

MANGOOLA OPEN CUT

GLENCORE

31 March 2022

Heidi Watters
Team Leader Compliance
Planning and Assessment | Department of Planning and Environment
PO Box 3145 | Singleton NSW 2330
(Submitted via Portal)

Dear Heidi,

RE: Mangoola Open Cut Annual Review - 2021

A copy of Mangoola Open Cut Annual Review for the 2021 reporting period has been uploaded to the planning portal along with this letter. It is also available at the below link:

<https://www.glencore.com.au/operations-and-projects/coal/current-operations/mangoola-open-cut/reporting-documents>

The Annual Review has been prepared in accordance with Schedule 5, Condition 6 of Project Approval 06_0014 which states:

ANNUAL REVIEW

6. By the end of March each year, or other timing as may be agreed by the Secretary, the Proponent must submit a report to the Department reviewing the environmental performance of the project to the satisfaction of the Secretary. This review must:
- (a) describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year;
 - (b) include a comprehensive review of monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against the:
 - relevant statutory requirements, limits or performance measures/criteria;
 - monitoring results of previous years; and
 - relevant predictions in the documents listed in condition 2 of Schedule 2;
 - (c) identify any non-compliance over the last year, and describe what actions were(or are being) taken to ensure compliance;
 - (d) identify any trends in monitoring data over the life of the project;
 - (e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
 - (f) describe what measures will be implemented over the next year to improve the environmental performance of the project.

The document has also been prepared in accordance with requirements of condition D11 of SSD 8642 which states:

GLENCORE

Annual Review

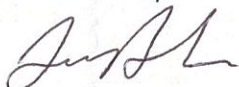
D11. By the end of March each year after the commencement of development, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Planning Secretary. This review must:

- (a) describe the development (including any rehabilitation) that was carried out in the previous calendar, and the development that is proposed to be carried out over the current calendar year;
- (b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the:
 - (i) relevant statutory requirements, limits or performance measures/criteria;
 - (ii) requirements of any plan or program required under this consent;
 - (iii) monitoring results of previous years; and
 - (iv) relevant predictions in the document/s listed in condition A2(c);
- (c) identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;
- (d) evaluate and report on:
 - (i) the effectiveness of the noise and air quality and greenhouse gas management systems;
 - (ii) compliance with the performance measures, criteria and operating conditions of this consent; and
 - (iii) the status of translocated plants and vegetation quadrat data from orchid monitoring sites;
- (e) identify any trends in the monitoring data over the life of the development;
- (f) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
- (g) describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.

The document has also been compiled in accordance with the Annual Review Guidelines published by the NSW Government in October 2015.

Should you have any queries in relation to this letter, or the Annual Review, please contact me on the below details.

Yours sincerely



Sam Palmer
Environment and Community Manager
Mangoola Coal, Glencore
T: +61 (0) 265 495 503
M: +61 (0) 408 905 812
E: sam.palmer@glencore.com.au

MANGOOLA OPEN CUT

GLENCORE

Mangoola Open Cut

2021 Annual Review

1 January 2021 to 31 December 2021

Aerial view of 2017 south pit rehabilitation



Main pit 2016 rehabilitation wetland area



Aerial view of south pit active mining and progressive rehabilitation



PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
10 Kings Road
New Lambton NSW 2305 Australia
(PO Box 447 New Lambton NSW 2305)
T: +61 2 4037 3200
E: newcastleau@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Mangoola Open Cut (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.30112-R01-v1.0	30 March 2022	Sam McDonald	Stephen Shoesmith	Stephen Shoesmith

EXECUTIVE SUMMARY


Name of Operation	Mangoola Open Cut
Name of Operator	Mangoola Coal Operations Pty Ltd
Development Consent / Project Approval #	PA 06_0014
	SSD 8642
Name of holder of Development Consent/ Project Approval	Mangoola Coal Operations Pty Ltd
Mining lease #	ML 1626, ML 1747, AL 9, EL 5552, ML 1817 and ML 1815
Name of holder of mining lease	Mangoola Coal Operations Pty Ltd
Water licence #	Various (refer Section 3.3)
Name of holder of water licence	Mangoola Coal Operations Pty Ltd
MOP start date	1 January 2021
MOP end date	2 July 2022
Annual Review start date	1 January 2021
Annual Review end date	31 December 2021

I, Sam Palmer, certify that this audit report is a true and accurate record of the compliance status of Mangoola Open Cut for the period 1 January 2021 to 31 December 2021 and that I am authorised to make this statement on behalf of Mangoola Open Cut.

Note.

a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.

b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).

Name of authorised reporting officer	Sam Palmer
Title of authorised reporting officer	Environment and Community Manager
Signature of authorised reporting officer	
Date	30 March 2022

CONTENTS

1	STATEMENT OF COMPLIANCE	13
2	INTRODUCTION	15
2.1	Mining Operations	15
2.2	Mine Contacts	16
3	APPROVALS	18
3.1	Project Approval	18
3.2	Development Consent.....	18
3.3	Leases	18
3.4	Licences	19
3.4.1	Environment Protection Licence.....	19
3.4.2	Surface Water Licences	19
3.4.3	Groundwater Licences	21
3.4.4	Radiation Licence.....	22
3.4.5	Sewage Management System Licence	22
3.5	Other Approvals.....	22
3.5.1	Mining Operations Plan (MOP).....	22
3.5.2	Compliance with MOD 6 EIS Predictions	22
4	OPERATIONS DURING THE REPORTING PERIOD	24
4.1	Mining Operations	24
4.1.1	Overview	24
4.1.2	Exploration.....	24
4.1.3	Land Preparation	24
4.1.4	Mining.....	24
4.2	Other Operations	26
4.2.1	Coal Processing.....	26
4.2.2	Coal Transport.....	26
4.2.3	Construction.....	26
4.2.4	Waste Management	26
4.3	Next Reporting Period.....	27
4.3.1	Mining.....	27
4.3.2	Exploration.....	27
4.3.3	Construction.....	27
4.3.4	Tailings Disposal	27
5	ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW.....	28
6	ENVIRONMENTAL PERFORMANCE	29

CONTENTS

6.1	Meteorology	29
6.2	Air Quality	31
6.2.1	Environmental Management	31
6.2.2	Environmental Monitoring Results	35
6.2.2.1	Results from the Reporting Period	35
6.2.2.2	Comparison with Predictions	38
6.2.2.3	Long Term Trend Analysis	39
6.2.3	Key Performance and/or Management Issues	40
6.2.4	Proposed Improvements	40
6.3	Noise	40
6.3.1	Environmental Management	40
6.3.2	Environmental Monitoring Results	46
6.3.2.1	Results from the Reporting Period	46
6.3.2.2	Comparison with Predictions	46
6.3.3	Key Performance and/or Management Issues	56
6.3.4	Proposed Improvements	56
6.4	Blasting and Vibration	56
6.4.1	Environmental Management	56
6.4.2	Environmental Monitoring Results	57
6.4.2.1	Results from the Reporting Period	57
6.4.2.2	Comparison with Predictions	59
6.4.2.3	Long Term Trend Analysis	60
6.4.3	Key Performance and/or Management Issues	60
6.4.4	Proposed Improvements	60
6.5	Erosion and Sediment Control	60
6.5.1	Environmental Management	60
6.5.2	Environmental Monitoring Results	61
6.5.3	Key Performance and/or Management Issues	61
6.5.4	Proposed Improvements	61
6.6	Biodiversity	62
6.6.1	Environmental Management	62
6.6.1.1	Weather Conditions 2021	62
6.6.2	Environmental Monitoring Results	62
6.6.2.1	Fauna Values	63
6.6.2.2	Threatened Species	63
6.6.2.3	Conservation Agreement Monitoring	64

CONTENTS

6.6.2.4	Landscape Function Analysis	66
6.6.2.5	Nest Box Monitoring.....	66
6.6.2.6	Threatened Terrestrial Orchid Monitoring	66
6.6.2.7	Groundwater Dependent Ecosystems.....	67
6.6.2.8	Infill Tree Planting 2021	68
6.6.3	Key Performance and/or Management Issues.....	69
6.6.4	Proposed Improvements.....	70
6.7	Weed and Pest	70
6.7.1	Environmental Management.....	70
6.7.1.1	Weed Management Activities	70
6.7.1.2	Feral and Pest Animal Management Activities	70
6.7.2	Key Performance and/or Management Issues.....	71
6.7.3	Proposed Improvements.....	71
6.8	Visual Mitigation	71
6.8.1	Environmental Management.....	71
6.8.2	Environmental Monitoring Results	71
6.8.3	Key Performance and/or Management Issues.....	71
6.8.4	Proposed Improvements.....	71
6.9	Aboriginal Heritage	72
6.9.1	Environmental Management.....	72
6.9.2	Environmental Monitoring Results	72
6.9.3	Key Performance and/or Management Issues.....	73
6.9.4	Proposed Improvements.....	73
6.10	European Heritage	74
6.10.1	Environmental Management.....	74
6.10.2	Environmental Monitoring Results	74
6.10.3	Key Performance and/or Management Issues.....	74
6.10.4	Proposed Improvements.....	74
6.11	Spontaneous Combustion	75
6.11.1	Environmental Management.....	75
6.11.2	Environmental Monitoring Results	75
6.11.3	Key Performance and/or Management Issues.....	75
6.11.4	Proposed Improvements.....	75
6.12	Bushfire	75
6.12.1	Environmental Management.....	75
6.12.2	Environmental Monitoring Results	75

CONTENTS

6.12.3	Key Performance and/or Management Issues.....	76
6.12.4	Proposed Improvements.....	76
6.13	Hydrocarbon Management	76
6.13.1	Environmental Management.....	76
6.13.2	Environmental Monitoring Results	76
6.13.3	Key Performance and/or Management Issues.....	76
6.13.4	Proposed Improvements.....	77
6.14	Public Safety	77
6.14.1	Environmental Management.....	77
6.14.2	Environmental Monitoring Results	77
6.14.3	Key Performance and/or Management Issues.....	78
6.14.4	Proposed Improvements.....	78
6.15	Greenhouse Gas Energy	78
6.15.1	Environmental Management.....	78
6.15.2	Environmental Monitoring Results	78
6.15.2.1	Results from the Reporting Period.....	78
6.15.2.2	Comparison with Predictions.....	79
6.15.3	Key Performance and/or Management Issues.....	79
6.15.4	Proposed Improvements.....	79
7	WATER MANAGEMENT	80
7.1	Water Balance	80
7.2	Salt Balance	81
7.3	Saline Material & Water Management and Minimisation	82
7.4	Water Take	83
7.4.1	Changes to Licences.....	84
7.5	Hunter River Salinity Trading Scheme Discharges	84
7.6	Surface Water Monitoring.....	85
7.6.1	Environmental Management.....	85
7.6.2	Environmental Monitoring Results	87
7.6.2.1	Results from the Reporting Period.....	87
7.6.2.2	Comparison with Predictions.....	94
7.6.2.3	Long Term Trend Analysis	95
7.6.3	Key Performance and/or Management Issues.....	96
7.6.4	Proposed Improvements.....	96
7.7	Groundwater Management.....	96

CONTENTS

7.7.1	Environmental Management.....	96
7.7.2	Environmental Monitoring Results	99
7.7.2.1	Results from the Reporting Period.....	99
7.7.2.2	Comparison with Predictions.....	104
7.7.2.3	Long Term Trend Analysis	104
7.7.3	Key Performance and/or Management Issues.....	105
7.7.4	Proposed Improvements.....	105
8	REHABILITATION	107
9	COMMUNITY	126
9.1	Community Engagement.....	126
9.1.1	Face to Face Meetings	126
9.1.2	Website.....	127
9.1.3	Community Newsletters	129
9.2	Community Contributions	129
9.3	Community Complaints	131
9.3.1	2021 Complaints Summary	131
9.3.2	Analysis of Complaints	132
9.3.3	Actions in Response to Complaints.....	135
10	INDEPENDENT AUDIT	136
11	INCIDENTS AND NON-COMPLIANCES	137
12	ACTIVITIES TO BE COMPLETED DURING NEXT REPORTING PERIOD	141
12.1	Management Plan Review.....	141
12.2	2022 Actions	143
13	REFERENCES	144

CONTENTS

DOCUMENT REFERENCES

TABLES

Table 1	Statement of Compliance	13
Table 2	Non-Compliances During 2021.....	13
Table 3	Compliance Status Categories.....	15
Table 4	Mine Contacts	16
Table 5	Mangoola PA 06_0014 and Modifications.....	18
Table 6	Mangoola SSD 8642 Approval	18
Table 7	Mangoola Leases	19
Table 8	Mangoola Surface Water Licences	19
Table 9	Mangoola Groundwater Licences.....	21
Table 10	PA 06_0014 MOD 6 Comparison Against Predictions	22
Table 11	2021 Production Summary	24
Table 12	Actions Required From 2020 Annual Review.....	28
Table 13	PA 06_0014 Air Quality Criteria.....	32
Table 14	SSD 8642 Air Quality Criteria.....	32
Table 15	2021 Depositional Dust Gauge Results (Insoluble Matter)	35
Table 16	2021 PM ₁₀ 24-hr Average Results.....	36
Table 17	2021 PM _{2.5} 24-hr and Annual Average Results	37
Table 18	2021 PM ₁₀ and TSP 24-hr Average Results.....	37
Table 19	Comparison of 2019 to 2021 Dust Emissions.....	38
Table 20	PA 06_0014 – Noise Impact Assessment Criteria.....	43
Table 21	EPL 12894 – Noise Impact Assessment Criteria	43
Table 22	SSD 8642 – Noise Impact Assessment Criteria.....	44
Table 23	EPL 12894 – Noise Impact Assessment Criteria	44
Table 24	Attended Noise Monitoring Results and Comparison against MOD 6 Predictions (L _{Aeq(15minute)})	48
Table 25	Attended Noise Monitoring Results and Comparison against MOD 6 Predictions (L _{Amax})	49
Table 26	Attended Noise Monitoring Results and Comparison against MCCO Predictions (L _{Aeq(15 minute)})	50
Table 27	Attended Noise Monitoring Results and Comparison against MCCO Predictions (L _{Amax})	51
Table 28	Compliance Monitoring Location Summary and Adopted Criterion	58
Table 29	Airblast Overpressure Summary	58
Table 30	Ground Vibration Summary	59
Table 31	2021 Annual Channel Stability Report Recommendations	61
Table 32	Aboriginal Heritage Monitoring and Inspections	72
Table 33	Greenhouse Gas Data	78
Table 34	Mangoola 2021 Water Balance (Calendar Year)	80
Table 35	Salt Sources and Balance	82
Table 36	Mangoola 2021 Water Take (Water Year)	83
Table 37	Surface Water Monitoring Results – pH and EC.....	87
Table 38	Surface Water Monitoring Results – TDS and TSS.....	89
Table 39	Annual Surface Water Specification Results	91

CONTENTS

Table 40	Comparison of 2021 Water Usage with the 2013 MOD 6 Assessment	95
Table 41	Discharge Events	96
Table 42	Groundwater Monitoring Results – pH, EC and Groundwater Level.....	100
Table 43	Annual Groundwater Speciation Results 2021 (AGE, 2021)	103
Table 44	Rehabilitation Status.....	107
Table 45	Rehabilitation Progress Compared to MOP Predictions	112
Table 46	Summary of MOP TARP Actions Completed in 2021	116
Table 47	Final Land Use Rehabilitation.....	118
Table 48	Comparison of the 2021 Rehabilitation Walkover Inspection Results with MOP Completion Criteria	119
Table 49	Comparison of the 2021 Rehabilitation Walkover Inspection Results to Threats to Rehabilitation as Extracted from MOP	122
Table 50	Website Audit – PA 06_0014.....	127
Table 51	Website Audit - SSD 8642	128
Table 52	Summary of Complaints in 2021	131
Table 53	Incidents, Non-Compliances and Exceedances	138
Table 54	Revision of Strategies, Plans and Programs	141
Table 55	2022 Actions.....	143

FIGURES

Figure 1	Regional Context	17
Figure 2	Mangoola Site Layout	25
Figure 3	2016-2021 Waste Streams Generated	27
Figure 4	Australian Rainfall Deciles (2021)	29
Figure 5	WSN 2021 Rainfall Data	30
Figure 6	WSN 2021 2m Temperature Data	31
Figure 7	Air Quality and Meteorological Monitoring Locations	34
Figure 8	Noise and Blast Monitoring Locations	42
Figure 9	Annual Review Attended Noise Monitoring Compliance Results ($L_{Aeq(15minute)}$) – January to November	54
Figure 10	Annual Review Attended Noise Monitoring Compliance Results (L_{Amax}) – January to November	54
Figure 11	Annual Review Attended Noise Monitoring Compliance Results ($L_{Aeq(15minute)}$) – December.....	55
Figure 12	Annual Review Attended Noise Monitoring Compliance Results (L_{Amax}) – December.....	55
Figure 13	Daily Blast Event(s) 2021.....	57
Figure 14	Flora, Fauna and GDE Monitoring Locations.....	65
Figure 15	Surface Water Monitoring Locations.....	86
Figure 16	Groundwater Monitoring Locations	98
Figure 17	Actual Rehabilitation and Disturbance Vs MOP Plan 3A	113
Figure 18	MOP Rehabilitation TARP Areas.....	117
Figure 19	2021 Complaints by Time of Day	132
Figure 20	2021 Complaints by Complainant ID	133
Figure 21	2021 Complaints by Location	134

CONTENTS

Figure 22	Long Term Daily Rainfall Data at WSN – 2010 to 2021.....	AB1
Figure 23	Long Term Annual Average Depositional Dust Monitoring Results – 2010 to 2021	AC1
Figure 24	Long Term Annual Average PM ₁₀ TEOM Monitoring Results – 2011 to 2021.....	AC2
Figure 25	Long Term 24h PM ₁₀ TEOM Monitoring Results – 2011 to 2021	AC3
Figure 26	Long Term Annual Average TSP HVAS Monitoring Results – 2010 to 2021	AC4
Figure 27	Long Term 24h PM ₁₀ HVAS Monitoring Results – 2010 to 2021	AC5
Figure 28	Long Term Blast Vibration Monitoring – BM01 to BM04 and BM07 to BM08	AD1
Figure 29	Long Term Overpressure Monitoring – BM01 to BM04 and BM07 to BM08	AD2
Figure 30	Long Term Blast Vibration Monitoring – Representative of Anvil Rock and Nearest Formation.....	AD3
Figure 31	Long Term Surface Water pH – 2010 to 2021	AE1
Figure 32	Long Term Surface Water EC – 2010 to 2021	AE2
Figure 33	Long Term Surface Water TSS – 2010 to 2021	AE3
Figure 34	Long Term Surface Water TDS – 2010 to 2021	AE4
Figure 35	Standing Water Level GW Bores – 2003 to 2021	AE5
Figure 36	Standing Water Level MP and BFC Bores – 2012 to 2021	AE6
Figure 37	GW Bores pH – 2004 to 2021	AE7
Figure 38	MP and BFC Bores pH – 2012 to 2021	AE8
Figure 39	GW Bores EC – 2004 to 2021	AE9
Figure 40	MP and BFC Bores EC – 2012 to 2021.....	AE10

PHOTOS

Photo 1	Planting throughout rehabilitation areas.	68
Photo 2	Tubestock established throughout the rehabilitation areas.....	69
Photo 3	2020 and 2021 South Pit Progressive Rehabilitation looking North	109
Photo 4	South Pit Rehabilitation Frog Ponds Constructed 2019.....	109
Photo 5	View from Main Pit Central towards 2019-2021 Progressive Rehabilitation	110
Photo 6	Frog Pond and Progressive Rehabilitation in Main Pit Central 2019 Area.....	110
Photo 7	2017 South Pit Rehabilitation looking toward Offset Area and 500kV Powerline	111
Photo 8	Translocated <i>Pomaderris reperta</i> in rehabilitation area.....	124
Photo 9	Translocated <i>Cymbidium canaliculatum</i> within rehabilitation area.....	125
Photo 10	2021 Mine Tours (when COVID 19 restrictions eased)	127
Photo 11	Mangoola's Damien Ryba at the Toybox 'Books in Homes' book giving ceremony	130
Photo 12	Apprentice working bee at the Hunter Sustainable Landcare community garden – bed building tuition prior to starting	131

APPENDICES

Appendix A	Annual Review Plan
Appendix B	Long Term Trend Graph – Rainfall
Appendix C	Long Term Trend Graphs – Air Quality
Appendix D	Long Term Trends Graphs – Blasting
Appendix E	Long Term Graphs – Surface and Groundwater

CONTENTS

Appendix F Annual Train Movements 2021

1 Statement of Compliance

A summary of compliance at Mangoola Open Cut during 2021 is provided in **Table 1**.

Table 1 Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	Yes/No
PA 06_0014	No
SSD 8642	Yes
EPL 12894	No
ML 1626	Yes
ML 1747	Yes
ML 1817	Yes
ML 1815	Yes
AL 9	Yes
EL 5552	Yes
EPBC 2018/8280	Yes

A summary of the non-compliances during the reporting period have been summarised in **Table 2**. The non-compliances during the 2021 reporting period are discussed further in **Section 11**. The non-compliance categories are described in **Table 3**.

Table 2 Non-Compliances During 2021

Relevant Approval	Condition #	Condition Description Summary	Compliance Status	Comment	Where Addressed
PA 06_0014	Schedule 3, Condition 19	24h PM ₁₀ criterion of 50µg/m ³	Non-compliant	Exceedance of 50 µg/m ³ 24h PM ₁₀ criteria on: <ul style="list-style-type: none"> 30 October 2021 – D01-DC (50.1 µg/m³) - DPIE reviewed the information presented in the report and was satisfied Mangoola Coal undertook reasonable and feasible mitigation measures to minimise dust emissions from the site on this day. 	Section 6.2.2 and Section 11
PA 06_0014	Schedule 3, Condition 17	Blast Management Plan	Non-compliant	On 1 October 2021 blast monitor BM07 failed to record a result. An internal investigation was conducted and identified that although the blast monitor was online, data could not be downloaded due to memory card corruption.	Section 6.4.3 and Section 11

Relevant Approval	Condition #	Condition Description Summary	Compliance Status	Comment	Where Addressed
EPL 12894	M2.2	Air Monitoring Requirements	Non-compliant	On 20 February 2021, the monitoring unit malfunctioned at Monitoring Point 20 (D8).	Section 6.2.3 and Section 11
EPL 12894	M4.1	Weather Monitoring Requirements	Non-compliant	<p>During the reporting period, Monitoring Points 5 and 18 failed to continuously monitor (1 hr / 15 min averaging periods) rainfall, wind speed, wind direction, temperature (2m), temperature (10m), sigma theta and solar radiation.</p> <p>Monthly data validation checks have been implemented, along with changes to contactor arrangements. The non-compliance was reporting the EPL Annual Return, dated 12 August 2021.</p>	Section 6.2.3 and Section 11
PIRMP		Surface Water Discharge – Sandy Creek Farm Dam 2	Non-compliant	<p>On 26 November 2021, water was discharged from Sandy Creek Farm Dam 2, a saline seepage management dam, into Sandy Creek via an unnamed drainage line.</p> <p>PIRMP was enacted in accordance with Section 147 of the POEO Act. DPIE and EPA were notified.</p> <p>An investigation was completed where the analysis had indicated that the predominant source of water discharged was runoff from the 25.7 ha clean water catchment caused by excessive rainfall.</p>	Section 7.6.3 and Section 11
PIRMP		Surface Water Discharge – Sandy Creek Farm Dam 2	Non-compliant	<p>On 8 December 2021, water was discharged from Sandy Creek Farm Dam 2, a saline seepage management dam, into Sandy Creek via an unnamed drainage line.</p> <p>PIRMP was enacted in accordance with Section 147 of the POEO Act. DPIE and EPA were notified.</p> <p>An investigation was completed where the analysis had indicated that the predominant source of water discharged was runoff from the 25.7 ha clean water catchment caused by excessive rainfall.</p>	Section 7.6.3 and Section 11

Relevant Approval	Condition #	Condition Description Summary	Compliance Status	Comment	Where Addressed
PIRMP		Surface Water Discharge – Sandy Creek Farm Dam 2	Non-compliant	On the 28 November, Mangoola failed to monitor at SW01 and SW02 following the 26 November discharge event. These sites were unable to be monitored due to safety concerns around access.	Section 7.6.3 and Section 11

Table 3 Compliance Status Categories

Risk Level	Colour Code	Description
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	Non-compliance with potential for serious environmental consequences, but is unlikely to occur; or potential for moderate environmental consequences, but is likely to occur
Low	Non-Compliant	Non-compliance with potential for moderate environmental consequences, but is unlikely to occur; or potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-Compliant	Non-compliance which does not result in any risk of environmental harm

2 Introduction

2.1 Mining Operations

Mangoola Open Cut (Mangoola) is owned and operated by Mangoola Coal Operations Pty Ltd which is a Glencore managed operation. Mangoola is located near Wybong, New South Wales (NSW), approximately 20 kilometres (km) west of Muswellbrook and approximately 10 km north of Denman in the Muswellbrook Local Government Area (LGA). A locality plan is presented in **Figure 1**. This Annual Review has been prepared for the 12-month reporting period of 1 January 2021 to 31 December 2021 (herein referred to as the reporting period).

Project Approval 06_0014 (PA 06_0014) was granted in June 2007 for the construction of an open cut coal mine and associated infrastructure in the Wybong area. The mine, then owned by Centennial Coal and known as the Anvil Hill Project, was approved to extract up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Since April 2014, Mangoola has been approved to extract up to 13.5 Mtpa ROM coal under PA 06_0014. The Site also operates a Coal Handling and Preparation Plant (CHPP) and Train Loading Facility.

On 26 April 2021, the NSW Independent Planning Commission (IPC) approved with conditions the Development Application for the Mangoola Coal Continued Operations (MCCO) Project under Part 4 of the Environmental Planning and Assessment Act 1979.

The State Significant Development (SSD) 8642 approval provides for the continuation of open cut mining immediately north of the existing mine at Mangoola Coal Operations. This will enable Glencore to extract a further 52 million tonnes of coal through to the end of 2030.

This Annual Review has been prepared in accordance with the following:

- Schedule 5, Condition 6 of PA 06_0014.
- Condition D10 of SSD 8642.
- The NSW Government Annual Review Guideline (October 2015).
- Mining Lease 1626 (ML 1626).
- Mining Lease 1747 (ML 1747).
- Mining Lease 1815 (ML 1815).
- Mining Lease 1817 (ML 1817).
- 2019-2021 Mining Operations Plan (MOP).
- Outcomes from the 2020 Annual Review feedback and inspection.

Copies and/or a link to this Annual Review will be made available to the Department of Planning, Industry and Environment (DPIE), the Department of Regional NSW – Resources Regulator (Resources Regulator), the Biodiversity Conservation Division (BCD), the Natural Resources Access Regulator (NRAR) and the Environment Protection Authority (EPA). Copies and/or a link to the company website will also be provided to the members of the Mangoola Community Consultative Committee (CCC). A copy will also be made available on the Mangoola website in accordance with PA 06_0014 and SSD 8642 for any member of the public to access.

2.2 Mine Contacts

The relevant mine contacts for Mangoola are listed in **Table 4**.

Table 4 Mine Contacts

Contacts	Details
Operations Manager	Jacob Hundertmark
Environment and Community Manager	Sam Palmer
Address	PO Box 495 Muswellbrook NSW 2333
Phone Number	(02) 6549 5500
Fax Number	(02) 6549 5655
24 Hour Community Hotline	1800 014 339
Website	www.mangoolamine.com.au
General Enquiries Email	mangoolaenquiries@glencore.com.au

Figure 1 - Regional Context



Legend

- | | |
|--|--|
| Approved EPL Boundary | Major road |
| MCCO Disturbance | Main road |
| NPWS reserve | Watercourse |
| State Forest | |

DISCLAIMER

Subject To Survey.

Glencore makes every effort to ensure the quality of the information available on this map. Before relying on the information on this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Glencore cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Glencore has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map.

DATA SOURCE

© NSW Department of Finance & Services (LPI) 2016
© NSW DTIRIS (Minerals & Petroleum) 2016
© Glencore 2016 © ESRI 2016

3 Approvals

Operations at Mangoola are regulated by a range of leases, licences and approvals, which are summarised in the following sections.

3.1 Project Approval

PA 06_0014 (as modified) allows for the extraction, processing and transportation of up to 13.5 Mtpa for a period of up to 21 years from the granting of a Mining Lease. Mining Lease 1626 was granted on 20 November 2008, therefore PA 06_0014 expires in 2029. Eight modifications to PA 06_0014 have been approved, as detailed in **Table 5**. It is noted that the expected date of surrender for PA 06_0014 is 26 April 2022.

Table 5 Mangoola PA 06_0014 and Modifications

Approval	Title	Date Granted	Expiry
06_0014	Original Approval	7 June 2007	20 November 2029
06_0014 Mod 1	Change to Road Access and Water Supply	22 July 2008	20 November 2029
06_0014 Mod 2	Relocate Water Supply Pipeline	23 June 2009	20 November 2029
06_0014 Mod 3	Relocate Mine Infrastructure Area	4 November 2009	20 November 2029
06_0014 Mod 4	Modify Approved Mine Plan	22 June 2012	20 November 2029
06_0014 Mod 5	Night-time Works	23 February 2010	20 November 2029
06_0014 Mod 6	Extraction Rate Increase	28 April 2014	20 November 2029
06_0014 Mod 7	Removal of Schedule 3, Condition 3 – Traffic Noise Criteria	22 August 2016	20 November 2029
06_0014 Mod 8	Update of Project Layout Plan	14 June 2017	20 November 2029

3.2 Development Consent

SSD 8642 allows for the continuation of open cut mining immediately north of the existing mine at Mangoola Coal Operations (**Table 6**). This will enable Glencore to extract a further 52 million tonnes of coal through to the end of 2030.

Table 6 Mangoola SSD 8642 Approval

Approval	Title	Date Granted	Expiry
SSD 8642	Original Approval	26 April 2021	31 December 2030

3.3 Leases

Mangoola currently holds six active leases as shown in **Table 7**.

Table 7 Mangoola Leases

Title	Date Granted	Expiry
ML 1626	20 November 2008	20 November 2029
ML 1747	24 August 2016	5 December 2037
ML 1815	29 September 2021	29 September 2042
ML 1817	27 October 2021	27 October 2042
Exploration Lease 5552	8 May 2006	7 November 2025
Assessment Lease 9	8 November 2004	7 November 2019 (renewal lodged 1 November 2019)

3.4 Licences

3.4.1 Environment Protection Licence

Mangoola operates under Environment Protection Licence (EPL) 12894, with an anniversary date of 7 July. Monitoring results are reported to the EPA as part of the Mangoola EPL Annual Return and monitoring data is available on the Mangoola website. One variation of the EPL was sought and approved for the integration of the MCCO.

The environmental reporting and monitoring activities undertaken at Mangoola as required under EPL 12894, are discussed in **Section 6**.

3.4.2 Surface Water Licences

Mangoola currently holds the following surface water licences, as detailed in **Table 8**.

Table 8 Mangoola Surface Water Licences

WAL No.	DPI Water Reference Number	Share Allocation (ML)	Water Source	WAL No.	DPI Water Reference number	Share Allocation (ML)	Water Source
503	20AL200112	159	Hunter Regulated River	6571	20AL201639	111	Hunter Regulated River
644	20AL200456	3	Hunter Regulated River	6572	20AL201640	8	Hunter Regulated River
645	20AL200457	432	Hunter Regulated River	6576	20AL201869	600	Hunter Regulated River
691	20AL200578	50	Hunter Regulated River	6577	20AL201870	8	Hunter Regulated River
692	20AL200579	8	Hunter Regulated River	7291*	20AL202589	63	Wybong Creek
735	20AL200676	72	Hunter Regulated River	7292*	20AL202610	44	Wybong Creek
822	20AL200912	3	Hunter Regulated River	9061	20AL203156	6	Hunter Regulated River
823	20AL200913	310	Hunter Regulated River	9062	20AL203157	18	Hunter Regulated River

WAL No.	DPI Water Reference Number	Share Allocation (ML)	Water Source	WAL No.	DPI Water Reference number	Share Allocation (ML)	Water Source
824	20AL200915	175	Hunter Regulated River	9343*	20AL203174	25	Wybong Creek
830	20AL200933	306	Hunter Regulated River	9344*	20AL203206	164	Wybong Creek
831	20AL200934	8	Hunter Regulated River	9986	20AL203182	5	Hunter Regulated River
895	20AL201081	8	Hunter Regulated River	9987	20AL203183	82	Hunter Regulated River
897	20AL201085	55	Hunter Regulated River	9988	20AL203184	8	Hunter Regulated River
898	20AL201086	8	Hunter Regulated River	11085*	20AL203320	128	Wybong Creek
933	20AL201156	43	Hunter Regulated River	11216	20AL203370	86	Hunter Regulated River
1000	20AL201324	3	Hunter Regulated River	13083	20AL203454	100	Hunter Regulated River
1001	20AL201325	334	Hunter Regulated River	13228	20AL202591	0	Wybong Creek
1057	20AL201469	509	Hunter Regulated River	13229	20AL202592	77	Wybong Creek
1159	20AL201722	159	Hunter Regulated River	18689	20AL209242	15	Muswellbrook
1239	20AL203080	40	Hunter Regulated River	18701	20AL209198	28	Muswellbrook
1349	20AL202949	8	Hunter Regulated River	18712	20AL209241	5	Muswellbrook
1387	20AL202878	40	Hunter Regulated River	20343	20AL204331	48	Wybong Creek
6260*	20AL202522	36	Wybong Creek	37027*	20AL213134	30	Wybong Creek
6261	20AL202524	1	Wybong Creek	37028*	20AL213135	96	Wybong Creek
6262*	20AL202525	8	Wybong Creek	6294*	20AL202631	39	Wybong Creek
6264*	20AL202531	30	Wybong Creek	6296*	20AL202639	86	Wybong Creek
6272*	20AL202554	50	Wybong Creek	6298*	20AL202643	39	Wybong Creek
6275	20AL202561	5	Wybong Creek	6300	20AL202647	5	Wybong Creek
6276*	20AL202562	12	Wybong Creek	6304	20CA202655	5	Wybong Creek
6278*	20AL202569	117	Wybong Creek	6305	20CA202656	74	Wybong Creek
6306*	20AL202658	52	Wybong Creek	7495	20AL202699	27	Wybong Creek

*WAL covered under water use approval 20MW065001 (Miscellaneous Works Approval for licence of harvestable rights).

3.4.3 Groundwater Licences

Mangoola currently holds the following groundwater licences shown in **Table 9**.

Table 9 Mangoola Groundwater Licences

WAL No.	Works Approval No.	Share Allocation (ML)	Type of Works	WAL No.	Works Approval No.	Share Allocation (ML)	Type of Works
6316	20CA202449	175	Well	-	20BL172827	0	Test bore
6317	20CA202451	19	Well	-	20BL171778	0	Test bore
6322	20CA202463	5	Well	-	20BL171860	0	Test bore
6327	20CA202482	30	Well	-	20BL171861	0	Test bore
18068	20CA208143	5	Bore	-	20BL171862	0	Test bore
18136	20CA208033	596	Bore	-	20BL171864	0	Test bore
18170	20CA207847	219	Well	-	20BL171865	0	Test bore
18214	20CA208151	218	Well	-	20BL171867	0	Test bore
18219	20CA208171	5	Bore	-	20BL172567	0	Test bore
18232	20CA208179	5	Bore	-	20BL172568	0	Test bore
18690	20CA209155	10	Bore/Well	-	20BL172569	0	Test bore
18695	20CA209151	131	Well	-	20BL172570	0	Test bore
18696	20CA209157	53	Well	-	20BL172573	0	Test bore
18701	20CA209199	28	Bore	-	20BL172788	0	Test bore
18718	20CA209147	151	Well/Bore	-	20BL172789	0	Test bore
30247	20CA212344	98	Well	-	20BL172790	0	Test bore
41561	WAL 41561	700	Excavation	-	20BL172806	0	Test bore
6325	20CA202475	0	Well	-	20BL172807	0	Test bore
-	20WA216010	1	Bore	-	20BL172808	0	Test bore
-	20WA207550	0	Bore	-	20BL172809	0	Test bore
-	20WA214821	0	Bore	-	20BL172811	0	Test bore
-	20WA207593	0	Well	-	20BL172812	0	Test bore
-	20WA207594	0	Well	-	20BL172813	0	Test bore
-	20WA209128	0	Bore	-	20BL172814	0	Test bore
-	20WA215330	0	Bore	-	20BL168135	0	Test bore
-	20WA207651	0	Bore	-	20BL168414	0	Test bore
-	20WA215537	0	Bore	-	20BL168696	0	Test bore
-	20WA207655	0	Well	-	20BL168743	0	Test bore
-	20WA207668	0	Well	-	20WA216315	0	Bore
-	20WA209113	0	Bore	-	20WA207700	0	Well
-	20WA212410	0	Bore	-	20WA209139	0	Spear points

WAL No.	Works Approval No.	Share Allocation (ML)	Type of Works	WAL No.	Works Approval No.	Share Allocation (ML)	Type of Works
-	20WA209136	0	Bore	-	20WA207718	0	Well
-	20WA209112	0	Bore	-	20WA215573	0	Well
-	20WA215016	0	Bore	-	20WA215826	0	Well
-	20WA215082	0	Bore	-	20BL167003	0	Bore
-	20WA215502	0	Bore		20CA211849	0	Well
-	20WA207649	0	Bore				

3.4.4 Radiation Licence

Mangoola holds Radiation Licence 5063445 which expires 28 April 2022. This annual licence was renewed during the reporting period.

3.4.5 Sewage Management System Licence

Mangoola Coal holds an approval to operate an onsite sewerage management system (licence number WTA5/2010) in accordance with the requirements of the Muswellbrook Shire Council and EPL 12894. The licence expires on 29 July 2026. All monitoring results required under EPL 12894 are published on the Mangoola Coal website.

3.5 Other Approvals

3.5.1 Mining Operations Plan (MOP)

The Mangoola Mining Operations Plan (MOP) was extended until 2 July 2022 in accordance with the transitional arrangements for the new reporting requirements under the Mining Act 1992. The Rehabilitation Management Plan, Annual Rehabilitation Report and Forward Program have been prepared in accordance with B91 of SSD 8642 and the Mining Act 1992. A comparison of 2021 rehabilitation and disturbance against the revised MOP predictions is provided in **Section 8.2**.

3.5.2 Compliance with MOD 6 EIS Predictions

In accordance with the Annual Review Guideline (October 2015), this Annual Review compares the predictions made in the PA 06_0014 Modification 6 EIS and SSD 8642 EIS with the environmental monitoring results from the 2021 reporting period. **Table 10** details the location of these prediction comparisons.

Table 10 PA 06_0014 MOD 6 Comparison Against Predictions

Environmental Aspect	Section Reference
Noise	Section 6.3.3
Blasting	Section 6.4.3
Air Quality	Section 6.2.3
Biodiversity	Section 6.6.3
Heritage	Section 6.9.3

Environmental Aspect	Section Reference
Surface Water	Section 7.6.3
Groundwater	Section 7.7.3

4 Operations During the Reporting Period

4.1 Mining Operations

4.1.1 Overview

Open cut mining continued at Mangoola during the reporting period. Truck and shovel mining methods are used to handle overburden and coal, following pre-strip and drilling and blasting activities. Product coal is loaded and transported to market via the rail loop connected to the Muswellbrook – Ulan railway. The mine operates 24 hours a day, seven days a week, and currently employs 378 full time equivalent employees (with approval for 450 employees). The general site layout is presented in **Figure 2**. Activities undertaken during the reporting period included open cut mining, coal processing and coal transport, which are detailed in the following sections.

4.1.2 Exploration

No exploration was undertaken during 2021.

4.1.3 Land Preparation

Land clearing is undertaken in accordance with the Mangoola Environmental Management System (EMS). Areas are assessed prior to clearing to minimise potential ecological, water management, sediment and erosion and cultural heritage impacts in accordance with the pre-clearing requirements.

4.1.4 Mining

Open cut mining operations continued during the reporting period, with 8.03 Million tonnes (Mt) of ROM coal being extracted. Mining operations during the reporting period continued in the Main Pit and South Pit. Approximately 27.82 million bank cubic metres (BCM) of overburden were moved. The 2021 production summary is presented in **Table 11**.

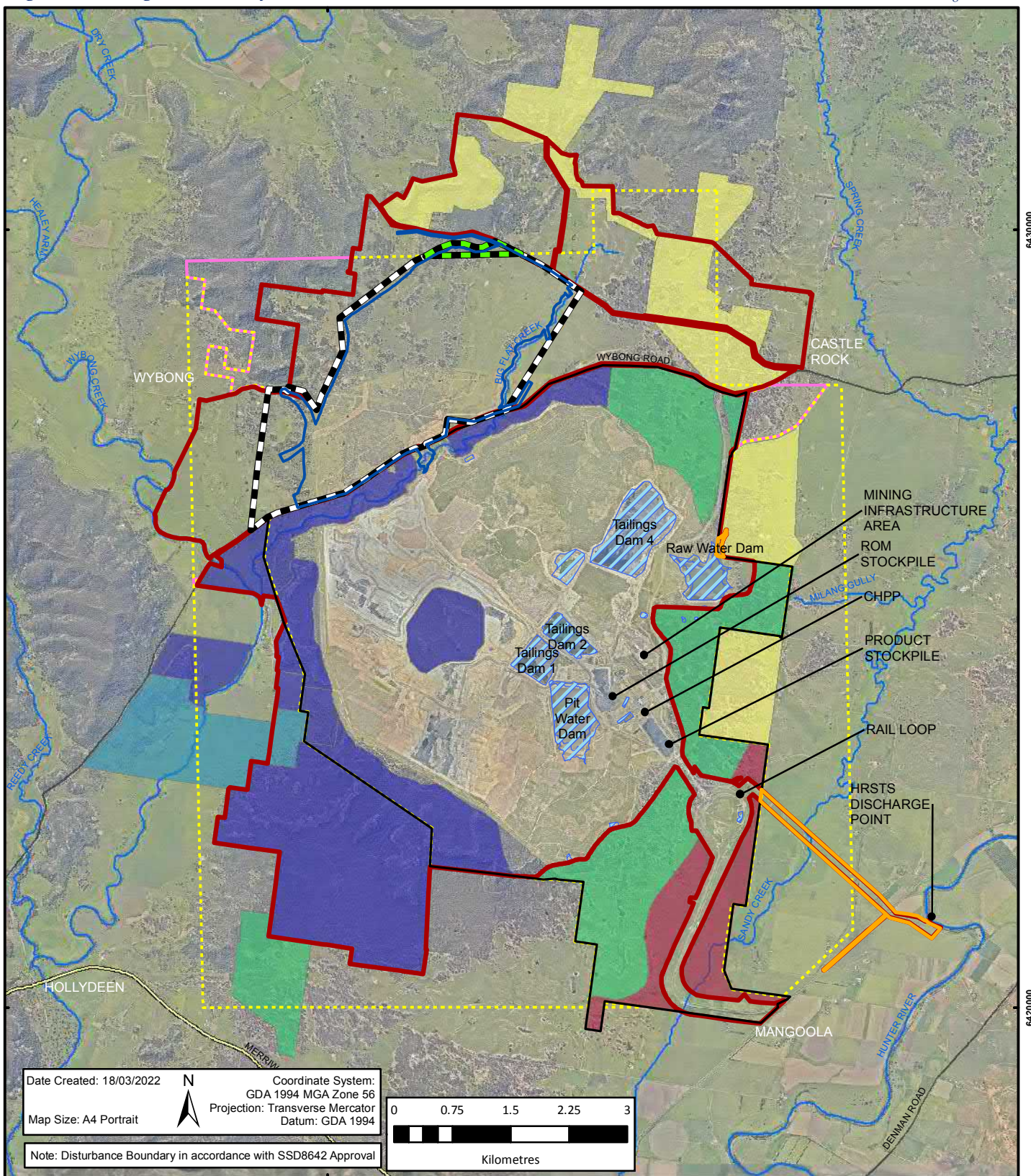
Table 11 2021 Production Summary

Material	Approved Limit (PA 06_0014)	2021 MOP Prediction	2020 Reporting Period (Actual)	2021 Reporting Period (Actual)	2022 Reporting Period (Forecast)
Waste Rock/ Overburden (BCM)	No limit	36,426,715	34,405,258	27,816,881	38,753,815
ROM Coal (t)	13,500,000	10,294,717	9,373,538	8,028,889	10,733,095
Coarse reject (t)	No limit	1,841,521	981,760	995,970	2,389,682
Fine reject (Tailings) (t)	No limit		958,751	881,949	
Saleable product (t)	No limit	8,453,196	7,003,610	6,441,666	8,383,413

* The MOP and RMP predict a combined reject volume rather than separating out into coarse and fine rejects.

ROM production in 2021 was below the MOP predictions by approximately 2.27 Mt due to market conditions, heavy rainfall and the Covid-19 pandemic, this total was within the PA 06_0014 approval limit. During 2021, the mining fleet remained unchanged and no gravel crushing operations occurred on site during 2021.

Figure 2 - Mangoola Site Layout



Legend

- | | | |
|-----------------------|--|-------------------|
| Approved EPL Boundary | ML1815 | Northern Corridor |
| MCCO Disturbance | ML1817 | Southern Offset |
| ML1626 | Aboriginal Cultural Heritage Offset Area | Western Corridor |
| ML1747 | Habitat Enhancement Offset | Dam locations |
| Assessment Lease 9 | | Major road |
| EL5552 | | Main road |

DISCLAIMER

Subject To Survey.

Glencore makes every effort to ensure the quality of the information available on this map. Before relying on the information on this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Glencore cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Glencore has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map.

DATA SOURCE

© NSW Department of Finance & Services (LPI) 2020
© NSW DTIRIS (Minerals & Petroleum) 2020
© Glencore 2020 © ESRI 2020

4.2 Other Operations

4.2.1 Coal Processing

During the reporting period approximately 6.4 Mt of product coal, 0.88 Mt of tailings, and 0.99 Mt of coarse rejects were produced from the CHPP. The CHPP washed or bypassed all coal produced at Mangoola and Mangoola utilised Tailings Dam 4 for fine rejects disposal.

Tailings Dam 4 has sufficient capacity for Life-Of-Mine. No capping took place for Tailings Dam 1 or Tailings Dam 2 during 2021.

4.2.2 Coal Transport

During the reporting period there were 1,454 train movements from the Mangoola rail loader, which transported approximately 6.62 Mt of coal. Each train consists of two movements (one movement into the loop and one movement out of the loop). This equates to an average of 3.98 train movements generated by Mangoola on a daily basis, with a maximum of 13 train movements in one day. This is within the 20 train movements per day limit stipulated in Schedule 3, Condition 49 of PA 06_0014 and B 93 of SSD 8642. No coal was transported other than by rail during the reporting period.

Annual train movements are included as **Appendix F**.

4.2.3 Construction

Construction works for the MCCO project commenced on 6 December 2021. This included the upgrade of three existing gates and the construction of two new access points. In addition, minor roadworks and traffic control measures were implemented on Wybong Road.

4.2.4 Waste Management

Waste at Mangoola is managed in accordance with the EMS (incorporating waste reuse and recycling). The EMS has been developed in accordance with the requirements of the *Protection of the Environment Operations Act 1997* (POEO Act).

A licensed waste contractor undertakes the collection, transport and recording of waste material, with as much material as possible being recycled. During the reporting period 1,746 tonnes of waste was disposed of offsite with 1,517 tonnes of that being recycled (86% recycled). This represents an overall decrease in total waste disposal compared to 2020 (1,903 tonnes).

The major waste streams during the reporting period were waste oil (665 tonnes), scrap steel (321 tonnes), mixed solid waste (208 tonnes) and effluent (366 tonnes).

A summary of waste disposal from 2016 to 2021 is presented in **Figure 3**.

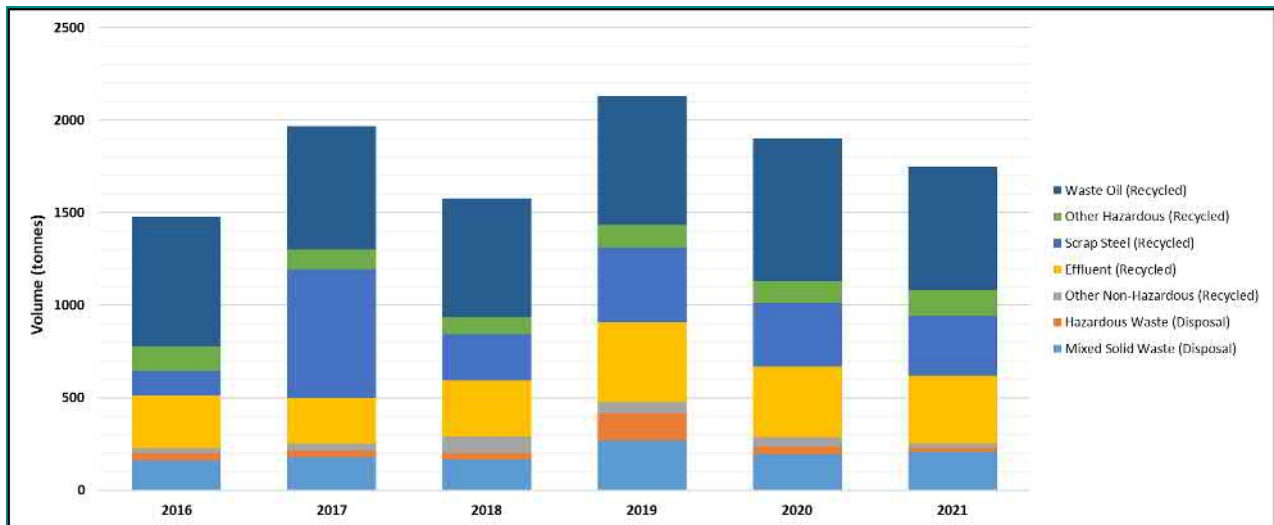


Figure 3 2016-2021 Waste Streams Generated

4.3 Next Reporting Period

4.3.1 Mining

During 2022, coal extraction will continue in the Main Pit and in South Pit. Forecast production for 2022 is 10.7 Mt of ROM coal and 8.4 Mt of product coal. Mining in 2022 will remain the same as 2021 with the same mining equipment, personnel and mining techniques to be utilised in-pit. Construction will continue for the MCCO project with mining forecast to commence in 2023.

Both Main and South Pit will continue progressing in line with the mine plan (and MOP) with rehabilitation expected to reach MOP / Rehabilitation Management Plan (RMP) predictions.

4.3.2 Exploration

Approximately 32 boreholes are to be drilled in AL9 for the MCCO project. Approximately half of these will be cored with the remainder of the holes open (chip) holes. A series of shallow LOX holes will be completed in the first year of mine disturbance.

4.3.3 Construction

Mangoola is continuing to develop plans to commence the wider construction program as approved by SSD 8642.

4.3.4 Tailings Disposal

During 2022, tailings will be disposed of in Tailings Dam 4, which has sufficient capacity for Life-Of-Mine.

5 Actions Required from Previous Annual Review

Mangoola received a letter from the DPIE on 27 July 2021, stating the Mangoola Annual Review 2020 was found to satisfy the requirements of the approval and the Departments Annual Review Guideline (2015).

The Resources Regulator advised that the Annual Review had been received and was subject to review to comply with the Mangoola mining authorisations and conditions of the Mining Act. No further correspondence was received.

The follow up actions to the commitments made in the 2020 Annual Review are summarised in **Table 12**.

Table 12 Actions Required From 2020 Annual Review

Action Required from Previous Annual Review	Due Date	Action Taken by Mangoola	Where Discussed
Mangoola will review the noise monitoring network to determine whether continuous noise monitoring units can be relocated to provide better coverage around the mining operations.	December	Noise Management Plan (including the continuous noise monitoring units) were updated to align with the SSD 8642 approval.	Section 6.3.1
Additional attended noise monitoring to be undertaken to the north-west of operations through the winter period to ensure noise emissions are managed appropriately.	Winter	Additional attended noise monitoring was completed through winter in line with NSW Health requirements due to the Covid 19 Pandemic.	Section 6.3.3
Validation and review of Numerical Groundwater Model, including revision of the GWMP.	December	The numerical model was not updated in 2020 due to unprecedented rain and additional drilling required. This action has been extended and will be completed in the 2022 review period.	Section 7.73 and Section 7.74

6 Environmental Performance

6.1 Meteorology

In accordance with Schedule 3, Condition 24 of PA 06_0014, and Condition P1.1 of EPL 12894, Mangoola continued to operate the Weather Station North (WSN) meteorological station throughout the reporting period. Additionally, the Weather Station South (WSS) meteorological station continued to operate, as required under EPL 12894. The WSN monitor is located to the north of the site, along Wybong Road, and the WSS monitor is located to the south of the site at the CHPP (refer **Figure 7**). Meteorological data recorded during the reporting period is available on the Mangoola website.

2021 was another wet year. Total annual rainfall for 2021 was 967.8 mm, which was consistent with the rainfall in 2020 (941 mm) (**Figure 5**). As shown in **Figure 5**, annual rainfall at WSN was lowest in April and highest in November 2021. Long term rainfall data is presented in **Appendix B**, which shows that rainfall at the site was higher than most years since reporting began in 2010 but lower than 2020.

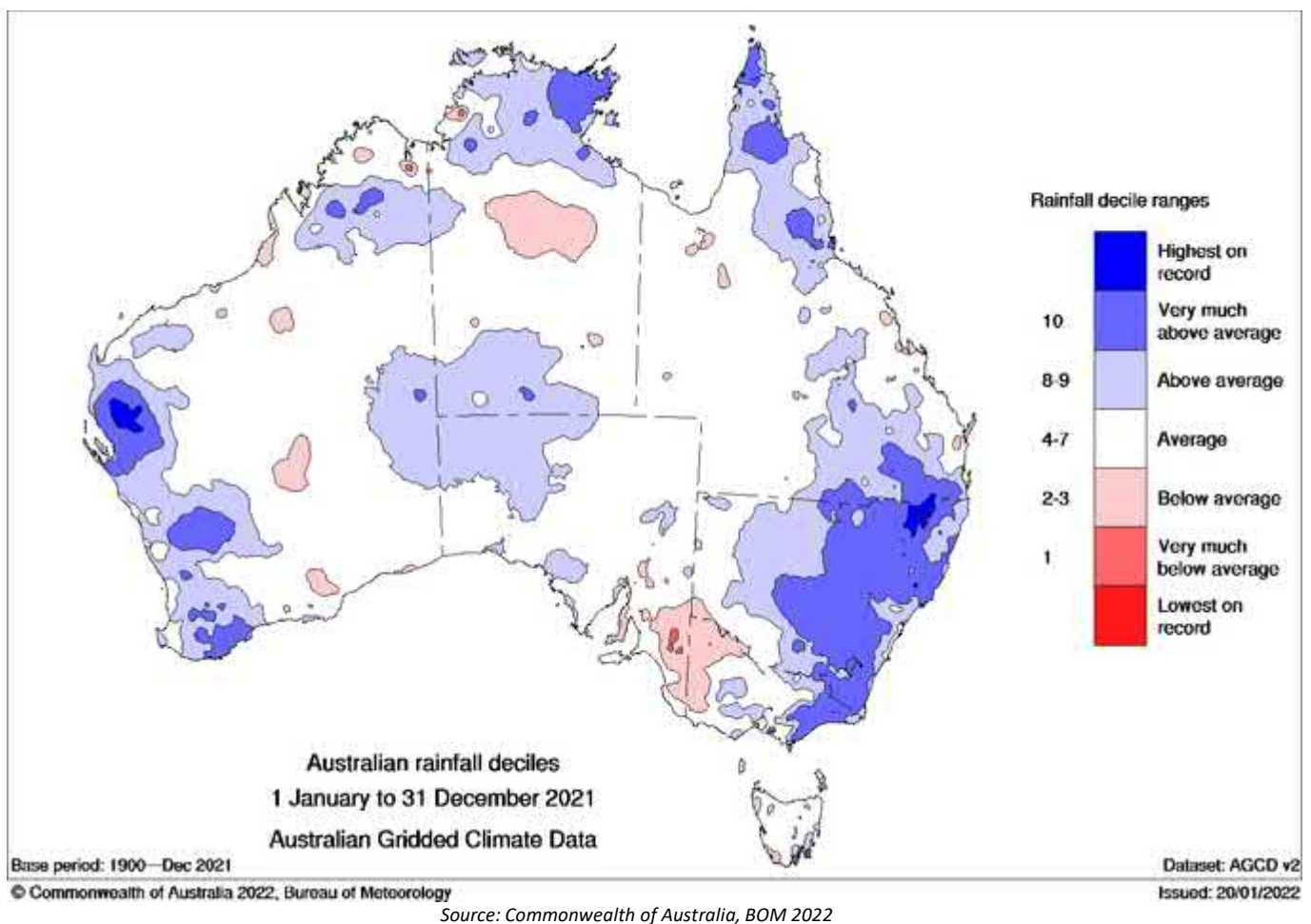


Figure 4 Australian Rainfall Deciles (2021)

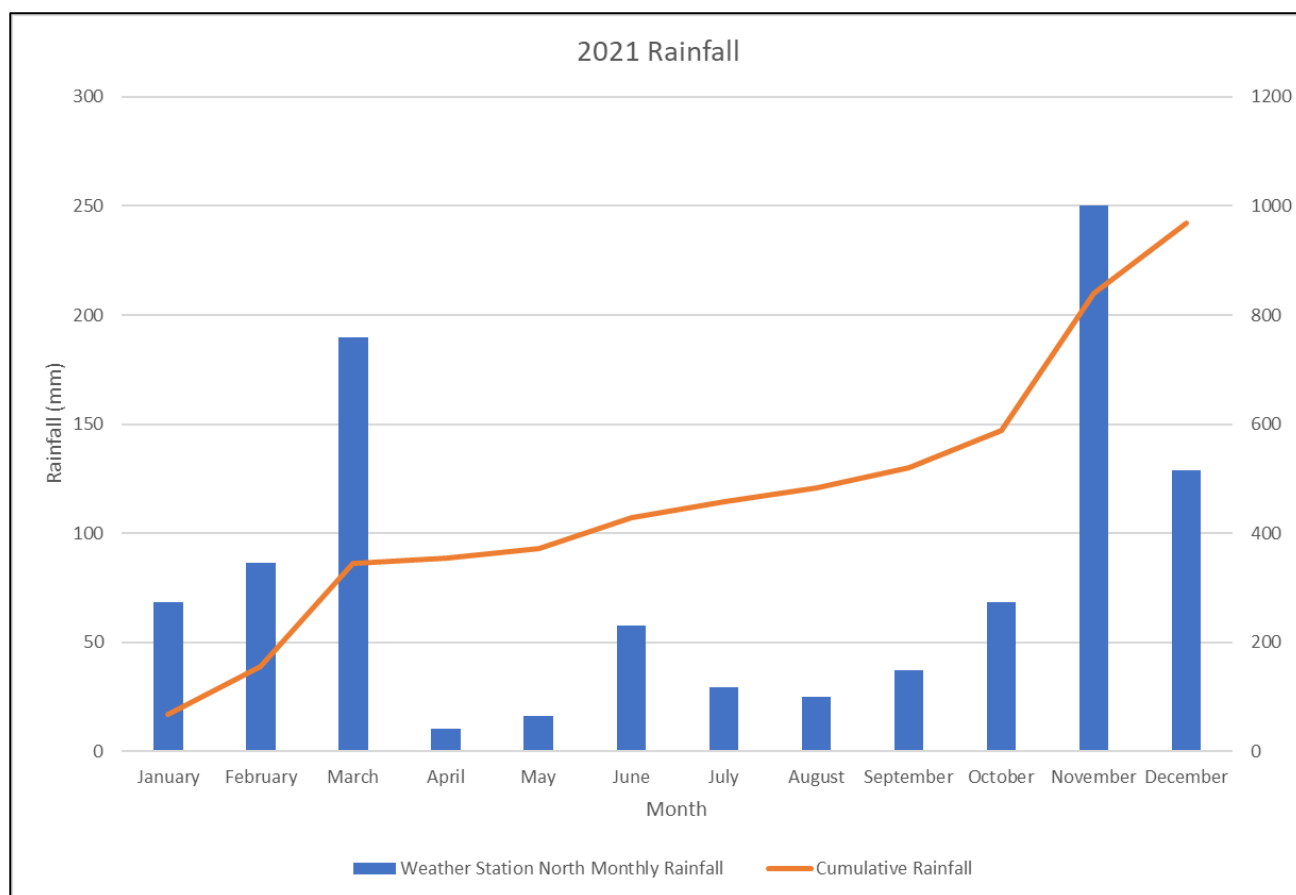


Figure 5 WSN 2021 Rainfall Data

As shown in **Figure 6**, the daily minimum and maximum 2 metre (m) above surface level temperatures ranged from -5.3°C to 37.2°C respectively, with an average daily maximum of 23.2°C, which is cooler than the 2020 daily average of 24.0°C. Humidity during 2021 ranged from 9.0% to 97.5%.

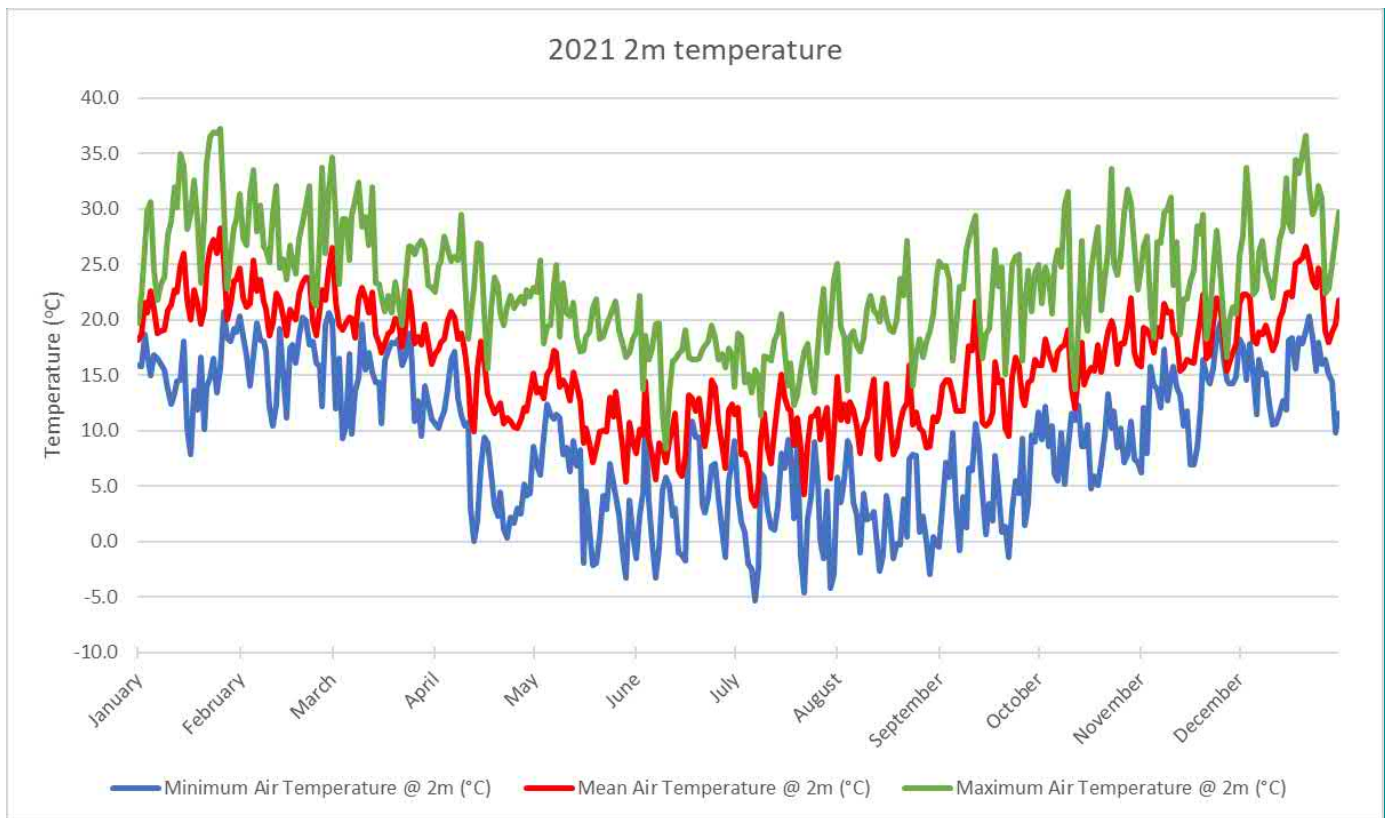


Figure 6 WSN 2021 2m Temperature Data

6.2 Air Quality

6.2.1 Environmental Management

Mangoola operates in accordance with the approved Air Quality Management (AQMP), which is available on the Mangoola website. The AQMP was approved in 2021 and describes air quality management and monitoring requirements associated with operating the mine. The Air Quality Management Plan was updated and approved by DPIE in 2021 to align with the new monitoring required for SSD 8642. Mangoola operated the following equipment (as shown in **Figure 7**) for the measurement of air quality in the reporting period.

- Eighteen depositional dust gauges known as DG01-DG04, DG06-DG07, DG09-20 which are monitored monthly;
- Five Tapered Element Oscillating Microbalance (TEOM) dust monitors continuously measuring PM₁₀ known as D02-DC to D06-DC;
- Two PM₁₀ E-Sampler Particulate Monitors continuously measuring PM₁₀ known as D7-DC and D8-DC (EPL Monitoring Points 19 and 20);
- Three High Volume Air Sampler (HVAS) dust monitors measuring Total Suspended Particulates (TSP) over one 24-hour period every six days, known as D02-TSP to D04-TSP; and
- Four HVAS dust monitors measuring PM₁₀ over one 24-hour period every six days, known as D01-PM₁₀, D05-PM₁₀, D06-PM₁₀ and D07-PM₁₀.

Monitoring equipment will be moved to align with the newly approved AQMP in the timeframes outlined in the document.

PA 06_0014 stipulate the criteria for PM₁₀, TSP and depositional dust. SSD 8642 does not have criteria for depositional dust but includes criteria for PM_{2.5} as presented in **Table 13** and **Table 14**.

Table 13 PA 06_0014 Air Quality Criteria

Pollutant	Averaging Period	Criterion ⁴
Long Term Impact Assessment Criteria for Particulate Matter		
TSP	Annual Average	¹ 90 µg/m ³
PM ₁₀	Annual Average	¹ 30 µg/m ³
Short Term Impact Assessment Criteria for Particulate Matter		
PM ₁₀	24-hour Average	¹ 50 µg/m ³
Long Term Impact Assessment Criteria for Deposited Dust		
Deposited Dust ³	Annual Average	¹ 4 g/m ² /month (maximum total deposited dust level) ² 2 g/m ² /month (maximum increase in deposited dust level)

1 – Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations sure to all other sources).

2 – Incremental impact (i.e. incremental increase in concentrations due to the development on its own)

3 – Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method, and

4 – Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

Table 14 SSD 8642 Air Quality Criteria

Pollutant	Averaging Period	Criterion ⁴
Long Term Impact Assessment Criteria for Particulate Matter		
TSP	Annual Average	^{1,3} 90 µg/m ³
PM ₁₀	Annual Average	^{1,3} 25 µg/m ³
PM _{2.5}	Annual Average	^{1,3} 8 µg /m ³
Short Term Impact Assessment Criteria for Particulate Matter		
PM ₁₀	24-hour Average	² 50 µg/m ³
PM _{2.5}	24-hour Average	¹ 25 µg/m ³

1 – Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations sure to all other sources).

2 – Incremental impact (i.e. incremental increase in concentrations due to the development on its own)

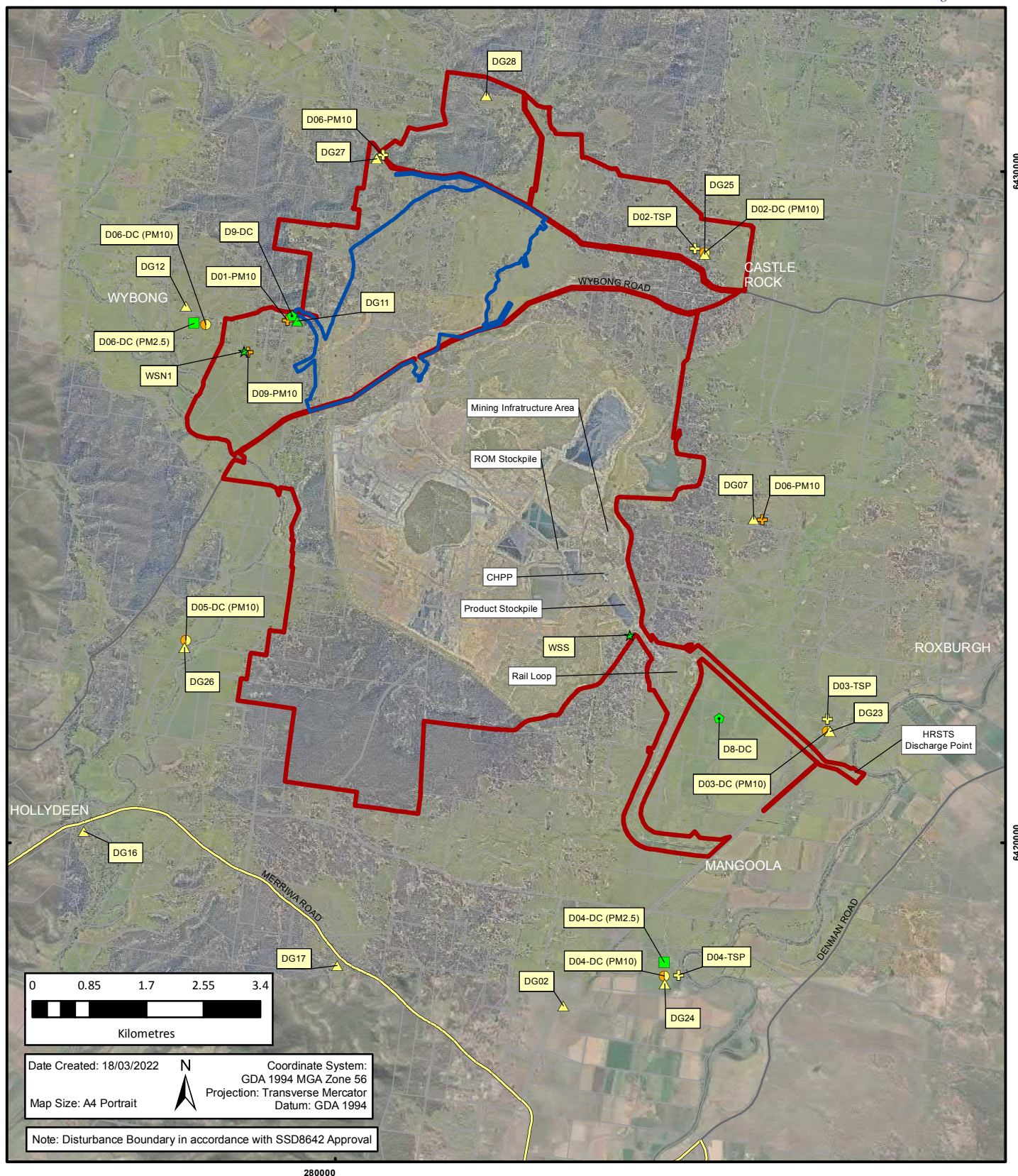
3 – Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

Mangoola currently implements a Dust Management Trigger Action Response Plan (TARP) developed in line with the *Dust Assessment Handbook* (NSW EPA 2019).

In addition, Mangoola also implements key operational controls as described in Section 3.2 in the AQMP. These controls include, but are not limited to, predictive meteorological forecasting, water carts, chemical dust suppressants, progressive rehabilitation and dust suppression sprays on stockpiles and conveyors.

Mangoola implements best practice for the management of air quality including the implementation of reasonable and feasible measures to minimise/mitigate offsite odours. Mangoola will continue to implement all controls in the Spontaneous Combustion Management Plan, Blast Fume Management Plan and the AQMP.

Figure 7 - Air Quality and Meteorological Monitoring Locations



Legend

- | | | |
|---|---|--|
| — Approved EPL Boundary | Monitoring Type - Purpose: | ▲ Depositional Dust Gauge - Representing private receptors |
| — MCCO Disturbance Area | ■ BAM - Other monitoring function | + HVAS - Representing private receptors |
| — Major road | ▲ Depositional Dust Gauge - Other monitoring function | + HVAS - Representing mine-owned and other-mine-owned receptors |
| — Main road | ◆ Esampler - Other monitoring function | ● TEOM - Representing private receptors and Representing mine-owned and other-mine-owned receptors |
| | ★ Meteorological Monitoring Location - Other monitoring function | |

DISCLAIMER

Subject To Survey.

Glencore makes every effort to ensure the quality of the information available on this map. Before relying on the information on this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Glencore cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Glencore has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map.

DATA SOURCE

© NSW Department of Finance & Services (LPI) 2020
© NSW DTIRIS (Minerals & Petroleum) 2020
© Glencore 2020 © ESRI 2020

6.2.2 Environmental Monitoring Results

6.2.2.1 Results from the Reporting Period

Depositional Dust Gauges

Depositional dust gauge data collected during the reporting period is available on the Mangoola website and is summarised in **Table 15**. The data presented is corrected for contamination of samples (by bird droppings or insects) and presents annual average deposition rate of insoluble solids as g/m²/month.

Table 15 2021 Depositional Dust Gauge Results (Insoluble Matter)

Gauge	Location Description	No. Of Samples Collected	No. of valid samples	Background level (g/m ² /month)	Annual Average [^] (g/m ² /month)
DG01	Cnr Babbington and Palace St	12	12	1.2	0.7
DG02	Mangoola Rd	12	11 – 1 x Dead mouse was in funnel	1.0	1.1
DG03	Mangoola Rd	12	12	0.9	0.7
DG04	Mangoola Rd	12	12	1.8	1.5
DG06	Mangoola Rd	12	12	1.7	1.0
DG07	Mangoola Rd	11	11 – 1 x Broken bottle	1.6	1.1
DG09	Castlerock Rd	12	12	1.3	1.5
DG10	Wybong Rd	12	12	1.7	1.0
DG11*	Wybong Post Office Rd	12	12	1.3	1.2
DG12	Wybong Post Office Rd	12	12	1.4	1.0
DG13	Yarraman Rd	12	12	0.9	1.2
DG14	Yarraman Rd	12	12	1.4	0.8
DG15	Wybong Rd	12	11 – 1 x Contaminated with insects and vegetation. Sample turbid and grey.	1.0	1.4
DG16	Golden Highway	12	10 – 2 x Dead lizards	0.9	0.6
DG17	Golden Highway	12	12	0.7	0.6
DG18	Denman Rd	12	7 – 5 x contaminated (insects, bird droppings, high combustible matter, turbid water)	1.6	3.4
DG19	Ridgelands Rd	12	12	1.1	1.0
DG20	Bells Lane East	12	11 – 1 x Broken bottle	1.2	1.3

[^] – Depositional Dust Criteria 4g/m²/month Max Annual Average; and

* – Represents management monitoring point (not used for compliance purposes).

During 2021, the annual average dust deposition did not exceed 4 g/m²/month at any monitoring locations. This is consistent with the results for 2020 and was helped by significantly higher rainfall throughout 2021. Additionally, the annual average results did not exceed background levels by more than 2 g/m²/month at any monitor.

TEOM (PM₁₀)

TEOM results for PM₁₀ concentrations are available on the Mangoola website and are summarised in **Table 16**.

Table 16 2021 PM₁₀ 24-hr Average Results

Gauge	Location Description	Minimum (µg/m ³)	Annual Average [#] (µg/m ³)	Maximum 24 hr (µg/m ³) [^]	Mangoola contribution (µg/m ³)
D02-DC	96 Ridglands Rd	2.5	12.8	36.9	-
D03-DC	830 Mangoola Rd	2.8	15.4	49.4	-
D04-DC	22 Bells Lane	2.0	13.2	33.9	-
D05-DC	2909 Wybong Rd	0.8	9.2	28.8	-
D06-DC	393 Wybong PO Rd	2.8	12.3	35.6	-
D7-DC*	Wybong Rd	0.0	11.1	58.2	-
D8-DC*	CHPP	0.0	8.9	64.8	-

* 'Early warning' unit which represents management monitoring point (not used for compliance purposes as it is not representative of private receptors);

PM₁₀ Annual Average Criterion 30 µg/m³ until the commencement of Development under SSD 8642 occurred on 6 December 2021. Following commencement of Stage 2 – PM₁₀ annual average criterion reduced from 30µg/m³ to 25 µg/m³ as listed in Table 14. TSP Annual Average Criterion 90 µg/m³; and

[^]PM₁₀ 24h Max Criteria 50 µg/m³.

Note: Data loss due to equipment malfunction 16-20/12/2021.

There were no exceedances of the 50 µg/m³ 24hr averaging period criterion or the 30 µg/m³ annual average criterion at any of the monitoring locations throughout the reporting period.

The annual average criteria was reduced from 30 to 25 ug/m₃ on 6 December at the commencement of SSD 8642. Notwithstanding this, the 2021 annual average PM₁₀ results were below 25 µg/m³.

TEOM (PM_{2.5})

TEOM results for PM_{2.5} concentrations are available on the Mangoola website and are summarised in **Table 17**.

PM_{2.5} was not required to be reported on until the commencement of SSD 8642 on 6 December 2021. Therefore, the PM_{2.5} annual average for 2021 is not valid and cannot be assessed against the annual average criteria of 8 µg/m³.

PM_{2.5} 24hr criteria of 25 µg/m³ was not exceeded from when the criteria came into effect (6 December 2021) to the 31 December 2021.

Table 17 2021 PM_{2.5} 24-hr and Annual Average Results

Gauge	Location Description	Minimum (µg/m ³)	Annual Average [#] (µg/m ³)	Maximum (µg/m ³) [^]	Mangoola contribution (µg/m ³)
D04-DC	22 Bells Lane	0.5	3.5	8.3	-
D06-DC	393 Wybong PO Rd	6.8	10.2	15.0	-

[#] PM_{2.5} Annual Average Criterion 8 µg/m³ was introduced as part of Development under SSD 8642 which commenced on 6 December 2021; and
[^]PM_{2.5} 24h Max Criteria 25 µg/m³.

High Volume Air Sampler (HVAS) TSP and PM₁₀

HVAS results for TSP and PM₁₀ concentrations are available on the Mangoola website and are summarised in **Table 18**.

Table 18 2021 PM₁₀ and TSP 24-hr Average Results

Monitoring Point	Minimum (µg/m ³)	Annual Average (µg/m ³) [*]	Maximum (µg/m ³) ^{**}
TSP			
D02-TSP [#]	1	27.8	93.0
D03-TSP [#]	6	30.3	74.0
D04-TSP [#]	3	23.8	68
PM₁₀			
D01-PM ₁₀ [^]	0	10.2	50.1
D05-PM ₁₀ ^{^#}	0	9.0	32.3
D06-PM ₁₀ [^]	0	10.9	28.0
D07-PM ₁₀ [^]	0	9.5	26.0

^{*} PM₁₀ Annual Average Criterion 30 µg/m³ until the commencement of Development under SSD 8642 occurred on 6 December 2021. Following commencement of Stage 2 – PM₁₀ annual average criterion reduced from 30µg/m³ to 25 µg/m³ as listed in Table 14. TSP Annual Average Criterion 90 µg/m³;

^{**} PM₁₀ 24hr Criterion 50 µg/m³, no specified 24hr Criterion for TSP under PA 06_0014;

[^] Monitor located on Mine Owned Land; and

[#] Representative of private receptors.

There were no exceedances of the TSP annual average criteria of 90 µg/m³. There were no exceedances of the PM₁₀ annual average of 30 µg/m³ during the reporting period. It should be noted the PM₁₀ annual average changed to 25 µg/m³ on the 6 December 2021 at the commencement of SSD 8642. Notwithstanding this, 2021 annual average PM₁₀ results were below 25 µg/m³.

The PM₁₀ 24hr maximum criteria of 50 µg/m³ was exceeded by 0.1 µg/m³ on 30 October 2021. An investigation was conducted which indicated that the elevated result was non-mining related. All other air quality units recorded results below relevant criteria.

It is noted that the elevated result was recorded at a monitor located on a mine-owned tenanted property, with the purpose of informing tenants of any elevated results. The exceedance was reported as an incident, as per the AQMP.

Odour

In accordance with PA 06_0014 and EPL 12894, no odour monitoring is required at Mangoola. Odour is not considered an issue at Mangoola and no complaints have been received during the reporting period in relation to odour. No incidents have been reported in relation to odour.

6.2.2.2 Comparison with Predictions

The PA 06_0014 MOD 6 Environmental Assessment (EA) Air Quality Impact Assessment (Todoroski Air Sciences, 2013) predicted dust emissions for the project in years 2, 5, and 10. As MOD 6 was approved in 2014, a comparison of 2021 dust data against Year 5 data has been made in **Table 19**.

Table 19 Comparison of 2019 to 2021 Dust Emissions

Dust Monitor	Closest Privately Owned Residence	Year 5 Prediction (MOD 6)	2019 Annual Average	2020 Annual Average	2021 Annual Average
Depositional Dust (g/m²/month)					
DG01	214	1.7	1.9	1.7	0.7
DG02	200	1.7	2.7	2.9	1.1
DG03	121	1.7	1.6	1.7	0.7
DG04	125D, E and F	2.1	2.7	2.2	1.5
DG06	125B	2.3	2.6	2.7	1.0
DG07	198	2.4	2.5	2.0	1.1
DG09	111	1.9	1.8	1.8	1.5
DG10	111	1.9	1.9	2.2	1.0
DG11	81	2.0	1.9	2.2	1.2
DG12	134B	1.9	1.7	2.1	1.0
DG13	134A	1.9	1.6	2.1	1.2
DG14	130	2.0	1.9	2.0	0.8
DG15	83	2.0	2.3	2.3	1.4
DG16	265	1.7	1.7	2.0	0.6
DG17	147	1.7	1.9	2.1	0.6
DG18	201A, B and C	1.8	2.8	2.2	3.4
DG19	81	2.0	2.1	2.0	1.0
DG20	184	1.7	2.1	2.0	1.3
TEOM (PM₁₀) Monitoring Sites (µg/m³)					
D02-DC	111	13.0	17.6	12.3	12.8
D03-DC	125D, E and F	23.0	21.0	17.2	15.4
D04-DC	184	11.0	20.6	13.6	13.2
D05-DC	176	9.0	15.6	10.5	9.2
D06-DC	110	14.0	20.0	14.6	12.3

Dust Monitor	Closest Privately Owned Residence	Year 5 Prediction (MOD 6)	2019 Annual Average	2020 Annual Average	2021 Annual Average
E-Samplers (PM₁₀) (µg/m³)					
D7-DC	130	15.0	13.3	8.7	11.1
D8-DC	125	23.0	15.6	11.9	8.9
HVAS (PM₁₀ and TSP) Monitors (µg/m³)					
D02-TSP	111	38.0	54.0	34.5	27.8
D03-TSP	125D, E and F	49.0	62.1	42.1	30.3
D04-TSP	184	33.0	49.9	32.9	23.8
D01-PM ₁₀	110	14.0	18.3	13.3	10.2
D05-PM ₁₀	157	10.0	18.3	11.5	9.0
D06-PM ₁₀	130	15.0	22.9	15.6	10.9
D07-PM ₁₀	190	26.0	23.3	14.1	9.5

As shown in **Table 19**, the 2021 annual averages for air quality were above the predicted levels in the Year 5 MOD 6 Assessment at one depositional dust monitor (DG18) and two TEOMs (D04-DC, D05-DC). All HVAS monitors were below the levels predicted in the Year 5 MOD 6 Assessment.

6.2.2.3 Long Term Trend Analysis

A long-term trend analysis of air quality monitoring results at Mangoola has been undertaken using data from July 2010 to December 2021 to identify any trends in the monitoring data over the life of the project. These graphs are presented in **Appendix C**. Depositional dust monitoring results have been variable since mining operations commenced in 2010, however results generally peaked in 2012 and declined to the lowest results during 2015-2016. Results were generally increasing during 2017-2019 which correlates with low rainfall and the ongoing drought conditions. Increased rainfall in 2020 resulted in lower results than the previous few years (refer **Appendix B**). Ongoing rain during 2021 saw results drop lower than those in 2020 close to the level of 2015-2016.

The annual average HVAS TSP data has shown a gradual increase from 2010 to 2014, then declining in 2015, remaining low in 2016 and 2017, before rising again in 2018 and 2019. The results from 2018 and 2019 saw an increase in TSP results due to prolonged period of drought and increased bushfire activity. Due to increased rain in 2020, results decreased to be consistent with results from 2015 to 2017. The 2021 average TSP results decreased further, likely a result of the consistent rain during the period.

The 24hr maximum TEOM data show seasonal peaks in the summer months. The annual average TEOM results have remained consistent with results from 2011 through to 2017 and results have been generally increasing during 2018-2019 which correlates with low rainfall and the ongoing drought conditions. Increased rain during 2020 decreased results to be consistent with those from 2015 to 2017. Ongoing rain during 2021 saw 24hr maximum TEOM (averages) remain consistent with those in 2020.

6.2.3 Key Performance and/or Management Issues

There was one exceedance of the 24hr PM₁₀ maximum criteria during 2021. As this elevated result was recorded at a monitor located on a mine-owned tenanted property, corrective actions were implemented as outlined in the AQMP. An investigation was conducted, indicating that the elevated result was non-mining related. All other air quality units recorded results below relevant criteria. The exceedance was reported internally as an incident, as per the AQMP.

PM₁₀ monitoring is required continuously in accordance with Condition M2.2 of EPL 12894. Between 20-23 February 2021, the monitoring unit malfunctioned at Monitoring Point 20 (D8-DC), as outlined in Table 4.3 of the approved AQMP. This was a non-compliance in accordance with Sampling Method – Special Method 1. Field maintenance was undertaken on the E-Sampler at the earliest time to attempt to repair, however the unit could not be fixed in the field and was taken offsite for repairs. A replacement unit was installed, however the stabilising period resulted in a loss of three days data. This was reported in the EPL 12894 Annual Return in 2021.

Continuous weather monitoring is required in accordance with Condition M4.1 of EPL 12894 and the approved AQMP. Any non-compliances relevant to data capture are not reported as incidents in accordance with the footnotes on Table 4.1, 4.2 and 4.3 of the AQMP which states 'units may not operate at this frequency 100% of the time due to maintenance and calibration requirements, power outages, prevention of access by landowner, no access due safety concerns of personnel and other external events outside the control of Mangoola Coal'.

There were no community complaints received by Mangoola during the reporting period relating to dust, which is a decrease from the two community complaints received in the previous reporting period. Further detail on the complaints received in 2021 is provided in **Section 9.3**.

6.2.4 Proposed Improvements

There are no proposed improvements for Air Quality for 2022.

6.3 Noise

6.3.1 Environmental Management

Mangoola coal operated under PA 06_0014 until the approval was granted for the MCCO project on 26 April 2021 and in accordance with the requirements the approved Noise Management Plan (NMP) prepared for PA 06_0014 was required to be updated to align with the conditions of SSD 8642. The NMP for SSD 8642 was approved by the Department of Planning, Industry and Environment (DPIE) on 22 November 2021. EPL 12894 was also varied to align with the approval of SSD 8642 and was subsequently approved on 6 December 2021 by the Environmental Protection Authority (EPA). As such, the Mangoola Coal regulatory requirements with regard to noise were approved on 6 December 2021. These changes have been discussed in more detail below.

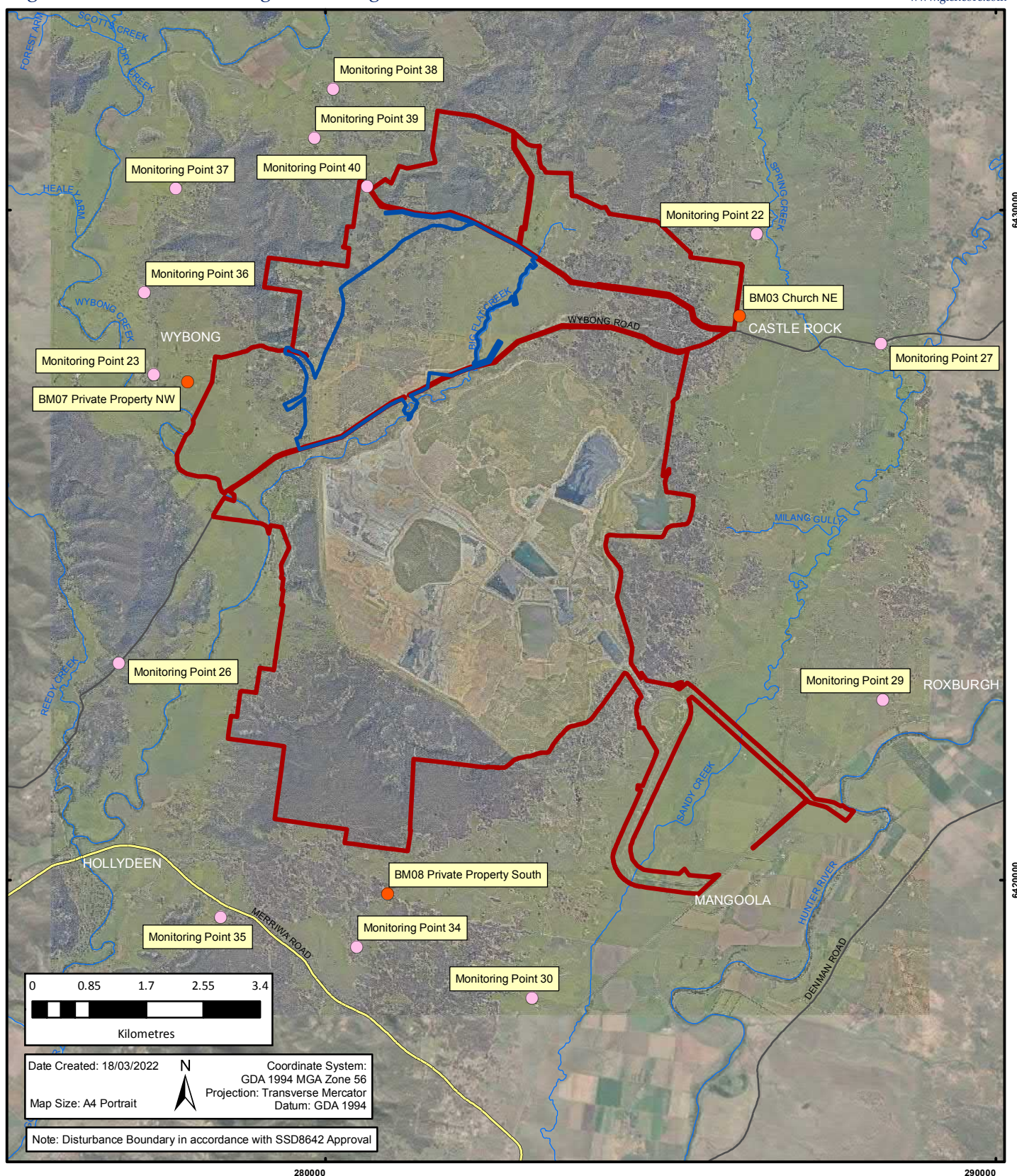
During the reporting period Mangoola has operated in accordance with the approved NMP required under PA 06_0014 and Development Consent SSD 8642 which are available on the Mangoola website. Attended noise monitoring was conducted to meet the requirements of PA 06_0014, SSD 8642 and EPL 12894. All noise monitoring undertaken during the reporting period is summarised as follows:

- From January through November, attended monthly monitoring occurred at eight locations representative of privately-owned residences and the Anglican Church (NM4, NM6, NM8, NM10, NM13-16) as per the NMP;

-
- In December (and after the approval of the updated NMP), attended monthly monitoring occurred at thirteen locations during the night-time period representative of privately-owned residences and the Anglican Church (NM4, NM8, NM10, NM13-22) and at six locations during the daytime period to capture potential construction activity associated with the MCCO project (NM4, NM18-22), as per the NMP; and
 - Continuous unattended noise monitoring was undertaken at five permanent locations (NC02, NC03, NC05, NC06 and NC10). Three mobile units are also utilised and are relocated as needed. This monitoring is used for proactive and reactive management of day-to-day operations at Mangoola Open Cut, rather than a tool to monitor compliance.

The noise monitoring locations are illustrated in **Figure 8**.

Figure 8 - Noise and Blasting Monitoring Locations



Legend

- Approved EPL Boundary
- MCCO Disturbance Area
- Major road
- Main road
- Attended Noise Monitoring Point
- Blast Monitor - Private Receptors

DISCLAIMER

Subject To Survey.

Glencore makes every effort to ensure the quality of the information available on this map. Before relying on the information on this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Glencore cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Glencore has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map.

DATA SOURCE

© NSW Department of Finance & Services (LPI) 2020
© NSW DTIRIS (Minerals & Petroleum) 2020
© Glencore 2020 © ESRI 2020

Noise Impact Assessment Criteria – January to November

Mangoola's noise limits are provided in Table 2, Schedule 3, Condition 2 of PA 06_0014 and Condition L3.2 of the EPL and are provided in **Table 20** and **Table 21**.

Table 20 PA 06_0014 – Noise Impact Assessment Criteria

Land Number	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Sleep Disturbance LA1(1minute)
132A	40	40	40	45
121, 132B	39	39	39	45
176	38	38	38	45
25, 66, 110, 130, 148, 154, 164 [#]	37	37	37	45
106C, 111, 174A, 174B, 175 [*]	36	36	36	45
109, 134A, 134B, 177, 190, 251	35	35	35	45
All other privately-owned land	35	35	35	45
Anglican Church, Castlerock Road	41	41	41	-

[#] Property ID 164 entered a negotiated agreement with Mangoola taking effect from 13 August 2018 at which time noise criteria ceased; and

^{*} Property ID 175 was purchased by Muswellbrook Coal on 29 October 2018 and by definition is no longer a privately owned property, therefore noise criteria are no longer applicable.

Table 21 EPL 12894 – Noise Impact Assessment Criteria

Monitoring Location	EPL ID Number	EA Reference	Night LAeq(15 minute)	Night LA1(1minute)
NM4	23	109, 110, 130, 148, 134A, 134B	37	45
NM6	24	66	37	45
NM8	26	176, 106C	38	45
NM10	27	251	35	45
NM13	29	190	35	45
NM14	30	200	35	45
NM15	22	154, 174A, 174B, 175 [*]	36	45
NM16 [^]	34	177	35	45

^{*} Property ID 175 was purchased by Muswellbrook Coal on 29 October 2018 and by definition is no longer a privately owned property, therefore noise criteria are no longer applicable.

Noise Impact Assessment Criteria – December

Mangoola's noise limits are provided in Table 1, Condition B1 of Schedule 2 of SSD 8642 and Condition L3.2 of the EPL and are provided in **Table 22** and **Table 23**.

Table 22 SSD 8642 – Noise Impact Assessment Criteria

Noise Assessment Location	Day LAeq(15 minute) Years 1 & 2	Day LAeq(15 minute) Year 3 onward	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LA1(1minute)
171, 176, 144	40	40	40	40	52
25, 128, 154, 193, 125A, 182B	40	40	38	38	52
261	42	40	38	38	52
54, 79, 114, 141, 151, 192, 206, 321, 125C, 182A, 241A, 241C, 190, 157	40	40	37	37	52
165, 177, 106B, 104, 166, 178, 251, 253, 260, 112B, 183C, 184A, 147, 112A, 112C, 240, 241B	40	40	36	36	52
134A	44	40	39	39	52
109A-F	43	40	39	39	52
263	42	40	39	39	52
164	40	40	35	35	52
Other privately-owned residences [^]	40	40	35	35	52
Wybong Hall and Anglican Church	48	48	48	48	-

[^]Property ID 132 entered a negotiated agreement with Mangoola taking effect from 17 November 2021 at which time this noise criteria ceased.

Table 23 EPL 12894 – Noise Impact Assessment Criteria

Monitoring Location	EPL ID Number	EA Reference	Night LAeq(15 minute)	Night LA1(1minute)
NM4	23	109, 110, 130, 148, 134A, 134B	41	54
NM8	26	176	35	51
NM10	27	251	38	50
NM13	29	125A, 125C, 190, 240, 241A, 241B, 241C, 182A, 182B	37	53
NM14	30	184A, 200	34	48
NM15	22	154	37	52
NM16 [^]	34	79, 177, 178, 147, 253, 141, 151	41	54
NM17	35	54, 114, 166, 112A, 112B, 112C, 106B	36	51
NM18	36	134A	39	52
NM19	37	165	35	51

Monitoring Location	EPL ID Number	EA Reference	Night LAeq(15 minute)	Night LA1(1minute)
NM20	38	206, 260, 261, 263, 321	38	51
NM21	39	144, 128	40	49
NM22	40	157, 171	46	58

From January to November, the approved NMP adopted eight attended noise monitoring (NM) locations that were representative of residences outlined in the PA and consistent with those provided in the EPL. Noise criteria only applied in specific meteorological conditions in accordance with the PA 06_0014 and EPL 12894.

As of December 2021, the approved NMP adopts 13 attended NM locations for night-time operations and six attended NM locations for daytime activity (operations and construction) that are representative of residences outlined in the Development Consent (DC) and consistent with those provided in the EPL. Noise criteria only apply in specific meteorological conditions in accordance with EPL 12894. Under the DC, noise criteria increase by 5 dB (compared to the standard noise criteria) when monitoring is undertaken during 'very noise-enhancing' conditions (ie outside the 'standard' and 'noise-enhancing' conditions).

Where several assessment locations are located in one NM catchment, a representative noise criteria has been adopted to ensure that the lowest (most stringent) criteria within the NM catchment can be achieved. Additionally, in accordance with the Noise Policy for Industry (NPI) (EPA 2017), relevant modifying factor adjustments apply when assessing the characteristics of Mangoola's mine noise emissions.

Cumulative Noise Criteria

Cumulative noise criteria for privately owned land were provided in Schedule 3, Condition 5 of PA 06_0014 as follows:

- LAeq(11 hour) 50 dB(A) – Day;
- LAeq(4 hour) 45 dB(A) – Evening; and
- LAeq(9 hour) 40 dB(A) – Night.

All reasonable and feasible measures must be made to ensure that the noise generated by Mangoola combined with the noise generated by other mines does not exceed the cumulative noise criteria.

Cumulative noise criteria were not included in SSD 8642 so, as of December 2021, there is no requirement to monitor or assess cumulative mine noise.

Management and Mitigation Measures

In addition to conducting noise monitoring, Mangoola continues to implement a number of mitigation measures with regard to the management of noise to minimise potential noise impact on nearby receivers, and to comply with the conditions of the Project Approval and DC. Mitigation measures are implemented as per the NMP and include, but are not limited to:

- Consideration of noise impacts during mine planning;
- Controlling mine noise at the source through the use of equipment with appropriate sound attenuation fitted, where practical;

- Maintaining mining equipment in a proper and efficient manner;
- Restricting, where possible, operations on outer dump faces or elevated dumps in sensitive areas during adverse weather conditions;
- Ensuring trucks operating during the night time are restricted to operational areas below the maximum elevation of the overburden emplacement areas; and
- Using real-time noise monitors that incorporate automatic alarms so that proactive control can be implemented.

6.3.2 Environmental Monitoring Results

6.3.2.1 Results from the Reporting Period

EPL 12894, PA 06_0014 and SSD 8642 Noise Monitoring

From January to November, monthly attended noise surveys were undertaken at eight representative locations in accordance with PA 06_0014 and EPL 12894. From December onward, monthly attended noise surveys were undertaken at 13 representative locations during the night-time and at six representative locations during the daytime to capture operations and construction activity, in accordance with SSD 8642 and EPL 12894. These locations have been outlined in **Section 6.3.1**.

During 2021, Mangoola was compliant with all the noise criteria set out in PA 06_0014, SSD 8642 and EPL 12894 (where the meteorological conditions were considered 'standard', 'noise-enhancing' or such that noise limits were applicable). A summary of results is presented in **Table 24** and **Table 25** for January to November and in **Table 26** and **Table 27** for December. Where the meteorological conditions did not apply (for PA 06_0014 and EPL 12894) or were 'very noise-enhancing' (for SSD 8642), these cells have been shaded grey.

All noise monitoring results are available in full on the Mangoola website.

Cumulative Noise Monitoring

During the reporting period cumulative mining noise was assessed based on the results of attended noise monitoring at NM10, NM13 and NM15, in accordance with the NMP.

Cumulative mine noise contributions, including those from Mangoola, were below the relevant noise limits at all monitoring locations during the reporting period.

6.3.2.2 Comparison with Predictions

The MOD 6 Noise and Vibration Assessment (EMM 2013) predicted the 10% $L_{Aeq(15minute)}$ and L_{Amax} operational noise levels at private receptors in Years 2, 5 and 10. As MOD 6 was approved in 2014, a comparison of 2021 noise data against the Year 5 data has been made in **Table 24** and **Table 25**.

The MCCO Noise and Vibration Assessment (Global Acoustic 2019) predicted the 10% $L_{Aeq(15minute)}$ and L_{Amax} operational noise levels at private receptors in Years 1, 3, 5 and 8. As MCCO was approved in 2021, a comparison of 2021 noise data against the Year 1 data has been made in **Table 26** and **Table 27**.

Where the data exceeded the predictions (and where the meteorological conditions were suitable), these have been bolded.

In **Table 26**, noise criteria and predictions for the daytime period have been included for the relevant daytime noise monitoring locations (NM4, NM17, NM18, NM19, NM20, NM21 and NM22).

Table 24 Attended Noise Monitoring Results and Comparison against MOD 6 Predictions ($L_{Aeq(15\text{minute})}$)

	NM4	NM6	NM8	NM10	NM13	NM14	NM15	NM16	Compliance Against Criteria
EA Property Reference	109, 110, 130, 148, 134A, 134B	66	176, 106C	251	190	200	154, 174A, 174B, 175~	177	
$L_{Aeq(15\text{ minute})}$ Criteria	37	37	38	35	35	35	36	35	
$L_{Aeq(15\text{ minute})}$ Year 5 Prediction	35 ¹ , 37 ² , 37 ³ , 37 ⁴ , 35 ⁵ , 35 ⁶	32	34 ⁷ , N/A ⁸	31	33	30	31 ⁹ , 29 ¹⁰ , 29 ¹¹ , 29 ¹²	35	
January	29	32	21	21	34 ¹³	28	IA	22	Yes
February	29	IA	31	IA	IA	IA	IA	IA	Yes
March	31	IA	27	IA	IA	IA	IA	IA	Yes
April	33	30	26	IA	28	33	IA	31	Yes
May	23	IA	28	25	29	33	<20	31	Yes
June	31	22	27	IA	IA	31	IA	31	Yes
July	≤20	20	≤20	29	31	27	23	28	Yes
August	<20	37	IA	33	28	<20	35	IA	Yes
September	30	28	25	IA	IA	IA	IA	IA	Yes
October	29	26	29	IA	IA	IA	IA	IA	Yes
November	34	IA	29	IA	IA	IA	IA	IA	Yes

1. EA Reference 109

2. EA Reference 110

3. EA Reference 130

4. EA Reference 148

5. EA Reference 134A

6. EA Reference 134B

7. EA Reference 176

8. Property 106C not included in 2013 Noise Assessment

9. EA Reference 154

10. EA Reference 174A

11. EA Reference 174B

12. EA Reference 175

13. Includes a positive 2 dB adjustment for LFN

IA= Inaudible

~ID175 purchased 29/10/18 by other mining company, no longer privately owned

Note: Grey shaded cells denote noise limits do not apply due to meteorological conditions.

Table 25 Attended Noise Monitoring Results and Comparison against MOD 6 Predictions (L_{Amax})

	NM4	NM6	NM8	NM10	NM13	NM14	NM15	NM16	Compliance Against Criteria
EA Property Reference	109, 110, 130, 148, 134A, 134B	66	176, 106C	251	190	200	154, 174A, 174B, 175 [~]	177	
L_{Amax}¹ Criteria	45	45	45	45	45	45	45	45	
L_{Amax} Year 5 Prediction	40 ² , 40 ³ , 40 ⁴ , 40 ⁵ , 38 ⁶ , 39 ⁷	38	<30 ⁸ , N/A ⁹	<30	35	38	<30 ¹⁰ , <30 ¹¹ , <30 ¹² , <30 ¹³	38	
January	33	39	28	24	34	30	IA	26	Yes
February	31	IA	44	IA	IA	IA	IA	IA	Yes
March	38	IA	30	IA	IA	IA	IA	IA	Yes
April	41	37	29	IA	29	42	IA	34	Yes
May	28	IA	34	28	33	45	22	42	Yes
June	39	26	38	IA	IA	38	IA	37	Yes
July	28	23	24	34	36	30	29	33	Yes
August	<20	40	IA	39	33	<20	37	IA	Yes
September	35	35	30	IA	IA	IA	IA	IA	Yes
October	31	<39	32	IA	IA	IA	IA	IA	Yes
November	36	IA	34	IA	IA	IA	IA	IA	Yes

1. For assessment purposes the L_{Amax} and the $LA1(1min)$ are interchangeable.

6. EA Reference 134A

12. EA Reference 174B

7. EA Reference 134B

13. EA Reference 175

8. EA Reference 176

IA = Inaudible

2. EA Reference 109

9. Property 106C not included in 2013 Noise Assessment

Note: Grey shaded cells denote noise limits not applicable due to meteorological conditions.

3. EA Reference 110

4. EA Reference 130

10. EA Reference 154

5. EA Reference 148

11. EA Reference 174A

Table 26 Attended Noise Monitoring Results and Comparison against MCCO Predictions ($L_{Aeq(15 \text{ minute})}$)

	NM4	NM8	NM10	NM13	NM14	NM15	NM16	NM17	NM18	NM19	NM20	NM21	NM22	Compliance Against Criteria
EA Property Reference	109A, 109B, 109C, 109D, 109E, 109F	176	251	125A, 125C, 190, 240, 241A, 241B, 241C, 182A, 182B	184A	154	79, 177, 178, 147, 253, 141, 151	54, 114, 166, 112A, 112B, 112C, 106B	134A	165	206, 260, 261, 263, 321	144, 128	157, 171	
$L_{Aeq(15 \text{ minute})}$ Criteria (Day/Night)	44/41	35	38	37	34	37	41	36	44/39	39/35	40/38	40/40	46/46	
$L_{Aeq(15 \text{ minute})}$ Year 1 Prediction (Day/Night)	38/39 ¹ , 38/39 ² , 38/39 ³ , 38/39 ⁴ , 38/39 ⁵ , 38/39 ⁶	40	36	38 ⁷ , 37 ⁸ , 37 ⁹ , 36 ¹⁰ , 37 ¹¹ , 36 ¹² , 37 ¹³ , 37 ¹⁴ , 38 ¹⁵	36	38	37 ¹⁶ , 36 ¹⁷ , 36 ¹⁸ , 36 ¹⁹ , 36 ²⁰ , 37 ²¹ , 37 ²²	37 ²³ , 37 ²⁴ , 36 ²⁵ , 36 ²⁶ , 36 ²⁷ , 36 ²⁸ , 36 ²⁹	38/39	33/35	32/34 ³⁰ , 31/34 ³¹ , 36/38 ³² , 35/39 ³³ , 35/37 ³⁴	38/40 ³⁵ , 33/37 ³⁶	31/34 ³⁷ , 34/39 ³⁸	
December - Day	IA	-	-	-	-	-	-	-	IA	IA	IA	IA	IA	Yes
December - Night	30	25	IA	IA	IA	IA	IA	IA	29	<26	IA	<25	27	Yes

1. EA Reference 109A
7. EA Reference 125A

2. EA Reference 109B
8. EA Reference 125C

3. EA Reference 109C
9. EA Reference 190

4. EA Reference 109D
10. EA Reference 240

5. EA Reference 109E
11. EA Reference 241A

6. EA Reference 109F
12. EA Reference 241B

13. EA Reference 241C	14. EA Reference 182A	15. EA Reference 182B	16. EA Reference 79	17. EA Reference 177	18. EA Reference 178
19. EA Reference 147	20. EA Reference 253	21. EA Reference 141	22. EA Reference 151	23. EA Reference 54	24. EA Reference 114
25. EA Reference 166	26. EA Reference 112A	27. EA Reference 112B	28. EA Reference 112C	29. EA Reference 106B	30. EA Reference 206
31. EA Reference 260	32. EA Reference 261	33. EA Reference 263	34. EA Reference 321	35. EA Reference 144	36. EA Reference 128
37. EA Reference 157	38. EA Reference 171	IA= Inaudible	Note: Grey shaded cells denote that a positive 5 dB adjustment was applied to the specified noise limit to account for 'very noise enhancing' weather conditions at the time of the measurement		

Table 27 Attended Noise Monitoring Results and Comparison against MCCO Predictions (L_{Amax})

	NM4	NM8	NM10	NM13	NM14	NM15	NM16	NM17	NM18	NM19	NM20	NM21	NM22	Compliance Against Criteria
EA Property Reference	109A, 109B, 109C, 109D, 109E, 109F	176	251	125A, 125C, 190, 240, 241A, 241B, 241C, 182A, 182B	184A	154	79, 177, 178, 147, 253, 141, 151	54, 114, 166, 112A, 112B, 112C, 106B	134A	165	206, 260, 261, 263, 321	144, 128	157, 171	
L_{Amax} Criteria	54	51	50	53	48	52	54	51	52	51	51	49	58	
L_{Amax} Year 1 Prediction	40 ¹ , 40 ² , 40 ³ , <40 ⁴ , 40 ⁵ , <40 ⁶	41	<40	<40 ⁷ , <40 ⁸ , <40 ⁹ , <40 ¹⁰ , <40 ¹¹ , <40 ¹² , <40 ¹³ , <40 ¹⁴ , <40 ¹⁵	<40	40	<40 ¹⁶ , <40 ¹⁷ , <40 ¹⁸ , <40 ¹⁹ , <40 ²⁰ , <40 ²¹ , <40 ²²	<40 ²³ , <40 ²⁴ , <40 ²⁵ , <40 ²⁶ , <40 ²⁷ , <40 ²⁸ , <40 ²⁹	<40	<40	<40 ³⁰ , <40 ³¹ , 41 ³² , 43 ³³ , 40 ³⁴	44 ³⁵ , 40 ³⁶	<40 ³⁷ , 43 ³⁸	
December	31	26	IA	IA	IA	IA	IA	IA	32	26	IA	<25	29	Yes

1. EA Reference 109A

2. EA Reference 109B

3. EA Reference 109C

4. EA Reference 109D

5. EA Reference 109E

6. EA Reference 109F

7. EA Reference 125A	8. EA Reference 125C	9. EA Reference 190	10. EA Reference 240	11. EA Reference 241A	12. EA Reference 241B
13. EA Reference 241C	14. EA Reference 182A	15. EA Reference 182B	16. EA Reference 79	17. EA Reference 177	18. EA Reference 178
19. EA Reference 147	20. EA Reference 253	21. EA Reference 141	22. EA Reference 151	23. EA Reference 54	24. EA Reference 114
25. EA Reference 166	26. EA Reference 112A	27. EA Reference 112B	28. EA Reference 112C	29. EA Reference 106B	30. EA Reference 206
31. EA Reference 260	32. EA Reference 261	33. EA Reference 263	34. EA Reference 321	35. EA Reference 144	36. EA Reference 128
37. EA Reference 157	38. EA Reference 171	IA= Inaudible	For assessment purposes the LAmax and the LA1(1min) are interchangeable.		

Note: Grey shaded cells denote that a positive 5 dB adjustment was applied to the specified noise limit to account for 'very noise enhancing' weather conditions at the time of the measurement

As shown in **Table 24**, the noise levels recorded at Mangoola from January-November 2021 were compared against the Year 5 noise predictions presented in the 2013 Noise and Vibration Assessment (EMM 2013) and the PA 06_0014 $L_{Aeq(15\text{minute})}$ criteria. On five monitoring occasions (where meteorological conditions met consent condition parameters for noise limits to apply), results were recorded above the Year 5 $L_{Aeq(15\text{minute})}$ predictions however, these levels were well below criteria. The remaining results were lower than the predicted levels where noise limits were applicable due to suitable meteorological conditions.

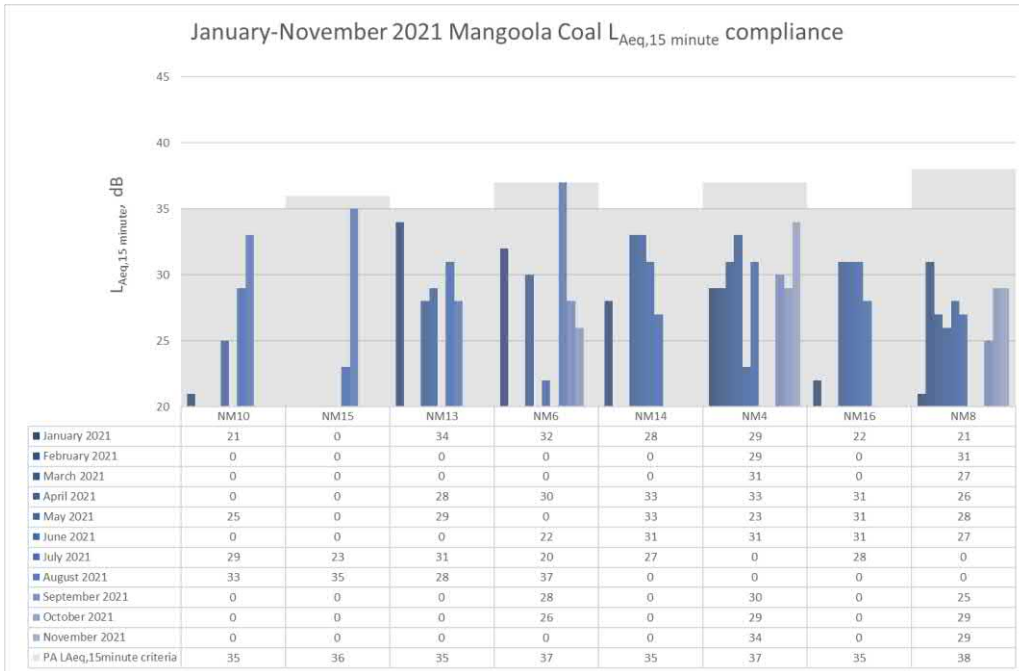
Table 25 compares the January-November 2021 L_{Amax} noise levels against 2013 Noise and Vibration Assessment Year 5 noise predictions and the PA 06_0014 $L_{A1(1\text{ minute})}$ criteria. Six monitoring locations recorded at least one result above the Year 5 L_{Amax} predictions, with one result above predicted levels at NM6, NM13 and NM15, two results above predicted levels at NM10 and NM14, and four results above predicted levels at NM8. All other measured L_{Amax} noise levels were below the predicted levels.

Table 26 provides a comparison of the December 2021 daytime and night-time noise levels measured at Mangoola to the Year 1 noise predictions presented in the MCCO Noise Impact Assessment (Global Acoustics 2019) and the relevant SSD 8642 $L_{Aeq(15\text{minute})}$ criteria. No results were recorded above the Year 1 $L_{Aeq(15\text{minute})}$ predictions.

Table 27 compares the December 2021 L_{Amax} noise levels against MCCO Noise Impact Assessment Year 1 noise predictions and the SSD 8642 $L_{A1(1\text{ minute})}$ criteria. All noise monitoring results were below the Year 1 L_{Amax} predictions.

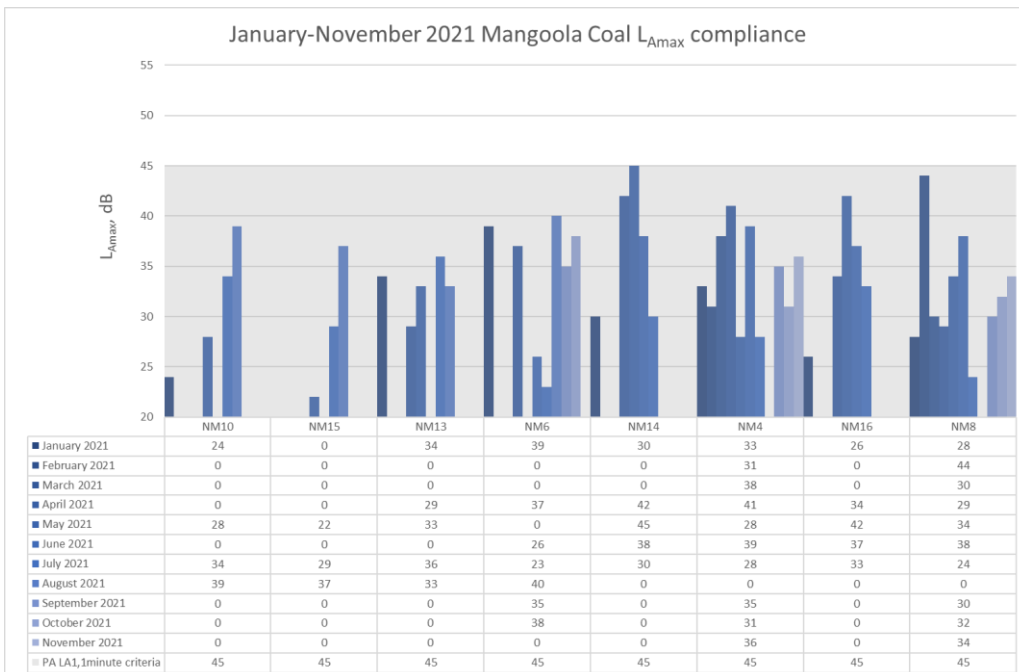
The main reason for the difference between modelled noise emissions and those measured is likely due to differences in the modelling assumptions compared to the actual operational or weather scenarios. This includes features such as mine topography as well as the locations and sound power levels of plant and equipment. In particular, during the December monitoring period there were very limited activities occurring with the MCCO project. Importantly, measured Mangoola noise emissions did not exceed the $L_{Aeq(15\text{minute})}$ or L_{Amax} noise criteria during 2021.

Figures 9, 10, 11 and 12 compare the 2021 noise levels recorded at Mangoola with the relevant approval criteria. A figure of the December daytime noise levels has not been included, as site noise was determined to be inaudible at all noise monitoring locations.



'0' indicates that the Mangoola Coal noise contribution was determined to be 20 dB or less.

Figure 9 Annual Review Attended Noise Monitoring Compliance Results ($L_{Aeq(15 \text{ minute})}$) – January to November



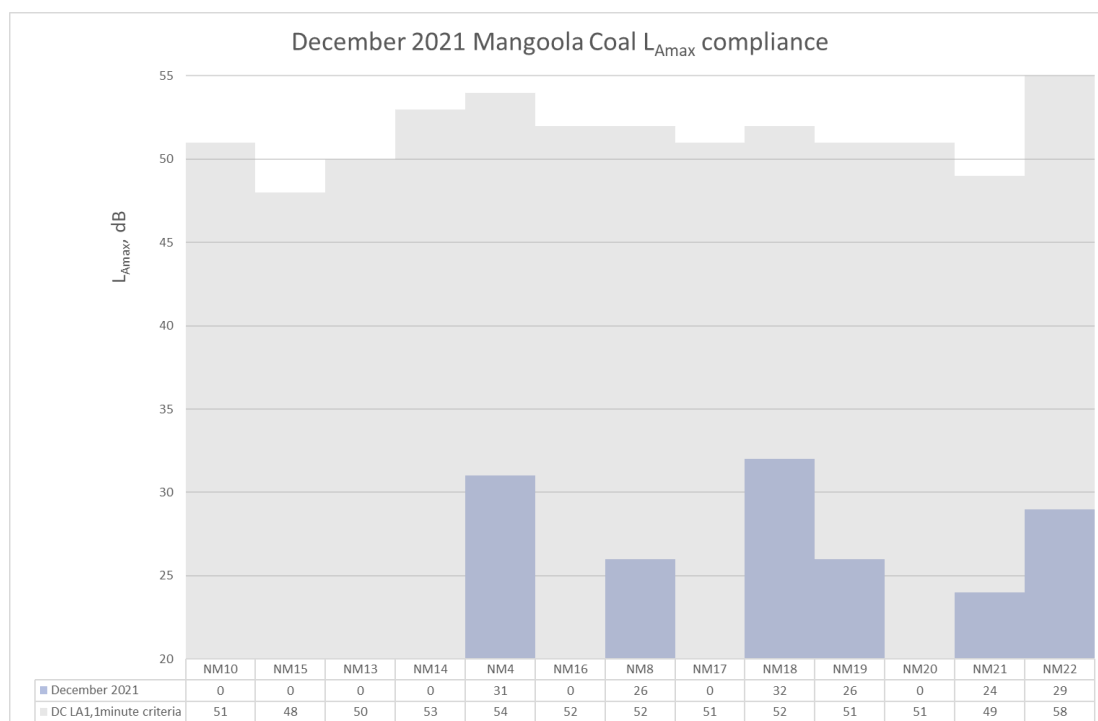
'0' indicates that the Mangoola Coal noise contribution was determined to be 20 dB or less.

Figure 10 Annual Review Attended Noise Monitoring Compliance Results (L_{Amax}) – January to November



'0' indicates that the Mangoola Coal noise contribution was determined to be 20 dB or less.

Figure 11 Annual Review Attended Noise Monitoring Compliance Results ($L_{Aeq(15\text{minute})}$) – December



'0' indicates that the Mangoola Coal noise contribution was determined to be 20 dB or less.

Figure 12 Annual Review Attended Noise Monitoring Compliance Results (L_{Amax}) – December

Long Term Trend Analysis

Exceedances of the PA 06_0014, SSD 8642 and EPL 12984 criteria have been generally decreasing over the previous years. During 2021, there were no occasions where Mangoola mine noise levels were measured to exceed the PA 06_0014, SSD 8642 or EPL 12894 criteria. These results represent a continuation of the zero exceedances reported in 2020.

6.3.3 Key Performance and/or Management Issues

During 2021, there were no new properties which triggered acquisition under PA 06_0014. There were no properties which triggered mitigation under PA 06_0014.

A noise impact agreement was entered into with Receptor 132 during the 2021 period and as such the noise criteria within SSD 8642 ceased.

There are eight properties that are eligible for acquisition (Property ID 25, 66, 83, 110, 130, 139, 148 and 205) as per Table 10, Condition C1 of SSD 8642. No properties eligible for acquisition have triggered those rights under Condition C1 of SSD 8642.

There are 22 properties that are eligible for additional mitigation (Property ID 128, 144, 154, 171, 176, 193, 261, 263, 109A, 109B, 109C, 109D, 109E, 109F, 125A, 134A, 182B, 164, 177, 251, 174A and 174B) as per Table 11, Condition C2 of SSD 8642. 1 new property (Property IDs R128), eligible for additional mitigation, triggered those rights under Condition C2 of SSD 8642. Ongoing mitigation was reoffered to the above receptor IDs in accordance with SSD 8642.

A total of 58 noise related complaints were received during 2021, which is a decrease from the 122 noise complaints received during the 2020 reporting period. These complaints were predominately from residences to the north-west of operations. In response to an increase in complaints in this area, weekly attended noise monitoring was once again conducted over Winter in line with the NSW Health requirements for the Covid 19 pandemic. Monitoring results indicated that the site was operating within noise compliance levels. Complaints are further discussed in Section 9.3.

6.3.4 Proposed Improvements

In response to changes to property ownership around the operation, Mangoola will review the noise monitoring network to determine whether continuous noise monitoring units can be relocated to provide better coverage around the mining operations.

6.4 Blasting and Vibration

6.4.1 Environmental Management

Blasting at Mangoola is undertaken in accordance with the approved Blast Management Plan (BMP) which was updated in 2020. The Blast Fume Management Procedure is also implemented, which defines practises to reduce the potential for fume generation and therefore reduce the impact of fume on the environment and community.

Prior to blasting and in accordance with the BMP, predictive and current meteorological data is reviewed to ensure that blasting is undertaken in appropriate weather conditions. In particular, wind speed, wind direction and the presence of temperature inversions are analysed prior to initiating blasting activities.

Blast overpressure and vibration was monitored at six monitoring locations during 2021, known as BM03, BM07, BM08, Anvil Rock, the closest rock formation to the blast, transmission line powerline pylons (where necessary) and Castle Hill Slab Hut. Blasting within close proximity to the powerline easement is undertaken as per a written agreement between the mining company and electricity infrastructure owner.

6.4.2 Environmental Monitoring Results

6.4.2.1 Results from the Reporting Period

During the reporting period there was an average of 2.2 blast events per week, which is compliant with Schedule 3, Condition 12(b) of PA 06_0014 and Condition B14 of SSD 8642, which allows a maximum of 6 blasts per week, averaged over a calendar year. A total of 114 blast events occurred during the reporting period and no more than 2 blast events per day which is compliant with Schedule 3, Condition 12(a) of PA 06_0014 and Condition B 14 of SSD 8642.

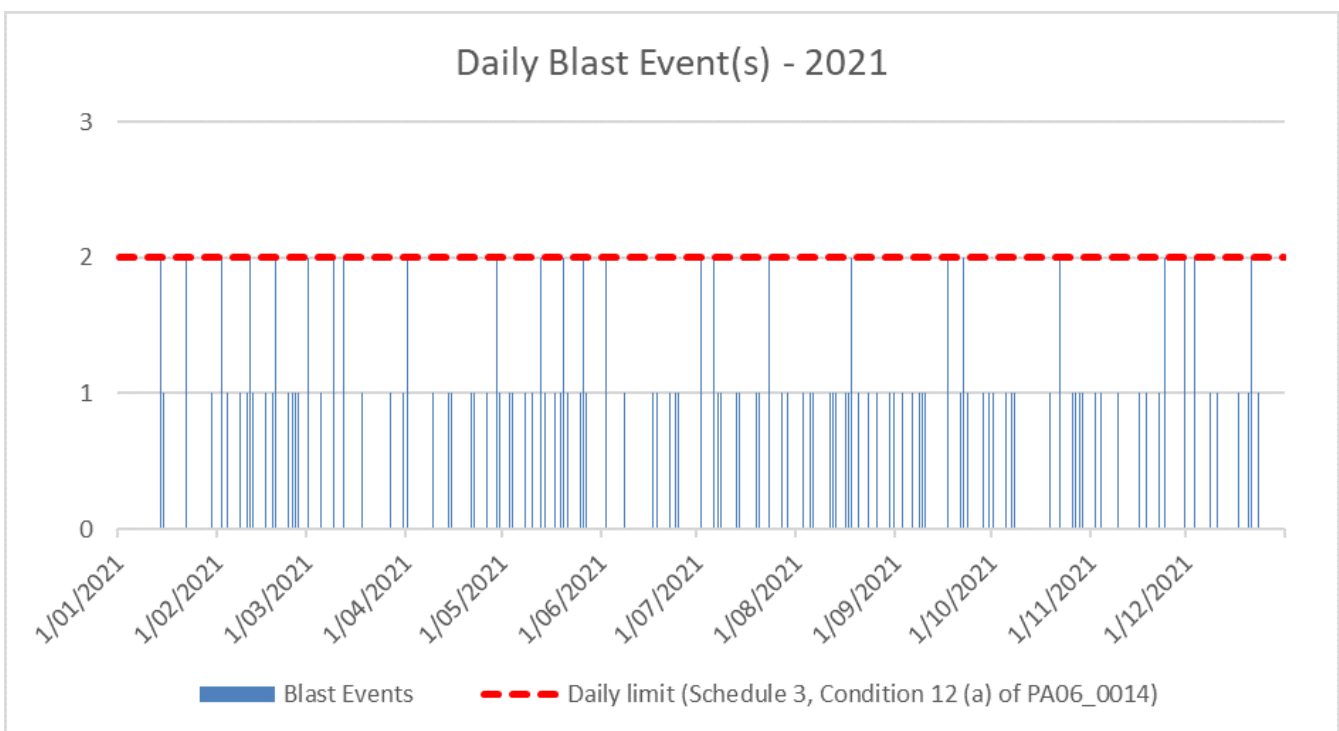


Figure 13 Daily Blast Event(s) 2021

Schedule 3, Condition 10 of PA 06_0014, Condition B10 of SSD 8642 as well as Section L4 of EPL 12894, provide the criteria for allowable air blast overpressure and ground vibration as measured at any privately owned residence. PA 06_0014 also provides ground vibration criteria for the Electricity Transmission Pylons. **Table 28** summarises the blasting criteria, as defined in the PA 06_0014 and EPL 12894, and other compliance monitoring requirements as defined in the approved BMP and Conservation Management Strategy (CMS) for Mangoola Open Cut.

Table 28 Compliance Monitoring Location Summary and Adopted Criterion

Monitoring Location Requirement	Monitoring Site Name (and PA/EPL ID)	Airblast Overpressure Limit	Ground Vibration Limit	Comments
PA ¹ : Nearest residence on privately owned land EPL ² : At monitoring points 16, 21 and 32	Private Property NW (BM07/21)	115 dB (Lin Peak) (allowable exceedance of 5% over 12 months) and 120 dB (Lin Peak)	5 mm/s (peak particle velocity (PPV)) (allowable exceedance of 5% over 12 months) and 10 mm/s (PPV)	Blast monitoring is conducted at the nearest residence on privately owned land to the blast zone. Locations may change over the life of the mine as properties are acquired and the mining progresses. Criteria applies to the nearest privately owned residence (as per PA 06_0014 and EPL definition). The EPL requires blast monitoring at monitoring points 16, 21 and 32 as per Condition M7.1. BM03 represents Point 16, BM07 represents Point 21 and BM08 represents Point 32.
	Church NE (BM03/16)			
	Private Property S (BM08/32)			
PA ¹ : 500 kV Transmission Line	Pylon 64X through to Pylon 75X	N/A (not measured)	60 mm/s ³ for tension towers	Monitoring requirements and limits apply as per agreement with the infrastructure owner (TransGrid).
			150mm/s ³ for suspension towers	
PA ¹ : Rock Formations	Anvil Hill The Book Rockshelter sites	N/A (not measured)	<i>Safe blasting limit as determined by specialist analysis</i>	Representative blast monitoring of Anvil Hill to inform vibration monitoring. The closest rock formation is monitored for every blast if not Anvil Hill.

1 PA: A requirement of Mangoola's PA 06_0014 (Schedule 3, Condition 10);

2 EPL: A requirement of Mangoola's EPL 12894 (condition L4.1, L4.2, L4.3 and L4.4 and M7.1);

3 As per TransGrid Agreement - Suspension tower limits were increased on 17th September 2020 to 150mm/s via agreement with TransGrid and DPIE.

The above criteria will be updated to align with the conditioning requirements of SSD 8642 with the commencement of mining and approval of the Blast Management Plan by DPIE. This information will be reported in the next Annual Review for 2022.

Airblast Overpressure

Airblast overpressure results at all monitoring locations for the reporting period are available on the Mangoola website, with the results recorded at the nearest privately owned residences and sensitive location summarised in **Table 29**.

Table 29 Airblast Overpressure Summary

Location	Minimum (dBL)	Average (dBL)	Maximum (dBL)	Exceedances (Y/N)
BM03	77	94.6	114.1	N
BM07	82.6	99.2	114.7	N
BM08	74.4	96.1	110.2	N

During the reporting period there was one incident where the blast monitor at BM07 failed to record a result. An internal investigation was conducted and identified that although the blast monitor was online, data could not be downloaded due to memory card corruption. This incident was recorded as a non-compliance against Schedule 3, Condition 17 of PA06_0014 (Blast Management Plan). Further detail on non-compliances is provided in **Section 11**.

All monitored blast events were compliant with the airblast over pressure limit of 115 dBL.

Ground Vibration

Ground vibration monitoring data for the reporting period is available on the Mangoola website and is summarised in **Table 30**.

Table 30 Ground Vibration Summary

Location	Minimum vibration (mm/s)	Average vibration (mm/s)	Maximum vibration (mm/s)*	Exceedances (Y/N)
Residences				
BM03	<0.1	0.1	0.4	N
BM07	<0.1	0.1	0.4	N
BM08	<0.1	0.1	0.5	N
Rock Formations				
Anvil Rock	0.1	4.2	31.5	N/A
Closest Rock Formation (where Anvil Rock is not the closest)	0.2	5.9	36.4	N/A
Powerlines				
Transmission Line Pylon	7.7	51.0	125.06	N

* Criteria for residences 5mm/s. Specialist determined safe limit for Anvil Rock and other rock formations for 2021 period is 50mm/s. Limit for powerlines as per TransGrid Agreement are 60mm/s for Tension towers and 150mm/s for Suspension towers.

#Limit for Suspension Towers increased to 150mm/s as of 17th September 2020.

¹ Monitoring at the closest powerline to the blast is required only where ground vibration limits are predicted to exceed 60mm/s peak particle velocity for suspension towers and 30mm/s for tension towers.

During 2021, there were no exceedances of the 5 mm/s threshold for residential receivers or the 50mm/s specialist determined safe limit for Anvil Rock (or other closest rock formations).

Monitoring was only required at the nearest pylon for 11 blast events in 2021. There were no instances where the vibration limit of 150mm/s on a suspension pylon footing was exceeded.

6.4.2.2 Comparison with Predictions

The PA 06_0014 MOD 6 EA included a Noise and Vibration Assessment (EMM 2013) which assessed the impacts of blasting. This assessment determined the limiting factors to the blast design with respect to the relevant blast criteria.

The MOD 6 Noise and Vibration Assessment (EMM 2013) determined that blast overpressure and vibration could be managed to be within PA06_0014 criteria at all times. During 2021, there were no exceedances of the blast overpressure criteria and no exceedances of vibration criteria, therefore the results were largely consistent with predictions made in the EA (EMM 2013).

6.4.2.3 Long Term Trend Analysis

In accordance with PA 06_0014, a long term trend analysis of blast monitoring results at Mangoola has been undertaken using data from July 2010 to December 2021, and included as **Appendix D**.

Ground vibration monitoring results have remained generally consistent since monitoring commenced, with no increasing trends developing in the data. All blast vibration monitoring results at private residences have been below the PA 06_0014 criteria since monitoring commenced. All results have been below the 10mm/s criteria, and while some results have exceeded the 5mm/s criteria between 2010 and 2020, these were within the allowable 5% frequency.

Airblast overpressure monitoring results at private residences (BM03, BM07 and BM08) have remained generally constant at all locations since monitoring began.

6.4.3 Key Performance and/or Management Issues

There were no exceedances of the 120 dB or 5 mm/s criteria for private receptors. In addition, the 50mm/s specialist determined safe limit for Anvil Rock (or other closest rock formations) was not exceeded.

During the reporting period there was one incident where the blast monitor at BM07 failed to record a result. An internal investigation was conducted and identified that although the blast monitor was online, data could not be downloaded due to memory card corruption. Further detail on non-compliances is provided in **Section 11**.

Two complaints were received in relation to blasting during the reporting period, which is a decrease from the six complaints received in 2020. Both complaints were relating to blast vibration/overpressure. Further detail on complaints is provided in **Section 9.3**.

6.4.4 Proposed Improvements

The Blast Management Plan will be updated to align with the condition requirements of SSD 8642 prior to commencement of mining within the area.

6.5 Erosion and Sediment Control

6.5.1 Environmental Management

Mangoola manages erosion and sediment on site in accordance with the approved Erosion and Sediment Control Plan (ESCP), which is included as Appendix C of the Water Management Plan (WMP). The ESCP was updated in 2021 and a copy is available on the Mangoola website.

Prior to land disturbance for any aspect of the mine, appropriate erosion and sediment controls are designed and constructed according to the ESCP as well as the guidelines *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) (the Blue Book) *Volume One and Volume 2E Mines and Quarries* (DECC 2008).

Site erosion and sediment controls are inspected at least monthly, and within 5 days of a high rainfall event (i.e. greater than 20 mm in 24 hours). Regular maintenance is undertaken as required to replace damaged sediment control structures and maintain other temporary measures. Annual channel stability monitoring is also undertaken at Mangoola to identify any erosion and sedimentation issues on surrounding creeks and drainage lines. The outcomes are reported in the *Annual Channel Stability Report* in accordance with Schedule 3, Condition 31(e) of PA 06_0014.

Construction commenced in accordance with SSD 8642 on 6 December 2021. The Erosion and Sediment Control plan was reviewed and not updated as the requirements of the management plan aligned with the conditioning of the SSD approvals. All construction works conducted are in accordance with the approved ESCP.

6.5.2 Environmental Monitoring Results

Monitoring of Erosion and Sediment Control structures was completed in accordance with the requirements of the approved ESCP.

The 2021 Annual Channel Stability Report (HLM 2021) saw no observed changes in the Ephemeral Stream Assessments for Big Flat Creek and Sandy Creek which surround Mangoola.

6.5.3 Key Performance and/or Management Issues

There were no issues with erosion and sediment control during the reporting period. Mangoola will review and implement if required any remedial measures as per the recommendations of the 2021 Annual Channel Stability Report, as provided in **Table 31**. Remedial actions will be implemented as required following onsite erosion and sediment control inspections completed routinely and following rainfall events.

Table 31 2021 Annual Channel Stability Report Recommendations

Recommendation	Mangoola Response
Big Flat Creek Continue to manage stock access.	This area is in Mangoola grazing land and is only lightly stocked due to the low carrying capacity. The area adjacent to Big Flat Creek was fenced off to exclude stock during 2021. Revegetation of adjacent offset areas is undertaken in accordance with the BOMPS.
Sandy Creek Manage stock access along Sandy Creek.	Several Mangoola offset areas and grazing land surround Sandy Creek. Fencing of offset areas to exclude cattle will continue to be maintained as per the BOMPS. Grazing is restricted due to low carrying capacity. The area will continue to be monitored and further stock reductions undertaken if required.
Repair active erosion points.	The area identified has a low stocking rate and any erosion in this grazing land area will continue to be monitored and remediation works undertaken if necessary.
Native revegetation and continue to manage weeds.	Weed management works continue to be undertaken regularly across all buffer land and offset areas. These works are prioritised based on weed type and numbers present. Revegetation across offset areas is undertaken in accordance with the BOMPS.

6.5.4 Proposed Improvements

The Erosion and Sediment Control Plan will be updated to align with the requirements of SSD 8642 prior to the commencement of mining.

6.6 Biodiversity

6.6.1 Environmental Management

Flora and fauna are managed in accordance with the approved MOP and Biodiversity Offset Management Plan and Strategy (BOMPS). The BOMPS was updated in 2018. Clearing activities at Mangoola have been designed to minimise impacts to any threatened flora and fauna species and vegetation communities. Suitably qualified personnel inspect all disturbance areas as part of the Pre-Clearing Procedure to ensure that no unapproved impact on any threatened species of flora or fauna will occur. Any fauna found during clearing activities are captured (where possible) and relocated by suitably qualified persons.

Two threatened terrestrial orchids and an endangered population of epiphytic orchid are present on lands at Mangoola, being *Diuris tricolor*, *Prasophyllum sp aff petilum* (Wybong) and *Cymbidium canaliculatum*. A Translocation Management Plan is in place to salvage and relocate threatened orchid species affected by the progression of mining activities and was updated and approved during 2018.

6.6.1.1 Weather Conditions 2021

Following increased and sustained rainfall, the intense drought of 2017-2019 eased to recovery conditions in winter of 2020. The Wybong Parish was declared as non-drought in September of 2020. During 2021, rainfall remained consistently high, similarly to the higher than average levels observed in 2020.

6.6.2 Environmental Monitoring Results

The following sites were monitored in 2021 as part of the BOMPS monitoring program:

- 12 fauna monitoring sites;
- 14 flora monitoring sites;
- Two groundwater dependent ecosystem monitoring sites;
- Rehabilitation monitoring included the establishment of 13 long term monitoring sites (for rehabilitation vegetation established 2011-2015) and 29 initial establishment monitoring sites; and
- Floristic values.

The breaking of the drought has resulted in floristic recovery, with general increases in vegetation height (particularly in regenerating/revegetation sites) and foliage cover at most sites. This is a good sign of resilience and recovery driven by favourable rainfall patterns. Native groundcover is increasing (in cover and richness); however, exotics are as well. This will need to be the key focus of management actions, in order to prevent exotics from dominating and inhibiting the recovery of native species diversity and abundance. Floristic results show declining trends in most highly invasive introduced species compositions which is reflective of site management actions. Despite these management actions, coverage of introduced species remains relatively high, particularly in areas subject to historical disturbance and revegetation works. Key weed species remain as galenia (*Galenia pubescens*) and thistles.

Coverage by weeds was highest in areas of derived native grassland that had been subject to revegetation (compared to remnant vegetation or rehabilitated vegetation). There are a number of sites where weed management works have showed a positive outcome by way of reduced cover and diversity of these species, and some increases in natives.

Remnant monitoring sites are considered generally stable and resilient. There is recovery in native species richness and all sites (with the exception of MAN06) have shown an improvement in native flora species. It is likely that MAN06 is taking longer than the others to recover due to the allelopathic affects associated with the high levels of slaty gum (*Eucalyptus dawsonii*) leaf litter at this site. Attention to managing exotic species will continue in these communities.

6.6.2.1 Fauna Values

Habitat value provided by rehabilitated areas continues to increase. Increases in height and foliage cover were recorded as were increases in habitat/niche complexity such as fallen timber, flowering and litter cover. Similar increases were seen at most revegetation sites.

Fauna diversity in 2021 (including in threatened species) was generally consistent with previous monitoring years. No new key threatened species previously known to occur at Mangoola were deemed to be at risk of localised extinction because of mining activities.

Three threatened fauna species continue to not be recorded during monitoring for a number of years being the masked owl (*Tyto novaehollandiae*), glossy black cockatoo (*Calyptorhynchus lathami*) and eastern cave bat (*Vespadelus troughtoni*) and consideration should be paid to these in future monitoring.

Mollusc numbers are mostly stable, and similar numbers to those previously recorded. Most live specimens were detected under logs, rocks etc, as is typical of these species particularly during dry weather when moisture is captured under structures.

General fauna compositions across remnant sites were consistent with previous monitoring, except for high levels of amphibian detection (due to increased water availability).

Note: As fauna monitoring survey techniques are slightly different to previous years (removal of remote camera surveys etc. prior to 2016), comparisons between monitoring years prior to this time are only generally informative.

6.6.2.2 Threatened Species

Nine threatened fauna species were recorded during monitoring in 2021, including:

- Brown tree creeper;
- Diamond firetail;
- Grey-crowned babbler;
- Speckled warbler;
- Grey-headed flying fox;
- Yellow-bellied sheath-tailed bat;
- Eastern freetail bat;
- Large-eared pied bat; and
- Little bentwing bat.

No targeted threatened flora species work was undertaken as part of this program during 2021 and none were identified at any of the monitoring sites. However, tiger orchids (*Cymbidium canaliculatum*) and weeping myall (*Acacia pendula*) were identified opportunistically while moving between sites including a new tiger orchid (*Cymbidium canaliculatum*) record which was identified near fauna site FA7. All these records are known to Mangoola.

Ecological monitoring locations are shown in **Figure 14**.

6.6.2.3 Conservation Agreement Monitoring

In 2021, the biodiversity offset areas were managed under the terms of the Conservation Agreements that are registered with the Biodiversity Conservation Division of DPIE.

Annual monitoring of the Conservation Areas was undertaken during 2021, which includes photo monitoring for comparison against baseline photos, quadrat monitoring to compare data to benchmarks and a walk-through assessment of all conservation areas. The following monitoring was undertaken:

- Big Flat Creek Conservation Area:
 - 11 photo monitoring points; and
 - 5 quadrat plots.
- Western Corridor and Anvil Hill Conservation Area:
 - 18 photo monitoring points; and
 - 11 quadrat plots.
- Southern Offset Conservation Area:
 - 8 photo monitoring points; and
 - 5 quadrat plots.
- Eastern Offset Conservation Area:
 - 10 photo monitoring points; and
 - 7 quadrat plots.
- Northern Corridor Conservation Area:
 - 12 photo monitoring points; and
 - 6 quadrat plots.

The monitoring data and reports related to the Conservation Agreements have been provided to the Biodiversity Conservation Trust as per conditions of the agreement.

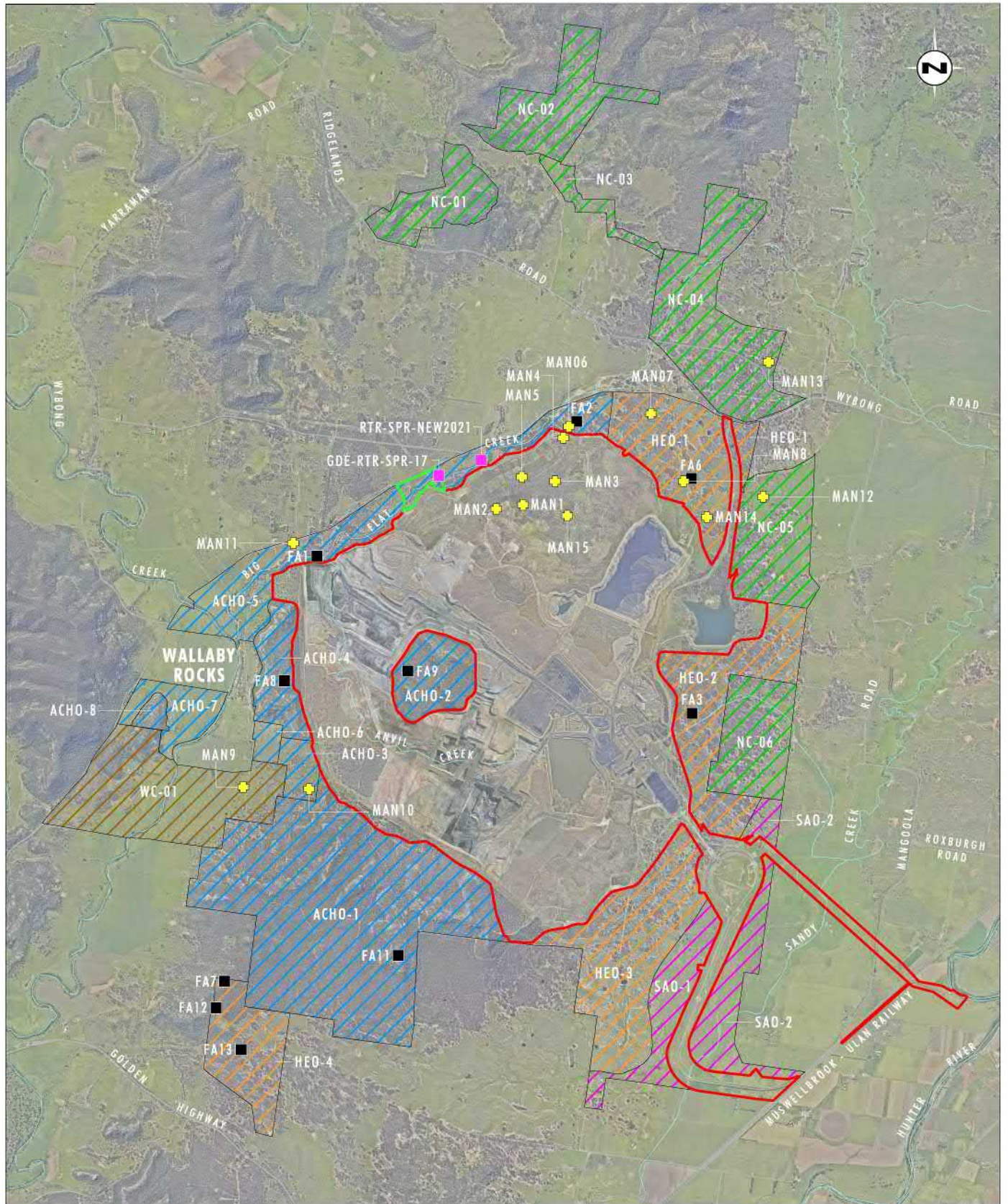


Image Source: Glencore (2020)
Data Source: Mangoola (2021)

0 1.0 2.0 3.0 km
1:65 000

Legend

- Approved Project Disturbance Area
- ▨ Aboriginal Cultural Heritage Offset Area
- ▨ Habitat Enhancement Offset Area
- ▨ Sustainable Agriculture Offset Area
- ▨ Northern Corridor
- ▨ Western Corridor
- Transport Corridor
- Creek Line
- Flora Monitoring 2021
- Fauna Monitoring 2021
- Groundwater Dependent Ecosystem Monitoring 2021

Figure 14 - Flora, Fauna and GDE Monitoring Locations

6.6.2.4 Landscape Function Analysis

Landscape Function Analysis (LFA) which was conducted every two years at Mangoola was removed after 2020. An independent monitoring methodology review was undertaken for all NSW Glencore sites by the Centre for Mined Land Rehabilitation in 2019. It was recommended to discontinue LFA monitoring as studies have demonstrated that the method does not provide meaningful indicators for mine rehabilitation sites and is not an appropriate demonstration of progress towards conditions seen at reference sites or a reflection of mine rehabilitation functional success.

6.6.2.5 Nest Box Monitoring

Nest boxes at Mangoola are monitored every two years for the presence of fauna and the condition of each box monitored every four years. A total of 581 nest boxes were monitored as part of the program during 2021, comprising 205 boxes monitored for content and condition, 293 monitored for content only and 83 for condition only. Due to a number of reasons including COVID-19 impacts and inaccessibility due to extended wet weather, this work was completed in January 2022, rather than November 2021 as scheduled.

Results are summarised below:

- 61 of the boxes monitored for content during 2021 showed some signs of use, comprising a mixture of eggs, shells, various nesting materials, feathers, scats and fur;
- 72 of the boxes monitored for content contained an animal at the time of monitoring. These included mammals, marsupials, reptiles, amphibians, birds and eggs;
- The squirrel glider (*Petaurus norfolcensis*) was recorded in a rear entry glider box in the Western Corridor;
- Of the rehabilitation nest boxes monitored in 2021, the Northern Rehabilitation boxes continue to show usage, with two boxes containing *Litoria peronii* and one box containing an unidentified rat. There were also five boxes with signs of bird use, with intact eggs or feathers (of an eastern rosella) recorded. This is a good sign (despite nest failure) that birds are beginning to make use of boxes in this area. Interestingly, these were found in the boobook and rear possum box designs. The Southern Rehabilitation boxes are predominantly large designs suitable for birds and possums. One *Litoria peronii* was recorded from a squirrel glider box in this area;
- Nest box occupation is lower in the rehabilitation areas, at 16% compared with the BOAs and corridors (33.2%);
- Pest species usage of boxes continues to be low with only one European honey-bee hive recorded.

6.6.2.6 Threatened Terrestrial Orchid Monitoring

Below average July-August rainfall in 2021 at Mangoola resulted in reduced orchid emergence and flowering relative to the very wet 2020 flowering season. Despite this, good outcomes have been achieved following the poor results attained during the 2017-2019 drought. Over the course of eleven years, improvements in monitoring methods have dramatically enhanced orchid detection rates with successive monitoring events. Considered together, detectability for most recipient plots in 2021 was between 1% and 44%.

The new recruitment first confirmed in 2020 for *Diuris* (but not *Prasophyllum*) increased from 29 in 2020 to 114 (29 in Plot 4A and 85 in Plot 4B) in 2021. Mapping of these individuals suggest a north-south trend in the dispersal of seed from translocated orchids, approximating the dominant wind direction during November-December. Additionally, 16 *Diuris* (4 in 4A, 12 in 4B) also emerged in soil cores originally planted out with *Prasophyllum*, but it is unknown if these are new recruits following translocation or if they were unknowingly already present in these cores at the time of planting. Sporadic individuals of *Diuris* within some offset plots observed in recent years may also represent new recruitment, however it is difficult to know if they were already in those locations prior to the initial translocation event. Following 2021 monitoring, this has almost certainly occurred in Translocation # 2 where seven *Diuris* were detected in close proximity, one clearly the largest and oldest specimen from which six smaller and younger plants originated. New recruitment has also potentially occurred in five other translocation plots within Translocations # 3 to # 6.

Permanently tagged orchids within the four orchid control plots were censused for the fifth time in 2021, and with the changing weather patterns is now beginning to yield important emergence and detection data. Since installation, numbered individuals of *Diuris* and *Prasophyllum* declined in detection during the drought years of 2017-19. An increase was observed in 2020 and further increases in 2021. In 2021 16 (24%) of the 74 originally tagged orchids were flowering, and an additional two *Diuris* and one *Prasophyllum* newly emerged and detected were added to the total tagged number (in addition to the 9 and 22 *new Diuris* marked in 2017 and 2020 respectively, and 3 *new Prasophyllum* in 2020). The total marked orchids now stand at 60 *Diuris* and 51 *Prasophyllum*.

For both species, less than 4% of all individuals were detected over six consecutive seasons, suggesting that annual emergence of individuals is uncommon.

Some minor issues relating to the management of translocation recipient sites became apparent and action is required to:

- Control outbreak of Coolatai grass near translocation #3 (Wybong PO Rd) as well as the gate to the offset area containing translocations #6 and #7; and
- Repair gap in mesh in translocation #6.

A trial burn conducted in May 2021 within Translocation # 6 (Rehabilitation 4A) found no deleterious impact on orchids, with increased detection evident including new *Diuris* recruits.

Changes to the monitoring regime are recommended for the 2022 season onwards, including replacing annual brush cutting with ecological burning, introducing post-fire orchid survey rather than monitoring all plots annually and discontinuing all monitoring in some selected plots.

6.6.2.7 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystem (GDE) monitoring was undertaken along Big Flat Creek to identify if floristic data reflects any substantial negative changes that may have resulted from groundwater depressurisation associated with groundwater inflows. Site RTR-SPR-NEW2021 was established in 2021 as a reference site against which any future changes to RTR-SPR-17 can be compared (in event of such events as drought), to guide the likelihood of floristic changes resulting from this, of groundwater depressurisation.

The GDE monitoring site (RTR-SPR-17) has experienced extensive dieback since 2017 with over-storey and mid-storey cover both reducing by over 50%. This dieback was prevalent throughout this area in both the mature and regenerating Swamp Oak (*Casuarina glauca*). This dieback remains obvious in 2021, however has not worsened substantially since 2019. The site continues to have regeneration present in low levels, and these younger plants remain in reasonable condition.

Observations made since the 2021 monitoring also detected foliage recovery in some of the swamp oak trees (both inside and outside of the predicted depressurisation zone).

Swamp Oak and River Oak (*Casuarina cunninghamiana*) dieback has been observed across the Hunter Valley over the past several years and is likely to be strongly influenced by the drought conditions.

Groundwater quantitative data is collected at two sites along Big Flat Creek and in proximity to RTR-SPR-17, being MP17-B and MP8-B (in alluvium and weathered conglomerate), these flows move in a south-westerly direction. In 2012, baseline depth to water (DtW) levels for MP17-B and MP8-B was recorded at 2.96m and 3.35m, respectively. These levels would have been within the root zones of treed vegetation or at least within a zone where soil capillary action allows groundwater to influence soil moisture and thus be available to surface vegetation.

Ongoing monitoring of these bores has identified them as being dry for at least six years. However, groundwater depressurisation around RTR-SPR-17 is occurring within the parameters predicted as part of the groundwater modelling of this site. It is probable that the Swamp Oak Riparian Forest vegetation (canopy species) above RTR-SPR-17 and RTR-SPR- 2021 is at least partially groundwater dependent. This dependence may be more pronounced during extended periods of drought where surface water availability is reduced or absent.

6.6.2.8 Infill Tree Planting 2021

Infill planting was conducted throughout indicated areas in North and South Rehabilitation areas.



Photo 1 Planting throughout rehabilitation areas.



Photo 2 Tubestock established throughout the rehabilitation areas

6.6.3 Key Performance and/or Management Issues

During the reporting period there were no reportable incidents, performance or management issues relating to flora and fauna. Management issue recommendations related to biodiversity monitoring are:

- Recommendations from the 2021 Ecological Monitoring Report (Umwelt 2022) are listed below:
 - Continue to undertake ongoing maintenance and monitoring of weed species in line with the identified areas of concern and the 2021 Weed Action Plan (ongoing action);
 - Continue to undertake targeted control works for all vertebrate pests;
 - Undertake supplementary or in-fill plantings of canopy and shrub species in specified areas within the offsets;
 - Undertake works to rectify erosion; and
 - Modify seeding/ planting ratios as recommended.
- Recommendations for future nest box activities (Umwelt 2022) include:
 - Continue to tag new nest box installations with cattle tags and re-tag existing boxes as numbers fade (ongoing);
 - Continue supplementary nest box installation in Rehabilitation areas as habitat matures;
 - Maintain nest box diversity to cater for a wide range of species (ongoing); and
 - Install diversity of small nest box designs into rehabilitation and regenerating areas to encourage use by small birds, microbats, reptiles, frogs, dasyurids and insects.

Mangoola will review and implement these recommendations where appropriate as part of the 2022 ecological monitoring program.

6.6.4 Proposed Improvements

Based on 11 years of monitoring Eastcoast Flora Survey recommend a revised monitoring program for the terrestrial orchids, which continues annual monitoring of selected recipient plots (those in mine rehabilitation, controls, and some Prasophyllum-dominated plots in offsets), introduces cyclical post-fire monitoring of most other plots for two consecutive years after burns, and discontinues all monitoring of other poorly performed plots (Translocation # 1, and all tuber translocations) (Bell, 2021).

6.7 Weed and Pest

6.7.1 Environmental Management

6.7.1.1 Weed Management Activities

During the reporting period, contractors were engaged to undertake weed management works at the mine, within rehabilitation and offset areas. Noxious and highly populated weeds were prioritised with environmental weeds treated opportunistically when encountered. A summary of the weed management and control activities undertaken during the reporting period is listed below:

- High and low volume spraying was conducted across all offset areas targeting *Eragrostis curvula* (African Love Grass), *Galenia pubescens* (Galenia), *Opuntia* sp (Prickly Pear), *L. ferocissimum* Bryophyllum sp (Mother of Millions), *Agavoideae* sp (Agave), *Hypericum perforatum* (St John's-wort), *Hyparrhenia hirta* (Coolatai Grass), *Sida rhombifolia* (Paddy's Lucerne), *Verbena bonariensis* (Purple Top), *Tagetes minuta* (Stinking Roger);
- Primary control areas were along tracks, creek lines, rip lines and within revegetation areas;
- Cut-and-paint works with chainsaws and handsaws were conducted throughout site using neat Roundup Biactive® targeting *Lycium ferocissimum* (African Boxthorn);
- Chainsaw works were conducted around the old farm houses and creek line within the offsets, targeting *Nerium oleander* (Oleander), *Cupressus* sp. (Cypress), *Acacia saligna* (Golden Wreath Wattle), *Lycium ferocissimum* (African Boxthorn), and *Paulownia tormentosa* (Princess Tree). Chainsaw works were conducted more broadly throughout the offset targeting *Lycium ferocissimum* (African Boxthorn).
- Widespread high and low volume weed control throughout all mine rehabilitation areas, primarily targeting Coolatai Grass (*Hyparrhenia hirta*), Stinking Roger (*Osteospermum calandestinum*), Ink Weed (*Phytolacca octandra*), Scotch Thistle (*Onopordum acanthium*), Galenia (*Galenia pubescens*), Blue Heliotrope (*Heliotrope amplexicaule*), Rhodes Grass (*Chloris gayana*) Fleabane (*Erigeron bonariensis*), St Johns Wort (*Hypericum perforatum*) and Saffron Thistle (*Cartahmus lanatus*); and
- Slashing was conducted in and around Orchid monitoring compounds. The biomass was raked, removed and placed outside the compound boundary.

Weed management requirements have increased in line with the improved seasonal and growing conditions, and therefore additional resources were applied during 2021.

6.7.1.2 Feral and Pest Animal Management Activities

Mangoola completed autumn and spring 1080 baiting programs during 2021 which resulted in 81 fox takes and 4 wild dog takes. Mangoola is a member of the Wybong Wild Dog Association and co-ordinates vertebrate pest control activities with regional neighbours to ensure maximum program efficiency.

Additional culling programs also resulted in 28 fallow deer and 96 feral pigs being culled.

6.7.2 Key Performance and/or Management Issues

No reportable incidents, performance or management issues regarding weeds and feral animal management occurred during the reporting period.

6.7.3 Proposed Improvements

Three additional feral pig traps were ordered during 2021, to improve pig trapping resources during 2022.

6.8 Visual Mitigation

6.8.1 Environmental Management

All works occurring onsite are undertaken in a manner which ensures that there is minimal impact on visual amenity in accordance with *AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting*. Mangoola is committed to minimising ongoing visual impacts as a result of its operations. In order to ensure visual impacts are minimised a variety of methods are implemented, including tree screen planting, visual bunds, building placement, light shielding and lighting direction to prevent light spillage.

6.8.2 Environmental Monitoring Results

Lighting inspections were undertaken as required by Mining Supervisors to monitor mobile lighting impacts from external viewing points.

Visual tree screening was established via direct seeding of appropriate local flora species along sections of Yarraman Road during 2018 to reduce visual exposure as the mine progresses to the north-west. As a result of the ongoing drought conditions in 2019, the direct seeding campaign undertaken in 2018 resulted in no germination and 2019 there was no attempt to re-sow due to ongoing drought. In 2020, the tree screen areas along Yarraman and Wybong Roads were sprayed (where required)/slashed and planted with tube-stock. Additional infill planting in these areas was also undertaken during 2021.

6.8.3 Key Performance and/or Management Issues

There were no performance or management issues regarding visual mitigation or lighting during the reporting period.

6.8.4 Proposed Improvements

The Visual Impact Management Plan will be submitted and approved by DPIE prior to the commencement of mining in the MCCO area in accordance with SSD 8642.

6.9 Aboriginal Heritage

6.9.1 Environmental Management

The management of activities relating to Aboriginal cultural heritage at Mangoola is undertaken in accordance with the Aboriginal Cultural Heritage Management Plan (ACHMP) and relevant other guidelines and legislation. The ACHMP was updated in 2021 and a copy is available on the Mangoola website.

A number of Aboriginal archaeological sites are recorded within or adjacent to the Mangoola project area. In order to assist with the management of Aboriginal cultural heritage, Mangoola maintains spatial information on all identified Aboriginal archaeological sites within the operational geographical information system. The GIS information is utilised to inform the GDP process.

6.9.2 Environmental Monitoring Results

Aboriginal heritage monitoring and inspections undertaken in 2021 have been summarised in **Table 32**.

Table 32 Aboriginal Heritage Monitoring and Inspections

Monitoring / Inspection	Dates	Attendees	Notes
2021 Offset Tree Planting + power pole installation (Sandy Creek Farm Dam 1) due diligence	24 th February 2021	Stephanie Rusden (OzArk - Archaeologist), Robyn Ellis (Mangoola Environment and Community Officer) and a representative from registered Aboriginal party.	During this inspection, eight new Aboriginal sites were recorded in the offsets proposed for tree planting: <ul style="list-style-type: none"> AHIMS #37-2-6294 - AHIMS #37-2-6301 Due to the scope of the proposed works and the ability to avoid impacts by excluding the site areas from disturbance through demarcation with temporary fencing, an AHIP application was not necessary for project.
2021 due diligence for proposed exploration/ water bore drilling program + due diligence for scarred tree relocation	6-7 th October 2021	Stephanie Rusden (OzArk - Archaeologist), Annemieke Grosser and Jake Hawkins (Mangoola Environment and Community Officers – one day each) and a representative from registered Aboriginal party.	During this inspection, no new Aboriginal sites were recorded. Proposed access routes and drill hole sites were selected to avoid known artefacts/scatters. The proposed work will have a minor impact on the ground disturbance. Work to stay within surveyed area and follow recommendations of the Due Diligence report. AHIP is not considered necessary for project. Project scheduled to commence 2022.
2021 Annual offset monitoring	22- 24 th November 2021	Stephanie Rusden (OzArk - Archaeologist), Rhys Wilson/Jack Clare/Annemieke Grosser (Mangoola Environment and Community Officers – 1 each day) and two representatives from registered Aboriginal parties.	Throughout 2021, Mangoola ensured that visitation to rock shelters was kept to a minimum. Visitation was undertaken to conduct required monitoring and measurements in line with approved management plans and statutory approvals. A summary of outcomes was presented at the annual meeting on 17 th December. Further information is available at the request of registered Aboriginal parties.

Monitoring / Inspection	Dates	Attendees	Notes
2021 due diligence for proposed exploration/ water bore drilling (amended sites/tracks)	2 nd December 2021	Stephanie Rusden (OzArk - Archaeologist), and a representative from registered Aboriginal party (Revisited areas that were amended for ecological considerations).	<p>During this inspection, no new Aboriginal sites were recorded.</p> <p>Proposed access routes and drill hole sites were selected to avoid known artefacts/scatters. The proposed work will have a minor impact on the ground disturbance. Work to stay within surveyed area and follow recommendations of the Due Diligence report. AHIP is not considered necessary for project. Project scheduled to commence 2022.</p>

On 17 December 2021, an Aboriginal stakeholder consultation meeting was held to review previous meeting minutes and actions, and provide an update on project progress, outcomes of monitoring activities, cultural heritage inspections/surveys and any salvage activities conducted in accordance with ACHMP requirements. Also included in the invitation letter and agenda, and discussed at the meeting, was the funding available to enhance or promote Aboriginal matters as per the process outlined in the ACHMP.

Also discussed at the meeting was the relocation of Aboriginal Scarred Tree (SC-ST-03) during following extensive consultation with Registered Aboriginal Parties and the Office of Environment and Heritage. A registered aboriginal party representative and archaeologist were present during the relocation to its new location within Heritage Enhancement Offset Area. This new location offers better access for teaching purposes and placement was as per the agreed Scarred Tree SC-ST-03 Management Recommendations.

6.9.3 Key Performance and/or Management Issues

There were no reportable incidents, performance or management issues relating to Aboriginal heritage during the reporting period however, actions captured in the 2021 Annual Stakeholder review meeting have been enacted.

A revised ACHMP was submitted to the DPIE on 18 August 2021 following the review of the draft ACHMP by Mangoola RAPs and Heritage NSW (as required under Schedule 2, Condition B68b of SSD 8642). A full revision of the plan was completed to address the conditions of SSD 8642 and additional management measures associated with the Mangoola Coal Continued Operations Project. The plan was reviewed again to consider feedback from RAPs, HNSW and DPIE before being re-submitted to DPIE. The ACHMP was approved by DPIE on 29 September 2021 and is available on the company website.

6.9.4 Proposed Improvements

In 2022, Mangoola will work with RAPs regarding the application and processing of funding available to enhance or promote Aboriginal matters as per the process outlined in the ACHMP available on the company website. Maintenance of the site GIS register will continue to add any new artefacts found as part of MCCO Project works/other due diligence.

6.10 European Heritage

6.10.1 Environmental Management

European heritage is managed at Mangoola in accordance with the Conservation Management Strategy (CMS). A copy of the CMS is available on the Mangoola website. Specifically, the CMS identifies known European Heritage sites at Mangoola and any relevant monitoring required to be completed to assess the potential impact primarily from blasting or clearing activities.

A revised CMS was submitted to the DPIE which included a review and completion of minor administrative updates to permit construction activities associated with SSD 8642. Whilst not deemed to have heritage significance, the commitment from the MCCO Project Response to Submissions to undertake an archival recording of the Millville property prior to demolition was included as part of the review. As required by this commitment, the archival recording of the Millville Property was completed in June 2021 and a copy of the report submitted to Heritage, Department of Premier and Cabinet, and MSC, for inclusion in their respective libraries as well as the Muswellbrook Shire Local Family and History Society for their records. Archival recording during demolition works will be undertaken if deemed to be warranted as a result of information obtained during the recording prior to demolition.

6.10.2 Environmental Monitoring Results

During the reporting period ground vibration monitoring at key heritage sites, such as Anvil Rock, was maintained.

No blast events have exceeded the vibration limit of 20mm/s at the Castle Hill site in 2021 and results from other blast monitors and structural monitoring undertaken has demonstrated that no damage has occurred to any sites.

6.10.3 Key Performance and/or Management Issues

No reportable incidents regarding European Heritage occurred during the reporting period.

Mangoola will continue to carry out ground vibration and physical monitoring in 2022 on Anvil Rock and The Book Rock Formations to inform the adequacy of blasting controls and management of these structures.

An annual review of safe blasting limits has been undertaken to inform blasting design to ensure there are no blasting impacts on Anvil Rock, The Book Rock Formations or Castle Hill heritage sites.

6.10.4 Proposed Improvements

In 2022, a Blast Management Plan will be developed for the MCCO Project in accordance with Conditions B23-B25 of SSD 8642. This will include the blast criteria for heritage structures as provided in Condition B11, Table 3 and a strategy to monitor, mitigate and manage the effects of blasting on heritage items. A Historic Heritage Management Plan will also be developed to comply with Schedule 2, Conditions B71 to B73 of SSD 8642 for the MCCO Project. This will be prepared and submitted for approval prior to mining in the new MCCO Project Area. Any requirements associated with these plans will be actioned accordingly.

There are no further proposed improvements in this area in 2022.

6.11 Spontaneous Combustion

6.11.1 Environmental Management

Management of spontaneous combustion is undertaken in accordance with the Mangoola Spontaneous Combustion Principal Hazard Management Plan (SCPHMP). This management plan details the monitoring and control measures implemented by Mangoola to reduce the incidence and impacts of spontaneous combustion, including stockpile inspections, staff training, priority processing of areas that are heating, and track rolling/battering down stockpiles that will be stored for greater than three months.

6.11.2 Environmental Monitoring Results

No significant instances of spontaneous combustion were detected at Mangoola during the reporting period. Implementation of the SCPHMP has been effective in preventing spontaneous combustion on site to date.

6.11.3 Key Performance and/or Management Issues

There were no reportable incidents, performance or management issues involving spontaneous combustion during the reporting period.

6.11.4 Proposed Improvements

There are no proposed improvements in this area in 2022.

6.12 Bushfire

6.12.1 Environmental Management

Potential risks associated with bushfire are managed through the implementation of monitoring and control strategies as documented in the Mangoola Bushfire Management Plan. This management plan was originally developed in consultation with the NSW Rural Fire Service, Muswellbrook Shire Council, and both the Mangoola and Wybong Rural Fire Brigades. A revised Bushfire management plan has been drafted and submitted to the DPIE in accordance to the conditions of SSD 8642.

6.12.2 Environmental Monitoring Results

There were no bushfires at Mangoola during 2021.

Mangoola continued to implement the bushfire hazard reduction program which included:

- **Item 1** – Building Asset Protection Zone (APZ) maintained at the rear of administration building to Bushfire Management Plan Asset Protection Zone standards (30m width, 10cm grass height) (complete);
- **Item 3** – Access improvement of site access roads to the south, roads to meet Rural Fire Surface (RFS) fire trail standards with 4m width no obstruction clearance and 4m height (complete);
- **Item 4** – Access maintenance of site access roads to south (monitor minor washout damage to ensure continued access) (complete);
- **Item 5** – Provide a bushfire awareness toolbox talk document prior to total fire ban, severe, extreme or catastrophic fire risk days (to be undertaken when triggered) (contingent on weather conditions); and

- **Item 6** – Name and signpost all firefighting access trails identified on the operational map to avoid confusion when liaising with external agencies (complete).

6.12.3 Key Performance and/or Management Issues

There were no performance or management issues relating to bushfires during the reporting period.

6.12.4 Proposed Improvements

The Bushfire management plan will be updated in accordance with the requirements of SSD 8642 and consultation with RFS.

6.13 Hydrocarbon Management

6.13.1 Environmental Management

Bulk fuel facilities are managed in accordance with *AS1940-2017 The Storage and Handling of Flammable and Combustible Liquids*. All permanent fuel facilities are fully bunded, with emergency measures in place to manage spills.

All hydrocarbon spills which occur are reported via the sites incident reporting system, and investigations carried out as required. When spills occur, they are managed with one of the spill kits available onsite or treated through oily-water separators.

There is also an active bioremediation area which was constructed within the mining area in 2018 and utilised as required during 2021.

6.13.2 Environmental Monitoring Results

During the reporting period, there were nine hydrocarbon spills which were reported internally. All spills were contained on site within the active mining area and no offsite pollution or environmental harm occurred as a result of these spills. Consequently, none of these incidents required external reporting to any government agencies.

In response to each spill, the following tasks were generally implemented:

- Source of the spill controlled (pumping/machinery stopped);
- Spill contained and cleaned up with absorbent material;
- Contaminated material taken to bioremediation area, where appropriate (improvement in 2018);
- Incident reported and investigation commenced where required;
- Machinery repaired, where required; and
- Where required, procedures were updated, and staff and contractors received additional training on adequate management of hydrocarbons or spills.

6.13.3 Key Performance and/or Management Issues

There were no key performance and/or management issues relating to hydrocarbon management in 2021.

6.13.4 Proposed Improvements

There are no proposed improvements in this area in 2022.

6.14 Public Safety

6.14.1 Environmental Management

Mangoola is committed to preventing risks to public safety as a result of operations at the mine. Ongoing reviews of potential public safety issues are undertaken on a regular basis around the mine area and associated public roads.

Day-to-day monitoring of public safety at Mangoola is undertaken through the use of a variety of methods, including:

- All site visitors are directed to the main office and are required to report and log on to an electronic visitors book;
- Implementation of a security system to ensure public and employee safety is maintained in accordance with the relevant requirements under the *Coal Work Health and Safety Act 2011*, *Mining Act 1992* and the Mining Leases;
- During hazardous activities such as blasting, sentries are posted throughout the site, and if required, public roads, to prevent unauthorised entry into the blasting zone;
- Site boundary fencing surround the perimeter of the site;
- Security patrols;
- Upgrade of local roads in accordance with Schedule 4, Conditions 46-47 of PA 06_0014;
- Restrictions of local road use in accordance with Schedule 4, Condition 48 of PA 06_0014; and
- Employee and contractor inductions regarding mine safety and environmental management issues prior to commencement of work at the site.

6.14.2 Environmental Monitoring Results

As required by Condition 45 of PA 06_0014, Mangoola was required to contribute funding to the upgrade of the Thomas Mitchell Drive and Denman Road intersection which was to be completed by 31 December 2017.

On 4 May 2016, Mangoola received an extension from the DPIE to complete the upgrade works by the end of 2019. During 2019 and 2020, further discussions were held between Mount Arthur Coal (who are completing the upgrade), Muswellbrook Shire Council and DPIE regarding the timing of works to be completed. On 16 April 2020, an extension from DPIE was granted until 31 December 2022.

Condition 46 and 47 were satisfied during 2016 and practical completion was received from Muswellbrook Shire Council on the 14 September 2016.

One traffic related complaint was received in 2021. A number of mines use the road and although it wasn't confirmed to be Mangoola workforce, considerate local road use was communicated to all employees (it is also included as part of site familiarisation inductions). Feedback was provided to the complainant. One other complaint was received in relation to a private property owner locked out of property access. This was rectified and again communicated to all personnel using this access.

6.14.3 Key Performance and/or Management Issues

There were no public safety incidents, performance or management issues in 2021.

6.14.4 Proposed Improvements

There are no proposed improvements in this area in 2022 although the MCCO Project will continue construction of project boundary fencing along Wybong Road (security fence) and also implement construction specific inductions/login processes and security patrols. Wybong PO Road will also be closed and entry secured.

6.15 Greenhouse Gas Energy

6.15.1 Environmental Management

Energy consumption (electricity, diesel and liquefied petroleum gas) at Mangoola is monitored and reported in accordance with Glencore requirements and the *National Greenhouse and Energy Reporting Act 2007* (NGER Act).

Mangoola operates in accordance with the approved *Energy Savings Action Plan* (ESAP). The ESAP has been produced to comply with Schedule 3, Condition 55 of PA 06_0014. Mangoola continually assesses the viability of initiatives to improve energy efficiency and reduce greenhouse emissions from proposed operations.

The ESAP identifies opportunities at Mangoola to reduce greenhouse gas emissions and energy consumption, as well as specifying actions to realise these opportunities.

The three-yearly energy audit was conducted in 2019 as required by the ESAP and energy efficiency improvement opportunities were investigated as a result.

6.15.2 Environmental Monitoring Results

6.15.2.1 Results from the Reporting Period

Data relating to electricity consumption, fossil fuel usage and the associated greenhouse gas emissions, during the 2020/2021 reporting period is presented in **Table 33**. In 2020/2021, the total emissions produced by Mangoola were 135,015 t CO₂-e which represents a ~22% decrease from 2019/2020 (173,405 t CO₂-e).

Table 33 Greenhouse Gas Data

Emissions Source	2019/2020 T CO ₂ -e	2020/2021 T CO ₂ -e	Year 2-9 Scope Total T CO ₂ -e
Scope 1 Emissions (Direct)			
Fossil Fuel	113,348	91,030	136,358 ¹
Fugitive Emissions	10,073	6,941	

Emissions Source	2019/2020 T CO ₂ -e	2020/2021 T CO ₂ -e	Year 2-9 Scope Total T CO ₂ -e
Total Scope 1	123,421	97,971	
Scope 2 Emissions (Indirect)			
Electricity	49,984	37,044	63,962
TOTAL EMISSIONS (SCOPE 1 & 2)	173,405	135,015	200,320
Scope 3 Emissions (Indirect) – MOD 6 GHG emissions assessment			
Associated with energy extraction and distribution			9,759
Product transport			1,713,926
Product use			23,529,897
TOTAL EMISSIONS (SCOPE 3 only)			25,253,582
TOTAL EMISSIONS (SCOPE 1, 2 & 3)			25,453,902

¹ Scope total made up of diesel use, explosive use and fugitive emissions – MOD 6 greenhouse gas assessment breakdown, current annual broken down more accurately than initial assessment.

6.15.2.2 Comparison with Predictions

The MOD 6 EA included an Air Quality Impact Assessment (Todoroski Air Sciences 2013) which predicted greenhouse gas emissions for years 1, 2-9, and 10 of the project. As MOD 6 was approved in 2014, 2021 can be considered Year 8 of the modified operations. The Year 2-9 greenhouse gas emissions predictions are presented in **Table 33**.

The data shown in **Table 27** represents the average annual predicted CO₂-e emissions for Years 2-9 of the modified operations. As shown in **Table 33**, the total emissions for 2020/2021 were 135,015t CO₂-e. This is 33% less than the 200,320 t CO₂-e predicted in the EA for Years 2-9 (Todoroski Air Sciences 2013) for Scope 1 (Direct) and 2 (Indirect) emissions. Scope 3 emissions are unable to be quantified and therefore have not been included here.

No reportable incidents regarding greenhouse gas and energy occurred during the reporting period.

6.15.3 Key Performance and/or Management Issues

As the three-yearly energy audit required under the ESAP was carried out in 2019, no further audits/reviews were completed in 2021.

6.15.4 Proposed Improvements

Greenhouse Gas will be incorporated in the Air Quality and Greenhouse Gas Management plan in 2022 as required by SSD 8642.

If the PA 06_0014 is not surrendered prior the ESAP will be reviewed in 2022 in accordance with Schedule 5 Condition 9.

7 Water Management

Mangoola manages water on site in accordance with the approved Mangoola Water Management Plan (WMP) which is available on the Mangoola website. The WMP was reviewed to align with the MCCO project and was resubmitted and approved in 2021. Mangoola implements the following hierarchy of water supply to meet demand and reduce water take:

1. On-site runoff from within the saline water system is preferentially use for dust suppression and CHPP process water;
2. On-site runoff from within the dirty water system is preferentially used for dust suppression and CHPP process water;
3. Groundwater inflows into the open cut pits is preferentially used for dust suppression and CHPP process water;
4. Clean water incidentally collected from undisturbed areas of the site is preferentially used for dust suppression and CHPP process water in accordance with the Harvestable Rights provisions; and
5. Water extracted from the Hunter River utilising existing water access licences or purchased on the open market.

7.1 Water Balance

Mangoola operates a comprehensive and calibrated site water balance to inform water management at the site. Water held and captured onsite at Mangoola by the water management system during the calendar year reporting period is shown in **Table 34**. The Mangoola Water balance is generated from a calibrated model, with an error margin of 1.4%.

Table 34 Mangoola 2021 Water Balance (Calendar Year)

Aspect	Volume (ML)
INFLOWS	
Rainfall Runoff	4,126
Hunter River Raw Water Supply	3.2
Groundwater Inflow	113
Spoil Seepage	424
Tailings Bleed Water	870
Total	5,536
OUTFLOWS	
Evaporation	1,253
CHPP Supply	2,643
Water Cart Usage	511
Wash Bay / Stockpile	9.6

Aspect	Volume (ML)
Hunter Release	0
Spill	35.6
Total	4,444
Inflow – Outflow	1,091
Recorded Stored on Site at Start of Annual Review Period	2,623
Recorded Stored on Site and End of Annual Review Period	3,859
Change in Storage	1,236
Error	1.4%

7.2 Salt Balance

As required by SSD 8642 Condition B50 (ii) a salt Balance was conducted for the 2021 reporting period. Saline material is any material moved on site that has the potential to generate saline water. Salt can be released when saline material is exposed to the surface, via weathering. The salt then has the potential to be transported by water.

Key sources of saline material at Mangoola include:

- Overburden material;
- ROM Coal;
- Product Coal; and
- Coal Rejects.

Key sources of saline water at Mangoola include:

- Direct rainfall onto the surface of water storage dams;
- Runoff – where salt on the surface of soils / saline material is dissolved by rainfall and transported in the system through runoff;
- Water imported from the Hunter River; and
- Groundwater inflow into the open cut pits.

7.3 Saline Material & Water Management and Minimisation

The measures to manage saline material and minimise the discharge of saline water from site include:

- Store ROM Coal and Product Coal in stockpiles that are contained within the mine Water Management System (WMS);
- Store Coal Rejects in emplacement dumps which are constructed such that runoff is contained in the mine WMS;
- Separation of different water qualities to reduce the volume saline water;
- Discharge saline water in accordance with the HRSTS once infrastructure is in place;
- Calibrated water balance model to better understand the likely water volumes and qualities to be managed;
- Water use for dust suppressions to reduce the volume of saline water in storages; and
- Out of pit storages to reduce the volume of saline water in the pit.

Table 35 Salt Sources and Balance

Salt Source	EC (uS/cm)	TDS (mg/L)
Rainfall	54	30
Hardstand Catchment Runoff	4,000	2,235
Pit Catchment Runoff	1,500	838
Tailings Catchment Runoff	5,000	2,793
Active Waste Catchment Runoff	5,000	2,793
Stockpile Catchment Runoff	6,000	3,352
Rehabilitation Catchment Runoff	1,000	559
Natural Catchment Runoff	200	112
Groundwater Inflow	8,000	4,469
Hunter River Imports	500	279
Aspect		Salt (T)
INFLOWS		
Rainfall Runoff		4,904
Hunter River Raw Water Supply		0.9
Groundwater Inflow		2,770
Spoil Seepage		
Tailings Bleed Water		4,605
Total		12,280
OUTFLOWS		
Evaporation		-
CHPP Supply		7,142
Water Cart Usage		1,382

Wash Bay / Stockpile	
Hunter Release	0
Spill	3.4
Total	8,527
Inflow – Outflow	3,752
Recorded Stored on Site at Start of Annual Review Period	3,275
Recorded Stored on Site and End of Annual Review Period	6,548
Change in Storage	3,273
Error	2.3%

7.4 Water Take

Mangoola currently operates two water extraction pumps within one pump station (20WA211008) to provide additional water for its operations, as required, from the Hunter River in accordance with its water extraction permits. The extraction limit for the Mangoola Hunter River Licences is 2,758 ML. The water allocation for the Hunter regulated river changes throughout the year and the water allocation has been at 100% for General Security from 1 July 2021 till the end of the reporting period.

The total Hunter River water extracted by Mangoola during the 2020-2021 water year was approximately 170 ML which was within the allowable extraction limit. This represents a decrease from the 1932 ML extracted from the Hunter River during the 2018-2019 water year.

Water taken by the operation during the previous water year (1 July 2020 to 30 June 2021) has been summarised in **Table 36**.

Table 36 Mangoola 2021 Water Take (Water Year)

Water Licence #	Water Sharing Plan, Source and Management Zone (as applicable)	Entitlement (ML) 100%	Entitlement (ML) 125%	Allocation Used (ML) (Previous Water Year)
Mangoola Licences				
503	Hunter Regulated River (zone 1A)	159	198.75	0
645	Hunter Regulated River (zone 1A)	432	540	0
691	Hunter Regulated River (zone 1A)	50	62.5	10
735	Hunter Regulated River (zone 1A)	72	90	0
823	Hunter Regulated River (zone 1A)	310	387.5	0
824	Hunter Regulated River (zone 1A)	175	218.75	0
830	Hunter Regulated River (zone 1A)	306	382.5	0
897	Hunter Regulated River (zone 1A)	55	68.75	0
933	Hunter Regulated River (zone 1A)	43	53.75	12
1159	Hunter Regulated River (zone 1A)	159	198.75	0

Water Licence #	Water Sharing Plan, Source and Management Zone (as applicable)	Entitlement (ML) 100%	Entitlement (ML) 125%	Allocation Used (ML) (Previous Water Year)
6571	Hunter Regulated River (zone 1A)	111	138.75	0
6576	Hunter Regulated River (zone 1A)	600	750	0
9062	Hunter Regulated River (zone 1A)	18	22.5	0
9987	Hunter Regulated River (zone 1A)	82	102.5	0
11216	Hunter Regulated River (zone 1A)	86	107.5	0
13083	Hunter Regulated River (zone 1A)	100	125	0
Hunter River Licences Sub-Total		2,758	3447.5	22
Colinta Licences*				
1001	Hunter Regulated River (zone 1A)	334	417.5	72
1057	Hunter Regulated River (zone 1A)	509	636.25	76
Colinta Licences Sub-Total		843	1035.75	148
Groundwater Inflows				
WAL41561	Excavation Groundwater	700		121.5
6308	Wybong Creek Water Source	96		0
6270	Wybong Creek Water Source	30		0
11085	Wybong Creek Water Source	128		0
Groundwater Licences Sub-Total		954		121.5
TOTAL		4,555		291.5

7.4.1 Changes to Licences

No changes to surface water licences occurred in 2021. The water take under the Havestable Rights provision is in line with 2019 Harvestable Rights assessment by Engeny and the reducing clean water catchment area of Anvil Creek. This harvestable rights provision was reviewed as part of the MCCO EIS.

7.5 Hunter River Salinity Trading Scheme Discharges

There were no water Hunter River Salinity Trading Scheme (HRSTS) discharges offsite from Mangoola during the 2021 reporting period. Mangoola began the installation of infrastructure for the water discharge system and started updating required approvals for release under the HRSTS. Water discharge to the Hunter River will commence in accordance with approvals in 2022.

A process for notification of all downstream landholders within 2 kilometres of the HRSTS discharge point has been drafted and will be implemented prior to the first release of water under the HRSTS.

7.6 Surface Water Monitoring

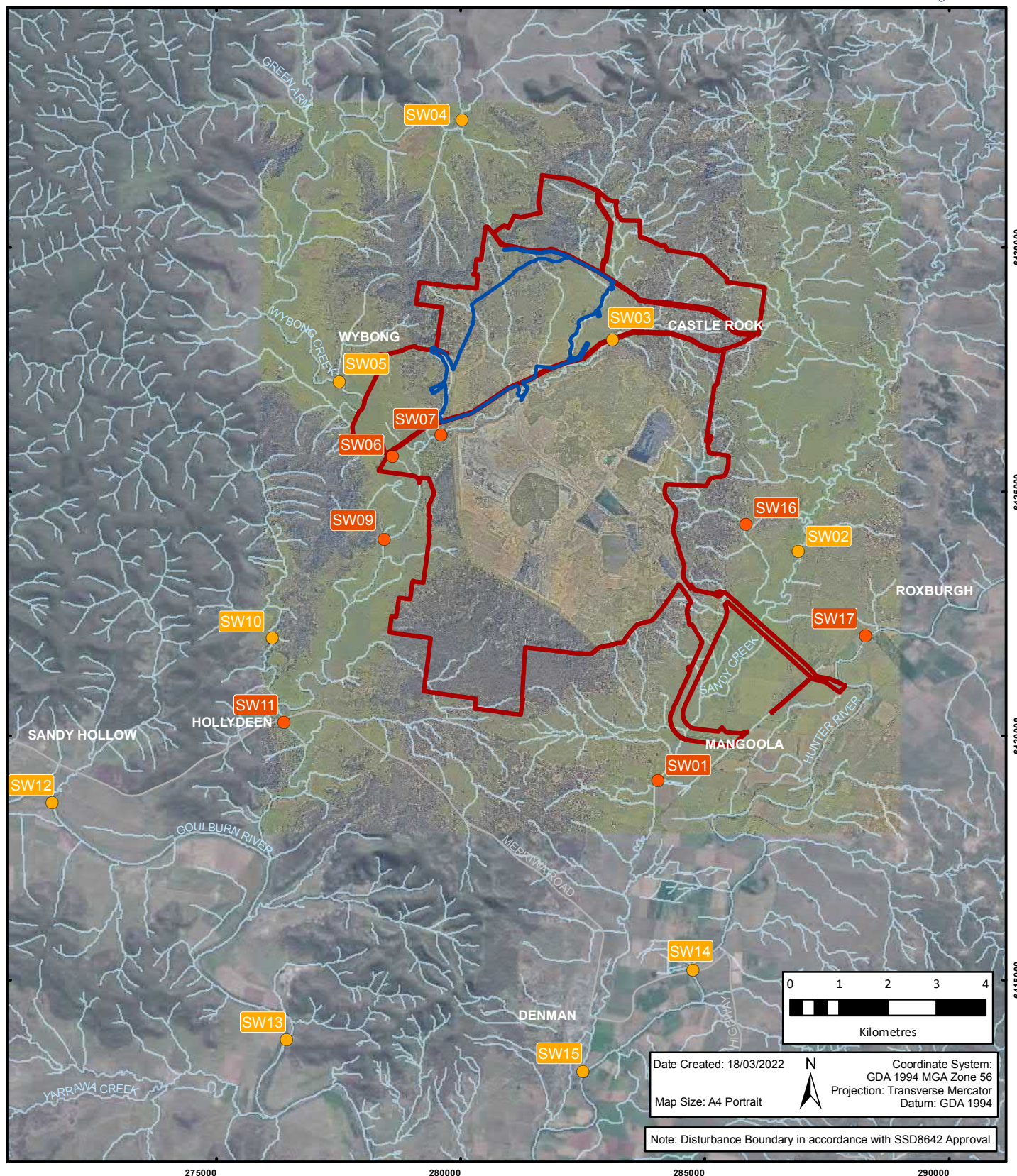
7.6.1 Environmental Management

Surface water quality continued to be monitored onsite at Mangoola and in the surrounding waterways during the reporting period in accordance with the Surface Water Monitoring Plan, which was updated in 2018. Surface water monitoring locations are shown on **Figure 15** and comprise of 16 sites (SW01-07 and SW09-17) which are sampled monthly for pH, Electrical Conductivity (EC), Total Suspended Solids (TSS), Total Dissolved Solids (TDS) and flow conditions by observation.

Water monitoring is also undertaken monthly as a requirement of EPL 12894. Monitoring is completed at surface water monitoring points SW16, SW03, SW04 and SW07 representing EPL monitoring point number 7, 8, 9 and 31, respectively.

There is no surface water monitoring criteria limit listed in EPL 12894. Surface water monitoring criteria is described in the approved Surface Water Management Plan.

Figure 15 - Surface Water Monitoring Locations



Legend

- Approved EPL Boundary
- MCCO Disturbance Area
- Major road
- Watercourse
- Surface Water Monitoring
- Background Surface Water Monitoring

DISCLAIMER

Subject To Survey.

Glencore makes every effort to ensure the quality of the information available on this map. Before relying on the information on this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Glencore cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Glencore has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map.

DATA SOURCE

© NSW Department of Finance & Services (LPI) 2020
© NSW DTIRIS (Minerals & Petroleum) 2020
© Glencore 2020 © ESRI 2020

7.6.2 Environmental Monitoring Results

7.6.2.1 Results from the Reporting Period

The pH and EC monitoring results for the reporting period have been summarised in **Table 37**. In accordance with the Surface Water Monitoring Plan (which was updated and approved during 2018) and the Surface Water Groundwater Response Plan, exceedances of surface water monitoring criteria are not reported to DPIE unless three consecutive elevated results are recorded (and an incident is deemed to have occurred (e.g. mining impacts have impacted results)). Detailed results of surface water quality monitoring collected during the reporting period are available on the Mangoola website.

Table 37 Surface Water Monitoring Results – pH and EC

Site	pH Results					EC Results (µS/cm)				No. of Samples and Flow Conditions
	Min	Ave	Max	Lower Criteria*	Upper Criteria*	Min	Ave	Max	Criteria*	
SW01	7.1	7.9	8.4	6.5	9.0/8.9	214	797	1,370	3,325/3,757	12 – no flow (5), flow (7)
SW02	7.2	7.8	8.1	6.5	8.2/8.2	1,060	4,037	6,020	5,569/5,654	12 – no flow (2), flow (10)
SW03	7.3	7.8	8.3	6.5	8.2/8.8	293	2,005	4,130	10,774/31,805	11 – no flow (5), flow (5)
SW04	8.0	8.2	8.4	6.5	8.7/8.5	413	920	1,190	1,939/1,947	11 – flow (11)
SW05	8.1	8.3	8.4	6.5	8.5/8.6	481	1,038	1,380	2,049/2,049	12 – flow (12)
SW06	8.2	8.3	8.4	6.5	8.5/8.5	517	1,087	1,480	2,540/2,422	11 – flow (11)
SW07	7.3	7.6	8.1	6.5	8.4/8.9	519	738	1,000	10,710/12,780	12 – no flow (5), flow (7)
SW09	8.2	8.3	8.4	6.5	8.4/8.6	657	1,104	1,520	3,130/3,365	12 – flow (12)
SW10	6.6	6.9	8.2	5.6/6.2	7.1/7.2	381	659	860	950/1,004	10 – no flow (1), flow (9)
SW11	6.7	8.1	8.4	6.5	8.4/8.5	693	1,165	1,580	2,400/2,465	12 – flow (12)
SW12	8.1	8.3	8.5	6.5	8.4/8.6	484	722	879	1,677/1,980	12 – flow (12)
SW13	8.1	8.3	8.4	6.5	8.4/8.6	511	797	1,150	1,425/1,545	10 – flow (10)

Site	pH Results					EC Results (µS/cm)				No. of Samples and Flow Conditions
	Min	Ave	Max	Lower Criteria*	Upper Criteria*	Min	Ave	Max	Criteria*	
SW14	7.9	8.1	8.4	6.5	8.2/8.5	451	647	823	753/835	12 – flow (12)
SW15	7.9	8.1	8.4	6.5	8.2/8.3	451	656	834	802/878	12 – flow (12)
SW16	6.0	6.8	7.3	6.2/6.5	7.8/8.0	118	218	350	683/809	12 – no flow (6), flow (6)
SW17	8.0	8.1	8.3	6.5	8.2/8.3	445	631	831	761/796	12 – flow (12)

* Criteria with two values denotes criteria for flow/no flow monitoring events (taken from May 2018 SWMP). Bold indicates this criterion was applicable at times in 2021.

Note: shaded sites are monitored to establish background conditions upstream or separate of mining operations and used in the investigation of exceedance of impact assessment criteria at locations directly downstream of mining operations.

Surface water pH levels were slightly alkaline across the site, ranging from 6.0 to 8.5, with an average pH of 7.9 which is the same as the average for 2020.

pH results which fell outside the pH level criteria included:

- SW16 during August (6.1) and September (6.0); and
- SW17 during August (8.3).

EC results across the site ranged from 118 $\mu\text{S}/\text{cm}$ to 6,020 $\mu\text{S}/\text{cm}$, with an average of 1,076 $\mu\text{S}/\text{cm}$ which is higher than the 2020 average of 1,004 $\mu\text{S}/\text{cm}$.

EC results which fell outside the EC level criteria included:

- SW17 during May (791 $\mu\text{S}/\text{cm}$), August (809 $\mu\text{S}/\text{cm}$) and November (831 $\mu\text{S}/\text{cm}$).

There were no reportable incidents associated with pH or EC levels during 2021.

The TDS and TSS monitoring results for the reporting period have been summarised in **Table 38**. Detailed results of surface water quality monitoring collected during the reporting period are available on the Mangoola website.

Table 38 Surface Water Monitoring Results – TDS and TSS

Site	Total Suspended Solids (mg/L)				Total Dissolved Solids (mg/L)				No. of Samples and Flow Conditions
	Min	Ave	Max	Criteria*	Min	Ave	Max	Criteria*	
SW01	6	41	80	189.8/246	210	492	848	1,888/2,128	12 – no flow (5), flow (7)
SW02	5	15	22	291/89	612	2,414	3,340	3,119/3,248	12 – no flow (2), flow (10)
SW03	7	62	158	1,335/367	325	1,287	2,430	6,243/20,410	11 – no flow (5), flow (5)
SW04	6	20	42	496.2/50	276	512	612	1,117/1,147	11 – flow (11)
SW05	7	16	39	629/50	326	589	786	1,180/1,299	12 – flow (12)
SW06	10	29	63	539/50	310	602	842	1,470/1,453	11 – flow (11)
SW07	6	82	613	129/75	349	438	562	5,775/7,494	12 – no flow (5), flow (7)
SW09	7	29	54	338/50	365	634	898	1,720/1,917	12 – flow (12)
SW10	5	18	51	43.9/77	272	397	528	574/758	10 – no flow (1), flow (9)
SW11	7	19	37	619/50	438	659	950	1,370/1,463	12 – flow (12),
SW12	6	32	60	482/50	326	413	512	971/1,205	12 – flow (12),
SW13	7	36	73	922/50	355	448	644	839/924	10 – flow (10)
SW14	8	30	80	183/50	274	388	503	455/514	12 – flow (12)
SW15	5	29	89	139/50	286	384	494	454/527	12 – flow (12)
SW16	29	173	959	438/449	246	656	1,910	882/976	12 – no flow (6), flow (6)
SW17	5	29	92	123/50	286	483	1,730	488/518	12 – flow (12)

* Criteria with two values denotes criteria for flow/no flow monitoring events (taken from May 2018 SWMP). Bold indicates this criterion was applicable at times in 2021.

Note that shaded sites are monitored to establish background conditions upstream or separate of mining operations and used in the investigation of exceedance of impact assessment criteria at locations directly downstream of mining operations.

TSS levels during the reporting period ranged from 5 mg/L to 959 mg/L, with an average of 41 mg/L which was lower than the 2020 average of 132 mg/L.

TSS results which fell outside the TSS level criteria included:

- SW07 during June (613 mg/L); and
- SW16 during September (959 mg/L).

TDS levels during the reporting period ranged from 210 mg/L to 3,340 mg/L, with an average of 675 mg/L which is higher than the 2020 average of 630 mg/L.

TDS results which fell outside the TDS level criteria included:

- SW16 during September (1,170 mg/L), October (1,080 mg/L) and November (1,910 mg/L); and
- SW17 during August (516 mg/L) and November (1,730 mg/L).

There were no reportable incidents associated with TSS or TDS levels during 2021.

Assessment of Surface Water Quality

In accordance with the Surface Water Monitoring Plan, speciation monitoring is undertaken annually at Mangoola surface water monitoring locations in June. There is no speciation monitoring criteria in the Surface Water Monitoring Plan. A summary of the surface water results for 2021 are presented in **Table 39**.

Table 39 Annual Surface Water Specification Results

Parameter	SW01	SW02	SW03	SW04	SW05	SW06	SW07	SW09	SW10	SW11	SW12	SW13	SW14	SW15	SW16	SW17
Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
pH	7.8	7.9	8.3	8.3	8.2	8.2	7.7	8.2	6.6	8.2	8.2	8.2	8.0	8.1	7.0	8.0
EC (µS/cm)	463	3,880	2,780	742	779	787	726	786	635	797	663	686	519	517	175	525
TSS (mg/L)	24	19	17	12	13	14	613	42.0	10.0	14.0	60.0	39.0	18.0	22.0	147.0	24.0
TDS (mg/L)	344	3,010	1,880	410	434	446	435	456	381	449	402	408	324	323	404	318
Nitrite (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01
Nitrate (mg/L)	0.05	0.02	0.07	0.45	0.41	0.43	0.02	0.45	0.07	0.48	0.3	0.33	0.62	0.6	0.08	0.64
TKN (mg/L)	2.3	0.7	0.3	0.1	0.1	0.2	3.5	0.2	0.6	0.3	0.4	0.3	0.3	0.2	2.9	0.3
Total Nitrogen as N (mg/L)	2.4	0.7	0.4	0.6	0.5	0.6	3.5	0.6	0.7	0.8	0.7	0.6	0.9	0.8	3	0.9
Total Phosphorus as P (mg/L)	0.3	0.1	0.0	0.2	0.2	0.3	0.4	0.2	0.0	0.3	0.2	0.2	0.1	0.1	0.7	0.1

Parameter	SW01	SW02	SW03	SW04	SW05	SW06	SW07	SW09	SW10	SW11	SW12	SW13	SW14	SW15	SW16	SW17
Sulphate (mg/L)	28	160	162	14	14	15	26	14	28	16	34	31	27	29	10	30
Calcium (mg/L)	22	120	80	40	37	41	14	40	9	37	31	34	36	38	5	37
Magnesium (mg/L)	14	190	90	44	44	44	25	42	17	44	36	37	26	26	3	24
Sodium (mg/L)	60	775	502	64	68	72	105	69	87	75	63	68	42	42	28	37
Potassium (mg/L)	10	10	9	2	2	2	5	2	10	2	5	4	2	2	8	2
Iron (mg/L)	1.5	0.5	0.4	0.4	0.4	0.5	12.2	0.6	3.0	0.9	1.7	1.4	0.5	0.7	14.0	0.7
Arsenic (mg/L)	0.002	<0.001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008	<0.001
Boron (mg/L)	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium (mg/L)	0.051	0.169	0.304	0.008	0.007	0.008	0.126	0.009	0.049	0.01	0.034	0.03	0.015	0.015	0.152	0.016
Cadmium (mg/L)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper (mg/L)	0.005	<0.001	<0.001	0.001	0.001	0.001	0.014	0.001	<0.001	0.002	0.002	0.002	0.001	0.002	0.006	0.002

Parameter	SW01	SW02	SW03	SW04	SW05	SW06	SW07	SW09	SW10	SW11	SW12	SW13	SW14	SW15	SW16	SW17
Manganese (mg/L)	0.024	0.098	0.06	0.026	0.024	0.022	0.331	0.025	1.3	0.07	0.105	0.093	0.033	0.033	0.253	0.039
Chloride (mg/L)	66	1300	878	76	94	102	149	100	160	110	83	85	37	38	36	38
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	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.016	<0.001
Silver (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc (mg/L)	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	0.038	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	0.011	<0.005
Mercury (mg/L)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<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)	0.2	0.4	0.2	0.2	0.2	0.1	0.1	0.1	<0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1
Bicarbonate (mg/L)	113	606	124	292	273	278	113	265	30	250	201	201	199	198	26	191

Stream Health Monitoring

Biosis (2022) undertook stream health monitoring surveys during autumn and spring in 2021. The stream health monitoring program encompasses seven potential impact sites (monitoring sites) across three major waterways that traverse the Mangoola Open Cut site – Big Flat Creek, Wybong Creek and Sandy Creek. The program also includes five control sites with catchments similar to the monitoring sites to differentiate potential mining impacts from environmentally driven variations due to natural processes.

The control sites are located across two waterways – Cuan Creek and Wybong Creek (upstream of the mine site). The monitoring program assesses macroinvertebrate community structures, water quality and overall catchment-riparian health using NSW AUSRIVAS and Signal2 sampling and analyses, HABSCORE assessments, and physicochemical surface water quality testing.

HABSCORE assessments during 2021 surveys indicated improved stream health conditions when compared with 2020, with the results clustering within the marginal and sub-optimal categories. This is likely to be a result of the sustained increase in water availability across the region since 2020. The AUSRIVAS and SIGNAL 2 analyses showed that, while sites have been in poor condition since the commencement of baseline monitoring, the macroinvertebrate assemblages improved over previous years with two control sites moving up from the severely impaired to moderately impaired category. Year to year fluctuations in these metrics are observed across both monitoring and control sites and therefore likely associated with changes in water availability and environmental conditions, most obviously during the most intense period of the recent drought in 2019. Stream health criteria have been established for major waterways identified as being potentially subject to impacts associated with mining activities. The assessment of the 2021 monitoring results against these criteria did not trigger the need for any further investigation with the results above the relevant trigger values. Overall, the monitoring and control sites have improved slightly over previous years but are generally still in the same poor condition observed at the commencement of the stream health monitoring project in 2009. As such it is concluded that no impacts to stream health associated with mine operation have occurred in 2021.

7.6.2.2 Comparison with Predictions

The PA 06_0014 MOD 6 EA included a Surface Water Assessment (WRM Water & Environment 2013) which predicted water usage for the project in years 2, 5, and 10, for a high water demand scenario and a low water demand scenario.

The high water demand scenario was based on 13.5 Mtpa of ROM coal washed through the CHPP, and the low water demand scenario was based on 8.0 Mtpa of ROM coal washed through the CHPP and 5.5 Mtpa of ROM coal processed as bypass coal (i.e. unwashed).

As MOD 6 was approved in 2014, 2021 constitutes Year 5 of the modified operations, therefore, the water usage data is compared against the Year 5 high water demand scenario predictions from the MOD 6 EA, as shown in **Table 40**.

The predictions against the MCCO project EIS will be shown in the 2022 Annual Review

Table 40 Comparison of 2021 Water Usage with the 2013 MOD 6 Assessment

Aspect of Water Management System	2021 Data (ML)	EA Prediction (Year 5) High water demand
CHPP water use	2,643	3,970 ML/annum
Haul Road Dust Suppression	511	480 ML/annum
Pipeline Water (Hunter River)	3.2	889 ML/annum
Hunter River Salinity Trading Scheme Offsite Release	0	16 ML/annum

As shown in **Table 40**, only the 2021 haul road dust suppression usage was greater than predictions made in the 2013 Surface Water Assessment. The CHPP water use and pipeline water (Hunter River) usage were both below the water demand predictions.

This decrease in pipeline water (Hunter River) was primarily due to the increased rainfall received on-site during 2021. The increase in the dust suppression is from an additional water cart being operational over the summer period to maintain dust suppression. Conversely, the Hunter River offsite release was less than the predictions in the 2013 Surface Water Assessment as infrastructure is yet to be installed.

7.6.2.3 Long Term Trend Analysis

In accordance with PA 06_0014 and SSD 8642, a long term trend analysis of surface water monitoring results at Mangoola has been undertaken using data from 2010 to 2021 to identify any trends in the monitoring data over the life of the project. Long term monitoring results for pH, EC, TDS and TSS are presented in **Appendix E**.

The results indicate the following:

- The pH of surface water monitoring locations has generally remained relatively stable since mining operations commenced in 2010;
- EC has generally remained stable from 2010-21 with the exception of monitoring locations SW01, SW02, SW03, and SW07, which have been periodically elevated. SW02 and SW03 are located upstream of the Mangoola Mining Lease boundary, and therefore the elevated salinity cannot be attributed to operations at Mangoola;
- Similarly, SW07, and SW01, while located within the Mangoola Mining Lease boundary, are downstream of SW03 and SW02 respectively. Monitoring locations SW01, SW02, SW03, and SW07 were dry for most of 2017-19 due to drought conditions. An increase in rain during 2020 and 2021 allowed most sites to be sampled during this period; and
- TSS and TDS have also generally remained stable from 2010-21, with a few elevated readings, however no discernible trends. At the sites with sufficient water for consistent sampling, results have shown an increase in TDS which occurred between 2017-19 due to the drought's impact on flow conditions. This trend declined due to increased rainfall in 2020 and has remained stable during 2021.

7.6.3 Key Performance and/or Management Issues

On 26 November and 8 December, water discharge events occurred where 9.7 ML and 18 ML (respectively) of water was discharged from Sandy Creek Farm Dam 2, a saline seepage management dam, into Sandy Creek via an unnamed drainage line.

On both occasions the PIRMP was enacted in accordance with Section 147 of the POEO Act.

Prior to the rainfall event, Sandy Creek Farm Dam 1 was dewatered to manage groundwater seepage from the raw water dam as per its purpose.

An investigation was completed where the analysis had indicated that the predominant source of water discharged was runoff from the 25.7 ha clean water catchment caused by excessive rainfall.

Discharge results show that there was no environmental harm caused based on the chemistry of the water discharged when compared to the receiving environment.

This incident was reported to EPA and DPIE in accordance with applicable statutory requirements.

In accordance with response letter from DPIE **Mangoola Coal (MP06_0014) – Incident Report (Water Discharge)** date 17 January 2021 below are the full results of the water quality monitoring conducted following the discharge event.

Table 41 Discharge Events

Sample Site	26 November pH / EC	27 November pH / EC	28 November pH / EC	29 November pH / EC	30 November pH / EC
Sandy Creek Farm Dam 2	7.48 / 582	7.48 / 618	7.43 / 698	7.53 / 733	7.63 / 736
SW02 (upstream in Sandy Creek)	6.81 / 85	7.64 / 561	No Sample – unsafe access to site	7.87 / 1,090	7.59 / 970

7.6.4 Proposed Improvements

The Water Management Plan will be updated in accordance with the requirements of SSD 8642 to satisfy the condition of B50 prior to the commencement of mining and submitted for approval.

7.7 Groundwater Management

7.7.1 Environmental Management

Mangoola monitors groundwater quality and levels within and surrounding the site in accordance with the approved Groundwater Monitoring Plan (GWMP) (Mangoola, 2014) which is available on the Mangoola website. The GWMP was updated in 2017 and submitted for comment to the EPA, Natural Resources Access Regulator (NRAR) and DPIE. Consultation is ongoing. This later version of the GWMP has not yet been approved.

Active groundwater monitoring locations are shown on **Figure 16** and comprise:

- six continuous data loggers (VW) to continuously monitor groundwater levels at regular intervals and vibrating wire piezometers;

-
- 35 groundwater monitoring bores (GW) sampled bi-monthly for groundwater level, pH, and EC. Due to the progression of mining, and one instance where the landowner has not granted permission to monitor, there are currently 25 groundwater monitoring locations sampled bi-monthly in line with the GWMP defined parameters;
 - 15 Monitoring Program (MP) bores sampled quarterly for groundwater level, pH and EC; and
 - 5 Big Flat Creek (BFC) bores sampled quarterly for groundwater level, pH and EC.

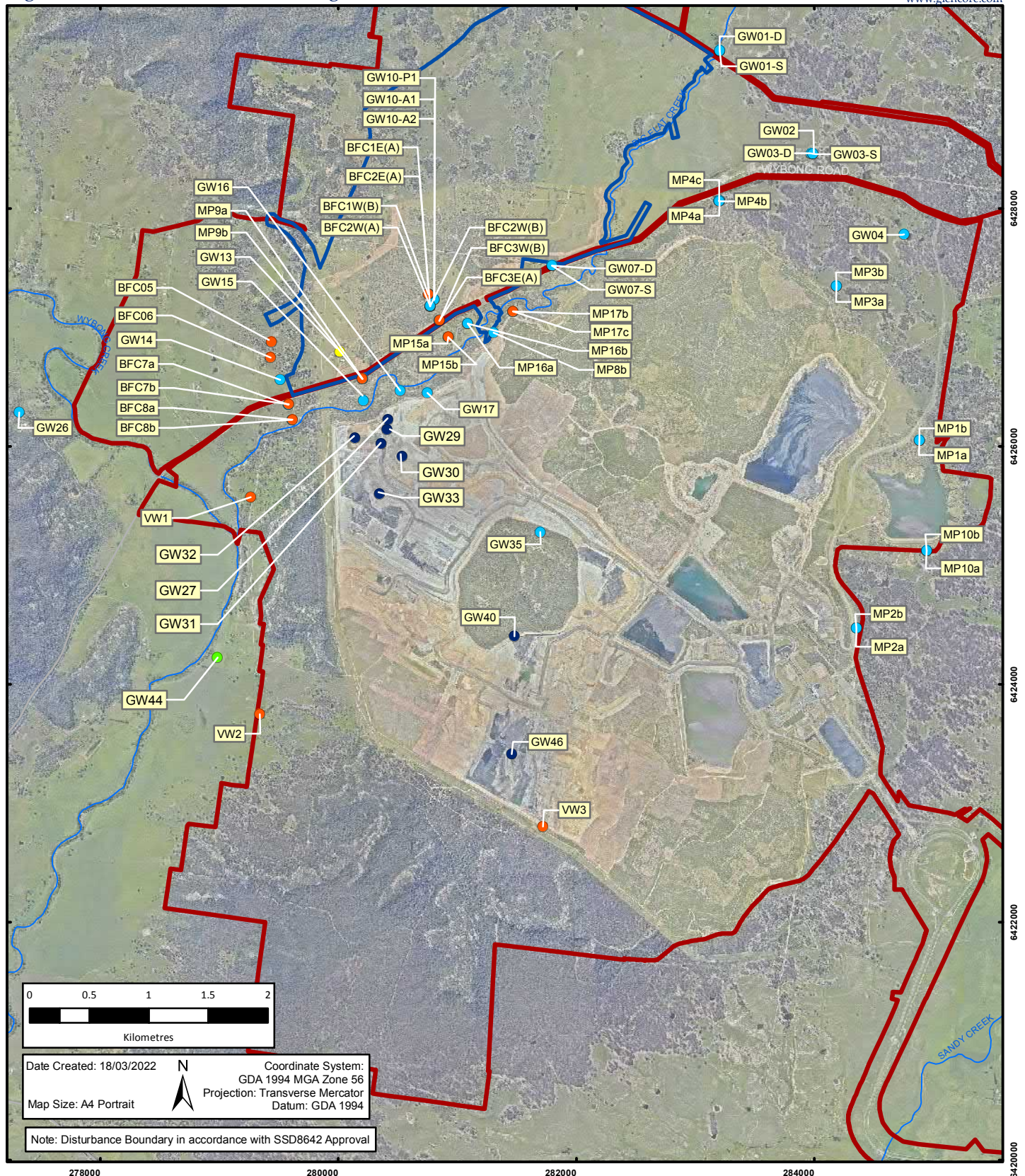
Mangoola also undertakes an annual comprehensive analysis of eight representative boreholes, being GW02 (coal measures), GW04 (coal measures), GW07 (alluvial), GW14 (Fassifern), GW18 (Fassifern), GW33 (deep alluvium), GW34 (Fassifern) and GW46 (alluvial).

Due to the progression of mining, there are currently four groundwater monitoring locations sampled annually in line with the GWMP (GW02, GW04, GW07-S and GW14).

Groundwater monitoring points GW04 and GW26 represents the EPL monitoring points 10 and 11.

Mangoola commenced the Mangoola Coal Continued Operations Project (MCCO) that was approved by the NSW and Commonwealth governments in 2021. The MCCO Environmental Impact Statement included commitments to install additional monitoring sites to assess the impact of the project on the groundwater regime and receptors. Mangoola has recently finalised the locations of the groundwater monitoring sites in preparation for commencement of the MCCO Project and drilling progressing in line with approval requirements. The GWMP will be updated with these new monitoring locations.

Figure 16 - Groundwater Monitoring Locations



Legend

- | | |
|---|--|
| Approved EPL Boundary | ● Well |
| MCCO Disturbance | ● Vibrating Wire Piezometer |
| — Main road | ● Bore / Stand Pipe |
| — Watercourse | ● Bore / Standpipe - No access from |
| | ● Bore / Stand Pipe - Decommissioned |

DISCLAIMER

Subject To Survey.

Glencore makes every effort to ensure the quality of the information available on this map. Before relying on the information on this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Glencore cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Glencore has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map.

DATA SOURCE

© NSW Department of Finance & Services (LPI) 2020
© NSW DTIRIS (Minerals & Petroleum) 2020
© Glencore 2020 © ESRI 2020

7.7.2 Environmental Monitoring Results

7.7.2.1 Results from the Reporting Period

The results of the groundwater monitoring undertaken during the reporting period are available in full on the Mangoola website. A summary of the groundwater results for 2021 are presented in **Table 42**. Where these results exceed criteria outlined in the approved Mangoola GWMP they have been bolded.

In accordance with the approved Mangoola Groundwater Monitoring Plan when three consecutive monitoring results are outside the adopted impact assessment criteria, Mangoola investigates as per the approved Surface Water and Groundwater Response Plan.

- GW02, GW10-P2, GW14 and GW15 exceeded the EC criteria during the January, March, May, July, September and November 2021 monitoring rounds; and
- GW04 (EPL point 10) exceeded the EC criteria during the January, July, September, and November 2021 monitoring rounds.

These elevated results were investigated as per the SWGWRP as outlined in the GWMP. An investigation by an independent consultant determined that the results for bores GW01-D, GW01-S and GW02 were due to background climatic conditions despite the above average rainfall conditions experienced in 2021 and were not attributable to Mangoola. Elevated EC concentrations at monitoring bores where mining activities have led to depressurisation (GW10P2, GW14, GW15 and perhaps GW26) are likely associated with altered flow paths, groundwater mixing and/or a lack of recharge (AGE, 2022). These elevated results are anticipated to persist while groundwater slowly responds to increased rainfall pattern. Groundwater level and parameter concentration will change from an increase in direct recharge from above rainfall conditions. As a result, the outcomes of the investigation found an incident had not occurred and, in accordance with the GWMP, the exceedances were not externally reportable to DPIE.

Table 42 Groundwater Monitoring Results – pH, EC and Groundwater Level

Monitoring Bores	Depth to Groundwater Results (m)			pH Results				EC Results (µS/cm)			
	Min	Ave	Max	Min	Ave	Max	Criteria	Min	Ave	Max	Criteria
BFC01A*	11.90	12.03	12.15	6.88	6.92	6.97	6.5-8.5	13,530	14,130	15,110	125-2,200
BFC02A*	12.06	12.15	12.26	6.84	6.99	7.08	6.5-8.5	14,150	14,870	15,800	125-2,200
BFC03A*	6.27	10.59	12.81	6.56	6.82	7.21	6.5-8.5	2,970	14,793	21,400	125-2,200
BFC07A*	12.91	12.91	12.91	N/A	N/A	N/A	6.5-8.5	N/A	N/A	N/A	125-2,200
BFC08A*	11.55	11.56	11.57	N/A	N/A	N/A	6.5-8.5	N/A	N/A	N/A	125-2,200
GW01-D*	1.38	1.55	1.64	6.82	7.18	7.67	6.5-8.5	2,660	9,563	18,380	125-2,200
GW01-S*	1.25	1.49	1.56	6.51	7.01	7.32	6.5-8.5	13,950	16,276	18,100	125-2,200
GW02	4.12	4.25	4.42	6.95	7.68	8.82	6.5-9.3	19,350	23,653	26,940	16,039
GW03-D	4.81	4.82	4.83	N/A	N/A	N/A	6.5-7.5	N/A	N/A	N/A	29,535
GW03-S	3.36	3.36	3.36	N/A	N/A	N/A	6.5-7.5	N/A	N/A	N/A	29,535
GW04^	12.11	12.17	12.25	7.15	7.38	8.20	6.5-7.3	8,120	8,912	9,550	8,174
GW047877	5.43	5.65	6.12	6.52	6.87	7.08	N/A	4,400	5,696	6,720	N/A
GW06	0.64	0.67	0.76	7.18	7.56	8.18	6.5-8.5	207	227	254	N/A
GW07-D	3.93	4.70	5.88	7.61	7.61	7.61	6.5-8.5	1,100	1,100	1,100	18,547
GW07-S	0.64	5.02	12.91	N/A	N/A	N/A	6.5-8.3	N/A	N/A	N/A	20,301
GW10-A1	1.39	1.39	1.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GW10-A2	11.36	11.94	13.52	6.52	7.242	7.81	6.5-7.9	267	346.2	525	12,864
GW10-P1	14.28	14.40	14.55	6.38	6.96	7.19	6.5-7.9	785	986	1,199	15,590
GW10-P2	15.46	15.72	16.02	6.89	7.15	7.45	6.5-8.1	10,180	11,700	12,710	8,034
GW13*	2.04	6.94	9.39	6.54	7.72	8.24	6.5-8.5	180	249	309	125-2,200
GW14	31.09	33.05	34.77	6.96	7.26	7.58	6.5-8.0	5,710	6,587	7,050	5,096
GW15	12.64	19.91	23.38	6.86	6.91	6.97	6.5-7.3	14,380	15,770	16,900	11,483

Monitoring Bores	Depth to Groundwater Results (m)			pH Results				EC Results (µS/cm)			
	Min	Ave	Max	Min	Ave	Max	Criteria	Min	Ave	Max	Criteria
GW16	22.13	22.13	22.13	N/A	N/A	N/A	6.5-7.1	N/A	N/A	N/A	21,584
GW17	N/A	N/A	N/A	N/A	N/A	N/A	6.5-7.4	N/A	N/A	N/A	17,997
GW202249	7.44	7.90	8.27	7.66	7.99	8.40	N/A	3,030	3,433	3,860	N/A
GW26*^	17.09	17.31	17.45	6.6	7.01	7.25	6.5-8.5	2321	2531	2776	125-2,200
GW35*	N/A	N/A	N/A	N/A	N/A	N/A	6.5-8.5	N/A	N/A	N/A	125-2,200
GW44	N/A	N/A	N/A	N/A	N/A	N/A	6.5-7.0	N/A	N/A	N/A	7,878
Jennar Well	2.98	3.26	3.90	6.73	7.27	7.93	N/A	1,343	1,779	2,023	N/A
MB1	2.04	5.05	5.84	7.11	7.32	7.60	N/A	1,315	12,747	21,820	N/A
MB2	3.25	3.52	3.66	7.08	7.20	7.29	N/A	12,820	15,426	16,800	N/A
MP10-A*	16.72	16.95	17.36	7.59	7.62	7.68	6.5-8.5	7,210	7,557	8,210	125-2,200
MP10-B*	9.55	9.92	10.22	6.35	6.89	7.95	6.5-8.5	15,120	16,353	18,110	125-2,200
MP13-A*	18.30	18.30	18.30	N/A	N/A	N/A	6.5-8.5	N/A	N/A	N/A	125-2,200
MP15-B*	12.09	13.08	14.90	N/A	N/A	N/A	6.5-8.5	N/A	N/A	N/A	125-2,200
MP16-B*	11.50	11.68	12.00	6.89	6.955	7.02	6.5-8.5	16700	16900	17100	125-2,200
MP17-B*	2.52	2.52	2.52	7.16	7.16	7.16	6.5-8.5	1,424	1,424	1,424	125-2,200
MP1-A*	11.73	11.82	11.91	8.04	8.06	8.09	6.5-8.5	5,910	360	6,790	125-2,200
MP1-B*	10.48	11.32	12.37	8.32	8.39	8.44	6.5-8.5	6,620	6,947	7,580	125-2,200
MP2-A*	38.52	38.67	38.85	7.57	7.63	7.75	6.5-8.5	14,400	14,767	15,390	125-2,200
MP2-B*	22.60	22.68	22.75	6.96	7.01	7.10	6.5-8.5	20,520	21,560	23,000	125-2,200
MP3-A*	28.53	28.64	28.73	7.65	7.67	7.71	6.5-8.5	8,550	8,930	9,670	125-2,200
MP3-B*	25.65	25.72	25.77	7.10	7.17	7.27	6.5-8.5	11,170	11,823	12,740	125-2,200
MP4-A*	1.48	1.75	1.93	7.38	7.59	8.02	6.5-8.5	8,790	10,489	11,530	125-2,200
MP4-B*	2.24	2.83	4.26	7.05	7.79	8.07	6.5-8.5	6,480	9,508	28,300	125-2,200
MP4-C*	2.63	4.08	4.41	6.62	6.87	7.93	6.5-8.5	7,650	26,121	30,280	125-2,200

Monitoring Bores	Depth to Groundwater Results (m)			pH Results				EC Results (µS/cm)			
	Min	Ave	Max	Min	Ave	Max	Criteria	Min	Ave	Max	Criteria
MP8-B*	N/A	N/A	N/A	N/A	N/A	N/A	6.5-8.5	N/A	N/A	N/A	125-2,200
MP9-A*	13.72	13.90	14.15	6.44	6.69	6.88	6.5-8.5	8,760	15,463	17,000	125-2,200

Notes: * Locations where insufficient groundwater monitoring data exists for site specific triggers as outlined in the Groundwater Monitoring Plan (GWMP). These are currently being updated in a revision to the GWMP. A subset of these bores where the maximum, minimum and average values are the same only have one data point or two data points with the same value.
^ EPL monitoring points, assessed against ANZECC criteria (if no impact criteria assigned under the GWMP) and investigated as per EPL12984.

Annual Speciation Assessment

In accordance with the Groundwater Monitoring Plan, speciation monitoring is undertaken annually at Mangoola groundwater monitoring locations (GW02, GW04, GW07-S and GW14) in September. GW46 which was previously monitored in 2019 was mined through in early 2020. Until site specific values are available, the GWMP states the impact assessment criteria for speciation data at all monitoring locations is based on the ANZECC (2000) guidelines for recreational water use. The groundwater results for 2021 are presented in **Table 43**.

Table 43 Annual Groundwater Speciation Results 2021 (AGE, 2021¹)

Parameter	Units	GW02	GW04	GW07-S*	GW14	Criteria
TDS	mg/L	12900	4520	-	3190	1000
Hydroxide	mg/L	<1	<1	-	<1	-
Carbonate	mg/L	<1	<1	-	<1	N/A
Bicarbonate	mg/L	381	1500	-	803	N/A
Sulfate	mg/L	17	117	-	31	400
Chloride	mg/L	7890	1760	-	1500	400
Dissolved Calcium	mg/L	52	44	-	92	N/A
Dissolved Magnesium	mg/L	398	13	-	107	N/A
Dissolved Sodium	mg/L	3540	1550	-	905	300
Dissolved Potassium	mg/L	48	10	-	20	N/A
Total Phosphorus	mg/L	<0.05	1.01	-	0.37	-
Dissolved Aluminium	mg/L	<0.01	<0.01	-	0.02	0.2
Dissolved Arsenic	mg/L	<0.001	<0.001	-	<0.001	0.005
Dissolved Barium	mg/L	0.025	0.263	-	0.7	1
Dissolved Boron	mg/L	<0.05	0.32	-	0.13	1
Dissolved Iron	mg/L	20.10	<0.05	-	0.14	0.3
Dissolved Lithium	mg/L	0.04	0.073	-	0.054	N/A
Dissolved Manganese	mg/L	1.56	0.08	-	0.35	0.1
Dissolved Rubidium	mg/L	0.049	0.026	-	0.038	N/A
Dissolved Selenium	mg/L	<0.01	<0.01	-	<0.01	0.01
Dissolved Silicon	mg/L	<0.05	6.79	-	7.29	N/A
Dissolved Strontium	mg/L	3.3	2.5	-	2.6	N/A
Dissolved Zinc	mg/L	<0.005	<0.005	-	<0.005	5

Note: * Monitoring site GW07-S was dry for the 2021 sample period.

¹ AGE, 2021. Letter Report: Mangoola Coal Mine Review of Annual Monitoring Bore Exceedances 2021. 19 November 2021.

It is noted that GW07-S was dry during September 2021 therefore no results were available. The results of the 2021 annual groundwater speciation sampling found that at all remaining sites, the ANZECC criteria were exceeded for TDS, Sodium, Chloride, Iron (GW02 only), and Manganese (except for GW04). The exceedances were investigated by AGE (2021) who determined that the water quality exceedances are primarily occurring due to inappropriate interim trigger values which are not representative of natural baseline conditions at Mangoola. Where results have been temporarily stable since the start of monitoring, AGE states that it is therefore unlikely that the exceedances will result in environmental harm.

7.7.2.2 Comparison with Predictions

Groundwater modelling for the original EA was undertaken by Mackie Environmental Research (MER) in 2006. Since then, the progressive three yearly updates to the numerical groundwater model completed by MER in 2010 and 2013, and AGE in 2016. The numerical groundwater model was further updated and recalibrated in 2018 as part of the EIS for the MOCO Project. The latest three yearly update to the groundwater model was completed by AGE in 2019 (AGE 2019b). The predictions from this model were calibrated with 2018/2019 water level monitoring data to validate the model calibration. The observed monitoring bore water level data was compared to the modelled water level data from the 2019 model predictions. Despite slight divergences between the observed and modelled datasets, the majority of the hydrographs showed similar trends in the 2021 reporting period.

The observed groundwater level trends can be generally categorised into stable or declining groundwater levels. The greatest groundwater level drawdown was measured on the western boundary of the mine, which is consistent with the model simulations and with the mining activities progressing below the groundwater table in this area. The effects of drawdown are most prominent in greater depths, decreasing with distance, both vertically and laterally, from the mining area. Groundwater levels in shallow bores screened within the alluvium of Wybong Creek began declining in 2016, suggesting climate rather than mining influences on groundwater levels in this area.

Engeny (2021) completed quarterly reviews of groundwater take associated with groundwater ingress into Main Pit using a spoil seepage model and pit water balance to track compliance with the licence conditions to take under Water Licence WAL41560 (Converted in 2021 – previously 20BL172598). Engeny concluded that the groundwater inflow volumes estimated by AGE were typically in accordance with the groundwater inflows from quarterly reviews (28.3 ML per quarter and 56.5 ML for YTD). Subsequently, Engeny adopted a groundwater inflow estimate of 113 ML/year for the 2021 period, based on the AGE numerical groundwater model in the water balance report.

7.7.2.3 Long Term Trend Analysis

In accordance with PA 06_0014 a long-term trend analysis of groundwater monitoring results at Mangoola has been undertaken using data since monitoring commenced to identify any trends in water quality over the life of the project.

Long term groundwater water level, pH and EC results are presented in Appendix E. A summary of long-term trends identified for each monitoring dataset is provided below:

- Groundwater levels from monitoring bores generally show fluctuations reflecting climatic conditions and rainfall particularly in the shallow strata. Groundwater levels in deeper Permian strata fluctuate less with rainfall and have recorded declining levels since 2014 when mining of the coal seams progressed below the water table. This has resulted in groundwater levels declining in the order of 30 metres at some sites (GW14, MP2-A, MP12-A, MP12-C, MP13-B and MP14-B);

- The majority of the GW monitoring bores have relatively stable long-term EC with the exception of GW02, GW10-P2, GW14 and GW15. Several of the BFC and MP bores located northwest of the mine along Big Flat Creek show fluctuations and increasing trends in EC for several years (BFC02A, MP2-A, MP2-B, MP3-A, MP4-C and MP9A). The bores experiencing increases in EC are also exhibiting declines in water levels/water pressure due to below average rainfall over successive years which have led to proportionally more saline water being drawn in from geological formation with inherent higher saline conditions than formations with fresher conditions (AGE 2022). Consequently, groundwater in bores affected by the mobilisation of more saline groundwater have shown increasing EC levels since 2014; and
- The pH of groundwater has generally recorded only limited fluctuations with most monitoring sites having no discernible trends. Generally, pH records depicted neutral conditions with no acidic conditions recorded from any boreholes.

7.7.3 Key Performance and/or Management Issues

The Natural Resources Access Regulator notified Mangoola that water licence 20BL172598 had been converted to WAL 41561 on 23 March 2021. There were no changes to the water allocation.

The Mangoola GWMP (Umwelt 2014) establishes groundwater impact criteria and conditions (groundwater level and quality) for site monitoring bores. Water level responses in the monitoring bores are in line with either predicted drawdowns or changes expected due to the below average rainfall-recharge between early 2017 and early 2020. There are no sites where changing water levels are unexpected or deviate from model predictions and require further investigation in accordance with the approved GWMP (2014).

Bi-monthly exceedances were reported by Mangoola for EC at five monitoring bores (GW02, GW10-P2, GW14 and GW15) following the January, March, May, July, September, and November 2021 sampling rounds, and an additional EPL monitoring bore (GW04) in the January, July, September, and November 2021 monitoring rounds. The annual groundwater chemistry speciation review (AGE 2021) also identified exceedances in TDS, sodium and chloride. as well as iron in GW02 and manganese in GW02 and GW14.

Where the criteria were exceeded for three consecutive monitoring events, the response protocol was enacted as per measures prescribed in the Mangoola Surface Water and Groundwater Response Plan (Glencore 2018). Following an exceedance, initial steps of the protocol require review of the results and an investigation to determine if an incident has occurred that could cause environmental harm. AGE was engaged to investigate the exceedances and report on findings. As per the Surface Water and Groundwater Response Plan, exceedances of trigger values are only reportable if an investigation determined that an incident had occurred. The AGE trigger level exceedance review reports concluded that the EC exceedances posed low potential for material environmental harm, and therefore no incidents were considered to have occurred.

7.7.4 Proposed Improvements

As noted above the three-yearly review of the numerical groundwater model (AGE 2019b) for Mangoola was completed during 2019. The updated model has been calibrated with available groundwater monitoring data, in line with the GWMP. The revised findings on the magnitude and timing of groundwater impacts have been subsequently incorporated into the GWMP in October 2019. The next validation and review of the groundwater model will be in 2022.

As indicated earlier additional monitoring bores have been proposed as part of the MCCO approved EIS of which, five new bores screened in Unweathered Conglomerates, four new bores screened in Great Northern Seam and Awaba Tuff and three bores screened in shallow strata associated with Wybong Creek and Sandy Creek alluvium. The installation of the bores will be completed in 2022.

In addition, as part of the approved EIS, Mangoola commit to complete additional baseline monitoring from existing bores along Big Flat Creek in the area adjacent the eastern flank of the out-of-pit emplacement area for a minimum of 12 months prior to the commencement of mining as requested.

The GWMP will be updated to align with the requirements of SSD 8642 prior to the commencement of mining operations.

8 Rehabilitation

Mangoola aims to develop rehabilitation of mined land that returns the site to a condition where the landforms, soils, hydrology, flora and fauna are self-sustaining and compatible with the surrounding land uses. Rehabilitation of the overburden emplacement areas is conducted progressively over the life of mine, as an integral component of mining operations.

8.1 Rehabilitation of Disturbed Land

Rehabilitation at Mangoola was undertaken in accordance with the approved 2021 MOP, except for a reduction in ROM coal extraction and rehabilitation as detailed below in **Table 44**. A copy of the current approved MOP is available on the Mangoola website. A total of 820 ha of rehabilitation has been undertaken to date. All rehabilitation areas are classified as being in the Ecosystem and Land Use Establishment Phase. A summary of rehabilitation during 2020 and 2021, and the projected rehabilitation for 2022, is provided in **Table 44**.

Table 44 Rehabilitation Status

Mine Area Type	Previous Reporting Period (Actual) (Ha)	This Reporting Period (Actual) (Ha)	Next Reporting Period (Forecast) (Ha)
A. Total mine footprint ¹	2,194	2248	2527
B. Total active disturbance ²	1,456	1431	1624
Infrastructure Areas	698	677	727
Topsoil Stockpile	22	19	41
Active Mining Areas	237	271	317
Waste Emplacements	365	330	405
Tailings Dams	117	117	117
Temporary Rehab	17	17	17
C. Land being prepared for Rehabilitation ³	0	14	20
D. Land under active Rehabilitation ⁴	738	803	903
E. Completed rehabilitation ⁵	0	0	0

¹ Total mine footprint includes all areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to mining and associated activities. Total mine footprint differs from MOP disturbance figure due to broader scale of disturbance interpretation in MOP figures.

² Total active disturbance includes all areas ultimately requiring rehabilitation.

³ Land being prepared for rehabilitation – includes the sum of mine disturbed land that is under the following rehabilitation phases – decommissioning, landform establishment and growth medium development (as defined in DRE MOP/RMP Guidelines).

⁴ Land under active rehabilitation - includes areas under rehabilitation and being managed to achieve relinquishment.

⁵ Completed rehabilitation – requires formal sign-off by DRE that the area has successfully met the rehabilitation land use objectives and completion criteria.

Topsoil is being managed to maximise the viability of soil biota. Topsoil management measures on site include varying stripping depths for different soil types, incorporation of mulched vegetation material into the topsoil resource, limiting topsoil storage stockpiles to a maximum of three metres in height, minimising any compaction of stockpiles, and seeding topsoil stockpiles with a cover crop.

Mangoola has continued with the natural landform design project and will implement this design in all final rehabilitation. The natural landform design has been integrated into the MOP. All rehabilitation undertaken is guided by the completion criteria outlined in the MOP. Current examples of site rehabilitation progress are shown in **Photo 3** to **Photo 7**.

A general overview of the 2021 rehabilitation process is presented below:

- After bulk shaping is completed, topsoil is applied at a nominal depth of 100-150mm in thickness. Direct topsoil placement from recently mulched and stripped areas is prioritised, where possible;
- Gypsum is applied as a soil ameliorant for incorporation into the topsoil;
- Ground timber and stag trees are placed, with the density depending on available resources;
- Frog ponds and aquatic habitat areas are shaped with habitat structures added;
- Topsoiled rehabilitation areas are double pass ripped, across the contour, to a depth ranging from 200 mm (level areas), 400 mm (gradual slopes) to 600 mm (steeper slopes); and
- Rehabilitation areas are seeded by hand. This provides more detail for targeted vegetation communities, such as riparian areas and eco-tonal changes based on soil type and aspect. Seed mixes are comprised of endemic Ironbark woodland complex species sourced from adjoining offset and buffer lands.

In addition to the natural landform created at Mangoola, plant species compositions have been selected based on vegetation types of the surrounding natural landforms, e.g. Forest Gum woodland or Rough-barked Apple woodland in the drainage lines or Ironbark woodland along the ridges and Spotted Gum forest on the ridge tops. An example of seed mixes used at Mangoola is provided in the MOP. During 2021, there was a continued focus on:

- The increase in flora species diversity into the rehabilitation seed mixes;
- The creation of aquatic habitat resources across rehabilitated areas;
- Infill tube-stock planting of recalcitrant or slow growing species to improve rehabilitation structure and complexity; and
- Fauna monitoring using remote cameras and bait lures.

During the reporting period, no rehabilitation areas received sign-off from the Resources Regulator as not all the rehabilitation criteria have been met.

Final capping and rehabilitation of Tailings Dam 1 (TD1) is planned to commence in 2023. Further cone penetration testing and shear vane testing for TD1 and TD2 will continue to be undertaken during 2022. A High Risk Area (HRA) notification for the capping of TD1 was submitted in December 2020 to the Resources Regulator which was subsequently approved. Due to the unprecedented rainfall experienced during late 2021 and early 2022 TD2 was required to be used as a short term water storage option. This unfortunately prevented the planned 2021 commencement of TD1 capping (due to the seepage from TD2) and the subsequent timing of TD2's capping commencement will need to be reassessed during 2023.

Construction of the capping layer will commence progressively, from the upper beach of TD1 in the north east of the dam. With regards to TD2, the tailings strength will continue to be routinely monitored by use of the shear vane apparatus, until tailings strengths develop to those similar to Tailings Dam 1, when construction of the capping layer commences. Throughout this process any surface water will be kept to a minimum on Tailing Dam 1 and 2 (once TD2 is emptied of its short term water storage) to maximise the effect of solar desiccation.



Photo 3 2020 and 2021 South Pit Progressive Rehabilitation looking North



Photo 4 South Pit Rehabilitation Frog Ponds Constructed 2019



Photo 5 View from Main Pit Central towards 2019-2021 Progressive Rehabilitation



Photo 6 Frog Pond and Progressive Rehabilitation in Main Pit Central 2019 Area



Photo 7 2017 South Pit Rehabilitation looking toward Offset Area and 500kV Powerline

8.2 Comparison with MOP Predictions

During 2021 Mangoola generally operated in accordance with the approved MOP, however ROM production was below the MOP predictions by approximately 2.27Mt due to market conditions, heavy rainfall and the Covid-19 pandemic. A comparison of 2021 rehabilitation against the predictions made in the MOP have been presented in **Table 45** and shown in the Annual Review Plan included as **Appendix A**.

Table 45 Rehabilitation Progress Compared to MOP Predictions

Predicted/Actual	Total Disturbance Area (ha)	Total Rehabilitation Area (ha) (per MOP Year)	Cumulative Rehabilitation Area (During MOP Term)
2021 Data (Actual)	2038.94	65.2	820.09 (includes 16.97 temporary rehabilitation)
MOP Year 1 Prediction	2034	90	838

As part of the Annual Review a comparison of actual disturbance and rehabilitation with MOP Plan 3A was undertaken as per **Figure 17**. MOP Plan 3A reflects an ideal state schedule whereby mining generally advances strip by strip and the dumps/rehabilitation follows sequentially

As a result of the production decreases during 2021 and the reduction in overburden movement, dumping was not completed in the main pit east or main pit west to enable the original rehabilitation target of 90ha to be achieved. Disturbance for the year was generally consistent with MOP Plan 3A.

8.3 Removal of Buildings

During 2021, no buildings or other infrastructure were removed or renovated.

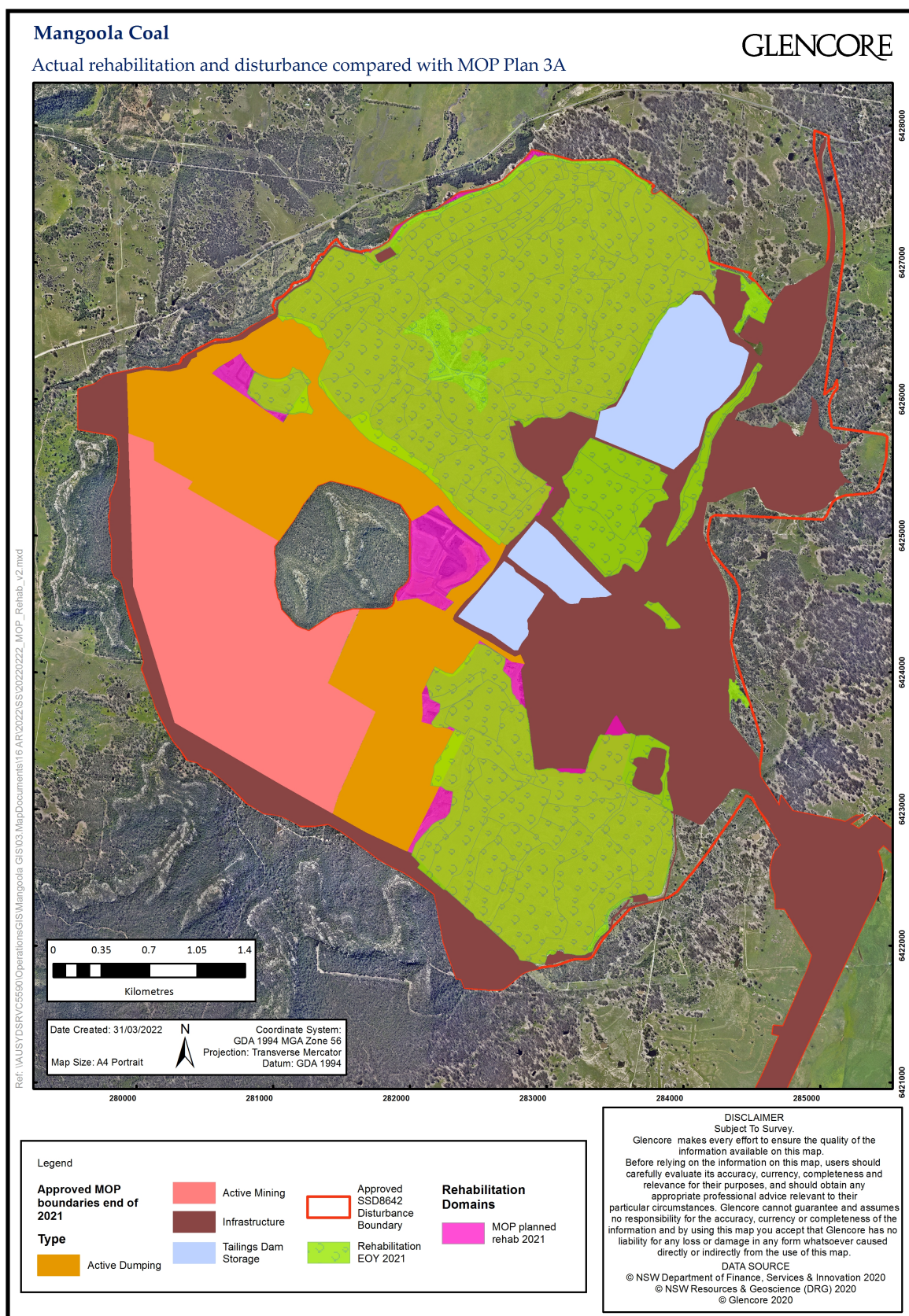


Figure 17 Actual Rehabilitation and Disturbance Vs MOP Plan 3A

8.4 Key Issues Affecting Rehabilitation

During October 2021, a walkthrough rehabilitation inspection audit was completed by a specialist consultant to review and report on the condition of mine rehabilitation and highlight areas where maintenance action is required. Due to the size of the area under rehabilitation, since 2020 the annual walkover inspection has been moved to a biennial schedule, with six rehabilitation blocks totalling 202ha in the southern rehabilitation area inspected during 2021.

The report stated that the Mangoola Open Cut rehabilitation works in the southern rehabilitation, most of which are still only in the establishment phase, to date remains highly successful and are generally progressing towards the completion criteria listed in the MOP. Native diversity across all rehabilitation domains of sufficient age to assess was generally moderate to high. Most areas exhibited appropriate species for the target vegetation community in all layers.

Thirteen occurrences of rill/gully erosion with the potential to impact rehabilitation were observed. Erosion in the form of rills and small gullies <500mm deep was primarily located on the newest rehabilitation areas where vegetative cover has not yet fully established and on the oldest rehabilitation in this area SP2016 where the slopes are steeper. Overall erosion control was observed to have been successful. The establishment of vegetation and stabilisation of erosion gullies in the oldest rehabilitation in this area (SP2016) has been successful in remediating previous erosion issues. The rehabilitation landscape design has been successful in limiting erosion potential across the rehabilitation areas.

No continuous areas of recalcitrant bare ground >400m² in size were identified in the walkover inspection. Topsoil management including consistent spreading and ripping is evident across the southern rehabilitation area. One area within the SP2019 rehabilitation block presented with lower establishment of vegetation than the surrounding rehabilitation and will need to be monitored.

Twelve exotic and inappropriate native species considered to have potential to adversely impact on the development of target vegetation communities were recorded across the rehabilitation area during the 2021 walkover inspection area. Active weed control works are recommended for these species.

Exotic annual and short-lived perennial species were recorded in moderate densities across all areas of the rehabilitation. Most of these were not considered to be problematic as they are generally environmental weeds and do not have a major impact on target vegetation development. Future rehabilitation monitoring should continue to report the abundances of these species and how this relates to seasonal conditions and rehabilitation age. Improving the diversity and density of target vegetation in the ground layer will be valuable in managing the prevalence of these weed species.

Vegetation health was high across the rehabilitation area with good growth rates observed in response to favourable environmental conditions in 2020-2021.

A diversity of artificial/salvaged habitat features are present across all areas of the Mangoola Coal rehabilitation. In particular, constructed drainage lines using a diversity of stag trees, logs, rocks and chains of ponds are looking promising. Utilisation of these features has been recorded including mammals, reptiles, amphibians, birds and invertebrates. The success of these habitat features deserves commendation.

Some threats to the rehabilitation as identified in the MOP have been identified, including minor erosion, small infestations of weeds requiring management and insufficient topsoil development in some areas. All of these should be monitored but do not pose a large threat at this time.

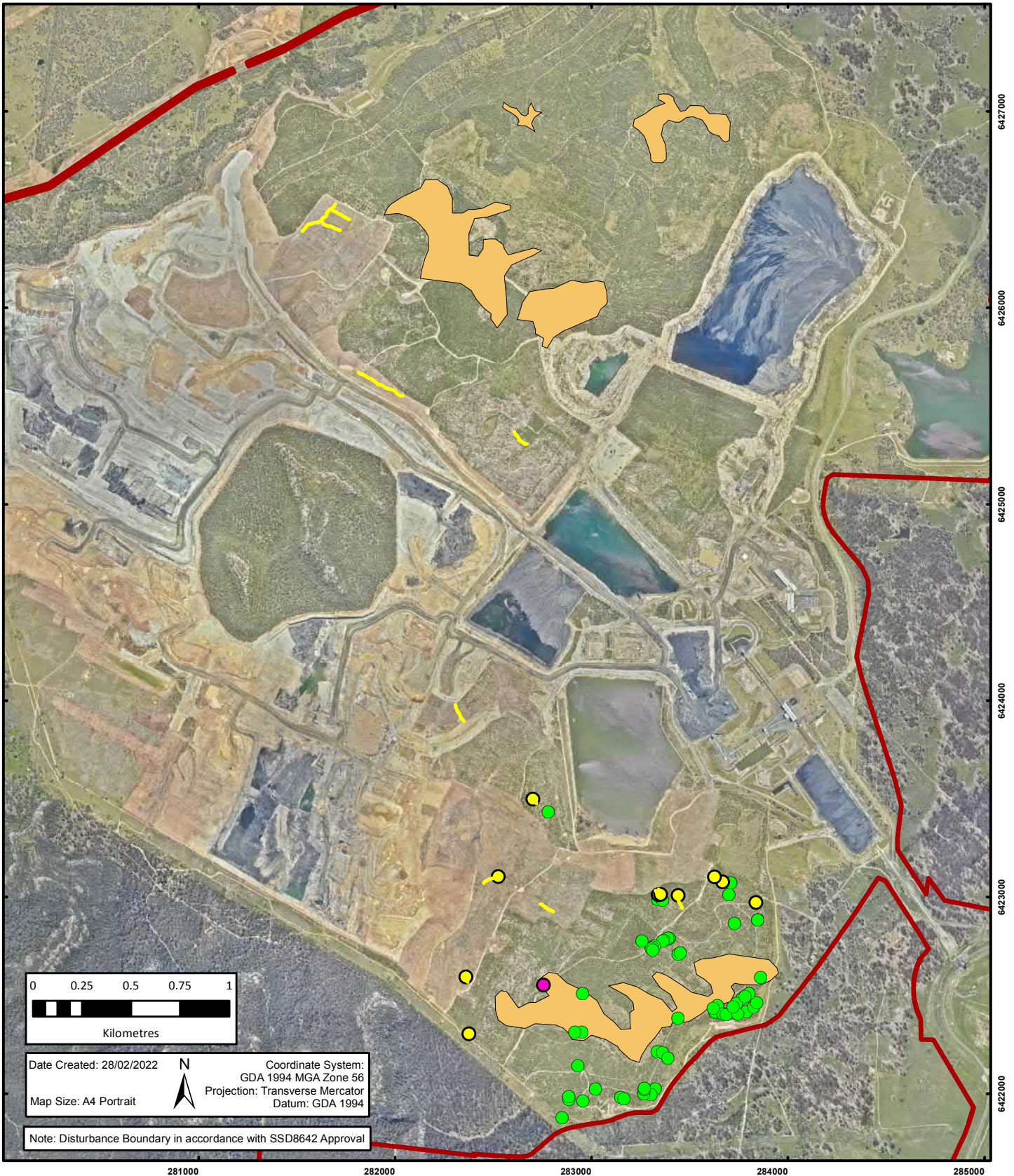
The report concluded by stating that while opportunities to improve remain, Mangoola displays continuous improvements and commitment to best practice and adaptive management within the rehabilitation and remains an industry leader in rehabilitation within the Hunter Valley and Australia wide.

During the reporting period the TARP as contained in the approved MOP was enacted. Triggers and corresponding actions are summarised in **Table 46** and shown in **Figure 18**.

Table 46 Summary of MOP TARP Actions Completed in 2021

Aspect/ Category	Key Element	Trigger Condition (Amber / Red)	Response
Landform Stability	Erosion Control	Significant gully or tunnel erosion present and/or rilling >200 mm deep. (Southern rehabilitation area), after November 2021 heavy rainfall event.	Contractors engaged to re-shape erosion rills, install new topsoil and rip lines then re-seed with appropriate native vegetation community seed mix.
		Significant gully or tunnel erosion present and/or rilling >200 mm deep. (Main Pit west rehabilitation area), after November 2021 heavy rainfall event.	Contractors engaged to re-shape erosion rills, install new topsoil and rip lines then re-seed with appropriate native vegetation community seed mix.
		Significant gully or tunnel erosion present and/or rilling >200 mm deep. (Main Pit central rehabilitation area), after November 2021 heavy rainfall event.	Contractors have been engaged to undertake repair works. Work scheduled for completion early 2022.
	Weed Presence	Twelve months following revegetation, >10% but <25% cover of undesirable species present. (Weeds in southern rehabilitation areas). High rainfall year contributing to additional weed growth across site.	Continue the ongoing site weed management program with a focus on the specific areas identified in the annual rehabilitation walkover report to ensure newly identified weed outbreaks are controlled.
		Twelve months following revegetation, >10% but <25% cover of undesirable species present. (Identification of native species inconsistent with the desired vegetation communities in the northern and southern rehabilitation areas). Undesirable species originally seeded in rehabilitation through contaminated seed mix. The supplier has since changed sourcing procedures to ensure that incorrect species are not provided.	Weed management contractor to continue to remove introduced species from the site during weed control activities. This is an ongoing task as some Eucalypts are difficult to identify in the juvenile stage and rely on development indicators over time for positive identification.
Topsoil Availability	Growth medium not acceptable for rehabilitation requirements	Some areas in south pit rehabilitation with no topsoil, low ground cover and litter not yet built up.	Monitor to assess if remedial works are required.
Topsoil Availability	Topsoil quality not sufficient to support required vegetation	Some areas in south pit rehabilitation with no topsoil, low ground cover and litter not yet built up.	Monitor to assess if remedial works are required.
Vegetation	Species composition	Designated grassland areas to be thinned.	Designated grassland areas in the rehabilitation have a variety of shrub and tree species establishing, due to germination from the topsoil seed bank. These areas will be mulched during 2022 and then regrowth sprayed with woody weed herbicide.

Figure 18 - MOP rehabilitation TARP areas 2021



Legend

- Approved EPL Disturbance Boundary
- 2021 weed areas (only assessed in SP rehab)
- 2021 erosion areas
- 2021 bare ground
- Grassland area mulching

DISCLAIMER Subject To Survey.

Glencore makes every effort to ensure the quality of the information available on this map. Before relying on the information on this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Glencore cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Glencore has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map.

DATA SOURCE

© NSW Department of Finance, Services & Innovation 2020
© NSW Resources & Geoscience (DRG) 2020
© Glencore 2020

8.4.1 Post Rehabilitation Land Use

As outlined in the MOP, the post-rehabilitation land use will be self-sustaining locally occurring vegetation communities, which emulate the pre-mining environment, enhance local and regional ecological linkages and provide for a sustainable final land use option. It has been developed with consideration of the inherently low land capability of the existing land (Class VI) across most of the site. The final void will remain onsite and will be appropriately rehabilitated and fenced to prevent access. Rehabilitation will establish a range of grassland, woodland and forest communities in addition to the offset area which surrounds the site.

Mangoola will establish native woodland and approximately 700 ha of native grassland across the site at closure.

Vegetation communities within the native woodland areas include:

- Forest Redgum Riparian Woodland;
- Ironbark Woodland Complex;
- Paperbark Woodland;
- Sheltered Grey gum Woodland;
- Slaty Box Woodland;
- Spotted Gum Open Forest; and
- Weeping Myall Woodland.

Table 47 compares the area of rehabilitation established for each final land use type during the 2021 reporting period and to date, against the MOP forecast.

Table 47 Final Land Use Rehabilitation

Secondary Domain Type	2021 reporting period (Actual)	Cumulative to date (Actual)	Area at end of MOP period (Forecast)
Ecosystem and Land Use Establishment			
Grassland	4.78	154.01	160.88
Woodland	60.42	666.08	677.12

In addition to the above Mangoola is monitoring overburden emplacement area rehabilitation against relevant completion criteria. **Table 48** and **Table 49** provide a summary of progress to date against relevant criteria for the stage of rehabilitation onsite, which has only been undertaken on rehabilitated waste emplacements areas to date. Further updates against criteria will be provided in future Annual Reviews as relevant criteria are triggered.

Many of the completion criteria listed in the MOP are not yet relevant, as they relate to stages of rehabilitation that have not yet been reached or triggered. The annual ecological monitoring program, rehabilitation walkover inspection and annual bushfire hazard inspection have assessed the relevant criteria, specifically landform stability, floristic diversity, vegetation health, weed presence, structural fauna habitat, management of pest species and bushfire management

Table 48 Comparison of the 2021 Rehabilitation Walkover Inspection Results with MOP Completion Criteria

Performance Indicator	Objective	Completion criteria	Rehabilitation Block Criteria Met Yes/No					
			SP 2016	SP 2017	SP 2018	SP 2019	SP 2020-1	SP 2020-2
Development of native ecosystems as per the final land use	Floristic diversity is progressing towards the ecosystems planned in the final land use	Native plant species richness assessed for each growth form	Trees: (3) Shrubs: 14 sp. Forbs: 8 sp.	Trees: (5) Shrubs: 15 sp. Forbs: 19 sp.	Trees: (5) Shrubs: 21 sp. Forbs: 15 sp.	Trees: (6) Shrubs: 26 sp. Forbs: 25 sp.	Trees: (5) Shrubs: 15 sp. Forbs: 20 sp.	Trees: (6) Shrubs: 16 sp. Forbs: 12 sp.
			Data for trees tentative and data for grasses not shown as identification of species not possible at this time. This data is not plot based and would be more appropriately assessed under the BAM monitoring programme.					
	Strata development is progressing towards the ecosystems planned in the final land use	For Grassland: -0-20% canopy -60-90% Groundcover	100 s/ha canopy 80% ground-cover	N/A	0 s/ha canopy 400-500 s/ha shrub	N/A	N/A	N/A
		For Woodland: -20-60% canopy -10-60% understorey - 40-80% groundcover	Canopies not developed enough yet to assess mature vegetation covers. See densities.					

Performance Indicator	Objective	Completion criteria	Rehabilitation Block Criteria Met Yes/No					
			SP 2016	SP 2017	SP 2018	SP 2019	SP 2020-1	SP 2020-2
		For Woodland: Minimum total tree/shrub densities to be 400stems/ha.	Trees: 50-650 s/ha Shrubs: 2000 s/ha	Trees: 100-1000 s/ha Shrubs: 2000-3000 s/ha	Trees: 100-200 s/ha Shrubs: 1000-2000 s/ha	Trees: 100 s/ha Shrubs: 2000-7000 s/ha	Trees: 100-400 s/ha Shrubs: 3000-4000 s/ha	Too young
	Weeds are not a major component of the planned ecosystems	Less than 30% weeds	Weeds not a major component of any of these areas and well below 30% cover. Most weeds are spring annuals which will not impact development of the rehabilitation area. Weeds that pose a threat and require management have been listed below. Older rehabilitation has a higher incidence of non-desired species.					
	No signs of ill health and stalling of canopy strata	More than 75% of trees are healthy and growing	No disease or unusual stunting of growth found on any rehabilitation area in this survey.					
	The rehabilitation is self-sustainable	For Woodland: Signs of flowering and seeds or second-generation seedlings for trees and shrubs	Some trees starting to flower	Trees too young to flower				

Performance Indicator	Objective	Completion criteria	Rehabilitation Block Criteria Met Yes/No					
			SP 2016	SP 2017	SP 2018	SP 2019	SP 2020-1	SP 2020-2
			All rehabilitation showed signs of prolific seeding for <i>Acacia</i> spp, <i>Daviesia</i> spp., <i>Dodonaea</i> spp., <i>Hovea</i> sp. and <i>Senna</i> sp.. Some second generation plants found for <i>A. deanii</i> and <i>A. falcata</i> .					
Fauna diversity is progressing towards the ecosystems planned in the final land use	Rehabilitation areas provide a range of structural habitats similar to pre-mining fauna communities.	Evidence of a range of structural habitats in rehabilitation areas. 1-10 boxes or hollows per ha	All rehabilitation blocks had stag trees, and many areas had logs and ponds. The chain of ponds in 2020-1 was particularly diverse with water holes, logs, rocks, and stags emerging from water holes. Vegetation consistent with wet areas was starting to develop. Eastern Rosella parrots were observed using a stag in 2020-1. A number of bird species were observed using the rehabilitation, in particular adjacent to offsets and in older rehabilitation. Wallabies were also observed using older rehabilitation. Aged scat of wombat found in 2019 rehab and inactive burrow under a log in adjacent offset.					
	Fauna pest species are managed and controlled (where possible)	Evidence of pest fauna usage of rehabilitation	Very low levels of evidence of deer (footprints) and hares (scat) were found.					

Table 49 Comparison of the 2021 Rehabilitation Walkover Inspection Results to Threats to Rehabilitation as Extracted from MOP

Issue/Risk	SP 2016	SP 2017	SP 2018	SP 2019	SP 2020-1	SP 2020-2
Unsuccessful translocation of threatened orchid species.	Not applicable for these areas. Status = Not Triggered					
Erosion on rehabilitation areas.	See MOP TARP for more information. Status = Partially Triggered	Status = Not Triggered		See MOP TARP for more information. Status = Partially Triggered		
Poor water quality in runoff from rehabilitation areas.	Not formally assessed however none visually identified. Status = Not Triggered					
Failure to meet criteria for each rehabilitation phase.	See Table 4.1 Status = Not Triggered			Woodland Areas younger than 5 years but exceeding targets for now; Grasslands older than 2 years meet criteria. See Table 4.1 Status = Not Triggered		
Weed infestation threatening rehabilitation success.	See MOP TARP Status = Partially Triggered					
Damage to rehabilitation by feral animals.	No significant damage to the Rehabilitation Area by feral animals was recorded during the 2020 Walkover Inspection. Status = Not Triggered					
Growth medium not acceptable for rehabilitation requirements.	Vegetation acceptable Status = Not Triggered		Parts of rehabilitation with no topsoil, low ground cover and litter not yet built up. Status = Partially Triggered		Topsoil evident, should support vegetation. Status = Not Triggered	
Lack of habitat features in rehabilitation area to attract fauna.	Habitat features present (ponds, stags, logs, boulders etc.). Status = Not Triggered					
Final landform instability resulting in poor water quality, exposed materials such as carbonaceous or Potentially Acid Forming Materials.	Not Identified Also see erosion of rehabilitation areas - MOP TARP. Status = Not Triggered					

Issue/Risk	SP 2016	SP 2017	SP 2018	SP 2019	SP 2020-1	SP 2020-2
Overburden material not suitable for rehabilitation or not sufficient amounts for rehabilitation.	Not identified. Status = Not Triggered					
Topsoil quality not sufficient to support required vegetation.	Vegetation acceptable Status = Not Triggered		Parts of rehabilitation with no topsoil, low ground cover and litter not yet built up. Status = Partially Triggered		Topsoil of a quality that should support vegetation. Status = Not Triggered	
Lack of local provenance seed for use in rehabilitation.	Local provenance seed collection is undertaken as part of the Mangoola rehabilitation strategy and is constantly reviewed and extended. Status = Not Triggered					
Rehabilitation not completed in accordance with rehabilitation strategy.	Works are being undertaken in line with the rehabilitation strategy. Status Not Triggered					
Spontaneous combustion of rehabilitation area.	No signs of spontaneous combustion were identified Status= Not Triggered					

8.5 Rehabilitation Trials and Research

Mangoola is undertaking a long-term orchid translocation trial for the threatened species *Diuris tricolor* and *Prasophyllum petilum*. Orchids were translocated to new areas and the survival rates have been monitored annually since 2010. The results of the 2021 orchid translocation monitoring are presented in **Section 6.6.2.3**.

Invertebrate habitat “bee and bug hotels” were introduced into the rehabilitation during 2019. These structures are being used by invertebrates, but no analysis has been carried out to identify particular species.

Mangoola is partnering with NSW BCD on a large scale translocation project of the critically endangered *Pomaderris reperta*. The aim of the project is to evaluate the effectiveness of propagation and translocation on this species as a means of extending its distribution within the natural range of the species. Two 12 m x 12 m translocation plots have been established within establishing Mangoola rehabilitation, and two identical sized plots located in Mangoola offset land (see **Photo 8** and **Photo 9**). Ongoing monitoring is showing very favourable results overall and data is being collected on the impact of differing ground preparation methods on plant survival rates. Many of the *Pomaderris* flowered during the 2021 season.

Translocation projects including *Cymbidium canaliculatum*, *Xanthorrhoea johnsonii* and *Macrozamia communis* continue to be undertaken throughout the rehabilitation areas.



Photo 8 Translocated *Pomaderris reperta* in rehabilitation area



Photo 9 Translocated *Cymbidium canaliculatum* within rehabilitation area

8.6 Actions for the Next Reporting Period

Rehabilitation activities proposed for the 2022 reporting period include the continuation of the rehabilitation research and trials for threatened flora species translocation, continued increases in the seed mix species diversity, mulching and treatment of some rehabilitation areas to achieve the desired grassland vegetation communities, creating additional complexity in aquatic habitat features, and a focus on achieving the rehabilitation targets as outlined in the approved MOP. In addition, some cool burns are planned to be undertaken in both grassland and woodland areas of approximately ten year old rehabilitation.

9 Community

9.1 Community Engagement

9.1.1 Face to Face Meetings

Mangoola has developed a comprehensive Stakeholder Engagement Strategy (SES) and Plan to identify and understand stakeholder views and concerns. The 2021 SES was also reviewed to consider the latest Government direction regarding the COVID-19 pandemic which has impacted the engagement techniques utilised as well as restricting non-essential face-to-face communications and site tours/visits.

During the reporting period, there was no exploration activity within AL9, therefore consultation under the Community Consultation Strategy (CCS) for AL9, developed in accordance with Conditions 4 and 5 of AL9, was limited to general Mangoola and MCCO Project updates. An Annual Community Consultation report was lodged with the Resources Regulator in November 2021. Likewise, there was no exploration activity conducted in EL5552 during the reporting period. A limited Annual Community Consultation report was lodged with DRG in February 2021 (with the next report due February 2021).

In 2021, there were no acquisitions under the Landholder Liaison Program and Property Acquisition Strategy (LLPPAS) that was developed in accordance with Condition 54 of AL9.

The Mangoola CCC met four times during the reporting period. The Q1 and Q2 meeting were held at Mangoola Coal. Due to COVID pandemic restrictions, the Q3 meeting was held via teleconference/WebEx and the Q4 meeting was held in Denman Memorial Hall (a larger venue) under a COVID-19 management plan with a WebEx dial in option. The CCC meetings include an update on mining and exploration operations, MCCO Project update, environmental monitoring, rehabilitation, land management activities (such as offset works, weed and pest control), community involvement and complaints.

One CCC tour was held at the Q1 2021 meeting (when COVID restrictions eased). Participants were shown the progress of the mine's rehabilitation. Other scheduled site CCC tours were postponed due to site COVID-19 controls and are now scheduled for 2022. As an alternative to site tours, drone footage of the mine and rehabilitation was presented at each CCC meeting. CCC meeting minutes are provided on the Mangoola website.

In addition to CCC tours, Mangoola normally offers rehabilitation tours through the quarterly Mangoola Community Newsletters as well as liaising directly with school groups, universities and other interested parties to facilitate tours. In response to COVID restrictions, such tour offers were suspended for a portion of 2021 resulting in a substantially reduced number of people touring the mine. Tours that did proceed included the CCC mine rehabilitation tour mentioned above and:

- Denman Men's Shed – the men's shed construct Mangoola's nest/habitat boxes for installation in mine rehabilitation (as well as offset areas). The participants were able to view the boxes in situ and learn how important they are in restoring ecological function;
- Merton Living Denman (aged care facility) toured the mine's Coal Handling and Preparation Plant. Some of our guests were also ex-miners and enjoyed the tour; and
- Scone High School students visited the mine and our rehabilitation as part of the Upper Hunter.



Photo 10 2021 Mine Tours (when COVID 19 restrictions eased)

Subject to pandemic status, tours will again be offered in 2022 through the Community Newsletter and other community interactions.

9.1.2 Website

Mangoola operates a website (www.mangoolamine.com.au) where members of the community can access information about the site, including the latest reports, management plans and environmental monitoring data, including previous Annual Reviews.

An Audit of the website was undertaken by SLR in December 2021 to reflect compliance of the website that was in place for the majority of the reporting year with Schedule 5, Condition 11 of PA 06_0014 and Condition D17 of SSD 8642. The findings of the audit are outlined in **Table 50** and **Table 51**.

Table 50 Website Audit – PA 06_0014

Condition	Comment
The Proponent must: (a) make the following information publicly available on its website:	-
The documents listed in condition 2 of Schedule 2;	Compliant – Approvals tab on website.

Condition	Comment
Current statutory approvals for the project	Compliant – Approvals tab on website.
Approved strategies, plans or programs required under the conditions of this approval	Compliant – Management Plan tab on website.
A comprehensive summary of the compliance monitoring results of the project, which have been reported in accordance with the various plans and programs approved under the conditions of this approval	Compliant – Detailed monitoring reports. Includes EPL monitoring. Copies of past Annual Reviews.
A complaints register, which is to be updated on a monthly basis	Compliant.
Minutes of CCC meetings	Compliant.
The last five annual reviews	Compliant – Annual Reviews / AEMR since 2008.
Any independent environmental audit; and the Proponent's response to the recommendations in any audit	Compliant. Link to audits.

Table 51 Website Audit - SSD 8642

Condition	Comment
The Proponent must: (a) make the following information and documents (as they are obtained, approved or as otherwise stipulated within the conditions of this consent) publicly available on its website:	-
The documents referred to in condition A2 (c) of this consent;	Compliant – Approvals tab on website.
All current statutory approvals for the project	Compliant – Approvals tab on website.
All approved strategies, plans or programs required under the conditions of this consent	Compliant – Management Plan tab on website.
The proposed staging plans for the development if the construction, operation or decommissioning of the development is to be staged	Compliant – MOP.
Minutes of CCC meetings	Compliant.
Regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent	Compliant – Detailed monitoring reports. Includes EPL monitoring. Copies of past Annual Reviews.
A comprehensive summary of the compliance monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs	Compliant – Detailed monitoring reports. Includes EPL monitoring. Copies of past Annual Reviews.
A summary of the current phase and progress of the development	Compliant - Annual Review.
Contact details to enquire about the development or to make a complaint	Compliant.
A complaints register, updated monthly	Compliant.
The Annual Reviews of the development	Compliant.

Condition	Comment
Audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report	Compliant. Link to audits.

9.1.3 Community Newsletters

Mangoola published and distributed four community newsletters during 2021. The newsletters provided information on the MCCO Project (reference to MCCO Project Community Information Sheet (CIS) containing the Electronic Public Hearing for the MCCO Project in March, the granted Planning Approval for SSD 8642 on the 26 April 2021, progression of securing supplementary approvals and planned construction activities). The newsletters provided further information on mine rehabilitation, operational updates (including COVID-19 controls implemented by the site), vertebrate pest animal control, proposed exploration and water bore drilling activities, various environmental management topics, community perception survey announcement and community investment updates.

The MCCO Project also distributed two Community Information Sheets in 2021. The first was prior to the granting of development consent and was an approvals process update and Independent Planning Commission hearing details mentioned above. The second (post granting of SSD 8642) was to announce commencement of construction and provide a summary of key construction activities, the planned closure of portion of Wybong PO Road and an update regarding the planned upgrade to Yarraman Road and Wybong Creek Crossing.

Copies are available on the Mangoola website.

9.2 Community Contributions

Mangoola is committed to supporting the local community in which it operates. 2021 saw a reduced number of applications for community investment due to the pandemic resulting in the postponing and cancelling of many events/projects. Despite this, Mangoola was still able to support a diverse range of innovative local community activities in 2021, with contributions of approximately \$60,000 made by Mangoola and additional funding through Glencore Coal Assets Australia. The 2021 recipients of sponsorship/donations during the reporting period are presented below:

- Hunter Sustainable Landcare;
- The Upper Hunter Show (including the Young Women of the Year);
- Wybong Community Hall and Wybong Cemetery (mowing and hall insurance);
- End of year presentations/awards for St Josephs Primary School Denman, Sandy Hollow Public School and Denman Public School;
- Muswellbrook High School Year 7 Camp;
- Three local rugby league teams;
- Merton Living Aged Care (Denman) – installation of two Temperature Test Stations;
- Upper Hunter Homeless Support Services (via Mangoola Charity Golf Day);
- Westpac Chopper Upper Hunter Charity Golf Day;
- Hunter Life Education – health education in local schools;

- Wybong Wild Dog Association (donated six wildlife cameras/SD cards);
- Muswellbrook Chamber of Commerce and Industry Business Awards (which, due to COVID-19 was carried over from 2020);
- Mangoola sponsored the Upper Hunter Education Fund (funds and tutoring);
- Beyond Bitumen Rally (Beyond Blue);
- National Tree Day (Donation for preparing ground at Hyde Park, Denman for tree Planting); and
- ToyBox – ‘Books in Homes’ program (joint project with other Glencore mines).

Additional in-kind support included volunteering for National Tree Day (planting trees) and the Mangoola apprentices worked with Liddell’s apprentices to help construct the new garden beds at the Muswellbrook Sustainability Hub community garden.

A key component of the Stakeholder Engagement Strategy is to ensure Mangoola supports the local community. Mangoola has implemented the Voluntary Planning Agreement (VPA) required under Schedule 2, Condition 12 of PA 06_0014 with Muswellbrook Shire Council. The VPA is designed to provide financial contributions commensurate with the terms set out in PA 06_0014. Mangoola is committed to meeting its obligations under the VPA. In 2022, discussions will continue with Muswellbrook Shire Council regarding the development of the VPA for the MCCO Project under development consent SSD 8642.



Photo 11 Mangoola’s Damien Ryba at the Toybox ‘Books in Homes’ book giving ceremony



Photo 12 Apprentice working bee at the Hunter Sustainable Landcare community garden – bed building tuition prior to starting

9.3 Community Complaints

Mangoola manages all complaints in accordance with the Mangoola Complaints Management Procedure, which details the process for receiving and responding to complaints. Complaints are received via a dedicated Community Response Line, in person, facsimile, email, letter or general telephone.

9.3.1 2021 Complaints Summary

A total of 62 community complaints were received by Mangoola during the reporting period. A summary of the time of year and subject of the complaints are provided in **Table 43**.

Table 52 Summary of Complaints in 2021

Month	Noise	Dust	Lighting	Blasting	Traffic	Other	Total
January	3			1			4
February	7						7
March	1						1
April	3			1			4
May	13				1	1	15
June	7						7
July	9						9
August	7						7
September	3						3

Month	Noise	Dust	Lighting	Blasting	Traffic	Other	Total
October	3						3
November	1						1
December	1						1
Total	58	0	0	2	1	1	62

9.3.2 Analysis of Complaints

Complaint Subject and Quantity

As shown in **Table 52**, the majority of complaints received in the reporting period were in relation to noise (93.6%). This percentage has increased slightly from 2020 (92%) but total noise complaints have reduced from 2020 (122 noise complaints). Further details on management and mitigation measures regarding noise that were implemented during the reporting period are provided in **Section 6.3**. Additional attended noise monitoring was conducted once again from June to September 2021 (cooler period) in the area north west of the mine which, during the previous year, was where most noise complaints came from.

The 62 complaints received in 2021 represent a 53% decrease from the 133 environmental complaints received in 2020. A review of complaints from 2007 to 2021 found that complaints peaked in 2011 (717 complaints) which represented the first full calendar year of operations.

Complaint Timing

Figure 19 shows the time of day that complaints were made during 2021. Analysis of this data shows that noise complaints are generally made in the early morning and late evening, whereas blast related complaints are generally made in the middle of the day.

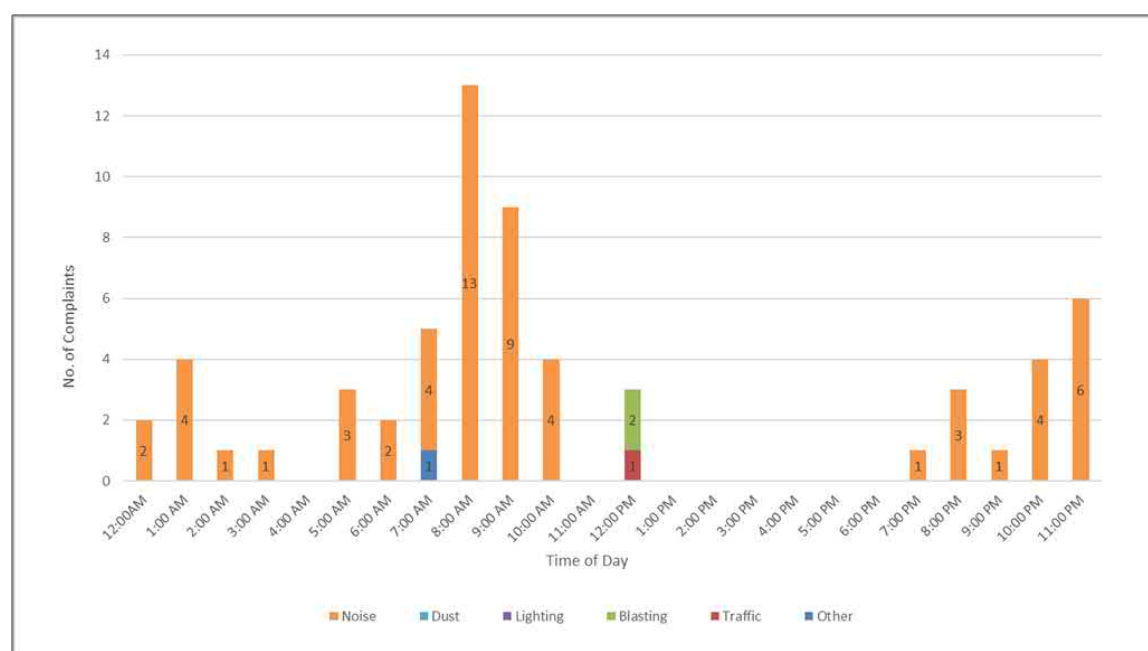


Figure 19 2021 Complaints by Time of Day

Complainants

Figure 20 shows the number of complaints made by each complainant during 2021. The 62 complaints were made by 14 individuals during 2021 and approximately a 60% of all complaints (37) were made by three complainants. These were predominantly in relation to noise.

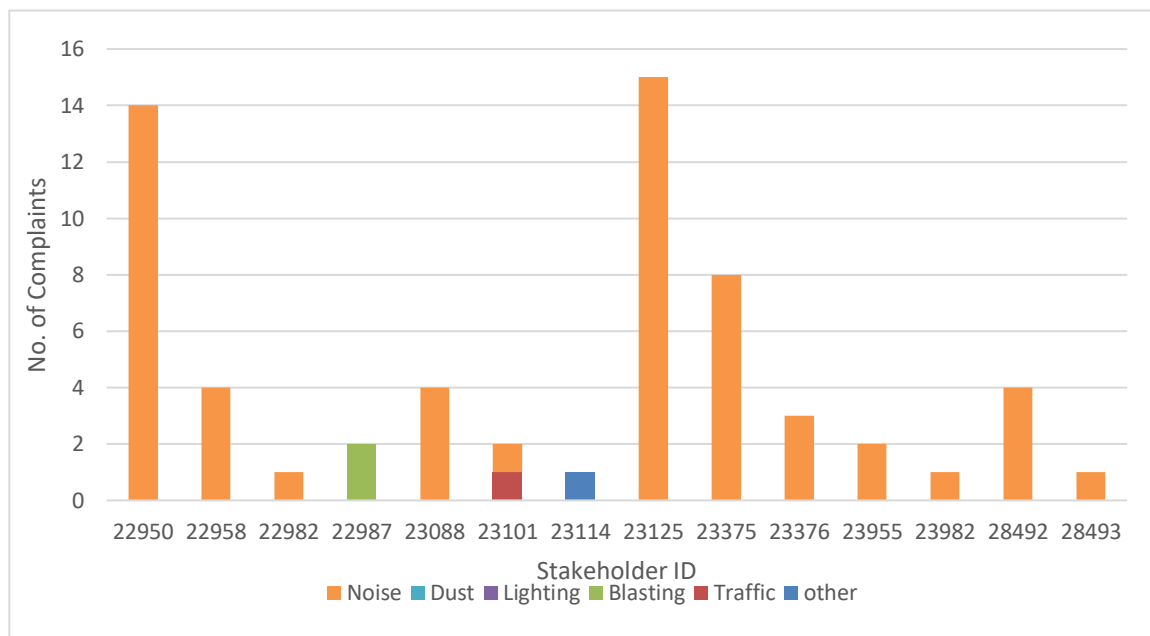


Figure 20 2021 Complaints by Complainant ID

Complaint Location

Figure 21 shows complaint location during 2021 with the majority of complaints received from the south-east and north-west sectors primarily related to noise.

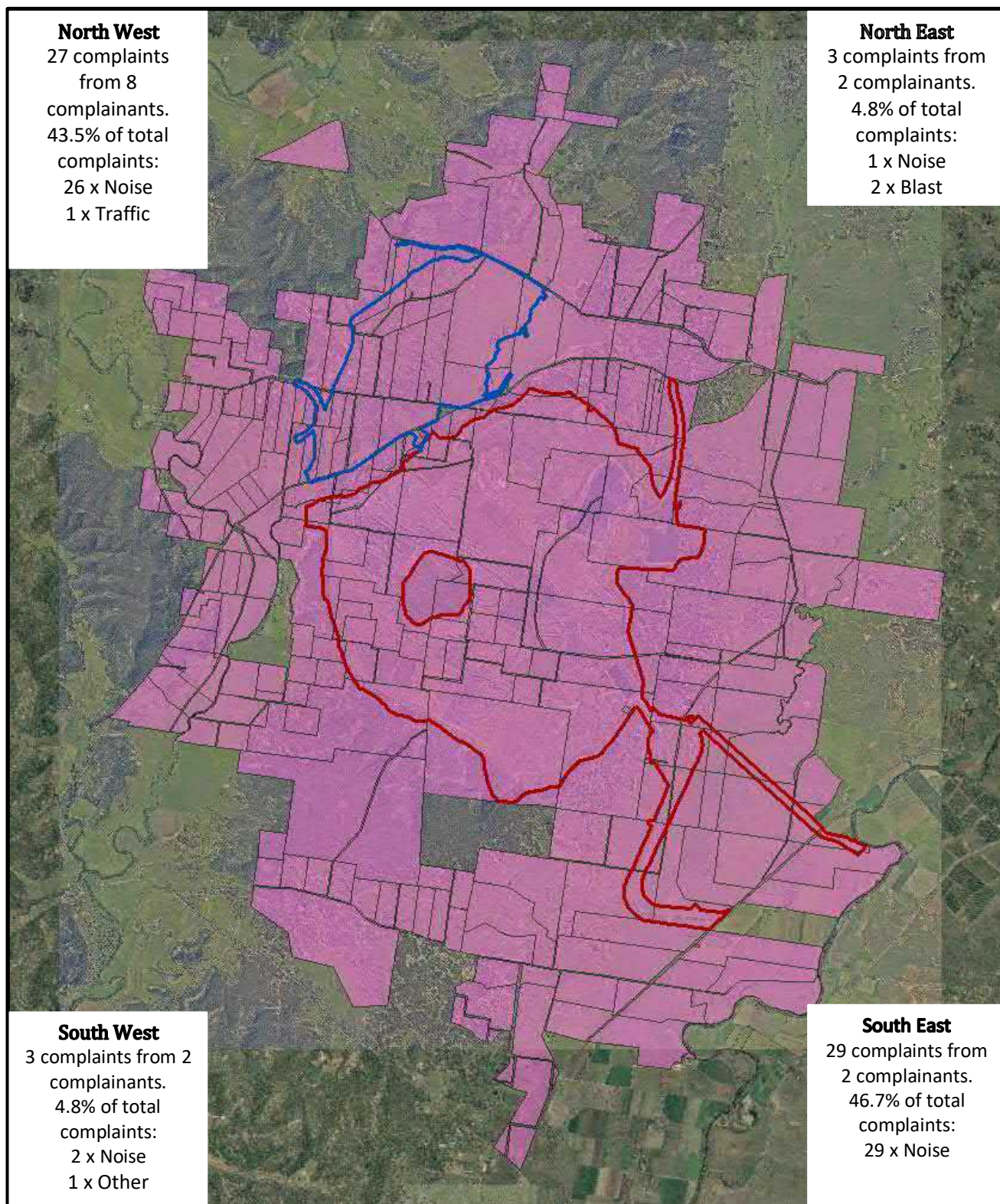


Figure 21 2021 Complaints by Location

9.3.3 Actions in Response to Complaints

In response to complaints received in 2021, the following responses were undertaken, depending on the nature of the complaint.

Noise

- Following receipt of a noise complaint, the real time noise monitors were reviewed, and noise alarms were reviewed to see if any were received prior to the complaint;
- Operational noise management controls were reviewed by the Mining Supervisor or CHPP Supervisor;
- Where noise alarms were received, and the Mining/CHPP Supervisor verified activities from our operation to be the source, the operation was reviewed with changes made as required to reduce noise levels, e.g. parking up equipment; and
- Supplementary weekly attended noise monitoring was undertaken at an additional four locations at a further distance north west of site as per previous year's. This was completed weekly during the winter period, in line with NSW heath restrictions. No non-compliances were measured during this monitoring.

Blast

- Depending on the nature of the blast complaint, the following were reviewed:
 - blast monitoring results;
 - the blast video;
 - pre-blast assessment to confirm meteorological conditions at time of blasting;
 - air quality monitoring results (N/A in 2021); and/or
 - other blasting activity in region (where blast time did not correlate with a Mangoola blast); and
- All blast overpressure and ground vibration results confirmed to be within compliance limits and discussed with complainant where relevant.

Dust

- There were no dust complaints received in 2021.

Traffic

- One traffic complaint was received in 2021 which was handled internally.

Property

- One property access complaint was received in 2021. The lock was reinstated in the chain and people who use the area were consulted regarding correct locking of gates.

All other complaints were investigated and handled on a case by cases basis with the aim of mitigating impacts (where required) and responding to community members.

10 Independent Audit

In accordance with Condition 7, Schedule 5 of PA 06_0014, an Independent Environmental Audit (IEA) is required every three years. An IEA was undertaken in 2019, occurring between 29 July 2019 to 1 August 2019, therefore the next IEA will be completed in 2022.

As required by SSD 8642, Condition D13, an independent audit will be conducted within one year of the commencement of development which occurred on 6 December 2021, therefore this audit is due prior to 6 December 2022.

Mangoola has begun organising for the completion of both independent audits within the required timeframes in 2022.

11 Incidents and Non-Compliances

All 2021 incidents, non-compliances and exceedances related to PA 06_0014, EPL 12894, and SSD (where applicable) and relevant management plans are summarised in **Table 53**.

Table 53 Incidents, Non-Compliances and Exceedances

Date	Summary	Non-Compliance	Details/Response
30/10/2021	Air Monitoring Requirements	PA 06_0014 Air Quality Management Plan	<p>D01-DC exceeded the 50 µg/m³ 24h PM₁₀ criteria (50.1 µg/m³) on 30 October 2021.</p> <p>DPIE were notified of the exceedance and an internal investigation commenced. The control measures and corrective actions listed in the AQMP were implemented and a report was provided to DPIE within seven days.</p> <p>DPIE reviewed the information presented in the report and was satisfied Mangoola Coal undertook reasonable and feasible mitigation measures to minimise dust emissions from the site on this day.</p>
20/02/2021	Failure to Monitor (D8)	EPL 12894 Air Quality Management Plan	<p>The monitoring unit malfunctioned at Monitoring Point 20 (D8). This was a non-compliance in accordance with Sampling Method – Special Method 1. Field maintenance was undertaken on the E-Sampler at the earliest time (19 March 2020) to attempt to repair, however the unit could not be fixed in the field and was taken offsite for repairs. A replacement unit was installed, however the stabilising period resulted in a loss of four three days data.</p> <p>This was reported in the EPL 12894 Annual Return in 2021.</p>

Date	Summary	Non-Compliance	Details/Response
Various	Failure to Monitor Weather Continuously	EPL 12894	<p>Failure to monitor continuously monitor weather at Monitoring Point 5 and Monitoring Point 18:</p> <p>Monitoring Point 5: Rainfall: 16 x 15 min averaging (av) periods; Temperature (2m): 2 x 15 min av periods; and Solar Radiation: 18 x 15 minute av periods.</p> <p>Monitoring Point 18: Rainfall: 345 x 15 min av periods; Wind speed: 299 x 15 min av periods; Wind direction: 299 x 15 min av periods; Temperature (2m): 343 x 15 min av periods; Temperature (10m) 299 x 15 min av periods; Sigma theta: 299 x 15 min av periods; and Solar radiation: 341 x 15 min av periods.</p> <p>Monthly data validation checks have been implemented, along with changes to contactor arrangements. The non-compliance was reporting the EPL Annual Return, dated 12 August 2021</p>
1/10/2021	Failure to Monitor	Blast Management Plan	On 1 October 2021 last monitor at BM07 failed to record a result. An internal investigation was conducted and identified that although the blast monitor was online, data could not be downloaded due to memory card corruption.

Date	Summary	Non-Compliance	Details/Response
26/11/2021	Discharge of Saline Water	SWMP and SWGWRP	<p>On 26 November 2021, water was discharged from Sandy Creek Farm Dam 2, a saline seepage management dam, into Sandy Creek via an unnamed drainage line.</p> <p>PIRMP was enacted in accordance with Section 147 of the POEO Act. DPIE and EPA were notified in accordance with applicable statutory requirements.</p> <p>An investigation was completed where the analysis had indicated that the predominant source of water discharged was runoff from the 25.7 ha clean water catchment caused by excessive rainfall.</p>
26/12/2021	Discharge of Saline Water	SWMP and SWGWRP	<p>On 8 December 2021, water was discharged from Sandy Creek Farm Dam 2, a saline seepage management dam, into Sandy Creek via an unnamed drainage line.</p> <p>PIRMP was enacted in accordance with Section 147 of the POEO Act. DPIE and EPA were notified in accordance with applicable statutory requirements.</p> <p>An investigation was completed where the analysis had indicated that the predominant source of water discharged was runoff from the 25.7 ha clean water catchment caused by excessive rainfall.</p>
28/11/2021	Failure to Monitor after discharge event (SW01 and SW02)	SWMP and SWGWRP	<p>Mangoola failed to monitor at SW01 and SW02 following the 26 November discharge event. These sites were unable to be monitored due to safety concerns around access.</p>

12 Activities to be Completed During Next Reporting Period

12.1 Management Plan Review

In accordance with Schedule 5, Condition 9 of PA06_0014 and Condition D8 of SSD 8642 the following strategies, plans and programs will be reviewed and/or revised in 2022 as necessary, as listed in **Table 54**.

Table 54 Revision of Strategies, Plans and Programs

Document	2022 Review	Comment
Air Quality Management Plan	Yes	Greenhouse Gas will be incorporated in the Air Quality and Greenhouse Gas Management plan in 2022 as required by SSD 8642. If the PA 06_0014 is not surrendered prior the ESAP will be reviewed in 2022 in accordance with Schedule 5 Condition 9.
Noise Management Plan	No	No changes required as a result of Annual Review.
Environmental Management Strategy	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Conservation Management Strategy / Historic Heritage Management Plan	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Blast Management Plan	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Blast Fume Management Procedure	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Water Management Plan	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Surface Water Monitoring Plan	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Groundwater Monitoring Plan	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Surface and Groundwater Response Plan	Yes	This plan is not required by SSD 8642 and will therefore not be required once PA 06_0014 is surrendered.
Erosion and Sediment Control Plan	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Site Water Balance	Yes	Completed annually.
Aboriginal Cultural Heritage Management Plan	No	No changes required as a result of Annual Review.
Biodiversity Offset Management Plan and Strategy	Yes	This Management Plan will be updated in accordance with the requirements of SSD 8642.
Translocation Management Plan	No	No changes required as a result of Annual Review.
Energy Savings Action Plan	No	This plan is not required by SSD 8642 and will therefore not be required once PA 06_0014 is surrendered.

Document	2022 Review	Comment
MOP 2021	Yes	Will be replaced by the Rehabilitation Management Plan by the 2 July 2022.
AL9 and EL 5552 Groundwater Monitoring and Modelling Plan	No	No changes required as a result of Annual Review.
AL9 Community Consultation Strategy	Yes	This document will be updated due to the proposed 2022 drilling program.

12.2 2022 Actions

Table 55 outlines the actions to be implemented during the 2022 reporting period.

Table 55 2022 Actions

Action	Due Date
The noise monitoring network will be reviewed to determine whether continuous noise monitoring units can be relocated to provide better coverage around the mining operations.	2022
The monitoring program for terrestrial orchids will be reviewed and updated based on the recommendations from Eastcoast Flora Survey.	2022
Engagement with RAPS regarding funding available to enhance or promote Aboriginal matters will be undertaken in accordance with the ACHMP.	2022
Mangoola GIS register will be updated to add new artefacts found as part of MCCO Project/other due diligence works.	2022
Continued construction of project boundary fencing along Wybong Road.	2022
The ESAP will be reviewed in 2022 (in the event PA 06_0014 has not surrendered).	2022
Validation and review of Numerical Groundwater Model, including revision of the GWMP.	2022
Completing installation of additional monitoring bores proposed as part of the MCCO approved EIS.	2022
Completing additional baseline monitoring from existing bores along Big Flat Creek in the area adjacent the eastern flank of the out-of-pit emplacement area for a minimum of 12 months prior to the commencement of mining.	2022
Continuation of the rehabilitation research and trials associated with threatened flora species translocations.	2022
Enhancement activities associated with species diversity, growth mediums and habitat features.	2022
Achieving the rehabilitation targets as outlined in the approved MOP.	2022
Cool burns in both grassland and woodland areas of approximately ten-year-old rehabilitation.	2022

13 References

- AGE (2019) *Mangoola Coal Mine – Groundwater Model Three-Year Inflow and Impact Prediction Validation (G1839S)*.
- AGE (2020) *Mangoola Coal Mine – Review of Annual Monitoring Bore Exceedances – GW02, GW04 and GW14*.
- Australian and New Zealand Environment Conservation Council (ANZECC) (2000) *National Water Quality Management Strategy: Australia Guidelines for Fresh and Marine Water Quality*.
- Biosis (2022) *Mangoola Coal Stream Health Monitoring Program: Autumn and Spring 2021*.
- Department of Environment and Climate Change NSW (2008) *Managing Urban Stormwater: Soils and Construction Volume 2E Mines and Quarries, DECC, Sydney NSW*.
- Eastcoast Flora Survey (2021) *Monitoring of translocated threatened orchids (Diuris tricolor, Prasophyllum petilum) at Mangoola Coal: 2021 Results*
- EMM (2013) *Mangoola Coal Modification 6 Noise and Vibration Assessment*.
- Engeny (2021) *Mangoola Open Cut 2021 Water Balance Summary – Letter Report to Mangoola Open Cut*.
- Enright (2021) *Mangoola Coal Operations Wild Dog and Fox Baiting Report – Autumn 2021*.
- Enright (2021) *Mangoola Coal Operations Wild Dog and Fox Baiting Report – Spring 2021*.
- Environment Protection Authority (2017) *Noise Policy for Industry*.
- Future Harvest Native Revegetation Services Pty Ltd (2021) *Mangoola Open Cut Annual Rehabilitation Monitoring Report - November 2021*.
- Glencore (2018) *Mangoola Coal Operations – Plan for Surface Water and Groundwater Response*.
- HLM (2021) *Annual Channel Stability Report (Year 14)*.
- Landcom (2004) *Managing Urban Stormwater: Soils and Construction Volume 1, 4th Edition*.
- Mackie Environmental Research (2006) *Anvil Hill Project: Groundwater Management Studies*.
- Mangoola Coal (2021) *Mangoola Coal Mining Operations Plan January 2021 – July 2022*.
- NSW Government (2015) *Annual Review Guideline*.
- Todoroski Air Sciences (2013) *Air Quality and Greenhouse Gas Assessment Mangoola Coal*.
- Umwelt (2014) *Mangoola Coal Groundwater Monitoring Plan*
- Umwelt (2022a) *Mangoola Open Cut – 2021 Ecological Monitoring Report*.

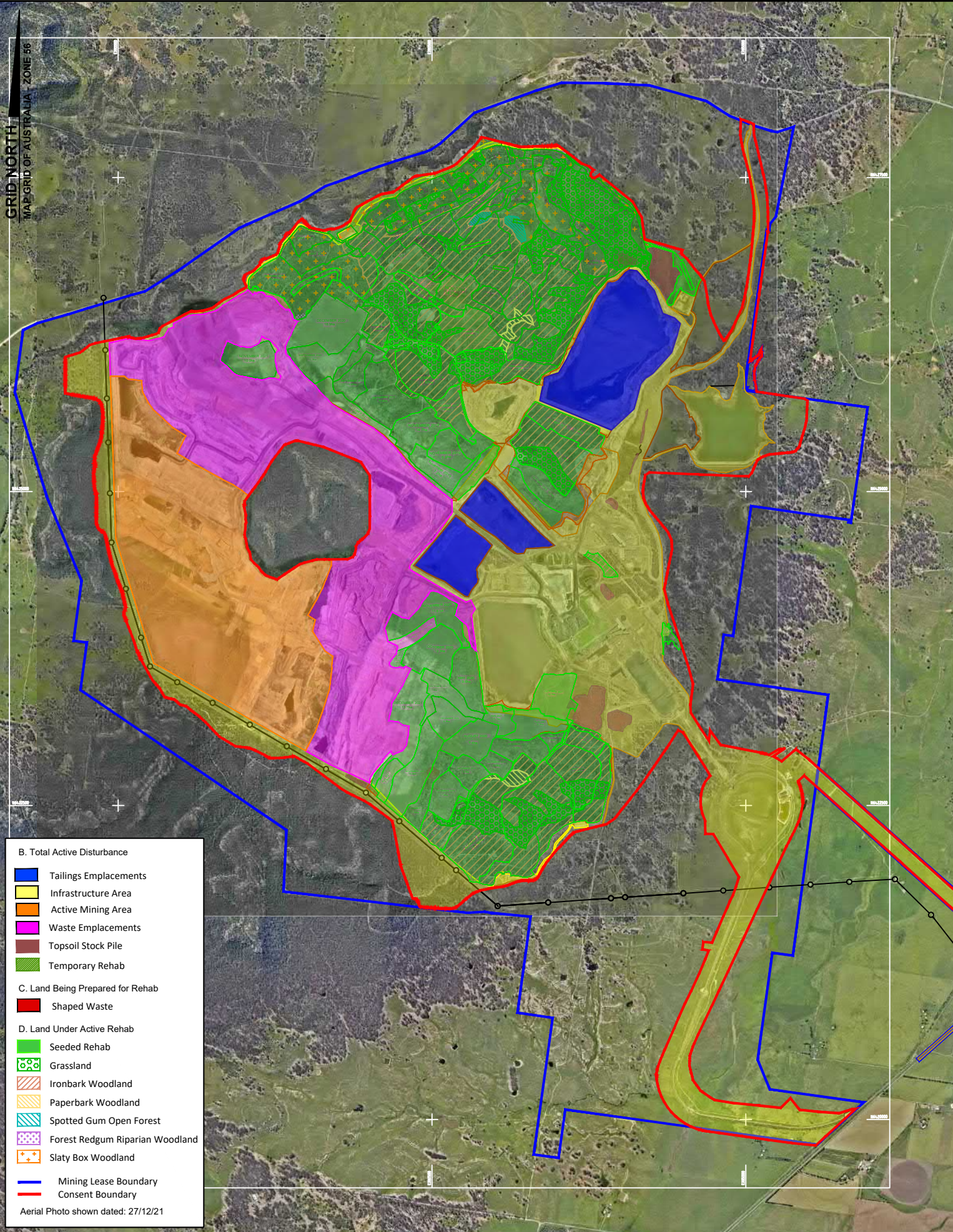
Umwelt (2022b) *Outcomes of Nest Box Monitoring in Biodiversity Offset Areas, Corridors and Rehabilitation Areas of Mangoola Open Cut – 2022.*

WRM (2013) *Mangoola Coal Modification to Project Approval Surface Water Assessment.*

APPENDIX A

Annual Review Plan

GRID NORTH:
MAP GRID OF AUSTRALIA - ZONE 56



B. Total Active Disturbance

- Tailings Emplacements
- Infrastructure Area
- Active Mining Area
- Waste Emplacements
- Topsoil Stock Pile
- Temporary Rehab

C. Land Being Prepared for Rehab

- Shaped Waste

D. Land Under Active Rehab

- Seeded Rehab
- Grassland
- Ironbark Woodland
- Paperbark Woodland
- Spotted Gum Open Forest
- Forest Redgum Riparian Woodland
- Slaty Box Woodland

- Mining Lease Boundary
- Consent Boundary

Aerial Photo shown dated: 27/12/21

SITE :
MANGOOLA

DEPARTMENT :
SURVEY

DRAWN :
SPJ

SCALE :
NTS

DATE :
18/02/22

SIGN:

DATUM:
MGA94/A.H.D.

GLENCORE

Mangoola Coal Operations Pty Ltd
Wybong Road, Muswellbrook NSW 2333 Australia
P.O. Box 495 Muswellbrook NSW 2333 Australia

TITLE:

Rehabilitation / Mining Summary 2021

DRAWING No. : 210303-GEN-AP-444-SJ-R0

File No. :

REV.

0

SHEET

A4

APPENDIX B

Long Term Trend Graph – Rainfall

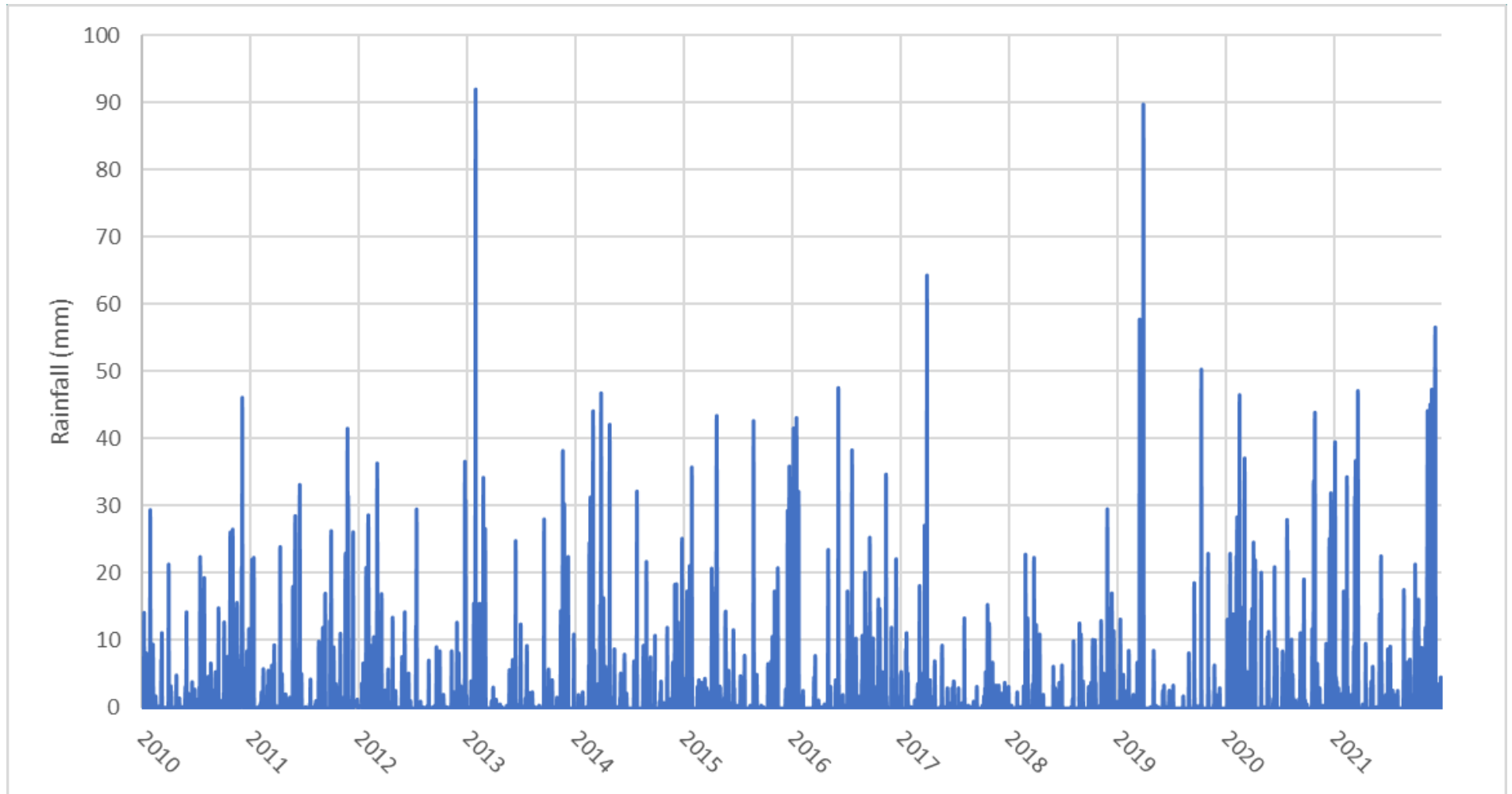


Figure 22 Long Term Daily Rainfall Data at WSN – 2010 to 2021

APPENDIX C

Long Term Trend Graphs – Air Quality

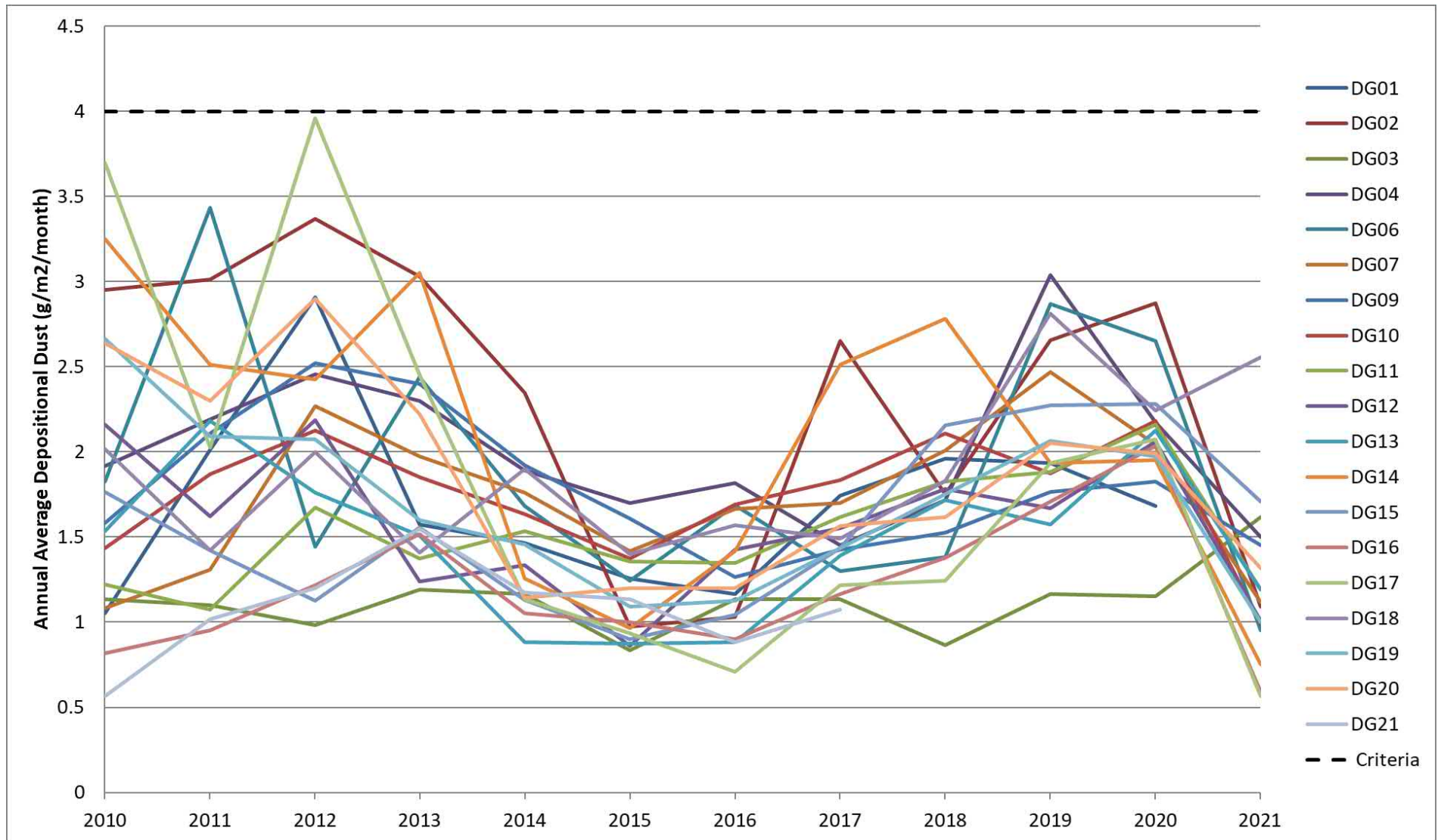


Figure 23 Long Term Annual Average Depositional Dust Monitoring Results – 2010 to 2021

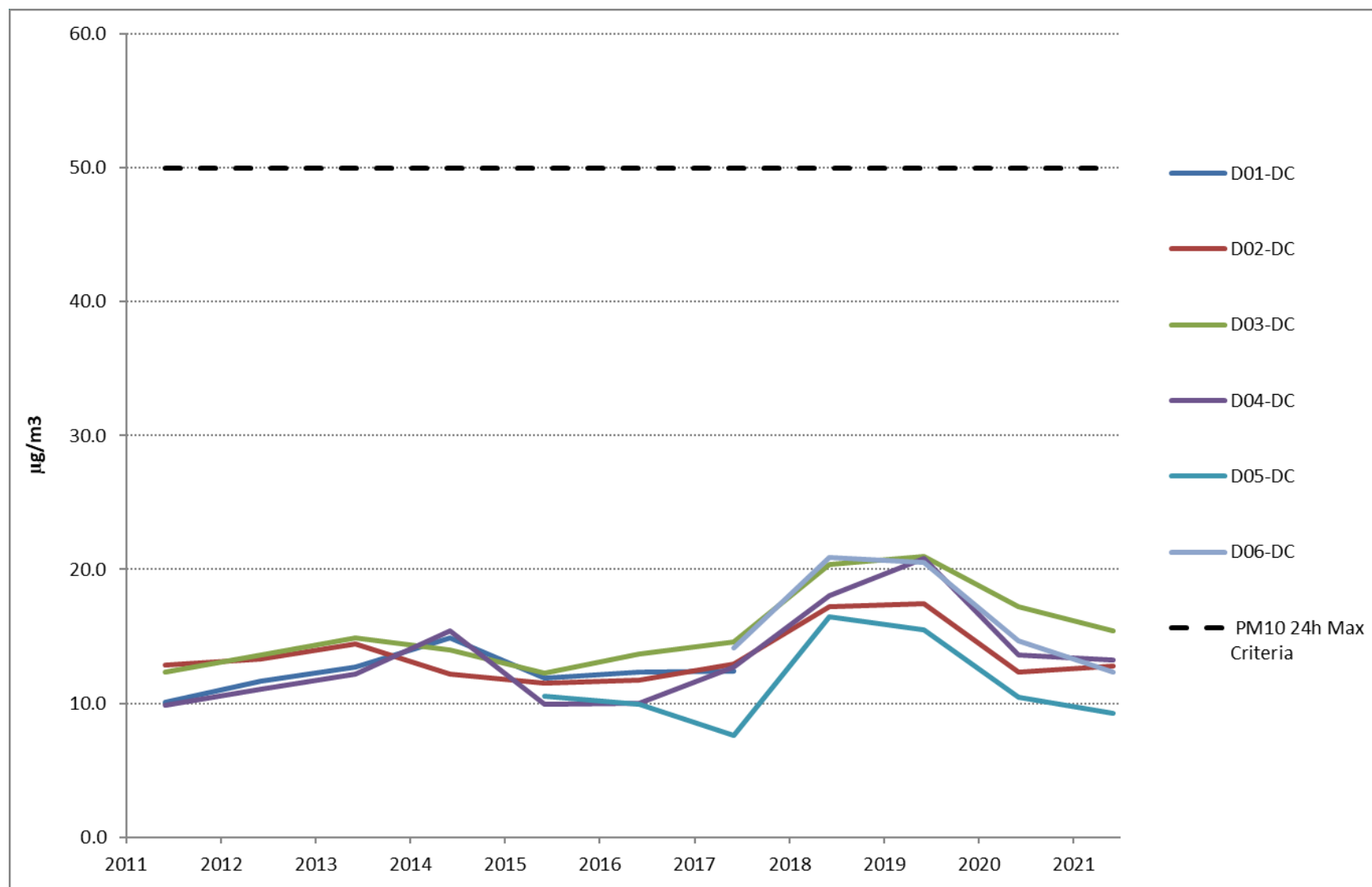


Figure 24 Long Term Annual Average PM₁₀ TEOM Monitoring Results – 2011 to 2021

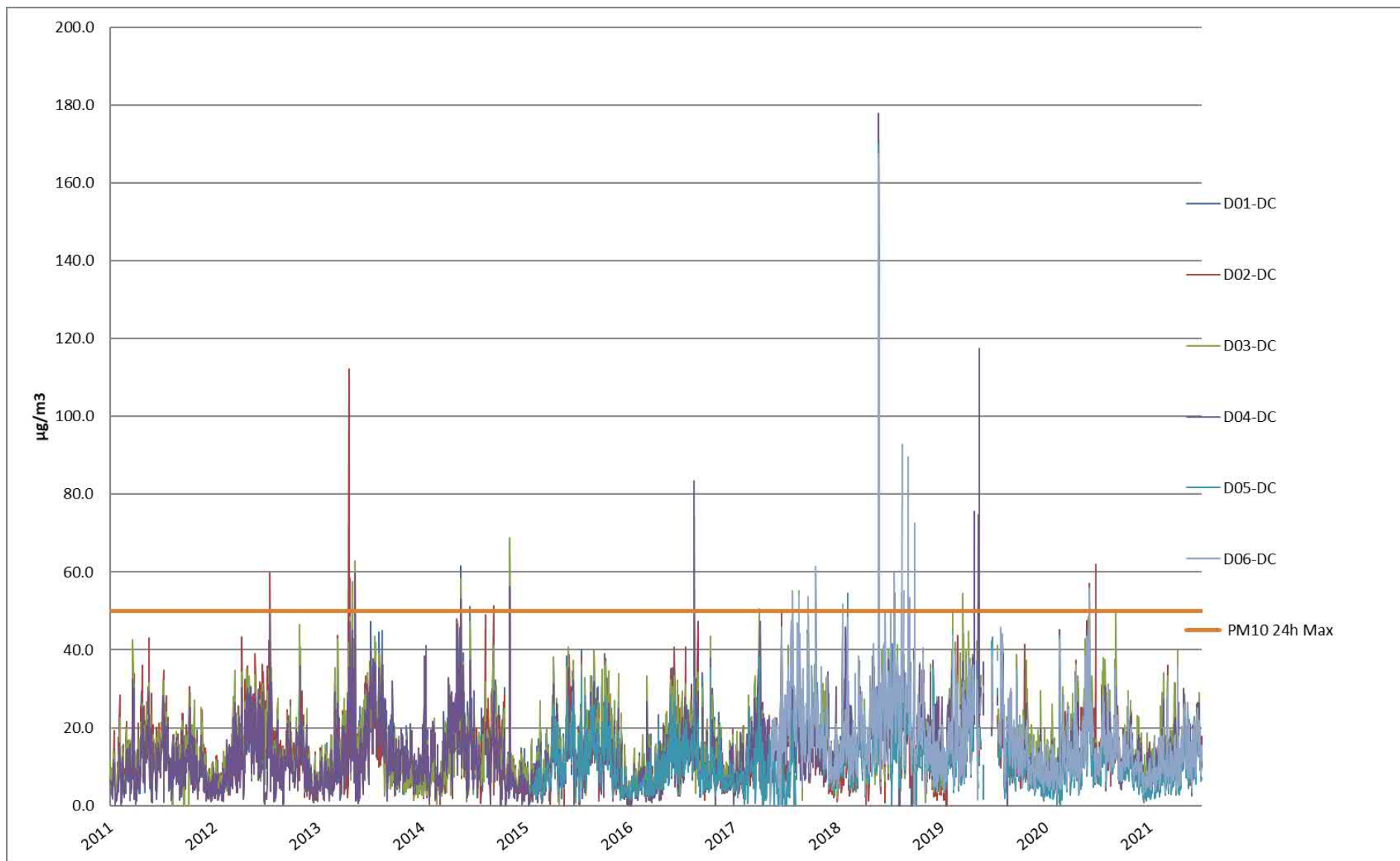


Figure 25 Long Term 24h PM₁₀ TEOM Monitoring Results – 2011 to 2021

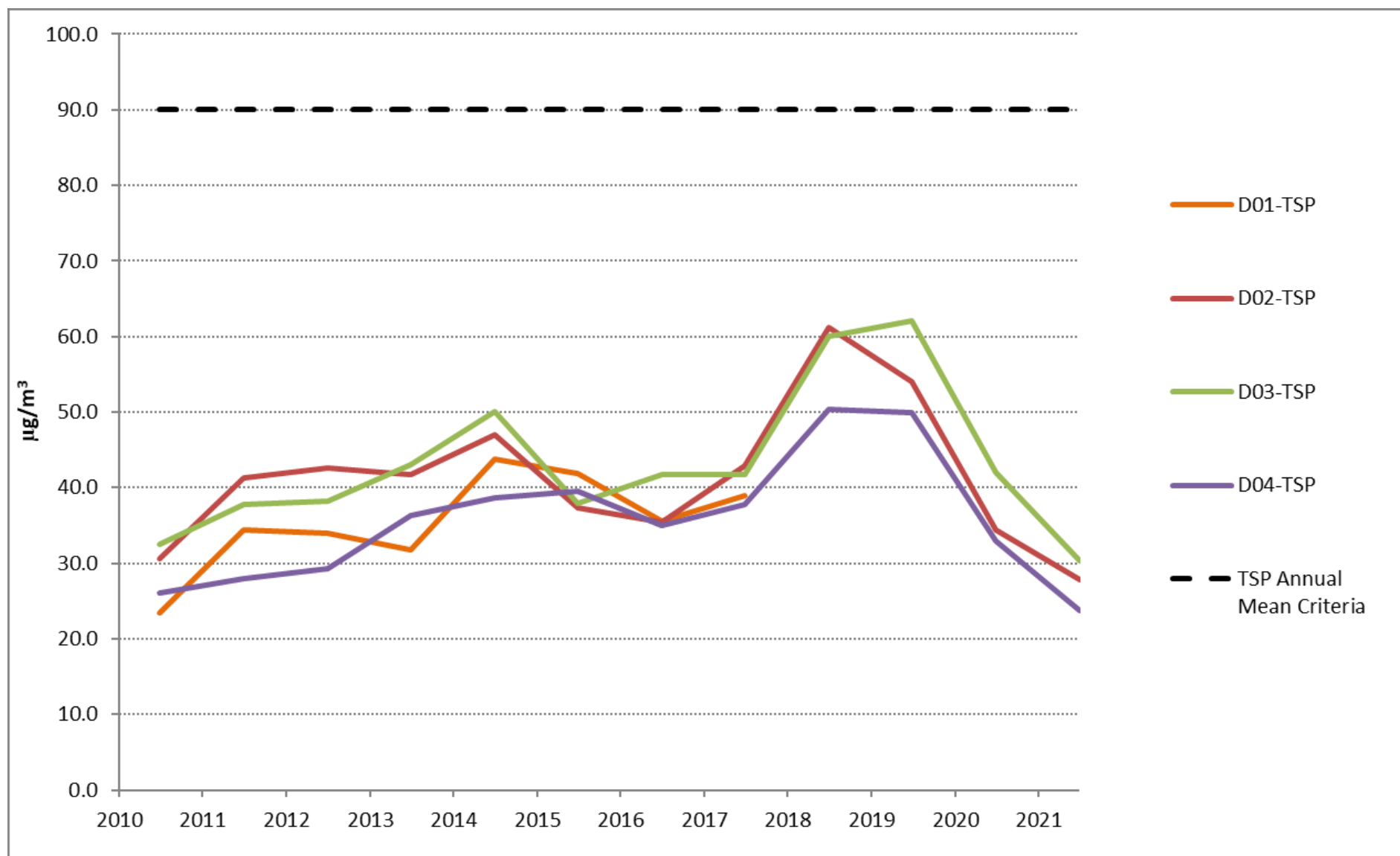
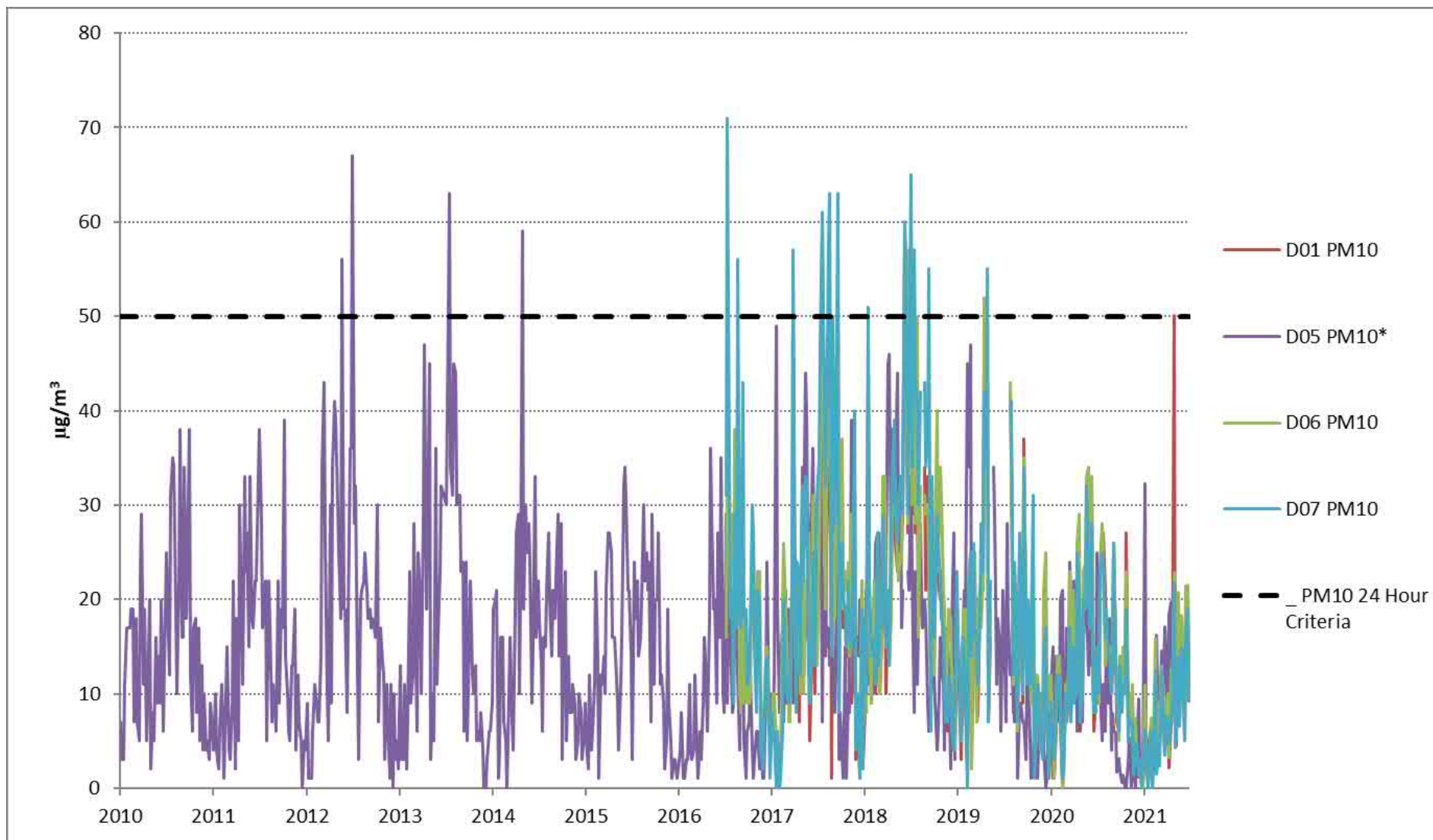


Figure 26 Long Term Annual Average TSP HVAS Monitoring Results – 2010 to 2021



* Note that D05-PM10 is the only monitor representative of a private receptor.

Figure 27 Long Term 24h PM10 HVAS Monitoring Results – 2010 to 2021

APPENDIX D

Long Term Trends Graphs – Blasting

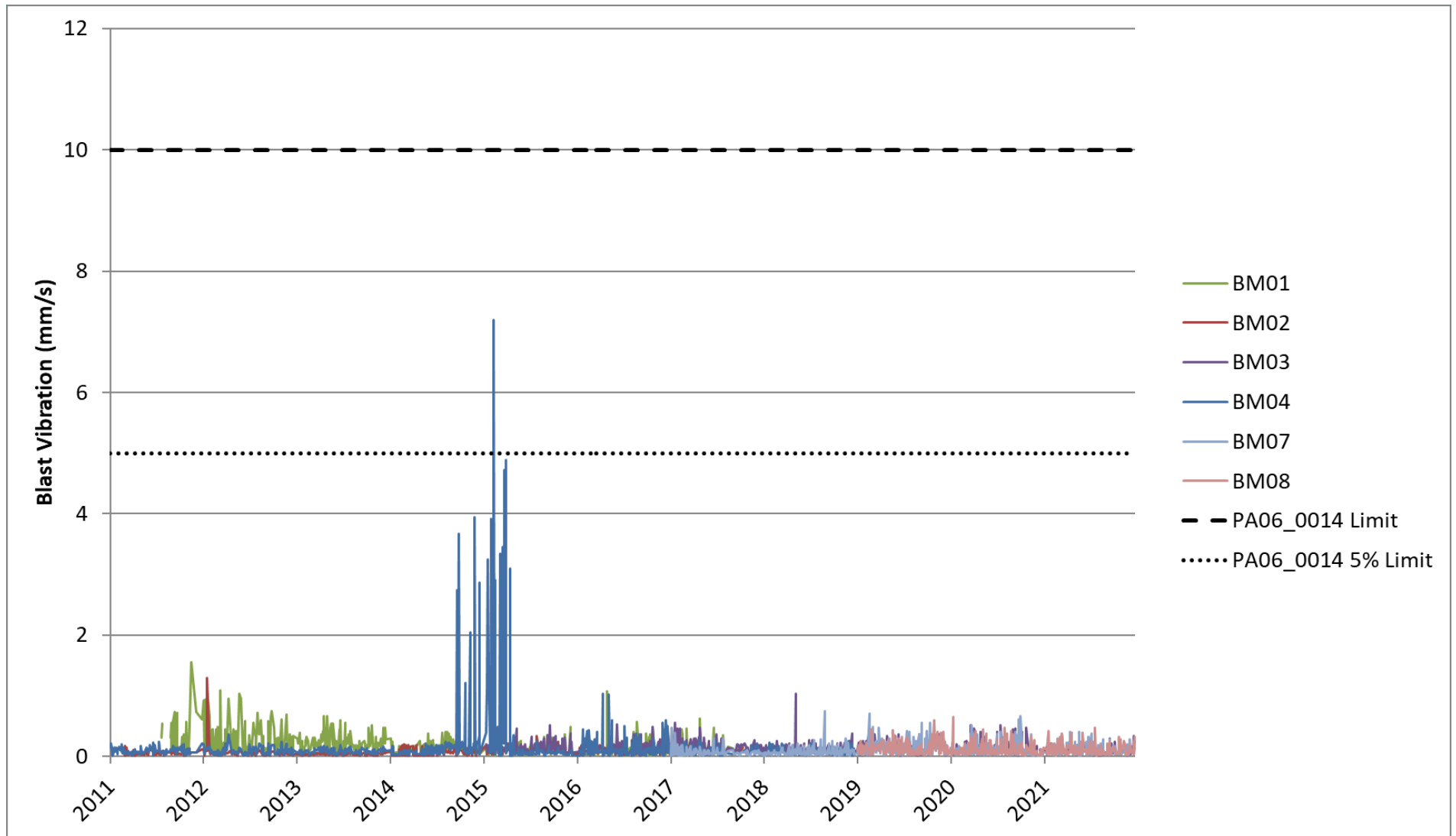


Figure 28 Long Term Blast Vibration Monitoring – BM01 to BM04 and BM07 to BM08

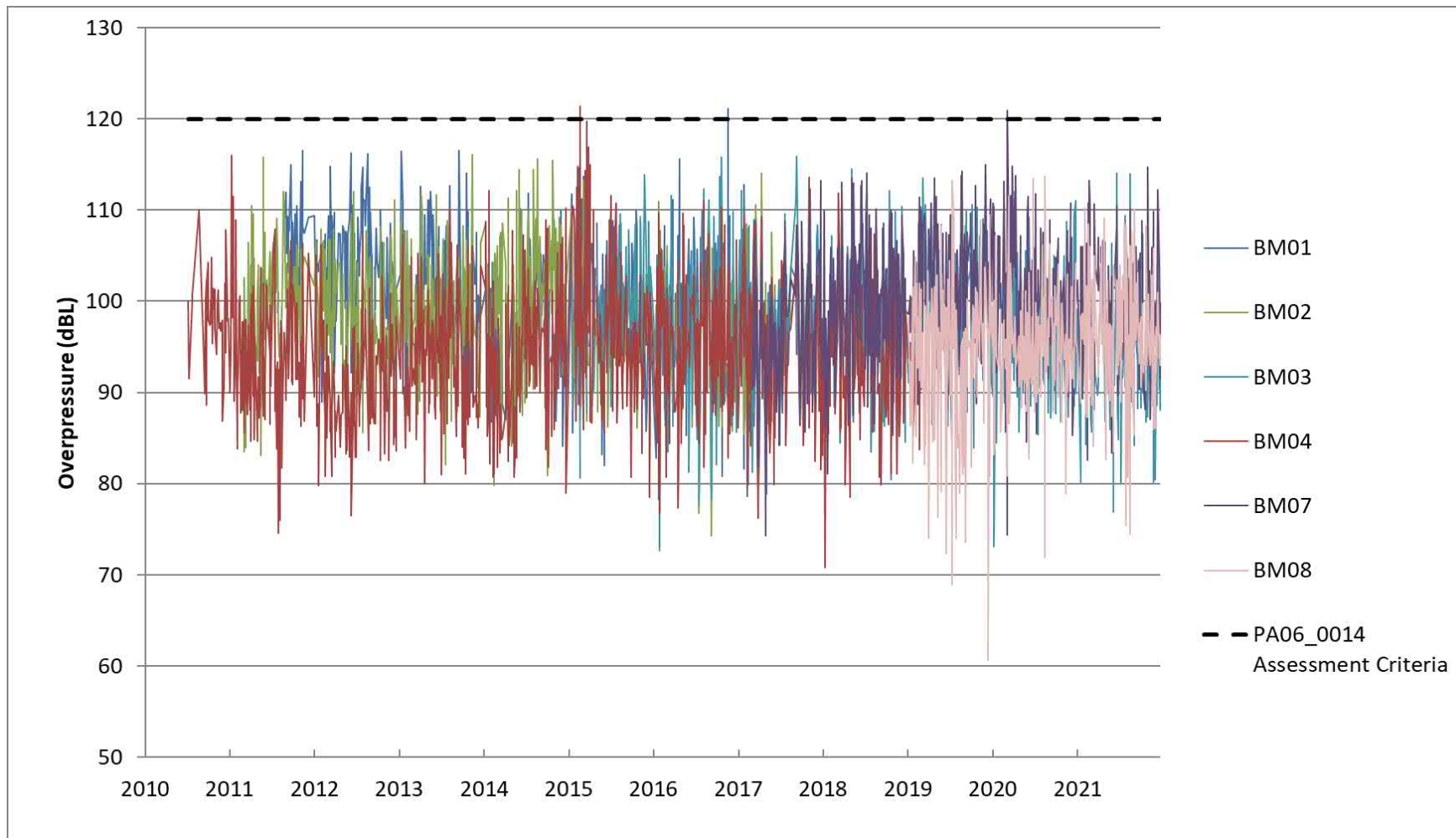


Figure 29 Long Term Overpressure Monitoring – BM01 to BM04 and BM07 to BM08

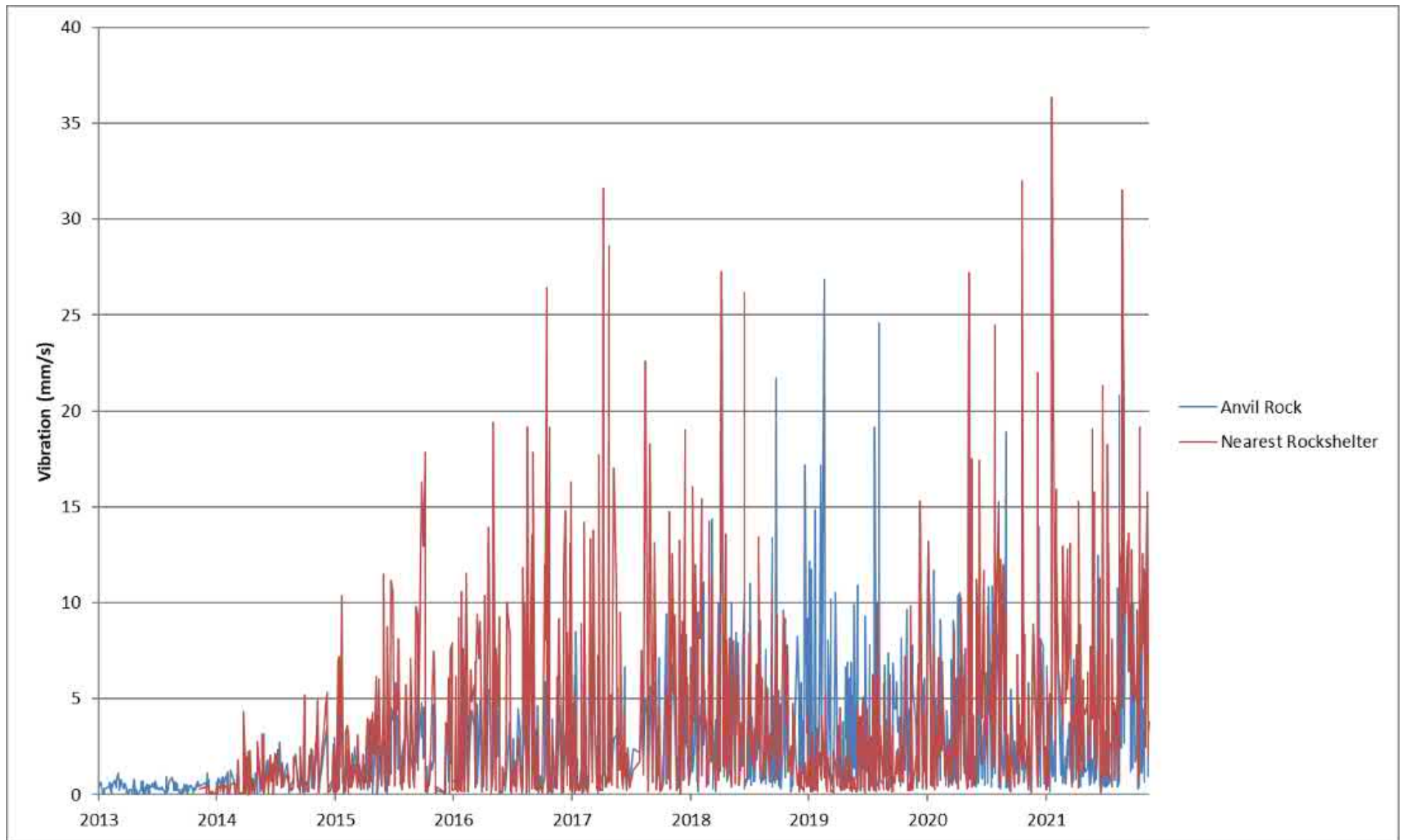


Figure 30 Long Term Blast Vibration Monitoring – Representative of Anvil Rock and Nearest Formation

APPENDIX E

Long Term Graphs – Surface and Groundwater

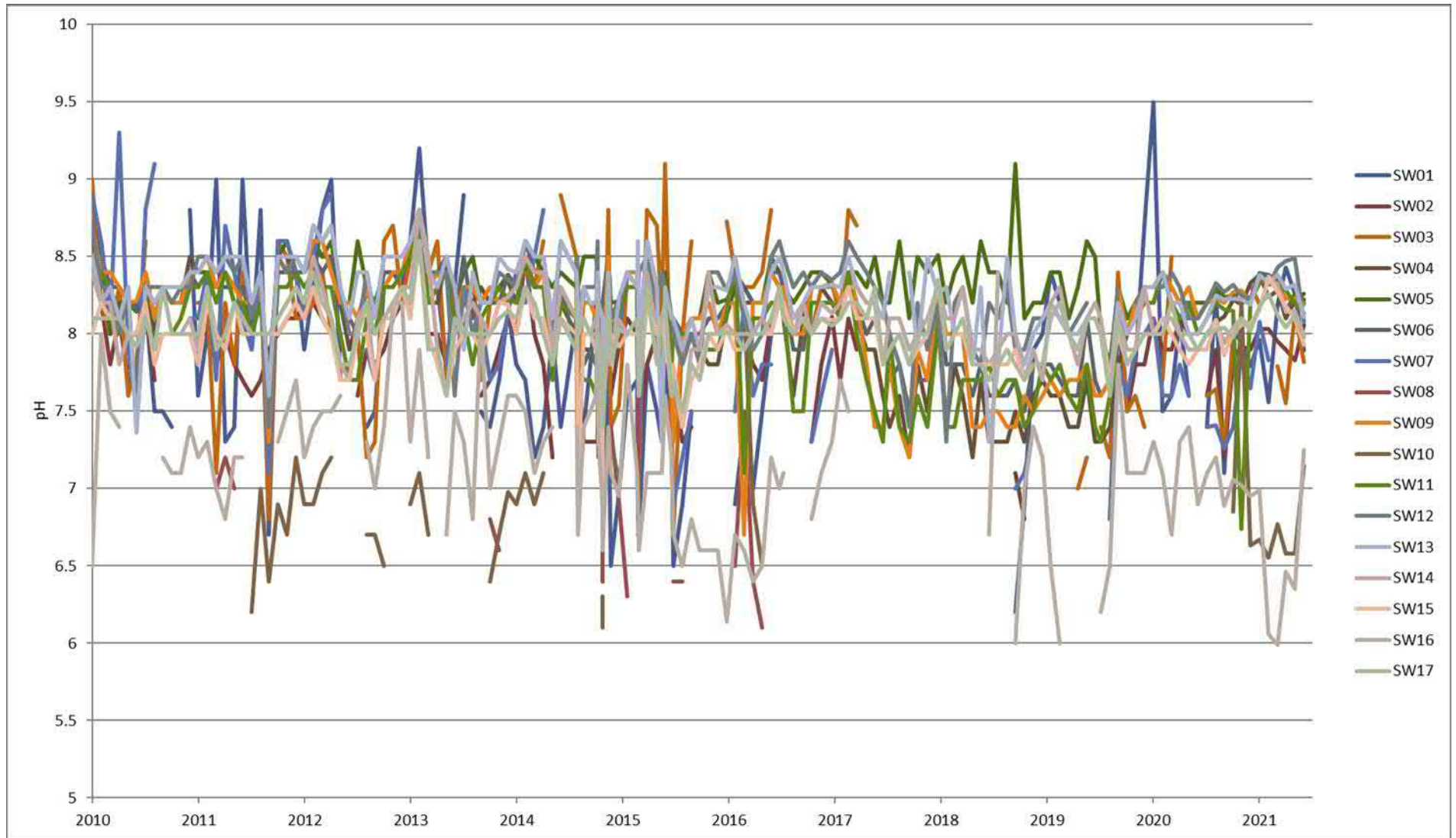


Figure 31 Long Term Surface Water pH – 2010 to 2021

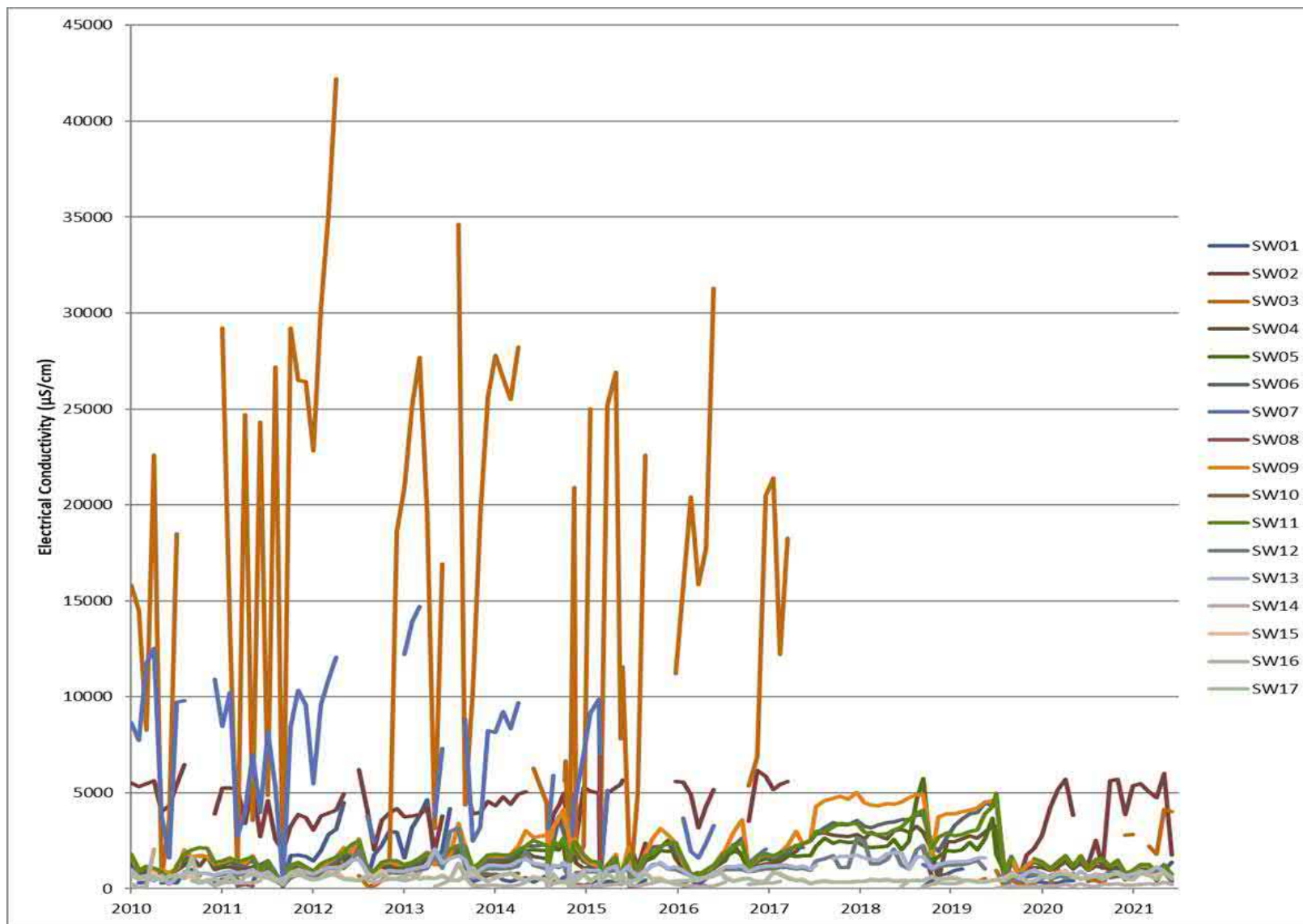


Figure 32 Long Term Surface Water EC – 2010 to 2021

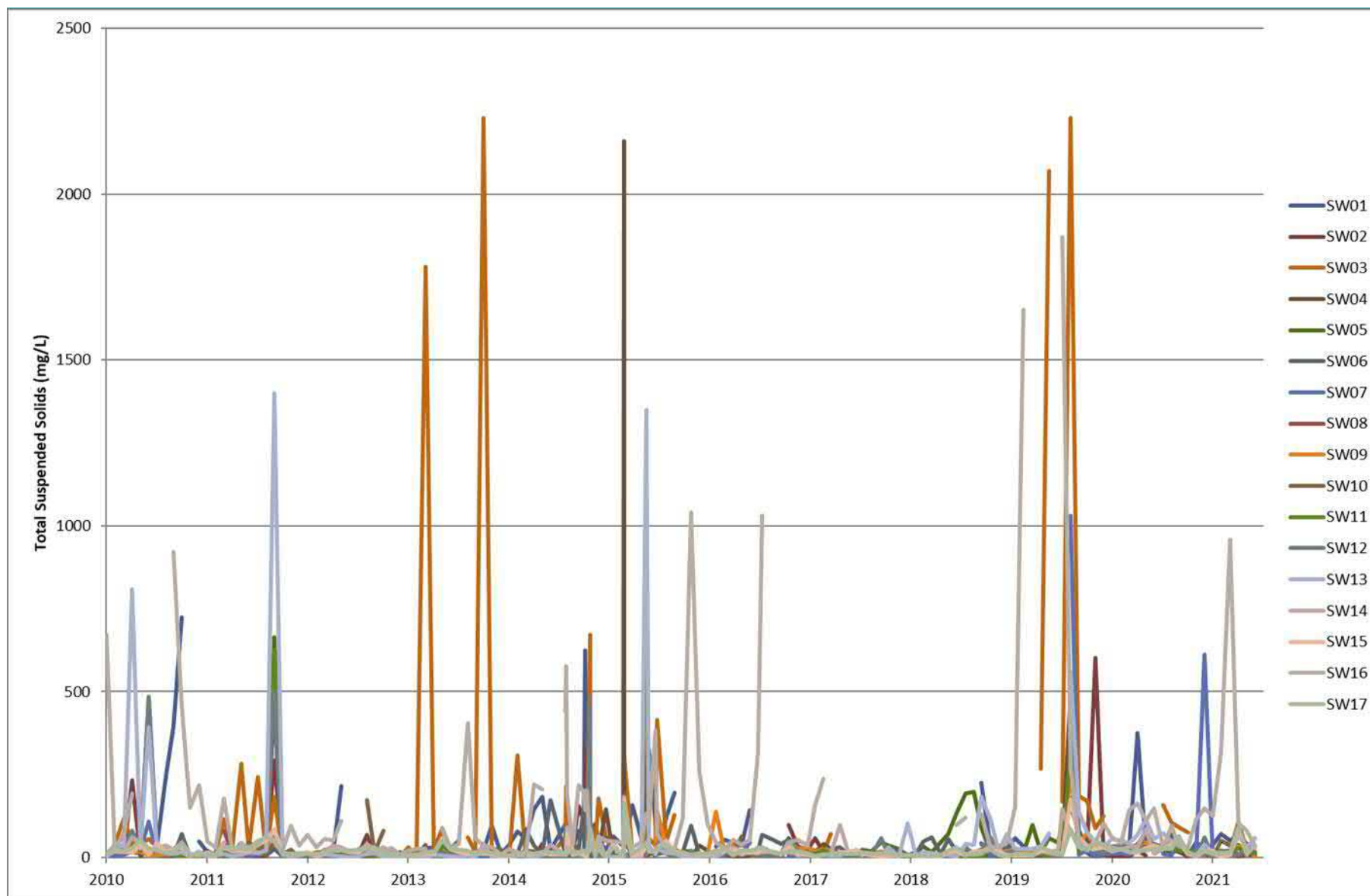


Figure 33 Long Term Surface Water TSS – 2010 to 2021

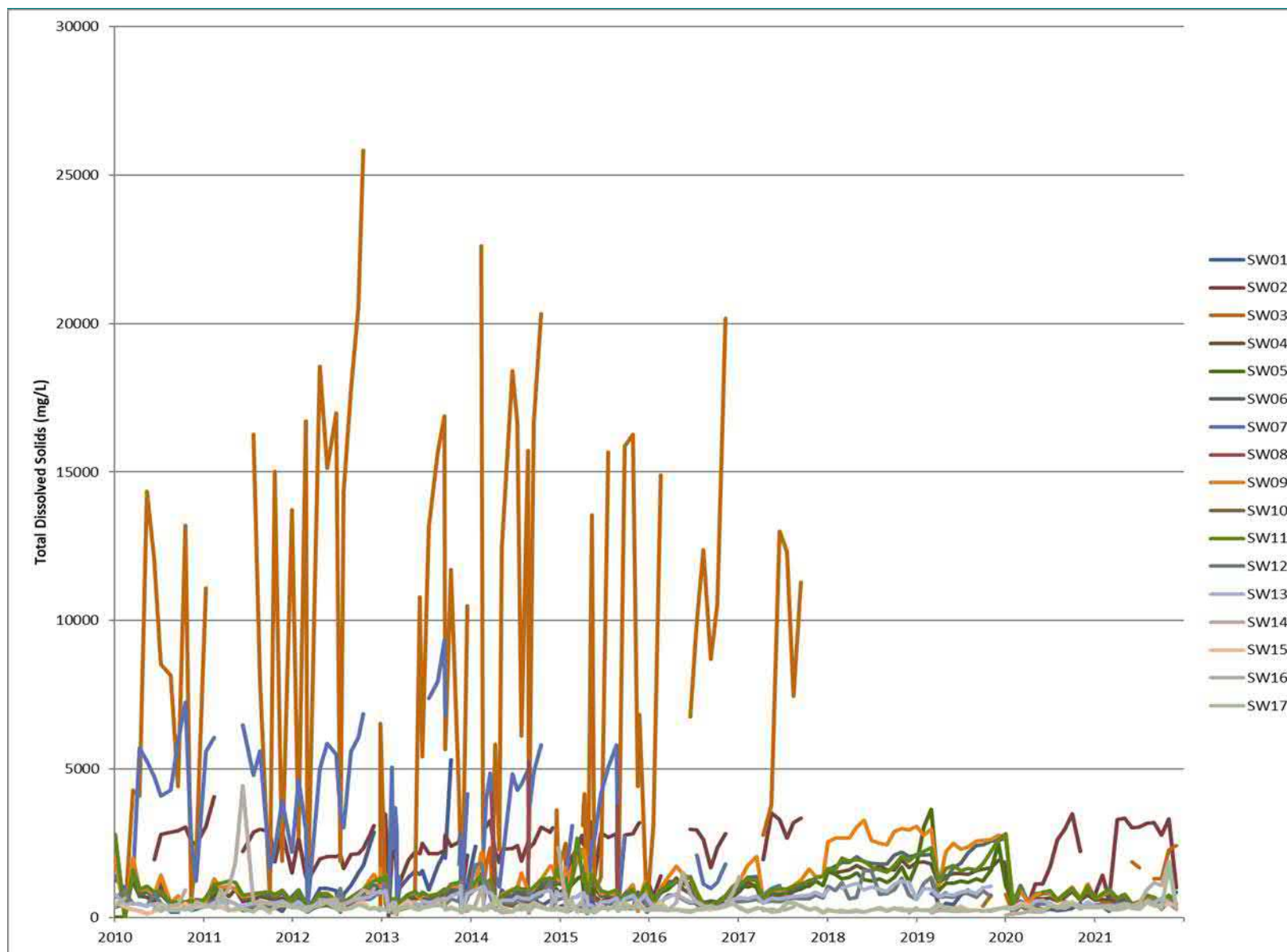


Figure 34 Long Term Surface Water TDS – 2010 to 2021

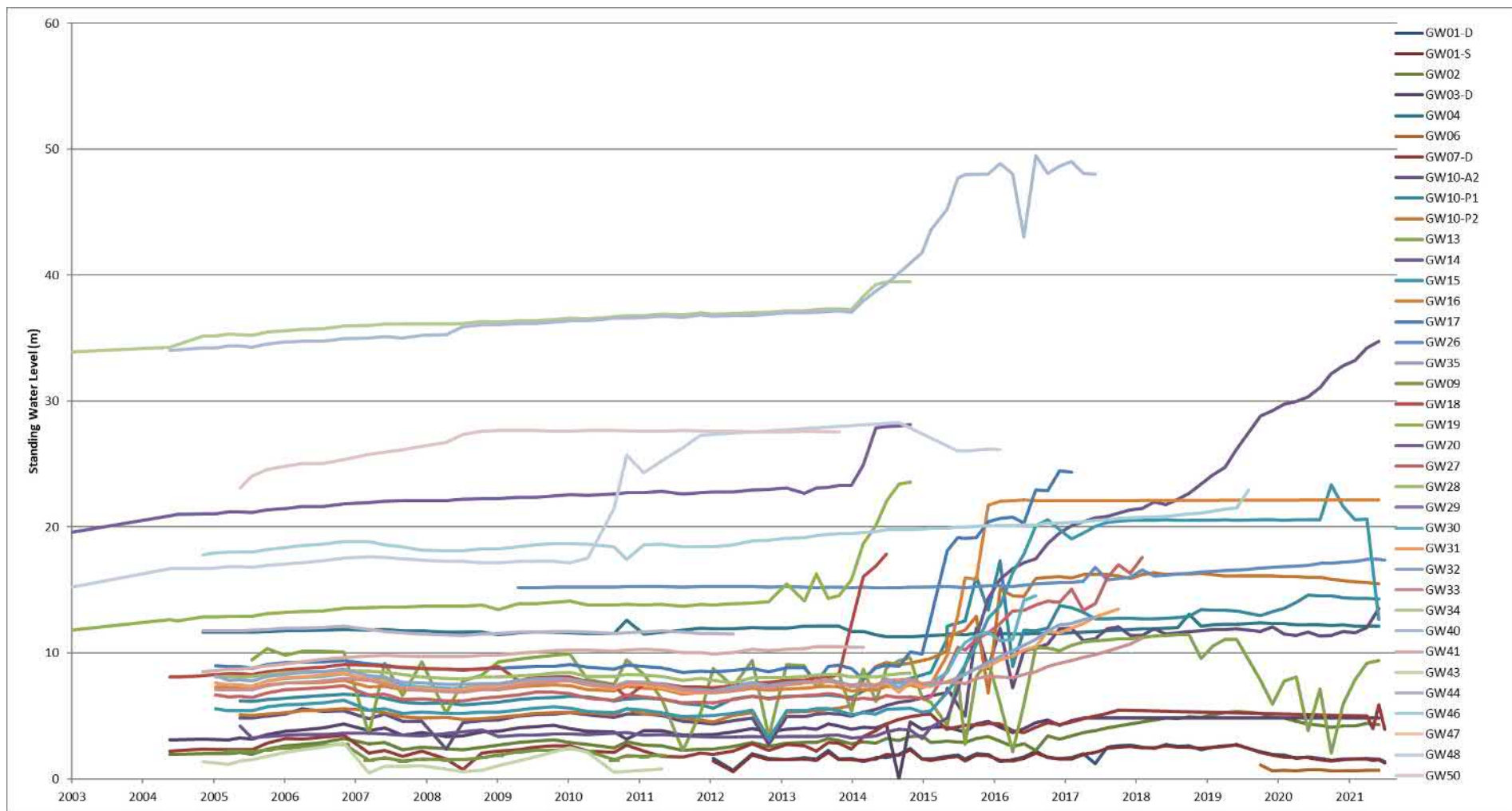


Figure 35 Standing Water Level GW Bores – 2003 to 2021

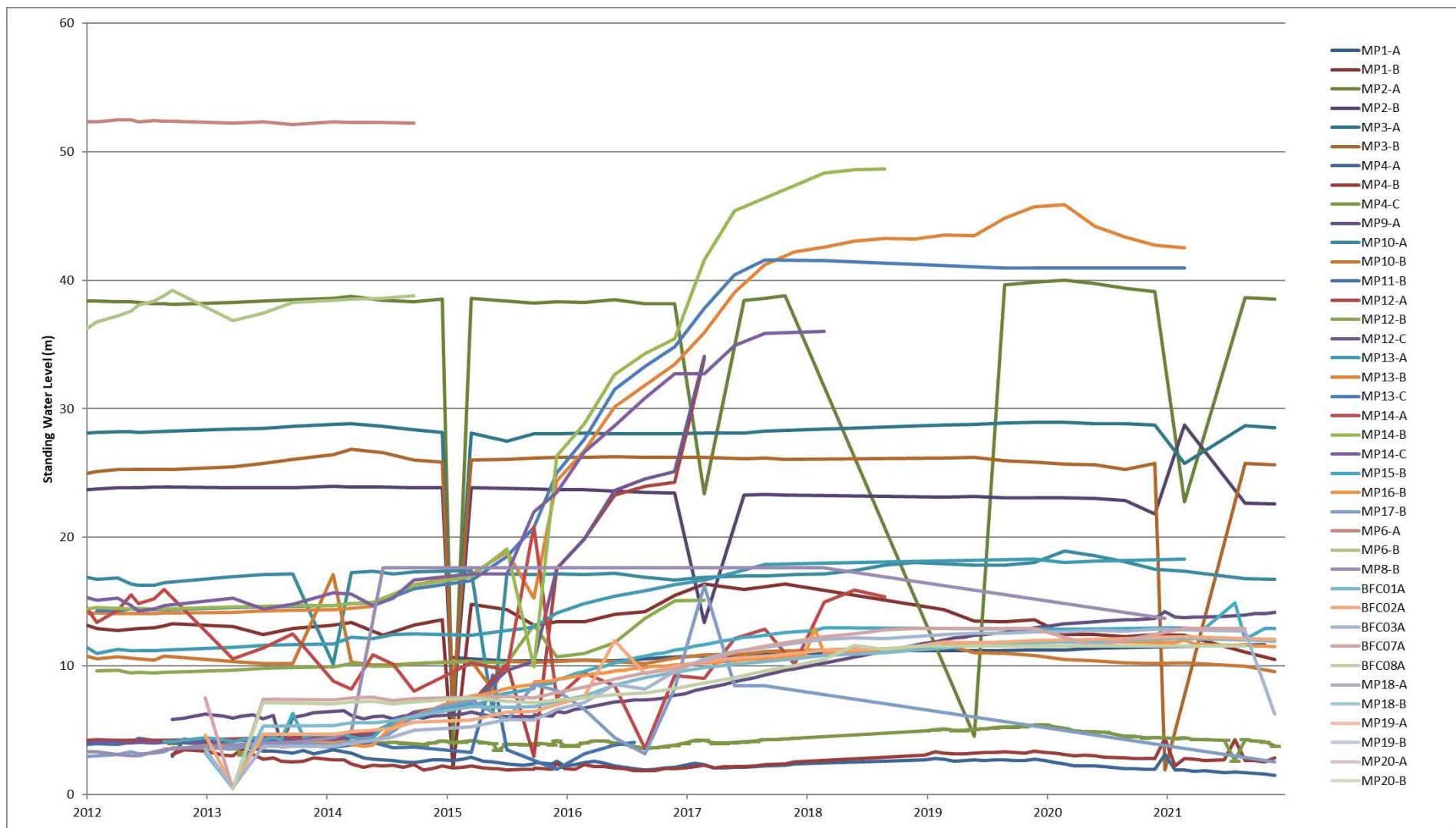


Figure 36 Standing Water Level MP and BFC Bores – 2012 to 2021

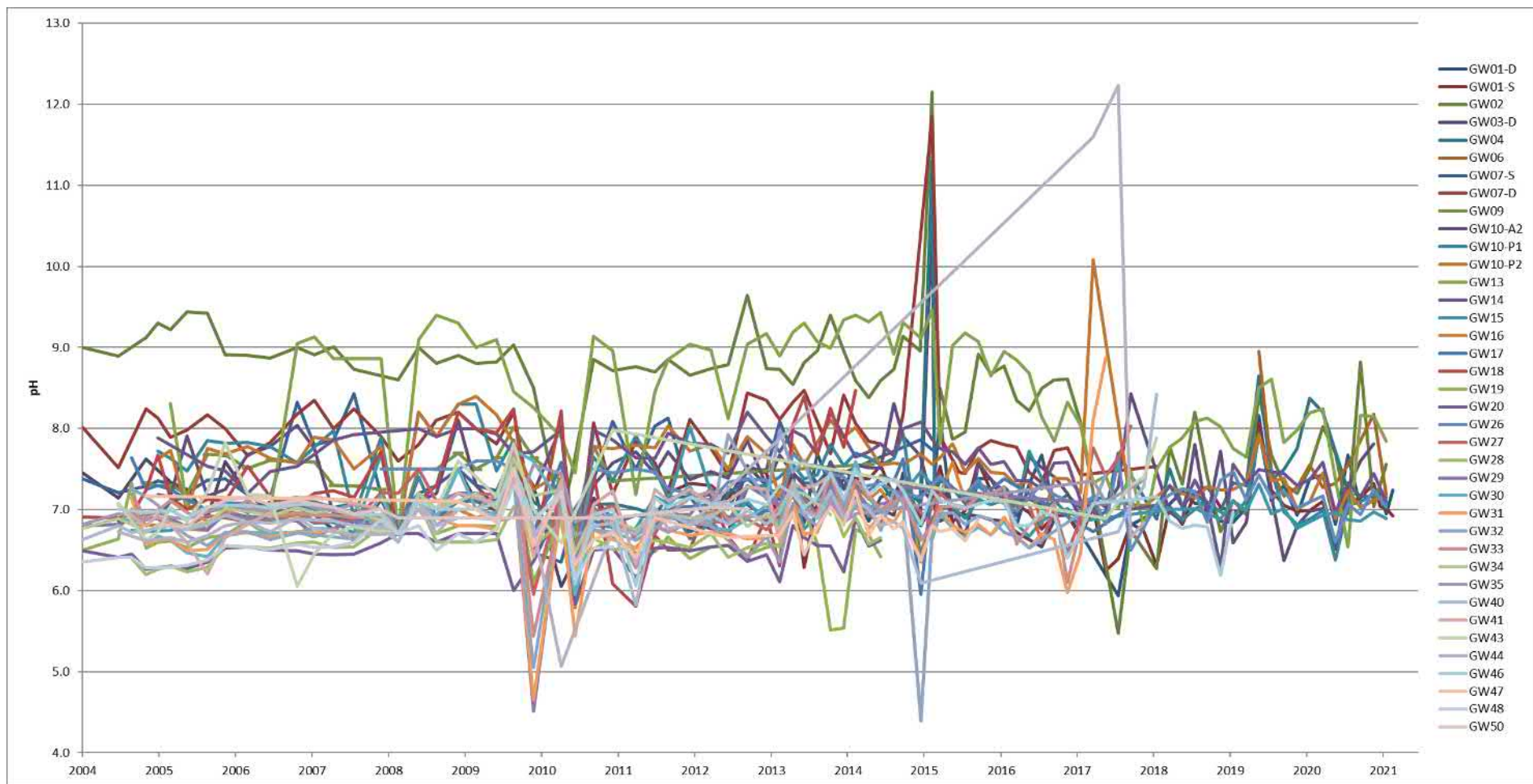


Figure 37 GW Bores pH – 2004 to 2021

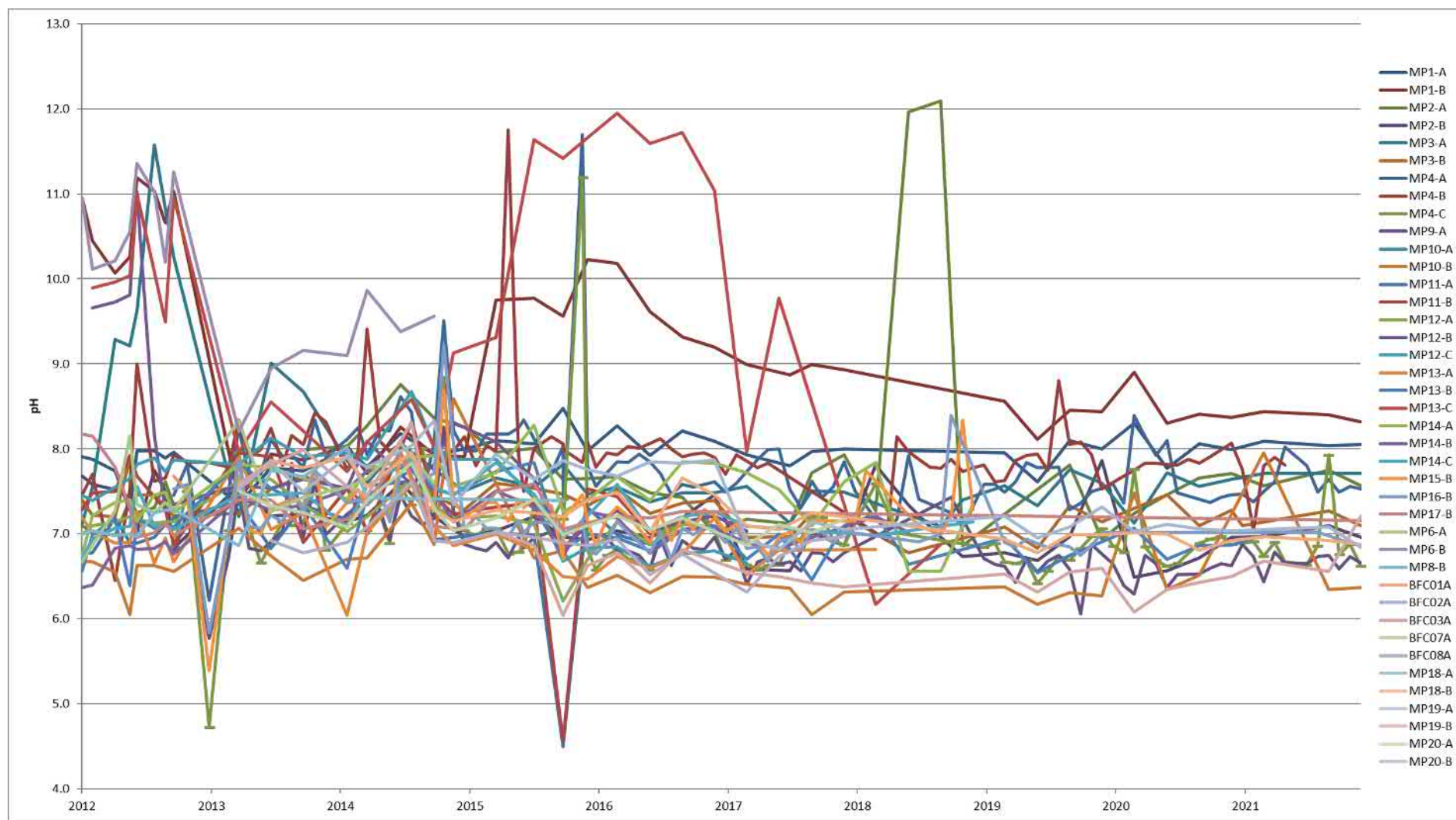


Figure 38 MP and BFC Bores pH – 2012 to 2021

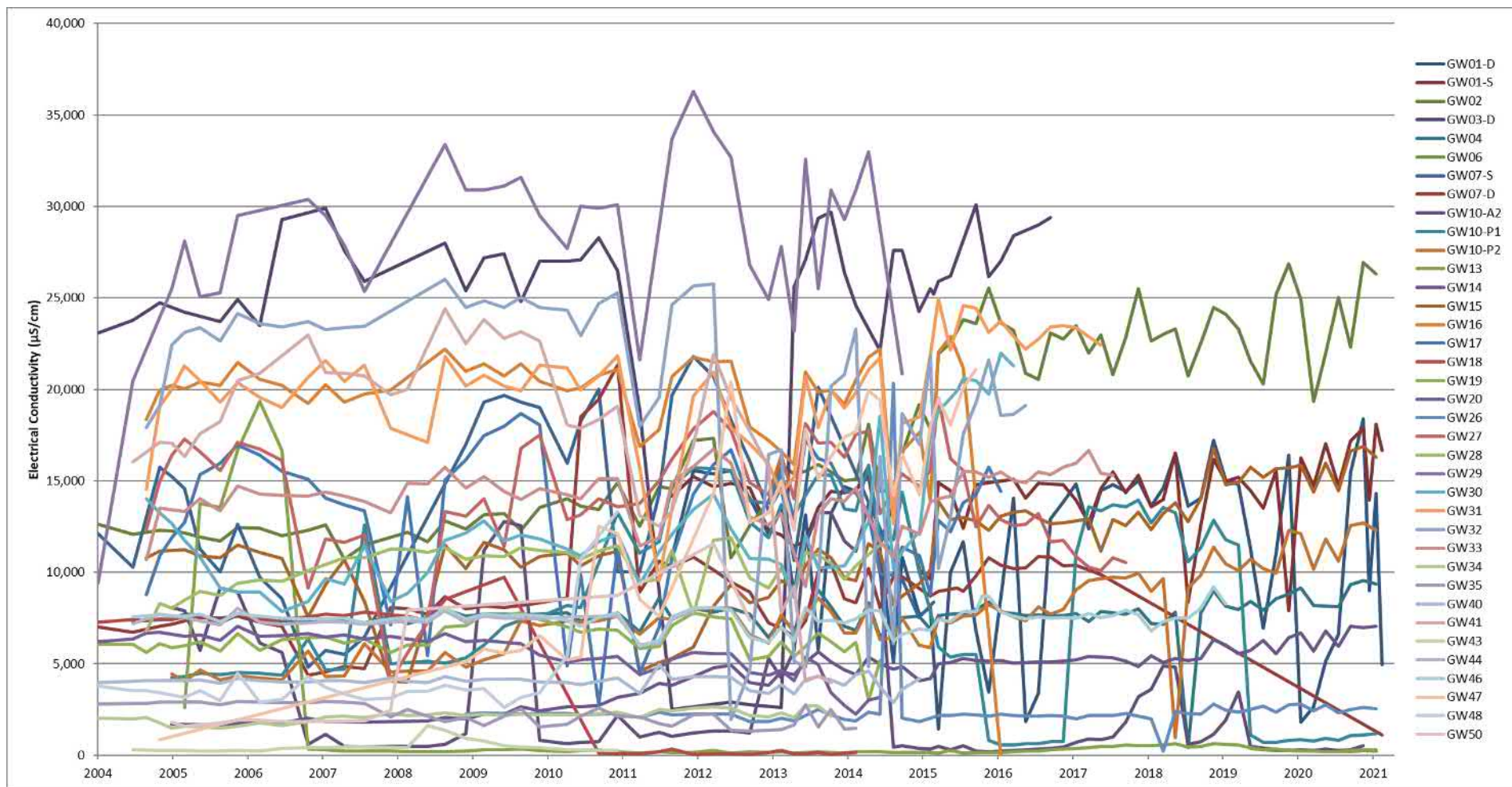


Figure 39 GW Bores EC – 2004 to 2021

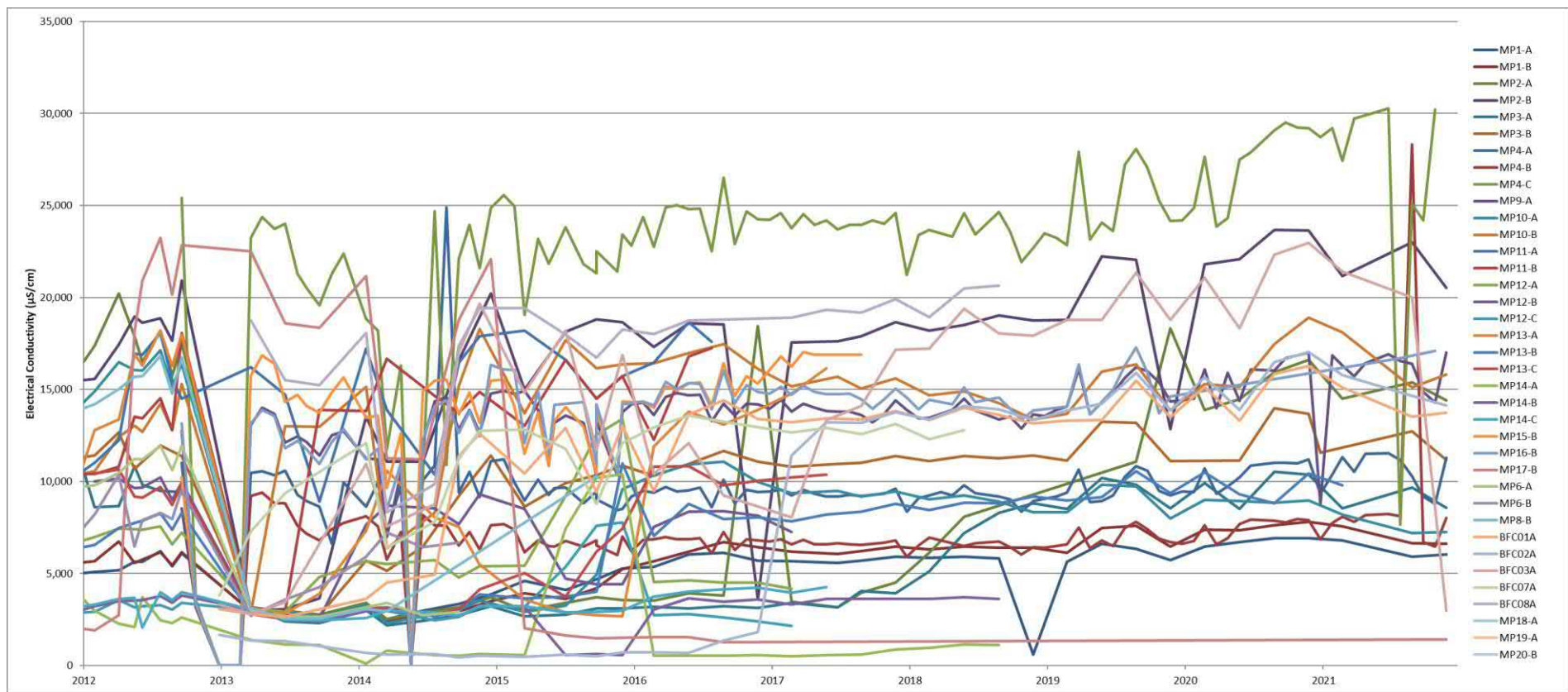


Figure 40 MP and BFC Bores EC – 2012 to 2021

APPENDIX F

Annual Train Movements 2021

Date and Time to Site	Date and Time from Site	Coal Transported (t)
01/01/2021 17:39	01-01-2021 20:01	9227
02/01/2021 03:31	02/01/2021 05:29	9234
02/01/2021 08:57	02/01/2021 11:48	9312
02/01/2021 14:31	02/01/2021 16:58	9104
04/01/2021 20:09	04/01/2021 22:48	9230
05/01/2021 03:55	05/01/2021 05:56	9315
06/01/2021 22:40	07/01/2021 00:48	8472
07/01/2021 09:03	07/01/2021 11:40	9305
07/01/2021 16:29	07/01/2021 18:15	9078
08/01/2021 10:34	08/01/2021 12:55	9137
08/01/2021 19:21	08/01/2021 22:05	9305
08/01/2021 23:00	09/01/2021 01:34	9141
09/01/2021 08:00	09/01/2021 09:50	9302
09/01/2021 13:04	09/01/2021 23:06	9128
10/01/2021 02:09	10/01/2021 08:51	9246
09/01/2021 23:30	10/01/2021 03:50	9211
10/01/2021 09:51	10/01/2021 13:39	9223
11/01/2021 01:05	11/01/2021 05:21	9296
11/01/2021 05:27	11/01/2021 08:13	9325
11/01/2021 09:36	11/01/2021 11:33	9300
11/01/2021 19:40	12/01/2021 00:03	9311
12/01/2021 07:14	12/01/2021 09:09	9227
12/01/2021 14:08	12/01/2021 17:16	9282
12/01/2021 21:17	12/01/2021 23:46	9300
12/01/2021 23:49	13/01/2021 02:14	9310
14/01/2021 08:08	14/01/2021 10:53	9227
14/01/2021 12:57	14/01/2021 14:58	9231
14/01/2021 19:19	14/01/2021 21:43	9282
16/01/2021 01:45	16/01/2021 03:52	8484
16/01/2021 15:15	16/01/2021 17:34	9058
17/01/2021 18:29	17/01/2021 20:31	9100
18/01/2021 18:19	18/01/2021 21:05	8498
19/01/2021 10:19	19/01/2021 12:28	9223
19/01/2021 22:49	20/01/2021 01:16	9073
21/01/2021 08:41	21/01/2021 11:17	9196
22/01/2021 19:59	22/01/2021 21:59	9252
23/01/2021 04:09	23/01/2021 06:14	8463
23/01/2021 21:39	24/01/2021 00:30	9099
25/01/2021 07:01	25/01/2021 09:16	8385
26/01/2021 11:00	26/01/2021 13:29	9051
27/01/2021 02:50	27/01/2021 05:24	8509

Date and Time to Site	Date and Time from Site	Coal Transported (t)
27/01/2021 22:35	28/01/2021 00:33	9292
28/01/2021 07:07	28/01/2021 09:20	9116
28/01/2021 20:18	28/01/2021 22:23	9306
29/01/2021 22:29	30/01/2021 00:30	9234
30/01/2021 02:16	30/01/2021 04:27	8408
30/01/2021 08:27	30/01/2021 10:55	9297
30/01/2021 13:15	30/01/2021 15:43	9295
30/01/2021 23:07	31/01/2021 01:08	9301
31/01/2021 13:06	31/01/2021 15:03	9278
01/02/2021 03:16	01/02/2021 05:32	9203
02/02/2021 04:54	02/02/2021 08:13	9315
02/02/2021 08:25	02/02/2021 10:22	9245
02/02/2021 23:51	03/02/2021 01:59	9312
04/02/2021 04:20	04/02/2021 06:44	9316
04/02/2021 09:43	04/02/2021 11:44	8488
04/02/2021 19:56	04/02/2021 21:49	9313
05/02/2021 00:16	05/02/2021 02:14	9310
05/02/2021 08:53	05/02/2021 11:07	9294
05/02/2021 11:12	05/02/2021 13:43	8493
05/02/2021 13:48	05/02/2021 16:08	9304
05/02/2021 19:34	05/02/2021 22:31	9297
06/02/2021 09:17	06/02/2021 11:09	9315
06/02/2021 11:21	06/02/2021 13:36	9239
06/02/2021 16:20	06/02/2021 18:45	9302
06/02/2021 22:20	07/02/2021 00:43	9312
07/02/2021 03:30	07/02/2021 06:37	9154
07/02/2021 06:45	07/02/2021 09:00	9326
07/02/2021 12:42	07/02/2021 14:33	9302
07/02/2021 14:50	07/02/2021 17:10	9289
07/02/2021 23:44	08/02/2021 01:43	9338
08/02/2021 01:55	08/02/2021 03:53	9140
08/02/2021 13:34	08/02/2021 16:09	8475
08/02/2021 20:09	08/02/2021 22:01	9130
12/02/2021 04:02	12/02/2021 09:38	9128
12/02/2021 15:35	12/02/2021 17:25	9321
14/02/2021 05:20	14/02/2021 08:09	9311
14/02/2021 12:47	14/02/2021 14:41	9136
15/02/2021 01:03	15/02/2021 03:07	9303
15/02/2021 17:07	15/02/2021 20:50	9275
16/02/2021 06:12	16/02/2021 09:56	8499
16/02/2021 09:37	16/02/2021 12:06	9126
18/02/2021 00:41	18/02/2021 02:42	9275

Date and Time to Site	Date and Time from Site	Coal Transported (t)
18/02/2021 07:22	18/02/2021 09:49	9302
18/02/2021 16:53	18/02/2021 19:25	8485
19/02/2021 00:41	19/02/2021 02:43	9138
19/02/2021 14:40	19/02/2021 16:48	9227
20/02/2021 00:17	20/02/2021 03:32	9291
21/02/2021 10:09	21/02/2021 12:51	8484
23/02/2021 12:42	23/02/2021 14:29	9302
23/02/2021 17:04	23/02/2021 18:54	8471
23/02/2021 23:31	24/02/2021 01:31	9307
26/02/2021 01:13	26/02/2021 03:15	9291
26/02/2021 05:51	26/02/2021 08:05	9151
26/02/2021 10:22	26/02/2021 12:15	9299
26/02/2021 18:56	26/02/2021 21:12	9308
27/02/2021 00:06	27/02/2021 02:13	9308
27/02/2021 05:58	27/02/2021 07:49	9299
28/02/2021 01:08	28/02/2021 02:52	9306
28/02/2021 02:54	28/02/2021 04:54	9307
28/02/2021 08:32	28/02/2021 10:23	9087
28/02/2021 13:01	28/02/2021 14:57	9306
01/03/2021 01:22	01/03/2021 04:00	9297
01/03/2021 10:32	01/03/2021 12:35	9119
05/03/2021 12:40	05/03/2021 14:52	9290
06/03/2021 02:55	06/03/2021 05:02	9315
06/03/2021 09:58	06/03/2021 13:12	9299
06/03/2021 15:39	06/03/2021 17:51	8474
06/03/2021 18:55	06/03/2021 20:44	9139
07/03/2021 19:16	07/03/2021 22:45	9272
07/03/2021 22:46	08/03/2021 01:09	9106
08/03/2021 07:01	08/03/2021 09:00	9309
08/03/2021 12:29	08/03/2021 16:54	9227
09/03/2021 04:54	09/03/2021 07:34	9330
09/03/2021 08:59	09/03/2021 11:03	9250
10/03/2021 12:25	10/03/2021 14:23	8489
11/03/2021 12:12	11/03/2021 14:23	8489
11/03/2021 15:26	11/03/2021 17:07	9114
12/03/2021 05:21	12/03/2021 07:38	9248
12/03/2021 12:30	12/03/2021 14:52	9133
13/03/2021 04:55	13/03/2021 08:10	8496
13/03/2021 11:19	13/03/2021 13:53	9128
14/03/2021 02:25	14/03/2021 04:20	9234
14/03/2021 05:32	14/03/2021 07:14	9089
14/03/2021 09:48	14/03/2021 12:09	9324

Date and Time to Site	Date and Time from Site	Coal Transported (t)
14/03/2021 12:22	14/03/2021 14:13	9298
16/03/2021 00:20	16/03/2021 02:42	9295
16/03/2021 02:45	16/03/2021 05:13	8499
16/03/2021 11:15	16/03/2021 13:08	9241
16/03/2021 19:22	16/03/2021 22:01	9289
17/03/2021 19:42	17/03/2021 21:39	9330
17/03/2021 23:31	18/03/2021 01:27	9151
18/03/2021 02:09	18/03/2021 05:19	9309
18/03/2021 08:00	18/03/2021 10:13	9289
18/03/2021 17:08	18/03/2021 20:24	9295
18/03/2021 23:20	19/03/2021 01:30	9233
19-03-2021 13:45	19/03/2021 15:35	9223
19/03/2021 22:07	20/03/2021 00:24	9234
20/03/2021 07:08	20/03/2021 09:21	9250
21/03/2021 06:38	21/03/2021 09:04	9250
21/03/2021 19:23	21/03/2021 21:32	9254
22/03/2021 01:49	22/03/2021 04:03	9249
22/03/2021 21:10	22/03/2021 23:11	9268
23/03/2021 01:31	23/03/2021 03:54	8473
23/03/2021 10:56	23/03/2021 14:26	9179
23/03/2021 15:30	23/03/2021 17:26	9244
24/03/2021 15:32	24/03/2021 17:57	8461
24/03/2021 23:12	25/03/2021 01:41	9240
25/03/2021 05:24	25/03/2021 07:43	8487
26/03/2021 00:56	26/03/2021 03:24	9329
26/03/2021 03:49	26/03/2021 05:54	8499
26/03/2021 07:01	26/03/2021 10:03	9234
27/03/2021 07:31	27/03/2021 09:30	9305
27/03/2021 12:50	27/03/2021 15:06	9289
28/03/2021 05:36	28/03/2021 07:29	8485
28/03/2021 08:57	28/03/2021 10:52	9314
28/03/2021 18:45	28/03/2021 21:13	9342
28/03/2021 21:45	28/03/2021 23:57	9300
29/03/2021 02:47	29/03/2021 05:02	9083
29/03/2021 12:30	29/03/2021 15:10	9283
30/03/2021 07:24	30/03/2021 09:46	9263
30/03/2021 09:50	30/03/2021 12:14	9292
31/03/2021 19:39	31/03/2021 21:21	9312
01/04/2021 20:03	01/04/2021 22:01	9329
01/04/2021 22:06	02/04/2021 00:34	9249
02/04/2021 12:06	02/04/2021 15:34	9139
02/04/2021 15:36	02/04/2021 17:31	9301

Date and Time to Site	Date and Time from Site	Coal Transported (t)
02/04/2021 21:13	03/04/2021 00:41	9289
03/04/2021 06:07	03/04/2021 08:57	8473
03/04/2021 11:59	03/04/2021 14:11	9273
04/04/2021 02:26	04/04/2021 04:44	9285
04/04/2021 07:02	04/04/2021 08:57	9244
04/04/2021 09:54	04/04/2021 11:43	9288
04/04/2021 13:00	04/04/2021 15:12	9295
04/04/2021 16:04	04/04/2021 18:37	9298
04/04/2021 21:10	04/04/2021 23:01	9327
05/04/2021 06:30	05/04/2021 08:28	8483
05/04/2021 08:41	05/04/2021 10:32	9311
05/04/2021 15:36	05/04/2021 17:38	9119
06/04/2021 10:13	06/04/2021 12:05	9237
07/04/2021 00:16	07/04/2021 02:49	9079
07/04/2021 06:10	07/04/2021 09:35	9137
07/04/2021 20:50	07/04/2021 22:38	9309
08/04/2021 20:56	08/04/2021 23:00	9237
09/04/2021 01:40	09/04/2021 03:41	9246
11/04/2021 04:35	11/04/2021 06:37	9272
12/04/2021 06:03	12/04/2021 09:15	9254
14/04/2021 07:15	14/04/2021 09:30	8488
16/04/2021 12:04	16/04/2021 13:52	9131
17/04/2021 07:24	17/04/2021 10:23	9309
17/04/2021 10:25	17/04/2021 13:02	9308
17/04/2021 15:25	17/04/2021 17:25	9310
17/04/2021 20:46	17/04/2021 22:53	9240
17/04/2021 23:03	18/04/2021 00:58	9143
18/04/2021 11:14	18/04/2021 13:54	9128
18/04/2021 21:27	19/04/2021 00:11	9295
19/04/2021 13:20	19/04/2021 15:51	9135
20/04/2021 02:18	20/04/2021 04:13	9083
20/04/2021 04:23	20/04/2021 06:17	9258
21/04/2021 03:01	21/04/2021 04:59	8478
21/04/2021 19:56	21/04/2021 23:07	9332
21/04/2021 23:12	22/04/2021 01:36	9317
23/04/2021 04:06	23/04/2021 07:37	9335
23/04/2021 09:03	23/04/2021 10:52	9300
24/04/2021 15:05	24/04/2021 17:06	9134
24/04/2021 17:38	24/04/2021 19:42	9303
25/04/2021 01:50	25/04/2021 04:22	8499
24/04/2021 23:12	25/04/2021 01:46	9287
25/04/2021 19:35	25/04/2021 21:36	9125

Date and Time to Site	Date and Time from Site	Coal Transported (t)
26/04/2021 00:15	26/04/2021 02:58	9271
26/04/2021 03:09	26/04/2021 05:21	9254
26/04/2021 08:13	26/04/2021 10:17	9154
26/04/2021 14:44	26/04/2021 17:27	9316
26/04/2021 23:11	27/04/2021 01:01	9308
27/04/2021 01:02	27/04/2021 03:01	9155
30/04/2021 10:17	30/04/2021 12:21	9293
30/04/2021 12:41	30/04/2021 14:42	8477
30/04/2021 22:02	01/05/2021 00:01	9312
01/05/2021 00:02	01/05/2021 02:02	8501
01/05/2021 05:58	01/05/2021 08:06	9303
01/05/2021 14:32	01/05/2021 17:09	8466
02/05/2021 08:24	02/05/2021 10:15	9155
02/05/2021 20:46	02/05/2021 23:04	8451
03/05/2021 00:28	03/05/2021 02:29	9259
03/05/2021 04:35	03/05/2021 06:26	9166
03/05/2021 08:33	03/05/2021 10:22	9295
03/05/2021 22:03	04/05/2021 00:07	9209
04/05/2021 00:09	04/05/2021 02:04	9295
04/05/2021 07:13	04/05/2021 09:19	8477
04/05/2021 03:19	04/05/2021 05:31	9323
04/05/2021 12:00	04/05/2021 13:58	9153
04/05/2021 14:36	04/05/2021 16:58	9322
04/05/2021 20:22	04/05/2021 22:11	9292
05/05/2021 03:19	05/05/2021 05:12	9326
05/05/2021 07:10	05/05/2021 10:28	9273
05/05/2021 11:43	05/05/2021 14:00	9311
05/05/2021 15:49	05/05/2021 17:45	9082
06/05/2021 03:58	06/05/2021 05:53	9250
06/05/2021 12:05	06/05/2021 14:17	9295
06/05/2021 15:25	06/05/2021 17:40	9134
06/05/2021 21:51	07/05/2021 00:35	9095
07/05/2021 02:17	07/05/2021 04:17	9137
08/05/2021 03:33	08/05/2021 05:28	9107
08/05/2021 08:53	08/05/2021 11:09	9308
08/05/2021 12:33	08/05/2021 14:28	9249
09/05/2021 13:08	09/05/2021 16:00	9296
09/05/2021 23:40	10/05/2021 01:44	9332
10/05/2021 08:04	10/05/2021 09:57	9307
10/05/2021 13:06	10/05/2021 14:51	9240
10/05/2021 17:45	10/05/2021 20:51	9299
10/05/2021 22:55	11/05/2021 00:54	9317

Date and Time to Site	Date and Time from Site	Coal Transported (t)
11/05/2021 10:32	11/05/2021 12:40	8495
11/05/2021 13:04	11/05/2021 15:00	9305
12/05/2021 04:15	12/05/2021 07:15	9315
12/05/2021 20:27	12/05/2021 22:16	9328
13/05/2021 02:16	13/05/2021 04:15	9313
13/05/2021 12:57	13/05/2021 14:58	9239
13/05/2021 15:47	13/05/2021 17:35	9337
13/05/2021 21:03	13/05/2021 23:37	9326
14/05/2021 07:20	14/05/2021 09:18	9102
14/05/2021 04:00	14/05/2021 05:47	8524
14/05/2021 13:27	14/05/2021 17:18	9143
15/05/2021 20:27	15/05/2021 22:23	9262
16/05/2021 07:26	16/05/2021 09:57	9150
16/05/2021 14:02	16/05/2021 16:05	8485
16/05/2021 16:57	16/05/2021 18:48	9314
16/05/2021 19:29	16/05/2021 21:29	8490
18/05/2021 20:37	18/05/2021 22:29	8483
19/05/2021 11:32	19/05/2021 13:13	9300
20/05/2021 00:54	20/05/2021 05:06	9321
20/05/2021 05:09	20/05/2021 07:28	9156
20/05/2021 11:51	20/05/2021 13:46	9291
21/05/2021 11:41	21/05/2021 14:14	9322
22/05/2021 04:30	22/05/2021 06:26	9315
22/05/2021 08:45	22/05/2021 10:30	9295
22/05/2021 11:19	22/05/2021 13:24	9288
22/05/2021 13:36	22/05/2021 15:30	8475
22/05/2021 22:22	23/05/2021 00:19	9301
23/05/2021 08:56	23/05/2021 10:48	9304
23/05/2021 13:01	23/05/2021 14:49	9310
24/05/2021 02:48	24/05/2021 04:57	8495
24/05/2021 05:02	24/05/2021 07:16	9103
24/05/2021 12:13	24/05/2021 14:13	9307
24/05/2021 14:27	24/05/2021 16:24	9141
24/05/2021 16:50	24/05/2021 19:29	9315
24/05/2021 20:37	24/05/2021 22:40	9268
27/05/2021 22:25	28/05/2021 01:30	9217
28/05/2021 09:34	28/05/2021 13:21	9301
28/05/2021 13:23	28/05/2021 15:48	9151
28/05/2021 19:27	28/05/2021 23:02	8493
29/05/2021 03:59	29/05/2021 07:22	9140
30/05/2021 09:23	30/05/2021 12:25	9085
31/05/2021 05:37	31/05/2021 09:10	9293

Date and Time to Site	Date and Time from Site	Coal Transported (t)
01/06/2021 07:43	01/06/2021 09:33	8507
01/06/2021 09:49	01/06/2021 11:56	9317
02/06/2021 04:08	02/06/2021 06:34	9092
02/06/2021 13:31	02/06/2021 15:36	8504
04/06/2021 09:40	04/06/2021 11:24	9317
05/06/2021 00:56	05/06/2021 02:44	9096
06/06/2021 11:29	06/06/2021 13:56	9293
06/06/2021 19:55	06/06/2021 22:15	9330
07/06/2021 13:27	07/06/2021 16:06	9308
08/06/2021 20:35	08/06/2021 22:46	8464
10/06/2021 06:54	10/06/2021 09:42	9312
10/06/2021 12:32	10/06/2021 14:37	8499
11/06/2021 15:29	11/06/2021 18:19	9096
11/06/2021 18:46	11/06/2021 21:17	9321
11/06/2021 21:22	11/06/2021 23:46	9317
12/06/2021 02:12	12/06/2021 05:16	9295
12/06/2021 07:52	12/06/2021 10:00	9097
12/06/2021 16:56	12/06/2021 18:50	9306
12/06/2021 23:23	13/06/2021 01:14	9323
13/06/2021 12:16	13/06/2021 14:17	9314
13/06/2021 18:13	13/06/2021 20:15	9154
14/06/2021 05:39	14/06/2021 09:40	9335
15/06/2021 07:56	15/06/2021 09:57	9145
15/06/2021 12:54	15/06/2021 14:51	9317
15/06/2021 20:18	15/06/2021 23:12	9154
16/06/2021 17:16	16/06/2021 19:25	8491
17/06/2021 01:12	17/06/2021 03:09	9154
17/06/2021 13:16	17/06/2021 15:03	8474
17/06/2021 19:26	17/06/2021 22:24	9328
18/06/2021 08:35	18/06/2021 10:45	8496
18/06/2021 12:34	18/06/2021 15:37	9312
18/06/2021 18:39	18/06/2021 20:42	9258
19/06/2021 03:25	19/06/2021 05:33	9322
19/06/2021 12:56	19/06/2021 14:53	8506
19/06/2021 20:24	19/06/2021 22:41	9154
20/06/2021 04:21	20/06/2021 06:21	8489
20/06/2021 09:25	20/06/2021 11:14	9094
20/06/2021 17:08	20/06/2021 20:22	9315
21/06/2021 22:27	22/06/2021 00:17	9155
22/06/2021 00:20	22/06/2021 02:25	8497
22/06/2021 07:53	22/06/2021 09:47	8484
23/06/2021 00:27	23/06/2021 03:01	9299

Date and Time to Site	Date and Time from Site	Coal Transported (t)
23/06/2021 22:34	24/06/2021 00:29	9302
24/06/2021 00:40	24/06/2021 02:56	8479
24/06/2021 06:16	24/06/2021 08:36	9306
24/06/2021 12:00	24/06/2021 16:15	9157
25/06/2021 02:11	25/06/2021 04:31	9317
25/06/2021 00:16	25/06/2021 02:07	8509
25/06/2021 08:27	25/06/2021 10:24	9339
25/06/2021 14:48	25/06/2021 16:38	9141
26/06/2021 11:27	26/06/2021 13:18	9294
26/06/2021 16:05	26/06/2021 18:09	8482
26/06/2021 20:59	26/06/2021 22:54	9308
27/06/2021 00:25	27/06/2021 03:09	9163
27/06/2021 09:49	27/06/2021 11:51	8496
27/06/2021 13:20	27/06/2021 15:15	9127
27/06/2021 19:06	27/06/2021 22:38	9314
28/06/2021 10:17	28/06/2021 12:08	9273
28/06/2021 14:22	28/06/2021 17:13	9276
28/06/2021 22:24	29/06/2021 00:02	9154
29/06/2021 11:31	29/06/2021 13:26	9085
29/06/2021 23:36	30/06/2021 01:30	9280
30/06/2021 09:22	30/06/2021 13:11	9342
30/06/2021 21:56	01/07/2021 00:05	9134
01/07/2021 13:07	01/07/2021 16:21	9289
01/07/2021 16:24	01/07/2021 19:06	9262
01/07/2021 23:35	02/07/2021 02:33	9321
02/07/2021 17:00	02/07/2021 20:36	9321
02/07/2021 20:39	02/07/2021 22:46	9310
03/07/2021 01:49	03/07/2021 04:57	9336
03/07/2021 06:16	03/07/2021 08:14	8494
03/07/2021 12:21	03/07/2021 14:48	9265
03/07/2021 16:50	03/07/2021 19:45	9315
04/07/2021 00:27	04/07/2021 02:15	9281
04/07/2021 03:47	04/07/2021 06:55	9097
04/07/2021 07:00	04/07/2021 12:00	8486
04/07/2021 13:02	04/07/2021 14:55	9155
04/07/2021 17:55	04/07/2021 21:17	9160
05/07/2021 02:55	05/07/2021 05:44	9302
05/07/2021 09:00	05/07/2021 11:12	9329
05/07/2021 15:28	05/07/2021 17:32	9322
06/07/2021 04:05	06/07/2021 06:04	9298
06/07/2021 07:07	06/07/2021 08:58	8495
06/07/2021 12:22	06/07/2021 15:23	9296

Date and Time to Site	Date and Time from Site	Coal Transported (t)
06/07/2021 15:49	06/07/2021 17:43	9137
06/07/2021 21:25	06/07/2021 23:14	9255
06/07/2021 23:18	07/07/2021 01:22	9317
07/07/2021 08:00	07/07/2021 11:17	9330
08/07/2021 01:33	08/07/2021 03:43	9329
08/07/2021 05:30	08/07/2021 09:26	9140
08/07/2021 22:11	09/07/2021 00:25	9249
09/07/2021 01:16	09/07/2021 03:14	9169
09/07/2021 03:24	09/07/2021 05:16	9306
09/07/2021 16:05	09/07/2021 18:29	9285
09/07/2021 21:30	09/07/2021 23:32	9241
10/07/2021 07:20	10/07/2021 09:35	9300
10/07/2021 11:51	10/07/2021 14:40	9144
10/07/2021 17:34	10/07/2021 20:04	9074
11/07/2021 02:34	11/07/2021 04:32	9289
11/07/2021 07:11	11/07/2021 09:33	9143
11/07/2021 15:47	11/07/2021 20:02	9284
11/07/2021 21:30	11/07/2021 23:28	9250
12/07/2021 22:38	13/07/2021 01:12	9307
13/07/2021 05:32	13/07/2021 08:15	9300
13/07/2021 09:28	13/07/2021 11:19	9246
13/07/2021 12:12	13/07/2021 14:57	9255
13/07/2021 23:18	14/07/2021 01:18	9151
14/07/2021 06:40	14/07/2021 09:11	9327
14/07/2021 11:26	14/07/2021 13:39	9332
14/07/2021 23:21	15/07/2021 01:20	9335
15/07/2021 02:37	15/07/2021 10:37	8470
15/07/2021 11:10	15/07/2021 12:24	5527
15/07/2021 13:24	15/07/2021 15:34	9285
16/07/2021 22:42	17/07/2021 00:27	9246
17/07/2021 05:49	17/07/2021 07:37	8476
17/07/2021 02:08	17/07/2021 05:05	9313
17/07/2021 07:45	17/07/2021 09:41	9124
17/07/2021 15:25	17/07/2021 18:04	9307
18/07/2021 12:34	18/07/2021 14:46	9298
18/07/2021 22:20	19/07/2021 00:27	9258
19/07/2021 02:54	19/07/2021 04:51	9156
19/07/2021 05:40	19/07/2021 09:11	9325
19/07/2021 12:11	19/07/2021 14:29	9324
19/07/2021 16:13	19/07/2021 18:05	9324
20/07/2021 09:15	20/07/2021 11:05	9335
20/07/2021 11:51	20/07/2021 14:08	9297

Date and Time to Site	Date and Time from Site	Coal Transported (t)
20/07/2021 14:47	20/07/2021 17:20	9300
20/07/2021 17:22	20/07/2021 19:32	8465
21/07/2021 01:35	21/07/2021 03:28	9143
21/07/2021 21:45	21/07/2021 23:41	9320
22/07/2021 02:19	22/07/2021 04:15	9343
22/07/2021 04:34	22/07/2021 07:22	8491
22/07/2021 07:33	22/07/2021 09:57	9161
22/07/2021 19:20	22/07/2021 21:03	9145
23/07/2021 01:30	23/07/2021 03:38	9280
23/07/2021 03:52	23/07/2021 06:27	9119
24/07/2021 01:23	24/07/2021 03:31	9255
25/07/2021 07:01	25/07/2021 08:54	9259
25/07/2021 09:05	25/07/2021 11:39	9131
26/07/2021 22:23	27/07/2021 01:23	9095
27/07/2021 07:31	27/07/2021 09:34	9302
27/07/2021 18:13	27/07/2021 20:07	9242
28/07/2021 06:55	28/07/2021 10:06	8469
28/07/2021 11:24	28/07/2021 13:32	9305
28/07/2021 20:36	28/07/2021 22:38	9274
29/07/2021 04:49	29/07/2021 08:14	9327
30/07/2021 05:07	30/07/2021 07:09	9256
30/07/2021 16:24	30/07/2021 18:23	9287
30/07/2021 17:51	30/07/2021 20:54	9238
31/07/2021 11:30	31/07/2021 13:24	9286
01/08/2021 03:39	01/08/2021 05:33	9258
01/08/2021 22:31	02/08/2021 00:22	8509
03/08/2021 11:24	03/08/2021 13:44	8495
03/08/2021 23:56	04/08/2021 01:40	9079
04/08/2021 03:30	04/08/2021 05:53	9142
04/08/2021 13:18	04/08/2021 15:13	9262
05/08/2021 15:11	05/08/2021 17:56	9292
05/08/2021 22:41	06/08/2021 00:38	8480
06/08/2021 02:25	06/08/2021 04:19	9277
06/08/2021 10:11	06/08/2021 12:35	8477
06/08/2021 12:42	06/08/2021 14:41	9313
06/08/2021 15:28	06/08/2021 18:20	9123
07/08/2021 02:33	07/08/2021 04:34	9328
07/08/2021 04:40	07/08/2021 06:59	9306
07/08/2021 09:51	07/08/2021 12:24	9317
08/08/2021 00:54	08/08/2021 03:44	9158
08/08/2021 03:50	08/08/2021 06:46	9265
08/08/2021 23:05	09/08/2021 00:58	9253

Date and Time to Site	Date and Time from Site	Coal Transported (t)
09/08/2021 04:49	09/08/2021 06:50	9318
09/08/2021 08:35	09/08/2021 10:23	9148
12/08/2021 19:23	12/08/2021 23:01	9282
13/08/2021 19:26	13/08/2021 22:17	9141
15/08/2021 02:01	15/08/2021 05:54	9261
15/08/2021 08:38	15/08/2021 11:14	9305
15/08/2021 21:59	16/08/2021 00:16	9316
16/08/2021 01:30	16/08/2021 03:35	8507
16/08/2021 14:42	16/08/2021 17:09	9125
16/08/2021 17:12	16/08/2021 20:09	9299
17/08/2021 08:03	17/08/2021 11:29	9305
17/08/2021 12:45	17/08/2021 15:08	9254
17/08/2021 18:41	17/08/2021 20:52	9140
19/08/2021 19:25	19/08/2021 21:32	8499
19/08/2021 23:36	20/08/2021 01:21	9143
20/08/2021 11:27	20/08/2021 13:16	9287
20/08/2021 19:15	20/08/2021 21:14	9247
21/08/2021 03:38	21/08/2021 06:11	9072
21/08/2021 15:27	21/08/2021 18:37	9308
22/08/2021 04:25	22/08/2021 06:53	9307
22/08/2021 07:02	22/08/2021 09:02	9165
22/08/2021 12:45	22/08/2021 14:49	8486
23/08/2021 01:02	23/08/2021 03:14	9298
23/08/2021 22:21	24/08/2021 00:11	9130
24/08/2021 00:12	24/08/2021 02:22	8485
24/08/2021 07:49	24/08/2021 09:48	8477
24/08/2021 10:14	24/08/2021 13:16	9153
24/08/2021 21:35	24/08/2021 23:41	9304
25/08/2021 01:30	25/08/2021 04:10	9326
25/08/2021 06:13	25/08/2021 08:48	9252
25/08/2021 13:13	25/08/2021 15:21	9063
26/08/2021 05:00	26/08/2021 07:13	9142
26/08/2021 18:25	26/08/2021 20:53	9248
26/08/2021 21:02	26/08/2021 23:03	9146
27/08/2021 08:32	27/08/2021 12:05	9123
27/08/2021 21:50	28/08/2021 01:03	9318
28/08/2021 08:33	28/08/2021 11:56	5610
28/08/2021 15:29	28/08/2021 17:28	9291
30/08/2021 11:49	30/08/2021 14:17	9275
30/08/2021 22:24	31/08/2021 01:03	9258
31/08/2021 04:28	31/08/2021 06:35	9251
31/08/2021 09:49	31/08/2021 12:25	9266

Date and Time to Site	Date and Time from Site	Coal Transported (t)
31/08/2021 12:00	31/08/2021 14:38	9284
31/08/2021 19:04	31/08/2021 22:27	9304
01/09/2021 01:39	01/09/2021 03:57	9329
01/09/2021 08:00	01/09/2021 09:52	9312
01/09/2021 20:31	01/09/2021 22:41	9262
02/09/2021 03:45	02/09/2021 05:58	9314
02/09/2021 13:41	02/09/2021 15:35	9303
03/09/2021 12:00	03/09/2021 14:10	8474
04/09/2021 04:00	04/09/2021 05:59	9316
04/09/2021 08:43	04/09/2021 11:15	9272
04/09/2021 12:17	04/09/2021 14:35	9244
04/09/2021 22:14	05/09/2021 00:36	9296
05/09/2021 03:23	05/09/2021 05:58	9314
05/09/2021 07:14	05/09/2021 09:41	9308
05/09/2021 14:37	05/09/2021 16:51	9295
05/09/2021 16:54	05/09/2021 21:37	9280
05/09/2021 21:49	06/09/2021 01:41	9297
06/09/2021 01:51	06/09/2021 08:12	9279
06/09/2021 08:16	06/09/2021 10:22	9312
06/09/2021 10:34	06/09/2021 13:45	9290
06/09/2021 13:50	06/09/2021 16:12	9249
07/09/2021 00:37	07/09/2021 03:47	9317
07/09/2021 03:50	07/09/2021 05:45	9302
07/09/2021 07:25	07/09/2021 09:45	9125
07/09/2021 13:55	07/09/2021 15:58	8451
09/09/2021 03:32	09/09/2021 05:36	9272
09/09/2021 06:01	09/09/2021 08:54	9308
09/09/2021 23:45	10/09/2021 02:02	9321
10/09/2021 05:38	10/09/2021 08:17	9315
10/09/2021 22:22	11/09/2021 00:13	8482
11/09/2021 02:10	11/09/2021 04:36	9281
11/09/2021 16:29	11/09/2021 19:16	9294
12/09/2021 09:32	12/09/2021 11:32	9284
13/09/2021 05:27	13/09/2021 08:10	8485
13/09/2021 19:33	13/09/2021 21:30	9282
14/09/2021 00:03	14/09/2021 02:45	9228
14/09/2021 17:22	14/09/2021 19:29	8495
14/09/2021 19:38	14/09/2021 21:41	9285
14/09/2021 21:47	14/09/2021 23:56	9211
15/09/2021 01:30	15/09/2021 05:09	9191
15/09/2021 07:26	15/09/2021 09:55	9300
15/09/2021 16:35	15/09/2021 18:31	9231

Date and Time to Site	Date and Time from Site	Coal Transported (t)
16/09/2021 03:44	16/09/2021 07:22	9305
16/09/2021 10:04	16/09/2021 12:24	8487
16/09/2021 13:50	16/09/2021 16:01	8477
16/09/2021 15:31	16/09/2021 18:03	9250
16/09/2021 19:13	16/09/2021 22:29	9301
17/09/2021 01:22	17/09/2021 03:24	8515
18-09-2021 1:21	18/09/2021 03:31	9295
18/09/2021 08:04	18/09/2021 10:28	9250
19/09/2021 08:06	19/09/2021 10:54	9302
19/09/2021 21:34	19/09/2021 23:41	9303
20/09/2021 02:07	20/09/2021 04:24	8498
20/09/2021 14:47	20/09/2021 16:44	9076
21/09/2021 23:40	22/09/2021 01:43	9095
22/09/2021 20:15	22/09/2021 22:36	9103
23/09/2021 00:10	23/09/2021 02:46	9307
23/09/2021 08:34	23/09/2021 11:09	9309
23/09/2021 13:13	23/09/2021 15:25	8488
24/09/2021 05:13	24/09/2021 08:18	8495
25/09/2021 13:20	25/09/2021 15:59	9041
25/09/2021 17:14	25/09/2021 21:26	9296
25/09/2021 21:29	26/09/2021 00:47	9143
26/09/2021 14:20	26/09/2021 17:24	9293
26/09/2021 18:50	26/09/2021 21:05	9294
26/09/2021 21:53	26/09/2021 23:44	9323
27/09/2021 02:45	27/09/2021 04:41	9315
27/09/2021 08:58	27/09/2021 10:59	9315
27/09/2021 22:41	28/09/2021 00:47	9295
28/09/2021 12:26	28/09/2021 14:26	9300
29/09/2021 08:54	29/09/2021 11:45	5429
29/09/2021 14:23	29/09/2021 17:37	9294
01/10/2021 01:54	01/10/2021 05:41	9344
01/10/2021 08:22	01/10/2021 10:30	9318
01/10/2021 11:30	01/10/2021 14:03	9281
02/10/2021 00:23	02/10/2021 03:20	9295
02/10/2021 03:22	02/10/2021 06:17	9325
02/10/2021 08:00	02/10/2021 10:04	9282
02/10/2021 15:31	02/10/2021 17:33	9289
03/10/2021 00:07	03/10/2021 01:56	9296
03/10/2021 06:11	03/10/2021 09:09	9141
03/10/2021 09:18	03/10/2021 11:45	9321
03/10/2021 16:01	03/10/2021 17:51	9280
03/10/2021 19:30	03/10/2021 21:16	9132

Date and Time to Site	Date and Time from Site	Coal Transported (t)
04/10/2021 03:32	04/10/2021 06:38	9294
09/10/2021 02:47	09/10/2021 05:30	9330
09/10/2021 05:59	09/10/2021 08:44	9316
09/10/2021 12:24	09/10/2021 14:19	9081
09/10/2021 23:14	10/10/2021 02:24	9313
10/10/2021 11:14	10/10/2021 13:19	9234
12/10/2021 10:30	12/10/2021 12:32	8468
13/10/2021 18:10	13/10/2021 20:19	8481
14/10/2021 13:28	14/10/2021 16:05	9114
15/10/2021 00:15	15/10/2021 01:57	8479
15/10/2021 04:11	15/10/2021 05:52	9257
15/10/2021 15:18	15/10/2021 19:30	9295
15/10/2021 21:25	15/10/2021 23:26	9285
16/10/2021 04:50	16/10/2021 07:20	9100
16/10/2021 12:20	16/10/2021 15:15	9312
17/10/2021 00:20	17/10/2021 02:29	8505
17/10/2021 08:50	17/10/2021 10:58	8476
17/10/2021 22:01	18/10/2021 01:14	9157
18/10/2021 07:03	18/10/2021 09:14	9317
18/10/2021 19:32	18/10/2021 21:35	8463
19/10/2021 03:11	19/10/2021 05:07	9149
19/10/2021 22:41	20/10/2021 00:44	8464
20/10/2021 01:10	20/10/2021 04:04	9281
20/10/2021 06:59	20/10/2021 09:46	8480
21/10/2021 09:23	21/10/2021 11:46	8489
21/10/2021 16:32	21/10/2021 19:10	9301
22/10/2021 11:48	22/10/2021 13:37	9137
22/10/2021 14:45	22/10/2021 16:43	8481
23/10/2021 05:34	23/10/2021 07:37	9153
23/10/2021 03:04	23/10/2021 05:26	9256
23/10/2021 18:55	23/10/2021 22:59	9136
24/10/2021 13:15	24/10/2021 15:28	9278
24/10/2021 16:20	24/10/2021 18:19	8469
24/10/2021 23:16	25/10/2021 02:28	9273
25/10/2021 11:46	25/10/2021 13:37	8479
25/10/2021 23:17	26/10/2021 02:03	9318
26/10/2021 02:12	26/10/2021 04:24	9077
29/10/2021 08:22	29/10/2021 10:35	9237
29/10/2021 17:20	29/10/2021 19:36	9276
31/10/2021 02:28	31/10/2021 11:48	9277
31/10/2021 11:59	31/10/2021 14:08	8468
31/10/2021 20:40	31/10/2021 23:28	9287

Date and Time to Site	Date and Time from Site	Coal Transported (t)
01/11/2021 03:40	01/11/2021 05:55	9312
01/11/2021 12:45	01/11/2021 15:38	9268
02/11/2021 02:01	02/11/2021 03:54	9255
02/11/2021 04:06	02/11/2021 05:59	9286
04/11/2021 03:07	04/11/2021 05:26	9100
04/11/2021 10:10	04/11/2021 12:41	8486
06/11/2021 05:34	06/11/2021 08:30	9262
06/11/2021 10:58	06/11/2021 13:11	9291
06/11/2021 08:35	06/11/2021 10:40	8474
06/11/2021 22:54	07/11/2021 00:40	9297
07/11/2021 09:38	07/11/2021 11:35	9314
07/11/2021 18:48	07/11/2021 20:51	9295
08/11/2021 07:44	08/11/2021 09:45	9308
08/11/2021 10:10	08/11/2021 12:16	8487
08/11/2021 16:17	08/11/2021 19:12	9269
09/11/2021 02:48	09/11/2021 05:07	8486
09/11/2021 07:52	09/11/2021 10:40	8483
09/11/2021 14:34	09/11/2021 18:19	9316
09/11/2021 21:06	09/11/2021 23:21	9310
10/11/2021 07:02	10/11/2021 09:01	9309
10/11/2021 22:03	11/11/2021 00:09	8480
12/11/2021 04:59	12/11/2021 08:00	9290
12/11/2021 20:10	12/11/2021 21:57	9252
13/11/2021 05:40	13/11/2021 08:11	9245
15/11/2021 15:18	15/11/2021 17:10	9246
15/11/2021 18:51	15/11/2021 20:58	9300
16/11/2021 04:38	16/11/2021 07:37	8498
16/11/2021 23:16	17/11/2021 01:11	9136
17/11/2021 01:35	17/11/2021 03:18	8489
17/11/2021 22:54	18/11/2021 02:30	9106
18/11/2021 04:08	18/11/2021 07:05	9305
18/11/2021 13:01	18/11/2021 15:05	9299
18/11/2021 17:42	18/11/2021 19:47	8468
18/11/2021 21:28	19/11/2021 00:08	9294
19/11/2021 04:24	19/11/2021 06:48	9321
19/11/2021 07:22	19/11/2021 10:06	8486
19/11/2021 12:04	19/11/2021 14:11	8492
20/11/2021 18:15	20/11/2021 21:15	9287
20/11/2021 21:18	20/11/2021 23:52	9304
21/11/2021 10:01	21/11/2021 12:24	9313
22/11/2021 03:18	22/11/2021 05:18	9158
26/11/2021 08:55	26/11/2021 14:56	9290

Date and Time to Site	Date and Time from Site	Coal Transported (t)
26/11/2021 15:21	26/11/2021 17:43	9238
26/11/2021 21:10	27/11/2021 00:13	9124
27/11/2021 02:47	27/11/2021 05:31	9296
27/11/2021 11:36	27/11/2021 14:09	9286
27/11/2021 15:01	27/11/2021 17:59	9241
27/11/2021 18:43	27/11/2021 21:07	9304
27/11/2021 21:14	27/11/2021 23:30	9180
28/11/2021 03:27	28/11/2021 05:42	9115
28/11/2021 07:49	28/11/2021 10:01	9241
28/11/2021 19:24	28/11/2021 22:38	9309
29/11/2021 17:14	29/11/2021 19:28	8482
29/11/2021 19:50	29/11/2021 22:43	9300
02/12/2021 18:56	02/12/2021 21:04	8403
03/12/2021 04:03	03/12/2021 05:56	9279
03/12/2021 13:08	03/12/2021 15:17	9114
03/12/2021 18:41	03/12/2021 20:35	8479
03/12/2021 21:00	03/12/2021 23:18	9276
04/12/2021 03:02	04/12/2021 05:40	9123
04/12/2021 06:03	04/12/2021 07:58	8474
04/12/2021 10:42	04/12/2021 12:51	9284
04/12/2021 15:35	04/12/2021 17:27	9285
05/12/2021 20:12	05/12/2021 22:33	9292
06/12/2021 11:10	06/12/2021 13:26	8460
07/12/2021 02:09	07/12/2021 04:12	9287
07/12/2021 10:50	07/12/2021 13:08	9240
08/12/2021 00:55	08/12/2021 03:52	9306
09/12/2021 04:38	09/12/2021 06:36	9284
09/12/2021 19:23	09/12/2021 21:17	9293
09/12/2021 22:38	10/12/2021 00:58	9152
10/12/2021 01:12	10/12/2021 03:35	9296
10/12/2021 04:56	10/12/2021 07:53	9257
11/12/2021 04:36	11/12/2021 08:02	9298
11/12/2021 08:06	11/12/2021 10:29	8489
12/12/2021 05:35	12/12/2021 07:45	9289
12/12/2021 07:56	12/12/2021 10:04	9238
12/12/2021 14:21	12/12/2021 17:20	9297
12/12/2021 18:57	12/12/2021 21:37	9296
13/12/2021 20:15	13/12/2021 22:30	8460
14/12/2021 05:47	14/12/2021 08:16	9305
14/12/2021 14:56	14/12/2021 16:57	8473
16/12/2021 17:23	16/12/2021 19:48	8468
16/12/2021 21:06	16/12/2021 23:24	9268

Date and Time to Site	Date and Time from Site	Coal Transported (t)
17/12/2021 11:22	17/12/2021 14:07	9266
18/12/2021 05:25	18/12/2021 08:26	9151
19/12/2021 09:01	19/12/2021 11:41	9307
19/12/2021 20:07	19/12/2021 22:34	9287
20/12/2021 01:32	20/12/2021 03:39	9297
20/12/2021 05:35	20/12/2021 09:38	8477
21/12/2021 13:02	21/12/2021 15:05	9266
27/12/2021 00:39	27/12/2021 02:27	9287
27/12/2021 03:26	27/12/2021 05:33	9292
28/12/2021 03:20	28/12/2021 06:16	8474
28/12/2021 01:40	28/12/2021 03:44	9290
29/12/2021 08:30	29/12/2021 10:26	8490
29/12/2021 12:47	29/12/2021 14:45	9281
30/12/2021 13:01	30/12/2021 14:54	8476

ASIA PACIFIC OFFICES

BRISBANE

Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA

GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN

Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST

Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY

21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE

Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE

10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

NEWCASTLE CBD

Suite 2B, 125 Bull Street
Newcastle West NSW 2302
Australia
T: +61 2 4940 0442

PERTH

Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY

Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE

12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

WOLLONGONG

Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 2 4249 1000

AUCKLAND

Level 4, 12 O'Connell Street
Auckland 1010
New Zealand
T: 0800 757 695

NELSON

6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628