jan-21	15.3	14.6	16.1
14-Jan-21	14.1	105.9	18.3
15-Jan-21	21.3	45.5	28.6
16-Jan-21	19.5	33.3	27.0
17-Jan-21	15.9	24.6	20.8
18-Jan-21	18.3	62.7	26.2
19-Jan-21	25.1	50.7	30.4
20-Jan-21	14.7	13.7	16.5
21-Jan-21	21.7	25.6	26.7
22-Jan-21	15.4	64.7	17.9
23-Jan-21	14.3	38.2	22.7
24-Jan-21	15.8	29.8	18.5
25-Jan-21	15.0	44.2	17.6
26-Jan-21	13.9	49.3	17.6
27-Jan-21	21.1	25.2	24.4
28-Jan-21	5.2	4.2	5.2
29-Jan-21	6.7	3.9	5.4
30-Jan-21	16.2	14.4	14.4
31-Jan-21	17.7	17.9	21.4

February 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Feb-21	17.0	14.4	16.5
02-Feb-21	10.2	11.2	11.1
03-Feb-21	18.9	17.0	18.7
04-Feb-21	19.7	27.1	16.8
05-Feb-21	17.9	19.3	18.2
06-Feb-21	13.3	17.4	13.6
07-Feb-21	11.7	15.8	13.6
08-Feb-21	17.7	15.7	17.7
09-Feb-21	15.5	11.4	14.1
10-Feb-21	11.7	9.3	11.0
11-Feb-21	10.6	11.5	10.1
12-Feb-21	18.8	36.9	17.7
13-Feb-21	10.6	15.5	11.7
14-Feb-21	18.0	17.1	17.9
15-Feb-21	15.2	13.5	17.2
16-Feb-21	9.2	8.8	10.0
17-Feb-21	11.3	11.1	11.6
18-Feb-21	17.0	15.0	17.4
19-Feb-21	12.1	10.8	12.0
20-Feb-21	8.2	6.8	9.2
21-Feb-21	12.1	13.5	12.6
22-Feb-21	15.5	23.3	14.6
23-Feb-21	15.2	15.5	16.3
24-Feb-21	13.3	13.3	15.0
25-Feb-21	8.6	20.1	12.1
26-Feb-21	13.0	32.5	16.7
27-Feb-21	19.2	16.6	18.4
28-Feb-21	18.9	20.2	20.9

March 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Mar-21	21.5	80.3	27.1
02-Mar-21	31.1	81.4	27.6
03-Mar-21	20.6	20.7	20.5
04-Mar-21	15.2	25.2	15.3
05-Mar-21	21.9	42.9	23.1
06-Mar-21	19.7	19.2	21.0
07-Mar-21	19.5	16.7	18.3
08-Mar-21	20.9	31.1	18.9
09-Mar-21	14.1	29.6	17.5
10-Mar-21	19.0	22.7	20.1
11-Mar-21	14.7	18.0	17.7
12-Mar-21	9.5	21.6	11.0
13-Mar-21	8.4	20.9	9.3
14-Mar-21	6.8	12.7	7.6
15-Mar-21	13.7	15.2	15.6
16-Mar-21	12.8	19.9	12.7
17-Mar-21	8.2	8.6	8.9
18-Mar-21	6.8	7.2	7.2
19-Mar-21	7.9	8.6	8.5
20-Mar-21	5.5	5.4	5.7
21-Mar-21	6.0	6.7	6.5
22-Mar-21	5.6	7.2	5.7
23-Mar-21	5.7	3.0	5.9
24-Mar-21	6.0	16.3	6.1
25-Mar-21	9.2	24.1	11.8
26-Mar-21	10.1	18.9	10.5
27-Mar-21	11.4	18.8	14.3
28-Mar-21	13.2	22.3	13.9
29-Mar-21	16.3	24.4	15.8
30-Mar-21	16.0	16.2	16.3
31-Mar-21	15.5	24.2	13.7

April 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Apr-21	14.2	15.9	12.5
02-Apr-21	8.6	12.1	10.2
03-Apr-21	10.3	11.8	9.9
04-Apr-21	9.5	15.8	9.4
05-Apr-21	18.6	17.9	18.4
06-Apr-21	25.3	11.2	12.5
07-Apr-21	26.2	9.9	9.6
08-Apr-21	16.8	4.9	2.5
09-Apr-21	12.1	37.2	10.7
10-Apr-21	16.7	23.4	14.2
11-Apr-21	14.9	24.4	14.8
12-Apr-21	16.6	40.6	11.5
13-Apr-21	16.9	20.1	9.8
14-Apr-21	17.0	96.4	17.0
15-Apr-21	18.0	71.6	31.8
16-Apr-21	25.1	51.2	26.8
17-Apr-21	12.3	9.9	10.4
18-Apr-21	10.5	11.8	10.1
19-Apr-21	11.1	35.0	11.4
20-Apr-21	12.3	55.5	12.6
21-Apr-21	15.8	34.0	16.3
22-Apr-21	12.7	57.0	15.1
23-Apr-21	15.3	58.3	17.9
24-Apr-21	24.4	22.0	17.7
25-Apr-21	19.6	21.0	17.8
26-Apr-21	19.5	23.9	18.2
27-Apr-21	16.9	21.7	14.4
28-Apr-21	15.0	32.5	12.5
29-Apr-21	16.8	28.6	13.1
30-Apr-21	21.0	28.5	13.8

May 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-May-21	12.7	20.4	12.8
02-May-21	17.9	19.2	12.8
03-May-21	10.3	27.6	11.0
04-May-21	10.0	24.8	16.2
05-May-21	9.8	10.7	10.2
06-May-21	12.4	12.2	8.9
07-May-21	10.5	11.3	8.6
08-May-21	9.1	13.8	9.7
09-May-21	16.5	19.0	14.5
10-May-21	9.8	67.7	14.1
11-May-21	10.3	30.8	13.2
12-May-21	17.6	32.1	17.6
13-May-21	14.5	51.0	16.9
14-May-21	9.7	33.9	13.7
15-May-21	10.0	30.5	13.8
16-May-21	8.7	27.0	9.7
17-May-21	12.1	33.1	13.5
18-May-21	8.8	25.1	11.5
19-May-21	9.1	46.9	13.2
20-May-21	10.7	50.4	13.6
21-May-21	19.4	27.1	15.8
22-May-21	15.2	12.0	10.6
23-May-21	11.5	16.7	10.5
24-May-21	11.6	18.5	11.7
25-May-21	5.5	27.3	6.4
26-May-21	10.9	31.9	13.8
27-May-21	7.9	37.5	13.1
28-May-21	9.9	27.6	14.0
29-May-21	23.7	29.8	15.1
30-May-21	16.8	23.5	22.1
31-May-21	11.3	19.7	11.5

June 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jun-21	14.1	39.3	17.7
02-Jun-21	11.4	41.6	16.1
03-Jun-21	27.0	44.6	21.0
04-Jun-21	6.5	40.2	8.4
05-Jun-21	9.1	15.9	9.0
06-Jun-21	9.0	30.3	7.7
07-Jun-21	6.1	30.5	11.7
08-Jun-21	13.6	48.1	16.8
09-Jun-21	3.4	27.4	3.1
10-Jun-21	3.3	15.0	5.1
11-Jun-21	5.2	58.9	5.3
12-Jun-21	5.2	28.0	5.7
13-Jun-21	4.5	35.4	4.8
14-Jun-21	6.4	21.3	7.9
15-Jun-21	7.9	39.4	11.3
16-Jun-21	9.9	64.2	16.5
17-Jun-21	6.2	50.5	6.7
18-Jun-21	5.1	71.7	7.2
19-Jun-21	5.9	47.5	9.9
20-Jun-21	19.0	9.0	11.3
21-Jun-21	14.7	17.4	14.1
22-Jun-21	9.1	30.9	10.1
23-Jun-21	13.3	38.7	13.4
24-Jun-21	8.3	73.7	11.1
25-Jun-21	4.9	63.6	5.8
26-Jun-21	5.2	25.3	7.3
27-Jun-21	5.3	17.7	6.2
28-Jun-21	9.4	50.0	13.5
29-Jun-21	11.4	9.2	12.4
30-Jun-21	9.5	16.7	8.6

July 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Jul-21	35.8	67.0	18.8
02-Jul-21	5.1	41.9	8.3
03-Jul-21	9.4	29.9	8.6
04-Jul-21	6.8	28.2	7.2
05-Jul-21	4.6	105.6	16.2
06-Jul-21	7.2	55.0	9.7
07-Jul-21	14.0	27.9	17.0
08-Jul-21	11.2	28.6	13.8
09-Jul-21	8.0	12.7	12.8
10-Jul-21	14.6	13.5	8.7
11-Jul-21	13.4	8.8	10.1
12-Jul-21	11.6	55.6	10.6
13-Jul-21	7.5	99.6	14.1
14-Jul-21	9.2	91.0	13.9
15-Jul-21	7.0	61.0	8.2
16-Jul-21	12.9	36.7	12.7
17-Jul-21	11.2	32.0	17.0
18-Jul-21	5.1	27.6	8.8
19-Jul-21	4.2	67.3	8.2
20-Jul-21	4.7	80.1	6.1
21-Jul-21	11.5	30.8	8.8
22-Jul-21	8.5	48.3	11.7
23-Jul-21	6.1	69.3	17.7
24-Jul-21	4.7	30.5	6.7
25-Jul-21	9.7	55.0	10.4
26-Jul-21	7.6	62.6	11.3
27-Jul-21	8.9	70.0	12.0
28-Jul-21	16.5	131.9	16.9
29-Jul-21	10.3	55.3	11.8
30-Jul-21	7.0	80.5	10.5
31-Jul-21	11.6	72.7	21.2

August 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Aug-21	13.3	63.83	15.4
02-Aug-21	17.4	20.8	22.0
03-Aug-21	13.6	41.5	15.0
04-Aug-21	5.2	76.6	8.7
05-Aug-21	4.7	124.3	7.9
06-Aug-21	5.4	65.4	8.7
07-Aug-21	6.5	31.5	8.5
08-Aug-21	12.1	16.3	10.8
09-Aug-21	28.9	20.1	20.1
10-Aug-21	11.1	42.2	11.4
11-Aug-21	10.7	110.8	13.2
12-Aug-21	15.3	68.7	16.7
13-Aug-21	15.5	30.0	13.3
14-Aug-21	26.3	36.7	19.6
15-Aug-21	13.5	39.4	20.7
16-Aug-21	10.4	132.9	14.1
17-Aug-21	9.1	53.2	11.7
18-Aug-21	17.9	24.0	15.9
19-Aug-21	19.6	51.2	22.1
20-Aug-21	16.7	144.3	20.7
21-Aug-21	11.3	123.5	17.3
22-Aug-21	10.2	66.3	17.6
23-Aug-21	12.7	167.9	27.0
24-Aug-21	3.6	22.6	4.6
25-Aug-21	5.6	23.3	6.8
26-Aug-21	6.2	69.7	10.7
27-Aug-21	7.1	69.9	11.0
28-Aug-21	6.8	52.0	11.1
29-Aug-21	23.23	28.0	20.2
30-Aug-21	9.3	66.4	13.3
31-Aug-21	11.1	90.1	16.3

September 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Sep-21	26.0	38.6	25.9
02-Sep-21	35.8	59.1	27.9
03-Sep-21	10.5	26.6	9.7
04-Sep-21	11.0	51.6	15.0
05-Sep-21	4.2	12.8	6.2
06-Sep-21	8.5	18.3	9.0
07-Sep-21	9.8	41.6	12.7
08-Sep-21	13.3	34.7	14.0
09-Sep-21	10.1	68.4	12.8
10-Sep-21	10.5	60.3	20.4
11-Sep-21	11.7	160.2	18.9
12-Sep-21	18.3	173.0	24.5
13-Sep-21	22.0	27.4	22.4
14-Sep-21	10.2	5.3	7.9
15-Sep-21	11.3	10.5	9.2
16-Sep-21	13.8	13.7	12.0
17-Sep-21	8.9	39.1	9.9
18-Sep-21	14.6	45.3	17.9
19-Sep-21	6.4	14.8	9.4
20-Sep-21	8.8	64.3	14.1
21-Sep-21	12.7	20.5	11.7
22-Sep-21	14.3	46.6	15.1
23-Sep-21	8.6	52.0	11.6
24-Sep-21	8.8	75.5	14.7
25-Sep-21	18.5	41.4	23.8
26-Sep-21	9.5	9.7	11.7
27-Sep-21	14.8	13.5	18.1
28-Sep-21	14.9	21.0	15.7
29-Sep-21	9.3	17.6	11.3
30-Sep-21	9.0	28.6	9.0

October 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Oct-21	10.4	25.5	11.77
02-Oct-21	5.3	13.4	7.8
03-Oct-21	5.9	19.5	9.9
04-Oct-21	11.3	24.1	12.5
05-Oct-21	12.3	51.7	18.1
06-Oct-21	13.8	111.7	16.3
07-Oct-21	13.8	145.9	17.8
08-Oct-21	34.4	39.8	36.4
09-Oct-21	16.5	No Data	15.2
10-Oct-21	21.6	89.6	23.8
11-Oct-21	4.1	6.1	5.0
12-Oct-21	8.1	7.1	8.4
13-Oct-21	No Data	4.7	No Data
14-Oct-21	No Data	22.5	2.7
15-Oct-21	No Data	115.3	13.0
16-Oct-21	No Data	14.8	3.4
17-Oct-21	No Data	20.7	5.7
18-Oct-21	No Data	34.0	9.4
19-Oct-21	11.4	56.6	14.1
20-Oct-21	10.3	17.3	11.3
21-Oct-21	14.4	13.2	14.9
22-Oct-21	15.3	25.8	15.6
23-Oct-21	17.4	26.6	16.6
24-Oct-21	11.1	17.5	11.7
25-Oct-21	13.9	58.0	14.7
26-Oct-21	16.8	25.4	20.2
27-Oct-21	13.4	24.5	12.6
28-Oct-21	15.5	61.4	17.8
29-Oct-21	21.9	116.5	25.0
30-Oct-21	23.9	27.2	25.6
31-Oct-21	12.6	10.5	12.9

November 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Nov-21	23.0	20.8	24.1
02-Nov-21	20.0	18.1	18.1
03-Nov-21	20.1	18.5	21.0
04-Nov-21	24.3	29.0	22.6
05-Nov-21	18.4	13.0	14.3
06-Nov-21	11.4	14.3	9.2
07-Nov-21	12.0	20.1	14.8
08-Nov-21	10.1	24.4	10.0
09-Nov-21	15.6	32.9	16.5
10-Nov-21	15.3	19.3	12.7
11-Nov-21	8.3	10.6	9.5
12-Nov-21	28.4	49.2	28.8
13-Nov-21	6.1	13.1	10.1
14-Nov-21	6.5	20.9	8.2
15-Nov-21	No Data	24.3	15.3
16-Nov-21	9.9	37.5	14.7
17-Nov-21	16.6	15.8	19.2
18-Nov-21	14.3	31.5	14.5
19-Nov-21	16.2	51.9	19.0
20-Nov-21	15.7	25.7	15.1
21-Nov-21	8.7	6.8	7.0
22-Nov-21	8.5	9.0	10.1
23-Nov-21	9.2	9.3	10.0
24-Nov-21	15.0	15.2	15.2
25-Nov-21	9.3	14.0	10.8
26-Nov-21	4.5	4.3	4.8
27-Nov-21	8.1	6.9	7.5
28-Nov-21	13.8	15.2	15.8
29-Nov-21	21.0	20.5	21.3
30-Nov-21	15.7	10.9	14.5

December 2021			
SAMPLE DATE	SITE 7	SITE 8	SITE 9
01-Dec-21	9.3	8.1	8.4
02-Dec-21	10.2	9.3	9.1
03-Dec-21	16.4	37.7	19.7
04-Dec-21	25.9	24.7	24.1
05-Dec-21	14.5	16.3	15.5
06-Dec-21	19.0	18.4	19.1
07-Dec-21	14.3	25.8	11.8
08-Dec-21	NR	NR	11.0
09-Dec-21	9.3	NR	8.8
10-Dec-21	11.0	21.8	12.8
11-Dec-21	10.1	10.4	10.1
12-Dec-21	13.5	12.2	13.5
13-Dec-21	21.7	24.3	22.9
14-Dec-21	21.4	NR	25.1
15-Dec-21	19.5	44.3	19.5
16-Dec-21	23.2	39.0	24.2
17-Dec-21	17.4	18.3	20.9
18-Dec-21	17.4	47.2	17.3
19-Dec-21	14.7	83.3	17.6
20-Dec-21	21.7	NR	22.2
21-Dec-21	19.3	NR	20.1
22-Dec-21	11.8	26.1	15.3
23-Dec-21	22.0	34.1	22.4
24-Dec-21	21.3	NR	20.7
25-Dec-21	14.1	13.6	13.8
26-Dec-21	10.3	10.9	10.0
27-Dec-21	8.5	10.7	10.2
28-Dec-21	7.5	8.9	10.0
29-Dec-21	9.0	9.1	10.2
30-Dec-21	13.6	10.5	11.9
31-Dec-21	19.8	13.4	15.0

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
13-Jan-21	8.04	8.65	No Access	No Access	7.57	7.61
8-Feb-21	8.05	8.30	No Access	No Access	7.66	7.65
9-Mar-21	7.70	8.06	7.00	No Access	7.73	7.79
13-Apr-21	7.74	8.36	No Access	No Access	7.64	7.73
12-May-21	7.56	8.24	No Access	No Access	7.60	7.68
21-Jun-21	7.61	8.04	No Access	No Access	7.51	7.60
19-Jul-21	7.95	8.09	No Access	No Access	7.84	7.93
23-Aug-21	7.87	8.29	No Access	No Access	7.74	7.77
13-Sep-21	7.92	8.20	No Access	No Access	7.73	7.78
18-Oct-21	8.01	8.06	No Access	No Access	7.65	7.61
29-Nov-21	8.16	7.95	No Access	No Access	7.58	7.56
20-Dec-21	8.29	8.16	No Access	No Access	7.76	7.82

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
13-Jan-21	6800	2110	No Access	No Access	940	1280
8-Feb-21	6360	2780	No Access	No Access	1160	2010
9-Mar-21	6570	3570	4050	No Access	1300	2270
13-Apr-21	6540	3260	No Access	No Access	1030	1390
12-May-21	6300	4490	No Access	No Access	1220	1760
21-Jun-21	5670	3870	No Access	No Access	1240	1560
19-Jul-21	6480	5240	No Access	No Access	1320	1630
23-Aug-21	6330	5850	No Access	No Access	1410	2030
13-Sep-21	6610	5650	No Access	No Access	1580	1600
18-Oct-21	6130	5030	No Access	No Access	1570	2330
29-Nov-21	3630	1940	No Access	No Access	374	447
20-Dec-21	3050	2910	No Access	No Access	858	1190

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	MCC08
13-Jan-21	8	6	No Access	No Access	<5	<5
8-Feb-21	<5	<5	No Access	No Access	<5	5
9-Mar-21	9	9	14	No Access	<5	<5
13-Apr-21	<5	<5	No Access	No Access	<5	<5
12-May-21	<5	9	No Access	No Access	<5	<5
21-Jun-21	12	8	No Access	No Access	<5	<5
19-Jul-21	9	15	No Access	No Access	<5	<5
23-Aug-21	<5	9	No Access	No Access	<5	<5
13-Sep-21	11	8	No Access	No Access	<5	8
18-Oct-21	14	10	No Access	No Access	<5	<5
29-Nov-21	7	22	No Access	No Access	8	6
20-Dec-21	9	7	No Access	No Access	7	7

QUARTERLY SURFACE WATER MONITORING RESULTS – pH

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
8-Mar-21	9.12	9.50	8.38	7.59	8.17	8.32
21-Jun-21	8.12	9.07	7.97	7.69	8.17	8.23
13-Sep-21	8.43	9.00	8.43	7.87	8.32	8.33
20-Dec-21	7.86	No Access	No Access	7.33	7.92	7.78

QUARTERLY SURFACE WATER MONITORING RESULTS – ELECTRICAL CONDUCTIVITY

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
8-Mar-21	459	10400	602	964	4420	10600
21-Jun-21	366	8720	1140	845	3510	8460
13-Sep-21	460	10900	1320	1120	5710	9880
20-Dec-21	502	No Access	No Access	731	3150	2320

QUARTERLY SURFACE WATER MONITORING RESULTS – TOTAL SUSPENDED SOLIDS

DATE	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
8-Mar-21	13	<5	<5	<5	12	<5
21-Jun-21	30	102	7	6.00	<5	12
13-Sep-21	107	31	8	6.00	7	20
20-Dec-21	8	No Access	No Access	6.00	10	9

ANNUAL SURFACE WATER MONITORING RESULTS

Sampled 8 March 2021

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC7	MCC8	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
pH	7.7	8.06	No Access	7.21	7.73	7.79	9.12	9.5	8.38	7.59	8.17	8.32
EC (*µS/cm*)	6570	3570		4050	1300	2270	459	10400	602	964	4420	10600
TSS *(mg/L)*	9	9		14	<5	<5	13	<5	<5	<5	12	<5
Alkalinity - Hydroxide *(mg $CaCO_3$/L)*	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
Alkalinity - Carbonate *(mg $CaCO_3$/L)*	<1	<1		<1	<1	<1	<1	27	<1	<1	<1	<1
Alkalinity - Bicarbonate *(mg $CaCO_3$/L)*	354	95		20	225	265	110	130	112	271	221	131
Total Alkalinity *(mg $CaCO_3$/L)*	354	95		20	225	265	110	158	112	271	221	131
Acidity *(mg $CaCO_3$/L)*	16	<1		8	10	14	<1	<1	<1	<1	3	<1
Sulfates *(mg/L)*	3220	1770		2650	83	290	87	5420	161	76	2420	4920
Chloride *(mg/L)*	634	279		33	272	483	32	932	30	137	128	1080
Calcium *(mg/L)*	563	390		535	69	120	22	266	38	32	222	406
Magnesium *(mg/L)*	432	188		285	29	62	16	1170	28	30	486	807
Sodium *(mg/L)*	548	257		165	168	289	46	959	39	136	231	1300
Potassium *(mg/L)*	40	18		14	3	3	7	44	12	4	19	28
Hardness - total (calculation - *mg/L*)	3180	1750		2510	292	555	121	5480	210	203	2560	4340
Iron - dissovled *(mg/L)*	<0.05	<0.05		<0.05	0.12	<0.05	<0.05	<0.05	<0.05	0.43	<0.05	<0.05
Aluminium *(mg/L)*	0.03	0.07		0.04	0.16	0.14	0.81	<0.01	0.2	0.01	0.03	0.04
Antimony *(mg/L)*	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic *(mg/L)*	<0.001	<0.001		<0.001	0.003	0.002	0.002	0.002	0.002	0.003	<0.001	0.001
Barium *(mg/L)*	0.028	0.039		0.029	0.038	0.039	0.057	0.027	0.041	0.041	0.053	0.036
Cadmium *(mg/L)*	<0.0001	<0.0001		0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC7	MCC8	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
Chromium *(mg/L)*	<0.001	<0.001		<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt *(mg/L)*	0.001	<0.001		0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper *(mg/L)*	<0.001	<0.001		<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead *(mg/L)*	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese *(mg/L)*	0.472	0.033		0.866	0.076	0.079	0.023	0.004	0.038	0.34	0.024	0.042
Molybdenum *(mg/L)*	0.002	0.008		<0.001	<0.001	<0.001	0.001	0.002	0.002	<0.001	0.001	<0.001
Nickel *(mg/L)*	0.012	0.006		0.06	<0.001	<0.001	0.003	0.003	0.003	<0.001	0.004	0.002
Selenium *(mg/L)*	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc *(mg/L)*	<0.005	<0.005		0.032	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron *(mg/L)*	0.47	0.15		0.06	0.06	0.08	<0.05	<0.05	<0.05	<0.05	0.06	0.11
Iron - total *(mg/L)*	1.81	0.12		0.14	0.58	0.3	1.17	<0.05	0.34	0.56	0.13	0.16
Mercury - total *(mg/L)*	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Fluoride *(mg/L)*	0.7	0.9		0.5	0.4	0.4	0.8	0.6	1	0.3	0.8	0.6
Nitrogen Ammonia *(mg/L)*	2.31	<0.01		0.11	0.02	0.04	0.02	0.04	0.08	0.01	<0.01	0.02
Nitrite as N *(mg/L)*	0.04	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01
Nitrate as N *(mg/L)*	0.4	0.05		0.28	<0.01	<0.01	<0.01	<0.01	0.15	<0.01	<0.01	<0.01
Nitrite + Nitrate as N *(mg/L)*	0.44	0.05		0.28	<0.01	<0.01	<0.01	<0.01	0.2	<0.01	<0.01	<0.01
Total Anions *(meq/L)*	92	46.6		56.5	13.9	25	4.91	142	6.44	10.9	58.4	136
Total Cations *(meq/L)*	88.5	46.6		57.7	13.2	23.7	4.59	152	6.2	10.1	61.6	144
Ionic Balance *(meq/L)*	1.93	0.05		1.04	2.52	2.5	3.34	3.43	1.84	3.71	2.67	3.01

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC7	MCC8	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
Oil & Grease *(mg/L)*	<5	<5		<5	<5	<5	<5	<5	<5	<5	<5	<5
Naphthalene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sum of polycyclic aromatic hydrocarbons	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ (zero)	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
C6 - C9 Fraction	<20	<20		<20	<20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	<50	<50		<50	<50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	<100	<100		<100	<100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	<50	<50		<50	<50	<50	<50	<50	<50	<50	<50	<50
C10 - C36 Fraction (sum)	<50	<50		<50	<50	<50	<50	<50	<50	<50	<50	<50

ANALYTE	Dam 1/2	MCC12 Final Settling Pond	No.1 Open Cut Void	No.2 Open Cut Void	MCC7	MCC8	MCC9	MCC23	MCC24	MCC25	MCC26	MCC27
C6 - C10 Fraction	<20	<20		<20	<20	<20	<20	<20	<20	<20	<20	<20
C6 - C10 Fraction minus BTEX (F1)	<20	<20		<20	<20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	<100	<100		<100	<100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	<100	<100		<100	<100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	<100	<100		<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	<100	<100		<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	<100	<100		<100	<100	<100	<100	<100	<100	<100	<100	<100
Benzene *(µg/L)*	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene *(µg/L)*	<2	<2		<2	<2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene *(µg/L)*	<2	<2		<2	<2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene (µg/L)	<2	<2		<2	<2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene *(µg/L)*	<2	<2		<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Xylenes *(µg/L)*	<2	<2		<2	<2	<2	<2	<2	<2	<2	<2	<2
Sum of BTEX *(µg/L)*	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene *(µg/L)*	<5	<5		<5	<5	<5	<5	<5	<5	<5	<5	<5

GROUND WATER MONITORING RESULTS – MINING AREAS

DATE	Relative Level (mAHD)	pH	Electrical Conductivity (µS/cm)	Depth to Water (mbgl)		
BORE RDH650				RDH616	RDH617	RDH624
13-Jan-21	106.47	6.9	5970	53.58	46.21	36.19
08-Feb-21	106.48	8.2	6390	53.64	46.31	36.17
08-Mar-21	105.79	6.9	6480	54.30	46.51	36.19
13-Apr-21	106.49	6.9	6370	54.38	46.58	36.12
12-May-21	106.49	7.0	6320	54.44	46.64	35.09
21-Jun-21	106.55	6.8	5660	54.09	46.24	36.08
19-Jul-21	106.67	6.9	6240	54.04	46.03	36.08
23-Aug-21	106.63	6.9	6330	54.94	46.33	36.08
13-Sep-21	106.48	7.0	6360	55.00	46.27	36.08
18-Oct-21	106.18	6.9	6380	53.58	45.56	36.1
29-Nov-21	106.21	6.9	6640	48.92	44.32	36.1
20-Dec-21	107.24	7.0	6530	50.66	45.50	35.58
AVERAGE	**106.47**	**7.0**	**6,306**	**53.46**	**46.04**	**35.99**

ANNUAL GROUNDWATER MONITORING RESULTS – MINING AREAS

Sampled 8 March 2021

ANALYTE	RDH529
pH	6.93
EC (*µS/cm*)	6480
TSS *(mg/L)*	22
Alkalinity - Hydroxide *(mg $CaCO_3$/L)*	<1
Alkalinity - Carbonate *(mg $CaCO_3$/L)*	<1
Alkalinity - Bicarbonate *(mg $CaCO_3$/L)*	444
Total Alkalinity - *(mg $CaCO_3$/L)*	444
Acidity - *(mg $CaCO_3$/L)*	55
Sulfates *(mg/L)*	2950
Chloride *(mg/L)*	541
Calcium *(mg/L)*	540
Magnesium *(mg/L)*	406
Sodium *(mg/L)*	525
Potassium *(mg/L)*	39
Hardness - total (calculation - *mg/L*)	3020
Iron - dissolved *(mg/L)*	7.94
Aluminium *(mg/L)*	<0.01
Antimony *(mg/L)*	<0.001
Arsenic *(mg/L)*	<0.001
Barium *(mg/L)*	0.029
Cadmium *(mg/L)*	<0.0001
Chromium *(mg/L)*	<0.001
Cobalt *(mg/L)*	0.001
Copper *(mg/L)*	<0.001
Lead *(mg/L)*	<0.001
Manganese *(mg/L)*	1.31
Molybdenum *(mg/L)*	0.002
Nickel *(mg/L)*	0.004
Selenium *(mg/L)*	<0.01
Zinc *(mg/L)*	0.05
Boron *(mg/L)*	<0.05
Iron - total *(mg/L)*	7.87
Mercury *(mg/L)*	<0.0001
Fluoride *(mg/L)*	0.8
Nitrogen Ammonia *(mg/L)*	4.28
Nitrite as N *(mg/L)*	<0.01
Nitrate *(mg/L)*	<0.01
Nitrite + Nitrate as N *(mg/L)*	<0.01
Total Anions *(meq/L)*	85.6
Total Cations *(meq/L)*	84.2
Ionic Balance *(meq/L)*	0.8

ANALYTE	RDH529
Oil & Grease *(mg/L)*	<5
Naphthalene	<1.0
Acenaphthylene	<1.0
Acenaphthene	<1.0
Fluorene	<1.0
Phenanthrene	<1.0
Anthracene	<1.0
Fluoranthene	<1.0
Pyrene	<1.0
Benz(a)anthracene	<1.0
Chrysene	<1.0
Benzo(b+j)fluoranthene	<1.0
Benzo(k)fluoranthene	<1.0
Benzo(a)pyrene	<0.5
Indeno(1.2.3.cd)pyrene	<1.0
Dibenz(a.h)anthracene	<1.0
Benzo(g.h.i)perylene	<1.0
Sum of polycyclic aromatic hydrocarbons	<0.5
Benzo(a)pyrene TEQ (zero)	<0.5
C6 - C9 Fraction	<20
C10 - C14 Fraction	<50
C15 - C28 Fraction	<100
C29 - C36 Fraction	<50
C10 - C36 Fraction (sum)	<50
C6 - C10 Fraction	<20
C6 - C10 Fraction minus BTEX (F1)	<20
>C10 - C16 Fraction	<100
>C16 - C34 Fraction	<100
>C34 - C40 Fraction	<100
>C10 - C40 Fraction (sum)	<100
>C10 - C16 Fraction minus Naphthalene (F2)	<100
Benzene *(µg/L)*	<1
Toluene *(µg/L)*	<2
Ethylbenzene *(µg/L)*	<2
meta- & para-Xylene (µg/L)	<2
ortho-Xylene *(µg/L)*	<2
Total Xylenes *(µg/L)*	<2
Sum of BTEX *(µg/L)*	<1
Naphthalene *(µg/L)*	<5

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)
13-Jan-21	2.58	7.2	1142	7.95	7.1	2750	Dry			18.14	19.13
8-Feb-21	2.52	8.2	1200	7.90	7.1	2540				17.93	19.07
9-Mar-21	2.91	7.2	1260	8.00	7.2	2370				17.96	19.05
13-Apr-21	2.48	7.2	1290	7.20	7.2	2290				17.89	19.02
12-May-21	2.56	7.2	1260	7.41	7.3	1900				17.95	19.04
21-Jun-21	2.84	7.0	1290	7.63	7.1	1710				17.93	19.08
19-Jul-21	2.48	7.3	1390	7.63	7.4	1720				17.96	19.12
23-Aug-21	3.24	7.2	1360	7.66	7.3	1560				17.95	18.98
13-Sep-21	3.12	7.2	1360	7.70	7.3	1510				17.95	18.98
18-Oct-21	2.46	7.2	1270	7.78	7.3	1570				17.95	19.06
29-Nov-21	1.62	7.3	512	No Access						18.13	19.13
20-Dec-21	No Access			No Access						18.16	19.15

ANNUAL GROUNDWATER MONITORING RESULTS – SANDY CREEK
Sampled 9 March 2021

ANALYTE	MCC1003	MCC1005	MCC1006
pH	7.22	7.17	
EC (*µS/cm*)	1260	2370	
TSS *(mg/L)*	<5	16	
Hardness - total (calculation - *mg/L*)	304	521	
Alkalinity - Hydroxide (mg CaCO3/L)	<1	<1	
Alkalinity - Carbonate *(mg $CaCO_3$/L)*	<1	<1	
Alkalinity - Bicarbonate *(mg $CaCO_3$/L)*	245	302	
Total Alkalinity - *(mg CaCO3/L)*	245	302	
Sulfates *(mg/L)*	128	138	
Chloride *(mg/L)*	194	510	
Calcium - total *(mg/L)*	69	98	
Magnesium - total *(mg/L)*	32	67	
Sodium - total *(mg/L)*	142	286	
Potassium - total *(mg/L)*	2	2	
Iron- filterable *(mg/L)*	<0.05	<0.05	
Arsenic *(mg/L)*	<0.001	<0.001	
Barium *(mg/L)*	0.03	0.026	
Cadmium *(mg/L)*	<0.0001	<0.0001	
Chromium *(mg/L)*	<0.001	0.002	
Copper *(mg/L)*	<0.001	<0.001	
Lead *(mg/L)*	<0.001	<0.001	
Manganese - filterable *(mg/L)*	<0.001	0.004	Dry
Nickel *(mg/L)*	<0.001	<0.001	
Selenium *(mg/L)*	<0.01	<0.01	
Zinc *(mg/L)*	0.006	0.034	
Boron *(mg/L)*	0.11	0.05	
Iron - total *(mg/L)*	0.08	0.12	
Mercury *(mg/L)*	<0.0001	<0.0001	
Fluoride - total *(mg/L)*	0.4	0.3	
Ammonia *(mg/L)*	<0.01	<0.01	
Nitrite *(mg N/L)*	<0.01	<0.01	
Nitrate *(mg N/L)*	1.23	3.48	
Nitrite + Nitrate as N *(mg/L)*	1.23	3.48	
Total Anions *(meq/L)*	13	23.3	
Total Cations *(meq/L)*	12.3	22.9	
Ionic Balance *(meq/L)*	2.87	0.86	
Oil & Grease (mg/L)	<5	<5	
Naphthalene	<1.0	<1.0	
Acenaphthylene	<1.0	<1.0	
Acenaphthene	<1.0	<1.0	
Fluorene	<1.0	<1.0	
Phenanthrene	<1.0	<1.0	
Anthracene	<1.0	<1.0	

ANALYTE	MCC1003	MCC1005	MCC1006
Fluoranthene	<1.0	<1.0	
Pyrene	<1.0	<1.0	
Benz(a)anthracene	<1.0	<1.0	
Chrysene	<1.0	<1.0	
Benzo(b+j)fluoranthene	<1.0	<1.0	
Benzo(k)fluoranthene	<1.0	<1.0	
Benzo(a)pyrene	<0.5	<0.5	
Indeno(1.2.3.cd)pyrene	<1.0	<1.0	
Dibenz(a.h)anthracene	<1.0	<1.0	
Benzo(g.h.i)perylene	<1.0	<1.0	
Sum of polycyclic aromatic hydrocarbons	<0.5	<0.5	
Benzo(a)pyrene TEQ (zero)	<0.5	<0.5	
C6 - C9 Fraction	<20	<20	
C10 - C14 Fraction	<50	<50	
C15 - C28 Fraction	<100	<100	
C29 - C36 Fraction	<50	<50	
C10 - C36 Fraction (sum)	<50	<50	
C6 - C10 Fraction	<20	<20	
C6 - C10 Fraction minus BTEX (F1)	<20	<20	
>C10 - C16 Fraction	<100	<100	
>C16 - C34 Fraction	<100	<100	
>C34 - C40 Fraction	<100	<100	
>C10 - C40 Fraction (sum)	<100	<100	
>C10 - C16 Fraction minus Naphthalene (F2)	<100	<100	
Benzene *(µg/L)*	<1	<1	
Toluene *(µg/L)*	<2	<2	
Ethylbenzene *(µg/L)*	<2	<2	
meta- & para-Xylene (µg/L)	<2	<2	
ortho-Xylene *(µg/L)*	<2	<2	
Total Xylenes *(µg/L)*	<2	<2	
Sum of BTEX *(µg/L)*	<1	<1	
Naphthalene *(µg/L)*	<5	<5	

This page has been left blank intentionally

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
06-Jan-21	12:34	106.1	0.17	85.0	0.08	102.5	0.23	102.5	0.34
08-Jan-21	13:13	99.0	0.10	81.5	0.03	92.1	0.14	95.1	0.10
11-Jan-21	13:06	87.0	0.13	81.5	0.04	88.6	0.13	90.0	0.14
22-Jan-21	9:54	103.0	0.27	85.0	0.14	No Data	No Data	100.1	0.57
27-Jan-21	12:10	102.6	0.13	89.5	0.11	93.4	0.17	108.9	0.12
01-Feb-21	12:14	101.0	0.16	81.5	0.08	101.6	0.23	99.6	0.32
03-Feb-21	13:19	103.9	0.21	85.0	0.11	101.6	0.35	102.1	0.42
04-Feb-21	13:11	101.5	0.15	85.0	0.12	100.0	0.27	100.1	0.69
05-Feb-21	13:16	111.8	0.22	91.1	0.12	110.0	0.36	107.9	0.99
09-Feb-21	10:00	101.5	0.21	81.5	0.07	96.5	0.21	107.6	0.34
11-Feb-21	13:17	87.0	0.14	85.0	0.04	92.1	0.21	90.0	0.16
23-Feb-21	13:16	110.5	0.15	98.4	0.06	109.8	0.24	102.5	0.30
26-Feb-21	13:02	100.4	0.18	85.0	0.06	97.4	0.19	100.7	0.31
01-Mar-21	13:10	91.4	0.20	85.0	0.10	98.1	0.21	88.1	0.27
02-Mar-21	15:16	100.4	0.11	101.1	0.09	100.0	0.18	102.1	0.20
03-Mar-21	13:11	101.0	0.10	91.1	0.05	100.6	0.19	107.2	0.13
04-Mar-21	11:37	96.5	0.15	87.5	0.05	96.5	0.19	99.0	0.27
05-Mar-21	12:18	102.6	0.14	97.1	0.12	100.0	0.17	103.3	0.23
10-Mar-21	13:08	103.5	0.34	85.0	0.17	102.5	0.39	108.1	0.88
18-Mar-21	12:44	105.1	0.14	81.5	0.07	No Data	No Data	107.2	0.34
25-Mar-21	9:47	98.3	0.13	81.5	0.06	96.0	0.13	91.6	0.35
26-Mar-21	9:47	98.3	0.10	81.5	0.04	97.0	0.10	97.6	0.10
30-Mar-21	13:11	102.6	0.25	87.5	0.12	97.0	0.23	100.1	0.62
31-Mar-21	13:39	94.3	0.10	89.5	0.05	94.9	0.11	98.3	0.20
01-Apr-21	13:06	94.3	0.12	91.1	0.07	93.5	0.09	94.1	0.18
06-Apr-21	13:13	106.1	0.16	100.1	0.07	106.6	0.18	103.6	0.33
07-Apr-21	13:03	97.4	0.18	96.3	0.06	100.2	0.13	98.3	0.52
09-Apr-21	13:14	102.1	0.22	87.5	0.09	94.9	0.15	92.9	0.46

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
14-Apr-21	12:07	107.0	0.13	95.5	0.11	97.9	0.09	103.3	0.19
15-Apr-21	13:07	93.0	0.10	89.5	0.11	97.9	0.06	94.1	0.17
16-Apr-21	13:17	98.3	0.12	96.3	0.11	97.0	0.07	99.6	0.19
20-Apr-21	12:12	99.0	0.15	94.6	0.06	99.5	0.15	96.0	0.30
21-Apr-21	13:11	97.4	0.09	89.5	0.04	102.0	0.03	85.6	0.10
23-Apr-21	13:10	97.4	0.13	91.1	0.07	98.8	0.18	99.0	0.25
26-Apr-21	13:06	100.4	0.11	96.3	0.10	99.5	0.11	102.1	0.35
28-Apr-21	13:04	93.0	0.09	93.6	0.12	97.9	0.07	96.0	0.18
30-Apr-21	13:30	89.5	0.08	85.0	0.08	90.0	0.07	91.6	0.13
04-May-21	10:57	89.5	0.15	85.0	0.09	91.9	0.12	94.1	0.22
10-May-21	13:14	95.5	0.15	81.5	0.09	93.5	0.14	91.6	0.49
12-May-21	13:04	101.5	0.15	81.5	0.08	101.5	0.12	96.9	0.24
14-May-21	13:07	99.7	0.10	81.5	0.05	97.9	0.07	96.9	0.23
18-May-21	13:06	98.3	0.12	91.1	0.04	97.0	0.07	96.9	0.15
19-May-21	13:02	98.4	0.30	97.6	0.34	99.6	0.22	105.4	0.56
21-May-21	13:05	91.7	0.18	91.6	0.12	88.1	0.14	102.6	0.15
26-May-21	13:06	91.7	0.20	95.1	0.19	94.1	0.15	103.5	0.21
27-May-21	12:24	94.2	0.21	92.9	0.11	88.1	0.16	93.0	0.25
08-Jun-21	9:03	93.0	0.38	95.1	0.23	96.1	0.39	102.6	1.16
15-Jun-21	13:08	94.2	0.23	94.1	0.13	97.6	0.18	103.9	0.35
17-Jun-21	13:06	110.8	0.26	103.2	0.14	96.1	0.17	114.1	0.33
21-Jun-21	13:14	97.7	0.29	96.0	0.17	101.6	0.26	110.7	0.54
25-Jun-21	9:45	95.2	0.32	98.9	0.24	102.1	0.28	105.4	0.61
28-Jun-21	13:10	91.7	0.19	90.0	0.10	93.0	0.20	89.5	0.22
30-Jun-21	13:12	102.2	0.25	102.8	0.15	105.6	0.21	105.7	0.49
05-Jul-21	9:35	94.2	0.15	94.1	0.12	95.1	0.12	89.5	0.11
06-Jul-21	13:07	99.1	0.44	98.9	0.23	101.6	0.42	100.4	0.78
19-Jul-21	13:02	97.7	0.18	96.0	0.10	93.0	0.19	106.4	0.23
29-Jul-21	9:09	94.2	0.36	94.1	0.17	96.9	0.26	106.1	0.73

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
30-Jul-21	13:23	99.7	0.29	101.1	0.13	101.6	0.23	110.1	0.50
02-Aug-21	15:04	96.1	0.25	97.6	0.13	102.1	0.17	109.0	0.30
06-Aug-21	13:13	97.7	0.32	96.0	0.16	96.9	0.26	104.7	0.49
09-Aug-21	13:00	91.7	0.22	90.0	0.14	91.6	0.19	95.5	0.22
11-Aug-21	11:04	107.0	0.27	109.4	0.12	101.2	0.20	102.6	0.35
13-Aug-21	10:46	96.1	0.22	96.0	0.11	97.6	0.16	93.0	0.48
17-Aug-21	13:01	90.1	0.25	88.0	0.10	91.6	0.25	97.4	0.33
23-Aug-21	13:02	107.7	0.20	101.6	0.11	102.1	0.20	99.0	0.25
27-Aug-21	9:00	103.7	0.28	102.4	0.18	104.4	0.39	96.5	0.71
01-Sep-21	13:44	102.6	0.44	102.4	0.18	102.9	0.35	107.6	0.57
03-Sep-21	13:12	100.2	0.21	98.3	0.09	90.0	0.15	93.0	0.12
07-Sep-21	13:06	94.2	0.59	94.1	0.26	95.1	0.53	106.7	1.46
08-Sep-21	13:14	90.1	0.24	90.0	0.10	88.1	0.18	94.4	0.18
10-Sep-21	10:42	91.7	0.26	91.6	0.11	94.1	0.24	94.4	0.22
15-Sep-21	13:08	99.1	0.55	96.8	0.29	103.7	0.55	102.6	1.10
16-Sep-21	13:03	88.2	0.27	88.0	0.14	95.1	0.30	105.7	0.70
17-Sep-21	13:08	96.1	0.22	97.6	0.10	96.9	0.15	104.7	0.30
21-Sep-21	9:44	101.2	0.43	95.1	0.18	98.3	0.33	106.7	0.84
22-Sep-21	13:03	94.2	0.24	98.3	0.12	96.9	0.21	103.0	0.49
24-Sep-21	10:01	93.0	0.27	98.9	0.11	90.0	0.20	94.4	0.24
29-Sep-21	10:29	88.2	0.18	92.9	0.10	93.0	0.15	95.5	0.15
29-Sep-21	12:05	94.2	0.43	98.9	0.33	96.1	0.46	103.5	0.81
08-Oct-21	9:04	99.7	0.51	97.6	0.30	99.0	0.57	104.3	0.71
15-Oct-21	12:14	108.0	0.36	111.1	0.26	115.3	0.23	105.7	0.50
19-Oct-21	13:14	93.0	0.25	97.6	0.24	94.1	0.29	98.3	0.45
22-Oct-21	13:04	93.0	0.21	91.6	0.11	90.0	0.15	96.5	0.17
01-Nov-21	13:04	93.0	0.33	95.1	0.16	96.1	0.32	102.6	0.76
03-Nov-21	13:04	93.0	0.38	96.0	0.18	95.1	0.35	106.1	0.79
09-Nov-21	12:06	93.0	0.51	96.8	0.27	98.3	0.44	105.4	1.22

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
10-Nov-21	12:56	99.1	0.37	96.0	0.25	96.1	0.36	95.5	1.46
16-Nov-21	9:42	94.2	0.45	95.1	0.24	96.1	0.50	103.0	0.93
17-Nov-21	12:37	93.0	0.20	92.9	0.10	94.1	0.18	102.1	0.22
18-Nov-21	10:40	90.1	0.21	91.6	0.10	91.6	0.16	94.4	0.23
19-Nov-21	11:14	93.0	0.26	94.1	0.11	96.1	0.19	99.0	0.36
29-Nov-21	13:03	91.7	0.17	94.1	0.11	93.0	0.16	87.0	0.22
10-Dec-21	12:48	105.1	0.20	99.5	0.10	112.6	0.17	105.7	0.24
15-Dec-21	13:01	101.2	0.49	102.8	0.32	103.7	0.50	107.0	1.20
17-Dec-21	13:14	98.4	0.40	98.9	0.17	100.1	0.36	107.3	1.08

This page has been left blank intentionally

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
10-Jan-21	8:10 AM	10-Jan-21	8:10 AM	Muswellbrook	ODOUR	Environmental Hotline - OCE responded	Odour	Complainant called MCC about a strong smell. Heavy fog was noted to be present at the time of the complaint. Coal was being mined in S22 and transported to the ROM. The OCE inspected the mine boundaries and did not detect odours or smoke. OCE noted that the fog was lifting at the time of the inspection. OCE called complainant back to discuss spontaneous combustion control. Monitoring and capping of spontaneous combustion is ongoing.
No complaints received during February 2021.								
No complaints received during March 2021.								
No complaints received during April 2021.								
No complaints received during May 2021.								
07-Jun-21	9:37 AM	07-Jun-21	9:37 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded	Odour	Complainant called MCC about a strong sulphur smell and a visual haze. Material from Strip 24 was being transported to Open Cut 2 rehab. Coal from Strip 23 was being processed and transported to the ROM. Water infusion sprays and water carts were conducting spontaneous combustion management. The OCE inspected the effectiveness of infusion sprays on Strip 23 and the ROM stockpile for hot coal. Complainant noted that they did not require a call back. No further action was taken.
11-Jun-21	7:12 PM	11-Jun-21	7:12 PM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded	Odour	Complainant called The Environmental Hotline regarding odour. At the time of complaint, a fire on the edge of coal was being capped by clay. An access point for a water cart was established and spraying began at 11:00 PM. A review of clay sealing options was undertaken. OCE called complainant to discuss current and ongoing spontaneous combustion management.

Date of Complaint	Time of Complaint	Date of Incident	Time of Incident	Location	Type of Complaint	Mode of Contact	Nature of Complaint	Action Taken
13-Jul-21	3:56 PM	13-Jul-21	3:56 PM	Woodlands Ridge	VISUAL	Environmental Hotline - OCE responded	Disaster that is going over there	Complainant called The Environmental Hotline regarding visual impacts. At the time of complaint, hot material was being moved to the ROM. A water cart was established on the ROM and sprayed until the hot material was processed. The OCE called complainant to discuss current and ongoing spontaneous combustion management. The complainant was satisfied with the outcome.
30-Jul-21	1:41 PM	30-Jul-21	1:41 PM	Muswellbrook	DUST	Environmental Hotline - OCE responded	Excess amount of dust that has been happening the past few days	Complainant called the Environmental Hotline to report dust. Hot coal was being mined and processed at the time of complaint. Processing was stopped to remove the hot coal and the water carts were used to cool hot coal on the mining area and on the ROM. An infusion spray is to be set up in strip 23. Clay capping is being applied to hot spots in the mine. The caller did not want a return call.
05-Aug-21	8:47 PM	30-Jul-21	10:15 AM	Muswellbrook	ODOUR	Email from EPA	Smoke and odour believed to be associated with spontaneous combustion	The EPA advised via email that an anonymous complaint was made via the EPA hotline on 30 July 2021. Hot coal was being mined and processed at the time of complaint. A water cart was being used to cool the hot coal on the mining area and on the ROM.
20-Aug-21	7:13 AM	20-Aug-21	7:13 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded	Detecting sulphur smell at complainant's house	Complainant called the Environmental Hotline to report a sulphur smell. Hot coal was being mined at the time of complaint. OCE inspected mine area to determine the origin of the odour. A water cart was used to cool hot spots.

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-Aug-21	7:05 AM	22-Aug-21	7:05 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded	Being affected by a strong odour	Complainant called the Environmental Hotline to report a strong odour. Hot coal was being processed in the mine and the ROM at the time of complaint. OCE inspected mine area to determine the source of the odour. A water cart was dispatched in the mine and the ROM to cool hot spots.
29-Aug-21	6:55 AM	29-Aug-21	6:55 AM	Muscle Creek	ODOUR	Environmental Hotline - OCE responded	Sulphur	Complainant called the Environmental Hotline to report sulphur. Mining was being conducted at strip 23 and strip 24 at the time of complaint. A water cart was operating for dust suppression and cooling of hot spots. The OCE attempted to return the call to the complainant but was not able to make contact.
07-Sep-21	1:09 PM	07-Sep-21	1:09 PM	McCully's Gap	BLAST	Direct call to MCC Office	Blast had shaken the house and windows	Complainant called the MCC office at 13:09 to ask if MCC had fired a blast minutes earlier, as their house and windows had shaken. A blast was fired in strip 24 at approximately 13:06. All of the blast monitoring results were below the EPL criteria. Vibration at the nearest monitor to the complainant's location was recorded at 1.46mm/sec. The complainant did not want a return call.
29-Sep-21	12:43 PM	29-Sep-21	12:05 PM	Muswellbrook	BLAST	Email from MSC	Shaking and vibration	Complainant contacted MSC to report shaking and vibration at approximately 12:05pm. A blast was fired in strip 24 at 12:05pm on 29 September. Vibration results from the monitoring network were below the EPL criteria and were provided to MSC via return email at 12:53pm on 29 September. With monitoring point B1 at 0.43mm/s, B2 at 0.33mm/s, B3 at 0.46mm/s and B4 at 0.81mm/s. MSC did not provide contact details for 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
29-Sep-21	12:43 PM	29-Sep-21	12:05 PM	Muswellbrook	BLAST	Email from MSC	Shaking and vibration	Complainant contacted MSC to report shaking and vibration at approximately 12:05pm. A blast was fired in strip 24 at 12:05pm on 29 September. Vibration results from the monitoring network were below the EPL criteria and were provided to MSC via return email at 12:53pm on 29 September. With monitoring point B1 at 0.43mm/s, B2 at 0.33mm/s, B3 at 0.46mm/s and B4 at 0.81mm/s. MSC did not provide contact details for the complainant.
29-Sep-21	12:43 PM	29-Sep-21	12:05 PM	Muswellbrook	BLAST	Email from MSC	Shaking and vibration	Complainant contacted MSC to report shaking and vibration at approximately 12:05pm. A blast was fired in strip 24 at 12:05pm on 29 September. Vibration results from the monitoring network were below the EPL criteria and were provided to MSC via return email at 12:53pm on 29 September. With monitoring point B1 at 0.43mm/s, B2 at 0.33mm/s, B3 at 0.46mm/s and B4 at 0.81mm/s. MSC did not provide contact details for the complainant.
29-Sep-21	12:43 PM	29-Sep-21	12:05 PM	Muswellbrook	BLAST	Email from MSC	Shaking and vibration	Complainant contacted MSC to report shaking and vibration at approximately 12:05pm. A blast was fired in strip 24 at 12:05pm on 29 September. Vibration results from the monitoring network were below the EPL criteria and were provided to MSC via return email at 12:53pm on 29 September. With monitoring point B1 at 0.43mm/s, B2 at 0.33mm/s, B3 at 0.46mm/s and B4 at 0.81mm/s. MSC did not provide contact details for the complainant.