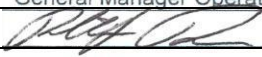




MOUNT PLEASANT OPERATION

2017 ANNUAL REVIEW
(ANNUAL REHABILITATION REPORT)

Document ID:	MP001-0000-ENV-REP-0002		
Company:	MACH Energy Australia Pty Ltd		
Effective Date:	28 March 2018	Status:	Issued for Use
Approved By:	Klay Marchant	Revision Number:	00

MOUNT PLEASANT OPERATION 2017 ANNUAL REVIEW	
Name of Operation	Mount Pleasant Operation
Name of Operator	MACH Energy Australia Pty Ltd
Development Consent	Development Consent DA 92/97
Name of Holder of Development Consent	MACH Energy Australia Pty Ltd
Mining Leases	Mining Lease 1645, Mining Lease 1708, Mining Lease 1709, Mining Lease 1750 and Mining Lease 1713
Name of Holder of Mining Leases	MACH Energy Australia Pty Ltd
Water Licences	Water Access Licences – see Table 3 Bore Licence Certificate 20BL168734
Name of Holder of Water Licences	MACH Energy Australia Pty Ltd
MOP Start Date	15 September 2016
MOP End Date	30 June 2018
Annual Review Start Date	1 January 2017
Annual Review End Date	31 December 2017
<p>I, Philip Price, certify that this audit report is a true and accurate record of the compliance status of the Mount Pleasant Operation for the period 1 January to 31 December 2017 and that I am authorised to make this statement on behalf of MACH Energy Australia Pty Ltd.</p> <p>Note.</p> <p>a) <i>The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</i></p> <p>b) <i>The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).</i></p>	
Name of Authorised Reporting Officer	Philip Price
Title of Authorised Reporting Officer	General Manager Operations
Signature of Authorised Reporting Officer	
Date	28/03/2018

STATEMENT OF COMPLIANCE

The compliance status of the Mount Pleasant Operation with its relevant approval conditions at the end of the reporting period (31 December 2017) is provided in Table 1.

Table 1
Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Development Consent DA 92/97	No
EPBC 2011/5795	Yes
Environment Protection Licence 20850	No
Authorisation 459	Yes
Mining Lease 1645	No
Mining Lease 1708	Yes
Mining Lease 1709	Yes
Mining Lease 1713	Yes
Mining Lease 1750	Yes
Water licences (as per Table 3)	Yes
Bore Licence Certificate 20BL168734	Yes

Table 2 summarises the non-compliances with the approval conditions.

Table 2
Summary of Non-Compliances

Relevant Approval	Condition Number	Condition Description	Compliance Status	Comment	Report Section
Development Consent DA 92/97	Condition 26, Schedule 3	Surface water discharges must comply with the Environment Protection Licence, Protection of the Environment Operations Act 1997 (POEO Act) and Protection of the Environment Operations Regulation.	NC	See Table 26	10.2
Development Consent DA 92/97	Condition 7, Schedule 5	Required notification of Secretary and other relevant agencies of any incident.	NC	See Table 26	10.2
EPL 20850	Condition L1.1	Licensee must comply with Section 120 of the POEO Act.	NC	See Table 26	10.2
EPL 20850	Condition O1.1	Licensed activities must be carried out in a competent manner.	NC	See Table 26	10.2
ML 1645	Condition 5 (a), Schedule 2	Required notification of DPE following breaches of the ML and environment protection legislation.	NC	See Table 26	10.2
ML 1645	Condition 5 (c), Schedule 2	Required notification of DPE following breaches of the POEO Act.	NC	See Table 26	10.2

Compliance Status Key for Table 2 – Non Compliances

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

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1 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), north-west of Muswellbrook and approximately 50 kilometres (km) north-west of Singleton (Figure 1). The villages of Aberdeen and Kayuga are located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively.

The development application for the MPO was made in 1997. This was supported by an Environmental Impact Statement (EIS) prepared by Environmental Resources Management Mitchell McCotter (ERM Mitchell McCotter, 1997). On 22 December 1999, the then Minister for Urban Affairs and Planning granted Development Consent DA 92/97 to Coal & Allied Operations Pty Ltd (Coal & Allied). This allowed for the “Construction and operation of an open cut coal mine, coal preparation plant, transport and rail loading facilities and associated facilities” at the MPO. The consent allowed for the extraction of 197 million tonnes (Mt) of run-of-mine (ROM) coal over a 21 year period, at a rate of up to 10.5 Mt of ROM coal per year.

The proponent of the MPO is MACH Energy Australia Pty Ltd (MACH Energy).

The MPO Modification 1 (MOD 1) was submitted for approval on 19 May 2010 with a supporting Environmental Assessment (EA) prepared by EMGA Mitchell McLennan (EMGA Mitchell McLennan, 2010), with the following changes proposed:

- The provision of an infrastructure envelope for siting the mine infrastructure.
- The provision of an optional conveyor/service corridor linking the MPO facilities with the Muswellbrook-Ulan Rail Line.
- Modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative boundary changes.

MOD 1 was approved on 19 September 2011.

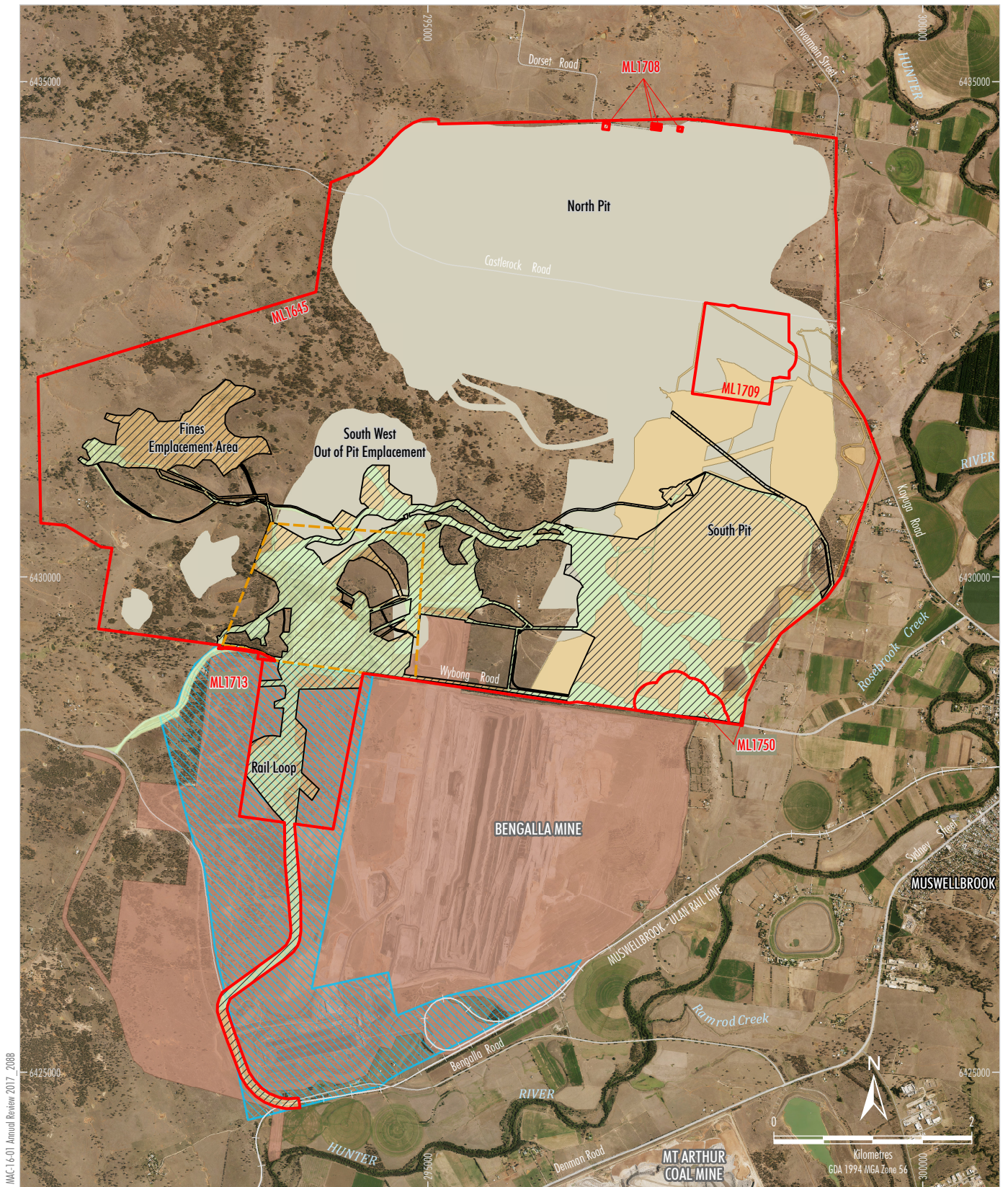
The MPO South Pit Haul Road Modification (MOD 2) was submitted for approval on 30 January 2017 with a supporting EA prepared by MACH Energy (MACH Energy, 2017a).

MOD 2 proposed to realign an indicative internal haul road to enable more efficient access to the South Pit open cut, with no other material changes to the approved MPO.

MOD 2 was approved on 29 March 2017.

In January 2017, MACH Energy confirmed with the Department of Planning and Environment (DPE) that they would proceed with the rail loop and load out facility design to transport coal (as opposed to a conveyor to the Bengalla Mine), in accordance with Condition 7, Schedule 2 of Development Consent DA 92/97.

Figure 2 shows the general arrangement of the MPO, as well as the disturbance which occurred in 2017 and the additional disturbance proposed in 2018.



LEGEND

- Mining Lease Boundary
- Infrastructure Area Envelope
- Approximate Extent of Approved Surface Development (1997 EIS Year 20) excluding MOP Footprint *
- MOP Footprint +
- 2017 Disturbance ^
- 2018 Forecast Additional Disturbance
- Conveyor/Services Corridor Envelope
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)

Notes:

- * Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, off-site coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, other ancillary works and construction disturbance.
- + Mount Pleasant Operation Mining Operations Plan and Rehabilitation Management Plan - Amendment C (April 2017)
- ^ Approximate extent determined from orthophoto flown December 2017

Source: NSW Division of Resources & Energy (2016); NSW Land & Property Information (2016); Department of Planning & Environment (2016); MACH Energy (2016)
 Orthophoto: MACH Energy (Dec 2017)

MACHEnergy
 MOUNT PLEASANT OPERATION
 2017 Mining Activities

Figure 2

1.1 PURPOSE AND SCOPE

This Annual Review details MACH Energy's environmental and community performance for the reporting period 1 January 2017 to 31 December 2017. This Annual Review has been prepared in accordance with the DPE *Post-approval requirements for State significant mining developments - Annual Review Guideline – October 2015* (DPE, 2015a) and MACH Energy's statutory approvals (Section 2), specifically Condition 3, Schedule 5 of Development Consent DA 92/97 and Condition 3(f) of Mining Leases 1645, 1708, 1709, 1713 and 1750.

This Annual Review is not intended to be an exhaustive description of MACH Energy's operations, approvals and activities, rather it is a summary of MACH Energy's compliance status with respect to MACH Energy's statutory approvals.

In March 2017, the Secretary of DPE revised the submission timing of the MPO Annual Review to the end of March each year.

This Annual Review is distributed to a range of stakeholders including government authorities, Muswellbrook Shire Council and members of the Community Consultative Committee (CCC). A copy of the Annual Review will be made publicly available on the MACH Energy website (<http://machenergyaustralia.com.au/>).

1.2 KEY PERSONNEL

Contact details for key MACH Energy personnel responsible for the environmental and community management of the MPO are provided in Table 1.

Table 1
Key Personnel

Position	Contact	Phone Number
General Manager Operations	Philip Price	-
General Manager Resource Development	Chris Lauritzen	-
Environmental Superintendent	Klay Marchant	0400 239 291
Land and Property Superintendent	Ian Webber	0428 162 856
External Relations Superintendent	Ngaire Baker	0400 214 885

2 APPROVALS

The MPO operates under a number of statutory approvals, leases and licences that regulate activities at the MPO (Tables 2 and 3).

Table 2
Consent, Lease and Licence Details

Consent/Lease/Licence	Authority	Grant/Renewal	Expiry Date
Development Consent DA 92/97 ¹	DPE	22/12/1999	-
EPBC Approval 2011/5795	DoEE	29/02/2012	28/10/2035
Environment Protection Licence (EPL) 20850	EPA	24/11/2016	-
Authorisation 459	DRG	07/04/1992	08/04/2018
Mining Lease (ML) 1645	DRG	17/12/2010	17/12/2031
ML 1708	DRG	02/02/2015	02/02/2036
ML 1709	DRG	02/02/2015	02/02/2036
ML 1713	DRG	02/02/2015	02/02/2036
ML 1750	DRG	03/03/17	03/03/2038
Bore Licence Certificate 20BL168734	CL&W	13/03/2003	Perpetuity

Note: EPBC = Environment Protection and Biodiversity Conservation, DoEE = Department of the Environment and Energy, EPL = Environment Protection Licence, ML = Mining Lease, EPA = NSW Environment Protection Authority, DRG = Division of Resources and Geoscience (under DPE), and CL&W = NSW Department of Primary Industries – Crown Lands & Water.

¹ Development Consent DA 92/97 has been modified twice since the original approval was granted in 1999. Approval for MOD 1 was granted on 19 September 2011 and approval for MOD 2 was granted on 29 March 2017.

Table 3
MACH Energy Water Access Licences (Water Management Act 2000)

Water Sharing Plan	Water Source	Licence Number	Entitlement (ML)
<i>Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009</i>	Hunter Regulated River Alluvial Water Source	18253	74
		18266	68
		18206	24
		18199	5
		18122	33
		18131	60
		21503	21
	Muswellbrook Water Source	23935	41
	Hunter Regulated River Water Source	879	224
		880	124
		1113	366
		973	3
		974	210
		975	8
		988	156
		989	8
		1307	37.5
		1229	480

Table 3 (Continued)
MACH Energy Water Access Licences (Water Management Act 2000)

Water Sharing Plan	Water Source	Licence Number	Entitlement (ML)
<i>Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources, 2009</i>	Hunter Regulated River Water Source (continued)	1230	8
		1259	33.2
		1227	99
		1258	5
		992	75
		7808	36
		702	267
		1260	4.8
		993	265
		1308	15.1
		604	183
		605	8
		677	24
		1338	17.5
		662	275
		663	16
		10775	243
		41438	420

ML = Megalitres.

During the next reporting period, MACH Energy will continue to manage its existing WALs and acquire new licences.

2.1 MANAGEMENT PLANS

The Development Consent DA 92/97 requires the proponent to submit management plans and strategies prior to carrying out any development on-site. The currently approved MPO management plans are summarised in Table 4.

Table 4
Approved Management Plans

Plan	Relevant Development Consent DA 92/97 Condition	Approval Date
Mining Operations Plan and Rehabilitation Management Plan (MOP) (Amendment C) ¹	Schedule 3, Condition 56	13 June 2017
Noise Management Plan (NMP)	Schedule 3, Condition 9	14 June 2017
Air Quality and Greenhouse Gas Management Plan (AQGGMP)	Schedule 3, Condition 23	15 June 2017
Aboriginal Heritage Management Plan (AHMP)	Schedule 3, Condition 36	5 July 2017
Water Management Plan (WMP)	Schedule 3, Condition 28	3 August 2017
Blast Management Plan (BMP)	Schedule 3, Condition 17	3 August 2017
Landscape Management Plan (LMP) ²	Schedule 3, Condition 47	23 July 2012
Waste Management Plan (WasteMP)	Schedule 3, Condition 52	29 September 2017
Rehabilitation Strategy	Schedule 3, Condition 54	23 July 2012
Biodiversity and Rehabilitation Management Plan (Biodiversity portion only) ²	Schedule 3, Condition 32	23 July 2012
Environmental Management Strategy	Schedule 5, Condition 1	18 September 2017

¹ The approved MOP meets the requirements for a Rehabilitation Management Plan (RMP) (Condition 56, Schedule 3 of Development Consent [DA 92/97]).

² MACH Energy is currently reviewing these plans (and revising them where necessary) to develop a contemporary suite of management plans.

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97, MACH Energy will review, and if necessary, revise, the strategies, plans and programs required under the consent within three months of the submission of this Annual Review, to the satisfaction of the Secretary of the DPE.

3 OPERATIONS SUMMARY

3.1 MINING OPERATIONS

MACH Energy commenced substantial works at the MPO on 25 November 2016. During 2017, MACH Energy continued construction activities on-site, including:

- construction in the Mine Infrastructure Area (MIA) including the construction of offices, a workshop, a tyre and fuel bay, bath houses, a sewage treatment plant, a car park and water tanks;
- the use of borrow pits in construction activities;
- construction of the Magazine/Reload facility;
- construction in the Coal Handling and Preparation Plant (CHPP), including the construction of offices, a car park, temporary and permanent buildings, a reclaim tunnel, an overland conveyor, a Train Load Out Facility and temporary construction of the pad/laydown area;
- construction of the Light Vehicle/Medium Vehicle Access Road, the Mine Haul Road and other various access roads;
- implementation of the Wybong Road Upgrade;
- construction of the Rail Loop and Spur;
- construction of the Bengalla Link Road Bridge;
- construction of the Hunter River Pump Station and Pipeline;
- relocation of the 66 kilovolt power line; and
- construction of the substation and switchyard.

Construction of erosion and sediment control infrastructure (e.g. sediment fences, diversions and contour banks) continued. In addition, construction of a number of dams was completed, including:

- ED3.
- EDMIA.
- CHPP Sediment Dam.
- Rail Loop Dam.
- High Wall Dam.
- Sediment Dam 1 and 3.

Construction was also commenced on a number of other dams (e.g. the MWD, ED2, Clean Water Dam and Tailings Dam).

Works were generally undertaken within standard hours as defined by the EPA's Interim Construction Noise Guideline (ICNG) (i.e. 7.00 am to 6.00 pm, Monday to Friday, 8.00 am to 1.00 pm, Saturday and no work on Sunday or public holidays). Notwithstanding, works were conducted outside standard hours on weekends on a small number of occasions (i.e. past 1 pm on Saturday and on Sunday). Operator attended noise monitoring was undertaken during these times to ensure noise impacts were acceptable (Section 5.2.2).

No night shift work was undertaken during the reporting period. All buildings constructed on-site were constructed in accordance with the Building Code of Australia (BCA) and the Subsidence Advisory NSW (SANSW).

Mining related activities which occurred during the reporting period included:

- commencement of topsoil stripping in Pit A to prepare for coal extraction; and
- drilling of overburden to prepare for blasting of the Mine Haul Road.

No coal extraction, overburden removal or rehabilitation was undertaken during the reporting period (Section 7).

Demolition of 11 houses occurred within ML 1645 within the initial open cut and emplacement areas. All demolition was carried out in accordance with Australian Standard (AS) 2601-2001: *The Demolition of Structures*. Where possible, upon relinquishing tenancy of these houses, MACH Energy transferred the tenants to other properties owned by MACH Energy.

Various landscape management activities were undertaken, including erection, removal and maintenance of various fence lines, the implementation of a visual bund along Wybong Road (Section 7.2) and weed and pest control measures (Section 5.5.2).

The amounts of waste rock, overburden, ROM coal, coarse reject, fine reject and product coal produced during the previous reporting period, current reporting period and forecast for the next reporting period, are outlined in Table 5.

Table 5
Production Summary

Material	Approved Limit	2016 Reporting Period (Actual)	2017 Reporting Period (Actual)	2018 Reporting Period (Forecast)
Waste Rock/Overburden (Mbcm)	N/A	0	0	9.3 Mbcm
ROM Coal (Mt)	10.5 Mt per calendar year ¹	0	0	2.2 Mt
Coarse Reject	N/A	0	0	0.28 Mt
Fine Reject (Tailings)	N/A	0	0	0.14 Mt
Saleable Product	N/A	0	0	1.36 Mt

Note: Mbcm = million bank cubic metres, N/A = not applicable and t = tonnes.

¹ Condition 6, Schedule 2 of Development Consent DA 92/97 relevantly states:

The Applicant must not extract more than 10.5 million tonnes of ROM coal from the site in a calendar year.

3.2 OTHER OPERATIONS

Relevant operational conditions outlined in Development Consent DA 92/97 and their corresponding compliance status during the reporting period are outlined in Table 6.

Table 6
Other Operational Conditions Met

Operational Condition from Development Consent DA 92/97		Condition Met?	Comment
Limits on Consent (Condition 5, Schedule 2).	<p>5. <i>The Applicant may carry out mining operations on the site until 22 December 2020.</i></p> <p><u>Note: Under this consent, the Applicant is required to rehabilitate the site and carry out additional undertakings to the satisfaction of both the Secretary and RMD. Consequently this consent will continue to apply in all other respects - other than the right to conduct mining operations - until the rehabilitation of the site and these additional undertakings have been carried out satisfactorily.</u></p>	Yes	-
Coal Extraction (Condition 6, Schedule 2)	6. <i>The Applicant must not extract more than 10.5 million tonnes of ROM coal from the site in a calendar year.</i>	Yes	No coal extraction was undertaken during the reporting period.
Coal Transport (Condition 7, Schedule 2).	<p>7. <i>The Applicant must transport all coal from the site by either (but not both):</i></p> <p>(a) conveyor to the Bengalla mine; or</p> <p>(b) rail via an on-site rail loop.</p> <p><i>Prior to the construction of the coal transport infrastructure on site, the Applicant must notify the Secretary of the coal transport option chosen.</i></p>	Yes	In January 2017, MACH Energy confirmed with the DPE that they would proceed with the rail loop and load out facility design to transport coal (as opposed to a conveyor to the Bengalla Mine).
Structural Adequacy (Condition 9, Schedule 2)	<p>9. <i>The Applicant must ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA and SANSW.</i></p> <p><u>Notes:</u></p> <ul style="list-style-type: none"> <u>Under Part 4A of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for the proposed building works;</u> <u>Part 8 of the EP&A Regulation sets out the requirements for the certification of the development;</u> <u>The development is located in the Muswellbrook Mine Subsidence District. Under Section 15 of the Mine Subsidence Compensation Act 1961, the Applicant is required to obtain the SANSW's approval before constructing any improvements on the site.</u> 	Yes	All buildings constructed during the reporting period were constructed in accordance with the BCA and the SANSW.
Demolition (Condition 10, Schedule 2)	10. <i>The Applicant must ensure that all demolition work on site is carried out in accordance with AS 2601-2001: The Demolition of Structures, or its latest version.</i>	Yes	Demolition was undertaken on a number of houses within ML 1645 in 2017 (Section 3.1). All demolition was carried out in accordance with AS 2601-2001: The Demolition of Structures.

Table 6 (Continued)
Other Operational Conditions Met

Operational Condition from Development Consent DA 92/97		Condition Met?	Comment
Protection of Public Infrastructure (Condition 11, Schedule 2)	<p>11. Unless the Applicant and the applicable authority agree otherwise, the Applicant must:</p> <p>(a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and</p> <p>(b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development,</p> <p><u>Note: This condition does not include matters that are expressly provided for in the conditions of this consent, such as the maintenance of public roads.</u></p>	Yes	<p>During the reporting period, an electricity transmission line was relocated along Wybong Road. In addition, road work upgrades were implemented along Wybong Road.</p> <p>MACH Energy incurred the full costs of these relocations/upgrades.</p> <p>During the reporting period, a truck carrying poly pipe made contact with the Kayuga Bridge. The incident was reported to Muswellbrook Shire Council immediately. The bridge was inspected and no damage was reported.</p>
Operation of Plant and Equipment (Condition 12, Schedule 2)	<p>12. The Applicant must ensure that all plant and equipment used on site, or to transport coal from the site, is:</p> <p>(a) maintained in a proper and efficient condition; and</p> <p>(b) operated in a proper and efficient manner.</p>	Yes	<p>All plant and equipment in use at the MPO is regularly serviced in accordance with the relevant Industry & Investment NSW Mining Design Guidelines, to ensure plant and equipment is maintained in suitable condition. All plant and equipment is operated in a proper and efficient manner.</p>

3.3 ACTIVITIES FORECAST FOR THE NEXT REPORTING PERIOD

The following activities are forecast to be undertaken during the 2018 reporting period:

- commencement of coal extraction within Pit A and Pit D;
- commencement of construction of the Tailings Dam;
- completion of construction of the Rail Loop;
- progression of construction in the Construction Area, MIA and various haul roads;
- completion of construction of a number of mine dams (e.g. MWD, ED2, Tailings Dam and Clean Water Dam);
- commencement of off-site coal transport using the rail infrastructure;
- progressive rehabilitation of temporary construction areas and mining areas;
- installation of various pumps and a pipe network;
- use of borrow pits to assist in construction activities; and
- topsoil stripping of disturbed areas.

Further information regarding proposed construction and mining activities in 2018 is provided in the approved MOP.

4 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

A reconciliation of the actions required from the previous Annual Review and actions taken in response by MACH Energy during the reporting period are outlined in Table 7.

Table 7
Actions Required by the 2016 Annual Review

Action	Requested by	Action Taken	Section Reference
<i>All maps, plans and figures should contain reference to the Development Approval boundary where applicable.</i>	DPE	The Development Approval boundary is currently under significant variation from MPO's pending modifications and has therefore not been included on the figures in this Annual Review. Should the Development Approval boundary be finalised prior to the submission of the next Annual Review, then all relevant figures within the Review will include the boundary.	-
<i>Further detail on waste management should be provided in future Annual Reviews and should include information on the tonnages or volumes of individual waste streams and recycled materials.</i>	DPE	Detail has been added to the waste section.	Section 5.8
<i>Further detail must be provided on topsoil management, storage and volume in future AR's. This should include a plan detailing location of topsoil stockpiles, photographs of stockpiling methods and discussion on methods used to ensure long term viability of re-use of any stockpiled material.</i>	DPE	Detail has been added to the topsoil management section.	Section 5.9
<i>In the next reporting period, operator-attended noise monitoring would be conducted in accordance with Condition M4 of EPL 20850 and real-time noise monitoring would continue.</i>	MACH Energy 2016 Annual Review	Operator attended noise monitoring has been conducted in accordance with Condition M4 of EPL 20850 and real-time noise monitoring has continued.	Section 5.2.2
<i>During the next reporting period, MACH Energy will lodge an updated Aboriginal Heritage Management Plan (including an Aboriginal Heritage Conservation Strategy) to the DP&E, following consultation with RAPs (commenced within the reporting period), in accordance with Conditions 35 and 36, Schedule 3 of Development Consent DA 92/97.</i>	MACH Energy 2016 Annual Review	During the reporting period, MACH Energy lodged an updated AHMP (including an Aboriginal Heritage Conservation Strategy) which was approved on 5 July 2017.	Section 5.6.1
<p><i>Key management measures proposed to be implemented during the next reporting period from these management plans include:</i></p> <ul style="list-style-type: none"> <i>the replacement of the TEOM air quality monitoring systems with Palas Fidas systems (Section 5.4.4). The Palas Fidas systems will continuously measure PM10, TSP and PM2.5 levels;</i> 	MACH Energy 2016 Annual Review	Palas Fidas monitoring systems were implemented during the reporting period and have been monitoring PM ₁₀ , PM _{2.5} and Total Suspended Particulates (TSP) since late 2016.	Section 5.4.2

Table 7 (Continued)
Actions Required by the 2016 Annual Review

Action	Requested by	Action Taken	Section Reference
<ul style="list-style-type: none"> the implementation of three HVAS systems which will continuously measure PM_{10} for 24 hours, once every six days; 	MACH Energy 2016 Annual Review	High Volume Air Samplers (HVAS) systems were implemented in late 2016 and have continuously measured TSP.	Section 5.4.2
<ul style="list-style-type: none"> the addition of six surface water monitoring sites to the surface water monitoring network; 	MACH Energy 2016 Annual Review	Six new surface water monitoring sites have been added to the surface water monitoring network.	Section 6.1.1
<ul style="list-style-type: none"> the implementation of biannual stream health monitoring at four locations on watercourses surrounding the MPO boundary. This includes a new stream health monitoring location on Sandy Creek; and 	MACH Energy 2016 Annual Review	Stream health monitoring was introduced during the reporting period, with a monitoring round occurring in Spring 2017, including on Sandy Creek.	Section 6.1.1
<ul style="list-style-type: none"> the development of design concepts to improve the integration of final landforms into regional landforms. 	MACH Energy 2016 Annual Review	<p>During the reporting period, MACH Energy submitted Modification 3 (MOD 3) to DPE. MOD 3 included design concepts to improve the integration of the final landform to better align with the underlying topography and facilitate the development of a final landform that is more consistent with the local topography.</p> <p>MOD 3 is currently in the Assessment phase with DPE.</p>	-

5 ENVIRONMENTAL PERFORMANCE

5.1 METEOROLOGY

Meteorological monitoring was undertaken during the reporting period at the mine meteorological station along Kayuga Road (M-WS4) (Figure 3). Data collected included 10 minute, hourly and 24 hourly wind speed, wind direction, sigma, temperature, humidity solar radiation and rainfall measurements. Data collected during the reporting period has been summarised for rainfall, temperature and wind in the following subsections.

5.1.1 Rainfall

During the reporting period, 377.4 millimetres (mm) of rain was recorded over 37 wet days at the MPO weather station (M-WS4). The highest daily rainfall was 51.8 mm on 30 March 2017.

Rainfall was significantly lower during the reporting period than previous years, with cumulative rainfall in 2017 being approximately half the recorded rainfall in 2016 (636.4 mm) and the number of wet days being approximately a third of 2016 readings (93 wet days) (MACH Energy, 2017b).

The monthly rainfall distribution, number of wet days and cumulative rainfall is summarised in Table 8. Monthly rainfall records and cumulative rainfall over the reporting period are shown in Chart 1.

Table 8
Rainfall Summary 2017

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Rainfall (mm)	18.2	19.6	149.6	18.8	26.4	29.8	3.4	11.2	11.2	41.6	25.8	21.8
Cumulative Rainfall (mm)	18.2	37.8	187.4	206.2	232.6	262.4	265.8	277.0	288.2	329.8	355.6	377.4
Wet Days*	3	3	10	4	2	4	0	1	1	3	2	4

* Note: Wet days are classified as days receiving rainfall greater than 2 mm.

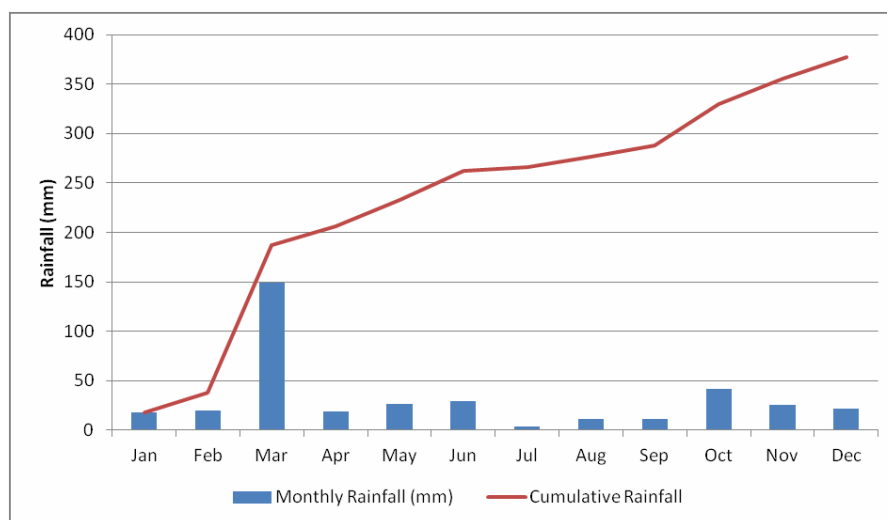


Chart 1: MPO Monthly and Cumulative Rainfall 2017



Noise and Meteorological Monitoring Sites

Figure 3

5.1.2 Temperature

During the reporting period, the maximum temperature recorded at M-WS4 was 45.1 degrees Celsius (°C) (12 February) and the minimum temperature recorded was -1.3°C (2 July). Monthly minimum and maximum temperatures derived from hourly temperature measurements are presented in Table 9. Daily mean temperatures are shown in Chart 2.

Table 9
Temperature Summary 2017

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum Temperature (°C)	15.4	10.7	11.5	5.0	1.1	0.0	-1.3	-1.0	-0.3	6.2	7.2	14.0
Maximum Temperature (°C)	40.8	45.1	33.0	26.0	24.3	18.8	21.6	24.5	33.5	34.7	31.8	40.6

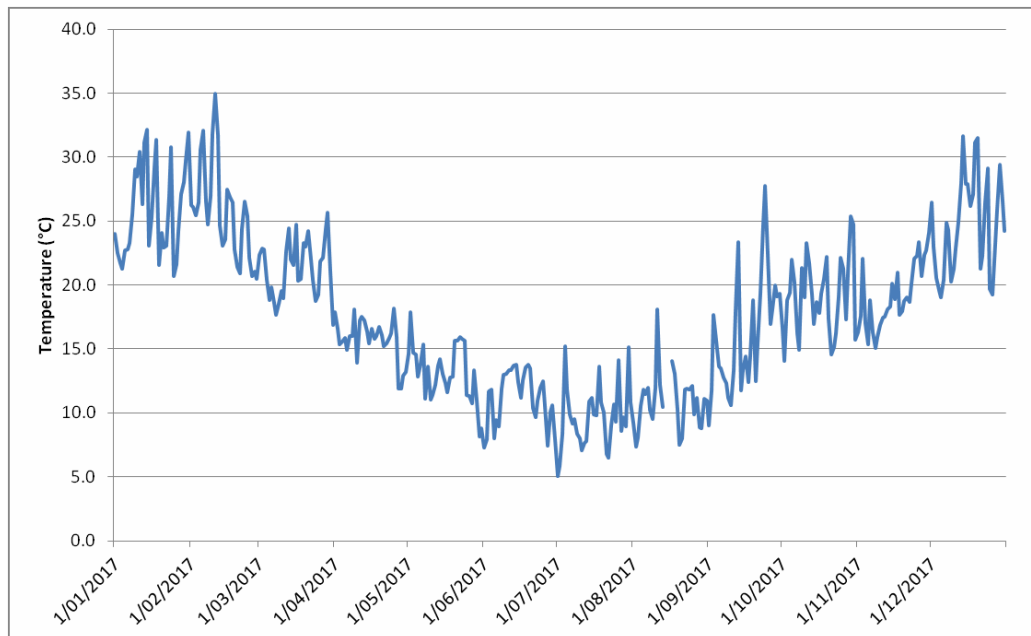


Chart 2: MPO Daily Mean Temperature 2017

5.1.3 Wind Speed and Direction

During the reporting period, the majority of prevailing winds were from the south-southeast and north-west. Only a very minor percentage of winds were generated from the north-east or south-west. This is consistent with trends observed in previous Annual Reviews (Coal & Allied, 2014, 2015 and 2016; MACH Energy, 2017b). Monthly wind speeds averaged from approximately 1.0 to 3.5 metres per second (m/s) (Table 10). Monthly average wind speeds and directions are summarised in Table 10 and an annual wind rose is presented in Chart 3.

Table 10
Wind Speed and Direction Summary 2017

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Wind Speed (m/s)	3.6	3.4	2.6	1.9	1.7	0.9	1.49	1.81	3.3	2.6	3.1	3.2
Average Wind Direction (degrees)*	212	218	189	228	253	293	233	211	274	209	149	210

* Wind directions are measured in degrees, clockwise from direct North.

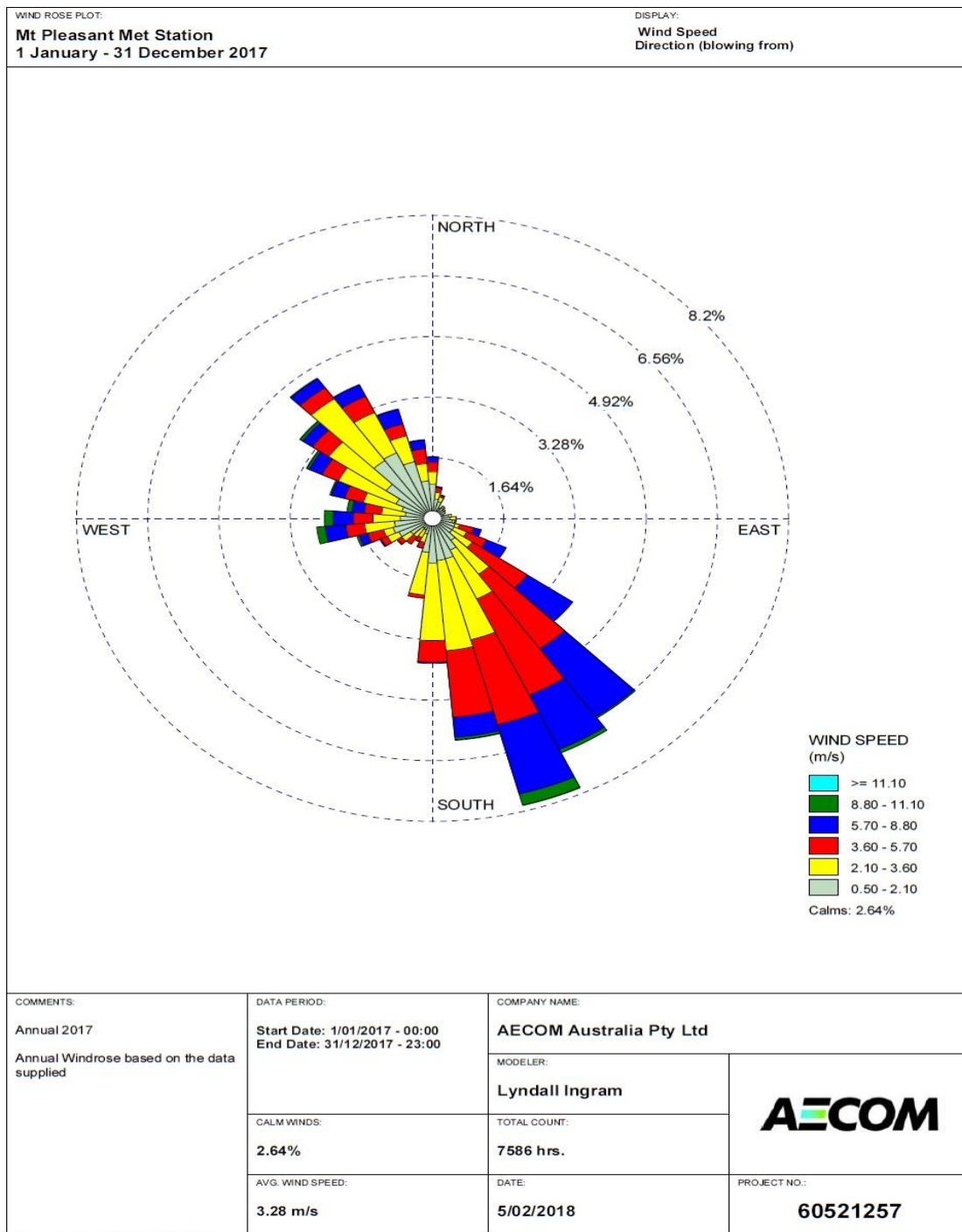


Chart 3: MPO Annual Wind Rose 2017

5.2 NOISE

Key noise criteria for the MPO are defined in Tables 3 and 5 of Development Consent DA 92/97 (Conditions 3 and 5, Schedule 3) and EPL 20850 (Condition L2). Additional noise conditions relating to land acquisition, noise mitigation upon request, rail noise, noise monitoring and preparation of the NMP are also detailed in these approval documents.

5.2.1 Approval Criteria and Management Plan Requirements

Development Consent DA 92/97 and Environment Protection Licence 20850

The Noise Impact Assessment Criteria defined in Table 3 of Development Consent DA 92/97 (Condition 3, Schedule 3) and EPL 20850 (Condition L2) are provided in Table 11.

Table 11
Noise Impact Assessment Criteria (dBA)

Location		Day	Evening	Night	
		L _{Aeq} (15min)	L _{Aeq} (15min)	L _{Aeq} (15min)	L _{A1} (1min)
NAG 1 ¹	260, 261	37	37	37	45
	258 ²	40	40	40	45
	259	39	39	39	45
	All other privately-owned land	35	35	35	45
NAG 2	272	36	36	36	45
	All other privately-owned land	35	35	35	45
NAG 3 ¹	139, 154, 240 ²	40	40	40	45
	241 ²	39	39	39	45
	All other privately-owned land	35	35	35	45
NAG 4	169	36	36	36	45
	All other privately-owned land	35	35	35	45
NAG 5	All privately-owned land	41	40	39	45
NAG 6 ¹	205 ²	41	41	41	45
	203, 242 ²	40	40	40	45
	202	39	39	39	45
	204	38	38	38	45
	All other privately-owned land	37	37	37	45
NAG 7 ¹	68, 74, 279 ²	43	42	42	45
	86, 290 ²	42	42	42	45
	77	42	41	41	45
	79, 80, 231 ³	41	41	41	45
	78 ²	41	40	40	45
	All other privately-owned land	40	37	37	45
NAG 8	35	42	41	41	45
	289	41	40	40	45
	23, 84	40	40	40	45
	All other privately-owned land	41	39	39	45

Table 11 (Continued)
Noise Impact Assessment Criteria (dBA)

Location		Day	Evening	Night	
		L _{Aeq} (15min)	L _{Aeq} (15min)	L _{Aeq} (15min)	L _{A1} (1min)
NAG 9	All privately-owned land	39	38	37	45
NAG 10	All privately-owned land	35	35	35	45
NAG 11	All privately-owned land	37	36	35	45
All other privately-owned land		35	35	35	45

Source: Development Consent DA 92/97 and EPL 20850.

Notes:

dBA = A-weighted decibels.

- ¹ The MOD 1 EA predicted maximum noise levels of 40 dBA at Receiver 257 (located in NAG 1), 39 dBA at Receiver 140 (located in NAG 3), 38 dBA at Receiver 198 (located in NAG 6) and 42 dBA at Receiver 83 (located in NAG 7). While these MOD 1 EA predictions are not reflected in Table 11, Receivers 257 and 140 are entitled to noise mitigation upon request under Development Consent DA 92/97.
- ² Following a detailed investigation conducted during preparation of the approved NMP, it was established that these Receivers are no longer present/inhabited.
- ³ Following a detailed investigation conducted during the preparation of the approved NMP, it was established that Receiver 231 is now an uninhabited mine-owned property.

The cumulative noise criteria defined in Table 5 of Development Consent DA 92/97 (Condition 5, Schedule 3) are provided in Table 12.

Table 12
Approval Criteria for Cumulative Noise (dBA)

Location	Day	Evening	Night
	L _{Aeq} (period)	L _{Aeq} (period)	L _{Aeq} (period)
NAG 8, 9	55	45	40
All other privately-owned land	50	45	40

Note: L_{Aeq}(period) = equivalent continuous noise level over a measured period.

The MOD 1 EA predictions for noise were used to establish the Noise Impact Assessment Criteria in Development Consent DA 92/97, and as such, by complying with the Noise Impact Assessment Criteria, operations at the MPO have remained consistent with the predictions in the MOD 1 EA.

Noise criteria and other noise related conditions stipulated in EPL 20850 are generally consistent with those prescribed in Development Consent DA 92/97.

Noise Management Plan

During the reporting period, MACH Energy prepared a NMP which was approved on 14 June 2017. The

NMP describes the following construction and operational noise controls to be implemented to limit construction and operational noise:

- Plant operates in less exposed areas during the more sensitive evening/night period.
- Lesser noise generating construction activities (e.g. welding and electrical works) can be conducted during the evening/night-time period.

- Vegetation clearance will be limited to daytime hours.
- “Quackers” will be used in place of reverse beepers.
- Noise suppression will be provided on major operational mobile plant.
- Temporary cessation of work within an area, or from a particularly noisy piece of equipment, will be considered when adverse weather conditions are present.
- All plant and machinery used on-site will be maintained regularly to minimise noise generation.
- All plant and machinery used on-site will be operated in a proper and efficient manner (e.g. at correct speed) to minimise noise generation.
- Regular communication and updates will be provided to local residents on the status and nature of site construction and operational activities.
- At least 48 hours prior to the commencement of any out of hours construction activities, MACH Energy will notify the Muswellbrook Shire Council and local residents of the timing and expected duration of the associated construction works. After the initial notification, MACH Energy will provide local residents with regular updates throughout the duration of the construction (e.g. via community newsletters or information updates on MACH Energy’s website [machenergyaustralia.com.au]).
- In the event of a complaint from a local resident, MACH Energy will implement the complaints response process.

The following performance indicators are specified in the NMP to track the performance of the MPO:

- effective implementation of the Real-time Response Protocol for noise;
- results of operator attended noise monitoring, conducted and assessed in accordance with the *NSW Industrial Noise Policy* (EPA, 2000), are compliant with the noise criteria in Table 11; and
- complaints are minimised and appropriate management actions are implemented following receipt of a complaint.

5.2.2 Performance during the Reporting Period

Operator attended Noise Monitoring

Operator attended monitoring was undertaken monthly by Global Acoustics Pty Ltd from January – June 2017 and quarterly thereafter, in accordance with the NMP and EPL 20850. In addition, operator attended monitoring was undertaken on 22 July and 23 August 2017, to ensure compliance during construction undertaken outside standard hours (i.e. on weekends, after 1 pm on Saturdays and on Sundays).

Operator attended monitoring was undertaken at six locations selected to represent the NAGs identified in Development Consent DA 92/97, as shown on Figure 3 and Table 13.

Table 13
Noise Monitoring Locations

Monitoring Location	NAG Represented
N-AT1	1
N-AT2	2
N-AT3	3/4/5
N-AT4	6/7
N-AT5	8/9
N-AT6	10/11

During the reporting period, MACH Energy complied with all statutory conditions relating to noise. MACH Energy also complied with all additional noise requirements detailed in the NMP.

Monitoring was undertaken in accordance with Condition M4 of EPL 20850 (i.e. at least quarterly and during day, evening and night periods).

All applicable $L_{Aeq(15min)}$ measured noise levels attributable to the MPO were compliant with the relevant noise criteria from Development Consent DA 92/97 and EPL 20850 during the reporting period. Results of the operator attended noise monitoring for each monitoring round during the reporting period are available on the MACH Energy website (www.machenergyaustralia.com.au).

Real-time Noise Monitoring

Real-time monitoring systems were installed at three locations in November 2016 prior to construction work commencing on-site (Figure 3). Real-time noise monitoring was undertaken at these three locations (N-BO1, N-BO2 and N-BO4) 24 hours per day, seven days per week for the duration of the reporting period. This real-time noise monitoring was not used to assess compliance with noise criteria, but instead was used for ongoing performance assessment and to assist in avoiding potential non-compliances.

During the reporting period, a number of low order (i.e. green and amber) real-time noise monitoring triggers occurred, which prompted the implementation of real-time response management actions, consistent with the Real-time Response Protocol outlined in the NMP.

Complaints

Four noise related complaints were received by MACH Energy during 2017 (Appendix A). In response to the complaints, the External Relations Manager (ERM) organised the cessation of noise intensive works and committed to informing the complainant at the recommencement of similar works in the future, where necessary. In all cases the ERM made further contact with the complainant to provide an update of the noise activities.

5.2.3 Trends and Key Management Implications

Noise levels from the MPO continued to comply with the relevant criteria at all monitoring sites during the operator attended monitoring surveys in 2017.

No environmental performance or management issues arose in regard to noise during the reporting period.

5.2.4 Implemented or Proposed Management Actions

All noise management measures outlined in the NMP and summarised in Section 5.2.1 were undertaken during the reporting period. In particular, MACH Energy implemented the following specific management measures:

- real-time noise monitoring was continued at the three real-time noise monitoring locations and the Real-time Response Protocol was implemented where appropriate;
- following approval of the NMP (June 2017), operator attended noise monitoring changed from being undertaken monthly to quarterly; and
- MACH Energy provided notice to potentially impacted sensitive receptors and the Muswellbrook Shire Council prior to out of hours construction works being undertaken during the reporting period, which included the timing and expected duration of the works.

5.3 BLASTING

Airblast overpressure and ground vibration assessment criteria for the MPO are defined in Table 7 of Development Consent DA 92/97 (Condition 10, Schedule 3) and EPL 20850 (Conditions L3.1, L3.2, L3.3, L3.4, L3.5 and L3.6). Additional conditions relating to blasting hours and frequency, property inspections and investigations, monitoring locations, measurement methodology, operating conditions and preparation of the BMP, are also detailed in these approvals.

During the reporting period, MACH Energy prepared a BMP in accordance with Condition 17, Schedule 3, which was approved on 3 August 2017.

5.3.1 Approval Criteria and Management Plan Requirements

Development Consent DA 92/97 and Environment Protection Licence 20850

A summary of the approval criteria for blasting is included in Table 14.

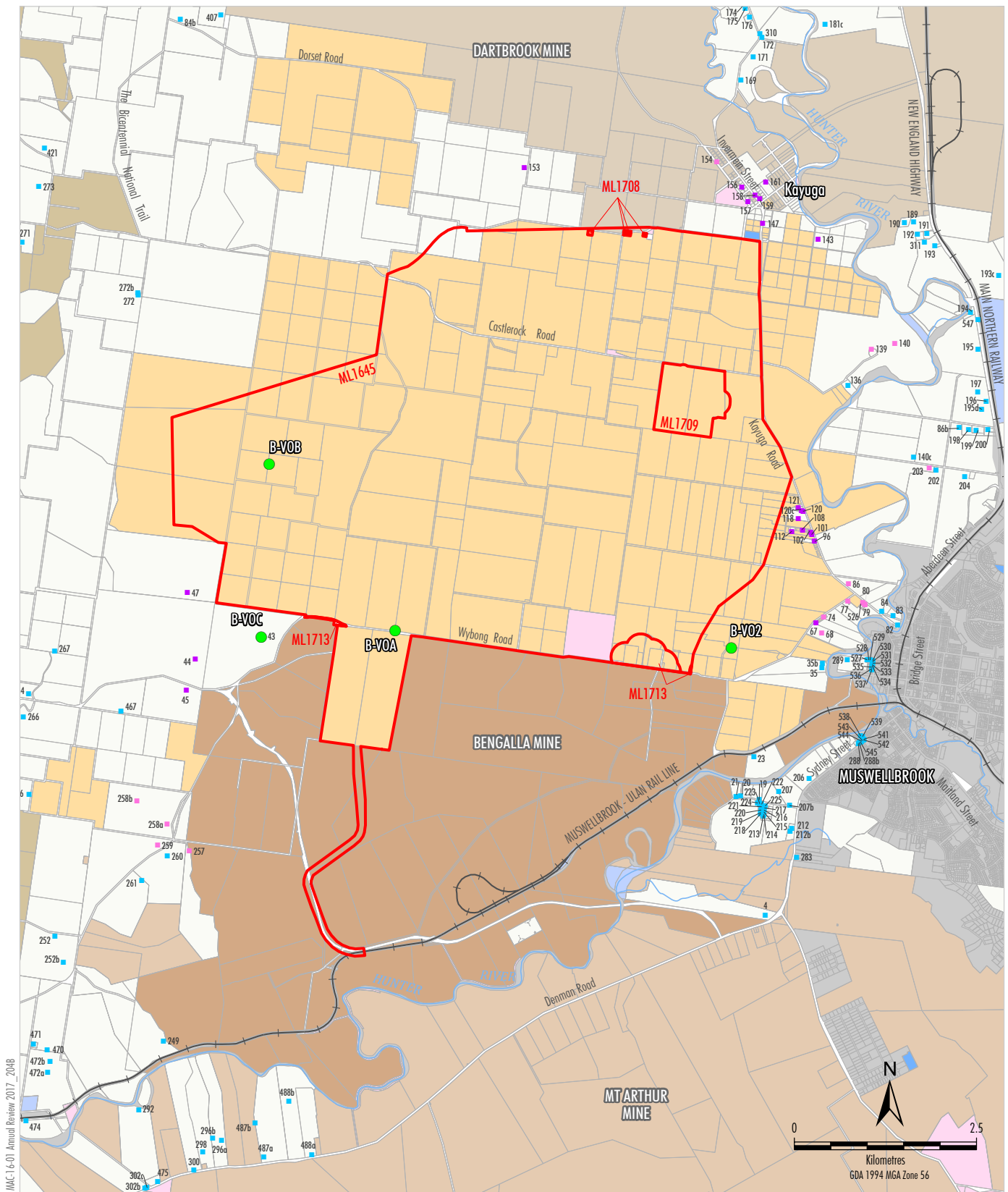
Table 14
Assessment Criteria for Blasting

Location	Airblast Overpressure (dB[Lin Peak])	Ground Vibration (mm/s)	Allowable Exceedance
Residence on privately-owned land	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months
Historic heritage sites	-	10	0%
All public infrastructure	-	50	0%

Source: Table 7 of Development Consent DA 92/97 (Condition 10, Schedule 3).

Note: mm/s = millimetres per second; dB = decibels.

Conditions L3.3, L3.4, L3.5 and L3.6 of EPL 20850 contain the same blasting assessment criteria for residences on privately-owned land as specified in Table 14. However, EPL 20850 requires that monitoring does not exceed these criteria at monitoring site B-VOC rather than at all residences on privately-owned land (Figure 4).



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LEGEND

- Mining Lease Boundary
- Privately-owned Residence - MPO Acquisition on Request
- Privately-owned Residence - MPO Mitigation on Request
- Other Privately-owned Residence
- Blast Monitoring Site (Vibration/Overpressure)

- Muswellbrook and Upper Hunter LEPs Zones B2, B5, IN1, SP2, R2, R5, RE1, RE2 and W1
- Crown
- Crown/State of NSW
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Mount Pleasant Controlled
- Bengalla Controlled
- Dartbrook Controlled
- Mt Arthur Controlled
- Other Mining/Resource Company Controlled
- Privately Owned Land

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); MACH Energy (2017)

MACHEnergy
MOUNT PLEASANT OPERATION
Blast Monitoring Sites

Figure 4

Airblast overpressure, ground vibration and fume monitoring was conducted for every blast event at the blast monitoring sites shown on Figure 4. This is with the exception of monitoring at site B-VOB which hasn't yet been installed as construction of the Tailings Dam is yet to be finalised. Once construction of the Tailings Dam is completed, blast monitoring at B-VOB will commence.

5.3.2 Performance during the Reporting Period

Blasting on-site commenced in December 2017. Four blasts in total occurred during the reporting period, as shown in Table 15, with all blasts undertaken in December.

Table 15
Blasting Summary 2017

Date of Shot	Blast Monitoring Site					
	B-VOC		B-VO2		B-VOA	
	GV	OP	GV	OP	GV	OP
01/12/17	0.17	108	0.1	101.1	0.53	102.9
07/12/17	0.19	99.8	0.13	101.2	0.26	105.5
13/12/17	0.14	91.2	0.07	96.9	0.17	97
29/12/17	0.09	94.3	0.18	99.6	0.18	99.6

GV = Ground Vibration measured in mm/s, OP = Overpressure measured in dB(Lin Peak).

All recorded blast measurements were in accordance with the relevant blasting criteria (Section 5.3.1).

5.3.3 Trends and Key Management Implications

As no blasting was undertaken during the previous reporting period, no trends or key management implications have been identified.

5.3.4 Implemented or Proposed Management Actions

Notifications of upcoming blasts were provided on MACH Energy's and MSC's website. In addition, MACH Energy notified private landholders or residents who expressed an interest in being informed of the MPO blasting schedule and were therefore on the MPO pre-blast notification register.

No road closures due to blasting occurred in 2017.

5.4 AIR QUALITY

Air quality criteria for the MPO are presented in Tables 8, 9 and 10 of Development Consent DA 92/97 (Condition 20, Schedule 3) and EPL 20850 (Condition O3.5). Additional conditions relating to operating conditions, greenhouse gas emissions, odour, acquisition criteria and preparation of the AQGGMP are also provided in Development Consent DA 92/97 and EPL 20850.

5.4.1 Approval Criteria and Management Plan Requirements

Development Consent DA 92/97 and Environment Protection Licence 20850

A summary of the approval criteria for air quality is included in Table 16.

Table 16
Approval Criteria for Particulate Matter

	Pollutant	Averaging Period	^a Criterion
Long-term Impact Assessment Criteria	TSP	Annual	^b 90 µg/m ³
	PM ₁₀	Annual	^b 30 µg/m ³
	Deposited Dust ^d	Annual	^c 2 g/m ² /month ^b 4 g/m ² /month
Short-term Impact Assessment Criteria	PM ₁₀	24 hour	^c 50 µg/m ³

Source: Development Consent DA 92/97 (Condition 20, Schedule 3).

Note: PM₁₀ = particulate matter less than or equal to 10 micrometres in diameter;
µg/m³ = micrograms per cubic metre; g/m²/month = grams per square metre per month.

^a Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Secretary of the DPE.

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

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

^d 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*.

Air quality criteria and other air quality related conditions stipulated in EPL 20850 are generally consistent with those prescribed in Development Consent DA 92/97, with the exception of Conditions O3.4 to O3.8, which state:

O3 Dust

...

O3.4 *The licensee must cease all dust generating activities during adverse conditions being the occurrence of both the adverse wind conditions set out in Condition O3.5 (b) and the adverse PM₁₀ concentrations set out in Condition O3.5(c).*

O3.5 *For the purpose of Condition O3.4 the following definitions apply.*

(a) 'dust generating activities' means drilling, blasting, earthworks, construction activities, all hauling activities on unsealed haul roads, all overburden and coal extraction operations including loading and dumping activities and grader, loader, dozer and dragline operations.

(b) 'adverse wind conditions' means a rolling 1-hour average wind direction between 270 degrees and 360 degrees (inclusive) measured at the meteorological station (EPA Identification No.4). Australian Standard AS3580.14-2014 is to be used to calculate the rolling 1 hour average wind direction

(c) 'adverse PM₁₀ concentrations' means a rolling 24-hour average PM₁₀ concentration of equal to or greater than 44 micrograms per cubic metre measured at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitor.

(d) Operation of watercarts is permitted at all times.

O3.6 *Shutdown of dust generating activities required by Condition O3.4 must be completed within 1 hour of receiving data that triggers action required by Condition O3.4.*

O3.7 *The licensee may resume dust generating activities at the premises when:*

(a) adverse wind conditions as defined in Condition O3.5(b); or

(b) adverse PM₁₀ concentrations as defined in Condition O3.5(c) are not measured for a minimum time period of 1 hour from the time that cessation of dust generation activities is completed.

O3.8 *The licensee must cease dust generating activities at the premises at any time when there is no access to the meteorological monitoring data required by Condition M5.1 and / or when there is no access to the PM₁₀ monitoring data at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitor.*

Note: An alternate PM₁₀ monitor location and associated trigger value is to be negotiated with the EPA. This alternate monitor and PM₁₀ trigger value is to be used for Condition O3.5(c), in the event that there is no access to the PM₁₀ monitoring data at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network.

Air Quality and Greenhouse Gas Management Plan

MACH Energy prepared an AQGGMP during the reporting period, which was approved on 15 June 2017.

The AQGGMP outlines specific management measures for adverse weather conditions, dust management, predictive modelling, real-time response protocols, odour and fume management, greenhouse gas emissions and cumulative air quality management.

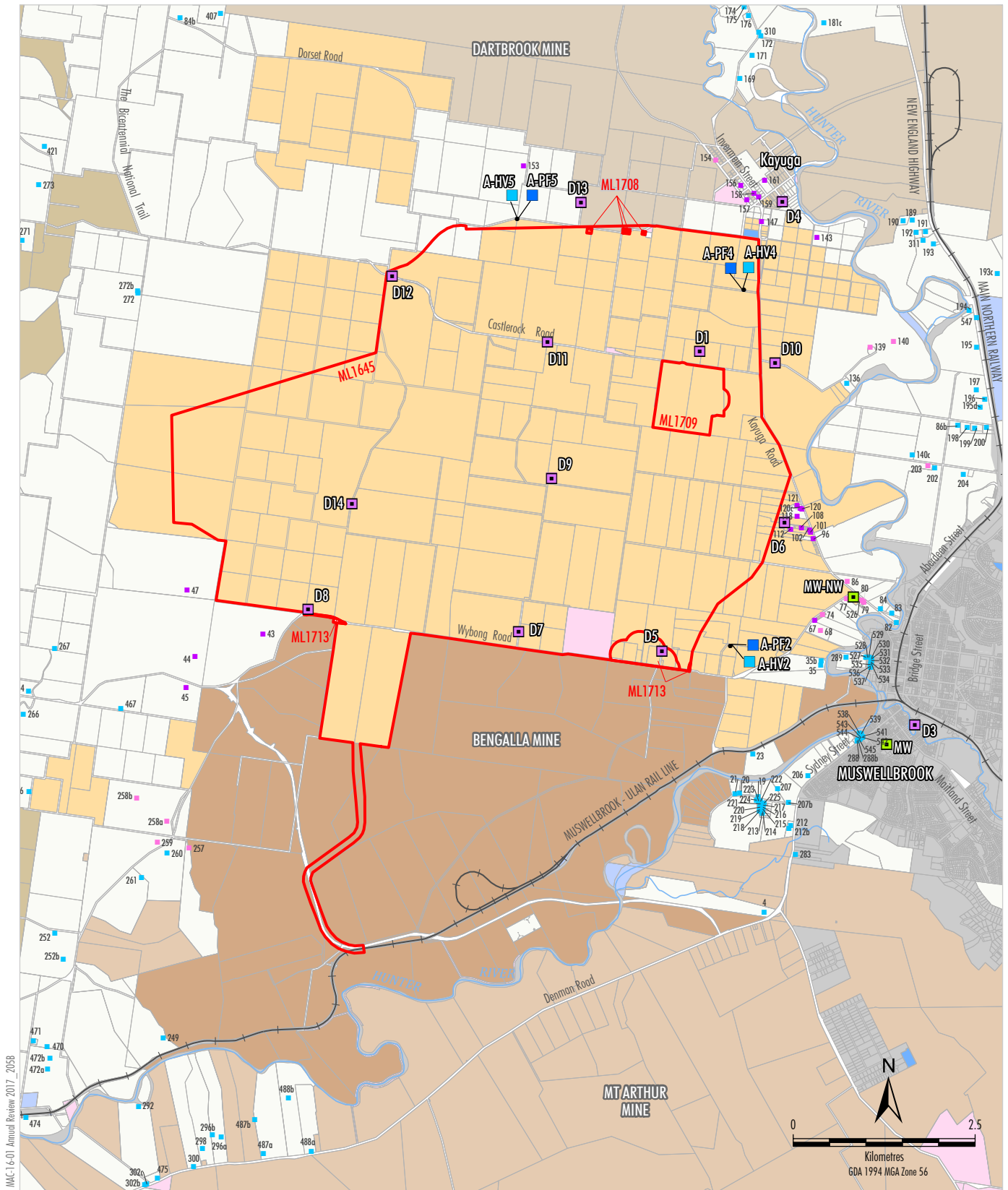
5.4.2 Performance during the Reporting Period

Dust Deposition

During the reporting period, dust deposition levels were collected at 13 dust deposition gauges situated around the MPO boundary (Figure 5). The gauges were sited in accordance with AS 3580.1.1:2007 and analysed for mass of total insoluble matter and ash in accordance with AS 3580.10.1-2003.

In August 2017, D5 and D7 were relocated approximately 100 metres (m) from their previous locations due to the original locations being cleared to make way for MPO operations. Given that the new locations were located so closely to the previous monitoring locations, the data for the sites before August have been merged with the more recent data to provide a full suite of monitoring data for the year. This monitoring data has been used to compare to data collected at the sites used in previous monitoring rounds.

Annual average levels of insoluble solids (i.e. dust deposition) are presented in Chart 4. Chart 5 provides a comparison between annual average dust deposition levels at each of the monitoring sites from 2014 to 2017.



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- LEGEND**
- Mining Lease Boundary
 - Privately-owned Residence - MPO Acquisition on Request
 - Privately-owned Residence - MPO Mitigation on Request
 - Other Privately-owned Residence
 - Monitoring Sites
 - Air Quality - High Volume Sampler
 - Air Quality - Palas Fidas
 - Dust Deposition Gauge
 - Upper Hunter Air Quality Monitoring Network

- Muswellbrook and Upper Hunter LEPs Zones B2, B5, IN1, SP2, R2, R5, RE1, RE2 and W1
- Crown
- Crown/State of NSW
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Mount Pleasant Controlled
- Bengalla Controlled
- Dartbrook Controlled
- Mt Arthur Controlled
- Other Mining/Resource Company Controlled
- Privately Owned Land

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2017); MACH Energy (2017)

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MOUNT PLEASANT OPERATION
Air Quality Monitoring Sites

Figure 5

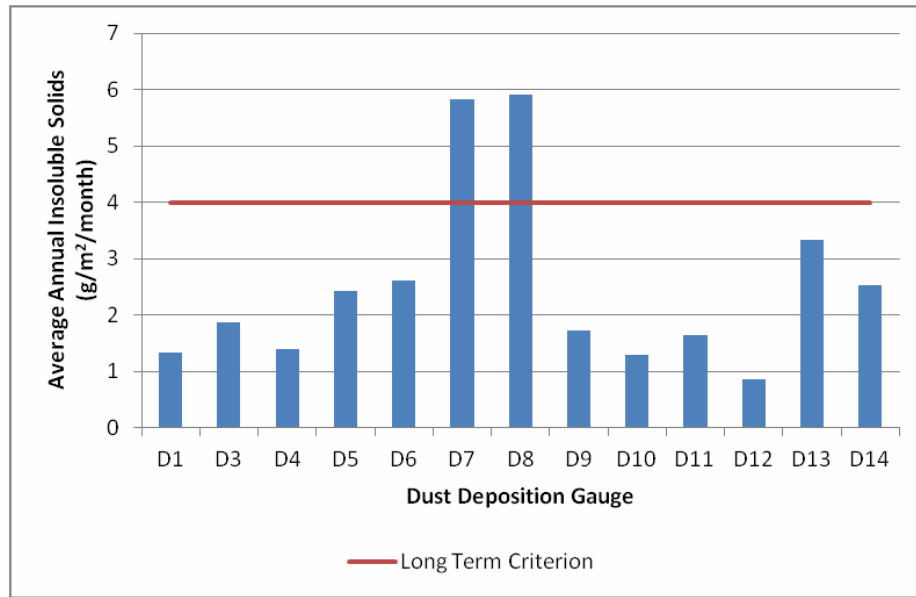


Chart 4: 2017 Annual Average Insoluble Solids

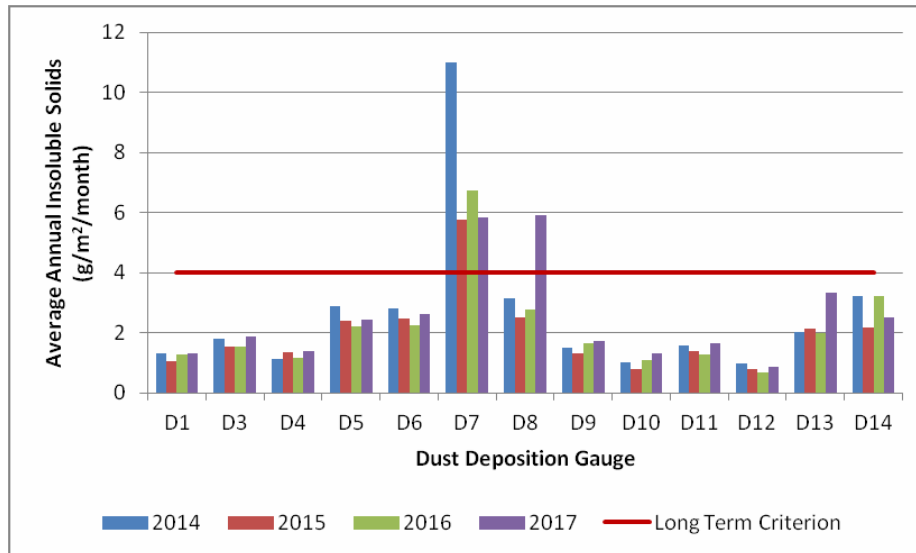


Chart 5: 2014 - 2017 Annual Average Insoluble Solids

PM₁₀ and PM_{2.5}

Palas Fidas monitoring systems were installed at three locations (Figure 5) in late 2016. The Palas Fidas systems collected PM₁₀¹ data continuously, which was averaged over 24 hours (Chart 6) and annually (Chart 7).

¹ PM₁₀ refers to particulate matter with an aerodynamic diameter less than 10 micrometres (µm).

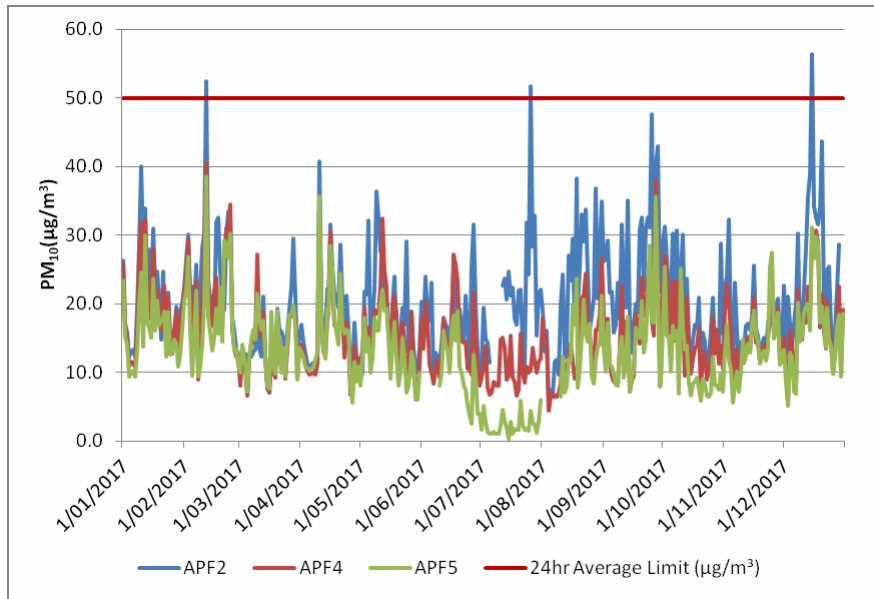


Chart 6: 24 hour Average PM₁₀ Levels

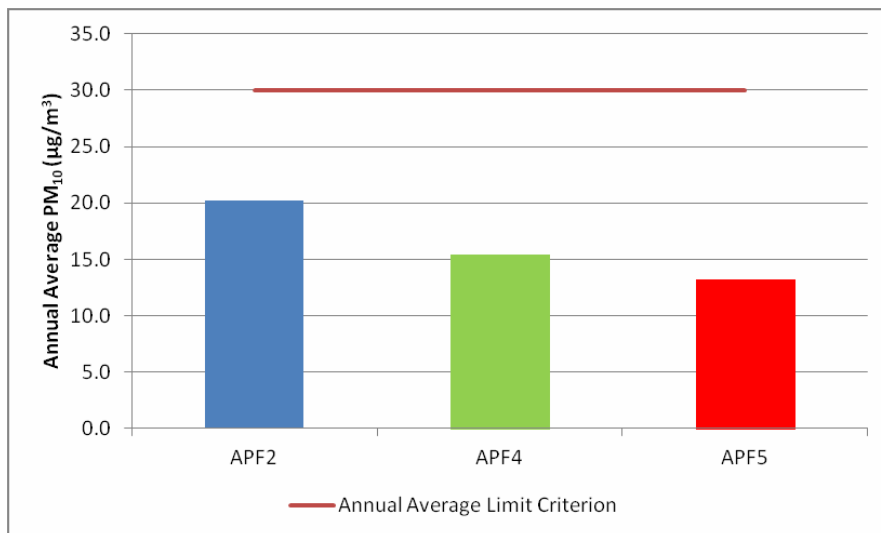


Chart 7: Annual Average PM₁₀ Levels

Total Suspended Particulate

TSP levels were recorded at the three HVAS systems (A-HV2, A-HV4 and A-HV5) located adjacent to the three Palas Fidas monitors (Figure 5). These HVAS systems were sited in conjunction with the Palas Fidas monitors in late 2016. Annual average TSP levels are presented in Chart 8.

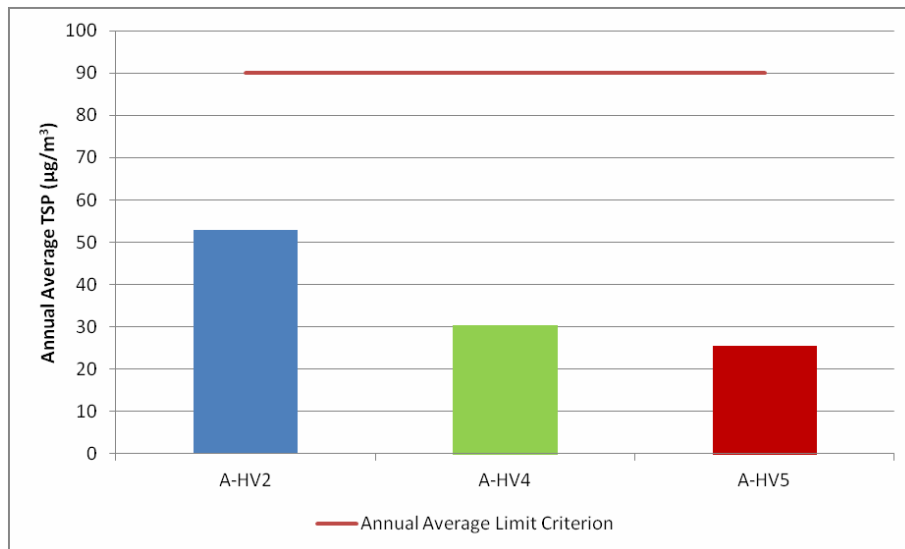


Chart 8: Annual Average TSP Levels

The annual average TSP levels were compliant with the annual average TSP criterion during the reporting period.

5.4.3 Trends and Key Management Implications

Dust deposition levels stayed relatively consistent between 2016 and 2017, with the exception of D8 and D13. Annual average levels of deposited dust were recorded below the Long-term Impact Assessment Criteria of 4 g/m²/month at all dust gauges, with the exception of D7 and D8.

D7 is located between the MPO and Bengalla Mine and is impacted by both operations. Baseline dust deposition levels at D7 have consistently been measured above the long term criterion prior to operations at the MPO commencing in late 2016. For this reason, the approved AQGGMP includes a provision for the continued monitoring of D7 for internal monitoring purposes, but notes that measurements at this site are not assessed for compliance. The elevated insoluble solid readings at D7 are therefore not deemed to be a non-compliance.

D8 recorded a marked increase in dust levels from 2016 to 2017. Elevated dust deposition levels were recorded at gauge D8 from February – December 2017. Dust deposition gauge D8 is located in close proximity to Wybong Road. These readings coincided with extensive road works being undertaken on Wybong Road in the vicinity of the dust gauge and were therefore not attributed to MPO operations. This reading has therefore not been recorded as a non-compliance (Environmental Resources Management Australia Pty Ltd [ERM], 2018).

D13 also recorded a slight increase compared to previous years, although it did not record an exceedance of the annual average criterion. The majority of works undertaken at the MPO during the reporting period were undertaken in the southern quadrant of the MPO area. D13 is located north of the MPO area and D11 (which did not record a corresponding increase), is located between the bulk of MPO operations and D13. Therefore, it is reasonable to assume that the increase at D13 was not due to MPO activities.

Both 24 hour and annual average PM₁₀ levels were below the relevant criteria during the reporting period, with the exception of three exceedances of the 24 hour average PM₁₀ levels at monitor APF2. These exceedances occurred on 12 February, 26 July and 15 December 2017.

The exceedance on 12 February was reported in the February Monthly Environmental Monitoring Report and was attributed to regional bushfires which caused elevated readings (MACH Energy, 2017c). In addition, the MPO was not operating during the exceedance as it occurred on a Sunday. This exceedance is therefore not considered to be a non-compliance.

The daily readings for 26 July and 15 December were recorded as $51.7 \mu\text{g}/\text{m}^3$ and $56.3 \mu\text{g}/\text{m}^3$, respectively. These readings were over the 24 hour average PM_{10} level of $50 \mu\text{g}/\text{m}^3$. Notwithstanding, APF2 is located on MACH Energy owned land and not privately-owned land and therefore these exceedances were not considered to be non-compliances.

During the reporting period, 24 hour average PM_{10} levels fluctuated between approximately 10 and $30 \mu\text{g}/\text{m}^3$ and no significant change was apparent during the year. As monitoring of PM_{10} levels commenced in late 2016, it is not possible to compare results with previous years. Notwithstanding, during the next reporting period a comparison between current and previous PM_{10} levels will be undertaken.

In accordance with Conditions O3.4 and O3.5 from EPL 20850, all dust generating activities at the MPO must be ceased when specific adverse conditions are identified at the on-site meteorological station or at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitor.

During 2017, PM_{10} levels at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitor exceeded a rolling 24 hour average of $44 \mu\text{g}/\text{m}^3$ on three occasions (12 February, 10 April and 15 December) (NSW OEH, 2018). Dust generating activities were discontinued on 10 April and 15 December (i.e. in accordance with EPL 20850 Condition O3.4), however, the MPO was not operating on 12 February (a Sunday) and therefore no action was taken. In addition, dust generating activities were discontinued on 28 September following a dust reading which neared the upper limit ($43.8 \mu\text{g}/\text{m}^3$).

Real-time monitoring of $\text{PM}_{2.5}$ was undertaken during the reporting period at the three Palas Fidas monitors (Figure 5). Monitoring of $\text{PM}_{2.5}$ is not monitored for compliance purposes and therefore has not been presented.

EIS predictions for air quality were modelled based upon five scenarios during the mine life (i.e. Years 2, 5, 10, 15 and 20 of mine production). These predictions were based upon dust levels from mining activities and there is no scenario for construction only air quality predictions. Therefore, EIS predictions for this stage of the MPO have not been considered in this Annual Review.

5.4.4 Implemented or Proposed Management Actions

During the reporting period, three HVAS and three Palas Fidas air quality monitoring systems were installed and commenced monitoring (Figure 5). The HVAS systems measured TSP levels continuously for 24 hours, once every six days. The Palas Fidas systems continuously measured PM_{10} , TSP and $\text{PM}_{2.5}$ levels.

In order to more accurately represent private receivers in the vicinity of the Muswellbrook NW Upper Hunter Air Quality Monitoring Network gauge, MACH Energy will seek approval for a revised AQGGMP in early 2018, to relocate site APF2 approximately 400 m south-east of its current position.

Site inductions undertaken in the reporting period included consideration of air quality requirements to ensure employee and contractor awareness of potential dust impacts, especially with respect to the nearest sensitive receptors. All contractors operated in compliance with the approved MPO AQGGMP.

5.5 BIODIVERSITY

In accordance with Condition 32, Schedule 3 of Development Consent DA 92/97, Coal & Allied prepared a Biodiversity and Rehabilitation Management Plan (Biodiversity portion only) for the MPO in 2012, which was approved on 23 July 2012.

During the reporting period, MACH Energy elected to develop the rail loop and load out infrastructure (Table 6). As such, no development is planned within the conveyor/service corridor and therefore, as per Condition 29, Schedule 3 of Development Consent DA 92/97, an offset strategy is not required.

5.5.1 Approval Criteria and Management Plan Requirements

The approved Biodiversity and Rehabilitation Management Plan (Biodiversity portion only) contains a number of performance measures and indicators which have been developed in accordance with the EIS and EA. Relevant performance measures and associated indicators for work undertaken on-site during the reporting period are provided in Table 17.

Appendix 3 of Development Consent DA 92/97 requires that pre-clearance surveys of relevant forest and woodland areas for threatened flora and fauna species are to be undertaken during the construction phase.

Table 17
Relevant Biodiversity Management Plan Performance Measures and Indicators

Criteria	Performance Measure	Performance Indicator
Topsoil conservation and reuse	Topsoil resources pre mining are defined.	<ul style="list-style-type: none"> Topsoil is stripped and placed in accordance with the topsoil stripping plan.
Weed Control	Weeds are controlled to appropriate levels.	<ul style="list-style-type: none"> Regular inspections of the MPO lands to identify areas requiring the implementation of weed management measures. Management of cattle movement to mitigate the risks associated with the control of weeds in manure, around stockyards, and key access corridors. Regular inspections and maintenance of topsoil stockpiles. Management of cattle movement to mitigate the risks associated with the control of weeds in manure, around stockyards, and key access corridors. Consultation with neighbouring land owners and the relevant government stakeholders, such as the Upper Hunter Weeds Authority, regarding regional weed management strategies. Implementation of appropriate weed management measures which may include mechanical removal, application of approved herbicides and biological control. Control of noxious weeds identified on the MPO owned land in accordance with the relevant Department of Primary Industries control category and the regional Weed Management Plan. Identification of weed infestations adjacent to or within the proposed disturbance area during preclearance surveys. Follow-up inspections to assess the effectiveness of the weed management measures implemented and the requirement for any additional management measures.
Pest animal species	Pest animal control for any declared pest animal species known on the MPO lands.	<ul style="list-style-type: none"> Mandatory pest control for any declared pests known to occur on MPO owned land. Use a range of appropriate pest control measures as determined (e.g. the destruction of habitat, trapping, targeted shooting programs and baiting). Follow-up inspections to assess the effectiveness of control measures implemented and the requirement for any additional control measures.

Table 17 (Continued)
Relevant Biodiversity Management Plan Performance Measures and Indicators

Criteria	Performance Measure	Performance Indicator
Bushfire preparedness and risk mitigation	Vegetation is managed to control fire.	<ul style="list-style-type: none"> Indicators as described in Bushfire Management Plan (Coal & Allied, June 2007). Monitoring of fuel loads as per the Bushfire Management Plan (Coal & Allied, June 2007). A hazard reduction burning program to reduce fuel levels may be considered in conjunction with advice and assistance from the NSW Rural Fire Service. Controlled burns are undertaken at intervals across the site to create a mosaic fire pattern to allow fauna refuge in unburnt vegetation. The rotation of cattle grazing provides an effective management option for reducing fuel loads. Fire bans, as determined by the NSW Rural Fire Service, will be adhered to by all personnel and will be enforced. Potential ignition sources such as those resulting from hot work practices including welding and cutting will be restricted where possible to workshop areas or within active parts of the mine where vegetation is non-existent. If this is not possible due to the remoteness of the location a Hot Work Permit is to be approved by the project supervisor. Hot Work Permits are not to be issued for work outside of workshops when 'Total Fire Bans' are in place. Water carts with fire fighting equipment capable of extinguishing fire outbreaks shall be maintained. This fire fighting equipment, together with graders and bulldozers used for mining, provides effective bushfire fighting capability. Responsiveness is enhanced by emergency preparedness training for mine-site personnel. Ready access is maintained for vehicles to engage in water abstractions at dams on-site or at defined water fill points. Outlets are compatible with fire fighting equipment. Firebreaks are established around the operations to prevent the spread of bushfires onto or from adjacent properties. These firebreaks are inspected annually for adequacy. Where the creation and maintenance of proposed firebreaks has the potential to interact with areas of Aboriginal Cultural Heritage Sites or Archaeologically Sensitive Areas, these activities will be undertaken in accordance with the AHMP. Any incident of unplanned bushfire will be reported directly to the Site Supervisor who will initiate an emergency response. If required, the Mine Manager will notify the local Rural Fire Service.
Seed collection	Seed Calendar to be developed for the site.	<ul style="list-style-type: none"> Seed Calendar contains information relating to: <ul style="list-style-type: none"> Species flowering time, which can be referenced in terms of habitat value; Fruiting and seed collection time; Additional information on collection; Viability data - where available.

Table 17 (Continued)
Relevant Biodiversity Management Plan Performance Measures and Indicators

Criteria	Performance Measure	Performance Indicator
Seed collection (continued)	Data on seed collection.	<ul style="list-style-type: none"> • Collated via the use of Geographic Information System (GIS) data including: <ul style="list-style-type: none"> – date; – species; and – location.
	Audits of the mine path in terms of seed availability.	<ul style="list-style-type: none"> • Undertaken 12 months prior to mining. • Resultant data is incorporated into the site GIS. • The location of key trees and/or stands of plants are recorded on GIS and marked in the field for future detection and assessment. • The area to be cleared is inspected as per the Ground Disturbance Permit (GDP) and Pre-Clearance Surveys with the occurrence of plants in fruit relayed to the sites environment staff. • Seed collectors are advised as to the timing of proposed clearing. • Plants located at accessible heights to enable seed collection are accessed with maximum harvesting of fruit / seed. • For overstorey species and those not previously accessible, the seed collectors are to be on-site on the day of clearing of vegetation. • In close liaison with the earthmoving operators, the site is under-scrubbed, removing all vegetative material not containing fruit/seed. The targeted plants are then fallen enabling ready access to the seed collectors. • In the case of eucalypts, the harvested brush material is placed on tarpaulins ideally located in immediate proximity to the fallen tree to enable the fruit to dry and release the seed. To ensure reduced time and cost this material is to remain on-site for approximately two to seven days – this will be seasonally dependent. Once the fruit is opened and seed released and harvested the brush material is either placed onto the topsoil for subsequent removal via the topsoil stripping process or used as brush matting in other areas. • Regular monitoring is undertaken of areas for appropriate, timely and cost effective seed collection.
Seed collection – grass species	Optimum use of the onsite grass seed resource.	<ul style="list-style-type: none"> • A grass seed audit is undertaken defining distribution and density of resources of native grass seed. • Grass seed should be harvested by vehicle mounted harvesters with the goal of maintaining a healthy production area. • Grass seed production areas will be managed to improve the targeted seed. The areas will be monitored for the incursion of key weed species, including though not limited to thistles, St John's Wort (<i>Hypericum perforatum</i>), Fleabane, Fireweed and exotic grasses.

Table 17 (Continued)
Relevant Biodiversity Management Plan Performance Measures and Indicators

Criteria	Performance Measure	Performance Indicator
Germination and establishment of vegetation	Utilisation of seed.	<ul style="list-style-type: none"> Record sheets and GIS databases are developed to track the collection, storage and utilisation of the MPO seed resource.
Minimise site impact in terms of compaction of soil, the spread of weeds and disturbance to vegetation	No uncontrolled entry of livestock or vehicles.	<ul style="list-style-type: none"> Vehicle access is restricted to defined access pathways for use by authorised vehicles. The main arterial tracks are maintained in good condition. Layout of surface works such as roads, survey lines, drill tracks and fencing, are planned and authorised to minimise dissection of habitat areas.
	Ground disturbance.	<ul style="list-style-type: none"> All works will be undertaken in accordance with the GDP system.
Maximising salvage and beneficial use of resources	Optimum harvesting of fencing timber.	<ul style="list-style-type: none"> Vegetation deemed suitable for fencing will be selectively cleared and stockpiled out of the disturbance area.
	Habitat trees.	<ul style="list-style-type: none"> Habitat trees are managed according to the GDP process.
Habitat augmentation	Fallen timber.	<ul style="list-style-type: none"> Fallen timber is left in situ in areas not impacted by mining.
Aboriginal heritage	No conflict between rehabilitation works / biodiversity and Aboriginal cultural heritage.	<ul style="list-style-type: none"> Site is managed according to the GDP process.

5.5.2 Implemented or Proposed Management Actions

In 2017, the following biodiversity related management actions were undertaken:

- An extensive grass seed collection program was undertaken in the MPO area following the seed audit undertaken during the previous reporting period. Seeds were collected in the on-site seed collection/storage area, or alternatively stored in the MPO long term seed storage facility off-site. MACH Energy is currently in discussions with seed contractors to expand the program to also include endemic native tree species.
- Pre-clearance surveys of the haul roads, light vehicle access roads, water management structures, pit areas, magazines, Fines Emplacement Area, sediment dams, and rail and conveyor corridors occurred during the reporting period, prior to disturbance. During construction, ecologists from Narla Environmental remained on-site to manage the clearing of habitat trees and provide assistance to clearing contractors on a daily basis.
- Tree planting occurred on the visual bund constructed along Wybong Road to assist in shielding the MPO from adjacent viewpoints (Section 7.2).
- Weed control measures undertaken in the reporting period, including:
 - Hunter Land Management undertook weed spraying targeting African Boxthorn (*Lycium ferocissimum*) on the Broomfield property.
 - Cumberland Plain Seeds undertook weed spraying targeting *Lycium ferocissimum* along Catslerock Road, as well as on the Warrawee and Boxfield properties.
 - Blackrock industries undertook spraying of noxious weeds along the MPO boundaries between April and June 2017.
 - Weed spraying targeting St John's Wort (*Hypericum perforatum*) was undertaken in December 2016 – February 2017.
- Targeted flora surveys were undertaken in the MPO boundary relevant to various modification applications in preparation.
- Pest control measures were implemented over the MPO area, including:
 - A wild dog and fox baiting program was undertaken by Hunter Land Management Pty Ltd in May and June 2017, which involved baiting 8 sites located across the MPO site. The baiting program had an uptake rate of 87.5% and all baits were recorded as being consumed by foxes or wild dogs, with no takes by any other species (Hunter Land Management, 2017).

5.6 HERITAGE

MACH Energy manages Aboriginal heritage on-site in accordance with Aboriginal Heritage Impact Permit #C0002053 (AHIP #C0002053) and AHIP #C0002092 issued by the Office of Environment and Heritage, and in accordance with the approved AHMP, prepared in accordance with Condition 36, Schedule 3 of Development Consent DA 92/97.

5.6.1 Approval Criteria and Management Plan Requirements

During the reporting period, MACH Energy prepared a contemporary AHMP which was approved on 5 July 2017. The AHMP contains a range of measurement measures related to recording and surface collection, archaeological excavation, artefact analysis, artefact management, scarred tree removal, archaeological salvage and archaeological monitoring.

5.6.2 Implemented or Proposed Management Actions

During the reporting period, the following on-ground management measures relevant to heritage (Aboriginal and historic heritage) were undertaken at the MPO:

- A number of historic heritage sites were managed (i.e. salvaged, excavated or demolished) during the reporting period. This included sites:
 - MP03 (Dever's);
 - MP07 (Bates 1);
 - MP08 (Bates 2);
 - MP10 (Scriven 1);
 - MP11 (Seabrook's);
 - MP12 (Bollibon – Nowland's);
 - MP17 (Clayden's); and
 - MP37 (Berrywood).
- The GDP process was undertaken prior to any surface disturbance undertaken within the AHIP #C0002053 and AHIP #C0002092 areas during the reporting period and included consideration of all Aboriginal and historic heritage sites, and salvage where required.
- All new site specific employees and contractors were required to undertake an induction which included an Aboriginal cultural heritage component. MACH Energy maintains a record of all employee and contractor inductions in accordance with Condition 36(c), Schedule 3 of Development Consent DA 92/97.

During the next reporting period, MACH Energy anticipates undertaking the following heritage works:

- salvage of a number of Aboriginal heritage sites, in accordance with the AHMP;
- development of a Conservation Management Plan for heritage site MP41 (Negoa);
- due diligence surveys on various proposed work sites; and
- archival recordings of a number of historic heritage sites in the MPO area.

5.7 EXPLORATION

MACH Energy undertook a pre-production drilling program during the reporting period, with approximately 80 boreholes being drilled in ML 1645 and ML 1750. Drilling was undertaken using the water injection method, which generates minimal dust and noise emissions. The majority of boreholes were located within the open cut/overburden emplacement area footprint and involved open hole (non core) drilling. The pre-production drilling program will continue into the next reporting period and is scheduled to be completed in February 2018.

5.8 WASTE

Waste data, incorporating both construction and operational waste, was collected during the reporting period by Remondis Australia and is presented in Table 18.

Table 18
Waste Data

Waste	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
General Waste (t)	1.8	4.8	3.6	3.6	6.2	7.0	7.8	12.9	224	128	208.3	302.5	910.5
Asbestos ¹ (t)	0	0	0	0	4.4	10.3	8.8	2.5	2.3	0	0	0	28.3
Recycled Waste (t)	1.2	2.9	2.4	2.4	22.1	1.9	4.6	5.5	9.9	14.7	91.6	114.8	274
Liquid Effluent (kL)	25.7	19.2	41.5	39	39.9	59	69	62	59.5	66.7	3591	4591	8663

Note: t = tonnes; kL = kilolitres.

¹ Asbestos is managed in accordance with an internal Asbestos Control Plan. All asbestos removal work is handled with appropriate respiratory protective equipment and is supervised by a competent person approved by SafeWork NSW. Asbestos is transported off-site and disposed of at a lawful disposal facility licensed by EPA.

During the reporting period, a contemporary WasteMP was prepared by MACH Energy and approved by DPE on 29 September 2017. The WasteMP contains management measures on waste storage, segregation, transport and disposal, as well as provisions for waste monitoring. Waste operations during the reporting period were undertaken in accordance with the approved WasteMP.

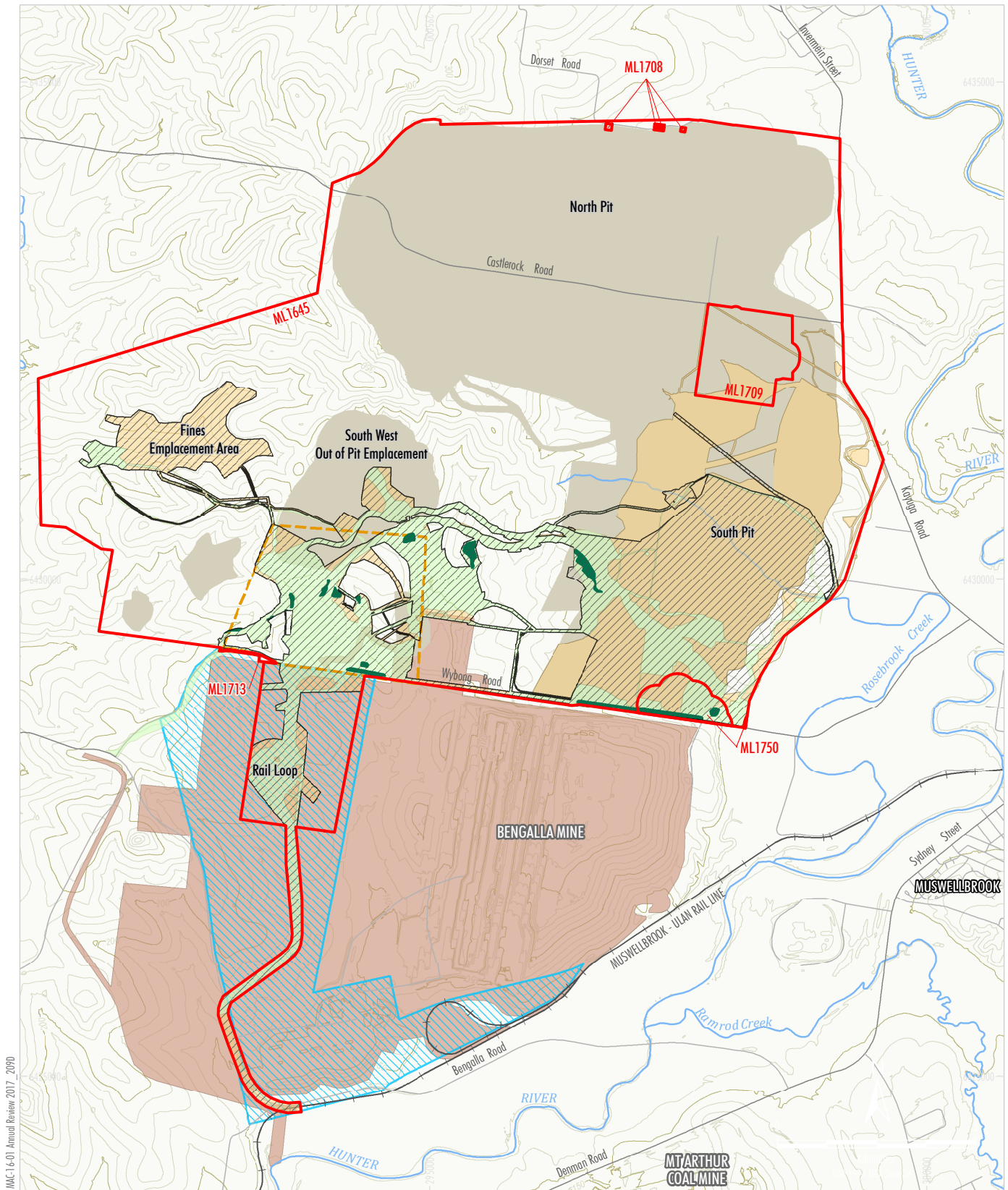
5.9 TOPSOIL MANAGEMENT

During the reporting period, topsoil stockpiles were located adjacent to the site access road, MIA, MWD and areas along Wybong Road, as shown on Figure 6. A total of approximately 297,700 m³ of topsoil was stored in stockpiles during the reporting period. A topsoil register with individual volumes for each stockpile is kept and maintained on-site.

Topsoil is stripped and re-spread immediately where practicable, on road verges, pads, dam embankments etc. Where it is impractical to respread topsoil immediately, topsoil is stockpiled, ripped, contoured and rehabilitated using a hydro seed/mulch mix of exotics and natives. The stockpiles are managed to maintain seed reserves and microbial soil associations.

Several of the topsoil stockpiles were active throughout the reporting period due to the construction phase, i.e. material being actively added to and taken from the stockpiles. As the construction phase nears completion (in the next reporting period), some of the stockpile locations and their management will be assessed for suitability as long-term stockpiles (e.g. they may be re-profiled and seeded).

Plate 1 provides an example topsoil stockpile at the MPO. Further descriptions of topsoil stockpile management options are outlined in the approved MOP.



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LEGEND

- Mining Lease Boundary
- Infrastructure Area Envelope
- Approximate Extent of Approved Surface Development (1997 EIS Year 20) excluding MOP Footprint *
- MOP Footprint +
- 2017 Disturbance ^
- 2018 Forecast Additional Disturbance
- Conveyor/Services Corridor Envelope
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Topsoil Stockpile

Notes:

- * Excludes some project components such as water management infrastructure, infrastructure within the Infrastructure Area Envelope, off-site coal transport infrastructure, road diversions, access tracks, topsoil stockpiles, power supply, temporary offices, other ancillary works and construction disturbance.
- + Mount Pleasant Operation Mining Operations Plan and Rehabilitation Management Plan - Amendment C (April 2017)
- ^ Approximate extent determined from orthophoto flown December 2017

Source: NSW Division of Resources & Energy (2016); NSW Land & Property Information (2016); Department of Planning & Environment (2016); MACH Energy (2016)
Orthophoto: MACH Energy (Dec 2017)

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MOUNT PLEASANT OPERATION
Topsoil Stockpile Locations

Figure 6



Plate 1: Example Topsoil Stockpile

5.10 VISUAL AMENITY AND LIGHTING

Extensive lighting management was undertaken during construction of the MIA and CHPP. This included prioritising lighting within the MIA area to achieve low impacts on surrounding receivers through glare assessment and lighting simulations. In addition, louvres were installed on lighting instalments where practicable.

No complaints relating to visual amenity or lighting from the MPO were received during the reporting period.

During the next reporting period, MACH Energy will prepare a contemporary LMP which will describe MACH Energy's management approach to minimising visual amenity and lighting impacts on surrounding receivers.

5.11 CONTAMINATED LAND

No contaminated land, that posed a potential or material harm to the environment, was encountered during the reporting period.

5.12 SPONTANEOUS COMBUSTION MANAGEMENT

There were no spontaneous combustion incidents at the MPO during the reporting period. Inspections for spontaneous combustion will be undertaken regularly when stockpiling of coal has commenced.

6 WATER MANAGEMENT

During the reporting period a contemporary WMP was approved which proposed the commencement of monitoring at a number of locations, including (Figure 7):

- surface water monitoring locations (W6A and sites W11 – W15); and
- stream health monitoring locations (Hunt 585, Hunt 854, Hunt 571, Hunt 506 and Sandy 1).

Coal extraction did not commence during the reporting period. Construction activities in 2017 were undertaken in accordance with the erosion and sediment control provisions of the approved WMP. Construction activities have been primarily restricted to works in the catchment of the unnamed tributary, commonly referred to as Dry Creek.

Mine water is not currently discharged from the MPO. Any future discharges of mine water will be undertaken in accordance with Development Consent DA 92/97 (Condition 26, Schedule 3), Development Consent SSD-5170 (i.e. Bengalla Mine's Development Consent) and EPL 20850.

6.1 SURFACE WATER

6.1.1 Approval Criteria

Surface Water Quality

Surface water monitoring is undertaken monthly and/or event based at fifteen locations (Figure 7) for pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS). Water samples are also collected quarterly at these sites for laboratory analysis.

Monitoring for Total Dissolved Solids (TDS) did not commence during the reporting period, however TDS values were calculated using monitored EC values. Monitoring for TDS is proposed to commence in the next reporting period.

During the reporting period five new surface water monitoring sites were introduced (Sites W11-W15), as part of further monitoring proposed in the approved WMP. In addition, historical site W6 was relocated approximately 500 m downstream and renamed site W6A. Safe access to site W1, which during previous years has not been monitored due to adjacent steep banks on the Hunter River, was re-established during the reporting period and was monitored from July onwards.

Prior to the reporting period, surface water monitoring undertaken at the MPO has focused on establishing the baseline condition of key watercourses prior to the commencement of coal extraction. Monitoring data has been reviewed against site-specific surface water quality triggers, developed using the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand [ANZECC & ARMCANZ], 2000).

Trigger levels have not been established for sites upstream of the MPO (i.e. W1 and W4) because these cannot be affected by the MPO. Sites located on the Hunter River and the unnamed drainage line (monitored adjacent to Wybong Road) (i.e. W2, W6 and W8) contain sufficient data to develop trigger levels. There was insufficient data to develop TDS trigger levels for these sites. The remaining sites (i.e. W5, W7, W8, W9 and W10) are located on ephemeral drainage lines which are frequently dry and do not have sufficient data to develop site-specific trigger levels. ANZECC & ARMCANZ (2000) default trigger levels for these sites have been adopted, until such time as sufficient data is available to develop site-specific triggers.

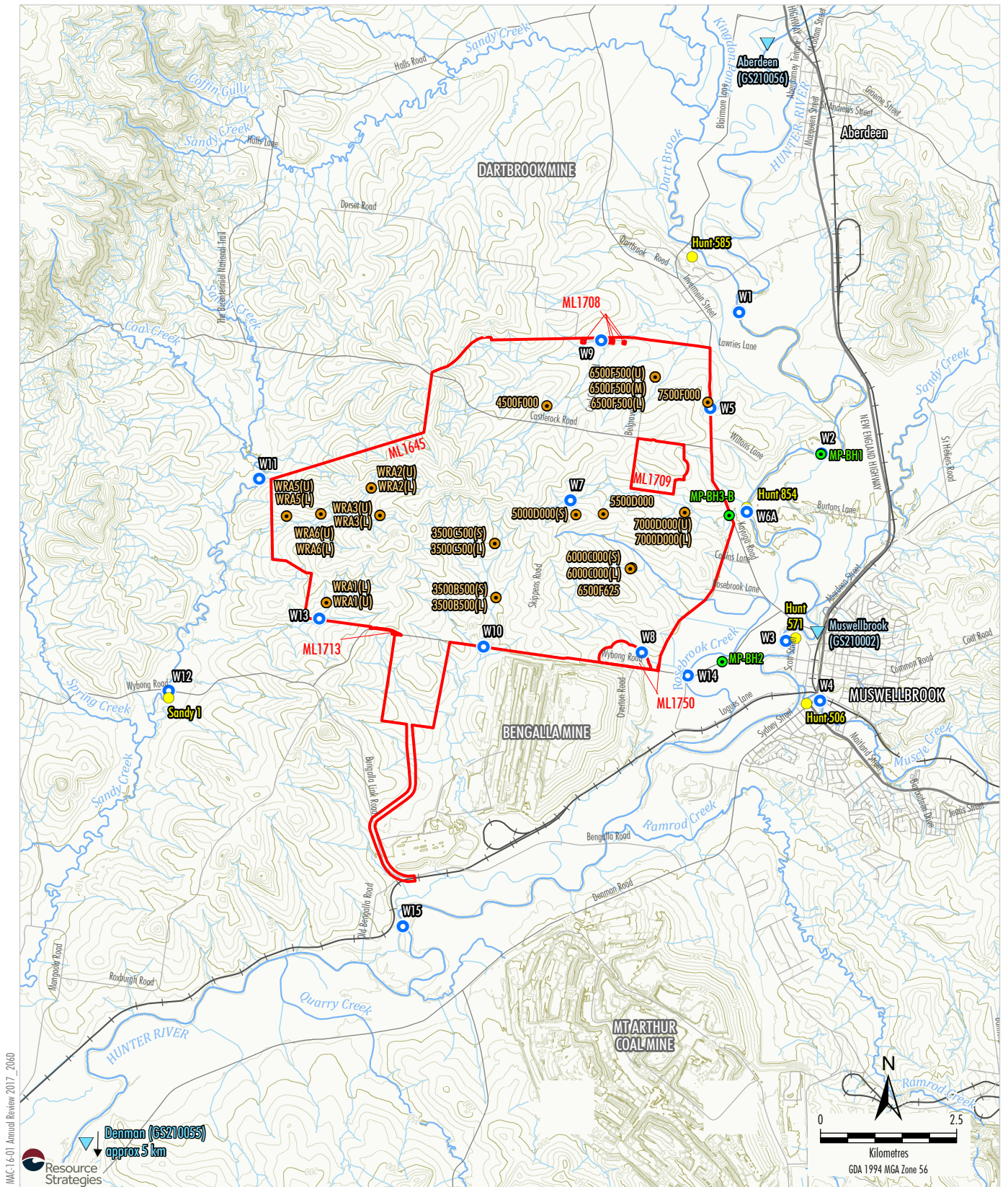


Figure 7

Trigger levels for the new surface water monitoring sites (W11-W15 [Figure 7]) will be established once sufficient monitoring data has been collected at these sites.

The site specific trigger levels are listed in Table 20.

Table 20
Surface Water Quality Trigger Levels

Site	pH	EC (µS/cm)	TSS (mg/L)
	20 th – 80 th Percentile Trigger Levels	80 th Percentile Trigger Level	80 th Percentile Trigger Level
Site Specific Trigger Levels			
W2	7.8 – 8.3	539	18
W6A	7.8 – 8.4	496	19
W8	6.9 – 7.6	318	672
Default Trigger Levels[^]			
W5	6.5 – 7.5	350	-
W7	6.5 – 7.5	350	-
W8	6.5 – 7.5	350	-
W9	6.5 – 7.5	350	-
W10	6.5 – 7.5	350	-

Note: µS/cm = microsiemens per centimetre and mg/L = milligrams per litre.

[^] Default trigger levels are based on the ANZECC & ARMCANZ (2000) guideline values for upland rivers in south-east Australia. ANZECC & ARMCANZ (2000) does not provide guideline values for TSS.

Trigger levels are not regarded as assessment criteria, rather they are used as an indicator of potential impacts and to initiate investigations into the surface water quality as reported by the monitoring program.

An investigation is triggered when both:

- a water quality indicator at a downstream receiving water monitoring location is above (or outside the range of) the trigger levels for three consecutive sampling events; and
- a water quality indicator at a downstream receiving water monitoring location is above (or below in event of a trigger of the lower pH limit) the indicator of the corresponding upstream monitoring location (where such a monitoring location exists) sampled on the same day.

The majority of sites are located on ephemeral drainage lines and therefore do not regularly experience flow for sampling. During the reporting period, sites W7, W10, W13 and W14 had insufficient water for manual sampling and are therefore not presented in Section 6.1.2.

Stream Health

Stream health monitoring was commenced during the reporting period at four sites located on the Hunter River, as well as a new site located on Sandy Creek (Sandy 1) (Figure 7). The first and only round of monitoring during the reporting period was undertaken in November 2017.

Stream health is monitored bi-annually during spring and autumn using the Australian River Assessment System (AusRivAS) aquatic invertebrate monitoring protocol. In addition to the aquatic macro invertebrate sampling, monitoring also includes: fish observations, site water quality, stream condition and presence of aquatic and riparian edge plants.

Trigger levels have been developed at two of the Hunter River stream health monitoring sites, as outlined in Table 21.

Table 21
Stream Health Trigger Levels

Site ID	Baseline Band of Impairment Score	Trigger Level (O/E Taxa)
Hunt 571	B	0.54
Hunt 854	A	0.84

O/E = Observed/Expected.

Should a measured O/E taxa value at a particular site deteriorate below the range for its baseline band of impairment score at two successive monitoring rounds, the stream health investigation protocol (refer to the WMP) would be initiated.

6.1.2 Performance during the Reporting Period

Surface Water Monitoring

Surface water monitoring for the reporting period has been split into three groups:

- monitoring in the Hunter River (sites W1, W2, W3, W6A and W15);
- monitoring in Sandy, Muscle and Rosebrook Creeks (sites W4, W11, W12, W13 and W14); and
- monitoring in ephemeral creeks and gullies (sites W5, W7, W8 and W9).

Hunter River

Monitored pH values for the Hunter River monitoring sites during the reporting period are shown in Chart 9. Additionally, a comparison between 2015, 2016 and 2017 pH values is provided in Chart 10.

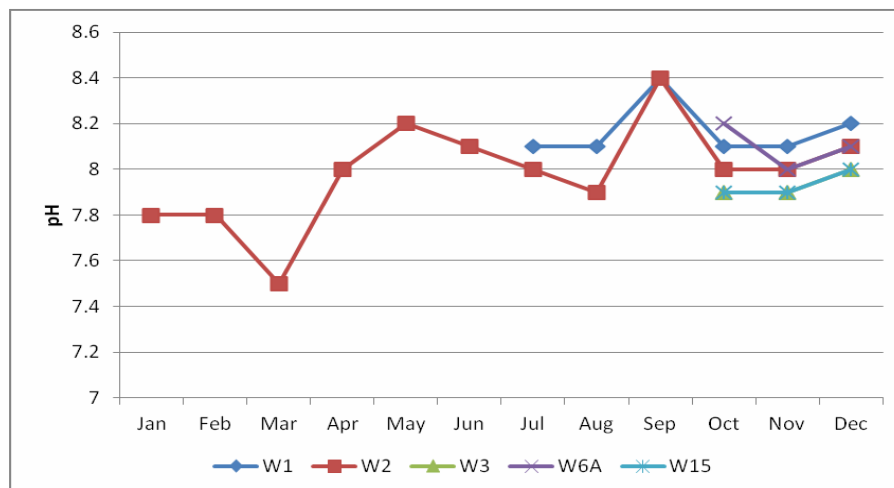


Chart 9: Hunter River pH Levels 2017

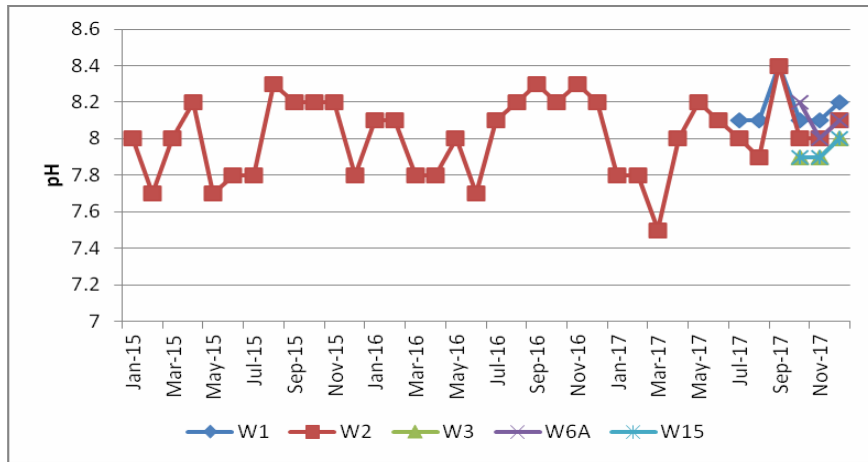


Chart 10: Hunter River pH Levels 2015 - 2017

EC values for the 2017 monitoring period are shown in Chart 11. Additionally, a comparison between 2015, 2016 and 2017 EC values is provided in Chart 12.

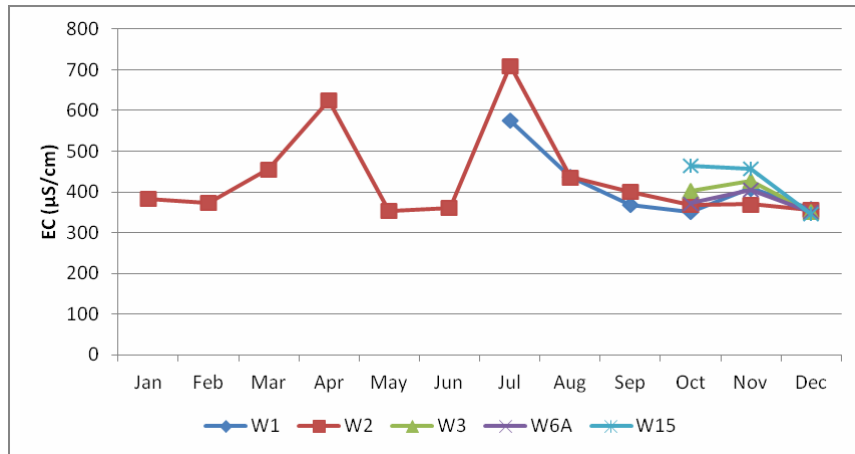


Chart 11: Hunter River EC Levels 2017

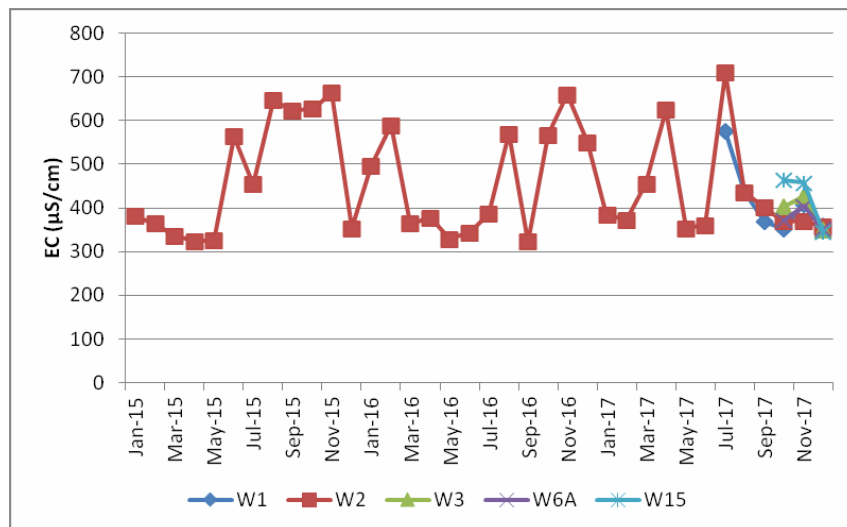


Chart 12: Hunter River EC Levels 2015 – 2017

TSS values for the 2017 monitoring period are shown in Chart 13. Additionally, a comparison between 2015, 2016 and 2017 TSS values is provided in Chart 14.

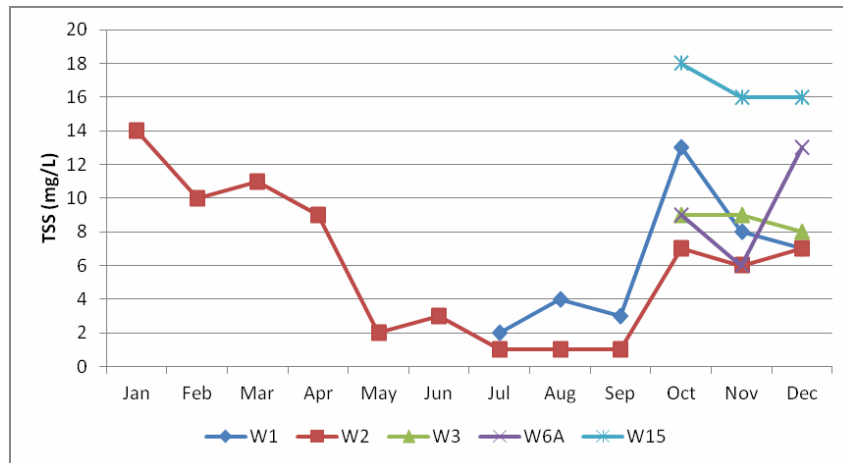


Chart 13: Hunter River TSS Levels 2017

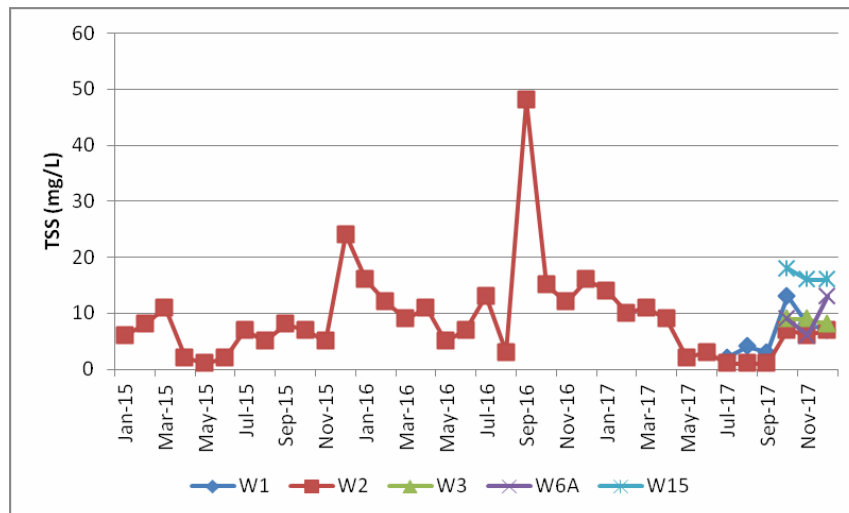


Chart 14: Hunter River TSS Levels 2015 - 2017

Calculated TDS values for the 2017 monitoring period are shown in Chart 15.

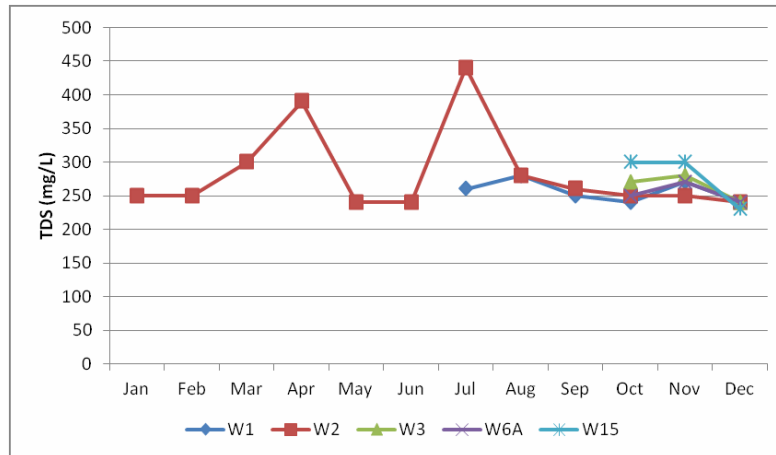


Chart 15: Hunter River Calculated TDS Levels 2017

Sandy, Muscle and Rosebrook Creeks

Monitored pH values for the Sandy, Muscle and Rosebrook Creek monitoring sites during the reporting period are shown in Chart 16. Additionally, a comparison between 2015, 2016 and 2017 pH values is provided in Chart 17.

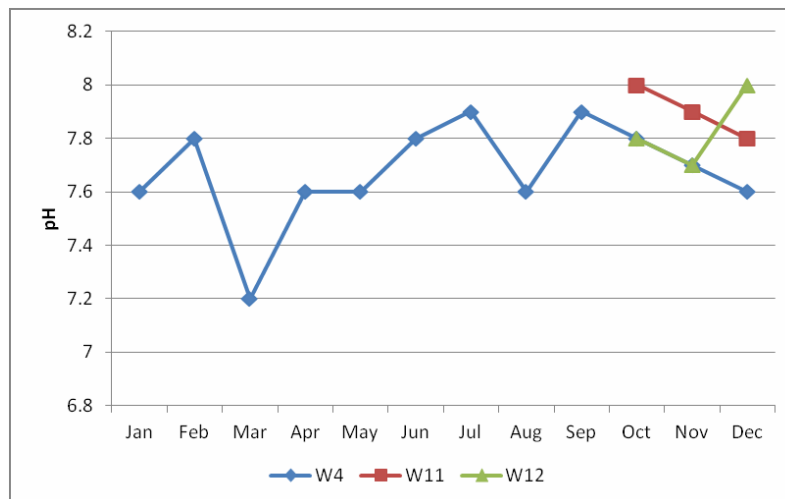


Chart 16: Sandy, Muscle and Rosebrook Creeks pH Levels 2017

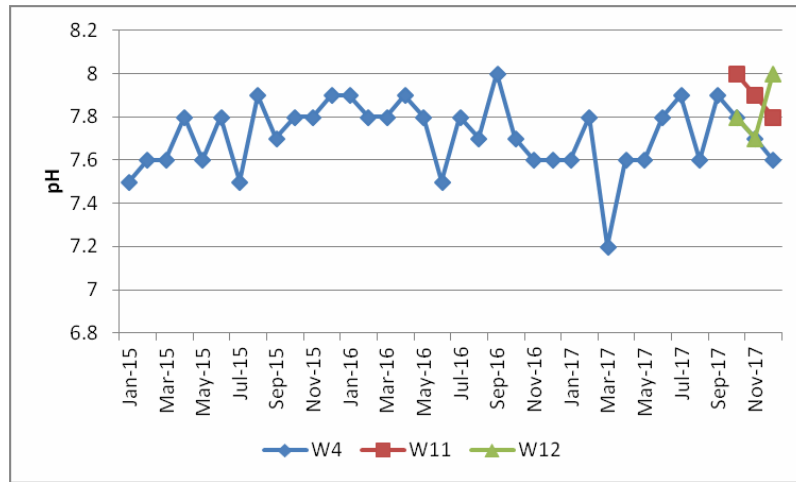


Chart 17: Sandy, Muscle and Rosebrook Creeks pH Levels 2015 - 2017

EC values for the 2017 monitoring period are shown in Chart 18. Additionally, a comparison between 2015, 2016 and 2017 EC values is provided in Chart 19.

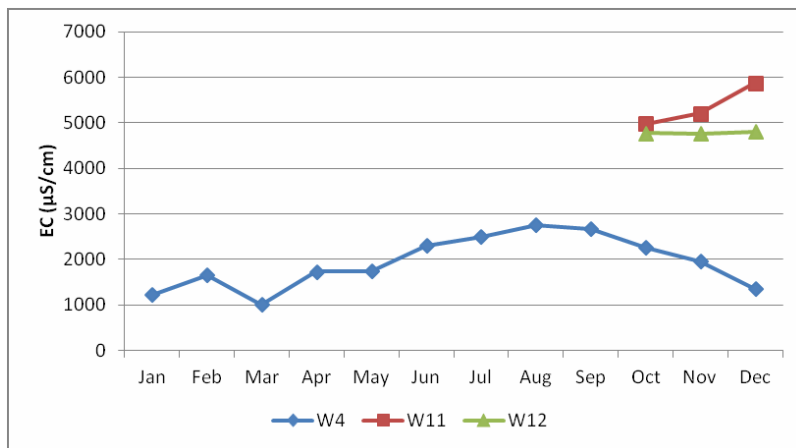


Chart 18: Sandy, Muscle and Rosebrook Creeks EC Levels 2017

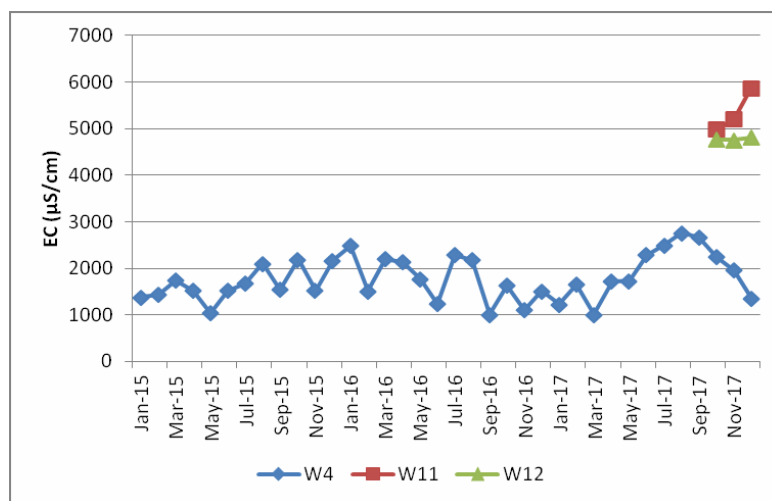


Chart 19: Sandy, Muscle and Rosebrook Creeks EC Levels 2015 - 2017

TSS values for the 2017 monitoring period are shown in Chart 20. Additionally, a comparison between 2015, 2016 and 2017 TSS values is provided in Chart 21.

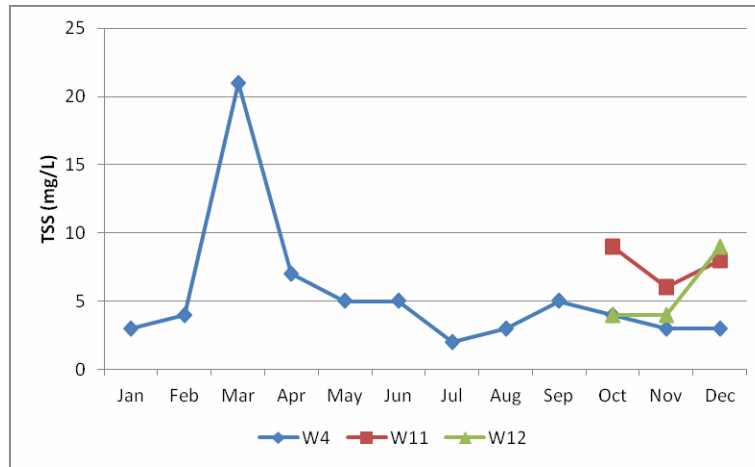


Chart 20: Sandy, Muscle and Rosebrook Creeks TSS Levels 2017

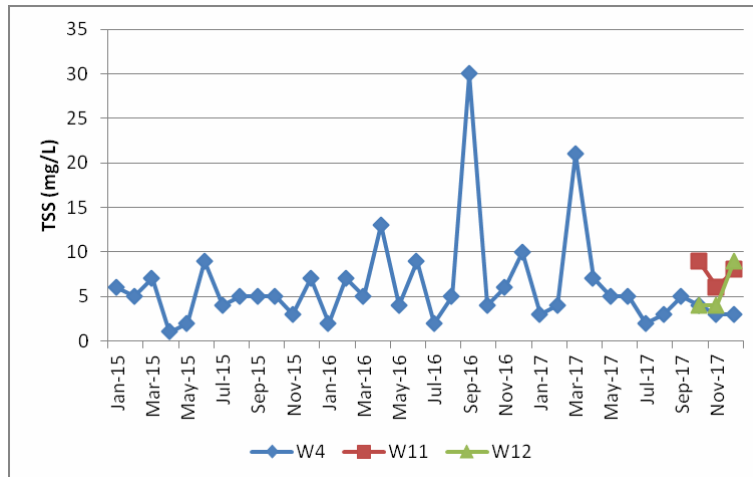


Chart 21: Sandy, Muscle and Rosebrook Creeks TSS Levels 2015 - 2017

Calculated TDS values for the 2017 monitoring period are shown in Chart 22.

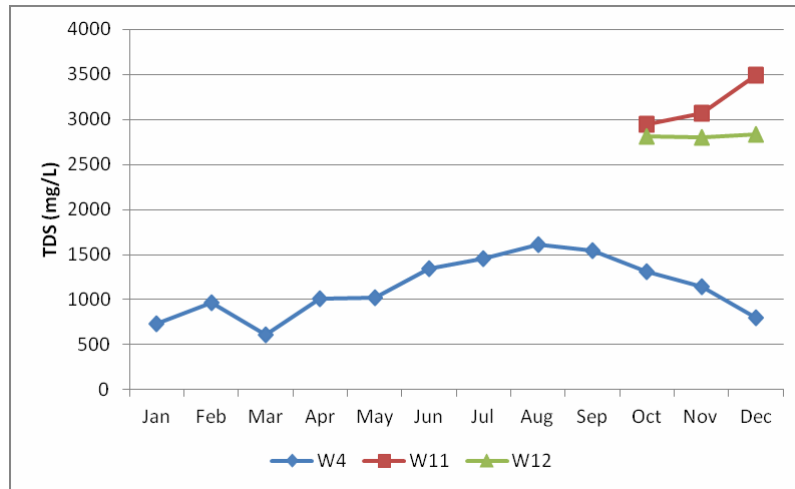


Chart 22: Sandy, Muscle and Rosebrook Creeks Calculated TDS Levels 2017

Ephemeral Creeks and Gullies

Monitored pH values for the ephemeral creek and gully monitoring sites during the reporting period are shown in Chart 23. Additionally, a comparison between 2015, 2016 and 2017 pH values is provided in Chart 24.

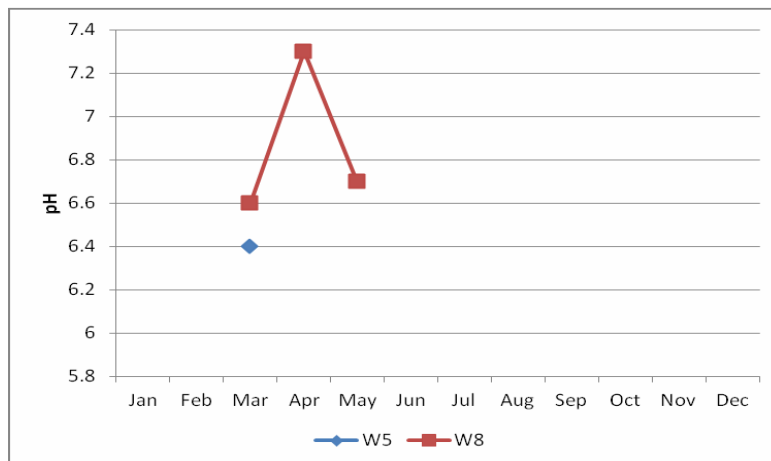


Chart 23: Ephemeral Creeks and Gullies pH Levels 2017

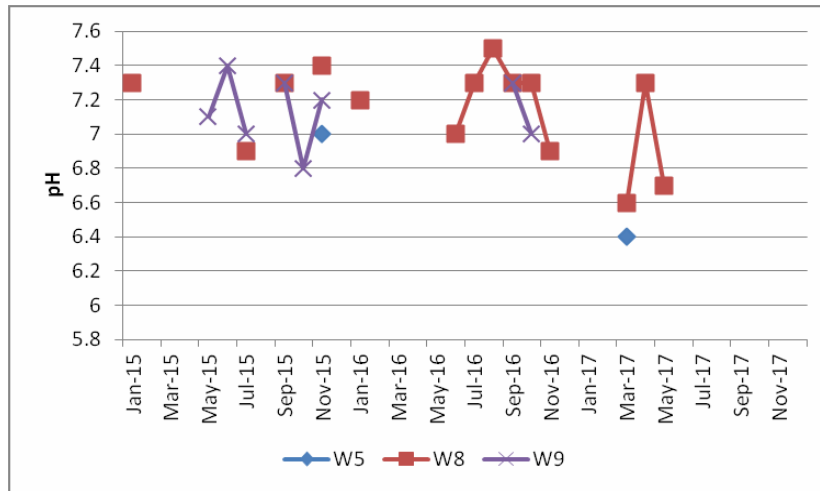


Chart 24: Ephemeral Creeks and Gullies pH Levels 2015 - 2017

EC values for the 2017 monitoring period are shown in Chart 25. Additionally, a comparison between 2015, 2016 and 2017 EC values is provided in Chart 26.

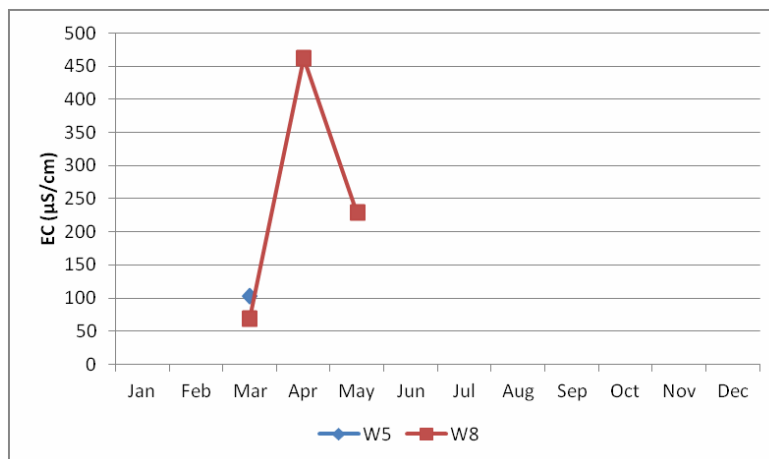


Chart 25: Ephemeral Creeks and Gullies EC Levels 2017

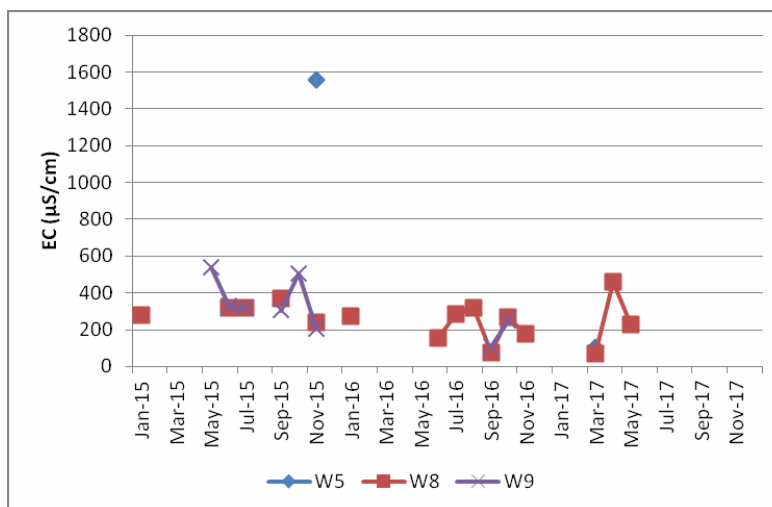


Chart 26: Ephemeral Creeks and Gullies EC Levels 2015 - 2017

TSS values for the 2017 monitoring period are shown in Chart 27. Additionally, a comparison between 2015, 2016 and 2017 TSS values is provided in Chart 28.

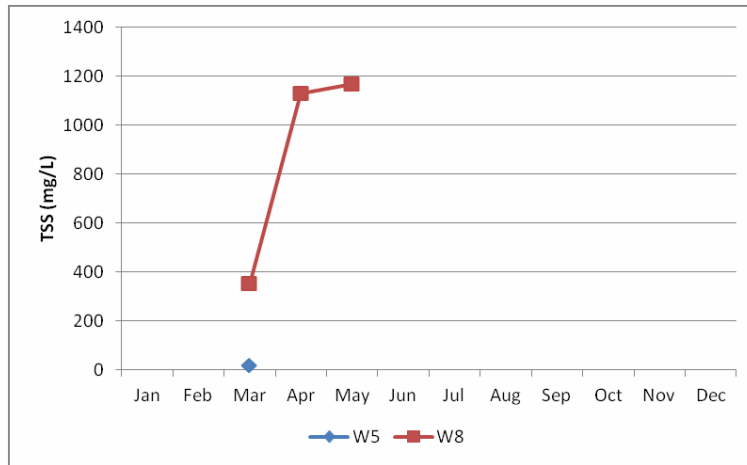


Chart 27: Ephemeral Creeks and Gullies TSS Levels 2017

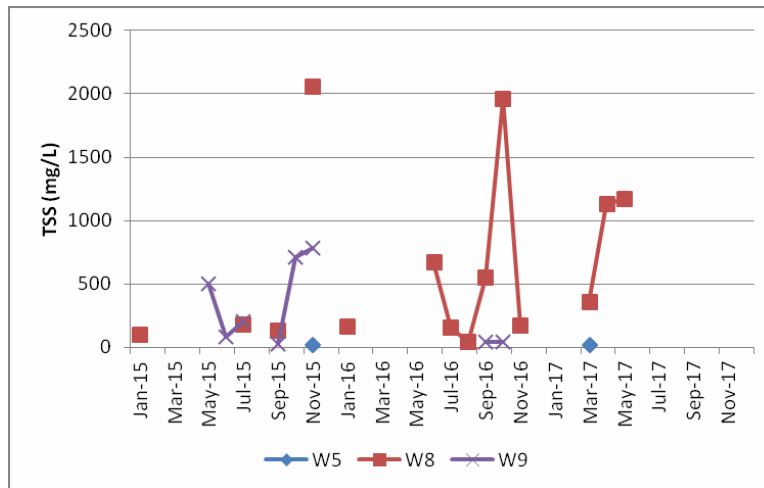


Chart 28: Ephemeral Creeks and Gullies TSS Levels 2015 - 2017

Calculated TDS values for the 2017 monitoring period are shown in Chart 29.

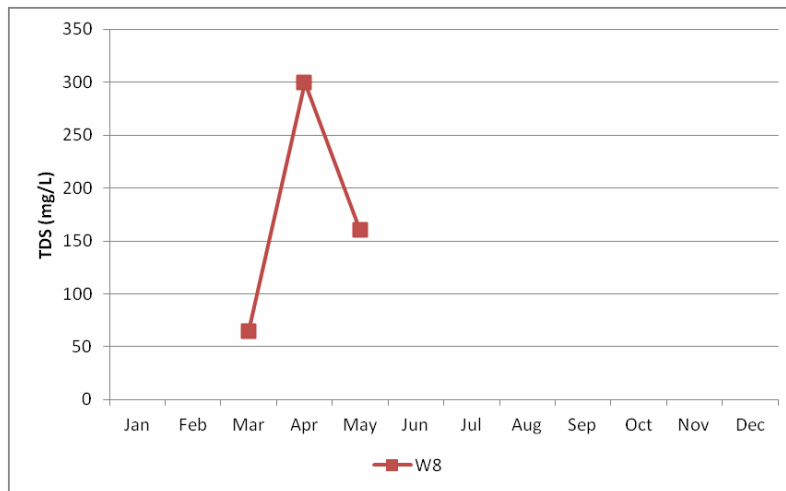


Chart 29: Ephemeral Creeks and Gullies Calculated TDS Levels 2017

Stream Health

A stream health monitoring report was prepared following the November 2017 monitoring round (Appendix B). The findings of the report were as follows:

- Aquatic habitat within the section of the Hunter River in the study area and at Dart Brook was generally in good condition although clearing, bank erosion and weed infestation was evident in the riparian zone.
- Sites within Muscle Creek and Sandy Creek showed substantial hydrological disturbance and weed infestation in the riparian zone. Baseline water quality data, particularly elevated salinity and reduced dissolved oxygen concentrations, reflect the condition of their catchments, which have been degraded by historical land use, including agriculture and rural development and mining.
- No aquatic species of conservation significance were recorded at the monitoring sites.
- Results from the AusRivAS and SIGNAL 2 analyses indicate that macroinvertebrates assemblages at all of the sites sampled were dominated by pollution tolerant taxa.
- The OE50 Taxa Score determined for Sites Hunt 854 (0.64) and Hunt 571 (0.51) on the Hunter River in spring 2017 was lower than the stream health trigger levels developed by MACH Energy (Section 6.1.1), particularly at Site Hunt 854.
- The aquatic macro-invertebrate fauna in the Hunter River and its tributaries appears to have experienced some degree of environmental stress prior to, and hence independent of, construction and operation of the MPO.
- It is recommended that monitoring using the methods employed for the spring 2017 survey is repeated in future monitoring periods and that data collected using the AusRivAS protocol is used to refine the trigger criteria for stream health within the Hunter River (Section 6.1.1).

6.1.3 Trends and Key Management Implications

Surface Water Monitoring

Hunter River Sites (W1, W2, W3, W6A & W15)

During the reporting period, pH levels at the Hunter River sites ranged from 7.5 to 8.4. Sites W2 and W6A stayed within their relevant pH trigger levels during the reporting period. Only site W2 has been consistently monitored for water quality since 2015. A comparison with 2015 and 2016 pH levels shows that pH levels have stayed consistently between 7.4 and 8.4 to date.

EC monitoring results for site W2 remained relatively consistent with the exception of two spikes above the EC trigger levels in April and July. EC values at W2 did not remain above the trigger levels for three consecutive samples. EC values at site W1 generally decreased over the reporting period. EC at sites W3, W6A and W15 were stable during the three rounds that they were sampled and stayed within relevant trigger levels. Sampling rounds since 2015 show that EC at site W2 frequently fluctuates between 300 mg/L and 700 mg/L.

TSS levels for all Hunter River sites were consistently low over the reporting period and stayed within all relevant trigger levels. Monitoring results since 2015 has shown that TSS at site W2 has remained generally consistent, with the exception of a spike in September 2016.

The 2015 – 2017 trends for pH, EC and TSS for site W2 were generally consistent with observations made in the EIS (ERM Mitchell McCotter, 1997).

Sandy, Muscle and Rosebrook Creek Sites (W4, W11, W12, W13 & W14)

Monitored pH values during the reporting period at the Sandy, Muscle and Rosebrook Creek sites ranged from 7.2 – 8. Only site W4 has been consistently measured for water quality since 2015. Monitoring since 2015 shows generally consistent values of pH for site W4.

EC monitoring results remained consistent at site W4, W11 and W12. Since 2015, EC at site W4 has consistently fluctuated between approximately 1000 – 3000 mg/L.

TSS values were consistent at sites W4, W11 and W12 during the reporting period, with the exception of a slight spike in site W4 during March 2017. TSS levels have remained generally consistent at W4 since 2015 between the range of 0 – 15 mg/L, with the exception of the spike in March 2017 and a spike in September 2016.

The 2015 – 2017 trends for pH and TSS for site W4 were generally consistent with observations made in the EIS (ERM Mitchell McCotter, 1997). EC levels at site W4 have increased since recordings made in the EIS. This site is located on Muscle Creek within Muswellbrook, which commonly has variable EC levels. This site has naturally occurring salts in surrounding soils and rocks, and data from previous annual reviews indicates that large fluctuations at this site are not unusual (Coal & Allied, 2016; MACH Energy, 2017b).

Ephemeral Creeks and Gullies (W5, W7, W8 & W9)

As described in Section 6.1.1, insufficient rainfall during 2017 resulted in limited recordings during the reporting period at the ephemeral creeks and gullies. There is therefore limited data to present and draw meaningful conclusions from in this Annual Review.

Monitored pH values during the reporting period at sites W5 and W8 remained within the range of 6.4 – 7.3. Measured pH was below the trigger range for site W8, but not for three consecutive monitoring rounds during the reporting period. Measured pH was slightly below the trigger range during the one recorded measuring round at site W5. Trends during the monitoring period were generally consistent with trends in 2015 – 2017 at sites W5 and W8.

EC values varied between approximately 50 – 450 mg/L during the three monitoring rounds at site W8, although this is consistent with trends observed from 2015 – 2017. EC at site W5 has only been measured twice from 2015 – 2017 (including the recording during March 2017). The recorded EC in March was greatly below what was recorded in November 2015. Given that this site is located on an ephemeral stream, it is reasonable to expect the readings at this site to vary drastically depending upon runoff during rainfall events.

Recorded TSS levels increased during April and May at site W8 compared to the March reading, although this is consistent with trends observed during 2015 – 2017. The monitoring round at site W5 is consistent with previous monitoring from 2015 – 2017.

Recorded EC at site W5 was lower in the reporting period compared to trends observed in the EIS (ERM Mitchell McCotter, 1997). Notwithstanding, recorded TSS and pH levels were consistent with findings in the EIS.

TDS levels for the monitoring period were calculated from monitored EC levels and therefore follow the same general trends as EC monitoring results. As monitored TDS data will be available during the next reporting period, more meaningful conclusions can be drawn regarding trends. Notwithstanding, the calculated TDS values are consistent with monitored data presented in the EIS.

Stream Health Monitoring

As contemporary stream health monitoring has only been undertaken for one monitoring round, there is limited data to observe trends and draw meaningful conclusions. Notwithstanding, it is clear that some degradation has occurred in streams surrounding the MPO, following the previous stream health monitoring undertaken in 2004. This is particularly evident in the reduced O/E Taxa levels which are below the trigger levels MACH developed based on the previous stream health monitoring.

MACH Energy will continue to monitor stream health during autumn and spring in future monitoring periods. As recommended in the stream health monitoring report, the corresponding data from these monitoring rounds will be used to refine the trigger levels for the existing stream health monitoring sites (Appendix B).

6.2 GROUNDWATER

6.2.1 Approval Criteria and Management Plan Requirements

Groundwater monitoring is undertaken at a network of bores which are broadly distributed across the MPO area and which cover all major hydrogeological units (Figure 7).

Groundwater monitoring includes:

- manually monitoring water levels on a quarterly basis;
- quarterly sampling of pH and EC;
- annual sampling of a suite of laboratory parameters; and
- regular groundwater inflows as recorded from flow meters or recording of pumping times and rates.

Groundwater trigger levels have been developed for the MPO based on the NSW Aquifer Interference Policy and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000). These trigger levels include surface water level (SWL) triggers for the eastern groundwater sites, and EC and pH for all sites, as presented in the WMP.

Beneficial use categories have been assigned to each monitoring bore based on its 80th percentile baseline EC and the EC ranges specified in the WMP. Should a measured EC value exceed the beneficial use quality range EC for a particular bore at three successive monitoring rounds (as defined in the WMP), the groundwater investigation protocol, as detailed in the Surface and Ground Water Response Plan, would be initiated.

At any bore where a monitored pH value is outside the applicable baseline range (20th – 80th percentile), at three successive monitoring rounds, the groundwater investigation protocol would be initiated.

6.2.2 Performance during the Reporting Period

Monitoring bores are split into three categories:

- Groundwater Central Bores: representative of the hard rock aquifer (3500B500 [L&S], 3500C500 [L&S], 4500F000, 5500D000, 5000D000 [S], 6000C000 [L&S], 6500F500 [L, M&U], 7000D000 [L&U] and 7500F000).
- Groundwater Eastern Bores: representative of the alluvial aquifer (MPBH1, MPBH2 & MPBH3).
- Groundwater Western Bores: representative of the hard rock aquifer in, or in the vicinity of, the Fines Emplacement Area (WRA1L, WRA1U, WRA2L, WRA2U, WRA3L, WRA5L, WRA6L & WRA6U).

The results of monitoring SWL (measured in metres below ground level [mbgl], EC and pH from 2014 to 2017 for the groundwater central bores are shown in Charts 30, 31 and 32 respectively.

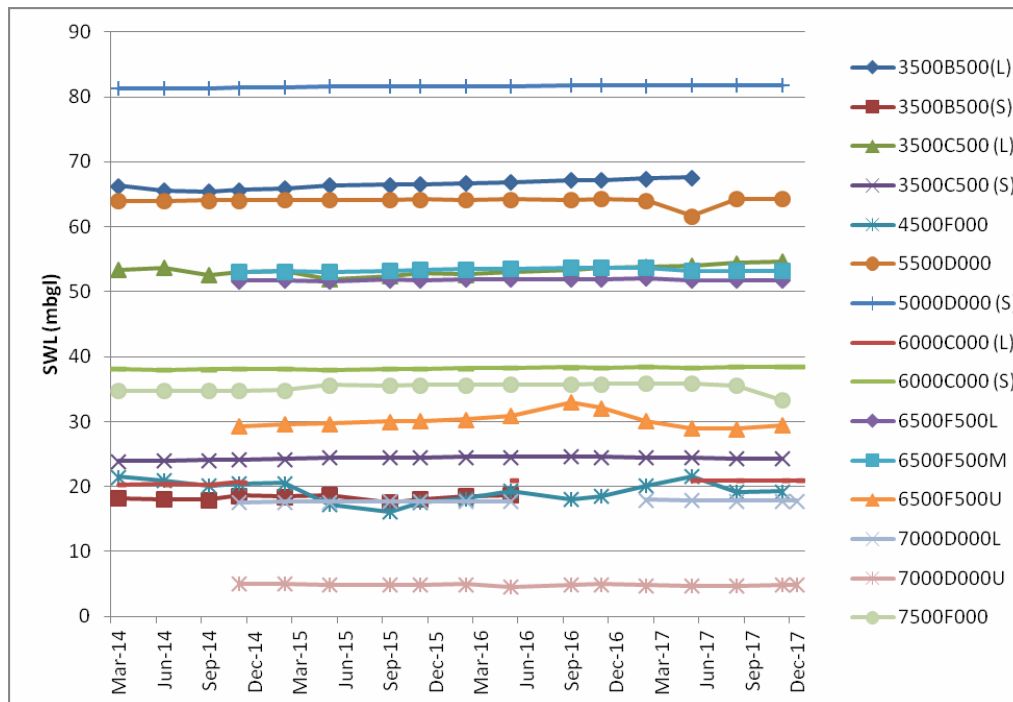


Chart 30: Groundwater Central Bores SWL 2014 – 2017

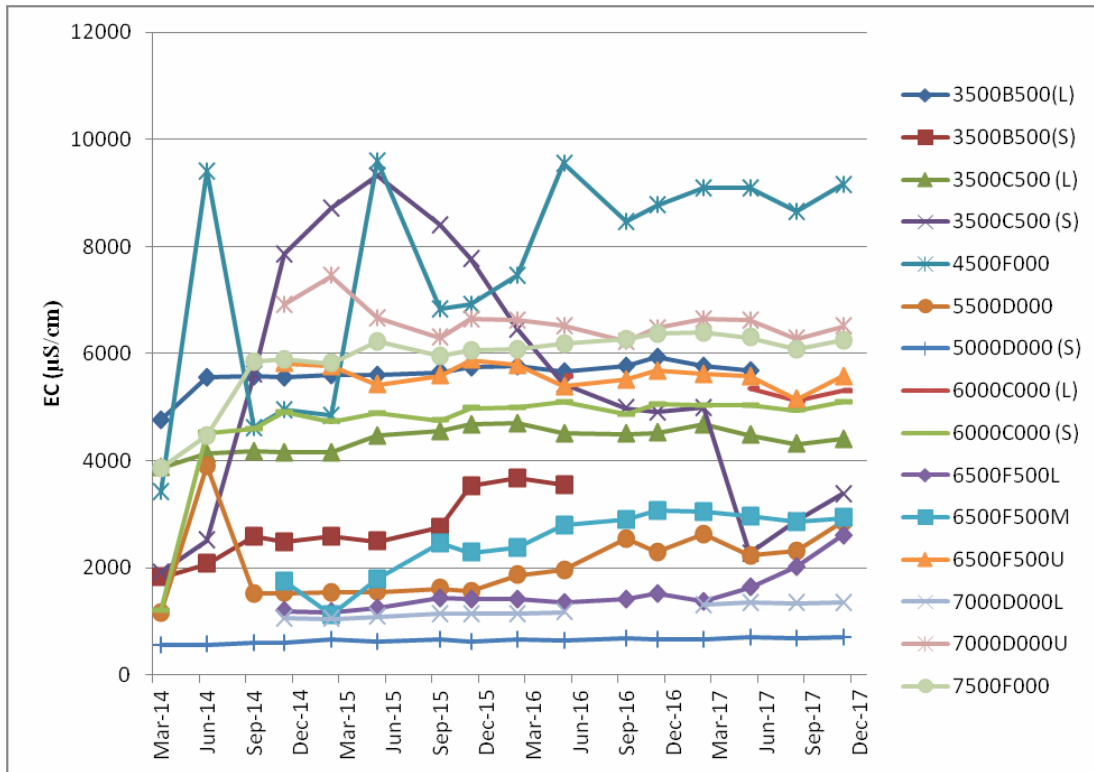


Chart 31: Groundwater Central Bores EC 2014 – 2017

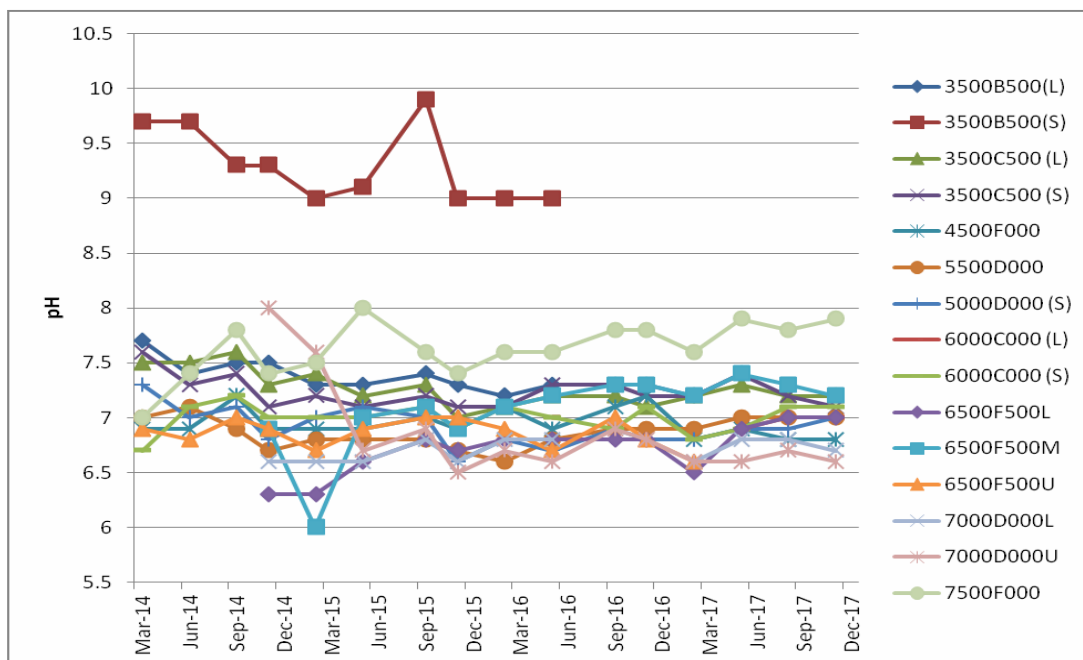


Chart 32: Groundwater Central Bores pH 2014 - 2017

The results of monitoring SWL, EC and pH from 2014 to 2017 for the groundwater eastern bores are shown in Charts 33, 34 and 35 respectively.

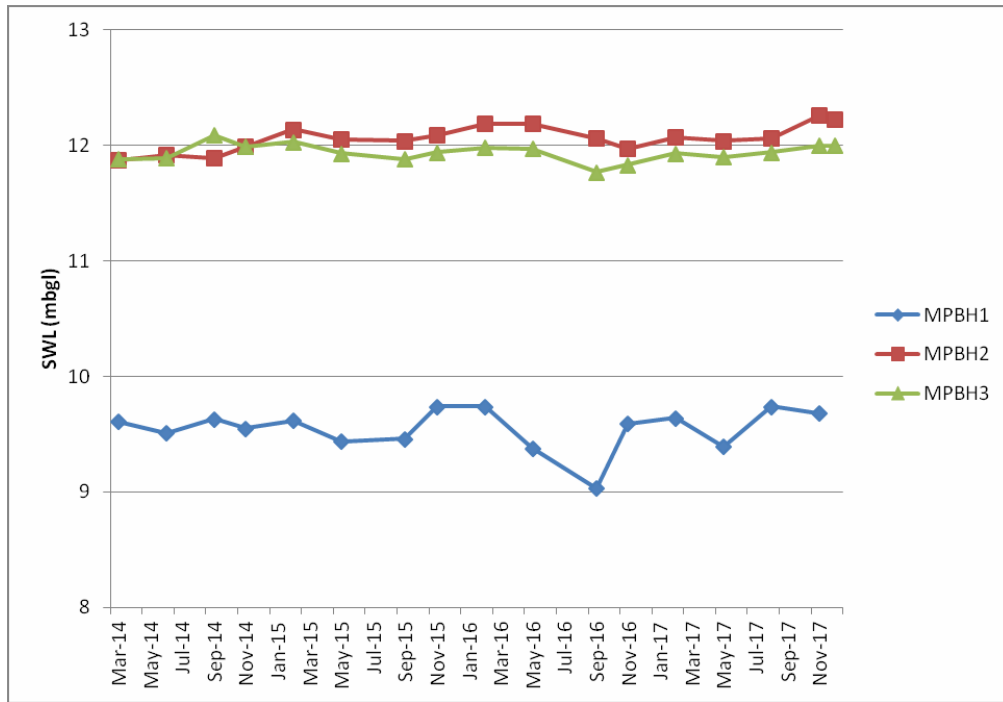


Chart 33: Groundwater Eastern Bores SWL 2014 - 2017

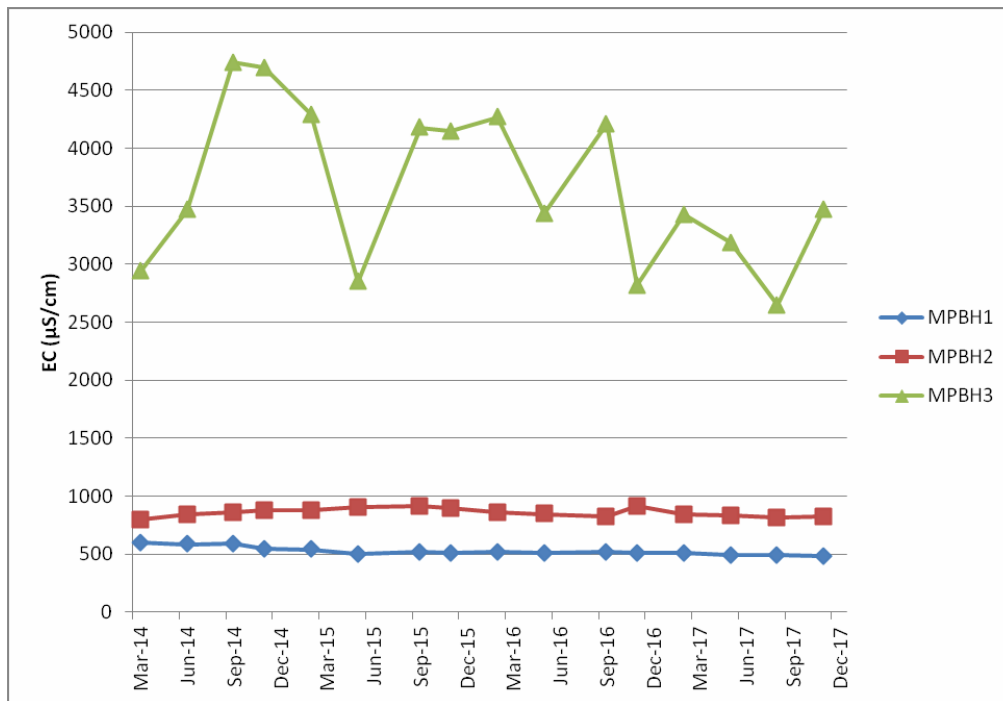


Chart 34: Groundwater Eastern Bores EC 2014 - 2017

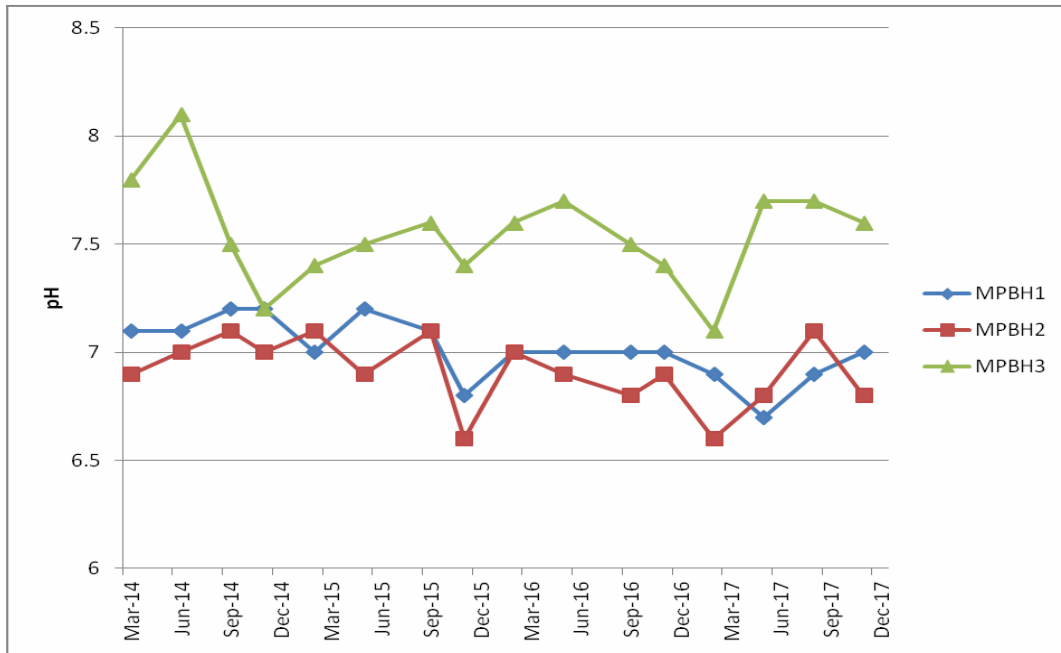


Chart 35: Groundwater Eastern Bores pH 2014 - 2017

The results of monitoring SWL, EC and pH from 2014 to 2017 for the groundwater western bores are shown in Charts 36, 37 and 38 respectively.

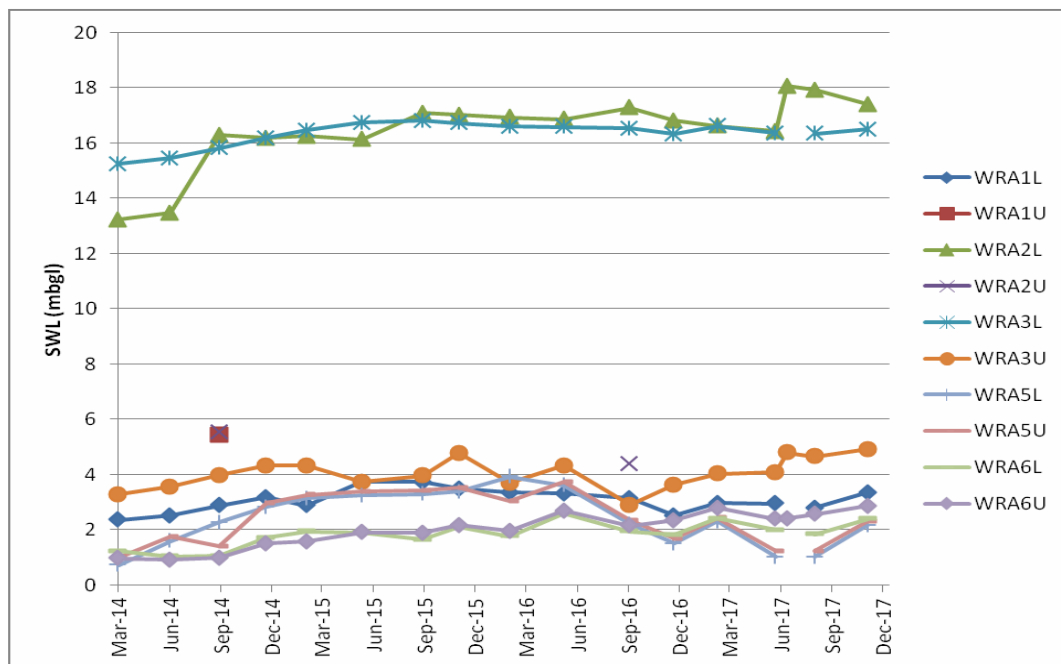


Chart 36: Groundwater Western Bores SWL 2014 - 2017

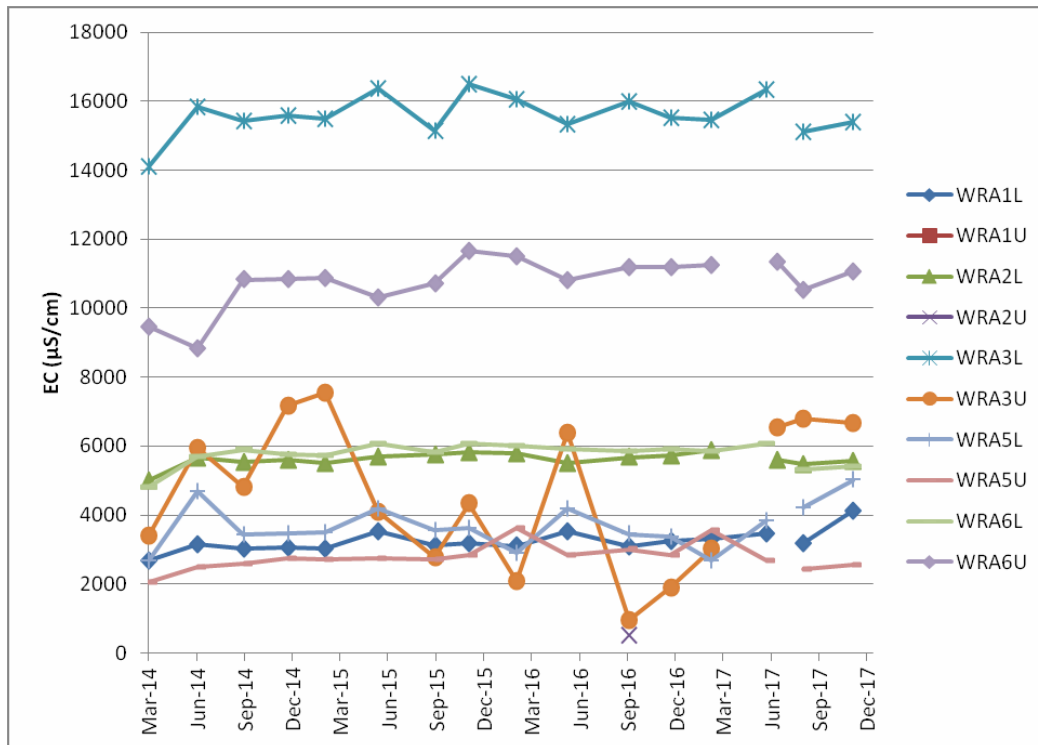


Chart 37: Groundwater Western Bores EC 2014 - 2017

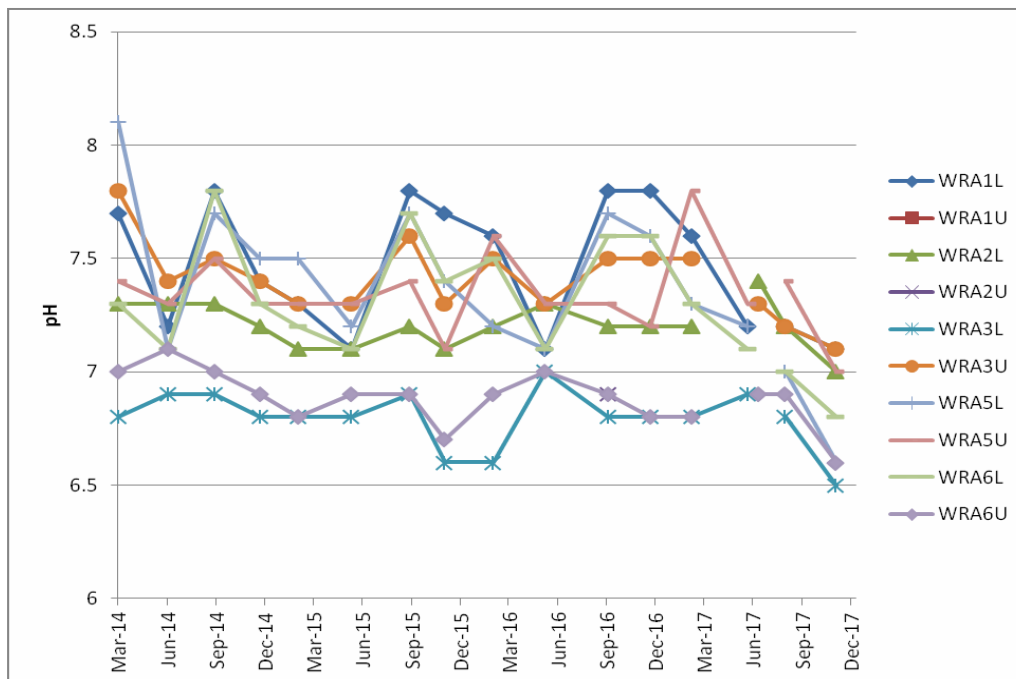


Chart 38: Groundwater Western Bores pH 2014 – 2017

During the second half of the reporting period, monitoring was not undertaken at site 3500B500(L) due to the site being disturbed. In addition, site 3500B500(S) was blocked on all monitoring rounds during the reporting period and was also disturbed in late 2017.

Western groundwater monitoring sites WRA1U and WRA2U were too dry to sample during any monitoring rounds in the reporting period.

6.2.3 Trends and Key Management Implications

No coal extraction was undertaken at the MPO during the reporting period.

Monitored SWLs have stayed generally consistent from 2014 – 2017. Although site WRA2L experienced a decline in water level in early 2014, the SWL for the site has since remained relatively stable. Monitored SWL levels remained below the trigger levels for all monitoring rounds during the review period.

Consistent with trends observed in the 2015 and 2016 Annual Reviews (Coal & Allied, 2016; MACH Energy, 2017b), the majority of EC values for the central bores have trended slightly upwards (Chart 31). This is with the exception of site 3500C500(S) which peaked in May 2015, and has since generally declined. Site 4500F000, which has fluctuated regularly in previous years, generally increased during the reporting period. Monitored EC at site 6500F500L also rose during the reporting period.

Monitored EC values remained stable for the eastern bore sites, with the exception of site MPBH3, which fluctuated regularly between approximately 2,500 and 3,500 $\mu\text{S}/\text{cm}$. Trends from previous Annual Reviews have shown that EC values at this site have been historically inconsistent (Coal & Allied, 2014, 2015 and 2016; MACH Energy, 2017b).

EC values remained relatively stable throughout the reporting period for the western bores (Chart 37). Continuing from trends observed in the 2015 and 2016 Annual Reviews (Coal & Allied, 2016; MACH Energy, 2017b), site WRA3U showed the most variation, increasing markedly from measurements in early 2017. Long term trends at the western bores indicate that yearly fluctuations in EC are most common at the western bores compared to the eastern and central bores (Coal & Allied, 2016; MACH Energy, 2017b). Sites WRA6U and WRA3L showed higher EC levels than other western bores during the reporting period, which has been consistent in recent years.

Consistent with trends observed in the 2015 & 2016 Annual Review (Coal & Allied, 2016; MACH Energy, 2017b), the pH values for the majority of sites have generally remained within the pH range of 6.5 to 8.0 during the reporting period. Sites 6500F500M and 6500F500L have previously recorded pH levels below 6.5, however remained stable between the 6.5 to 8.0 range in the reporting period. A number of western bores including WRA1L, WRA5L, WRA5U, WRA6L and WRA3U have historically shown frequent fluctuations between recording rounds and this continued in the reporting period (Coal & Allied, 2016; MACH Energy, 2017b). All western bores showed a strong downward trend in late 2017.

As described in Section 6.2.1, trigger levels have been developed as part of the approved WMP for EC and pH for all groundwater bores. As defined in the WMP, monitored values outside the range of trigger levels for three consecutive monitoring rounds would initiate the groundwater investigation protocol, as detailed in the Surface and Ground Water Response Plan.

Given that the WMP was approved in August 2017 and only two monitoring rounds were collected in the reporting period following August, none of the groundwater bores exceeded trigger levels for three consecutive rounds. Notwithstanding, a number of bores were outside the trigger levels for pH during the two monitoring rounds recorded (3500C500 [L], 5500D000, 6500F500 [L], 7500F000, WRA1[L], WRA5 [L], WRA6 [L]) as well as two bores which were outside the trigger levels for EC for the two rounds (4500F000 and 6500F500 [M]).

During the next reporting period these bores will need to be closely monitored to determine whether they exceed the trigger levels in the third consecutive monitoring round and if so, if the groundwater investigation protocol is required to commence.

6.3 HUNTER RIVER SALINITY TRADING SCHEME DISCHARGES

MACH Energy has 15 credits under the Hunter River Salinity Trading Scheme, however, no discharges to the Hunter River occurred during the reporting period.

6.4 WATER TAKE

No coal extraction was undertaken at the MPO during the reporting period. No water was taken for use at the MPO during the water reporting period (i.e. 1 July 2016 to 30 June 2017).

Table 22
MPO Water Take

Water Licence	Entitlement	Available Water	Passive Take/Inflows	Active Pumping	Total
-	-	-	-	-	-
-	-	-	-	-	-

During the Annual Review reporting period (i.e. 1 January 2017 to 31 December 2017), a total of 540 ML was used for dust suppression and construction.

7 REHABILITATION

Proposed rehabilitation activities for the MPO are defined in the approved MOP, which has been developed to meet the requirements for a RMP (Condition 56, Schedule 3 of Development Consent DA 92/97).

As per the rehabilitation schedule in the approved MOP, no rehabilitation was completed during the reporting period, and no rehabilitation has been previously completed at the site. Coal extraction has not yet commenced, and is not scheduled to commence until 2018.

Details of the activities completed during the reporting period are outlined in Section 3.1. Construction work undertaken prior to MACH Energy's acquisition of the MPO included construction of an environmental dam, a sedimentation dam and a gravel access track in 2004, which accounted for approximately 9 hectares (ha) of disturbance.

The rehabilitation status for the previous, current and following reporting periods are outlined in Table 23, consistent with the approved MOP.

Table 23
Rehabilitation Status

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	2016	2017	2018
Total Mine Footprint ¹	27.2 ha	292 ha	1,085 ha
Total Active Disturbance ²	27.2 ha	292 ha	1,075 ha
Land being prepared for Rehabilitation ³	0	0	5 ha
Land under active rehabilitation ⁴	0	0	5 ha
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. As such it is the sum of total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem establishment, ecosystem development and relinquished lands (as defined in DRG MOP/RMP Guidelines). Please note that subsidence remediation areas are excluded.

² Total active disturbance includes all areas ultimately requiring rehabilitation such as: on-lease exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, waste emplacements (active/unshaped/in or out-of-pit), and tailings dams (active/unshaped/uncapped).

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 DRG MOP/RMP Guidelines).

⁴ Land under active rehabilitation - includes areas under rehabilitation and being managed to achieve relinquishment - includes the following rehabilitation phases as described in the DRG MOP/RMP Guidelines – “ecosystem and land use establishment” (area seeded OR surface developed in accordance with final land use) and “ecosystem and land use sustainability” (revegetation assessed as showing signs of trending towards relinquishment OR infrastructure development).

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

Post rehabilitation land uses for the MPO are defined in Appendix 7 of Development Consent DA 92/97.

As per the approved MOP, rehabilitation is planned to commence in the next reporting period. This rehabilitation will include approximately 10 ha of dump profiling, contouring, topsoil placement and seeding (Table 23). Temporary rehabilitation including hydromulching and seeding of temporary landforms (e.g. mine access road versions etc.) will be undertaken across the site to minimise erosion and sediment management.

7.1 EROSION AND SEDIMENT MANAGEMENT

Initial erosion and sediment control measures implemented on-site included the construction of an environmental dam in 2004 and installation of the high-level spillway for the dam in 2005. Following this, regular inspections of these structures to assess cover growth and stability and to ensure there is sufficient capacity for sediment containment, have been undertaken.

General erosion and sediment management measures undertaken in the reporting period included:

- a number of erosion and sediment control audits were undertaken by certified professionals. Areas which were targeted for the various audits included the:
 - MWD;
 - Rail Loop;
 - Tailings Dam;
 - CHPP;
 - MIA; and
 - ED3;
- development of a construction sediment dam computer model to predict the water volume increase on-site under various modelled rainfall events;
- development of the Surface Water Management Procedure which describes Trigger Action Response Plans, dam inspection procedures, locations of on-site dams etc.; and
- construction of a number of mine water dams and sediment dams (Section 3.1).

7.2 LAND MANAGEMENT

Landscape management included removal, erection and maintenance of fence lines in the MPO including:

- replacing the fence line that runs adjacent Wybong Road on the edge of the MPO ML boundary;
- removal of a number of internal fences within the MPO operational footprint; and
- general maintenance of fence lines along Kayuga, Castlerock and Dorset Road.

A visual bund was constructed along sections of the MPO adjacent Wybong Road to minimise the visual amenity of the MPO. During the reporting period, 800 trees, incorporating an array of native species, were planted along the bund to assist in shielding the site.

Weed and pest control measures undertaken during the reporting period are outlined in Section 5.5.2. Topsoil management is discussed in Section 5.9.

7.3 BUSHFIRE MANAGEMENT

The main objectives of bushfire management at the MPO are to minimise the risk of bushfires and to rapidly control any outbreaks that might occur. Control measures are in place to:

- minimise potential spreading of bushfires in and around the MPO;
- protect people, property and assets;
- protect areas of heritage value; and
- protect threatened fauna and/or flora.

The control measures implemented to prevent and manage bushfires focus on minimising the amount of fuel available at the MPO and its surrounding land. These measures include:

- slashing of vegetation along roads and internal tracks which are used as fire trails and assist in dividing the site into control zones;
- the use of livestock to reduce pasture based fuel loads on land suitable for grazing; and
- maintaining a network of water supply points to assist the NSW Rural Fire Service with logistical support.

During the reporting period, the following activities were undertaken in respect to fire preparation:

- a Bushfire Management Plan was reviewed and updated;
- maintenance of property and boundary and roadside firebreaks; and
- slashing of paddocks in the MPO boundary to control bushfire risk.

There were no major outbreaks of fire at the MPO during the reporting period.

7.4 REHABILITATION MONITORING

Various ecological works were undertaken at the MPO during the reporting period, including as part of the GDP process, and as part of flora surveys and assessments for the two recent modifications lodged with DPE (i.e. MOD 3 and Modification 4). These works included mapping vegetation communities, searches for threatened flora species, communities and populations, and detailed floristic data collection at numerous survey plots.

With the final landform design currently undergoing review and improvement (the subject of MOD 3 and planned submission of a State Significant Development application) MACH Energy is not yet in a position to select detailed analogue sites. Notwithstanding, in undertaking the ecological works referenced above, MACH Energy is building an extensive knowledge of the characteristics of the MPO site and surrounding area. As the design of the more accurate final landform is refined, MACH Energy will have a more accurate understanding of the type of analogue sites required to be monitored (i.e. in terms of flora species mix, vegetation types, landforms etc.).

8 COMMUNITY

MACH Energy's approach to community relations is focused on extending and strengthening the relationships that Mount Pleasant representatives have already formed with the local community.

MACH Energy released a community newsletter in September 2017 and January 2018 outlining the community activities undertaken during the reporting period. MACH Energy plans to continue to release regular community newsletters in the next reporting period to inform stakeholders/interested parties of activities at the MPO.

During the reporting period, MACH Energy undertook community relations in four key areas: communication, consultation and engagement, community development, and relationships with the local Aboriginal community. These activities are outlined in detail in the following sections.

8.1 COMMUNICATION

A number of points of communication have been established with the community. Members of the local community are encouraged to engage MACH Energy in the way that proves most convenient for them.

MACH Energy maintains a website (<http://machenergyaustralia.com.au/>) which is used to provide information to stakeholders and interested parties about the operation and environmental performance of the MPO. Information provided on the website includes key environmental management documentation, monthly environmental monitoring reports, an environmental complaints register (which is updated on a monthly basis) and CCC meeting minutes.

MACH Energy maintains a Community Hotline (1800 886 889) that is dedicated to the receipt of community complaints, enquiries or information. The Community Hotline is publicly advertised in a variety of MACH Energy's public communication tools and will be available during construction and operating hours, to receive any complaints or enquiries from anyone seeking information about the MPO. Communication received from the hotline is recorded in a Community and Stakeholder Engagement Database. This database records all necessary information regarding the nature of the communication, and if necessary, any action taken by MACH Energy as a result of the communication.

Seven community complaints were received during the reporting period (Appendix A) and related to:

- noise (4);
- dust (2); and
- other (1) (a complaint relating to the condition of road works on Wybong Road).

In response to all complaints, the ERM or Environmental Superintendent made contact with the complainant to describe the MPO activities which would have been causing the issue. In response to the complaint, activities were modified or ceased where necessary (Appendix A).

On two separate days in November and December 2017, MACH Energy hosted a stall at the Muswellbrook Fair Shopping Centre for the purpose of gaining feedback from the community. The majority of enquiries at the stall related to seeking jobs at the MPO, which were referred to the contractors working on-site.

8.2 CONSULTATION AND ENGAGEMENT

A CCC is administered by MACH Energy, with a membership comprised of an independent chair, as well as appropriate representation from MACH Energy and the general community. The CCC is operated in general accordance with the *Community Consultative Committee Guidelines* (DPE, 2016).

In 2017, the CCC met four times during March, June, September and December. These meetings provided regular updates about the MPO, as well as an avenue to discuss aspects of the MPO which concerned community stakeholders. General discussions from these meetings related to:

- progress of construction;
- progress of land management activities at the MPO;
- general overview of MPO progress;
- current status of approvals, management plans, modifications and supporting environmental documents; and
- updates on community initiatives.

MACH Energy invites a range of its team members to present updates to the committee as direct contact enhances the two-way communication between both parties.

Full meeting minutes for the 2017 CCC meetings are provided on the MACH Energy website (Section 8.1).

8.3 COMMUNITY DEVELOPMENT

As part of acquisition of the MPO, MACH Energy has maintained the Aboriginal Community Development Fund (ACDF) developed by Coal & Allied. The fund was a community benefit specified in the Native Title Agreement made with the Wonnarua People in 2005. Since its commencement in 2006, the ACDF has contributed more than \$4 million into projects which benefit the Upper Hunter Valley Aboriginal community.

Since the acquisition, MACH Energy representatives have joined the existing ACDF community members to administer funds, manage its current projects and to seek-out new partnerships. Key partnerships which were maintained during the reporting period as part of the ACDF are presented in Table 24.

Table 24
Aboriginal Community Development Fund Partnerships

Partner	Description
Many Rivers Microfinance	A not-for-profit microenterprise organisation which assists Indigenous and other Australians to establish and develop small businesses.
Polly Farmer Foundation – Enrichment Centre	Graham (Polly) Farmer Foundation assists aspiring Aboriginal students who have the capacity to complete school, but potentially in the absence of additional support, are unlikely to do so. Project staff work closely with students to provide them with intensive and targeted support throughout their secondary schooling.
Parents and Learning (PAL)	The PAL program builds capacity in Indigenous communities by supporting parents to become engaged in their children's learning, especially in the development of early literacy and numeracy skills. PAL kits are provided to parents who are taught to use the kits as well as techniques to encourage full engagement of their children in their learning.

During the reporting period, a two day workshop was held with members of the ACDF to review the strategic direction of the Fund. The workshop, which received positive feedback from the committee members, highlighted local issues which could be targeted for meaningful partnerships from the ACDF in the future (MACH Energy, 2017d).

In conjunction with the ACDF, MACH Energy hosted the Singleton Cultural Spectacular on 19 August 2017. The Cultural Spectacular showcased Aboriginal and Australian culture through food demonstrations, craft, oral presentations and live music. The event, which attracted around 1000 members of the local community, was held at the Singleton Showground (MACH Energy, 2017d).

In 2018, MACH Energy plans to host a similar event in Muswellbrook. In addition, in 2018 MACH Energy plans to sponsor the Hunter Valley Coal Festival and will organise a visual presence at the Family and Community Day in Singleton.

8.4 RELATIONSHIPS WITH LOCAL ABORIGINAL COMMUNITY

MACH Energy works closely with the local Aboriginal community, including undertaking regular consultation with the RAPs.

The list of RAPs identified for the MPO was based on previous consultation undertaken for the original EIS (ERM Mitchell McCotter, 1997), the MPO Modification EA (EMGA Mitchell McLennan, 2010), the applications (including variations and transfer applications) for AHIP #C0002053 and AHIP #C0000247, and the on-going management of Aboriginal heritage on-site. MACH Energy maintains a contact register, containing up to date contact details for the 84 RAPs, and is committed to maintaining on-going consultation with these RAPs throughout the life of the MPO.

During 2017, three meetings relating to MOD 4 were undertaken with the RAPs on 10 October, 17 October and 7 December.

Appropriate notice was given to RAPs before due diligence inspections were undertaken, and RAPs had a strong presence in these inspections. A number of RAPs were selected as suitably qualified, and assisted in the field work undertaken as representatives of the local Aboriginal community.

9 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit (IEA) was undertaken in the reporting period in accordance with Condition 9, Schedule 5 of Development Consent DA 92/97.

The Audit considered compliance until 25 November 2017. MACH Energy commissioned ERM to complete the IEA, which was undertaken on-site from 5 – 6 December 2017.

The audit included a review of:

- conditions contained within Development Consent DA 92/97, including the Statement of Commitments;
- EPL 20850;
- ML 1645, ML 1708, ML 1709, ML 1713 and ML 1750; and
- implementation of the management plans prepared under Development Consent DA 92/97 (Table 4).

A qualitative risk assessment was completed on the findings, consistent with AS/New Zealand Standard (NZS) 4360:2004 *Risk management*, the HB 436:2004 *Risk Management Guidelines Companion to AS/NZS 4360:2004* and the *Independent Audit Guidelines* (DPE, 2015b). The number of non-compliances with the statutory conditions and implementation of the management plans is summarised in Table 25.

Table 25
Summary of Audit Findings

Non-compliance	Administrative Non-compliance	Observations	Total Conditions
6	1	7	163

The IEA Report is required to be submitted to DPE (including an action response table addressing the audit findings) in February 2018.

In accordance with Condition 9, Schedule 5 of Development Consent DA 92/97, MACH Energy is required to commission, commence and pay the full cost of the next IEA by 25 November 2020.

10 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

10.1 ENVIRONMENTAL INCIDENTS

On 31 October 2017, an unintended clean water discharge occurred at the MPO. Approximately 0.3 - 0.4 ML of water was released from site due to a pump erroneously being left running, thereby overflowing a dam located in the Rail Spur. The water travelled off-site and through a number of erosion and sediment controls installed by Bengalla Mining Company on the adjacent Bengalla ML.

No discharges are permitted by the MPO EPL and the discharge was therefore a non-compliance with conditions L1.1 and O1.1 of EPL 20850, and Condition 26, Schedule 3 of Development Consent DA 92/97.

Following the incident, MACH Energy immediately notified EPA of the incident. DPE was notified via an incident report submitted within 7 days of the incident occurring. This was a non-compliance in accordance with Condition 7, Schedule 5 of Development Consent DA 92/97, and Conditions 5 (a) and 5 (c), Schedule 2 of ML 1645, which require immediate notification of incidents to DPE.

Accordingly, DPE issued a show cause letter to MACH Energy on 17 November 2017. MACH Energy responded to the show cause letter on 29 November 2017 and outlined several operational changes which occurred in response to the unintended clean water discharge. These included:

- Senior MACH Energy employees were reminded of their obligation to immediately report environmental incidents (as required by Condition 7, Schedule 5 of Development Consent DA 92/97).
- Greater clarity of roles and responsibilities were provided to site and corporate office personnel to ensure clear accountability for reporting under Development Consent DA 92/97.
- Revision of the MPO *Pollution Incident Response Management Plan* (required under EPL 20850) to reinforce reporting requirements.
- The addition of an automated system for water diversion, thereby limiting human error.
- The addition of an internal Surface Water Management Procedure which provides a set of recommended work practices for use by MPO employees and contractors for the Water Management System within the Operation.

A revision of the WMP will be submitted for approval in the next reporting period. This revision will detail the Surface Water Management Procedure (an internal management plan developed following the clean water discharge) and outline its position in the overarching Water Management System at the MPO.

No other environmental incidents occurred on-site during the reporting period.

10.2 NON-COMPLIANCES

A summary of non-compliances during the reporting period, and if applicable, the actions taken in response to the non-compliances, is outlined in Table 26. All non-compliances during the reporting period are related to the one event, i.e. the clean water discharge described in Section 10.1.

Table 26
Compliance Summary

Approval Document Reference	Condition	Observation	Action/Comment
Development Consent DA 92/97 Condition 26, Schedule 3	<i>The Applicant must ensure that any surface water discharges from the site comply with the:</i> (a) <i>Discharge limits (both volume and quality) set for the development in any EPL; or</i> (b) <i>Relevant provisions of the POEO Act or <u>Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002.</u></i>	A clean water discharge occurred on 31 October 2017 (Section 10.1).	MACH Energy made a number of operational changes to MPO water management to minimise the risk of a similar incident occurring (Section 10.1).
EPL 20850 Condition L1.1	<i>Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.</i>	The discharge was due to MPO plant and equipment being used in an improper manner.	
EPL 20850 Condition O1.1	<i>Licensed activities must be carried out in a competent manner.</i> <i>This includes:</i> (a) <i>the processing, handling, movement and storage of materials and substances used to carry out the activity; and</i> (b) <i>the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.</i>		
ML 1645 Condition 7, Schedule 5	<i>The Applicant must immediately notify the Secretary and any other relevant agencies of any incident. Within 7 days of the date of the incident, the Applicant shall provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be required.</i>	MACH Energy notified EPA immediately and submitted an incident report to DPE within 7 days of the discharge. However, DPE was not notified immediately.	Senior MACH Energy employees have been reminded of their obligation to immediately report environmental incidents (as required by Condition 7, Schedule 5 of Development Consent DA 92/97) (Section 10.1).
ML 1645 Condition 5 (a), Schedule 2	<i>The lease holder must notify the Department of all:</i> i) <i>breaches of the conditions of this mining lease or breaches of the Act causing or threatening material harm to the environment; and</i> ii) <i>breaches of environmental protection legislation causing or threatening material harm to the environment (as defined in the Protection of the Environment Operations Act 1997), arising in connection with significant surface disturbing activities, including mining operations, mining purposes and prospecting operations, under this mining lease. The notification must be given immediately after the leaseholder becomes aware of the breach.</i>		
Development Consent DA 92/97 Condition 5 (c), Schedule 2	<i>In addition to the requirements set out in conditions 5(a) and (b), the leaseholder must immediately advise the Department of any notification made under section 148 of the Protection of the Environment Operations Act 1997 arising in connection with significant surface disturbing activities including mining operations, mining purposes and prospecting operations, under this mining lease.</i>		

11 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Key management measures proposed to be implemented during the next reporting period include:

- updating the LMP and the Biodiversity Management Plan;
- updating the AQGGMP and NMP to revise the location of monitoring locations (Section 5.4.2);
- commencement of TDS surface water monitoring (Section 6.1);
- review of the pH and EC trigger levels if groundwater sites continue to show monitoring data outside the trigger levels (Section 6.2.3); and
- updating the MOP to reflect a new MOP term from 30 June 2018 – 30 June 2019.

12 REFERENCES

- Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.
- Bio-Analysis Pty Ltd (2018) *Mount Pleasant Operation Stream Health Monitoring Site Spring 2017 Survey*.
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- Hunter Land Management Pty Ltd (2017) *Vertebrate Pest Control Report – MACH Energy Mt Pleasant*.
- MACH Energy Australia Pty Ltd (2017a) *Mount Pleasant Operation – South Pit Haul Road Modification*.
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- MACH Energy Australia Pty Ltd (2017c) *Monthly Environmental Monitoring Report February 2017*.
- MACH Energy Australia Pty Ltd (2017d) *Mount Pleasant Operation Community Newsletter – September 2017*.
- Office of Environment and Heritage (2018) *Air Quality Search Data - Muswellbrook NW Upper Hunter Air Quality Monitor*. Accessed: 14 February 2018.
Available at: <http://www.environment.nsw.gov.au/AQMS/search.htm>

APPENDIX A
COMPLAINTS SUMMARY 2017

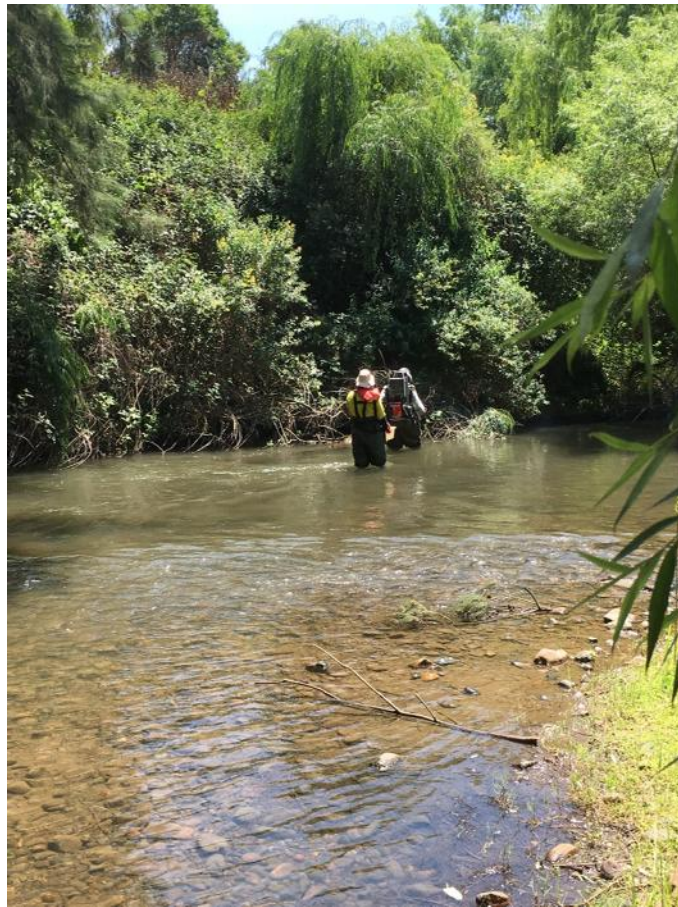
Table A1
Complaints Summary 2017

Complaint Number	Date	Time	Method of Complaint	Nature of Complaint	Complaint Details	Action Taken
1	12/04/2017	11:00	Hotline	Noise	The complainant phoned the MACH Energy 24 hour hotline to make a complaint regarding noise from Wybong Road works.	The External Relations Manager (ERM) advised the complainant the noise was from clear and grub activities associated with Wybong Road. The mulcher was shut down in response to the complaint. The ERM committed to informing the complainant in advance of the next stage of clear and grub works along Wybong Road. Monitoring results indicated acceptable Noise levels. No further actions required. Complainant advised of investigation, results and actions.
2	30/05/2017	16:36	Hotline	Noise	The complainant phoned the MACH Energy 24 hour hotline to make a complaint regarding noise at 16:36.	The ERM called the complainant at 17:06. The noise was associated with clear and grub activities for the 66kV powerline. The activity had since ceased and was a one off task. No further clear and grub activities were planned in that area. Monitoring results indicated acceptable noise levels. No actions required. Complainant advised of investigation, results and actions.
3	24/06/2017	14:00	Hotline	Noise	The complainant phoned the MACH Energy 24 hour hotline to make a complaint regarding noise from Wybong Road works.	The ERM and Project Director (PD) called the complainant on 25/6/2017. The noise was associated with construction activities for Wybong Road. Monitoring results indicated acceptable noise levels. The complainant was advised of investigation, results and actions.
4	1/07/2017	15:30	Hotline	Other	The complainant phoned the MACH Energy 24 hour hotline to make a complaint regarding the condition of road works on Wybong Road.	The ERM called the complainant and advised that repairs to Wybong Road has been scheduled between 3 - 4 July 2017.
5	21/07/2017	11:30	Hotline	Noise	The complainant phoned the MACH Energy 24 hour hotline to make a complaint regarding noise.	The ERM called the complainant. Monitoring results indicated acceptable noise levels. No actions required. Complainant advised of investigation, results and actions.
6	28/07/2017	13:00	Hotline	Dust	The complainant phoned the MACH Energy 24 hour hotline to make a complaint regarding dust on Wybong Road.	The Environmental Superintendent (ES) advised the caller MACH reviewed operations and the real time monitoring network. A review of activities was undertaken in following areas (Rail Loop, Site Wide Earthwork areas and Wybong Road). Activities on Wybong Road were modified to reduce dust.
7	6/09/2017	15:30	Hotline	Dust	The complainant phoned the MACH Energy 24 hour hotline to make a complaint regarding dust on Wybong Road.	The ES reviewed the real time monitoring network and activities on site. Activities had been modified to reduce dust and a number of water carts were operating to control dust. Monitoring results indicated acceptable levels.

APPENDIX B
STREAM HEALTH MONITORING SPRING 2017 SURVEY

MOUNT PLEASANT OPERATION

STREAM HEALTH MONITORING SPRING 2017 SURVEY



**Prepared for
AECOM Australia on behalf of MACH Energy Australia**

12 March 2018

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EXECUTIVE SUMMARY

The approved Mount Pleasant Operation (MPO) is owned and operated by MACH Energy Australia Pty Ltd. The approved operation includes the construction and operation of an open cut coal mine and associated infrastructure. The major facilities of the MPO are currently being constructed. Construction of the MPO re-commenced in November 2016.

BIO-ANALYSIS Pty Ltd was commissioned by AECOM on behalf of MACH Energy to implement a stream health monitoring programme, as required by MACH Energy's Surface Water Monitoring Plan, to assess the biological health of the aquatic ecology at sections of the Hunter River and tributaries outside the boundary of MPO.

The monitoring programme focusses on three main indicators:

- Aquatic habitat, including riparian habitat, aquatic macrophytes and fish habitat;
- Aquatic macroinvertebrates sampled using the Australian River Assessment System (AUSRIVAS) protocol;
- Fish sampled using backpack electrofishing.

Limited in situ water quality sampling was also done to assist in interpreting trends in the above indicators.

This report provides the results of the first investigation, undertaken in November 2017.

Aquatic habitat within the section of the Hunter River in the study area and at Dart Brook was generally in good condition although weed infestation was evident in the riparian zone. Sites within Muscle Creek and Sandy Creek showed substantial hydrological disturbance, elevated salinity, reduced dissolved oxygen concentrations and weed infestation in the riparian zone.

Macroinvertebrates assemblages at all of the sites sampled were dominated by pollution tolerant taxa. Four species of fish (including two introduced species) were caught by electrofishing. No aquatic species of conservation significance were recorded within the Study Area.

In conclusion, stream health performance measures developed by MACH Energy for two sites on the Hunter River were exceeded in spring 2017. Results suggest that stream health in the Hunter River has experienced some degree of environmental stress prior to, and hence independent of, construction and operation of the MPO.

It is recommended that monitoring using the methods employed for the spring 2017 survey is repeated in autumn 2018. Data collected can be used to refine the performance measures developed by MACH Energy for stream health within the Hunter River.

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1.0 INTRODUCTION

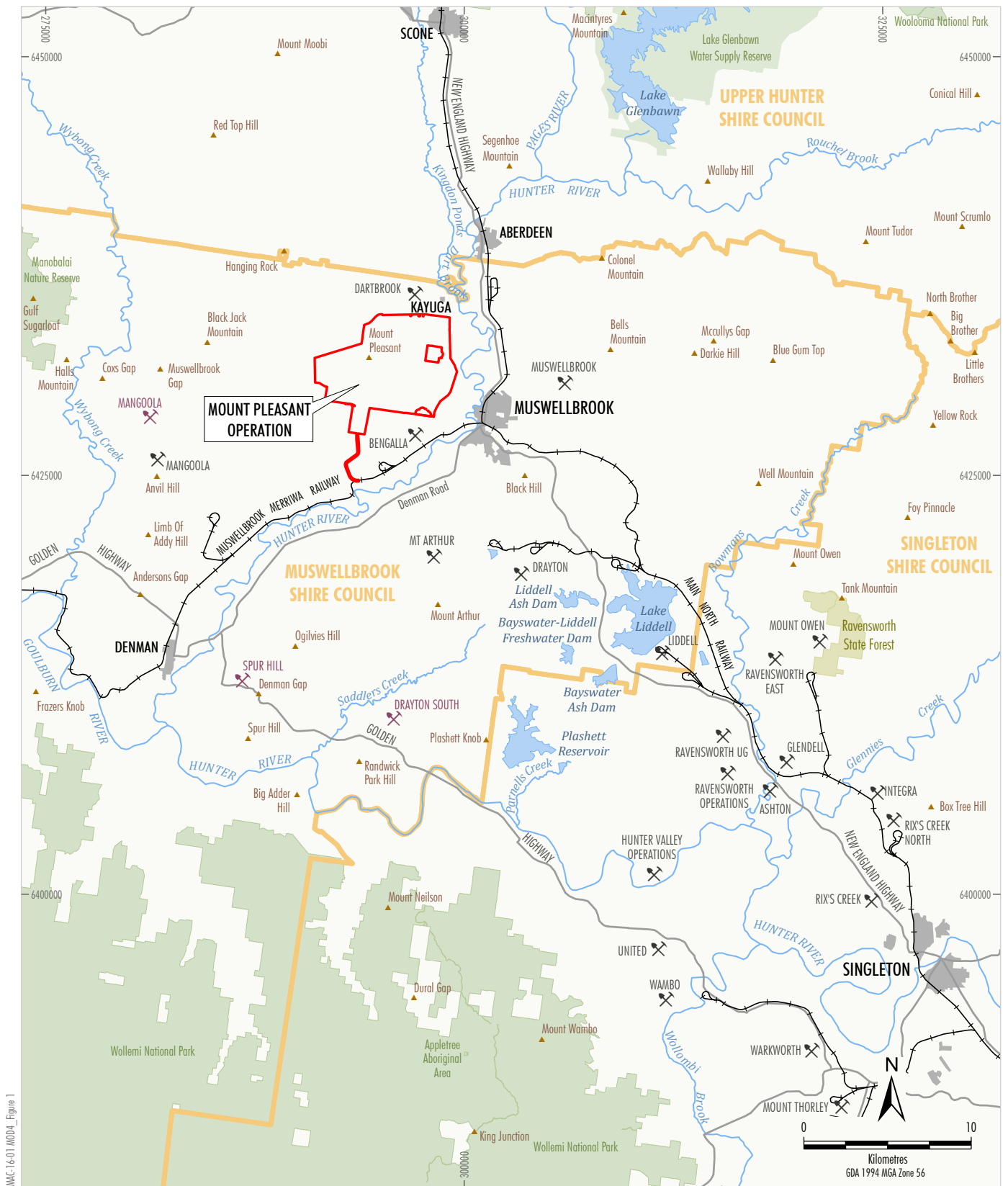
The Mount Pleasant Operation (MPO) is owned and operated by MACH Energy Australia Pty Ltd (MACH Energy). The approved MPO includes the construction and operation of an open cut coal mine and associated infrastructure located in the Upper Hunter Valley of New South Wales (NSW), approximately four kilometres (km) north-west of Muswellbrook (Figure 1).

The MPO is being developed in accordance with a Development Consent granted by the (then) NSW Minister for Urban Affairs and Planning on 22 December 1999 (Development Consent DA 92/97), as subsequently modified¹. At this time, the mine is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal for a period of 21 years from the date of the granting of the development consent. The major facilities of the MPO are currently being constructed by MACH Energy. Construction operations recommenced in November 2016.

BIO-ANALYSIS Pty Ltd was commissioned by AECOM on behalf of MACH Energy to implement a stream health monitoring programme, as required by MACH Energy's Surface Water Monitoring Plan (SWMP), to assess the biological health of the aquatic ecology at selected sections of the Hunter River and tributaries outside the boundary of MPO.

This Report provides the stream health results of the first investigation undertaken in November 2017, in accordance with requirements in the SWMP for the MPO.

¹ To date, three applications to modify the Minister's consent for the MPO have been submitted. A copy of the consolidated Development Consent DA 92/97 incorporating Mod 1 and Mod 2 is provided as Attachment 1 in (REF). Modification 3 is currently being assessed by the Department of Planning and Environment.



AMC-16-01 MOD4 Figure 1



Figure 1

2.0 METHODS

2.1 Study Area

The MPO is located within the Muswellbrook Local Government Area (LGA). Kayuga is located immediately to the north of the mine and the town of Aberdeen is located further north east, on the eastern side of the Hunter River. Muswellbrook is located 4 km south-east of the MPO (Figure 1).

The town of Denman is also located some 18 km to the south west near the confluence of the Hunter and Goulburn Rivers (Figure 1).

The drainage network in the vicinity of the MPO is generally characterised by steep gullies which drain from the surrounding hills into the flat alluvial plains adjacent to the Hunter River. The river, which flows in a southerly direction approximately 1 km to the east of the MPO's Mining Lease 1645 (ML1645) boundary, is the largest drainage feature within the catchment.

A number of ephemeral drainage lines traverse the MPO area and drain into the Hunter River. The eastern portion of the MPO area drains via Rosebrook Creek (Figure 1), as well as other ephemeral, unnamed drainages. Areas in the south and west of the MPO boundary drain to an ephemeral drainage line (commonly referred to as Dry Creek) and Sandy Creek, respectively, both of which flow into the Hunter River (Figure 1). No permanently flowing waterways are present within the MPO area.

Surrounding land uses include agriculture (grazing, dairy, vineyards, horse and cattle studs, turf, flower and market gardens) and mining (ERM Mitchell McCotter, 1997). As such, the catchment area has been cleared extensively. The Bengalla Mine adjoins the southern boundary of the MPO area, with Mount Arthur Coal Mine further south (Figure 1). Mangoola Coal is located west of the MPO area and surface facilities for the Dartbrook Mine are to the north.

Climate within the vicinity of Muswellbrook is warm temperate with an average annual rainfall of approximately 600 mm (BOM, 2017).

2.2 Performance Measures and Indicators

A Surface Water Management Plan (SWMP) for the MPO was prepared by MACH Energy to satisfy the requirements under Development Consent DA 92/97 (as modified on 19 September 2011) and specifically Condition 28(c), Schedule 3 (MACH Energy, 2017). The primary aim of the SWMP is to manage surface water related impacts associated with construction and operation of the MPO.

MACH Energy (2017) developed stream health trigger levels as an indicator of potential impacts for two sites situated on the Hunter River (i.e. Sites Hunt 571 and Hunt 854) using historical data collected at those sites and presented in Hose and Turak (2004) (Table 1).

Should an O/E taxa value at a particular site deteriorate below the range for its baseline band of impairment score at two successive monitoring rounds, a stream health investigation protocol would be initiated under the Surface and Ground Water Response Plan (SGWRP)².

Table 1. Historical data used to develop stream health trigger values for two Hunter River sites by MACH Energy.

Site ID	Historical Data				MACH Energy Trigger Values	
	Edge		Riffle			
	Band	O/E Taxa	Band	O/E Taxa	Band	O/E Taxa
Hunt 585	B	0.79	B	0.75	-	-
Hunt 506	B	0.77	-	-	-	-
Hunt 571	B	0.56	B	0.73	B	0.54
Hunt 854	A	1.02	-	-	A	0.84

Location of sites: Hunt 585: Dart Brook @ MacIntyre Bridge; Hunt 506: Muscle Creek @ Muswellbrook; Hunt 571: Hunter River @ Muswellbrook; Hunt 854: Hunter River downstream of Aberdeen (Figure 2)

MCO has established stream health trigger levels for a monitoring site on Sandy Creek (i.e. Site 'Sandy 1'). In the event of deterioration in stream health is observed at this site, MACH Energy would consult with MCO during implementation of their response plan (MACH Energy, 2017).

² Condition 28(e), Schedule 3 of DA92/97

MPO Stream Health Monitoring (spring 2017)

BIO-ANALYSIS Pty Ltd: Marine, Estuarine & Freshwater Ecology

2.3 Field Methods

To fulfil the requirements of MPOs SWMP, a stream health assessment was required to be done at 2 sites along the Hunter River (HR-3 and HR-4) and at sites situated on Dart Brook (DB), Muscle Creek (MC) and Sandy Creek (SC) (Table 2, Figure 2).

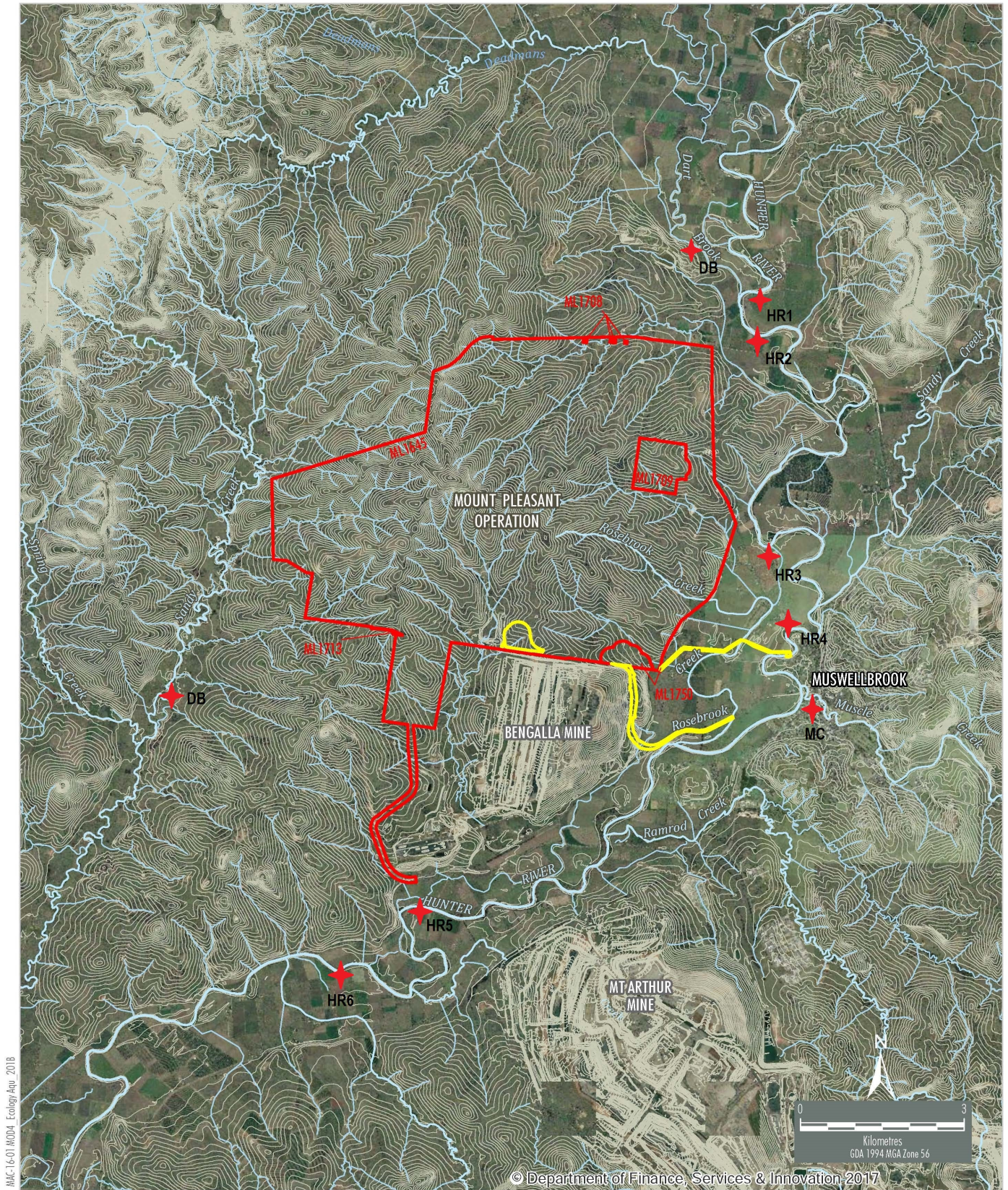
An additional 4 sites were included in the sampling program, to provide an indication of variability among sites along the Hunter River and of stream health in the river upstream (Site HR-1 and HR-2) and downstream (HR-5 and HR-6) of the MPO area (Table 2, Figure 2).

Sites were sampled on 28 November 2017. Each site was approximately 100 m long and their GPS co-ordinates are listed in Appendix A. Collections of fish and macroinvertebrates were done in accordance with Section 37 of the NSW Fisheries Management Act 1994 using Scientific Collection Permit Number P03/0032(B) and NSW Agriculture, Animal Research Authority Care and Ethics Certificate of Approval Number 03/2445.

Table 2. Stream Health Monitoring Sites.

BA Site Code	Historical Site Code	Site Location	Description
HR1	W1	Hunter River u/s River Street	Upstream control
HR2	W1	Hunter River d/s of River Street	Upstream control
HR3	Hunt 854	Hunter River @ Burtons Lane	Adjacent to MPO – impact site
HR4	Hunt 571	Hunter River @ Muswellbrook	Adjacent to MPO – impact site
HR5	W15	Hunter River off Bengalla Road	Downstream impact
HR6	SW17	Hunter River near Roxburgh	Downstream impact
SC	Sandy 1	Sandy Creek @ Wybong Rd	Hunter tributary – impact site
DB	Hunt 585	Dart Brook @ MacIntyre Bridge	Hunter tributary – control site
MC	Hunt 506	Muscle Creek @ Muswellbrook	Hunter tributary – control site

u/s – upstream; d/s - downstream



- LEGEND**
- Mining Lease Boundary
 - Contour (5 m Intervals)
 - Modification Area
 - ★ Stream Health Monitoring Sites

Source: NSW Land & Property Information (2017); NSW Division of Resources & Geoscience (2017)

MACHEnergy
MOUNT PLEASANT OPERATION

Topography and Drainage

Figure 2

2.3.1 Habitat Assessment

The condition of the aquatic habitat at each site was assessed using a modified version of the Riparian Channel and Environmental (RCE) inventory method (Chessman et al., 1997). This method involves evaluation and scoring of the characteristics of the adjacent land, the condition of riverbanks, channel and bed of the watercourse, and degree of disturbance evident at each site. The maximum score (52) indicates a stream with little or no obvious physical disruption and the lowest score (13) indicates a heavily channelled stream without any riparian vegetation.

The condition of aquatic habitat at each site would also be assessed according to the NSW Department of Primary Industries Policy and Guidelines for Fish Habitat Conservation and Management (NSW DPI, 2013). The two key indices are habitat *type* and *class*.

The in-stream and emergent aquatic macrophytes at each site would be surveyed to provide an indication of the dominant species present and their cover.

Each study area would be photographed and the locations recorded with a hand-held GPS (satellite-based Global Positioning System).

2.3.2 Water Quality

Water quality was measured at each site using a Yeo-Kal 611 water quality probe and meter. The physico-chemical properties measured were electrical conductivity ($\mu\text{S}/\text{cm}$), dissolved oxygen (% saturation and mg/L), pH (pH units), temperature ($^{\circ}\text{C}$), oxygen-reduction potential (mV) and turbidity (NTU). Alkalinity was also measured, using a CHEMetrics alkalinity kit.

Three replicate measures of each variable were collected from just below the water surface at each site, except for alkalinity, where only one measurement was taken at each site.

2.3.3 Aquatic Macroinvertebrates

Aquatic macroinvertebrates were sampled using the AUSRIVAS protocol (Turak et al., 2004). Samples of stream edge habitats and riffle habitats (where available) were collected over a total length of 10 m (usually in 1-2 m sections) at each site using a 250 µm dip net.

The contents of each net sample were placed into a white sorting tray and animals collected for a minimum period of 30 minutes. Thereafter, removals were done in 10 minute periods, up to a total of one hour (Turak et al., 2004). If no new taxa were found within a 10 minute period, removals ceased (Turak et al., 2004). The animals collected were placed inside a labelled container and preserved with 70 % alcohol.

Environmental variables required for running the AUSRIVAS predictive model, including modal river width, percentage boulder or cobble cover, latitude and longitude were recorded at each site.

2.3.4 Fish

Fish were sampled using a Smith-Root 15C Electrofisher backpack unit. The Electrofisher was used to stun the fish in open water, around the edge of pools, around snags and aquatic vegetation, overhanging banks and rocky crevices. Four replicate electrofishing 'shots' were completed at each suitable site sampled. All stunned fish were collected using a dip net and placed into plastic trays filled with water to be counted and identified.

Incidental observations such as evidence of disease were noted. Native species would subsequently be returned to the water. Any alien species were not returned to the water as per the conditions of our scientific collection permit.

2.4 Laboratory Methods

In the laboratory, AUSRIVAS samples would be sorted under a binocular microscope (at 40X magnification) and identified to family level with the exception of Acarina (to order), Chironomidae (to sub-family), Nematoda (to phylum), Nemertea (to phylum), Oligochaeta (to class), Ostracoda (to subclass) and Polychaeta (to class). Some families of Anisoptera (dragonfly larvae) would be identified to species, because they could potentially include threatened aquatic species listed under the *Fisheries Management Act, 1994* (FM Act).

Up to 10 animals of each family would be counted, in accordance with the AUSRIVAS protocol (Turak et al., 2004).

2.5 Data Analyses

2.5.1 Water Quality

The water quality measurements taken during the site inspection were used to assess water quality within the study area in terms of health of aquatic ecosystems by comparison with guideline values recommended by the ANZECC and ARMCANZ (2000) guidelines for slightly disturbed upland rivers in south-east Australia.

2.5.2 Aquatic Macroinvertebrates

Data were analysed using the appropriate AUSRIVAS predictive models developed for New South Wales. The ecological health of a waterway is assessed by comparing the macroinvertebrates collected at a site (i.e. Observed) to those predicted to occur (Expected) if the site is in an undisturbed or 'reference' condition. The principal outputs of the AUSRIVAS model would include the Observed to Expected ratio (OE50Taxa Score) and the BAND level for each site, which represents different levels of impairment.

The SIGNAL 2 biotic index (Stream Invertebrate Grade Number Average level) developed by Chessman (2003) was also used to give an indication of water quality at the sites sampled. The SIGNAL score for a macroinvertebrate sample is calculated by averaging the pollution sensitivity grade numbers of the families present, which may range from 10 (most sensitive) to 1 (most tolerant).

The SIGNAL 2 scores are interpreted by plotting the score and the number of taxa on a biplot graph (Chessman, 2003). The y-axis (SIGNAL 2 score) ranges from 1 to 10. The x-axis ranges from 0 to 40 (the maximum number of families).

In general, high values of both SIGNAL 2 and the number of macroinvertebrate families suggests that diversity of physical habitats is high and that stress factors like toxic chemicals and harsh physical conditions are not present. The high SIGNAL 2 scores suggests that turbidity, salinity and nutrient concentrations are low. Streams in undisturbed native forest are expected to fall in this quadrant.

Lower SIGNAL 2 scores and a high diversity of macroinvertebrate families generally indicates higher levels of turbidity, salinity or nutrients than those in undisturbed watercourses. The high number of macroinvertebrate types suggests that physical conditions are still benign and toxic chemicals are not present in large amounts. Many agricultural streams without severe impacts are expected to fall into this quadrant.

High SIGNAL 2 scores and a low diversity often indicate toxic pollution or harsh physical conditions (or inadequate sampling).

Low SIGNAL 2 scores and low diversity usually indicate that sites are exposed to one or more forms of human impact such as urban, industrial or agricultural pollution, or downstream effects of dams (Chessman, 2003).

2.6 Quality Assurance/Quality Control (QA/QC)

Data collected in the field were checked for accuracy and completeness before leaving each site. In the office, field data and other records were incorporated into appropriate excel data sheets and checked. Spreadsheets were locked prior to analysis to prevent accidental over-writes or corruption.

In the laboratory, macroinvertebrate samples were identified by an appropriately qualified staff member. Data for each sample were entered into an excel spreadsheet and then checked.

3.0 RESULTS

3.1 Aquatic Habitat Characteristics

3.1.1 Hunter River

The section of the Hunter River within the study area is generally characterised by a series of continuous, slow flowing pools up to approximately 30 m wide and 1.5 m deep (Plates 1-12). The channel substratum was composed primarily of silty sand and pebble/gravel edge habitat with a considerable cover of detritus. Large woody debris and undercut banks were present at all sites. Limited riffle habitat was present at Site HR6.

The riparian zone along the Hunter River has been heavily degraded largely due to clearing of vegetation, bank erosion and invasion by introduced plant species, including Morning Glory (*Ipomoea indica*), Privet (*Ligustrum* species) and Willow (*Salix* sp.) (Plates 1-2). River Oak (*Casuarina cunninghamiana*) and River Red Gum (*Eucalyptus camaldulensis*) were common.

Submerged, native species of macrophytes commonly found included Clasped Pondweed (*Potamogeton perfoliatus*) and Water Milfoil (*Myriophyllum* sp.), particularly at Site HR-4. The emergent macrophyte assemblages were characterised by Cumbungi (*Typha domingensis*), Umbrella Sedge (*Cyperus eragrostis*), Common Reed/ Phragmites (*Phragmites australis*), Mat Rush (*Lomandra longifolia*) and Common Rush (*Juncus usitatus*). The species present within the study area have a wide distribution and are abundant in similar aquatic habitats elsewhere in south eastern Australia.

The section of the Hunter River within the study area was classified as Class 1, Type 1 fish habitat according to the DPI (2013) classification. It received an RCE score of 40.



Plate 1: Hunter River – Site HR1 (sp-17)
View across stream



Plate 2: Hunter River – Site HR1 (sp-17)
View downstream



Plate 3: Hunter River – Site HR2 (sp-17)
View upstream



Plate 4: Hunter River – Site HR2 (sp-17)
View downstream



Plate 5: Hunter River – Site HR3 (sp-17)
View upstream



Plate 6: Hunter River – Site HR3 (sp-17)
View downstream



Plate 7: Hunter River – Site HR4 (sp-17)
View across-stream



Plate 8: Hunter River – Site HR4 (sp-17)
View downstream

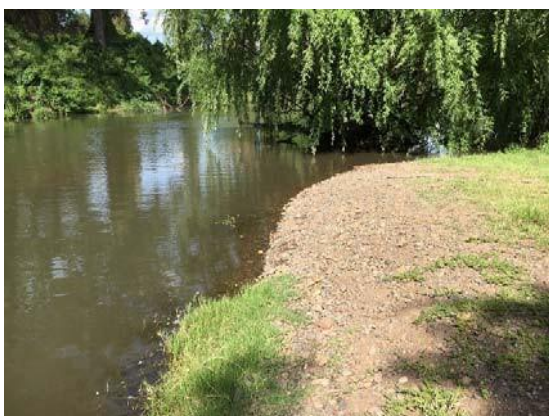


Plate 9: Hunter River – Site HR5 (sp-17)
View upstream



Plate 10: Hunter River – Site HR5 (sp-17)
View downstream



Plate 11: Hunter River – Site HR6 (sp-17)
View across-stream



Plate 12: Hunter River – Site HR6 (sp-17)
View downstream

3.1.2 Hunter River Tributaries

Due to the highly ephemeral nature of drainage lines within the MPO boundary, stream health monitoring locations were chosen on significant tributaries of the Hunter River outside of the MPO boundary.

Muscle Creek

The site sampled on Muscle Creek was situated on the floodplain approximately 1 km upstream of the confluence with the Hunter River (Figure 2). The stream channel was highly modified with large boulders used in places to stabilise the stream bank (Plates 13&14). The creek consisted of long pools with a maximum depth of approximately 2 m. The average stream width was approximately 10 m, but ~ 0.5 m immediately downstream of a small pedestrian crossing across the middle of the study reach and up to 15 m in the larger, downstream pool. The substratum was dominated by silt and gravel and also contained cobble, pebble and rock. At the time of sampling, there appeared to be no flow

Emergent macrophytes, including Phragmites, Cumbungi and Mat Rush were moderately abundant in-stream but the stream bank was mostly clear of vegetation. The water was moderately turbid and algal growth was observed as floating scum around the edges of the pool.

The site was classified as Class 1, Type 1 fish habitat according to the DPI (2013) classification although was observed as degraded due to bank degradation, exotic plant invasion, presence of algal growth and alien fish species (one carp and several Gambusia were observed). The site received an RCE score of 21.

Sandy Creek

The site sampled on Sandy Creek was located downstream of the MPO and upstream of Mangoola Open Cut mine (Figure 2). Wybong Road crosses the stream at the bottom of the study reach. The banks were approximately 3 m high and were heavily disturbed on either side by historical agricultural activities. Stream width was about 1 m to greater than 7 m, with an average of around 5 m (Plates 15&16). The maximum depth was < 0.5 m. The substratum was predominantly clay and silt with an anoxic layer.

At the time of sampling there was no flow and the water appeared stagnant. The site was classified as Class 1, Type 1 fish habitat according to the DPI (2013) classification. It received an RCE score of 26.

A dense bed of the submerged macrophyte, Hornwort (*Ceratophyllum demersum*), was observed at the downstream end of the reach. Dense emergent growth of Cumbungi choked the stream channel immediately upstream of the Wybong Road crossing.

Dart Brook

Sampling site Dark Brook was chosen at a road crossing approximately 1 km upstream from the confluence with the Hunter River. The surrounding land use was mostly agriculture and there was some evidence of recent stock access to the stream bank. This section of the stream consisted of pools up to approximately 6 m wide and 1.5 m deep (Plates 17&18). The substratum was dominated by accumulations of silt, pebble and cobble and some boulders. No submerged macrophytes were observed. Emergent macrophytes included Phragmites and River Club-Rush (*Schoenoplectus validus*), both of which commonly grow in fresh to brackish water. Water clarity was fair. The site was classified as Class 1, Type 1 fish habitat according to the DPI (2013) classification. It received an RCE score of 34.



Plate 13: Muscle Creek – Site MC (sp-17)
View downstream



Plate 14: Muscle Creek– Site MC (sp-17)
View upstream



Plate 15: Sandy Creek – Site SC (sp-17)
View upstream



Plate 16: Sandy Creek– Site SC (sp-17)



Plate 17: Dart Brook – Site DB (sp-17)
View near crossing



Plate 18: Dart Brook – Site DB (sp-17)
View upstream

3.2 Water Quality

Mean physico-chemical water quality measurements are summarised in Table 1. Values highlighted in bold type indicate where results were outside the default trigger values (DTVs) recommended by ANZECC/ARMCANZ (2000) for protection of aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia.

In general, the mean water temperature at the sites sampled ranged from 21.1 to 25.9 °C (Table 3). Mean pH (range = 7.7 – 8.5) exceeded the upper DTV (i.e. pH 6.5-8.0; ANZECC/ARMCANZ, 2000) for upland rivers at four of the six sites sampled on the Hunter River (i.e. Site HR1, HR2, HR3 and HR6) and at the sites sampled on Dart Brook (DB) and Sandy Creek (SC) (Table 3).

Mean conductivity values (range = 264 – 8,000 µS/cm) were well above the upper DTV (ANZECC/ARMCANZ, 2000) at the tributary sites, particularly at SC (Table 3).

Mean dissolved oxygen (DO) (range = 43.7 – 141.2 % Saturation) was below the lower DTV (ANZECC/ARMCANZ, 2000) at Site's HR5, HR6, DB, MC and SC but above the upper DTV at Site HR2 (Table 3).

Mean turbidity (range = 10.1 – 46.4 NTU) was above the upper DTV at five of the six sites sampled on the Hunter River (Table 1). Mean alkalinity ranged from 10-11 mg/L CaCO₃ (Table 3).

The raw water quality data are provided in Appendix 3.

Table 3. Mean (\pm SE) values of water quality variables recorded at each site (spring 2017).

Indicator Variable	HR1	HR2	HR3
Temperature °C ($n = 3$)	22.4 (0.0)	22.9 (0.0)	24.7 (0.0)
pH ($n = 3$)	8.3 (0.0)	8.2 (0.0)	8.2 (0.0)
Conductivity ($\mu\text{S}/\text{cm}$) ($n = 3$)	264.0 (0.0)	267.3 (1.3)	271.7 (1.3)
Dissolved Oxygen (% Saturation) ($n = 3$)	95.5 (0.4)	141.2 (3.6)	101.7 (0.5)
Turbidity (NTU) ($n = 3$)	16.4 (1.4)	26.7 (1.2)	46.4 (0.3)
Alkalinity	11	11	11
	HR4	HR5	HR6
Temperature °C ($n = 3$)	24.6 (0.0)	25.4 (0.0)	25.9 (0.0)
pH ($n = 3$)	7.9 (0.0)	7.9 (0.0)	8.1 (0.0)
Conductivity ($\mu\text{S}/\text{cm}$) ($n = 3$)	296.3 (1.3)	317.7 (1.3)	329.0 (0.0)
Dissolved Oxygen (% Saturation) ($n = 3$)	93.2 (0.6)	66.5 (0.8)	74.7 (0.0)
Turbidity (NTU) ($n = 3$)	26.5 (0.9)	30.5 (0.5)	35.3 (0.8)
Alkalinity	11	10	11
	DB	MC	SC
Temperature °C ($n = 3$)	25.1 (0.0)	23.3 (0.0)	21.1 (0.0)
pH ($n = 3$)	8.1 (0.0)	7.7 (0.2)	8.5 (0.0)
Conductivity ($\mu\text{S}/\text{cm}$) ($n = 3$)	4257.3 (1.3)	1589.0 (2.6)	8000.0 (0.0)
Dissolved Oxygen (% Saturation) ($n = 3$)	64.2 (0.8)	86.6 (0.1)	43.7 (0.0)
Turbidity (NTU) ($n = 3$)	24.2 (0.5)	26.9 (0.9)	10.1 (0.1)
	10	11	11

NB: Guideline values recommended by the ANZECC/ARMCANZ (2000) guidelines for upland rivers in south-east Australia: pH (6.5 – 8.0); Conductivity (30 – 350 $\mu\text{S}/\text{cm}$); Turbidity (2 – 25 NTU); Dissolved Oxygen (90–110 % Saturation). There are no ANZECC/ARMCANZ (2000) guideline values for Temperature or Alkalinity.

3.3 Aquatic Macroinvertebrates

3.3.1 General Findings

A total of 29 taxa were identified from the edge habitat samples collected at nine sites in spring 2017 using the AUSRIVAS protocol (Appendix 4). An Eastern snake-necked turtle (*Chelodina longicollis*) was also collected, at the site sampled on Muscle Creek. The number of taxa ranged from 8 at Site HR1 to 18 at the Dart Brook site (Table 4). Two taxa, Chironominae (non-biting midges) and Leptoceridae (caddis flies) occurred at all sites.

The OE50 scores ranged between 0.41 (HR1) and 0.73 (HR6) (Table 3). Of the nine sites sampled, two were grouped in Band C (HR1 and HR4) and seven were grouped within Band B (HR2, HR3, HR5, HR6, MC, SC and DB) (Table 4). Thus, fewer families of macroinvertebrates than expected were collected from all sites sampled in spring 2017 compared to reference sites selected by the AUSRIVAS model (Table 4).

Taxon with > 0.85 probability of occurrence but not collected included the scavenger water beetle family, Hydrophilidae, at sites HR1 and HR5 and the mayfly families, Baetidae, at site HR6 and Leptophlebiidae, at sites MC and SC (Table 4).

The SIGNAL 2 scores ranged from 2.88 to 3.41 (Table 4), which may indicate exposure to several kinds of physical and chemical enrichment or contamination.

Table 4. AUSRIVAS outputs for sites sampled (spring 2017) ($n = 1$).

Watercourse	BA Site Code	Historical Site Code	No Taxa	SIGNAL-2	OE50	Band
Hunter River	HR1	W1	8	3.31	0.41	C
	HR2	W1	11	3.38	0.59	B
	HR3	Hunt 854	13	3.19	0.64*	B
	HR4	Hunt 571	12	2.88	0.51*	C
	HR5	W15	10	3.04	0.61	B
	HR6	SW17	13	3.38	0.73	B
Sandy Creek	SC	Sandy 1	11	3.28	0.61	B
Dart Brook	DB	Hunt 585	18	3.41	0.66	B
Muscle Creek	MC	Hunt 506	13	3.24	0.55	B

*Stream health performance indicators: HR3/Hunt 854 = 0.84; HR4/Hunt 571 = 0.54 (MACH Energy, 2017).

3.3.2 Changes in Aquatic Macroinvertebrate Assemblages

The OE50 Taxa Scores determined for Site HR3 (0.64) and Site HR4 (0.51) on the Hunter River in spring 2017 were lower than the recommended stream health performance indicator scores (i.e. Site HR3: 0.84; Site HR4: 0.54) (Table 4).

3.4 Fish

Four species of fish (including two introduced species) were caught by electrofishing sites on the Hunter River and Muscle Creek in November 2017 (Table 5). Sites on Sandy Creek and Dart Brook were unable to be electro-fished due to high salinity levels (i.e. > 2,000 $\mu\text{S}/\text{cm}$).

Carp were sited but not caught at Site HR4 and Site MC (Table 5). Freshwater shrimps (Atyidae) were common and also caught in dip nets whilst sampling aquatic macroinvertebrates (Table 5).

All of the species caught have been recorded during previous fish surveys done on the Hunter River (McDowall, 1996; DPI 2006; Howell and Creese, 2010). No threatened species of fish listed under the NSW FM Act or the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) were recorded in the Study Area on this sampling occasion (Table 5) or by previous surveys (McDowall, 1996; DPI 2006; Howell and Creese, 2010).

Table 5. Species collected electrofishing.

Species	Common Name	HR1	HR2	HR3	HR4	HR5	HR6	MS
<i>Anguilla reinhardtii</i>	Long-finned eel	√	√	√	√			
<i>Cyprinus carpio</i>	Common carp*			√	√			
<i>Mugil cephalus</i>	Sea mullet				√		√	
<i>Gambusia holbrooki</i>	Mosquito fish*							
<i>Atyidae</i> sp.	Freshwater shrimp	√	√	√	√			

*Non-native/Alien species

**Plate 19: Carp collected at Site HR3.****Plate 20: Sea Mullet collected at Site HR4.**

5.0 DISCUSSION & RECOMMENDATIONS

Surveys carried out at potential impact and reference locations provide data on water quality and assemblages of aquatic macroinvertebrates and fish that can be used to assess the nature and extent of impacts, if any, associated with construction and mining activities. A summary of the key findings of the monitoring program to date (including observations made on stream characteristics) is provided below.

- Aquatic habitat within the section of the Hunter River in the study area and at Dart Brook was generally in good condition although clearing, bank erosion and weed infestation was evident in the riparian zone. Under normal flow conditions, the deep pools present, instream aquatic macrophytes and large woody debris would provide important habitat for many species of aquatic fauna, including fish;
- Sites within Muscle Creek and Sandy Creek showed substantial hydrological disturbance and weed infestation in the riparian zone. Baseline water quality data, particularly elevated salinity and reduced dissolved oxygen concentrations, reflected the condition of their catchments, which have been degraded by historical land uses that include agriculture, rural development and mining;
- No aquatic species of conservation significance were recorded within the Study Area;
- Results from the AUSRIVAS and SIGNAL 2 analyses indicate that macroinvertebrates assemblages at all of the sites sampled were dominated by pollution tolerant taxa;
- The OE50 Taxa Scores determined for two sites on the Hunter River in spring 2017 were lower than the recommended stream health performance indicator scores developed for those sites.

The aquatic macroinvertebrate fauna in the Hunter River and tributary's appears to have experienced some degree of environmental stress prior to, and hence independent of, construction and operation of the MPO.

It is recommended that monitoring using the methods employed for the spring 2017 survey is repeated in autumn 2018 and that data collected using the AUSRIVAS protocol is used to refine the performance indicator values developed by MACH Energy as trigger criteria for stream health within the Hunter River.

It is also recommended that baited traps and fyke nets are used in areas too deep to be reached with the backpack electrofisher at the Hunter River sites. These methods could be effectively and economically used in association with the use of the backpack electrofisher for the autumn 2018 survey.

6.0 ACKNOWLEDGEMENTS

This report was written by Sharon Cummins. Dan Roberts (BIO-ANALYSIS) and Scott McDonald (AECOM) are thanked for management support. Michael Murray, Liane Peyra and Jennifer Cummins (BIO-ANALYSIS), Scott McDonald and Jess Robins (AECOM) are thanked for assistance in the field and laboratory.

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APPENDICES

Appendix 1 - GPS positions (UTMs) for stream monitoring sites (spring 2017).

Watercourse	Site Code	Easting	Northing
Hunter River	HR1	0299795	6435454
	HR2	0299978	6434650
	HR3	0300138	6430799
	HR4	0300819	6429261
	HR5	0293733	6424204
	HR6	0292292	6423010
Dart Brook	DB	0298880	6436242
Muscle Creek	MC	0301145	6427940
Sandy Creek	SC	0289187	6428160

Datum: WGS 84, Zone 56H

Appendix 2 - Riparian Channel & Environment (RCE) Score Sheet

	Descriptor & Category			Descriptor & Category	
1	Land use pattern beyond the immediate riparian zone -Undisturbed native vegetation -Mixed native vegetation and pasture/exotics -Mainly pasture, crops or pine plantation -Urban	4 3 2 1	8	Riffle/pool sequence -Frequent alternation of riffles and pools -Long pools with infrequent short riffles -Natural channel without riffle/pool sequence -Artificial channel: no riffle/pool sequence	4 3 2 1
2	Width of riparian strip of woody vegetation - > 30 m - Between 5 and 30 m - < 5 m - No woody vegetation	4 3 2 1	9	Retention devices in stream - Many large boulders and/or debris dams - Rocks/logs present: limited damming effect - Rocks/logs present; but unstable, no damming - Stream with few or no rocks/logs	4 3 2 1
3	Completeness of riparian strip of woody vegetation - Riparian strip without breaks in vegetation - Breaks at intervals of > 50 m - Breaks at intervals of 10 – 50 m - Breaks at intervals < 10 m	4 3 2 1	10	Channel sediment accumulations - Little or no accumulation of loose sediments - Some gravel bars but little sand or silt - Bars of sand and silt common - Braiding by loose sediment	4 3 2 1
4	Vegetation of riparian zone within 10 m of channel - Native tree and shrub species - Mixed native and exotic trees and shrubs - Exotic trees and shrubs - Exotic grasses/weeds only	4 3 2 1	11	Stream bottom - Mainly clean stones with obvious interstices - Mainly stones with some cover of algae/silt - Bottom heavily silted but stable - Bottom mainly loose and mobile sediment	4 3 2 1
5	Stream bank structure - Banks fully stabilised by trees, shrubs, etc - Banks firm but held mainly by grass and herbs - Banks loose, partly held by sparse grass etc - Banks unstable, mainly loose sand or soil	4 3 2 1	12	Stream detritus - Mainly unsilted wood, bark, leaves - Some wood, leaves etc, with much fine detritus - Mainly fine detritus mixed with sediment - Little or no organic detritus	4 3 2 1
6	Bank undercutting - None or restricted by tree roots - Only on curves and at constrictions - Frequent along all parts of stream - Severe, bank collapses common	4 3 2 1	13	Aquatic vegetation - Little or no macrophyte or algal growth - Substantial algal growth: few macrophytes - Substantial macrophyte growth; little algae - Substantial macrophyte and algal growth	4 3 2 1
7	Channel form - Deep: width/depth ratio < 7:1 - Medium: width/depth ratio < 8:1 to 15:1 - Shallow: width/depth ratio > 15:1 - Artificial: concrete or excavated channel	4 3 2 1			

Appendix 3 - Water Quality Data (spring 2017)

Indicator Variable	HR1-1	HR1-2	HR1-3	HR2-1	HR2-2	HR2-3	HR3-1	HR3-2	HR3-3
Temperature °C	22.4	22.4	22.4	22.9	22.9	22.9	24.7	24.7	24.7
pH	8.27	8.27	8.27	8.24	8.25	8.25	8.17	8.17	8.17
Conductivity (µS/cm)	264	264	264	270	266	266	269	273	273
Dissolved Oxygen (% Saturation)	96.3	94.9	95.4	148.2	139.1	136.2	102.2	102.2	100.7
Turbidity (NTU)	15.1	19.3	14.9	24.2	28.0	27.8	47.0	46.3	45.9
Alkalinity	11			11					
	HR4-1	HR4-2	HR4-3	HR5-1	HR5-2	HR5-3	HR6-1	HR6-2	HR6-3
Temperature °C	24.56	24.57	24.58	25.4	25.4	25.4	25.86	25.86	25.86
pH	7.94	7.95	7.95	7.93	7.94	7.95	8.09	8.09	8.09
Conductivity (µS/cm)	295	299	295	315	319	319	329	329	329
Dissolved Oxygen (% Saturation)	94.1	92	93.5	65	67.3	67.3	74.7	74.7	74.7
Turbidity (NTU)	24.7	27.2	27.6	30.0	31.4	30.0	36.8	34.8	34.2
Alkalinity	11			10			11		
	DB-1	DB-2	DB-3	MC-1	MC-2	MC-3	SC-1	SC-2	SC-3
Temperature °C	25.08	25.13	25.14	23.3	23.3	23.3	21.08	21.1	21.1
pH	8.07	8.08	8.08	7.85	7.4	7.86	8.46	8.46	8.46
Conductivity (µS/cm)	4260	4256	4256	1584	1590	1593	8000	8000	8000
Dissolved Oxygen (% Saturation)	65.7	63.6	63.3	86.5	86.6	86.7	43.7	43.8	43.7
Turbidity (NTU)	23.3	24.5	24.9	28.8	26.0	26.0	10.3	10.1	9.9
Alkalinity	10			11			10.9		

Appendix 4 - Macroinvertebrate taxa collected using the AUSRIVAS protocol (spring 2017).

Taxon	Common Name	HR1	HR2	HR3	HR4	HR5	HR6	MC	SC	DB
Ancyclidae	Freshwater snails	0	0	0	0	1	0	2	0	0
Atyidae	Freshwater Shrimps	10	10	10	10	10	10	2	0	2
Bithyniidae	Freshwater snails	0	0	0	0	0	1	2	0	0
Caenidae	Mayfly nymphs	1	1	4	1	1	2	0	0	9
Ceratopogonidae	True Fly larvae	0	0	0	0	0	0	0	10	2
Chironomidae - Chironominae	True Fly larvae	10	10	6	14	7	1	24	12	11
Chironomidae - Tanypodinae	True Fly larvae	0	0	1	0	4	1	0	0	2
Coenagrionidae	Damselfly nymphs	2	0	1	1	0	0	0	2	0
Corixidae	Aquatic bugs	6	9	14	11	27	24	2	0	1
Culicidae	True Fly larvae	0	0	0	0	0	0	0	1	0
Dugesidae	Flatworms	0	0	0	4	0	0	0	0	0
Dytiscidae	Water Beetles	2	0	5	1	3	0	2	9	1
Ecnomidae	Caddis Fly larvae	0	2	0	1	0	0	7	0	2
Elmidae	Water Beetles	0	1	0	0	0	0	1	0	0
Empididae	True Fly larvae	0	0	1	0	0	0	0	0	0
Gerridae	Aquatic Bugs	0	0	0	0	0	1	0	0	0
Gyrinidae	Water Beetles	0	0	0	0	0	1	0	0	1
Haliplidae	Aquatic Bugs	0	0	0	0	0	0	0	2	1
Hydrophilidae	Water Beetles	0	1	1	1	0	1	2	1	1
Hydroptilidae	Caddis Fly larvae	0	2	1	0	1	1	0	0	0
Leptoceridae	Caddis Fly larvae	8	14	3	3	8	3	5	2	1
Libellulidae	Dragonfly nymphs	0	0	0	2	0	2	1	3	1
Physidae	Freshwater snails	0	7	1	5	6	1	4	0	3
Psphenidae	Aquatic Bugs	0	1	0	0	0	0	0	0	0
Pyalidae	Freshwater Snails	0	0	0	0	0	0	0	1	0
Scirtidae	Water Beetles	0	0	1	0	0	0	0	2	1
Sialidae	Alderflies/Dobsonflies	0	0	0	0	0	0	0	0	1
Sphaeriidae	Freshwater bivalves	0	0	0	0	0	0	0	0	1
Stratiomyidae	True Fly larvae	1	0	0	0	0	0	1	0	1
Number of Taxa		8	11	13	12	10	13	13	11	18

Data collected on 28 November 2017