MOUNT PLEASANT OPERATION

MOUNT PLEASANT OPTIMISATION PROJECT

EPBC APPROVAL 2020/8735

2024/2025 ANNUAL COMPLIANCE REPORT

Document ID:	MPO EPBC 2020/8735 Approval 2024/2025 Annual Compliance Report		
Company:	MACH Energy Australia Pty Ltd		
Effective Date:	21/11/2025	**Status:**	Final
Endorsed By:	Lisa Richards	**Revision Number:**	01

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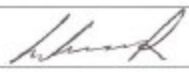
EPBC APPROVAL 2020/8735 - 2024/2025 ANNUAL COMPLIANCE REPORT	
Name of Operation/Project	Mount Pleasant Operation – Mount Pleasant Optimisation Project
Approval Holder	MACH Energy Australia Pty Ltd
ACN of Approval Holder	608 495 441
Name of Holder of Development Consent	MACH Energy Australia Pty Ltd
Approved Action	To realign the approved Northern Link Road, increase the open cut coal extraction up to 21 Mtpa within the approved Mount Pleasant Project (EPBC 2011/5795) development area, including accessing deeper coal reserves in the North Pit, continued use of the controlled release dam and associated infrastructure as described in the Continuation of Bengalla Mine, NSW, Water Management Plan, (EPBC Act referral 2012/6378), and to extend the life of the mine to 22 December 2048 [See EPBC Act referral 2020/8735].
Location of the Action	Muswellbrook Local Government Area, NSW
Dates for the Reporting Period	24 September 2024 and 23 September 2025
Date of Preparation	21 November 2025
Environmental Risks	No new environmental risks identified
Declaration of accuracy In making this declaration, I am aware that sections 490 and 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or documents. The offence is punishable on conviction by imprisonment or a fine, or both. I declare that all the information and documentation supporting this compliance report is true and correct in every particular. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.	
Signature	
Name of person accepting responsibility for the report	Lisa Richards
Position of person accepting responsibility for the report	Environment Community Relations Manager
Organisation	MACH Energy Australia Pty Ltd, ACN 608 495 441
Date	21/11/25

In accordance with Condition 31 of EPBC Approval 2020/8735:

> "*The approval holder must prepare a compliance report for each 12-month period following the date of this approval decision, or as otherwise agreed to in writing by the Minister.*"

The EPBC 2020/8735 approval decision (the Approval) was published on 24 September 2024. The following Annual Compliance Report addresses compliance with the conditions of EPBC Approval 2020/8735 between 24 September 2024 and 23 September 2025.

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
Part A – Conditions specific to the Action			
1.	*The **approval holder** must not exceed the **clearing** limits specified below.* *a) 26.4 hectares of **White Box-Yellow Box-Blakely's Red Gum Grassy Woodland TEC** (as depicted in Annexure 2).* *b) 27.4 hectares of **Striped legless lizard (Delma impar/Delma vescolineata) habitat** (as depicted in Annexure 3).*	Compliant	Approximately 24.77 ha of "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland TEC" was cleared as part of the Action between 24 September 2024 and 23 September 2025. The cumulative area of "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland TEC" cleared as part of the Action as of 23 September 2025 is approximately 24.77 ha. Approximately 24.77 ha of "Striped legless lizard (Delma impar/Delma vescolineata) habitat" was cleared as part of the Action between 24 September 2024 and 23 September 2025. The cumulative area of Striped legless lizard (Delma impar/Delma vescolineata) habitat" cleared as part of the Action as of 23 September 2025 is approximately 24.77 ha.
2.	*The **approval holder** must not **clear** outside the **Mount Pleasant Optimisation Project Area** (as depicted in Annexure 1) as part of this Action.*	Compliant	Clearance as part of the Action has not occurred outside the Mount Pleasant Optimisation Project Area (refer Annexure 1, EPBC Approval).
3.	*Prior to commencement of **construction** of the Northern Link Road, or other timeframe agreed to by the **Minister**, the **approval holder** must **retire** 307 **Biodiversity credits** for Northern Link Road Option 1 or 229 **Biodiversity credits** for Northern Link Road Option 2 (or additional credits as agreed by the **NSW Planning Secretary**) for the listed **White Box-Yellow Box-Blakely's Red Gum Grassy Woodland TEC**.*	Compliant	MACH Energy is proceeding with a refined alignment of the Northern Link Road Option 2. The retirement of additional credits for the Northern Link Road Option 2 (270 credits in total compared to 229 credits) was agreed with the NSW Planning Secretary on 18 March 2025 with the approval letter available here: link. MACH Energy retired 270 Biodiversity credits for the listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland TEC on 2 May 2025. MACH Energy commenced construction of the Northern Link Road on, or soon after, 9 June 2025.
4.	*Prior to 16 July 2026, or other timeframe agreed to by the **Minister**, the **approval holder** must **retire** 293 **Biodiversity credits** for Northern Link Road Option 1 or 225 **Biodiversity credits** for Northern Link Road Option 2 for either Delma impar or Delma vescolineata.*	Not Applicable	Not triggered. Credits will be retired prior to 16 July 2026.

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
5.	*The **approval holder** must comply with conditions B63, B64 and B65 of Part B of the **State development consent** to prepare and implement the **Biodiversity Management Plan** and conditions B87, B88, B89, B90, B91 and B92 of Part B of the **State development consent** to prepare and implement a Rehabilitation Strategy and Rehabilitation Management Plan.*	Compliant	The Biodiversity Management Plan (BMP) was approved by the NSW Department of Planning, Housing & Infrastructure on 5 November 2024. The Rehabilitation Strategy was approved by the NSW Department of Planning, Housing & Infrastructure on 23 July 2025. The Rehabilitation Management Plan (RMP) was prepared in accordance with the provisions under the *Mining Act 1992*. All plans/strategies have been implemented.
Water Resources			
6.	*The **approval holder** must not extract more than 21 million tonnes of **run-of-mine coal** from the **Mount Pleasant Optimisation Project Area** as part of the Action in any calendar year and must cease extraction by 22 December 2048.*	Compliant	Approximately 11.43 Mt of run-of-mine coal was extracted from the Mount Pleasant Optimisation Project Area in calendar year 2024. Approximately 12.77 Mt of run-of-mine coal is forecast for extraction from the Mount Pleasant Optimisation Project Area in calendar year 2025.
7.	*The **approval holder** must ensure the Action has no **adverse effect** on the **function** of a **water resource**.*	Compliant	No adverse effects have been recorded during monitoring as per the Water Management Plan.
8.	*The **approval holder** must comply with conditions B39, B40, B41, B42, B43, B44, B45, B46, B47, B48, B49, B50, B51, B52, B53, B54, B87-B92 of Part B of the **State development consent**.*	Compliant	MACH Energy has complied with consent conditions, *B39- B54* for Water in the State Development Consent. MACH Energy has complied with consent conditions, *B87-B92* for Rehabilitation in the State Development Consent.

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
9.	*The **approval holder** must, within 5 **business days** of its approval by the **NSW Planning Secretary** (including any approval of a revised version), submit to the **department**:* *a) the **Water Management Plan*** *b) a table stating every **trigger level** and where it is specified in the **Water Management Plan** and* *c) if a revised version of the **Water Management Plan** is approved by the **NSW Planning Secretary**, a document specifying what changes have been made from the previous version (including by supplying a copy with these changes marked in track mode) and a description of any implications of the changes for **protected matters**.*	Compliant	EPBC 2020/8735 was issued on 24 September 2024. On 30 September 2024 (i.e. within five business days of EPBC 2020/8735 coming into effect), MACH Energy provided electronic correspondence notifying the DCCEEW of the approval of Version 2 of the Water Management Plan and provided a table stating every trigger level and where it was specified in the Water Management Plan. DCCEEW notified MACH Energy of receipt of this correspondence on 23 October 2024. Version 3 of the Water Management Plan was approved by the NSW Planning Secretary on 7 February 2025. On 12 February 2025 (i.e. within five business days of the approval), MACH Energy provided electronic correspondence notifying the DCCEEW of the Water Management Plan approval. DCCEEW notified MACH Energy of receipt of this correspondence on 13 February 2025. Version 4 of the Water Management Plan was submitted on 2 August 2025 and is currently awaiting approval, after which MACH Energy will provide electronic correspondence to the DCCEEW within five business days of the approval.
10.	*The **approval holder** must notify the **department** within 5 **business days** of submitting a request to have a revised version of the **Water Management Plan** approved by the **NSW Planning Secretary**.*	Compliant	MACH Energy submitted a request to have Version 3 of the Water Management Plan approved by the NSW Planning Secretary on 17 December 2024. On 17 December 2024 (i.e. within five business days of the request), MACH Energy provided electronic correspondence notifying the DCCEEW of the request. MACH Energy submitted a request to have Version 4 of the Water Management Plan approved by the NSW Planning Secretary on 11 August 2025. On 12 August 2025 (i.e. within five business days of the request), MACH Energy provided electronic correspondence notifying the DCCEEW of the request. DCCEEW notified MACH Energy of receipt of this correspondence on 12 August 2025.
11.	*If, at any time until the end date of this approval, the **approval holder** predicts or detects the reaching of a **trigger level**, the **approval holder** must notify the **department** of the predicted or actual reaching within 10 **business days** of predicting or detecting the reaching of the **trigger level**, and publish on the **website**, within 3 months of the detection or reaching, the notification and a description of any relevant corrective actions that have been undertaken to prevent the breach of a **performance measure**.*	Compliant	On 25 August 2025, the Department was notified within 10 business days after MACH Energy became aware of a surface water pH trigger at site W15. The pH trigger at W15 is published on the MACH Energy website under the July 2025 Monthly Environmental Monitoring Report. Following a review of the data, the pH triggered level was caused by significant flood flows and therefore no performance measure was exceeded, and no corrective measures were required.

	EPBC Approval 2020/8735 Conditions	Status	MACH Energy Comment
12.	*Upon receiving notification of a predicted or actual reaching of a **trigger level** under condition 11, the **Minister** may direct the **approval holder** to undertake specific corrective actions to minimise impacts to **water resources**. The **approval holder** must implement any specific corrective actions to minimise impacts to **water resources** as directed by the **Minister**.*	Not applicable	Not triggered. The Minister has not requested specific corrective actions to minimise impacts to water resources.
13.	*If the **approval holder** predicts or detects a breach of a **performance measure**, the **approval holder** must notify the **department** of the predicted or actual breach within 5 **business days** of predicting or detecting the breach.*	Compliant	Not triggered. In the event of a breach of a performance measure, MACH Energy will notify the department of the breach within 5 business days.
14.	*If the **approval holder** predicts or detects a reaching of a **performance measure** the **approval holder** must submit to the **department**, within 60 **business days** of predicting or detecting an exceedance of the **performance measure**, for the **Minister's** approval, an Impact Response Plan. The Impact Response Plan must:* *a) be prepared by a **suitably qualified expert**;* *b) describe all potential and actual impacts to **water resources** arising from the breach;* *c) describe and, where possible, include local scale numerical modelling of, all potential contributing activities;* *d) derive a scientifically robust rectification strategy based on multiple lines of evidence and field data to support the assessment of the **environmental value** of any affected **water resources** (including the groundwater-dependence of any potential **GDEs**)* *e) explain why any further investigations are or are not required to determine the cause of the reaching of the **performance measure** and to propose effective corrective actions;* *f) specify the mitigation and management measures that the **approval holder** has taken and/or proposes to take to address the reaching of the **performance measure**, including demonstrating the effectiveness of the mitigation and management measures using relevant data;* *g) specify the duration for which the Impact Response Plan must be implemented;* *h) provide justification for how the proposed mitigation and management measures will prevent or reverse the reaching of the **performance measure** and ensure compliance with condition 7; and* *i) include a **peer review** and details of how the **approval holder** has addressed any inadequacies raised in the **peer review**.*	Compliant	Not triggered. No exceedance of performance measures has been recorded.
15.	*If the **approval holder** reaches a **performance measure**, the **approval holder** must, no later than 9 months after the date on which reaching of the **performance measure**, cease any element of mining as part of the Action that has contributed to reaching of the **performance measure** until or unless the Impact Response Plan in relation to reaching of the **performance measure** has been approved in writing by the **Minister**. The **approval holder** must commence implementing each approved Impact Response Plan within 5 **business days** of it being approved by the **Minister** and continue to implement it for the period specified in the approved Impact Response Plan.*	Not applicable	Not triggered.

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
16.	*The **approval holder** must publish each approved Impact Response Plan on the **website** within 5 **business days** of its approval. The **approval holder** must notify the **department** within 5 **business days** of an Impact Response Plan being published and keep the Impact Response Plan published on the **website** until the end date of this approval.*	Not applicable	Not triggered.
17.	*If the **Minister** is not satisfied that the corrective actions or rectification measures specified in an Impact Response Plan will or are likely to achieve the outcome(s) required by condition 7, the **Minister** may direct the **approval holder** to undertake specific corrective action(s) to limit and/or prevent further impacts to **water resources**. The **approval holder** must implement any specific corrective actions to minimise impacts to **water resources** as directed by the **Minister**.*	Not applicable	Not triggered.
18.	*If the **Minister** directs the **approval holder** to undertake specific corrective action(s) under condition 17, the **approval holder** must, no later than 6 months after the date on which the **Minister** gave such a direction under condition 17, cease any element of mining as part of the Action that has contributed to reaching of the **performance measure** as part of the Action until or unless the **Minister** notifies the **approval holder** in writing that it may resume these elements of mining.*	Not applicable	Not triggered.
19.	*The **approval holder** must include in each **compliance report** a copy of all monitoring reports required by the Surface Water Management and Monitoring Plan (required under condition B52.(f)(iii) of the **State development consent**) and the Groundwater Management Plan (required under condition B52.(f)(iv) of the **State development consent**) included in the **Water Management Plan** to be provided to the NSW Government in the subject period of that **compliance report**.*	Compliant	MACH Energy prepares an annual review which includes a report of the surface water monitoring data and groundwater monitoring data required by the various monitoring plans. A copy of the annual review is provided with this compliance report. MACH Energy has also included its monthly environmental monitoring reports and stream health monitoring reports for Spring 2024 and Autumn 2025.
Part B – Administrative conditions			
Submission and publication of plans			
20.	*The **approval holder** must submit all **plans** required by these conditions electronically to the **department**.*	Compliant	The Water Management Plan was provided electronically to the Department when required by Condition 9 to be submitted to the Department. The requirement for an Impact Response Plan (IRP) is yet to be triggered.

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
21.	*Unless otherwise agreed to in writing by the **Minister**, the **approval holder** must publish each **plan** on the **website** within 15 **business days** of the date:* *a) of this approval, if the version of the **plan** to be implemented is specified in these conditions, or* *b) the **plan** is approved by the **Minister** in writing, if the **plan** requires the approval of the **Minister**, or* *c) the **plan** is submitted to the **department** in accordance with a requirement of these conditions, if the **plan** does not require the approval of the **Minister**, or* *d) the **plan** is approved by a state or territory government official as required under a state or territory government condition which must be complied with in accordance with these **EPBC Act** conditions.*	Compliant	The approved BMP, RMP, WMP and IRP are available on the MACH Energy website http://machenergyaustralia.com.au/ The Rehabilitation Strategy is available on the MACH Energy website http://machenergyaustralia.com.au/ This first Annual Compliance Report (i.e. this document) required under the conditions will be published on the MACH Energy website (http://machenergyaustralia.com.au/) within three months of every 12-month anniversary of the commencement of construction.
22.	*The **approval holder** must keep all published **plans** required by these conditions on the **website** until the expiry date of this approval.*	Compliant	MACH Energy will have all published plans required by the approval conditions available on the website until 22 December 2058.
23.	*The **approval holder** is required to exclude or redact **sensitive ecological data** from **plans** published on the **website** or otherwise provided to a member of the public. If **sensitive ecological data** is excluded or redacted from a **plan**, the **approval holder** must notify the **department** in writing what exclusions and redactions have been made in the version published on the **website**.*	Compliant	Not triggered. No sensitive ecological data is published in the plans.
Notification of date of commencement of the action			
24.	*The **approval holder** must notify the **department** electronically of the date of **commencement of the Action**, within 5 **business days** following **commencement of the Action**.*	Compliant	MACH Energy provided electronic correspondence dated 4 October 2024 notifying the Department of Climate Change, Energy, the Environment and Water (the Department) of commencement of the Action on 30 September 2024 (i.e. within 3 business days). The Department acknowledged this correspondence on 8 October 2024.
25.	*If the **commencement of the action** does not occur within 5 years from the date of this approval, then the **approval holder** must not **commence the action** without the prior written agreement of the **Minister**.*	Compliant	Commencement of the Action occurred on the 8 October 2024, which was less than 5 years from the date of the approval.
Compliance records			
26.	*The **approval holder** must maintain accurate and complete **compliance records**.*	Compliant	MACH Energy maintains comprehensive compliance records comprising all activities and outcomes associated with the Approval conditions. These records are available at the request of the Department.

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
27.	*If the **department** makes a request in writing, the **approval holder** must provide electronic copies of **compliance records** to the **department** within the timeframe specified in the request.* ***Note: Compliance records** may be subject to audit by the **department**, or by an independent auditor in accordance with section 458 of the **EPBC Act**, and/or be used to verify compliance with the conditions. Summaries of the results of an audit may be published on the **department's** website or through the general media.*	Compliant	Not triggered. The Department has not made a request in writing for electronic copies of compliance records.
28.	*The **approval holder** must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under the conditions of this **approval are prepared in accordance with the** Guidelines for biological survey and mapped data, Commonwealth of Australia 2018, or as otherwise specified by the **Minister** in writing.*	Compliant	MACH Energy ensures that data required under the conditions of the approval follow the Guidelines for biological survey and mapped data, Commonwealth of Australia 2018.
29.	*The **approval holder** must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the Guide to providing maps and boundary data for EPBC Act projects, Commonwealth of Australia 2021, or as otherwise specified by the **Minister** in writing.*	Compliant	MACH Energy ensures that data required under the conditions of the approval follow the Guide to providing maps and boundary data for EPBC Act projects, Commonwealth of Australia 2021.
30.	*The **approval holder** must submit all **monitoring data** (including **sensitive ecological data**), surveys, maps, other spatial and metadata and all species occurrence record data (sightings and evidence of presence) electronically to the **department** within 20 **business days** of the submission of a **compliance report**.*	Compliant	MACH Energy will electronically submit all data required under the conditions of the approval to the department within 20 business days after the submission of this Annual Compliance Report.
Annual compliance reporting			
31.	*The **approval holder** must prepare a **compliance report** for each 12-month period following the date of this approval decision, or as otherwise agreed to in writing by the **Minister**.*	Compliant	The Annual Compliance Report (i.e. this document) will be published on the MACH Energy website https://machenergyaustralia.com.au/mount-pleasant/documentation/ within three months of every 12-month anniversary of the commencement of construction. This Annual Compliance Report covers the period of 24 September 2024 to 23 September 2025.
32.	*Each **compliance report** must be consistent with the Annual Compliance Report Guidelines, Commonwealth of Australia 2014.*	Compliant	The Annual Compliance Report (i.e. this document) follows the Annual Compliance Report Guidelines, Commonwealth of Australia 2014.

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
33.	*Each **compliance report** must include:* *a) Accurate and complete details of compliance and any non-compliance with the conditions and the **plans**, and any **incidents**.* *b) One or more **shapefile** showing all **clearing** of **protected matters**, and/or their habitat, undertaken within the 12-month period at the end of which that **compliance report** is prepared.* *c) A schedule of all **plans** in existence in relation to these conditions and accurate and complete details of how each **plan** is being implemented.*	Compliant	This Annual Compliance Report accurately represents the compliance status of each condition. The Annual Compliance Report is accompanied by a shapefile of the clearing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland TEC and Striped Legless Lizard habitat. A register of relevant plans required under EPBC Approval 2020/8735 with submission dates, approval dates and condition numbers is included with the Annual Compliance Report.
34.	*The **approval holder** must:* *a) Publish each **compliance report** on the **website** within 60 **business days** following the end of the 12-month period for which that **compliance report** is required.* *b) Notify the **department** electronically, within 5 **business days** of the date of publication that a **compliance report** has been published on the **website**.* *c) Provide the weblink for the **compliance report** in the notification to the **department**.* *d) Keep all published **compliance reports** required by these conditions on the **website** until the expiry date of this approval.* *e) Exclude or redact **sensitive ecological data** from **compliance reports** published on the **website** or otherwise provided to a member of the public.* *f) If **sensitive ecological data** is excluded or redacted from the published version, submit the full **compliance report** to the **department within** 5 **business days** of its publication on the **website** and notify the **department** in writing what exclusions and redactions have been made in the version published on the **website**.* ***Note: Compliance reports** may be published on the **department's** website.*	Compliant	The Annual Compliance Report (i.e. this document) will be published on the MACH Energy website http://machenergyaustralia.com.au/ within 60 business days at the end of each 12-month period. The department will be notified within 5 business days after been published on the website. The Annual Compliance Report will remain on the website until the expiry date of this approval (22 December 2058). No sensitive ecological data is published in the plans.
Reporting non-compliance			
35.	*The **approval holder** must notify the **department** electronically, within 2 **business days** of becoming aware of any **incident** and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a **plan**.*	Compliant	Not triggered. MACH Energy will notify the department after becoming aware of potential non- compliances within 2 business days.
36.	*The **approval holder** must specify in the notification:* *a) Any condition or commitment made in a **plan** which has been or may have been breached.* *b) A short description of the **incident** and/or potential non-compliance and/or actual non-compliance.* *c) The location (including co-ordinates), date and time of the **incident** and/or potential non-compliance and/or actual non-compliance.* ***Note**: If the exact information cannot be provided, the **approval holder** must provide the best information available.*	Not applicable	Not triggered.

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
37.	*The **approval holder** must provide to the **department** in writing, within 12 **business days** of becoming aware of any **incident** and/or potential non-compliance and/or actual non-compliance, the details of that **incident** and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a **plan**. The **approval holder** must specify:* *a) Any corrective action or investigation which the **approval holder** has already taken.* *b) The potential impacts of the **incident** and/or non-compliance.* *c) The method and timing of any corrective action that will be undertaken by the **approval holder**.*	Not applicable	Not triggered.
Independent audit			
38.	*The **approval holder** must ensure that an **independent audit** of compliance with the conditions is conducted for every five-year period following the **commencement of the Action** until this approval expires, unless otherwise specified in writing by the **Minister**.*	Not applicable	Not triggered. It has not been five years since the commencement of the Action.
39.	*For each **independent audit**, the **approval holder** must:* *a) Provide the name and qualifications of the nominated **independent** auditor, the draft audit criteria, and proposed timeframe for submitting the **audit report** to the **department** prior to commencing the **independent audit**.* *b) Only commence the **independent audit** once the nominated **independent** auditor, audit criteria and timeframe for submitting the **audit report** have been approved in writing by the **department**.* *c) Submit the **audit report** to the **department** for approval within the timeframe specified and approved in writing by the **department**.* *d) Publish each **audit report** on the **website** within 15 **business days** of the date of the **department's** approval of the **audit report**.* *e) Keep every **audit report** published on the **website** until this approval expires.*	Not applicable	Not triggered. See above.
40.	*Each **audit report** must report for the five-year period preceding that **audit report**.*	Not applicable	Not triggered. See above.
41.	*Each **audit report** must be completed to the satisfaction of the **Minister** and be consistent with the Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines, Commonwealth of Australia 2019.*	Not applicable	Not triggered. See above.
Completion of the action			
42.	*The **approval holder** must comply with condition A5[1] in Schedule 2 of the **State development consent**.* *[1] Condition A5 in the **State development consent** states that mining operations may be carried out on the site, within the approved disturbance area, until 22 December 2048.*	Compliant	Mining operations are occurring and can continue to occur until 22 December 2048.
43.	*The **approval holder** must notify the **department** electronically 60 **business days** prior to the expiry date of this approval, that the approval is due to expire.*	Not applicable	Not triggered. It is more than 60 business days prior to the expiry date of the approval (22 December 2058).

EPBC Approval 2020/8735 Conditions		Status	MACH Energy Comment
44.	*Within 20 **business days** after the **completion of the Action**, and, in any event, before this approval expires, the **approval holder** must notify the **department** electronically of the date of **completion of the Action** and provide **completion data**. The **approval holder** must submit any spatial data that comprises **completion data** as a **shapefile**.*	Not applicable	Not triggered. The Action has not yet been completed.
Changes to State development consent			
45.	*The **approval holder** must notify the **department** in writing of any proposed change to the **State development consent** that may relate to **protected matters** within 5 **business days** of formally proposing a change or within 5 **business days** of submitting an application to propose a change.*	Compliant	Not triggered. No changes to the State development consent have been proposed in the period.
46.	*The **approval holder** must notify the **department** in writing of any change to the **State development consent** conditions that may relate to **protected matters**, within 10 **business days** of a change to conditions being approved.*	Compliant	Not triggered. No changes to the State development consent conditions have occurred in the period.

MOUNT PLEASANT OPERATION

MOUNT PLEASANT OPTIMISATION PROJECT

EPBC APPROVAL 2020/8735

2024/2025 ANNUAL COMPLIANCE REPORT

Attachment 1

Monitoring Data

Contents

1. 2409 MPO_Monthly_Environmental_Monitoring_Report_September_2024
2. 2410 MPO_Monthly_Environmental_Monitoring_Report_October_2024
3. 2411 MPO_Monthly_Environmental_Monitoring_Report_November_2024
4. 2412 MPO_Monthly_Environmental_Monitoring_Report_December_2024
5. 2501 MPO_Monthly_Environmental_Monitoring_Report_January_2025
6. 2502 MPO_Monthly_Environmental_Monitoring_Report_February_2025
7. 2503 MPO_Monthly_Environmental_Monitoring_Report_March_2025
8. 2504 MPO_Monthly_Environmental_Monitoring_Report_April_2025
9. 2505 MPO_Monthly_Environmental_Monitoring_Report_May_2025
10. 2506 MPO_Monthly_Environmental_Monitoring_Report_June_2025
11. 2507 MPO_Monthly_Environmental_Monitoring_Report_July_2025
12. 2508 MPO_Monthly_Environmental_Monitoring_Report_August_2025
13. 2509 MPO_Monthly_Environmental_Monitoring_Report_September_2025
14. MPO Stream Health Monitoring Report (Autumn 2025) (Draft 2025.0311)
15. MPO Stream Health Monitoring Report (Spring 2024) (Final Report)
16. Mount Pleasant Operation Annual Review 2024
17. Pre-clearance Survey

MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

September 2024

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 September 2024
Reporting Period End Date	30 September 2024
Date All Data Received	08 November 2024

Links to three key regulatory documents are provided here:

- MACH Energy Environment Protection Licence EPL 20850; and
- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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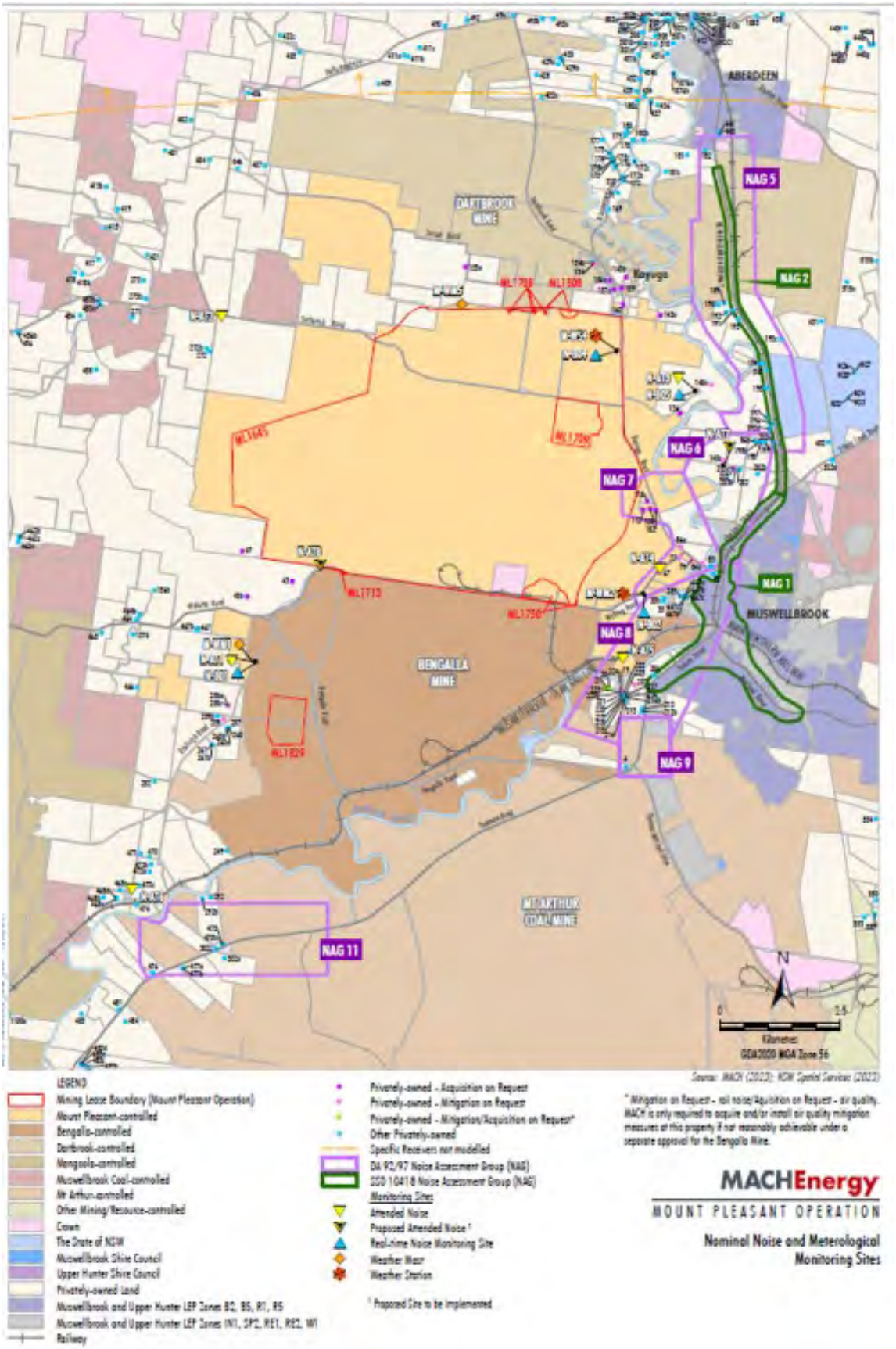

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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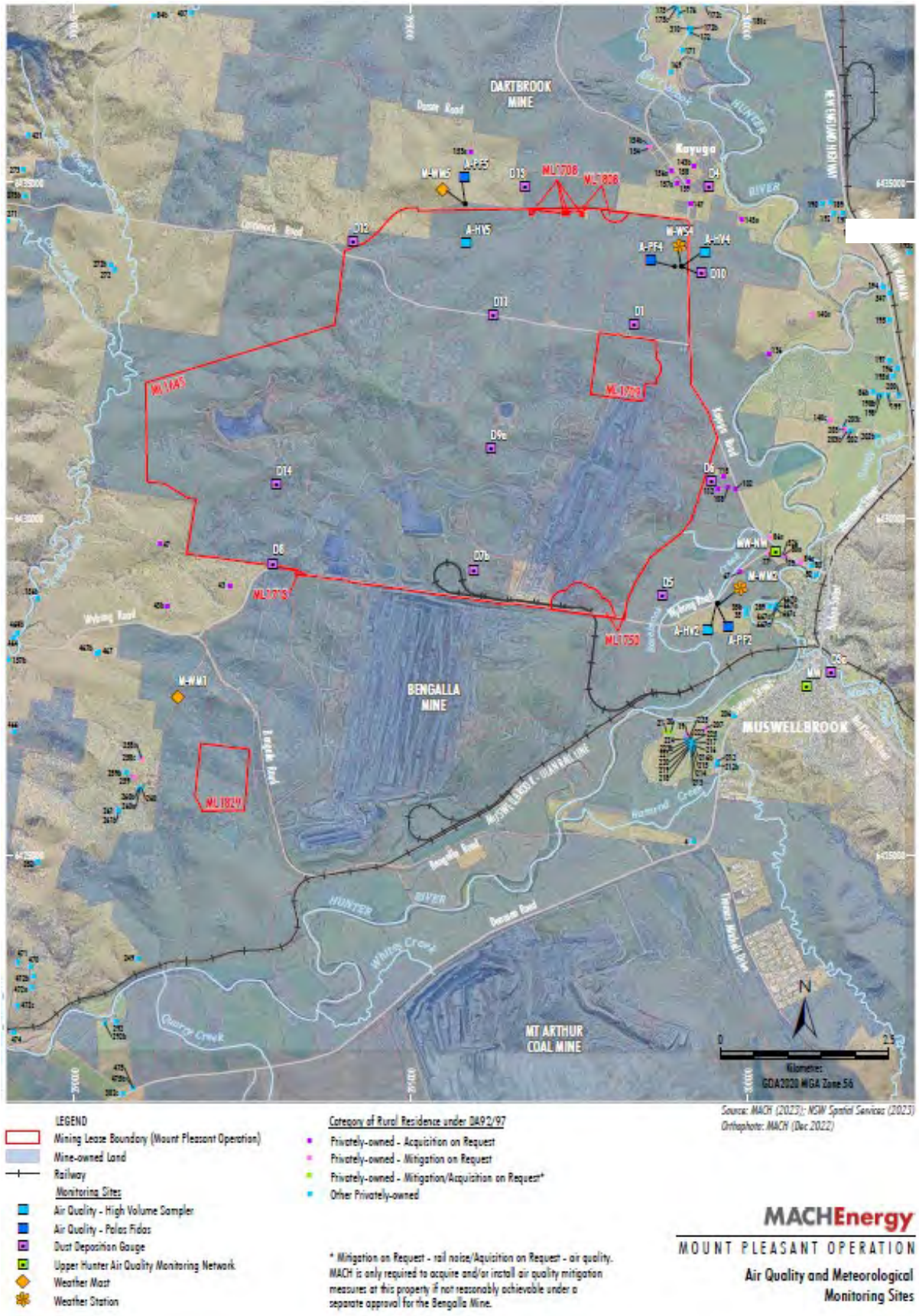

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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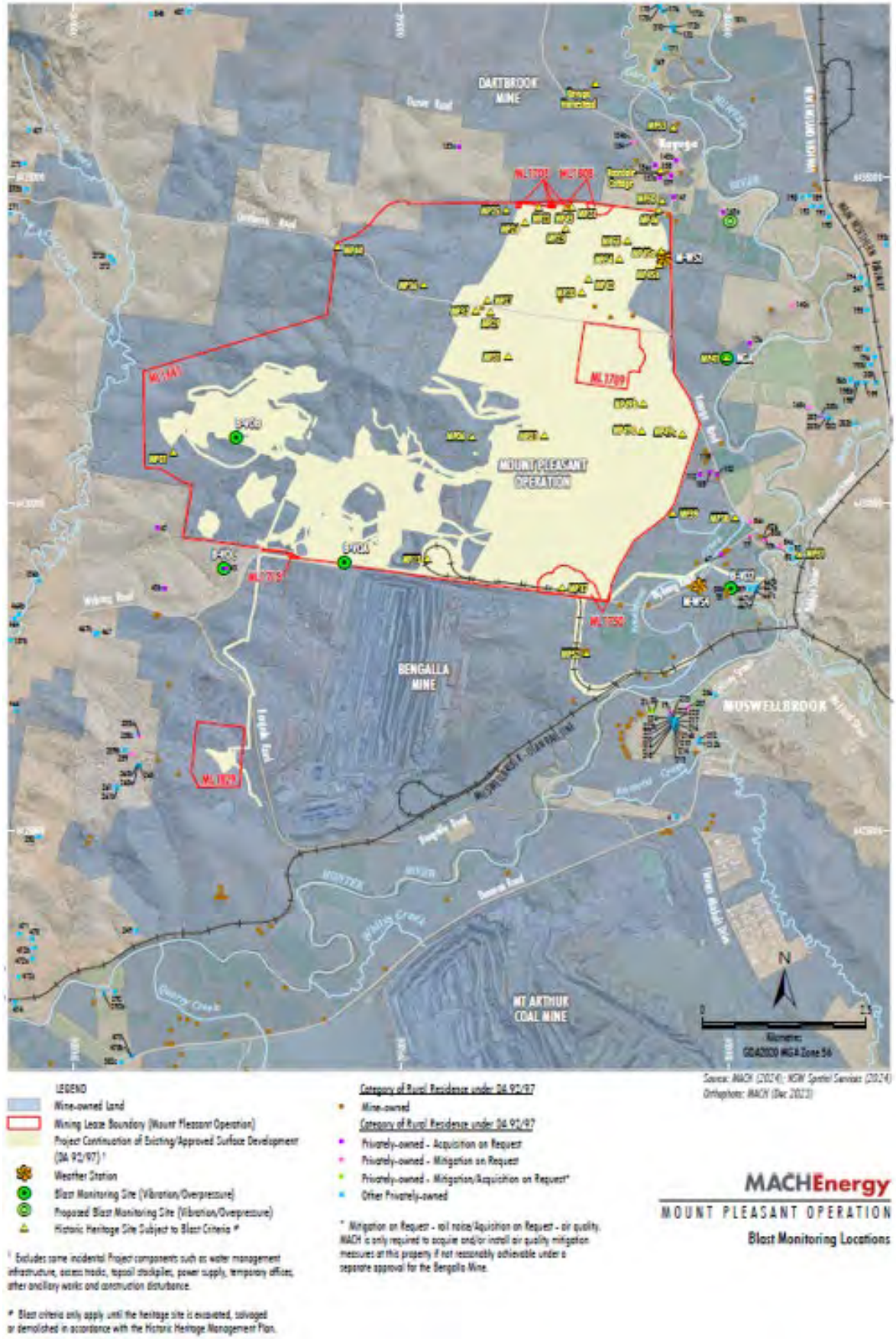

Figure 2-3 – MPO Blast Monitoring Locations

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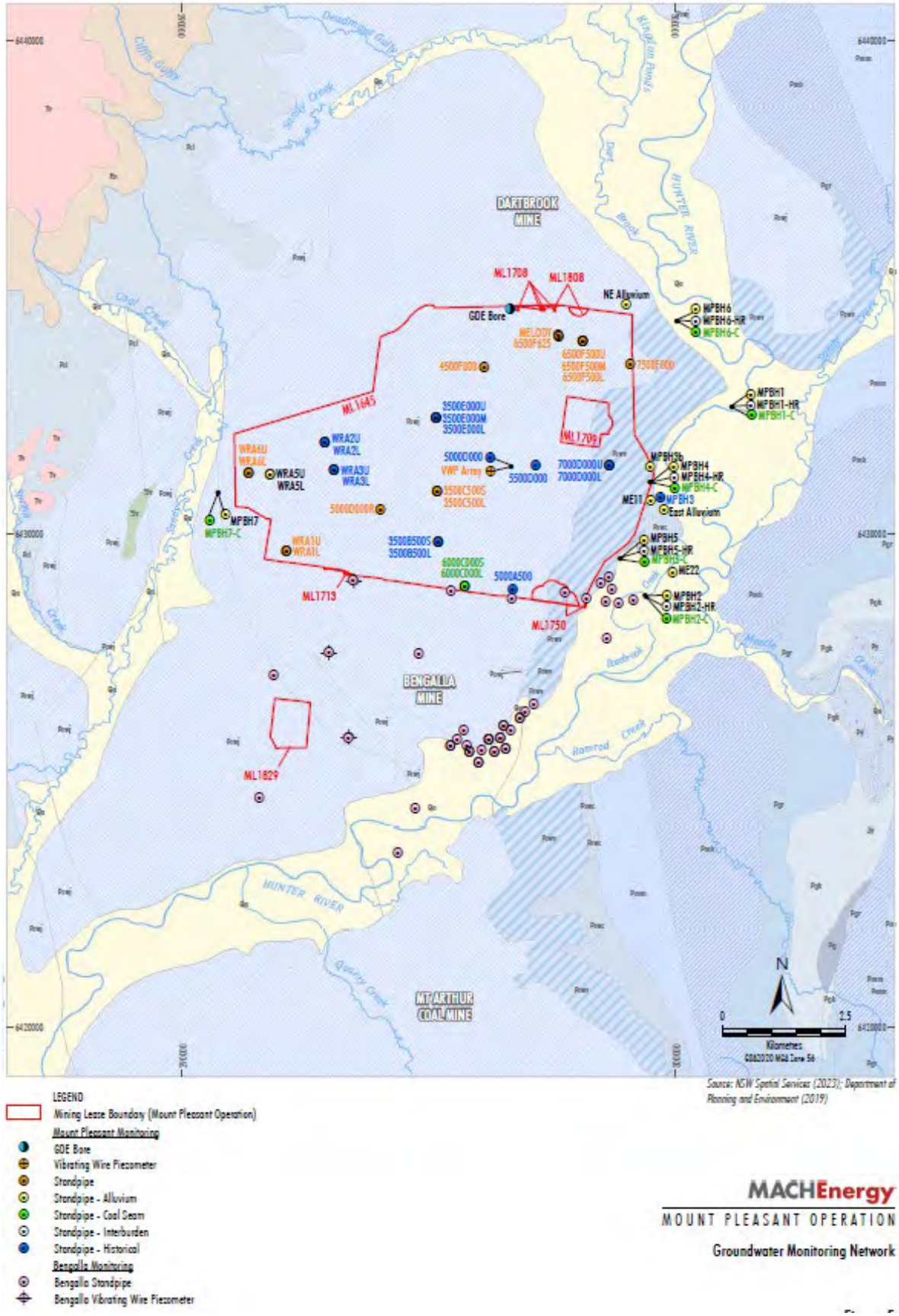

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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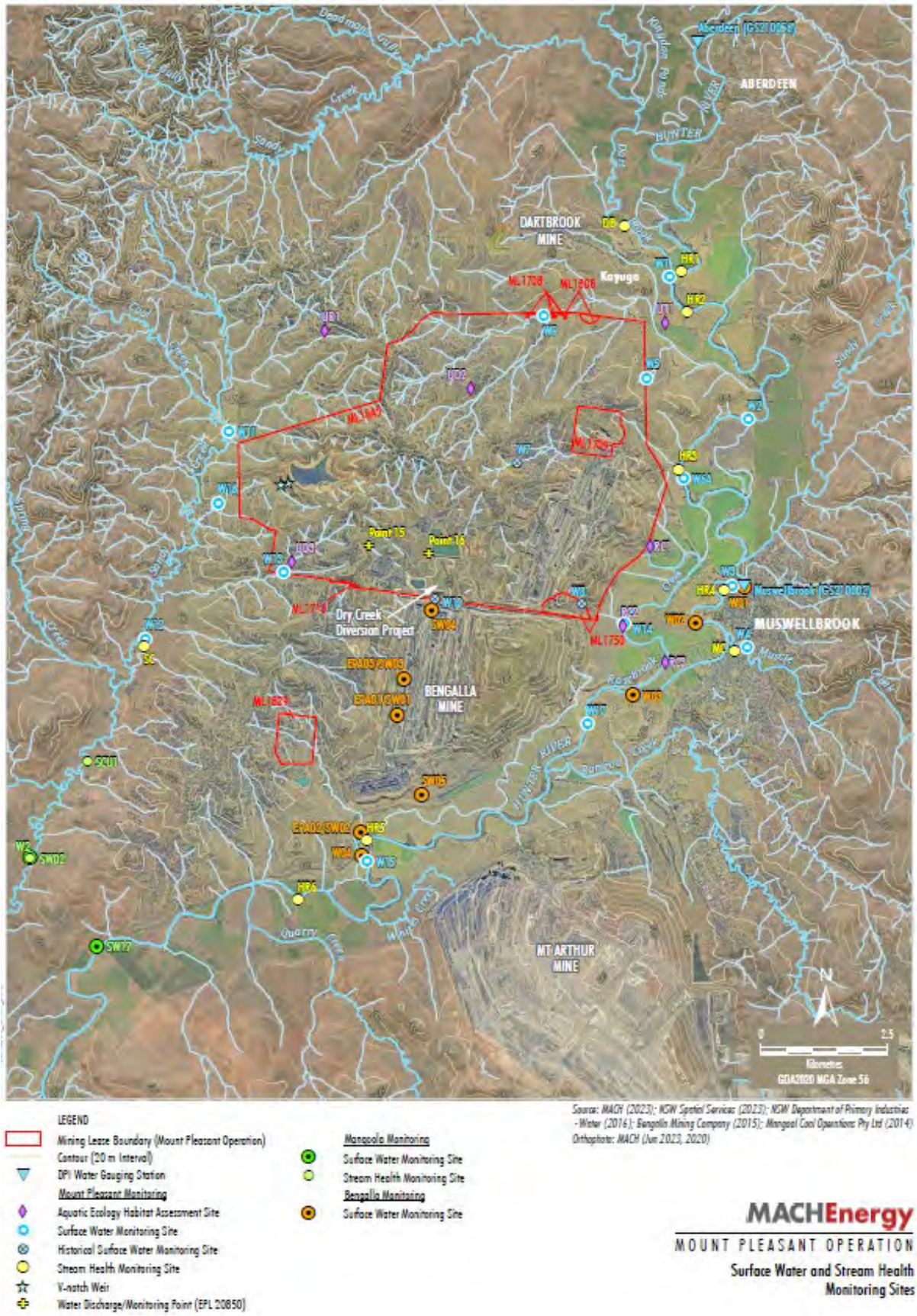

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 (>90.3%) during September 2024 (the monitoring period) except for PM_{10} and $PM_{2.5}$ (69.4%). An additional monitor (E-BAM) is located at M-WS2 to provide additional capture for air quality until the issue is resolved. Additional meteorological data was collected at M-WS4 (92.4%).

Throughout September 2024, there was 38.4mm and 42.2mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

4.2 Results

The dust deposition exposure period for gauges commenced on 28 August 2024. Sample collection was undertaken on 26 September 2024 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for August 2024 have been provided as an indication of performance between September 2023 – September 2024 and does not represent annual average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – September 2024

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	2.1	1.9
D3	1.1	1.3
D4	1.0	1.1
D5a	2.1	2.2
D6	1.7	2.0
D7b	9.7	**9.6**
D8	4.4	**4.2**
D9a	3.6	3.6
D10	0.9	1.1
D11	3.4	3.6
D12	0.8	0.9
D13	1.2	1.2
D14	2.5	2.9
Criterion	-	**4**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14.

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Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

Field notes from the September sampling event noted that the majority of gauges contained insects and sediment. It was also noted that no sample was retrieved from D11 due to a damaged dust gauge. All September 2024 insoluble solid results were included in the annual rolling average calculations. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (9.6 g/m2) and D8 (4.2 g/m2).

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

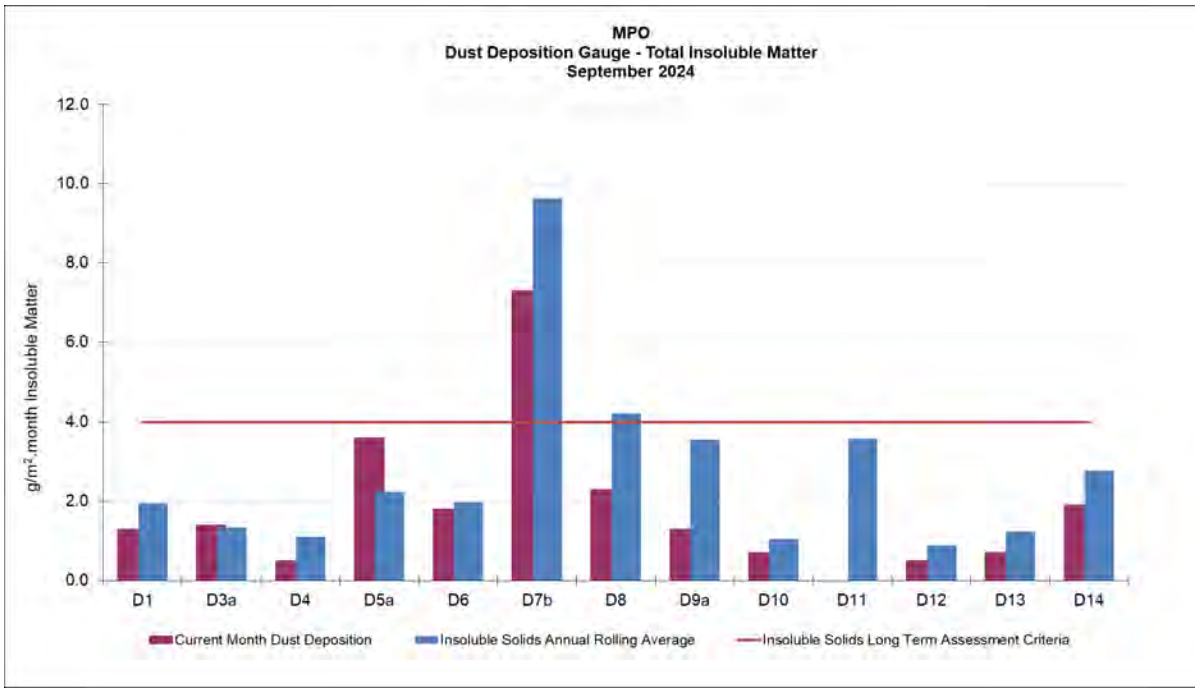

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – September 2024

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

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Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Annual rolling averages for September 2024 have been provided as an indication of performance between September 2023 – September 2024 and do not represent annual average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – September 2024

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
2/09/2024	-	116	26.6	35.3
9/09/2024	-	73.1	26.0	35.1
14/09/2024	-	37.2	15.8	14.5
20/09/2024	-	79.2	19.4	25.2
26/09/2024	-	51.2	40.6	36.0
*Monthly Mean	-	71.3	25.7	29.2
Annual Rolling Average	*90*	50	48	33

Notes:
*Results in **bold** indicate an elevated reading*

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

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6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during September 2024.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages for September 2024 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in September 2024. Real time PM_{10} 24 hour daily average results for September 2024 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – September 2024

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
1/09/2024	-	12	11	35.7	50
2/09/2024	-	14	13	-	50
3/09/2024	-	17	23	8.4	50
4/09/2024	-	19	18	13.6	50
5/09/2024	-	17	15	22.5	50
6/09/2024	-	17	15	23.4	50
7/09/2024	28	16	17	33.8	50
8/09/2024	22	14	14	19.3	50
9/09/2024	15	9	-	15.8	50
10/09/2024	17	13	-	18.9	50
11/09/2024	28	22	-	27.5	50
12/09/2024	13	10	-	10.6	50
13/09/2024	14	-	-	16.4	50
14/09/2024	17	-	-	21.9	50
15/09/2024	12	-	-	17.9	50
16/09/2024	15	-	-	24.5	50
17/09/2024	15	-		16.5	50
18/09/2024	-	-	-	14.3	50
19/09/2024	-	-	-	21.6	50
20/09/2024	-	-	-	27.7	50
21/09/2024	17	-	8	20.5	50

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22/09/2024	16	-	8	19.9	50
23/09/2024	17	-	9	18.8	50
24/09/2024	23	16	14	23.1	50
25/09/2024	50	29	22	39.9	50
26/09/2024	21	17	20	16.4	50
27/09/2024	11	8	10	10.2	50
28/09/2024	11	8	10	10.1	50
29/09/2024	13	9	11	11.5	50
30/09/2024	16	-	11	12.4	50

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites September 2024.

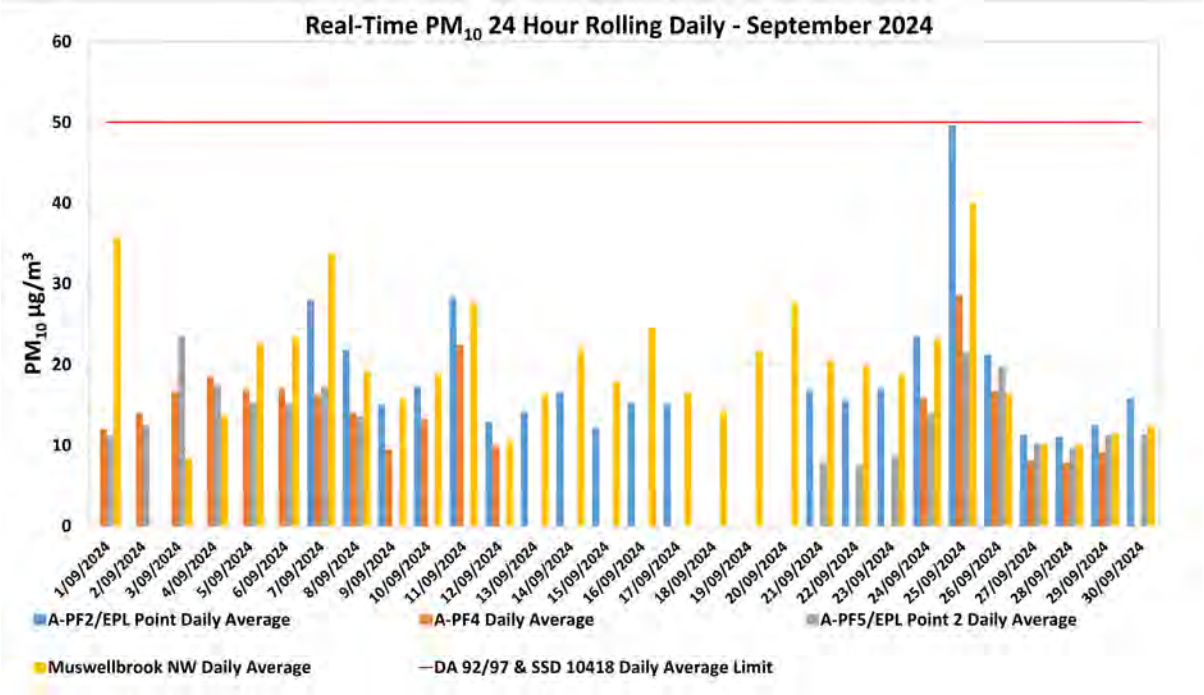

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for September 2024.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during September 2024. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

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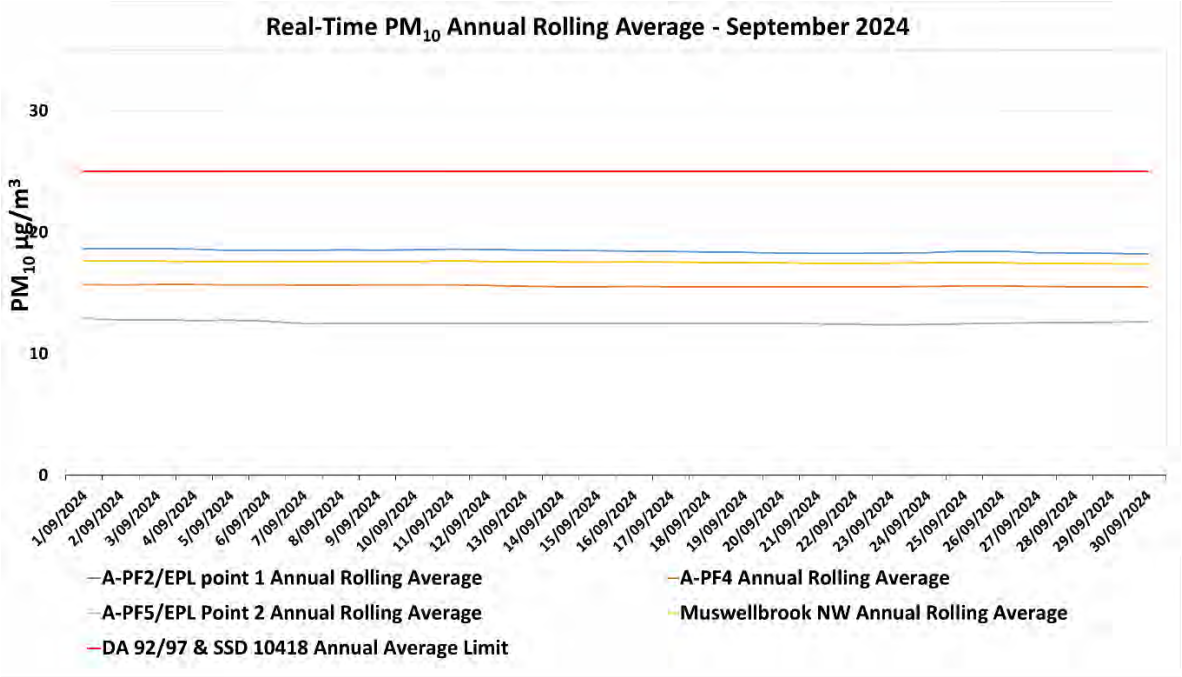

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for September 2024.

6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during September 2024. Real time $PM_{2.5}$ 24 hour rolling average results for September 2024 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – September 2024

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
1/09/2024	-	4	4	25
2/09/2024	-	4	4	25
3/09/2024	-	5	6	25
4/09/2024	-	6	6	25
5/09/2024	-	6	6	25
6/09/2024	-	7	6	25
7/09/2024	9	6	6	25
8/09/2024	7	6	6	25
9/09/2024	4	3	-	25
10/09/2024	5	5	-	25
11/09/2024	10	8	-	25
12/09/2024	6	5	-	25
13/09/2024	5	-	-	25
14/09/2024	6	-	-	25
15/09/2024	4	-	-	25
16/09/2024	4	-	-	25

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17/09/2024	5	-	-	25
18/09/2024	-	-	-	25
19/09/2024	-	-	-	25
20/09/2024	-	-	-	25
21/09/2024	4	-	3	25
22/09/2024	4	-	3	25
23/09/2024	4	-	3	25
24/09/2024	6	4	4	25
25/09/2024	15	10	9	25
26/09/2024	9	8	8	25
27/09/2024	4	4	4	25
28/09/2024	5	4	4	25
29/09/2024	5	4	5	25
30/09/2024	6	-	5	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

Real time $PM_{2.5}$ 24-hour average results for September 2024 are presented in **Figure 6-3** below.

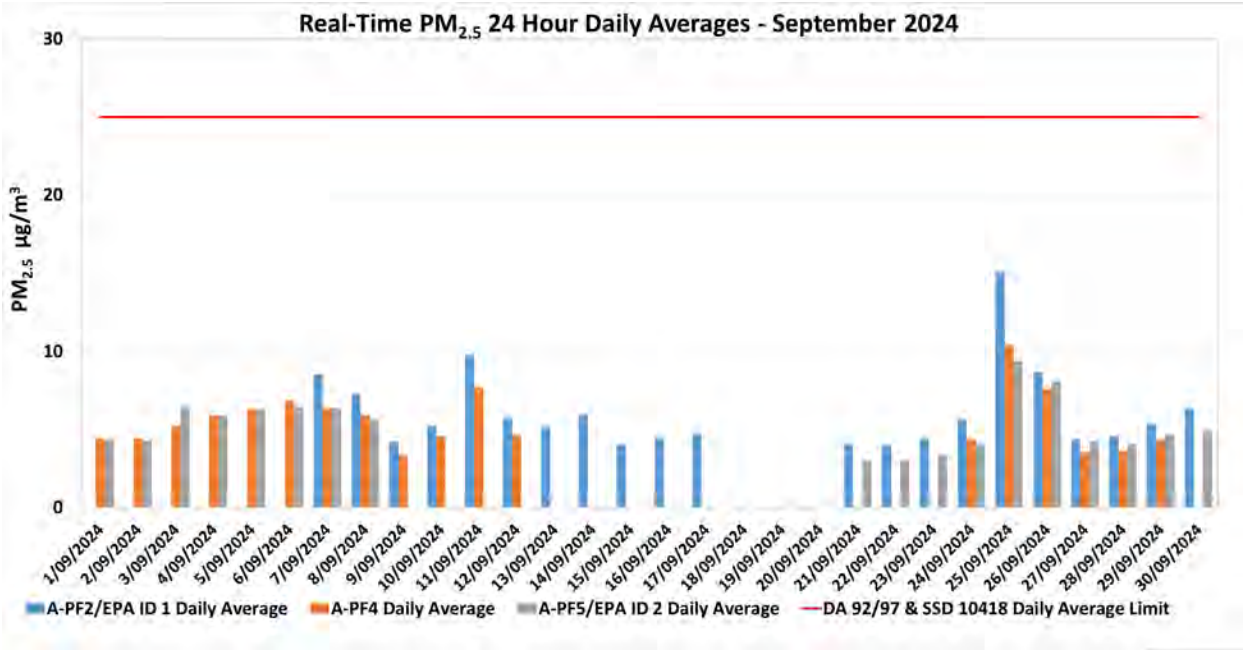

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for September 2024.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during September 2024. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

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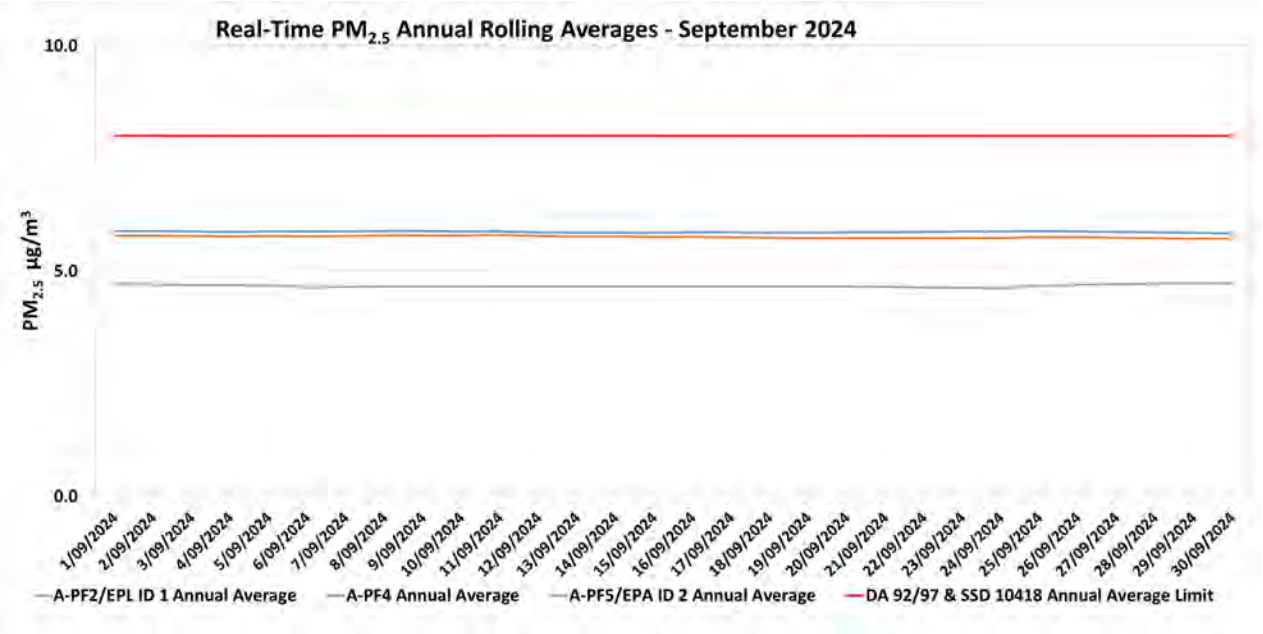

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for September 2024.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2024) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 27 September 2024. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 27 September 2024

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.2	**700**	400	8.8
W2	**	**	**	**
W3	8.2	880	510	15
W4	7.7	2000	1200	**21**
W5	*	*	*	*
W6A	8.3	**830**	460	**27**
W9	7.1	310	250	66
W11	**8.3**	3600	1900	<5
W12	8.0	4950	2700	5.5
W13	**8.4**	**4750**	2700	11
W14	*	*	*	*
W15	**8.2**	**910**	510	14
W16	**8.3**	**8300**	4800	12
W17	8.1	**920**	510	12

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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During the 27 September 2024 monitoring event, two (2) sites were dry and one (1) site was unable to be accessed due to track conditions. Sites W11, W13, W15 and W16 were above the respective pH trigger levels. Sites W1, W6A, W13, W15, W16 and W17 were above the respective EC trigger levels. Sites W4 and W6A were above the respective TSS triggers levels.

Sites W13 and W16 have been above respective pH trigger levels for three consecutive monitoring events (July, August, and September 2024). Sites W6A, W13 and W16 have been above the respective EC trigger levels for the three consecutive monitoring events (July, August, and September).

In accordance with the MPO Water Management Plan (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required. Site W6A was exceeding the respective EC level (496 µS/cm) for three consecutive monitoring events (July, August, and September). Site W16 was exceeding the respective EC site specific trigger levels for upstream monitoring location W11 (7,050 µS/cm) for three consecutive monitoring events (July, August, and September).

An investigation relating to recent environmental conditions (ACT Williams, January 2024) concluded that prevailing climatic factors, combined with increased contributions of naturally high EC (Electrical Conductivity) water from tributary inflows, have influenced water quality at several monitoring locations including W6A. Similar impacts were observed at W16, the upstream monitoring location W11, and W13 which remains unaffected by mining activities. Additionally, the Fines Emplacement Area (FEA) Water Quality Assessment (AECOM, 2021) identified naturally high EC levels in a spring expressing as artesian flow downstream, further contributing to the observed changes in water quality.

8. Groundwater Monitoring

Groundwater monitoring did not occur during this reporting period. The next quarterly monitoring event is scheduled for November 2024.

9. Noise Monitoring

Attended noise monitoring was undertaken during the night period of 24/25 September 2024 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2021) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in September 2024 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 24/25 September 2024

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	25/09/2024 01:34	IA	45	1.0	Yes	E	No

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N-AT2	24/09/2024 22:57	IA	45	3.0	Yes	E	No
N-AT3	24/09/2024 23:31	IA	45	2.9	Yes	D	No
N-AT4	24/09/2024 23:57	IA	45	1.1	Yes	F	No
N-AT5	25/09/2024 00:18	36	45	1.0	Yes	F	No
N-AT6	25/09/2024 01:10	IA	45	0.7	Yes	F	No
N-AT7	24/09/2024 22:17	IA	45	3.0	Yes	D	No
N-AT8	25/09/2024 00:44	46	45	0.7	Yes	F	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 24/25 September 2024

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	25/09/2024 01:34	IA	37	1.0	Yes	E	No
N-AT2	24/09/2024 22:57	IA	35	3.0	Yes	E	No
N-AT3	24/09/2024 23:31	IA	40	2.9	Yes	D	No
N-AT4	24/09/2024 23:57	IA	38	1.1	Yes	F	No
N-AT5	25/09/2024 00:18	30	37	1.0	Yes	F	No
N-AT6	25/09/2024 01:10	IA	35	0.7	Yes	F	No
N-AT7	24/09/2024 22:17	IA	37	3.0	Yes	D	No
N-AT8	25/09/2024 00:44	38	NA[5]	0.7	Yes	F	NA[5]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 24/25 September 2024

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB

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N-AT1	25/09/2024 01:34	IA	40	No
N-AT2	24/09/2024 22:57	IA	40	No
N-AT3	24/09/2024 23:31	IA	40	No
N-AT4	24/09/2024 23:57	IA	40	No
N-AT5	25/09/2024 00:18	30	40	No
N-AT6	25/09/2024 01:10	IA	40	No
N-AT7	24/09/2024 22:17	IA	40	No
N-AT8	25/09/2024 00:44	38	NA[4]	NA[4]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

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10. Blast Monitoring

The MPO Blast Management Plan (SSD 10418) is undergoing additional consultation with Council and will be finalised early 2025. There were nine (9) blast events during September (a total of 67 blasts YTD). Results for September 2024 are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – September 2024

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
Tuesday 03/09/2024	13:06	0.140	96.3	0.200	94	N
Friday 06/09/2024	9:19	0.500	106	0.610	103.1	Y
Monday 09/09/2024	15:00	0.230	97.4	0.500	102.7	N
Thursday 12/09/2024	10:00	0.640	100	0.800	103.9	N
Friday 13/09/2024	11:40	0.190	95.6	0.250	108.2	N
Wednesday 18/09/2024	15:00	0.420	99.4	0.730	106	N
Friday 20/09/2024	11:00	0.360	103.3	0.280	104.6	Y
Tuesday 24/09/2024	13:00	0.270	88.6	0.480	95.5	N
Thursday 26/09/2024	15:29	0.110	89.2	0.310	96.9	N

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

October 2024

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 October 2024
Reporting Period End Date	31 October 2024
Date All Data Received	08 November 2024

Links to three key regulatory documents are provided here:

- MACH Energy Environment Protection Licence EPL 20850; and
- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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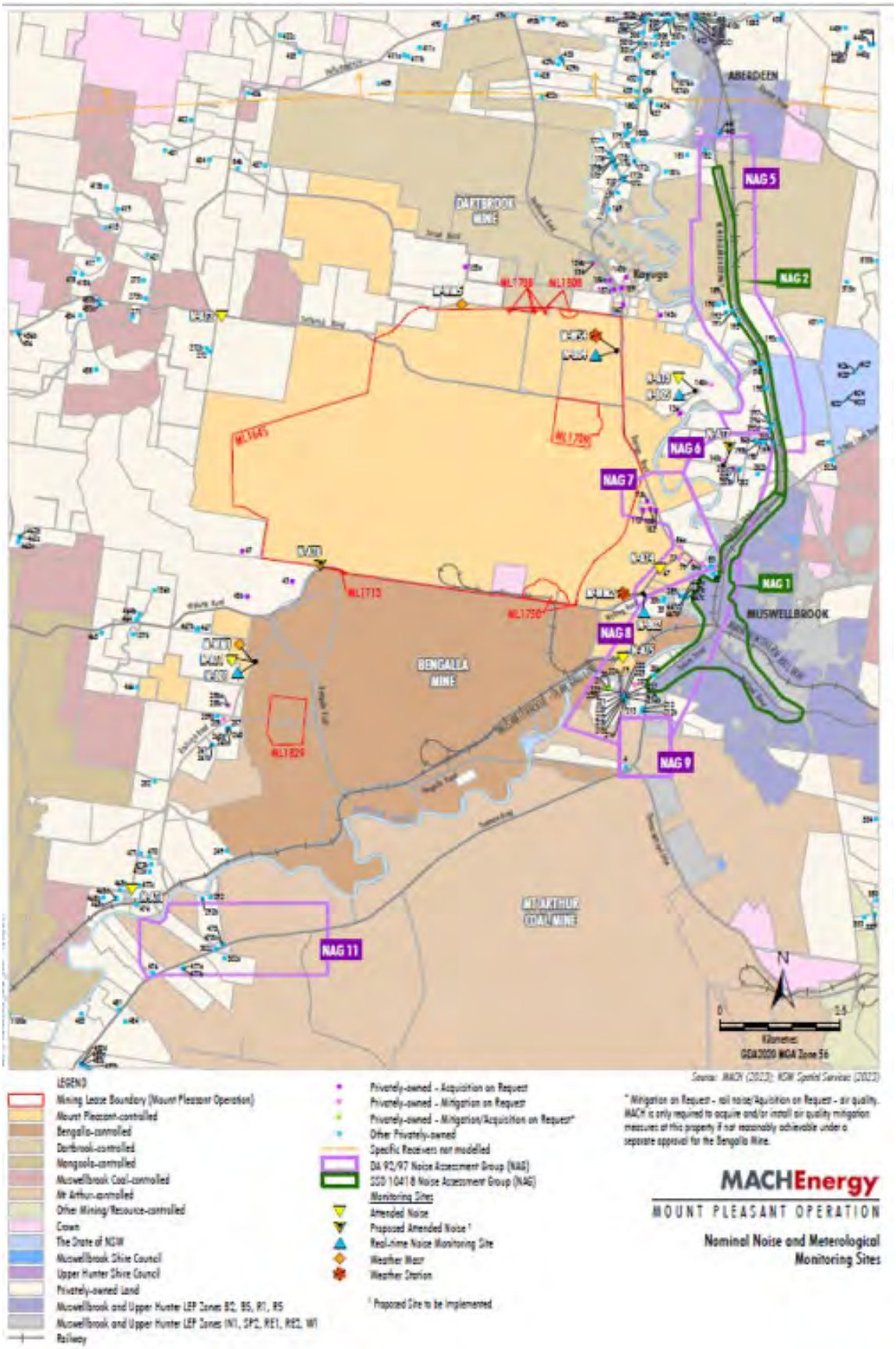

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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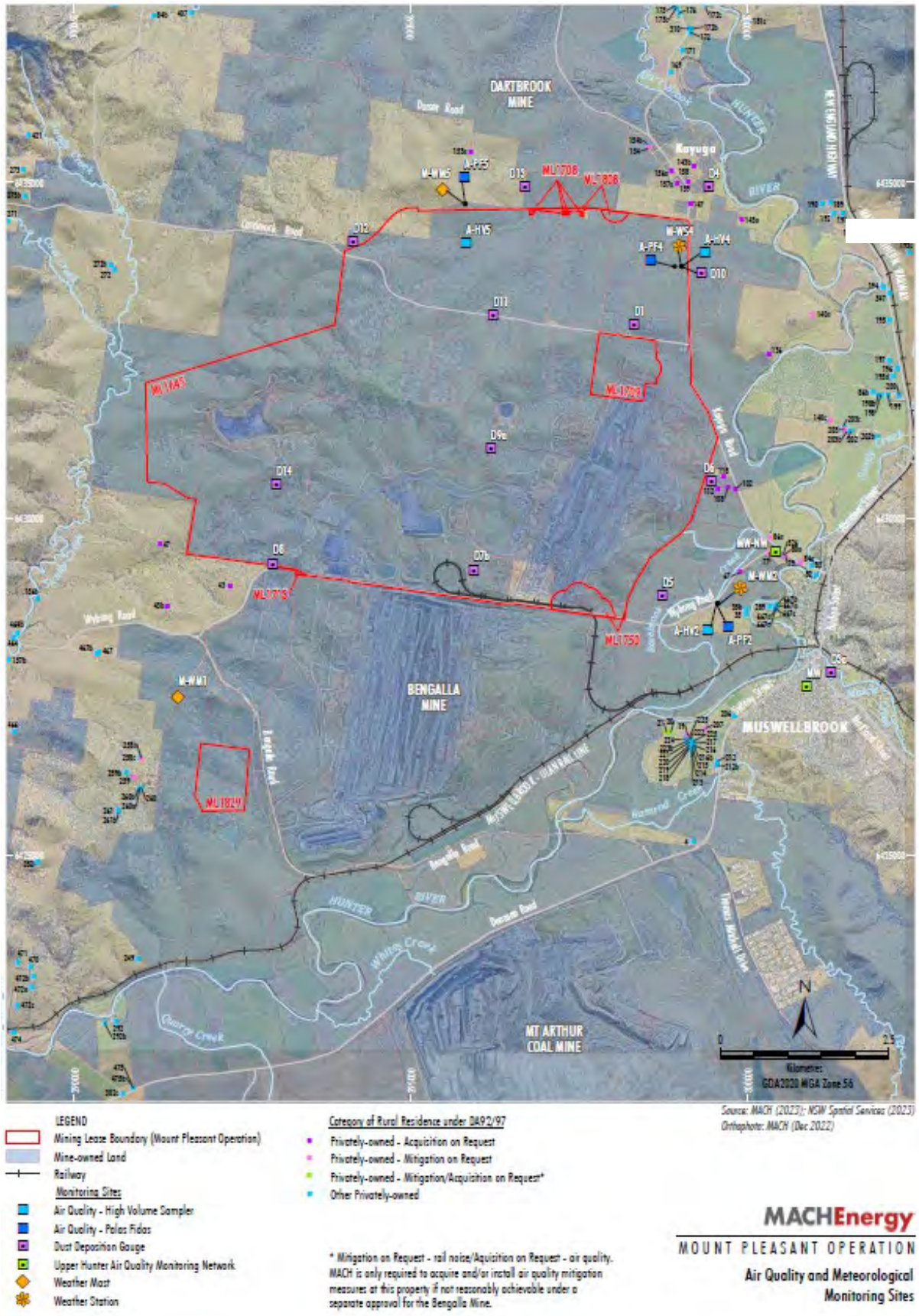

LEGEND

Mining Lease Boundary (Mount Pleasant Operation)

Mine-owned Land

Railway

Monitoring Sites

Air Quality - High Volume Sampler

Air Quality - Palas Fidas

Dust Deposition Gauge

Upper Hunter Air Quality Monitoring Network

Weather Mast

Weather Station

Category of Rural Residence under DA92/97

Privately-owned - Acquisition on Request

Privately-owned - Mitigation on Request

Privately-owned - Mitigation/Acquisition on Request*

Other Privately-owned

* Mitigation on Request - rail noise/Aquisition on Request - air quality. MACH is only required to acquire and/or install air quality mitigation measures at this property if not reasonably achievable under a separate approval for the Bengalla Mine.

Source: MACH (2023); NSW Spatial Services (2023)
Orthophoto: MACH (Dec 2022)

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MOUNT PLEASANT OPERATION

Air Quality and Meteorological Monitoring Sites

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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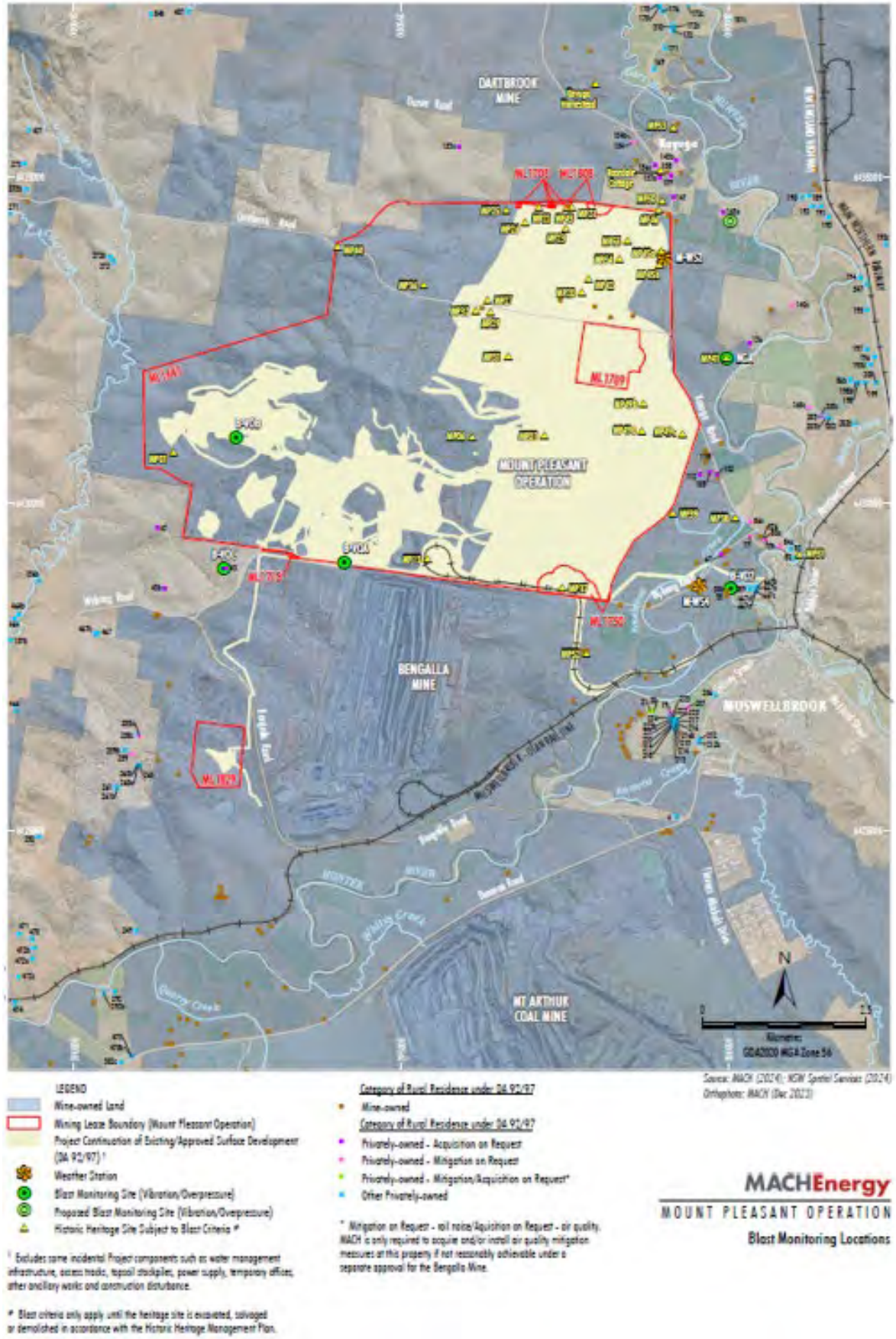

Figure 2-3 – MPO Blast Monitoring Locations

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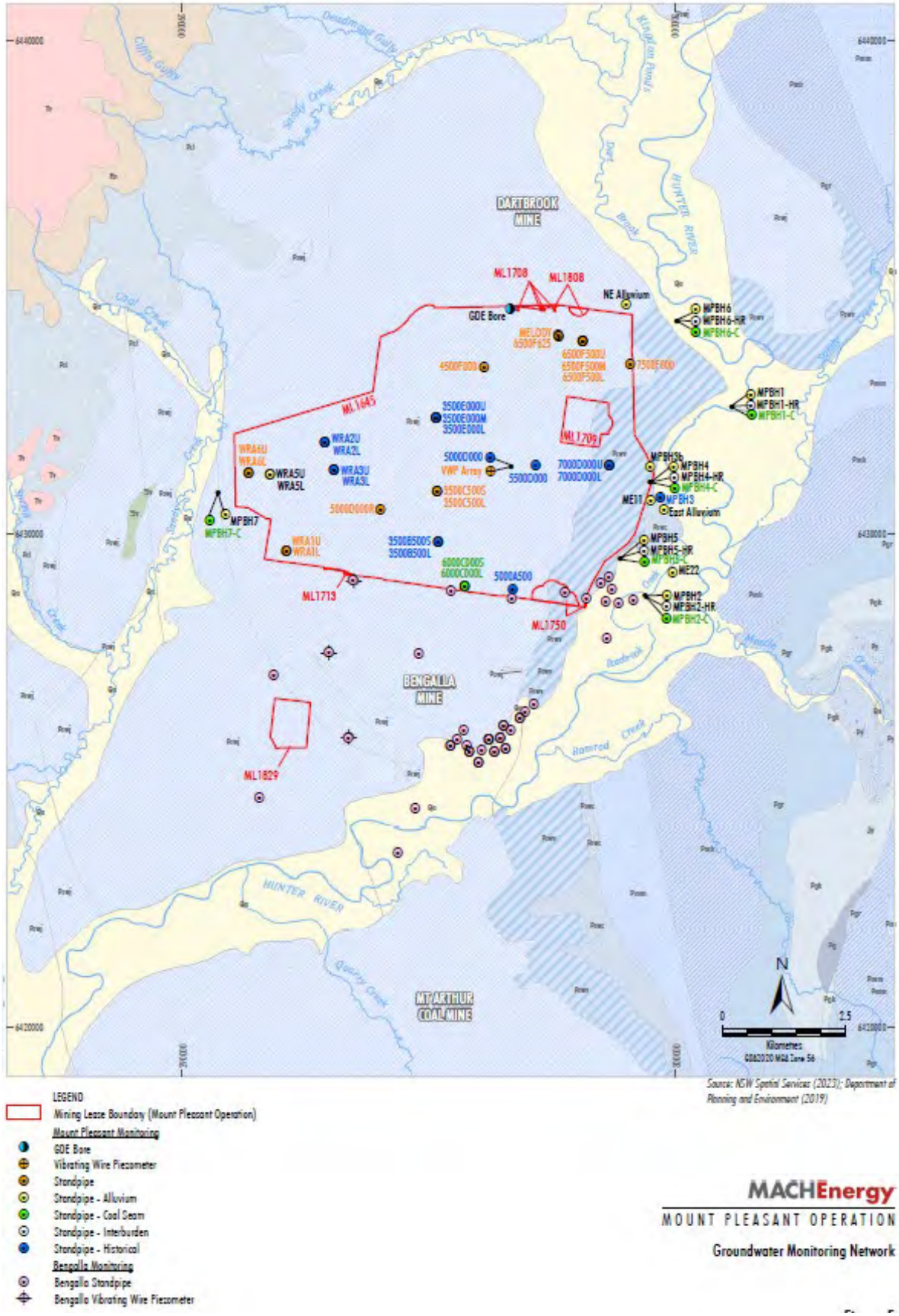

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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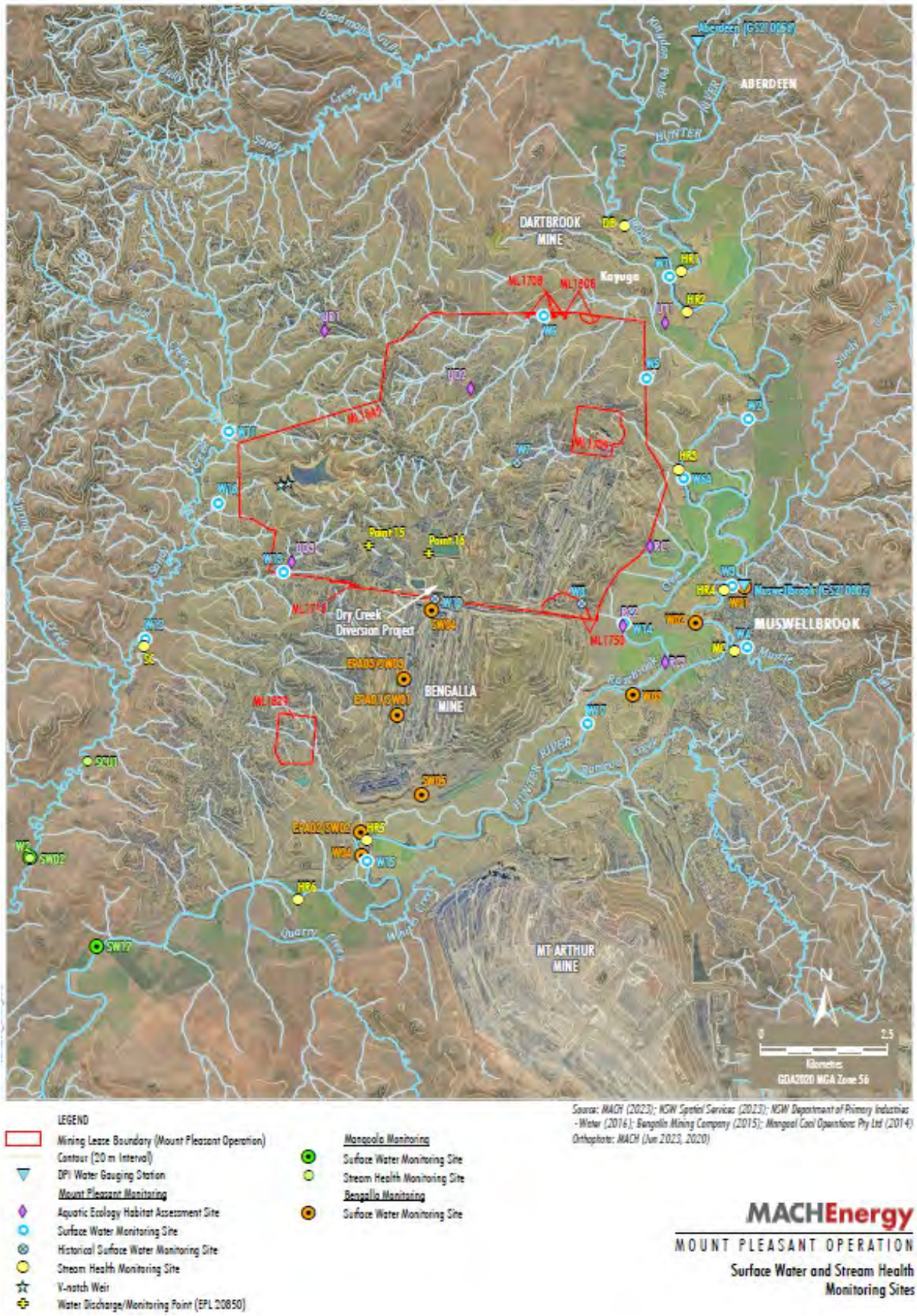

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 (>96.5%) during October 2024 (the monitoring period). An additional monitor (E-BAM) is located at M-WS2 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4 (45.3%).

Throughout October 2024, there was 32.6mm and 37.0mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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until surrender where it will be discontinued.

4.2 Results

The dust deposition exposure period for gauges commenced on 26 and 27 September 2024. Sample collection was undertaken on 28 October 2024 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for October 2024 have been provided as an indication of performance between October 2023 – October 2024 and does not represent annual average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – October 2024

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	2.0	1.9
D3	1.1	1.2
D4	1.0	1.1
D5a	2.0	2.1
D6	1.6	1.7
D7b	9.1	**9.4**
D8	4.3	**4.1**
D9a	3.4	3.5
D10	0.9	1.0
D11	3.2	3.5
D12	0.8	0.9
D13	1.2	1.3
D14	2.5	2.7
Criterion	-	**4**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to

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be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

Field notes from the October sampling event noted that the majority of gauges contained insects and sediment. All October 2024 insoluble solid results were included in the annual rolling average calculations. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (9.4 g/m2) and D8 (4.1 g/m2).

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

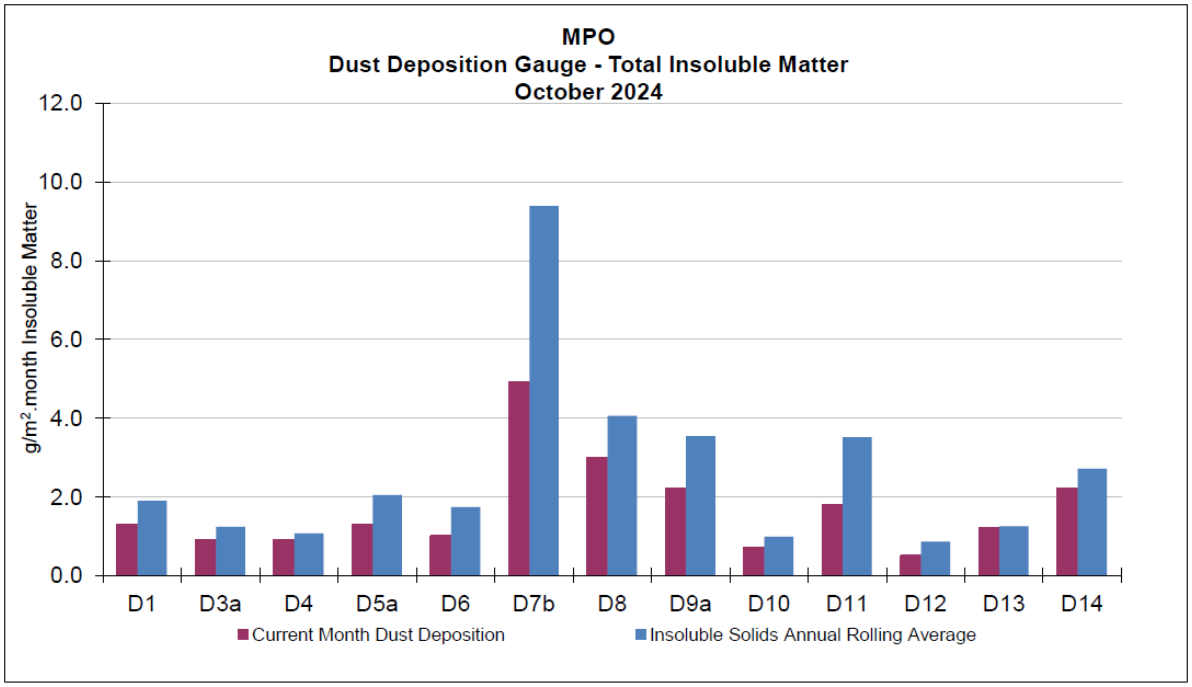

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – October 2024

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

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Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Annual rolling averages for October 2024 have been provided as an indication of performance between October 2023 – October 2024 and do not represent annual average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – October 2024

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
2/10/2024	-	128.0	55.2	21.8
8/10/2024	-	51.2	59.4	41.1
14/10/2024	-	53.9	30.8	27.9
20/10/2024	-	31.1	53.1	35.5
26/10/2024	-	57.3	71.7	53.2
*Monthly Mean	-	64.3	54.0	35.9
Annual Rolling Average	*90*	49	47	32

Notes:
*Results in **bold** indicate an elevated reading*

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

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6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during October 2024.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages for October 2024 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in October 2024. Real time PM_{10} 24 hour daily average results for October 2024 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – October 2024

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
1/10/2024	-	15	21	16.6	50
2/10/2024	17	11	16	17.3	50
3/10/2024	17	11	17	13.8	50
4/10/2024	19	13	15	17.1	50
5/10/2024	18	9	9	16.4	50
6/10/2024	15	9	9	17.9	50
7/10/2024	23	11	10	23.2	50
8/10/2024	20	15	17	22.9	50
9/10/2024	9	7	10	8.5	50
10/10/2024	13	11	10	12.8	50
11/10/2024	20	14	13	23.7	50
12/10/2024	21	18	20	23.2	50
13/10/2024	14	12	17	14.8	50
14/10/2024	14	13	15	14.7	50
15/10/2024	15	15	16	14.2	50
16/10/2024	14	13	17	14.9	50
17/10/2024	16	19	30	16.0	50
18/10/2024	18	16	22	18.2	50
19/10/2024	14	8	10	13.7	50
20/10/2024	16	15	18	15.3	50
21/10/2024	14	13	16	15.4	50

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22/10/2024	20	-	20	22.8	50
23/10/2024	19	-	11	22.4	50
24/10/2024	21	-	19	23.3	50
25/10/2024	17	-	19	18.3	50
26/10/2024	17	-	20	20.8	50
27/10/2024	22	-	18	25.6	50
28/10/2024	24	-	14	27.7	50
29/10/2024	24	-	28	27.6	50
30/10/2024	23	-	18	26.3	50
31/10/2024	23	-	23	24.5	50

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites October 2024.

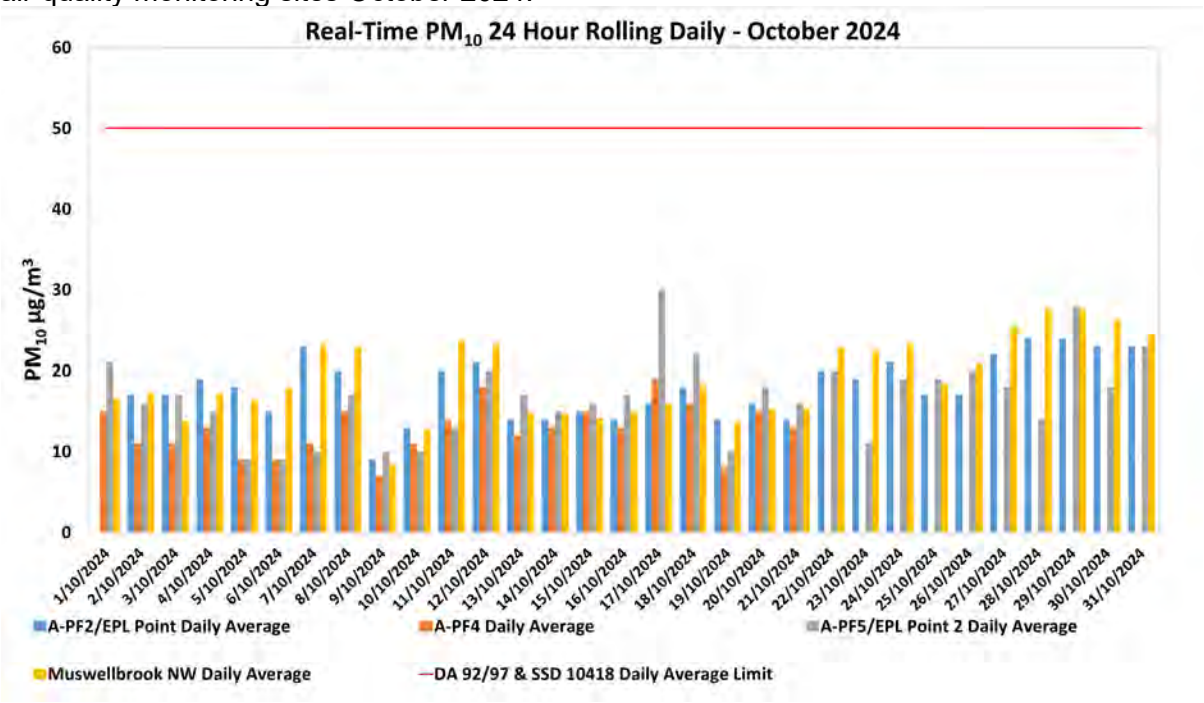

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for October 2024.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during October 2024. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

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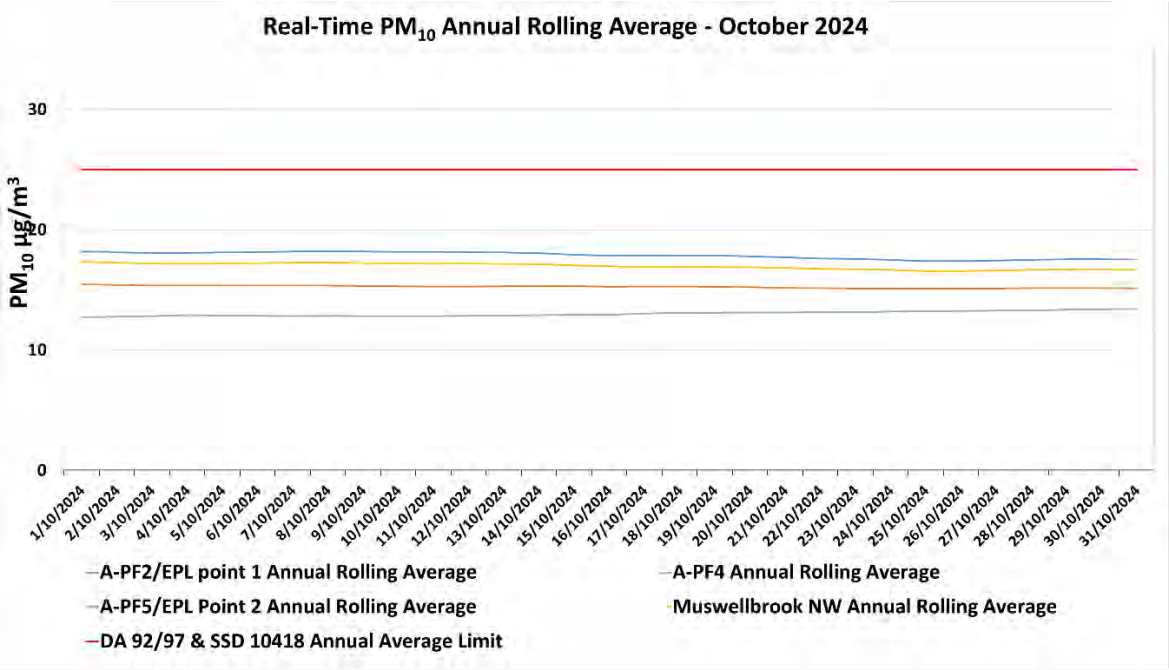

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for October 2024.

6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during October 2024. Real time $PM_{2.5}$ 24 hour rolling average results for October 2024 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – October 2024

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
1/10/2024	-	7	7	25
2/10/2024	7	5	6	25
3/10/2024	6	5	6	25
4/10/2024	6	5	5	25
5/10/2024	6	4	4	25
6/10/2024	4	3	3	25
7/10/2024	6	5	4	25
8/10/2024	8	7	7	25
9/10/2024	4	3	5	25
10/10/2024	5	5	5	25
11/10/2024	6	6	5	25
12/10/2024	7	8	7	25
13/10/2024	5	5	6	25
14/10/2024	5	5	5	25
15/10/2024	6	7	7	25
16/10/2024	5	5	7	25

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17/10/2024	7	8	9	25
18/10/2024	7	6	6	25
19/10/2024	5	4	4	25
20/10/2024	7	7	8	25
21/10/2024	5	5	5	25
22/10/2024	6	6	6	25
23/10/2024	6	-	4	25
24/10/2024	7	-	6	25
25/10/2024	5	-	5	25
26/10/2024	5	-	6	25
27/10/2024	6	-	5	25
28/10/2024	6	-	5	25
29/10/2024	8	-	8	25
30/10/2024	7	-	7	25
31/10/2024	6	-	5	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

Real time $PM_{2.5}$ 24-hour average results for October 2024 are presented in **Figure 6-3** below.

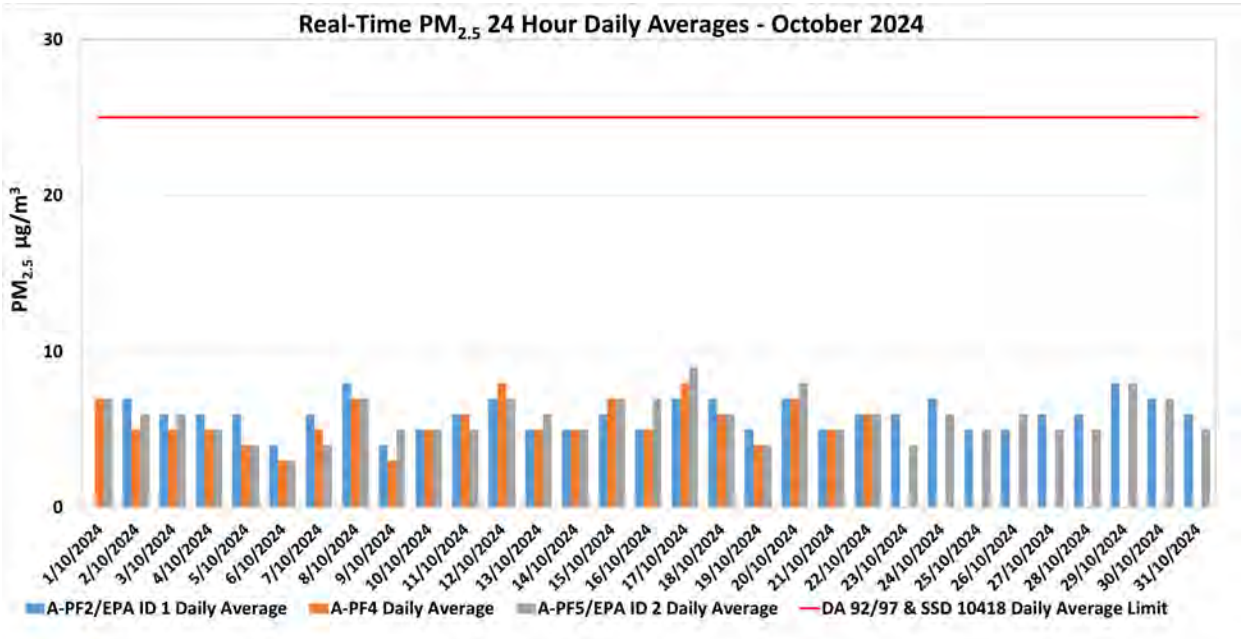

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for October 2024.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during October 2024. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

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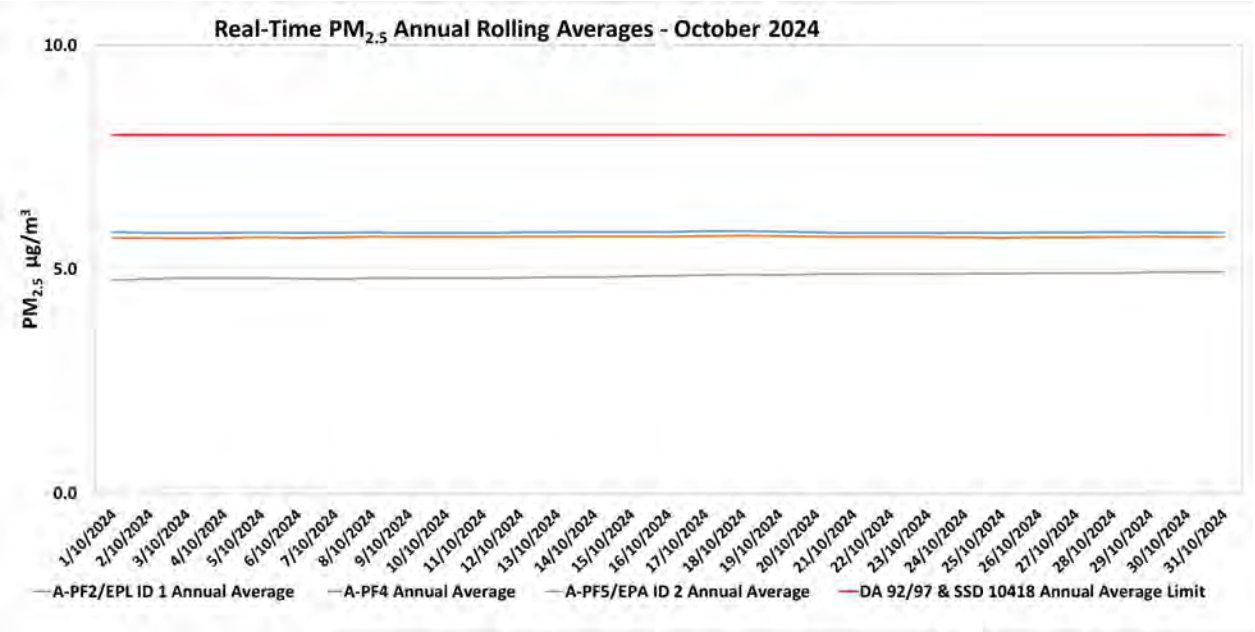

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for October 2024.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2024) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 18 October 2024. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 18 October 2024

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.2	**660**	363	5
W2	**	**	**	**
W3	8.1	780	414	13
W4	7.6	1600	907	**15**
W5	*	*	*	*
W6A	8.2	**770**	396	**42**
W9	*	*	*	*
W11	**	**	**	**
W12	7.7	4850	2470	<5
W13	**	**	**	**
W14	*	*	*	*
W15	**	**	**	**
W16	**	**	**	**
W17	8.1	**817**	430	16

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

During the 18 October 2024 monitoring event, three (3) sites were dry and five (5) site was unable to be accessed due to track conditions. Sites W1, W6A and W17 were above the respective EC trigger levels. Two (2) sites were above respective trigger levels for TSS. All sampled sites were below respective pH trigger levels.

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Site W6A was above the respective EC trigger level for three consecutive monitoring events during the last monthly environmental report (September 2024) and continues to be above trigger levels for October 2024. Results also showed site W6A and W4 were above respective TSS levels for three consecutive monitoring events (August, September and October 2024).

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

Site W6A continued to exceed the respective EC trigger level (496 µS/cm) for October 2024; however, according to Table 26 of the WMP no further investigation is required as the upstream site W1 (Hunter River reference site) was also found to be exceeding trigger levels.

Site W6A and W4 exceeded the respective TSS levels (19 mg/L and 11 mg/L). An investigation relating to recent environmental conditions (ACT Williams, January 2024) concluded that prevailing climatic factors, combined with increased contributions of naturally high EC (Electrical Conductivity) water from tributary inflows, have influenced water quality at several monitoring locations including W6A. Site W4 is an upstream reference location and therefore any exceedances of trigger levels are not considered due to project operations.

8. Groundwater Monitoring

Groundwater monitoring did not occur during this reporting period. The next quarterly monitoring event is scheduled for November 2024.

9. Noise Monitoring

Attended noise monitoring was undertaken during the night period of 29/30 October 2024 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2021) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in October 2024 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 29/30 October 2024

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	29/10/2024 22:57	IA	45	1.1	Yes	F	No
N-AT2	30/10/2024 00:01	31	45	4.1	Yes	E	No
N-AT3	29/10/2024 22:48	35	45	5.4	Yes	D	No
N-AT4	29/10/2024 22:07	IA	45	1.3	Yes	F	No
N-AT5	29/10/2024 22:28	IA	45	0.6	Yes	F	No
N-AT6	30/010/2024 00:46	IA	45	1.6	Yes	D	No

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N-AT7	29/10/2024 22:18	IA	45	5.2	Yes	D	No
N-AT8	29/10/2024 23:23	41	45	1.7	Yes	E	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 29/30 October 2024

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	29/10/2024 22:57	IA	37	1.1	Yes	F	No
N-AT2	30/10/2024 00:01	27	35	4.1	Yes	E	No
N-AT3	29/10/2024 22:48	30	40	5.4	Yes	D	No
N-AT4	29/10/2024 22:07	IA	38	1.3	Yes	F	No
N-AT5	29/10/2024 22:28	IA	37	0.6	Yes	F	No
N-AT6	30/010/2024 00:46	IA	35	1.6	Yes	D	No
N-AT7	29/10/2024 22:18	IA	37	5.2	Yes	D	No
N-AT8	29/10/2024 23:23	35	NA[5]	1.7	Yes	E	NA[5]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 29/30 October 2024

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	29/10/2024 22:57	IA	40	No
N-AT2	30/10/2024 00:01	27	40	No
N-AT3	29/10/2024 22:48	30	40	No
N-AT4	29/10/2024 22:07	IA	40	No

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N-AT5	29/10/2024 22:28	IA	40	No
N-AT6	30/010/2024 00:46	IA	40	No
N-AT7	29/10/2024 22:18	IA	40	No
N-AT8	29/10/2024 23:23	35	NA[4]	NA[4]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

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10. Blast Monitoring

The MPO Blast Management Plan (SSD 10418) is undergoing additional consultation with Council and will be finalised early 2025. There were eight (8) blast events during October (a total of 75 blasts YTD). Results for October 2024 are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – October 2024

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
Thursday 03/10/2024	12:02	1.970	102.4	0.730	96.5	N
Friday 04/10/2024	11:07	1.970	102.4	0.730	96.5	N
Thursday 10/10/2024	9:30	0.180	86.5	0.170	94.7	N
Monday 14/10/2024	14:56	0.280	90.4	0.450 m	92.8	N
Thursday 17/10/2024	15:33	0.260	84.5	0.440	96.5	N
Tuesday 22/10/2024	13:07	0.220	92.4	0.220	92.4	N
Thursday 24/10/2024	16:49	0.060	88.9	0.060	88.6	N
Thursday 31/10/2024	13:02	0.340	107	0.200	104.9	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

November 2024

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 November 2024
Reporting Period End Date	30 November 2024
Date All Data Received	7 January 2025

Links to three key regulatory documents are provided here:

- MACH Energy Environment Protection Licence EPL 20850; and
- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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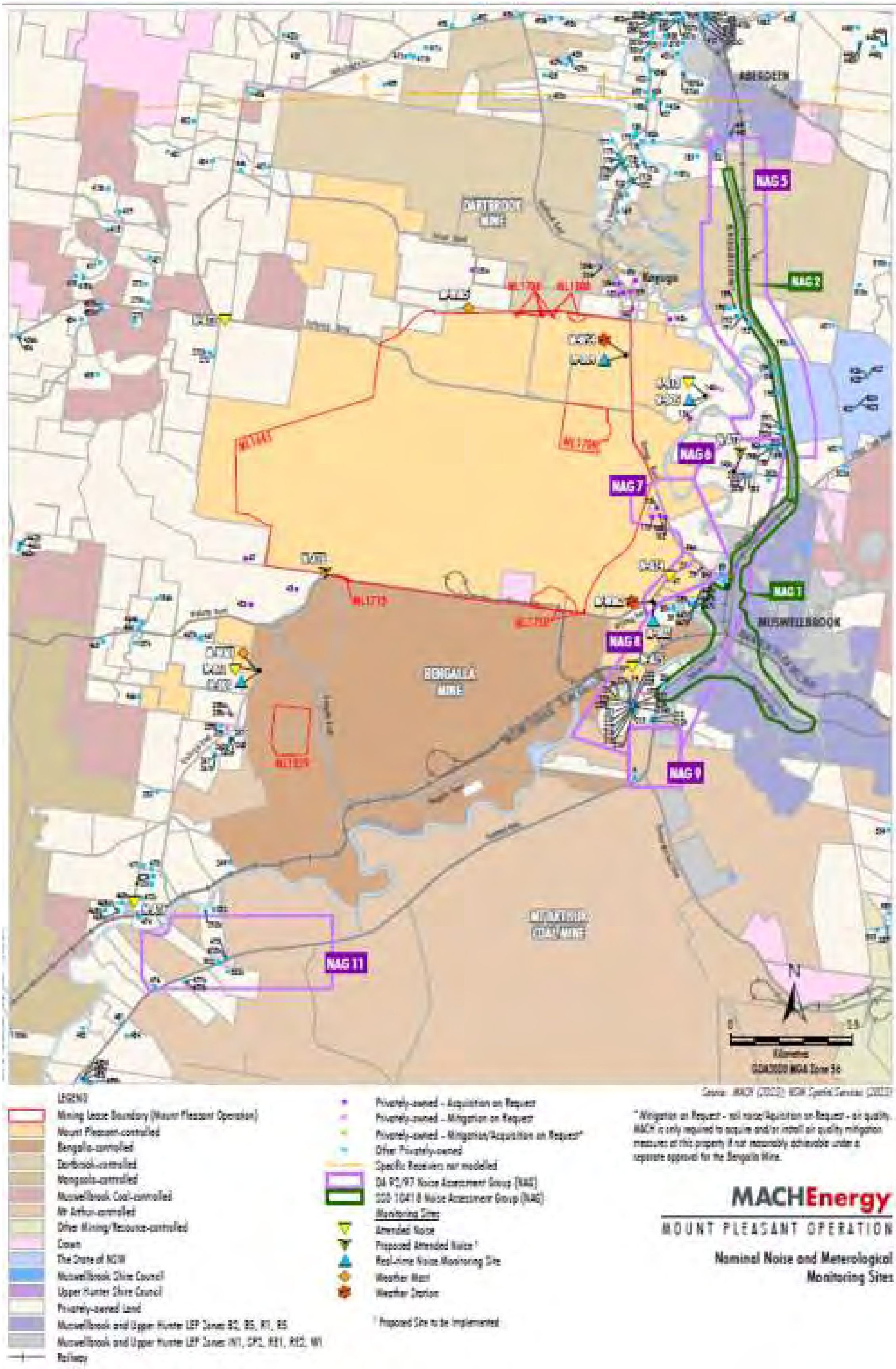

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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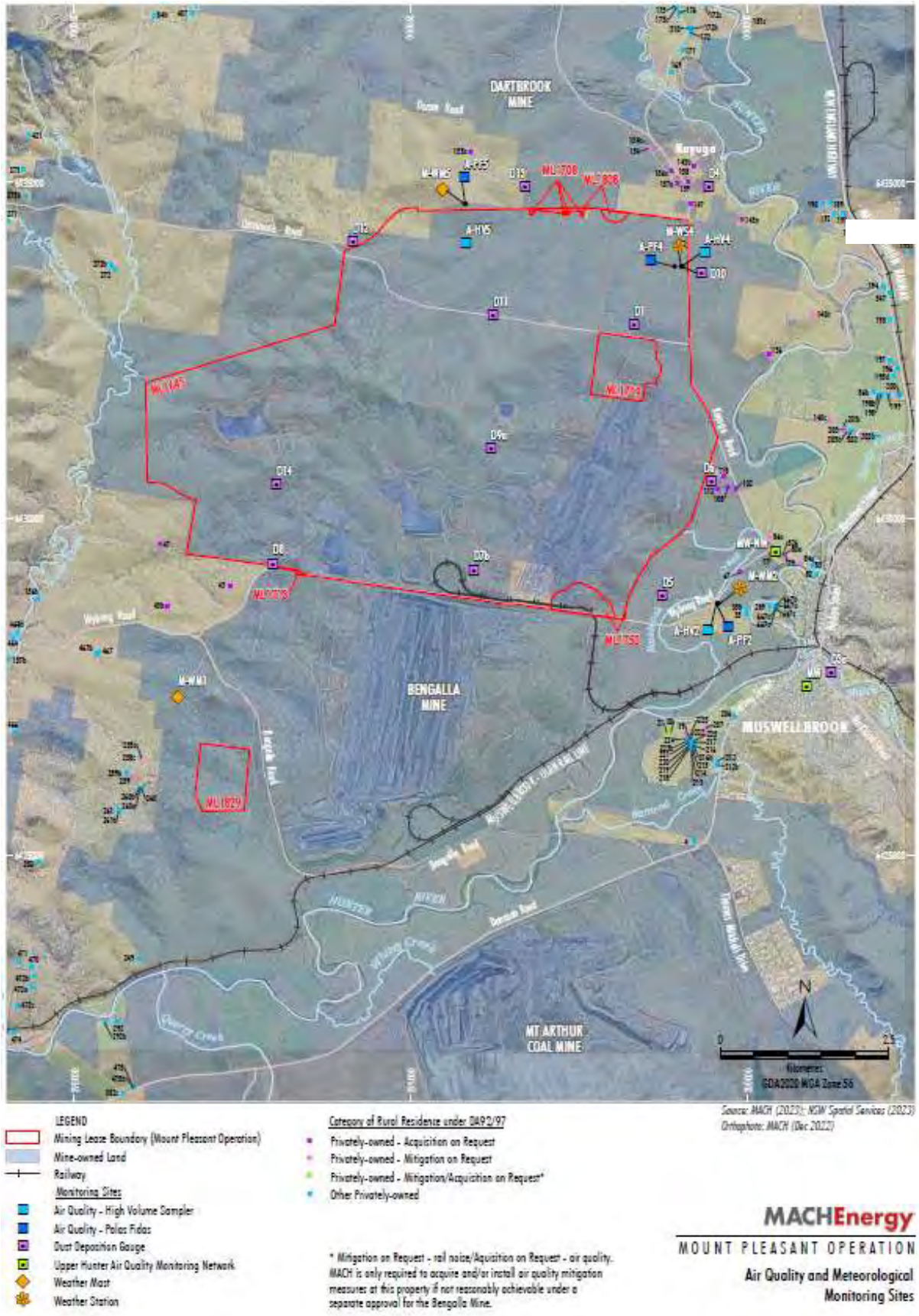

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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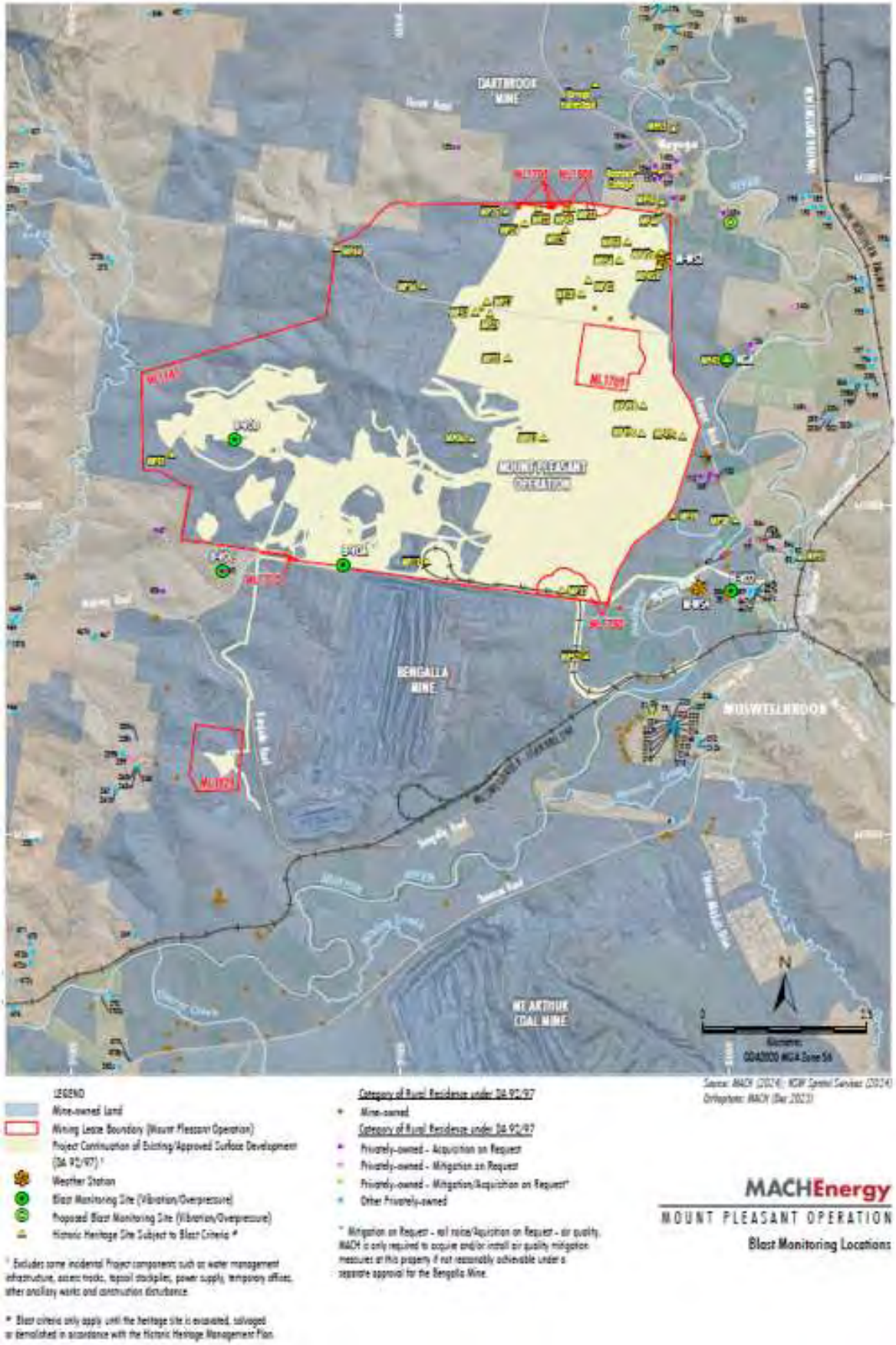

Figure 2-3 – MPO Blast Monitoring Locations

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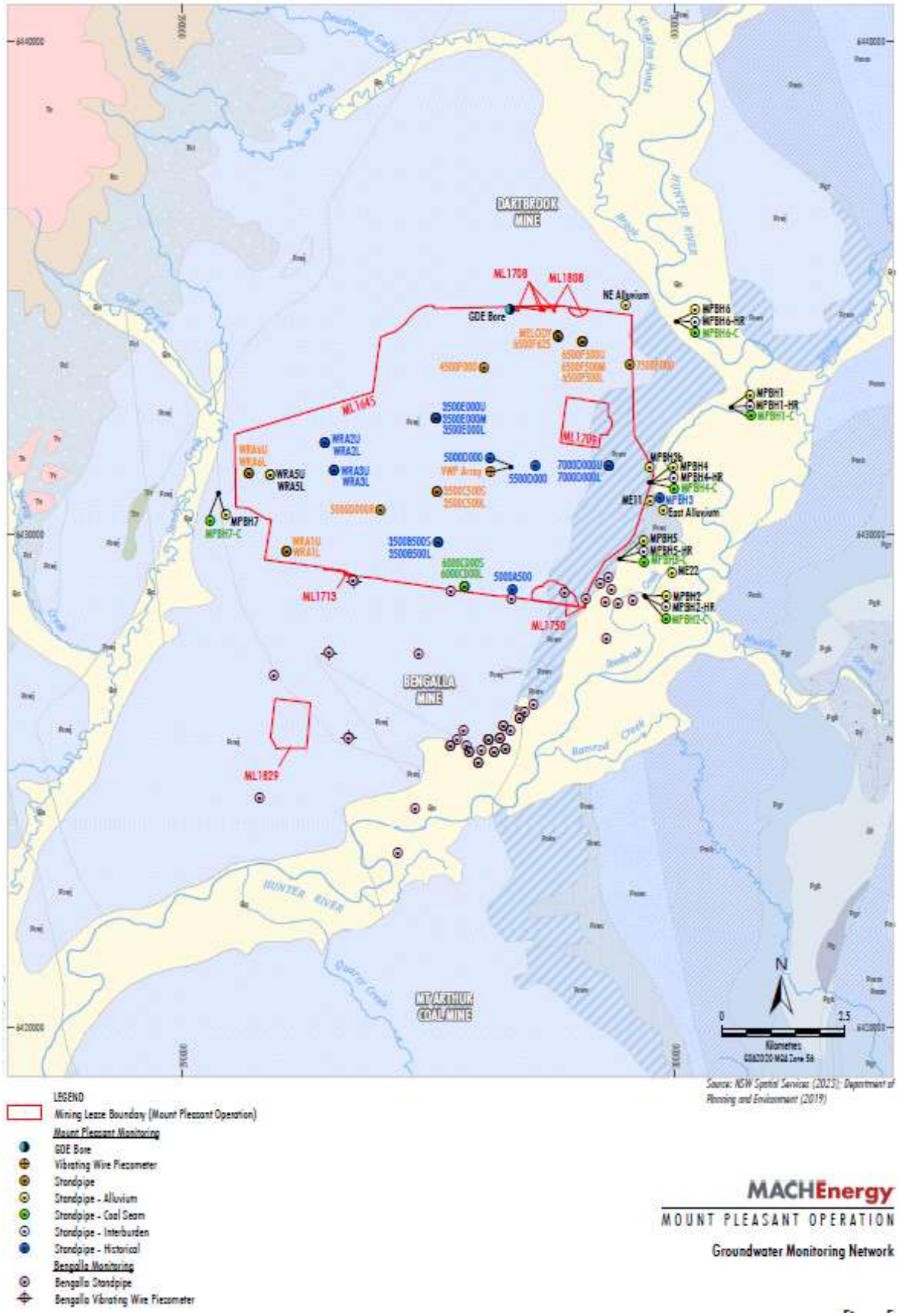

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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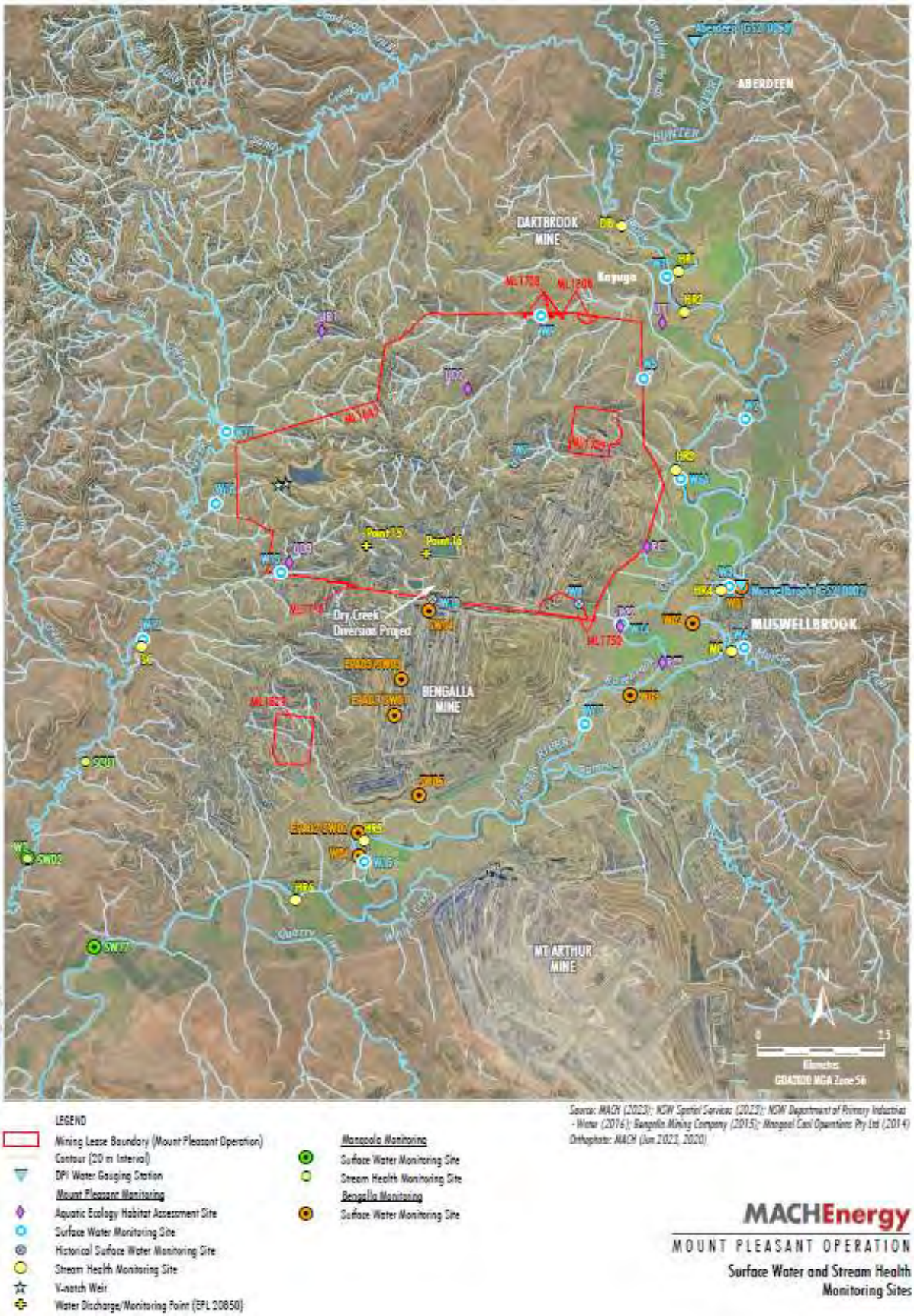

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 (>58.2%) during November 2024 (the monitoring period). An additional monitor (E-BAM) is located at M-WS2 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4 (>16.4%).
Throughout November 2024, there was 99.3mm and 100.0mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 does not explicitly mention dust deposition gauges, there is a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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4.2 Results

The dust deposition exposure period for gauges commenced on 28 October 2024. Sample collection was undertaken on 29 November 2024 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for November 2024 have been provided as an indication of performance between November 2023 – November 2024 and does not represent annual average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – November 2024

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	2.0	2.0
D3	1.2	1.3
D4	1.1	1.1
D5a	2.1	2.0
D6	1.7	1.8
D7b	8.8	**8.8**
D8	4.5	**4.3**
D9a	3.5	3.4
D10	1.1	1.1
D11	3.3	3.2
D12	0.9	0.9
D13	1.3	1.3
D14	2.8	2.7
Criterion	-	**4**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

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Field notes from the November sampling event noted that all the gauges contained insects, four also contained vegetation and one contained bird droppings. All insoluble solid results were included in the annual rolling average calculations. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (8.8 g/m2) and D8 (4.3 g/m2).

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

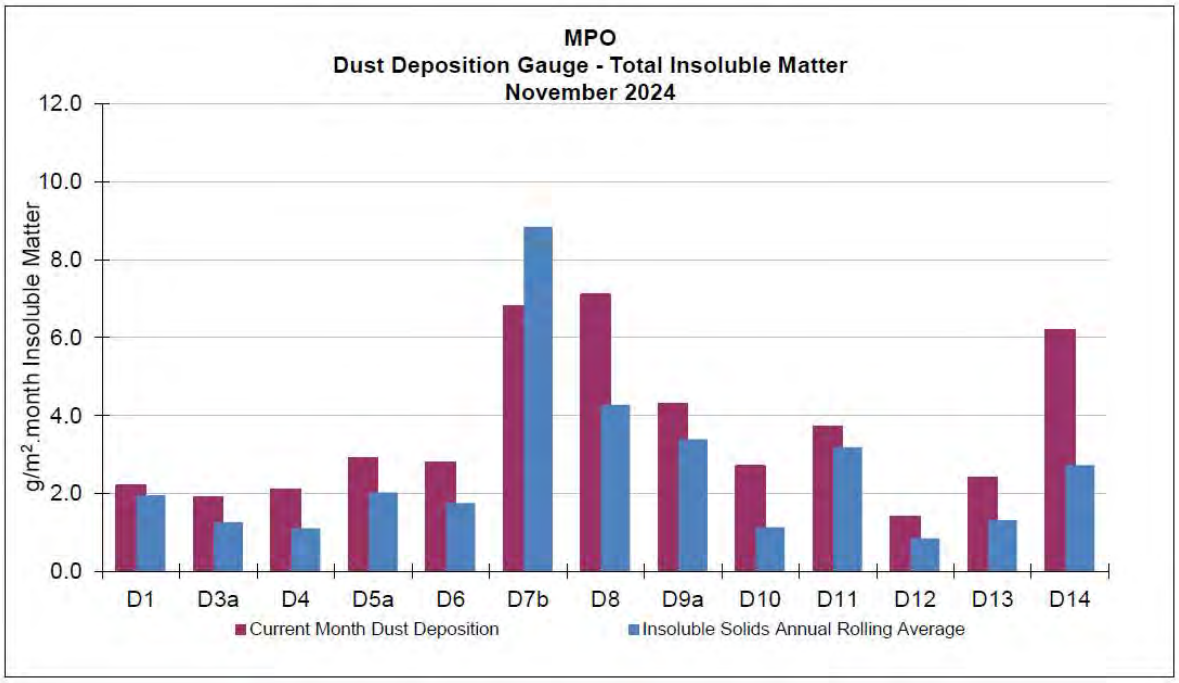

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – November 2024

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

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5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Annual rolling averages for November 2024 have been provided as an indication of performance between November 2023 – November 2024 and do not represent annual average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – November 2024

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
1/11/2024	-	48.3	72.2	49.3
7/11/2024	-	27.9^	67.7	118.0
13/11/2024	-	40.9	44.0	31.7
19/11/2024	-	40.0	51.2	27.0
25/11/2024	-	67.4	72.1	52.0
*Monthly Mean	-	49.2	61.4	55.6
Annual Rolling Average	*90*	49	45	33

Notes:
** Results have been rounded to one decimal place for reporting purposes where applicable.*
^ Indicates makeup run results for run date 11/11/2024.

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during November 2024.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages for November 2024 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

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6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in November 2024. Real time PM_{10} 24 hour daily average results for November 2024 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – November 2024

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
1/11/2024	16	-	17	19.6	50
2/11/2024	14	-	18	15.7	50
3/11/2024	27	-	22	26.5	50
4/11/2024	35	-	26	39.1	50
5/11/2024	21	-	20	23	50
6/11/2024	26	-	15	22.7	50
7/11/2024	-	-	-	39.8	50
8/11/2024	28	-	-	25.4	50
9/11/2024	22	-	23	28.7	50
10/11/2024	24	-	29	28.2	50
11/11/2024	20	-	21	24.1	50
12/11/2024	14	-	13	10.3	50
13/11/2024	15	-	14	13.4	50
14/11/2024	-	-	14	15.5	50
15/11/2024	-	-	12	12.6	50
16/11/2024	-	-	14	13.8	50
17/11/2024	-	-	14	18	50
18/11/2024	-	-	11	13.5	50
19/11/2024	-	13	17	19.8	50
20/11/2024	-	13	17	15.2	50
21/11/2024	-	9	13	13.3	50
22/11/2024	-	11	24	14.2	50
23/11/2024	-	-	16	19	50
24/11/2024	-	-	20	22.9	50
25/11/2024	-	-	25	23.5	50
26/11/2024	-	-	24	26.1	50
27/11/2024	30	-	14	33.7	50
28/11/2024	23	-	14	22	50
29/11/2024	26	-	23	24.1	50
30/11/2024	14	-	13	11.5	50

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites November 2024.

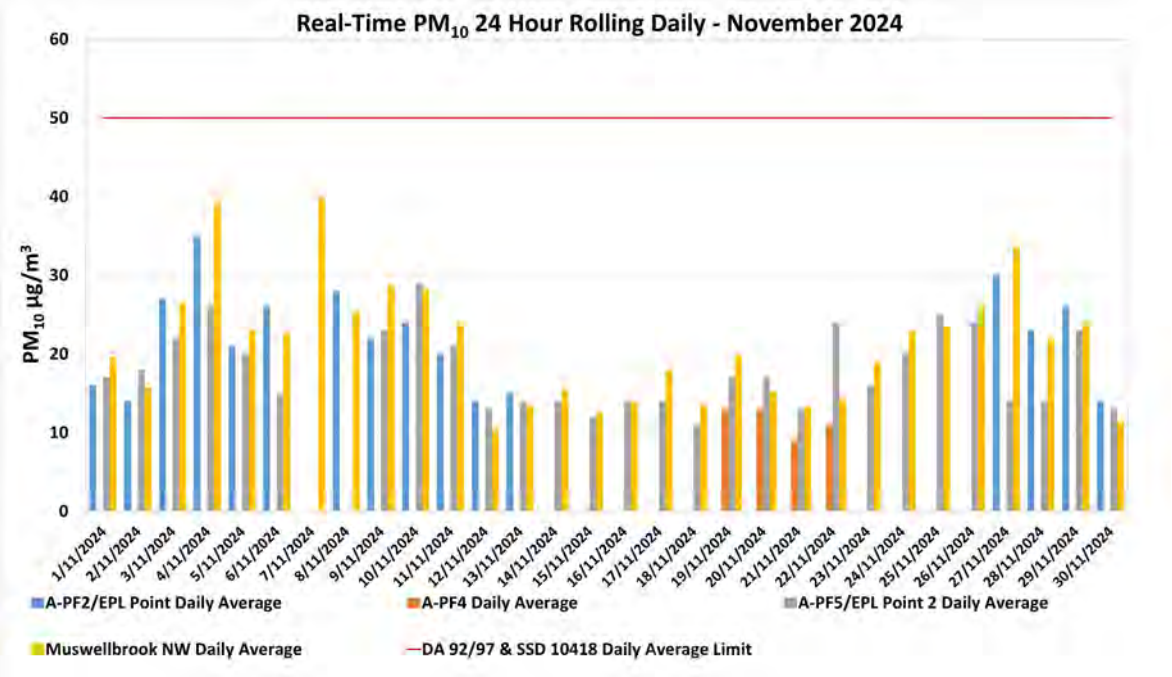

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for November 2024.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during November 2024. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

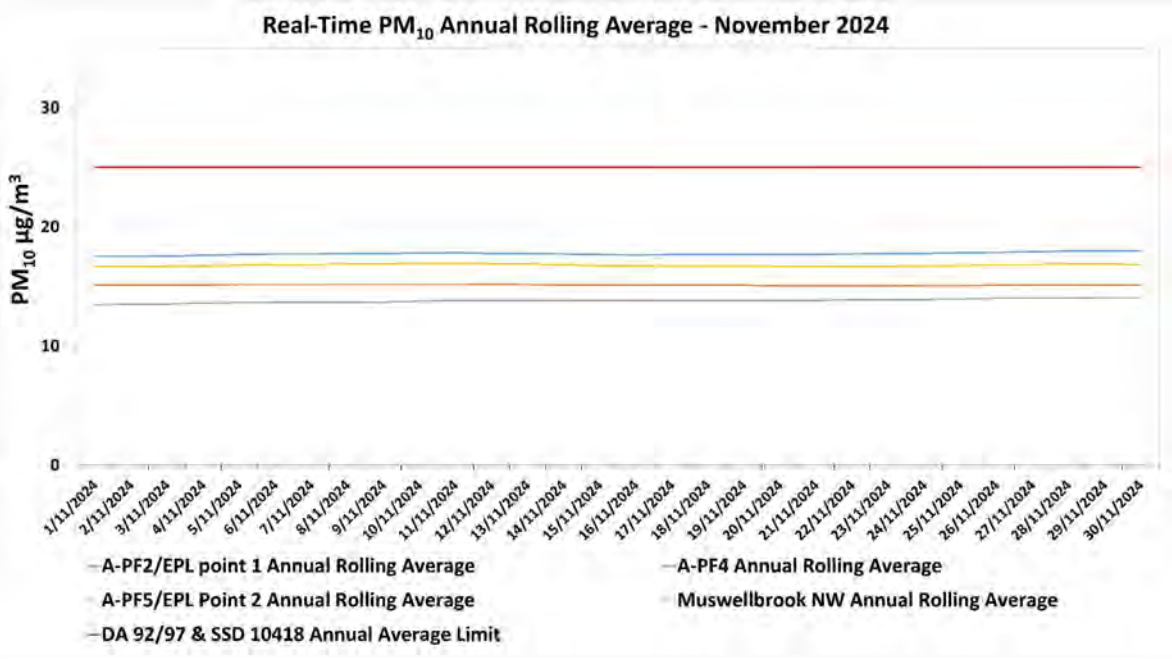

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for November 2024.

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6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during November 2024. Real time $PM_{2.5}$ 24 hour rolling average results for November 2024 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – November 2024

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
1/11/2024	6	-	6	25
2/11/2024	5	-	5	25
3/11/2024	7	-	6	25
4/11/2024	8	-	7	25
5/11/2024	8	-	8	25
6/11/2024	7	-	6	25
7/11/2024	-	-	-	25
8/11/2024	6	-	-	25
9/11/2024	6	-	6	25
10/11/2024	7	-	7	25
11/11/2024	8	-	8	25
12/11/2024	6	-	6	25
13/11/2024	6	-	5	25
14/11/2024	-	-	6	25
15/11/2024	-	-	5	25
16/11/2024	-	-	5	25
17/11/2024	-	-	4	25
18/11/2024	-	-	4	25
19/11/2024	-	5	6	25
20/11/2024	-	5	6	25
21/11/2024	-	4	4	25
22/11/2024	-	4	5	25
23/11/2024	-	-	5	25
24/11/2024	-	-	5	25
25/11/2024	-	-	6	25
26/11/2024	-	-	6	25
27/11/2024	7	-	5	25
28/11/2024	7	-	6	25
29/11/2024	12	-	11	25
30/11/2024	5	-	5	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Real time $PM_{2.5}$ 24-hour average results for November 2024 are presented in **Figure 6-3** below.

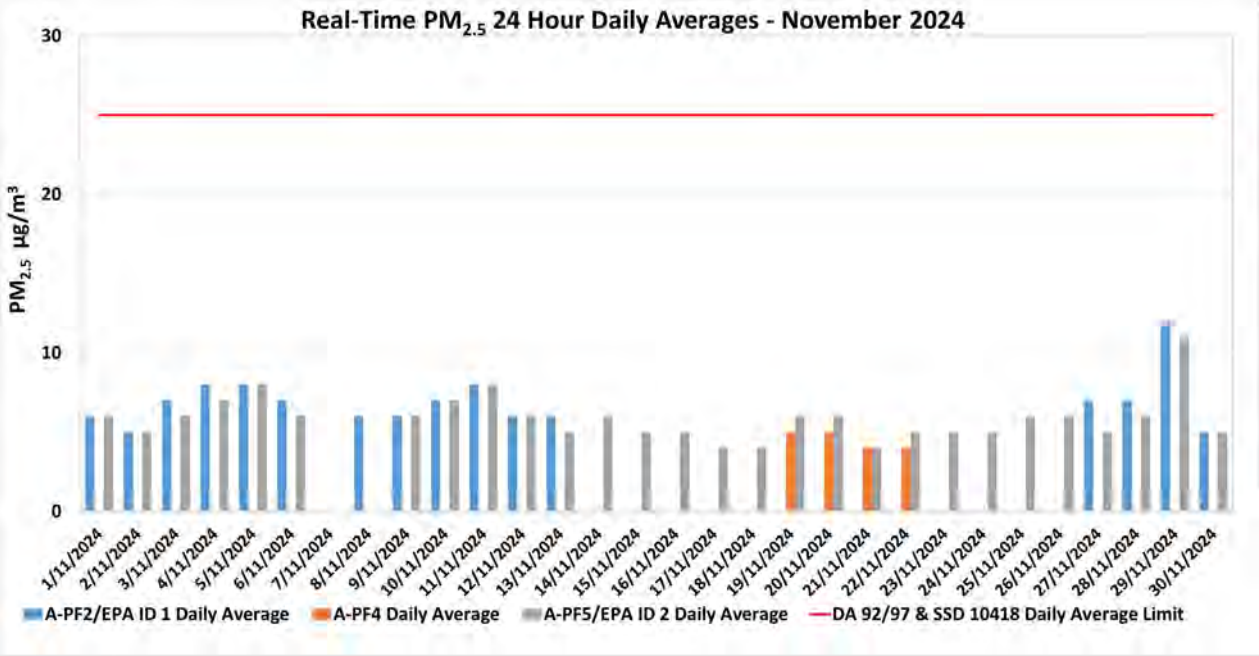

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for November 2024.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during November 2024. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

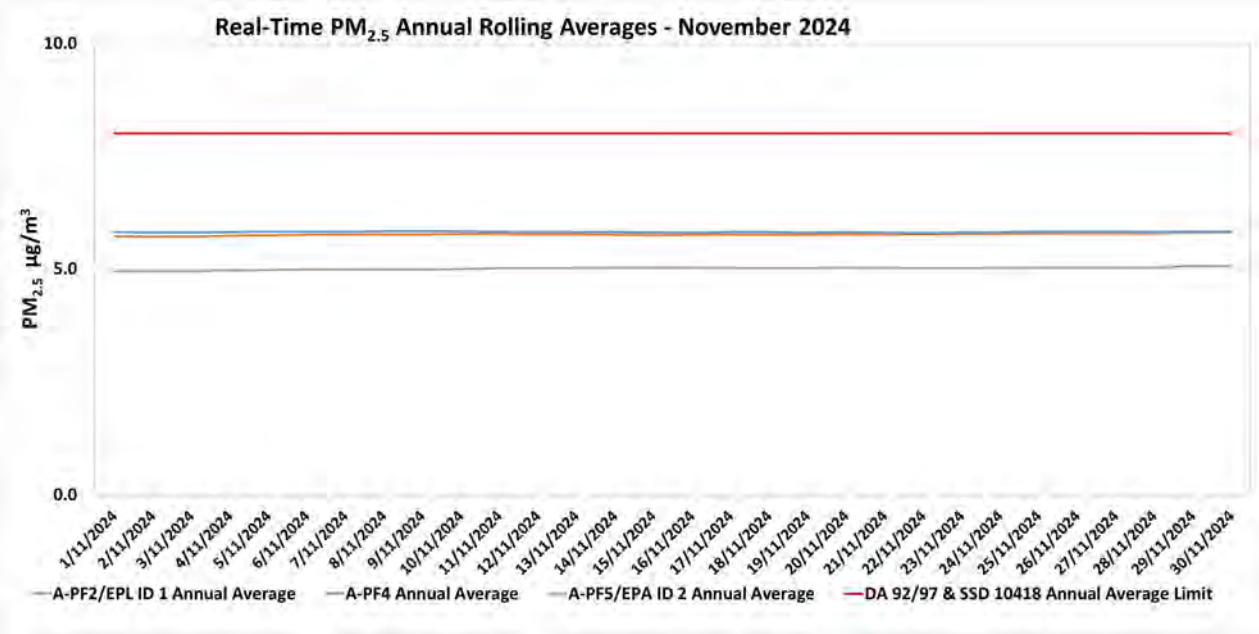

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for November 2024.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites monthly, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2024) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 25 November 2024. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 25 November 2024

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.1	**610**	330	18
W2	8.2	**750**	390	18
W3	8.1	870	490	19
W4	7.8	2350	1400	9
W5	*	*	*	*
W6A	8.3	**750**	400	**21**
W9	*	*	*	*
W11	**8.2**	3850	2100	5.2
W12	8.0	5200	3000	6.6
W13	*	*	*	*
W14	*	*	*	*
W15	**	**	**	**
W16	**8.3**	**7950**	4600	17
W17	8.1	**950**	580	22

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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During the 25 November 2024 monitoring event, four (4) sites were dry, and one (1) site was unable to be accessed due to track conditions. Sites W1, W2, W6A, W16 and W17 were above their respective EC trigger levels. Site W6A was above its respective trigger level for TSS. Sites W11 and W16 were above their respective pH trigger levels.

Site W6A was above the respective EC trigger level for four consecutive monitoring events during the last monthly environmental report (October 2024) and continues to be above trigger levels for November 2024. Results also showed site W6A is above its trigger level for TSS for four consecutive monitoring events (August, September, October, and November 2024).

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

Site W6A continued to exceed the respective EC trigger level (750 µS/cm) for November 2024; however, according to Table 26 of the WMP no further investigation is required as the upstream site W1 (Hunter River reference site) was also found to be exceeding trigger levels.

Site W6A exceeded its trigger level for TSS (21 mg/L). An investigation relating to recent environmental conditions (ACT Williams, January 2024) concluded that prevailing climatic factors, combined with increased contributions of naturally high EC (Electrical Conductivity) water from tributary inflows, have influenced water quality at several monitoring locations including W6A.

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8. Groundwater Monitoring

Quarterly groundwater monitoring was conducted between 19, 20 and 28 of November 2024. Water level results for the groundwater bores are presented in **Table 8-1**. The quarterly pH and EC results are presented in **Table 8-2** and **Table 8-3**, respectively.

Table 8-1 - MPO Quarterly Groundwater Water Level Results

Monitoring Location/ ID	Water Level Trigger Range		Nov 2024 Water Level (DTW)	Aug 2024 Water Level (DTW)	May 2024 Water Level (DTW)	Triggered (Yes/No)
	80th Percentile (DTW)	Trigger				
WRA1L	-	>± 0.5m	**2.36**	3.75	**4.07**	
WRA1U	-	>± 0.5m	*	*	*	
WRA3L-R**	-	>± 0.5m	93.72	-	-	
WRA3U-R**	-	>± 0.5m	30.75	-	-	
WRA5L-R**	-	>± 0.5m	^^	-	-	
WRA5U-R**	-	>± 0.5m	^^	-	-	
WRA6L	-	>± 0.5m	1.04	0.8	0.88	
WRA6U	-	>± 0.5m	1.87	1.74	1.83	
MPBH1	9.71	10.70	10.1	9.73	9.99	No
MPBH2	12.20	13.59	12.17	12.07	12	No
MPBH3b	13.04	Dry (or 14.0m)	12.2	12.18	12.28	No
MPBH4	-	>± 0.5m	12.12	12.09	12.19	
MPBH5	-	>± 0.5m	*	*	*	
MPBH1-C	-	>± 0.5m	10.25	9.83	10.16	
MPBH1-HR	-	>± 0.5m	**35.28**	**38.93**	**22.48**	
MPBH2-C	-	>± 0.5m	12.46	12.36	12.29	
MPBH2-HR	-	>± 0.5m	12.41	12.34	12.2	
MPBH4-C	-	>± 0.5m	11.71	11.66	11.74	
MPBH4-HR	-	>± 0.5m	50.69	50.83	50.66	
MPBH5-C	-	>± 0.5m	11.96	**12.3**	11.62	
MPBH5-HR	-	>± 0.5m	12.03	11.95	11.82	
MPBH6	-	>± 0.5m	10.2	10.04	10.22	
MPBH6-C	-	>± 0.5m	11.61	11.82	11.86	
MPBH6-HR	-	>± 0.5m	11.05	10.95	11.18	
MPBH7	10.1	>± 0.5m	**5.84**	**5.31**	6.55	No
MPBH7-C	-	>± 0.5m	**18.23**	15.62	**15.84**	
3500C500L	-	>± 0.5m	26.67	**26.53**	25.78	
3500C500S	-	>± 0.5m	25.61	**25.41**	26.23	
4500F000	-	>± 0.5m	^	22.53	22.63	

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Monitoring Location/ ID	Water Level Trigger Range		Nov 2024 Water Level (DTW)	Aug 2024 Water Level (DTW)	May 2024 Water Level (DTW)	Triggered (Yes/No)
	80th Percentile (DTW)	Trigger				
5000D000-R	-	>± 0.5m	139.17	139.19	139.02	
5500D000	-	>± 0.5m	41.9	**41.45**	**40.89**	
6000C000L-R**	-	>± 0.5m	^^	-	-	
6000C000U-R**	-	>± 0.5m	^^	-	-	
6500F500L	-	>± 0.5m	**51.43**	50.66	**51.12**	
6500F500M	-	>± 0.5m	**52.32**	51.64	**51.9**	
6500F500U	-	>± 0.5m	31.92	**32.22**	30.25	
6500F625	-	>± 0.5m	16.04	15.93	15.78	
Melody	-	>± 0.5m	13.05	12.81	13.09	
7500F000	-	>± 0.5m	36.3	36.11	35.91	
GDE Bore Shallow**	-	>± 0.5m	*	-	-	
GDE Bore Deep**	-	>± 0.5m	10.67	-	-	
NE Alluvium**	-	>± 0.5m	^^	-	-	
East Alluvium**	-	>± 0.5m	*	-	-	

Results in **bold** indicate that the bore has exceeded the adopted assessment criterion for changes in standing water level from the previous measurement.
* Dry/insufficient water to sample.
**New site.
^Unsafe access.
^^ Site to be visited in December 2024.

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Table 8-2 - MPO Quarterly Groundwater pH Results

Monitoring Location/ ID	pH Trigger Range		Nov 2024 pH	Aug 2024 pH	May 2024 pH	Triggered (Yes/No)
	Lower	Upper				
WRA1L	6.0	8.5	7.1	7.2	7.1	No
WRA1U			*	*	*	-
WRA3L-R**			7.6	-	-	-
WRA3U-R**			*	-	-	-
WRA5L-R**			^^	-	-	-
WRA5U-R**			^^	-	-	-
WRA6L			7	7	6.9	No
WRA6U			6.9	6.7	6.8	No
MPBH1			7	7.1	6.9	No
MPBH2			6.8	7	6.9	No
MPBH3b			7.8	7.8	7.4	No
MPBH4			7	6.9	7.1	No
MPBH5			*	*	*	-
MPBH1-C			**8.7**	7.9	**8.6**	No
MPBH1-HR			8	8.1	7.8	No
MPBH2-C			7.7	8.2	**10.7**	No
MPBH2-HR			7.5	7.9	7.5	No
MPBH4-C			8	8	7.9	No
MPBH4-HR			7.2	7.3	7.3	No
MPBH5-C			**9.8**	**9.3**	**10.3**	**Yes**
MPBH5-HR			7.5	7.6	7.6	No
MPBH6			7	7.1	7.1	No
MPBH6-C			7	7.1	7.7	No
MPBH6-HR			7.3	7.3	7.4	No
MPBH7			7	7	7	No
MPBH7-C			7	7.1	7	No
3500C500L			7.5	7.6	7.6	No
3500C500S			7.1	6.9	6.9	No
4500F000			^	6.8	6.8	No
5000D000-R			7.4	7.5	7.5	No
5500D000			6.9	7	7	No
6000C000L-R**			^^	-	-	-
6000C000U-R**			^^	-	-	-
6500F500L			7.2	7.2	7.2	No
6500F500M			7.3	7.3	7.3	No

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Monitoring Location/ ID	pH Trigger Range		Nov 2024 pH	Aug 2024 pH	May 2024 pH	Triggered (Yes/No)
	Lower	Upper				
6500F500U			6.8	6.8	6.7	No
6500F625			6.9	7	6.9	No
Melody			6.9	6.9	6.9	No
7500F000			7.7	7.8	7.8	No
GDE Bore Shallow**			*	-	-	-
GDE Bore Deep**			7.5	-	-	-
NE Alluvium**			^^	-	-	-
East Alluvium**			*	-	-	-

** Dry/insufficient water to sample.*
***New site.*
^Unsafe access.
^^ Site to be visited in December 2024.
*An investigation is triggered when pH values are recorded outside the baseline range (20th – 80th percentile). Results shown in **bold** are outside of this range.*

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Table 8-3 - MPO Quarterly Groundwater EC Results

Monitoring Location/ ID	Maximum Beneficial Use Trigger	Nov 2024 EC[1]	Aug 2024 EC[1]	May 2024 EC[1]	Triggered (Yes/No)
WRA1L	7800	3050	3200	3750	No
WRA1U	*	***	***	***	-
WRA3L-R**	*	6100	-	-	-
WRA3U-R**	*	*	-	-	-
WRA5L-R**	*	^^	-	-	-
WRA5U-R**	*	^^	-	-	-
WRA6L	7800	5700	6000	6850	No
WRA6U	22000	8650	8950	8950	No
MPBH1	800	640	620	640	No
MPBH2	930	**1300**	**1200**	**1300**	**Yes**
MPBH3b	7800	5600	5550	5650	No
MPBH4	*	5650	5550	5550	-
MPBH5	*	***	***	***	-
MPBH1-C	*	1500	820	790	-
MPBH1-HR	*	1550	1500	1500	-
MPBH2-C	*	1050	1050	1300	-
MPBH2-HR	*	1250	1350	1250	-
MPBH4-C	*	4950	4850	4950	-
MPBH4-HR	*	5500	5700	5750	-
MPBH5-C	*	920	760	1400	-
MPBH5-HR	*	860	840	800	-
MPBH6	*	1250	1200	1250	-
MPBH6-C	*	2750	2800	3200	-
MPBH6-HR	*	4750	3600	6150	-
MPBH7	*	9750	10600	10900	-
MPBH7-C	*	10300	10800	10800	-
3500C500L	7800	3900	3810	3750	No
3500C500S	7800	**8250**	**12200**	**12000**	**Yes**
4500F000	22000	^	8150	8650	No
5000D000-R	*	4500	4400	4400	-
5500D000	7800	4350	4400	4200	No
6000C000L-R**	*	^^	-	-	-
6000C000U-R**	*	^^	-	-	-
6500F500L	7800	2550	2450	2600	No
6500F500M	7800	2600	2450	2500	No
6500F500U	7800	4900	4850	5550	No

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Monitoring Location/ ID	Maximum Beneficial Use Trigger	Nov 2024 EC[1]	Aug 2024 EC[1]	May 2024 EC[1]	Triggered (Yes/No)
6500F625	7800	4300	3850	3600	No
Melody	*	5800	5400	5600	-
7500F000	7800	6350	6250	6450	No
GDE Bore Shallow**	*	*	-	-	-
GDE Bore Deep**	*	10700	-	-	-
NE Alluvium**	*	^^	-	-	-
East Alluvium**	*	*	-	-	-

** Indicates no trigger limit identified*
*** New site*
**** Dry/insufficient water to sample*
^Unsafe access.
^^ Site to be visited in December 2024.
[1]Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).
An investigation is triggered when EC values recorded exceed the beneficial use quality range (as described in the GWMP) for three successive monitoring rounds. Results outside this range are shown in **bold.**

During the November 2024 monitoring event, sites WRA1U, MPBH5, GDE Bore Shallow and East Alluvium were dry. WRA3U-R contained insufficient water to sample and six (6) sites had changes in standing water level of greater than ± 0.5m from the previous measurement. All monitoring locations were within the pH trigger limits except sites MPBH1-C, MPBH5-C. MPBH5-C has been outside the limits for three consecutive monitoring events. All monitoring locations were below their respective EC trigger limits except sites 3500C500S and MPBH2. Both 3500C500S and MPBH2 have been outside these limits for three consecutive monitoring events.

600C00L-R, 600C00U-R, WRA5L-R and WRA5U-R were not sampling in November 2024. Sampling is scheduled to take place in December 2024. NE Alluvium was unable to be accessed.

An investigation is triggered if elevated measurements occur for three consecutive sampling events in accordance MPO Water Management Plan (MACH Energy, 2022). An investigation was triggered (AGE, 2023) examining the cause of elevated EC values in the alluvial zone, specifically MPBH2. The data strongly suggests that the cause of the increase in EC is persistent above-average stage in the adjacent Hunter River, caused by above-average rainfall since 2020, which is causing a rise in groundwater levels in similar alluvial bores. Trigger values have since been reviewed and will be incorporated in future Water management plans. The next quarterly ground water monitoring event is scheduled for February 2025.

9. Noise Monitoring

Attended noise monitoring was undertaken during the night of 27 November 2024 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2021) in accordance with DA 92/97, SSD 10418 and EPL 20850.

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9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in November 2024 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 27 November 2024

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2.4]	Criterion dB	Wind Speed m/s	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	27/11/2024 23:26	IA	45	1.3	Yes	E	No
N-AT2	27/11/2024 22:49	26	45	2.2	No	F	NA
N-AT3	27/11/2024 22:11	29	45	1.5	Yes	E	No
N-AT4	27/11/2024 22:37	35	45	0.7	Yes	F	No
N-AT5	27/11/2024 22:58	26	45	0.9	Yes	F	No
N-AT6	27/11/2024 23:56	IA	45	1.4	Yes	F	No
N-AT7	27/11/2024 22:11	IA	45	1.5	Yes	E	No
N-AT8	27/11/2024 23:28	37	45	1.4	NA[6]	E	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 27 November 2024

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2.4]	Criterion dB	Wind Speed m/s	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	27/11/2024 23:26	IA	37	1.3	Yes	E	No
N-AT2	27/11/2024 22:49	22	35	2.2	No	F	NA
N-AT3	27/11/2024 22:11	26	40	1.5	Yes	E	No
N-AT4	27/11/2024 22:37	29	38	0.7	Yes	F	No
N-AT5	27/11/2024 22:58	23	37	0.9	Yes	F	No
N-AT6	27/11/2024 23:56	IA	35	1.4	Yes	F	No
N-AT7	27/11/2024 22:11	IA	37	1.5	Yes	E	No

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N-AT8	27/11/2024 23:28	33	NA[5]	1.4	NA[6]	E	NA[5]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 27 November 2024

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	27/11/2024 23:26	IA	40	No
N-AT2	27/11/2024 22:49	22	40	No
N-AT3	27/11/2024 22:11	26	40	No
N-AT4	27/11/2024 22:37	29	40	No
N-AT5	27/11/2024 22:58	23	40	No
N-AT6	27/11/2024 23:56	IA	40	No
N-AT7	27/11/2024 22:11	IA	40	No
N-AT8	27/11/2024 23:28	33	NA[4]	NA[4]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *Cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

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10. Blast Monitoring

The MPO Blast Management Plan (SSD 10418) is undergoing additional consultation with Council and will be finalised early 2025. There were six (6) blast events during November (a total of 81 blasts YTD). Results for November 2024 are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – November 2024

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
Tuesday 05/11/2024	13:14	0.620	104.8	0.620	104.8	N
Tuesday 12/11/2024	15:11	0.540	97.1	0.410	102.2	N
Thursday 14/11/2024	13:09	0.300	102.9	0.460	99.9	N
Wednesday 20/11/2024	13:14	0.030	106.1	0.050	91.5	N
Friday 22/11/2024	09:02	0.520	95.8	0.220	94.1	N
Thursday 28/11/2024	15:40	0.610	98.8	0.870	98.5	N

END OF REPORT

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Mount Pleasant Operation

Monthly Environmental Monitoring Report

December 2024

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 December 2024
Reporting Period End Date	31 December 2024
Date All Data Received	30 January 2025

Links to three key regulatory documents are provided here:

- MACH Energy Environment Protection Licence EPL 20850; and
- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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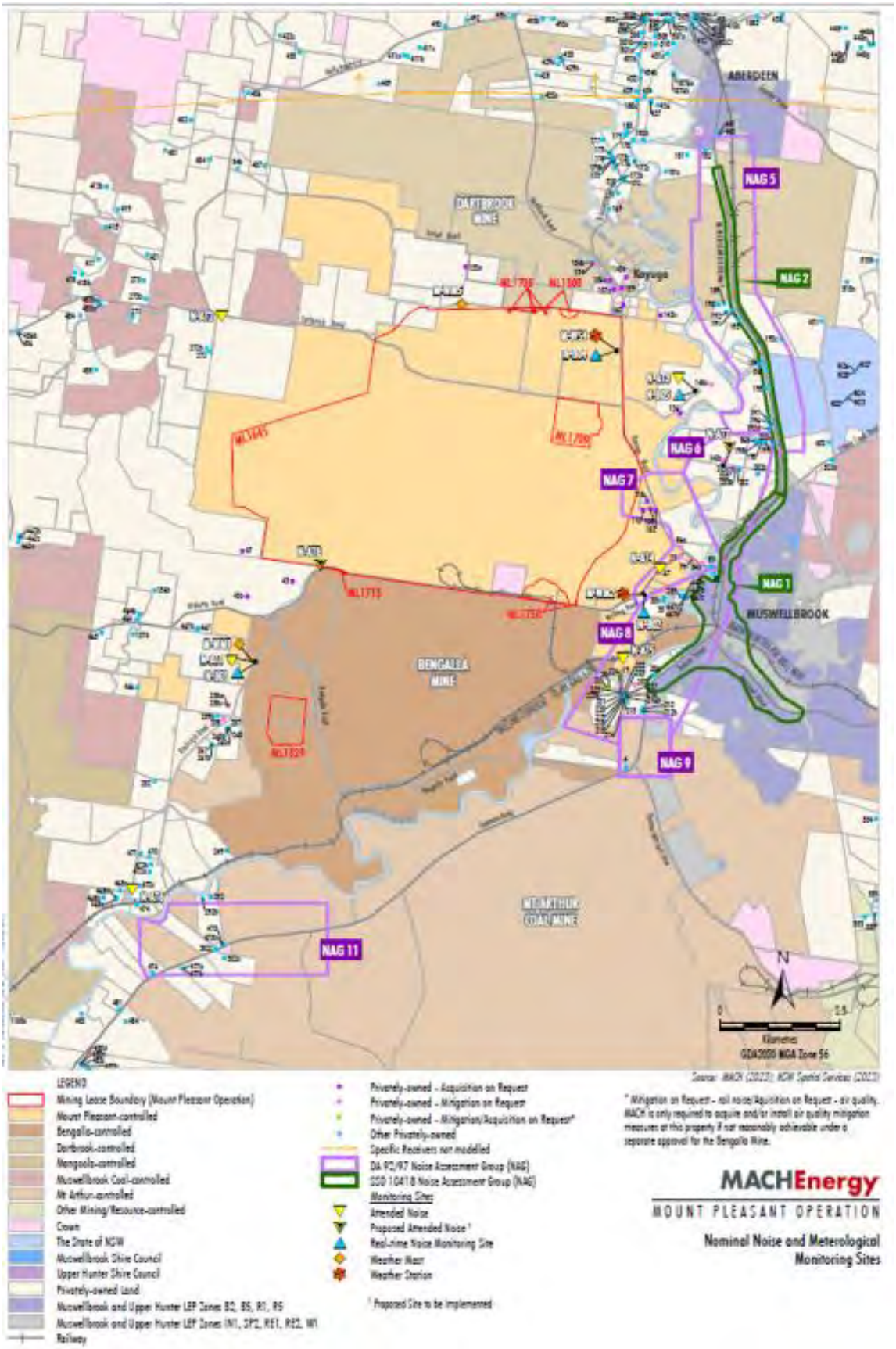

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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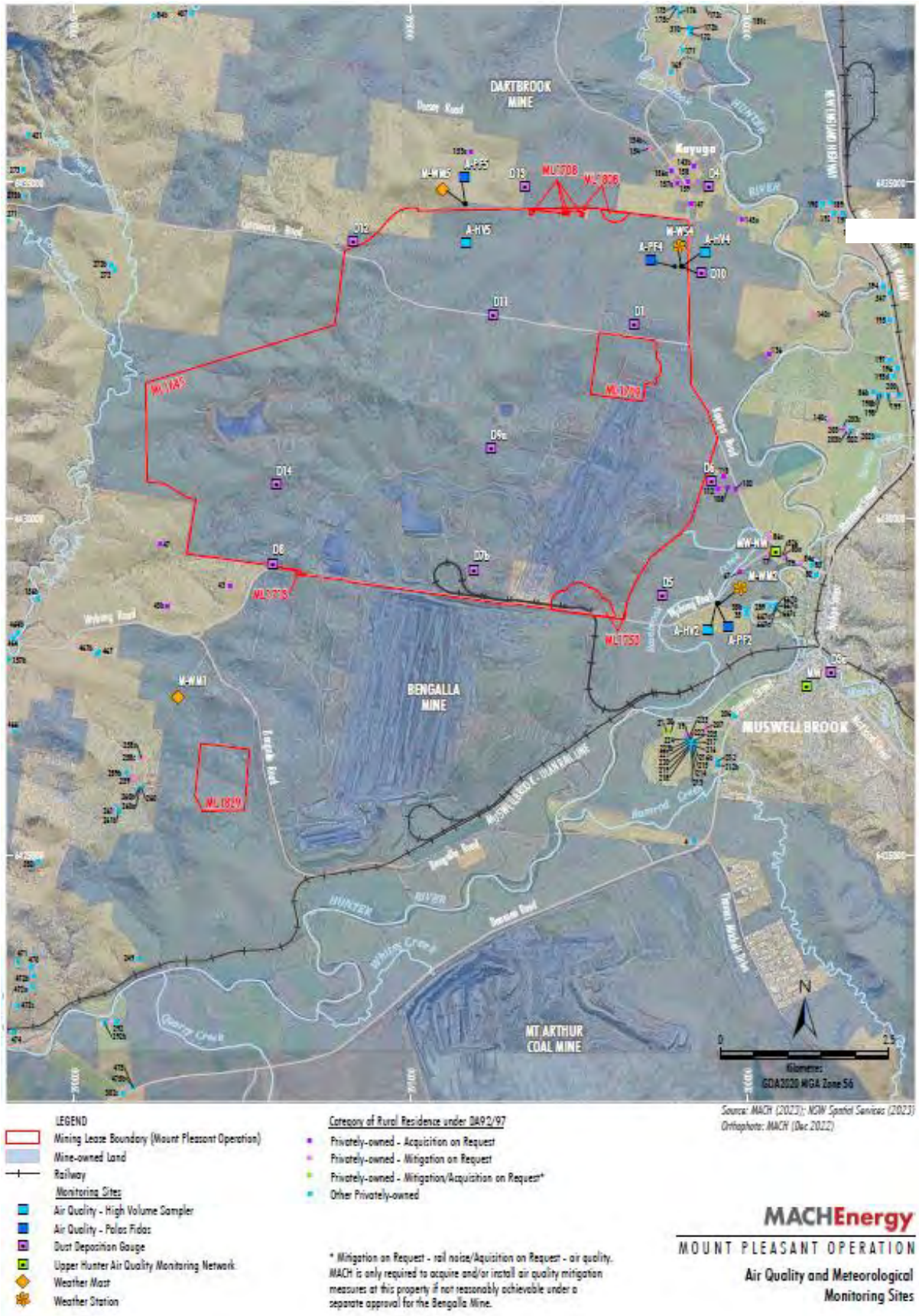

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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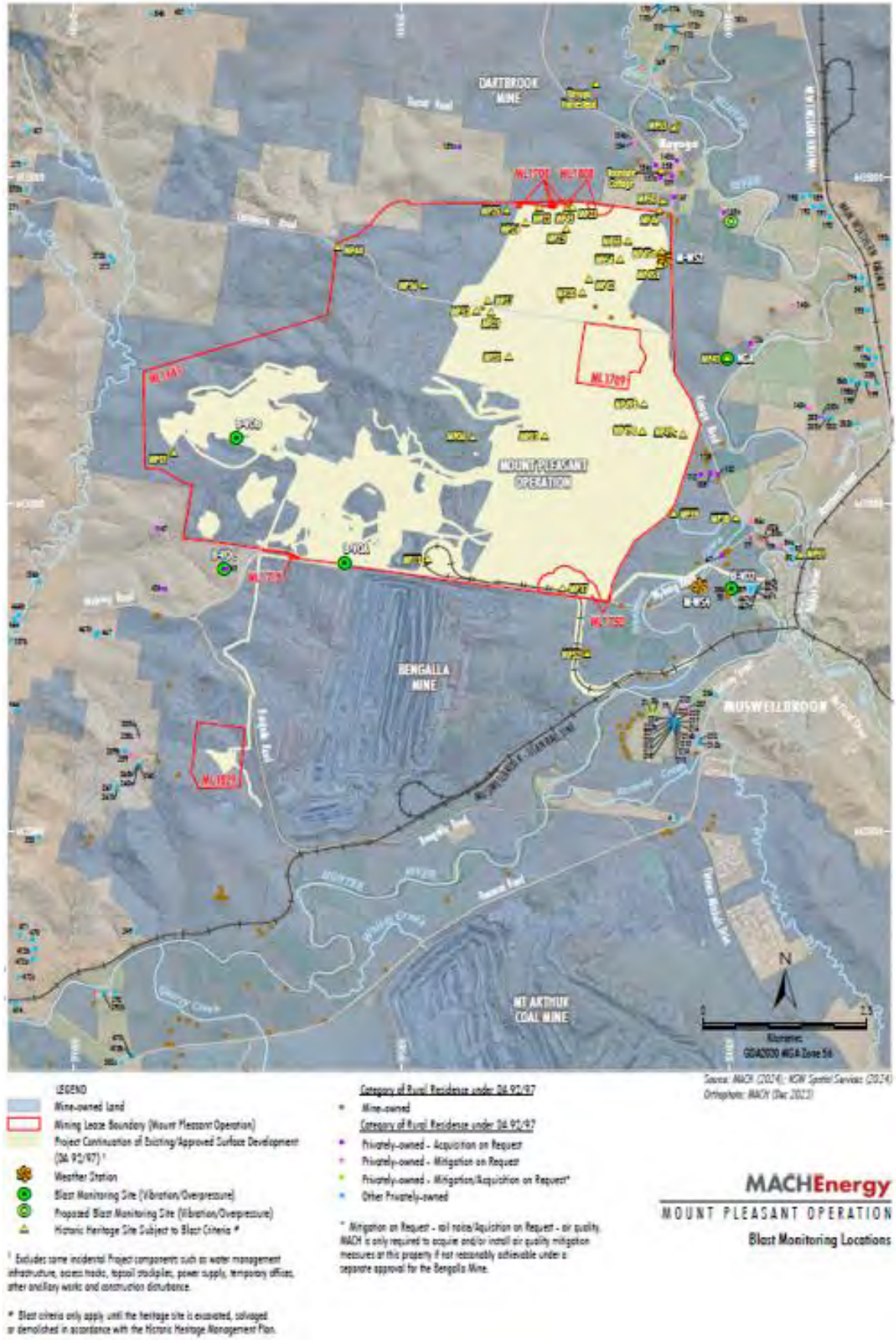

Figure 2-3 – MPO Blast Monitoring Locations

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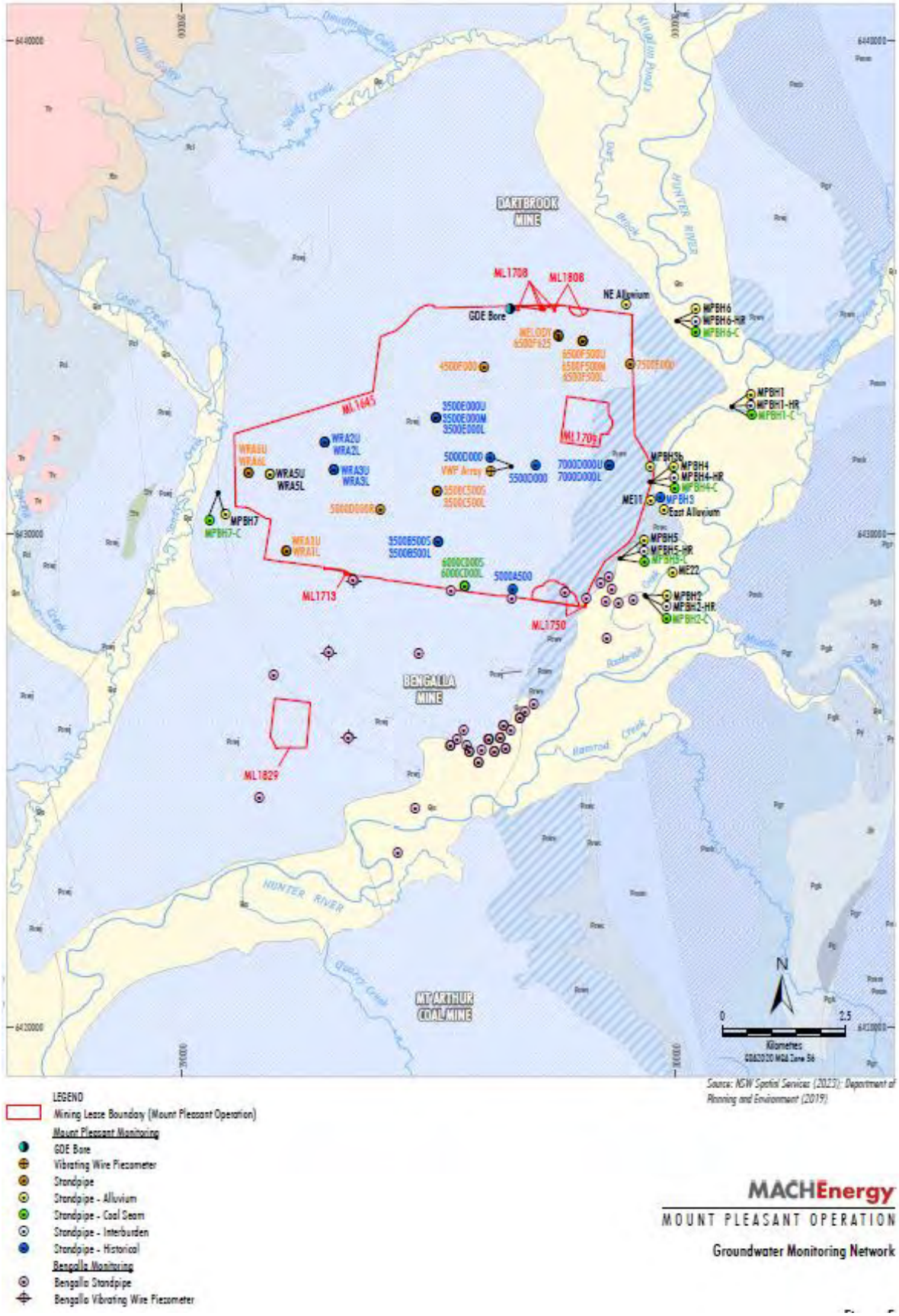

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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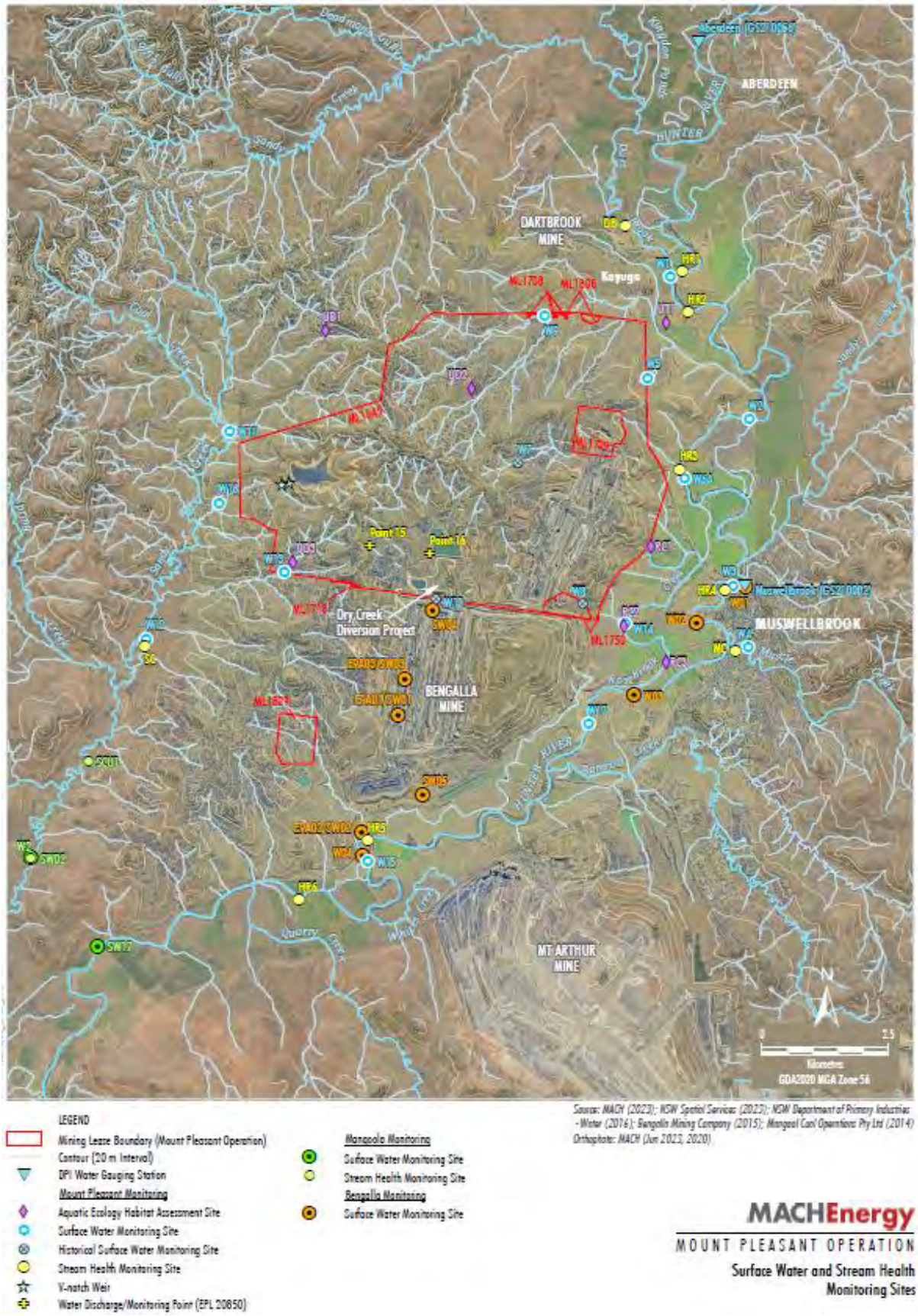

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 during December 2024 (the monitoring period). An additional monitor (E-BAM) is located at M-WS2 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4.
Throughout December 2024, there was 41.4mm and 43.6mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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4.2 Results

The dust deposition exposure period for gauges commenced on 29 November 2024. Sample collection was undertaken on 30 December 2024 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for December 2024 have been provided as an indication of performance between January 2024 – December 2024 and represents annual average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – December 2024

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	2.2	2.2
D3	1.2	1.2
D4	1.1	1.1
D5a	2.1	2.1
D6	1.9	1.9
D7b	8.6	8.6
D8	4.6	4.6
D9a	3.4	3.4
D10	1.1	1.1
D11	3.3	3.3
D12	1	1
D13	1.4	1.4
D14	3	3
Criterion	-	**4**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

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Field notes from the December sampling event noted that all of the gauges contained insects, four also contained vegetation and two contained bird droppings. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (8.8 g/m2) and D8 (4.3 g/m2).

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

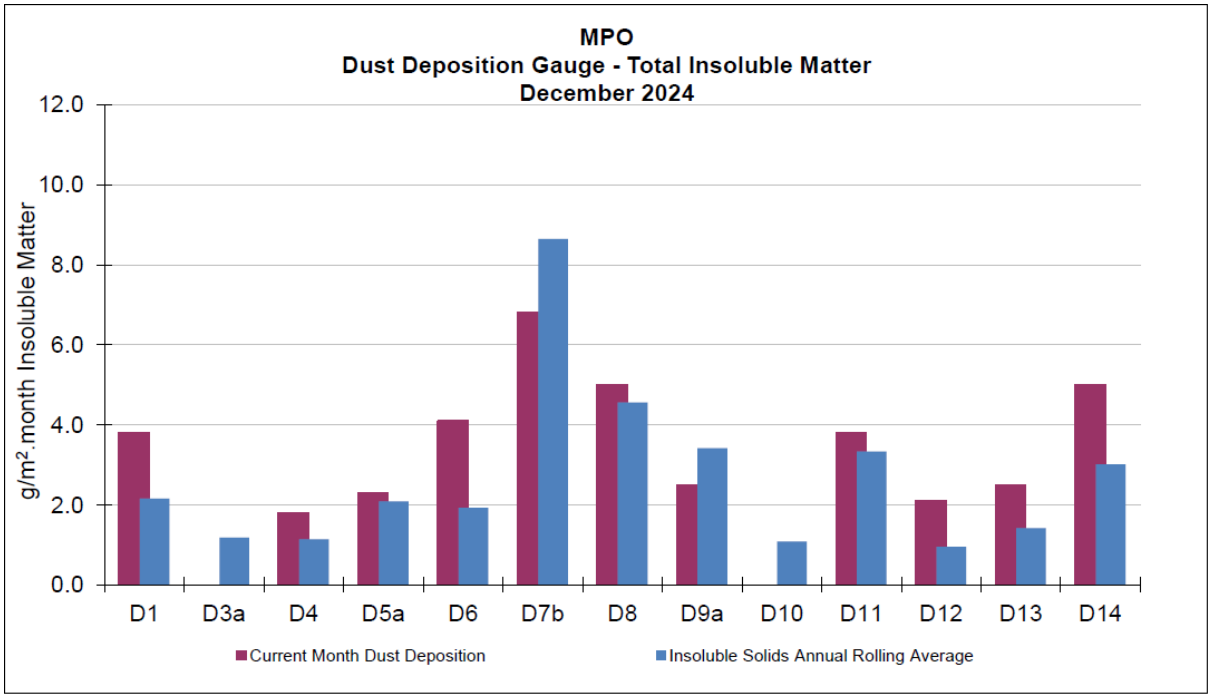

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – December 2024

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

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5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Annual rolling averages for December 2024 have been provided as an indication of performance between January 2024 – December 2024 and represent annual average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – December 2024

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
1/12/2024	-	32.4	25.4	22.8
7/12/2024	-	79.1	26.6	29
13/12/2024	-	89.8	77.7	95.2
19/12/2024	-	40.2	64.8	32.6
25/12/2024	-	42.2	39.8	35.5
31/12/2024		66.5	120	49.2
*Monthly Mean	-	58.4	59	44
Annual Rolling Average	*90*	47	44	33

Notes:
** Results have been rounded to one decimal place for reporting purposes where applicable.*
^ Indicates makeup run results for run date 11/11/2024.

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during December 2024.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages for December 2024 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

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6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in December 2024. Real time PM_{10} 24 hour daily average results for December 2024 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – December 2024

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
1/12/2024	13		4	19.6	50
2/12/2024	15		4	15.7	50
3/12/2024	15		4	26.5	50
4/12/2024	16		6	39.1	50
5/12/2024	14		6	23	50
6/12/2024	19		7	22.7	50
7/12/2024	21		4	39.8	50
8/12/2024	16		4	25.4	50
9/12/2024	16		6	28.7	50
10/12/2024	27		7	28.2	50
11/12/2024	26		7	24.1	50
12/12/2024	32		6	10.3	50
13/12/2024	30		7	13.4	50
14/12/2024	33		11	15.5	50
15/12/2024	33		11	12.6	50
16/12/2024	19		7	13.8	50
17/12/2024	29		5	18	50
18/12/2024	14		5	13.5	50
19/12/2024	16		5	19.8	50
20/12/2024	18		6	15.2	50
21/12/2024	24		6	13.3	50
22/12/2024	27		8	14.2	50
23/12/2024	32		6	19	50
24/12/2024	26	34	4	22.9	50
25/12/2024	13	12	4	23.5	50
26/12/2024	31	13		26.1	50
27/12/2024	33	17		33.7	50
28/12/2024	27	24		22	50
29/12/2024	25	24		24.1	50
30/12/2024	20	16		11.5	50
31/12/2024	23	19			

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites December 2024.

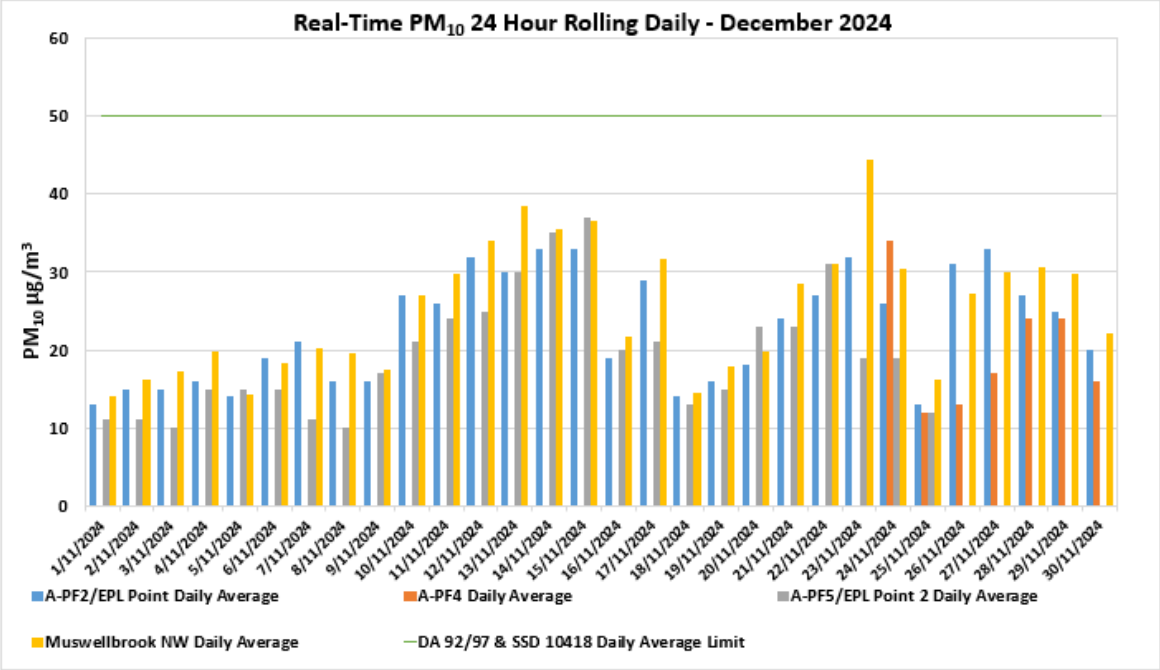

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for December 2024.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during December 2024. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

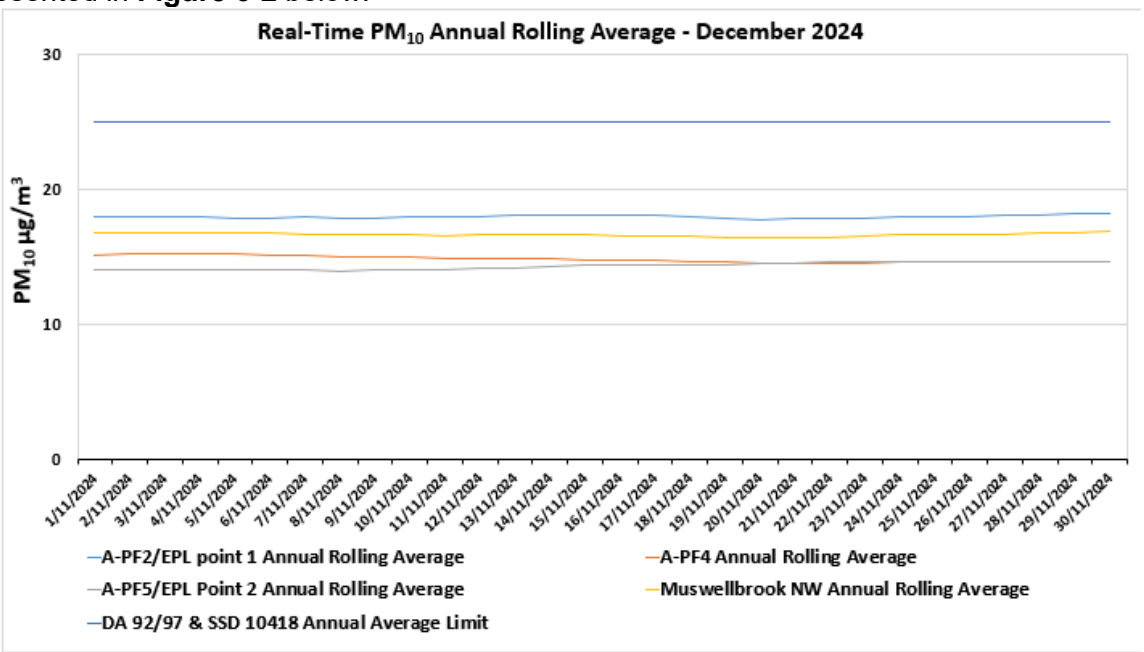

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for December 2024.

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6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during December 2024. Real time $PM_{2.5}$ 24 hour rolling average results for December 2024 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – December 2024

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
1/12/2024	4		4	25
2/12/2024	4		4	25
3/12/2024	5		4	25
4/12/2024	6		6	25
5/12/2024	6		6	25
6/12/2024	8		7	25
7/12/2024	5		4	25
8/12/2024	5		4	25
9/12/2024	6		6	25
10/12/2024	8		7	25
11/12/2024	7		7	25
12/12/2024	7		6	25
13/12/2024	6		7	25
14/12/2024	11		11	25
15/12/2024	12		11	25
16/12/2024	7		7	25
17/12/2024	6		5	25
18/12/2024	6		5	25
19/12/2024	6		5	25
20/12/2024	5		6	25
21/12/2024	6		6	25
22/12/2024	8		8	25
23/12/2024	7		6	25
24/12/2024	5	6	4	25
25/12/2024	5	4	4	25
26/12/2024	6	5		25
27/12/2024	7	5		25
28/12/2024	9	8		25
29/12/2024	6	6		25
30/12/2024	7	6		25
31/12/2024	8	8		25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Real time $PM_{2.5}$ 24-hour average results for December 2024 are presented in **Figure 6-3** below.

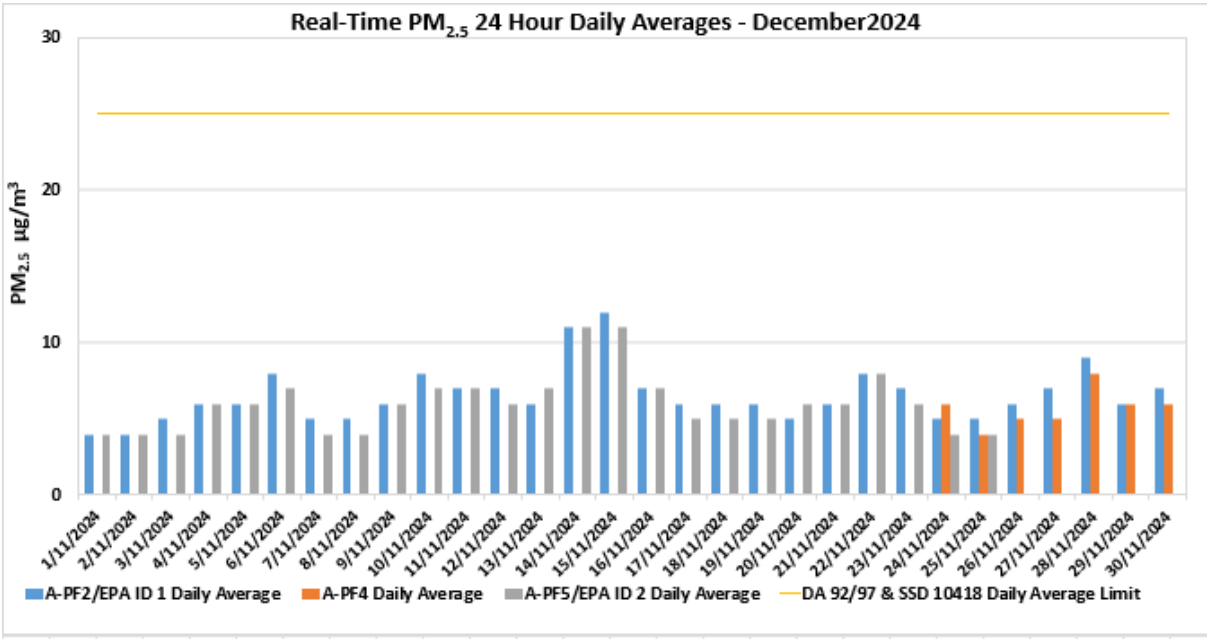

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for December 2024.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during December 2024. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

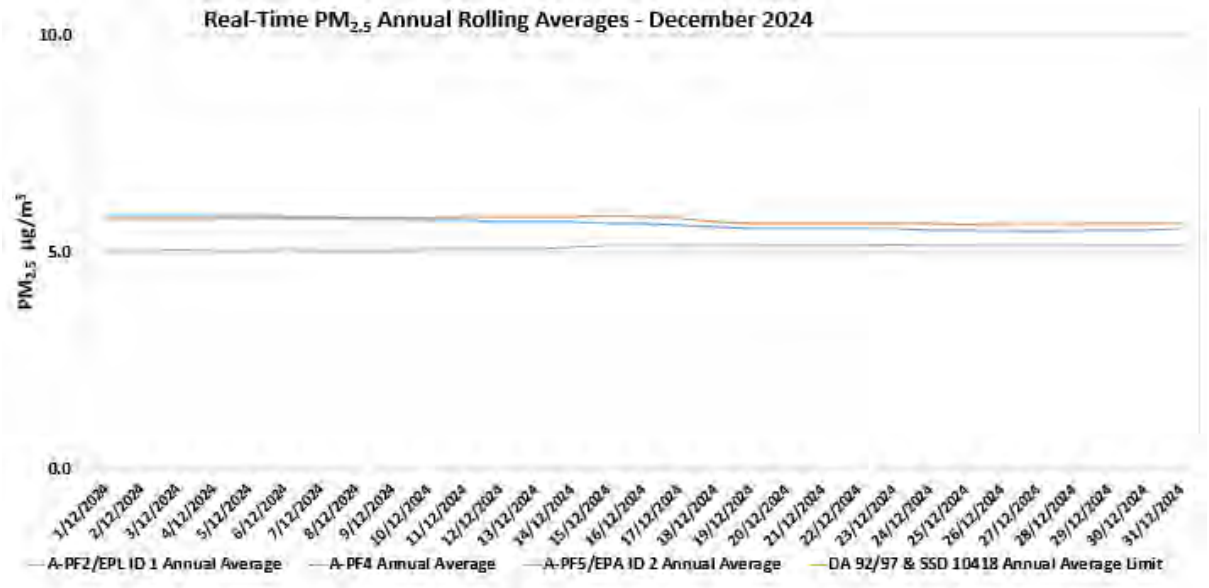

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for December 2024.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2024) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 19 December 2024. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 19 December 2024

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.1	510	240	18
W2	8.1	**580**	302	18
W3	8	660	363	28
W4	7.7	2250	1350	6
W5	*	*	*	*
W6A	8.2	**590**	315	11
W9	*	*	*	*
W11	**8.2**	3850	2150	<5
W12	7.9	5000	2760	8
W13	*	*	*	*
W14	*	*	*	*
W15	**	**	**	**
W16	**8.6**	**8650**	4960	33
W17	7.9	**750**	420	30

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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During 19 December 2024 monitoring event, four (4) sites were dry and one (1) site was unable to be accessed due to track conditions. Sites W2, W6A, W16 and W17 were above their respective EC trigger levels. Sites W11 and W16 were above their respective pH trigger levels.

Site W6A was above the respective EC trigger level for four consecutive monitoring events during the last monthly environmental report (October 2024) and continues to be above trigger levels for December 2024.

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

Site W6A continued to exceed the respective EC trigger level (750 µS/cm) for December 2024; however, according to Table 26 of the WMP no further investigation is required as the upstream site W2 (Hunter River reference site) was also found to be exceeding trigger levels.

8. Groundwater Monitoring

The next quarterly groundwater monitoring event is scheduled for February 2025

9. Noise Monitoring

Attended noise monitoring was undertaken during the night of 19th December 2024 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2021) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in December 2024 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 19 December 2024

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:42pm	IA	45	1.1 / 230	Yes	E	No
N-AT2	0:39pm	IA	45	3.4 / 156	No	E	NA
N-AT3	0:26pm	IA	45	4.2 / 145	No	E	NA
N-AT4	0:53pm	IA	45	1.6 / 220	Yes	E	No
N-AT5	1:14pm	IA	45	1.6 / 211	Yes	E	No
N-AT6	1:41pm	IA	45	1.1 / 230	Yes	E	No
N-AT7	0:01pm	IA	45	3.8 / 148	No	E	NA
N-AT8	1:15pm	57	NA[2]	1.6 / 211	NA[6]	E	NA[6]

Notes:

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1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 19 Dec 2024

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	11:42pm	IA	37	1.3	Yes	E	No
N-AT2	10:39pm	IA	35	2.2	No	E	NA
N-AT3	10:26pm	IA	40	1.5	No	E	NA
N-AT4	10:53pm	IA	38	0.7	Yes	E	No
N-AT5	11:14pm	IA	37	0.9	Yes	E	No
N-AT6	11:41pm	IA	35	1.4	Yes	E	No
N-AT7	10:01pm	IA	37	1.5	No	E	NA
N-AT8	11:15pm	54	NA[5]	1.4	NA[6]	E	NA[5]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 19 Dec 2024

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	11:42pm	39	40	No
N-AT2	10:39pm	IA	40	NA
N-AT3	10:26pm	IA	40	NA
N-AT4	10:53pm	IA	40	No
N-AT5	11:14pm	IA	40	No
N-AT6	11:41pm	25	40	No
N-AT7	10:01pm	IA	40	NA
N-AT8	11:15pm	54	NA[4]	NA[4]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*

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2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

10. Blast Monitoring

The MPO Blast Management Plan (SSD 10418) is undergoing additional consultation with Council and will be finalised early 2025. There were six (6) blast events during December (a total of 87 blasts YTD). Results for December 2024 are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – December 2024

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
4/12/2024	12:56	0.330 mm/s	96.5 DBL	0.430 mm/s	100.3 DBL	Y
13/12/2024	14:47	0.470 mm/s	104.8 DBL	0.260 mm/s	100.2 DBL	Y
13/12/2024	13:30	1.190 mm/s	91.6 DBL	0.590 mm/s	96.9 DBL	Y
18/12/2024	15:40	0.370 mm/s	107.9 DBL	0.420 mm/s	111.3 DBL	Y
20/12/2024	10:01	0.690 mm/s	88.2 DBL	0.620 mm/s	90.9 DBL	Y
24/12/2024	9:12	0.210 mm/s	87.1 DBL	0.790 mm/s	92.8 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

January 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 January 2025
Reporting Period End Date	31 January 2025
Date All Data Received	5 March 2025

Links to three key regulatory documents are provided here:

- MACH Energy Environment Protection Licence EPL 20850; and
- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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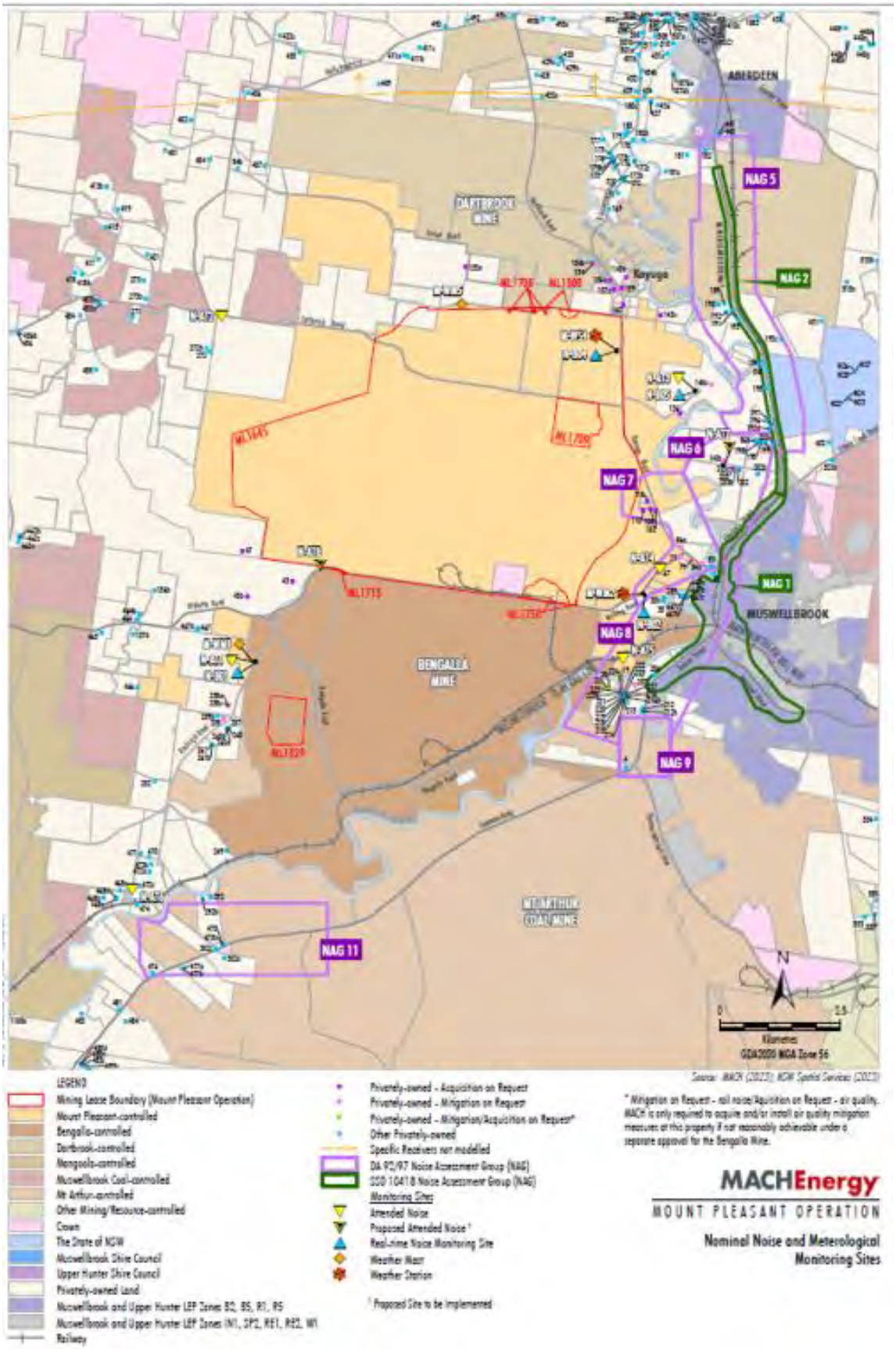

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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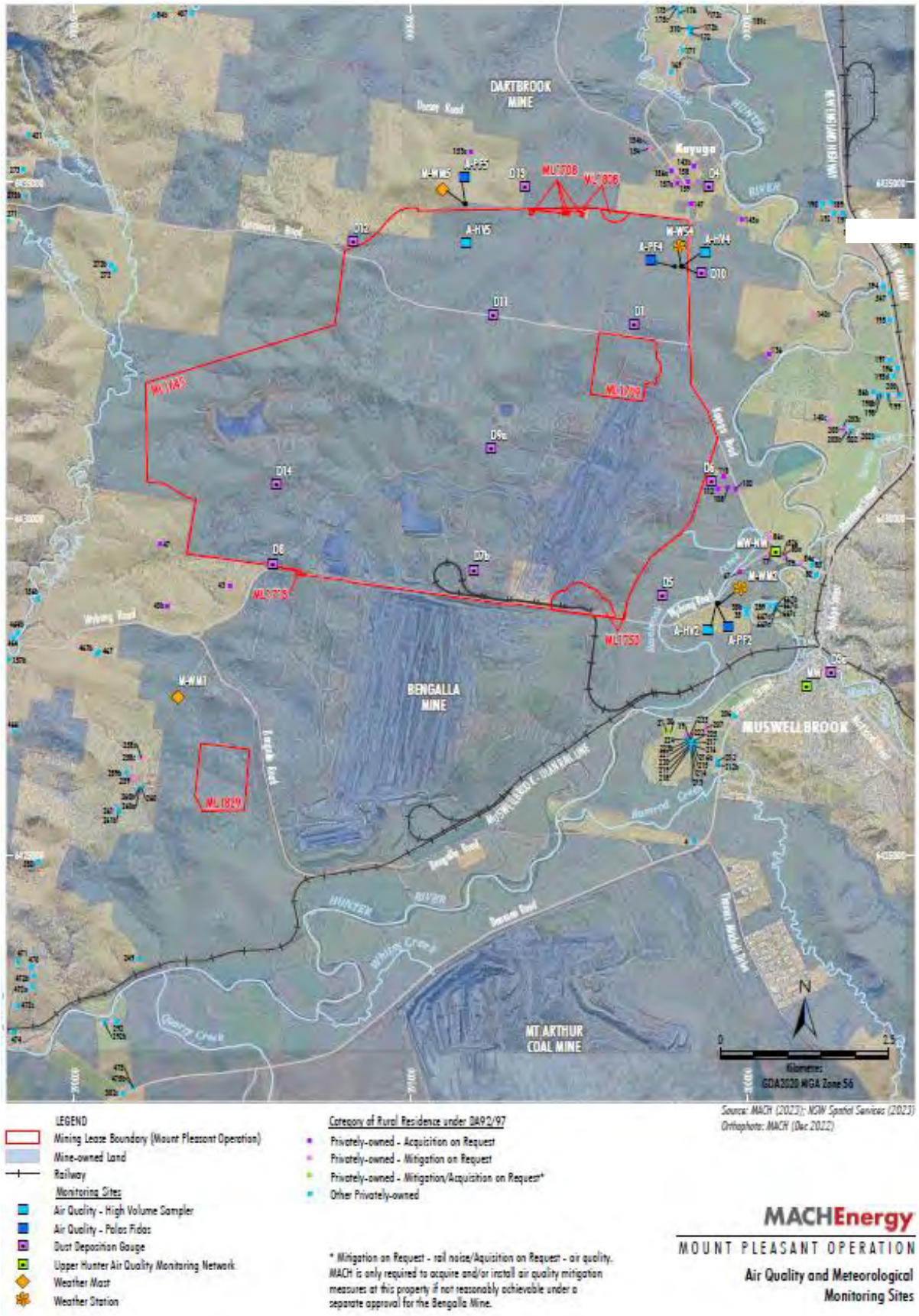

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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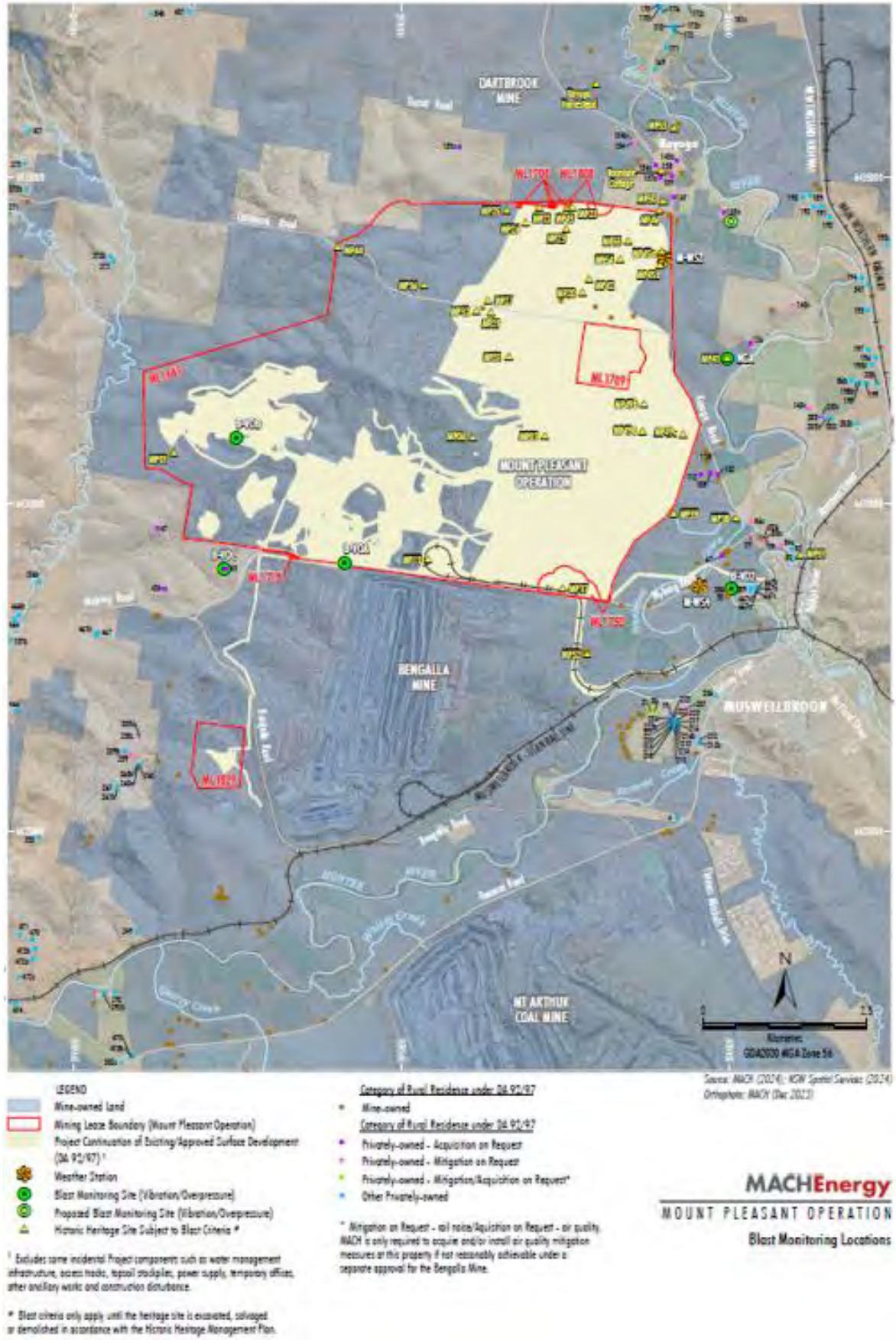

Figure 2-3 – MPO Blast Monitoring Locations

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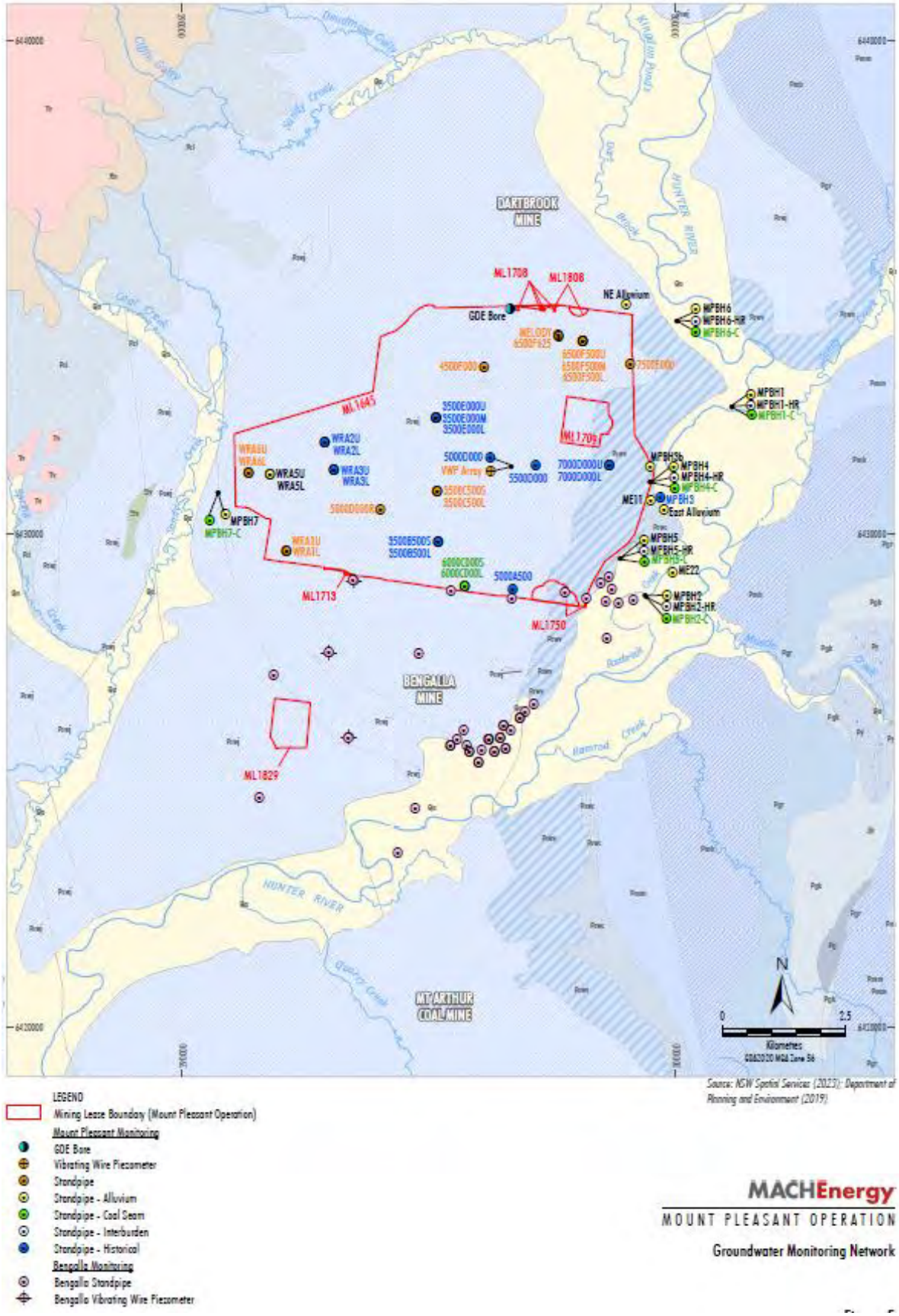

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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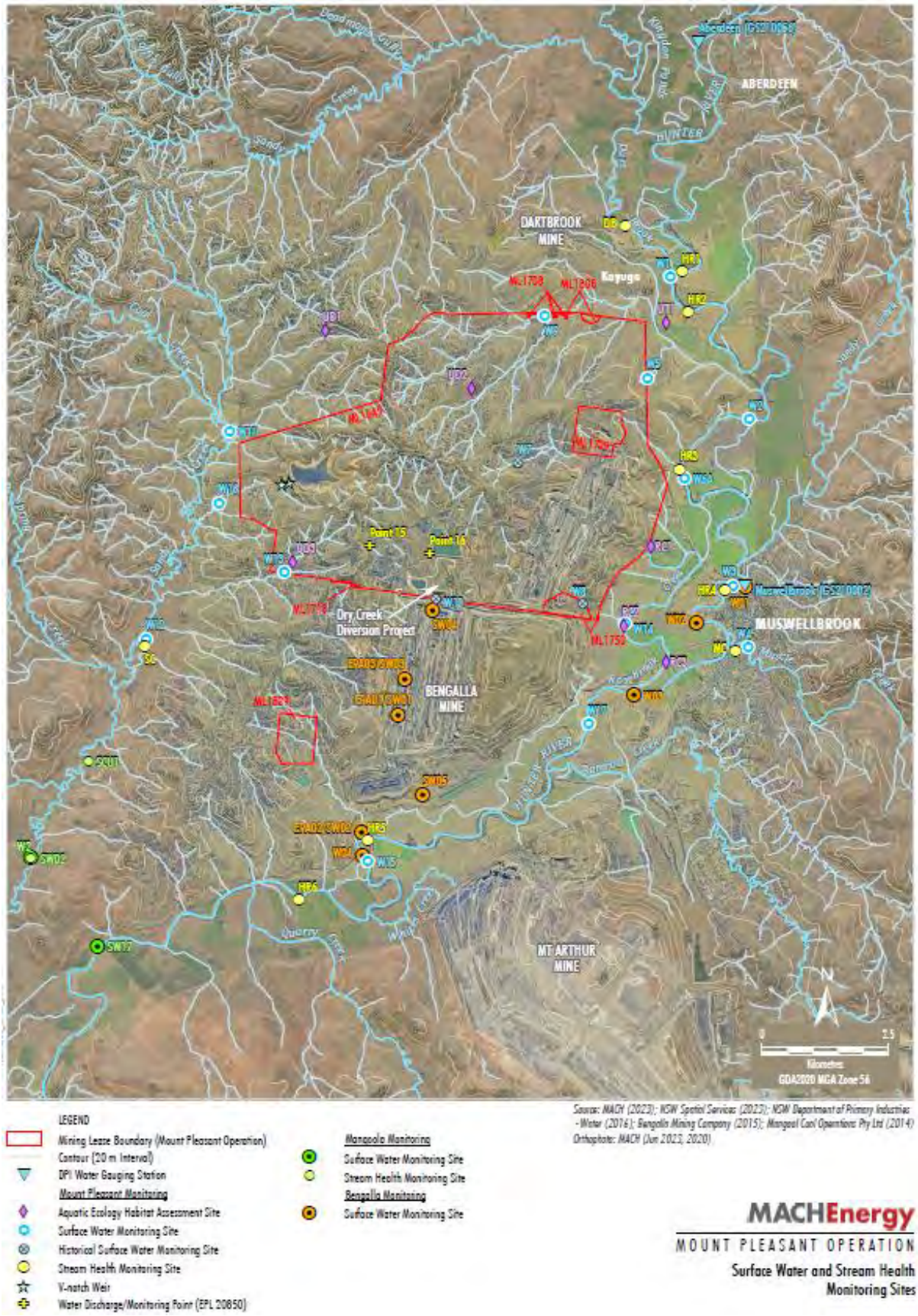

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 during January 2025 (the monitoring period). An additional monitor (E-BAM) is located at M-WS2 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4.
Throughout January 2025, there was 74mm and 123.4mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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4.2 Results

The dust deposition exposure period for gauges commenced on 30 December 2024. Sample collection was undertaken on 29 January 2025 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for January 2025 have been provided as an indication of performance between February 2024 – January 2025 and represents 12 month average results for 2024 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – January 2025

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	3.9	2.3
D3	3.2	1.3
D4	1.8	1.2
D5a	2.2	2.2
D6	2.4	2
D7b	8.2	8.8
D8	5.1	4.7
D9a	6.7	3.6
D10	*	1.1
D11	3.8	3.4
D12	2.7	1.1
D13	3.4	1.6
D14	4.6	3.2
Criterion	-	4

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

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Field notes from the January sampling event noted that all thirteen gauges contained insects, three also contained vegetation, one contained bird droppings and two contained suspended solids. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (8.8 g/m2) and D8 (4.7 g/m2).

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

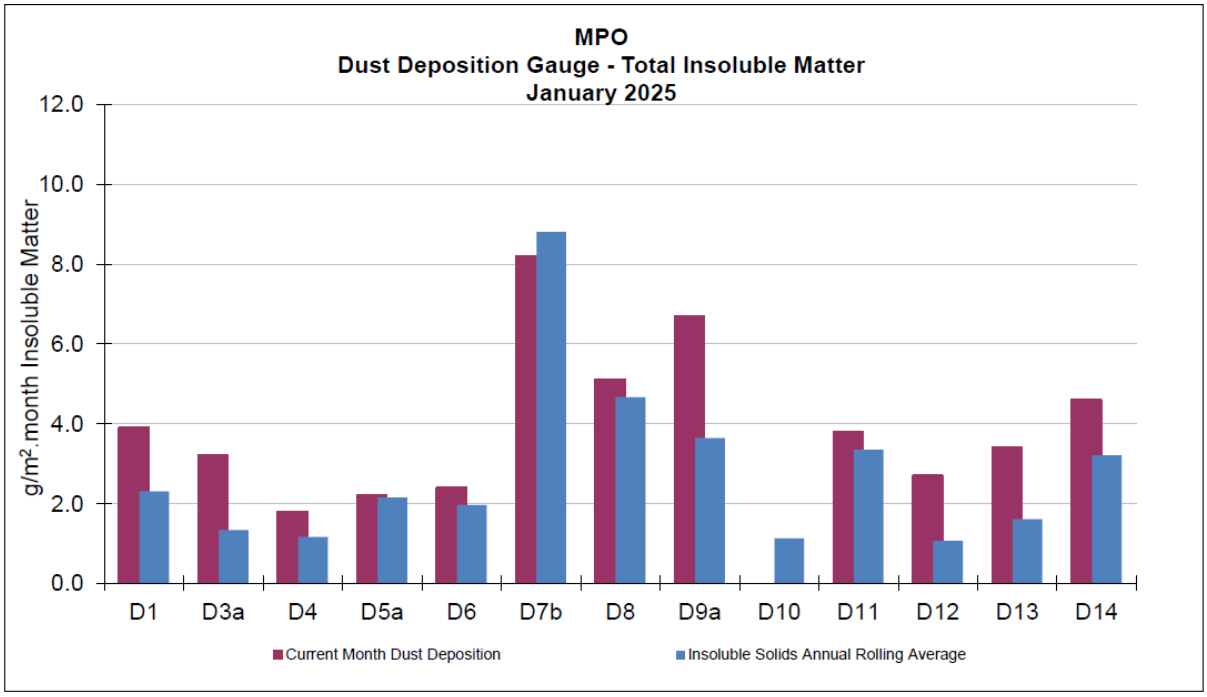

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – January 2025

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

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5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Annual rolling averages for January 2025 have been provided as an indication of performance between February 2024 – January 2025 and represent a 12 month average results as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – January 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
1/12/2024	-	115	88.2	133
7/12/2024	-	40.1	66.4	60.3
13/12/2024	-	17.1	21.5	13.6
19/12/2024	-	81.7	93.9	54.3
25/12/2024	-	31.6	59.2	27
*Monthly Mean	-	57.1	65.8	57.6
Annual Rolling Average	90	47	45	35

Notes:
** Results have been rounded to one decimal place for reporting purposes where applicable.*
^ Indicates makeup run results for run date 11/11/2024.

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during January 2025.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages for January 2025 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during the last 12 month as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

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6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in January 2025. Real time PM_{10} 24 hour daily average results for January 2024 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – January 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
1/01/2025	19	22		27.6	50
2/01/2025	18	19		31.2	50
3/01/2025	11	14		16.4	50
4/01/2025	17	27		23.9	50
5/01/2025	24	50		31	50
6/01/2025	23	29		31.7	50
7/01/2025	9	12		11.9	50
8/01/2025	4	8		7.9	50
9/01/2025	6	10		10.5	50
10/01/2025	6	10		9	50
11/01/2025	6	10		9.1	50
12/01/2025	8	13		14.3	50
13/01/2025	12	23		16.7	50
14/01/2025	16	30		25.5	50
15/01/2025	34	22		-	50
16/01/2025	9			7.4	50
17/01/2025	8		15	13.5	50
18/01/2025	5		10	12.3	50
19/01/2025	12		17	17.6	50
20/01/2025	12		27	21.9	50
21/01/2025	15		29	26.8	50
22/01/2025	19		31	29.8	50
23/01/2025	17		33	25	50
24/01/2025	17		21	27.9	50
25/01/2025	13		22	21.2	50
26/01/2025	12		22	21.6	50
27/01/2025	13		18	19.8	50
28/01/2025	16		19	24.2	50
29/01/2025	21		25	30.5	50
30/01/2025	9		15	14.6	50
31/01/2025	7	10	14	12.7	50

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites January 2025.

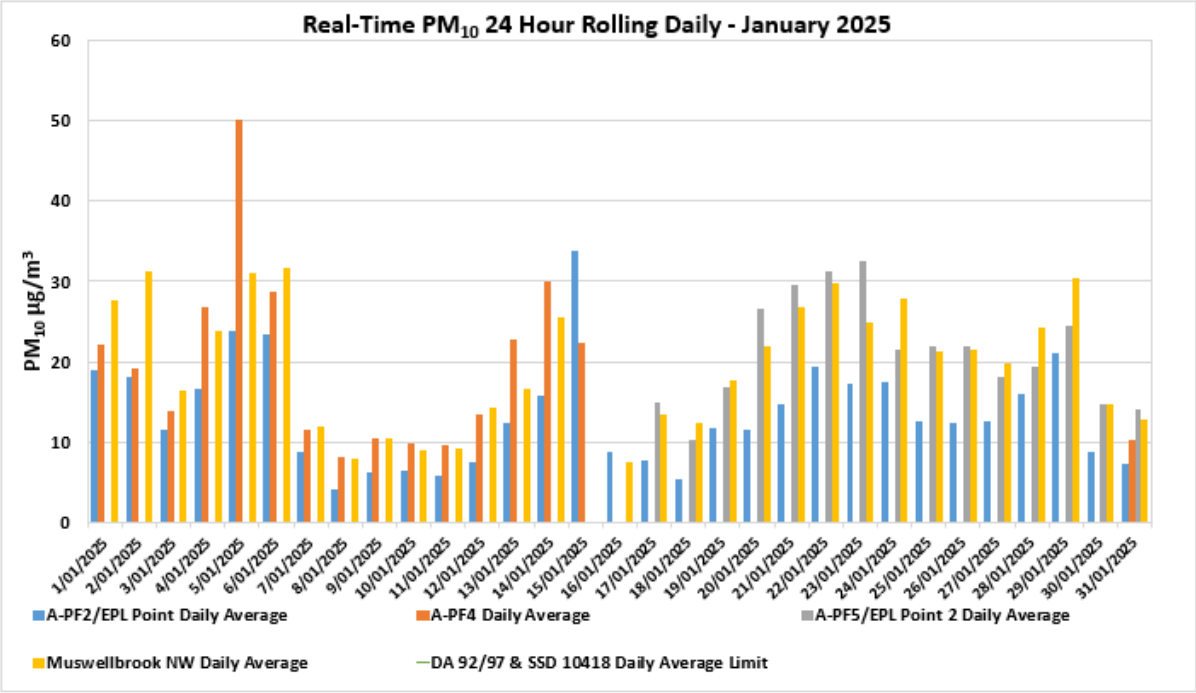

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for January 2025.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during January 2025. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

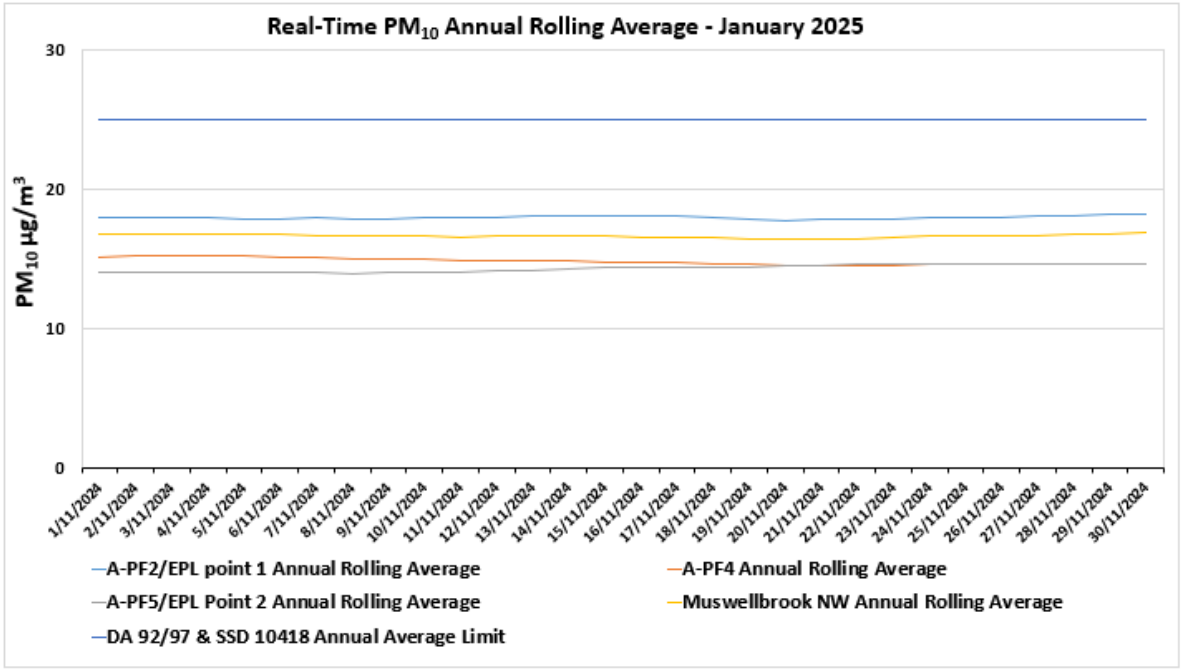

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Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for January 2025.

6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during January 2025. Real time $PM_{2.5}$ 24 hour rolling average results for January 2025 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – January 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
1/01/2025	9	8		25
2/01/2025	8	8		25
3/01/2025	6	6		25
4/01/2025	6	6		25
5/01/2025	8	9		25
6/01/2025	7	7		25
7/01/2025	6	5		25
8/01/2025	3	3		25
9/01/2025	4	4		25
10/01/2025	4	4		25
11/01/2025	4	4		25
12/01/2025	4	4		25
13/01/2025	6	7		25
14/01/2025	7	8		25
15/01/2025		6		25
16/01/2025				25
17/01/2025			5	25
18/01/2025	4		4	25
19/01/2025	6		6	25
20/01/2025	6		7	25
21/01/2025	6		7	25
22/01/2025	7		7	25
23/01/2025	8		9	25
24/01/2025	8		7	25
25/01/2025	6		6	25
26/01/2025	6		6	25
27/01/2025	6		6	25
28/01/2025	7		6	25
29/01/2025	11		10	25
30/01/2025	6		6	25
31/01/2025	4	4	5	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Real time $PM_{2.5}$ 24-hour average results for January 2025 are presented in **Figure 6-3** below.

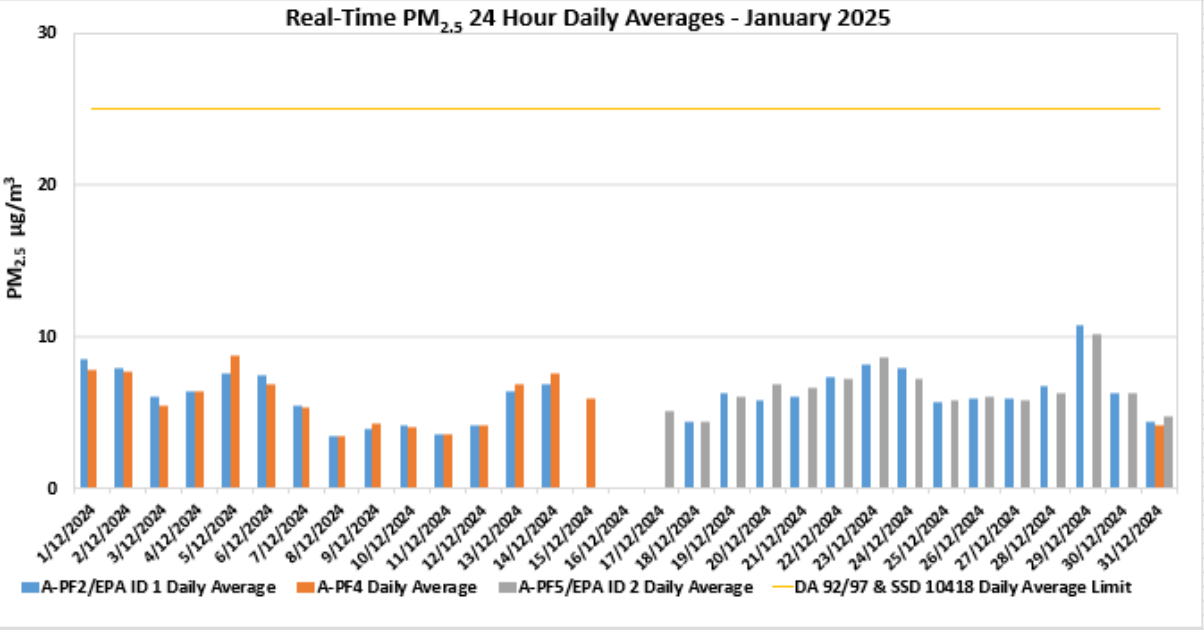

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for January 2024.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during January 2025. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

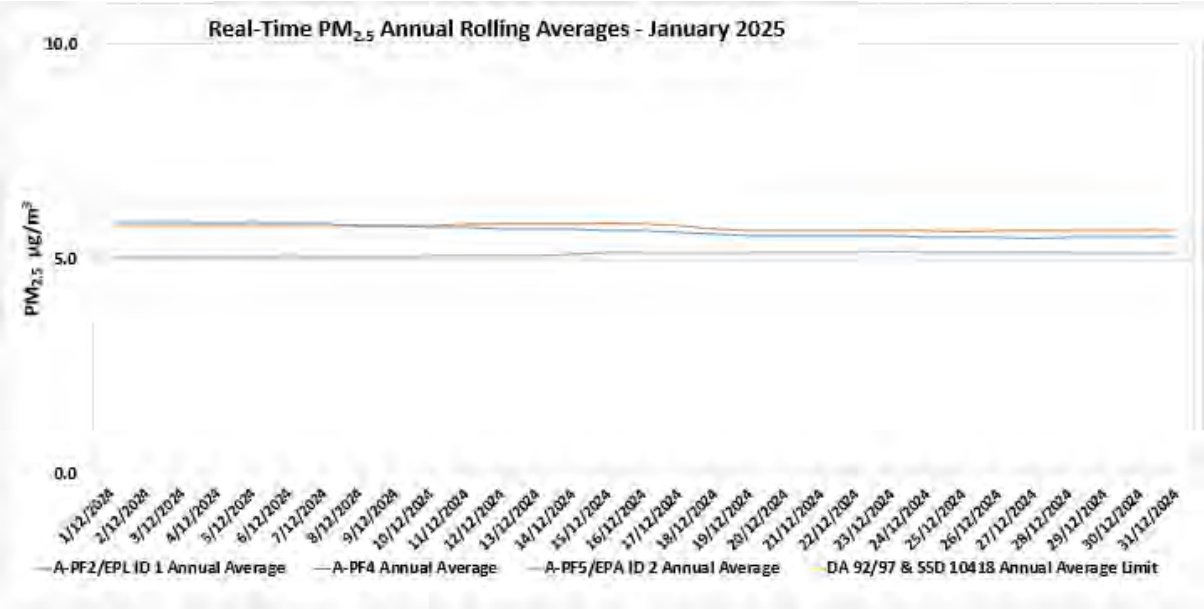

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for January 2025.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2024) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 16 January 2025. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 16 January 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	7.8	460	260	18
W2	**	**	**	**
W3	7.9	530	270	25
W4	7.8	2350	1300	17
W5	*	*	*	*
W6A	7.8	520	260	29
W9	6.7	80	150^	19
W11	**	**	**	**
W12	8.2	4500	2500	< 5
W13	8.2	2550	1400	37
W14	*	*	*	*
W15	8	660	370	26
W16	**	**	**	**
W17	8	660	370	33

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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During 16 January 2025 monitoring event, two (2) sites was dry and one (3) site were unable to be accessed due to track conditions. Sites W6A, W13, W15 and W17 were above their respective EC trigger levels. Sites W12 and W13 were above their respective pH trigger levels. Sites W6A and W15 were above the respective TSS trigger levels.

Site W6A was above the respective EC trigger level for five consecutive monitoring events during the last monthly environmental report (December 2024) and continues to be above trigger levels for January 2025.

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

Site W6A continued to exceed the respective EC trigger level (520 µS/cm) for January 2025); however, according to Table 26 of the WMP no further investigation is required as the upstream site W2 (Hunter River reference site) was also previously found to be exceeding trigger levels.

8. Groundwater Monitoring

The next quarterly groundwater monitoring event is scheduled for February 2025

9. Noise Monitoring

Attended noise monitoring was undertaken during the night of 14th January 2025 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2021) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in January 2025 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 14 January 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	11:31pm	IA	45	1.1 / 219	Yes	E	No
N-AT2	10:44pm	IA	45	1.6 / 178	Yes	D	No
N-AT3	10:15pm	IA	45	2.6 / 170	Yes	D	No
N-AT4	10:41pm	33	45	0.7 / 270	Yes	D	No
N-AT5	11:02pm	IA	45	0.5 / 314	No	F	No
N-AT6	11:49pm	IA	45	0.5 / 083	No	F	No
N-AT7	10:05pm	IA	45	2.7 / 161	Yes	D	No
N-AT8	11:22pm	43	NA[2]	0.8 / 285	NA[6]	F	NA[6]

Notes:

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1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 14 Jan 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2.4]	Criterion dB	Wind Speed m/s	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	11:31pm	IA	45	1.1 / 219	Yes	E	No
N-AT2	10:44pm	IA	45	1.6 / 178	Yes	D	No
N-AT3	10:15pm	IA	45	2.6 / 170	Yes	D	No
N-AT4	10:41pm	26	45	0.7 / 270	Yes	D	No
N-AT5	11:02pm	IA	45	0.5 / 314	No	F	No
N-AT6	11:49pm	IA	45	0.5 / 083	No	F	No
N-AT7	10:05pm	IA	45	2.7 / 161	Yes	D	No
N-AT8	11:22pm	39	NA[2]	0.8 / 285	NA[6]	F	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 14 Jan 2025

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	11:31pm	IA	40	No
N-AT2	10:44pm	IA	40	No
N-AT3	10:15pm	IA	40	No
N-AT4	10:41pm	26	40	No
N-AT5	11:02pm	IA	40	No
N-AT6	11:49pm	IA	40	No
N-AT7	10:05pm	IA	40	No
N-AT8	11:22pm	39	NA[4]	NA[4]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*

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2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

10. Blast Monitoring

There were six (6) blast events during January 2025 (a total of 6 blasts YTD). Results for January are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – January 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
2/01/2025	12:51	0.290 mm/s	107 DBL	0.330 mm/s	118 DBL	Y
8/01/2025	15:07	0.550 mm/s	102 DBL	0.340 mm/s	104 DBL	Y
14/01/2025	13:28	0.190 mm/s	86.1 DBL	0.380 mm/s	90.5 DBL	Y
16/01/2025	14:43	0.310 mm/s	106 DBL	0.230 mm/s	95.5 DBL	Y
23/01/2025	13:00	0.120 mm/s	106 DBL	0.240 mm/s	107 DBL	Y
31/01/2025	10:31	1.850 mm/s	105 DBL	0.610 mm/s	103 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

February 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 February 2025
Reporting Period End Date	28 February 2025
Date All Data Received	23 March 2025

Links to three key regulatory documents are provided here:

- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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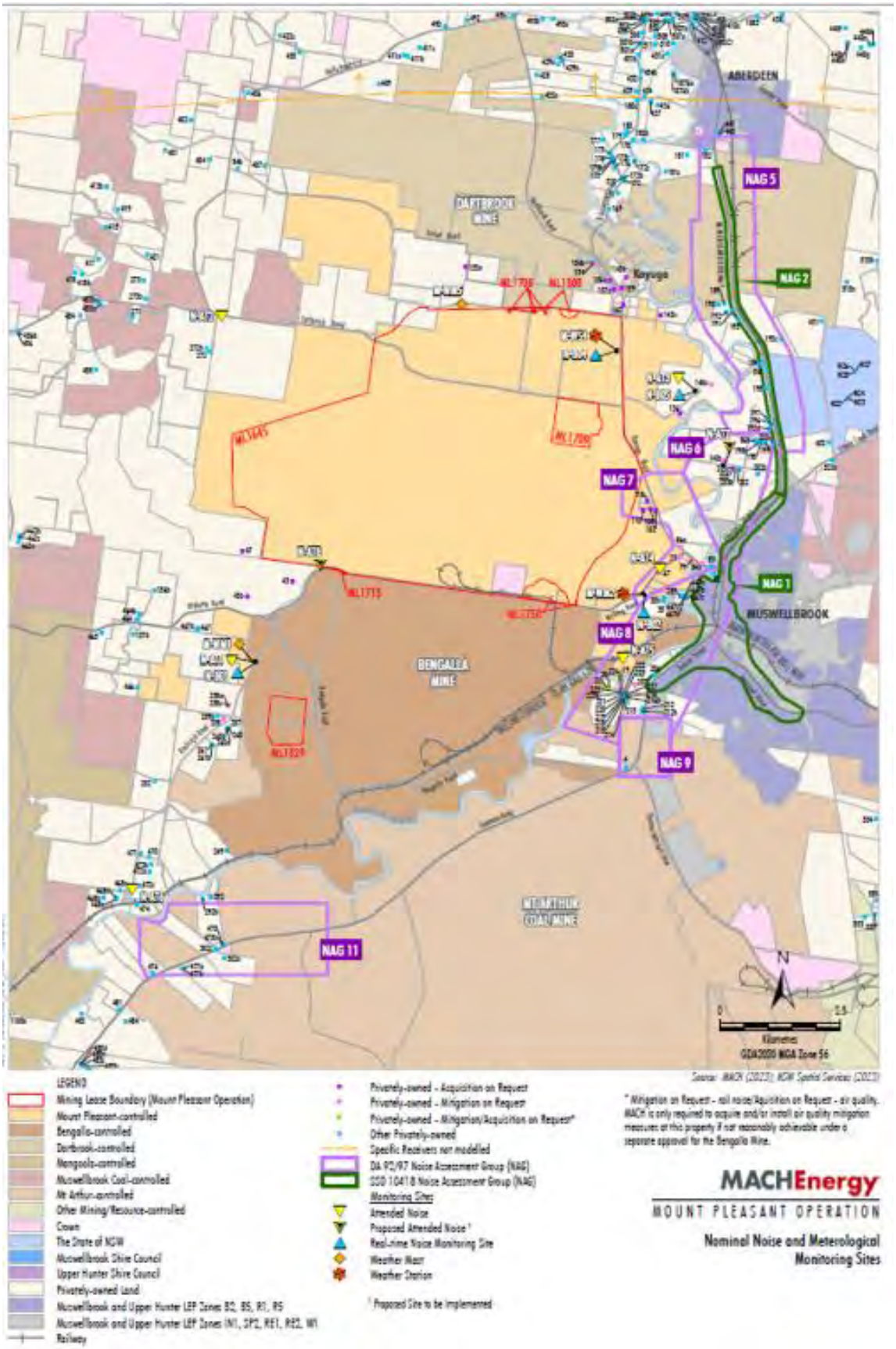

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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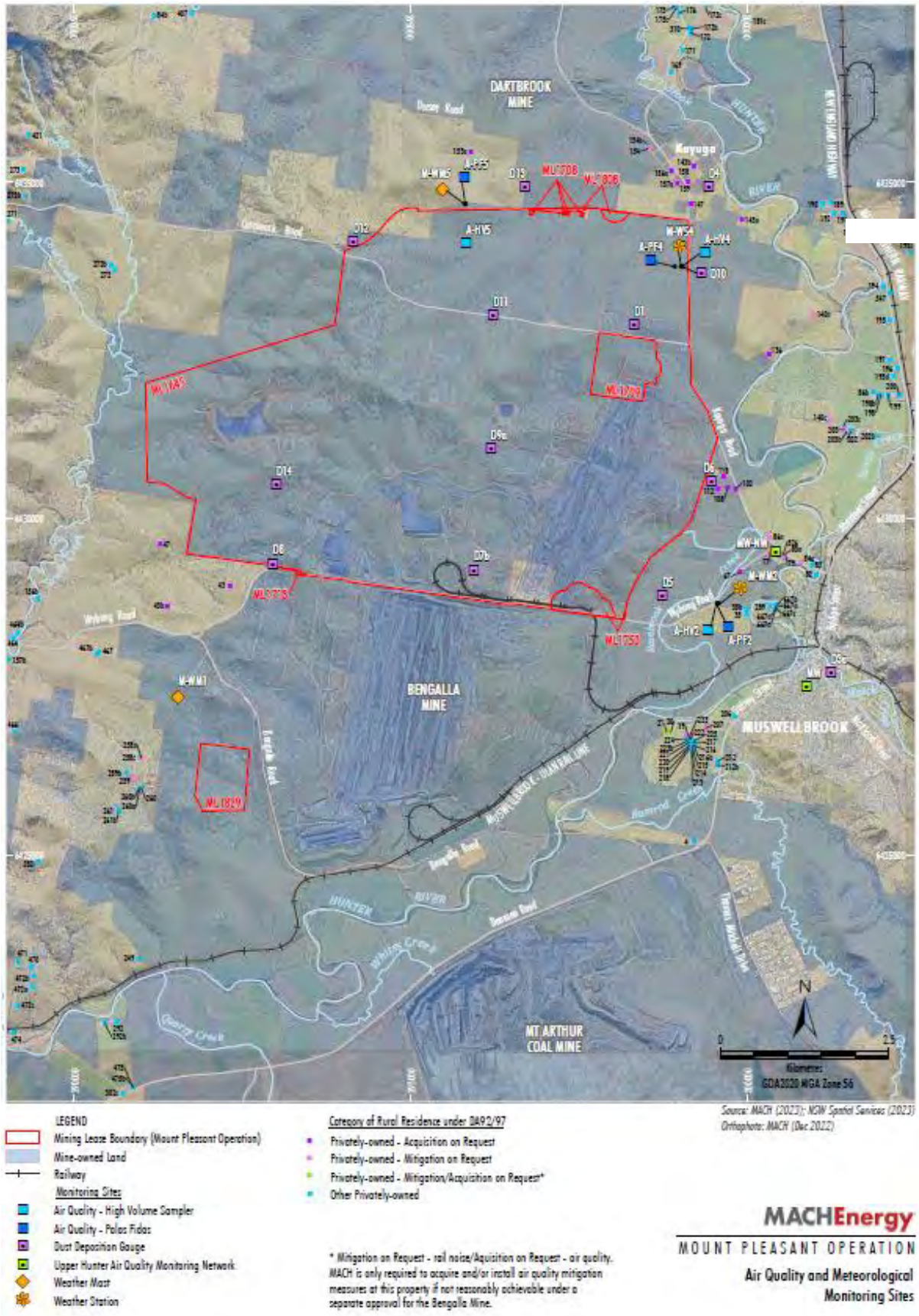

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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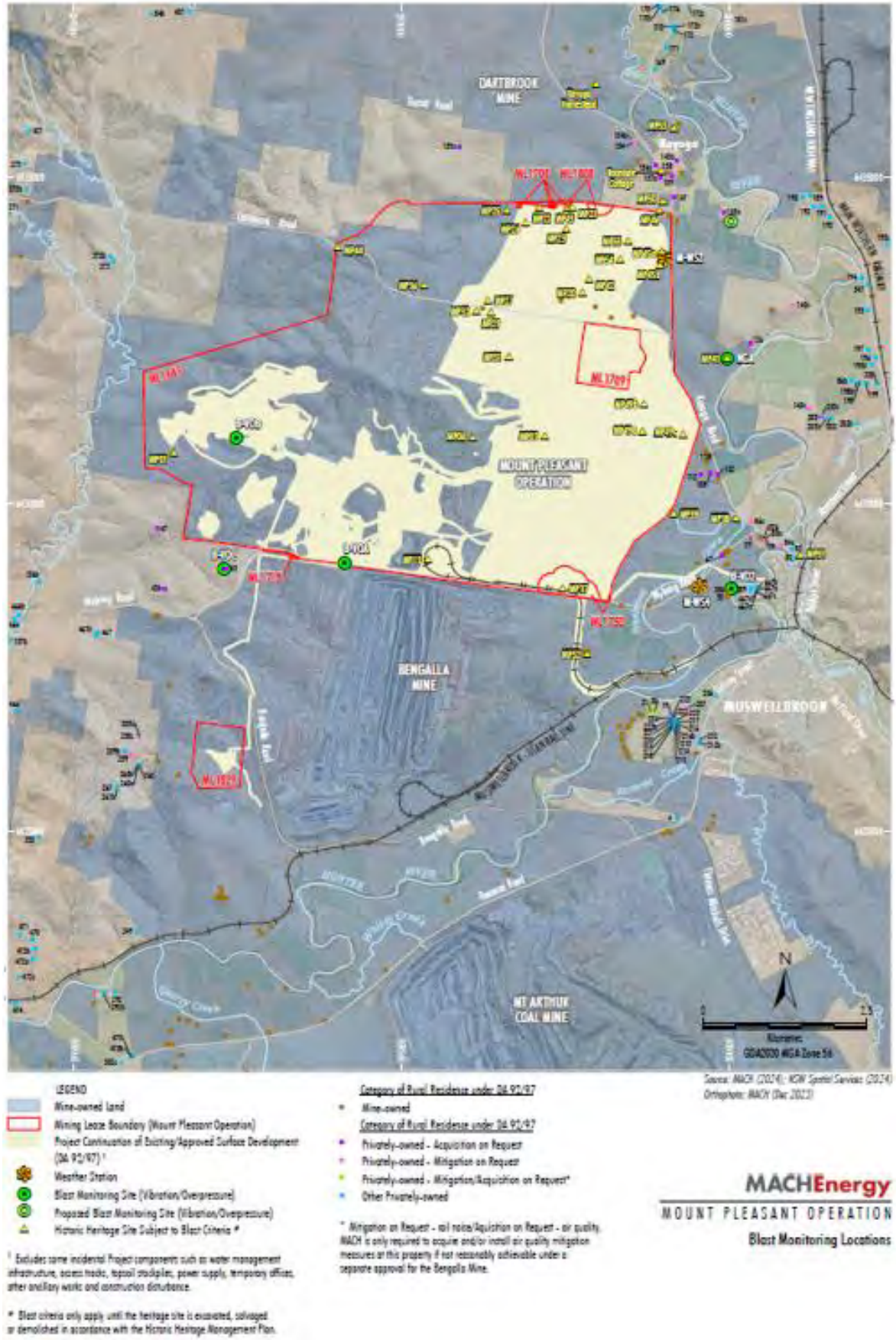

Figure 2-3 – MPO Blast Monitoring Locations

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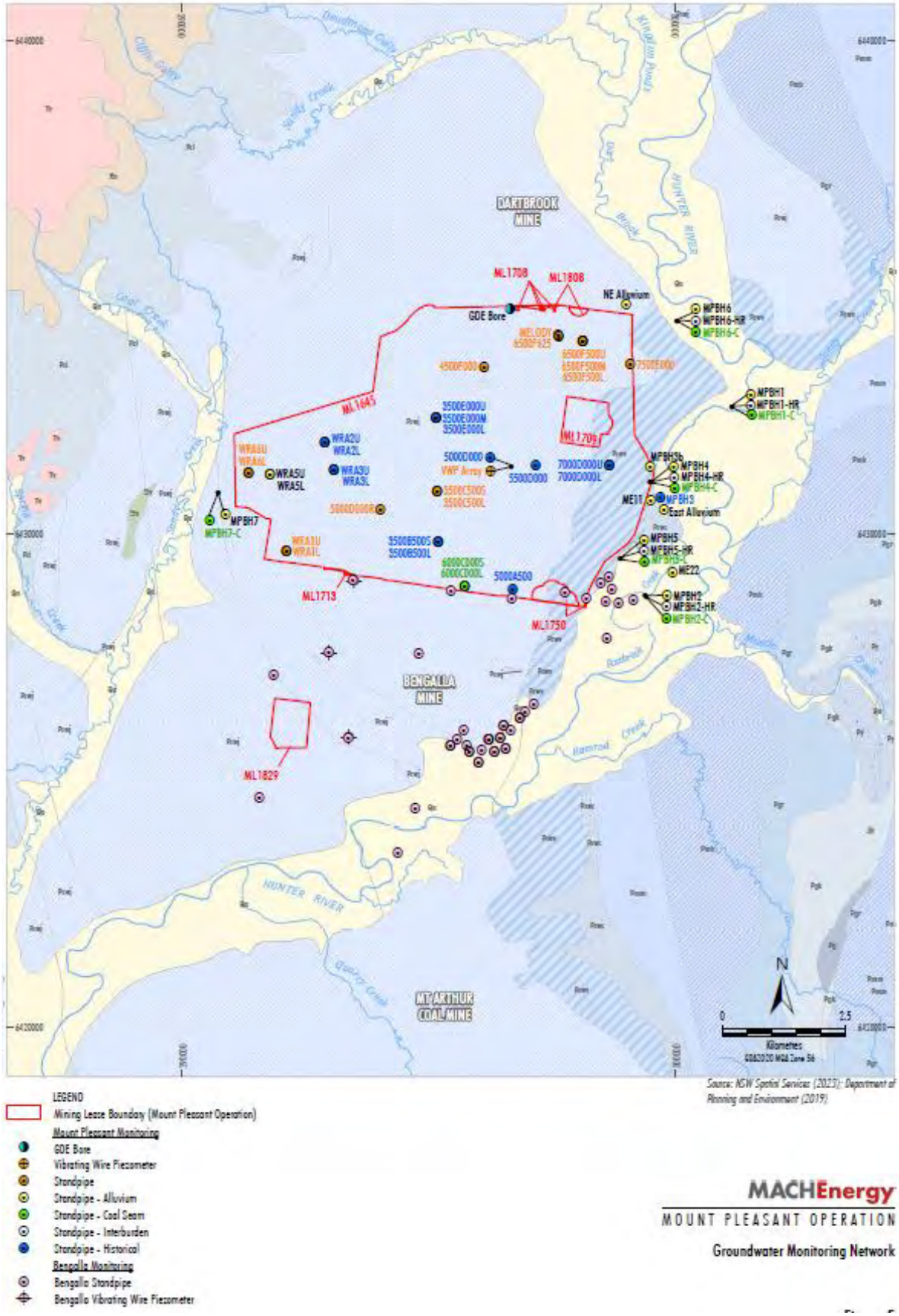

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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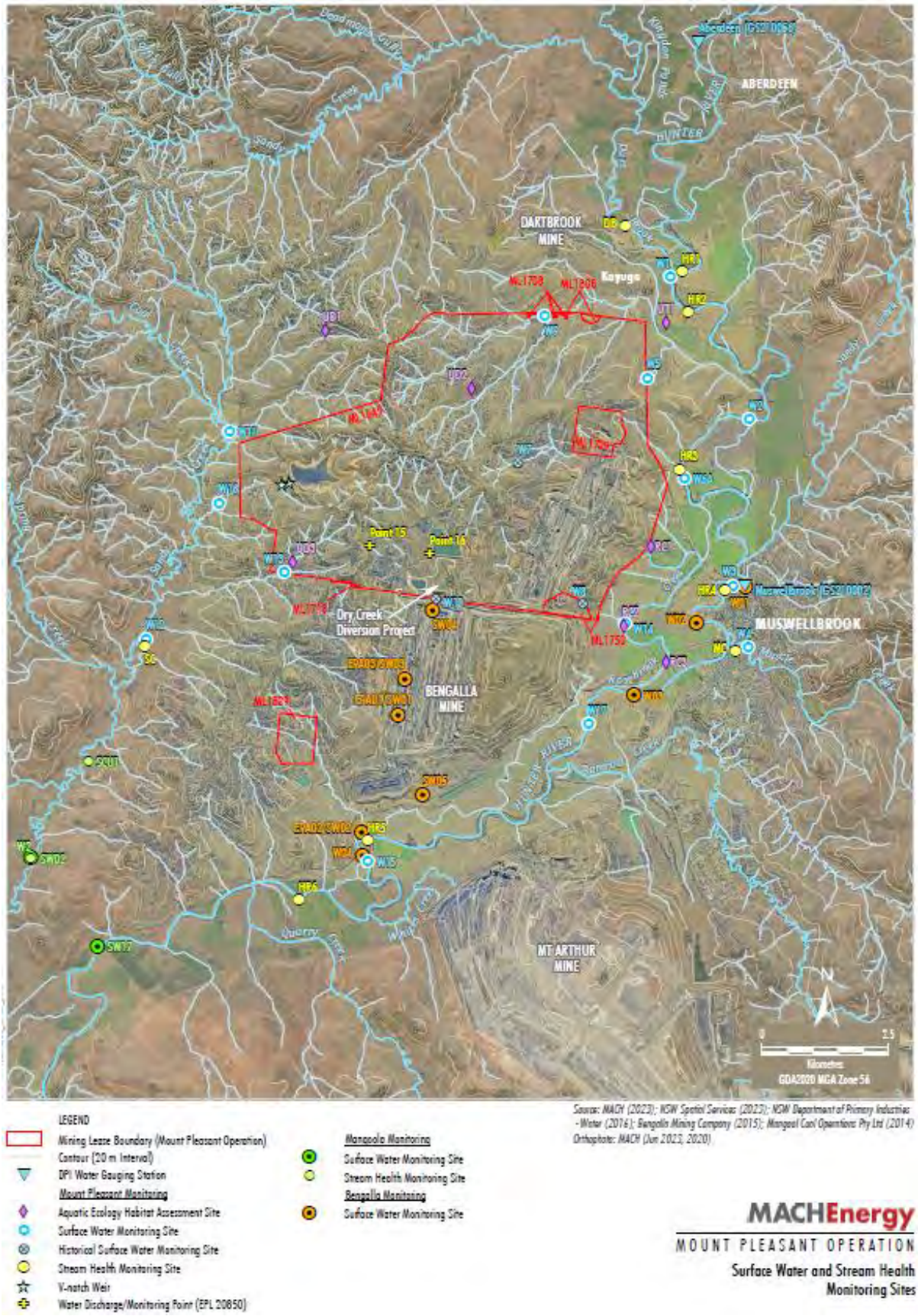

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 during February 2025 (the monitoring period). An additional monitor (E-BAM) is located at M-WS2 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4.
Throughout February 2025, there was 46.2mm and 53mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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4.2 Results

The dust deposition exposure period for gauges commenced on 29 January 2025. Sample collection was undertaken on 27 February 2025 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for February 2025 have been provided as an indication of performance between March 2024 – February 2025 and represents 12month average results as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – February 2025

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	3.2	2.4
D3	3.6	3.6
D4	1.5	1.1
D5a	1.9	2.1
D6	1.8	1.9
D7b	8.5	9.2
D8	6.3	4.8
D9a	5.9	3.7
D10	1.2	1.1
D11	3.8	3.3
D12	2.5	1.1
D13	3.2	1.7
D14	5.7	3.5
Criterion	-	4

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

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Field notes from the February sampling event noted that all thirteen gauges contained insects, nine also contained vegetation, one contained bird droppings. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (9.2 g/m2) and D8 (4.8 g/m2).

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

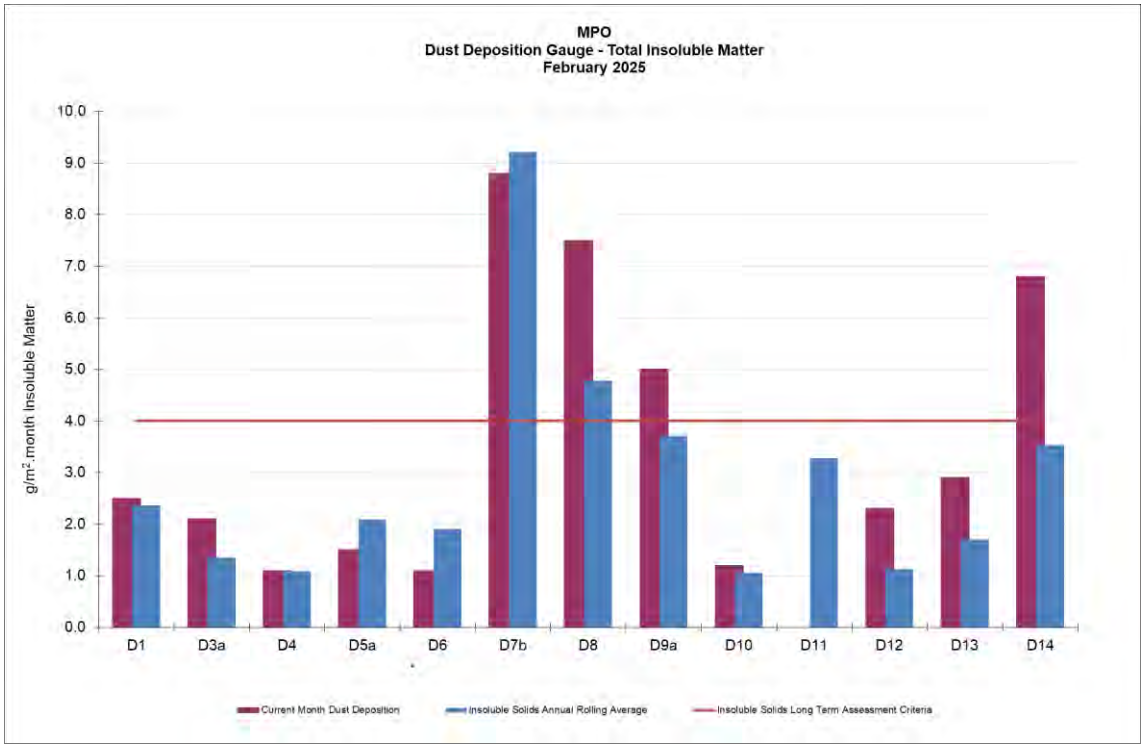

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – February 2025

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

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5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Twelve month rolling averages to February 2025 is provided as an indication of performance between March 2024 – February 2025 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – February 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
5/02/2025	-	29.2	59.9	51.8
11/02/2025	-	16.4	30.7	26.8
17/02/2025	-	44.9	95.6	54.3
23/02/2025	-	82.5	91.8	54.7
*Monthly Mean	-	43.2	69.5	46.9
Annual Rolling Average	90	46	45	36

Notes:
** Results have been rounded to one decimal place for reporting purposes where applicable.*
^ Indicates makeup run results for run date 11/11/2024.

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during February 2025.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages to February 2025 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during the last 12 month as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

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6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in February 2025. Real time PM_{10} 24 hour daily average results for February 2025 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – February 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
1/02/2025	12.93	10.67	13.04	13.04	50
2/02/2025	13.85	11.68	15.17	15.17	50
3/02/2025	12.85	10.65	17.49	17.49	50
4/02/2025	16.83	14.14	21.03	21.03	50
5/02/2025	20.43	16.02	17.13	17.13	50
6/02/2025			27.74	27.74	50
7/02/2025	15.86		18.49	18.49	50
8/02/2025	16.17		22.66	22.66	50
9/02/2025	18.41		19.46	19.46	50
10/02/2025	23.35		23.21	23.21	50
11/02/2025	15.44		15.64	15.64	50
12/02/2025	12.57		14.05	14.05	50
13/02/2025	13.00	11.74	14.98	14.98	50
14/02/2025	15.84	13.44	23.52	23.52	50
15/02/2025	16.04	13.12	14.40	14.40	50
16/02/2025	22.45	16.33	11.31	11.31	50
17/02/2025	16.67	21.51	23.59	23.59	50
18/02/2025	17.25	14.58	22.50	22.50	50
19/02/2025	21.99	18.39	26.03	26.03	50
20/02/2025	21.28	16.23	26.66	26.66	50
21/02/2025	20.93	14.09	19.82	19.82	50
22/02/2025	19.06	13.37	16.73	16.73	50
23/02/2025	19.99	14.79	18.87	18.87	50
24/02/2025	25.42	14.31	13.46	13.46	50
25/02/2025	31.00	20.59	21.20	21.20	50
26/02/2025	22.20	15.46	18.59	18.59	50
27/02/2025	22.17	18.49	26.63	26.63	50
28/02/2025	22.77	19.74	26.95	26.95	50

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites February 2025.

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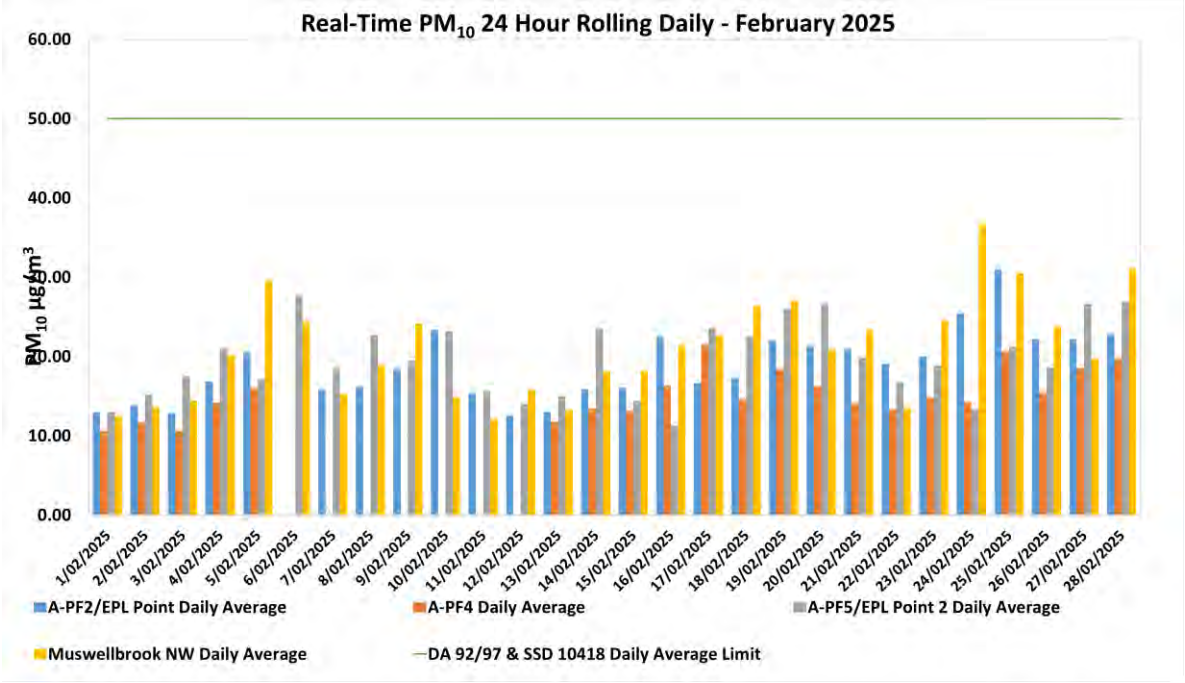
Figure 6-1: Real-time PM_{10} 24 Daily Average Results for February 2025.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during February 2025. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.



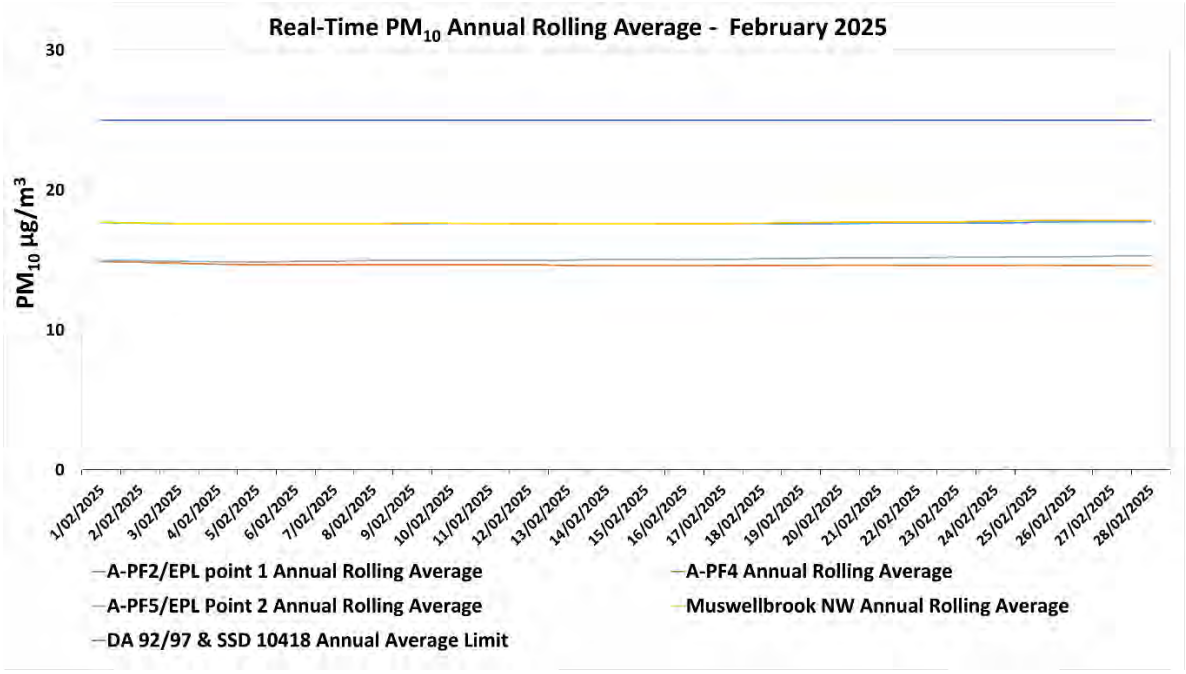


Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for February 2025.

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6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during February 2025. Real time $PM_{2.5}$ 24 hour rolling average results for Februaryy 2025 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – February 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
1/02/2025	4.81	4.72	4.89	25
2/02/2025	4.94	4.78	5.00	25
3/02/2025	4.41	4.11	4.79	25
4/02/2025	4.95	4.60	5.27	25
5/02/2025	5.38	4.54	6.10	25
6/02/2025			11.50	25
7/02/2025	6.67		7.12	25
8/02/2025	5.41		5.90	25
9/02/2025	6.83		6.74	25
10/02/2025	10.54		9.89	25
11/02/2025	6.06		5.82	25
12/02/2025	5.47		5.49	25
13/02/2025	5.55	5.45	5.72	25
14/02/2025	5.32	4.93	6.02	25
15/02/2025	5.29	4.70	4.74	25
16/02/2025	5.41	4.29	3.67	25
17/02/2025	4.39	4.94	5.27	25
18/02/2025	5.13	4.77	6.15	25
19/02/2025	5.64	5.10	7.00	25
20/02/2025	5.40	4.89	6.97	25
21/02/2025	5.91	5.24	6.42	25
22/02/2025	6.06	5.58	6.63	25
23/02/2025	5.27	4.87	5.96	25
24/02/2025	5.90	4.71	5.37	25
25/02/2025	8.70	7.66	8.42	25
26/02/2025	6.95	6.18	7.28	25
27/02/2025	6.77	6.15	8.05	25
28/02/2025	6.29	5.71	7.55	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

Real time $PM_{2.5}$ 24-hour average results for February 2025 are presented in **Figure 6-3** below.

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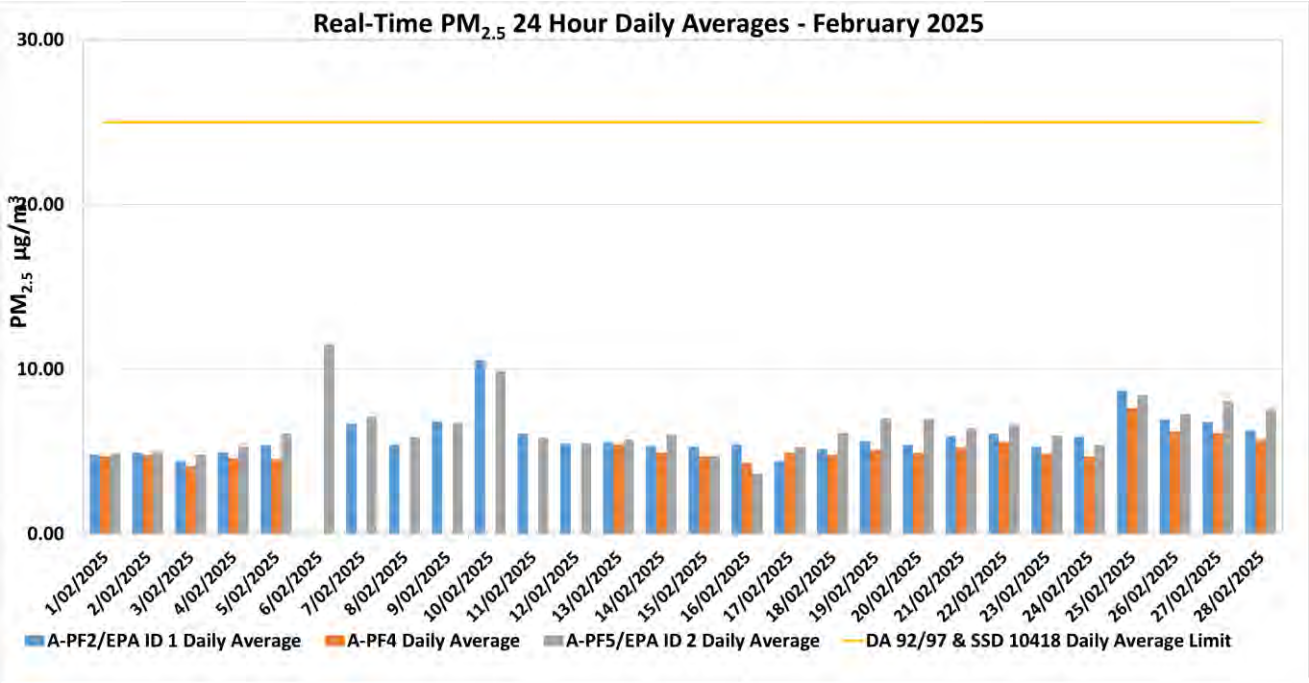

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for February 2024.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during February 2025. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

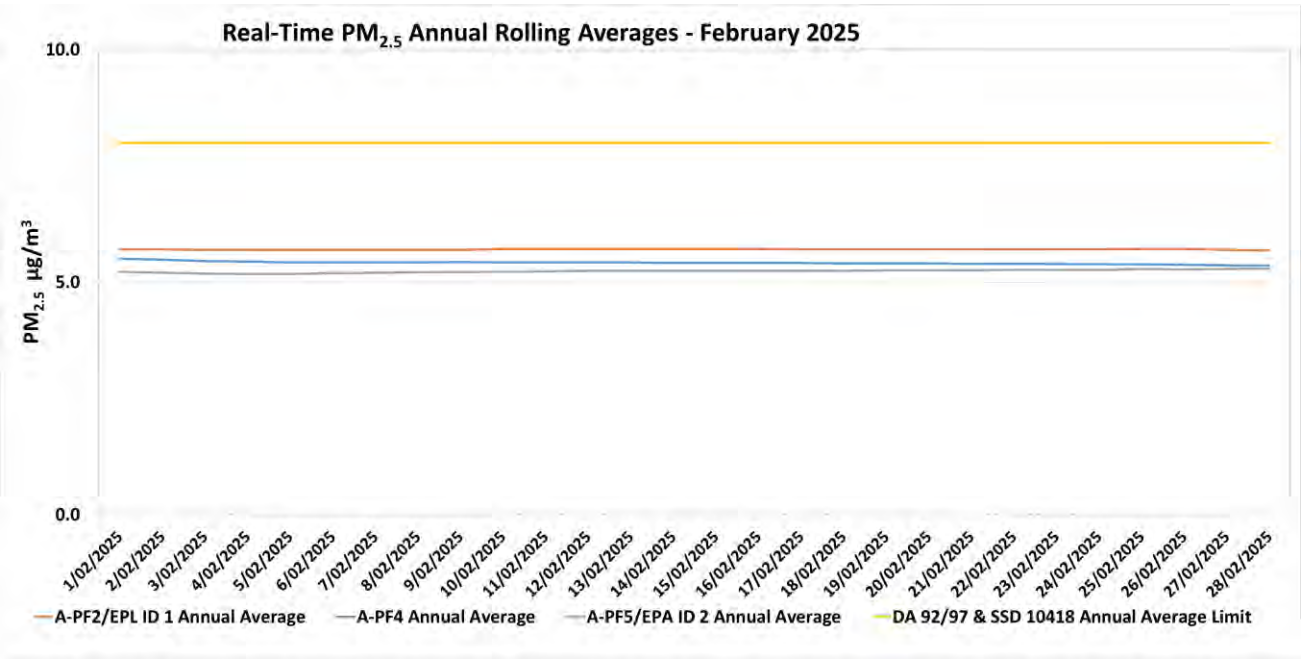

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for February 2025.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2024) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 12 February 2025. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 12 February 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.0	**558**	300	13
W2	7.9	**811**	450	9.5
W3	8.1	648	350	16
W4	7.7	1870	1100	9
W5	*	*	*	*
W6A	8.2	**793**	460	17
W9	*	*	*	*
W11	**8.4**	3610	2000	< 5
W12	8.1	5070	2800	12
W13	8.2	2910	1700	16
W14	*	*	*	*
W15	**8.3**	**881**	450	**49**
W16	8.3	4910	2800	18
W17	7.4	**773**	420	30

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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During 12 February 2025 monitoring event, three (3) sites were dry. Sites W1, W2, W6A, W15 and W17 were above their respective EC trigger levels. Sites W11 and W15 were above their respective pH trigger levels. Sites W15 was above the TSS trigger level.

Site W6A was above the respective EC trigger level for five consecutive monitoring events during the last monthly environmental report (January 2024) and continues to be above trigger levels for February 2025.

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

Site W6A continued to exceed the respective EC trigger level (520 µS/cm) for February 2025); however, according to Table 26 of the WMP no further investigation is required as the upstream site W2 (Hunter River reference site) was also found to be exceeding trigger levels.

8. Groundwater Monitoring

Quarterly groundwater monitoring was conducted between 18, 20 and 26 of February 2025. Water level results for the groundwater bores are presented in **Table 8-1**. The quarterly pH and EC results are presented in **Table 8-2** and **Table 8-3**, respectively.

Table 8-1 - MPO Quarterly Groundwater Water Level Results

Monitoring Location/ ID	Water Level Trigger Range		February 2025 Water Level (DTW)	Nov 2024 Water Level (DTW)	August 2024 Water Level (DTW)	Triggered (Yes/No)
	80th Percentile (DTW)	Trigger				
WRA1L	-	>± 0.5m	2.44	1.98	3.37	
WRA1U	-	>± 0.5m	*	*	*	
WRA3L-R**	-	>± 0.5m	*	-	-	
WRA3U-R**	-	>± 0.5m	*	-	-	
WRA5L-R**	-	>± 0.5m	*	-	-	
WRA5U-R**	-	>± 0.5m	*	-	-	
WRA6L	-	>± 0.5m	0.37	0.36	0.12	
WRA6U	-	>± 0.5m	0.91	0.88	0.75	
MPBH1	9.71	10.70	9.72	9.74	9.37	No
MPBH2	12.20	13.59	11.82	11.74	11.64	No
MPBH3b	13.04	Dry (or 14.0m)	11.89	11.83	11.81	No
MPBH4	-	>± 0.5m	12.19	12.09	12.19	
MPBH5	-	>± 0.5m	*	*	*	
MPBH1-C	-	>± 0.5m	9.623	9.623	9.203	
MPBH1-HR	-	>± 0.5m	32.22	34.69	38.34	

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Monitoring Location/ ID	Water Level Trigger Range		February 2025 Water Level (DTW)	Nov 2024 Water Level (DTW)	August 2024 Water Level (DTW)	Triggered (Yes/No)
	80th Percentile (DTW)	Trigger				
MPBH2-C	-	>± 0.5m	11.833	11.743	11.643	
MPBH2-HR	-	>± 0.5m	11.856	11.756	11.686	
MPBH4-C	-	>± 0.5m	10.913	10.843	10.793	
MPBH4-HR	-	>± 0.5m	49.875	49.895	50.036	
MPBH5-C	-	>± 0.5m	11.479	11.359	11.669	
MPBH5-HR	-	>± 0.5m	11.52	11.42	11.34	
MPBH6	-	>± 0.5m	9.44	9.41	9.25	
MPBH6-C	-	>± 0.5m	10.848	10.838	11.048	
MPBH6-HR	-	>± 0.5m	10.355	10.295	10.195	
MPBH7	10.1	>± 0.5m	5.29	4.95	4.42	No
MPBH7-C	-	>± 0.5m	17.435	17.66	15.045	
3500C500L	-	>± 0.5m	25.98	25.79	25.65	
3500C500S	-	>± 0.5m	**25.08**	24.73	24.53	
4500F000	-	>± 0.5m	22.34	^	21.58	
5000D000-R	-	>± 0.5m	138.43	138.21	138.23	
5500D000	-	>± 0.5m	Removed	40.94	40.49	
6000C000L-R**	-	>± 0.5m	*	*	-	
6000C000U-R**	-	>± 0.5m	*	*	-	
6500F500L	-	>± 0.5m	50.48	50.46	49.69	
6500F500M	-	>± 0.5m	**52.49**	**51.35**	50.67	
6500F500U	-	>± 0.5m	31.8	31.92	32.22	
6500F625	-	>± 0.5m	16.1	16.04	15.93	
Melody	-	>± 0.5m	13.1	13.05	12.81	
7500F000	-	>± 0.5m	**36.68**	35.98	35.79	
GDE Bore Shallow**	-	>± 0.5m	*	*	-	
GDE Bore Deep**	-	>± 0.5m	10.86	10.67	-	
NE Alluvium**	-	>± 0.5m	^	^	-	
East Alluvium**	-	>± 0.5m	*	*	-	

Results in **bold** indicate that the bore has exceeded the adopted assessment criterion for changes in standing water level from the previous measurement.
* Dry/insufficient water to sample.
**New site.
^Unsafe access.

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Table 8-2 - MPO Quarterly Groundwater pH Results

Monitoring Location/ ID	pH Trigger Range		Feb 2025 pH	Nov 2024 pH	Aug 2024 pH	Triggered (Yes/No)
	Lower	Upper				
WRA1L	6.0	8.5	7.1	7.1	7.2	No
WRA1U			*	*	*	-
WRA3L-R**			7.5	7.6	-	-
WRA3U-R**			*	*	-	-
WRA5L-R**			6.9	7.1	-	-
WRA5U-R**			7.5	7.5	-	-
WRA6L			7	7	7	No
WRA6U			6.9	6.9	6.7	No
MPBH1			7	7	7.1	No
MPBH2			6.9	6.8	7	No
MPBH3b			7.4	7.8	7.8	No
MPBH4			6.9	7	6.9	No
MPBH5			*	*	*	-
MPBH1-C			**8.7**	**8.7**	7.9	**Yes**
MPBH1-HR			8	8	8.1	No
MPBH2-C			**10.2**	7.7	8.2	**Yes**
MPBH2-HR			8.4	7.5	7.9	No
MPBH4-C			8	8	8	No
MPBH4-HR			7.2	7.2	7.3	No
MPBH5-C			**9.1**	**9.8**	**9.3**	**Yes**
MPBH5-HR			7.4	7.5	7.6	No
MPBH6			7.1	7	7.1	No
MPBH6-C			7	7	7.1	No
MPBH6-HR			7.3	7.3	7.3	No
MPBH7			7.3	7	7	No
MPBH7-C			7.1	7	7.1	No
3500C500L			7.5	7.5	7.6	No
3500C500S			7.1	7.1	6.9	No
4500F000			6.8	^	6.8	No
5000D000-R			7.5	7.4	7.5	No
5500D000			Removed	6.9	7	No
6000C000L-R**			*	*	-	-
6000C000U-R**			*	*	-	-
6500F500L			7.2	7.2	7.2	No
6500F500M			7.3	7.3	7.3	No

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Monitoring Location/ ID	pH Trigger Range		Feb 2025 pH	Nov 2024 pH	Aug 2024 pH	Triggered (Yes/No)
	Lower	Upper				
6500F500U			6.8	6.8	6.8	No
6500F625			6.7	6.9	7	No
Melody			6.8	6.9	6.9	No
7500F000			7.7	7.7	7.8	No
GDE Bore Shallow**			*	*	-	-
GDE Bore Deep**			7.4	7.5	-	-
NE Alluvium**			^	^	-	-
East Alluvium**			*	*	-	-

** Dry/insufficient water to sample.*
***New site.*
^Unsafe access.
*An investigation is triggered when pH values are recorded outside the baseline range (20th – 80th percentile). Results shown in **bold** are outside of this range.*

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Table 8-3 - MPO Quarterly Groundwater EC Results

Monitoring Location/ ID	Maximum Beneficial Use Trigger	Feb 2025 EC[1]	Nov 2024 EC[1]	Aug 2024 EC[1]	Triggered (Yes/No)
WRA1L	7800	3080	3050	3200	No
WRA1U	*	***	***	***	-
WRA3L-R**	*	*	*	-	-
WRA3U-R**	*	4800	5320	-	-
WRA5L-R**	*	4800	5320	-	-
WRA5U-R**	*	*	*	-	-
WRA6L	7800	5880	5700	6000	No
WRA6U	22000	9010	8650	8950	No
MPBH1	800	675	640	620	No
MPBH2	930	**1247**	**1300**	**1200**	**Yes**
MPBH3b	7800	5920	5600	5550	No
MPBH4	*	5620	5650	5550	-
MPBH5	*	***	***	***	-
MPBH1-C	*	1450	1500	820	-
MPBH1-HR	*	1580	1550	1500	-
MPBH2-C	*	1436	1078	1072	-
MPBH2-HR	*	1631	1229	1361	-
MPBH4-C	*	4950	4970	4860	-
MPBH4-HR	*	5880	5500	5690	-
MPBH5-C	*	1042	919	761	-
MPBH5-HR	*	842	856	843	-
MPBH6	*	1230	1250	1194	-
MPBH6-C	*	2710	2730	2780	-
MPBH6-HR	*	1490	4760	3580	-
MPBH7	*	11480	9770	10580	-
MPBH7-C	*	10760	10280	10800	-
3500C500L	7800	3770	3890	3810	No
3500C500S	7800	6010	**8270**	**12160**	No
4500F000	22000	8440	^	8150	No
5000D000-R	*	4490	4500	4410	-
5500D000	7800	Removed	4350	4400	No
6000C000L-R**	*	4530	4780	-	-
6000C000U-R**	*	*	*	-	-
6500F500L	7800	2530	2550	2450	No
6500F500M	7800	2780	2610	2450	No
6500F500U	7800	5120	4920	4860	No

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Monitoring Location/ ID	Maximum Beneficial Use Trigger	Feb 2025 EC[1]	Nov 2024 EC[1]	Aug 2024 EC[1]	Triggered (Yes/No)
6500F625	7800	4480	4310	3850	No
Melody	*	6140	5810	5400	-
7500F000	7800	6450	6350	6270	No
GDE Bore Shallow**	*		*	-	-
GDE Bore Deep**	*	11240	10710	-	-
NE Alluvium**	*	^	^	-	-
East Alluvium**	*	*	*	-	-

** Indicates no trigger limit identified*
*** New site*
**** Dry/insufficient water to sample*
^Unsafe access.
[1]Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).
An investigation is triggered when EC values recorded exceed the beneficial use quality range (as described in the GWMP) for three successive monitoring rounds. Results outside this range are shown in **bold.**

During the February 2025 monitoring event, sites WRA1U, MPBH5, GDE Bore Shallow and East Alluvium were dry. WRA3U-R contained insufficient water to sample and three (3) sites had changes in standing water level of greater than ± 0.5m from the previous measurement. All monitoring locations were within the pH trigger limits except sites MPBH1-C, MPBH2-C and MPBH5-C. MPBH5-C has been outside the limits for three consecutive monitoring events. All monitoring locations were below their respective EC trigger limits except MPBH2. MPBH2 have been outside these limits for three consecutive monitoring events.

An investigation is triggered if elevated measurements occur for three consecutive sampling events in accordance MPO Water Management Plan (MACH Energy, 2022). An investigation was triggered (AGE, 2023) examining the cause of elevated EC values in the alluvial zone, specifically MPBH2. The data strongly suggests that the cause of the increase in EC is persistent above-average stage in the adjacent Hunter River, caused by above-average rainfall since 2020, which is causing a rise in groundwater levels in similar alluvial bores. Trigger values have since been reviewed and will be incorporated in future Water management plans. The next quarterly ground water monitoring event is scheduled for May 2025.

9. Noise Monitoring

Attended noise monitoring was undertaken during the night of 26th February 2025 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2021) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in February 2025 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

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Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 26 February 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	11:24pm	IA	45	1.0 / 208	Yes	E	No
N-AT2	10:45pm	IA	45	2.7 / 169	Yes	D	No
N-AT3	10:05pm	IA	45	3.0 / 167	Yes	D	No
N-AT4	10:31pm	IA	45	1.4 / 182	Yes	D	No
N-AT5	10:55pm	32	45	1.3 / 206	No	F	No
N-AT6	11:52pm	IA	45	1.0 / 198	No	F	No
N-AT7	10:08pm	IA	45	2.9 / 168	Yes	D	No
N-AT8	11:24pm	44	NA[2]	1.0 / 208	NA[6]	F	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 26 Feb 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	11:24pm	IA	45	1.0 / 208	Yes	D	No
N-AT2	10:45pm	IA	45	2.7 / 169	Yes	D	No
N-AT3	10:05pm	IA	45	3.0 / 167	Yes	D	No
N-AT4	10:31pm	IA	45	1.4 / 182	Yes	D	No
N-AT5	10:55pm	28	45	1.3 / 206	Yes	D	No
N-AT6	11:52pm	IA	45	1.0 / 198	Yes	E	No
N-AT7	10:08pm	IA	45	2.9 / 168	Yes	D	No
N-AT8	11:24pm	40	NA[2]	1.0 / 208	NA[6]	D	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

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Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 26 Feb 2025

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	11:24pm	IA	40	No
N-AT2	10:45pm	IA	40	No
N-AT3	10:05pm	IA	40	No
N-AT4	10:31pm	IA	40	No
N-AT5	10:55pm	28	40	No
N-AT6	11:52pm	IA	40	No
N-AT7	10:08pm	IA	40	No
N-AT8	11:24pm	40	NA[4]	NA[4]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

10. Blast Monitoring

There were six (7) blast events during February 2025 (a total of 13 blasts YTD). Results for February are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – February 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
5/02/2025	12:01	0.430 mm/s	86 DBL	0.520 mm/s	97.9 DBL	Y
10/02/2025	11:24	0.390 mm/s	92.7 DBL	0.440 mm/s	98.5 DBL	Y
13/02/2025	15:51	0.150 mm/s	96.4 DBL	0.310 mm/s	96.2 DBL	Y

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17/02/2025	11:02	0.160 mm/s	95.8 DBL	0.100 mm/s	92.1 DBL	Y
21/02/2025	10:58	0.310 mm/s	97.6 DBL	0.250 mm/s	94.6 DBL	Y
26/02/2025	16:14	0.760 mm/s	99.7 DBL	0.630 mm/s	103 DBL	Y
28/02/2025	13:05	0.150 mm/s	102 DBL	0.300 mm/s	98.9 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

March 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 March 2025
Reporting Period End Date	31 March 2025
Date All Data Received	13 April 2025M

Links to three key regulatory documents are provided here:

- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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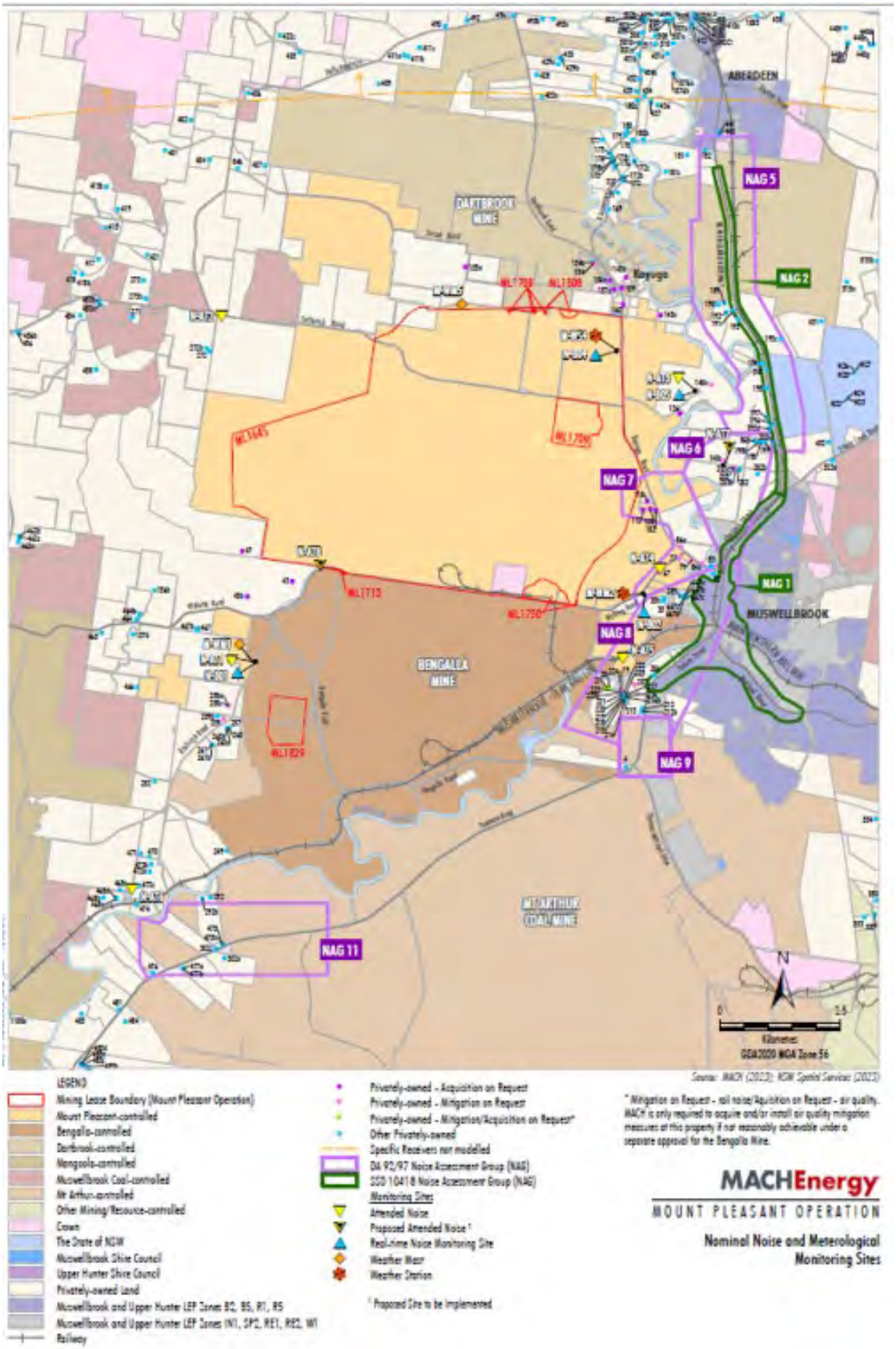

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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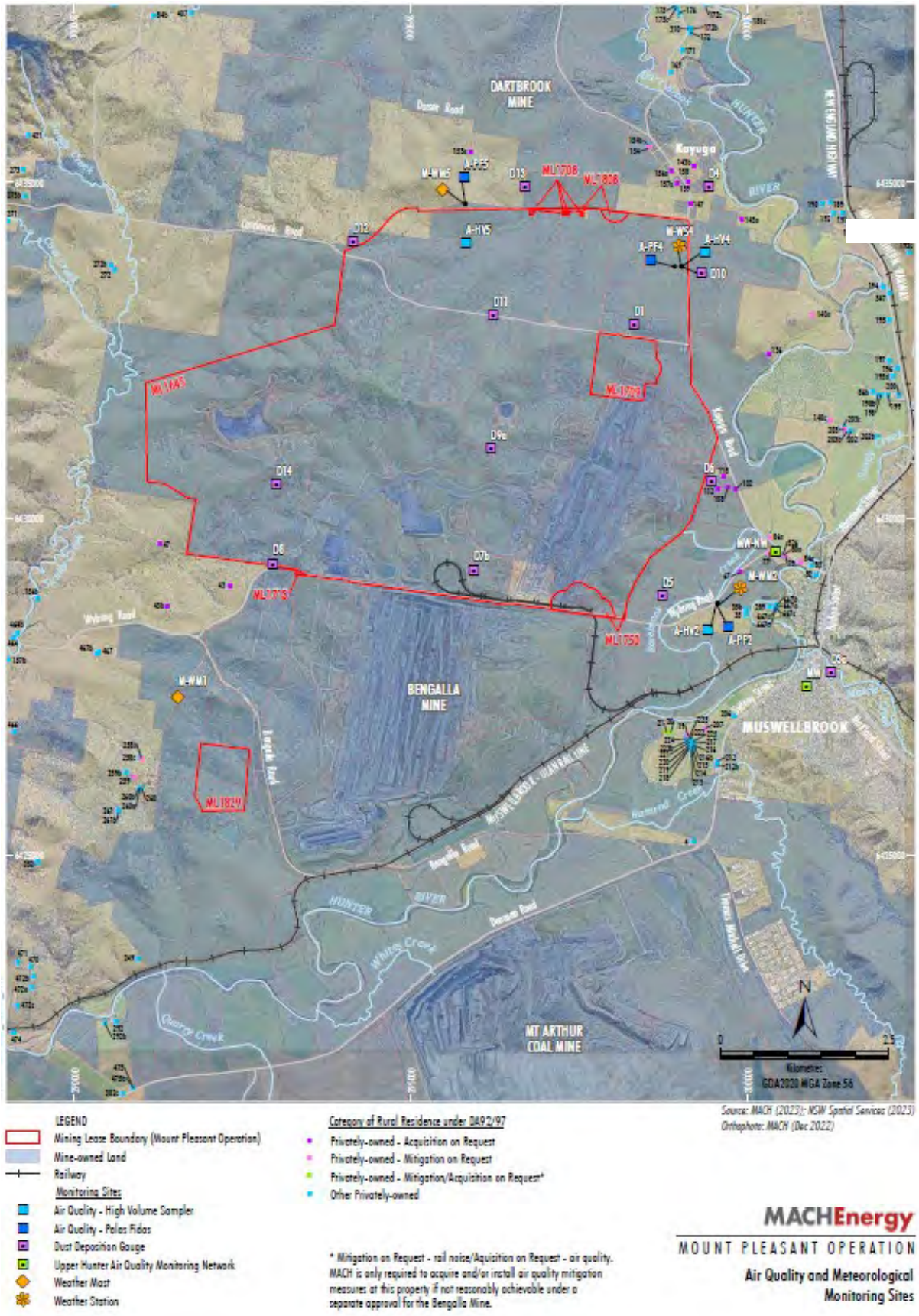

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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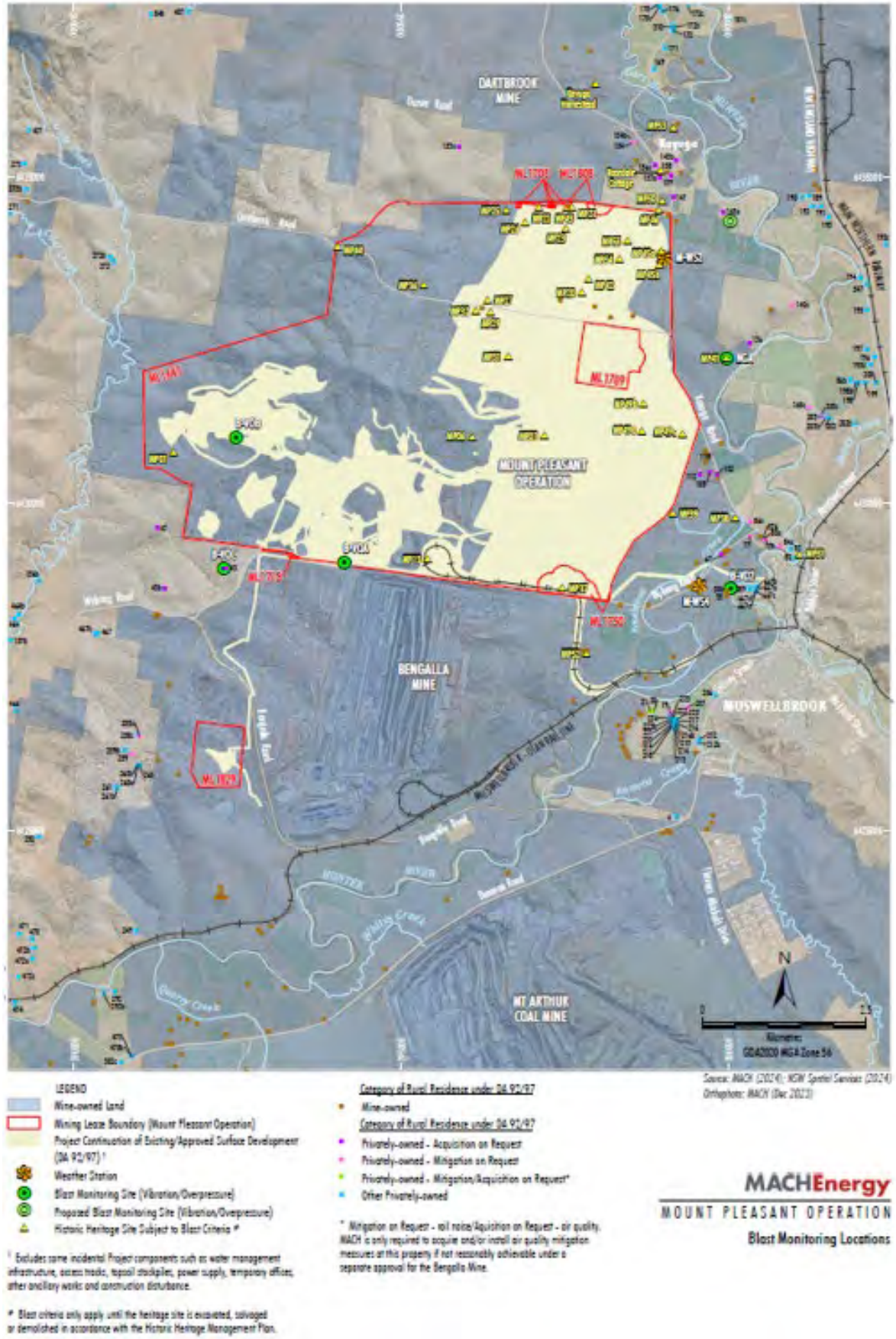

Figure 2-3 – MPO Blast Monitoring Locations

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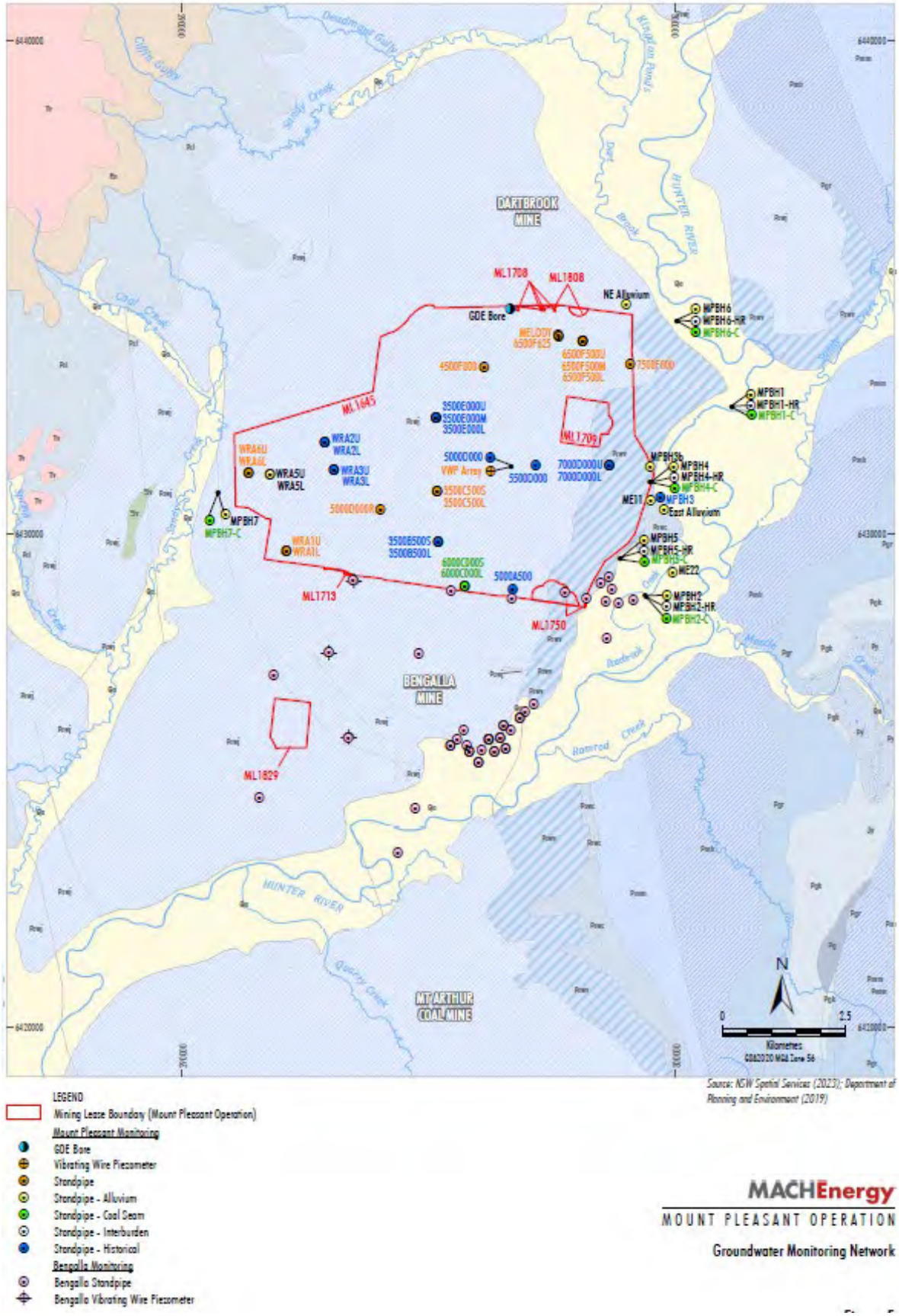

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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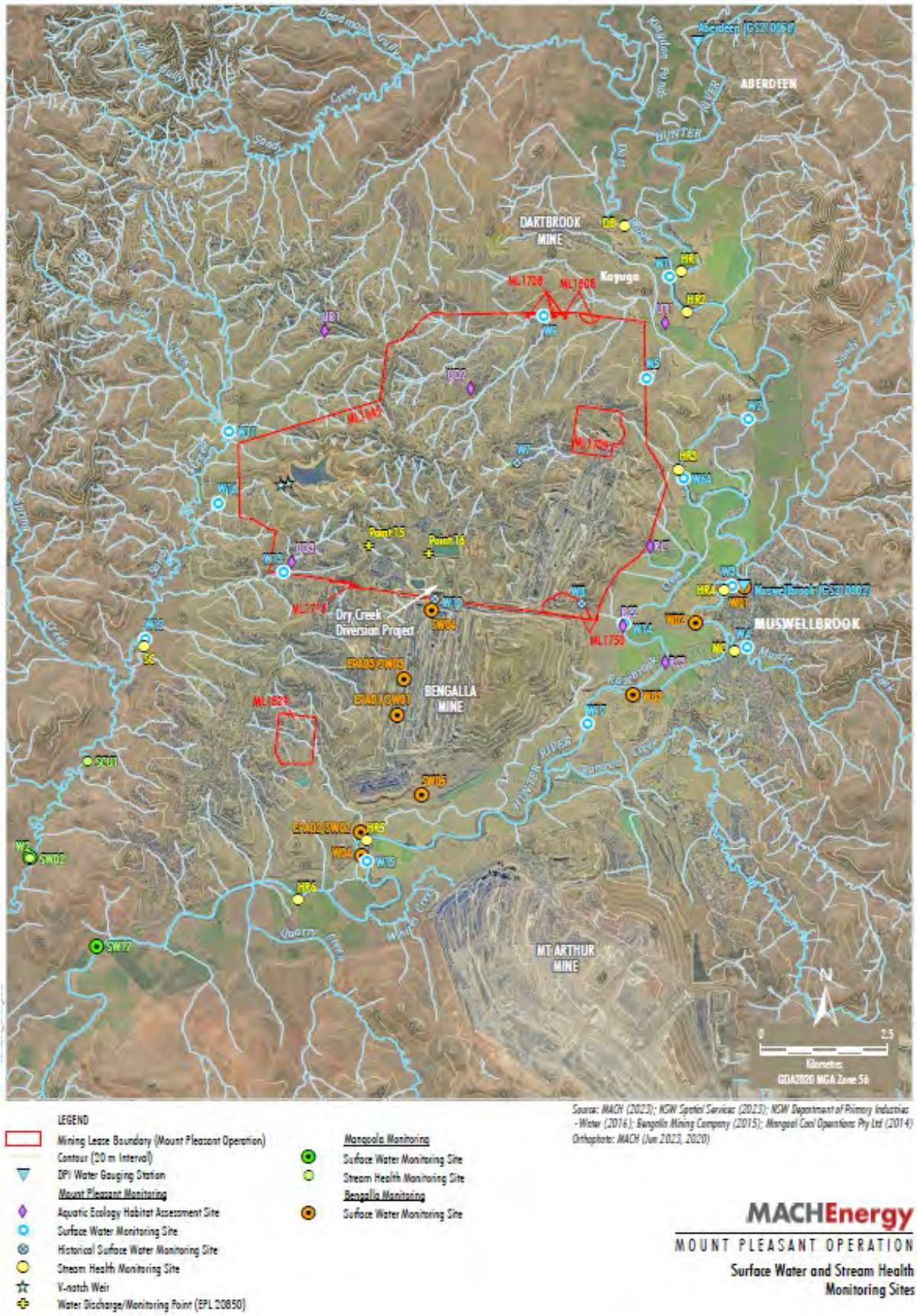

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 during March 2025 (the monitoring period). An additional monitor (E-BAM) is located at M-WS2 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4.
Throughout March 2025, there was 152.2mm and 130.8mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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4.2 Results

The dust deposition exposure period for gauges commenced on 27 February 2025 sample collection was undertaken on 27 March 2025 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for March 2025 have been provided as an indication of performance between April 2024 – March 2025 and represents 12month average results as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – March 2025

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	3.0	2.5
D3	2.2	1.4
D4	1.1	1.2
D5a	1.8	2.1
D6	1.7	1.9
D7b	8.5	9.0
D8	6.7	4.8
D9a	6.0	3.7
D10	1.1	1.0
D11	6.5	3.9
D12	2.5	1.3
D13	3.0	1.8
D14	5.9	3.7
Criterion	-	4

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

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Field notes from the March sampling event noted that all thirteen gauges contained insects, two had algae grown, one contained bird droppings. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (9.2 g/m2), D8 (4.8 g/m2), and D11 (6.5 g/m2).

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

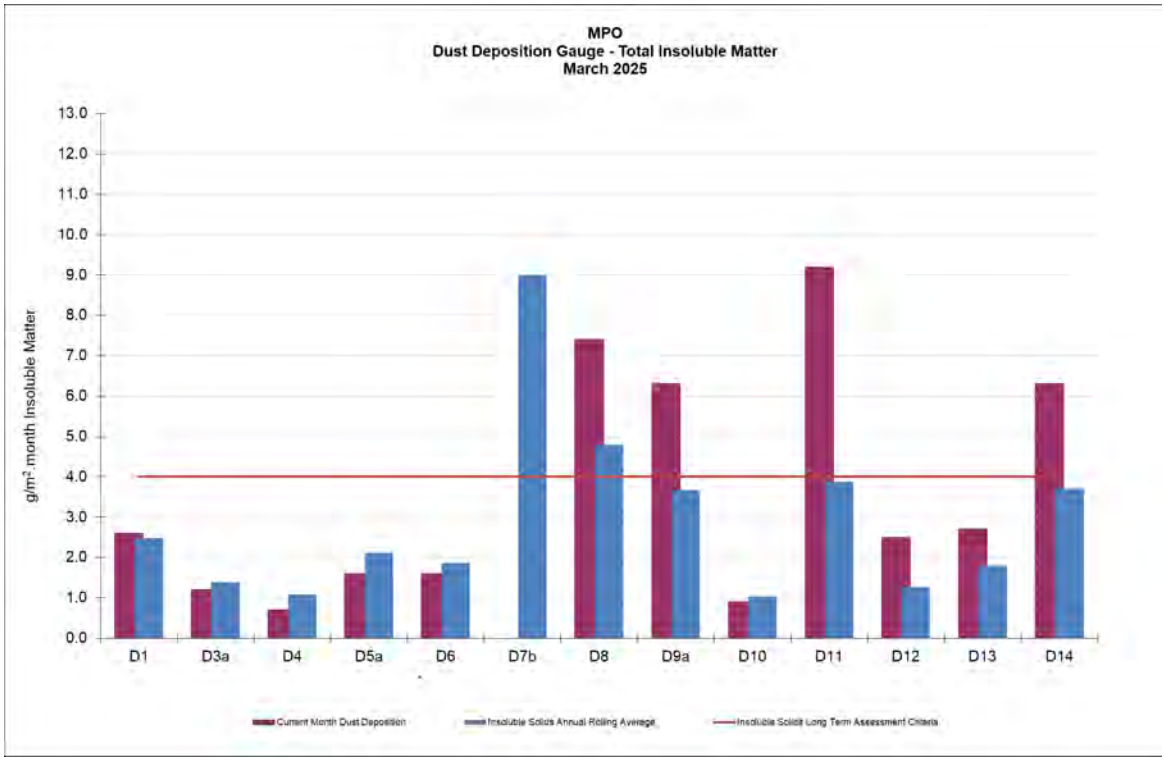

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – March 2025

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

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5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Twelve month rolling averages to March 2025 is provided as an indication of performance between April 2024 – March 2025 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – March 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
1/03/2025	-	68.6	127	83.2
7/03/2025		37.3	125	27.4
13/03/2025		47.7	32.7	29.2
19/03/2025	-	49.6	70.4	37
25/03/2025	-	16.9	51.6	14.2
31/03/2025	-	28	77.6	35.8
*Monthly Mean	-	41.4	80.7	37.8
Annual Rolling Average	90	45	47	35

Notes:
** Results have been rounded to one decimal place for reporting purposes where applicable.*
^ Indicates makeup run results for run date 11/11/2024.

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during March 2025.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages to March 2025 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during the last 12 month as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

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6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in March 2025. Real time PM_{10} 24 hour daily average results for March 2025 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – March 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
1/03/2025	34.07	33.35	28.61	37.1	50
2/03/2025	29.52	26.92		29.2	50
3/03/2025	24.98	21.47		24.9	50
4/03/2025	17.00	14.16		19.7	50
5/03/2025	13.34	11.82		15.9	50
6/03/2025	12.68	10.96		12.8	50
7/03/2025	14.27	12.27		17.3	50
8/03/2025	12.54	10.77		9.5	50
9/03/2025	11.76	10.17		13.6	50
10/03/2025	13.44	12.45		12.2	50
11/03/2025	11.11	10.65	12.53	11.1	50
12/03/2025	10.15	9.56	11.58	9.9	50
13/03/2025	11.29	10.50	12.29	14.3	50
14/03/2025	14.09	11.98	10.90	19.1	50
15/03/2025	14.32	12.72	11.04		50
16/03/2025	15.19	13.03	11.53	12.8	50
17/03/2025	22.87	15.14	13.99	51.1	50
18/03/2025	18.99	16.74	19.70	26.1	50
19/03/2025	17.21	17.07	21.51	26.3	50
20/03/2025	23.62	20.56	28.30	25.4	50
21/03/2025	20.35	16.21	14.23	18.6	50
22/03/2025	12.75	12.17	11.79	13.1	50
23/03/2025	11.21	11.21	13.46	8.7	50
24/03/2025	9.85	9.65	11.85	12.1	50
25/03/2025	10.34	10.13	12.28	10.3	50
26/03/2025	10.06	10.08	12.94	11	50
27/03/2025	10.69	10.44	22.45	15.8	50
28/03/2025	10.58	9.45	30.86	9.8	50
29/03/2025	7.78	9.39	23.08	6.3	50
30/03/2025	8.95	13.85	13.85	8.4	50
31/03/2025	8.83	12.73	17.33	9	50

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites March 2025.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during March 2025. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

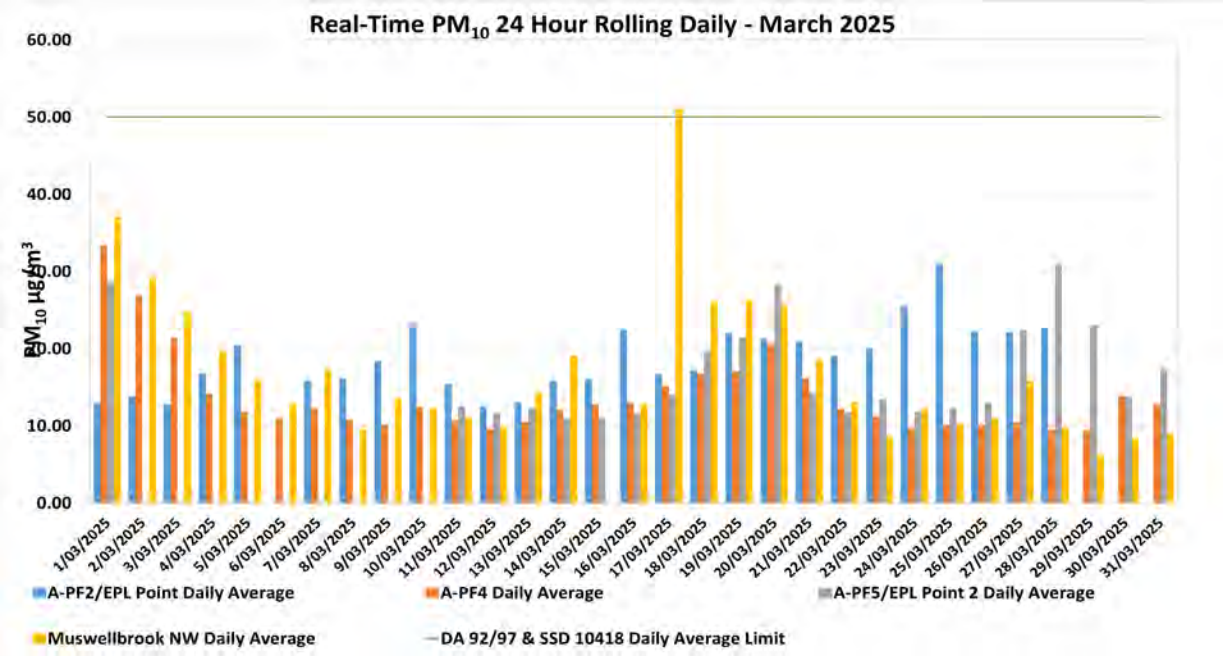

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for March 2025.

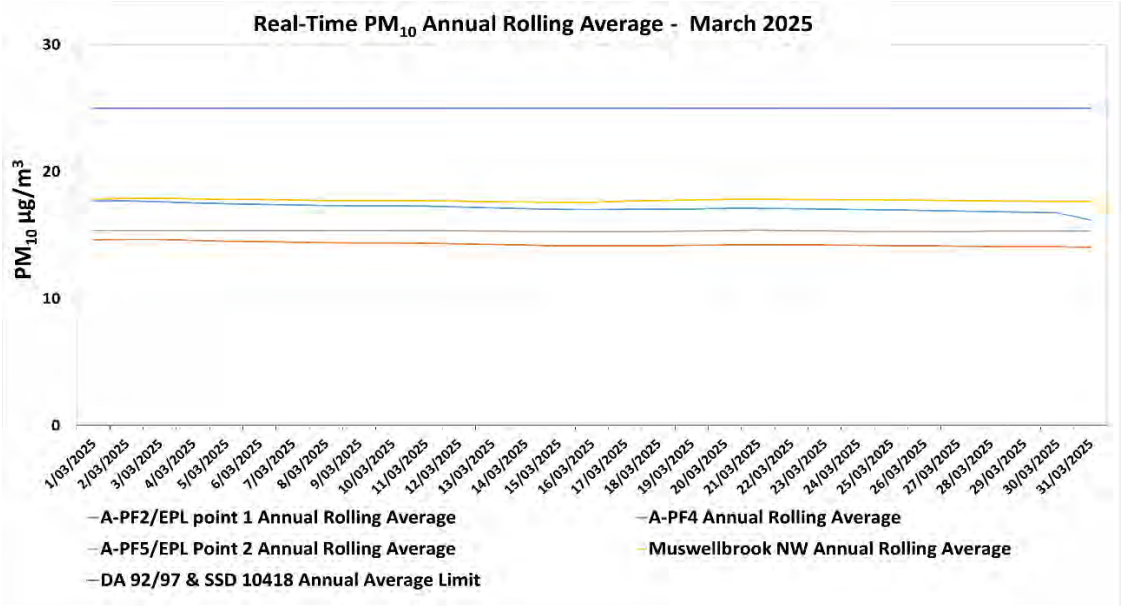

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for March 2025.

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6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during March 2025. Real time $PM_{2.5}$ 24 hour rolling average results for March 2025 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – March 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
1/03/2025	9.62	9.62	6.42	25
2/03/2025	10.32	10.32	6.63	25
3/03/2025	8.28	8.28	5.96	25
4/03/2025	6.07	6.07	5.37	25
5/03/2025	5.11	5.11	8.42	25
6/03/2025	5.13	5.13	7.28	25
7/03/2025	5.11	5.11	8.05	25
8/03/2025	4.59	4.59	7.55	25
9/03/2025	4.40	4.40	7.78	25
10/03/2025	4.49	4.49		25
11/03/2025	3.73	3.73		25
12/03/2025	3.79	3.79		25
13/03/2025	4.28	4.28		25
14/03/2025	4.67	4.67		25
15/03/2025	4.59	4.59		25
16/03/2025	4.40	4.40		25
17/03/2025	5.27	5.27		25
18/03/2025	5.53	5.53		25
19/03/2025	4.88	4.88	4.15	25
20/03/2025	5.58	5.58	4.01	25
21/03/2025	5.53	5.53	4.11	25
22/03/2025	4.36	4.36	3.96	25
23/03/2025	5.15	5.15	3.92	25
24/03/2025	4.43	4.43	3.93	25
25/03/2025	4.60	4.60	4.51	25
26/03/2025	3.98	3.98	5.81	25
27/03/2025	3.90	3.90	5.36	25
28/03/2025	3.90	3.90	5.98	25
29/03/2025	3.12	3.12	4.62	25
30/03/2025	3.39	3.39	4.17	25
31/03/2025	3.20	3.20	5.60	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Real time $PM_{2.5}$ 24-hour average results for March 2025 are presented in **Figure 6-3** below.

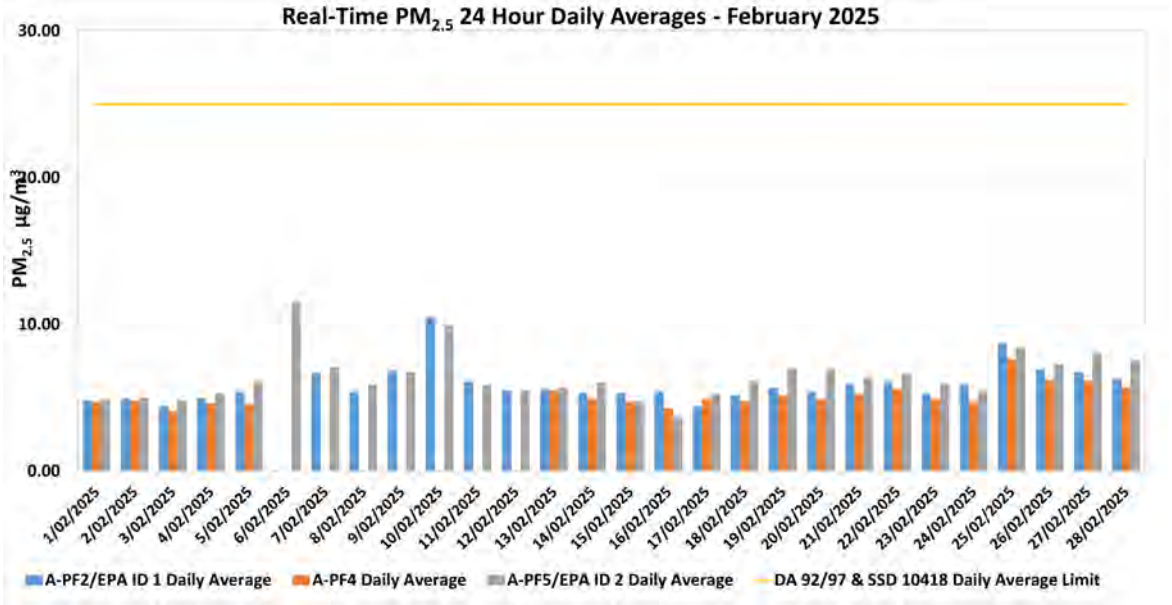

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for March 2025.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during March 2025. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

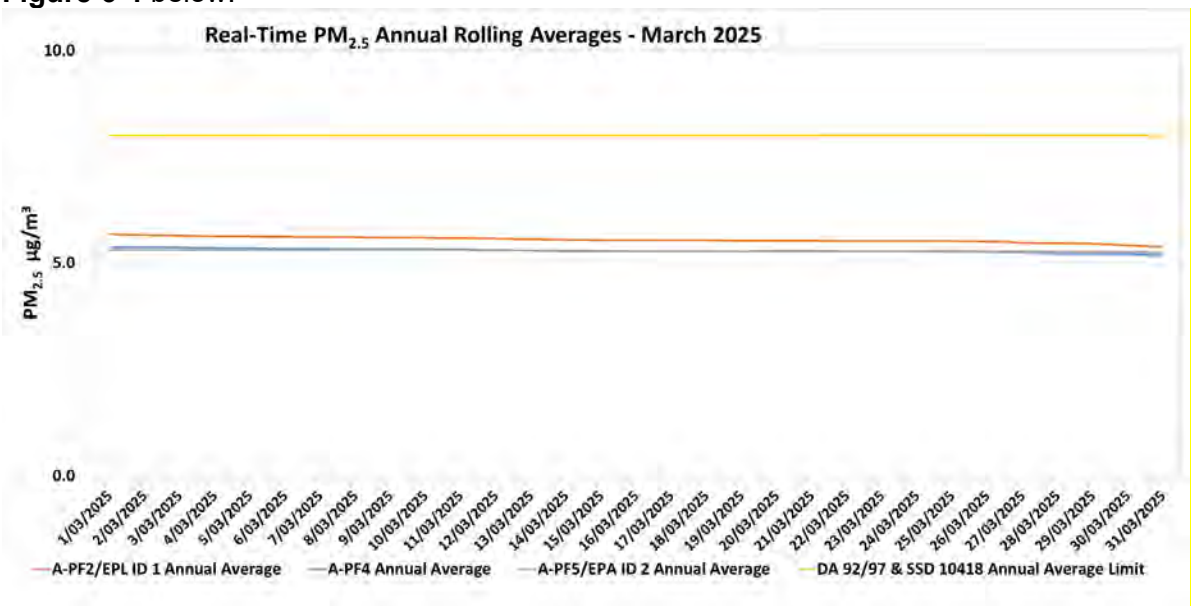

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for March 2025.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2024) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 25 March 2025. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 25 March 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	7.9	526	300	**20**
W2	7.7	**578**	330	18
W3	7.9	596	340	19
W4	7.5	2110	1300	9
W5	*	*	*	*
W6A	8.0	**574**	330	17
W9	*	*	*	*
W11	**8.3**	3990	2200	6.1
W12	7.9	4940	2700	15
W13	*	*	*	*
W14	*	*	*	*
W15	7.9	**639**	370	**25**
W16	*	*	*	*
W17	7.8	620	360	20

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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7.3.1.1.1.1.1 During 25 March 2025 monitoring event, five (5) sites were dry. Sites W2, W6A, and W15 were above their respective EC trigger levels. Sites W1 and W15 were above pH trigger levels. Sites W15 was above the TSS trigger level.

Site W6A was above the respective EC trigger level for six consecutive monitoring events during the last monthly environmental report (February 2025) and continues to be above trigger levels for March 2025.

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

Site W6A continued to exceed the respective EC trigger level (520 µS/cm) for March 2025); however, according to Table 26 of the WMP no further investigation is required as the upstream site W2 (Hunter River reference site) was also found to be exceeding trigger levels.

8. Groundwater Monitoring

No groundwater sampling was undertaken in March 2025. Next annual and quarterly l groundwater sampling is scheduled for May2025.

9. Noise Monitoring

Attended noise monitoring was undertaken during the night of the 9th April 2025 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2021) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in April 2025 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 9 April 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2.4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:36am	IA	45	0.7 / 077	Yes	D	No
N-AT2	10:50pm	IA	45	1.4 / 171	Yes	D	No
N-AT3	11:25pm	IA	45	1.2 / 161	Yes	D	No
N-AT4	11:53pm	IA	45	0.7 / 262	Yes	E	No
N-AT5	12:15am	26	45	0.7 / 190	Yes	E	No
N-AT6	1:11am	IA	45	1.1 / 131	Yes	E	No
N-AT7	10:09pm	IA	45	2.4 / 164	Yes	D	No
N-AT8	12:42am	37	NA[2]	1.0 / 154	NA[6]	D	NA[6]

Notes:

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1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 9 April 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2.4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:36am	IA	37	2.2 / 179	Yes	D	No
N-AT2	10:50pm	IA	35	6.1 / 161	Yes	D	No
N-AT3	11:25pm	IA	40	5.2 / 158	Yes	D	No
N-AT4	11:53pm	IA	38	2.6 / 161	Yes	E	No
N-AT5	12:15am	22	37	2.7 / 159	Yes	E	No
N-AT6	1:11am	IA	35	2.5 / 163	Yes	E	No
N-AT7	10:09pm	IA	37	5.0 / 161	Yes	D	No
N-AT8	12:42am	33	NA[2]	2.0 / 167	NA[6]	D	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 9 April 2025

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	1:36am	IA	40	No
N-AT2	10:50pm	IA	40	No
N-AT3	11:25pm	IA	40	No
N-AT4	11:53pm	IA	40	No
N-AT5	12:15am	22	40	No
N-AT6	1:11am	IA	40	No
N-AT7	10:09pm	IA	40	No
N-AT8	12:42am	33	NA[4]	NA[4]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*

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2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

10. Blast Monitoring

There were eight (8) blast events during March 2025 (a total of 31 blasts YTD). Results for March are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – March 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
4/03/25	16:35	0.460 mm/s	107 DBL	0.590 mm/s	103 DBL	Y
7/03/25	9:51	0.210 mm/s	105 DBL	0.260 mm/s	98 DBL	Y
11/03/25	14:54	0.110 mm/s	86.6 DBL	0.160 mm/s	90.4 DBL	Y
14/03/25	11:06	0.480 mm/s	93 DBL	0.360 mm/s	94.9 DBL	Y
18/03/25	13:23	0.010 mm/s	95.7 DBL	0.040 mm/s	94.6 DBL	Y
18/03/25	13:07	0.080 mm/s	93.6 DBL	0.130 mm/s	91.5 DBL	Y
19/03/25	14:05	0.340 mm/s	91.1 DBL	0.330 mm/s	90.9 DBL	Y
21/03/25	09:56	0.540 mm/s	91.7 DBL	0.280 mm/s	101 DBL	Y
26/03/25	15:10	0.500 mm/s	99.4 DBL	0.480 mm/s	99.9 DBL	Y
28/03/25	11:11	1.260 mm/s	109 DBL	0.260 mm/s	105 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

April 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 April 2025
Reporting Period End Date	30 April 2025
Date All Data Received	20 May 2025

Links to three key regulatory documents are provided here:

- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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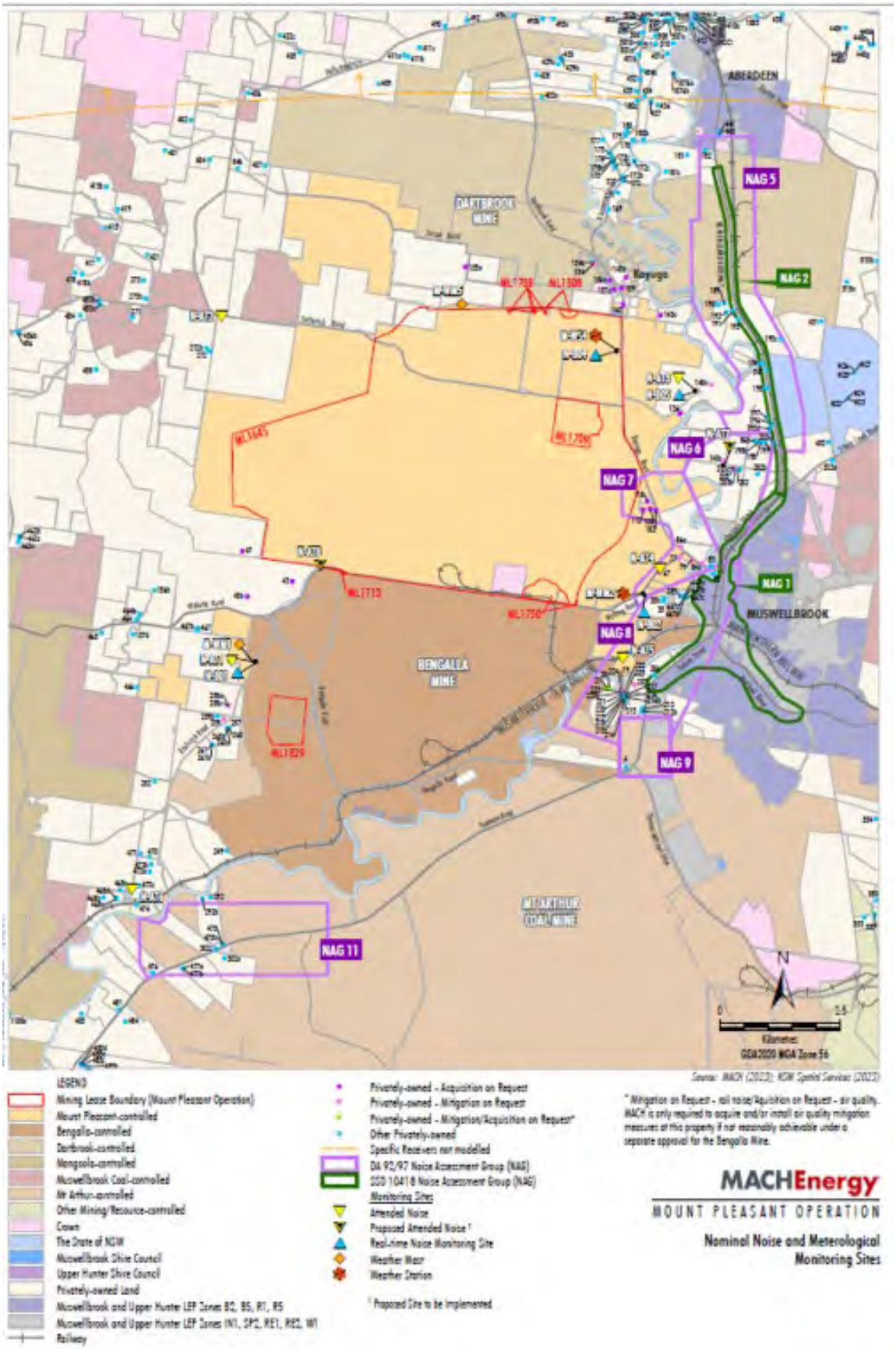

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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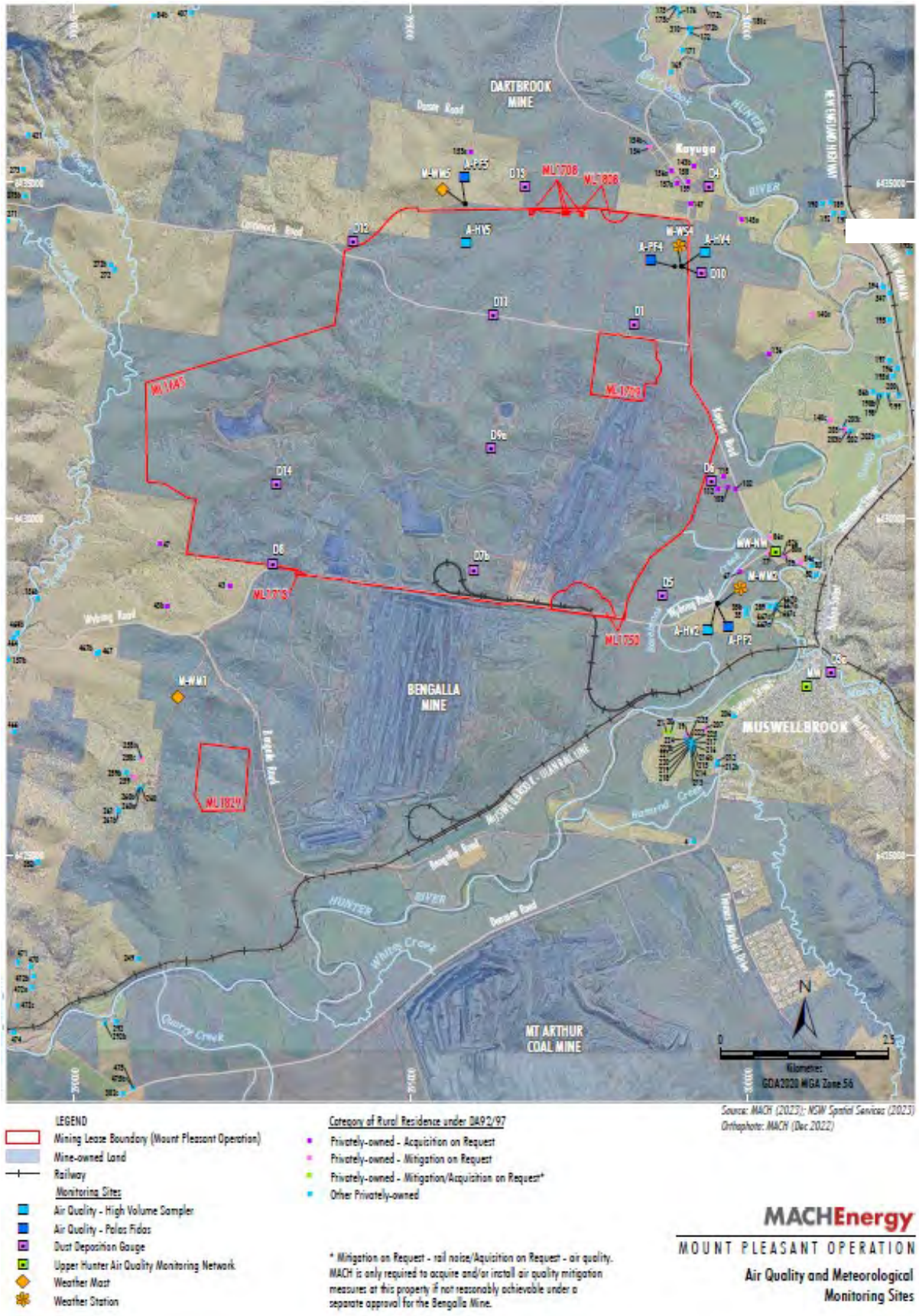

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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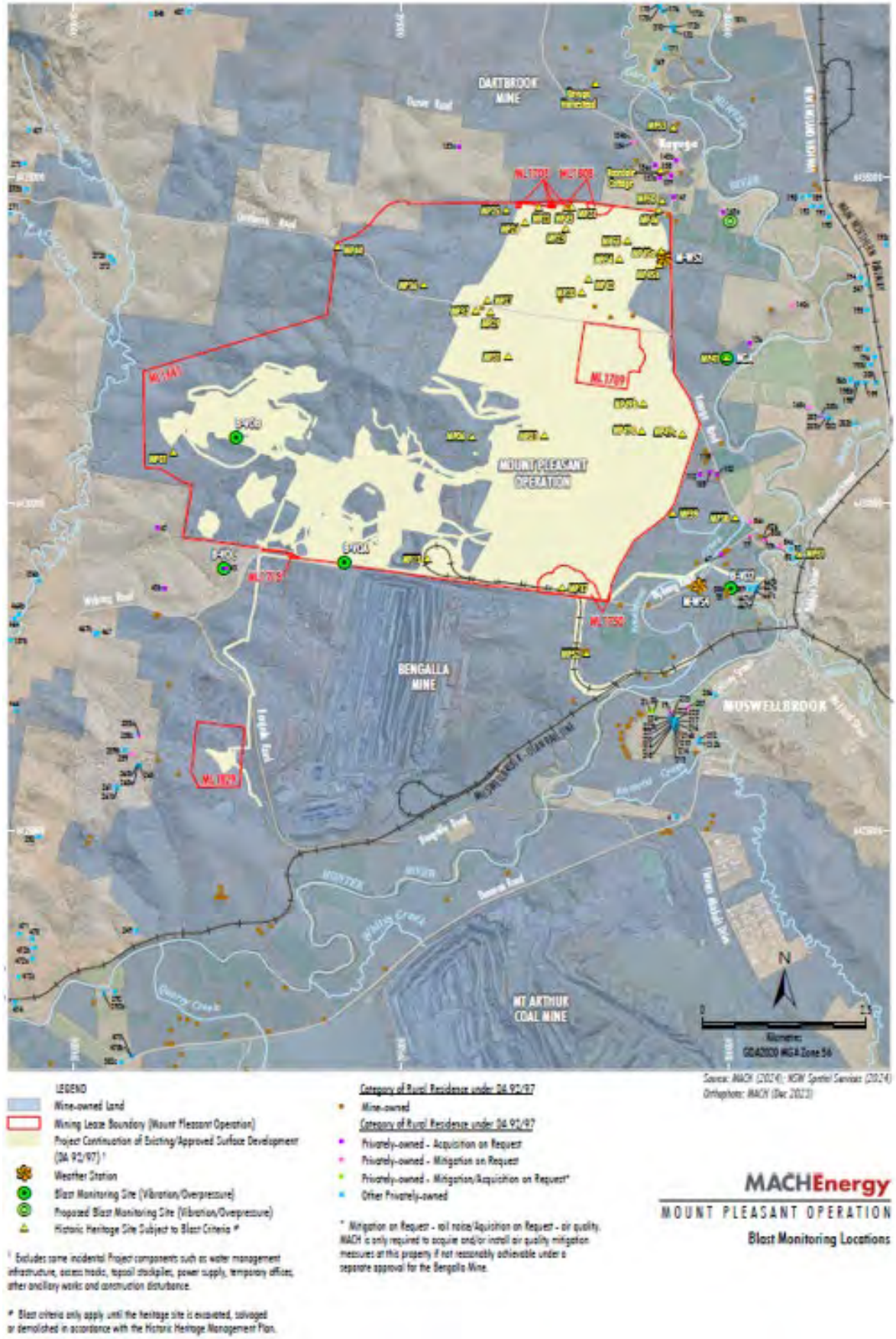

Figure 2-3 – MPO Blast Monitoring Locations

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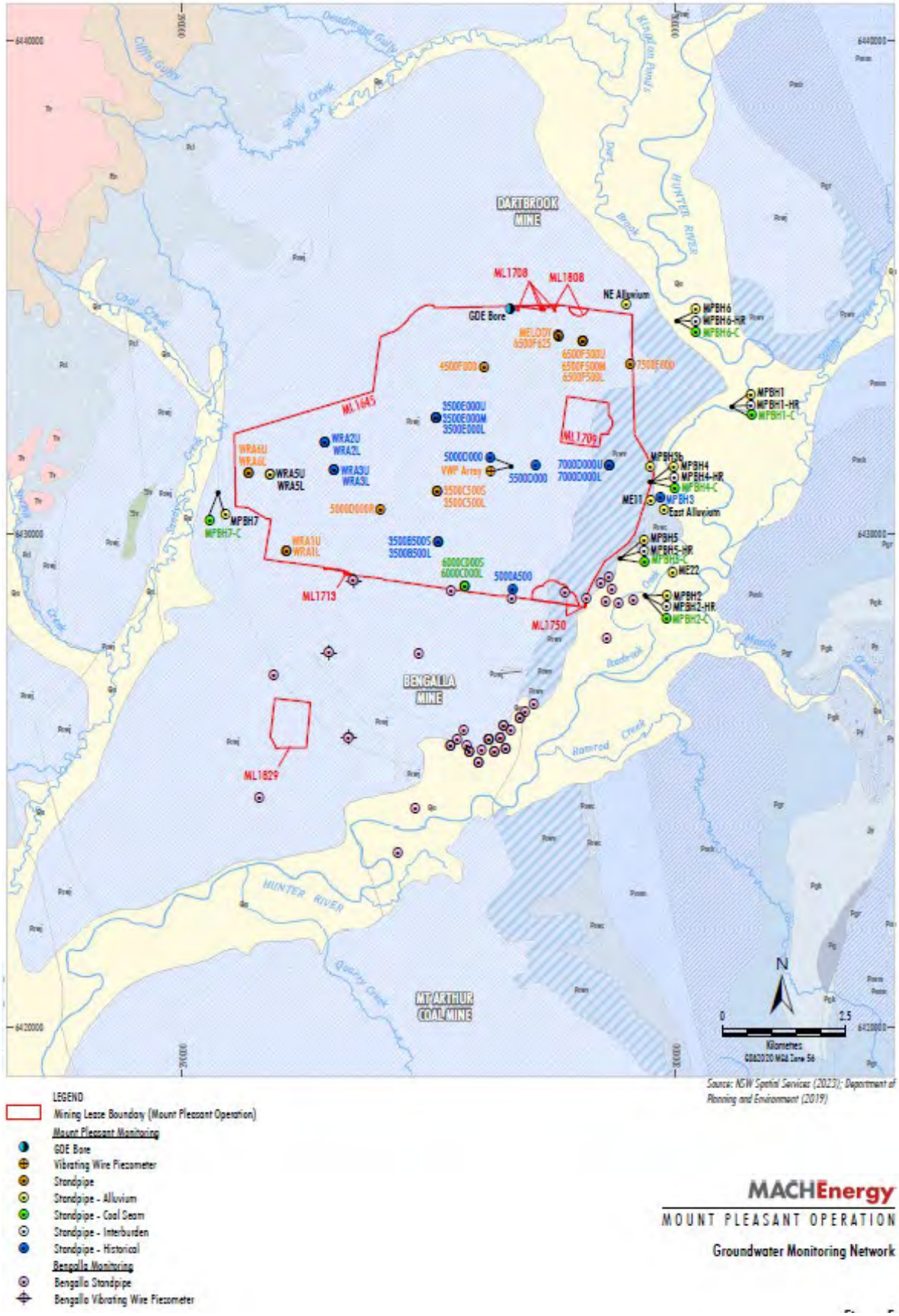

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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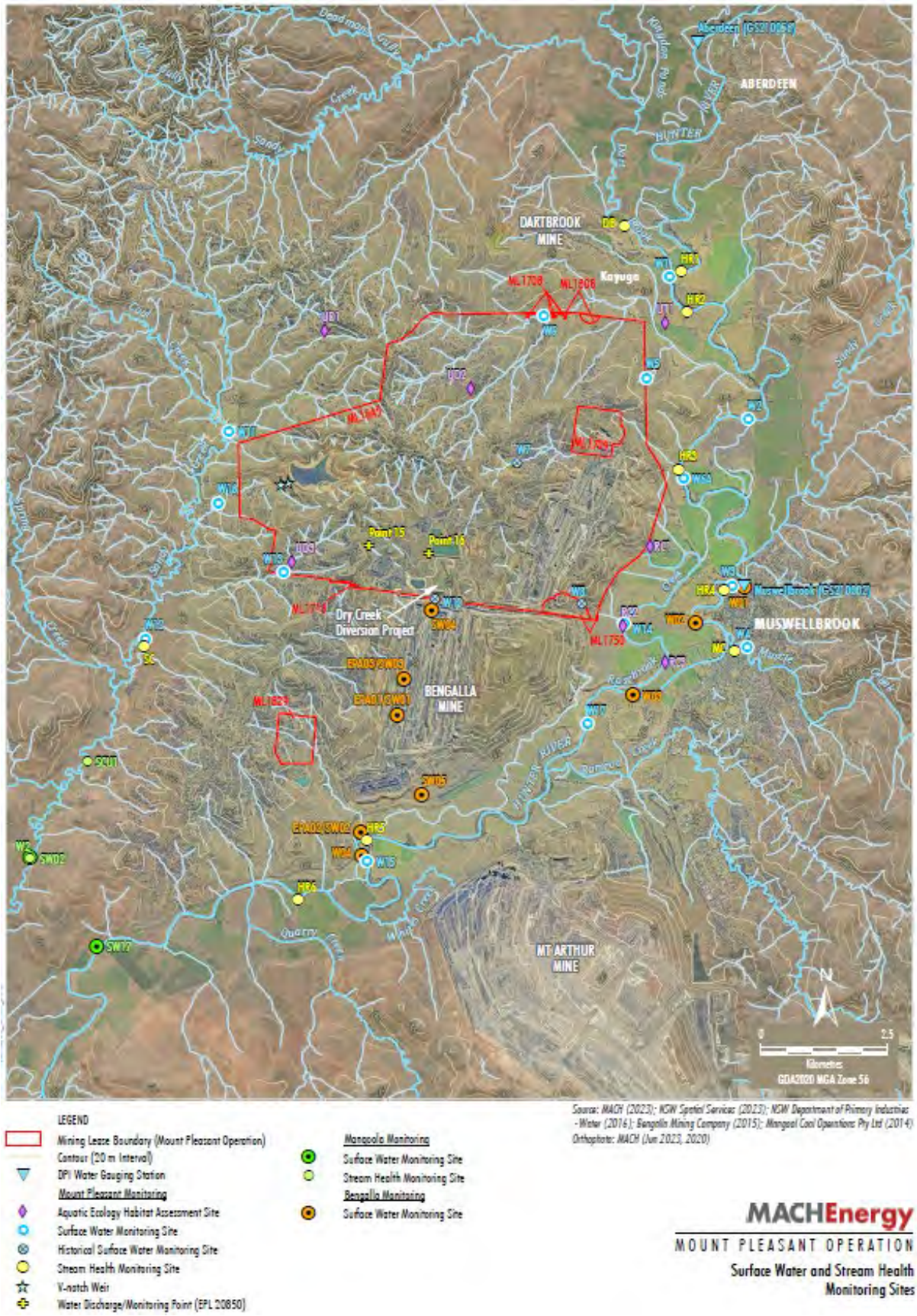

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 during April 2025 (the monitoring period). An additional monitor (E-BAM) was relocated to M-WS4 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4.
Throughout April 2025, there was 43mm and 58.6mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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4.2 Results

The dust deposition exposure period for gauges commenced on 27 March 2025 sample collection was undertaken on 28 April 2025 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for April 2025 have been provided as an indication of performance between May 2024 – April 2025 and represents 12month average results as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – April 2025

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	3.8	2.8
D3	2.0	1.5
D4	1.3	1.1
D5a	1.8	2.1
D6	1.8	1.9
D7b	8.0	**7.8**
D8	6.3	**4.8**
D9a	5.5	3.7
D10	1.2	1.1
D11	6.5	**4.0**
D12	2.3	1.3
D13	3.2	2.0
D14	5.4	3.8
Criterion	-	**4.0**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

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Field notes from the April sampling event noted that all thirteen gauges contained insects, two had bird droppings. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (7.8 g/m2), D8 (4.8 g/m2) and D11 (4.0 g/m2) .

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

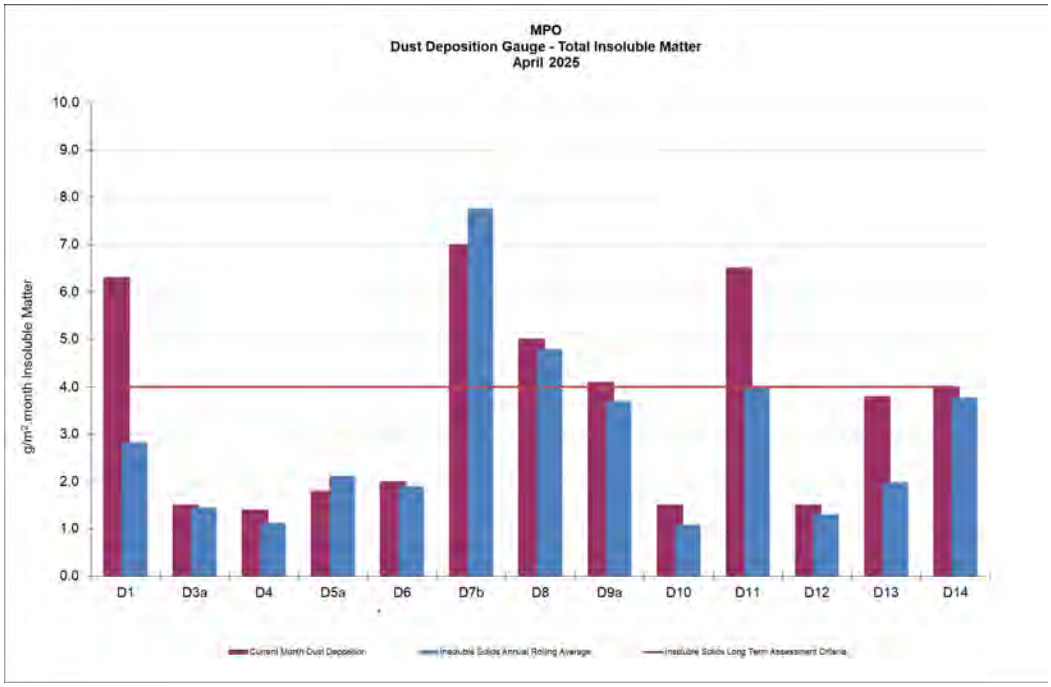

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – April 2025

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

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5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Twelve month rolling averages to April 2025 is provided as an indication of performance between May 2024 – April 2025 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – April 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
6/04/2025	-	56.7	34.6	39.3
12/04/2025		47.1	73.2	40.2
18/04/2025		39	47.7	69.1
24/04/2025	-	21.4	59.5	22.8
30/04/2025	-	25.8	77.3	25.5
6/04/2025	-	56.7	34.6	39.3
*Monthly Mean	-	43.5	73.2	40.2
Annual Rolling Average	90	46	48	35

Notes:
** Results have been rounded to one decimal place for reporting purposes where applicable.*
^ Indicates makeup run results for run date 11/11/2024.

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during April 2025.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages to April 25 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during the last 12 month as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

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6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in April 2025. Real time PM_{10} 24 hour daily average results for April 2025 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – April 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
1/04/2025	9.78	33.35	28.61	12.2	50
2/04/2025	12.59	26.92		18	50
3/04/2025	15.17	21.47		18.4	50
4/04/2025	15.05	14.16		21.4	50
5/04/2025		11.82		21.8	50
6/04/2025		10.96		23.4	50
7/04/2025		12.27		21.7	50
8/04/2025		10.77		19.5	50
9/04/2025		10.17		15.4	50
10/04/2025		12.45		21.5	50
11/04/2025	16.75	10.65	12.53	22	50
12/04/2025	20.34	9.56	11.58	21.4	50
13/04/2025	12.03	10.50	12.29	10.5	50
14/04/2025	12.55	11.98	10.90	21.3	50
15/04/2025	20.81	12.72	11.04	17.1	50
16/04/2025	12.75	13.03	11.53	17	50
17/04/2025	17.12	15.14	13.99	19.9	50
18/04/2025	13.24	16.74	19.70	15.7	50
19/04/2025	18.22	17.07	21.51	27.4	50
20/04/2025	21.64	20.56	28.30	20.2	50
21/04/2025	20.61	16.21	14.23	27.8	50
22/04/2025	21.45	12.17	11.79	21.4	50
23/04/2025	12.64	11.21	13.46	13.6	50
24/04/2025	14.11	9.65	11.85	15.5	50
25/04/2025	11.37	10.13	12.28	10.4	50
26/04/2025	12.09	10.08	12.94	13.7	50
27/04/2025	11.09	10.44	22.45	7.3	50
28/04/2025	9.79	9.45	30.86	12.7	50
29/04/2025	9.79	9.39	23.08	12.5	50
30/04/2025	10.22	13.85	13.85	11	50

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites April 2025.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during April 2025. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

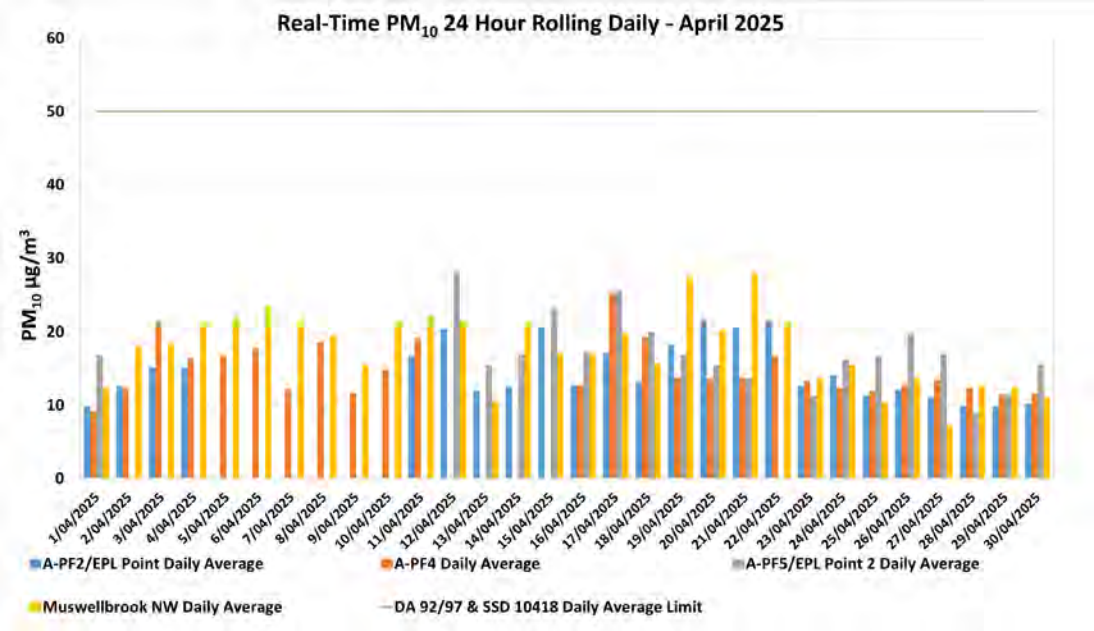

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for April 2025.

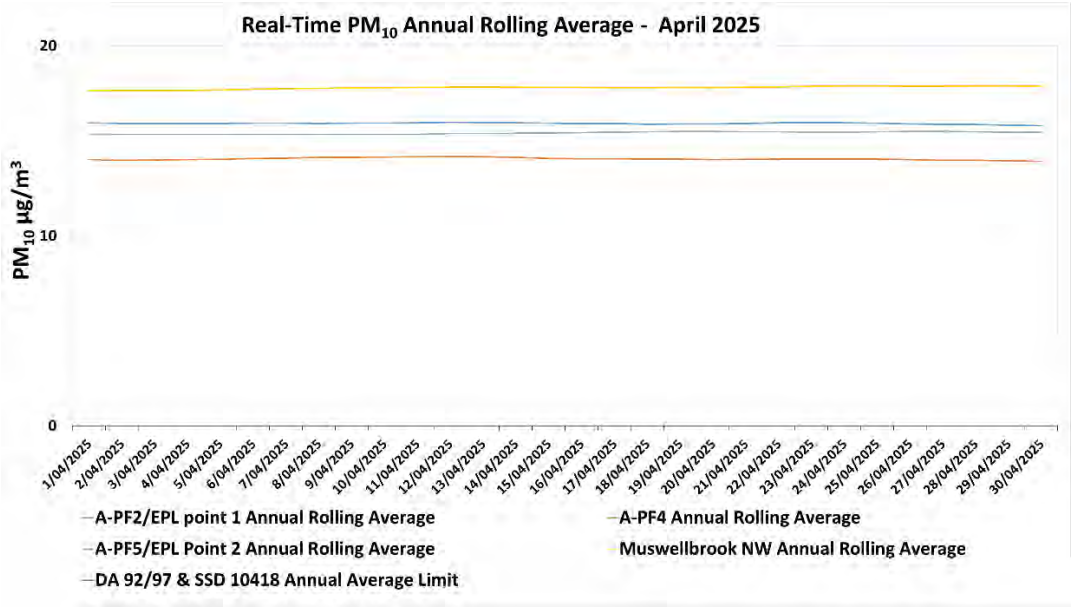

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for April 2025.

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6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during April 2025. Real time $PM_{2.5}$ 24 hour rolling average results for April 2025 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – April 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
1/04/2025	3.11	3.07	16.80	25
2/04/2025	4.34	4.43		25
3/04/2025	5.37	6.56		25
4/04/2025	5.17	5.40		25
5/04/2025		5.59		25
6/04/2025		5.08		25
7/04/2025		3.84		25
8/04/2025		4.66		25
9/04/2025		4.52		25
10/04/2025		4.79		25
11/04/2025	5.02	5.29		25
12/04/2025	7.37		28.25	25
13/04/2025	4.83		15.39	25
14/04/2025	4.03		16.95	25
15/04/2025	6.80		23.21	25
16/04/2025	4.21	4.47	17.25	25
17/04/2025	5.15	6.46	25.64	25
18/04/2025	4.88	5.76	19.98	25
19/04/2025	5.83	4.76	16.88	25
20/04/2025	5.45	4.50	15.44	25
21/04/2025	5.23	4.80	13.64	25
22/04/2025	4.78	4.41		25
23/04/2025	4.96	5.00	11.27	25
24/04/2025	5.56	5.33	16.22	25
25/04/2025	4.93	4.91	16.69	25
26/04/2025	5.18	5.16	19.76	25
27/04/2025	4.48	4.72	17.00	25
28/04/2025	3.42	3.88	9.03	25
29/04/2025	3.75	4.12	11.45	25
30/04/2025	4.27	4.58	15.47	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Real time $PM_{2.5}$ 24-hour average results for April 2025 are presented in **Figure 6-3** below.

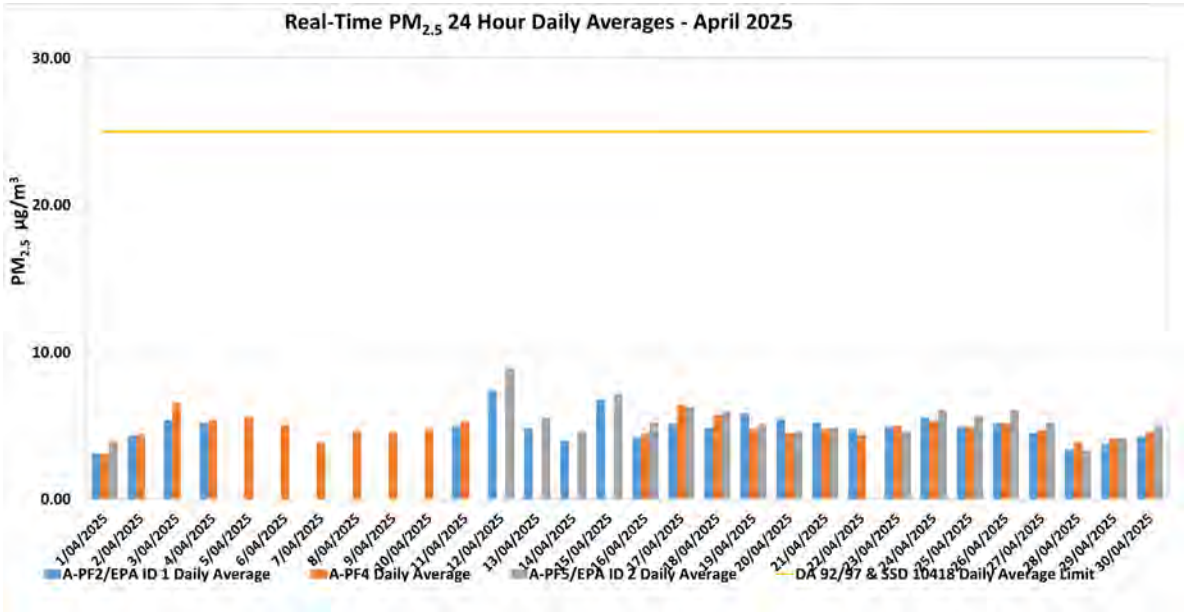

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for April 2025.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during April 2025. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

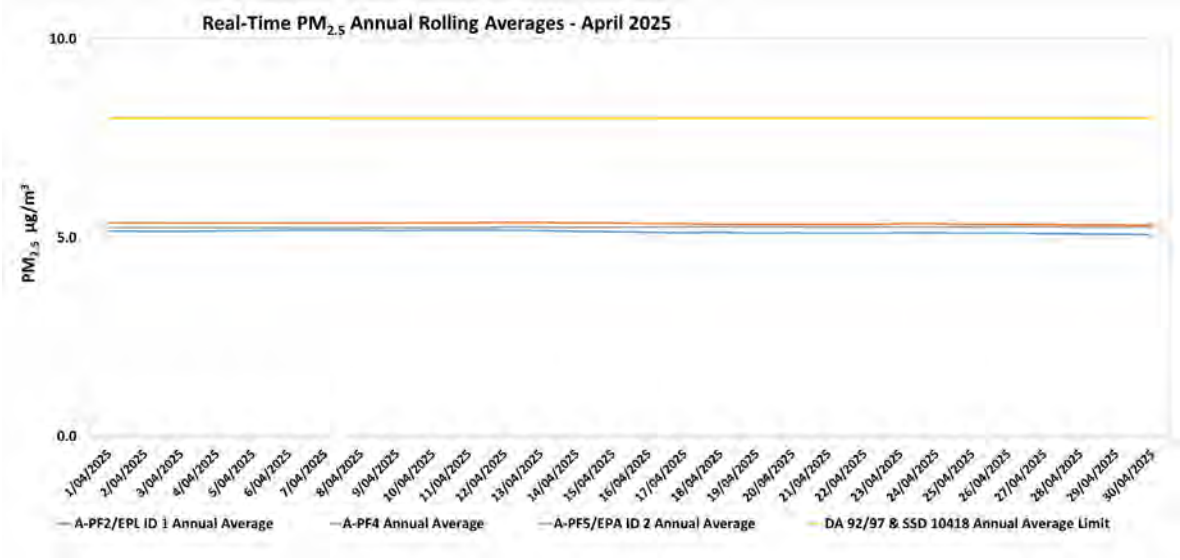

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for April 2025.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2024) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 25 April 2025. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 25 April 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	7.9	345	180	16
W2	8.0	357	210	16
W3	7.9	355	240	16
W4	7.6	2290	1300	17
W5	*	*	*	
W6A	7.9	356	210	21
W9	*	*	*	
W11	**8.2**	3970	2100	6
W12	8.0	5480	3300	6.3
W13	*	*	*	
W14	*	*	*	
W15	7.9	344	210	24
W16	8.3	7040	4300	14
W17	7.9	349	230	31

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

During 25 April 2025 monitoring event, three (3) sites were dry. Site W11 was above pH trigger levels.

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In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

8. Groundwater Monitoring

No groundwater sampling was undertaken in April 2025. Next annual and quarterly l groundwater sampling is scheduled for May2025.

9. Noise Monitoring

Attended noise monitoring was undertaken during the night of 28th Match 2025 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2021) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in April 2025 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 28 April 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:36am	IA	45	0.7 / 077	Yes	D	No
N-AT2	10:50pm	IA	45	1.4 / 171	Yes	D	No
N-AT3	11:25pm	IA	45	1.2 / 161	Yes	D	No
N-AT4	11:53pm	IA	45	0.7 / 262	Yes	E	No
N-AT5	12:15am	26	45	0.7 / 190	Yes	E	No
N-AT6	1:11am	IA	45	1.1 / 131	Yes	E	No
N-AT7	10:09pm	IA	45	2.4 / 164	Yes	D	No
N-AT8	12:42am	37	NA[2]	1.0 / 154	NA[6]	D	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

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Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 28 April 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2.4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:36am	IA	37	2.2 / 179	Yes	D	No
N-AT2	10:50pm	IA	35	6.1 / 161	Yes	D	No
N-AT3	11:25pm	IA	40	5.2 / 158	Yes	D	No
N-AT4	11:53pm	IA	38	2.6 / 161	Yes	E	No
N-AT5	12:15am	22	37	2.7 / 159	Yes	E	No
N-AT6	1:11am	IA	35	2.5 / 163	Yes	E	No
N-AT7	10:09pm	IA	37	5.0 / 161	Yes	D	No
N-AT8	12:42am	33	NA[2]	2.0 / 167	NA[6]	D	NA[6]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 28 April 2025

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	1:36am	IA	40	No
N-AT2	10:50pm	IA	40	No
N-AT3	11:25pm	IA	40	No
N-AT4	11:53pm	IA	40	No
N-AT5	12:15am	22	40	No
N-AT6	1:11am	IA	40	No
N-AT7	10:09pm	IA	40	No
N-AT8	12:42am	33	NA[4]	NA[4]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

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10. Blast Monitoring

There were ten (10) blast events during April 2025 (a total of 23 blasts YTD). Results for April are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – April 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
3/04/25	14:58	0.090 mm/s	89.9 DBL	0.060 mm/s	88.5 DBL	Y
4/04/25	10:58:00	0.340 mm/s	91.9 DBL	0.440 mm/s	92.6 DBL	Y
9/04/25	15:03	0.090 mm/s	97.2 DBL	0.060 mm/s	101 DBL	Y
10/04/25	14:19	0.220 mm/s	89.1 DBL	0.450 mm/s	95.9 DBL	Y
15/04/25	11:40	0.570 mm/s	103 DBL	0.620 mm/s	102 DBL	Y
17/04/25	11:15	0.590 mm/s	97.3 DBL	0.480 mm/s	94.8 DBL	Y
24/04/25	14:40	0.730 mm/s	101 DBL	0.480 mm/s	102 DBL	Y
28/04/25	16:01	0.440 mm/s	93.6 DBL	0.540 mm/s	89.4 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

May 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 May 2025
Reporting Period End Date	31 May 2025
Date All Data Received	20 June 2025

Links to three key regulatory documents are provided here:

- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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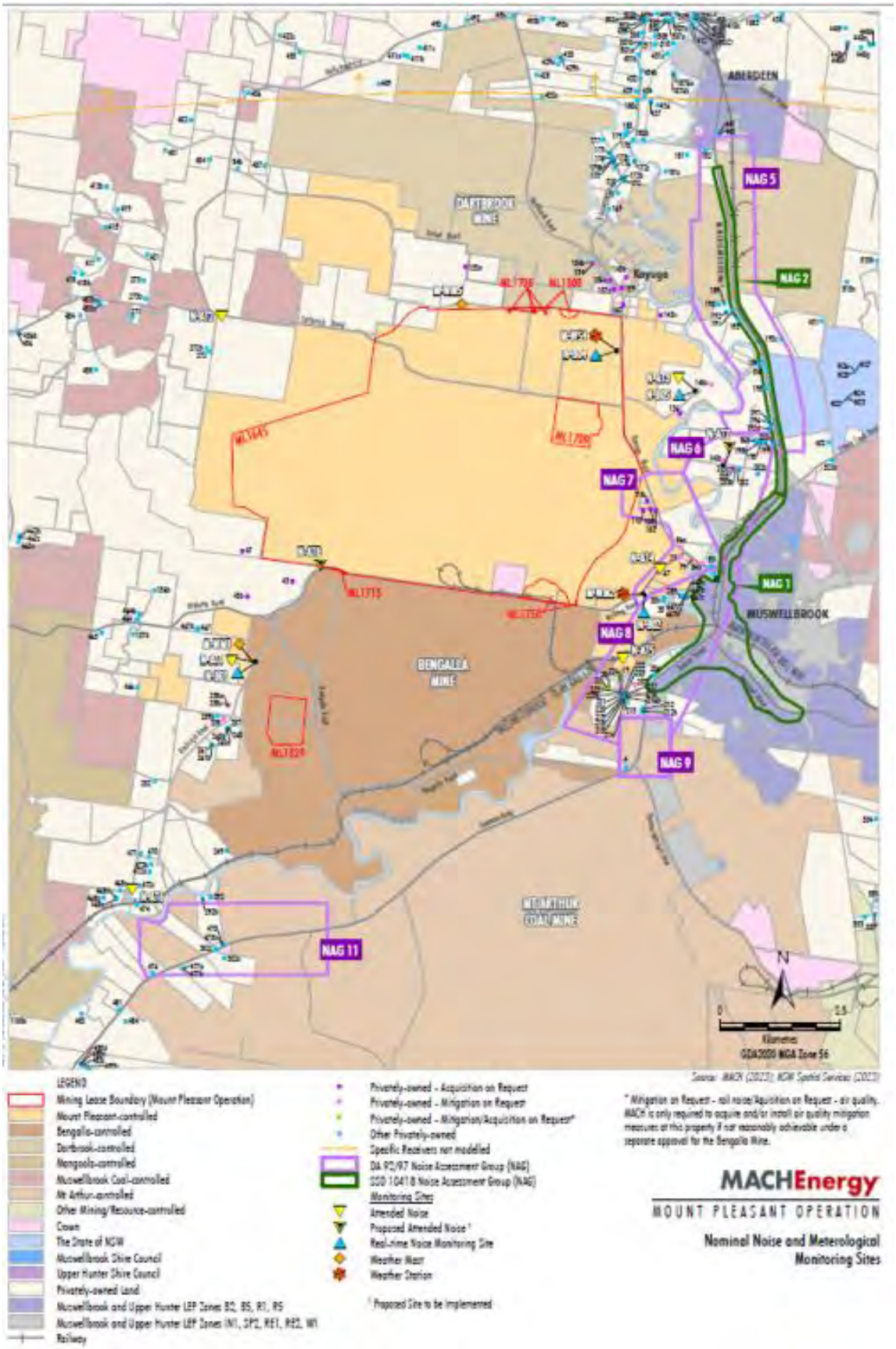

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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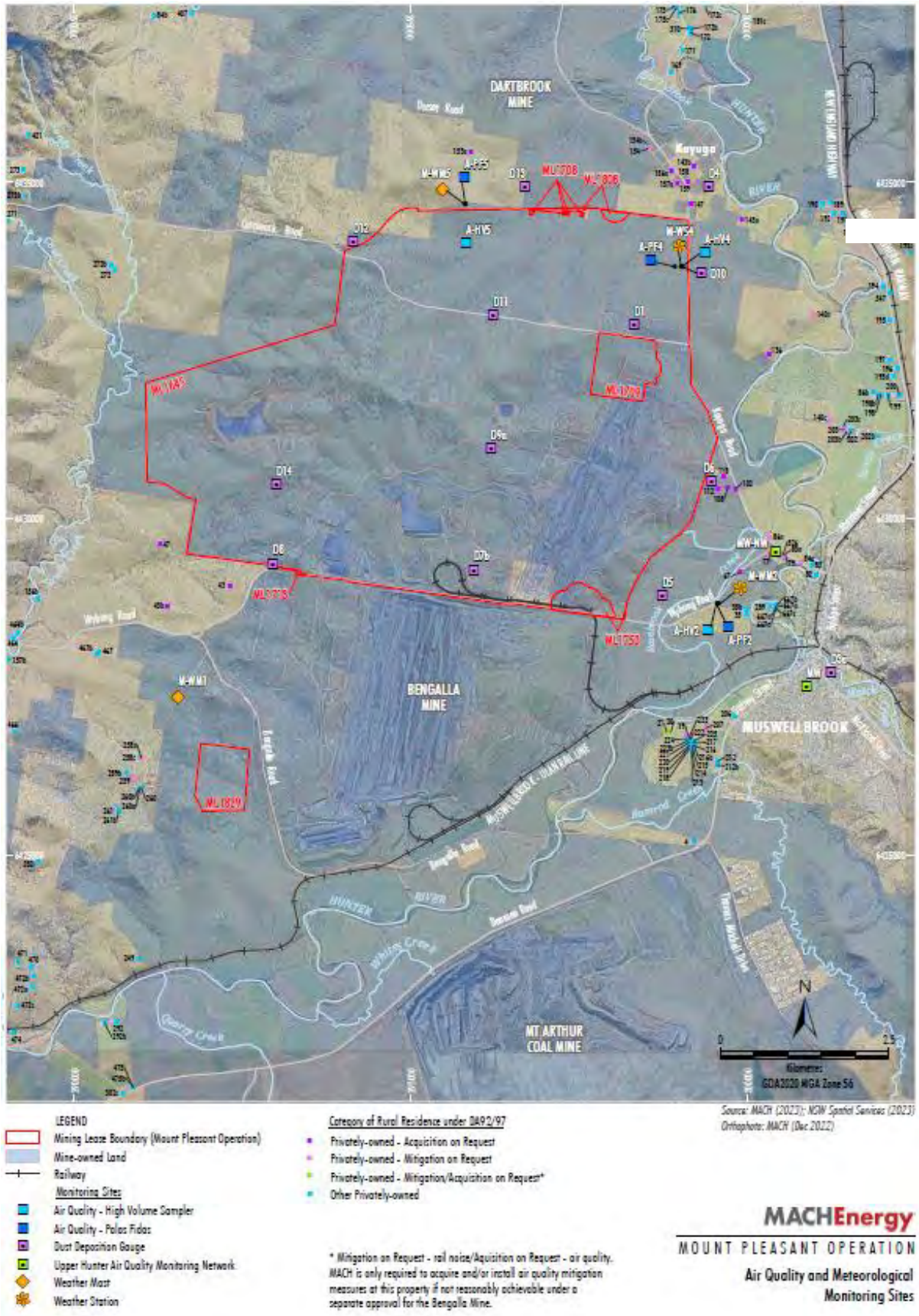

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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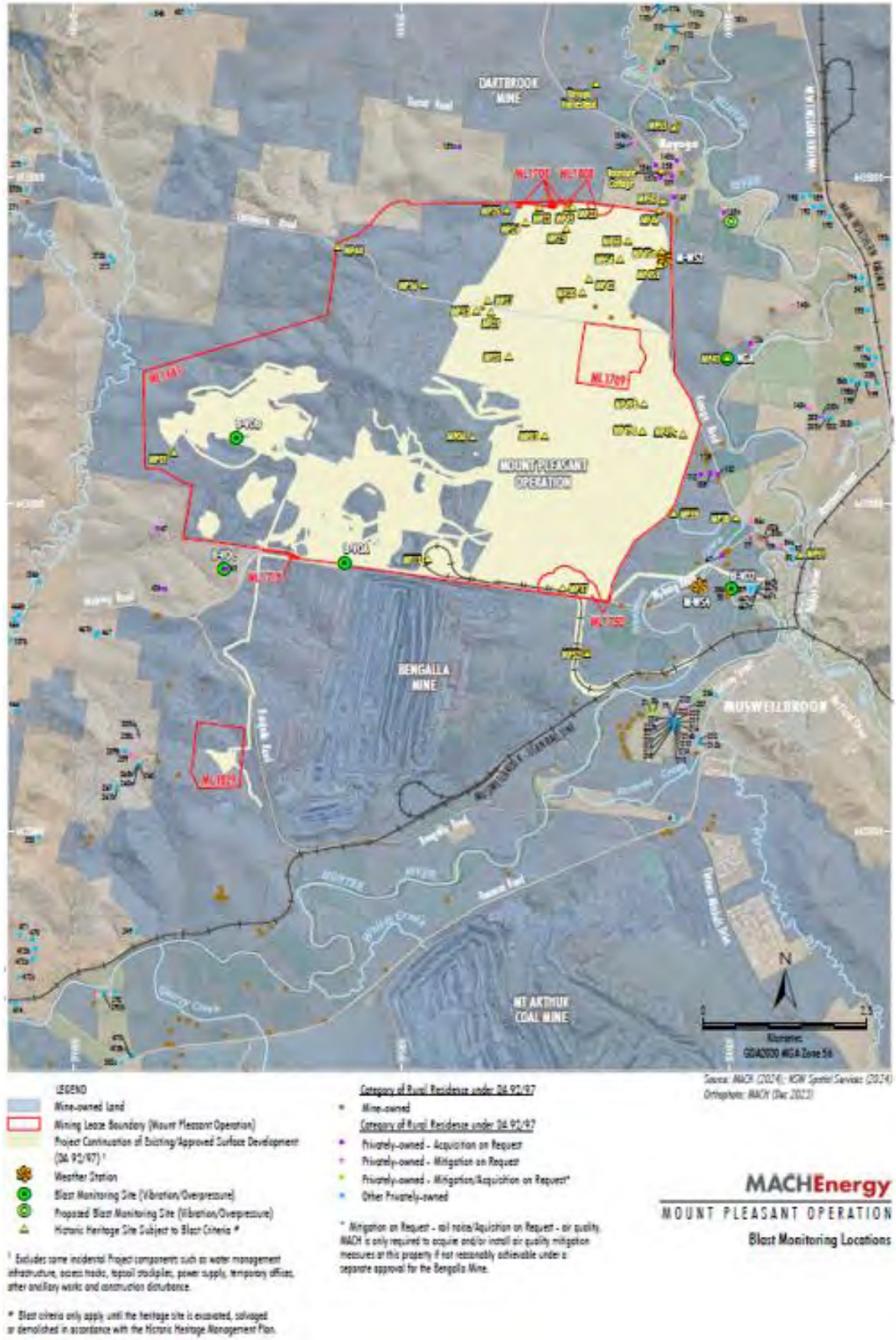

Figure 2-3 – MPO Blast Monitoring Locations

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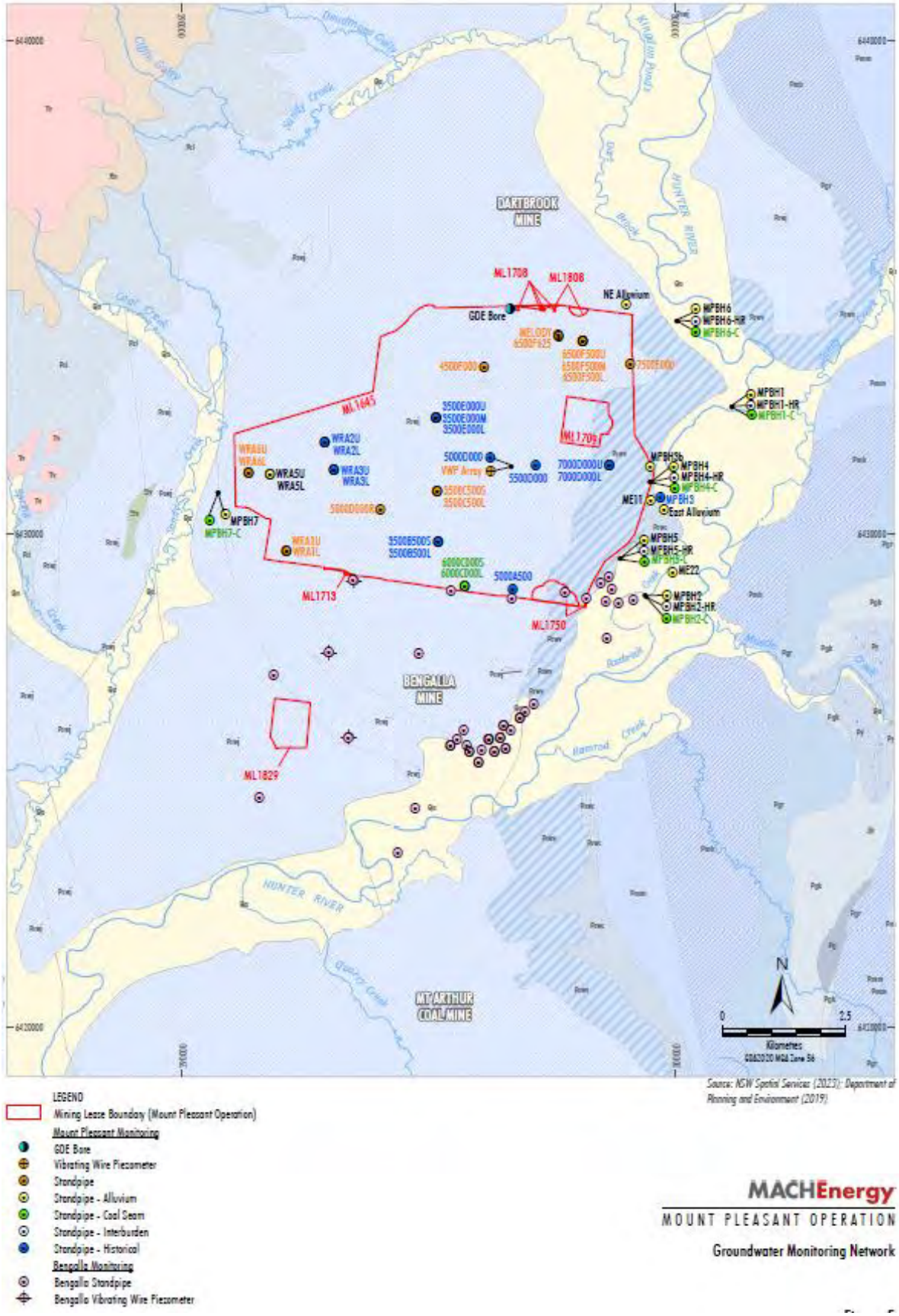

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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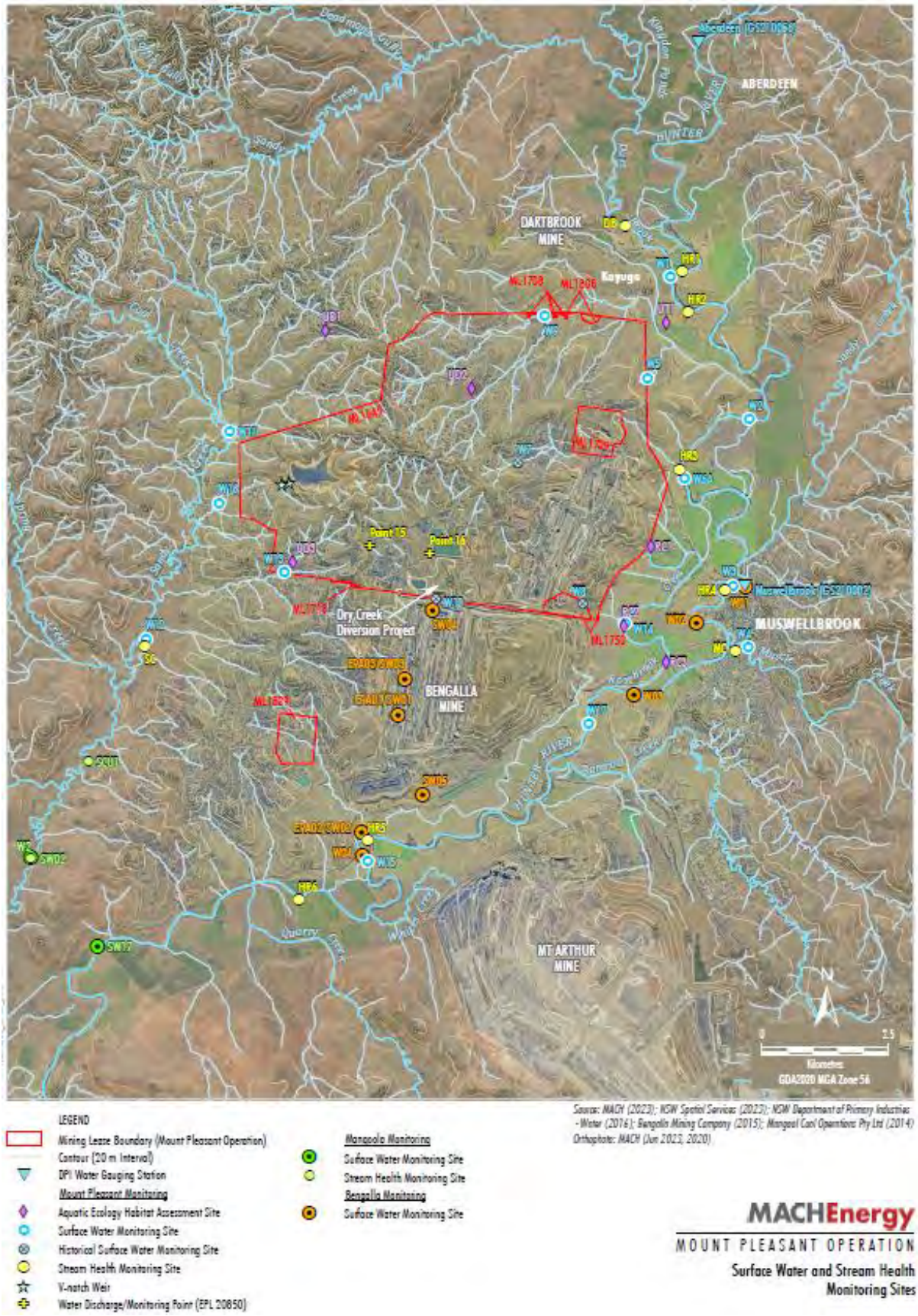

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 during May 2025 (the monitoring period). An additional monitor (E-BAM) was relocated to M-WS4 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4.
Throughout May 2025, there was 136.4mm and 132.6mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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4.2 Results

The dust deposition exposure period for gauges commenced on 28 April 2025 sample collection was undertaken on 28 May 2025 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for May 2025 have been provided as an indication of performance between June 2024 – May 2025 and represents 12month average results as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – May 2025

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	3.9	3.0
D3	1.7	1.5
D4	1.1	1.1
D5a	1.6	2.1
D6	1.8	2.0
D7b	7.6	**7.6**
D8	6.0	**4.9**
D9a	5.3	3.7
D10	1.2	1.2
D11	6.6	**4.3**
D12	2.1	1.4
D13	3.0	2.1
D14	5.0	3.9
Criterion	-	**4.0**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

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Field notes from the May sampling event noted that all thirteen gauges contained insects, two had bird droppings. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites.

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

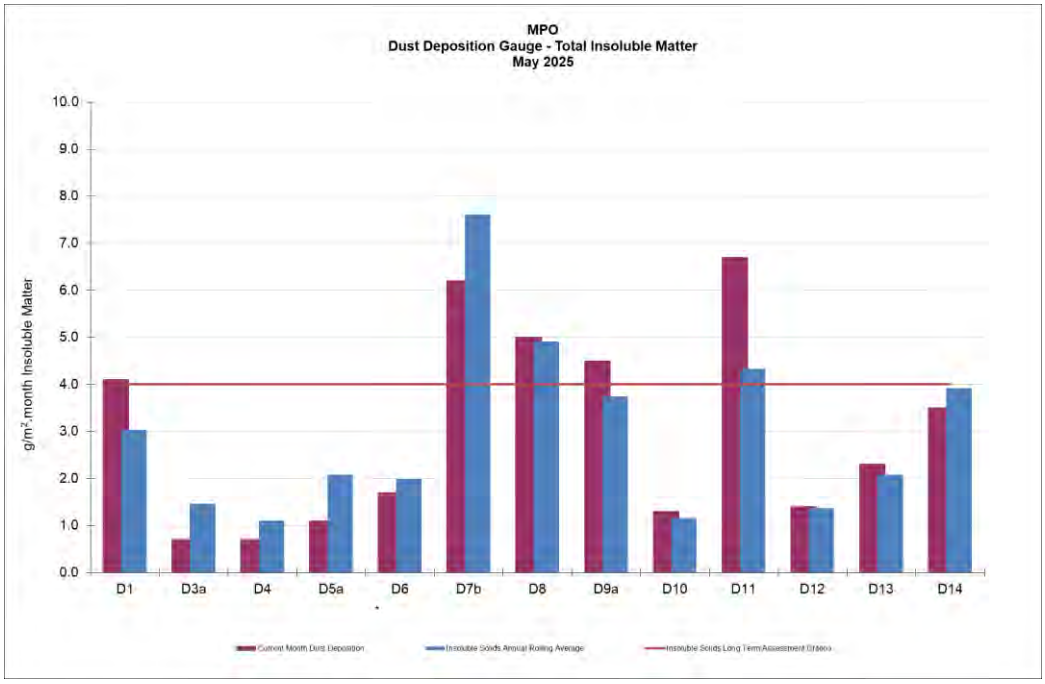

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – May 2025

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval

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DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Twelve month rolling averages to May 2025 is provided as an indication of performance between June 2024 – May 2025 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – May 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
6/05/2025	-	60.8	41	39
12/05/2025		18.7	90	21.8
18/05/2025		22.9	49.5	23.5
24/05/2025	-	22.4	10.2	11.1
30/05/2025	-	65.1	38.4	41.3
*Monthly Mean	-	38	45.8	27.3
Annual Rolling Average	90	47	49	36

Notes:
** Results have been rounded to one decimal place for reporting purposes where applicable.*
^ Indicates makeup run results for run date 11/11/2024.

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3. Elevated dust result during the month were due to a regional dust storm that cam in from western Australia.

6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (PM_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during May 2025.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages to May 25 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during the last 12 month as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in May 2025. Real time PM_{10} 24 hour daily average results for May 2025 are presented in **Table 6-1.**

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Table 6-1: MPO Palas Fidas PM_{10} Data – May 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result				
01/05/2025	11.24	12.30	19.95	18	50
02/05/2025	12.51	11.26	19.18	14.1	50
03/05/2025	9.41	9.56	15.26	13.1	50
04/05/2025	9.67	9.76	17.91	12	50
05/05/2025	9.87	9.49	13.73	11.8	50
06/05/2025	13.93	12.85	21.54	21.5	50
07/05/2025	13.98	8.81	9.00	17.6	50
08/05/2025	14.85	10.73	11.30	19.5	50
09/05/2025	14.14	14.78	19.98	17.3	50
10/05/2025	11.10		16.82	12.1	50
11/05/2025	9.43		14.48	7.7	50
12/05/2025	8.85		14.92	9.6	50
13/05/2025	9.83		16.94	9.2	50
14/05/2025	12.63		17.23	16.3	50
15/05/2025	17.11	9.92	25.97	16	50
16/05/2025	12.90	7.75	15.31	13	50
17/05/2025	11.95	9.23	11.41	16.5	50
18/05/2025	12.56	8.06	13.84	12.4	50
19/05/2025	9.45	6.00	12.33	6.3	50
20/05/2025	7.10	6.29	7.45	8.7	50
21/05/2025	7.54		7.39	7.1	50
22/05/2025	6.71	6.23	6.93	7	50
23/05/2025	9.03	8.34		8.2	50
24/05/2025	10.33	7.39		11.3	50
25/05/2025	11.75	8.65		19.4	50
26/05/2025	15.65	12.47		15.9	50
27/05/2025	37.22	25.66		**90.9**	50
28/05/2025	33.42		13.37	11.8	50
29/05/2025	9.42		7.42	16.4	50
30/05/2025	11.08		10.64	18.6	50
31/05/2025	14.29		15.84	17.2	50

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites May 2025.

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6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during May 2025. High reading at Muswellbrook station was due to regional dust storm. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

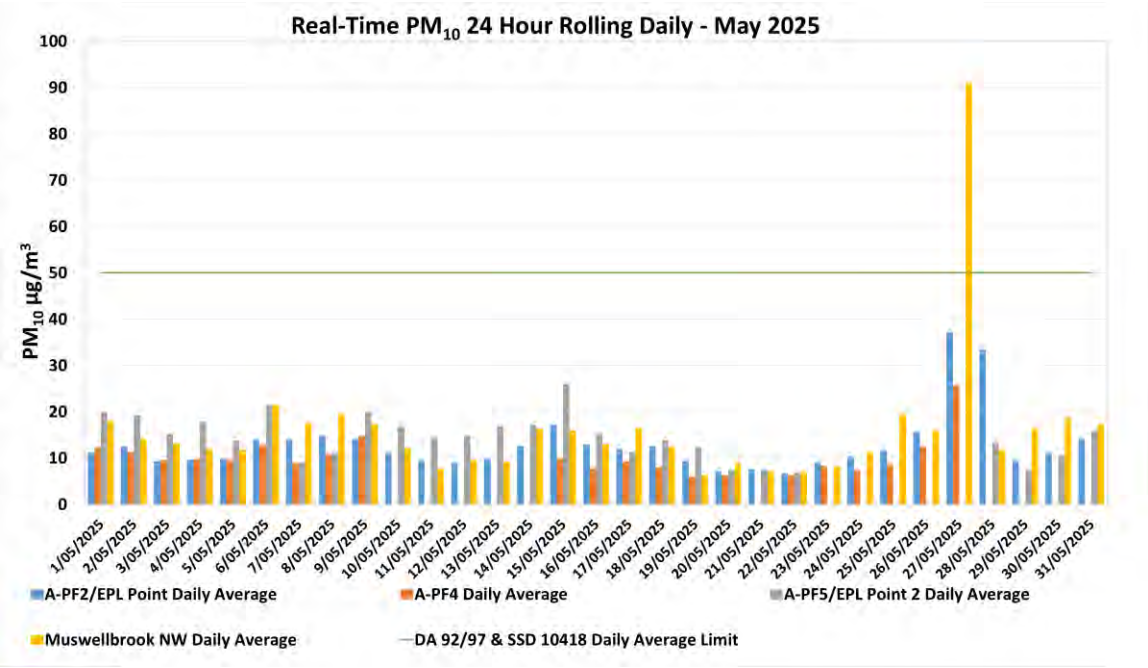

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for May 2025.

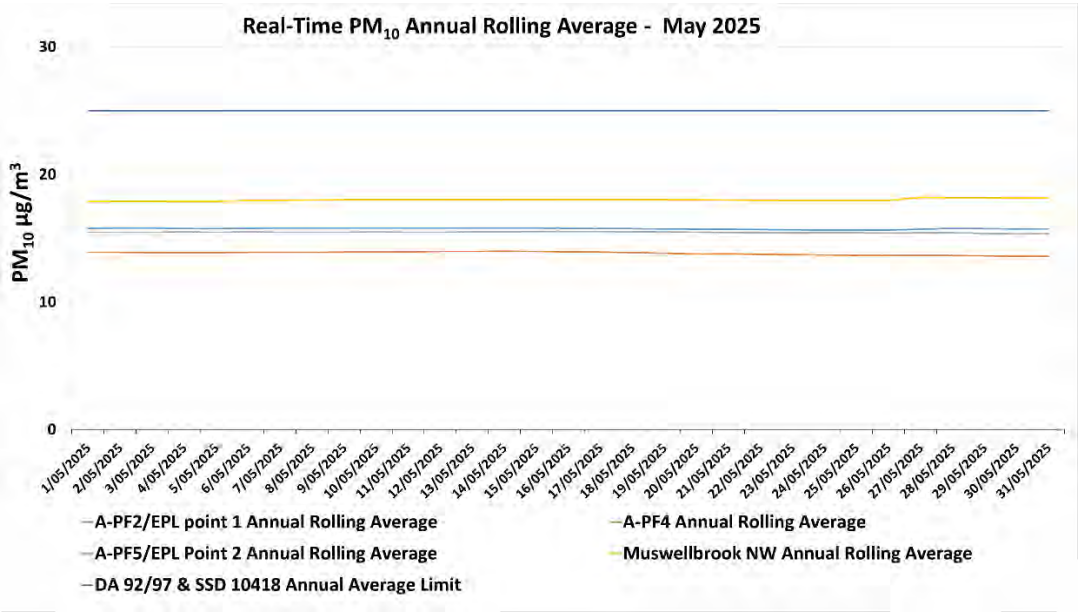

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for May 2025.

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6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during May 2025. Real time $PM_{2.5}$ 24 hour rolling average results for May 2025 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – May 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
01/05/2025	3.90	4.37	5.05	25
02/05/2025	3.88	3.87	4.81	25
03/05/2025	3.63	3.70	4.52	25
04/05/2025	3.99	3.79	4.73	25
05/05/2025	4.37	4.15	4.79	25
06/05/2025	4.81	4.40	5.45	25
07/05/2025	4.53	3.48	3.43	25
08/05/2025	4.22	3.72	3.82	25
09/05/2025	4.63	4.77	5.69	25
10/05/2025	4.27		5.45	25
11/05/2025	4.19		4.87	25
12/05/2025	4.00		4.53	25
13/05/2025	4.08		4.93	25
14/05/2025	5.06		5.68	25
15/05/2025	6.56	5.50	7.79	25
16/05/2025	5.43	4.59	6.14	25
17/05/2025	5.85	5.50	5.44	25
18/05/2025	5.50	4.80	5.28	25
19/05/2025	3.74	3.23	4.23	25
20/05/2025	3.28	3.16	3.43	25
21/05/2025	3.58		3.65	25
22/05/2025	3.25	3.18	3.43	25
23/05/2025	4.15	4.06		25
24/05/2025	3.84	3.23		25
25/05/2025	4.25	3.58		25
26/05/2025	5.47	4.74		25
27/05/2025	8.18	6.79		25
28/05/2025	6.73		4.01	25
29/05/2025	3.67		3.18	25
30/05/2025	4.54		4.30	25
31/05/2025	5.86		5.90	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Real time $PM_{2.5}$ 24-hour average results for May 2025 are presented in **Figure 6-3** below.

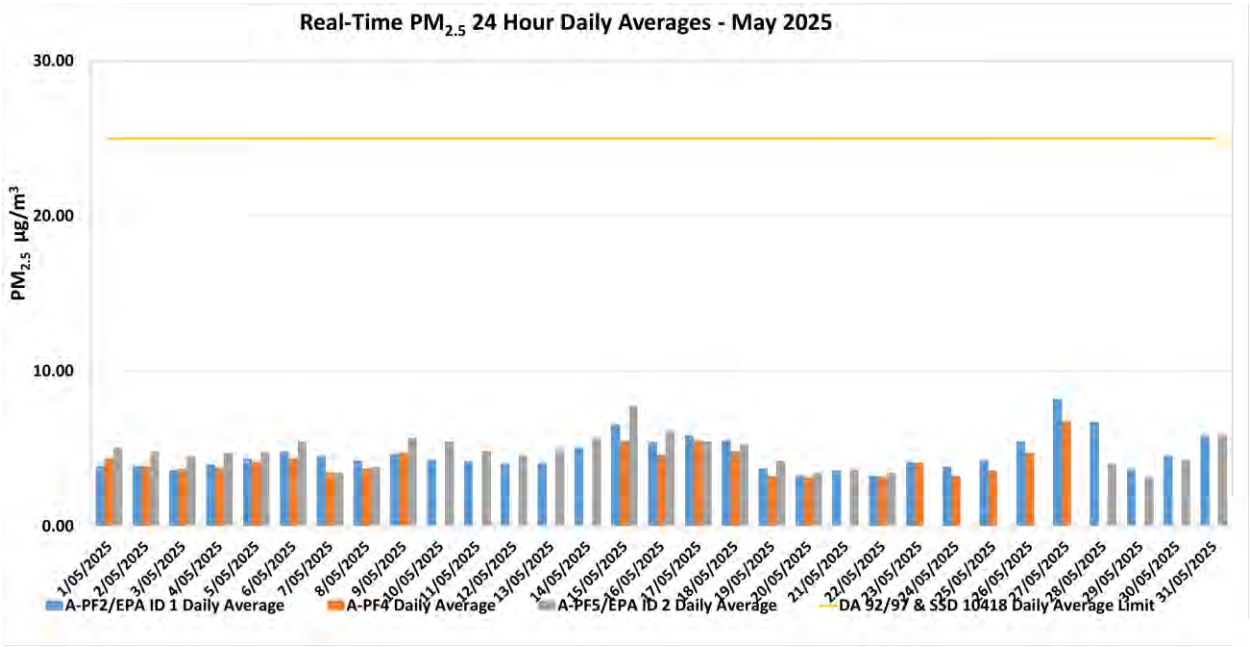

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for May 2025.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during May 2025. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

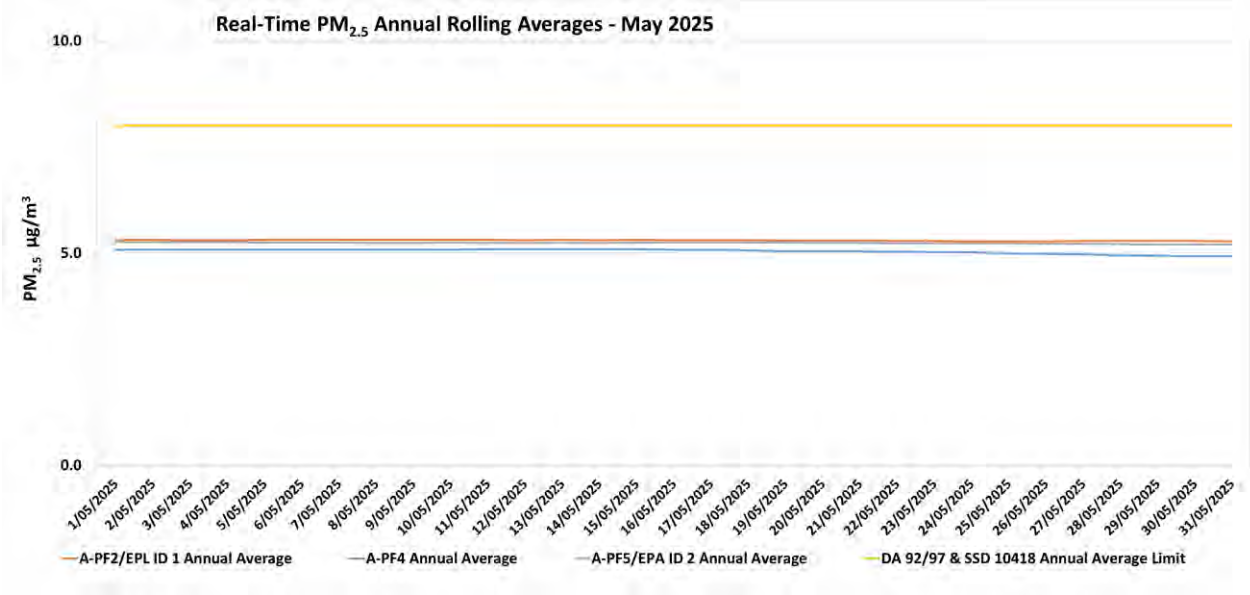

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for May 2025.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2025) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 27 May 2025. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 27 May 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	7.6	365	230	42
W2	**	**	**	**
W3	7.5	300	190	180
W4	6.8	106	220	160
W5	6.7	75	300	21
W6A	7.6	374	190	32
W9	6.7	117	300	34
W11	**	**	**	**
W12	7.4	205	280	530
W13	7.2	132	310	120
W14	*	*	*	*
W15	8.1	356	220	62
W16	**	**	**	**
W17	**	**	**	**

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

During 27 May 2025 monitoring event, one (1) site was dry, and four (4) were unable to be accessed.

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In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

8. Groundwater Monitoring

Quarterly groundwater monitoring was conducted between 8, 12, 13, 14, 26 and 29 of May 2025. Water level results for the groundwater bores are presented in **Table 8-1**. The quarterly pH and EC results are presented in **Table 8-2** and **Table 8-3**, respectively.

Table 8-1 - MPO Quarterly Groundwater Water Level Results

Monitoring Location/ ID	Water Level Trigger Range		May 2025 Water Level (DTW)	February 2025 Water Level (DTW)	Nov 2024 Water Level (DTW)	Triggered (Yes/No)
	80th Percentile (DTW)	Trigger				
WRA1L	-	>± 0.5m	2.73	2.44	1.98	
WRA1U	-	>± 0.5m	*	*	*	
WRA3L-R**	-	>± 0.5m	*	*	-	
WRA3U-R**	-	>± 0.5m	*	*	-	
WRA5L-R**	-	>± 0.5m	*	*	-	
WRA5U-R**	-	>± 0.5m	*	*	-	
WRA6L	-	>± 0.5m	0.03	0.37	0.36	
WRA6U	-	>± 0.5m	0.75	0.91	0.88	
MPBH1	9.71	10.70	9.06	9.72	9.74	No
MPBH2	12.20	13.59	11.81	11.82	11.74	No
MPBH3b	13.04	Dry (or 14.0m)	11.68	11.89	11.83	No
MPBH4	-	>± 0.5m	11.70	12.19	12.12	
MPBH5	-	>± 0.5m	*	*	*	
MPBH1-C	-	>± 0.5m	*	9.623	9.623	
MPBH1-HR	-	>± 0.5m	*	32.22	34.69	
MPBH2-C	-	>± 0.5m	11.83	11.833	11.743	
MPBH2-HR	-	>± 0.5m	11.87	11.856	11.756	
MPBH4-C	-	>± 0.5m	10.41	10.913	10.843	
MPBH4-HR	-	>± 0.5m	*	49.875	49.895	
MPBH5-C	-	>± 0.5m	*	11.479	11.359	
MPBH5-HR	-	>± 0.5m	*	11.52	11.42	
MPBH6	-	>± 0.5m	8.85	9.44	9.41	
MPBH6-C	-	>± 0.5m	10.18	10.848	10.838	
MPBH6-HR	-	>± 0.5m	8.88	10.355	10.295	
MPBH7	10.1	>± 0.5m	5.42	5.29	4.95	No

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Monitoring Location/ ID	Water Level Trigger Range		May 2025 Water Level (DTW)	February 2025 Water Level (DTW)	Nov 2024 Water Level (DTW)	Triggered (Yes/No)
	80th Percentile (DTW)	Trigger				
MPBH7-C	-	>± 0.5m	17.62	17.435	17.66	
3500C500L	-	>± 0.5m	26.42	25.98	25.79	
3500C500S	-	>± 0.5m	**25.70**	25.08	24.73	
4500F000	-	>± 0.5m	*	22.34	^	
5000D000-R	-	>± 0.5m	138.63	138.43	138.21	
5500D000	-	>± 0.5m	134.32	Removed	40.94	
6000C000L-R**	-	>± 0.5m	*	*	*	
6000C000U-R**	-	>± 0.5m	*	*	*	
6500F500L	-	>± 0.5m	**52.10**	50.48	50.46	
6500F500M	-	>± 0.5m	52.77	52.49	51.35	
6500F500U	-	>± 0.5m	31.74	31.8	31.92	
6500F625	-	>± 0.5m	16.18	16.1	16.04	
Melody	-	>± 0.5m	13.14	13.1	13.05	
7500F000	-	>± 0.5m	36.55	36.36	35.98	
GDE Bore Shallow**	-	>± 0.5m	*	*	*	
GDE Bore Deep**	-	>± 0.5m	10.92	10.86	10.67	
NE Alluvium**	-	>± 0.5m	*	^	^	
East Alluvium**	-	>± 0.5m	*	*	*	

Results in **bold** indicate that the bore has exceeded the adopted assessment criterion for changes in standing water level from the previous measurement.
* Dry/insufficient water to sample.
**New site.
^Unsafe access.

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Table 8-2 - MPO Quarterly Groundwater pH Results

Monitoring Location/ ID	pH Trigger Range		May 2025 pH	Feb 2025 pH	Nov 2024 pH	Triggered (Yes/No)
	Lower	Upper				
WRA1L	6.0	8.5	7.1	7.1	7.1	No
WRA1U			*	*	*	-
WRA3L-R**			7.5	7.5	7.6	No
WRA3U-R**			*	*	*	-
WRA5L-R**			7.4	6.9	7.1	No
WRA5U-R**			7.5	7.5	7.5	No
WRA6L			7	7	7	No
WRA6U			6.9	6.9	6.9	No
MPBH1			6.9	7	7	No
MPBH2			6.8	6.9	6.8	No
MPBH3b			7.7	7.4	7.8	No
MPBH4			6.9	6.9	7	No
MPBH5			*	*	*	-
MPBH1-C			*	**8.7**	**8.7**	-
MPBH1-HR			*	8	8	-
MPBH2-C			7.4	**10.2**	7.7	No
MPBH2-HR			7.7	8.4	7.5	No
MPBH4-C			8	8	8	No
MPBH4-HR			*	7.2	7.2	-
MPBH5-C			*	**9.1**	**9.8**	-
MPBH5-HR			*	7.4	7.5	-
MPBH6			7	7.1	7	No
MPBH6-C			7.2	7	7	No
MPBH6-HR			7.4	7.3	7.3	No
MPBH7			7.1	7	7	No
MPBH7-C			7.1	7.1	7	No
3500C500L			7.5	7.5	7.5	No
3500C500S			7.3	7.1	7.1	No
4500F000			*	6.8	^	-
5000D000-R			7.5	7.5	7.4	No
5500D000			*	Removed	6.9	-
6000C000L-R**			8.4	*	*	No
6000C000U-R**			*	*	*	-
6500F500L			7.2	7.2	7.2	No
6500F500M			7.2	7.3	7.3	No

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Monitoring Location/ ID	pH Trigger Range		May 2025 pH	Feb 2025 pH	Nov 2024 pH	Triggered (Yes/No)
	Lower	Upper				
6500F500U			6.8	6.8	6.8	No
6500F625			7	6.7	6.9	No
Melody			6.8	6.8	6.9	No
7500F000			7.8	7.7	7.7	No
GDE Bore Shallow**			*	*	*	-
GDE Bore Deep**			6.8	7.4	7.5	No
NE Alluvium**			*	^	^	-
East Alluvium**			*	*	*	-

** Dry/insufficient water to sample.*
***New site.*
^Unsafe access.
*An investigation is triggered when pH values are recorded outside the baseline range (20th – 80th percentile). Results shown in **bold** are outside of this range.*

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Table 8-3 - MPO Quarterly Groundwater EC Results

Monitoring Location/ ID	Maximum Beneficial Use Trigger	May 2025 EC[1]	Feb 2025 EC[1]	Nov 2024 EC[1]	Triggered (Yes/No)
WRA1L	7800	3120	3080	3050	No
WRA1U	*	***	***	***	-
WRA3L-R**	*	7500	*	*	-
WRA3U-R**	*	***	4800	5320	-
WRA5L-R**	*	5070	4800	5320	-
WRA5U-R**	*	5980	*	*	-
WRA6L	7800	6670	5880	5700	No
WRA6U	22000	8430	9010	8650	No
MPBH1	800	604	675	640	No
MPBH2	930	**1222**	**1247**	**1300**	**Yes**
MPBH3b	7800	5280	5920	5600	No
MPBH4	*	5290	5620	5650	-
MPBH5	*	***	***	***	-
MPBH1-C	*	***	1450	1500	-
MPBH1-HR	*	***	1580	1550	-
MPBH2-C	*	1363	1436	1078	-
MPBH2-HR	*	1113	1631	1229	-
MPBH4-C	*	4820	4950	4970	-
MPBH4-HR	*	***	5880	5500	-
MPBH5-C	*	***	1042	919	-
MPBH5-HR	*	***	842	856	-
MPBH6	*	1274	1230	1250	-
MPBH6-C	*	3770	2710	2730	-
MPBH6-HR	*	6150	1490	4760	-
MPBH7	*	7630	11480	9770	-
MPBH7-C	*	10220	10760	10280	-
3500C500L	7800	3820	3770	3890	No
3500C500S	7800	5610	6010	**8270**	No
4500F000	22000	***	8440	^	-
5000D000-R	*	4500	4490	4500	-
5500D000	7800	***	Removed	4350	No
6000C000L-R**	*	4760	4530	4780	-
6000C000U-R**	*	***	*	*	-
6500F500L	7800	2570	2530	2550	No
6500F500M	7800	2670	2780	2610	No
6500F500U	7800	5080	5120	4920	No

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Monitoring Location/ ID	Maximum Beneficial Use Trigger	May 2025 EC[1]	Feb 2025 EC[1]	Nov 2024 EC[1]	Triggered (Yes/No)
6500F625	7800	4190	4480	4310	No
Melody	*	6280	6140	5810	-
7500F000	7800	6290	6450	6350	No
GDE Bore Shallow**	*	***	***	*	-
GDE Bore Deep**	*	12850	11240	10710	-
NE Alluvium**	*	***	^	^	-
East Alluvium**	*	***	*	*	-

** Indicates no trigger limit identified*
*** New site*
**** Dry/insufficient water to sample*
^Unsafe access.
[1]Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).
An investigation is triggered when EC values recorded exceed the beneficial use quality range (as described in the GWMP) for three successive monitoring rounds. Results outside this range are shown in **bold.**

During the May 2025 monitoring event, sites WRA1U, GDE Bore Shallow, NE Alluvium and East Alluvium were dry. WRA3U-R contained insufficient water to sample and two (2) sites had changes in standing water level of greater than ± 0.5m from the previous measurement. All monitoring locations were within the pH trigger limits. All monitoring locations were below their respective EC trigger limits except MPBH2. MPBH2 have been outside these limits for five consecutive monitoring events.

An investigation is triggered if elevated measurements occur for three consecutive sampling events in accordance MPO Water Management Plan (MACH Energy, 2022). An investigation was triggered (AGE, 2023) examining the cause of elevated EC values in the alluvial zone, specifically MPBH2. The data strongly suggests that the cause of the increase in EC is persistent above-average stage in the adjacent Hunter River, caused by above-average rainfall since 2020, which is causing a rise in groundwater levels in similar alluvial bores. Trigger values have since been reviewed and will be incorporated in future Water management plans. The next quarterly ground water monitoring event is scheduled for August 2025.

9. Noise Monitoring

Attended noise monitoring was undertaken during the night of 28th Match 2025 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2024) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in May 2025 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

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Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 29 and 30 May 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:18am	IA	45	0.9 / 343	Yes	E	No
N-AT2	10:40pm	31	45	1.8 / 329	Yes	D	No
N-AT3	11:15pm	37	45	1.4 / 338	Yes	E	No
N-AT4	11:41pm	IA	45	1.5 / 040	Yes	D	No
N-AT5	12:02am	35	45	1.1 / 020	Yes	D	No
N-AT6	12:55am	IA	45	1.1 / 034	Yes	D	No
N-AT7	10:00pm	IA	45	2.1 / 342	Yes	D	No
N-AT8	12:28am	IA	NA[2]	0.9 / 208	NA[6]	E	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 29 and 30 May 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:18am	IA	37	0.9 / 343	Yes	E	No
N-AT2	10:40pm	27	35	1.8 / 329	Yes	D	No
N-AT3	11:15pm	34	40	1.4 / 338	Yes	E	No
N-AT4	11:41pm	IA	38	1.5 / 040	Yes	D	No
N-AT5	12:02am	30	37	1.1 / 020	Yes	D	No
N-AT6	12:55am	IA	35	1.1 / 034	Yes	D	No
N-AT7	10:00pm	IA	37	2.1 / 342	Yes	D	No
N-AT8	12:28am	IA	NA[2]	0.9 / 208	NA[6]	E	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

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Table 9-3 – $L_{Aeq, period}$ Cumulative Noise: Attended Night Monitoring – 29 and 30 May 2025

Location	Start Date and Time	Measured Mining Only $L_{Aeq, period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	1:18am	IA	40	No
N-AT2	10:40pm	27	40	No
N-AT3	11:15pm	34	40	No
N-AT4	11:41pm	IA	40	No
N-AT5	12:02am	30	40	No
N-AT6	12:55am	IA	40	No
N-AT7	10:00pm	IA	40	No
N-AT8	12:28am	IA	NA[2]	NA[2]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

10. Blast Monitoring

There were nine (9) blast events during May 2025 (a total of 32 blasts YTD). Results for May are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – May 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
1/05/25	15:06	0.520 mm/s	97.4 DBL	0.790 mm/s	95.5 DBL	Y
6/05/2025	11:32	0.460 mm/s	90.7 DBL	0.590 mm/s	96.4 DBL	Y
9/05/2025	10:59	0.760 mm/s	100.5 DBL	1.040 mm/s	104.1 DBL	Y

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9/05/2025	09:03	0.300 mm/s	96.9 DBL	0.080 mm/s	87 DBL	Y
13/05/2025	14:50	0.030 mm/s	97.6 DBL	0.040 mm/s	95.6 DBL	Y
14/05/2025	16:12	0.780 mm/s	106.1 DBL	0.160 mm/s	87.6 DBL	Y
16/05/2025	09:12	0.490 mm/s	96.3 DBL	0.280 mm/s	93.7 DBL	Y
29/05/2025	15:01	0.710 mm/s	96 DBL	0.950 mm/s	101.3 DBL	Y
29/05/2025	15:49	0.270 mm/s	79.4 DBL	0.220 mm/s	92.3 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

June 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 June 2025
Reporting Period End Date	30 June 2025
Date All Data Received	16 July 2025

Links to three key regulatory documents are provided here:

- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Palas Fidas Air Quality Monitoring sites.
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with *MPO Environmental Monitoring Program* (*EMP*), Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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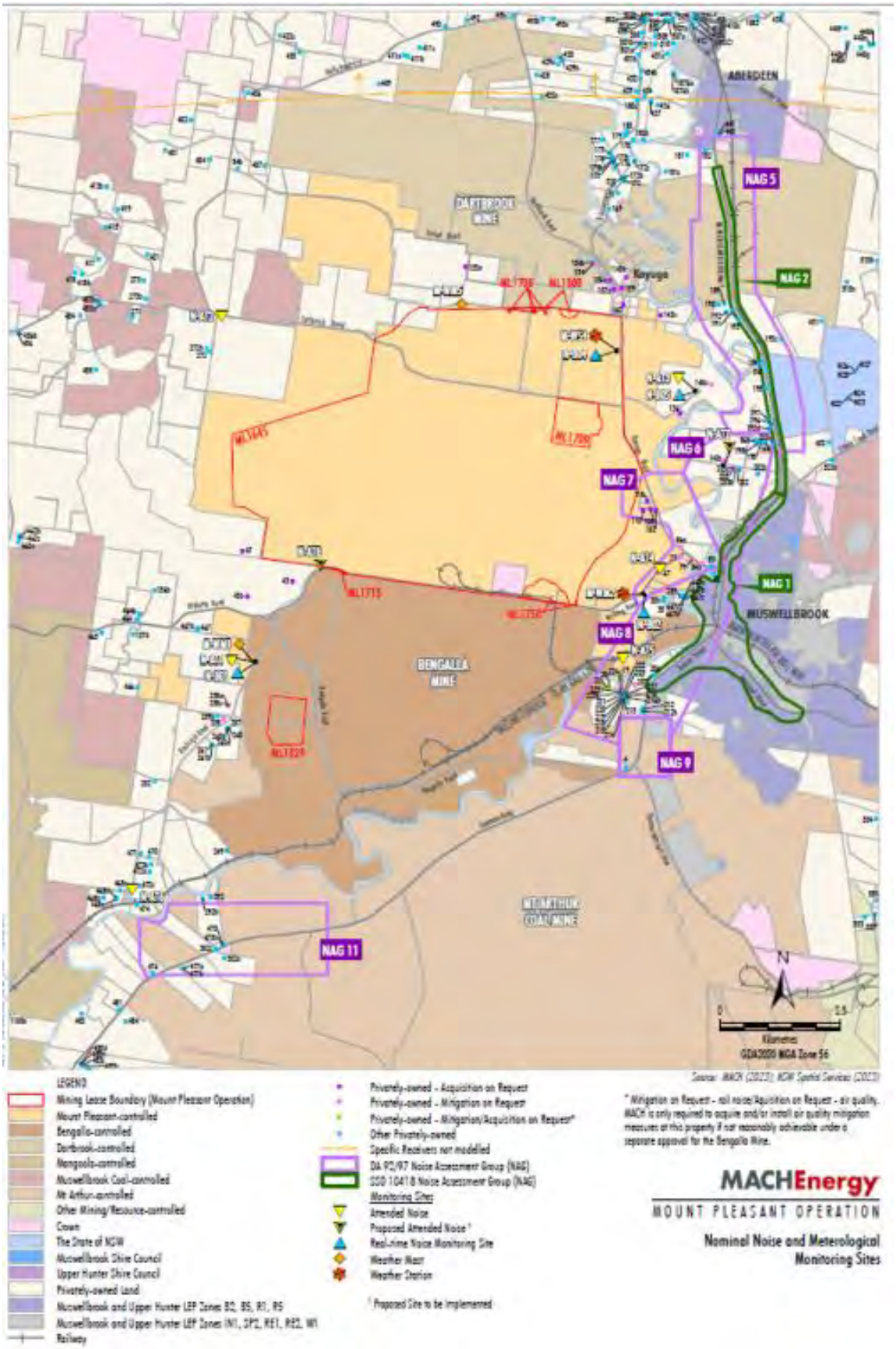

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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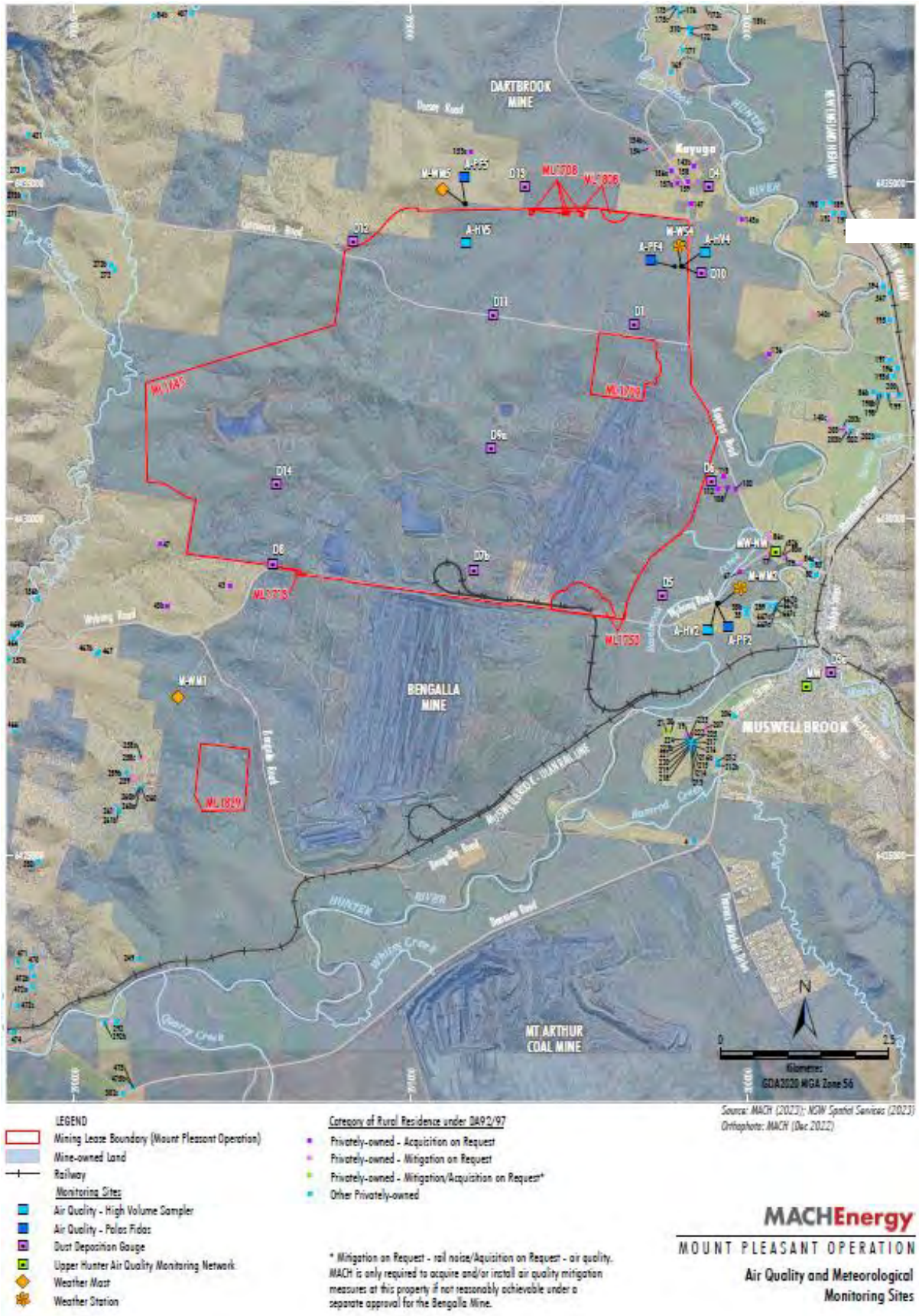

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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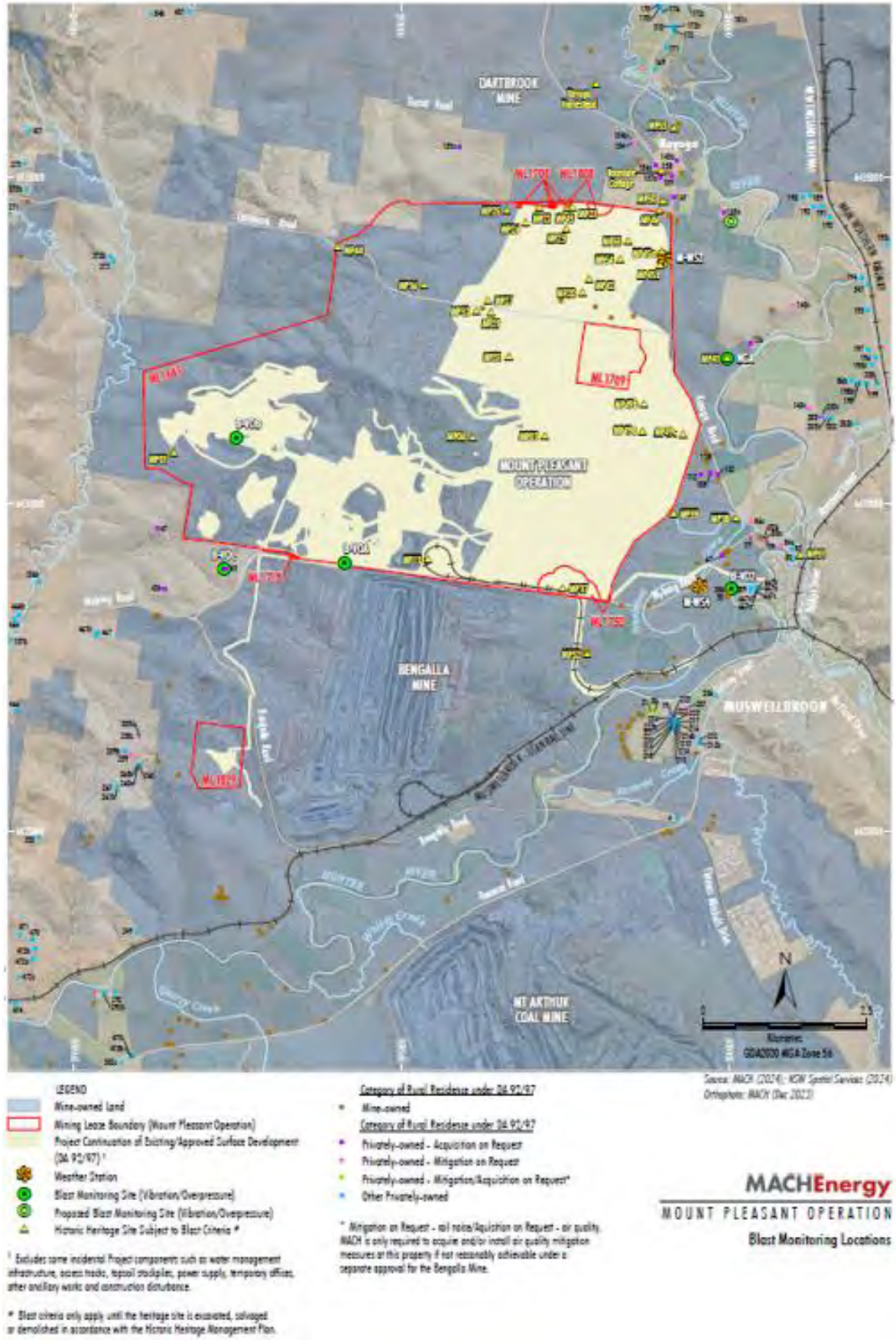

Figure 2-3 – MPO Blast Monitoring Locations

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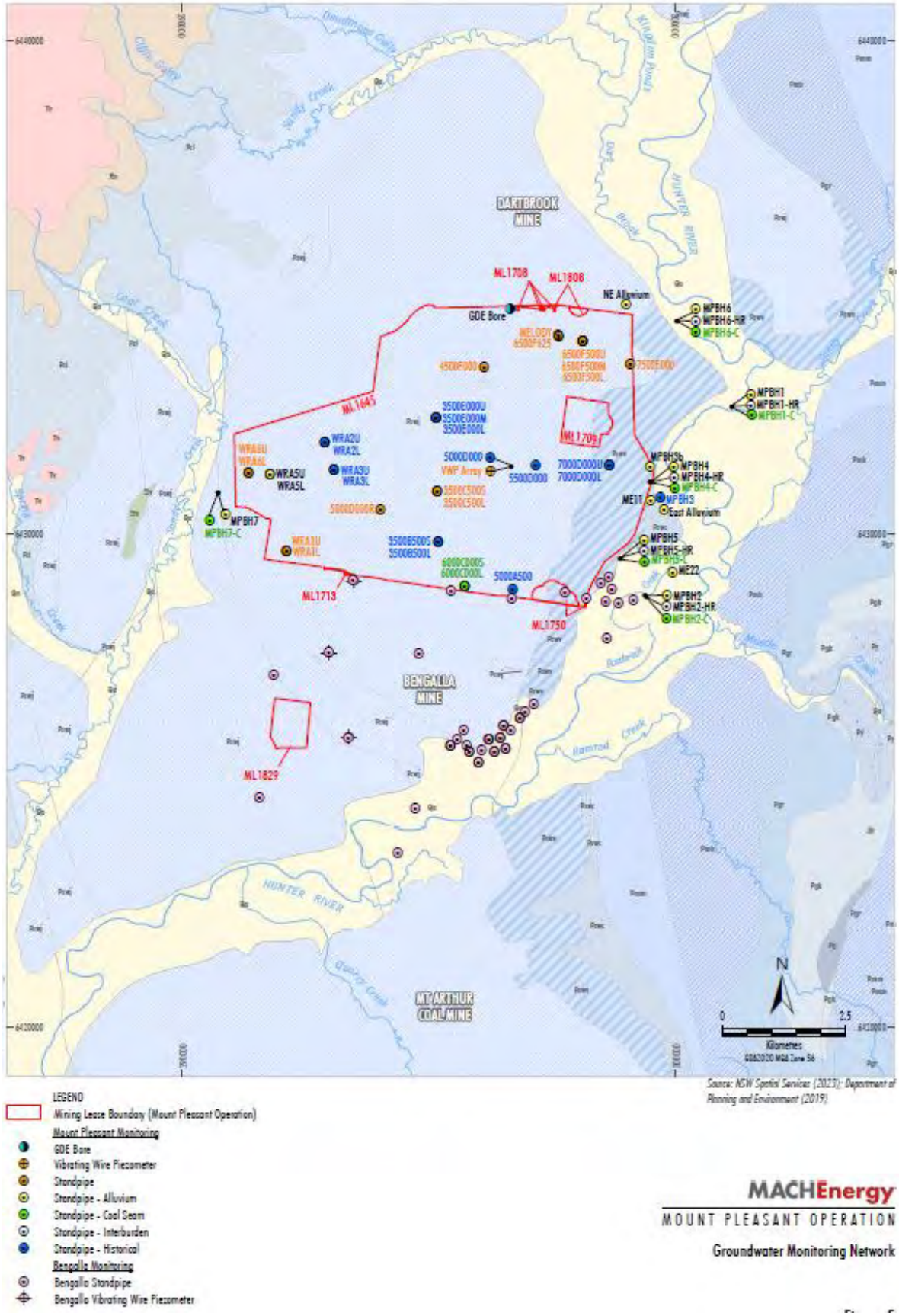

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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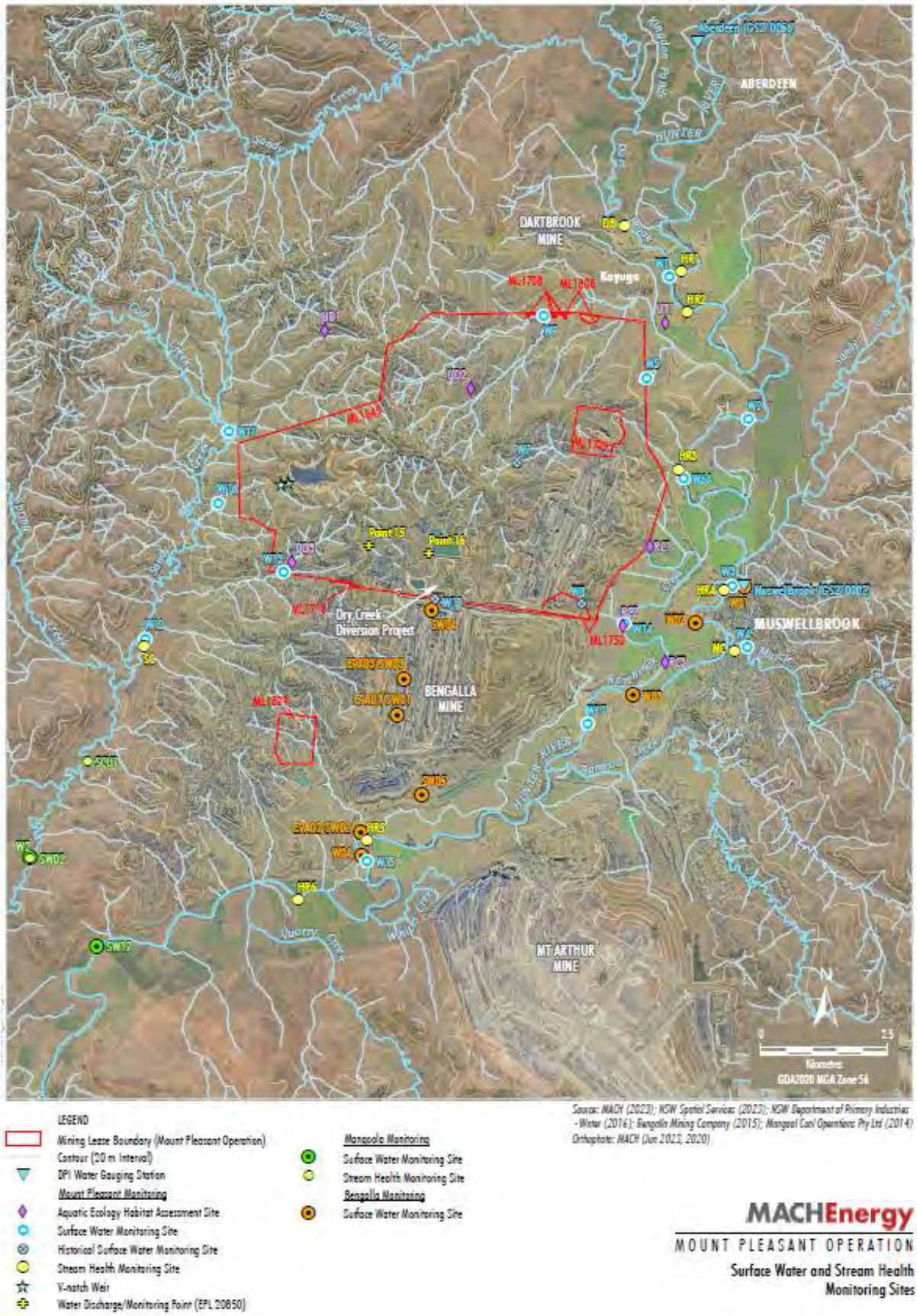

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 during June 2025 (the monitoring period). An additional monitor (E-BAM) was relocated to M-WS4 to provide additional capture for air quality. Additional meteorological data was collected at M-WS4.
Throughout June 2025, there was 20.2mm and 20.0mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

Dust deposition was monitored according to the OEH's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC 2007), which references *Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method*. The dust deposition monitoring network comprises of 13 dust deposition gauges (DDG). Details of the monitoring locations are shown in **Figure 2-2**.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM_{10}, and $PM_{2.5}$. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices, effectively supplanting the older dust deposition gauges. This transition from the previous development consent DA92/97 (which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued.

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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4.2 Results

The dust deposition exposure period for gauges commenced on 25 June 2025 sample collection was undertaken on 25 June 2025 by AECOM with sample analysis performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory. Results are summarised in **Table 4-1**. Annual rolling averages for June 2025 have been provided as an indication of performance between July 2024 – June 2025 and represents 12 month average results as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – June 2025

Location	YTD Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	3.7	2.9
D3	1.5	1.3
D4	1.0	1.0
D5a	1.8	2.1
D6	1.8	2.0
D7b	8.4	**7.4**
D8	5.5	**4.7**
D9a	4.8	3.8
D10	1.1	1.1
D11	5.8	**4.3**
D12	1.8	1.3
D13	2.7	2.0
D14	4.6	3.9
Criterion	-	**4.0**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*

Contaminated results, as described in Section 4.1, are not included in the 12-month rolling average. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area. Furthermore, there are no privately-owned receivers in the vicinity of D8, D9 and D14. Whilst these sites do not represent residence(s) on privately-owned land, they will continue to be monitored in accordance with the *MPO Air Quality and Greenhouse Gas Management Plan* (MACH Energy, 2019).

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Field notes from the June sampling event noted that all thirteen gauges contained insects, two had bird droppings and one had vegetation. Annual average dust deposition results were below the annual average criterion of 4 g/m2.month at all sites except D7b (7.4 g/m2), D8 (4.7 g/m2) and D11 (4.3 g/m2).

Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

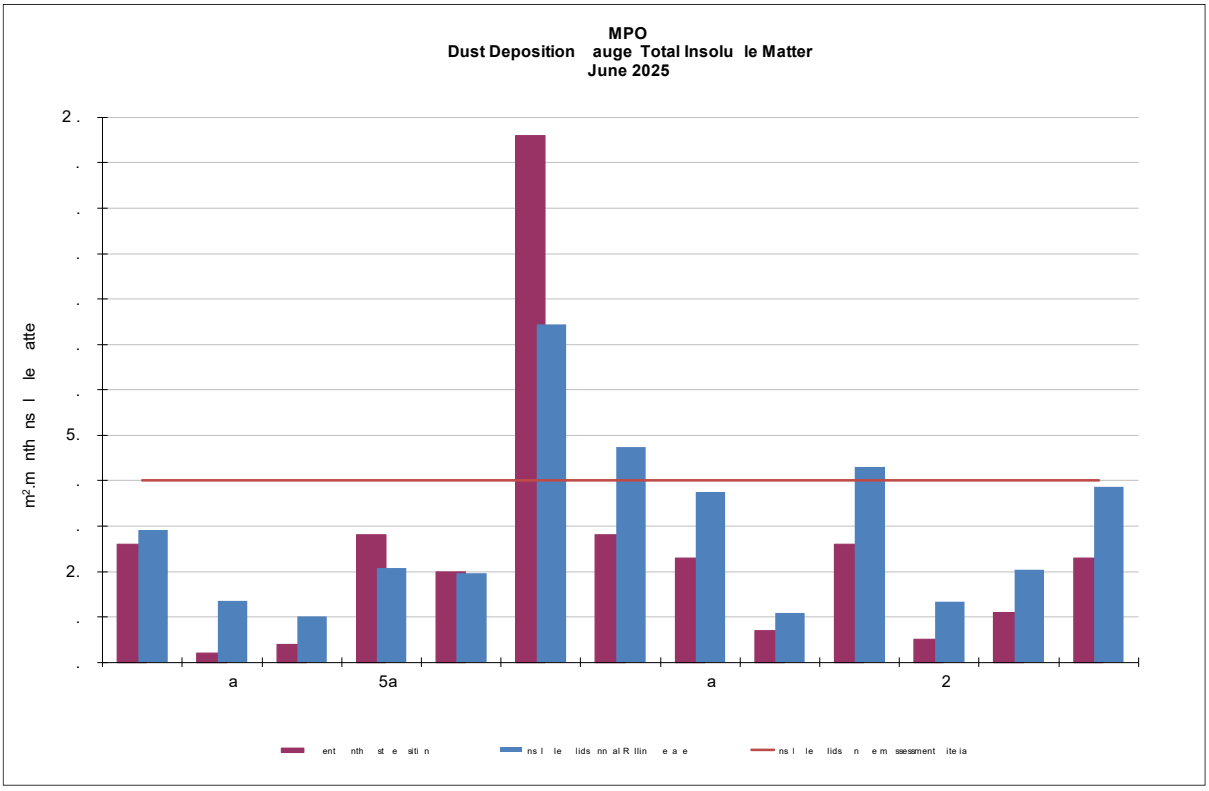

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average – June 2025

5. Total Suspended Particulates

All High-Volume Air Samplers (HVAS) are run for 24 hours every six days in accordance with *AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2007), referencing *AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method*, for the monitoring of TSP.

Three TSP HVAS units are included in the MPO air quality monitoring network and are displayed in **Table 5-1** below. These units were commissioned in March 2017.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

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5.1 Assessment Criteria

TSP is assessed against the guidelines defined in the *EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90 µg/m^3.

5.2 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in **Table 5-2**. Twelve month rolling averages to June 2025 is provided as an indication of performance between July 2024 – June 2025 as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – June 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
05/06/2025	-	12.9	12.3	15.6
11/06/2025		95.5	2	6.5
17/06/2025		60.8	7.4	11.1
23/06/2025	-	33.8	17.8	28.4
29/06/2025	-	37.4	14	46
*Monthly Mean	-	48.1	47	21.5
Annual Rolling Average	90	48	46	36

Notes:
** Results have been rounded to one decimal place for reporting purposes where applicable.*

5.3 Discussion

For the reporting period, the annual rolling average TSP data at all sites was below the annual average criterion of 90 µg/m^3.

6. Real Time Air Quality Monitoring

Continuous particulate matter less than 10 µm (P_{10}) and particulate matter less than 2.5 µm ($PM_{2.5}$) monitoring was conducted by three Palas Fidas units (one utilised for management only) at MPO during June 2025.

The EPA identification numbers 1 and 2 refer to Palas Fidas units installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third unit (A-PF4) is installed on Kayuga Road with data used for management purposes only.

Real time PM_{10} and $PM_{2.5}$ 12-month rolling averages to June 25 have been provided in Section 6.2 and 6.4 respectively, as an indication of performance during the last 12 month as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

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6.1 PM_{10} Results – 24 Hour Rolling Average

In accordance with the DA 92/97 and SSD 10418 limit of 50 µg/m^3 for the 24-hour daily average, there were no elevated readings in June 2025. Real time PM_{10} 24 hour daily average results for June 2025 are presented in **Table 6-1.**

Table 6-1: MPO Palas Fidas PM_{10} Data – June 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	Muswellbrook NW	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m^3)
	24-hour Average Result				
01/06/2025	12.35		15.37	10.2	50
02/06/2025	11.18		12.57	10.4	50
03/06/2025	12.36		14.64	10.7	50
04/06/2025	12.58	12.81	10.32	10.8	50
05/06/2025	8.95	9.95	9.76	9.3	50
06/06/2025	10.39	8.41	7.70	8.1	50
07/06/2025	13.09	7.80	6.34	15.4	50
08/06/2025	13.80	9.02	8.28	17.8	50
09/06/2025	12.76	7.06	6.47	15.2	50
10/06/2025	17.78	5.85	5.55	20.5	50
11/06/2025	21.95	5.46	5.16	16.8	50
12/06/2025	12.90	6.21	5.24	11.8	50
13/06/2025	12.96	8.09	6.71	15.2	50
14/06/2025	14.51	12.10	11.96	14.1	50
15/06/2025	12.77	10.97	12.08	12.1	50
16/06/2025	12.97	8.29	6.74	12.5	50
17/06/2025	13.60	8.11	6.98	13.2	50
18/06/2025	15.39	10.22	10.66	18	50
19/06/2025	17.85	18.07	22.88	18.8	50
20/06/2025	18.19	23.60	22.83	20.6	50
21/06/2025	17.92	22.62	23.13	20.8	50
22/06/2025	16.33	16.80	20.54	12.8	50
23/06/2025	14.36	10.18	7.65	13.2	50
24/06/2025	10.90	10.42	8.16	8.6	50
25/06/2025	12.36	9.30	8.75	25.7	50
26/06/2025	10.79	8.09	7.55	9.8	50
27/06/2025	9.14	8.57	9.13	11	50
28/06/2025	10.96	9.49	9.83	8.1	50
29/06/2025	9.70	9.86	10.04	12.4	50
30/06/2025	13.27	14.85	12.20	12.6	50

*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Figure 6-1 below shows the results of real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites June 2025.

6.2 PM_{10} Results – Annual Rolling Average

There was no exceedance of the PM_{10} annual rolling average reported at MPO during June 2025. Real time PM_{10} annual rolling averages during the reporting period are presented in **Figure 6-2** below.

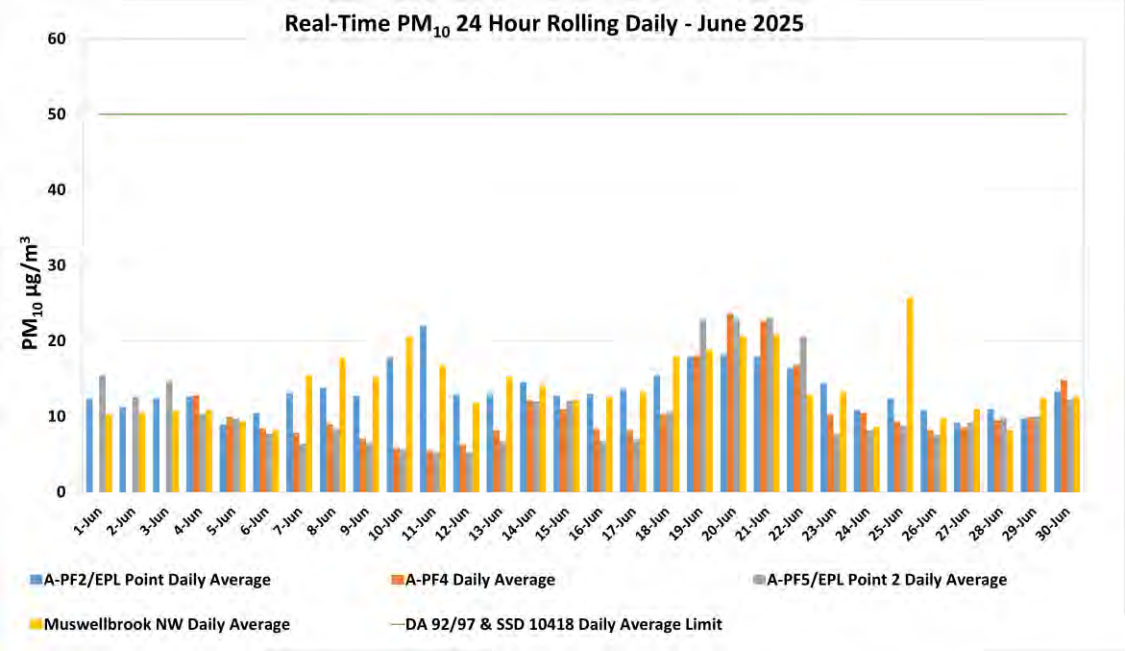

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for June 2025.

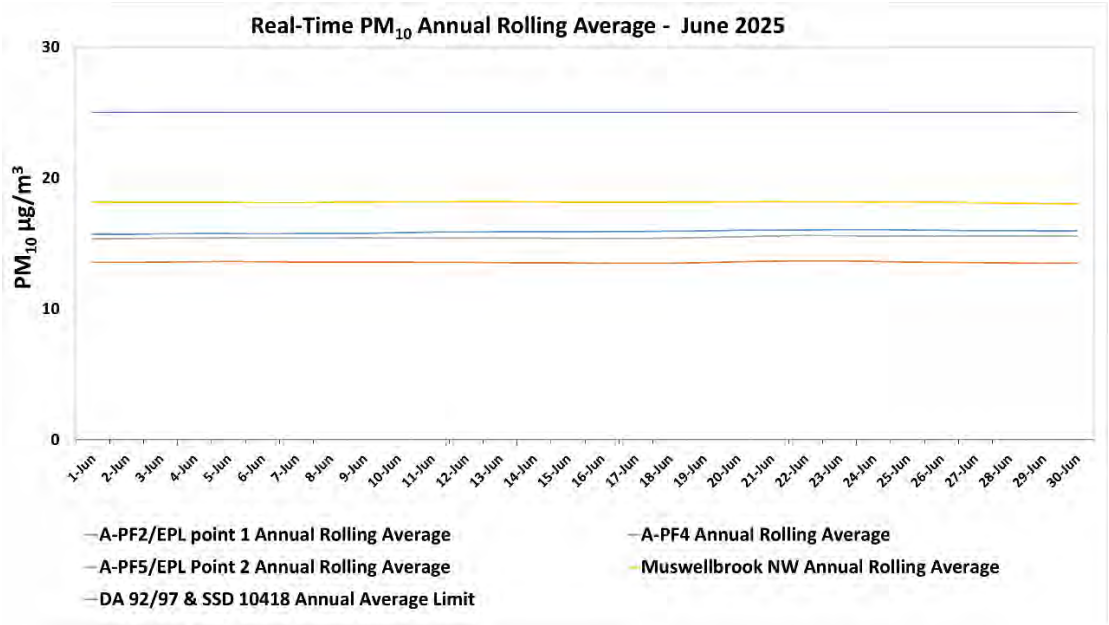

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for June 2025.

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6.3 $PM_{2.5}$ Results – 24 Hour Daily Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during June 2025. Real time $PM_{2.5}$ 24 hour rolling average results for June 2025 are presented in **Table 6-2.**

Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – June 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
01/06/2025	5.36		5.28	25
02/06/2025	5.04		4.75	25
03/06/2025	5.14		4.92	25
04/06/2025	5.20	4.87	4.32	25
05/06/2025	3.85	3.99	3.85	25
06/06/2025	4.18	3.59	3.37	25
07/06/2025	4.84	3.28	2.75	25
08/06/2025	4.39	3.57	3.49	25
09/06/2025	3.82	3.04	2.95	25
10/06/2025	3.61	2.56	2.52	25
11/06/2025	4.20	2.59	2.51	25
12/06/2025	3.71	2.89	2.56	25
13/06/2025	4.09	3.39	3.04	25
14/06/2025	5.24	4.19	3.69	25
15/06/2025	5.38	4.14	4.10	25
16/06/2025	4.84	3.86	3.25	25
17/06/2025	4.14	3.39	3.10	25
18/06/2025	4.42	3.88	3.59	25
19/06/2025	5.69	5.36	5.79	25
20/06/2025	5.80	5.79	5.31	25
21/06/2025	5.68	5.51	5.30	25
22/06/2025	5.58	4.89	5.01	25
23/06/2025	4.81	3.68	3.27	25
24/06/2025	3.80	3.51	3.18	25
25/06/2025	3.64	3.24	3.18	25
26/06/2025	3.31	3.00	2.92	25
27/06/2025	3.80	3.53	3.51	25
28/06/2025	5.11	3.95	3.92	25
29/06/2025	4.87	4.52	4.56	25
30/06/2025	6.18	5.81	5.39	25

Notes:
*Results in **bold** indicate elevated readings during adverse weather conditions.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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Real time $PM_{2.5}$ 24-hour average results for June 2025 are presented in **Figure 6-3** below.

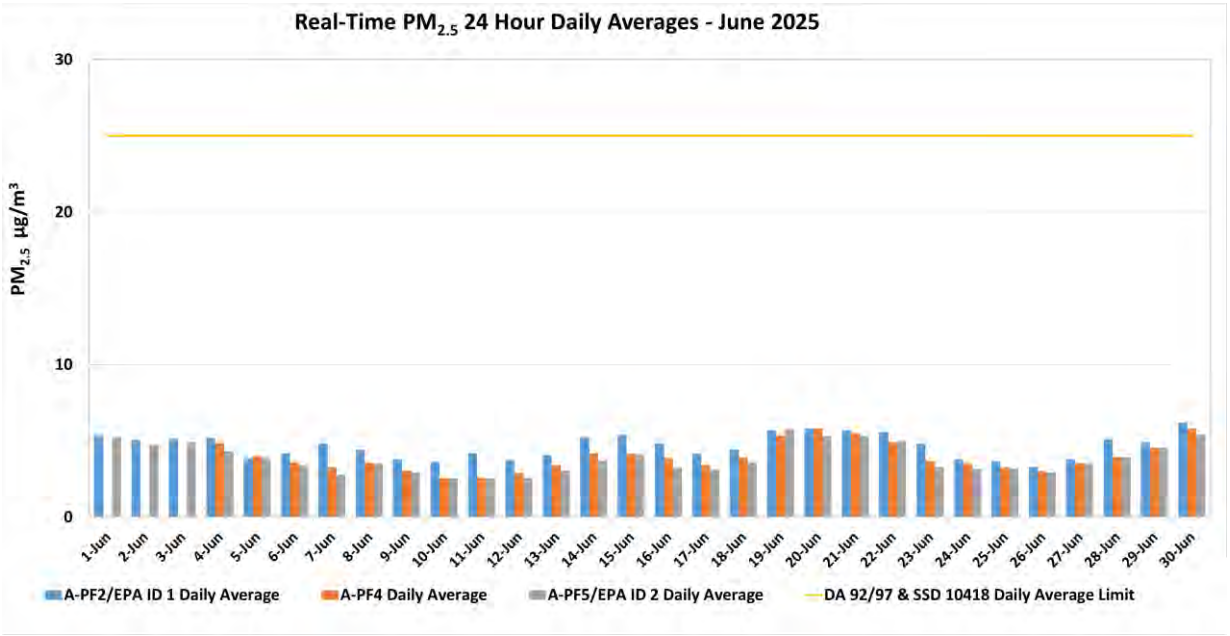

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for June 2025.

6.4 $PM_{2.5}$ Results - Annual Rolling Average

There was no exceedance of the $PM_{2.5}$ annual rolling average reported at MPO during June 2025. Real time $PM_{2.5}$ annual rolling averages during the reporting period are presented in **Figure 6-4** below.

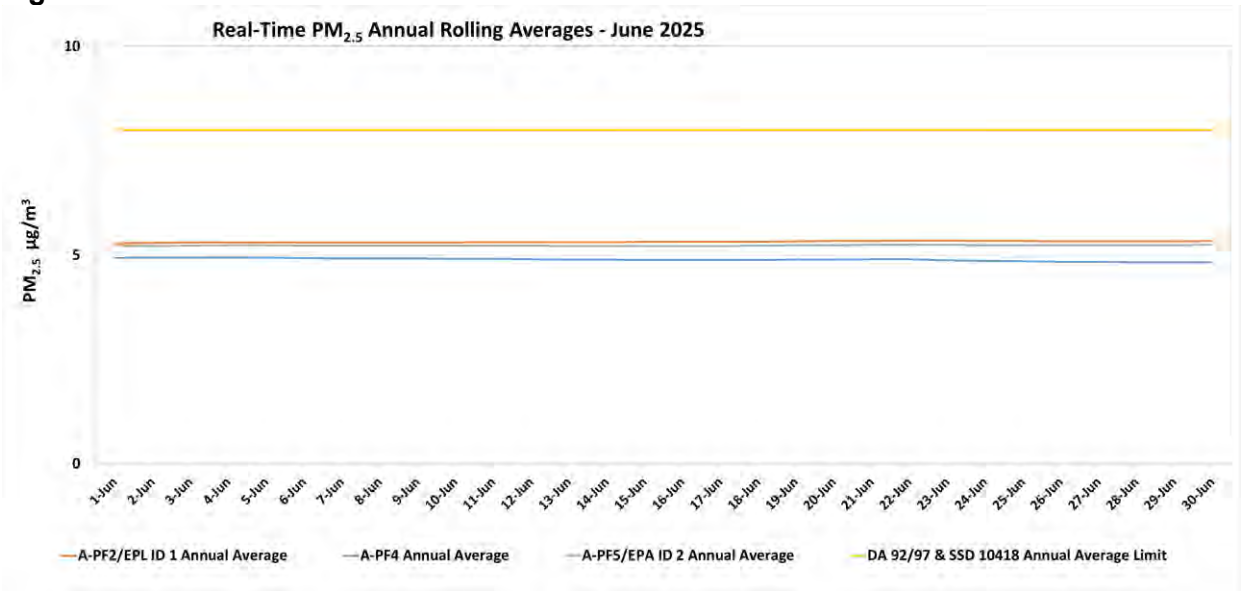

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for June 2025.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at 14 sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2025) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

7.3 Results

Surface water monitoring was conducted by AECOM on 30 June 2025. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 30 June 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.2	506	250	<5
W2	8.1	**543**	270	<5
W3	8.1	572	280	5.7
W4	7.9	1976	1100	<5
W5	*	*	*	*
W6A	8.3	**534**	270	<5
W9	*	*	*	*
W11	**8.2**	**8390**	4800	10
W12	**8.2**	4790	2600	<5
W13	8.4	5780	3300	6.1
W14	*	*	*	*
W15	**8.3**	**675**	310	5.1
W16	8.2	4150	2100	<5
W17	8.1	562	300	5.7

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

During 30 June 2025 monitoring event, three (3) sites were dry. Site W11, W12 and W15 were above pH trigger levels. Site W2, W6A, W11 and W15 were above electrical conductivity trigger levels.

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In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

8. r oundwater Monitoring

No groundwater sampling was undertaken in June 2025. Next annual and quarterly groundwater sampling is scheduled for August 2025.

9. Noise Monitoring

Attended noise monitoring was undertaken during the night of 12th and 13th June 2025 at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2024) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.1 Results

The results for nighttime attended noise monitoring for noise generated by MPO in June 2025 against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 12 and 13 June 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:43am	IA	45	1.2 / 063	Yes	E	No
N-AT2	10:58pm	IA	45	1.8 / 291	Yes	D	No
N-AT3	11:36pm	28	45	2.5 / 289	Yes	E	No
N-AT4	12:04am	IA	45	1.1 / 041	Yes	D	No
N-AT5	12:25am	IA	45	1.6 / 071	Yes	D	No
N-AT6	1:20am	IA	45	0.9 / 202	Yes	E	No
N-AT7	10:16pm	37	45	2.6 / 288	Yes	E	No
N-AT8	12:51am	35	NA[2]	1.5 / 068	NA[6]	E	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

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Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 12 and 13 June 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:43am	IA	37	1.2 / 063	Yes	E	No
N-AT2	10:58pm	IA	35	1.8 / 291	Yes	D	No
N-AT3	11:36pm	25	40	2.5 / 289	Yes	E	No
N-AT4	12:04am	IA	38	1.1 / 041	Yes	D	No
N-AT5	12:25am	IA	37	1.6 / 071	Yes	D	No
N-AT6	1:20am	IA	35	0.9 / 202	Yes	E	No
N-AT7	10:16pm	34	37	2.6 / 288	Yes	E	No
N-AT8	12:51am	30	NA[2]	1.5 / 068	NA[6]	E	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 12 and 13 June 2025

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	1:43am	IA	40	No
N-AT2	10:58pm	IA	40	No
N-AT3	11:36pm	25	40	No
N-AT4	12:04am	IA	40	No
N-AT5	12:25am	IA	40	No
N-AT6	1:20am	IA	40	No
N-AT7	10:16pm	34	40	No
N-AT8	12:51am	30	NA[2]	NA[2]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

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The purpose of the noise monitoring is to quantify and describe the existing acoustic environment around the mining operation and compare results with relevant limits as per the *MPO Noise Management Plan* (MACH Energy, 2021).

10. Blast Monitoring

There were eleven (11) blast events during June 2025 (a total of 43 blasts YTD). Results for June are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – June 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
04/06/25	15:52	0.560 mm/s	93.6 DBL	0.720 mm/s	100.6 DBL	Y
06/06/2025	10:42	0.310 mm/s	91.7 DBL	0.360 mm/s	95.9 DBL	Y
11/06/2025	15:01	0.620 mm/s	97.6 DBL	0.700 mm/s	103.3 DBL	Y
12/06/2025	15:09	0.020 mm/s	79.4 DBL	0.050 mm/s	88.9 DBL	Y
16/06/2025	15:04	0.210 mm/s	88.9 DBL	0.260 mm/s	91.5 DBL	Y
18/06/2025	11:39	0.670 mm/s	94.4 DBL	0.250 mm/s	96.9 DBL	Y
20/06/2025	16:38	0.750 mm/s	100.3 DBL	0.620 mm/s	96.3 DBL	Y
21/06/2025	10:12	0.020 mm/s	92.6 DBL	0.030 mm/s	88 DBL	Y
24/06/2025	16:23	0.460 mm/s	105.3 DBL	0.260 mm/s	106.4 DBL	Y
26/06/25	15:14	0.620 mm/s	95.9 DBL	0.370 mm/s	96.8 DBL	Y
26/06/25	16:10	0.220 mm/s	78.3 DBL	0.180 mm/s	79.5 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

July 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 July 2025
Reporting Period End Date	31 July 2025
Date All Data Received	14 August 2025

Links to three key regulatory documents are provided here:

- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Continuous particulate monitors
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with the respective Management Plans as required by Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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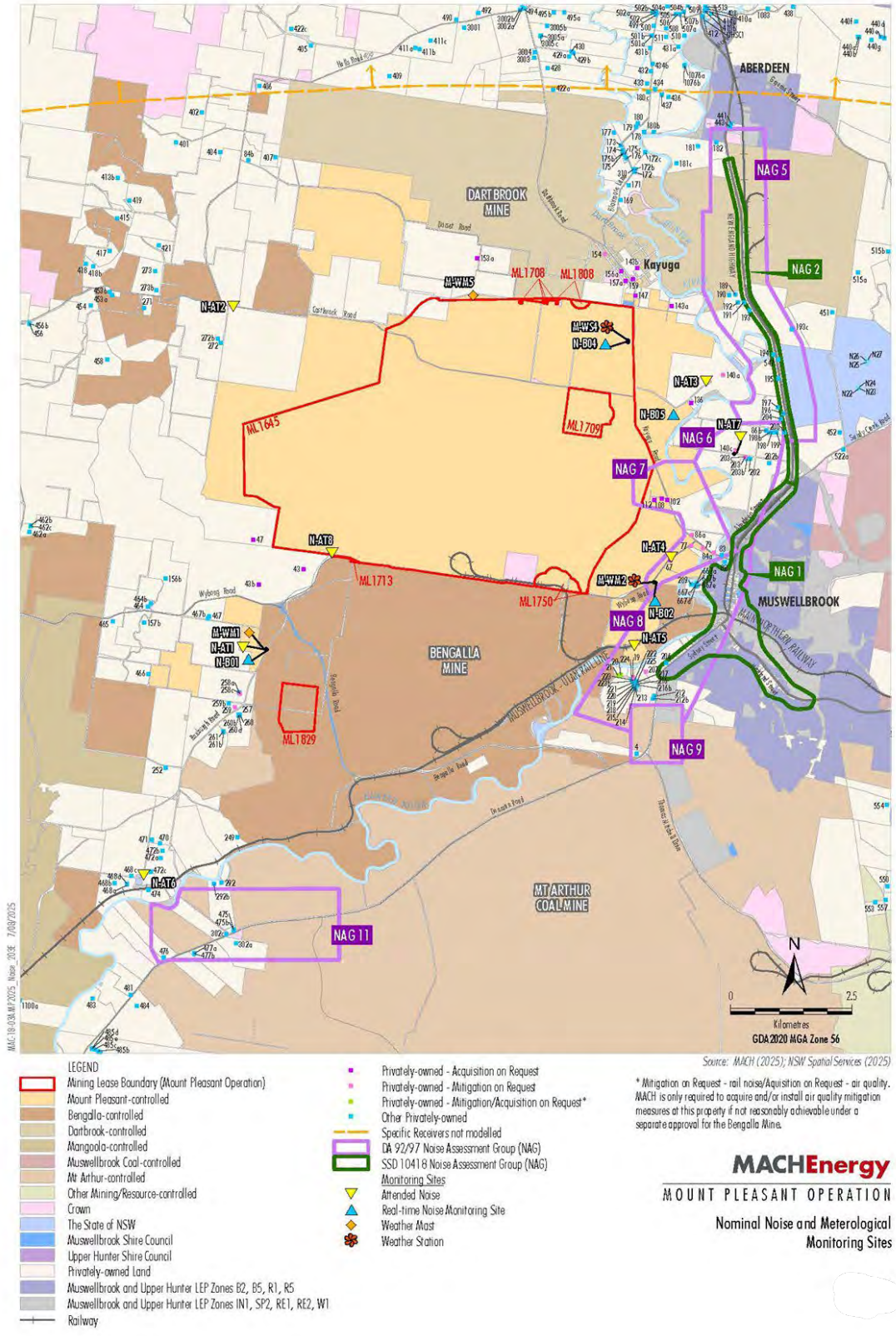

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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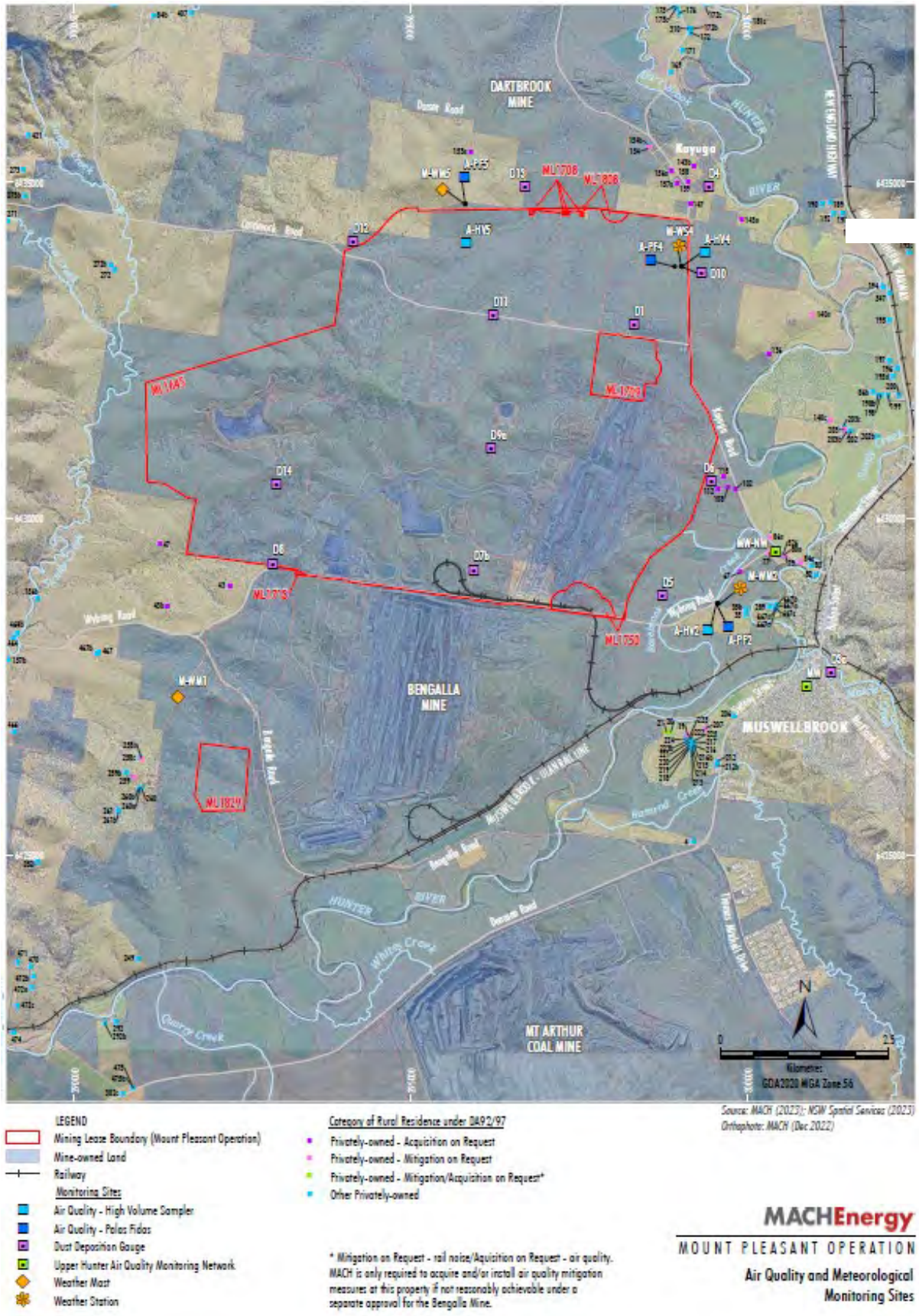

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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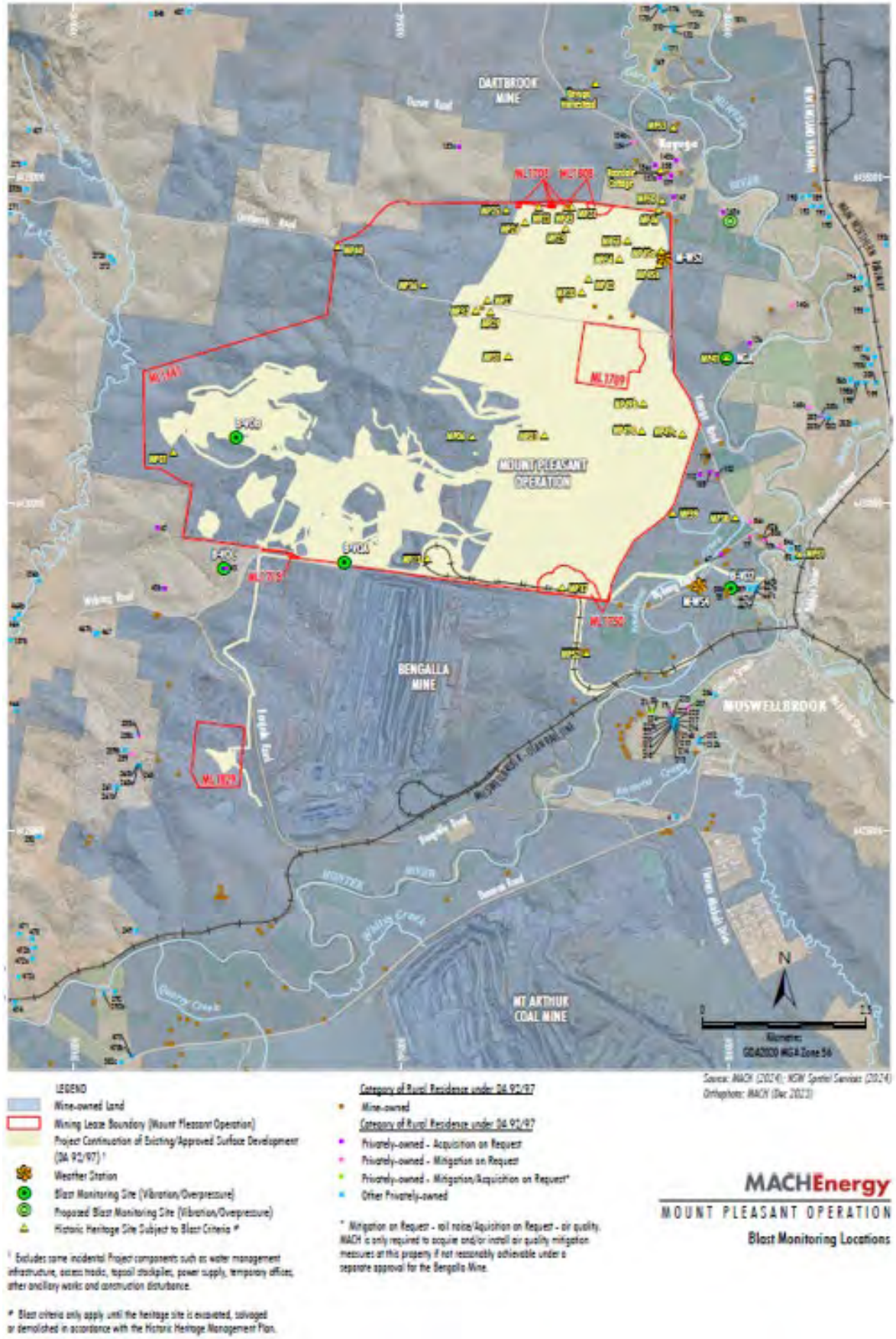

Figure 2-3 – MPO Blast Monitoring Locations

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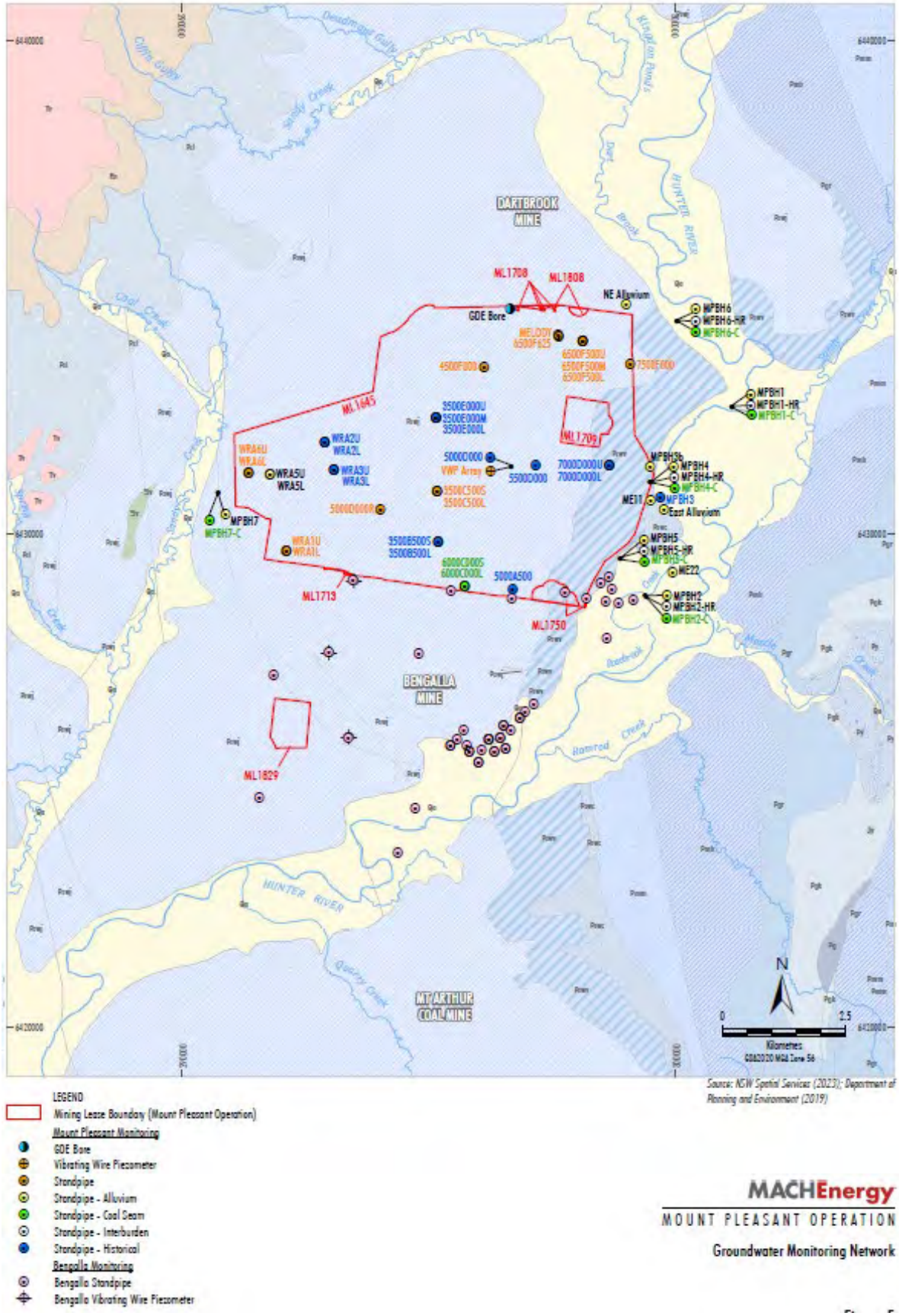

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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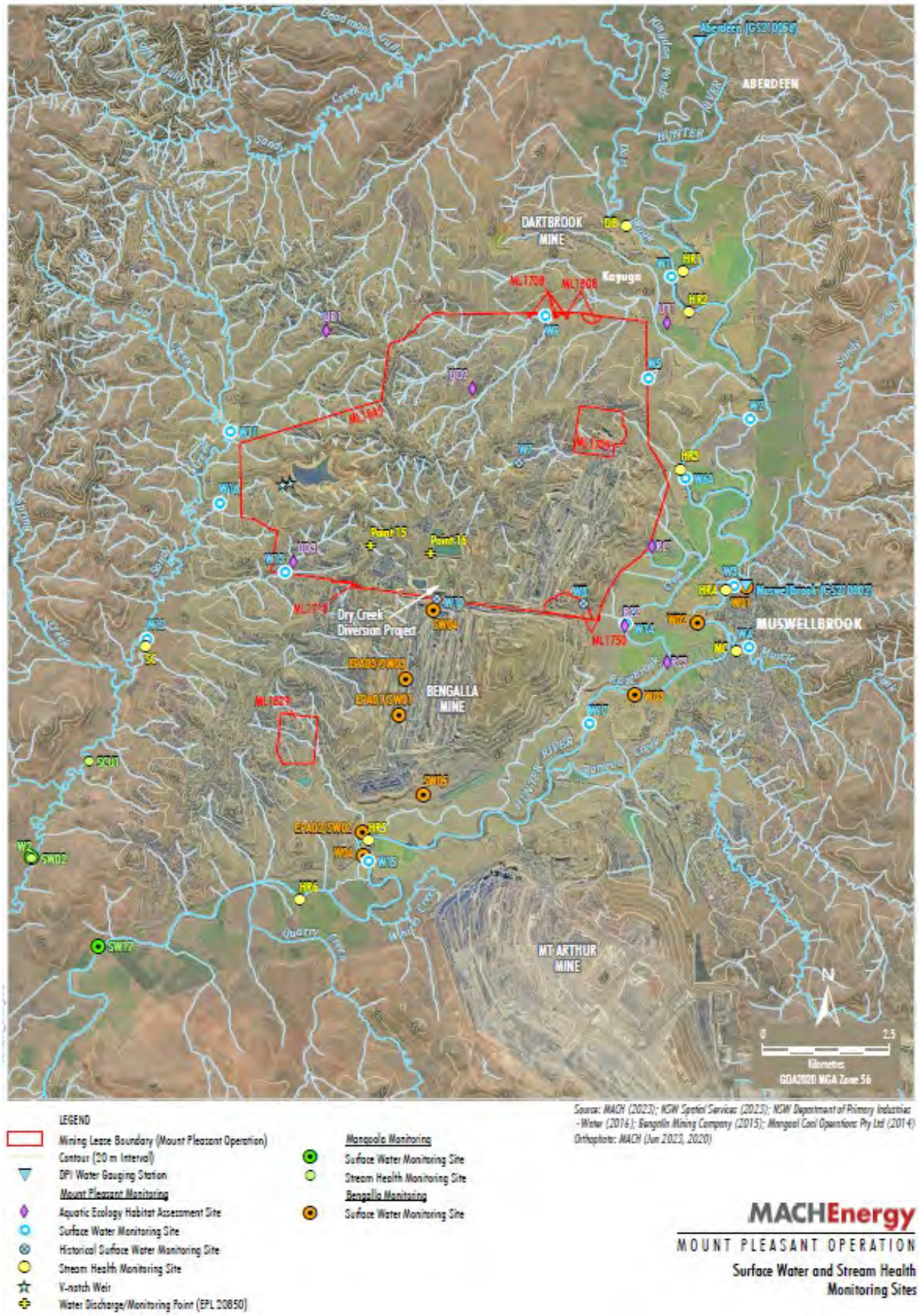

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 and M-WS4 during the monitoring period. Throughout July 2025, there was 41.8mm and 51.2mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

The dust deposition monitoring network comprises of thirteen (13) dust deposition gauges (DDG) that are collected on a monthly basis. Details of the monitoring locations are shown in Figure 2-2.

4.2 Assessment Criteria

Dust Deposition were assessed as per the MPO Air Quality and Greenhouse Gas Management Plan (MACH Energy, 2024). Dust deposition was monitored according to the OEH's Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DECC 2007), which references Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM10, and PM2.5. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices. This transition from the previous development consent DA92/97

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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(which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area.

4.3 Results

Dust Deposition Data was conducted by AECOM during the monitoring period. Sample analysis was performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory.

Results are summarised in **Table 4-1**. Annual rolling averages have been provided as an indication of performance in the 12 months leading up to the current monitoring period as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – July 2025

Location	Monthly Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	2.3	3.0
D3	1.2	1.4
D4	0.4	1.1
D5a	2.7	2.2
D6	1.8	2.0
D7b	18.2**	**7.5**
D8	4.4	**4.9**
D9a	2.7	3.9
D10	1.0	1.2
D11	2.5	**4.4**
D12	0.9	1.4
D13	1.2	2.1
D14	3.1	**4.0**
Criterion	-	**4.0**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*
*** Contaminated results*

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Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

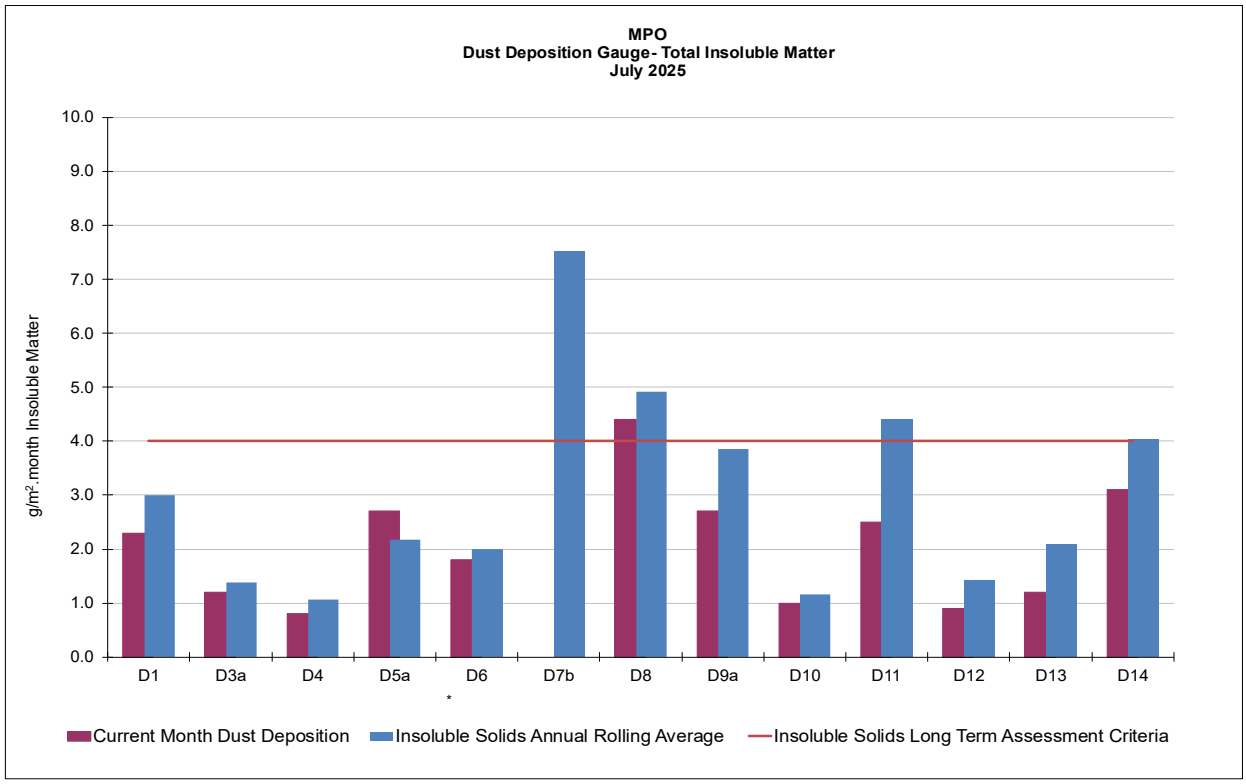

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average

5. Total Suspended Particulates

5.1 Methodology

Three Total Suspended Particulate Matter (TSP) High-Volume Air Samplers (HVAS) are run for 24 hours every six days. The locations are displayed in **Table 5-1** below.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

5.2 Assessment Criteria

Total Suspended Particulates were assessed as per the MPO Air Quality and Greenhouse Gas Management Plan (MACH Energy, 2024) in accordance with AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DECC, 2007), referencing AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method, for the monitoring of TSP.

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TSP is assessed against the guidelines defined in the EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90µg/m3.

5.3 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in Table 5-2. Twelve month rolling averages to the current month are provided as an indication of performance as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – July 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
05/07/2025	-	26	46.4	20.2
11/07/2025		77.8	7.1	7.8
17/07/2025		54.4	57.4	78.7
23/07/2025	-	104	9.7	15.5
29/07/2025	-	92.2	8.7	14.6
*Monthly Mean	-	70.9	25.9	27.4
Annual Rolling Average	90	52	49	38

Notes:
**Results have been rounded to one decimal place for reporting purposes where applicable.*
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*

6. Real Time Air Quality Monitoring

6.1 Methodology

Continuous particulate matter monitoring less than 10 µm (PM10) and particulate matter less than 2.5 µm (PM2.5) was conducted continuously at three locations (one utilised for management only) at MPO during the monitoring period.

6.2 Assessment Criteria

The EPA identification numbers 1 and 2 refer to monitors installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third monitor (A-PF4) is installed on Kayuga Road with data used for management purposes only. Project Approval Schedule 3, Condition 20 of DA 92/97 and Development Consent Schedule 2, Condition B28 of SSD 10418 specify a limit for PM10 of 50 µg/m3 and PM2.5 of 25 µg/m3 in a 24-hour daily average.

6.3 Results

Real time PM10 and PM2.5 annual rolling averages to the current month have been provided in **Figures 6.2 and 6.4**, respectively. **Figure 6.1 and Table 6.1** below show the real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites during the

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monitoring period. Real time $PM_{2.5}$ 24-hour average results during the reporting period are presented in **Figure 6.3** and **Table 6.2.**

Table 6-1: MPO Continuous Particulate PM_{10} Data – July 2025

Date	A-PF2/ EPA ID 1	A-PF4	A-PF5/ EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
01/07/2025	12.84	12.21	13.16	50
02/07/2025	8.65	6.62	6.54	50
03/07/2025	8.53	5.66	5.61	50
04/07/2025	7.81	5.68	5.33	50
05/07/2025	8.48	7.74	8.11	50
06/07/2025	13.40	14.12	15.17	50
07/07/2025	14.32	10.07	8.87	50
08/07/2025	12.80	7.03	6.48	50
09/07/2025	13.84	9.25	8.04	50
10/07/2025	44.57	12.15	10.40	50
11/07/2025	18.96	9.18	8.44	50
12/07/2025	15.05	7.64	7.07	50
13/07/2025	12.38	7.78	6.72	50
14/07/2025	16.08	8.70	7.02	50
15/07/2025	21.03	9.09	7.54	50
16/07/2025	13.80	7.29	6.46	50
17/07/2025	13.04	10.56	9.16	50
18/07/2025	27.39	35.15	25.65	50
19/07/2025	19.68	33.06	19.64	50
20/07/2025	16.75	15.48	12.38	50
21/07/2025	15.16	12.42	14.30	50
22/07/2025	13.01	14.35	21.06	50
23/07/2025	18.15	15.48	17.49	50
24/07/2025	17.52	7.14	6.56	50
25/07/2025	8.82	8.07	8.41	50
26/07/2025	15.48	19.61	23.21	50
27/07/2025	10.73	6.88	6.25	50
28/07/2025	34.26	5.37	5.09	50
29/07/2025	26.22	5.78	5.17	50
30/07/2025	14.90	14.69	13.95	50
31/07/2025	9.88	12.47	12.76	50

*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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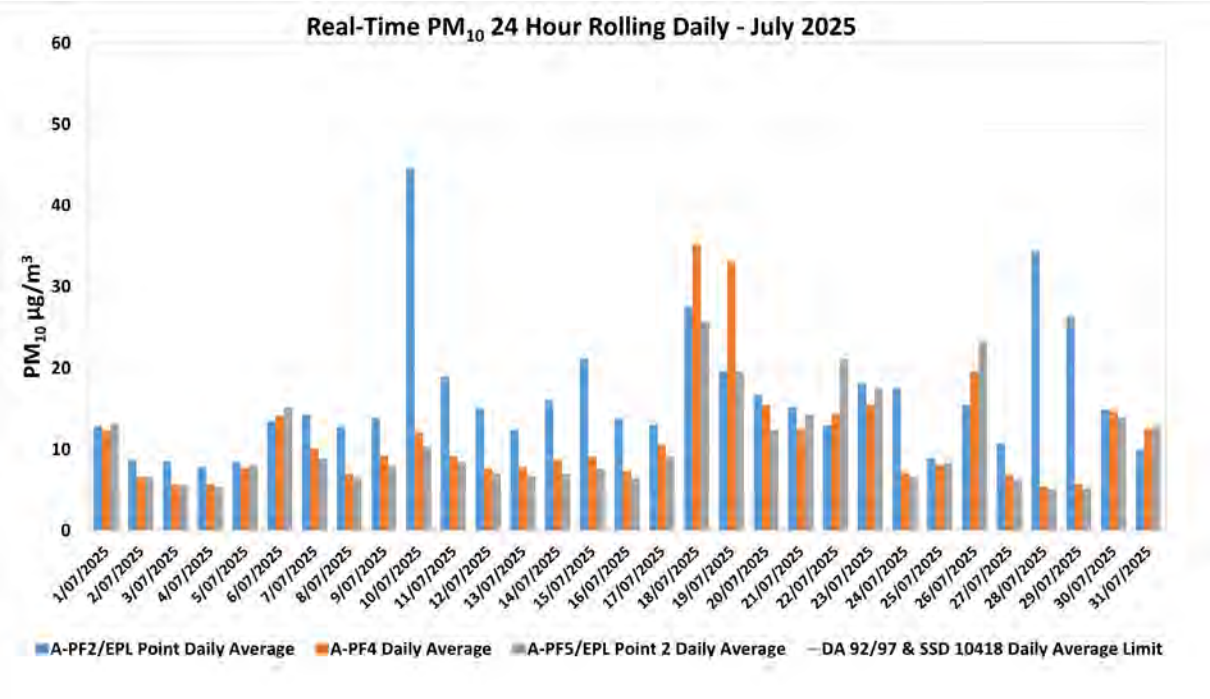

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for July 2025.

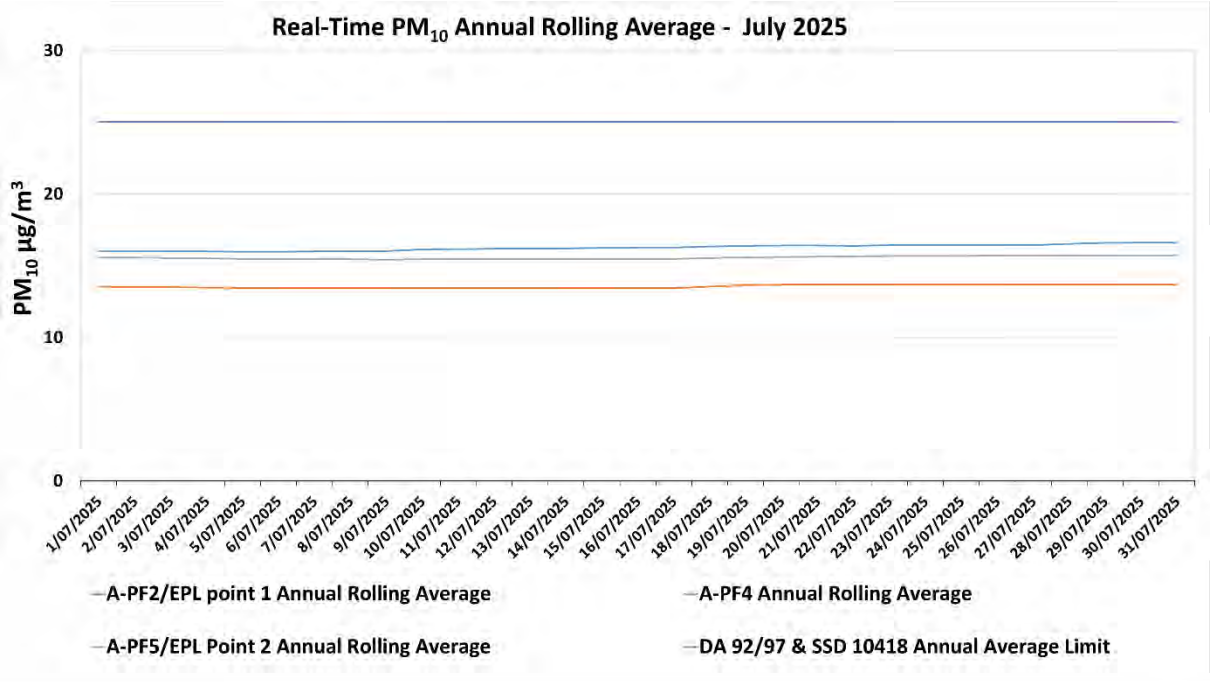

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for July 2025.

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Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – July 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
01/07/2025	5.89	5.42	4.98	25
02/07/2025	3.50	3.20	3.04	25
03/07/2025	2.85	2.52	2.55	25
04/07/2025	3.16	2.78	2.67	25
05/07/2025	3.77	3.47	3.21	25
06/07/2025	5.28	5.16	4.82	25
07/07/2025	4.49	3.93	3.59	25
08/07/2025	3.63	3.08	2.94	25
09/07/2025	3.66	3.17	3.00	25
10/07/2025	7.38	3.54	3.30	25
11/07/2025	3.97	3.16	3.07	25
12/07/2025	3.94	3.25	3.17	25
13/07/2025	4.08	3.49	3.25	25
14/07/2025	3.97	3.31	3.06	25
15/07/2025	4.56	3.41	3.10	25
16/07/2025	4.03	3.25	3.06	25
17/07/2025	4.09	3.64	3.28	25
18/07/2025	5.95	6.31	5.14	25
19/07/2025	5.78	6.84	5.29	25
20/07/2025	5.77	4.97	4.28	25
21/07/2025	5.71	4.54	4.40	25
22/07/2025	5.23	5.44	6.76	25
23/07/2025	5.92	5.27	5.51	25
24/07/2025	4.26	3.11	2.99	25
25/07/2025	3.50	3.20	3.08	25
26/07/2025	4.76	5.20	5.13	25
27/07/2025	3.25	2.82	2.70	25
28/07/2025	5.15	2.57	2.52	25
29/07/2025	4.29	2.65	2.56	25
30/07/2025	4.25	4.08	3.98	25
31/07/2025	3.88	4.66	4.32	25

*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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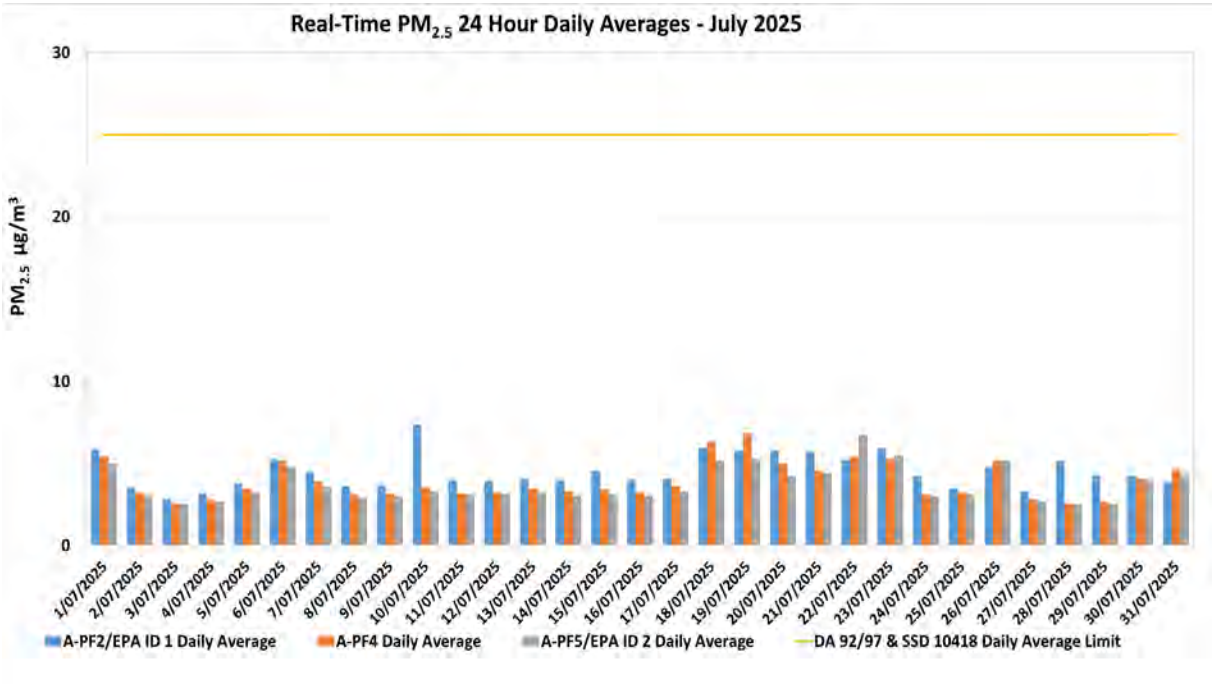

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for July 2025.

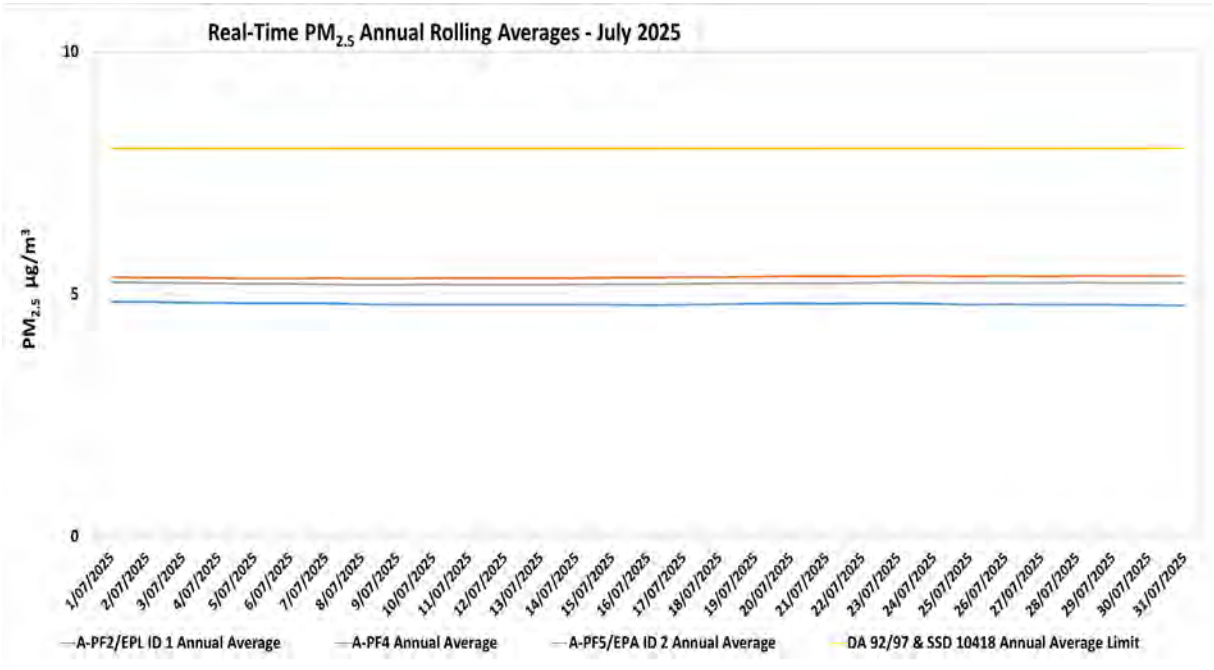

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for July 2025.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at fourteen (14) sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2025) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

7.3 Results

Surface water monitoring was conducted by AECOM during the monitoring period. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 30 July 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.2	437	220	6.7
W2	8.2	467	240	12
W3	8.3	463	240	14
W4	7.7	1980	1100	6.1
W5	*	*	*	*
W6A	8.2	455	230	8.6
W9	*	*	*	*
W11	8.0	3900	2000	<5
W12	8.1	4600	2600	11
W13	8.0	6340	3500	15
W14	*	*	*	*
W15	**8.3*** **	**466**	240	19
W16	8.4	8460	4900	6.2
W17	**8.2**	477	240	18

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
**** Investigation Required*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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This is the third consecutive sampling event where pH levels have been above trigger levels for W15.

An investigation was undertaken in accordance with the MPO Water Management Plan. MACH Energy investigations have determined the trigger is not caused by activities at MPO. MACH Energy believes the trigger is a result of significant flood flows in the Hunter River during the period and is within normal variability in pH levels within the Hunter River. The department was notified of the trigger event, and no further action is required. pH levels at W15 will continue to be monitored.

8. Groundwater Monitoring

No groundwater sampling was undertaken in July 2025. Next annual and quarterly groundwater sampling is scheduled for August 2025.

9. Noise Monitoring

9.1 Methodology

Attended noise monitoring was undertaken during the monitoring period at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2024) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.2 Results

The results for nighttime attended noise monitoring against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 17 and 18 July 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:42am	IA	45	0.7 / 105	Yes	F	No
N-AT2	11.05pm	32	45	2.1 / 290	Yes	E	No
N-AT3	11:38pm	27	45	1.2 / 257	Yes	F	No
N-AT4	12:04am	IA	45	0.9 / 083	Yes	D	No
N-AT5	12:25am	IA	45	1.4 / 132	Yes	E	No
N-AT6	1:19am	IA	45	1.7 / 196	Yes	E	No
N-AT7	10:25pm	27	45	1.4 / 263	Yes	F	No
N-AT8	12:52am	IA	NA[2]	1.2 / 018	NA[6]	D	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location*

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Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 17 and 18 July 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2.4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	1:42am	IA	37	0.7 / 105	Yes	F	No
N-AT2	11.05pm	29	35	2.1 / 290	Yes	E	No
N-AT3	11:38pm	24	40	1.2 / 257	Yes	F	No
N-AT4	12:04am	IA	38	0.9 / 083	Yes	D	No
N-AT5	12:25am	IA	37	1.4 / 132	Yes	E	No
N-AT6	1:19am	IA	35	1.7 / 196	Yes	E	No
N-AT7	10:25pm	24	37	1.4 / 263	Yes	F	No
N-AT8	12:52am	IA	NA[2]	1.2 / 018	NA[6]	D	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 17 and 18 July 2025

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	1:42am	38	40	No
N-AT2	11.05pm	29	40	No
N-AT3	11:38pm	24	40	No
N-AT4	12:04am	IA	40	No
N-AT5	12:25am	29	40	No
N-AT6	1:19am	32	40	No
N-AT7	10:25pm	24	40	No
N-AT8	12:52am	IA	NA[2]	NA[2]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

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10. Blast Monitoring

There were thirteen (13) blast events (a total of 56 blasts YTD). Results are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – July 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
01/07/25	16:58	0.320 mm/s	113 DBL	0.400 mm/s	113.5 DBL	Y
02/07/2025	15:05	0.160 mm/s	104.5 DBL	0.200 mm/s	108 DBL	Y
03/07/2025	11:33	0.170 mm/s	105.9 DBL	0.340 mm/s	99.9 DBL	Y
09/07/2025	16:56	1.200 mm/s	95 DBL	0.530 mm/s	104 DBL	Y
15/07/2025	14:52	1.230 mm/s	102.1 DBL	0.400 mm/s	102 DBL	Y
17/07/2025	10:21	0.710 mm/s	101.8 DBL	0.680 mm/s	103.2 DBL	Y
18/07/2025	12:46	0.050 mm/s	94.5 DBL	0.100 mm/s	84.7 DBL	Y
21/07/2025	15:37	0.210 mm/s	97.8 DBL	0.220 mm/s	90.6 DBL	Y
24/07/25	15:13	1.450 mm/s	105 DBL	1.030 mm/s	101.8 DBL	Y
25/07/25	15:24	0.240 mm/s	90.4 DBL	0.240 mm/s	78.4 DBL	Y
28/07/25	09:15	0.370 mm/s	106.2 DBL	0.230 mm/s	103 DBL	Y
30/07/25	11:13	0.340 mm/s	96 DBL	0.310 mm/s	88.7 DBL	Y
31/07/25	10:36	0.130 mm/s	95.1 DBL	0.160 mm/s	89.3 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

August 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 August 2025
Reporting Period End Date	31 August 2025
Date All Data Received	18 September 2025

Links to three key regulatory documents are provided here:

- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Continuous particulate monitors
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with the respective Management Plans as required by Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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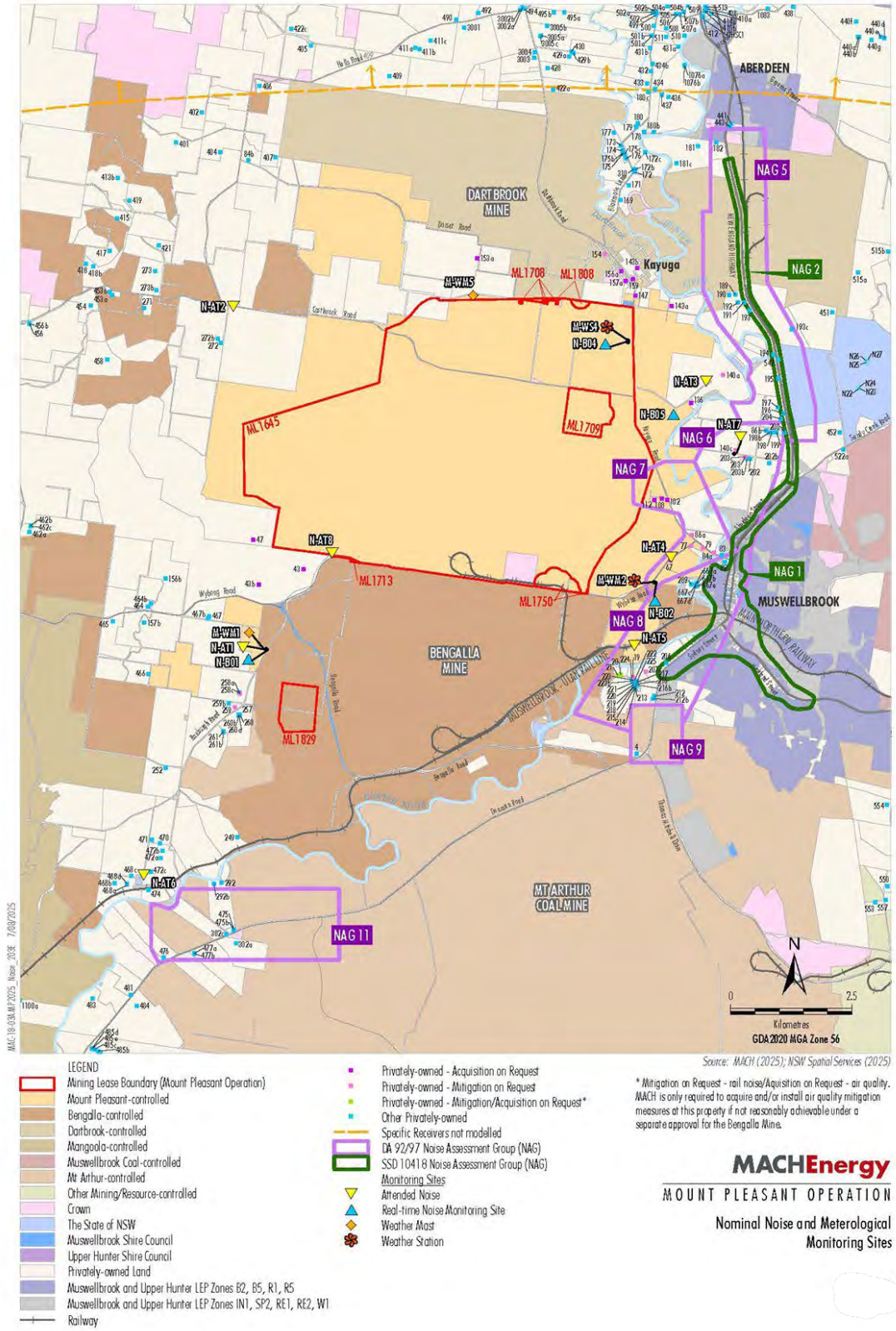

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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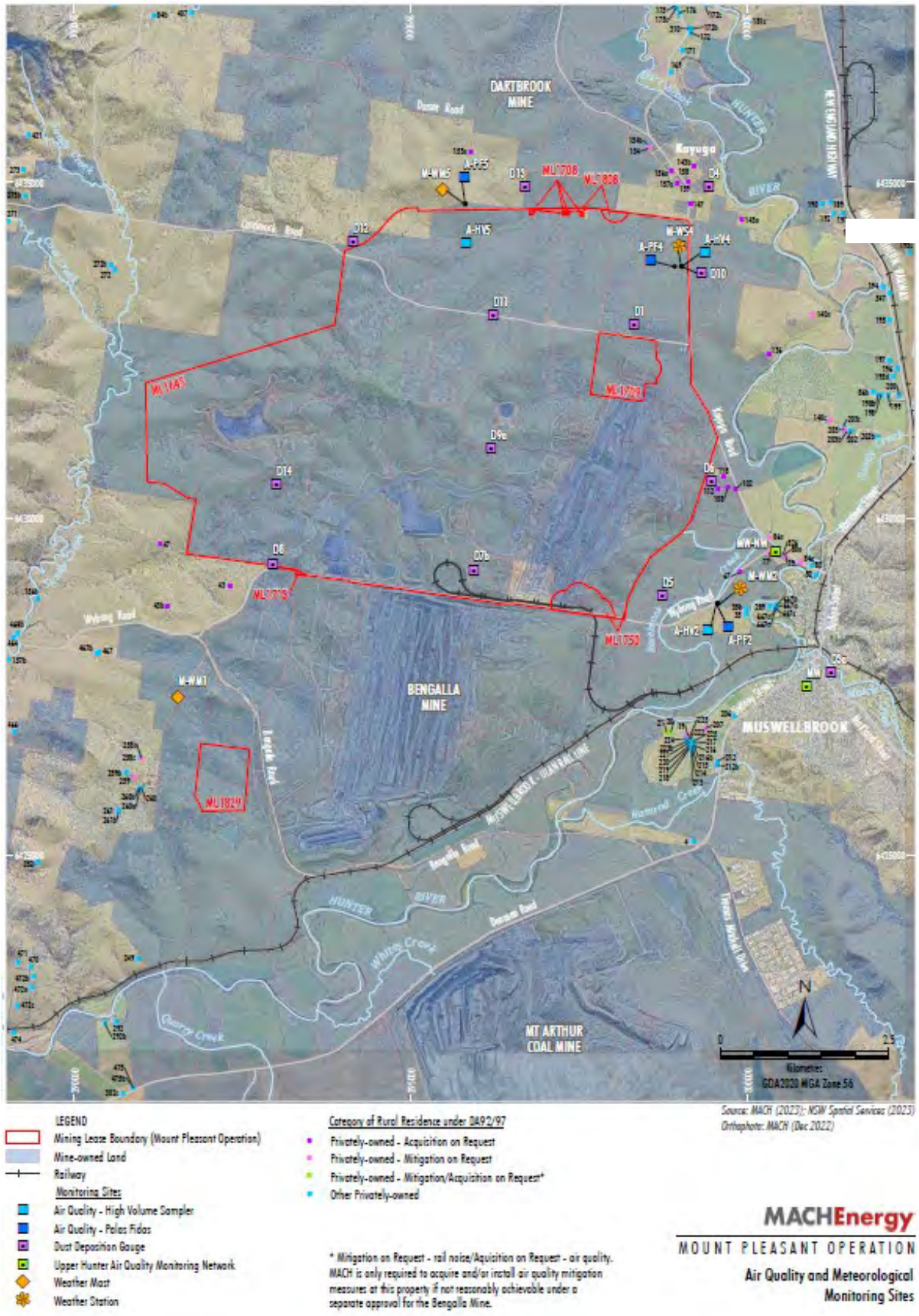

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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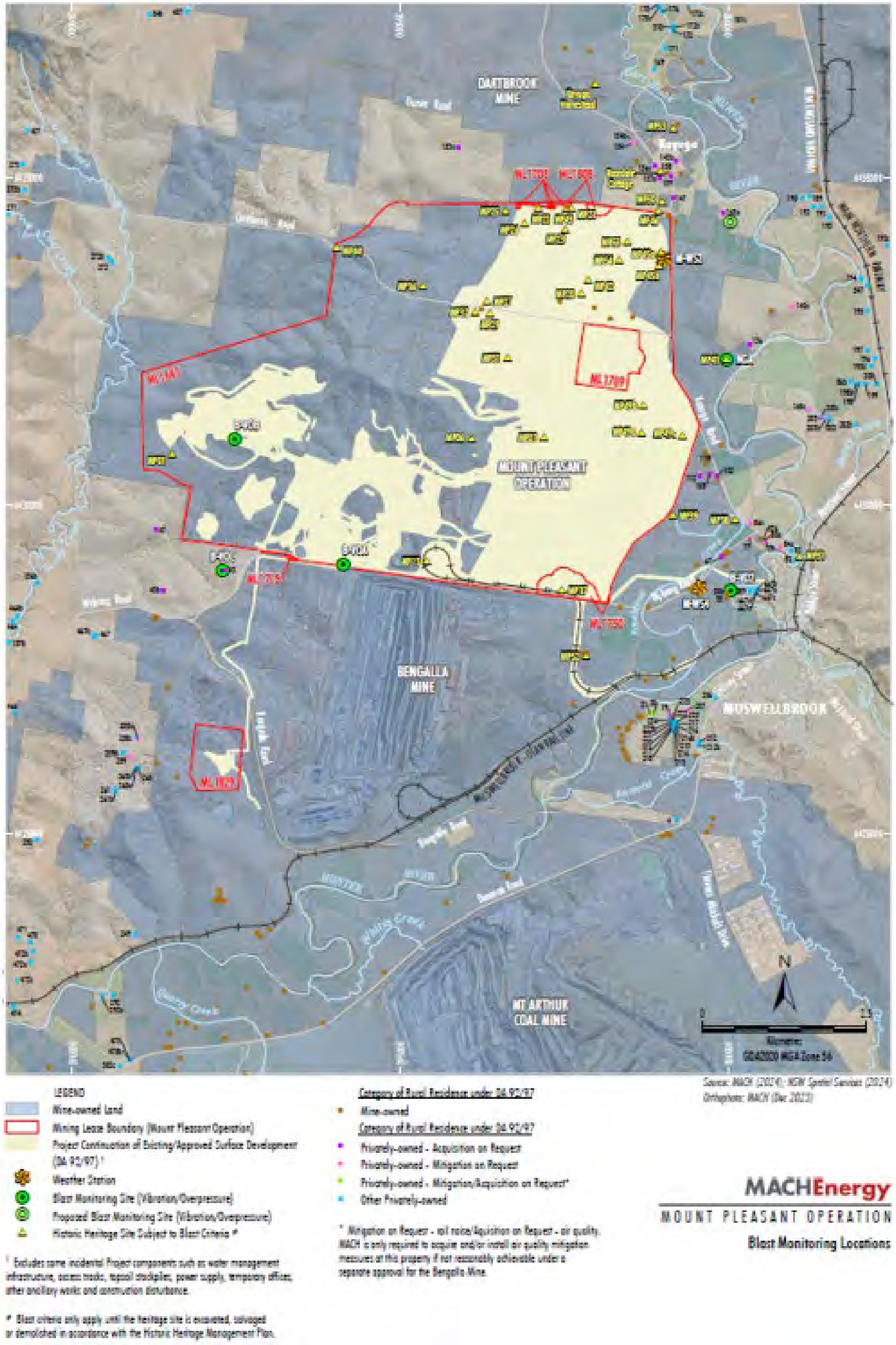

Figure 2-3 – MPO Blast Monitoring Locations

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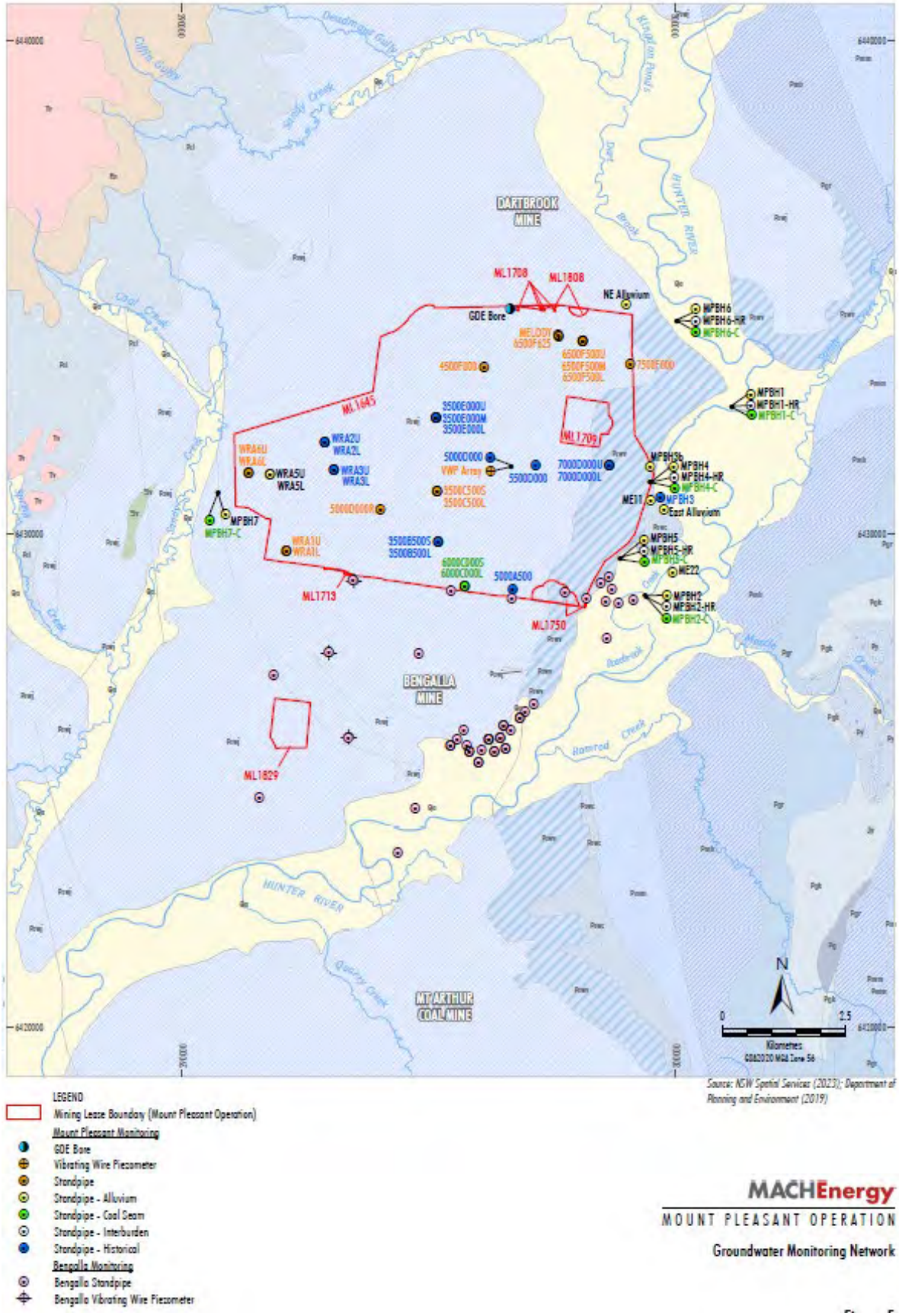

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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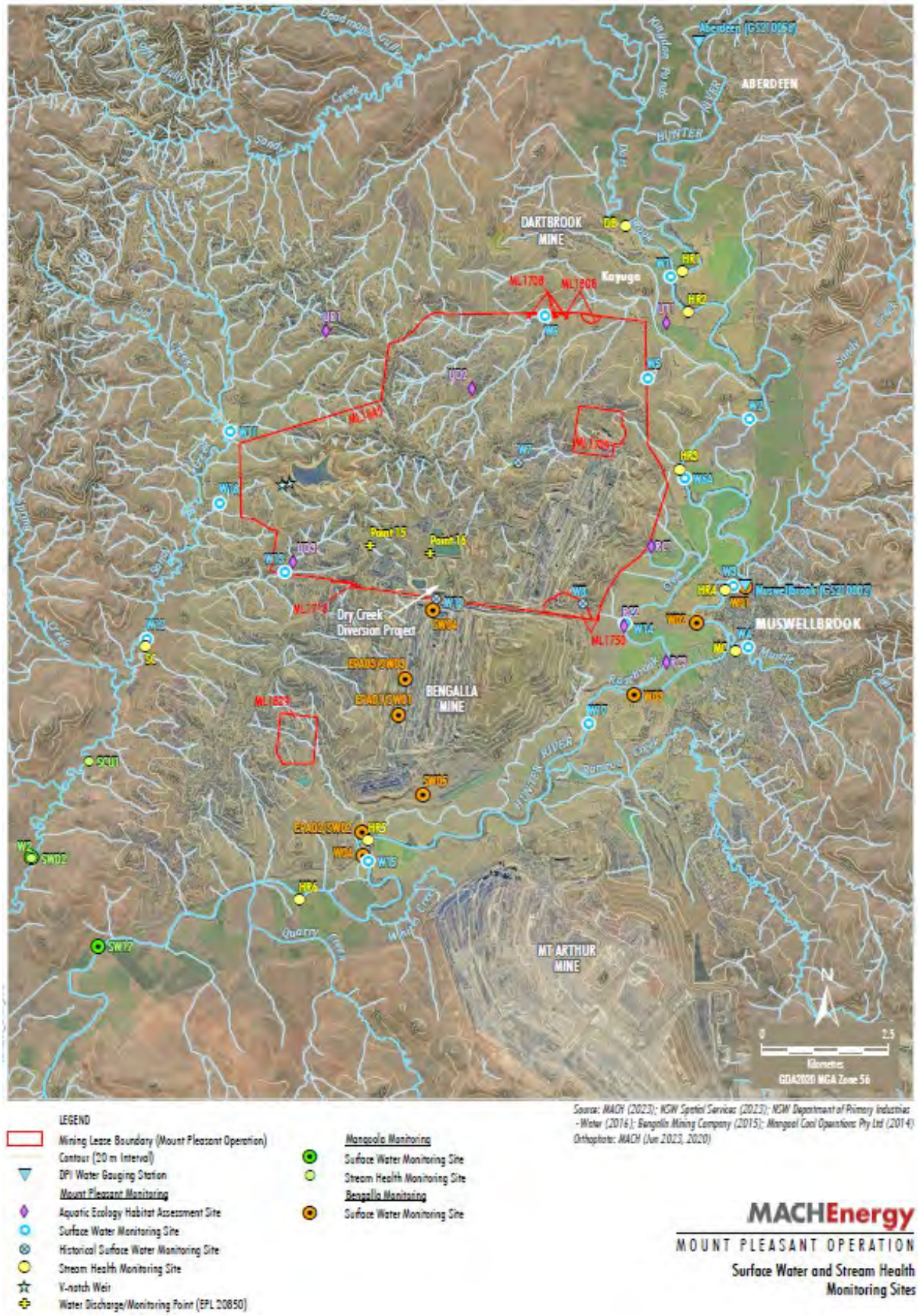

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 and M-WS4 during the monitoring period. Throughout August 2025, there was 130.8mm and 143.8mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

The dust deposition monitoring network comprises of thirteen (13) dust deposition gauges (DDG) that are collected on a monthly basis. Details of the monitoring locations are shown in Figure 2-2.

4.2 Assessment Criteria

Dust Deposition were assessed as per the MPO Air Quality and Greenhouse Gas Management Plan (MACH Energy, 2024). Dust deposition was monitored according to the OEH's Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DECC 2007), which references Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM10, and PM2.5. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices. This transition from the previous development consent DA92/97

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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(which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area.

4.3 Results

Dust Deposition Data was conducted by AECOM during the monitoring period. Sample analysis was performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory.

Results are summarised in **Table 4-1**. Annual rolling averages have been provided as an indication of performance in the 12 months leading up to the current monitoring period as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – August 2025

Location	Monthly Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	10.0	3.6
D3	1.1	1.4
D4	0.6	1.1
D5a	1.8	2.1
D6	1.3	2.0
D7b	160**	**7.5**
D8	4.5	**4.9**
D9a	2.2	3.7
D10	0.9	1.2
D11	3.4	**4.4**
D12	0.9	1.4
D13	0.9	2.1
D14	2.8	**4.1**
Criterion	-	**4.0**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*
*** Contaminated results*

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Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

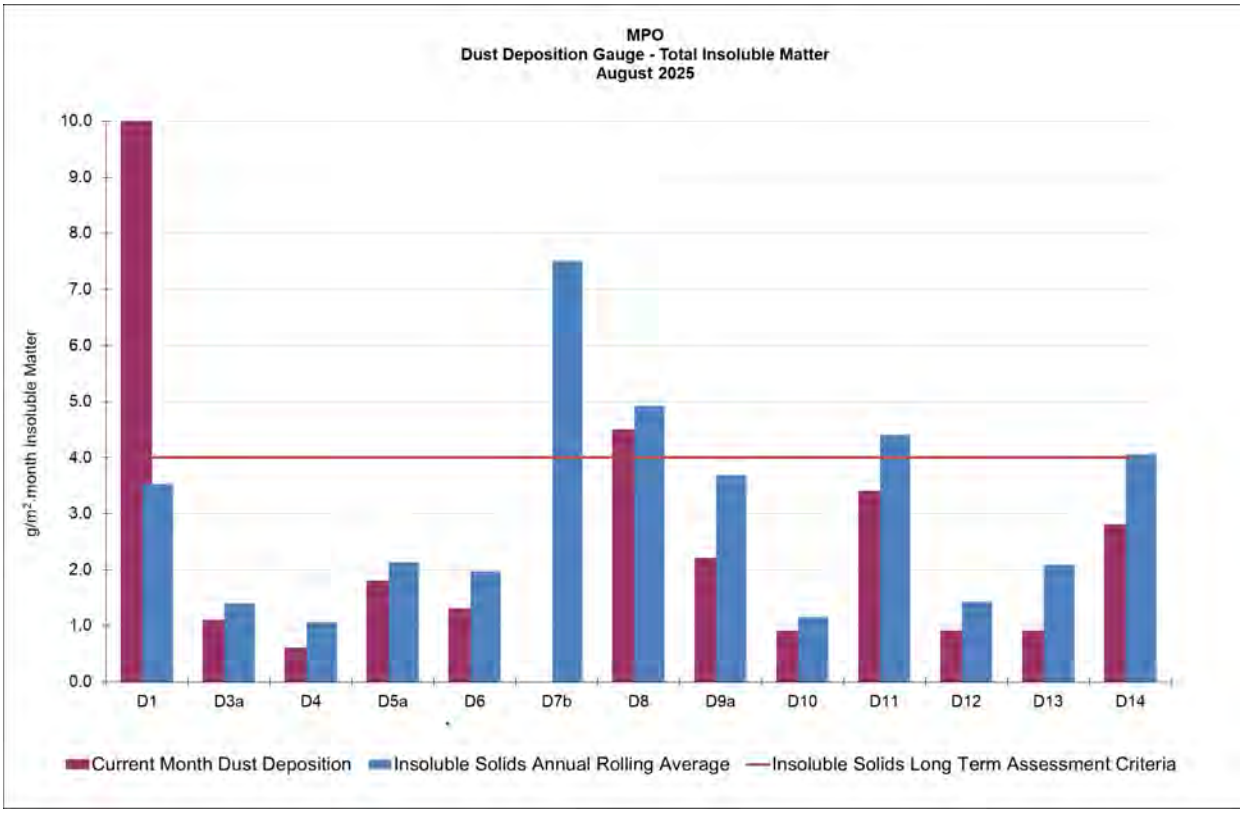

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average

5. Total Suspended Particulates

5.1 Methodology

Three Total Suspended Particulate Matter (TSP) High-Volume Air Samplers (HVAS) are run for 24 hours every six days. The locations are displayed in **Table 5-1** below.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

5.2 Assessment Criteria

Total Suspended Particulates were assessed as per the MPO Air Quality and Greenhouse Gas Management Plan (MACH Energy, 2024) in accordance with AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DECC, 2007), referencing AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method, for the monitoring of TSP.

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TSP is assessed against the guidelines defined in the EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA 2016), Project Approval DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90µg/m3.

5.3 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in Table 5-2. Twelve month rolling averages to the current month are provided as an indication of performance as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – August 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
04/08/2025	-	16.7	26.3	18.4
10/08/2025		10.5	37.8	10.7
16/08/2025		72.6	16.9	18.6
22/08/2025	-	21	12.2	18.7
28/08/2025	-	75.9	6.6	7.3
*Monthly Mean	-	39.3	20.0	14.7
Annual Rolling Average	90	52	48	36

Notes:
**Results have been rounded to one decimal place for reporting purposes where applicable.*
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*

6. Real Time Air Quality Monitoring

6.1 Methodology

Continuous particulate matter monitoring less than 10 µm (PM10) and particulate matter less than 2.5 µm (PM2.5) was conducted continuously at three locations (one utilised for management only) at MPO during the monitoring period.

6.2 Assessment Criteria

The EPA identification numbers 1 and 2 refer to monitors installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third monitor (A-PF4) is installed on Kayuga Road with data used for management purposes only. Project Approval Schedule 3, Condition 20 of DA 92/97 and Development Consent Schedule 2, Condition B28 of SSD 10418 specify a limit for PM10 of 50 µg/m3 and PM2.5 of 25 µg/m3 in a 24-hour daily average.

6.3 Results

Real time PM10 and PM2.5 annual rolling averages to the current month have been provided in **Figures 6.2 and 6.4**, respectively. **Figure 6.1 and Table 6.1** below show the real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites during the

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monitoring period. Real time $PM_{2.5}$ 24-hour average results during the reporting period are presented in **Figure 6.3** and **Table 6.2.**

Table 6-1: MPO Continuous Particulate PM_{10} Data – August 2025

Date	A-PF2/ EPA ID 1	A-PF4	A-PF5/ EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
01/08/2025	11.83	12.51	14.98	50
02/08/2025	9.44	9.21	11.59	50
03/08/2025	6.90	6.42	6.33	50
04/08/2025	9.86	9.99	9.48	50
05/08/2025	12.06	10.62	11.35	50
06/08/2025	10.81	7.52	6.95	50
07/08/2025	11.02	7.95	8.12	50
08/08/2025	11.07	9.83	13.25	50
09/08/2025	10.99	10.04	12.49	50
10/08/2025	8.83	7.89	11.20	50
11/08/2025	10.01	9.19	15.97	50
12/08/2025	10.58	10.21	14.95	50
13/08/2025	12.75	10.53	10.72	50
14/08/2025	13.78	33.06	15.76	50
15/08/2025	11.84	18.21	14.17	50
16/08/2025	14.46	11.06	8.25	50
17/08/2025	18.66	7.50	6.43	50
18/08/2025	11.71	7.43	7.23	50
19/08/2025	11.98	8.85	13.36	50
20/08/2025	10.84	9.47	11.23	50
21/08/2025	7.46	7.41	8.68	50
22/08/2025	9.72	9.33	10.14	50
23/08/2025	10.52	9.57	8.10	50
24/08/2025	12.26	14.05	11.59	50
25/08/2025	12.46	10.88	9.16	50
26/08/2025	12.17	10.92	9.83	50
27/08/2025	16.92	9.75	7.73	50
28/08/2025	17.50	7.93	7.10	50
29/08/2025	20.17	7.72	6.64	50
30/08/2025	15.02	7.78	6.65	50
31/08/2025	11.85	8.22	7.04	50

*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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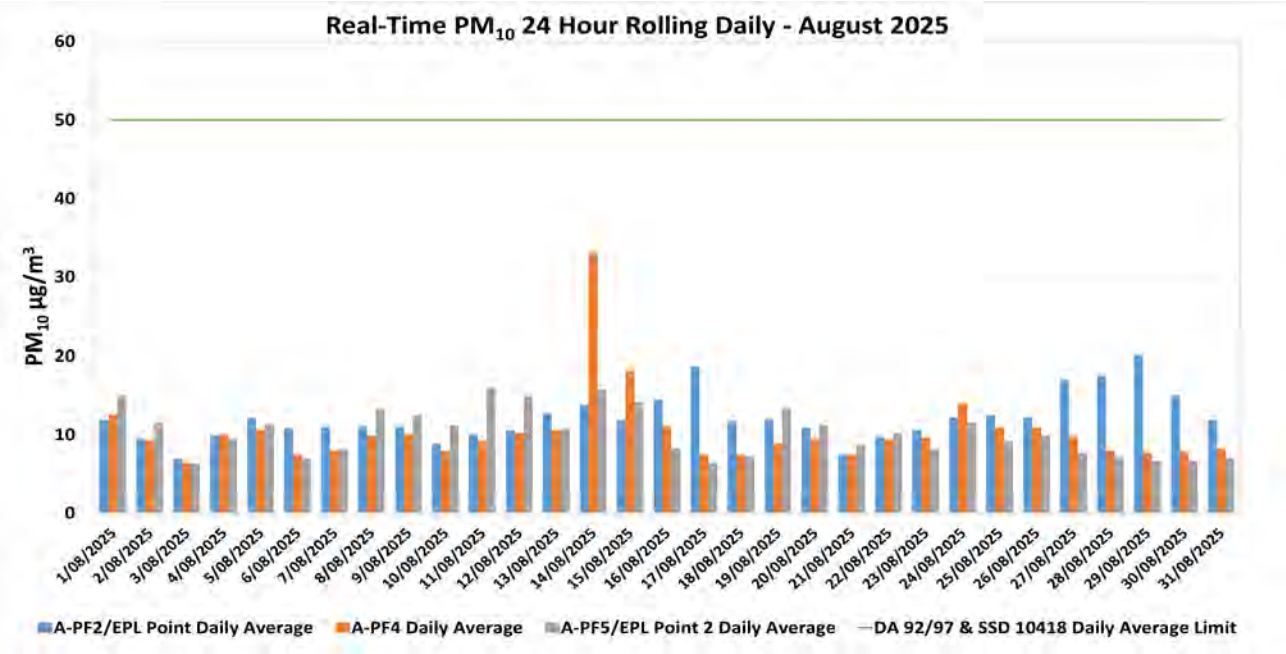

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for August 2025.

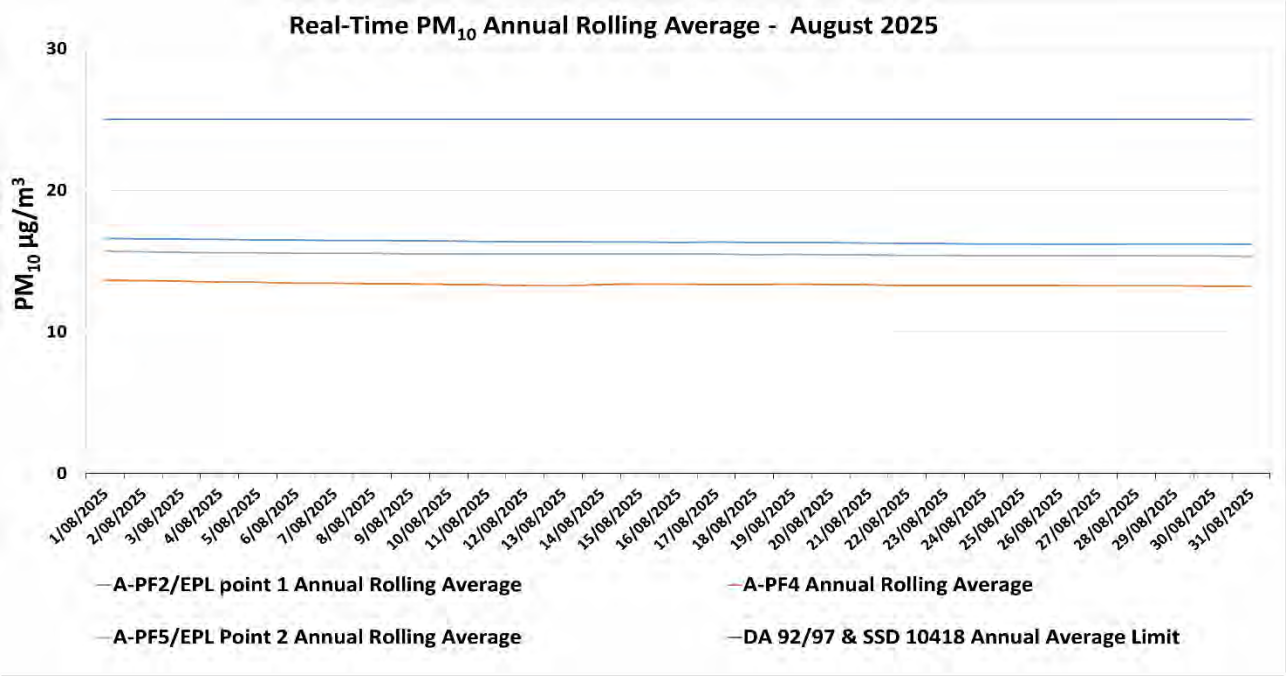

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for August 2025.

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Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – August 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
01/08/2025	4.43	4.45	4.85	25
02/08/2025	4.16	4.02	4.55	25
03/08/2025	3.40	3.28	3.28	25
04/08/2025	4.44	4.51	4.34	25
05/08/2025	5.26	4.92	4.94	25
06/08/2025	3.93	3.43	3.34	25
07/08/2025	3.75	3.21	3.32	25
08/08/2025	4.67	4.34	5.23	25
09/08/2025	5.09	4.78	5.58	25
10/08/2025	4.15	3.84	4.83	25
11/08/2025	4.15	3.82	4.98	25
12/08/2025	5.07	4.67	4.95	25
13/08/2025	4.95	4.33	4.03	25
14/08/2025	4.64	6.56	4.25	25
15/08/2025	5.14	5.64	4.65	25
16/08/2025	5.24	4.63	3.88	25
17/08/2025	4.24	3.21	2.96	25
18/08/2025	3.59	3.18	3.01	25
19/08/2025	3.65	3.34	3.89	25
20/08/2025	4.40	4.32	4.51	25
21/08/2025	3.70	3.78	4.35	25
22/08/2025	5.07	4.92	5.17	25
23/08/2025	4.72	4.64	4.12	25
24/08/2025	4.39	4.67	4.05	25
25/08/2025	4.48	4.38	3.76	25
26/08/2025	4.21	4.01	3.42	25
27/08/2025	4.94	3.91	3.42	25
28/08/2025	4.15	3.39	3.19	25
29/08/2025	4.70	3.23	2.98	25
30/08/2025	3.77	3.10	2.87	25
31/08/2025	3.77	3.57	3.22	25

*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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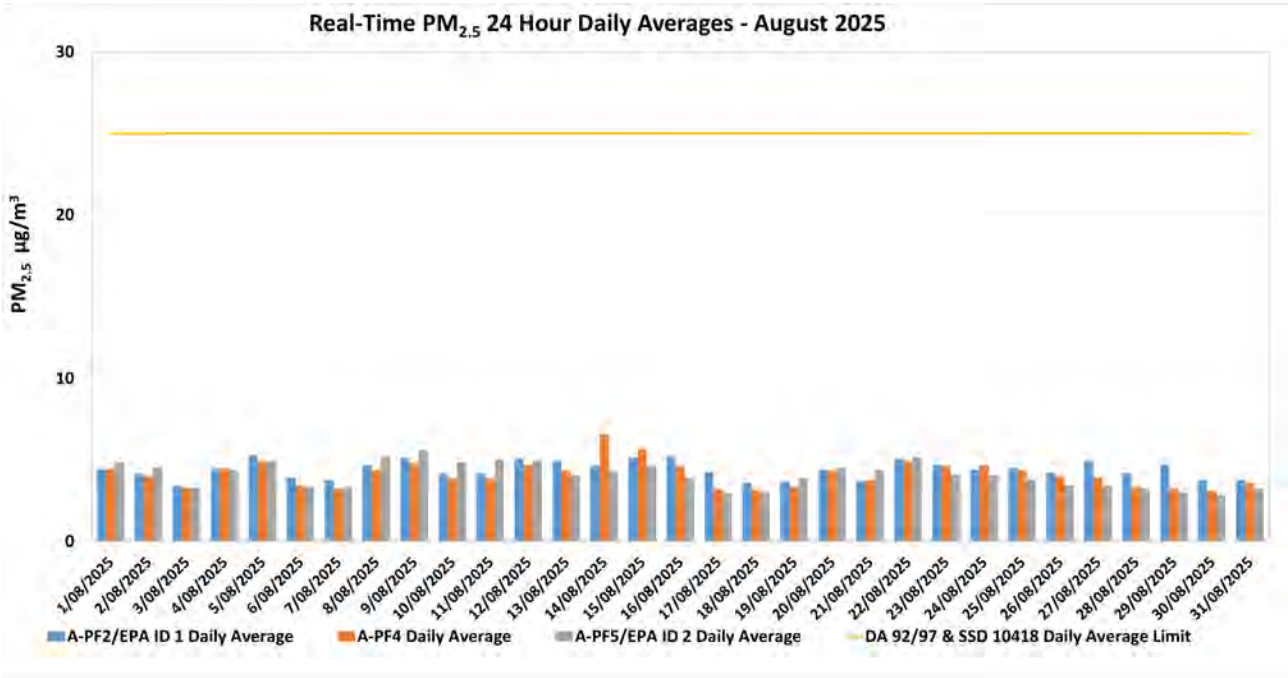

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for August 2025.

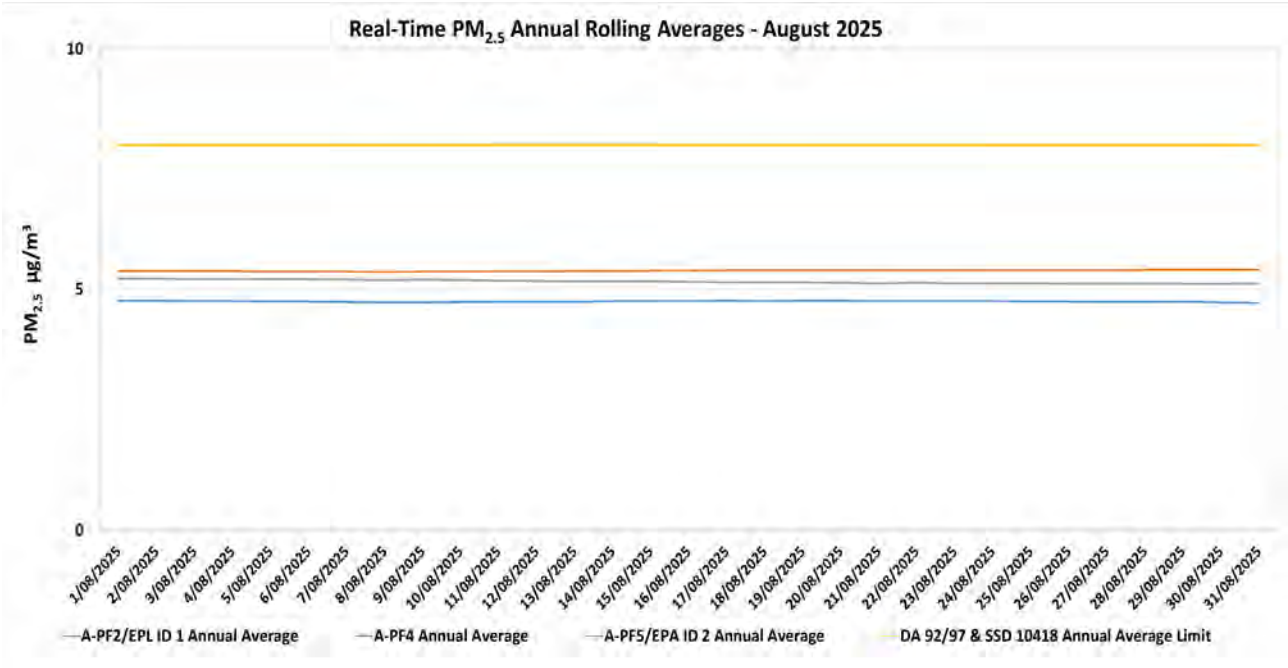

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for August 2025.

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7. Surface Water Monitoring

7.1 Methodology

Surface water quality is monitored at fourteen (14) sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

7.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2025) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data. Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2025) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

7.3 Results

Surface water monitoring was conducted by AECOM during the monitoring period. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 7-1.**

Table 7-1 – MPO Monthly Surface Water Monitoring Results – 4 August 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	7.4	194	195	**176**
W2	**	**	**	**
W3	7.4	199	214	145
W4	**	**	**	**
W5	6.4	140	186	36
W6A	**	**	**	**
W9	6.9	227	358	25
W11	**	**	**	**
W12	7.8	609	415	**89**
W13	7.8	352	336	44
W14	7.1	142	245	193
W15	7.8	306	246	**143**
W16	8.0	1692	1040	44
W17	**	**	**	**

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
**** Investigation Required*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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Table 7-2 – MPO Monthly Surface Water Monitoring Results – 21 August 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.1	322	211	**23**
W2	**	**	**	**
W3	8.1	344	214	24
W4	7.8	958	568	7
W5	7.1	71	150	11
W6A	**	**	**	**
W9	7.3	75	230	73
W11	**	**	**	**
W12	**8.2**	315	253	**860**
W13	**	**	**	**
W14	7.2	177	159	47
W15	**	**	**	**
W16	**	**	**	**
W17	**	**	**	**

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
**** Investigation Required*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

8. Groundwater Monitoring

8.1 Methodology

Groundwater monitoring is conducted on a quarterly basis, in February, May, August and November.

8.2 Assessment Criteria

An investigation is triggered if elevated measurements occur for three consecutive sampling events in accordance MPO Water Management Plan (MACH Energy, 2022). An investigation was triggered (AGE, 2023) examining the cause of elevated EC values in the alluvial zone, specifically MPBH2. The data strongly suggests that the cause of the increase in EC is persistent above-average stage in the adjacent Hunter River, caused by above-average rainfall since 2020, which is causing a rise in groundwater levels in similar alluvial bores. Trigger values have since been reviewed and will be incorporated in future Water management plans.

8.3 Results

Water level results for the groundwater bores are presented in Table 8-1. The quarterly pH and EC results are presented in Table 8-2 and Table 8-3, respectively.

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Table 8-1 - MPO Quarterly Groundwater Water Level Results

Monitoring Location/ ID	Water Level Trigger Range		August 2025 Water Level (DTW)	May 2025 Water Level (DTW)	February 2025 Water Level (DTW)	Triggered (Yes/ No)
	80th Percentile (DTW)	Trigger				
WRA1L	-	>± 0.5m	**1.77**	2.73	2.44	No
WRA1U	-	>± 0.5m	*	*	*	No
WRA3L-R**	-	>± 0.5m	*	*	*	No
WRA3U-R**	-	>± 0.5m	*	*	*	No
WRA5L-R**	-	>± 0.5m	^	*	*	No
WRA5U-R**	-	>± 0.5m	^	*	*	No
WRA6L	-	>± 0.5m	0.15	0.03	0.37	No
WRA6U	-	>± 0.5m	0.82	0.75	0.91	No
MPBH1	9.71	10.70	7.01	9.06	9.72	No
MPBH2	12.20	13.59	11.03	11.81	11.82	No
MPBH3b	13.04	Dry (or 14.0m)	10.56	11.68	11.89	No
MPBH4	-	>± 0.5m	**11**	**11.70**	12.19	No
MPBH5	-	>± 0.5m	*	*	*	No
MPBH1-C	-	>± 0.5m	6.863	^	9.623	No
MPBH1-HR	-	>± 0.5m	34.73	^	32.22	No
MPBH2-C	-	>± 0.5m	**11.063**	11.83	11.833	No
MPBH2-HR	-	>± 0.5m	**28.916**	11.87	11.856	No
MPBH4-C	-	>± 0.5m	**9.503**	10.41	10.913	No
MPBH4-HR	-	>± 0.5m	49.605	^	49.875	No
MPBH5-C	-	>± 0.5m	12.179	^	11.479	No
MPBH5-HR	-	>± 0.5m	11.11	^	11.52	No
MPBH6	-	>± 0.5m	8.391	8.85	9.44	No
MPBH6-C	-	>± 0.5m	9.738	10.18	10.848	No
MPBH6-HR	-	>± 0.5m	8.815	8.88	10.355	No
MPBH7	10.1	>± 0.5m	**4.327**	5.42	5.29	No
MPBH7-C	-	>± 0.5m	17.415	17.62	17.435	No
3500C500L	-	>± 0.5m	**27.11**	26.42	25.98	No
3500C500S	-	>± 0.5m	25.44	25.70	25.08	No
4500F000	-	>± 0.5m	22.09	^	22.34	No
5000D000-R	-	>± 0.5m	138.92	138.63	138.43	No
5500D000	-	>± 0.5m	**134.92**	134.32	Removed	No
6000C000L-R**	-	>± 0.5m	*	*	*	No
6000C000U-R**	-	>± 0.5m	*	*	*	No
6500F500L	-	>± 0.5m	52.16	52.10	50.48	No

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Monitoring Location/ ID	Water Level Trigger Range		August 2025 Water Level (DTW)	May 2025 Water Level (DTW)	February 2025 Water Level (DTW)	Triggered (Yes/ No)
	80th Percentile (DTW)	Trigger				
6500F500M	-	>± 0.5m	52.61	52.77	52.49	No
6500F500U	-	>± 0.5m	**26.56**	31.74	31.8	No
6500F625	-	>± 0.5m	**14.45**	16.18	16.1	No
Melody	-	>± 0.5m	**10**	13.14	13.1	No
7500F000	-	>± 0.5m	36.51	36.55	36.36	No
GDE Bore Shallow**	-	>± 0.5m	*	*	*	No
GDE Bore Deep**	-	>± 0.5m	^	10.92	10.86	No
NE Alluvium**	-	>± 0.5m	*	*	^	No
East Alluvium**	-	>± 0.5m	*	*	*	No

Results in **bold** indicate that the bore has exceeded the adopted assessment criterion for changes in standing water level from the previous measurement.
* Dry/insufficient water to sample.
**New site.
^Unsafe access.

Table 8-2 - MPO Quarterly Groundwater pH Results

Monitoring Location/ ID	pH Trigger Range		August 2025 pH	May 2025 pH	February 2025 pH	Triggered (Yes/No)
	Lower	Upper				
WRA1L	6.0	8.5	7.4	7.1	7.1	No
WRA1U			*	*	*	No
WRA3L-R**			7.5	7.5	7.5	No
WRA3U-R**			*	*	*	No
WRA5L-R**			^	7.4	6.9	No
WRA5U-R**			^	7.5	7.5	No
WRA6L			7.5	7	7	No
WRA6U			6.8	6.9	6.9	No
MPBH1			7.3	6.9	7	No
MPBH2			6.7	6.8	6.9	No
MPBH3b			7.4	7.7	7.4	No
MPBH4			6.9	6.9	6.9	No
MPBH5			*	*	*	No
MPBH1-C			7.2	^	**8.7**	No
MPBH1-HR			7.6	^	8	No
MPBH2-C			8.1	7.4	**10.2**	No
MPBH2-HR			7.5	7.7	8.4	No
MPBH4-C			7.4	8	8	No
MPBH4-HR			7.4	^	7.2	No

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Monitoring Location/ ID	pH Trigger Range		August 2025 pH	May 2025 pH	February 2025 pH	Triggered (Yes/No)
	Lower	Upper				
MPBH5-C			**11.1**	^	**9.1**	No
MPBH5-HR			7.6	^	7.4	No
MPBH6			7	7	7.1	No
MPBH6-C			7.2	7.2	7	No
MPBH6-HR			7	7.4	7.3	No
MPBH7			7.3	7.1	7	No
MPBH7-C			7.1	7.1	7.1	No
3500C500L			7.5	7.5	7.5	No
3500C500S			7.3	7.3	7.1	No
4500F000			6.8	^	6.8	No
5000D000-R			7.5	7.5	7.5	No
5500D000			*	*	Removed	No
6000C000L-R**			8.4	8.4	*	No
6000C000U-R**			*	*	*	No
6500F500L			7.2	7.2	7.2	No
6500F500M			7.2	7.2	7.3	No
6500F500U			6.8	6.8	6.8	No
6500F625			7	7	6.7	No
Melody			6.8	6.8	6.8	No
7500F000			7.8	7.8	7.7	No
GDE Bore Shallow**			*	*	*	No
GDE Bore Deep**			6.8	6.8	7.4	No
NE Alluvium**			*	*	^	No
East Alluvium**			*	*	*	No

** Dry/insufficient water to sample.*
***New site.*
^Unsafe access.
*An investigation is triggered when pH values are recorded outside the baseline range (20th – 80th percentile). Results shown in **bold** are outside of this range.*

Table 8-3 - MPO Quarterly Groundwater EC Results

Monitoring Location/ ID	Maximum Beneficial Use Trigger	August 2025 EC[1]	May 2025 EC[1]	Feb 2025 EC[1]	Triggered (Yes/No)
WRA1L	7800	2990	3120	3080	No
WRA1U	*	***	***	***	-
WRA3L-R**	*	7810	7500	***	-
WRA3U-R**	*	***	***	4800	-
WRA5L-R**	*	^	5070	4800	-

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Monitoring Location/ ID	Maximum Beneficial Use Trigger	August 2025 EC[1]	May 2025 EC[1]	Feb 2025 EC[1]	Triggered (Yes/No)
WRA5U-R**	*	^	5980	***	-
WRA6L	7800	5540	6670	5880	No
WRA6U	22000	7760	8430	9010	No
MPBH1	800	576	604	675	No
MPBH2	930	**1083**	**1222**	**1247**	**Yes**
MPBH3b	7800	4480	5280	5920	No
MPBH4	7800	5470	5290	5620	No
MPBH5	*	***	***	***	-
MPBH1-C	*	612	^	1450	-
MPBH1-HR	*	1626	^	1580	-
MPBH2-C	*	1223	1363	1436	-
MPBH2-HR	*	1424	1113	1631	-
MPBH4-C	*	4870	4820	4950	-
MPBH4-HR	*	5240	^	5880	-
MPBH5-C	*	831	^	1042	-
MPBH5-HR	*	1149	^	842	-
MPBH6	*	989	1274	1230	-
MPBH6-C	*	2650	3770	2710	-
MPBH6-HR	*	1543	6150	1490	-
MPBH7	*	6690	7630	11480	-
MPBH7-C	*	10290	10220	10760	-
3500C500L	7800	3830	3820	3770	No
3500C500S	7800	5710	5610	6010	No
4500F000	22000	8620	***	8440	-
5000D000-R	*	5020	4500	4490	-
5500D000	7800	***	***	Removed	No
6000C000L-R**	*	4550	4760	4530	-
6000C000U-R**	*	***	***	***	-
6500F500L	7800	2470	2570	2530	No
6500F500M	7800	2770	2670	2780	No
6500F500U	7800	5300	5080	5120	No
6500F625	7800	987	4190	4480	No
Melody	*	914	6280	6140	-
7500F000	7800	6390	6290	6450	No
GDE Bore Shallow**	*	***	***	***	-
GDE Bore Deep**	*	12920	12850	11240	-
NE Alluvium**	*	***	***	^	-

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Monitoring Location/ ID	Maximum Beneficial Use Trigger	August 2025 EC[1]	May 2025 EC[1]	Feb 2025 EC[1]	Triggered (Yes/No)
East Alluvium**	*	***	***	***	-

** Indicates no trigger limit identified*
*** New site*
**** Dry/insufficient water to sample*
^Unsafe access.
[1]Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).
An investigation is triggered when EC values recorded exceed the beneficial use quality range (as described in the GWMP) for three successive monitoring rounds. Results outside this range are shown in **bold.**

An investigation in February 2024, found that the frequent EC triggers for MPBH2 are a result of increased rainfall events. Further Investigations have been undertaken during 2025, in accordance with recommendations from Specialist Groundwater Consultants AGE, the *MPO Water Management Plan* (MACH Energy, 2025) has been revised to new recommended trigger levels for MPBH2. The revised MPO Water Management Plan was submitted to the Department of Planning Housing and Infrastructure in August 2025.

9. Noise Monitoring

9.1 Methodology

Attended noise monitoring was undertaken during the monitoring period at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2024) in accordance with DA 92/97, SSD 10418 and EPL 20850.

9.2 Results

The results for nighttime attended noise monitoring against noise criteria is shown in **Table 9-1**; **Table 9-2;** and **Table 9-3.**

Table 9-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 18 and 19 August 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	3:19am	IA	45	0.4 / 235	Yes	E	No
N-AT2	11:14pm	28	45	3.2 / 140	Yes	G	NA
N-AT3	12:43am	IA	45	2.2 / 113	Yes	E	No
N-AT4	2:09am	IA	45	0.5 / 224	Yes	F	No
N-AT5	2:50am	IA	45	0.3 / 222	Yes	E	No
N-AT6	3:42am	IA	45	0.6 / 283	Yes	E	No
N-AT7	1:33am	IA	45	2.1 / 124	Yes	F	NA
N-AT8	10:35pm	41	NA[2]	1.6 / 155	NA[6]	D	NA[2]

Notes:
1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*

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3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

Table 9-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 18 and 19 August 2025

Location	Start Date and Time	MPO Only $L_{A1,1min}$ dB[2.4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	3:19am	IA	37	0.4 / 235	Yes	E	No
N-AT2	11:14pm	24	35	3.2 / 140	Yes	G	NA
N-AT3	12:43am	IA	40	2.2 / 113	Yes	E	No
N-AT4	2:09am	IA	38	0.5 / 224	Yes	F	No
N-AT5	2:50am	IA	37	0.3 / 222	Yes	E	No
N-AT6	3:42am	IA	35	0.6 / 283	Yes	E	No
N-AT7	1:33am	IA	37	2.1 / 124	Yes	F	NA
N-AT8	10:35pm	37	NA[2]	1.6 / 155	NA[6]	D	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 9-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 18 and 19 August 2025

Location	Start Date and Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	3:19am	37	40	No
N-AT2	11:14pm	24	40	NA
N-AT3	12:43am	IA	40	No
N-AT4	2:09am	26	40	No
N-AT5	2:50am	IA	40	No
N-AT6	3:42am	33	40	No
N-AT7	1:33am	IA	40	NA
N-AT8	10:35pm	41	NA[2]	NA[2]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*

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2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

10. Blast Monitoring

There were eleven (11) blast events (a total of 67 blasts YTD). Results are presented in **Table 10-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 10-1 – MPO Blast Monitoring Results – August 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
4/08/2025	12:30	0.250 mm/s	86.8 DBL	0.370 mm/s	89.3 DBL	Y
7/08/2025	10:34	0.550 mm/s	97.2 DBL	0.560 mm/s	94.4 DBL	Y
8/08/2025	13:05	0.370 mm/s	91.4 DBL	0.710 mm/s	88.4 DBL	Y
11/08/2025	12:01	0.250 mm/s	114.3 DBL	0.170 mm/s	94.1 DBL	Y
13/08/2025	13:28	0.080 mm/s	102.2 DBL	0.150 mm/s	73.2 DBL	Y
16/08/2025	09:01	0.350 mm/s	96 DBL	0.270 mm/s	102 DBL	Y
19/08/2025	14:44	0.550 mm/s	102.8 DBL	0.200 mm/s	92.8 DBL	Y
20/08/2025	14:58	0.500 mm/s	97.6 DBL	0.350 mm/s	88.9 DBL	Y
21/08/2025	11:18	0.310 mm/s	100.4 DBL	0.670 mm/s	91 DBL	Y
25/08/2025	15:47	0.080 mm/s	93.2 DBL	0.090 mm/s	97.3 DBL	Y
29/08/2025	09:54	0.420 mm/s	112.9 DBL	0.420 mm/s	108 DBL	Y

END OF REPORT

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MACHEnergy

Mount Pleasant Operation

Monthly Environmental Monitoring Report

September 2025

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1. Introduction

The Mount Pleasant Operation (MPO) is located within Upper Hunter Valley of New South Wales, approximately three kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton. The villages of Aberdeen and Kayuga are located 12 km north-northeast and 3 km north of the operations, respectively.

The purpose of this report is to provide a monthly update of monitoring data in accordance with the requirements of NSW Environmental Protection Licence (EPL) 20850, Section 66(6) of the *Protection of the Environment Operations Act 1997* (*POEO Act*), the MPO Development Approval (DA 92/97) and the MPO Development Consent (SSD 10418).

Table 1-1 – Mount Pleasant Operation

Name of Operation	Mount Pleasant Operation
Name of Licensee	MACH Energy Australia Pty Ltd
Environmental Protection Licence	20850
Project Approval	DA 92/97 and SSD 10418
Reporting Period Start Date	1 September 2025
Reporting Period End Date	30 September 2025
Date All Data Received	14 October 2025

Links to three key regulatory documents are provided here:

- Mount Pleasant Operation Development Application Approval DA 92/97; and
- Mount Pleasant Operation Development Consent SSD 10418.

2. Monitoring Requirements

The MPO EPL 20850 specifically requires the monitoring of:

- 2 x Continuous particulate monitors
- Noise monitoring.
- Blast monitoring; and
- Meteorological monitoring.

Monitoring of sites not required by the EPL are conducted in accordance with the respective Management Plans as required by Project Approval (DA 92/97) and Development Consent (SSD 10418).

All monitoring is undertaken by suitably qualified and experienced person(s). The MPO Environmental Monitoring Network is shown in the following figures**:**

- **Figure 2-1** shows MPO attended noise monitoring locations and Noise Assessment Groups (NAGs).
- **Figure 2-2** shows the MPO Air Quality Monitoring network.
- **Figure 2-3** shows the MPO Blast Monitoring Locations.
- **Figure 2-4** shows the MPO Groundwater Monitoring network; and
- **Figure 2-5** shows the MPO Surface Water Monitoring network.

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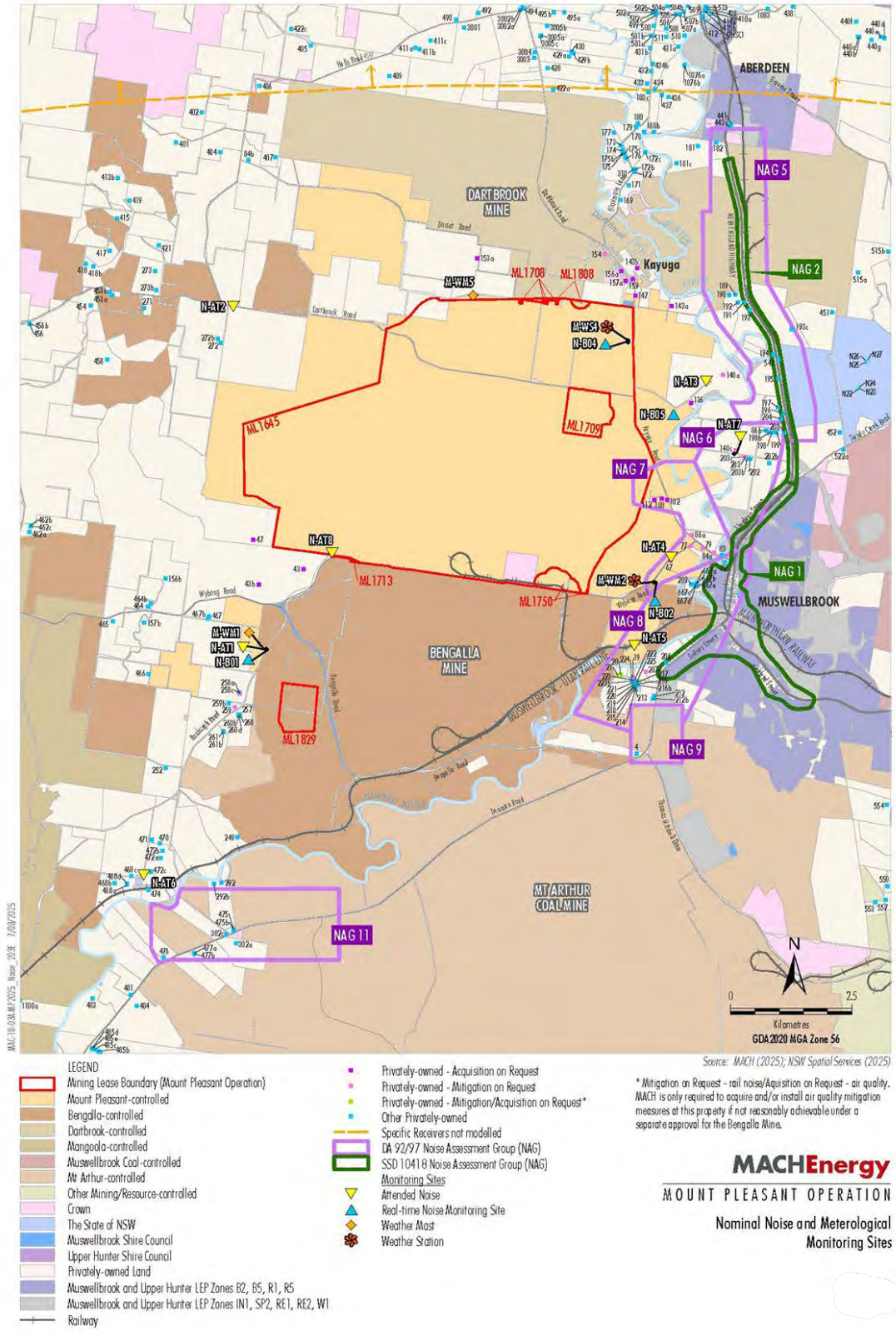

Figure 2-1 – MPO Attended Noise Monitoring Assessment Groups and Locations - Approved (SSD 10418) Water Management Plan

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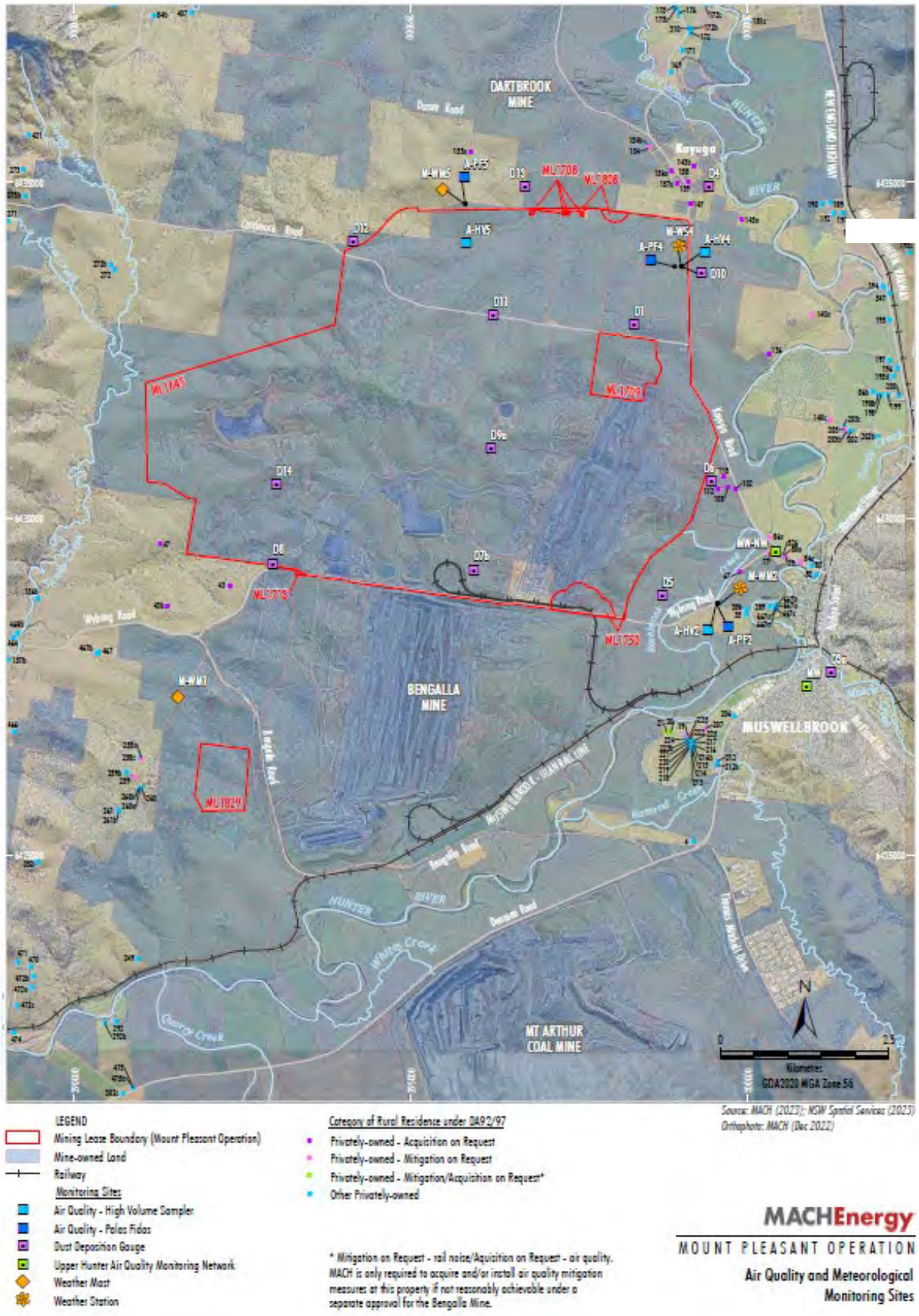

Figure 2-2 – MPO Air Quality and Meteorological Monitoring Network - Approved (SSD 10418) Water Management Plan

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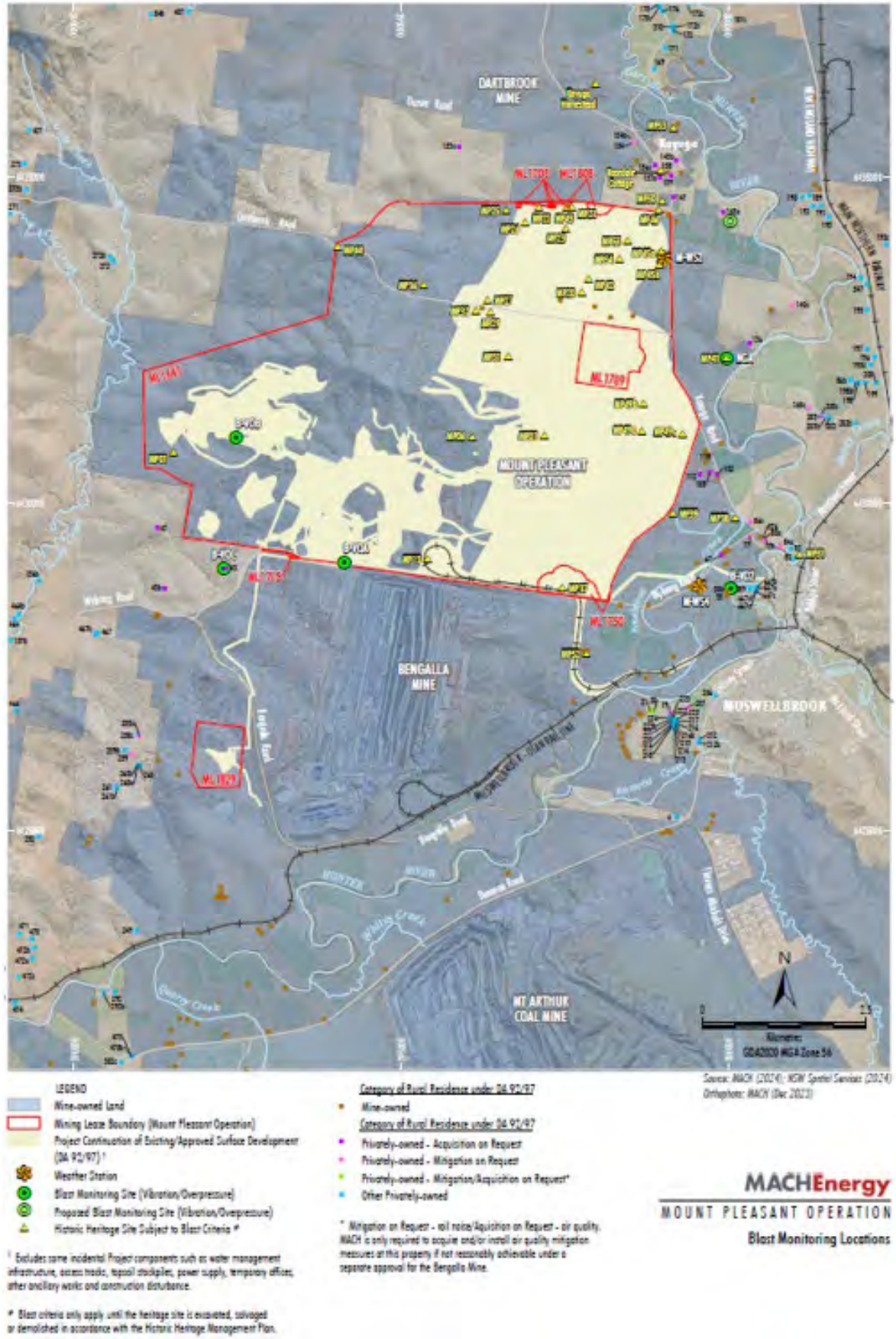

Figure 2-3 – MPO Blast Monitoring Locations

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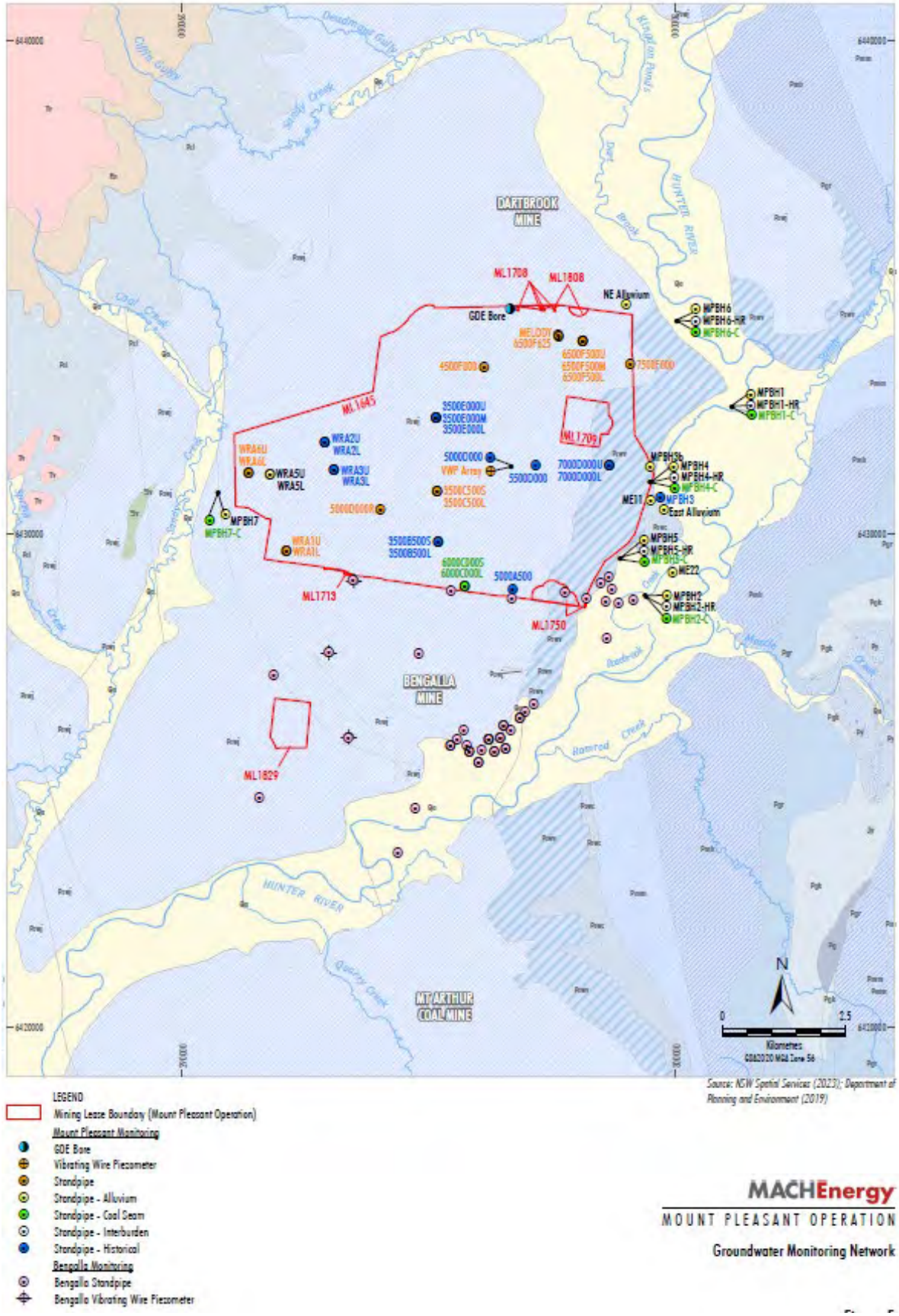

Figure 2-4 – MPO Groundwater Monitoring Network – Approved (SSD 10418) Water Management Plan

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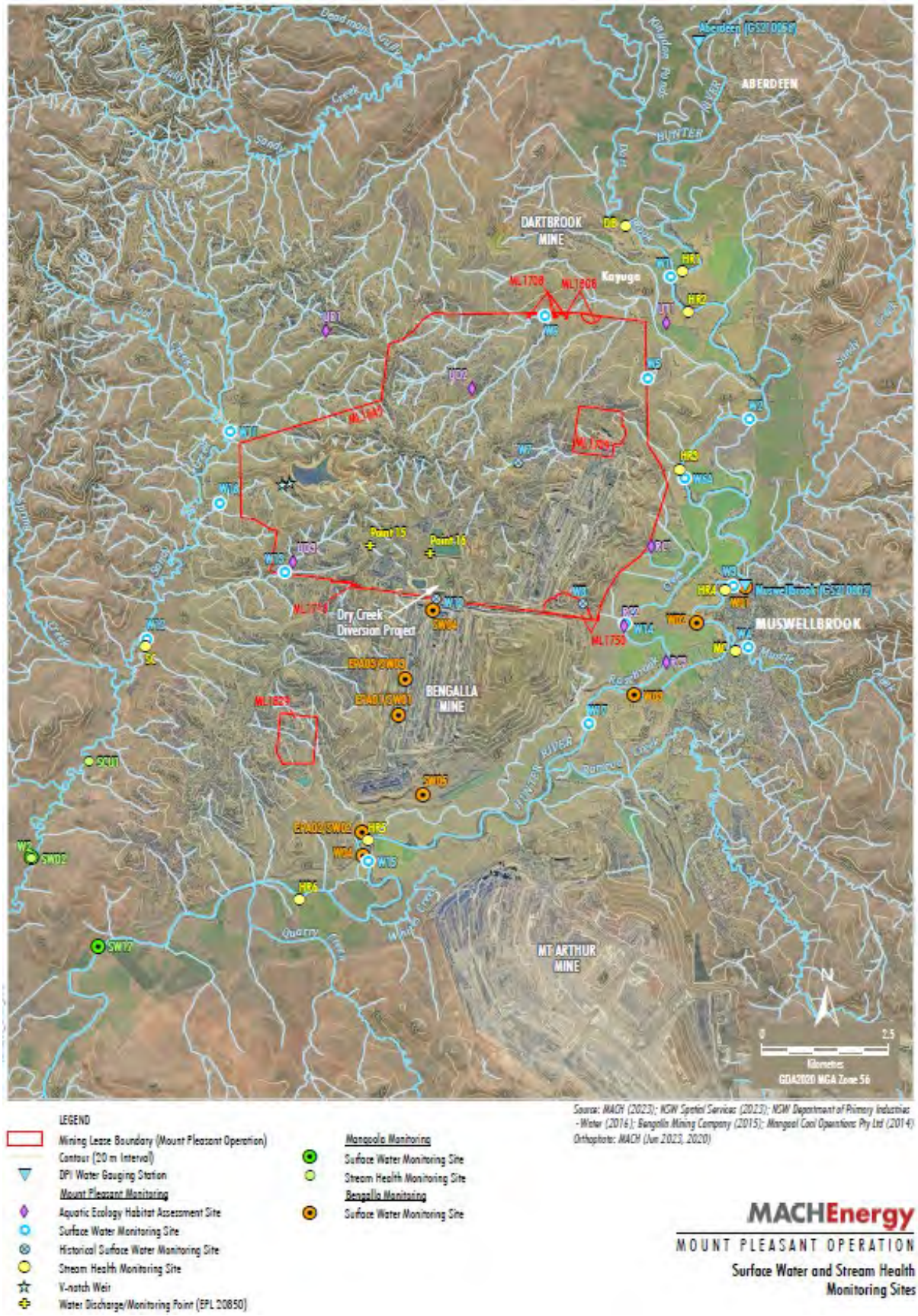

Figure 2-5 – MPO Surface Water Monitoring Network - Approved (SSD 10418) Water Management Plan

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3. Meteorological Monitoring

Weather data is measured continuously[1] at the Kayuga Road (M-WS4) and the Wybong Road (M-WS2) meteorological stations. In addition to air quality parameters (particulate matter less than 10 µm and less than 2.5 µm (PM_{10} and $PM_{2.5}$)), the weather stations measure wind speed and direction, temperature (at 2 metres (m) and 10m), temperature inversion (using the sigma theta method), solar radiation, relative humidity, rainfall, and atmospheric pressure.

Meteorological data was captured at M-WS2 and M-WS4 during the monitoring period. Throughout September 2025, there was 25.6mm and 20.8mm of rainfall recorded at M-WS2 and M-WS4, respectively.

4. Dust Depositional Monitoring

4.1 Methodology

The dust deposition monitoring network comprises of thirteen (13) dust deposition gauges (DDG) that are collected on a monthly basis. Details of the monitoring locations are shown in Figure 2-2.

4.2 Assessment Criteria

Dust Deposition were assessed as per the MPO Air Quality and Greenhouse Gas Management Plan (MACH Energy, 2024). Dust deposition was monitored according to the OEH's Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DECC 2007), which references Australian Standard (AS)/New Zealand Standard (NZS) 3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air: Determination of particulate matter – Deposited matter – Gravimetric Method.

DDG samples can be contaminated by a variety of means, notably by the presence of insects and bird droppings. Results for contaminated gauges were not included in the calculation of the annual averages as this would result in skewed or misleading results for the purpose of dust deposition assessment. The Australian Standard does not provide criteria for the determination of contamination of a DDG. AECOM determines a gauge sample to be contaminated only after reference to field observation sheets, historical monitoring location data, laboratory notes and results, prevailing atmospheric conditions, and feedback from field technicians. For example, a gauge sample with a statistically abnormally high insoluble solids result, a low ash residue result (indicating an elevated level of organic matter) and field notation that bird droppings or insects were present is likely to be considered contaminated.

While the new SSD 10418 doesn't explicitly mention dust deposition gauges, there's a notable shift in regulations towards embracing high volume air sampler results and continuous air quality monitoring programs, with a specific focus on total particulate matter, PM10, and PM2.5. These modern monitoring techniques offer a more comprehensive approach to environmental surveillance, furnishing real-time data and insights into air quality conditions. By harnessing these advanced methods, MPO can ensure the implementation of robust monitoring practices. This transition from the previous development consent DA92/97

[1] The EPA's Ambient air monitoring guidance note (Guidance Note) states that after allowing sufficient down time for routine maintenance and calibrations a continuous monitoring system should be able to achieve at least a 95% availability.

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(which is yet to be surrendered) to SSD 10418 signifies a proactive measure towards upholding environmental compliance. Therefore, Dust Depositional Monitoring will continue to be included in monthly reporting as per DA92/97 up until surrender where it will be discontinued. Site D7b is located within close proximity to the northern boundary of a neighbouring mining operation and thus can be influenced by this site. D7b will continue to be monitored, however will not be used to assess compliance or to represent residential receivers in the area.

4.3 Results

Dust Deposition Data was conducted by AECOM during the monitoring period. Sample analysis was performed by ALS, a National Accreditation and Testing Authority (NATA) accredited laboratory.

Results are summarised in **Table 4-1**. Annual rolling averages have been provided as an indication of performance in the 12 months leading up to the current monitoring period as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 4-1: Dust Depositional Results – September 2025

Location	Monthly Insoluble Solids (g/m^2.month)	Insoluble Solids Annual Rolling Average (g/m^2.month)
D1	1.0	3.6
D3	1.3	1.4
D4	0.7	1.1
D5a	3.5	2.1
D6	2.1	2.0
D7b	17.3**	**7.5**
D8	3.4	**5.0**
D9a	2.2	3.8
D10	0.9	1.2
D11	1.9	**4.2**
D12	0.5	1.4
D13	1.0	2.1
D14	8.3**	**4.3**
Criterion	-	**4.0**

Notes:
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
** Insufficient monthly results to calculate annual average*
*** Contaminated results*

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Figure 4-1 compares the monthly insoluble solids results to the annual averages for each dust gauge and the assessment criterion.

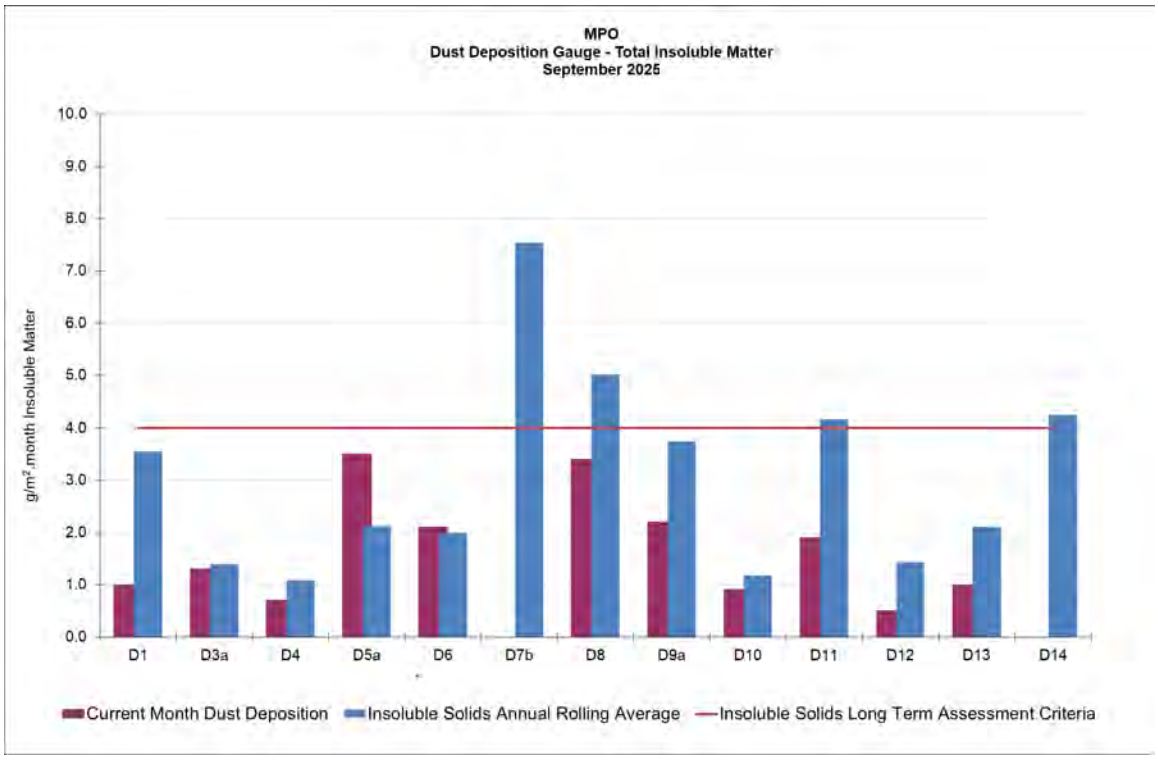

Figure 4-1: MPO Dust Deposition Monthly Results and Annual Rolling Average

5. Total Suspended Particulates

5.1 Methodology

Three Total Suspended Particulate Matter (TSP) High-Volume Air Samplers (HVAS) are run for 24 hours every six days. The locations are displayed in **Table 5-1** below.

Table 5-1 Total Suspended Particulate Monitoring Sites

ID	Description
A-PF2	Reilly's
M-WS4	Kayuga Road Met Station
A-PF5	Athlone

5.2 Assessment Criteria

Total Suspended Particulates were assessed as per the MPO Air Quality and Greenhouse Gas Management Plan (MACH Energy, 2024) in accordance with AM-15 of Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DECC, 2007), referencing AS/NZS 3580.9.3:2015 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – Total suspended particulate matter (TSP) - High volume sampler gravimetric method, for the monitoring of TSP.
TSP is assessed against the guidelines defined in the EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA 2016), Project Approval

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DA 92/97 and Development Consent SSD 10418. The DA 92/97 and SSD 10418 both specify an annual average project contribution plus background criterion of 90µg/m3.

5.3 Results

Sample collection was undertaken by AECOM with sample analysis performed by ALS, a NATA accredited laboratory. TSP results for the monitoring period are provided in Table 5-2. Twelve month rolling averages to the current month are provided as an indication of performance as per Schedule 3, Condition 20 of DA 92/97 and Schedule 2, Condition B28 of SSD 10418.

Table 5-2 Total Suspended Particulate Monitoring Data – September 2025

Run Date	Assessment Criterion	TSP µg/m^3		
		HVAS A-PF2	HVAS A-PF5	HVAS M-WS4
03/09/2025	-	48.7	14.1	15
09/09/2025		53.6	17.2	27.6
15/09/2025		51.5	19	23.4
21/09/2025	-	89.2	15.3	15.8
27/09/2025	-	128	33.9	45.4
*Monthly Mean	-	74.2	19.9	25.4
Annual Rolling Average	90	52	48	36

Notes:
**Results have been rounded to one decimal place for reporting purposes where applicable.*
*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*

6. Real Time Air Quality Monitoring

6.1 Methodology

Continuous particulate matter monitoring less than 10 µm (PM10) and particulate matter less than 2.5 µm (PM2.5) was conducted continuously at three locations (one utilised for management only) at MPO during the monitoring period.

6.2 Assessment Criteria

The EPA identification numbers 1 and 2 refer to monitors installed on Wybong Road (A-PF2) and Dorset Road (A-PF5), respectively. In addition, a third monitor (A-PF4) is installed on Kayuga Road with data used for management purposes only. Project Approval Schedule 3, Condition 20 of DA 92/97 and Development Consent Schedule 2, Condition B28 of SSD 10418 specify a limit for PM10 of 50 µg/m3 and PM2.5 of 25 µg/m3 in a 24-hour daily average.

6.3 Results

Real time PM10 and PM2.5 annual rolling averages to the current month have been provided in **Figures 6.2 and 6.4**, respectively. **Figure 6.1 and Table 6.1** below show the real-time PM_{10} 24 hour daily average results at MPO air quality monitoring sites during the monitoring period. Real time $PM_{2.5}$ 24-hour average results during the reporting period are presented in **Figure 6.3** and **Table 6.2.**

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Table 6-1: MPO Continuous Particulate PM_{10} Data – September 2025

Date	A-PF2/ EPA ID 1	A-PF4	A-PF5/ EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
01/09/2025	12.69	8.79	7.09	50
02/09/2025	16.80	13.66	13.59	50
03/09/2025	18.52	17.24	14.66	50
04/09/2025	18.39	11.45	8.70	50
05/09/2025	19.41	14.14	13.14	50
06/09/2025	16.35	14.78	17.80	50
07/09/2025	15.47	14.93	14.66	50
08/09/2025	17.78	14.85	10.72	50
09/09/2025	19.94	16.04	13.05	50
10/09/2025	13.14	12.07	9.82	50
11/09/2025	9.15	6.49	6.13	50
12/09/2025	7.69	5.69	5.39	50
13/09/2025	10.48	6.40	6.16	50
14/09/2025	11.36	7.53	7.10	50
15/09/2025	14.65	10.66	8.64	50
16/09/2025	16.79	15.01	11.98	50
17/09/2025	29.59	15.08	14.45	50
18/09/2025	21.95	13.91	11.60	50
19/09/2025	22.46	23.63	13.84	50
20/09/2025	18.56	12.40	8.56	50
21/09/2025	15.12	7.82	7.51	50
22/09/2025	17.67	8.40	7.55	50
23/09/2025	15.61	15.24	15.16	50
24/09/2025	16.28	15.62	12.17	50
25/09/2025	25.52	11.71	6.79	50
26/09/2025	27.53	21.14	9.54	50
27/09/2025	45.46	22.78	10.19	50
28/09/2025	40.96	30.43	15.24	50
29/09/2025	29.31	31.09	12.64	50
30/09/2025	27.34	34.64	11.41	50

*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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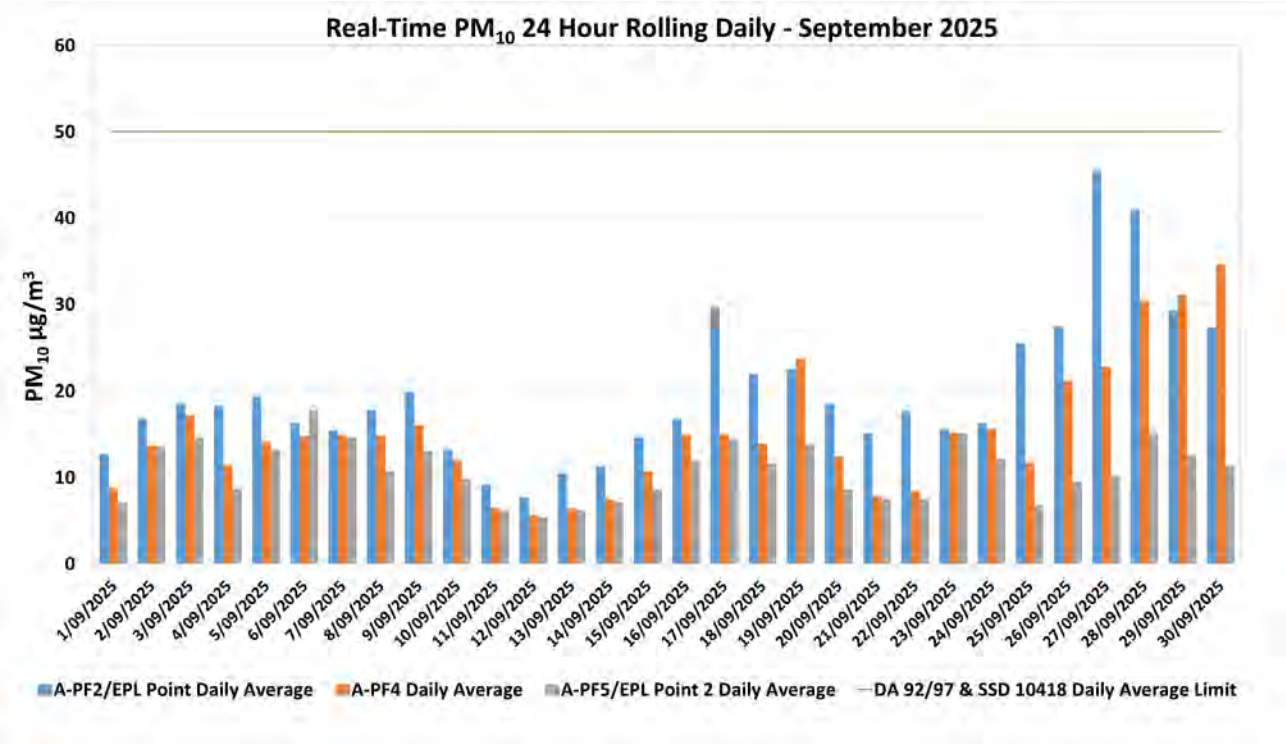

Figure 6-1: Real-time PM_{10} 24 Daily Average Results for September 2025.

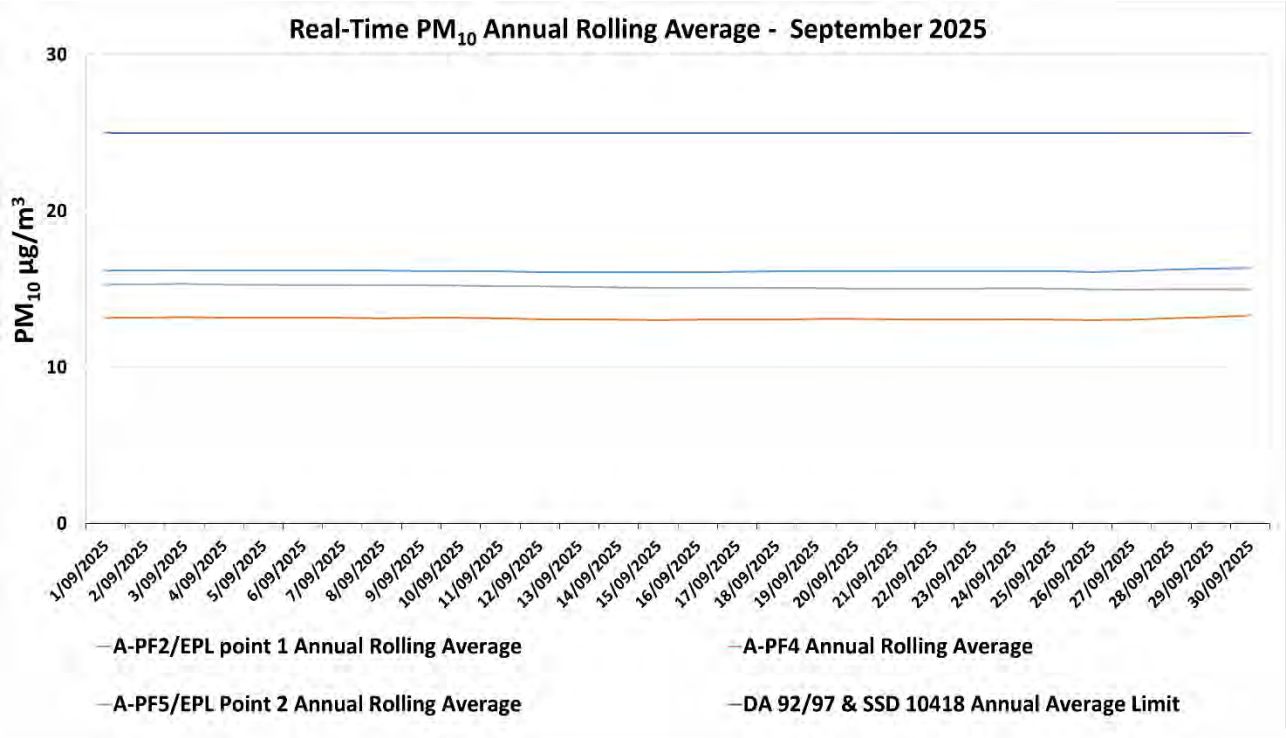

Figure 6-2: Real-time PM_{10} Annual Rolling Average Results for September 2025.

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Table 6-2: MPO Palas Fidas $PM_{2.5}$ Data – September 2025

Date	A-PF2/EPA ID 1	A-PF4	A-PF5/EPA ID 2	A-PF2, A-PF4, A-PF5 24 Hour Average Limit (µg/m³)
	24-hour Average Result			
01/09/2025	4.33	3.83	3.23	25
02/09/2025	5.32	4.90	4.54	25
03/09/2025	5.95	5.89	4.82	25
04/09/2025	5.69	4.89	3.94	25
05/09/2025	6.20	5.52	4.71	25
06/09/2025	5.58	5.53	5.50	25
07/09/2025	5.62	5.78	5.14	25
08/09/2025	6.06	5.83	4.65	25
09/09/2025	6.17	5.94	5.23	25
10/09/2025	5.03	5.17	4.70	25
11/09/2025	3.30	3.00	2.91	25
12/09/2025	3.03	2.78	2.68	25
13/09/2025	3.66	3.01	2.84	25
14/09/2025	3.80	3.36	3.14	25
15/09/2025	5.22	4.76	4.26	25
16/09/2025	6.38	6.31	5.71	25
17/09/2025	7.49	6.20	5.78	25
18/09/2025	5.14	4.47	3.97	25
19/09/2025	5.36	5.51	3.37	25
20/09/2025	4.64	4.14	3.60	25
21/09/2025	4.01	3.36	3.30	25
22/09/2025	4.39	3.62	3.41	25
23/09/2025	3.85	3.95	3.77	25
24/09/2025	4.15	4.29	3.74	25
25/09/2025	5.94	4.88	3.86	25
26/09/2025	8.07	7.56	5.70	25
27/09/2025	9.81	7.79	6.03	25
28/09/2025	12.87	12.47	9.58	25
29/09/2025	10.66	11.07	7.32	25
30/09/2025	9.78	10.19	6.45	25

*Results in **bold** indicate an elevated measurement of adopted assessment criteria.*
Results with "- "indicate dates where data was affected by maintenance or servicing (scheduled and unscheduled)

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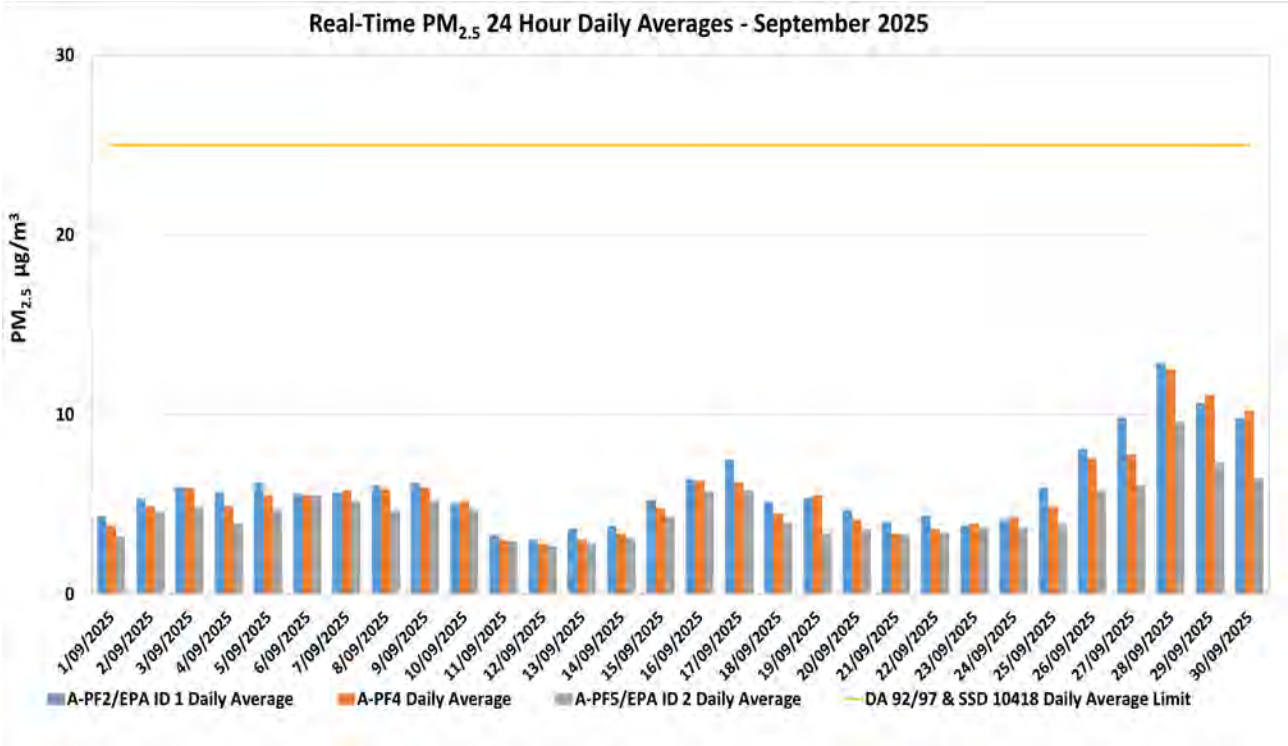

Figure 6-3: Real-time $PM_{2.5}$ 24 hour Daily Average Results for September 2025.

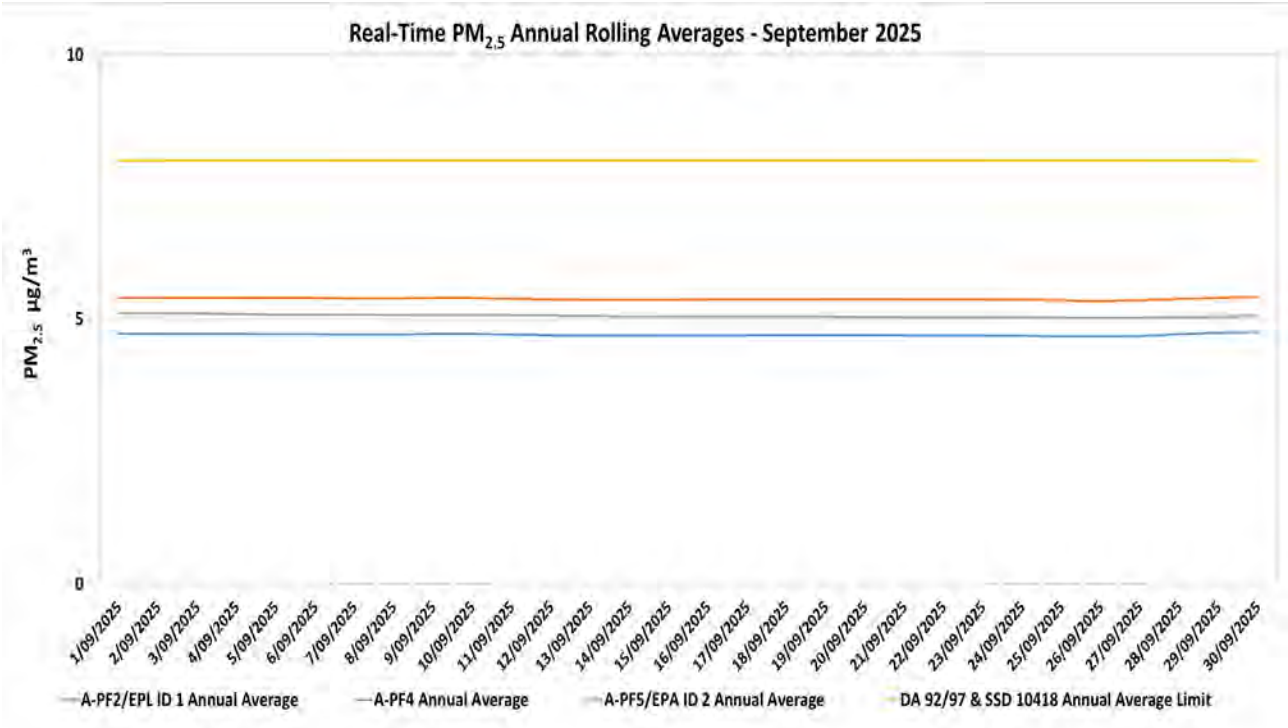

Figure 6-4: Real-time $PM_{2.5}$ Annual Rolling Average Results for September 2025.

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7. Dust Shutdowns

7.1 Methodology

PM_{10} dust levels and wind direction is continually monitored at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network Station to assess any exceedances over a 24-hour period.

7.2 Assessment Criteria

Adverse conditions that lead to the shutdown of dust generating activities at Mount Pleasant are assessed as per EPL 20850 requirement O3. Adverse conditions are defined as the occurrence of both adverse wind conditions and adverse PM_{10} conditions measured at the Muswellbrook NW Air Quality Monitoring Station.

- Adverse wind conditions are the result of a one-hour average wind direction between 250 degrees and 340 degrees.
- Adverse PM_{10} conditions are the occurrence of the rolling 24- hour average PM_{10} concentration exceeding 44 µg/m^3.

When adverse conditions have passed and a minimum of one hour of no dust generating activities have been undertaken, activities may resume.

7.3 Results

Table 7.1. presents a log of times throughout the reporting period when adverse conditions occurred, when dust generating activities were ceased in accordance with EPL Condition O3.4 and when activities were resumed.

Table 7-1 Dust Shutdowns MPO- September 2025

Date	Time Dust Generating Activities were Ceased	Time Dust Generating Activities were Resumed	Shutdown Hours	24- hour rolling PM10 Average	Wind Direction
27/09/2025	15:20	17:20	2 hours	54.9 µg/m^3	329˚

8. Surface Water Monitoring

8.1 Methodology

Surface water quality is monitored at fourteen (14) sites on a monthly basis, with additional monitoring conducted if triggered by a rain event. A more comprehensive suite of analysis is performed at these sites on a quarterly basis.

8.2 Assessment Criteria

Surface waters were assessed as per the *MPO Water Management Plan* (MACH Energy, 2025) in accordance with site specific trigger values that have been developed using the ANZECC (2000) guidelines for sites that contain a minimum of two years of monthly data.

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Sites with insufficient data are assessed on default trigger values adopted from ANZECC (2000) guidelines.

In accordance with the MPO Water Management Plan (WMP) Table 26 (MACH Energy, 2024) if a water quality indicator at a potential impact monitoring location or at a downstream receiving water monitoring location is above (or outside the range) of the site-specific trigger value for three consecutive sampling events an investigation is required.

8.3 Results

Surface water monitoring was conducted by AECOM during the monitoring period. Laboratory analysis was performed by ALS NATA accredited laboratory. Monthly monitoring results for pH, EC, TSS and Total Dissolved Solids (TDS) are presented in **Table 8-1.**

Table 8-1 – MPO Monthly Surface Water Monitoring Results – 30 September 2025

Station	pH	Electrical Conductivity (EC) (µs/cm)[1]	Total Dissolved Solids (TDS) (mg/L)	Total Suspended Solids (TSS) (mg/L)
W1	8.0	**587**	325	11
W2	8.0	**607**	330	12
W3	8.0	597	319	17
W4	7.9	2120	1290	7
W5	*	*	*	*
W6A	8.0	**587**	329	15
W9	*	*	*	*
W11	**8.2**	3590	1920	<5
W12	8.1	4380	2410	<5
W13	*	*	*	*
W14	*	*	*	*
W15	7.9	**554**	310	19
W16	8.1	8550	5190	12
W17	8.0	573	316	21

*Note: Results in **bold** indicate exceedances of adopted assessment criteria.*
**Dry or insufficient water to sample.*
*** No access due to track conditions.*
**** Investigation Required*
[1] Results have been rounded in accordance with the In-house method Q4AN(EV)-332-WI2 (EC).

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9. Groundwater Monitoring

9.1 Methodology

Groundwater monitoring is conducted on a quarterly basis, in February, May, August and November.

10. Noise Monitoring

10.1 Methodology

Attended noise monitoring was undertaken during the monitoring period at eight (8) monitoring locations as per the *MPO Noise Management Plan* (MACH Energy, 2024) in accordance with DA 92/97, SSD 10418 and EPL 20850.

10.2 Results

The results for nighttime attended noise monitoring against noise criteria is shown in **Table 10-1**; **Table 10-2;** and **Table 10-3.**

Table 10-1 – $L_{A1,1min}$ Generated by MPO: Attended Night Monitoring – 3 and 4 September 2025

Location	Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	12:11am	IA	45	2.5 / 021	Yes	E	No
N-AT2	11:30pm	IA	45	3.1 / 294	Yes	E	NA
N-AT3	10:54pm	40[3] 42 adjusted	45	3.2 / 289	Yes	E	NA
N-AT4	11:20pm	38	45	1.7 / 043	Yes	D	No
N-AT5	11:41pm	34	45	1.8 / 038	Yes	D	No
N-AT6	1:04am	IA	45	2.2 / 020	Yes	D	No
N-AT7	10:43pm	41	45	3.2 / 294	Yes	E	NA
N-AT8	12:25am	37	NA[2]	2.1 / 030	NA[6]	D	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{A1,1minute}$ attributed to MPO.*
3. *NA in exceedance column means meteorological conditions outside those specified in Condition L2.3 of EPL 20850 and thus criterion is not applicable.*
4. *IA = inaudible; and*
5. *Bold results indicate exceedance of criteria.*
6. *This is not a compliance monitoring location.*

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Table 10-2 – $L_{Aeq,15min}$ Generated by MPO: Attended Night Monitoring – 3 and 4 September 2025

Location	Time	MPO Only $L_{A1,1min}$ dB[2,4]	Criterion dB	Wind Speed m/s Direction °	Criterion Applies[1]	Stability Class	Exceedance dB[3]
N-AT1	12:11am	IA	37	2.5 / 021	Yes	E	No
N-AT2	11:30pm	IA	35	3.1 / 294	Yes	E	NA
N-AT3	10:54pm	36[3] 38 adjusted	40	3.2 / 289	Yes	E	NA
N-AT4	11:20pm	35	38	1.7 / 043	Yes	D	No
N-AT5	11:41pm	30	37	1.8 / 038	Yes	D	No
N-AT6	1:04am	IA	35	2.2 / 020	Yes	D	No
N-AT7	10:43pm	36	37	3.2 / 294	Yes	E	NA
N-AT8	12:25am	33	NA[2]	2.1 / 030	NA[6]	D	NA[2]

Notes:

1. *As per Condition L2.3 of EPL 20850, noise emission limits do not apply during wind speeds greater than 3m/s at 10m above ground level, or stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level, or stability category G temperature inversion conditions.*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MPO.*
3. *IA = inaudible; and*
4. *Bold results indicate exceedance of criteria.*
5. *This is not a compliance monitoring location.*

Table 10-3 – $L_{Aeq,\ period}$ Cumulative Noise: Attended Night Monitoring – 3 and 4 September 2025

Location	Time	Measured Mining Only $L_{Aeq,\ period}$ dB[1,2,3]	Cumulative Noise Criterion LAeq dB	Exceedance dB
N-AT1	12:11am	IA	40	No
N-AT2	11:30pm	IA	40	NA
N-AT3	10:54pm	36[3] 38 adjusted	40	NA
N-AT4	11:20pm	35	40	No
N-AT5	11:41pm	38	40	No
N-AT6	1:04am	31	40	No
N-AT7	10:43pm	36	40	NA
N-AT8	12:25am	33	NA[2]	NA[2]

Notes:

1. *These are the results for MPO and all other mining sources. 15-minute measurements have been assumed to apply across the entire night period as a conservative measure and to represent "worst case" results; and*
2. *By definition, cumulative noise refers to two or more noise sources. If only one other source of mining is audible, or if MPO is inaudible, the measured cumulative noise defined here is 'Nil'.*
3. *NA in exceedance column means criterion was not applicable due to atmospheric conditions.*
4. *This is not a compliance monitoring location.*

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11. Blast Monitoring

There were twelve (12) blast events (a total of 79 blasts YTD). Results are presented in **Table 11-1**. All blast results during this monitoring period were below the criteria stated in Schedule 3, Condition 10 of DA 92/97, Schedule 2; Condition B12 of SSD 10418; and L5 of EPL 20850.

Table 11-1 – MPO Blast Monitoring Results – September 2025

Day & Date Fired	Time Fired	BVOC Vibration (mm/s)	BVOC Overpressure (dBL)	BVO2 Vibration (mm/s)	BVO2 Overpressure (dBL)	Blast Fume Compliant
1/09/2025	15:34	1.060 mm/s	91.3 DBL	0.720 mm/s	101.8 DBL	Y
3/09/2025	12:33	1.970 mm/s	98.5 DBL	0.720 mm/s	102 DBL	Y
8/09/2025	15:08	0.590 mm/s	102 DBL	0.530 mm/s	106.6 DBL	Y
9/09/2025	15:23	0.750 mm/s	96.8 DBL	1.120 mm/s	108.9 DBL	Y
12/09/2025	15:12	1.520 mm/s	113.1 DBL	0.620 mm/s	115 DBL	Y
15/09/2025	15:05	0.050 mm/s	97.8 DBL	0.070 mm/s	107.2 DBL	Y
17/09/2025	10:51	1.020 mm/s	96.4 DBL	0.410 mm/s	101.6 DBL	Y
19/09/2025	16:06	0.490 mm/s	88.5 DBL	0.630 mm/s	99.4 DBL	Y
22/09/2025	9:10	0.050 mm/s	89.6 DBL	0.070 mm/s	91.9 DBL	Y
23/09/2025	13:13	0.150 mm/s	87.8 DBL	0.220 mm/s	92.8 DBL	Y
25/09/2025	13:50	0.310 mm/s	99.1 DBL	0.410 mm/s	96.9 DBL	Y
27/09/2025	15:16	0.230 mm/s	97.9 DBL	0.200 mm/s	104 DBL	Y

END OF REPORT

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MOUNT PLEASANT OPERATION

STREAM HEALTH & STYGOFAUNA MONITORING

Autumn 2025 SURVEY



Prepared for
AECOM Australia on behalf of MACH Energy Australia

3 November 2025

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Cover photo	Bats observed in trees growing in riparian habitat adjacent to the Muscle Creek survey site (13/05/2025).

DRAFT

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EXECUTIVE SUMMARY

Introduction

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 km north-west of Muswellbrook and approximately 50 km north-west of Singleton. The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively.

Development of the MPO is undertaken within Mining Lease (ML) 1645, ML 1713, ML 1708, ML 1709, ML 1750 and ML 1808 and is operated in accordance with the relevant Authorities for the above MLs and in accordance with Development Consent DA 92/97, consent SSD10418 (activated in February 2024) and Environmental Protection Licence (EPL) 20850. Any discharges at the MPO will be undertaken in accordance with the Hunter River Salinity Trading Scheme (HRSTS) and EPL 20850. MACH Energy currently holds 51 discharge credits.

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

BIO-ANALYSIS Pty Ltd was commissioned by AECOM on behalf of MACH Energy in 2017 to implement a stream health monitoring programme, as required by MACH Energy's Surface Water Monitoring Plan (SWMP). MACH Energy are required to assess the biological health of the aquatic ecology at selected locations along the Hunter River and its tributaries (the Study Area), outside and surrounding the MPO mining lease boundaries.

The spring 2017 survey forms the basis for the ongoing monitoring to assess stream health in accordance with the Surface Water Management Plan (SWMP) (MACH Energy, 2019), to determine any change in selected aquatic indicators throughout the life of the MPO and ascertain whether these changes can be attributed to the MPO. The stream health 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 and fyke nets.

Limited *in situ* water quality sampling is also done to assist in interpreting trends in the above indicators. Stream health monitoring is required to be done in spring and autumn each year.

The results of the current survey (autumn 2025) are compared with those obtained in each of spring and autumn since the spring 2017 survey.

An additional requirement this year was to monitor alluvial bores in the vicinity of the Hunter River, to determine the presence of any stygofauna taxa. As per MPO's approved Water Management Plan (SSD10418), bores were sampled in May 2026.

Results

Six species of fish (including two introduced species), freshwater shrimp and freshwater prawns were collected in autumn 2025. Long-finned eels (ranging between approximately 70-120 cm in length) were collected at two of the six Hunter River sites sampled (HR5&6), Muscle Creek and Dartbrook. Carp continue to be abundant at Site HR5 within the Hunter River and within the lower reaches of Dartbrook.

Altogether, ten species of fish have been caught/observed by the stream health monitoring programme since spring 2017, including Australian bass, Long-finned eels, Freshwater catfish, Australian smelt, Sea mullet, native gudgeons, Common carp and Mosquito fish. Overall, the species composition of assemblages has been comparable throughout the survey period. No threatened species of fish listed under the NSW *Fisheries Management Act, 1994* (FM Act) or the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) have been observed.

Four likely stygofauna from two families (i.e., Neonipharidae and Isotomidae) were identified from two (MP-BH1 and MP-BH2) of seven bores sampled in May 2025. These taxa are known from previous surveys of stygofauna within the Hunter River alluvium.

Macroinvertebrate assemblages have consistently (i.e. before and during mining activities at the MPO) been dominated by pollution tolerant taxa. Some pollution sensitive taxa have also commonly been collected, including caddis fly and mayfly families, upstream and downstream of the MPO area, including at the time of the autumn 2025 survey.

Of the two sites sampled on the Hunter River to assess changes (if any) associated with the MPO, one site (Site HR3) has consistently scored below its indicator criteria (Band A - equivalent to AUSRIVAS reference condition) while the other (Site HR4: Band B - significantly impaired) has scored lower on thirteen out of the sixteen sampling occasions. Similar deviations from historical AUSRIVAS band levels have been recorded at sites sampled at Dart Brook and Muscle Creek, which are not exposed to mining activities at the MPO.

Importantly for this stream health study, none of the statistical tests used to formally examine trends in the condition of aquatic macroinvertebrate fauna (assemblage structure, diversity, OE50 and SIGNAL2 scores) have indicated a change that could be attributed to a MPO related impact.

Therefore, it is not considered necessary for MACH Energy to initiate a stream health investigation under their Surface and Ground Water Response Plan, particularly since the MPO continues to be a nil discharge site.

Conclusions and Recommendations

As of June 2023, MPO has an established HRSTS Discharge Point however, no discharges have been made to date. There has been no flow recorded in the ephemeral waterways that drain the eastern portion of the MPO area to the Hunter River, including Rosebrook Creek, since October 2022.

Examination of results from the autumn 2025 survey found no measurable changes in the indicator variables examined in relation to the findings of the baseline survey that could be indicative of an impact associated with the MPO.

It is recommended that the stream health monitoring programme is continued using the methods employed for baseline and operation phase surveys, to ensure continuity of the programme.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

1.0 INTRODUCTION 8

2.0 METHODS 11

2.1 Study Area 11
2.2 Previous Investigations 12
2.3 Performance Measures and Indicators 12
2.4 Field Methods 13
2.4.1 Stream Health Monitoring 13
2.4.2 Habitat Assessment 16
2.4.3 Water Quality 16
2.4.4 Aquatic Macroinvertebrates 17
2.4.5 Fish 17
2.4.6 Stygofauna Monitoring 18
2.5 Laboratory Methods 19
2.6 Data Analyses 20
2.7 Quality Assurance/Quality Control (QA/QC) 23
3.0 RESULTS 24

3.1 Aquatic Habitat Characteristics 24
3.2 Water Quality 34
3.3 Aquatic Macroinvertebrates 41
3.3.1 General Findings 41
3.3.2 Stream Health Performance Indicators 42
3.3.3 Changes in Aquatic Macroinvertebrate Fauna 44
3.4 Fish 51
3.5 Groundwater Monitoring 54
5.0 DISCUSSION 56

5.1 Aquatic Habitat 56
5.2 Water Quality 57
5.3 Aquatic Macroinvertebrates 58
5.4 Fish 58
5.5 Stream Health Performance Indicators 59
6.0 CONCLUSIONS & RECOMMENDATIONS 60

7.0 REFERENCES 60

APPENDICES 65

Appendix 1 - GPS positions (UTMs) for stream monitoring sites (autumn 2025). 65
Appendix 2 - Riparian Channel & Environment (RCE) Score Sheet 66
Appendix 3 - Water Quality Data (autumn 2025) 67
Appendix 4 - Macroinvertebrate taxa collected using the AUSRIVAS protocol (autumn 2025) 68

DRAFT

Tables

Table 1. Stream Health Performance Criteria 13
Table 2. Stream Health Monitoring Sites 14
Table 3. Bores sampled for Stygofauna. 18
Table 4. Mean (+ SE) values of water quality variables recorded between spring 2017 and autumn 2025. 35
Table 5. AUSRIVAS outputs for sites sampled (autumn 2025) (n = 1). 42
Table 6. Band of Impairment Scores (spring 2017 to autumn 2025). 43
Table 7. Summary of PERMANOVA analysis. 44
Table 8. Results of SIMPER analyses (autumn 2025). 45
Table 9. Summary of PERMANOVA analysis of the Number of Taxa. 46
Table 10. Summary of PERMANOVA analysis for OE50 Scores. 47
Table 11. Summary of PERMANOVA analysis. 47
Table 12. Species of fish and crustaceans observed and/or collected using a Backpack Electrofisher (at sites HR1-HR6, MC and DB) and Dip nets (all sites) in autumn 2025. 52
Table 13. Species of fish and crustaceans collected/observed at the survey sites between spring 2017 and spring 2024. 53
Table 14. Invertebrates recorded from bores near the MPO (12 May 2025). 54
Table 15. Mean (+ SE) Values of Groundwater Quality 55

Figures

Figure 1. Project Area 10
Figure 2. Stream Health Monitoring Sites 15
Figure 3. Annual rainfall (mm) measured at Muswellbrook from 1 January 2013 to 31 December 2024. 24
Figure 4. Principal Component Ordination (PCO) of the centroids estimated for AUSRIVAS macroinvertebrate assemblages between spring 2017 (Time 1) and autumn 2025 (Time 16). 45
Figure 5. Mean number of taxa collected between spring 2017 and autumn 2025. 48
Figure 6. Mean OE50 Taxa Scores and their respective Band Scores (B-C) for AUSRIVAS samples collected between spring 2017 and autumn 2025. 49
Figure 7. Mean SIGNAL2 Indices for AUSRIVAS samples collected between spring 2017 and autumn 2025. 50

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1.0 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 km north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively (Figure 1).

Development of the MPO is undertaken within Mining Lease (ML) 1645, ML 1713, ML 1708, ML 1709, ML 1750 and ML 1808 and is operated in accordance with the relevant Authorities for the above MLs. MPO is operated in accordance with Development Consent DA 92/97, as subsequently modified[1], consent SSD10418 (activated in February 2024) and Environmental Protection Licence 20850 Currently MPO is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal until 2026. MACH Energy commenced mining operations in January 2018.

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

BIO-ANALYSIS Pty Ltd was commissioned by AECOM on behalf of MACH Energy in 2017 to implement a stream health monitoring programme, as required by MACH Energy's Surface Water Management Plan (SWMP) (MACH Energy, 2019), to assess the biological health of the aquatic ecology at selected locations along the Hunter River and its tributaries (the Study Area), outside and surrounding the MPO mining lease boundaries (Figure 2).

An additional requirement this year was to monitor alluvial bores in the vicinity of the Hunter River to determine the presence of any stygofauna taxa. As per MPO's approved Water Management Plan (SSD10418), bores were to be sampled in May 2026.

This Report provides the results of investigations undertaken in autumn (12-14 May) 2025 in accordance with requirements outlined in the SWMP and the Water Management Plan (SSD10418). The objectives of this survey were to:

[1] To date, four applications to modify the Minister's consent for the MPO have been submitted. A copy of the consolidated Development Consent DA 92/97 incorporating Mods 1, 2, 3, and 4 is provided as Attachment 1 in (REF).

- Undertake the 2025 autumn survey within the Study Area as required by the SWMP and the Water Management Plan (SSD10418)
- Determine the presence of any stygofauna taxa;
- Determine whether any changes in stream health have occurred since the 2017 spring survey and whether changes, if any, are due to potential mining-related impacts at the MPO,
- Provide MPO with recommendations on further surveys or response mechanisms, as required, by the SWMP if stream health within the Study Area has deteriorated.

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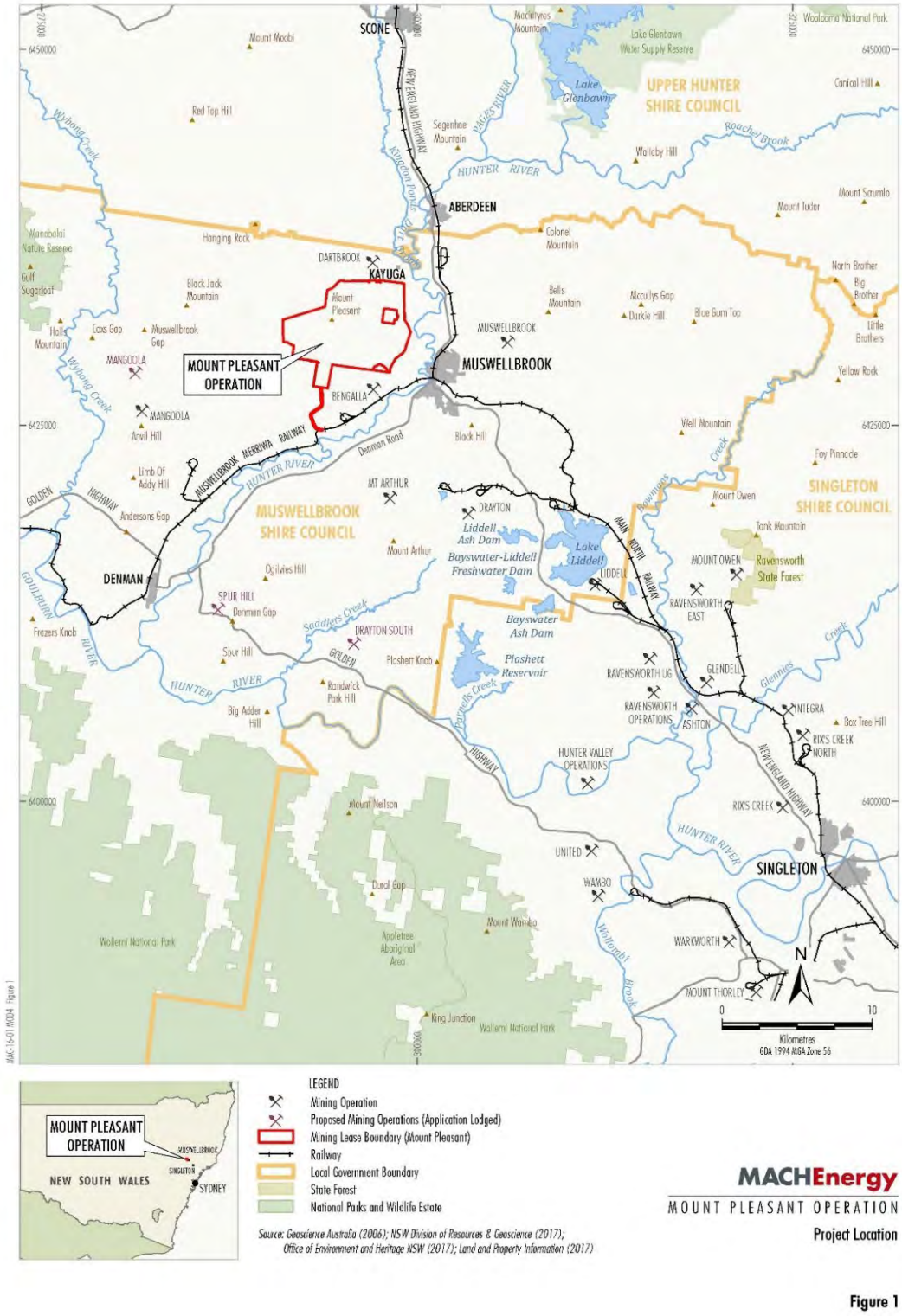

Figure 1. Project Area

2.0 METHODS

2.1 Study Area

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

The township of Denman is located approximately 18 km to the southwest 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 Hunter River flows in a southerly direction approximately 1 km to the east of the MPO's mining lease boundaries and 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 MPO's ML boundaries.

Surrounding land uses include agriculture (grazing, dairy, vineyards, horse and cattle studs, turf, flower and market gardens) and coal mining (ERM Mitchell McCotter, 1997). The Bengalla Coal Mine immediately adjoins the southern boundary of MPO. The Mount Arthur Coal Mine is located approximately 5 km to the south. The Mangoola Coal Mine is located approximately 8 km to the west. The Dartbrook Coal Mine immediately adjoins to the north (Figure 1). As such, the catchment area in the region of MPO has been historically cleared and altered.

The regional climate for the Muswellbrook areas is warm temperate with an average annual rainfall of approximately 600 mm (BOM, 2020).

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2.2 Previous Investigations

Stream Health Monitoring

The initial stream health monitoring was implemented in November 2017. The results of the first survey are described in the "Stream Health Monitoring Spring 2017 Survey" report (BIO-ANALYSIS, 2018). Since the Spring 2017 Survey, surveys have been done in autumn (May) and spring (November) 2018, autumn (May) 2019 and spring (October) 2019, autumn (May) 2020 and spring (November) 2020, autumn (May) 2021, spring (October) 2021, autumn (May) 2022, spring (September) 2022, autumn (May) 2023, spring (October) 2023, autumn (May) 2024 and spring (October) 2024 (BIO-ANALYSIS, 2018-2024).

Stygofauna Assessment

Seven accessible bores (MP-BH1-3, MP-BH3b, 18298, 7000D000(u) and WRA1L) were sampled for stygofauna for the Mount Pleasant Optimisation Project Aquatic Ecology Assessment on 27 and 28 November 2018 (BA, 2020). Of these, 100 litres of water was able to be pumped from four boreholes (MP-BH1, MP-BH2, 7000D000(u) and WRA1(L)) within three groundwater systems (i.e. Alluvium, Interburden and Permian).

Three likely stygofauna (Cyclopoida, Ostracoda and Isotomidae) were identified from bore samples in the alluvial aquifer (east of the MPO, along the Hunter River), where the groundwater was relatively fresh. Each of these taxa are known from previous surveys of stygofauna within the Hunter alluvium.

2.3 Performance Measures and Indicators

Stream health performance criteria were developed for the SWMP by MACH Energy for two sites on the Hunter River (Table 1), by combining riffle and edge habitat scores obtained at those sites in the mid-1990s using the New South Wales Australian River System (AUSRIVAS) techniques (MACH Energy, 2019). Should an AUSRIVAS score deteriorate below the range for its historical band of impairment score for two successive monitoring rounds, a stream health investigation protocol is to be initiated under the MPO's Surface and Ground Water Response Plan (SGWRP) (MACH Energy, 2019).

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Table 1. Stream Health Performance Criteria

Site Identification	Band of Impairment Score	Trigger Value (O/E Taxa)
Hunt 571	**B**	**0.54**
Hunt 854	**A**	**0.84**

Location of sites: Hunt 571: Hunter River @ Muswellbrook; Hunt 854: Hunter River downstream of Aberdeen (Figure 2)

Band of impairment scores for sites sampled at Dart Brook (Site Hunt 585: Band B) and Muscle Creek (Hunt 506: Band B) were also presented within the SWMP (MACH Energy, 2019).

Mangoola Coal Operations 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 being observed by Mangoola Coal Operations at this site, MACH Energy would consult with Mangoola Coal Operations during implementation of their response plan as required by the SWMP.

2.4 Field Methods

2.4.1 Stream Health Monitoring

To fulfil the requirements of the SWMP, a stream health assessment was required to be completed at two 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 four sites were included in the monitoring programme from the spring 2017 survey (BIO-ANALYSIS, 2018), 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).

For the autumn 2025 survey, sites were sampled on 13 & 14 May 2025. Each site was approximately 100 m in length with their GPS co-ordinates listed in Appendix A. Collections of fish and macroinvertebrates were completed in accordance with Section 37 of the *NSW Fisheries Management Act 1994* using Scientific Collection Permit Number FP23/124.

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Table 2. Stream Health Monitoring Sites

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

u/s – upstream; d/s - downstream

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Figure 2. Stream Health Monitoring Sites

2.4.2 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.

Based on the original classification established by Peterson (1992), site condition was rated:

- Poor for RCE scores of 0-24%;
- Fair for RCE scores of 25-43%;
- Good for RCE scores of 44-62%;
- Very good for RCE scores of 63-81%; and
- Excellent for RCE scores of 82-100%.

The condition of aquatic habitat at each site was also 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 were surveyed to provide an indication of the dominant species present and their cover.

Each stream health monitoring site within the Study Area was photographed and the locations recorded with a hand-held GPS (satellite-based Global Positioning System).

2.4.3 Water Quality

Water quality is measured at each site using a water quality probe and meter. The physico-chemical properties measured were electrical conductivity (µS/cm), dissolved oxygen (% saturation and mg/L), pH (pH units), temperature (^{o}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. It should be noted that water quality measurements collected during the biological sampling provide a snapshot of quality at the time of sampling under the prevailing flow conditions. Routine monthly and rain event surface water monitoring is undertaken at selected sites within the Study Area for MACH Energy by AECOM.

2.4.4 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.

2.4.5 Fish

Fish were sampled using a Smith-Root LR-24 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 fish species were subsequently returned to the water.

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Additional sampling of fish was undertaken at two sites in the Hunter River, by deploying fyke nets (panels up to 4 m long on either side of a central funnel 2.5 m long, with 5 mm mesh) and bait traps.

2.4.6 Stygofauna Monitoring

Stygofauna taxa were sampled within eight bores within the vicinity of the Hunter River in May 2025 (Table 3), using methods in accordance with stygofauna sampling and groundwater dependent ecosystem (GDE) assessment guidelines (Hancock and Boulton 2005; Hose and Lategan, 2012; Hose et al., 2015; Department of Environment and Science, 2018a and 2018b; Doody et al., 2019).

Table 3. Bores sampled for Stygofauna.

Bore	Easting	Northing	Depth to Water	Depth to Bottom	Notes
MP-BH1	301136	6432569	10.10	18.03	Good recharge rate. Extract 230 L on an annual basis
MP-BH1-C	301136	6432569	10.25	76.78	Not a good recharge rate. Sampling method is purge & return
MP-BH1-HR	301136	6432569	35.28	52.26	Not a good recharge rate. Sampling method is purge & return
MP-BH2	299404	6428717	12.17	17.41	Good recharge rate. Extract 130L on an annual basis
MP-BH2-C	299385	6428747	12.46	74.90	Good recharge rate. Extract 400L on an annual basis
MP-BH2-HR	299385	6428747	12.41	53.50	Not a good recharge rate. Sampling method is purge & return
GDE D	296720	6434574	DRY	6.98	Bores newly drilled. Bore was dry on first visit this month
GDE S	296722	6434584	10.67	25.02	Bores newly drilled. Bore recharge rate unknown

Firstly, a weighted stygofauna net (50 µm mesh with a 40 mm diameter opening) was lowered to the bottom of each bore, bounced four times to dislodge resting invertebrate fauna and slowly (to avoid a bow-wave) retrieved to the surface. Once at the surface, net contents were emptied into a 50 µm mesh sieve. The net, vial and sinkers were rinsed over the sieve. In total, six net hauls were collected. The cumulative contents of the sieve were then transferred to a labelled plastic container and preserved with 100% ethanol.

After each sampling, nets were washed in Decon90, rinsed in deionized water and air-dried to prevent the transfer of stygofauna between bores during the survey.

Pump samples were collected immediately after netting. A Watterra PowerPack PP1 groundwater pump was used to extract up to 300 L of water from each bore. A sampling hose was fed into the bore until it reached the bottom of the bore casing, then lifted approximately 2 m above the bottom of the bore. Prior to pumping, three rows of ten x 10L buckets were set out. Buckets were carefully (to avoid splashing and overflows) filled sequentially.

Once the buckets were filled, a Yeo-Kal 618 probe was used to measure temperature, electrical conductivity (µS/cm), dissolved oxygen (% saturation and mg/L) and pH (pH units) in the first bucket and then every 5 buckets.

Subsequently, water from the first 10 buckets was passed through a 50 µm mesh sieve, the sieve contents transferred to a labelled plastic container and preserved with 100 % ethanol. The second and third rows of buckets were then sieved separately, to give three x 100 L samples per bore site (not including the net sample).

Net and pump samples were later transported to the laboratory to be processed in a sorting dish under a ISSCO ML400 series Stereo Microscope and identified as far as possible using taxonomic keys.

2.5 Laboratory Methods

In the laboratory, aquatic macroinvertebrate samples were sorted under a magnification lamp and preserved in 80% alcohol. Samples were later identified using 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) were identified to species, because they could potentially include threatened aquatic species listed under the *Fisheries Management Act, 1994* (FM Act).

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Up to 25 animals of each family were counted, in accordance with the AUSRIVAS protocol (Turak et al., 2004) and the SIGNAL2 (Stream Invertebrate Grade Number Average Level) biotic index developed by Chessman (2003).

Stygofauna samples were sorted and identified to the lowest level possible using a binocular microscope (at 40X magnification).

2.6 Data Analyses

The objective of analyses of water quality and aquatic macroinvertebrate data was to determine whether any significant changes to stream health indices may have occurred following commencement of mining at the MPO. Any significant change in stream health as determined by stream health trigger levels adjacent or immediately downstream of the Project would be investigated to determine the source of the change. For this report, data collected in spring 2017, autumn and spring 2018, autumn and spring 2019, autumn and spring 2020, autumn and spring 2021, autumn and spring 2022, autumn and spring 2023 and autumn and spring 2024 and autumn 2025 were examined.

Stygofauna data collected by the current survey were compared to data collected from the bores sampled within November 2018.

Water Quality

The water quality measurements taken during each survey were compared with guideline values recommended by the ANZECC and ARMCANZ (2000) for slightly disturbed upland rivers in south-east Australia.

Data were also compared to surface water quality trigger levels developed for the MPO's SWMP for two sites (i.e. W1 and W6) situated within the Hunter River near Sites HR2 and HR3 (MACH Energy, 2018). The trigger levels were developed using the approach recommended by ANZECC & ARMCANZ (2000).

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Aquatic Macroinvertebrates

AUSRIVAS

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 include:

- Observed to Expected ratio (OE50): the ratio of the number of macroinvertebrate families collected at a site which had a predicted probability of occurrence of greater than 50 % (i.e. Observed) to the sum of the probabilities of all of the families predicted with greater than a 50 % chance of occurrence (i.e. Expected) (Ransom et al., 2004)
- BAND: for each model, the OE50 taxa ratios are divided into bands representing different levels of impairment. Band X represents a more diverse assemblage of macroinvertebrates than control sites; Band A is considered equivalent to reference condition; Band B represents sites below reference condition (i.e. significantly impaired); Band C represents sites well below reference condition (i.e. severely impaired); and Band D represents impoverished sites (i.e. extremely impaired) (Ransom et al., 2004).

SIGNAL 2

The SIGNAL2 biotic index (Stream Invertebrate Grade Number Average Level) developed by Chessman (2003) is commonly 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 SIGNAL2 scores from samples collected between spring 2017 and spring 2024 are presented graphically to provide an indication of changes over time.

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Statistical Methods

The objective of this assessment was to examine whether any significant changes to selected aquatic macroinvertebrate indicators of stream health may have occurred following commencement of mining at the MPO.

The analytical design took into consideration:

- Survey: A random factor with 16 levels (spring 2017 to autumn 2025 surveys);
- Treatment: a fixed factor with 2 levels: Control and Impact;
- Reach: a random factor with 2 levels nested within Treatment (Midstream (Site HR3 & HR4) and Downstream (Sites HR5 & HR6) reaches are nested within the level 'Impact', while Upstream (Site HR1& HR2) and Tributary (Site MC, SC and DB) reaches are nested in the level 'Control', of the factor Treatment.

A factor representing variation associated with different phases of the MPO (i.e. Baseline- and During-mining) was not included in the design as only one survey could be undertaken prior to the commencement of mining, hence there was no replication for the Baseline-phase. The statistically significant interaction of Survey x Treatment (i.e. Impact and Control) and/or Survey x Reach(Treatment) could potentially provide evidence that a change in stream health had occurred due to mining.

Multivariate Analyses

A matrix of differences in the types of taxa between all possible pairs of samples was created by calculating their respective Bray-Curtis dissimilarity coefficients. Permutational Multivariate Analyses of Variance (PERMANOVA, Anderson 2001; Anderson et al, 2008) was used to examine spatial differences and temporal changes, and their interaction, in aquatic macroinvertebrate presence/absence data collected using AUSRIVAS. Any statistically significant differences (i.e. $P < 0.05$) in the levels of factors and interaction terms were examined by *Post-hoc* permutational t-tests. Significant differences between groups (e.g. impact versus control) may arise due to differences between group means, differences in dispersion (variance) among groups or a combination of both. Each of these outcomes could be indicative of an impact.

Apparent multivariate patterns in the data were examined by Principal Coordinates Analyses (PCoA), which provide a graphical representation of relationships between samples from two-dimensional ordination plots. The amount of variation "explained" by the *x*- and *y*-axis is indicated and the dissimilarity between data points can be determined from their distances apart on the axis (Anderson et al., 2008).

Similarity of percentages (SIMPER) was then used to determine those taxa primarily responsible for the observed similarities (or dissimilarities) between groups (e.g. Location) of interest (Clarke and Warwick, 1994).

Univariate Analyses

Using the same analytical design as for multivariate analyses, PERMANOVA was used to examine spatial and temporal patterns in the total number of taxa, OE50 and Signal scores. The analyses were based on a Euclidean distance matrix of all possible pairs of samples.

2.7 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 and stygofauna samples were identified by Dr Sharon Cummins. Data for each sample were entered into an excel spreadsheet and then checked.

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3.0 RESULTS

3.1 Aquatic Habitat Characteristics

Since 2013, annual rainfall recorded at Muswellbrook (Station 61192), ranged from 434.2 mm (2023) to 1117.8 mm (2022) (Figure 3). Within the two months prior to the 2025 autumn survey (13 & 14 May 2025), a total of 198.4 mm of rain was recorded by a meteorological station situated approximately 25 km from Muswellbrook (i.e. Station 61095). A total of x mm of rain was recorded by the meteorological station situated on the MPO site (Station ID: A-PF4) in the week prior to the 2025 autumn survey (i.e. 5 to 12 May 2025).

Within the two months prior the 2025 autumn survey, mean water levels measured in the Hunter River at Muswellbrook Bridge (Station 210002) ranged from approximately 0.46 m to 0.71 m (BOM, 2025a). At the time of the 2025 autumn survey, water level ranged from 1.109 m (13 May 2025) to 1.126 m (14 May 2025) (BOM, 2025a).

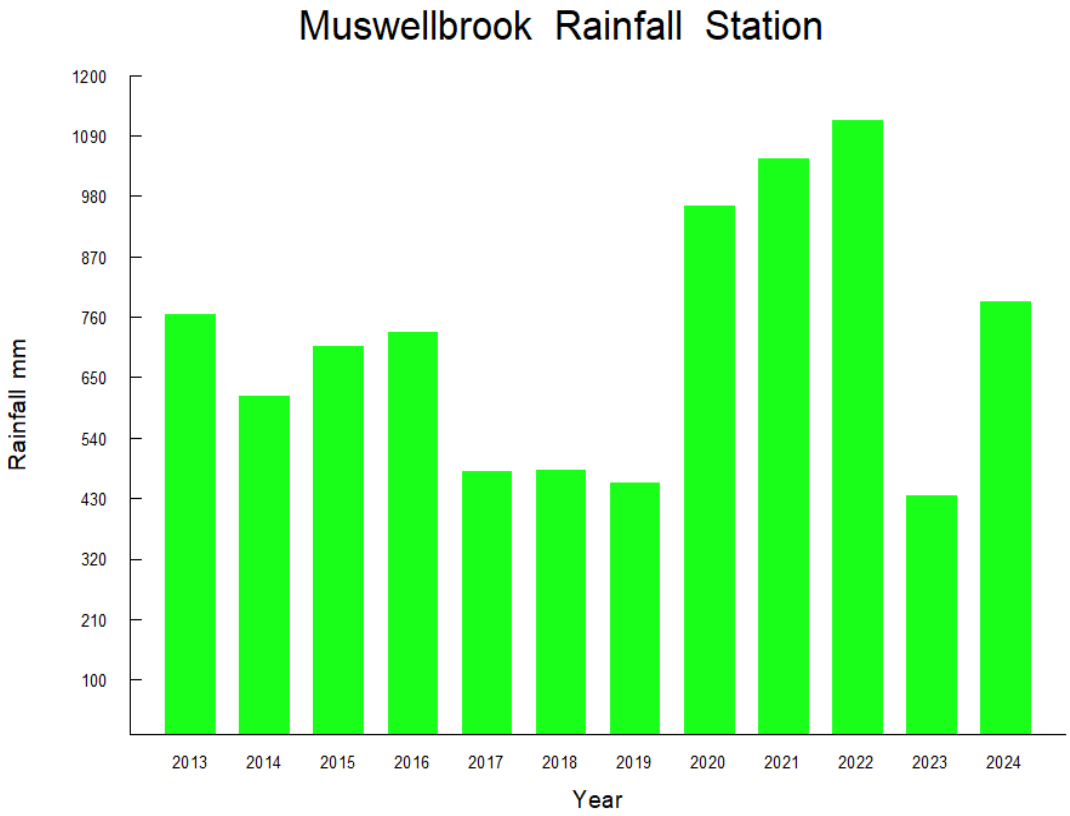

Figure 3. Annual rainfall (mm) measured at Muswellbrook from 1 January 2013 to 31 December 2024. NB Rainfall data for 2013-2017 and 2020-2023 were collected at Station 61192 (Muswellbrook – Spring Creek (Castle Vale), data for 2018 and 2019 was collected at Station 61095 Rouchel Brook (Albano).

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 28 m wide and greater than 1 meter deep (Plates 1-12). The channel substratum is composed primarily of silts and fine sands (as are the banks of the main channel) overlying a mostly gravel bed.

Vegetation of the riparian zone is dense, comprising mixed native and exotic trees and shrubs including River Oak (*Casuarina cunninghamiana*) and River Red Gum (*Eucalyptus camaldulensis*), Morning Glory (*Ipomoea indica*), Privet (*Ligustrum* species), Trad (*Tradescantia albiflora*), Bamboo (*Bambusa* sp.), Balloon Vine (*Cardiospermum grandiflorum*) and Willow (*Salix* spp.) are common. Emergent macrophyte assemblages were characterised by Typha spp., Umbrella Sedge (*Cyperus eragrostis*), Common Reed/ Phragmites (*Phragmites australis*), Mat Rush (*Lomandra longifolia*), Common Rush (*Juncus usitatus*) and Marsh Club-rush (*Bolboschoenus fluviatilis*). The submerged species of macrophyte, Clasped Pondweed (*Potamogeton perfoliatus*) and *Myriophyllum* sp., have commonly been noted at several of the sites sampled. The species identified 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 NSW (2013) classification.

Hunter River upstream of the MPO (HR1 & HR2)

The most upstream site (HR1) is situated within farming land, approximately 200 m upstream of the confluence with Dart Brook (Figure 1, Plate 1). Vegetation of the riparian zone is relatively dense, mostly comprised by River Oak and Willow trees interspersed by Balloon Vine, Giant Reed (*Arundo donax*), Bamboo and Trad in areas that had not been scoured from the bank by recent high flows. At the time of the autumn 2025 survey, the river was flowing relatively fast. Water clarity at HR1 was good. The RCE score was 42 (80%) in autumn 2025 (range = 38/73% to 43/83% between spring 2017 and spring 2024).

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Plate 1: Hunter River – Site HR1 (au-25)
View upstream



Plate 2: Hunter River – Site HR1 (au-25)
View downstream

Site HR2, a large pool up to approximately 25 m wide and 1.6 m deep (Plate 3&4), is situated approximately 900 m downstream of the confluence of the Hunter River with Dart Brook (Figure 1). The substratum in the edge habitat has consistently been predominantly cobble, gravel and pebble overlayed with a sandy-silt matrix. The steep right bank has gradually been revegetated by mostly grasses and small shrubs since sampling commenced in spring 2017 (Plate 3&4). River Oak and Willow trees were present. Riparian vegetation mostly consisted of Giant Reed, Balloon Vine, Trad and Bamboo with occasional native species, including *Persicaria decipiens*, *Typha* spp. and *Schoenoplectus validus*. At the time of the autumn 2025 water clarity was good and flow moderate-high. This site was given an RCE score of 38 (73%) in autumn 2025 (range = 37/71% to 45/87% between spring 2017 and spring 2024).



Plate 3: Hunter River – Site HR2 (au-25)
View upstream



Plate 4: Hunter River – Site HR2 (au-25)
View downstream

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Hunter River adjacent to the MPO (HR3 & HR4)

Site HR3 is situated approximately 6.8 km downstream of Site HR2 (Figure 1). Similar to the upstream sites, riparian vegetation was mostly comprised by River Oaks, Willows and scattered Eucalypts. A considerable proportion of the exotic plant understorey had been scoured by floodwaters during late 2021 (Plates 5&6). Small sections of the right bank (facing downstream) had slumped, causing small trees and shrubs to fall into the river (Plates 5&6). At the time of the autumn 2025 survey, a large proportion of understorey vegetation (predominantly exotic grass) observed on the right bank by the spring 2024 survey was absent (Plates 5 & 6).

The river channel at Site HR3 is up to approximately 14 m wide and 1.1 m deep. Substratum in the edge habitat was predominantly composed of gravel (approximately 70 %) with a mixture of sand and silt. Large woody debris was abundant within the channel and the left bank (facing downstream) (Plates 5 & 6). *Persicaria decipiens* and *Schoenoplectus validus* were less common than observed by previous surveys. Water clarity was good and flow moderate to high. This site was given an RCE score of 41 (78%) in autumn 2025 (range = 37/71% to 42/81% between spring 2017 and spring 2024).



Plate 5: Hunter River – Site HR3 (au-25)
View downstream



Plate 6: Hunter River – Site HR3 (au-25)
View across stream

Site HR4 is situated near the Water Treatment Plant at Muswellbrook and the inlet to the approved water pipeline between the Hunter River and the MPO Mine Water Dam. The study reach consists of long pools up to 10.5 m wide with infrequent short riffles.

The riverbanks are stabilised by trees (mostly Willow and River Oak) and shrubs (including Balloon Vine and Bamboo). During the autumn 2025 survey, two large willow trees were observed to have fallen into the river, likely as a result of recent high river flows (see Plates 7 & 8). Large woody debris has always been common alongside the stream banks.

The substratum in the edge habitat is predominantly gravel and cobble with boulders, pebble and silty sand. The submerged macrophytes, Clasped Pondweed (*Potamogeton perfoliatus*) and *Myriophyllum* sp., have commonly been observed at this site. At the time of the current survey, water clarity was good and water level high. This site obtained an RCE score of 42 (80%) at the time of the autumn 2025 survey (range = 39/75% to 43/83% between spring 2017 and spring 2024).



Plate 7: Hunter River – Site HR4 (au-25)
View upstream



Plate 8: Hunter River – Site HR4 (au-25)
View downstream

Hunter River downstream of the MPO (HR5 and HR6)

Site HR5 is situated immediately downstream of the proposed discharge point from the MPO and the discharge point from Bengalla Coal Mine (Figure 2). This site consists of a long, relatively deep pool with a small area of riffle habitat at the top of the site (Plates 9&10). River Oaks, Willows and scattered Eucalypts are present along the stream bank.

Fallen trees, particularly Willows and large accumulations of woody debris were common along the river channel and banks. Balloon Vine is once again common along either bank, as well as Giant Reed, Typha and *Persicaria decipiens*. The substratum in the edge habitat is predominantly a gravel-pebble matrix with a silt overlay.

Submerged macrophytes have not been recorded at this site. At the time of this survey and surveys done since autumn and 2023, carp were seen feeding near the stream bank. Water clarity was good and flow moderate (Plates 9&10). This site was given an RCE score of 41 (79%) in autumn 2025 (range = 36/69% to 44/85% between the spring 2017 and spring 2024 surveys).



Plate 9: Hunter River – Site HR5 (au-25)
View upstream



Plate 10: Hunter River – Site HR5 (au-25)
View downstream

Site HR6 is situated approximately 4 km downstream of the proposed discharge point from the MPO and the discharge point from Bengalla Coal Mine (Figure 2). The width of the riparian strip is relatively narrow (i.e. between 5 and 30 m) and comprised by mixed native and exotic trees and shrubs (Plates 11&12). This site consists of a long, relatively deep pool with a short section of riffle habitat at the top of the study reach (Plates 11&12). The substratum in the edge habitat is predominantly a gravel matrix overlayed with silt. Fallen trees and other woody debris are common within the river channel.

At the time of the current survey, flow and water level were elevated while water clarity was good (Plates 11&12). Balloon Vine is once again common along either bank, as well as Giant Reed, Typha and *Persicaria decipiens.* There were signs of recent collapse of a section of the stream bank and Willows into the river channel. This site was given an RCE score of 42 (80%) in autumn 2025 (range = 38/73% to 42/81% between the spring 2017 and spring 2024 surveys).



Plate 11: Hunter River – Site HR6 (au-25)
View upstream



Plate 12: Hunter River – Site HR6 (au-25)
View downstream

3.1.2 Hunter River Tributaries

Due to the highly ephemeral nature of drainage lines within the MPO's ML boundaries, stream health monitoring locations were chosen in tributaries with more reliable flows to the Hunter River, consequently outside of the MPO boundary.

Muscle Creek

The site sampled on Muscle Creek is situated on the floodplain approximately 1 km upstream of the confluence with the Hunter River (Figure 2). It consists of a highly modified urbanised environment that has been greatly disturbed as a result of the existing rail line and associated rail infrastructure, previous fuel depot, roadways and the township of Muswellbrook. Since the spring 2020 survey, planned works by the Australian Rail Track Corporation Limited to replace the Muscle Creek underbridge, located near the confluence of the Hunter River, have been observed.

The stream channel is highly modified, particularly in the downstream reaches of the study site, with large boulders used in places to stabilise the stream bank (Plates 13&14). Trees have been planted along both sides of the creek to help stabilise the banks. For the past 2-3 years, a colony of bats has commonly been observed roosting in trees at the survey site. At the time of the current survey, a large number of bats were present and bat guano (poo) deposits were common on riparian vegetation and habitat (Plates 13&14).

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Emergent macrophytes, including Typha, Phragmites, and Mat Rush, were moderately abundant along the stream bank and in-stream (Plates 13&14). *Lomandra longifolia* and *Persicaria decipiens* were also common, as was Balloon Vine, Trad and exotic grasses.

The average stream width is approximately 10 m with a depth of up to approximately 1.5 m. The substratum is mostly comprised by a gravel/cobble/pebble matrix covered by silt and fine sand. At the time of the autumn 2025 survey, there was flow along the study reach. Water clarity was poor at the time of sampling.

The site is classified as Class 1, Type 1 fish habitat according to the DPI (2013) classification. The site received an RCE score of 29 (55%) in autumn 2025. The RCE score has ranged between 21 (40%) and 34 (65%) between the spring 2017 and spring 2024 surveys.



Plate 13: Muscle Creek – Site MC (au-25)
View upstream



Plate 14: Muscle Creek– Site MC (au-25)
View across stream

Sandy Creek

The site sampled on Sandy Creek is located downstream of the MPO and upstream of the Mangoola Coal Operations (Figure 2). Wybong Road bridge crosses the stream at the bottom of the study reach. The stream banks at the survey site are approximately 3 m high and heavily disturbed on either side by historical agricultural activities. Wombat burrows were also present. The stream channel commonly ranges from about 1 m to greater than 7 m wide, with an average of around 5 m (Plates 15&16).

Unlike the findings from surveys done between spring 2017 and spring 2022, the channel connecting pools along the study reach was inundated and flow was apparent (Plates 15&16). The substratum is dominated by poorly sorted gravel overlain by fine-grained sediments and clay with occasional cobbles.

In the large pool at the top of the site, accumulations of green filamentous algae commonly observed up to the spring 2022 have been less common, most likely due to flows along the reach having been re-established. At the time of the current survey, green filamentous algae and Chara/Nitella spp. were present in the pool. The pool substratum was covered by a thin layer of fine silt.

The site is classified as Class 1, Type 1 fish habitat according to the DPI (2013) classification and scored an RCE value of 37 (71%) in autumn 2025. Previously (i.e., since the spring 2017 survey), the RCE score ranged between 21/40% and 35/67%. The higher score is mostly due to inundation and recovery of flow along the stream channel and increased vegetation along the stream bank after drought and stream bank erosion.



Plate 15: Sandy Creek – Site SC (sp-24)
View upstream



Plate 16: Sandy Creek– Site SC (sp-24)
View upstream

Dart Brook

Sampling site Dart Brook was chosen near a road crossing approximately 700 m upstream from the confluence with the Hunter River. The surrounding land use was mostly agriculture. This site consists of pools up to 6.4 m wide and 1.2 m deep and a run at the downstream end (Plates 17&18). The bed is dominated by poorly sorted gravel overlain by sand and silt with occasional boulders.

The stream banks are composed of cohesive fine-grained sediments with gravel. Small areas of active erosion are apparent along the top of the steep (approximately 8 m) right bank and along sections of the channel. Emergent macrophytes included Typha, River Club-Rush (*Schoenoplectus validus)* and Umbrella sedge (*Cyperus eragrostis*).

At the time of the autumn 2025 survey, flow and water level were elevated while water clarity was fair (Plate 17&18). Fallen trees, woody debris and exotic weeds were common along the stream bank. Balloon vine appeared to have increased its distribution along both sides of the stream bank.

The site is classified as Class 1, Type 1 fish habitat according to the DPI NSW (2013) classification. It received an RCE score of 37 (71%) in autumn 2025. Previously, the RCE scores have ranged between 32 (62%) and 41 (79%) (between the spring 2017 and spring 2024 surveys).



Plate 17: Dart Brook – Site DB (au-25)
View downstream



Plate 18: Dart Brook – Site DB (au-25)
View upstream

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3.2 Water Quality

Mean physico-chemical water quality measurements from spring 2017 to autumn 2025 are summarised in Table 3. Values highlighted in bold type indicate where results were outside the appropriate default trigger values (DTVs) recommended by ANZECC/ARMCANZ (2000). Where appropriate, pH and conductivity data were also compared with site specific trigger criteria[2].

The main findings for the autumn 2025 survey are summarised as follows:

- Mean water temperature ranged from 16.0 (Site SC) to 19.3 °C (Site HR3). Water temperatures have ranged from 12.5 to 25.4 °C in edge habitats throughout the survey period
- pH levels (range = 7.2 – 8.2) exceeded the upper DTVs recommended by the ANZECC/ARMCANZ (2000) guidelines at Site SC;
- Mean conductivity levels (range = 378 to 6,054 µS/cm) exceeded the upper DTV at HR1, HR2, DB, MC and SC. Notably:
    - Conductivity measured at Site HR1 (range = 256 to 843 µS/cm) and Site HR2 (range = 267 to 800 µS/cm) during autumn 2025 did not exceed the site-specific criteria established for those site's (i.e., 589 µS/cm[2])[2]
    - Conductivity measured at Site DB in autumn 2025 (i.e., 1,350 µS/cm) was within the range collected by surveys done at that site since spring 2017 (range = 980 to 5,905 µS/cm), as was conductivity measured at Site SC (6,054 µS/cm) (i.e. range = 914 to 11,200 µS/cm)
    - Conductivity measured at Site MC exceeded the upper guideline value in autumn 2025 (i.e., 2,957 µS/cm), spring 2023 (2,673 µS/cm) and autumn 2023 (2,799).
- Dissolved oxygen levels (range = 65 to 119 % saturation) were below the lower DTVs at the Site MC and DB but elevated at HR5 and HR6.
- Turbidity levels (range = 7.4 to 16.1 NTU) were within the recommended DTVs at all sites at the time of the autumn 2025 survey (Table 3)

The raw water quality data are provided in Appendix 3.

[2] Using the approach recommended by ANZECC & ARMCANZ (2000), surface water quality trigger levels were developed at two sites (W1: situated between Site HR1 and HR2; and W6: situated at HR3) situated within the Hunter River (MACH Energy, 2018). Sites W1 and W6 are sampled monthly and during rain events by AECOM. The 80th percentile trigger values for pH and conductivity (EC) are: Site W1: pH = 7.8 – 8.3, EC = 589 µS/cm; Site W6: pH = 7.8-8.4, EC = 496 µS/cm.

Table 4. Mean (+ SE) values of water quality variables recorded between spring 2017 and autumn 2025.

Variable	DTV[3]	Sp-17	Aut-18	Sp-18	Aut-19	Sp-19[#]	Aut-20	Sp-20	Aut-21	Sp-21	Aut-22
Site HR1											
Temperature °C		22.4 (0.0)	17.1 (0.0)	20.2 (0.0)	15.5 (0.0)	19.6	13.3 (0.0)	N/R	17.3 (0.0)	19.2 (0.0)	17.0 (0.0)
pH	6.5 – 8.0	**8.3** (0.0)	**8.6** (0.0)	**8.1** (0.0)	**8.1** (0.0)	**8.29**	**8.6** (0.0)	**8.7** (0.0)	8.0 (0.0)	7.0 (0.0)	8.3 (0.0)
EC (µS/cm)	30 – 350	264 (0.0)	256 (0.0)	276 (0.3)	321 (0.0)	**356**	**445** (0.3)	**528** (0.0)	**528** (0.0)	**622.0** (0.0)	**720** (0.9)
DO (% Sat)	90–110	95.5 (0.4)	93.7 (0.0)	95.4 (0.1)	**87.6** (0.1)	108.2	**75.1** (0.2)	97.8 (0.0)	92.6 (0.2)	**75.8** (0.2)	94.6 (0.0)
Turbidity (NTU)	< 50	16.4 (1.4)	**44.6** (0.4)	13.8 (0.3)	**42.6** (0.9)	2.9	**98.6** (3.2)	14.9 (1.0)	**38.9** (0.5)	9.7 (0.3)	8.8 (0.3)
Site HR2											
Temperature °C		22.9 (0.0)	16.2 (0.0)	19.3 (0.0)	15.7 (0.0)	22.1	13.4 (0.1)	N/R	17.4 (0.0)	19.5 (0.0)	17.0 (0.0)
pH	6.5 – 8.0	**8.2** (0.0)	**8.5** (0.0)	**8.2** (0.1)	7.9 (0.0)	**8.3**	**8.3** (0.1)	**8.5** (0.0)	7.9 (0.0)	7.1 (0.0)	**8.3** (0.0)
EC (µS/cm)	30 – 350	267 (1.3)	311 (0.0)	276 (0.0)	323 (2.2)	**387**	**474** (7.0)	**534** (0.0)	**629** (0.0)	**658.0** (0.0)	**800** (0.0)
DO (% Sat)	90–110	**141.2** (3.6)	**85.8** (0.1)	92.5 (0.2)	**89.3** (0.5)	97.8	**59.5** (0.5)	**81.2** (0.3)	**89.4** (0.1)	**72.9** (0.2)	92.1 (0.0)
Turbidity (NTU)	< 50	**26.7** (1.2)	**43.2** (0.2)	12.8 (0.2)	**43.8** (0.7)	2.6	**118.7** (1.2)	**59.7** (0.2)	10.6 (0.4)	14.7 (1.3)	14.7 (0.5)
Site HR3											
Temperature °C		24.7 (0.0)	16.1 (0.0)	18.7 (0.0)	14.5 (0.0)	21.7	13.7 (0.0)	N/R	16.8 (0.0)	21.8 (0.0)	16.9 (0.0)
pH	6.5 – 8.5	8.2 (0.0)	**8.6** (0.0)	7.9 (0.0)	7.7 (0.0)	8.27	**8.7** (0.0)	**8.8** (0.0)	8.0 (0.0)	7.5 (0.0)	8.3 (0.0)
EC (µS/cm)	125–2,200	272 (1.3)	266 (0.0)	313 (0.0)	329 (0.0)	357	419 (0.0)	540 (0.0)	640 (0.3)	633.0 (0.0)	815 (0.3)
DO (% Sat)	85 – 110	101.7 (0.5)	85.7 (0.1)	**80.9** (0.1)	**72.3** (0.1)	**115.1**	**81.8** (0.1)	91.2 (0.2)	**81.0** (0.1)	93.4 (0.1)	91.6 (0.1)
Turbidity (NTU)	< 50	46.4 (0.3)	49.4 (0.2)	6.9 (0.2)	18.9 (0.8)	3.3	45.0 (0.0)	26.2 (2.1)	23.4 (1.0)	19.4 (1.0)	14.7 (0.3)

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.

NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia for HR1 and HR2 and in lowland rivers (i.e. < 150 m altitude) for HR3.

[3] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers will be used for these sites here and for subsequent surveys.

Table 4. (Cont'd).

Variable	DTV[4]	Sp-22	Aut-23	Sp-23	Aut-24	Sp-24	Aut-25				
Site HR1											
Temperature °C		13.8 (0.0)	17.8 (0.0)	22.2 (0.0)	17.9 (0.0)	17.1 (0.0)	19.0 (0.0)				
pH	6.5 – 8.0	**8.1** (0.0)	**8.2** (0.0)	**8.3** (0.0)	7.9 (0.0)	8.0 (0.0)	7.3 (0.0)				
EC (µS/cm)	30 – 350	**382** (2.0)	**843.0** (0.0)	307 (0.0)	**418.0** (0.0)	**630** (0.3)	**378** (0.0)				
DO (% Sat)	90–110	97.7 (0.2)	109.9 (0.0)	**21.6** (0.1)	104.2 (0.2)	**81.2** (0.7)	93.4 (0.1)				
Turbidity (NTU)	< 50	2.5 (0.1)	1.8 (0.0)	5.5 (0.5)	5.7 (0.0)	10.7 (0.2)	8.3 (0.0)				
Site HR2											
Temperature °C		14.1 (0.0)	17.5 (0.0)	22.0 (0.0)	17.7 (0.0)	17.1 (0.0)	19.2 (0.0)				
pH	6.5 – 8.0	**8.1** (0.0)	**8.1** (0.0)	**8.3** (0.0)	7.9 (0.0)	8.0 (0.0)	7.3 (0.0)				
EC (µS/cm)	30 – 350	**409** (2.0)	**997.0** (0.0)	**485** (0.3)	**436.3** (0.3)	**714.3** (0.3)	**403** (0.3)				
DO (% Sat)	90–110	92.3 (0.2)	108.6 (0.1)	**20.2** (0.3)	90.9 (0.1)	**81.3** (0.5)	99.5 (1.5)				
Turbidity (NTU)	< 50	2.8 (0.4)	1.4 (0.0)	6.0 (0.2)	10.4 (0.7)	12.5 (0.2)	8.3 (0.2)				
Site HR3											
Temperature °C		15.9 (0.0)	18.6 (0.0)	22.1 (0.0)	18.9 (0.0)	17.1 (0.0)	19.3 (0.0)				
pH	6.5 – 8.5	7.9 (0.0)	8.2 (0.0)	8.2 (0.0)	7.8 (0.0)	7.9 (0.0)	7.5 (0.0)				
EC (µS/cm)	125–2,200	490 (3.2)	1018 (0.0)	515 (1.0)	436.7 (0.3)	734.7 (0.3)	406 (0.3)				
DO (% Sat)	85 – 110	104.8 (1.1)	113.8 (0.2)	**19.6** (0.4)	108.3 (0.1)	**76.6** (0.2)	103 (1.5)				
Turbidity (NTU)	< 50	**5.2** (0.0)	3.0 (0.1)	13.1 (0.2)	10.2 (0.2)	16.7 (0.3)	9.2 (0.2)				

NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia for HR1 and HR2 and in lowland rivers (i.e. < 150 m altitude) for HR3.

[4] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

Table 4. (Cont'd).

Variable	DTV[5]	Sp-17	Aut-18	Sp-18	Aut-19	Sp-19[#]	Aut-20	Sp-20	Aut-21	Sp-21	Aut-22
Site HR4											
Temperature °C		24.6 (0.0)	16.6 (0.0)	21.5 (0.0)	15.2 (0.0)	22.2	13.9 (0.0)	N/R	17.0 (0.0)	22.2 (0.0)	16.7 (0.0)
pH	6.5 – 8.5	7.9 (0.0)	8.4 (0.0)	8.0 (0.0)	7.7 (0.0)	8.24	8.3 (0.0)	8.5 (0.0)	7.9 (0.0)	7.2 (0.0)	8.2 (0.0)
EC (µS/cm)	125–2,200	296 (1.3)	274 (20.0)	290 (0.0)	368 (1.7)	361	467.0 (0.0)	1,610 (0.0)	623 (0.3)	669.0 (0.0)	861 (0.0)
DO (% Sat)	85 – 110	93.2 (0.6)	100.0 (0.2)	101.0 (0.1)	**79.3** (0.1)	**120.8**	**61.6** (0.0)	**58.2** (0.1)	**83.4** (0.2)	85.1 (0.0)	88.3 (0.0)
Turbidity (NTU)	< 50	26.5 (0.9)	**55.7** (0.1)	28.5 (0.4)	**51.7** (0.7)	6.7	46.0 (0.3)	28.2 (0.2)	12.0 (1.4)	17.7 (0.1)	18.2 (0.1)
Site HR5											
Temperature °C		25.4 (0.0)	15.5 (0.0)	22.3 (0.1)	15.3 (0.0)	22.3	14.8 (0.0)	N/R	17.1 (0.0)	21.3 (0.1)	16.6 (0.0)
pH	6.5 – 8.5	7.9 (0.0)	8.5 (0.0)	7.7 (0.0)	7.8 (0.0)	8.08	8.4 (0.0)	**8.7** (0.0)	7.9 (0.0)	6.6 (0.0)	8.2 (0.0)
EC (µS/cm)	125–2,200	318 (1.3)	338 (2.0)	322 (0.9)	424 (0.0)	365	407.3 (0.7)	657 (18.0)	669 (0.0)	698.7 (0.3)	908 (0.3)
DO (% Sat)	85 – 110	**66.5** (0.8)	90.3 (0.6)	89.5 (0.2)	**79.7** (0.7)	107.9	**56.2** (0.1)	**61.7** (0.2)	**77.5** (0.1)	**67.5** (1.1)	86.6 (0.0)
Turbidity (NTU)	< 50	30.5 (0.5)	**57.2** (0.2)	35.3 (0.1)	45.2 (1.4)	6.8	**68.8** (1.4)	44.6 (0.7)	12.1 (0.3)	26.8 (1.7)	16.9 (0.4)
Site HR6											
Temperature °C		25.9 (0.0)	17.0 (0.1)	22.5 (0.0)	15.9 (0.0)	22.2	14.9 (0.0)	N/R	16.9 (0.0)	21.5 (0.0)	16.4 (0.0)
pH	6.5 – 8.5	8.1 (0.0)	8.4 (0.0)	7.8 (0.0)	7.9 (0.0)	8.07	8.5 (0.0)	**8.9** (0.0)	7.9 (0.0)	7.2 (0.1)	8.3 (0.0)
EC (µS/cm)	125–2,200	329 (0.0)	331 (1.2)	321 (0.3)	448 (0.0)	364	387.3 (0.3)	636.0 (0.6)	739 (0.3)	715.0 (0.0)	914 (0.3)
DO (% Sat)	85 – 110	**74.7** (0.0)	**83.8** (0.6)	100.8 (0.3)	91.7 (1.5)	107	**72.2** (0.0)	**57.1** (1.0)	**73.0** (0.2)	**78.6** (0.1)	88.9 (0.0)
Turbidity (NTU)	< 50	35.3 (0.8)	**59.1** (0.6)	34.3 (0.2)	35.8 (0.5)	12.7	41.6 (0.3)	23.4 (1.2)	6.5 (0.3)	22.2 (0.2)	17.8 (0.4)

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.

NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in lowland rivers (i.e. systems at < 150 m altitude) in southeast Australia.

[5] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

Table 4. (Cont'd).

Variable	DTV[6]	Sp-22	Aut-23	Sp-23	Aut-24	Sp-24	Aut-25				
Site HR4											
Temperature °C		15.7 (0.0)	17.2 (0.0)	22.2 (0.0)	18.4 (0.0)	17.0 (0.0)	19.2 (0.0)				
pH	6.5 – 8.5	8.0 (0.0)	8.0 (0.0)	8.0 (0.0)	7.7 (0.0)	7.8 (0.0)	7.9 (0.0)				
EC (µS/cm)	125–2,200	393 (0.0)	1111 (0.0)	604 (9.8)	460.3 (0.3)	770.7 (0.3)	414.0 (0.0)				
DO (% Sat)	85 – 110	95.0 (0.1)	106.0 (0.0)	**18.7** (0.6)	97.5 (0.1)	**76.7** (0.2)	106.0 (0.7)				
Turbidity (NTU)	< 50	7.9 (0.2)	2.6 (0.0)	10.3 (0.3)	12.2 (0.3)	22.9 (1.3)	7.4 (0.2)				
Site HR5											
Temperature °C		15.7 (0.0)	16.8 (0.0)	21.3 (0.0)	17.9 (0.0)	17.5 (0.0)	18.5 (0.1)				
pH	6.5 – 8.5	7.9 (0.0)	8.1 (0.0)	8.2 (0.0)	7.7 (0.0)	7.9 (0.0)	8.1* (0.0)				
EC (µS/cm)	125–2,200	455 (7.0)	1272 (0.3)	680 (0.3)	492.3 (0.7)	869.0 (0.0)	419.0 (0.0)				
DO (% Sat)	85 – 110	N/R	99.4 (0.0)	**15.4** (0.4)	88.9 (0.0)	**74.7** (0.3)	**118.7** (0.4)				
Turbidity (NTU)	< 50	6.9 (0.2)	5.7 (0.1)	19.9 (0.7)	22.7 (0.1)	26.8 (0.6)	10.1 (0.4)				
Site HR6											
Temperature °C		15.6 (0.0)	17.0 (0.0)	21.3 (0.1)	17.7 (0.0)	17.2 (0.0)	18.8 (0.0)				
pH	6.5 – 8.5	7.9 (0.0)	8.1 (0.0)	8.1 (0.0)	7.8 (0.0)	7.7 (0.0)	8.2* (0.0)				
EC (µS/cm)	125–2,200	423 (0.0)	1299 (1.2)	730 (0.3)	493.7 (0.3)	917.7 (0.3)	422.7 (0.3)				
DO (% Sat)	85 – 110	N/R	96.5 (0.1)	**16.7** (0.1)	90.2 (0.1)	**66.2** (0.1)	95.4 (0.0)				
Turbidity (NTU)	< 50	6.2 (0.1)	3.3 (0.1)	20.3 (0.2)	18.8 (0.6)	32.0 (0.5)	10.7 (0.4)				

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.

- pH measurements appear to be out by 1 pH unit

N/R = Not Recorded

[6] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

Table 4. (Cont'd).

Variable	DTV[7].	Sp-17	Aut-18	Sp-18	Aut-19	Sp-19[#]	Aut-20	Sp-20	Aut-21	Sp-21	Aut-21
DB											
Temperature °C		25.1 (0.0)	12.6 (0.0)	22.1 (0.1)	13.5 (0.0)	20.3	12.5 (0.0)	N/R	16.2 (0.0)	20.8 (0.0)	17.1 (0.0)
pH	6.5 – 8.0	**8.1** (0.0)	**8.8** (0.0)	**8.2** (0.0)	8.0 (0.0)	**8.24**	**8.4** (0.0)	**8.4** (0.0)	8.0 (0.0)	7.1 (0.0)	**8.1** (0.0)
EC (µS/cm)	30 – 350	**4,257** (1.3)	**5,905** (5.0)	**4,400** (0.0)	**3,648** (0.6)	**5,210**	**1,230** (0.6)	**980** (0.0)	**1014** (0.3)	**914.0** (0.0)	**1013 (0.0)**
DO (% Sat)	90–110	**64.2** (0.8)	**60.5** (0.3)	**88.7** (0.4)	**54.9** (0.2)	**63.9**	**73.9** (0.2)	**56.6** (0.2)	**72.6** (0.0)	**73.2** (0.0)	**88.0 (0.0)**
Turbidity (NTU)	< 25	24.2 (0.5)	**52.4** (0.7)	**26.5** (0.7)	**53.2** (0.4)	**31**	**31.4** (0.8)	19.9 (0.2)	**40.0** (0.1)	32.8 (0.1)	23.6 (0.4)
MC											
Temperature °C		23.3 (0.0)	15.1 (0.0)	23.9 (0.0)	15.0 (0.0)	24.5	14.1 (0.0)	N/R	16.4 (0.0)	21.9 (0.0)	16.1 (0.0)
pH	6.5 – 8.5	7.7 (0.2)	**8.3** (0.0)	7.7 (0.0)	7.5 (0.0)	7.79	8.0 (0.0)	8.4 (0.0)	7.6 (0.0)	6.7 (0.0)	8.0 (0.0)
EC (µS/cm)	125–2,200	1589 (2.6)	1406 (15)	1232 (1.0)	1517 (0.3)	1327	1599 (0.0)	1163 (0.0)	1872 (0.3)	1592 (2.9)	2113 (0.3)
DO (% Sat)	85 – 110	86.6 (0.1)	**83.9** (0.1)	107.3 (0.2)	**52.5** (0.2)	**113.9**	**40.3** (0.0)	**41.3** (0.1)	**64.6** (0.2)	**57.0** (0.1)	**83.0** (0.0)
Turbidity (NTU)	< 50	26.9 (0.9)	**45.8** (0.1)	23.5 (0.7)	**42.2** (2.1)	2.7	35.9 (0.0)	**4.6** (0.0)	15.3 (0.3)	4.3 (0.1)	14.6 (0.2)
SC											
Temperature °C		21.1 (0.0)	14.1 (0.1)	17.3 (0.0)	12.9 (0.0)	22	12.8 (0.0)	N/R	13.9 (0.0)	18.3 (0.0)	15.7 (0.0)
pH	6.5 – 8.0	**8.5** (0.0)	**8.6** (0.0)	8.0 (0.0)	7.9 (0.0)	7.91	**8.8** (0.0)	**8.9** (0.0)	7.7 (0.0)	7.6 (0.0)	**8.4** (0.0)
EC (µS/cm)	30 – 350	**8,000** (0.0)	**8,027** (0.3)	**9,600** (0.0)	**7,064** (13)	**11,200**	**3,006** (0.6)	**6,068** (0.3)	**4,326** (0.3)	**914.0** (0.0)	**4299** (0.3)
DO (% Sat)	90–110	**43.7** (0.0)	**49.0** (5.3)	**10.9** (0.0)	**40.8** (1.4)	**39.1**	**73.4** (0.0)	**39.6** (0.0)	**39.6** (0.1)	94.4 (0.5)	**75.6** (0.0)
Turbidity (NTU)	< 25	10.1 (0.1)	**77.1** (5.2)	4.8 (0.2)	**28.0** (0.2)	2.1	18.8 (0.3)	8.0 (0.1)	1.1 (0.0)	16.8 (0.1)	3.5 0.0)

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.

NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia for DB and SC but for lowland rivers (i.e. < 150 m altitude) for MC.

[7] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

Table 4. (Cont'd).

Variable	DTV[8].	Sp-22	Aut-23	Sp-23	Aut-24	Sp-24	Aut-25				
DB											
Temperature °C		14.6 (0.0)	16.4 (0.7)	18.8 (0.1)	17.5 (0.0)	16.9 (0.0)	18.0 (0.0)				
pH	6.5 – 8.0	**8.2** (0.0)	7.9 (0.0)	**8.2** (0.0)	7.6 (0.0)	7.9 (0.0)	7.2 (0.0)				
EC (µS/cm)	30 – 350	**456** (0.0)	**2,029** (0.0)	**3110** (5.8)	**2,905 (**1.2)	**1,051** (0.0)	**1,350** (0.0)				
DO (% Sat)	90–110	89.8 (0.1)	**87.8** (0.0)	**23.6** (0.1)	**79.9** (0.3)	**70.6** (0.0)	**83.3** (1.1)				
Turbidity (NTU)	< 25	3.2 (0.0)	3.7 (0.1)	17.6 (0.5)	**29.1 (**0.3)	14.8 (0.5)	16.1 (0.3)				
MC											
Temperature °C		16.1 (0.0)	16.4 (0.0)	19.7 (0.0)	17.2 (0.0)	16.8 (0.0)	18.4 (0.0)				
pH	6.5 – 8.5	7.5 (0.0)	7.6 (0.0)	7.7 (0.0)	7.4 (0.0)	7.5 (0.0)	7.9 (0.0)				
EC (µS/cm)	125–2,200	710 (1.9)	**2,799** (0.0)	**2,673** (3.3)	2,000 (0.3)	2,000 (0.0)	**2,957** (0.7)				
DO (% Sat)	85 – 110	N/R (0.3)	**71.1** (0.0)	**13.5** (0.5)	**63.4** (0.0)	**57.1** (0.2)	**65.0** (0.8)				
Turbidity (NTU)	< 25	7.8 (0.1)	3.2 (0.0)	13.2 (0.2)	**25.0** (0.1)	21.3 (0.2)	9.2 (0.1)				
SC											
Temperature °C		14.6 (0.0)	15.0 (0.0)	17.4 (0.3)	14.9 (0.0)	16.9 (0.0)	16.0 (0.0)				
pH	6.5 – 8.0	7.7 (0.0)	7.9 (0.0)	8.0 (0.0)	7.8 (0.0)	7.9 (0.0)	**8.2** (0.0)				
EC (µS/cm)	30 – 350	**1,481** (1.7)	**4,934** (0.3)	**5,617** (15)	**5,888 (**1.0)	**1,051** (0.0)	**6,054** (1.5)				
DO (% Sat)	90–110	N/R (0.3)	**65.4** (0.2)	**54.9** (0.2)	**88.4 (0.1)**	**70.6** (0.0)	**128.6** (0.1)				
Turbidity (NTU)	< 25	9.6 (0.0)	1.3 (0.0)	7.6 (0.3)	15.1 (0.5)	14.8 (0.5)	3.5 (0.1)				

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.
N/R = Not Recorded. NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia for DB and SC but for lowland rivers (i.e. < 150 m altitude) for MC.

[8] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

3.3 Aquatic Macroinvertebrates

3.3.1 General Findings

A total of 23 taxon were identified from the edge habitat samples collected at the nine sites sampled in autumn 2025 (Appendix 4). The number of taxa ranged from 4 at Site MC and 10 at Site SC (Appendix 4). Chironominae (non-biting midges) were collected at each of the nine sites sampled, while Atyidae (Freshwater shrimp) were collected at eight sites (Appendix 4). The alien fish, Mosquito fish (*Gambusia holbrooki*), was also collected, at six of the survey sites, using the AUSRIVAS technique (Appendix 4).

The OE50 scores ranged between 0.22 (MC) and 0.54 (HR1) (Table 4). At the time of the autumn 2025 survey, three sites were grouped in Band B (i.e. HR1, HR2 and SC) and six were grouped within Band C (i.e. HR3-6, MC and DB) (Table 4). Thus, fewer families of macroinvertebrates than expected were collected from all sites sampled in autumn 2025 compared to reference sites selected by the AUSRIVAS model (Table 4).

Taxon with > 0.80 probability of occurrence, but not collected, included the caddis fly family Leptoceridae (at all sites except Site DB and SC). The mayfly families, Leptophlebiidae, at all sites except H1, and Caenidae, at HR1-3 and MC, were also expected but not collected. Also missing was the fly larvae family, Tanypodinae, from all sites, and Freshwater shrimps (Atyidae), from SC.

The SIGNAL 2 scores ranged from 2.65 (Site HR2) to 3.85 (Site DB) (Table 4). The results obtained for all sites (i.e., SIGNAL-2 score = < 4.0) indicate severe pollution (Chessman, 2003).

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Table 5. AUSRIVAS outputs for sites sampled (autumn 2025) (n = 1).

Watercourse	BA Site Code	Historical Site Code	No Taxa	SIGNAL-2	OE50	Band
Hunter River	HR1	W1	7	3.38	0.31	C
	HR2	W1	8	2.65	0.36	C
	HR3	Hunt 854	6	3.00	0.22	C
	HR4	Hunt 571	6	2.88	0.35	C
	HR5	W15	7	3.20	0.29	C
	HR6	SW17	6	3.18	0.29	C
Muscle Creek	MC	Hunt 506	4	3.00	0.14	C
Sandy Creek	SC	Sandy 1	10	3.10	0.39	C
Dart Brook	DB	Hunt 585	8	3.85	0.35	C

3.3.2 Stream Health Performance Indicators

Site HR3 has consistently scored below its historical band of impairment score (i.e. Band A – equivalent to AUSRIVAS reference condition) and the score obtained by the baseline survey (i.e. Band B – significantly impaired) (Table 5). Site HR4 has regularly scored below its historical band of impairment score (i.e. Band B) but not below its Baseline band level (i.e. Band C – severely impaired), except for during spring 2023 (Table 5).

Notably, deviations from historical AUSRIVAS band levels have also been recorded at sites sampled at Dart Brook (DB) and Muscle Creek (MC), which are not exposed to mining activities at the MPO (Table 5).

Criteria developed for the MPO sites were based on data collected on a single occasion in the mid-1990s. Given that ecological measurements vary from one place to another, and few ecological variables are constant through time, statistical analyses were used to formally examine trends in the condition of aquatic macroinvertebrate fauna and the stream health performance indicators in Section 3.3.3. To date, formal analyses have not detected any statistically significant changes that could be indicative of an impact associated with the MPO.

Table 6. Band of Impairment Scores (spring 2017 to autumn 2025).

BA Site Code	Historical Site Code	AUSRIVAS Band Levels				
		mid-1990s	Sp17	Aut18	Sp18	Aut19
DB	Hunt 585	B	B	B	C	B
MC	Hunt 506	B	B	C	C	C
HR3	Hunt 854	A	B	C	C	B
HR4	Hunt 571	B	C	C	C	B
		mid-1990s	Sp19	Aut20	Sp20	Aut21
DB	Hunt 585	B	D	C	B	C
MC	Hunt 506	B	C	C	C	B
HR3	Hunt 854	A	C	C	B	B
HR4	Hunt 571	B	C	C	C	C
		mid-1990s	Sp21	Aut22	Sp22	Aut23
DB	Hunt 585	B	B	B	B	C
MC	Hunt 506	B	C	B	C	C
HR3	Hunt 854	A	B	C	C	C
HR4	Hunt 571	B	B	C	C	B
		mid-1990s	Sp23	Au24	Sp24	Au25
DB	Hunt 585	B	C	C	C	C
MC	Hunt 506	B	D	C	C	C
HR3	Hunt 854	A	D	C	C	C
HR4	Hunt 571	B	D	C	C	C

3.3.3 Changes in Aquatic Macroinvertebrate Fauna

Assemblages

Similar to the findings of previous surveys, PERMANOVA did not detect any evidence to suggest that the structure of assemblages of aquatic macroinvertebrates at locations situated downstream of mining activities at the MPO changed significantly in relation to the control locations (Table 6, Figure 4). Visual examination of the Principal Component Ordination (PCO) shows symbols representing assemblages collected at the Midstream-Impact and Downstream-Impact treatments have changed in a similar manner (i.e., direction and dispersion) as assemblages situated at the Hunter River and Tributary Control reaches, including at the time of the autumn 2025 survey (Figure 4).

Similar to the findings of the previous surveys, SIMPER analyses examining the autumn 2025 data indicated that Atyidae made a considerable contribution to the structure of assemblages within each of the study reaches (Table 7, Figure 4). The aquatic bug, Corixidae, also contributed greatly to assemblages within the Hunter River (Table 7). Chironominae (fly larvae) and the dragonfly larvae, Coenagrionidae, made important contributions to the structure of assemblages within the Tributary sites (Table 7, Figure 4). The mayfly larvae, Caenidae, contributed greatly (ranked second) to the structure of assemblages within the downstream reaches within the Hunter River (Table 7).

Table 7. Summary of PERMANOVA analysis. Bold numbers indicate significant results at P < 0.05. Percentages of Components of Variation (% CV) are shown.

Source	*df*	MS	Pseudo-*F*	*P*	%CV
Survey	**15**	**5802**	**3.32**	**0.000**	**22.43**
Treatment	1	7390	1.43	0.175	8.82
Reach(Treatment)	**4**	**7714**	**4.42**	**0.000**	**18.87**
Survey x Treatment	15	1746	1.00	0.496	0.19
Survey x Reach(Treatment)	**28**	**1746**	**1.11**	**0.163**	**9.04**
Residual	80	1575			40.67
Total	143				

Table 8. Results of SIMPER analyses indicating the relative contribution of individual taxa to the structure of assemblages of macroinvertebrates at each of the study reaches in autumn 2025.

Taxa	US-Control	MS-Impact	DS-Impact	Tributary-Control
Atyidae	2 (38 %)	2 (18%)	1 (67 %)	1 (60 %)
Chironominae		3 (18%)	3 (11 %)	2 (24%)
Corixidae	1 (54 %)	1 (64 %)	4 (11 %)	
Caenidae			2 (11 %)	
Coenagrionidae				3 (8 %)

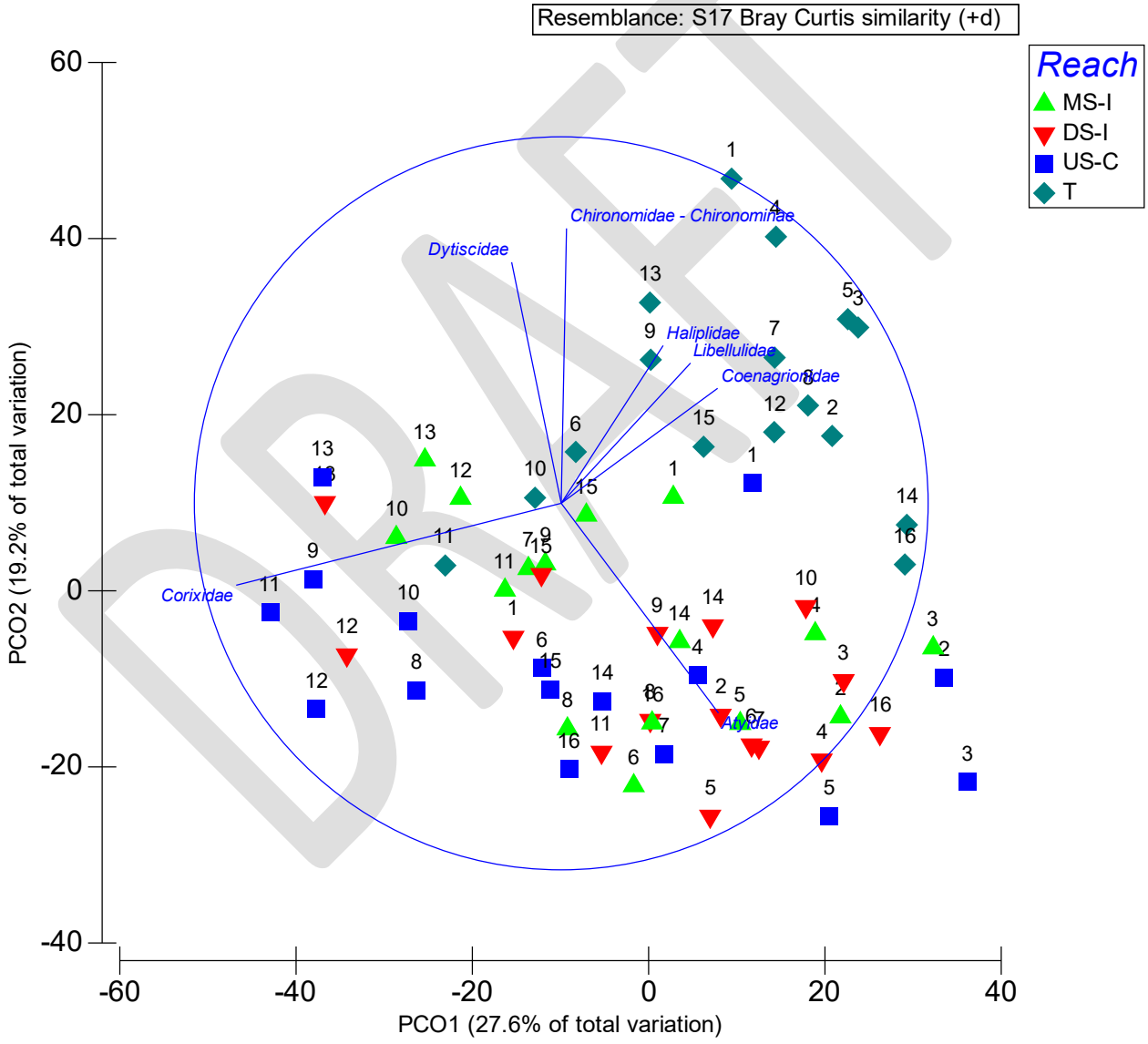

Figure 4. Principal Component Ordination (PCO) of the centroids estimated for AUSRIVAS macroinvertebrate assemblages sampled from edge habitat (MS-I = Midstream-Impact; DS-I = Downstream-Impact; US-C = Upstream-Control; T = Tributary-Control) between spring 2017 (Time 1) and autumn 2025 (Time 16).

Number of Taxa

The mean number of taxa sampled within each 'reach' has ranged from 3.0 (± 1.0) (HR-D in spring 2023 and spring 2022) to 15.5 (± 0.5) (HR-M in autumn 2019) (Figure 5). The PERMANOVA analysis detected significant differences among Surveys and Reaches but no terms were indicative of an impact (i.e. Survey x Treatment) (Table 8, Figure 5). Graphically, fewer taxa have commonly (eleven of fifteen surveys) been collected within the downstream reach situated within the Hunter River (i.e., HR-D) than at the other reaches sampled (Figure 5). Similar numbers of taxa have been collected over time (Figure 5).

Table 9. Summary of PERMANOVA analysis of the Number of Taxa. Bold numbers indicate significant results at P < 0.05. T = Time. NB 'Time' is a random factor.

Source	df	MS	Pseudo-*F*	*P*
Survey	**15**	**43.32**	**8.59**	**0.001**
Treatment	1	0.27	0.03	0.994
Reach(Treatment)	**4**	**25.27**	**5.01**	**0.001**
Survey x Treatment	15	4.86	0.96	0.531
Survey x Reach(Treatment)	28	5.04	0.73	0.805
Residual	80	6.94		
Total	143			

OE50 Scores

The OE50 Taxa Scores ranged from 0.07 (±0.0) (HR-D in spring 2023) to 0.75 (±0.03) (HR-M in autumn 2019), indicating that the macroinvertebrate assemblage within the Hunter River have ranged from severely to significantly impaired relative to reference sites selected by the AUSRIVAS model (Figure 6).

Similar to the findings of previous surveys, PERMANOVA detected significant differences among surveys, but no terms were indicative of an impact (Table 9, Figure 6). Graphically, the condition of aquatic macroinvertebrate fauna improved at each of the reaches sampled between autumn and spring 2024 (Figure 6). The OE50 score's obtained at the time of the autumn 2025 survey were lower than the values obtained at the time of the spring 2017 survey (Figure 6). Importantly, scores obtained for the reaches situated downstream of mining activities during autumn 2025 were similar to those obtained at the control locations (Figure 6).

Table 10. Summary of PERMANOVA analysis for OE50 Scores. Bold numbers indicate significant results at P < 0.05.

Source	*df*	MS	Pseudo-*F*	*P*
Survey	15	**0.123**	**7.293**	**0.001**
Treatment	1	0.000	0.004	0.958
Reach(Treatment)	4	0.038	2.131	0.077
Survey x Treatment	15	0.016	0.938	0.543
Survey x Reach(Treatment)	28	0.017	0.945	0.542
Residual	80	0.018		
Total	143			

SIGNAL2 Indices

The mean SIGNAL2 Index ranged from to 2.42 (±0.1) (HR-D in spring 2023) to 4.25 (±0.8) (HR-M in spring 2022) throughout the survey period (Figure 7). SIGNAL 2 values less than 4 indicate that macroinvertebrate assemblages have consistently been dominated by pollution tolerant taxa (Figure 7).

PERMANOVA detected a significant Survey x Reach(Treatment) interaction, but no terms were indicative of an impact (Table 10, Figure 7). Graphically, the SIGNAL 2 scores obtained during autumn 2025 were similar to surveys done previously (Figure 7). Continued low diversity and presence of less pollution tolerant species, particularly mayflies and caddisflies, obtained at those sites and is likely to have contributed to the lower scores.

Table 11. Summary of PERMANOVA analysis. Bold numbers indicate significant results at P < 0.05.

Source	df	MS	Pseudo-*F*	*P*
Survey	15	0.56	1.60	0.144
Treatment	1	0.02	0.14	0.820
Reach(Treatment)	4	0.41	1.17	0.354
Survey x Treatment	15	0.15	0.43	0.952
Survey x Reach(Treatment)	**28**	**0.35**	**2.31**	**0.006**
Residual	80	0.15		
Total	143			

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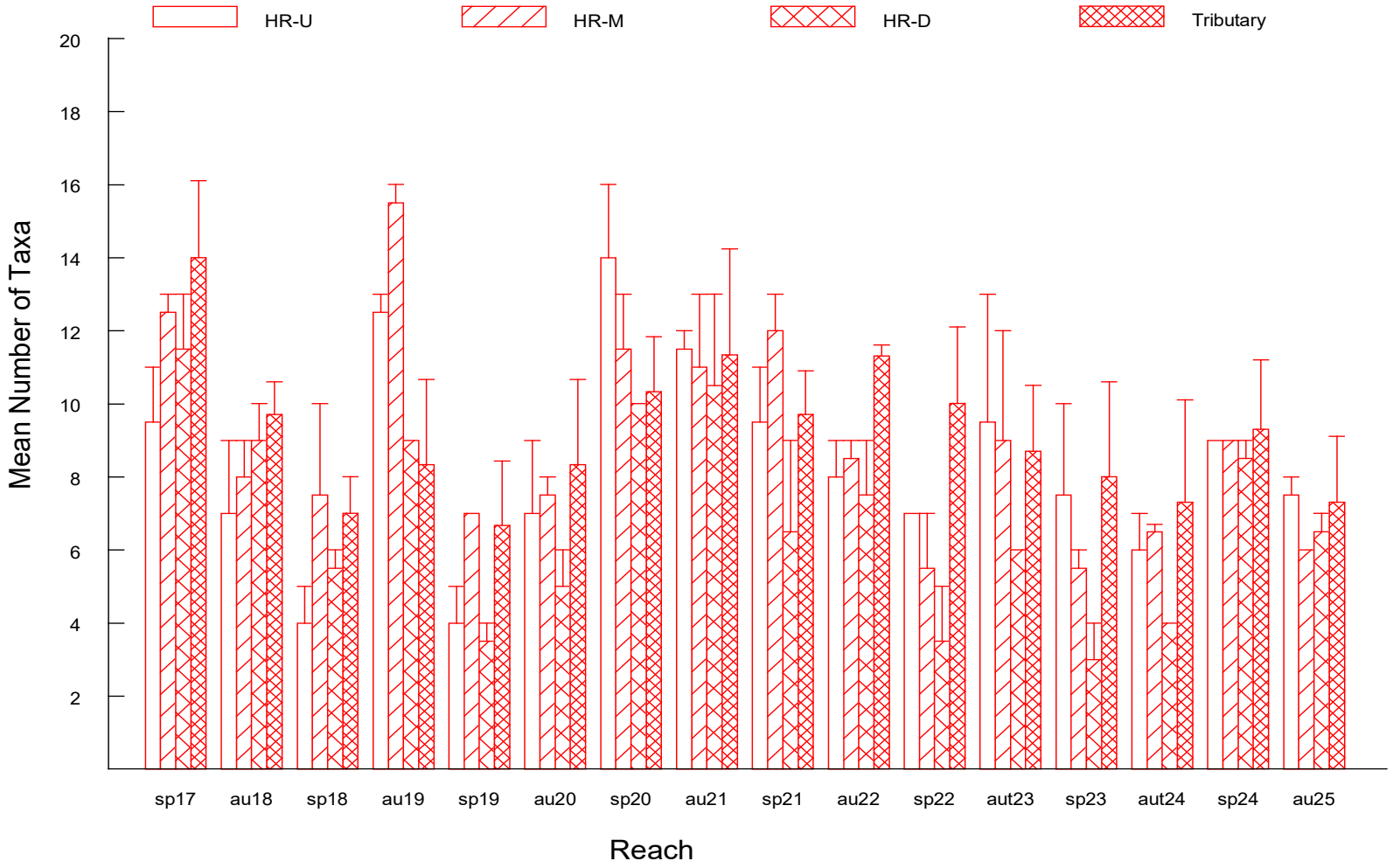

Figure 5. Mean number of taxa collected from edge habitat within the river (n =2 sites) and tributary (n = 3 sites) reaches between spring 2017 and autumn 2025.



Figure 6. Mean OE50 Taxa Scores and their respective Band Scores (B-C) for AUSRIVAS samples collected between spring 2017 and autumn 2025.

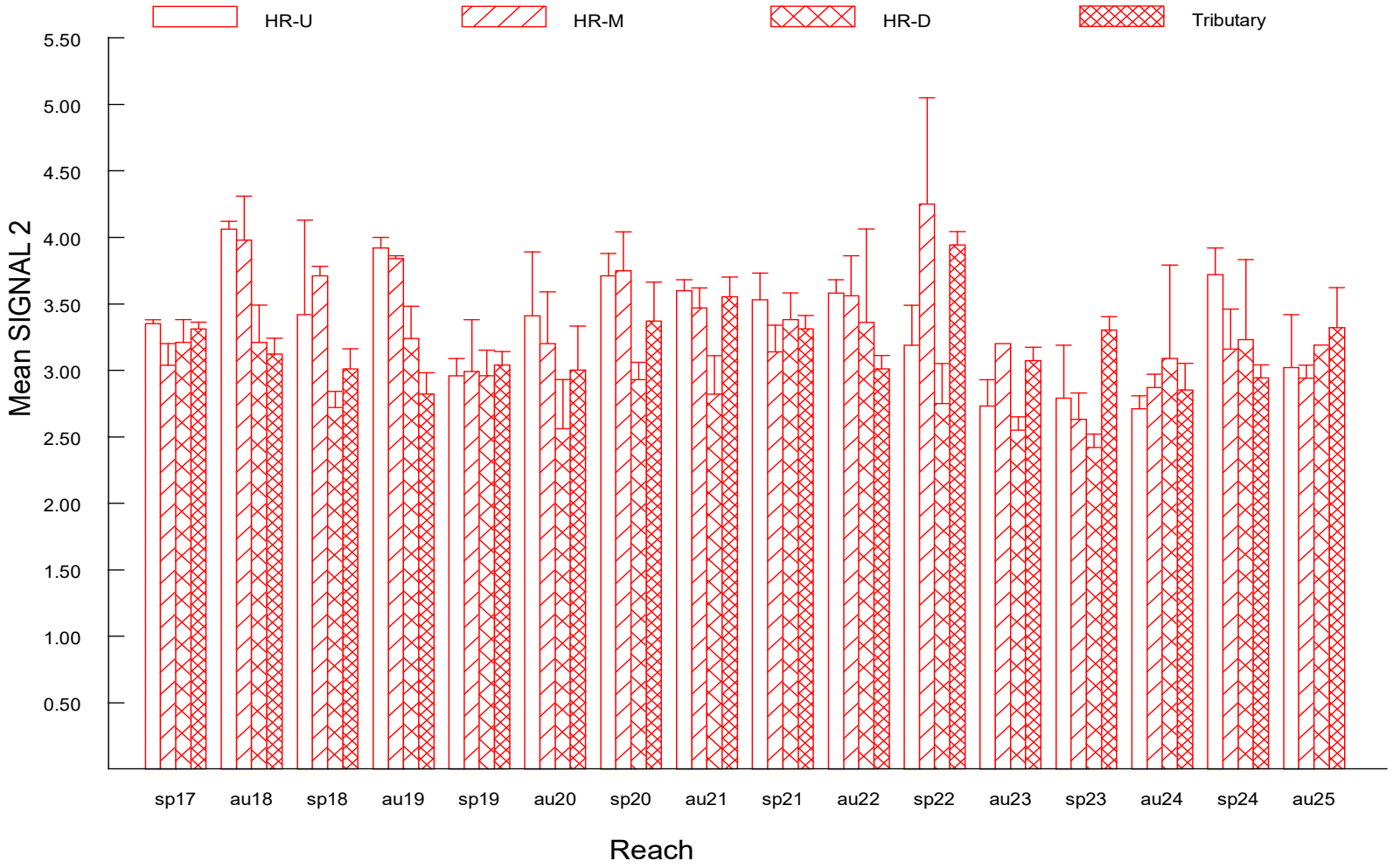

Figure 7. Mean SIGNAL2 Indices for AUSRIVAS samples collected from edge habitat at each site between spring 2017 and autumn 2025.

3.4 Fish

Six species of fish (including two introduced species), freshwater shrimp and freshwater prawns were recorded at the eight sites able to be sampled for fish at the time of the autumn 2025 survey (Table 13). Eels (ranging between 70-120 cm in length) were observed/caught at two of the six Hunter River sites sampled (i.e. Sites HR-2&5), Muscle Creek and Dartbrook (Table 13). Carp (up to ~ 50 cm in length) were caught/observed at Site HR3, HR5 and DB (Table 13). Mosquito Fish (*Gambusia holbrooki*) were collected at all sites except Site HR3, at the time of the autumn 2026 survey (Table 13). Freshwater shrimps (Atyidae) and freshwater prawns (Palaemonidae) were also collected.

Altogether, ten[9] species of fish, including eight native and two alien species, have been collected at the sites sampled since spring 2017 (Table 14). Most notably, a platypus (*Ornithorhynchus anatinus*) was collected in a fyke net set at Site HR1 in autumn 2021. Carp, Flat head gudgeon and Australian smelt were collected at Sandy Creek for the first time in autumn 2024 (Table 14).

All 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 10) or by previous surveys (McDowall, 1996; DPI NSW 2006; Howell and Creese, 2010).

[9] One dead individual observed at Site HR1 in spring 2019 was incorrectly identified as a Wild goldfish (*Carassius auratus*), instead of Common carp.

Table 12. Species of fish and crustaceans observed and/or collected using a Backpack Electrofisher (at sites HR1-HR6, MC and DB) and Dip nets (all sites) in autumn 2025 survey (13&14 May 2025).

Species	Common Name	HR1	HR2	HR3	HR4	HR5	HR6	MC	SC[A]	DB
Anguilla reinhardtii	Long-finned eel					√	√	√		√
Anguilla australis	Short-finned eel									
Cyprinus carpio	Common carp*			√		√				√
Gambusia holbrooki	Mosquito fish*	√	√		√	√	√	√	√	√
Gobiomorphus australis	Striped gudgeon									
Macquaria novemaculeata	Australian bass									
Mugil cephalus	Sea mullet			√	√					
Philypnodon grandiceps	Flat head gudgeon						√	√		
Retropinna semoni	Australian smelt									
Tandanus tandanus	Freshwater catfish	√								√
Emydura macquarii	Eastern short-neck turtle									
Atyidae sp.	Freshwater shrimps	√	√	√	√	√	√	√		√
Palaemonidae sp.	Freshwater prawns	√	√	√	√		√	√		√

*Non-native/Alien species.

[A]Unable to be electrofished due to elevated levels of conductivity.

Table 13. Species of fish and crustaceans collected/observed at the survey sites between spring 2017 and spring 2024.

Species	Common Name	HR1	HR2	HR3	HR4	HR5	HR6	MC	SC[A]	DB[B]
Anguilla reinhardtii	Long-finned eel	√	√	√	√	√	√	√		√
Cyprinus carpio	Common carp*	√	√	√	√	√	√	√		√
Gobiomorphus australis	Striped gudgeon	√	√	√		√	√			
Macquaria novemaculeata	Australian bass	√	√	√		√	√			√
Mugil cephalus	Sea mullet			√	√		√			
Gambusia holbrooki	Mosquito fish*	√	√	√	√	√	√	√	√	√
Philypnodon grandiceps	Flat head gudgeon		√	√		√				
Hypseleotris klunzingeri	Western carp gudgeon				√					
Retropinna semoni	Australian smelt	√	√	√	√	√	√			
Tandanus tandanus	Freshwater catfish	√				√				
Emydura macquarii	Eastern short-neck turtle			√						
Atyidae sp.	Freshwater shrimps	√	√	√	√	√	√	√	√	√
Palaemonidae sp.	Freshwater prawns	√	√	√	√	√	√	√	√	√

*Non-native/Alien species.

[A]Sandy Creek was unable to be electrofished in spring 2021, autumn 2021, spring 2020, autumn 2020, spring 2019, autumn 2019, spring 2018, autumn 2018, autumn 2022, autumn 2023 and autumn 2024 due to elevated levels of conductivity.

[B]Dartbrook was unable to be electrofished in autumn 2023, mostly likely due to elevated levels of conductivity

3.5 Groundwater Monitoring

3.5.1 Groundwater Habitat

Of the eight groundwater bores proposed to be sampled, one (GDE-D) was unable to be sampled because it was dry (Table 10). Of the bores that were able to be sampled, between approximately 4 to 300 L was pumped from two groundwater systems (Table 10). At the time of sampling, groundwater in the alluvial aquifers was relatively fresh (611 to 1,490 µS/cm) (Table 10). The pH measured in the bores ranged from 6.8 to 8.5 and dissolved oxygen concentrations from 24.9% to 53.1% saturation (Table 7).

3.5.2 Stygofauna Taxa

Low numbers of invertebrates were collected from three of the seven bores sampled (Table 11). No invertebrates were collected from Bore's MP-BH1-C, MP-BH1-HR, MP-BH2-HR or GDE (Table 11).

Two likely stygofauna (Neoniphargidae and Isotomidae) were identified from the invertebrate samples collected (Table 11). Hypogastruridae were not considerably to be stygofauna due to the presence of pigmentation (Table 11). Each of these taxa are known from previous surveys of stygofauna within the Hunter alluvium (Hancock and Boulton, 2008; Hose et al., 2015; ELA, 2013 and 2019).

Table 14. Invertebrates recorded from bores near the MPO (12 May 2025).

Class/Order	Lower taxa	MP-BH1	MP-BH2	MP-BH2 C	Likelihood of Stygofauna
Amphipoda	Neoniphargidae	1	(1)	-	Likely
Collembola	Isotomidae	2	-	-	Likely
Collembola	Hypogastruridae	-	-	1	Unlikely
Coleoptera	Elmidae	-	1	-	Unlikely
Number of Taxa		**2**	**2**	**1**	
Total Individuals		**3**	**2**	**1**	

Note[1]: Numbers in brackets represent samples collected using the net. Pump samples were unable to be collected from GDE-D.

Note[2]: Macroinvertebrate taxa were not present in samples collected from MP-BH1-C, MP-BH1-HR, MP-BH2-HR or GDE-S.

Table 15. Mean (+ SE) Values of Groundwater Quality Recorded in the First and Fifth Bucket and then every Five Buckets Collected from each Bore (n = 7, where there is sufficient groundwater recharge).

Bore	Date Sampled	Aquifer	Water Level (mbgl)	Volume Pumped (L)	Temp (°C)	pH	Electrical Conductivity (µS/cm)	Dissolved Oxygen (% Sat)
MP-BH1	13/5/2025	Alluvium	9.42	300	19.4 (0.1)	6.8 (0.1)	611 (0.4)	40.4 (2.1)
MP-BH1-C	13/5/2025	Alluvium	9.60	100	20.2 (0.0)	7.1 (0.1)	699 (15.8)	42.6 (13.5)
MP-BH1-HR	13/5/2025	Alluvium	30.59	4	20.8 (0.3)	7.1 (0.2)	1,184 (270)	40.1 (0.2)
MP-BH2	13/5/2025	Alluvium	12.24	300	20.0 (0.1)	6.7 (0.2)	1,268 (0.4)	53.1 (0.8)
MP-BH2-C	13/5/2025	Alluvium	12.55	300	21.1 (0.1)	8.5 (0.2)	1,490 (29.6)	27.4 (5.3)
MP-BH2-HR	13/5/2025	Alluvium	12.52	8	22.1 (0.5)	7.3 (0.1)	1,376 (86.2)	49.6 (7.7)
GDE-D	13/5/2025	Alluvium	Dry	Dry	N/R	N/R	N/R	N/R
GDE-S	13/5/2025	Alluvium	10.92	300	20.2 (0.2)	7.4 (0.3)	12,376 (280.3)	24.9 (5.5)

[#]The well was unable to be pumped. N/R: Not Recorded

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5.0 DISCUSSION

Discharges at the MPO will be undertaken in accordance with the Hunter River Salinity Trading Scheme (HRSTS) and EPL 20850. MACH Energy currently holds 51 discharge credits as of June 2023. As of June 2023, MPO has an established HRSTS Discharge Point however, no discharges have been made to date. Two Sediment Dam releases have been made to the eastern portion of the MPO area, on 8/03/2022 and 21/10/2022.

There has been no flow recorded in the ephemeral waterways that drain the eastern portion of the MPO area to the Hunter River, including Rosebrook Creek, since October 2022.

5.1 Aquatic Habitat

The aquatic habitat in sections of the Hunter River, Dartbrook, Muscle Creek and Sandy Creek visited by this survey continues to be in relatively good condition despite historical clearing of vegetation to the top of the bank, stream bank erosion and weed infestation in the riparian zone. Relatively dense vegetation (including Casuarina and Willow trees) within a large proportion of the riparian strip (between approximately 5 to 30 m wide) continue to help stabilise banks and reduce erosion and sediment mobilisation.

Deep pools, large woody debris and rocks continue to provide important habitat for many species of aquatic fauna, including fish. Beds of emergent and submerged species plants observed at the study sites would also fulfill many important ecological roles, including the provision of refuge and nursery for aquatic fauna, a source of food for macroinvertebrates and fish and are important in nutrient cycling. Australian bass, Long-finned eels, Sea mullet, Australian smelt, Freshwater catfish and gudgeons, have commonly been caught at the Hunter River sites, confirming that the river is providing habitat for native species of fish.

The overall condition of riparian habitat at the smaller tributary site at Dart Brook has consistently been classified as ‘moderate’. Although relatively narrow (between 5 and 30 m), mixed native and exotic trees and shrubs are abundant within the riparian strip. A range of habitats available to fish and macroinvertebrates are present, including rocks, logs and emergent macrophytes (including Phragmites, Typha and Mat Rush). Australian bass have been caught at this site although not since the autumn 2018 survey, respectively. Long finned eels and carp were common at the time of the autumn 2025 survey.

Conductivity levels (up to 5,905 µS/cm) have consistently exceeded ANZECC/ARMCANZ (2000) guidelines, including at the time of the autumn 2025 survey (i.e. 1,350 µS/cm).

The Muscle Creek site consists of a highly modified urbanised environment that has been greatly disturbed as a result of the existing rail line and associated rail infrastructure, previous fuel depot, roadways and the township of Muswellbrook. Muswellbrook Shire Council with the support of the local community have been working to rehabilitate the riparian zone within the downstream reaches of the creek. At the time of the current survey, a large colony of bats was observed roosting in trees adjacent to the creek. Notably, the release of bat guano into a water body has been shown to cause measurable changes in water quality, including elevated turbidity and conductivity levels and concentrations of nitrate, ammonia and phosphate (Perera et al., 2019).

The western portion of the MPO lies within the Sandy Creek catchment. Similar to the findings of surveys done since autumn 2023, the stream channel between previously isolated pools was inundated and flow was apparent in autumn 2025, improving connectivity along the creek and salinity (6,054 µS/cm at the time of the autumn 2025 survey compared to 11,200 µS/cm during spring 2019).

5.2 Water Quality

Water quality patterns have generally been consistent with data collected prior to the commencement of operations at the MPO. Electrical conductivity has commonly exceeded the ANZECC/ARMCANZ (2000) guideline value (i.e., 350 µS/cm) at the Hunter River sites situated upstream of the MPO (i.e. Sites HR1 and HR2: range = 256 to 800 µS/cm) and the Tributary sites (Dartbrook: range = 980 to 5,905 µS/cm; Muscle Creek: range = 1163 to 2,957µS/cm; Sandy Creek: range = 914 to 11,000 µS/cm), including prior to commencement of the Project and during the autumn 2025 survey. This is not surprising given that the Hunter River catchment includes a large proportion of salt bearing sedimentary rocks and soils, and surface and underground drainage from this contributes natural salinity to the river (see Krogh et al., 2013). Importantly, conductivity levels measured at the sites situated downstream of MPO inputs continue to be within the ANZECC guideline values, and the range in values measured at those sites since the spring 2017 survey.

The pH levels measured at the Hunter River sites continue to show slightly alkaline values, particularly at the upstream sites sampled (Sites HR1 and HR2). Both sites, however, continue to be within the site-specific trigger criteria for that section of the Hunter River (i.e., 7.8 – 8.3). Similarly, pH levels measured in Dartbrook (range = 7.1 to 8.8) and Sandy Creek (range = 7.6 to 8.9) have commonly been slightly alkaline.

5.3 Aquatic Macroinvertebrates

Similar to the spring 2024 survey, a total of 23 taxon were identified from edge habitat samples collected at the survey sites sampled in autumn 2025. Throughout the survey period, the mean number of taxa sampled within each of the study reaches (i.e., HR-U, HR-M, HR-DS and Tributary) has ranged from 3.0 (± 1.0) (HR-D in spring 2023) to 15.5 (± 0.5) (HR-M in autumn 2019).

The relatively low number of species collected by this and previous investigations (including prior to commencement of mining at the MPO), indicate that the macroinvertebrate assemblage has experienced some degree of environmental stress. This is evident in the OE50 Taxa Scores and Band levels obtained.

As discussed previously, lower than expected taxa scores are almost certainly related to the compounding effects from exposure to multiple historical stressors, including flow alteration, sedimentation, salinity, nutrient inputs, hydraulic disturbance and predation by exotic species of fish, such as Mosquito fish and Carp. Nevertheless, some pollution sensitive taxa have commonly been present, such as caddis fly and mayfly families, including at the time of the current survey. Importantly for this stream health study, none of the PERMANOVA tests indicated a change in autumn 2025 that could be attributed to a MPO related impact.

5.4 Fish

The section of the Hunter River within the Study Area is classified as Class 1, Type 1 fish habitat. Altogether ten species of fish have been collected at the sites sampled since spring 2017, including Australian bass, Long-finned eels, native gudgeons, Common carp and Mosquito fish. Eastern short-neck turtles and a platypus (*Ornithorhynchus anatinus*) have also been captured and released.

The distribution and abundance of Carp within the Hunter River appears to have increased considerably since the autumn 2023 survey, particularly at Site HR5 on the Hunter River and at Dartbrook where there are shallow areas adjacent to the main channel with fallen trees and vegetated areas. Numbers appear similar to those recorded prior to flood flows during spring 2021.

No threatened species of fish listed under the NSW FM Act or the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) have been observed using electrofishing, fyke nets or bait traps at the sites sampled in the Hunter River, or electrofishing in Muscle Creek, Sandy Creek or Dart Brook by this sampling programme or by previous surveys (McDowall, 1996; DPI NSW 2006; Howell and Creese, 2010).

5.5 Stream Health Performance Indicators

Of the two sites sampled on the Hunter River to assess changes (if any) associated with the MPO, Site HR3 has consistently scored below its indicator criteria (Band A) while Site HR4 (Band B) has scored lower on thirteen out of the sixteen (81%) sampling occasions. Similarly, band of impairment scores obtained at the 'control' sites sampled (i.e. at Muscle Creek and Dart Brook) have been lower than their indicator criteria on numerous occasions. Importantly, formal analyses have not detected any statistically significant changes in the stream health performance indicators that could be indicative of an impact associated with the MPO. Furthermore, the MPO continues to be a nil discharge site. Therefore, it is not considered appropriate for MACH Energy to initiate a stream health investigation under the SGWRP, in accordance with the SWMP.

5.6 Stygofauna Monitoring

Groundwater within the bores sampled in May 2025 was relatively fresh (611 to 1,490 µS/cm). Four likely stygofauna from two families (i.e., Neoniphargidae and Isotomidae) were identified from two (MP-BH1 and MP-BH2) of the seven bores sampled. These taxa are known from previous surveys of stygofauna within the Hunter River alluvium (Hancock and Boulton, 2008; Hose et al., 2015; ELA, 2013 and 2019; BIO-ANALYSIS, 2020).

6.0 CONCLUSIONS & RECOMMENDATIONS

There was no evidence to suggest a change in macroinvertebrate indicators occurred at HR3, HR4, HR5 or HR6 in autumn 2025 that could be associated with the MPO. Where changes did occur, they were comparable with those that occurred upstream at control site's HR1 and HR2 and at the Tributary sites (i.e., DB, MC and SC).

The MPO is licenced to discharge via HRSTS but no discharge has been made to date.
For these reasons, it is not considered necessary for MACH Energy to initiate a stream health investigation under their Surface and Ground Water Response Plan, particularly since the MPO continues to be a nil discharge site. It is recommended that the stream health monitoring programme is continued using the methods employed for baseline and operation phase surveys, to ensure continuity of the programme.

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APPENDICES

Appendix 1 - GPS positions (UTMs) for stream monitoring sites (autumn 2025).

Watercourse	Site Code	Easting	Northing
Hunter River	HR1	0299756	6435440
	HR2	0299785	6434794
	HR3	0300136	6430786
	HR4	0300739	6429276
	HR5	0293706	6424216
	HR6	0292299	6423021
Dart Brook	DB	0298881	6436241
Muscle Creek	MC	0301148	6427955
Sandy Creek	SC	0289157	6428193

Datum: WGS 84, Zone 56H

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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			

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Appendix 3 - Water Quality Data (autumn 2025)

Indicator Variable	HR1-1	HR1-2	HR1-3	HR2-1	HR2-2	HR2-3	HR3-1	HR3-2	HR3-3
Temperature °C	19	19	19	19.17	19.16	19.16	19.3	19.3	19.3
pH	7.25	7.26	7.27	7.24	7.25	7.27	7.45	7.47	7.48
Conductivity (µS/cm)	378	378	378	403	402	403	406	406	407
Dissolved Oxygen (% Saturation)	93.5	93.6	93.2	96.6	100.1	101.7	106.1	101.7	101.5
Turbidity (NTU)	8.2	8.3	8.3	8.6	8.2	8	9.6	9	9
Alkalinity	100			100			100		
	HR4-1	**HR4-2**	**HR4-3**	**HR5-1**	**HR5-2**	**HR5-3**	**HR6-1**	**HR6-2**	**HR6-3**
Temperature °C	19.2	19.2	19.2	18.4	18.8	18.4	18.82	18.82	18.82
pH	7.93	7.94	7.94	9.2	9.2	9.2	9.19	9.19	9.19
Conductivity (µS/cm)	414	414	414	419	419	419	423	422	423
Dissolved Oxygen (% Saturation)	107.3	104.9	105.7	118.1	118.7	119.4	95.4	95.5	95.4
Turbidity (NTU)	7	7.5	7.7	9.3	10.4	10.5	10.4	10.2	11.6
Alkalinity	90			90			100		
	DB-1	**DB-2**	**DB-3**	**MC-1**	**MC-2**	**MC-3**	**SC-1**	**SC-2**	**SC-3**
Temperature °C	18	18	18	18.36	18.35	18.35	15.96	15.96	15.96
pH	7.19	7.23	7.26	7.92	7.92	7.93	8.23	8.24	8.25
Conductivity (µS/cm)	1350	1350	1350	2956	2958	2958	6057	6054	6052
Dissolved Oxygen (% Saturation)	81.5	83.3	85.2	66.4	64.8	63.8	85.6	85.7	85.8
Turbidity (NTU)	15.7	16	16.7	9.2	9.1	9.4	3.8	3.3	3.5
Alkalinity	100			100			>100		

N/R: Not Recorded

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Appendix 4 - Macroinvertebrate taxa collected using the AUSRIVAS protocol (autumn 2025).

Taxa	HR-1	HR-2	HR-3	HR-4	HR-5	HR-6	MC	SC	DB
Physidae	0	1	0	0	0	0	0	0	0
Corbiculidae	0	0	0	0	0	1	0	1	0
Oniscidae	0	0	0	0	0	0	0	0	1
Atyidae	14	15	25	2	6	30	32	18	0
Palamonidae	2	0	2	0	5	0	0	0	0
Baetidae	1	1	0	1	0	2	0	0	0
Caenidae	0	0	0	1	1	1	0	1	7
Leptophlebiidae	2	0	0	0	0	0	0	0	0
Coenagrionidae	0	0	0	0	0	0	1	1	2
Isostictidae	0	0	0	0	0	0	0	0	1
Libellulidae	0	0	0	0	0	0	0	0	5
Protoneuridae	1	0	1	0	0	0	1	0	0
Corixidae	20	25	19	7	1	3	0	0	0
Gerridae	0	2	3	0	0	0	0	0	0
Notonectidae	0	0	0	0	0	0	0	0	1
Dytiscidae	0	2	0	1	1	0	0	0	26
Gyrinidae	0	0	0	0	0	0	0	0	6
Hydraenidae	0	1	0	0	0	0	0	0	0
Ceratopogonidae	0	0	0	0	1	0	0	0	0
Chironomidae - Chironominae	2	4	3	2	1	1	2	5	7
Simuliidae	0	0	0	0	0	0	0	5	0
Leptoceridae	0	0	0	0	0	0	0	2	2
Hydropsychidae	0	0	0	0	0	0	0	1	0
Number of Taxa	**7**	**8**	**6**	**6**	**7**	**6**	**4**	**8**	**10**
Gambusia	1	0	0	1	4	0	21	11	21

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MOUNT PLEASANT OPERATION

STREAM HEALTH MONITORING

Spring 2024 SURVEY



Prepared for
AECOM Australia on behalf of MACH Energy Australia

4 November 2025

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Disclaimer

This report has been prepared by BIO-ANALYSIS Pty Ltd (BA) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with AECOM Pty Ltd on behalf of MACH Energy Australia Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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

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

EXECUTIVE SUMMARY

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 km north-west of Muswellbrook and approximately 50 km north-west of Singleton. The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively.

Development of the MPO is undertaken within Mining Lease (ML) 1645, ML 1713, ML 1708, ML 1709, ML 1750 and ML 1808 and is operated in accordance with the relevant Authorities for the above MLs and in accordance with Development Consent DA 92/97, consent SSD10418 (activated in February 2024) and Environmental Protection Licence (EPL) 20850. Any discharges at the MPO will be undertaken in accordance with the Hunter River Salinity Trading Scheme (HRSTS) and EPL 20850. MACH Energy currently holds 51 discharge credits.

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

BIO-ANALYSIS Pty Ltd was commissioned by AECOM on behalf of MACH Energy in 2017 to implement a stream health monitoring programme, as required by MACH Energy's Surface Water Monitoring Plan (SWMP). MACH Energy are required to assess the biological health of the aquatic ecology at selected locations along the Hunter River and its tributaries (the Study Area), outside and surrounding the MPO mining lease boundaries.

The spring 2017 survey forms the basis for the ongoing monitoring to assess stream health in accordance with the Surface Water Management Plan (SWMP) (MACH Energy, 2019), to determine any change in selected aquatic indicators throughout the life of the MPO and ascertain whether these changes can be attributed to the MPO. The stream health 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 and fyke nets.

Limited *in situ* water quality sampling is also done to assist in interpreting trends in the above indicators. Stream health monitoring is required to be done in spring and autumn each year.

The results of the current survey (spring 2024) are compared with those obtained in each of spring and autumn since the spring 2017 survey.

Five species of fish (including two introduced species), freshwater shrimp and freshwater prawns were collected in spring 2024. Notably, only four of the nine sites were able to be sampled at the time of the spring 2024 survey, due to elevated flows and/or conductivity levels. Eels (ranging between 40-70 cm in length) were present at two of the six Hunter River sites sampled, and at muscle Creek. The distribution and abundance of Carp within the Hunter River and at the Tributary sites appears to have increased considerably since flood flows in 2021. Carp have also been particularly abundant at Site HR5 within the Hunter River and within the lower reaches of Dartbrook.

Altogether, ten species of fish have been caught/observed by the stream health monitoring programme since spring 2017, including Australian bass, Long-finned eels, native gudgeons, Common carp and Mosquito fish. Overall, the species composition of assemblages has been comparable with that observed by previous surveys. No threatened species of fish listed under the NSW *Fisheries Management Act, 1994* (FM Act) or the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) have been observed.

Macroinvertebrate assemblages at the sites sampled have consistently (i.e. before and during mining activities at the MPO) been dominated by pollution tolerant taxa. Some pollution sensitive taxa were also identified, including caddis fly and mayfly families, upstream and downstream of the MPO area, including at the time of the spring 2024 survey.

Of the two sites sampled on the Hunter River to assess changes (if any) associated with the MPO, one site (Site HR3) has consistently scored below its indicator criteria (Band A - equivalent to AUSRIVAS reference condition) while the other (Site HR4: Band B - significantly impaired) has scored lower on twelve out of the fifteen sampling occasions. Similar deviations from historical AUSRIVAS band levels have been recorded at sites sampled at Dart Brook and Muscle Creek, which are not exposed to mining activities at the MPO.

Importantly for this stream health study, none of the statistical tests used to formally examine trends in the condition of aquatic macroinvertebrate fauna (assemblage structure, diversity, OE50 and SIGNAL2 scores) have indicated a change that could be attributed to a MPO related impact. Therefore, it is not considered necessary for MACH Energy to initiate a stream health investigation under their Surface and Ground Water Response Plan, particularly since the MPO continues to be a nil discharge site.

Conclusions and Recommendations

As of June 2023, MPO has an established HRSTS Discharge Point however, no discharges have been made to date. There has been no flow recorded in the ephemeral waterways that drain the eastern portion of the MPO area to the Hunter River, including Rosebrook Creek, since October 2022.

Examination of results from the spring 2024 survey found no measurable changes in the indicator variables examined in relation to the findings of the baseline survey that could be indicative of an impact associated with the MPO.

It is recommended that the stream health monitoring programme is continued using the methods employed for baseline and operation phase surveys, to ensure continuity of the programme.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

1.0 INTRODUCTION 8

2.0 METHODS 10

2.1 Study Area 10
2.2 Previous Investigations 11
2.3 Performance Measures and Indicators 11
2.4 Field Methods 12
2.4.1 Habitat Assessment 15
2.4.2 Water Quality 15
2.4.3 Aquatic Macroinvertebrates 16
2.4.4 Fish 16
2.5 Laboratory Methods 17
2.6 Data Analyses 17
2.7 Quality Assurance/Quality Control (QA/QC) 20
3.0 RESULTS 21

3.1 Aquatic Habitat Characteristics 21
3.2 Water Quality 31
3.3 Aquatic Macroinvertebrates 38
3.3.1 General Findings 38
3.3.2 Stream Health Performance Indicators 39
3.3.3 Changes in Aquatic Macroinvertebrate Fauna 41
3.4 Fish 48
5.0 DISCUSSION 51

5.1 Aquatic Habitat 51
5.2 Water Quality 52
5.3 Aquatic Macroinvertebrates 52
5.4 Fish 53
5.5 Stream Health Performance Indicators 53
6.0 CONCLUSIONS & RECOMMENDATIONS 54

7.0 REFERENCES 54

APPENDICES 58

Appendix 1 - GPS positions (UTMs) for stream monitoring sites (spring 2024). 58
Appendix 2 - Riparian Channel & Environment (RCE) Score Sheet 59
Appendix 3 - Water Quality Data (spring 2024) 60
Appendix 4 - Macroinvertebrate taxa collected using the AUSRIVAS protocol (spring 2024) 61

Tables

Table 1. Stream Health Performance Criteria 11
Table 2. Stream Health Monitoring Sites 13
Table 3. Mean (+ SE) values of water quality variables recorded between spring 2017 and spring 2024. 32
Table 4. Summary of PERMANOVA analysis. Bold numbers indicate significant results at P < 0.05. 44
Table 5. Species of fish and crustaceans observed and/or collected using a Backpack Electrofisher (at sites HR1, HR2, HR5 and MC) and Dip nets in spring 2024 survey (16&17 October 2024). 49

Figures

Figure 1. Project Area 9
Figure 2. Stream Health Monitoring Sites 14
Figure 3. Annual rainfall (mm) measured at Muswellbrook from 1 January 2013 to 31 December 2024. NB Rainfall data for 2013-2017 and 2020-2023 were collected at Station 61192 (Muswellbrook – Spring Creek (Castle Vale), data for 2018 and 2019 was collected at Station 61095 Rouchel Brook (Albano). 21
Figure 4. Principal Component Ordination (PCO) of the centroids estimated for AUSRIVAS macroinvertebrate assemblages sampled from edge habitat (MS-I = Midstream-Impact; DS-I = Downstream-Impact; US-C = Upstream-Control; T = Tributary-Control) between spring 2017 (Time 1) and spring 2024 (Time 15). 42
Figure 5. Mean number of taxa collected from edge habitat within the river (n =2 sites) and tributary (n = 3 sites) reaches between spring 2017 and spring 2024. 45
Figure 6. Mean OE50 Taxa Scores and their respective Band Scores (B-C) for AUSRIVAS samples collected between spring 2017 and spring 2024. 46
Figure 7. Mean SIGNAL2 Indices for AUSRIVAS samples collected from edge habitat at each site between spring 2017 and spring 2024. 47

1.0 INTRODUCTION

The Mount Pleasant Operation (MPO) is located in the Upper Hunter Valley of New South Wales (NSW), approximately 3 km north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The village of Aberdeen and locality of Kayuga are also located approximately 5 km north-northeast and 1 km north of the MPO boundary, respectively (Figure 1).

Development of the MPO is undertaken within Mining Lease (ML) 1645, ML 1713, ML 1708, ML 1709, ML 1750 and ML 1808 and is operated in accordance with the relevant Authorities for the above MLs. MPO is operated in accordance with Development Consent DA 92/97, as subsequently modified[1], consent SSD10418 (activated in February 2024) and Environmental Protection Licence 20850 Currently MPO is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal until 2026. MACH Energy commenced mining operations in January 2018.

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

BIO-ANALYSIS Pty Ltd was commissioned by AECOM on behalf of MACH Energy in 2017 to implement a stream health monitoring programme, as required by MACH Energy's Surface Water Management Plan (SWMP) (MACH Energy, 2019), to assess the biological health of the aquatic ecology at selected locations along the Hunter River and its tributaries (the Study Area), outside and surrounding the MPO mining lease boundaries (Figure 2).

This Report provides the results of investigations undertaken in spring (16 & 17 October) 2024 in accordance with requirements outlined in the SWMP. The objectives of the most recent survey were to:

- Undertake the 2024 spring survey within the Study Area as required by the SWMP
- Determine whether any changes in stream health have occurred since the 2017 spring survey
- Determine whether changes in stream health, if any, are due to potential mining-related impacts at the MPO, and

[1] To date, four applications to modify the Minister's consent for the MPO have been submitted. A copy of the consolidated Development Consent DA 92/97 incorporating Mods 1, 2, 3, and 4 is provided as Attachment 1 in (REF).

- Provide MPO with recommendations on further surveys or response mechanisms, as required, by the SWMP if stream health within the Study Area has deteriorated.



Figure 1. Project Area

2.0 METHODS

2.1 Study Area

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

The township of Denman is located approximately 18 km to the southwest 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 Hunter River flows in a southerly direction approximately 1 km to the east of the MPO's mining lease boundaries and 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 MPO's ML boundaries.

Surrounding land uses include agriculture (grazing, dairy, vineyards, horse and cattle studs, turf, flower and market gardens) and coal mining (ERM Mitchell McCotter, 1997). The Bengalla Coal Mine immediately adjoins the southern boundary of MPO. The Mount Arthur Coal Mine is located approximately 5 km to the south. The Mangoola Coal Mine is located approximately 8 km to the west. The Dartbrook Coal Mine immediately adjoins to the north (Figure 1). As such, the catchment area in the region of MPO has been historically cleared and altered.

The regional climate for the Muswellbrook areas is warm temperate with an average annual rainfall of approximately 600 mm (BOM, 2020).

2.2 Previous Investigations

The initial stream health monitoring was implemented in November 2017. The results of the first survey are described in the "Stream Health Monitoring Spring 2017 Survey" report (BIO-ANALYSIS, 2018). Since the Spring 2017 Survey, surveys have been done in autumn (May) and spring (November) 2018, autumn (May) 2019 and spring (October) 2019, autumn (May) 2020 and spring (November) 2020, autumn (May) 2021, spring (October) 2021, autumn (May) 2022, spring (September) 2022, autumn (May) 2023, spring (October) 2023 and autumn (May) 2024.

2.3 Performance Measures and Indicators

Stream health performance criteria were developed for the SWMP by MACH Energy for two sites on the Hunter River (Table 1), by combining riffle and edge habitat scores obtained at those sites in the mid-1990s using the New South Wales Australian River System (AUSRIVAS) techniques (MACH Energy, 2019). Should an AUSRIVAS score deteriorate below the range for its historical band of impairment score for two successive monitoring rounds, a stream health investigation protocol is to be initiated under the MPO's Surface and Ground Water Response Plan (SGWRP) (MACH Energy, 2019).

Table 1. Stream Health Performance Criteria

Site Identification	Band of Impairment Score	Trigger Value (O/E Taxa)
Hunt 571	**B**	**0.54**
Hunt 854	**A**	**0.84**

Location of sites: Hunt 571: Hunter River @ Muswellbrook; Hunt 854: Hunter River downstream of Aberdeen (Figure 2)

Band of impairment scores for sites sampled at Dart Brook (Site Hunt 585: Band B) and Muscle Creek (Hunt 506: Band B) were also presented within the SWMP (MACH Energy, 2019).

Mangoola Coal Operations 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 being observed by Mangoola Coal Operations at this site, MACH Energy would consult with Mangoola Coal Operations during implementation of their response plan as required by the SWMP.

2.4 Field Methods

To fulfil the requirements of the SWMP, a stream health assessment was required to be completed at two 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).

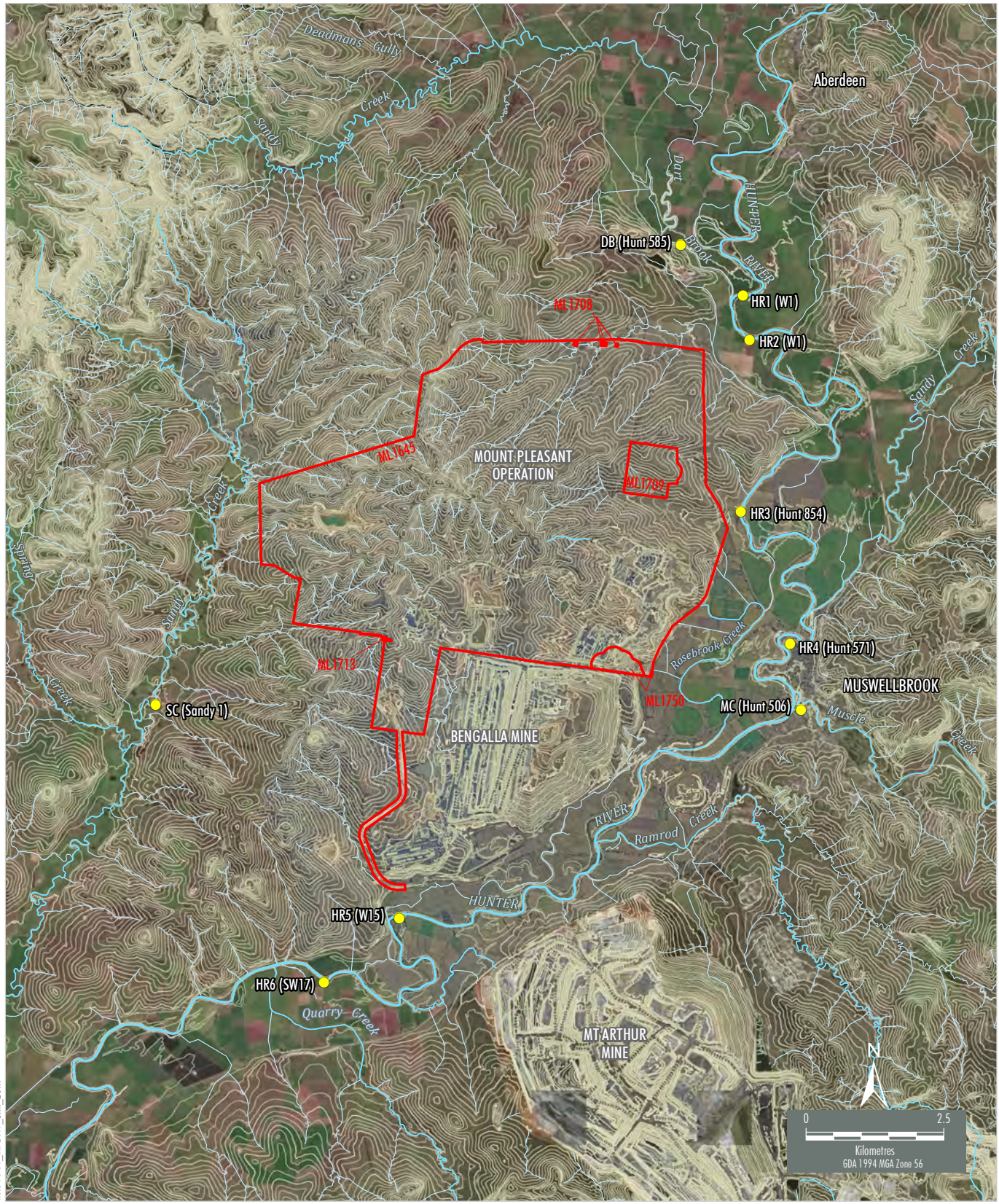
An additional four sites were included in the monitoring programme from the spring 2017 survey (BIO-ANALYSIS, 2018), to provide an indication of variability among sites along the Hunter River and of stream health in the river upstream (Site HR-1 and HR-2) and downstream (HR-5 and HR-6) of the MPO area (Table 2, Figure 2).

For the spring 2024 survey, sites were sampled on 16 & 17 October 2024. Each site was approximately 100 m in length with their GPS co-ordinates listed in Appendix A. Collections of fish and macroinvertebrates were completed in accordance with Section 37 of the *NSW Fisheries Management Act 1994* using Scientific Collection Permit Number FP23/124.

Table 2. Stream Health Monitoring Sites

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

u/s – upstream; d/s - downstream



MAC-16-01_MP2019_SHR_201A

LEGEND

Contour (5 m Intervals)

Mining Lease Boundary

Stream Health Monitoring Site

Source: NSW Land & Property Information (2017); NSW Division of Resources & Energy (2019); MACH (2019)
Orthophoto: MACH Energy (Jun 2019); Esri, DigitalGlobe (2018)

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Local Drainage Network and Topography

Figure 2

2.4.1 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.

Based on the original classification established by Peterson (1992), site condition was rated:

- Poor for RCE scores of 0-24%;
- Fair for RCE scores of 25-43%;
- Good for RCE scores of 44-62%;
- Very good for RCE scores of 63-81%; and
- Excellent for RCE scores of 82-100%.

The condition of aquatic habitat at each site was also 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 were surveyed to provide an indication of the dominant species present and their cover.

Each stream health monitoring site within the Study Area was photographed and the locations recorded with a hand-held GPS (satellite-based Global Positioning System).

2.4.2 Water Quality

Water quality is measured at each site using a water quality probe and meter. The physico-chemical properties measured were electrical conductivity (µS/cm), dissolved oxygen (% saturation and mg/L), pH (pH units), temperature (ºC), 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. It should be noted that water quality measurements collected during the biological sampling provide a snapshot of quality at the time of sampling under the prevailing flow conditions. Routine monthly and rain event surface water monitoring is undertaken at selected sites within the Study Area for MACH Energy by AECOM.

2.4.3 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.

2.4.4 Fish

Fish were sampled using a Smith-Root LR-24 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 fish species were subsequently returned to the water.

Additional sampling of fish was undertaken at two sites in the Hunter River, by deploying fyke nets (panels up to 4 m long on either side of a central funnel 2.5 m long, with 5 mm mesh) and bait traps.

2.5 Laboratory Methods

In the laboratory, AUSRIVAS samples were 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 25 animals of each family were counted, in accordance with the AUSRIVAS protocol (Turak et al., 2004) and the SIGNAL2 (Stream Invertebrate Grade Number Average Level) biotic index developed by Chessman (2003).

2.6 Data Analyses

The objective of data analyses was to determine whether any significant changes to stream health indices may have occurred following commencement of mining at the MPO. Any significant change in stream health as determined by stream health trigger levels adjacent or immediately downstream of the Project would be investigated to determine the source of the change. For this report, data collected in spring 2017, autumn and spring 2018, autumn and spring 2019, autumn and spring 2020, autumn and spring 2021, autumn and spring 2022, autumn and spring 2023 and autumn and spring 2024 were examined.

2.6.1 Water Quality

The water quality measurements taken during each survey were compared with guideline values recommended by the ANZECC and ARMCANZ (2000) for slightly disturbed upland rivers in south-east Australia.

Data were also compared to surface water quality trigger levels developed for the MPO's SWMP for two sites (i.e. W1 and W6) situated within the Hunter River near Sites HR2 and HR3 (MACH Energy, 2018). The trigger levels were developed using the approach recommended by ANZECC & ARMCANZ (2000).

2.6.2 Aquatic Macroinvertebrates

AUSRIVAS

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 include:

- Observed to Expected ratio (OE50): the ratio of the number of macroinvertebrate families collected at a site which had a predicted probability of occurrence of greater than 50 % (i.e. Observed) to the sum of the probabilities of all of the families predicted with greater than a 50 % chance of occurrence (i.e. Expected) (Ransom et al., 2004)
- BAND: for each model, the OE50 taxa ratios are divided into bands representing different levels of impairment. Band X represents a more diverse assemblage of macroinvertebrates than control sites; Band A is considered equivalent to reference condition; Band B represents sites below reference condition (i.e. significantly impaired); Band C represents sites well below reference condition (i.e. severely impaired); and Band D represents impoverished sites (i.e. extremely impaired) (Ransom et al., 2004).

SIGNAL 2

The SIGNAL2 biotic index (Stream Invertebrate Grade Number Average Level) developed by Chessman (2003) is commonly 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 SIGNAL2 scores from samples collected between spring 2017 and spring 2024 are presented graphically to provide an indication of changes over time.

Statistical Methods

The objective of this assessment was to examine whether any significant changes to selected indicator variables of stream health may have occurred following commencement of mining at the MPO.

The analytical design took into consideration:

- Survey: A random factor with 15 levels (spring 2017, autumn and spring 2018, autumn and spring 2019, autumn and spring 2020, autumn and spring 2021, autumn and spring 2022, autumn and spring 2023, autumn and spring 2024 surveys);
- Treatment: a fixed factor with 2 levels: Control and Impact;
- Reach: a random factor with 2 levels nested within Treatment (Midstream (Site HR3 & HR4) and Downstream (Sites HR5 & HR6) reaches are nested within the level 'Impact', while Upstream (Site HR1& HR2) and Tributary (Site MC, SC and DB) reaches are nested in the level 'Control', of the factor Treatment.

A factor representing variation associated with different phases of the MPO (i.e. Baseline- and During-mining) was not included in the design as only one survey could be undertaken prior to the commencement of mining, hence there was no replication for the Baseline-phase. The statistically significant interaction of Survey x Treatment (i.e. Impact and Control) and/or Survey x Reach(Treatment) could potentially provide evidence that a change in stream health had occurred due to mining.

Multivariate Analyses

A matrix of differences in the types of taxa between all possible pairs of samples was created by calculating their respective Bray-Curtis dissimilarity coefficients. Permutational Multivariate Analyses of Variance (PERMANOVA, Anderson 2001; Anderson et al, 2008) was used to examine spatial differences and temporal changes, and their interaction, in aquatic macroinvertebrate presence/absence data collected using AUSRIVAS. Any statistically significant differences (i.e. $P < 0.05$) in the levels of factors and interaction terms were examined by *Post-hoc* permutational t-tests. Significant differences between groups (e.g. impact versus control) may arise due to differences between group means, differences in dispersion (variance) among groups or a combination of both. Each of these outcomes could be indicative of an impact.

Apparent multivariate patterns in the data were examined by Principal Coordinates Analyses (PCoA), which provide a graphical representation of relationships between samples from two-dimensional ordination plots. The amount of variation "explained" by the *x*- and *y*-axis is indicated and the dissimilarity between data points can be determined from their distances apart on the axis (Anderson et al., 2008).

Similarity of percentages (SIMPER) was then used to determine those taxa primarily responsible for the observed similarities (or dissimilarities) between groups (e.g. Location) of interest (Clarke and Warwick, 1994).

Univariate Analyses

Using the same analytical design as for multivariate analyses, PERMANOVA was used to examine spatial and temporal patterns in the total number of taxa, OE50 and Signal scores. The analyses were based on a Euclidean distance matrix of all possible pairs of samples.

2.7 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

Since 2013, annual rainfall recorded at Muswellbrook (Station 61192), ranged from 434.2 mm (2023) to 1117.8 mm (2022) (Figure 3). Within the two months prior to the 2024 spring survey (16 &17 October 2024), a total of 102.8 mm of rain was recorded by a meteorological station situated approximately 25 km from Muswellbrook (i.e. Station 61095).

Within the two months prior the 2024 spring survey, mean water levels measured in the Hunter River at Muswellbrook Bridge (Station 210002) ranged from approximately 0.49 m to 2.07 m (BOM, 2024). At the time of the 2024 spring survey, mean water level ranged from 0.58 m (16 October 2024) to 0.63 m (17 October 2024) (BOM, 2024).

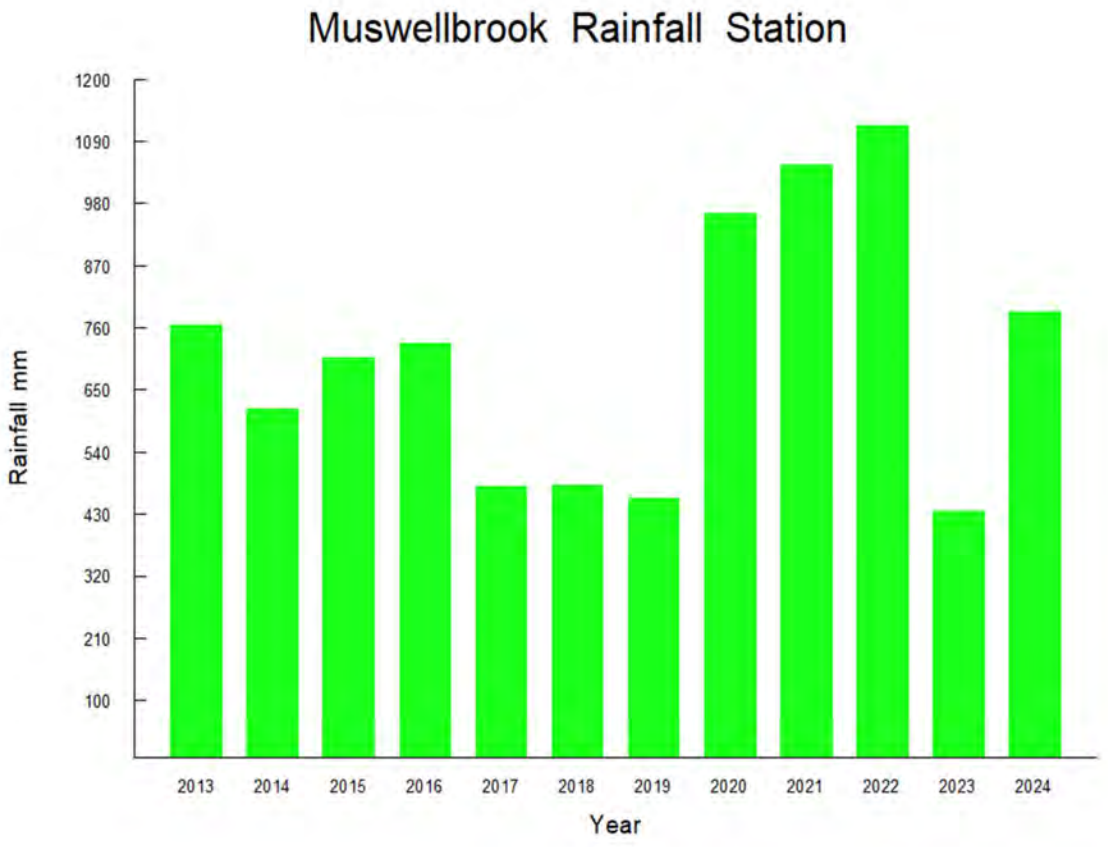

Figure 3. Annual rainfall (mm) measured at Muswellbrook from 1 January 2013 to 31 December 2024. NB Rainfall data for 2013-2017 and 2020-2023 were collected at Station 61192 (Muswellbrook – Spring Creek (Castle Vale), data for 2018 and 2019 was collected at Station 61095 Rouchel Brook (Albano).

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 28 m wide and greater than 1 meter deep (Plates 1-12). The channel substratum is composed primarily of silts and fine sands (as are the banks of the main channel) overlying a mostly gravel bed.

Vegetation of the riparian zone is dense, comprising mixed native and exotic trees and shrubs including River Oak (*Casuarina cunninghamiana*) and River Red Gum (*Eucalyptus camaldulensis*), Morning Glory (*Ipomoea indica*), Privet (*Ligustrum* species), Trad (*Tradescantia albiflora*), Bamboo (*Bambusa* sp.), Balloon Vine (*Cardiospermum grandiflorum*) and Willow (*Salix* spp.) are common. Emergent macrophyte assemblages were characterised by Typha spp., Umbrella Sedge (*Cyperus eragrostis*), Common Reed/ Phragmites (*Phragmites australis*), Mat Rush (*Lomandra longifolia*), Common Rush (*Juncus usitatus*) and Marsh Club-rush (*Bolboschoenus fluviatilis*). The submerged species of macrophyte, Clasped Pondweed (*Potamogeton perfoliatus*) and *Myriophyllum* sp., have commonly been noted at several of the sites sampled. The species identified 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 NSW (2013) classification.

Hunter River upstream of the MPO (HR1 & HR2)

The most upstream site (HR1) is situated within farming land, approximately 200 m upstream of the confluence with Dart Brook (Figure 1, Plate 1). Vegetation of the riparian zone is relatively dense, mostly comprised by River Oak and Willow trees interspersed by Balloon Vine, Bamboo and Trad in areas that had not been scoured from the bank by recent high flows. At the time of the spring 2024 survey, adult carp were observed feeding in shallow areas close to the shore. Water clarity at HR1 was good and flow moderate. The RCE score was 42 (80%) in spring 2024 (range = 38/73% to 43/83% between spring 2017 and autumn 2024).



Plate 1: Hunter River – Site HR1 (sp-24)
View upstream



Plate 2: Hunter River – Site HR1 (sp-24)
View downstream

Site HR2, a large pool up to approximately 25 m wide and 1.6 m deep (Plate 3&4), is situated approximately 900 m downstream of the confluence of the Hunter River with Dart Brook (Figure 1). The substratum in the edge habitat was predominantly cobble, gravel and pebble overlayed with a sandy-silt matrix. Fish hotels that were present but deteriorating within this section of river channel in spring 2017 were not observed. A large section of the steep right bank has been observed to be actively eroding since sampling commenced in spring 2017 (Plate 3&4). River Oak and Willow trees were present. Riparian vegetation mostly consisted of Balloon Vine, Trad and Bamboo with occasional native species, including *Persicaria decipiens, Typha* spp., and *Schoenoplectus validus*. At the time of the spring 2024 survey, water clarity was good and flow moderate. This site was given an RCE score of 38 (73%) in spring 2024 (range = 37/71% to 45/87% between spring 2017 and autumn 2024).



Plate 3: Hunter River – Site HR2 (sp-24)
View upstream



Plate 4: Hunter River – Site HR2 (sp-24)
View downstream

Hunter River adjacent to the MPO (HR3 & HR4)

Site HR3 is situated approximately 6.8 km downstream of Site HR2 (Figure 1). Similar to the upstream sites, riparian vegetation was mostly comprised by River Oaks, Willows and scattered Eucalypts. A considerable proportion of the exotic plant understorey was scoured by floodwaters during late 2021 (Plates 5&6). Small sections of the right bank (facing downstream) had slumped, causing small trees and shrubs to fall into the river (Plates 5&6).

At the time of the spring 2024 survey, extensive bank erosion observed by the autumn 2024 survey had been stabilised by recent growth of understorey vegetation (predominantly exotic grass) on both sides of the channel (up to approximately 14 m wide and 1.1 m deep) (Plates 5 & 6). Substratum in the edge habitat was predominantly gravel (70 %) with a mixture of sand and silt. Large woody debris was abundant within the channel and deposited along the left bank. *Persicaria decipiens* and *Schoenoplectus validus* were common. Water clarity was good and flow moderate to high. This site was given an RCE score of 41 (78%) in spring 2024 (range = 37/71% to 42/81% between spring 2017 and autumn 2024).



Plate 5: Hunter River – Site HR3 (sp-24)
View upstream



Plate 6: Hunter River – Site HR3 (sp-24)
View downstream

Site HR4 is situated near the Water Treatment Plant at Muswellbrook and the inlet to the approved water pipeline between the Hunter River and the MPO Mine Water Dam. The study reach consists of long pools up to 10.5 m wide with infrequent short riffles. The riverbanks are fully stabilised by trees (mostly Willow and River Oak) and shrubs, including Balloon Vine and Bamboo (Plates 7&8).

Large woody debris has always been common alongside the stream banks. The substratum in the edge habitat is predominantly gravel and cobble with boulders, pebble and silty sand. The submerged macrophytes, Clasped Pondweed (*Potamogeton perfoliatus*) and *Myriophyllum* sp., have commonly been observed at this site but not since flooding during 2021.

At the time of the spring 2024 survey, accumulations of green macro-algae were less common than during spring 2023, most likely due to rapid flow along the study reach. Water clarity was good and water level high. This site obtained an RCE score of 42 (80%) at the time of the spring 2024 survey (range = 39/75% to 43/83% between spring 2017 and spring 2023).



Plate 7: Hunter River – Site HR4 (sp-24)
View upstream



Plate 8: Hunter River – Site HR4 (sp-24)
View downstream

Hunter River downstream of the MPO (HR5 and HR6)

Site HR5 is situated immediately downstream of the proposed discharge point from the MPO and the discharge point from Bengalla Coal Mine (Figure 2). This site consists of a long, relatively deep pool with a small area of riffle habitat at the top of the site (Plates 9&10). River Oaks, Willows and scattered Eucalypts are present along the stream bank.

Considerable scouring of the understorey vegetation (mostly Balloon Vine) and stream channel occurred between the spring 2021 and spring 2022 surveys, associated with flood flows during late 2021. Fallen trees and large accumulations of woody debris are common along the river channel and banks. Balloon Vine is once again common along either bank, as well as Typha and *Schoenoplectus validus*. The substratum in the edge habitat is predominantly a gravel-pebble matrix with a silt overlay.

Submerged macrophytes have not been recorded at this site. At the time of this and the 2024 autumn and 2023 spring surveys, carp were seen feeding near the stream bank. Water clarity was fair and flow moderate (Plates 9&10). This site was given an RCE score of 40 (77%) in spring 2024 (range = 36/69% to 44/85% between the spring 2017 and autumn 2024 surveys).



Plate 9: Hunter River – Site HR5 (sp-24)
View upstream



Plate 10: Hunter River – Site HR5 (sp-24)
View downstream

Site HR6 is situated approximately 4 km downstream of the proposed discharge point from the MPO and the discharge point from Bengalla Coal Mine (Figure 2). The width of the riparian strip is relatively narrow (i.e. between 5 and 30 m) and comprised by mixed native and exotic trees and shrubs (Plates 11&12). This site consists of a long, relatively deep pool with a short section of riffle habitat at the top of the study reach (Plates 11&12). The substratum in the edge habitat is predominantly a gravel matrix overlayed with silt. Fallen trees and other woody debris are common within the river channel.

At the time of the current survey, flow and water level were elevated while water clarity was fair (Plates 11&12). There were signs of recent collapse of a section of the stream bank into the river channel. This site was given an RCE score of 41 (78%) in spring 2024 (range = 38/73% to 42/81% between the spring 2017 and autumn 2024 surveys).



Plate 11: Hunter River – Site HR6 (sp-24)
View upstream



Plate 12: Hunter River – Site HR6 (sp-24)
View downstream

3.1.2 Hunter River Tributaries

Due to the highly ephemeral nature of drainage lines within the MPO's ML boundaries, stream health monitoring locations were chosen in tributaries with more reliable flows to the Hunter River, consequently outside of the MPO boundary.

Muscle Creek

The site sampled on Muscle Creek is situated on the floodplain approximately 1 km upstream of the confluence with the Hunter River (Figure 2). It consists of a highly modified urbanised environment that has been greatly disturbed as a result of the existing rail line and associated rail infrastructure, previous fuel depot, roadways and the township of Muswellbrook. Since the spring 2020 survey, planned works by the Australian Rail Track Corporation Limited to replace the Muscle Creek underbridge, located near the confluence of the Hunter River, have been observed.

The stream channel is highly modified, particularly in the downstream reaches of the study site, with large boulders used in places to stabilise the stream bank (Plates 13&14). Trees have been planted along both sides of the creek to help stabilise the banks (Plates 13 & 14). Emergent macrophytes, including Typha, Phragmites, and Mat Rush, were moderately abundant along the stream bank and in-stream (Plates 13&14). *Lomandra longifolia* and *Persicaria decipiens* were also common, as was Balloon Vine, Trad and exotic grasses.

The average stream width is approximately 10 m with a depth of up to approximately 1.5 m.

The substratum is mostly comprised by a gravel/cobble/pebble matrix covered by silt and fine sand. At the time of the spring 2024 survey, there was flow along the study reach. Water clarity was fair-good at the time of sampling.

The site is classified as Class 1, Type 1 fish habitat according to the DPI (2013) classification. The site received an RCE score of 34 (65%) in spring 2024. The RCE score has ranged between 21 (40%) and 34 (65%) between the spring 2017 and autumn 2024 surveys.



Plate 13: Muscle Creek – Site MC (sp-24)
View upstream



Plate 14: Muscle Creek– Site MC (sp-24)
View downstream

Sandy Creek

The site sampled on Sandy Creek is located downstream of the MPO and upstream of the Mangoola Coal Operations (Figure 2). Wybong Road bridge crosses the stream at the bottom of the study reach. The stream banks at the survey site are approximately 3 m high and heavily disturbed on either side by historical agricultural activities. Wombat burrows were also present. The stream channel commonly ranges from about 1 m to greater than 7 m wide, with an average of around 5 m (Plates 15&16).

Unlike the findings from surveys done between spring 2017 and spring 2022, the channel connecting pools along the study reach was inundated and flow was apparent (Plates 15&16). The substratum is dominated by poorly sorted gravel overlain by fine-grained sediments and clay with occasional cobbles.

In the large pool at the top of the site, accumulations of green filamentous algae commonly observed up to the spring 2022 have been less common, most likely due to flows along the reach having been re-established. At the time of the current survey, small, isolated accumulations of Chara/Nitella spp. were present in the pool. The pool substratum was covered by a thin layer of fine, grey silt.

The site is classified as Class 1, Type 1 fish habitat according to the DPI (2013) classification and scored an RCE value of 35 (67%) in spring 2024. Previously (i.e., since the spring 2017 survey, the RCE score ranged between 21/40% and 36/67%. The higher score is mostly due to inundation and recovery of flow along the stream channel and increased vegetation along the stream bank after drought and stream bank erosion.



Plate 15: Sandy Creek – Site SC (sp-24)
View upstream



Plate 16: Sandy Creek– Site SC (sp-24)
View upstream

Dart Brook

Sampling site Dart Brook was chosen near a road crossing approximately 700 m upstream from the confluence with the Hunter River. The surrounding land use was mostly agriculture. This site consists of pools up to 6.4 m wide and 1.2 m deep and a run at the downstream end (Plates 17&18). The bed is dominated by poorly sorted gravel overlain by sand and silt with occasional boulders. The stream banks are composed of cohesive fine-grained sediments with gravel. Small areas of active erosion are apparent along the top of the steep (approximately 8 m) right bank and along sections of the channel. Emergent macrophytes included Typha, River Club-Rush (*Schoenoplectus validus)* and Umbrella sedge (*Cyperus eragrostis*).

At the time of the 2024 spring survey, flow and water level were elevated while water clarity was fair (Plate 17&18). Fallen trees, woody debris and exotic weeds were common along the stream bank. Balloon vine appeared to have increased its distribution along both sides of the stream bank.

The site is classified as Class 1, Type 1 fish habitat according to the DPI NSW (2013) classification. It received an RCE score of 36 (68%) in spring 2024. Previously, the RCE scores have ranged between 32 (62%) and 41 (79%) (between the spring 2017 and autumn 2024 surveys).



Plate 17: Dart Brook – Site DB (sp-24)
View downstream



Plate 18: Dart Brook – Site DB (sp-24)
View upstream

3.2 Water Quality

Mean physico-chemical water quality measurements from spring 2017 to spring 2024 are summarised in Table 3. Values highlighted in bold type indicate where results were outside the appropriate default trigger values (DTVs) recommended by ANZECC/ARMCANZ (2000). Where appropriate, pH and conductivity data were also compared with site specific trigger criteria[2].

The main findings for the spring 2024 survey are summarised as follows:

- Mean water temperature ranged from 16.8 (Site MC) to 17.5 °C (Site HR5). Water temperatures have ranged from 12.5 to 25.4 °C in edge habitats throughout the survey period
- pH levels (range = 7.5 – 8.0) were within the DTVs recommended by the ANZECC/ARMCANZ (2000) guidelines at all of the sites sampled
- Mean conductivity levels ranged from 630 to 2,000 µS/cm in spring 2024, exceeded the upper DTV at HR1, HR2, DB and SC
    - Conductivity measured at Site HR2 (range = 267 to 800 µS/cm) exceeded the site-specific criteria established for that site (i.e., 589 µS/cm)
    - Conductivity measured at Site DB was within the range collected by surveys done at that site since spring 2017 (range = 980 to 5,905 µS/cm), as was conductivity measured at Site SC (i.e. range = 914 to 11,200 µS/cm)
    - Conductivity measured at Site MC in spring 2023 (2,673 µS/cm) and in autumn 2023 (2,799) exceeded the upper guideline value
- Dissolved oxygen levels (range = 57.1 to 81.3 % saturation) were below the lower DTVs at the Hunter River sites and at Site SC and DB.
- Turbidity levels (range = 10.7 to 32 NTU) were within the recommended DTVs at all sites at the time of the spring 2024 survey (Table 3)

The raw water quality data are provided in Appendix 3.

[2] Using the approach recommended by ANZECC & ARMCANZ (2000), surface water quality trigger levels were developed at two sites (W1: situated between Site HR1 and HR2; and W6: situated at HR3) situated within the Hunter River (MACH Energy, 2018). Sites W1 and W6 are sampled monthly and during rain events by AECOM. The 80th percentile trigger values for pH and conductivity (EC) are: Site W1: pH = 7.8 – 8.3, EC = 589 µS/cm; Site W6: pH = 7.8-8.4, EC = 496 µS/cm.

Table 3. Mean (± SE) values of water quality variables recorded between spring 2017 and spring 2024.

Variable	DTV[3]	Sp-17	Aut-18	Sp-18	Aut-19	Sp-19[#]	Aut-20	Sp-20	Aut-21	Sp-21	Aut-22
Site HR1											
Temperature °C		22.4 (0.0)	17.1 (0.0)	20.2 (0.0)	15.5 (0.0)	19.6	13.3 (0.0)	N/R	17.3 (0.0)	19.2 (0.0)	17.0 (0.0)
pH	6.5 – 8.0	**8.3** (0.0)	**8.6** (0.0)	**8.1** (0.0)	**8.1** (0.0)	**8.29**	**8.6** (0.0)	**8.7** (0.0)	8.0 (0.0)	7.0 (0.0)	8.3 (0.0)
EC (µS/cm)	30 – 350	264 (0.0)	256 (0.0)	276 (0.3)	321 (0.0)	**356**	**445** (0.3)	**528** (0.0)	**528** (0.0)	**622.0** (0.0)	**720** (0.9)
DO (% Sat)	90–110	95.5 (0.4)	93.7 (0.0)	95.4 (0.1)	**87.6** (0.1)	108.2	**75.1** (0.2)	97.8 (0.0)	92.6 (0.2)	**75.8** (0.2)	94.6 (0.0)
Turbidity (NTU)	< 50	16.4 (1.4)	**44.6** (0.4)	13.8 (0.3)	**42.6** (0.9)	2.9	**98.6** (3.2)	14.9 (1.0)	**38.9** (0.5)	9.7 (0.3)	8.8 (0.3)
Site HR2											
Temperature °C		22.9 (0.0)	16.2 (0.0)	19.3 (0.0)	15.7 (0.0)	22.1	13.4 (0.1)	N/R	17.4 (0.0)	19.5 (0.0)	17.0 (0.0)
pH	6.5 – 8.0	**8.2** (0.0)	**8.5** (0.0)	**8.2** (0.1)	7.9 (0.0)	**8.3**	**8.3** (0.1)	**8.5** (0.0)	7.9 (0.0)	7.1 (0.0)	**8.3** (0.0)
EC (µS/cm)	30 – 350	267 (1.3)	311 (0.0)	276 (0.0)	323 (2.2)	**387**	**474** (7.0)	**534** (0.0)	**629** (0.0)	**658.0** (0.0)	**800** (0.0)
DO (% Sat)	90–110	**141.2** (3.6)	**85.8** (0.1)	92.5 (0.2)	**89.3** (0.5)	97.8	**59.5** (0.5)	**81.2** (0.3)	**89.4** (0.1)	**72.9** (0.2)	92.1 (0.0)
Turbidity (NTU)	< 50	**26.7** (1.2)	**43.2** (0.2)	12.8 (0.2)	**43.8** (0.7)	2.6	**118.7** (1.2)	**59.7** (0.2)	10.6 (0.4)	14.7 (1.3)	14.7 (0.5)
Site HR3											
Temperature °C		24.7 (0.0)	16.1 (0.0)	18.7 (0.0)	14.5 (0.0)	21.7	13.7 (0.0)	N/R	16.8 (0.0)	21.8 (0.0)	16.9 (0.0)
pH	6.5 – 8.5	8.2 (0.0)	**8.6** (0.0)	7.9 (0.0)	7.7 (0.0)	8.27	**8.7** (0.0)	**8.8** (0.0)	8.0 (0.0)	7.5 (0.0)	8.3 (0.0)
EC (µS/cm)	125–2,200	272 (1.3)	266 (0.0)	313 (0.0)	329 (0.0)	357	419 (0.0)	540 (0.0)	640 (0.3)	633.0 (0.0)	815 (0.3)
DO (% Sat)	85 – 110	101.7 (0.5)	85.7 (0.1)	**80.9** (0.1)	**72.3** (0.1)	**115.1**	**81.8** (0.1)	91.2 (0.2)	**81.0** (0.1)	93.4 (0.1)	91.6 (0.1)
Turbidity (NTU)	< 50	46.4 (0.3)	49.4 (0.2)	6.9 (0.2)	18.9 (0.8)	3.3	45.0 (0.0)	26.2 (2.1)	23.4 (1.0)	19.4 (1.0)	14.7 (0.3)

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.

NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia for HR1 and HR2 and in lowland rivers (i.e. < 150 m altitude) for HR3.

[3] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers will be used for these sites here and for subsequent surveys.

Table 3. (Cont'd).

Variable	DTV[4]	Sp-22	Aut-23	Sp-23	Aut-24	Sp-24					
Site HR1											
Temperature °C		13.8 (0.0)	17.8 (0.0)	22.2 (0.0)	17.9 (0.0)	17.1 (0.0)					
pH	6.5 – 8.0	**8.1** (0.0)	**8.2** (0.0)	**8.3** (0.0)	7.9 (0.0)	8.0 (0.0)					
EC (µS/cm)	30 – 350	**382** (2.0)	**843.0** (0.0)	307 (0.0)	**418.0** (0.0)	**630** (0.3)					
DO (% Sat)	90–110	97.7 (0.2)	109.9 (0.0)	**21.6** (0.1)	104.2 (0.2)	**81.2** (0.7)					
Turbidity (NTU)	< 50	2.5 (0.1)	1.8 (0.0)	5.5 (0.5)	5.7 (0.0)	10.7 (0.2)					
Site HR2											
Temperature °C		14.1 (0.0)	17.5 (0.0)	22.0 (0.0)	17.7 (0.0)	17.1 (0.0)					
pH	6.5 – 8.0	**8.1** (0.0)	**8.1** (0.0)	**8.3** (0.0)	7.9 (0.0)	8.0 (0.0)					
EC (µS/cm)	30 – 350	**409** (2.0)	**997.0** (0.0)	**485** (0.3)	**436.3** (0.3)	**714.3** (0.3)					
DO (% Sat)	90–110	92.3 (0.2)	108.6 (0.1)	**20.2** (0.3)	90.9 (0.1)	**81.3** (0.5)					
Turbidity (NTU)	< 50	2.8 (0.4)	1.4 (0.0)	6.0 (0.2)	10.4 (0.7)	12.5 (0.2)					
Site HR3											
Temperature °C		15.9 (0.0)	18.6 (0.0)	22.1 (0.0)	18.9 (0.0)	17.1 (0.0)					
pH	6.5 – 8.5	7.9 (0.0)	8.2 (0.0)	8.2 (0.0)	7.8 (0.0)	7.9 (0.0)					
EC (µS/cm)	125–2,200	490 (3.2)	1018 (0.0)	515 (1.0)	436.7 (0.3)	734.7 (0.3)					
DO (% Sat)	85 – 110	104.8 (1.1)	113.8 (0.2)	**19.6** (0.4)	108.3 (0.1)	**76.6** (0.2)					
Turbidity (NTU)	< 50	**5.2** (0.0)	3.0 (0.1)	13.1 (0.2)	10.2 (0.2)	16.7 (0.3)					

NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia for HR1 and HR2 and in lowland rivers (i.e. < 150 m altitude) for HR3.

[4] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

Table 3. (Cont'd).

Variable	DTV[5]	Sp-17	Aut-18	Sp-18	Aut-19	Sp-19[#]	Aut-20	Sp-20	Aut-21	Sp-21	Aut-22
Site HR4											
Temperature °C		24.6 (0.0)	16.6 (0.0)	21.5 (0.0)	15.2 (0.0)	22.2	13.9 (0.0)	N/R	17.0 (0.0)	22.2 (0.0)	16.7 (0.0)
pH	6.5 – 8.5	7.9 (0.0)	8.4 (0.0)	8.0 (0.0)	7.7 (0.0)	8.24	8.3 (0.0)	8.5 (0.0)	7.9 (0.0)	7.2 (0.0)	8.2 (0.0)
EC (µS/cm)	125–2,200	296 (1.3)	274 (20.0)	290 (0.0)	368 (1.7)	361	467.0 (0.0)	1,610 (0.0)	623 (0.3)	669.0 (0.0)	861 (0.0)
DO (% Sat)	85 – 110	93.2 (0.6)	100.0 (0.2)	101.0 (0.1)	**79.3** (0.1)	**120.8**	**61.6** (0.0)	**58.2** (0.1)	**83.4** (0.2)	85.1 (0.0)	88.3 (0.0)
Turbidity (NTU)	< 50	26.5 (0.9)	**55.7** (0.1)	28.5 (0.4)	**51.7** (0.7)	6.7	46.0 (0.3)	28.2 (0.2)	12.0 (1.4)	17.7 (0.1)	18.2 (0.1)
Site HR5											
Temperature °C		25.4 (0.0)	15.5 (0.0)	22.3 (0.1)	15.3 (0.0)	22.3	14.8 (0.0)	N/R	17.1 (0.0)	21.3 (0.1)	16.6 (0.0)
pH	6.5 – 8.5	7.9 (0.0)	8.5 (0.0)	7.7 (0.0)	7.8 (0.0)	8.08	8.4 (0.0)	**8.7** (0.0)	7.9 (0.0)	6.6 (0.0)	8.2 (0.0)
EC (µS/cm)	125–2,200	318 (1.3)	338 (2.0)	322 (0.9)	424 (0.0)	365	407.3 (0.7)	657 (18.0)	669 (0.0)	698.7 (0.3)	908 (0.3)
DO (% Sat)	85 – 110	**66.5** (0.8)	90.3 (0.6)	89.5 (0.2)	**79.7** (0.7)	107.9	**56.2** (0.1)	**61.7** (0.2)	**77.5** (0.1)	**67.5** (1.1)	86.6 (0.0)
Turbidity (NTU)	< 50	30.5 (0.5)	**57.2** (0.2)	35.3 (0.1)	45.2 (1.4)	6.8	**68.8** (1.4)	44.6 (0.7)	12.1 (0.3)	26.8 (1.7)	16.9 (0.4)
Site HR6											
Temperature °C		25.9 (0.0)	17.0 (0.1)	22.5 (0.0)	15.9 (0.0)	22.2	14.9 (0.0)	N/R	16.9 (0.0)	21.5 (0.0)	16.4 (0.0)
pH	6.5 – 8.5	8.1 (0.0)	8.4 (0.0)	7.8 (0.0)	7.9 (0.0)	8.07	8.5 (0.0)	**8.9** (0.0)	7.9 (0.0)	7.2 (0.1)	8.3 (0.0)
EC (µS/cm)	125–2,200	329 (0.0)	331 (1.2)	321 (0.3)	448 (0.0)	364	387.3 (0.3)	636.0 (0.6)	739 (0.3)	715.0 (0.0)	914 (0.3)
DO (% Sat)	85 – 110	**74.7** (0.0)	**83.8** (0.6)	100.8 (0.3)	91.7 (1.5)	107	**72.2** (0.0)	**57.1** (1.0)	**73.0** (0.2)	**78.6** (0.1)	88.9 (0.0)
Turbidity (NTU)	< 50	35.3 (0.8)	**59.1** (0.6)	34.3 (0.2)	35.8 (0.5)	12.7	41.6 (0.3)	23.4 (1.2)	6.5 (0.3)	22.2 (0.2)	17.8 (0.4)

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.

NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in lowland rivers (i.e. systems at < 150 m altitude) in southeast Australia.

[5] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

Table 3. (Cont'd).

Variable	DTV[6]	Sp-22	Aut-23	Sp-23	Aut-24	Sp-24					
Site HR4											
Temperature °C		15.7 (0.0)	17.2 (0.0)	22.2 (0.0)	18.4 (0.0)	17.0 (0.0)					
pH	6.5 – 8.5	8.0 (0.0)	8.0 (0.0)	8.0 (0.0)	7.7 (0.0)	7.8 (0.0)					
EC (µS/cm)	125–2,200	393 (0.0)	1111 (0.0)	604 (9.8)	460.3 (0.3)	770.7 (0.3)					
DO (% Sat)	85 – 110	95.0 (0.1)	106.0 (0.0)	**18.7** (0.6)	97.5 (0.1)	**76.7** (0.2)					
Turbidity (NTU)	< 50	7.9 (0.2)	2.6 (0.0)	10.3 (0.3)	12.2 (0.3)	22.9 (1.3)					
Site HR5											
Temperature °C		15.7 (0.0)	16.8 (0.0)	21.3 (0.0)	17.9 (0.0)	17.5 (0.0)					
pH	6.5 – 8.5	7.9 (0.0)	8.1 (0.0)	8.2 (0.0)	7.7 (0.0)	7.9 (0.0)					
EC (µS/cm)	125–2,200	455 (7.0)	1272 (0.3)	680 (0.3)	492.3 (0.7)	869.0 (0.0)					
DO (% Sat)	85 – 110	N/R	99.4 (0.0)	**15.4** (0.4)	88.9 (0.0)	**74.7** (0.3)					
Turbidity (NTU)	< 50	6.9 (0.2)	5.7 (0.1)	19.9 (0.7)	22.7 (0.1)	26.8 (0.6)					
Site HR6											
Temperature °C		15.6 (0.0)	17.0 (0.0)	21.3 (0.1)	17.7 (0.0)	17.2 (0.0)					
pH	6.5 – 8.5	7.9 (0.0)	8.1 (0.0)	8.1 (0.0)	7.8 (0.0)	7.7 (0.0)					
EC (µS/cm)	125–2,200	423 (0.0)	1299 (1.2)	730 (0.3)	493.7 (0.3)	917.7 (0.3)					
DO (% Sat)	85 – 110	N/R	96.5 (0.1)	**16.7** (0.1)	90.2 (0.1)	**66.2** (0.1)					
Turbidity (NTU)	< 50	6.2 (0.1)	3.3 (0.1)	20.3 (0.2)	18.8 (0.6)	32.0 (0.5)					

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.

N/R = Not Recorded

[6] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

Table 3. (Cont'd).

Variable	DTV[7].	Sp-17	Aut-18	Sp-18	Aut-19	Sp-19[#]	Aut-20	Sp-20	Aut-21	Sp-21	Aut-21
DB											
Temperature °C		25.1 (0.0)	12.6 (0.0)	22.1 (0.1)	13.5 (0.0)	20.3	12.5 (0.0)	N/R	16.2 (0.0)	20.8 (0.0)	17.1 (0.0)
pH	6.5 – 8.0	**8.1** (0.0)	**8.8** (0.0)	**8.2** (0.0)	8.0 (0.0)	**8.24**	**8.4** (0.0)	**8.4** (0.0)	8.0 (0.0)	7.1 (0.0)	**8.1** (0.0)
EC (µS/cm)	30 – 350	**4,257** (1.3)	**5,905** (5.0)	**4,400** (0.0)	**3,648** (0.6)	**5,210**	**1,230** (0.6)	**980** (0.0)	**1014** (0.3)	**914.0** (0.0)	**1013 (0.0)**
DO (% Sat)	90–110	**64.2** (0.8)	**60.5** (0.3)	**88.7** (0.4)	**54.9** (0.2)	**63.9**	**73.9** (0.2)	**56.6** (0.2)	**72.6** (0.0)	**73.2** (0.0)	**88.0 (0.0)**
Turbidity (NTU)	< 25	24.2 (0.5)	**52.4** (0.7)	**26.5** (0.7)	**53.2** (0.4)	**31**	**31.4** (0.8)	19.9 (0.2)	**40.0** (0.1)	32.8 (0.1)	23.6 (0.4)
MC											
Temperature °C		23.3 (0.0)	15.1 (0.0)	23.9 (0.0)	15.0 (0.0)	24.5	14.1 (0.0)	N/R	16.4 (0.0)	21.9 (0.0)	16.1 (0.0)
pH	6.5 – 8.5	7.7 (0.2)	**8.3** (0.0)	7.7 (0.0)	7.5 (0.0)	7.79	8.0 (0.0)	8.4 (0.0)	7.6 (0.0)	6.7 (0.0)	8.0 (0.0)
EC (µS/cm)	125–2,200	1589 (2.6)	1406 (15)	1232 (1.0)	1517 (0.3)	1327	1599 (0.0)	1163 (0.0)	1872 (0.3)	1592 (2.9)	2113 (0.3)
DO (% Sat)	85 – 110	86.6 (0.1)	**83.9** (0.1)	107.3 (0.2)	**52.5** (0.2)	**113.9**	**40.3** (0.0)	**41.3** (0.1)	**64.6** (0.2)	**57.0** (0.1)	**83.0** (0.0)
Turbidity (NTU)	< 50	26.9 (0.9)	**45.8** (0.1)	23.5 (0.7)	**42.2** (2.1)	2.7	35.9 (0.0)	**4.6** (0.0)	15.3 (0.3)	4.3 (0.1)	14.6 (0.2)
SC											
Temperature °C		21.1 (0.0)	14.1 (0.1)	17.3 (0.0)	12.9 (0.0)	22	12.8 (0.0)	N/R	13.9 (0.0)	18.3 (0.0)	15.7 (0.0)
pH	6.5 – 8.0	**8.5** (0.0)	**8.6** (0.0)	8.0 (0.0)	7.9 (0.0)	7.91	**8.8** (0.0)	**8.9** (0.0)	7.7 (0.0)	7.6 (0.0)	**8.4** (0.0)
EC (µS/cm)	30 – 350	**8,000** (0.0)	**8,027** (0.3)	**9,600** (0.0)	**7,064** (13)	**11,200**	**3,006** (0.6)	**6,068** (0.3)	**4,326** (0.3)	**914.0** (0.0)	**4299** (0.3)
DO (% Sat)	90–110	**43.7** (0.0)	**49.0** (5.3)	**10.9** (0.0)	**40.8** (1.4)	**39.1**	**73.4** (0.0)	**39.6** (0.0)	**39.6** (0.1)	94.4 (0.5)	**75.6** (0.0)
Turbidity (NTU)	< 25	10.1 (0.1)	**77.1** (5.2)	4.8 (0.2)	**28.0** (0.2)	2.1	18.8 (0.3)	8.0 (0.1)	1.1 (0.0)	16.8 (0.1)	3.5 0.0)

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.

NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia for DB and SC but for lowland rivers (i.e. < 150 m altitude) for MC.

[7] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

Table 3. (Cont'd).

Variable	DTV[8].	Sp-22	Aut-23	Sp-23	Aut-24	Sp-24					
DB											
Temperature °C		14.6 (0.0)	16.4 (0.7)	18.8 (0.1)	17.5 (0.0)	16.9 (0.0)					
pH	6.5 – 8.0	**8.2** (0.0)	7.9 (0.0)	**8.2** (0.0)	7.6 (0.0)	7.9 (0.0)					
EC (µS/cm)	30 – 350	**456** (0.0)	**2,029** (0.0)	**3110** (5.8)	**2,905 (**1.2)	**1051** (0.0)					
DO (% Sat)	90–110	89.8 (0.1)	**87.8** (0.0)	**23.6** (0.1)	**79.9** (0.3)	**70.6** (0.0)					
Turbidity (NTU)	< 25	3.2 (0.0)	3.7 (0.1)	17.6 (0.5)	**29.1 (**0.3)	14.8 (0.5)					
MC											
Temperature °C		16.1 (0.0)	16.4 (0.0)	19.7 (0.0)	17.2 (0.0)	16.8 (0.0)					
pH	6.5 – 8.5	7.5 (0.0)	7.6 (0.0)	7.7 (0.0)	7.4 (0.0)	7.5 (0.0)					
EC (µS/cm)	125–2,200	710 (1.9)	**2799** (0.0)	**2673** (3.3)	2,000 (0.3)	2,000 (0.0)					
DO (% Sat)	85 – 110	N/R (0.3)	**71.1** (0.0)	**13.5** (0.5)	**63.4** (0.0)	**57.1** (0.2)					
Turbidity (NTU)	< 25	7.8 (0.1)	3.2 (0.0)	13.2 (0.2)	**25.0** (0.1)	21.3 (0.2)					
SC											
Temperature °C		14.6 (0.0)	15.0 (0.0)	17.4 (0.3)	14.9 (0.0)	16.9 (0.0)					
pH	6.5 – 8.0	7.7 (0.0)	7.9 (0.0)	8.0 (0.0)	7.8 (0.0)	7.9 (0.0)					
EC (µS/cm)	30 – 350	**1481** (1.7)	**4934** (0.3)	**5617** (15)	**5888 (**1.0)	**1051** (0.0)					
DO (% Sat)	90–110	N/R (0.3)	**65.4** (0.2)	**54.9** (0.2)	**88.4 (0.1)**	**70.6** (0.0)					
Turbidity (NTU)	< 25	9.6 (0.0)	1.3 (0.0)	7.6 (0.3)	15.1 (0.5)	14.8 (0.5)					

[#] Replicate measurements of water quality were unable to be collected at the time of the spring 2019 survey, due to technical issues with BA's water quality instrument. Temperature, pH, conductivity and dissolved oxygen measurements were collected using AECOM's water quality instrument. Water samples were collected and sent to ALS Water – Newcastle to be analysed for turbidity.
N/R = Not Recorded. NB Default trigger values are based on the ANZECC/ARMCANZ (2000) guidelines for the protection of slightly disturbed aquatic ecosystems in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia for DB and SC but for lowland rivers (i.e. < 150 m altitude) for MC.

[8] In reports done prior to the autumn 2020 survey, the DTVs were based on the ANZECC/ARMCANZ (2000) guidelines for upland rivers (i.e. >150 m altitude). However, Sites HR3, HR4, HR5, HR6 and MC occur at <150 m altitude. For this reason, guideline values for lowland rivers were used for these sites for the autumn 2020 and subsequent surveys.

3.3 Aquatic Macroinvertebrates

3.3.1 General Findings

A total of 23 taxon were identified from the edge habitat samples collected at the nine sites sampled in spring 2024 (Appendix 4). The number of taxa ranged from 7 at Site DB and 13 at Site SC (Table 4). Chironominae (non-biting midges) and Corixidae (water boatmen) were collected at eight of the nine sites sampled (Table 4). Coenagrionidae (Damselflies) were collected at seven sites while Atyidae (Freshwater shrimp) were collected at six sites (Table 4). The alien fish, Mosquito fish (*Gambusi*a *holbrooki*), was also collected using the AUSRIVAS technique (Table 4).

The OE50 scores ranged between 0.23 (MC) and 0.49 (HR1 and SC) (Table 4). All of the sites sampled in spring 2024 were grouped within Band C (Table 4). Thus, fewer families of macroinvertebrates than expected were collected from all sites sampled in spring 2024 compared to reference sites selected by the AUSRIVAS model (Table 4).

Taxon with > 0.80 probability of occurrence, but not collected, included the caddis fly family Leptoceridae (at Site DB). The mayfly families, Leptophlebiidae, at all sites except H2, and Caenidae, at HR4, were also expected but not collected. Also missing was the fly larvae family, Tanypodinae, from sites H2-H5 and MC, and Water Mites (Acarina), from all sites except SC.

The SIGNAL 2 scores ranged from 2.64 (Site HR5) to 3.88 (Site HR1) (Table 4). The results obtained for all sites (i.e., SIGNAL-2 score = < 4.0) indicate severe pollution (Chessman, 2003).

Table 4. AUSRIVAS outputs for sites sampled (spring 2024) (*n* = 1).

Watercourse	BA Site Code	Historical Site Code	No Taxa	SIGNAL-2	OE50	Band
Hunter River	HR1	W1	9	3.88	0.49	C
	HR2	W1	9	3.56	0.47	C
	HR3	Hunt 854	9	2.82	0.32	C
	HR4	Hunt 571	9	3.50	0.3	C
	HR5	W15	8	2.64	0.31	C
	HR6	SW17	9	3.81	0.35	C
Muscle Creek	MC	Hunt 506	8	2.83	0.23	C
Sandy Creek	SC	Sandy 1	13	3.14	0.49	C
Dart Brook	DB	Hunt 585	7	2.86	0.36	C

3.3.2 Stream Health Performance Indicators

Site HR3 has consistently scored below its historical band of impairment score (i.e. Band A – equivalent to AUSRIVAS reference condition) and the score obtained by the baseline survey (i.e. Band B – significantly impaired) (Table 5). Site HR4 has regularly scored below its historical band of impairment score (i.e. Band B) but not below its Baseline band level (i.e. Band C – severely impaired), except for during spring 2023 (Table 5).

Notably, deviations from historical AUSRIVAS band levels have also been recorded at sites sampled at Dart Brook (DB) and Muscle Creek (MC), which are not exposed to mining activities at the MPO (Table 5).

Criteria developed for the MPO sites were based on data collected on a single occasion in the mid-1990s. Given that ecological measurements vary from one place to another, and few ecological variables are constant through time, statistical analyses were used to formally examine trends in the condition of aquatic macroinvertebrate fauna and the stream health performance indicators in Section 3.3.3. To date, formal analyses have not detected any statistically significant changes that could be indicative of an impact associated with the MPO.

Table 5. Band of Impairment Scores (spring 2017 to spring 2024).

BA Site Code	Historical Site Code	AUSRIVAS Band Levels				
		mid-1990s	Sp17	Aut18	Sp18	Aut19
DB	Hunt 585	B	B	B	C	B
MC	Hunt 506	B	B	C	C	C
HR3	Hunt 854	A	B	C	C	B
HR4	Hunt 571	B	C	C	C	B
		mid-1990s	Sp19	Aut20	Sp20	Aut21
DB	Hunt 585	B	D	C	B	C
MC	Hunt 506	B	C	C	C	B
HR3	Hunt 854	A	C	C	B	B
HR4	Hunt 571	B	C	C	C	C
		mid-1990s	Sp21	Aut22	Sp22	Aut23
DB	Hunt 585	B	B	B	B	C
MC	Hunt 506	B	C	B	C	C
HR3	Hunt 854	A	B	C	C	C
HR4	Hunt 571	B	B	C	C	B
		mid-1990s	Sp23	Au24	Sp24	
DB	Hunt 585	B	C	C	C	
MC	Hunt 506	B	D	C	C	
HR3	Hunt 854	A	D	C	C	
HR4	Hunt 571	B	D	C	C	

3.3.3 Changes in Aquatic Macroinvertebrate Fauna

Assemblages

PERMANOVA indicated statistically significant differences among reaches within treatments, which varied among Surveys (Table 6). *Post hoc* tests however, were unable to detect significant variation in the structure of macroinvertebrate assemblages between Reaches nested within Treatments for any of the Survey periods. Visual examination of the Principal Component Ordination (PCO) shows the symbols representing the assemblage collected at of the study reaches (i.e., the Upstream-Control, Midstream-Impact and Downstream-Impact 'reaches' of the Hunter River and the Tributary-Control) in spring 2024 survey group relatively close together (Figure 4). This result indicates that there was little difference in the structure of assemblages within the different impact and control reaches. A further observation is that the structure of the assemblage within the Upstream-Control has been more variable over time compared to the Midstream-Impact, Downstream-Impact and Tributary 'reaches' (Figure 4).

Similar to the findings of the previous survey (autumn 2024), SIMPER analyses examining the spring 2024 data indicated that Corixidae made a considerable contribution (i.e., > 40 %) to the structure of assemblages within each of the study reaches sampled in the Hunter River (Table 7, Figure 4). The mayfly larvae, Caenidae, contributed greatly (ranked second) to the structure of assemblages within the upstream and downstream reaches within the Hunter River (Table 7). Chironominae and Atyidae made the most important contributions to the structure of assemblages within the Tributary sites (Table 7, Figure 4).

Table 6. Summary of PERMANOVA analysis. Bold numbers indicate significant results at $P < 0.05$. Percentages of Components of Variation (% CV) are shown.

Source	*df*	MS	Pseudo-*F*	*P*	%CV
Survey	14	**14**	**51615**	**0.002**	**20.94**
Treatment	1	1	1279.3	0.671	0.00
Reach(Treatment)	4	**4**	**21552**	**0.011**	**19.95**
Survey x Treatment	14	14	18374	0.649	0.00
Survey x Reach(Treatment)	26	**26**	**38828**	**0.000**	**24.52**
Residual	75	75	53217		34.60
Total	134				

Table 7. Results of SIMPER analyses indicating the relative contribution of individual taxa to the structure of assemblages of macroinvertebrates at each of the study reaches in spring 2024.

Taxa	US-Control	MS-Impact	DS-Impact	Tributary-Control
Atyidae	3 (16 %)			2 (16 %)
Chironominae			3 (13 %)	1 (44%)
Corixidae	1 (44 %)	1 (69 %)	1 (63 %)	
Caenidae	2 (19 %)		2 (13 %)	
Leptoceridae	4 (14 %)	4 (8%)		
Physidae				3 (10 %)
Coenagrionidae		2 (8 %)	4 (6 %)	5 (6 %)
Dytiscidae		3 (8%)		4 (8%)

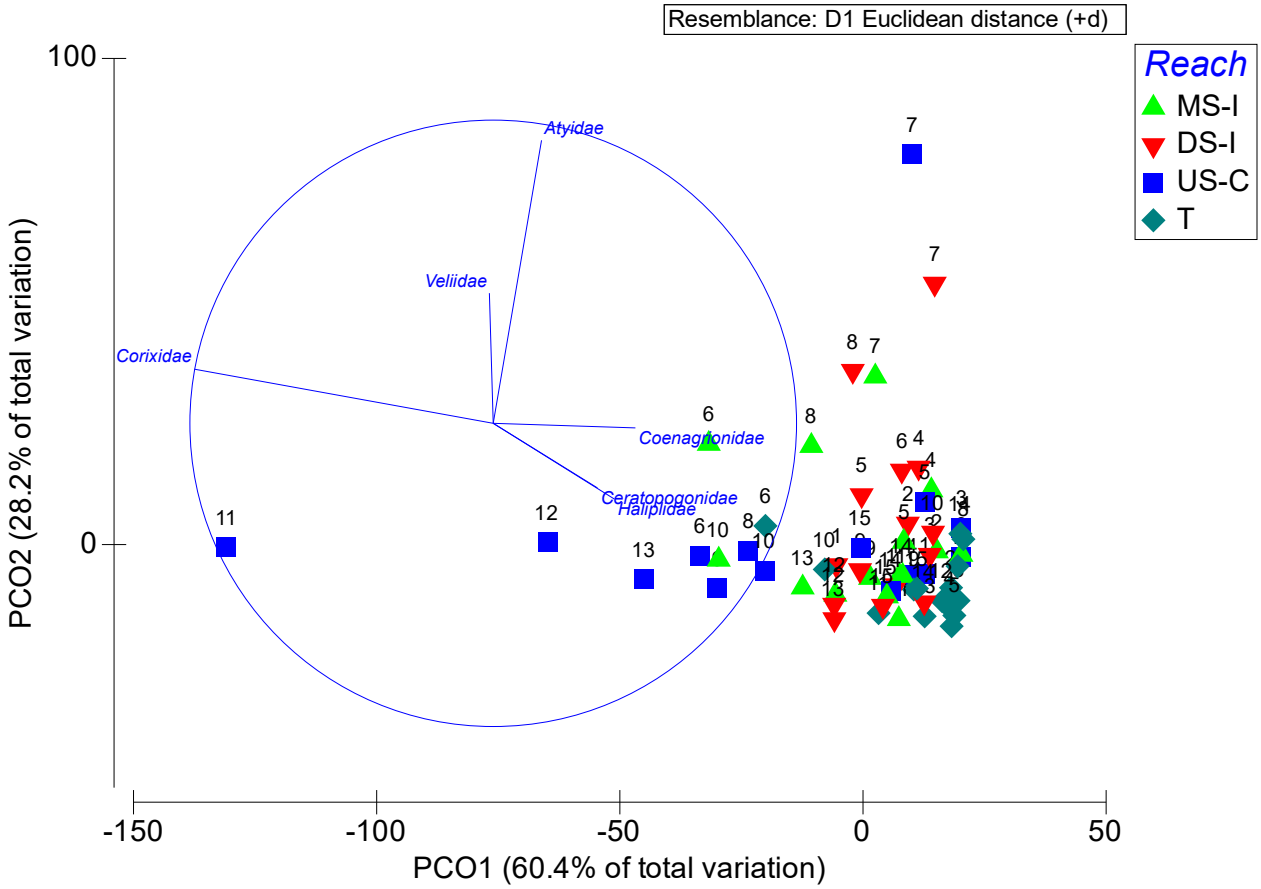

Figure 4. Principal Component Ordination (PCO) of the centroids estimated for AUSRIVAS macroinvertebrate assemblages sampled from edge habitat (MS-I = Midstream-Impact; DS-I = Downstream-Impact; US-C = Upstream-Control; T = Tributary-Control) between spring 2017 (Time 1) and spring 2024 (Time 15).

Number of Taxa

The mean number of taxa sampled within each 'reach' has ranged from 3.0 (± 1.0) (HR-D in spring 2023 and spring 2022) to 15.5 (± 0.5) (HR-M in autumn 2019) (Figure 5). The PERMANOVA analysis detected significant differences among Surveys and Reaches but no terms were indicative of an impact (i.e. Survey x Treatment) (Table 8, Figure 5). Graphically, fewer taxa have commonly (eleven of fifteen surveys) been collected within the downstream reach situated within the Hunter River (i.e., HR-D) than at the other reaches sampled (Figure 5). Similar numbers of taxa have been collected over time (Figure 5).

Table 8. Summary of PERMANOVA analysis of the Number of Taxa. Bold numbers indicate significant results at *P* < 0.05. T = Time. NB 'Time' is a random factor.

Source	df	MS	Pseudo-*F*	*P*
Survey	**14**	**44.41**	**8.37**	**0.001**
Treatment	1	0.15	0.01	0.922
Reach(Treatment)	**4**	**25.32**	**4.78**	**0.006**
Survey x Treatment	14	5.11	0.96	0.495
Survey x Reach(Treatment)	26	5.30	0.74	0.790
Residual	75	7.14		
Total	134			

OE50 Scores

The OE50 Taxa Scores ranged from 0.07 (±0.0) (HR-D in spring 2023) to 0.75 (±0.03) (HR-M in autumn 2019), indicating that the macroinvertebrate assemblage within the Hunter River have ranged from severely to significantly impaired relative to reference sites selected by the AUSRIVAS model (Figure 6).

Similar to the findings of previous surveys, PERMANOVA detected significant differences among surveys, but no terms were indicative of an impact (Table 9, Figure 6). Graphically, the condition of aquatic macroinvertebrate fauna improved at each of the reaches sampled between autumn and spring 2024 (Figure 6). The OE50 score's obtained at the time of the spring 2024 survey were similar to the values obtained since spring 2017 (Figure 6).

Table 9. Summary of PERMANOVA analysis for OE50 Scores. Bold numbers indicate significant results at *P* < 0.05.

Source	*df*	MS	Pseudo-*F*	*P*
Survey	**14**	**0.12**	**6.90**	**0.001**
Treatment	1	0.00	0.02	0.881
Reach(Treatment)	4	0.04	2.16	0.098
Survey x Treatment	14	0.02	0.96	0.540
Survey x Reach(Treatment)	26	0.02	0.97	0.532
Residual	75	0.02		
Total	134			

SIGNAL2 Indices

The mean SIGNAL2 Index ranged from to 2.42 (±0.1) (HR-D in spring 2023) to 4.25 (±0.8) (HR-M in spring 2022) throughout the survey period (Figure 7). SIGNAL 2 values less than 4 indicate that macroinvertebrate assemblages have consistently been dominated by pollution tolerant taxa (Figure 7).

PERMANOVA detected a significant Survey x Reach(Treatment) interaction, but no terms were indicative of an impact (Table 10, Figure 7). Graphically, the SIGNAL 2 scores obtained during spring 2024 were similar to surveys done previously (Figure 7). Continued low diversity obtained at those sites is likely to have contributed to the lower scores.

Table 4. Summary of PERMANOVA analysis. Bold numbers indicate significant results at *P* < 0.05.

Source	df	MS	Pseudo-*F*	*P*
Survey	14	0.56	1.53	0.167
Treatment	1	0.17	0.68	0.662
Reach(Treatment)	4	0.66	1.80	0.170
Survey x Treatment	14	0.13	0.36	0.984
Survey x Reach(Treatment)	26	**0.37**	**2.43**	**0.002**
Residual	75	0.15		
Total	134			

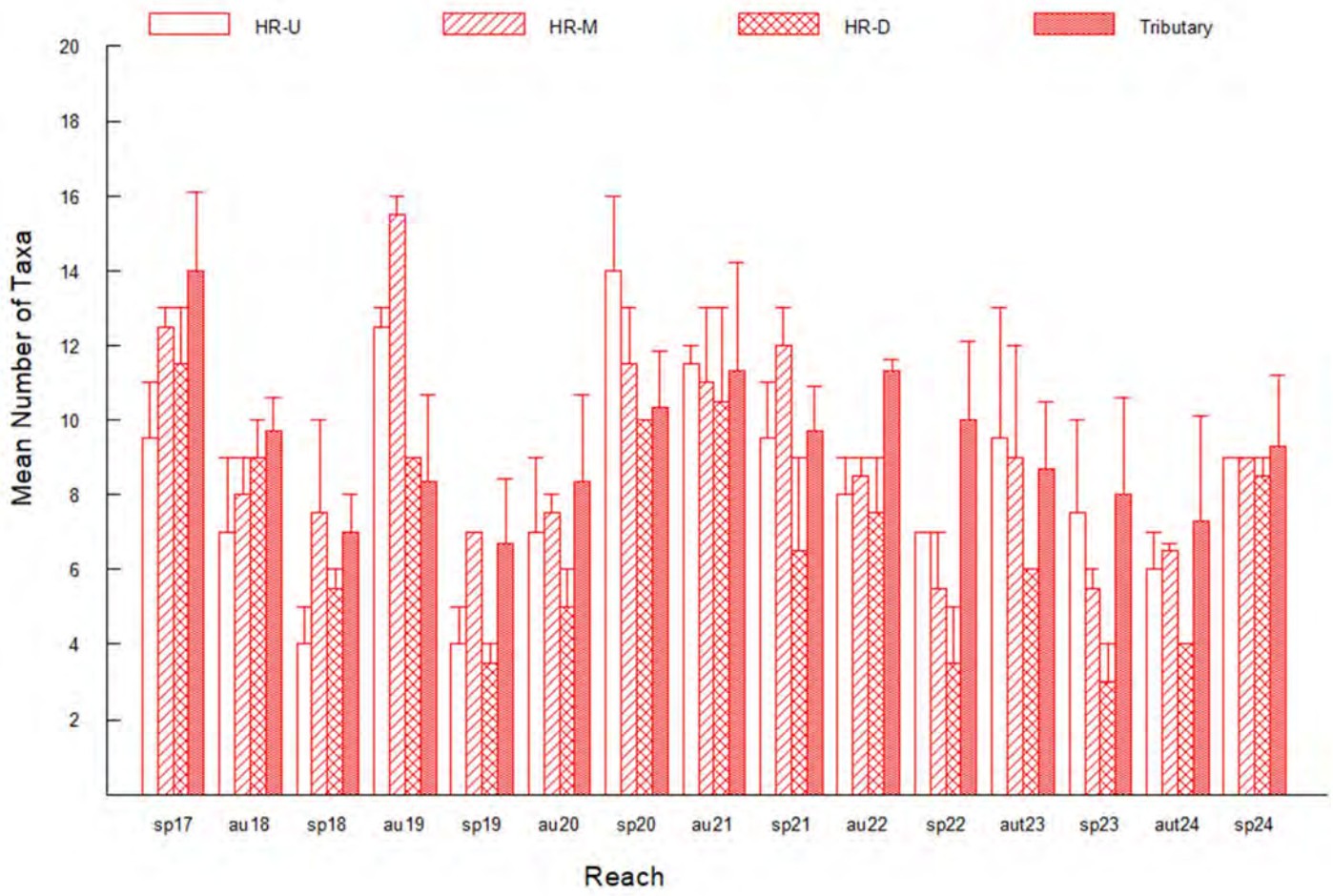

Figure 5. Mean number of taxa collected from edge habitat within the river (*n* =2 sites) and tributary (*n* = 3 sites) reaches between spring 2017 and spring 2024.

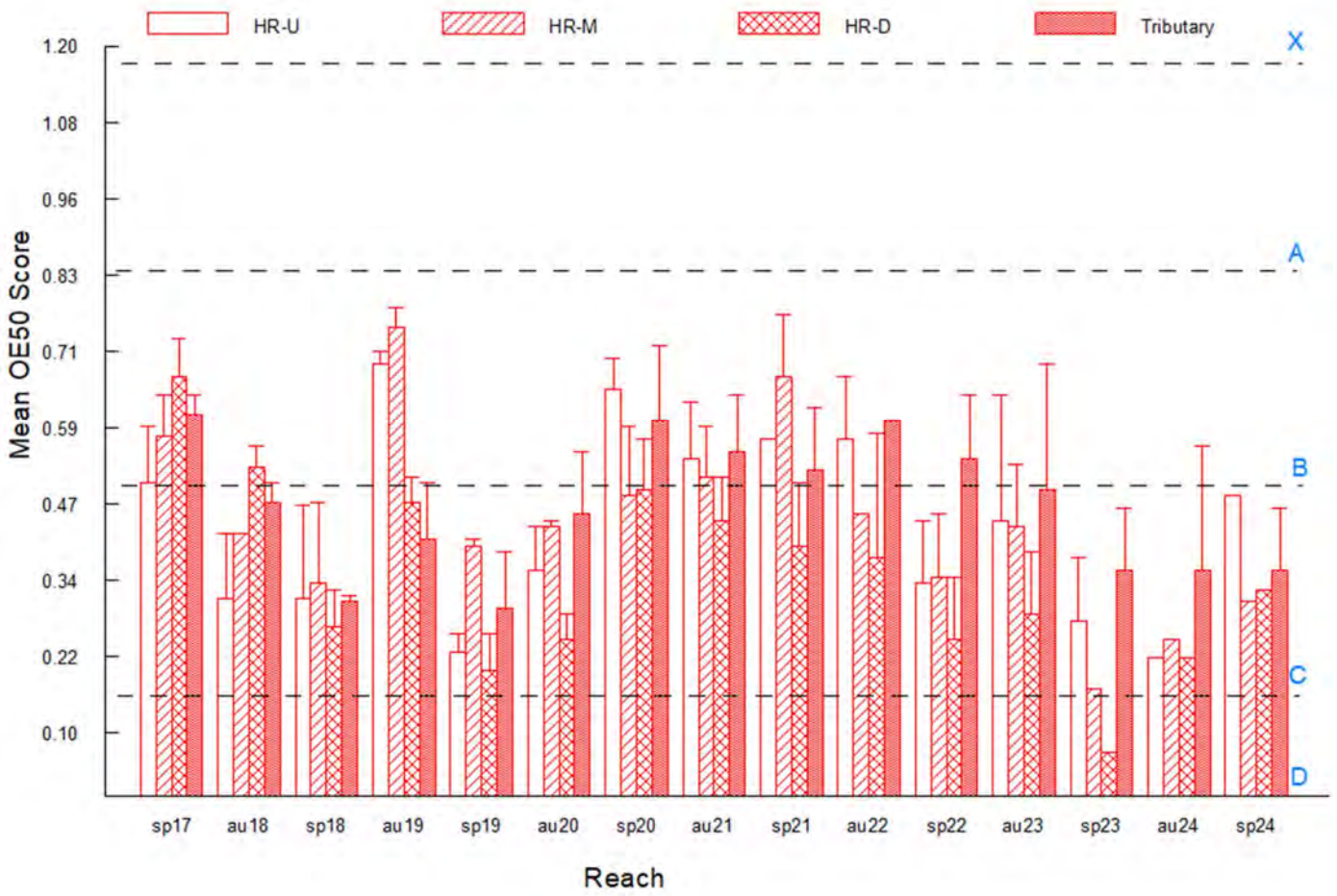

Figure 6. Mean OE50 Taxa Scores and their respective Band Scores (B-C) for AUSRIVAS samples collected between spring 2017 and spring 2024.

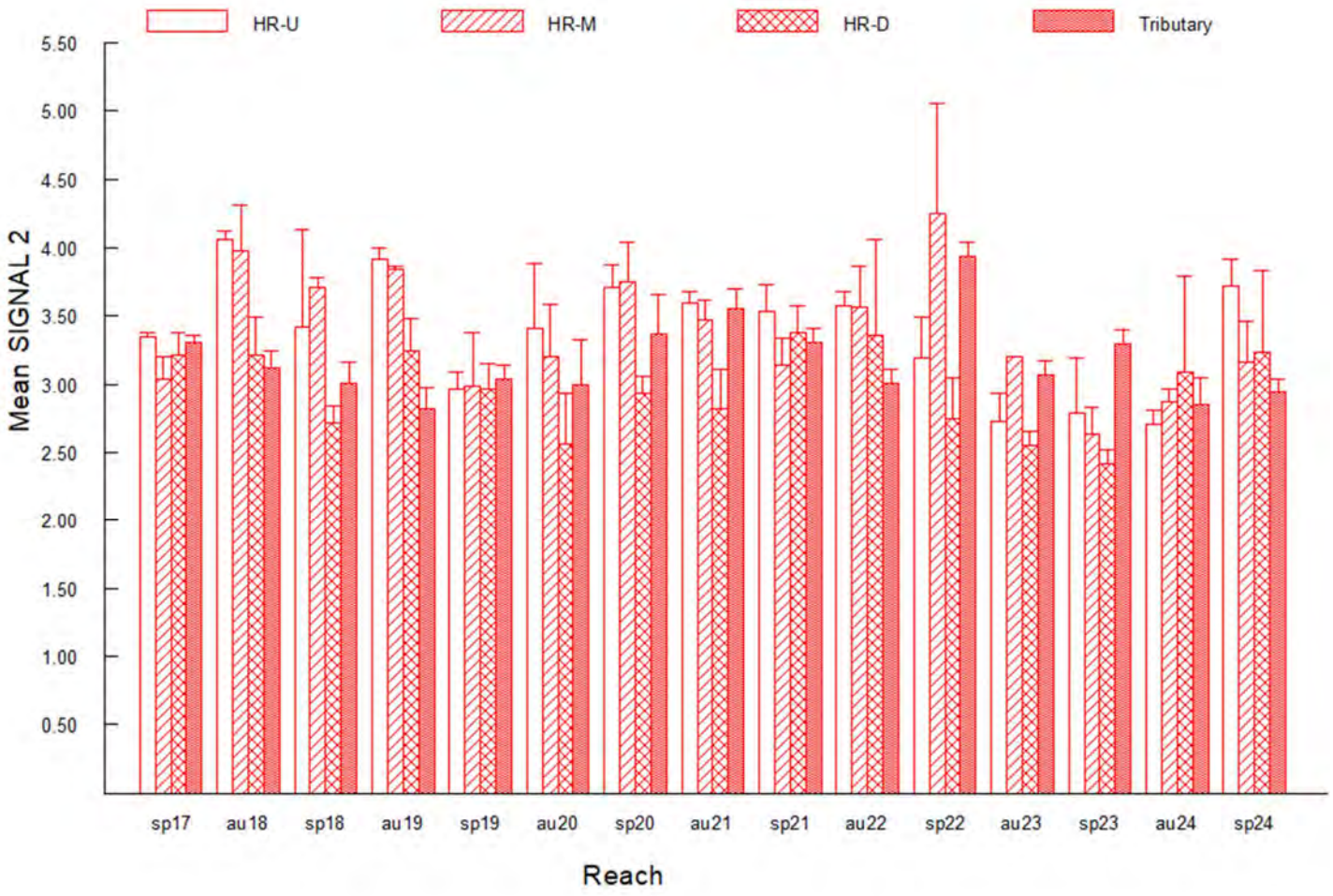

Figure 7. Mean SIGNAL2 Indices for AUSRIVAS samples collected from edge habitat at each site between spring 2017 and spring 2024.

3.4 Fish

Five species of fish (including two introduced species), freshwater shrimp and freshwater prawns were recorded at the four sites able to be sampled for fish at the time of the spring 2024 survey (Table 13). Eels (ranging between 40-70 cm in length) were observed/caught at two of the six Hunter River sites sampled and at Muscle Creel (Table 13). Carp (up to ~ 50 cm in length) were caught/observed at Site HR1, HR5 and MC (Table 13). Mosquito Fish (*Gambusia holbrooki*) were collected at Site HR3, MC and SC at the time of the spring 2024 survey (Table 13). Freshwater shrimps (Atyidae) and freshwater prawns (Palaemonidae) were also collected.

Altogether, ten[9] species of fish, including eight native and two alien species, have been collected at the sites sampled since spring 2017 (Table 14). Most notably, a platypus (*Ornithorhynchus anatinus*) was collected in fyke nets set at Site HR1 in autumn 2021. Carp, Flat head gudgeon and Australian smelt were collected at Sandy Creek for the first time in autumn 2024 (Table 14).

All 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 10) or by previous surveys (McDowall, 1996; DPI NSW 2006; Howell and Creese, 2010).

[9] One dead individual observed at Site HR1 in spring 2019 was incorrectly identified as a Wild goldfish (*Carassius auratus*), instead of Common carp.

Table 5. Species of fish and crustaceans observed and/or collected using a Backpack Electrofisher (at sites HR1, HR2, HR5 and MC) and Dip nets in spring 2024 survey (16&17 October 2024).

Species	Common Name	HR1	HR2	HR3 [B]	HR4[B]	HR5 [B]	HR6[B]	MC	SC[A]	DB[B]
Anguilla reinhardtii	Long-finned eel		√			√		√		
Anguilla australis	Short-finned eel									
Cyprinus carpio	Common carp*	√				√		√		
Gambusia holbrooki	Mosquito fish*			√				√	√	
Gobiomorphus australis	Striped gudgeon		√							
Macquaria novemaculeata	Australian bass									
Mugil cephalus	Sea mullet					√				
Philypnodon grandiceps	Flat head gudgeon									
Retropinna semoni	Australian smelt									
Tandanus tandanus	Freshwater catfish									
Emydura macquarii	Eastern short-neck turtle									
Atyidae sp.	Freshwater shrimps	√	√	√		√		√	√	
Palaemonidae sp.	Freshwater prawns	√				√		√		

*Non-native/Alien species.

[A]Unable to be electrofished due to elevated levels of conductivity.

[B]Sites HR3, HR4, HR6 and DB were unable to be electrofished during spring 2024 due to rain at the time of sampling and/or flow was too fast. Species listed were either observed or collected in Dip Net samples.

Table 13. Species of fish and crustaceans collected/observed at the survey sites between spring 2017 and autumn 2024.

Species	Common Name	HR1	HR2	HR3	HR4	HR5	HR6	MC	SC[A]	DB[B]
Anguilla reinhardtii	Long-finned eel	√	√	√	√	√	√	√		√
Cyprinus carpio	Common carp*	√	√	√	√	√	√	√		√
Gobiomorphus australis	Striped gudgeon	√	√	√		√	√			
Macquaria novemaculeata	Australian bass	√	√	√		√	√			√
Mugil cephalus	Sea mullet			√	√		√			
Gambusia holbrooki	Mosquito fish*	√	√	√	√	√	√	√	√	√
Philypnodon grandiceps	Flat head gudgeon		√	√		√				
Hypseleotris klunzingeri	Western carp gudgeon				√					
Retropinna semoni	Australian smelt	√	√	√	√	√	√			
Tandanus tandanus	Freshwater catfish	√				√				
Emydura macquarii	Eastern short-neck turtle			√						
Atyidae sp.	Freshwater shrimps	√	√	√	√	√	√	√	√	√
Palaemonidae sp.	Freshwater prawns	√	√	√	√	√	√	√	√	√

*Non-native/Alien species.

[A]Sandy Creek was unable to be electrofished in spring 2021, autumn 2021, spring 2020, autumn 2020, spring 2019, autumn 2019, spring 2018, autumn 2018, autumn 2022, autumn 2023 and autumn 2024 due to elevated levels of conductivity.

[B]Dartbrook was unable to be electrofished in autumn 2023, mostly likely due to elevated levels of conductivity

5.0 DISCUSSION

Discharges at the MPO will be undertaken in accordance with the Hunter River Salinity Trading Scheme (HRSTS) and EPL 20850. MACH Energy currently holds 51 discharge credits as of June 2023. As of June 2023, MPO has an established HRSTS Discharge Point however, no discharges have been made to date. Two Sediment Dam releases have been made to the eastern portion of the MPO area, on 8/03/2022 and 21/10/2022.

5.1 Aquatic Habitat

Aquatic habitat and fauna in sections of the Hunter River and tributaries within the Study Area have experienced some degree of environmental stress prior to commencement of the Mount Pleasant Operation (January 2018) and continues to do so. For instance, a large section of the stream bank at Site HR2, situated upstream of the mine, had collapsed into the Hunter River since the previous survey (autumn 2024). Elevated sediment loads can lead to decreased light available for submerged aquatic vegetation, smothering of benthic organisms and habitats (such as riffles, deep holes and spawning grounds for fish), among others. Exotic plants, including Willows have been a dominant component of the riparian vegetation for decades: although willows can be effective at stabilising stream banks, their invasive nature results in thickets that grow into the channel and block its flow and capacity, diverting water around and out of the main watercourse causing flooding and additional erosion (Cremer et al., 1995; Cremer, 2003).

Nevertheless, deep pools, large woody debris and assemblages of emergent macrophyte continue to provide important habitat for many species of native fish at the study sites (including Australian bass, Long-finned eels, Australian smelt, mullet and gudgeons).

The western portion of the MPO lies within the Sandy Creek catchment. Similar to the findings of surveys done since autumn 2023, the stream channel between previously isolated pools was inundated and flow was apparent in spring 2024, improving connectivity along the creek and salinity (5,008 µS/cm at the time of the spring 2024 survey compared to 11,200 µS/cm during spring 2019).

The overall condition of aquatic habitat at the study site in Sandy Creek (RCE scores range from 20/39% in spring 2018 to 36/69% in autumn 2023 and 2024 since monitoring commenced in spring 2017). In comparison, the overall condition of aquatic habitats in Muscle Creek and Dart Brook has ranged between 21 (40%) and 35 (67%) and 30 (58%) and 41 (79%), respectively.

5.2 Water Quality

Water quality patterns have generally been consistent with data collected prior to the commencement of operations at the MPO. Electrical conductivity has commonly exceeded the ANZECC/ARMCANZ (2000) guideline value (i.e., 350 µS/cm) at the Hunter River sites situated upstream of the MPO (i.e. Sites HR1 and HR2: range = 256 to 800 µS/cm) and the Tributary sites (Dartbrook: range = 980 to 5,905 µS/cm; Muscle Creek: range = 1163 to 2,799 µS/cm; Sandy Creek: range = 914 to 11,000 µS/cm), including prior to commencement of the Project and during the spring 2024 survey. This is not surprising given that the Hunter River catchment includes a large proportion of salt bearing sedimentary rocks and soils, and surface and underground drainage from this contributes natural salinity to the river (see Krogh et al., 2013). Importantly, conductivity levels measured at the sites situated downstream of MPO inputs continue to be within the ANZECC guideline values, and the range in values measured at those sites since the spring 2017 survey.

The pH levels measured at the Hunter River sites continue to show slightly alkaline values, particularly at the upstream sites sampled (Sites HR1 and HR2). Both sites, however, continue to be within the site-specific trigger criteria for that section of the Hunter River (i.e., 7.8 – 8.3). Similarly, pH levels measured in Dartbrook (range = 7.1 to 8.8) and Sandy Creek (range = 7.6 to 8.9) have commonly been slightly alkaline.

5.3 Aquatic Macroinvertebrates

A total of 23 taxon were identified from edge habitat samples collected at the nine sites sampled in spring 2024. Throughout the survey period, the mean number of taxa sampled within each of the study reaches (i.e., HR-U, HR-M, HR-DS and Tributary) has ranged from 3.0 (± 1.0) (HR-D in spring 2023) to 15.5 (± 0.5) (HR-M in autumn 2019).

The relatively low number of species collected by this and previous investigations (including prior to commencement of mining at the MPO), indicate that the macroinvertebrate assemblage has experienced some degree of environmental stress. This is evident in the OE50 Taxa Scores and Band levels obtained.

As discussed previously, lower than expected taxa scores are almost certainly related to the compounding effects from exposure to multiple historical stressors, including flow alteration, sedimentation, salinity, nutrient inputs, hydraulic disturbance and predation by exotic species of fish, such as Mosquito fish and Carp. Nevertheless, some pollution sensitive taxa have commonly been present, such as caddis fly and mayfly families, including at the time of the current survey. Importantly for this stream health study, none of the PERMANOVA tests indicated a change in spring 2024 that could be attributed to a MPO related impact.

5.4 Fish

Altogether ten species of fish have been collected at the sites sampled since spring 2017, including Australian bass, Long-finned eels, native gudgeons, Common carp and Mosquito fish. Eastern short-neck turtles and a platypus (*Ornithorhynchus anatinus*) have also been captured and released. The section of the Hunter River within the Study Area is classified as Class 1, Type 1 fish habitat. As discussed above, the distribution and abundance of Carp within the Hunter River appears to have increased considerably since the autumn 2023 survey. Numbers appear similar to those recorded prior to flood flows during spring 2021.

No threatened species of fish listed under the NSW FM Act or the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) have been observed using electrofishing, fyke nets or bait traps at the sites sampled in the Hunter River, or electrofishing in Muscle Creek, Sandy Creek or Dart Brook by this sampling programme or by previous surveys (McDowall, 1996; DPI NSW 2006; Howell and Creese, 2010).

5.5 Stream Health Performance Indicators

Of the two sites sampled on the Hunter River to assess changes (if any) associated with the MPO, Site HR3 has consistently scored below its indicator criteria (Band A) while Site HR4 (Band B) has scored lower on twelve out of the fifteen (80%) sampling occasions. Similarly, band of impairment scores obtained at the 'control' sites sampled (i.e. at Muscle Creek and Dart Brook) have been lower than their indicator criteria on numerous occasions.

Importantly, formal analyses have not detected any statistically significant changes in the stream health performance indicators that could be indicative of an impact associated with the MPO. Furthermore, the MPO continues to be a nil discharge site. Therefore, it is not considered appropriate for MACH Energy to initiate a stream health investigation under the SGWRP, in accordance with the SWMP.

6.0 CONCLUSIONS & RECOMMENDATIONS

There was no evidence to suggest a change in macroinvertebrate indicators occurred at HR3, HR4, HR5 or HR6 in spring 2024 that could be associated with the MPO. Where changes did occur, they were comparable with those that occurred upstream at control site's HR1 and HR2 and at the Tributary sites (i.e., DB, MC and SC).

The MPO is licenced to discharge via HRSTS but no discharge has been made to date.

For these reasons, it is not considered necessary for MACH Energy to initiate a stream health investigation under their Surface and Ground Water Response Plan, particularly since the MPO continues to be a nil discharge site. It is recommended that the stream health monitoring programme is continued using the methods employed for baseline and operation phase surveys, to ensure continuity of the programme.

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APPENDICES

Appendix 1 - GPS positions (UTMs) for stream monitoring sites (spring 2024).

Watercourse	Site Code	Easting	Northing
Hunter River	HR1	0299759	6435349
	HR2	0299779	6434790
	HR3	0300136	6430786
	HR4	0300732	6429275
	HR5	0293706	6424216
	HR6	0292353	6423065
Dart Brook	DB	0298881	6436241
Muscle Creek	MC	0301148	6427955
Sandy Creek	SC	0289157	6428193

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

Appendix 3 - Water Quality Data (spring 2024)

Indicator Variable	HR1-1	HR1-2	HR1-3	HR2-1	HR2-2	HR2-3	HR3-1	HR3-2	HR3-3
Temperature °C	17.09	17.09	17.09	17.07	17.06	17.07	17.11	17.11	17.11
pH	7.94	7.95	7.96	7.96	7.97	7.97	7.91	7.91	7.91
Conductivity (µS/cm)	631	630	630	714	715	714	734	735	735
Dissolved Oxygen (% Saturation)	79.9	81.4	82.3	80.4	81.3	82.1	76.3	76.7	76.9
Turbidity (NTU)	11.2	10.6	10.4	12.3	12.8	12.3	16.7	17.2	16.3
Alkalinity	70			70			70		
	HR4-1	**HR4-2**	**HR4-3**	**HR5-1**	**HR5-2**	**HR5-3**	**HR6-1**	**HR6-2**	**HR6-3**
Temperature °C	17	17.01	17	17.5	17.5	17.49	17.2	17.2	17.2
pH	7.79	7.79	7.79	7.93	7.93	7.93	7.72	7.73	7.73
Conductivity (µS/cm)	770	771	771	869	869	869	917	918	918
Dissolved Oxygen (% Saturation)	76.3	76.7	77	74.1	74.7	75.3	66	66.2	66.4
Turbidity (NTU)	25.4	22.6	20.8	27.1	25.7	27.6	33	31.3	31.8
Alkalinity	80			80			80		
	DB-1	**DB-2**	**DB-3**	**MC-1**	**MC-2**	**MC-3**	**SC-1**	**SC-2**	**SC-3**
Temperature °C	16.91	16.91	16.9	16.79	16.78	16.78	14.91	14.92	14.92
pH	7.87	7.87	7.87	7.48	7.48	7.49	7.53	7.54	7.54
Conductivity (µS/cm)	1051	1051	1051	2000	2000	2000	5009	5008	5006
Dissolved Oxygen (% Saturation)	70.7	70.6	70.6	56.8	57.1	57.5	55.3	55.4	55.5
Turbidity (NTU)	14	15.7	14.7	21	21.5	21.4	12.9	14.2	12.6
Alkalinity	N/R			100			100		

N/R: Not Recorded

Appendix 4 - Macroinvertebrate taxa collected using the AUSRIVAS protocol (spring 2024).

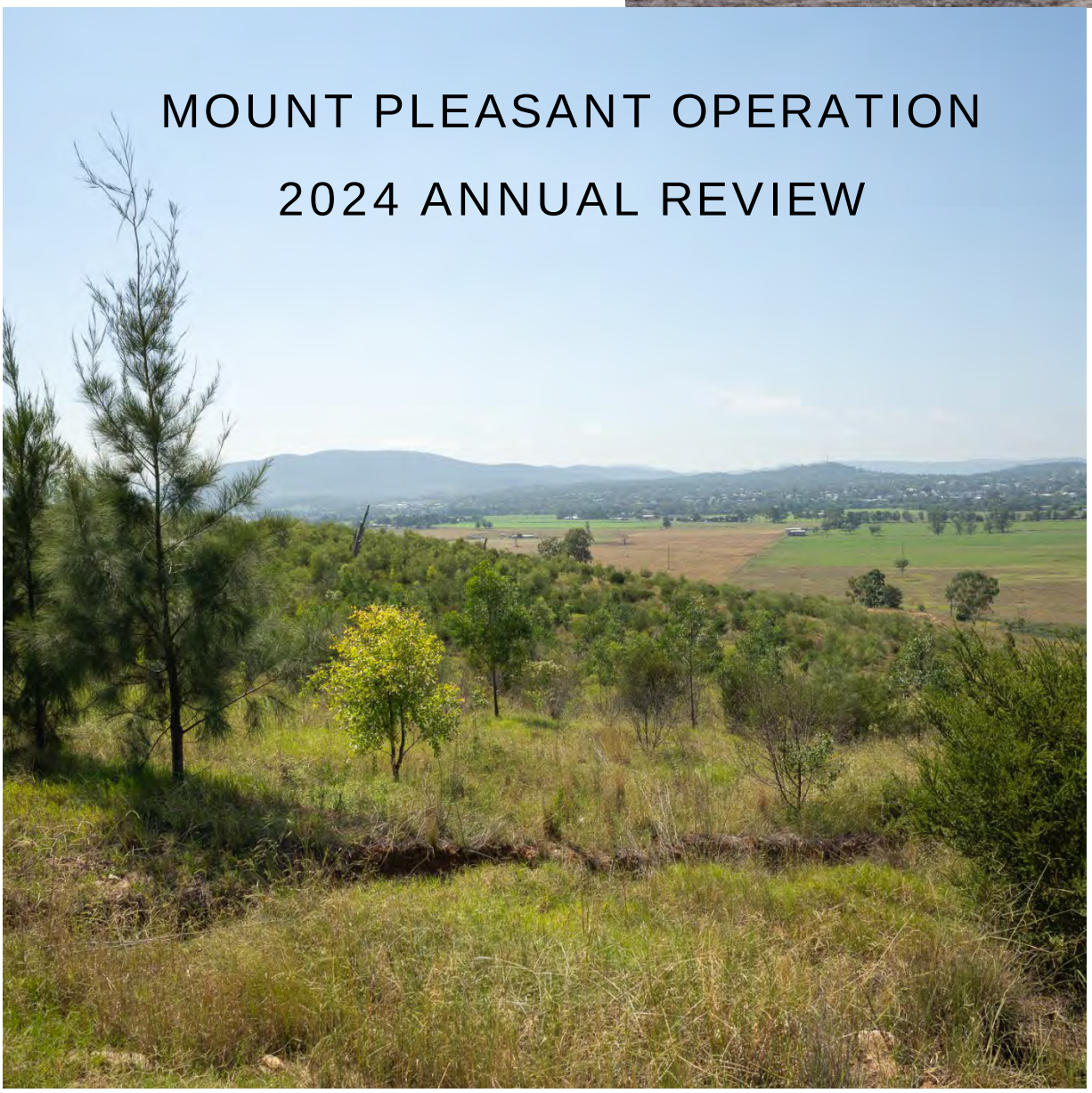
Taxa	HR-1	HR-2	HR-3	HR-4	HR-5	HR-6	MC	SC	DB
Bithyniidae	0	0	0	0	0	0	1	0	0
Physidae	0	0	0	2	0	0	1	1	1
Acariformes	0	0	0	0	0	0	0	1	0
Atyidae	20	7	10	0	5	0	5	18	0
Baetidae	1	4	1	1	0	3	0	0	4
Caenidae	12	8	4	0	2	3	0	0	3
Leptophlebiidae	0	3	0	0	0	0	0	0	0
Coenagrionidae	0	1	1	2	1	1	2	4	0
Libellulidae	1	0	0	0	0	0	0	2	0
Corixidae	19	22	20	9	20	10	1	0	25
Mesoveliidae	0	0	0	1	0	0	0	0	0
Dytiscidae	0	0	4	1	4	0	0	8	3
Elmidae	0	0	0	3	0	0	0	0	0
Gyrinidae	0	0	0	0	0	0	0	1	0
Hydraenidae	0	0	0	0	0	0	0	1	0
Hydrophilidae	0	1	1	0	1	0	0	0	0
Hydroptilidae	3	0	0	0	0	0	0	0	0
Hypogastruridae	0	0	0	0	0	0	0	1	0
Chironomidae - Chironominae	3	2	0	11	2	3	13	10	2
Chironomidae - Tanypodinae	3	0	0	0	0	1	0	1	1
Stratiomyidae	0	0	1	0	0	2	2	4	0
Tipulidae	0	0	0	0	0	1	0	0	0
Leptoceridae	21	6	1	5	1	8	1	3	0
Number of Taxa	**9**	**9**	**9**	**9**	**8**	**9**	**8**	**13**	**7**
Gambusia	0	0	3	0	0	0	0	0	2

MACH Energy



MOUNT PLEASANT OPERATION

2024 ANNUAL REVIEW



Company:	MACH Energy Australia Pty Ltd		
Effective Date:	31 March 2025	**Status:**	Approved
Approved By:	Michael Redman	**Revision Number:**	00

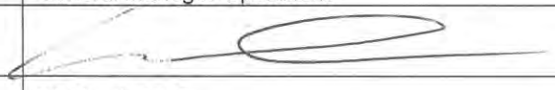
MOUNT PLEASANT OPERATION 2023 ANNUAL REVIEW	
Name of Operation	Mount Pleasant Operation
Name of Operator	MACH Energy Australia Pty Ltd
Development Consent	Development Consent DA 92/97 Development Consent SSD 10418
Name of Holder of Development Consent	MACH Energy Australia Pty Ltd
Mining Leases	Mining Lease 1645, Mining Lease 1708, Mining Lease 1709, Mining Lease 1713, Mining Lease 1750, Mining Lease 1808 and Mining Lease 1829.
Name of Holder of Mining Leases	MACH Energy Australia Pty Ltd J.C.D 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
Annual Review Start Date	1 January 2024
Annual Review End Date	31 December 2024

I, Michael Redman, 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 2024 and that I am authorised to make this statement on behalf of MACH Energy Australia Pty Ltd.

Note.

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

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

Name of Authorised Reporting Officer	Michael Redman
Title of Authorised Reporting Officer	General Manager Operations
Signature of Authorised Reporting Officer	
Date	31 March 2025

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 2024) is provided in Table SoC-1.

Table SoC-1
Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Development Consent DA 92/97	No
Development Consent SSD 10418	No
EPBC 2011/5795	Yes
EPBC 2020/8735*	Yes
Environment Protection Licence 20850	No
Authorisation 459	Yes
Mining Lease 1645	Yes
Mining Lease 1708	Yes
Mining Lease 1709	Yes
Mining Lease 1713	Yes
Mining Lease 1750	Yes
Mining Lease 1808	Yes
Mining Lease 1829	Yes
Water licences (as per Table 3)	Yes
Bore Licence Certificate 20BL168734	Yes

*EPBC 2020/8735 approved 24 September 2024 aligned with disturbance with Development Consent SSD 10418.

Non-compliances are characterised as shown in Table SoC-2. Table SoC-3 summarises non-compliances with the approval conditions. During the reporting period, there were four observations that resulted in non-compliances against approval conditions (Table SoC-3).

Table SoC-2
Compliance Status Key for Table SoC-3 – 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: • potential for serious environmental consequences, but is unlikely to occur; or • potential for moderate environmental consequences, but is likely to occur.
Low	Non-compliant	Non-compliance with: • potential for moderate environmental consequences, but is unlikely to occur; or • potential for low environmental consequences, but is likely to occur.
Administrative Non-compliance	Non-compliant	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).

Table SoC-3
Summary of Non-Compliances

Relevant Approval	Condition Number	Condition Description	Compliance Status	Comment	Report Section
Development Consent SSD 10418 Development Consent DA 92/97	B52 (iv) S3 C28	Water Management Plant to include (iv) Groundwater Management Plan The GWMP commits to including reporting on elevation at each bore with water levels being presented in Australian Height Datum (AHD) and depth in the Annual Review.	NC (Low risk)	See Table 34	Section 10.2
Development Consent SSD 10418	B55 B56	The Applicant must retire the biodiversity credits specified in Table 7, unless otherwise agreed by the Planning Secretary in consultation with BCD. The retirement of credits must be carried out in consultation with BCD and in accordance with the Biodiversity Offsets Scheme of the BC Act. Prior to disturbance within the Development Footprint 1 (Stage 1) (as shown on Figure 9 in Appendix 2) the Applicant must retire the Stage 1 credits as specified in Table 7.	NC (Low risk)	See Table 34	Section 10.2
EPL 20850	M2.1 M2.2	For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns The licensee must continuously monitor PM10 at Point 1 and 2.	NC (Low risk)	See Table 34	Section 10.2
EPL 20850	M4.1	The licensee must continuously monitor weather parameters at Point 11 and 4.	NC (Low risk)	See Table 34	Section 10.2
EPL 20850	M9.1	The licensee must record the average PM10 concentration at Monitoring Points 1 and 2 at intervals of 10 minutes. This data must be made available upon request by any authorised officer of the EPA who asks to see them.	NC (Low risk)	See Table 34	Section 10.2
Mining Lease (ML) Standard Conditions	C16 (3)(b)	(3) If a document is published on the website of the holder of the mining lease, the holder must ensure that it is published— (b) for a forward program or an annual rehabilitation report—within 14 days after it is given to the Secretary or amended,	NC (Low risk)	See Table 34	Section 10.2

TABLE OF CONTENTS

1. INTRODUCTION 1
1.1 PURPOSE AND SCOPE 5
1.2 KEY PERSONNEL 5
2 APPROVALS 6
2.1 MANAGEMENT PLANS 9
3 OPERATIONS SUMMARY 10
3.1 MINING OPERATIONS 10
3.2 OTHER OPERATIONS 11
3.3 ACTIVITIES FORECAST FOR THE NEXT REPORTING PERIOD 11
4 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW 18
5 ENVIRONMENTAL PERFORMANCE 19
5.1 METEOROLOGY 19
5.1.1 Rainfall 19
5.1.2 Temperature 19
5.1.3 Wind Speed and Direction 19
5.2 NOISE 24
5.2.1 Approval Criteria and Management Plan Requirements 24
5.2.2 Performance During the Reporting Period 28
5.2.3 Trends and Key Management Implications 30
5.2.4 Implemented or Proposed Management Actions 30
5.3 BLASTING 31
5.3.1 Approval Criteria and Management Plan Requirements 31
5.3.2 Performance During the Reporting Period 31
5.3.3 Trends and Key Management Implications 34
5.3.4 Implemented or Proposed Management Actions 34
5.4 AIR QUALITY 34
5.4.1 Approval Criteria and Management Plan Requirements 34
5.4.2 Performance During the Reporting Period 37
5.4.3 Trends and Key Management Implications 43
5.4.4 Implemented or Proposed Management Actions 48
5.5 BIODIVERSITY 48
5.5.1 Approval Criteria and Management Plan Requirements 48
5.5.2 Implemented or Proposed Management Actions 49
5.6 HERITAGE 50
5.6.1 Approval Criteria and Management Plan Requirements 50
5.6.2 Implemented or Proposed Management Actions 50
5.7 EXPLORATION 51
5.8 WASTE 51

5.9 TOPSOIL MANAGEMENT 53
5.10 VISUAL AMENITY AND LIGHTING 55
5.11 CONTAMINATED LAND 55
5.12 SPONTANEOUS COMBUSTION MANAGEMENT 55
5.13 GEOCHEMISTRY 56
6 WATER MANAGEMENT 57
6.1 SURFACE WATER 59
6.1.1 Approval Criteria 59
6.1.2 Performance During the Reporting Period 61
6.1.3 Trends and Key Management Implications 70
6.2 GROUNDWATER 72
6.2.1 Approval Criteria and Management Plan Requirements 72
6.2.2 Performance During the Reporting Period 76
6.3 HUNTER RIVER SALINITY TRADING SCHEME DISCHARGES 83
6.4 WATER TAKE 83
6.5 SITE WATER BALANCE 84
7 REHABILITATION 85
7.1 EROSION AND SEDIMENT MANAGEMENT 87
7.2 BUSHFIRE MANAGEMENT 88
7.3 REHABILITATION MONITORING 88
7.4 LAND MANAGEMENT 89
8 COMMUNITY 89
8.1 COMMUNICATION 89
8.2 CONSULTATION AND ENGAGEMENT 91
8.3 COMMUNITY DEVELOPMENT 95
8.4 RELATIONSHIPS WITH LOCAL ABORIGINAL COMMUNITY 96
8.5 OTHER CONTRIBUTIONS TO COMMUNITY 96
9 INDEPENDENT ENVIRONMENTAL AUDIT 97
10 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD 98
10.1 ENVIRONMENTAL INCIDENTS 98
10.2 NON-COMPLIANCES 98
11 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD 101
12 REFERENCES 102

LIST OF FIGURES

Figure 1 Regional Location

Figure 2 2024 Mining Activities

Figure 3 Noise and Meteorological Monitoring Sites

Figure 4 Blast Monitoring Sites

Figure 5 Air Quality Monitoring Sites

Figure 6 Topsoil Stockpile Locations

Figure 7 Surface Water and Groundwater Monitoring Locations

LIST OF TABLES

Table 1 Key Personnel

Table 2 Consent, Lease and Licence Details

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

Table 4 Approved Management Plans

Table 5 Production Summary

Table 6 Key Operational Conditions Met

Table 7 Rainfall Summary 2024

Table 8 Temperature Summary 2024

Table 9 Development Consent DA 92/97Noise Impact Assessment Criteria (dBA)

Table 10 Development Consent DA 92/97 Cumulative Noise Criteria (dBA)

Table 11 Development Consent DA 92/97 Construction Noise Criteria (dBA)

Table 12 Development Consent SSD 10418 Construction Noise Criteria (dBA)

Table 13 Noise Monitoring Locations

Table 14 Assessment Criteria for Blasting

Table 15 Comparison of SSD EIS Predictions and 2024 Raw Monitoring Data

Table 16 Approval Criteria for Particulate Matter

Table 17 Greenhouse Gas performance Measures (SSD 10418)

Table 18 New Mobile Plant Summary

Table 19 MPO Emissions Summary Financial Year 2024

Table 20 MOD 3 Predictions Emission Summary for 2023 and 2024

Table 21 MPO Waste Data

Table 22 Surface Water Quality Trigger Levels

Table 23 Stream Health Trigger Levels

Table 24 Groundwater Triggers – Water Level

Table 25 Groundwater Triggers – Water Quality

Table 26 Results of Standing Water Level (mBGL)

Table 27 Results of Standing Water Level (mAHD)

LIST OF TABLES (CONTINUED)

Table 28 Summary of measured EC and pH in MPO monitoring bores during the reporting period

Table 29 MPO Water Take Licence Summary

Table 30 MPO Annual Water Balance

Table 31 Rehabilitation Status

Table 32 Aboriginal Community Development Fund Partnerships

Table 33 Summary of ongoing 2023 Independent Environmental Audit Recommendations and MACH Energy Responses

Table 34 Compliance Summary

LIST OF CHARTS

Chart 1 MPO Monthly and Cumulative Rainfall 2024

Chart 2 MPO Monthly Mean Temperature 2024

Chart 3 MPO Annual Wind Rose APF-4 2024

Chart 4 2024 Annual Average Insoluble Solids

Chart 5 2014 – 2024 Annual Average Insoluble Solids

Chart 6 24-hour Average PM_{10} Levels

Chart 7 24-hour Average $PM_{2.5}$ Levels

Chart 8 Annual Average PM_{10} Levels

Chart 9 Annual Average $PM_{2.5}$ Levels

Chart 10 Annual Average TSP Levels

Chart 11 Hunter River pH Levels 2024

Chart 12 Hunter River pH Levels 2017–2024

Chart 13 Hunter River EC Levels 2024

Chart 14 Hunter River EC Levels 2017–2024

Chart 15 Hunter River TSS Levels 2024

Chart 16 Hunter River TSS Levels 2017–2024

Chart 17 Hunter River TDS Levels 2024

Chart 18 Hunter River TDS levels 2017-2024

Chart 19 Sandy, Muscle and Rosebrook Creeks pH Levels 2024

Chart 20 Sandy, Muscle and Rosebrook Creeks pH Levels 2017–2024

Chart 21 Sandy, Muscle and Rosebrook Creeks EC Levels 2024

Chart 22 Sandy, Muscle and Rosebrook Creeks EC Levels 2017–2024

Chart 23 Sandy, Muscle and Rosebrook Creeks TSS Levels 2024

Chart 24 Sandy, Muscle and Rosebrook Creeks TSS Levels 2017–2024

Chart 25 Sandy, Muscle and Rosebrook Creeks TDS Levels 2024

Chart 26 Sandy, Muscle and Rosebrook Creeks TDS Levels 2017–2024

Chart 27 Complaints Analysis 2017–2024

Chart 28 Complaints by Type 2024

LIST OF PLATES

Plate 1	Eastern Out of Pit Emplacement Rehabilitation
Plate 2	The CCC Visit the Fines Emplacement Area
Plate 3	The CCC Visit the Warrawee Nursery (October 2024)
Plate 4	NAIDOC Recognition at Mount Pleasant
Plate 5	Upper Hunter Mining Dialogue School Mine Tour 2024

LIST OF APPENDICES

Appendix A	Noise Monitoring Summary 2024
Appendix B	Blasting Summary 2024
Appendix C	Rail Movement Summary 2024
Appendix D	Mount Pleasant Operation – 2024 Annual Air Quality Review
Appendix E	Mount Pleasant Operation – 2024 Independent Environmental Audit Report

1. INTRODUCTION

The Mount Pleasant Operation (MPO) is located within the Upper Hunter Valley of New South Wales (NSW), approximately 3 kilometres (km) north-west of Muswellbrook and approximately 50 km north-west of Singleton (Figure 1). The villages of Aberdeen and locality of Kayuga are also located approximately 5 km north north-east and 1 km north of the MPO boundary, respectively (Figure 1). MACH Energy Australia Pty Ltd (MACH Energy) purchased the MPO from Coal & Allied Operations Pty Ltd (Coal & Allied) in 2016.

MACH Mount Pleasant Operations Pty Ltd is the manager of the MPO as agent for, and on behalf of, the unincorporated Mount Pleasant Joint Venture between MACH Energy (95 per cent [%] owner) and J.C.D. Australia Pty Ltd (5% owner).

The initial 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) (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. 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 operation 24 hours per day, seven days per week and 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 MPO Modification 1 (MOD 1) was submitted for approval on 19 May 2010. MOD 1 included 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 and modification of the existing Development Consent DA 92/97 boundaries to accommodate the optional conveyor/service corridor and minor administrative 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 Environmental Assessment (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. MOD 2 was approved on 29 March 2017.

The MPO Mine Optimisation Modification (MOD 3) was submitted on 31 May 2017. MOD 3 comprised an extension to the time limit on mining operations (to 22 December 2026) and extensions to the South Pit Eastern Out of Pit Emplacement to facilitate development of an improved final landform. MOD 3 was approved on 24 August 2018.

The MPO Rail Modification (MOD 4) was submitted on 18 December 2017. MOD 4 proposed the following changes:

- duplication of the approved rail spur, rail loop, conveyor and rail load-out facility and associated services;
- duplication of the Hunter River water supply pump station, water pipeline and associated electricity supply that followed the original rail spur alignment; and
- demolition and removal of the redundant approved infrastructure within the extent of the Bengalla Mine, once the new rail, product loading and water supply infrastructure has been commissioned and is fully operational.

MOD 4 was approved on 16 November 2018. Appendix 2 of the modified Development Consent DA 92/97 illustrates the Conceptual Project Layout Plan of the approved MPO at 2021 and 2025, Approved Surface Disturbance Plan and Conceptual Final Landform incorporating the MOD 4 infrastructure relocations (Development Consent DA 92/97 Attachment 1). MOD 4 residual construction works were completed during the reporting period.

Modification 5 (MOD 5) was submitted to rectify an administrative error in Development Consent DA 92/97 and was approved by the NSW Department of Planning and Environment (DPE) (formerly Department of Planning, Industry and Environment [DPIE]) on 29 June 2022.

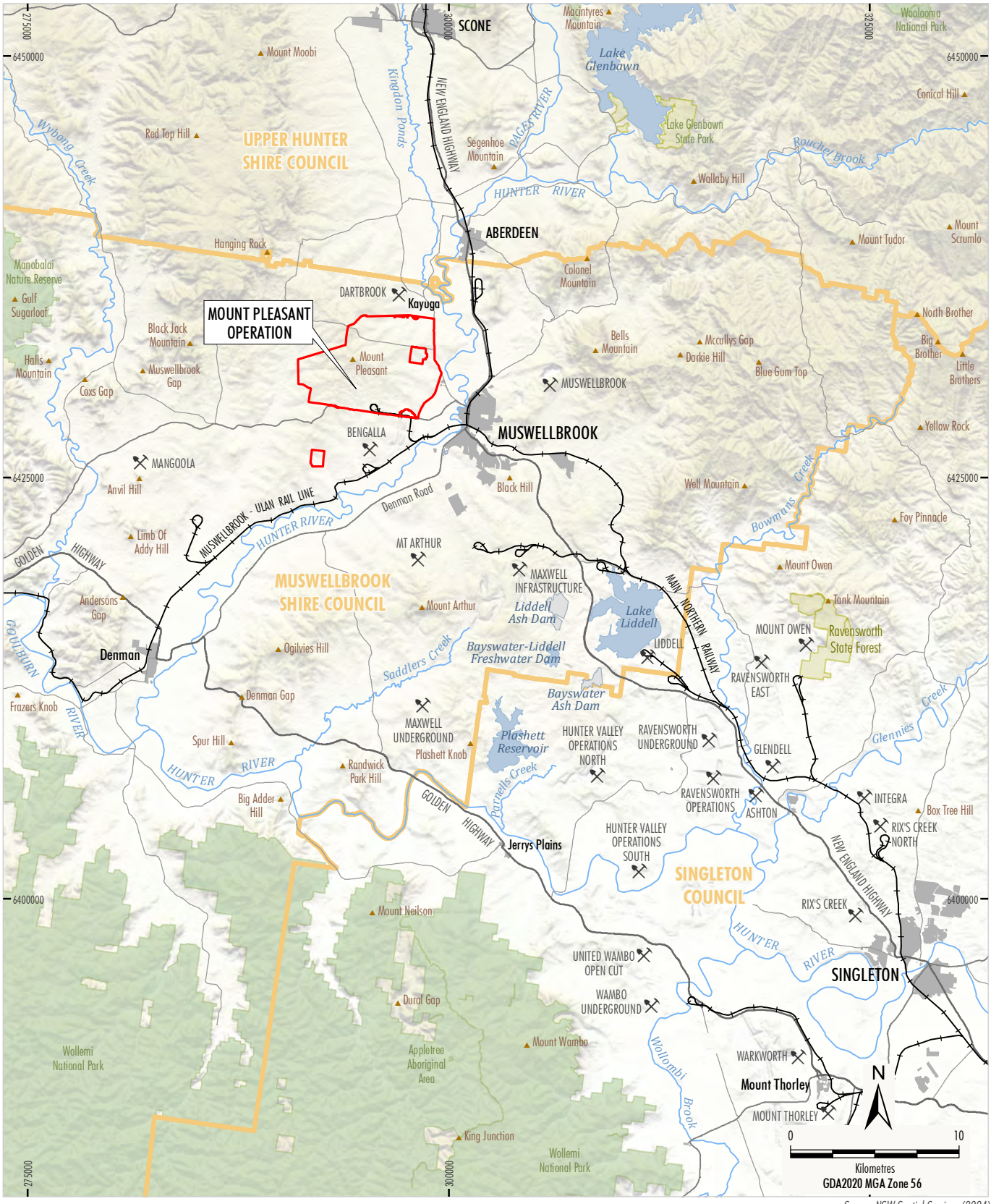
Following the approval of MOD 5, MACH Energy completed a review of its approved Environmental Management Strategy and management plans in accordance with Condition 4(d), Schedule 5 of the Development Consent DA 92/97. The review determined that no updates were required to the management plans.

Modification 6 (MOD 6) was submitted to modify Development Consent DA 92/97 and was approved on 6 November 2023 by DPE (now the NSW Department of Planning, Housing and Infrastructure [DPHI]). MOD 6 will allow for the construction and operation of a re-transmission facility including a tower or mast, shed and associated transmission infrastructure to re-transmit local digital television signals from the Broadcast Australia site at Rossgole Lookout. Appendix 2 of the modified Development Consent DA 92/97 illustrates the Revised Approved Surface Disturbance Plan incorporating the MOD 6 infrastructure.

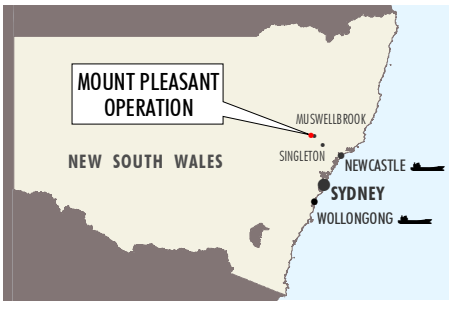
On 6 September 2022, the NSW Independent Planning Commission approved the development application for the Mount Pleasant Optimisation Project (SSD 10418), in accordance with Part 4 of the *NSW Environmental Planning and Assessment Act 1979*. The Mount Pleasant Optimisation Project extends the mine life of the existing MPO until 2048 by mining deeper coal reserves and extending part of the open cut areas. MACH Energy commenced development of Development Consent SSD 10418 on 12 February 2024.

This Annual Review reflects the currently approved MPO under MOD 6 of the Development Consent DA 92/97 (prior to its surrender), and the requirements of Development Consent SSD 10418 (Section 1.1).

Figure 2 shows the general arrangement of the MPO, as well as the extent of disturbance and rehabilitation at the end of 2024 and the forecast additional disturbance and rehabilitation proposed for 2025.



Source: NSW Spatial Services (2024)



LEGEND

- Mining Operation
- Railway
- Local Government Boundary
- State Forest/Reserve
- National Parks and Wildlife Estate
- Mining Lease Boundary (Mount Pleasant Operation)

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MOUNT PLEASANT OPERATION

Regional Location

Figure 1

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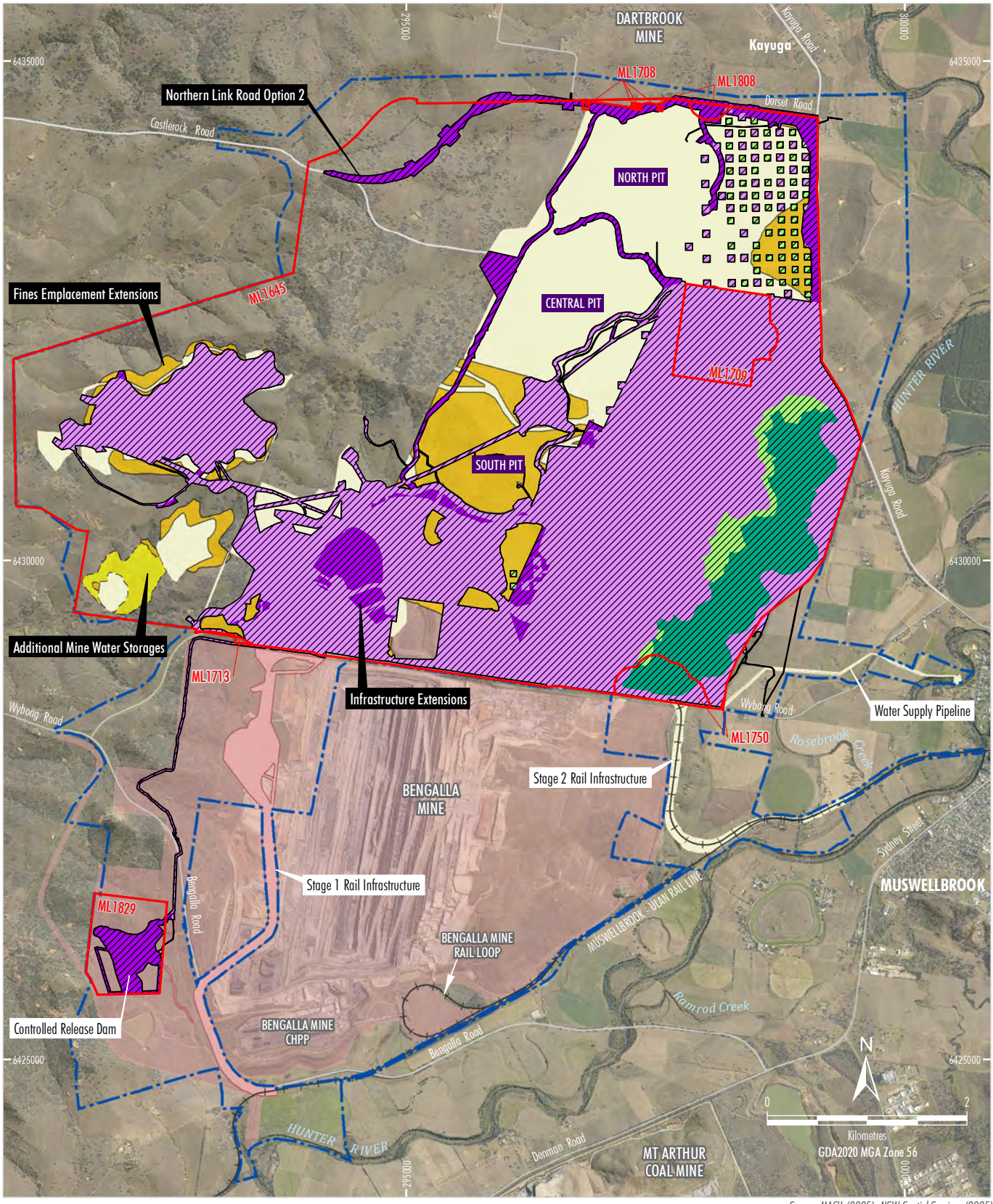

MAC-18-03A AR2024_2020

LEGEND

- Railway
- Development Application Area (SSD 10418)
- Mining Lease Boundary (Mount Pleasant Operation)
- Project Continuation of Existing/Approved Surface Development (DA92/97) [1]
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Existing/Approved Mount Pleasant Operation Infrastructure within Bengalla Mine Approved Disturbance Boundary (SSD-5170) [1]
- Development Footprint 1 (Stage 1) - General Extension Areas [1]
- Development Footprint 1 (Stage 2) - Mine Water Dam 3 [1]
- Foward Program 2025 Footprint
- End 2024 Active Mining Disturbance Area
- 2025 Forecast Disturbance Area
- End 2024 Rehabilitation Area
- 2025 Forecast Rehabilitation Area

NOTES

[1] Excludes some incidental Project components such as water management infrastructure, access tracks, topsoil stockpiles, power supply, temporary offices, other ancillary works and construction disturbance.

Source: MACH (2025); NSW Spatial Services (2025); Department of Planning and Environment (2016)
Orthophoto: MACH (Dec 2024)

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MOUNT PLEASANT OPERATION

2024 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 2024 to 31 December 2024. This Annual Review has been prepared in accordance with the DPE (now DPHI) *Post-approval requirements for State significant mining developments - Annual Review Guideline – October 2015* (DPE, 2015) and MACH Energy's statutory approvals (Section 2), specifically Condition 3, Schedule 5 of Development Consent DA 92/97 (prior to its surrender) and Condition D11, Schedule 2 of Development Consent SSD 10418.

Following commencement of development under Development Consent SSD 10418, and before the surrender of DA 92/97[1], the conditions of Development Consent SSD 10418 prevail to the extent of any inconsistency with the conditions of those consents.

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 the DPE (now DPHI) 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 (MSC) and members of the Community Consultative Committee (CCC). A copy of the Annual Review will be made publicly available on the MACH Energy website (https://machenergyaustralia.com.au/mount-pleasant/documentation/).

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	Michael Redman	1800 931 873
General Manager - Resource Development	Chris Lauritzen	
Environment and Community Manager	Lisa Richards	

[1] In accordance with Part A, Condition A14 of Development Consent SSD 10418, MACH Energy obtained written approval from the Planning Secretary allowing for a time extension to surrender Development Consent DA 92/97 by 12 February 2026.

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 Date	Expiry Date
Development Consent DA 92/97[1]	DPHI	22/12/1999	22/12/2026
Development Consent SSD 10418[2]	NSW IPC	06/09/2022	22/12/2048
EPBC Approval 2011/5795[3]	DCCEEW^	29/02/2012	28/10/2040
EPBC Approval 2020/8735	DCCEEW^	24/10/2024	22/12/2058
EPL 20850[4]	EPA	24/11/2016	-
Authorisation 459[5]	MEG	07/04/1992	07/04/2025
ML 1645	MEG	17/12/2010	17/12/2031
ML 1708	MEG	02/02/2015	02/02/2036
ML 1709	MEG	02/02/2015	02/02/2036
ML 1713	MEG	02/02/2015	02/02/2036
ML 1750	MEG	03/03/2017	03/03/2038
ML 1808	MEG	29/09/2020	29/09/2041
ML1829[6]	MEG	20/07/2023	10/02/2037
Bore Licence Certificate 20BL168734	DoI - L&W	13/03/2003	Perpetuity

Note:

EPBC = *Environment Protection and Biodiversity Conservation Act 1999*.

DCCEEW = Department of Climate Change, Energy, the Environment and Water.

EPL = Environment Protection Licence.

EPA = NSW Environment Protection Authority.

MEG = Mining, Exploration and Geosciences within the Department of Regional NSW (formerly Division of Resources and Geoscience); and DoI - L&W = NSW Department of Industry – Lands & Water.

NSW IPC = NSW Independent Planning Commission.

^ Commonwealth Department of Agriculture, Water and the Environment (formerly Commonwealth Department of the Environment and Energy) was superseded by DCCEEW on 1 July 2022.

1 Development Consent DA 92/97 has been modified six times since the original approval was granted in 1999. Approval for MOD 1 was granted on 19 September 2011, approval for MOD 2 was granted on 29 March 2017, approval for MOD 3 was granted on 24 August 2018, approval for MOD 4 was granted on 16 November 2018, approval for MOD 5 was granted on 29 June 2022 and approval for MOD 6 was granted 6 November 2023.

2 Development Consent SSD 10418 commenced on 12 February 2024.

3 EPBC Approval 2011/5795, originally granted on 29 February 2012, was extended from 28 October 2035 to 28 October 2040 on 16 November 2020. The approval was further varied on 24 January 2023 to incorporate Biodiversity Management Areas and their security.

4 EPL 20850 has been varied 16 times since original approval was granted in 2016. During the reporting period, the licence was varied on 4 December 2024 to include various changes to premises boundaries, monitoring points and administrative changes.

5 A renewal of this Authorisation was granted on 10 February 2023.

6 ML 1829 includes Bengalla Coal Mine operated land and is granted under agreement with Bengalla Coal Mine.

MACH Energy will continue to manage its existing Water Access Licences (WALs) (Table 3) and acquire new licences, as required during the next reporting period.

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

Water Access Licence WAL no.	Water Source	Type	Share (units)
879	Hunter Regulated River Water Source	Regulated River (High Security)	243
880			124
1113			366
973			3
638			225
High Security Subtotal			**961**
639	Hunter Regulated River Water Source	Regulated River (General Security)	134
974			210
988			156
1229			480
1227			99
992			75
7808			36
702			267
993			265
604			183
662			9
10775			243
41438			455
969			39
1074			5
8406			168
8598			3
10531			120
General Security Subtotal			**2,947**
975	Hunter Regulated River Water Source	Domestic and Stock	8
989			8
1230			8
605			8
677			24
663			16
13785			1
1259		Supplementary Water	33.2
1258			5
1307			37.5
1260			4.8
1308			15.1
1338			17.5
8445			12.6
Other Subtotal			**198.7**

Water Access Licence WAL no.	Water Source	Type	Share (units)
18253	Hunter Regulated River Alluvial Water Source		74
18266			68
18206			24
18199			5
18122			33
18131			60
21503			21
18154			5
18177			5
23935	Muswellbrook Water Source		41
41437	Sydney Basin - North Coast Groundwater Source		640
40298			90
18836	Krui River Water Source		12
44101	Dart Brook Water Source		20
Aquifer Subtotal			**1098**

2.1 MANAGEMENT PLANS

Development Consent DA 92/97 requires MACH Energy 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	Relevant Development Consent SSD 10418 Condition	Approval Date
Rehabilitation Management Plan (RMP)	Schedule 3, Condition 56	Schedule 2, Condition B92	29 September 2023
Noise Management Plan (NMP)	Schedule 3, Condition 9	Schedule 2, Condition B9	26 November 2024
Air Quality and Greenhouse Gas Management Plan (AQGGMP)[1]	Schedule 3, Condition 23	Schedule 2, Condition B32	29 November 2024
Aboriginal Cultural Heritage Management Plan (ACHMP)	Schedule 3, Condition 36	Schedule 2, Condition B69	16 October 2024
Historic Heritage Management Plan (HHMP)	-	Schedule 2, Condition B73	17 September 2024
Water Management Plan (WMP)	Schedule 3, Condition 28	Schedule 2, ConditionB52	2 August 2024
Blast Management Plan (BMP)[2]	Schedule 3, Condition 17	Schedule 2, Condition B24	14 April 2020
Visual Impact Management Plan (VIMP)[3] (previously the Landscape Management Plan)	Schedule 3, Condition 47	Schedule 2, Condition B77	20 December 2024
Bushfire Management Plan	-	Schedule 2, Condition B85	Pending approval
Traffic Management Plan (TMP)	-	Schedule 2, Condition B99	17 September 2024
Waste Management Plan (WasteMP)	Schedule 3, Condition 52	-	14 January 2019
Rehabilitation Strategy[4]	Schedule 3, Condition 54	Schedule 2, Condition B89	18 March 2024
Biodiversity Management Plan (BioMP)	Schedule 3, Condition 32	Schedule 2, Condition B63	5 November 2024
Environmental Management Strategy	Schedule 5, Condition 1	Schedule 2, Condition D1	7 January 2024

Note:

1 The AQGGMP was conditionally approved under Development Consent SSD 10418 on 29 November 2024. MACH Energy will review and respond to the comments by the dates stipulated in the correspondence provided by DPHI, update the AQGGMP accordingly and report in the next Annual Review period.

2 The BMP was updated in accordance with Development Consent SSD 10418. As at 31 December 2024, the revised BMP was awaiting approval from DPHI. This Annual Review reports against the currently approved BMP under Development Consent DA 92/97 (14 April 2020).

2 Following approval of MOD 6 (6 November 2023), in accordance with Schedule 5, Condition 4 of Development Consent DA 92/97, a review and revision of the VIMP was undertaken in consultation with MSC. The VIMP was updated to incorporate the management measures for the design of the re-transmission facility and submitted to DPHI on 22 December 2023. The updated VIMP (DA 92/97) was approved by DPHI on 15 March 2024 (Version 3). The VIMP has been updated in accordance with Development Consent SSD 10418. This Annual Review reports against the currently approved VIMP under Development Consent SSD 10418 (20 December 2024).

3 The Rehabilitation Strategy has been updated in accordance with Development Consent SSD 10418 and has been submitted for consultation with relevant parties. This Annual Review reports against the currently approved Rehabilitation Strategy under Development Consent DA 92/97 (18 March 2024).

In accordance with Condition 4, Schedule 5 of Development Consent DA 92/97 (prior to its surrender) and Part D, Condition D7 of Development Consent SSD 10418, 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 Planning Secretary of DPHI.

3 OPERATIONS SUMMARY

3.1 MINING OPERATIONS

MACH Energy commenced construction works at the MPO on 25 November 2016 with mining activities commencing in November 2017. During 2024, MACH Energy completed the following construction activities on site, including:

- commencement of the Fines Emplacement Area (FEA) Stage 3 Lift Project to increase the capacity for fines deposition;
- ongoing progressive rehabilitation of temporary construction areas and mining areas;
- completed expansion works to the infrastructure area to increase support offices and meeting areas;
- completion of workshop facility upgrades including new maintenance bays to support the mobile equipment fleet; and
- completion of sitewide civil works and earthworks including maintenance and repair at the mine infrastructure area (MIA) and MIA expansion program.

Mining activities that occurred during the reporting period included:

- continuation of steady-state coal extraction with the development of the open cut footprint progressing to the west;
- continuation of mining coal to the west of the open cut following undertaking all pre-strip and blasting activities;
- ongoing modifications to the Coal Handing and Preparation Plant (CHPP) including construction of additional annexures to improve capacity of fines circuit, and
- exploration drilling for stratigraphic, coal quality and structural assessments.

During the reporting period, a total of 11.43 Mt of ROM coal was produced.

The amounts of 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	2023 Reporting Period (Actual)	2024 Reporting Period (Actual)	2025 Reporting Period (Forecast)
Overburden (Mbcm)	N/A	39.92	38.93	41.19
ROM Coal (Mt)	21 Mt per calendar year[1]	10.5	11.43	12.78
Coarse Reject (Mt)	N/A	2.54	2.35	2.76
Fine Rejects (Mt)	N/A	0.90	1.24	1.49
Saleable Product (Mt)	N/A	7.62	7.99	8.58

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

[1] Condition A6, Schedule 2 of Development Consent SSD 10418 states:
A maximum of 21 million tonnes of ROM coal may be extracted from the site in any calendar year.
Prior to SSD 10418 approval this limit was defined by Condition 6, Schedule 2 of Development Consent DA 92/97 which 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

Key operational conditions outlined in both Schedule 2 of Development Consent DA 92/97 and Development Consent SSD 10418, and their corresponding compliance status during the reporting period are outlined in Table 6.

3.3 ACTIVITIES FORECAST FOR THE NEXT REPORTING PERIOD

The following construction activities are forecast to be undertaken during the 2025 reporting period:

- Ongoing installation of visual bunding and vegetation screening as required, to provide screening of the MPO from sensitive viewpoints.
- Commencement of the FEA Stage 3 Lift Project to increase the capacity for fines deposition.
- Continuation of CHPP upgrades and raw coal throughput, train load out (TLO) upgrade and optimisation for additional train loading.
- ROM permanent lighting installation and dust suppression systems.
- Continuation of the civil and drainage upgrades at the CHPP area including works at the CHPP sediment dam.
- Commence construction of Northern link Road (NLR) and Dorset Road upgrades as an alternate route for Castlerock Road.
- Controlled release infrastructure (DW1) and powerline rerouting in ML 1829.
- Continued construction of water management infrastructure in advance of mining.
- Progressive rehabilitation of temporary construction areas and mining areas.

Further information regarding proposed construction and mining activities in 2025 is provided in the Forward Program.

Table 6
Key Operational Conditions Met

Operational Condition from Development Consent DA 92/97		Condition Met?	Comment
Mining Operations (Condition 5, Schedule 2)	5. *The Applicant may carry out mining operations on the site until 22 December 2026.* *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 DRG. 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.*	Yes	-
Coal Extraction (Condition 6, Schedule 2)	6. *The Applicant must not extract more than 10.5 million tonnes of ROM coal from the site in a calendar year.*	Yes	ROM coal extraction exceeded 10.5 Mt during 2024 in accordance with (Schedule 2, Condition A6 of SSD 10418).
Coal Transport (Condition 7, Schedule 2)	7. *Product coal may only be transported from the site by rail.*	Yes	Product coal was transported from the site by rail only.
Train Movement (Condition 8, Schedule 2)	8. *The Applicant must ensure that train movements at the site (i.e. arrival or dispatch) do not exceed:* *(a) a maximum of 18 per day; or* *(b) 6 per day, averaged over each calendar year.* *Note: In this condition, "day" means any 24-hour period.*	Yes	The maximum number of train movements at the site was 7 in one day. The average number of train movements per day, averaged over the calendar year, was approximately 3 per day (Appendix C).

Operational Condition from Development Consent DA 92/97		Condition Met?	Comment
Structural Adequacy (Condition 9, Schedule 2)	9. *All new buildings and structures, and any alterations or additions to existing buildings and structures, that are part of the development, must be constructed in accordance with:* *(a) the relevant requirements of the BCA; and* *(b) any additional requirements of SA NSW where the building or structure is located on land within a declared Mine Subsidence District.* *Notes:* • *Under Part 6 of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for the proposed building works;* • *Part 8 of the EP&A Regulation sets out the requirements for the certification of the development;* • *The development is located in the Muswellbrook Mine Subsidence District. Under Section 21 of the Mine Subsidence Compensation Act 2017, the Applicant is required to obtain the Chief Executive of SA NSW's approval before carrying out certain development in a Mine Subsidence District.*	Yes	All buildings constructed during the reporting period were constructed in accordance with the Building Code of Australia (BCA) and the Subsidence Advisory (SA) NSW.
Demolition (Condition 10, Schedule 2)	10. *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.*	Yes	Demolition work was carried out in accordance with Australian Standard *AS 2601-2001: The Demolition of Structures.*
Protection of Public Infrastructure (Condition 11, Schedule 2)	11. *Unless the Applicant and the applicable authority agree otherwise, the Applicant must:* *(a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and* *(b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development,* *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.*	Yes	During 2024, there were general road maintenance activities undertaken on Wybong Road and Bengalla Link Road. MACH Energy incurred the full costs of these maintenance works.

Operational Condition from Development Consent DA 92/97		Condition Met?	Comment
Operation of Plant and Equipment (Condition 12, Schedule 2)	*12. The Applicant must ensure that all plant and equipment used on site, or to transport coal from the site, is:* *(a) maintained in a proper and efficient condition; and* *(b) operated in a proper and efficient manner.*	Yes	All plant and equipment in use at the MPO is maintained in suitable condition.

Table 6 (Continued)
Key Operational Conditions Met

Operational Condition from Development Consent SSD 10418		Condition Met?	Comment
Mining Operations (Schedule 2, Condition A5)	*A5. Mining operations may be carried out on the site, within the approved disturbance area, until 22 December 2048.* *Notes:* • *Under this consent, the Applicant is required to decommission and rehabilitate the site and carry out other requirements in relation to mining operations. Consequently, this consent will continue to apply in all respects other than to permit the carrying out of mining operations until the rehabilitation of the site and other requirements have been carried out to the required standard.* • *Mining operations and rehabilitation are also regulated under the Mining Act 1992.*	Yes	Cessation date has not yet occurred.
Coal Extraction and Transportation (Schedule 2, Condition A6)	*A6. A maximum of 21 million tonnes of ROM coal may be extracted from the site in any calendar year.*	Yes	ROM coal extraction did not exceed 21 Mt during 2024.
Coal Extraction and Transportation (Schedule 2, Condition A7)	*A7. A maximum of 17 million tonnes of product coal may be transported from the site in any calendar year.*	Yes	Transported coal did not exceed with 7.9 Mt transported from MPO during 2024.
Coal Extraction and Transportation (Schedule 2, Condition A8)	*A8. Product coal may only be transported from the site by rail.*	Yes	Product coal was transported from the site by rail only.
Coal Extraction and Transportation (Schedule 2, Condition A9)	*A9. A maximum of 10 laden trains may leave site in any 24-hour period.*	Yes	No exceedances of 10 laden trains leaving site were recorded during 2024.

Operational Condition from Development Consent SSD 10418		Condition Met?	Comment
Hours of Operation (Schedule 2, Condition A10)	*A10. The applicant may undertake mining operations 24 hours a day, 7 days a week.* *Note: For limitations on blasting operations see condition B14.*	Yes	Operations occur over a 24-hour / 7-day period.
Protection of Public Infrastructure (Schedule 2, Condition A27)	*A27. Unless the Applicant and the applicable authority agree otherwise, the Applicant must:* *(a) repair, or pay the full costs associated with repairing, any public infrastructure[a] that is damaged by carrying out the development; and* *(b) relocate, or pay the full costs associated with relocating, any public infrastructure[a] that needs to be relocated as a result of the development.* *[a] This condition does not apply to any damage to roads caused as a result of general road usage or otherwise addressed by contributions required by condition A16 and A17 or to damage that has been compensated under the Mining Act 1992.*	Yes	This was not triggered during the reporting period.
Protection of Public Infrastructure (Schedule 2, Condition A28)	*A28. The applicant must ensure that mining activities on the site are not reasonably likely to cause damage to road reserves outside of the site.*	Yes	No public infrastructure has been identified as needing repair or relocation as a result of the development.
Protection of Public Infrastructure (Schedule 2, Condition A29)	*A29. Should the increased elevation of the development's waste rock emplacement result in adverse impacts on the reception of broadcasting services from the Rossgole Tower transmission facilities, the Applciant must implement make-good provisions to the satisfaction of the Planning Secretary (such as raising the existing tower or construction of a re-transmission station) which would meet the siting and technical requirements of the Australian Communications and Media Authority.*	Yes	No impacts to Rossgole tower occurred due to increased elevation of the waste rock emplacement.

Operational Condition from Development Consent SSD 10418		Condition Met?	Comment
Demolition (Schedule 2, Condition A30)	*A30. All demolition must be carried out in accordance with Australian Standard AS 2601-2001 The Demolition of Structures (Standards Australia, 2001).*	Yes	Demolition work was carried out in accordance with Australian Standard *AS 2601-2001: The Demolition of Structures.*
Structural Adequacy (Schedule 2, Condition A31)	*A31. All new buildings and structures, and any alterations or additions to existing buildings and structures, that are part of the development, must be constructed in accordance with the relevant requirements of the BCA.* *Notes:* • *Under Part 6 of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for the proposed building works.* • *The Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021 sets out the requirements for the certification of the development.*	Yes	All buildings constructed during the reporting period were constructed in accordance with the BCA.
Operation of Plant and Equipment (Schedule 2, Condition A32)	*A32. All plant and equipment used on site, or to monitor the performance of the development must be:* *(a) maintained in a proper and efficient condition; and* *(b) operated in a proper and efficient manner.*	Yes	All plant and equipment in use at the MPO is maintained in suitable condition.
Compliance (Schedule 2, Condition A33)	*A33. The Applicant must ensure that all of its employees, contractors (and their sub-contractors) are made aware of, and are instructed to comply with, the conditions of this consent relevant activities they carry out in respect of the development.*	Yes	All employees and contractors are inducted on site in relation to compliance and consent requirements.

4 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

DPHI approved the 2023 Annual Review on 28 October 2024. The approval was given against the Development Consent DA 92/97 as the Development Consent SSD 10418 had not yet commenced for the reporting period (1 January 2023 – 31 December 2023). The Annual Review generally satisfied the reporting requirements with no further actions except for the following:

- For future Annual Reviews, under the provisions of Schedule 2, Condition 3 of the consent DA 92/97[2], include a status update on all actions arising from Independent Audits of the mine until all actions are completed. Where estimated completion dates are missed, provide additional detail along with a new estimated completion date where appropriate.

To address the above action Table 33 includes the current status of the previous recommendations from the 2023 Independent Environmental Audit (IEA).

As requested by DPHI, a copy of the 2023 Annual Review was made publicly available on the MACH Energy website, following approval on 28 October 2024.

[2] Note this condition is duplicated within the Development Consent SSD 10418 Condition A3, Schedule 2.

5 ENVIRONMENTAL PERFORMANCE

5.1 METEOROLOGY

Meteorological monitoring was undertaken during the reporting period at the mine meteorological stations along Kayuga Road (M-WS4) and Wybong Road (M-WM2) (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. M-WS4 has been utilised for this summary as the original meteorological station at the MPO.

5.1.1 Rainfall

During the reporting period, 634.8 millimetres (mm) of rain was recorded over 63 wet days at the MPO weather station M-WS4. The highest daily rainfall was 53.8 mm on 5 April 2024.

There was an increase in the cumulative rainfall and a decrease in the number of wet days for the reporting period in comparison to the 2023 reporting period (432.4 mm and 71 days, respectively). Cumulative rainfall at the MPO has generally been consistent with 2019 levels since the commencement of the MPO, except for 2016, 2020, 2021 and 2022 where significantly more rainfall was received at the site.

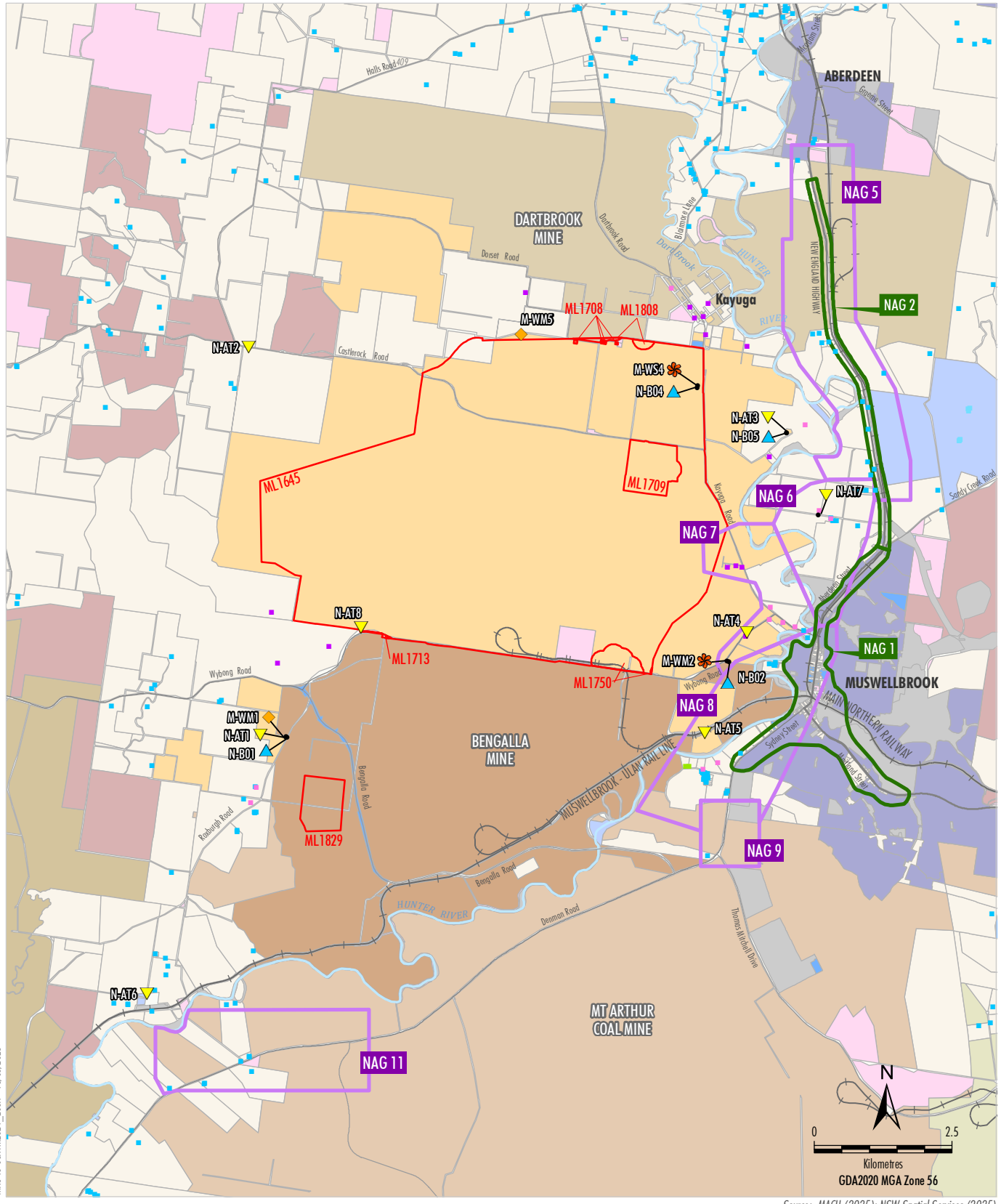
The monthly rainfall distribution, number of wet days and cumulative rainfall is summarised in Table 7. Monthly rainfall records and cumulative rainfall over the reporting period are shown in Chart 1.

5.1.2 Temperature

During the reporting period, the maximum temperature recorded at the MPO weather station M-WS4 was 41.2 degrees Celsius (ºC) (26 January), and the minimum temperature recorded was 1.1 ºC (30 July). Monthly minimum and maximum temperatures derived from hourly temperature measurements are presented in Table 8. Monthly mean temperatures are shown in Chart 2. Monthly temperatures at the MPO during the reporting period are generally consistent with those measured since 2020.

5.1.3 Wind Speed and Direction

During the reporting period, the majority of prevailing winds were from the south- southeast and west-northwest. Only a minor percentages of winds were generated from the north-east, east and south-west. Results are consistent with trends observed in previous Annual Reviews (Coal & Allied, 2014, 2015 and 2016; MACH Energy, 2017b; 2018; 2019; 2020; 2021; 2022; 2023 and 2024). An annual wind rose is presented in Chart 3.



MAC-18-03A AR2024_203A 18/03/2025

LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Other Mining/Resource-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1
- Railway
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned
- DA 92/97 Noise Assessment Group (NAG)
- SSD 10418 Noise Assessment Group (NAG)

Monitoring Sites

- Attended Noise
- Real-time Noise Monitoring Site
- Weather Mast
- Weather Station

Source: MACH (2025); NSW Spatial Services (2025)

* Mitigation on Request - rail noise/Aquisition on Request - air quality. MACH is only required to acquire and/or install air quality mitigation measures at this property if not reasonably achievable under a separate approval for the Bengalla Mine.

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Noise and Meteorological Monitoring Sites

Figure 3

Table 7
Rainfall Summary 2024

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Rainfall (mm)	36.6	75.8	33.2	99.8	48.8	79.2	36.0	42.0	42.2	37.0	60.6	43.6
Cumulative Rainfall (mm)	36.6	112.4	145.6	245.4	294.2	373.4	409.4	451.4	493.6	530.6	591.2	634.8
Wet Days*	4	8	3	8	5	5	4	5	4	3	1	6

Note:

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

Table 8
Temperature Summary 2024

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum Temperature (°C)	13.8	10.7	13.5	8.2	4.0	1.8	1.1	1.8	2.4	2.7	10.9	11.8
Maximum Temperature (°C)	41.2	35.7	37.4	31.3	23.9	21.9	19.7	28.2	28.9	30.1	37.2	39.7

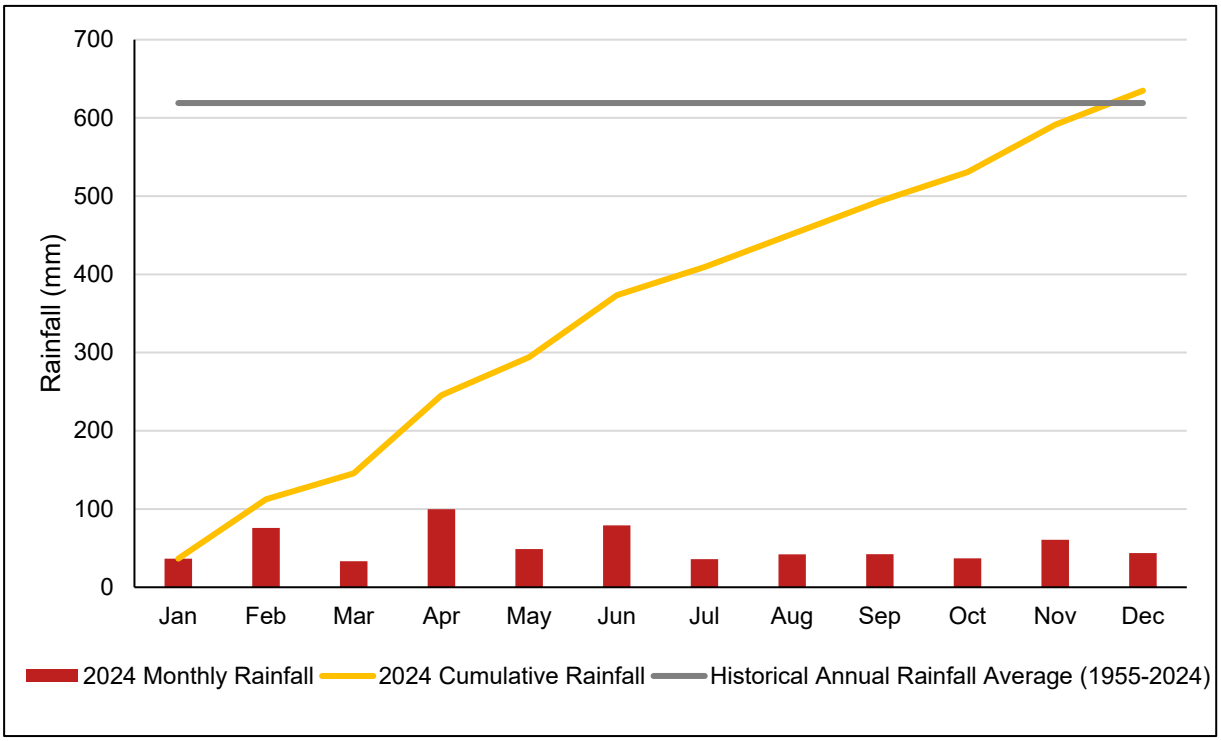


Chart 1: MPO Monthly and Cumulative Rainfall 2024

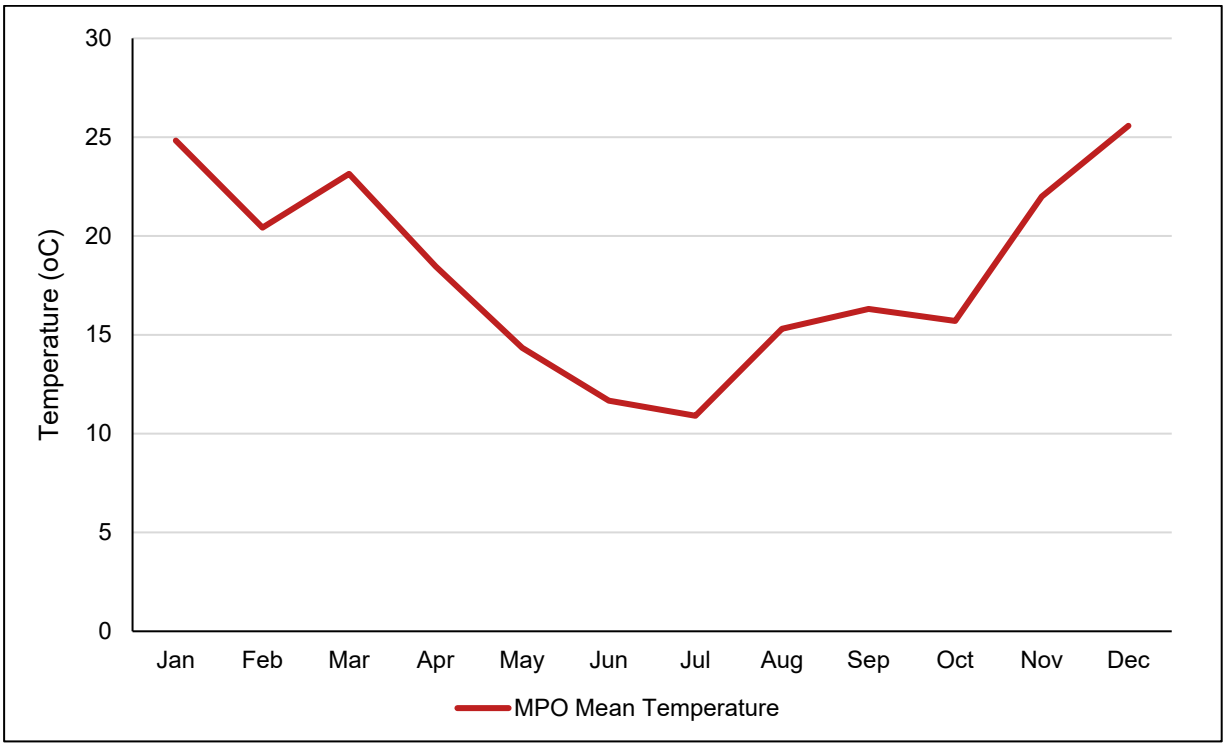


Chart 2: MPO Monthly Mean Temperature 2024

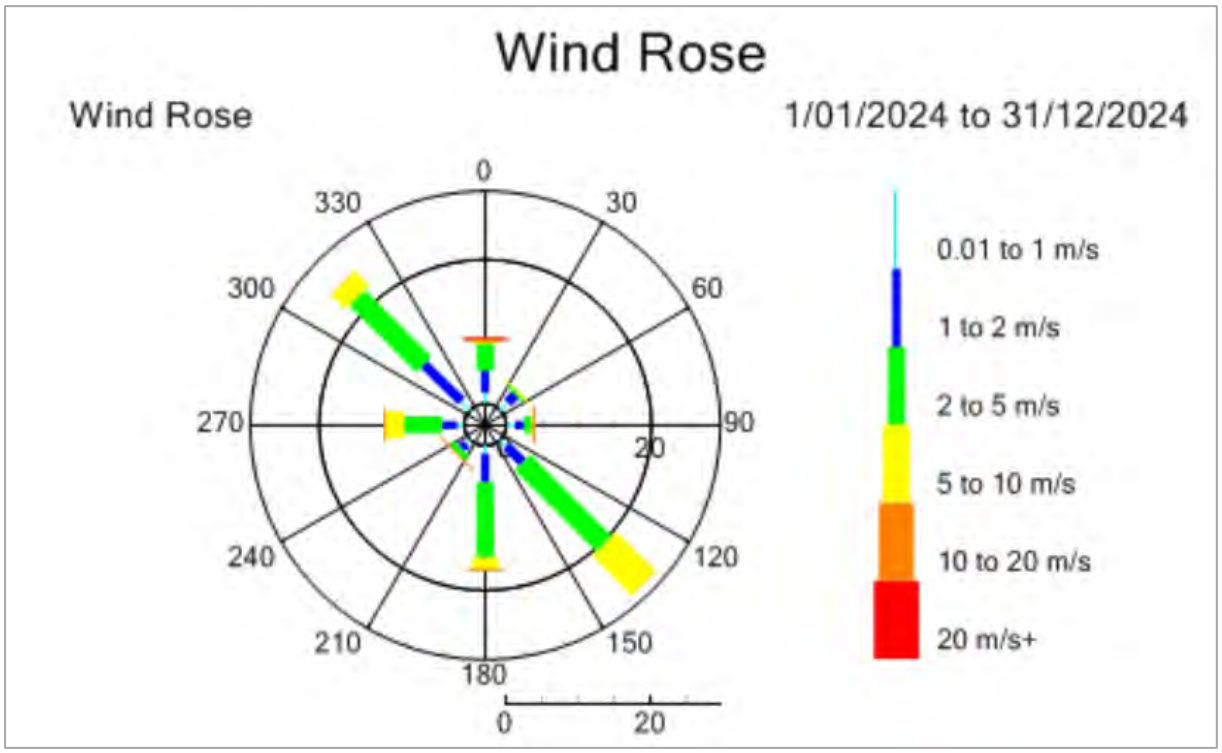


Chart 3: MPO Annual Wind Rose APF-4 2024

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), Table 1 of Development Consent SSD 10418 (Condition B1, Schedule 2) and EPL 20850 (Condition P1.3). 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 Development Consent SSD 10418

The Noise Impact Assessment Criteria defined in Table 3 of Development Consent DA 92/97 (Condition 3, Schedule 3) is provided in Table 9.

Table 9
Development Consent DA 92/97 Noise Impact Assessment Criteria (dBA)

Location	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
68[1], 74[1]	43	42	42	45
86a	42	42	42	45
35[2], 35b[2], 77	42	41	41	45
79, 80a[1], 140c, 526[1]	41	41	41	45
289	41	40	40	45
84a, 139, 154, 203, 257, 258a	40	40	40	45
83	40	39	39	45
86b, 140a, 202, 259	39	39	39	45
198, 202b	38	38	38	45
260, 261	37	37	37	45
169, 272	36	36	36	45
NAG 5 - All privately-owned land	41	40	39	45
NAG 6 - All privately-owned land	37	37	37	45
NAG 7 - All privately-owned land	40	37	37	45
NAG 8 - All privately-owned land	41	39	39	45
NAG 9 - All privately-owned land	39	38	37	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.

Notes: dBA = A-weighted decibels.

L_{Aeq} = A-weighted equivalent continuous noise level.

$L_{Aeq\ (15\ min)}$ = equivalent continuous noise level over a 15 minute period.

$L_{Aeq\ (1\ min)}$ = equivalent continuous noise level over a 1 minute period.

[a] The Noise Assessment Locations and NAGs referred to in Table 9, are shown on Figure 3.

[1] Acquired by MACH Energy. Noise criteria does not apply at this residence while owned by MACH Energy.

[2] Acquired by Bengalla Mining Company. Noise criteria do not apply at this residence while owned by Bengalla Mining Company or another mining company.

The cumulative noise criteria defined in Table 5 of Development Consent DA 92/97 (Condition 5, Schedule 3) are provided in Table 10.

Table 10
Development Consent DA 92/97 Cumulative Noise Criteria (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 construction noise criteria defined in Table 10A of Development Consent DA 92/97 (Condition 44H, Schedule 3) are provided in Table 11.

Table 11
Development Consent DA 92/97 Construction Noise Criteria (dBA)

Location	Standard Construction Hours
	$L_{Aeq(15min)}$
67, 215, 216, 218,219	47
206, 217, 220, 221, 225, 532, 533	48
222, 223, 531	49
224, 530	50
19, 20, 21, 207, 289	51
527, 528	56
529	54
68	57
23	69
All other privately-owned land	5 dBA above the daytime operational $LA_{eq(15min)}$ noise criteria in Table 11

Source: Development Consent DA 92/97

The Noise Impact Assessment Criteria defined in Table 1 of Development Consent SSD 10418 (Condition B1, Schedule 2) is provided in Table 12.

Table 12
Development Consent SSD 10418 Noise Impact Assessment Criteria (dBA)

Location[a]	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
19, 77, 79, 84a, 140c, 169, 171, 172, 172b, 172c, 181c, 189, 190, 191, 192, 202, 203, 203b, 203c, 207, 213, 214, 215, 216, 216b, 217, 218, 219, 220, 221, 222, 223, 223b, 224, 225, 289, 526[1], 667a	40	37	37	45
20, 21, 35[2], 35b[2], 67, 74[1], 86a	40	38	38	45
43	40	39	39	45
43b	40	39	39	46
96[1]	40	39	39	48
47	40	40	40	45
102	40	40	40	48
108	40	40	40	50
140a	40	40	40	47
82, 83, 86b, 310, 180b, 197, 202b, 212, 212b	40	36	36	45
112	40	36	36	47
194, 195, 547	42	41	36	45
193	42	41	37	45
All other residences in Noise Assessment Group (NAG) 1	40	36	36	45
All other residences in NAG 2	42	41	35	45
Other privately-owned residences	40	35	35	45

Source: Development Consent SSD 10418.

Notes: dBA = A-weighted decibels.

L_{Aeq} = A-weighted equivalent continuous noise level.

$L_{Aeq\ (15\ min)}$ = equivalent continuous noise level over a 15 minute period.

$L_{Aeq\ (1\ min)}$ = equivalent continuous noise level over a 1 minute period.

[a] The Noise Assessment Locations and NAGs referred to in Table 12, are shown on Figure 3.

[1] Acquired by MACH Energy. Noise criteria does not apply at this residence while owned by MACH Energy.

[2] Acquired by Bengalla Mining Company. Noise criteria do not apply at this residence while owned by Bengalla Mining Company or another mining company.

Noise criteria and other noise related conditions stipulated in EPL 20850 are generally consistent with those prescribed in Development Consent DA 92/97 and Development Consent SSD 10418.

Noise Management Plan

A NMP was prepared by MACH Energy in accordance with Condition 9, Schedule 3 of the Development Consent DA 92/97 and Condition B9, Schedule 2 of Development Consent SSD 10418. The NMP was approved on 26 November 2024.

The NMP outlines the reasonable and feasible mitigation and management measures adopted at the MPO and describes the following construction and operational noise controls to be implemented to limit construction and operational noise:

- As part of the mine design, mine planners design haul routes and/or dumping locations that are suitable for use under noise-enhancing conditions that can be present during evening/night-time periods.
- At the commencement of shift, the Open Cut Examiner reviews the latest forecast meteorological conditions to assess noise-enhancing conditions, particularly during the more sensitive evening/night-time periods. Where there is a higher risk of noise-enhancing conditions, equipment is selectively located in areas that are shielded by waste emplacement and/or are located at lower elevations in the open cut pit.
- Plant will operate in less exposed areas during the more sensitive evening/night 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 onsite 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.
- In the event of a complaint from a local resident, MACH Energy will implement the complaints response process.
- Regular Sound Power Level Testing of the new mobile plant fleet. A summary of the new plant is provided in Section 5.4.3 (Table 18).

Further noise mitigation measures that will be implemented under Development Consent SSD 10418 include:

- progressive staged increases in ROM coal extraction from 10.5 Mtpa to 21 Mtpa, as mining progresses west and the integrated eastern waste rock landform provides additional shielding as a major noise barrier;
- continued implementation of noise suppression to all new major mobile equipment (where reasonable and feasible) to reduce emitted noise levels (in addition to the continued use of noise suppressed mobile equipment at the existing MPO); and
- design of the integrated eastern waste rock landform to provide further shielding of operations to receivers in and around the township of Muswellbrook and village of Aberdeen, including advance development of a bund on the boundary of North Pit that would subsequently be incorporated with the integrated emplacement.

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* (INP)(EPA, 2000) and *Noise Policy for Industry* (NPfI) as relevant, are compliant with the noise criteria in Table 10.

- 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 Spectrum Acoustics (January – December) during the 2024 reporting period, in accordance with the NMP, Development Consent DA 92/97, Development Consent SSD 10418 and EPL 20850. Operator attended monitoring was undertaken at six locations selected to represent privately-owned receivers surrounding the MPO, as shown on Figure 3 and in Table 13.

During the reporting period, MACH Energy complied with all relevant development consent conditions relating to noise. A summary of the noise monitoring results recorded during the reporting period are presented in Appendix A.

Monitoring was undertaken in accordance with EPL 20850 and Australian Standard *AS 1055 Acoustics, Description and Measurement of Environmental Noise*.

All applicable measured noise levels attributable to the MPO were compliant with the relevant noise criteria from Development Consent DA 92/97, Development Consent SSD 10418 and EPL 20850 during the reporting period. There were no exceedances of the construction noise criteria from Development Consent DA 92/97 (Table 11) and Development Consent SSD 10418 (Table 12) during the reporting period.

Table 13
Noise Monitoring Locations

Monitoring Location				Justification
Site ID	Description	Easting	Northing	
N-AT1	South-west of the MPO	291557	6427357	Representative of dwellings to the south-west
N-AT2	North-west of the MPO	290867	6434443	Representative of dwellings to the north-west
N-AT3	East of the MPO	300646	6432899	Representative of dwellings to the north-east and east[1]
N-AT4	South-east of the MPO	299924	6429264	Representative of dwellings to the east[2]
N-AT5	South-east of the MPO	299152	6427434	Representative of dwellings to the south-east[3]
N-AT6	South-west of the MPO	289011	6422684	Representative of dwellings to the south southwest[4]
N-AT7	East of the MPO	301219	6431398	Representative of dwellings to the east[5]
N-AT8	West of the MPO	292905	6429341	Representative of dwellings to the west

Notes:
• Coordinates in GDA 2020.
• Location of NAGs and attended noise monitoring sites as described in Figure 3.
[1] Including NAG 5 under Development Consent DA 92/97 and NAG 2 under Development Consent SSD 10418.
[2] NAGs 6 and 7 under Development Consent DA 92/97.
[3] NAGs 8 and 9 under Development Consent DA 92/97 and NAG 1 under Development Consent SSD 10418.
[4] NAG 11 under Development Consent DA 92/97.
[5] NAG 6 under Development Consent DA 92/97.

Results of the operator attended noise monitoring for each monitoring round during the reporting period are available in the monthly reporting on the MACH Energy website (https://machenergyaustralia.com.au/mount-pleasant/documentation/).

Real-time Noise Monitoring

Real-time monitoring systems were installed at three locations (N-B01, N-B02 and N-B04) in November 2016 prior to construction work commencing on-site and an additional monitor was purchased (N-B05) in June 2020 (Figure 3).

Real-time noise monitoring was undertaken at these locations 24 hours per day, seven days per week for the duration of the reporting period. The real-time noise monitoring is not used to assess compliance with noise criteria but instead used for ongoing performance assessment and to inform implementation of real-time response management actions.

The real-time response triggers are based on noise modelling undertaken for the MPO at various time and recorded meteorological parameters. They are set to inform operations in real time of noise levels at key locations and trigger management responses.

During the reporting period, several real-time noise monitoring triggers occurred, where these were related to mining noise from the MPO they prompted the implementation of real-time response management actions, consistent with the Real-time Response Protocol outlined in the NMP.

Complaints

A total of 29 noise-related complaints were received by MACH Energy during the reporting period (see Complaints Summary 2024: https://machenergyaustralia.com.au/mount-pleasant/documentation/). The number of noise related complaints increased in comparison to the 16 received the previous reporting period. In response to the complaints, the noise monitoring records were reviewed, and the External

Relations Manager organised the cessation of noise-intensive works where necessary. In all cases, the External Relations Manager made further contact with the complainant to provide an update to the sites noise management. All operator attended noise monitoring results for the reporting period were compliant.

On 17 September 2024, a noise-related complaint was received from the EPA. The EPA conducted attended noise monitoring at various locations around the Mount Pleasant Operation using the attended noise monitoring points as defined on EPL 20850. Noise monitoring at EPA Point 7 (Wiltons Lane Kayuga) during the evening period indicated elevated noise levels approaching or above the $L_{Aeq(15\ minute)}$ criteria. At the time of attended noise monitoring, there was a noise alarm triggered at N-B05. All other monitors were operating as normal with no alarms were triggered. In response, the shift OCE completed an inspection of the North East corner of the pit near Kayuga Road and a Noise Trigger Action Response Plan (TARP) was completed. Changes to mining operations were made and noise impacts were monitored for the remainder of the shift. No further alarms were received.

Out of Hours Work Monthly Reporting

No out of hours work was reported during the reporting period.

5.2.3 Trends and Key Management Implications

The monitoring results are generally consistent with the results recorded during the 2023 reporting period (MACH Energy, 2024). Noise levels were observed to have decreased at N-AT3 and N-AT4 as mining progressed north (i.e. away from the monitors).

Despite all operator attended noise monitoring being compliant, noise-related complaints increased in 2024 compared to 2023 (29 in 2024 compared to 16 in 2023). MACH Energy continued the development of the Eastern Out of Pit Overburden Emplacement Area during the reporting period, which provides shielding of operations to Muswellbrook and nearby residences.

Comparison to SSD EIS Predictions

SSD EIS predictions for noise were modelled for seven scenarios during the project life of mining (i.e. Year 2026, Year 2028, Year 2031, Year 2034, Year 2041, Year 2044 and Year 2047). The attended monitoring noise levels were below the predicted levels under applicable meteorological conditions.

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. MACH Energy continued to implement real-time noise monitoring at the four real-time noise monitoring locations with the Real-time Response Protocol used where appropriate. Two relocatable BarnOwl directional noise monitors were also used to verify regional noise levels.

A review of the effectiveness of noise management systems has undertaken throughout the reporting period. Reviews were undertaken in response to noise complaints, during quarterly monitoring and during the development of the annual report. Reviews have determined that the current measures being implemented, including reactive management measures have effectively managed noise generation at the operations. This is reflected by there being no exceedances of noise criteria for the reporting period. The review effectiveness of noise management systems will continue to be undertaken in the 2025 period.

5.3 BLASTING

Airblast overpressure and ground vibration assessment criteria for the MPO are defined in Table 2 of Development Consent DA 92/97 (Condition 10, Schedule 3) and EPL 20850 (Conditions L4.2, L4.3, L4.4 and L4.5). 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 approval documents.

The BMP was updated in accordance with Development Consent SSD 10418. As at 31 December 2024, the revised BMP was awaiting approval from DPHI. This Annual Review reports against the currently approved BMP under Development Consent DA 92/97 (14 April 2020).

5.3.1 Approval Criteria and Management Plan Requirements

Development Consent DA 92/97, Development Consent SSD 10418 and EPL 20850

A summary of the assessment 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[a]	120	10	0%
	115	5	5% of the total number of blasts over a calendar year
Mine-owned residences	-	10	0%
Historic heritage sites[b]	-	10	0%
All public infrastructure	-	50 (or a limit determined by the structural design methodology in AS 2187.2 – 2006, or its latest version)	0%

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

Notes: mm/s = millimetres per second and dB = decibels.
[a] The locations referred to in Table 14 are shown in Appendix 3 of Development Consent SSD 10418.
[b] These limits do not apply to historic heritage sites located within the approved disturbance area.

Conditions L5.2, L5.3, L5.4 and L5.5 of EPL 20850 contain the same blasting assessment criteria for residences on privately-owned land as specified in Table 15. 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).

Airblast overpressure, ground vibration and fume monitoring were conducted for every blast event at the blast monitoring sites shown on Figure 4.

5.3.2 Performance During the Reporting Period

A total of 87 blasts occurred during the reporting period and are detailed in Appendix B.

During 2024 there were no exceedances of the assessment criteria for blasting as defined in Table 14.

Comparison to SSD EIS Predictions

A comparison of MPO's blast performance against the SSD EIS predictions is summarised in Table 15. Monitors B-VOC and B-VO2 are located in close proximity to Receiver 43 and Receiver 67 and comparative discussion is provided below. For other receivers, direct comparison with monitoring results is obscured by the distance between blast locations, receivers and blast monitors.

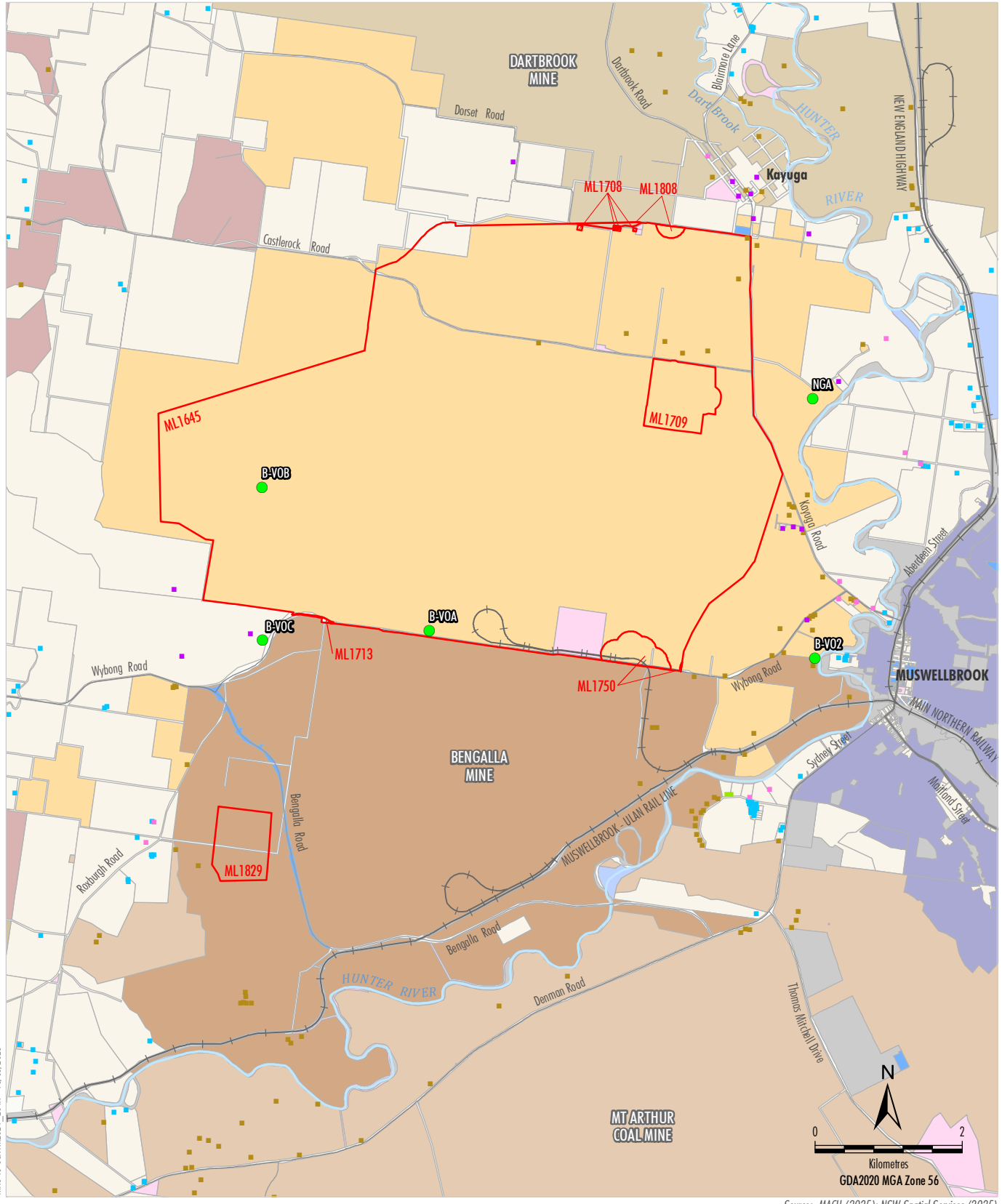
Table 15
Comparison of SSD EIS Predictions and 2024 Raw Monitoring Data

Closest Receiver ID	SSD EIS Predictions		Closest Blast Monitoring Site to Land Holder	Maximum Recorded Level in 2024	
	Airblast Overpressure (dBL [in Peak])	Ground Vibration (mm/s)		Airblast Overpressure (dBL [in Peak])	Ground Vibration (mm/s)
43	111.2 to 112.5	0.5 to 1.4	B-VOC	107.9	2.64
272	111.1 to 111.3	0.5 to 0.6	B-VOC	107.9	2.64
153	111.3 to 113.1	0.7 to 1.8	B-VOA	113.9	6.01
147	111.4 to 120.4	0.7 to 9.3	B-VO2	111.3	2.66
136	111.7 to 118.1	0.9 to 6.2	B-VO2	111.3	2.66
121	112.7 to 116.9	1.5 to 4.8	B-VO2	111.3	2.66
112	112.9 to 116.0	1.7 to 4.0	B-VO2	111.3	2.66
67	112.0 to 114.2	1.1 to 2.5	B-VO2	111.3	2.66
23	111.4 to 114.1	0.7 to 2.5	B-VO2	111.3	2.66

Source: Table M-1 of MPO SSD EIS Noise & Blasting Assessment (Appendix A of the document).

Blast predictions are made using a site-specific empirical prediction model to best predict airblast and ground vibration levels. At Receivers 43, 272, 67 and 23 maximum recorded results for overpressure are lower than the range of predictions made in SSD EIS. However, the maximum recorded results for ground vibration were higher than the range of predictions made in SSD EIS. As mentioned above, this may be due to the distances between blast locations, receivers and blast monitors and also a difference in site conditions, compared to the empirical data used to establish the predictions. At Receiver 153 the maximum recorded results for overpressure and ground vibration were higher than the range of predictions made in SSD EIS.

At all other receivers, Table 15 shows that blast monitoring data at the most representative monitoring site are within the predicted ranges. Blast monitoring data will continue to be collected, and a site-specific empirical prediction model will continue to be refined to assist blast planning and performance review.



MAC-18-03A AR2024_204A 18/03/2025

LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1
- Railway

Category of Rural Residence under SSD 10418

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned

Monitoring Sites

- Blasting (Vibration/Overpressure)

Source: MACH (2025); NSW Spatial Services (2025)

* Mitigation on Request - rail noise/Aquisition on Request - air quality. MACH is only required to acquire and/or install air quality mitigation measures at this property if not reasonably achievable under a separate approval for the Bengalla Mine.

MACHEnergy

MOUNT PLEASANT OPERATION

Blast Monitoring Sites

Figure 4

Complaints

A total of ten blasting-related complaints were received by MACH Energy during 2024 (see Complaints Summary 2024: https://machenergyaustralia.com.au/mount-pleasant/documentation/). The number of blasting related complaints received during the reporting period increased by five compared to the previous reporting period. In response to the complaints, blasting activities were reviewed for compliance. All blasting results for the reporting period were compliant with relevant blast overpressure and vibration criteria (Section 5.3.1). Following the compliance review, the External Relations Manager made further contact with the complainants to provide an update of the blasting activities.

5.3.3 Trends and Key Management Implications

There were 87 blasts recorded during 2024, compared with 72 in 2023.

Blasting-related complaints increased slightly in 2024 compared to 2023. However, airblast overpressure and ground vibration levels recorded during 2024 generally decreased compared with 2023 as blasting occurred further from Muswellbrook and nearby receivers as mining activities progressed west during the reporting period. All overpressure and vibration measurements during the reporting period complied with the relevant criteria within Development Consent DA 92/97, Development Consent SSD 10418 and EPL 20850.

5.3.4 Implemented or Proposed Management Actions

Notifications of upcoming blasts were provided on MACH Energy's and MSC's websites. 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.

Any blasts within 500 m of Wybong, Kayuga, Castlerock and Dorset Roads triggered a road closure and implementation of relevant mitigation measures. In 2024, 33 road closures occurred on Wybong Road due to blasting activities within Pit A. No other roads were closed due to blasting activities.

All appropriate steps to reduce dust generation from blasting and ensure best practice blasting techniques were undertaken in accordance with the MPO BMP. MACH Energy will continue to implement these measures.

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), Table 3 of Development Consent SSD 10418 (Condition B28, Schedule 2) and EPL 20850 (Condition O3.4). 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, Development Consent SSD 10418 and EPL 20850.

5.4.1 Approval Criteria and Management Plan Requirements

Development Consent DA 92/97 and Development Consent SSD 10418

In accordance with Condition 20, Schedule 3 of Development Consent DA 92/97 and Condition B28, Schedule 2 of Development Consent SSD 10418, MACH Energy must ensure that all reasonable and feasible avoidance mitigation measures are employed so that particulate matter emissions generated by the MPO do not exceed the criteria summarised in Table 16 at any residence on privately-owned land (excluding land subject to acquisition upon request for potential air quality impacts).

Table 16
Approval Criteria for Particulate Matter

	Pollutant	Averaging Period	[d]Criterion
Long-term Impact Assessment Criteria	TSP	Annual	[a, d] 90 µg/m^3
	PM_{10}	Annual	[a, d] 25 µg/m^3
	$PM_{2.5}$	Annual	[a, d] 8 µg/m^3
	Deposited Dust[c,d]	Annual	[b] 2 g/m^2/month
			[a] 4 g/m^2/month
Short-term Impact Assessment Criteria	PM_{10}	24 hour	[b] 50 µg/m^3
	$PM_{2.5}$	24 hour	[b] 25 µg/m^3

Source: Development Consent DA 92/97 (Condition 20, Schedule 3),
Development Consent SSD 10418 (Condition B28, Schedule 2)

Note: TSP = Total Suspended Particulates;
PM_{10} = particulate matter less than or equal to 10 micrometres in diameter;
$PM_{2.5}$ = particulate matter less than or equal to 2.5 micrometres in diameter;
µg/m^3 = micrograms per cubic metre; and
g/m^2/month = grams per square metre per month.

[a] *Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).*

[b] *Incremental impact (i.e. incremental increase in concentrations due to the development on its own).*

[c] *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.*

[d] *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Planning Secretary.*

Environment Protection Licence 20850

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 and Development Consent SSD 10418 with the exception of Conditions O3.4 to O3.9, which state:

O3 Dust

…

O3.4 The Licensee must cease all dust generating activities during adverse conditions being the occurrence of both:

i) the adverse wind conditions set out in Condition O3.5 (b), and

ii) 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 the 1-hour average wind direction between 250 degrees and 340 degrees (inclusive) measured at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitor. Australian Standard AS3580.14-2014 is to be used to calculate the 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 monitoring station.

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

(e) Activities within the Coal Handling and Preparation Plant and Materials Handling Area, including run-of-mine (ROM) coal, product coal handling (including dozer/loader operations) and train loading operations as identified in blue on plan titled 'Mach Energy Materials Handling Area Dust Exclusion Zone General Arrangement Mount Pleasant Coal Drawing 90500-51-1-SV-Material Handling Area Update-r1' (EPA ref DOC23/37979-1) are not included as dust generating activities provided all automated dust suppression spray systems at the ROM hopper, conveyor transfer points and product stockpiles are in use, at least one water cart is in use on the ROM stockpile and an adjustable hood is lowered onto rail wagons loadings.

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 At any time when there is no access to the meteorological data or PM10 data from the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitoring station, definitions of 'adverse wind conditions' and 'adverse PM10 concentrations' in condition O3.5 are replaced with:

- *'adverse wind conditions' means a 1-hour average wind direction between 245 and 345 degrees (inclusive) measured at EPA Monitoring Point 11, identified in condition P1.3*
- *'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 EPA Monitoring Point 1, identified in condition P1.3*

Note: If at any time, there is no access to the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitoring station and to either 1-hour average wind direction data from monitoring point 11 or PM 10 data from monitoring point 1 the licensee must cease dust generating activities at the premises.

O3.9 For the purpose of condition O3.5 (e), dust suppression systems must be operated in a manner to ensure that there is no visible dust emissions emitted from the premises.

Air Quality and Greenhouse Gas Management Plan

MACH Energy prepared an AQGGMP which was approved on 29 November 2024. The AQGGMP was revised to reflect the requirements of the recent approval of Development Consent SSD 10418.

The AQGGMP outlines the reasonable and feasible mitigation and management measures adopted at the MPO in accordance with Condition 20, Schedule 3 of Development Consent DA 92/97 and Condition B28, Schedule 2 of Development Consent SSD 10418. The reasonable and feasible mitigation measures include (but are not limited to):

- specific management measures for adverse weather conditions (e.g. ceasing all dust generating activities during specific weather conditions as required by Conditions O3.4 to O3.9 of EPL 20850);
- general dust management measures (e.g. use of water carts to minimise wheel generated dust etc.);
- the use of predictive meteorological and air quality forecasting to assist in day-to-day planning;
- real-time response protocols with tiered management actions based on several alert levels;
- odour and fume management measures;
- spontaneous combustion management measures;

- greenhouse gas emission reduction strategies and abatements;
- cumulative air quality management, including a protocol for communication with representatives of other mining operations; and
- review of the air quality monitoring network with progression of the approved disturbance footprint.

5.4.2 Performance During the Reporting Period

Dust Deposition

During the reporting period, dust deposition levels were collected at 11 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*.

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 2024.

Monthly data that is highly contaminated (e.g. from bird droppings, insects or proximal construction works) has been excluded from annual average dust deposition levels.

As stated within the AQGGMP (MACH Energy, 2024), once Development Consent DA 92/97 is surrendered, MACH Energy will look to decommission sites D6, D9, D11, D13 and D14 in addition to any other dust deposition gauge that is providing unreliable or unrepresentative data. This will be reported in the subsequent Annual Review. The remaining gauges will be those located in key locations, allowing for continued monitoring near Muswellbrook and surrounding areas that provide good background data.

The data indicates that the annual average deposited dust levels measured at the MPO monitors representative of residences on privately-owned land, were below the cumulative criterion of 4 g/m^2/month in 2024. As such, it is considered that compliance with the relevant criterion in Table 10 of DA 92/97 Schedule 3 Condition 20 is achieved (TAS, 2025).

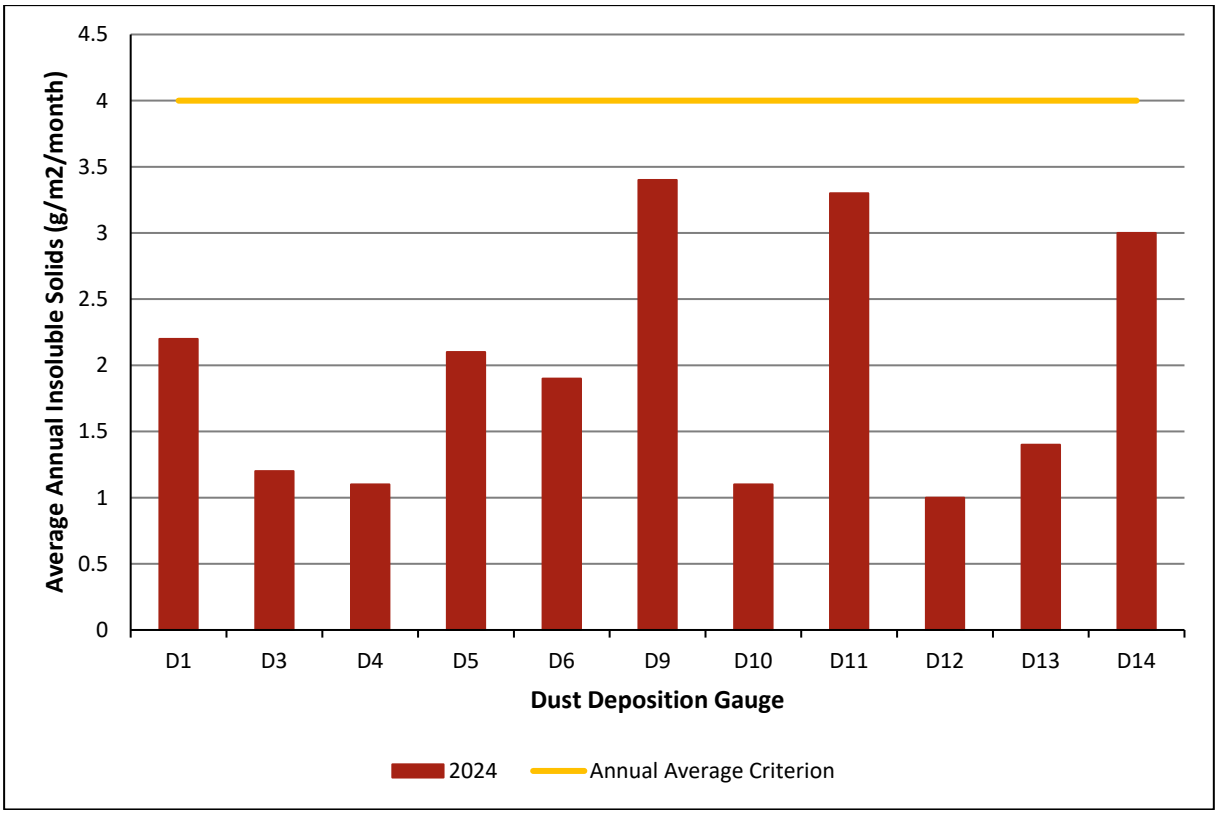


Chart 4: 2024 Annual Average Insoluble Solids

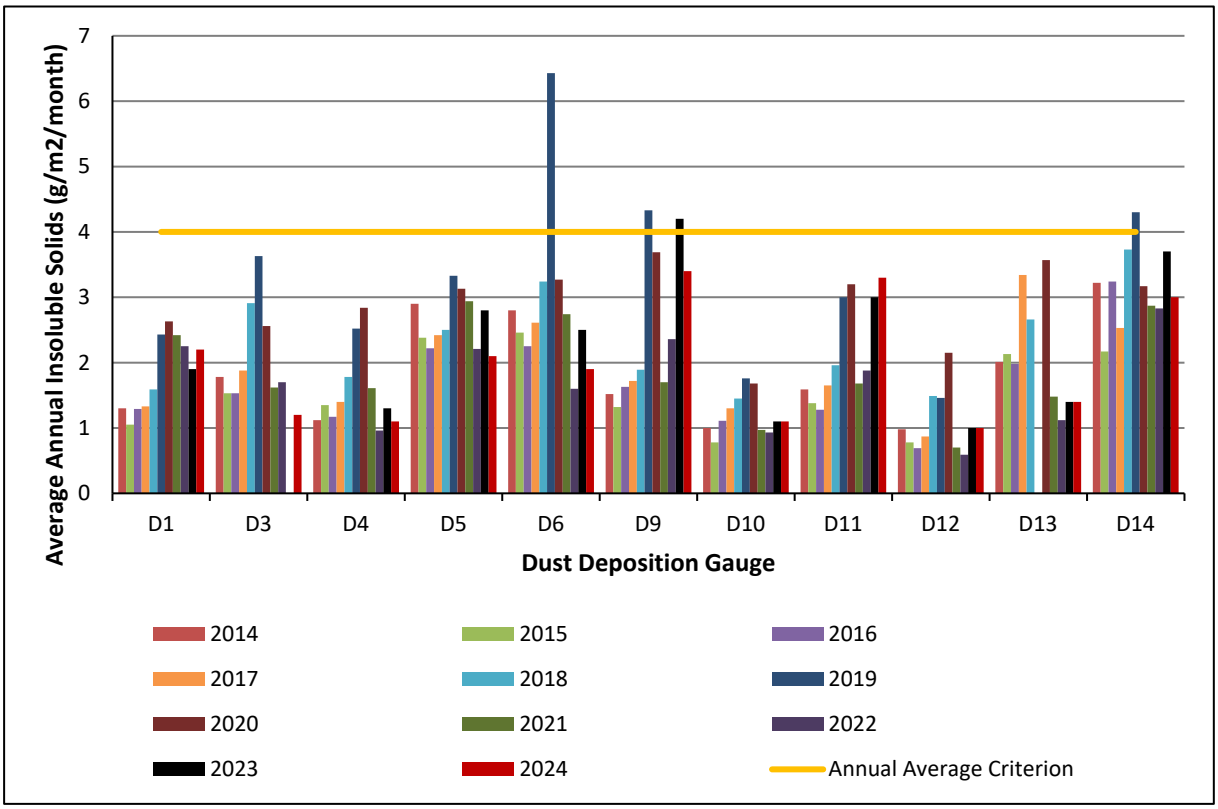
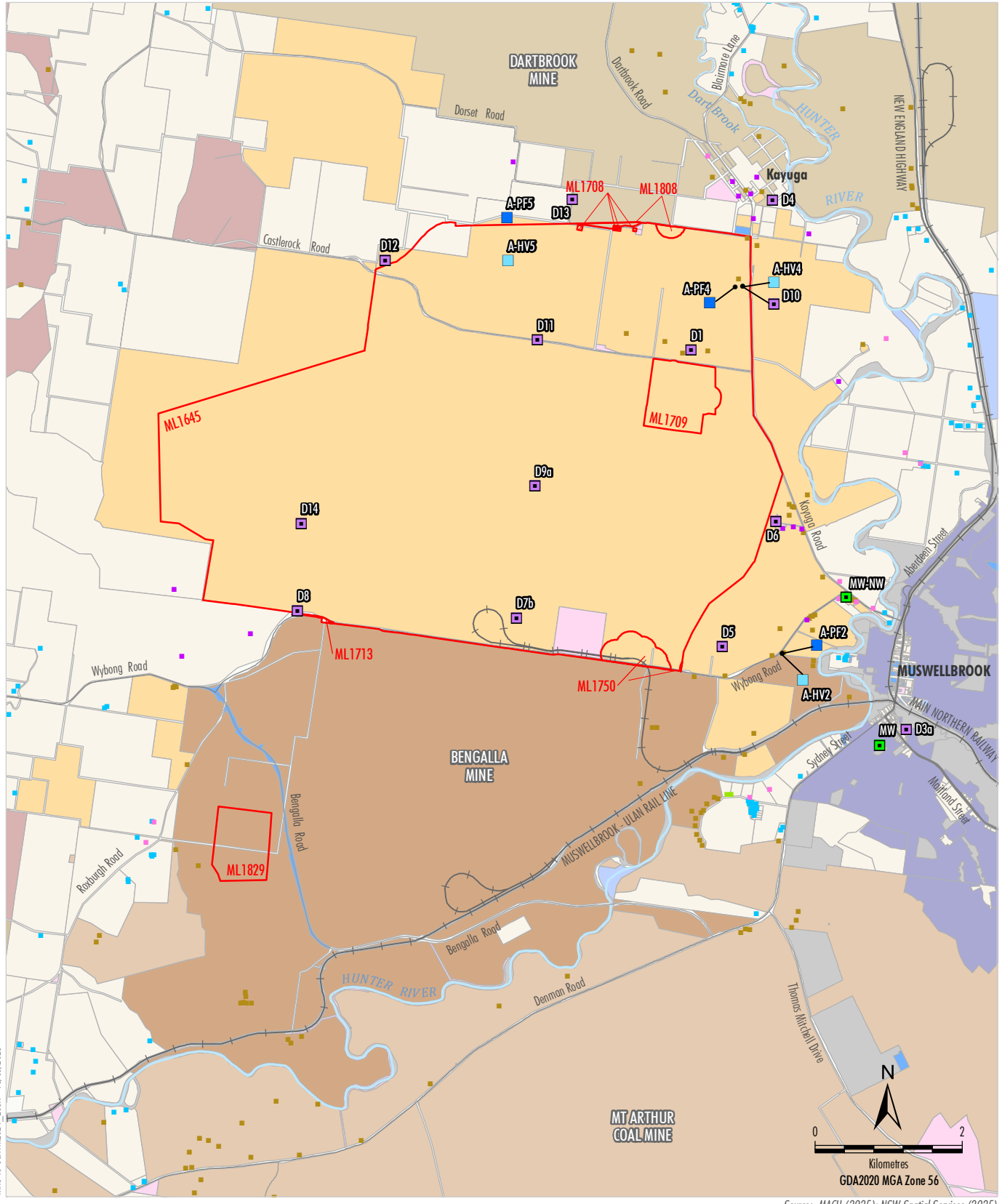


Chart 5: 2014 - 2024 Annual Average Insoluble Solids



MAC-18-03A AR2024_205A 18/03/2025

LEGEND

- Mining Lease Boundary (Mount Pleasant Operation)
- Mount Pleasant-controlled
- Bengalla-controlled
- Dartbrook-controlled
- Mangoola-controlled
- Muswellbrook Coal-controlled
- Mt Arthur-controlled
- Crown
- The State of NSW
- Muswellbrook Shire Council
- Privately-owned Land
- Muswellbrook and Upper Hunter LEP Zones B2, B5, R1, R5
- Muswellbrook and Upper Hunter LEP Zones IN1, SP2, RE1, RE2, W1
- Railway

Category of Rural Residence under SSD 10418

- Mine-owned
- Privately-owned - Acquisition on Request
- Privately-owned - Mitigation on Request
- Privately-owned - Mitigation/Acquisition on Request*
- Other Privately-owned

Monitoring Sites

- Air Quality - High Volume Sampler
- Air Quality - Palas Fidas
- Dust Deposition Gauge
- Upper Hunter Air Quality Monitoring Network

Source: MACH (2025); NSW Spatial Services (2025)

* Mitigation on Request - rail noise/Aquisition on Request - air quality. MACH is only required to acquire and/or install air quality mitigation measures at this property if not reasonably achievable under a separate approval for the Bengalla Mine.

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Air Quality Monitoring Sites

Figure 5

PM_{10} and $PM_{2.5}$

Palas Fidas monitoring systems were installed at three locations (Figure 5) in late 2016. The Palas Fidas systems collected PM_{10} and $PM_{2.5}$ data continuously, which was averaged over 24 hours (Chart 6 and Chart 7) and annually (Chart 8 and Chart 9).

Due to monitor damage, there was insufficient data to calculate valid annual average PM_{10} and $PM_{2.5}$ levels at A-PF5 for 2024. An average of the available data has been presented in Chart 8 and Chart 9 for this monitor. MACH Energy are in the process of replacing some of the existing Palas Fidas monitors to ensure continuous data collection.

The data indicates that the 24-hour average PM_{10} levels were generally low throughout 2024.

It is noted that in the March 2024 monthly environmental monitoring report, MPO reported two 24-hour average levels greater than 50 µg/m^3 at A-PF2 on 30/03/2024 and 31/03/2024. The data were reviewed for these days, and it is considered that the extremely high hourly PM_{10} levels recorded are invalid as they do not appear to be realistic (levels of this magnitude were not recorded at the co-located EBAM monitor or other surrounding monitors during this period) and are considered likely to be caused by moisture or some other form of contamination.

There were no recorded exceedances of $PM_{2.5}$ during 2024.

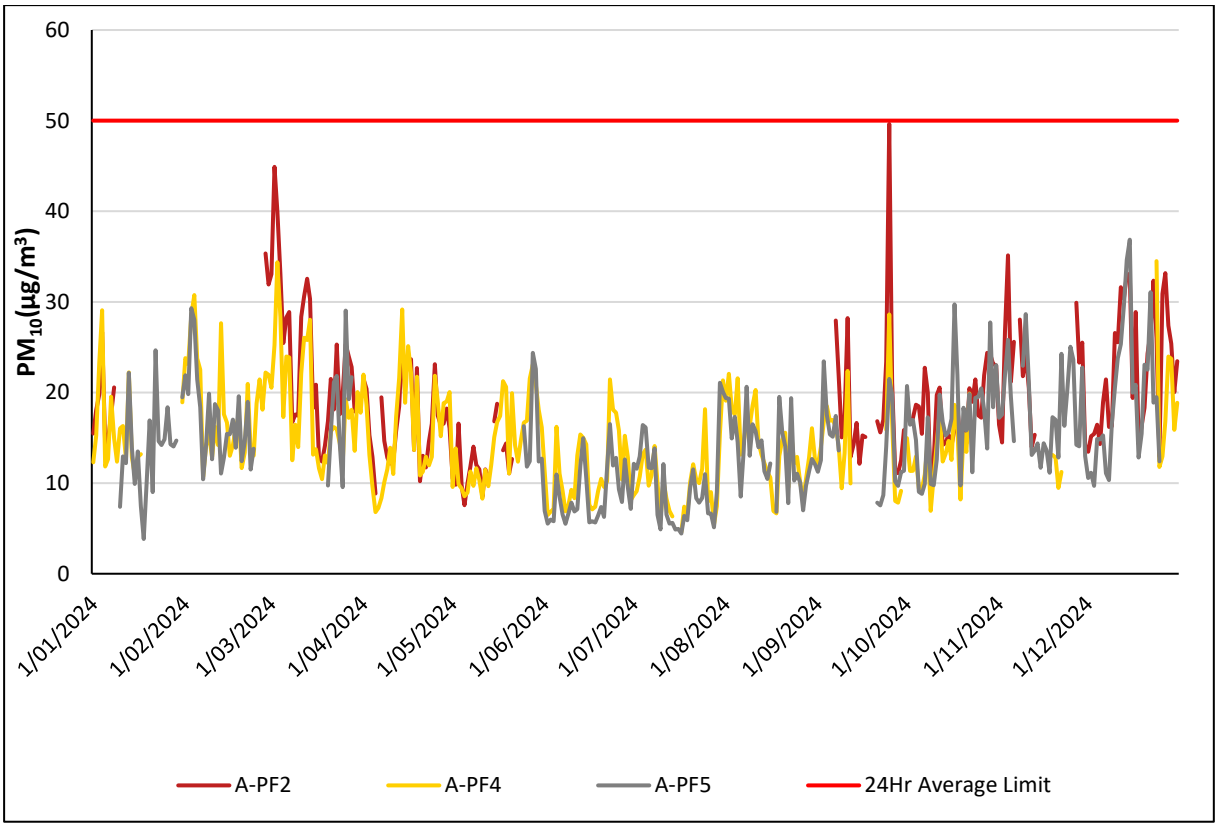


Chart 6: 24-hour Average PM_{10} Levels

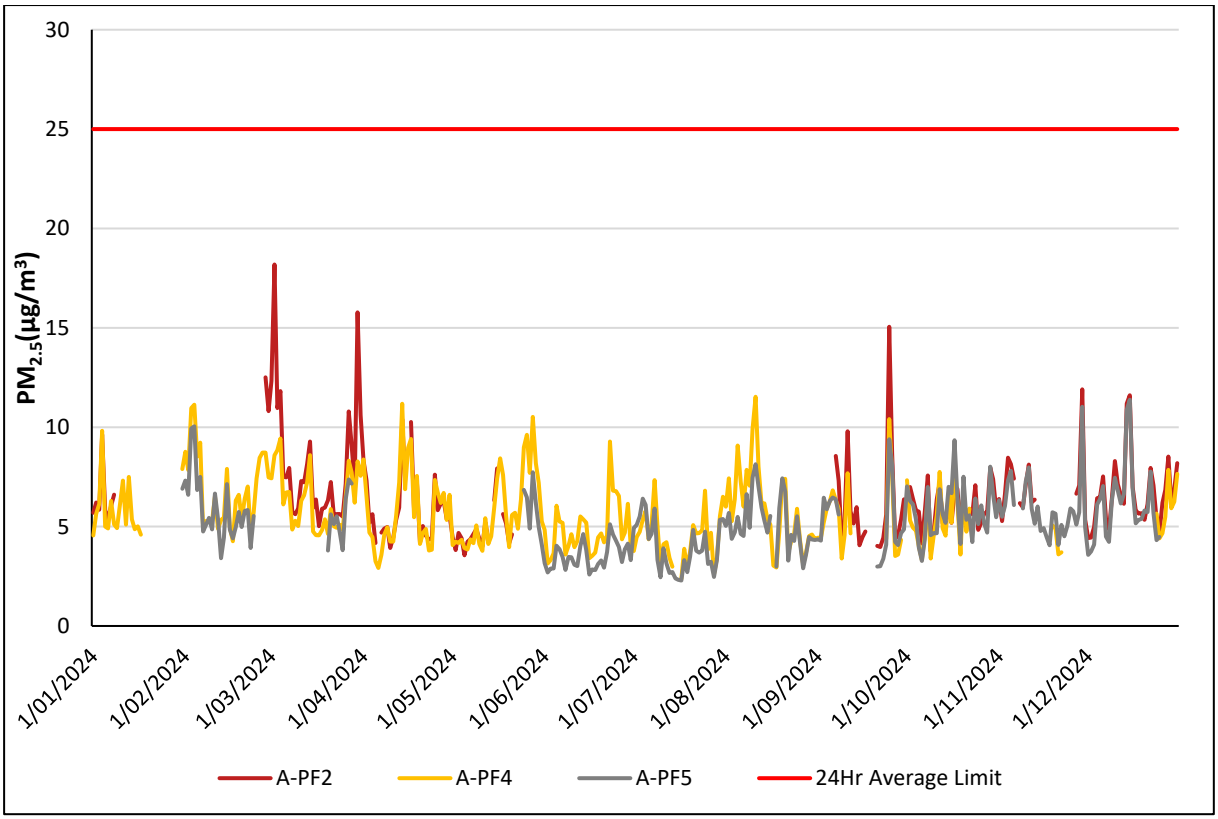


Chart 7: 24-hour Average $PM_{2.5}$ Levels

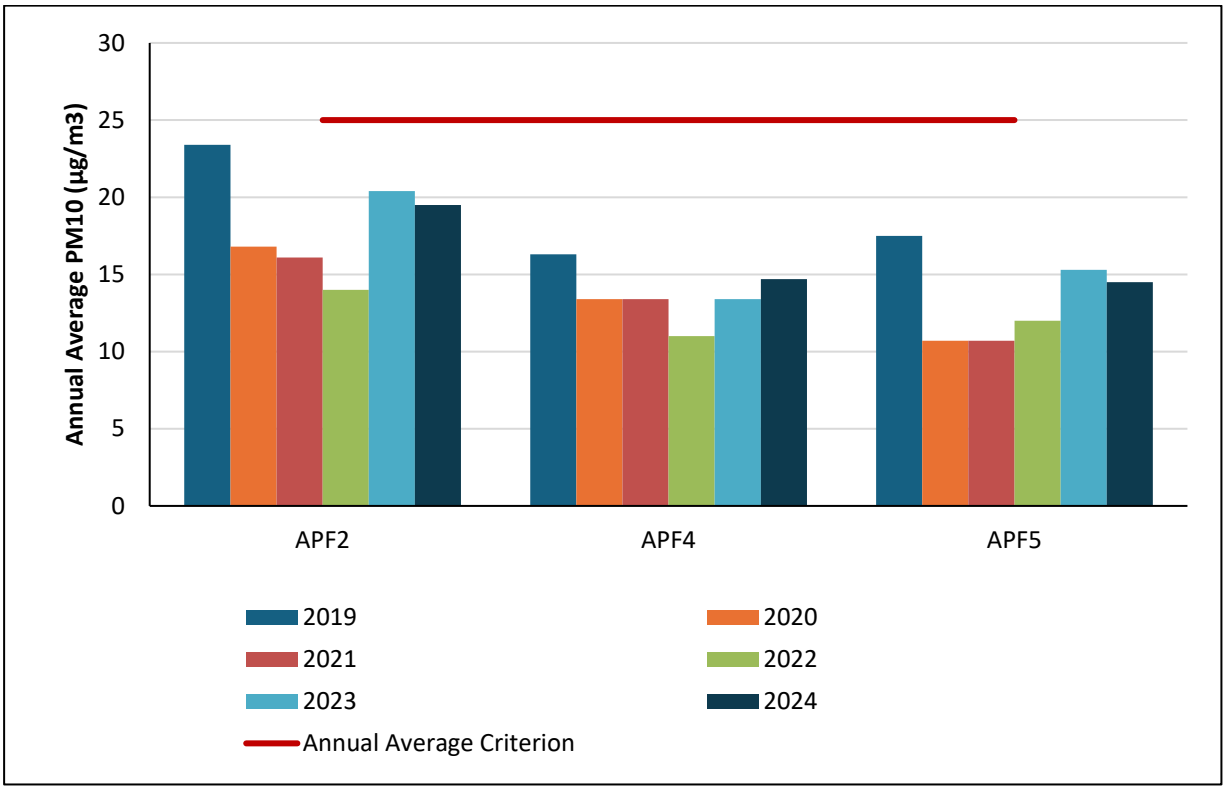


Chart 8: Annual Average PM_{10} Levels

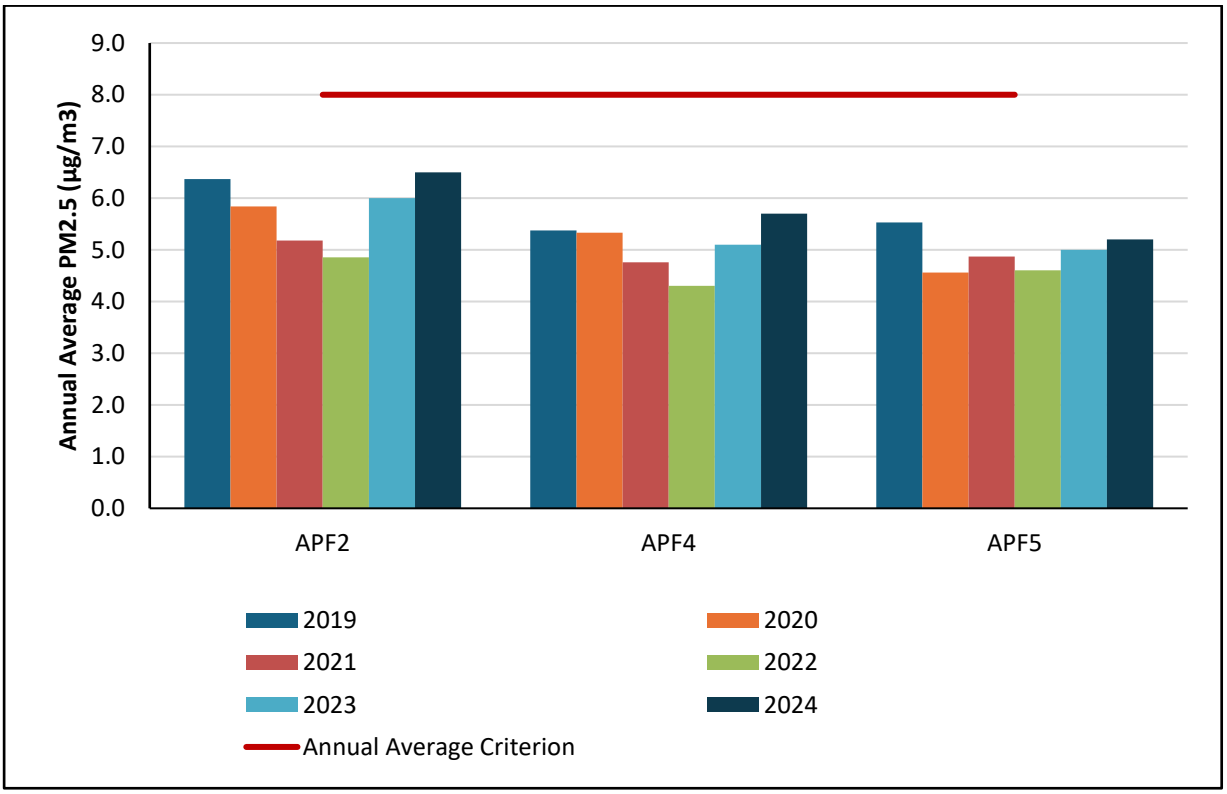


Chart 9: Annual Average $PM_{2.5}$ Levels

Total Suspended Particulate

TSP levels were recorded at the three High Volume Air Sampler (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 10.

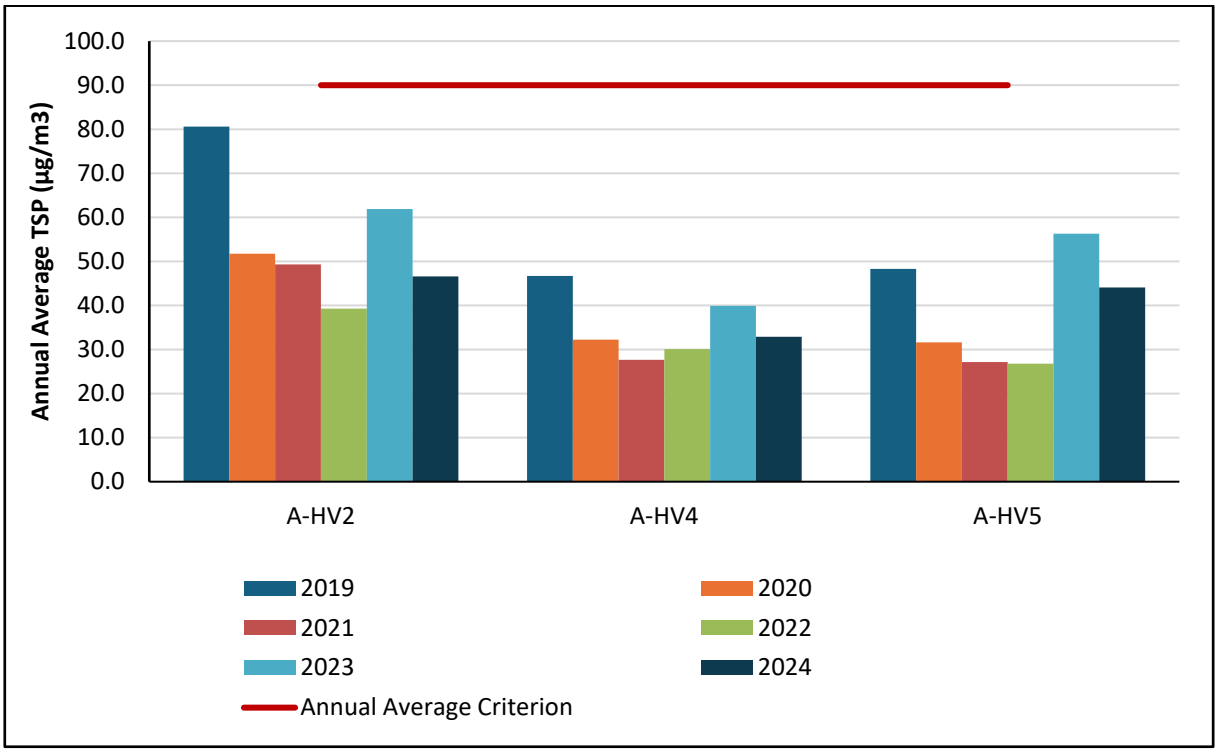


Chart 10: Annual Average TSP Levels

Complaints

Eleven air quality-related complaints were received by MACH Energy during 2024 in comparison to twelve complaints received in the 2023 reporting period (see Complaints Summary 2024: https://machenergyaustralia.com.au/mount-pleasant/documentation/). In response to the complaints, particulate matter levels at nearby monitoring locations were reviewed. For all complaints, the air quality levels at nearby monitoring stations were below the relevant criteria when the complaint was received.

5.4.3 Trends and Key Management Implications

Dust Deposition

TAS reported in the 2024 Annual Air Quality Review (TAS, 2025) that the annual average deposited dust levels were below the cumulative criterion of 4 g/m^2/month in 2024 at all MPO compliance monitors.

PM_{10} and $PM_{2.5}$

The measured 24-hour average PM_{10} levels were generally low during the reporting period.

Chart 6 shows that PM_{10} levels fluctuated at the three monitors throughout the year, with no apparent trends other than A-PF-2 generally recording higher levels than A-PF-4 and A-PF-5. Chart 8 indicates annual average PM_{10} levels slightly decreased between 2023 and 2024.

Real-time monitoring of $PM_{2.5}$ was also undertaken during the reporting period at the three monitors (Figure 5). The measured cumulative 24-hour average $PM_{2.5}$ levels were below the relevant criteria during the reporting period.

Chart 7 shows that $PM_{2.5}$ levels fluctuated at the three monitors throughout the year, with no apparent trends. Chart 9 indicates annual average $PM_{2.5}$ levels slightly increased between 2023 and 2024.

TAS reported in the 2024 Annual Air Quality Review that the MPO was generally compliant with the relevant criteria for both annual and 24-hour average levels for PM_{10} and $PM_{2.5}$ (Table 16) for the reporting period (TAS, 2025).

Total Suspended Particulate

Chart 10 indicates annual average TSP levels decreased between 2023 and 2024.

TAS reported in the 2024 Annual Air Quality Review that the MPO was generally compliant with the relevant criterion for TSP (Table 16) for this reporting period (TAS, 2024).

Greenhouse Gas Emissions

In accordance with Condition 19, Schedule 3 of Development Consent DA 92/97 and Condition B36, Schedule 2 of Development Consent SSD 10418, MACH Energy has implemented all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site.

In accordance with Part B, Condition B36 of Development Consent SSD 10418, MACH Energy will comply with the performance measures in Table 17.

Table 17
Greenhouse Gas Performance Measures (SSD 10418)

Feature	Performance Measure
Scope 1	• Less than 0.87 million tonnes CO_2-e emitted per calendar year, or lower emissions as determined under Condition B34. • Less than 0.80 million tonnes CO_2-e emitted per calendar year (5-year rolling average), or lower emissions as determined under Condition B34. • Less than 13.9 million tonnes CO_2-e emitted over the life of the development, or lower emissions as determined under Condition B34.
Scope 2	• Minimise CO_2-e emissions by using electricity generated by renewable or carbon neutral energy sources where reasonable and feasible.

The primary source of GHG emissions at the MPO is the release of carbon dioxide (CO_2) and methane (CH_4) during the combustion of diesel fuel. Fugitive emissions of CO_2 and CH_4 during the use of explosives will be minor in comparison to diesel combustion emissions.

Greenhouse gas emissions at the MPO are minimised through abatements via efficient use of diesel fuel by the mobile fleet. A list of the new mobile plant added to the fleet in 2024 is provided in Table 18.

Table 18
New Mobile Plant Fleet Summary

Fleet Description	Quantity
Caterpillar 793D	3
Komatsu D475A-8	2
Volvo FMX11 CTX	1

The AQGGMP outlines the reasonable and feasible greenhouse gas mitigation and management measures adopted at the MPO and describes the following controls that are implemented to reduce Scope 1 emissions, which includes (but not limited to):

- Optimising the design of haul roads for energy efficient operation by minimising the distance travelled between the pit and the CHPP.
- Minimising the re-handling of material (i.e. coal, overburden and topsoil).
- Maintaining the fleet in good operating order, including:
  - servicing all machinery in accordance with maintenance contracts and adopting original equipment manufacturer recommendations for maintenance;
  - targeted maintenance, as far as reasonably practical, equipment remains fit for purpose over its whole life cycle; and
  - define failure modes, effects and criticality which helps to minimise potential equipment failure.
- Consideration of replacing diesel with hybrid diesel electric vehicles, when new fleet are required.
- Selecting new equipment and vehicles that have high energy efficiency.
- Consideration of energy efficiency of all new major electrical equipment.

A discussion of the comparative ROM production, diesel consumption, use of oil and grease and the greenhouse gas emissions reported under the National Greenhouse and Energy Reporting Scheme (NGERs) for 2024 financial year and Development Consent SSD 10418 Environment Impact Statement 2021 (SSD EIS) predictions is provided below.

A summary of ROM production, diesel consumption, use of oil and grease and the greenhouse gas emissions reported under the NGERs for 2024 financial year are shown in Table 19. The associated estimated GHG emissions presented in SSD EIS (Appendix S - *Mount Pleasant Optimisation Project - Greenhouse Gas Assessment*) are also shown in Table 20.

NGERs is based upon financial year reporting, and the SSD EIS greenhouse gas estimates are based on calendar years. This Annual Review reports on the 2024 financial year data, as reported in NGERs. Table 19 includes references to the fugitive emission factors adopted in the SSD EIS and those reported in the NGERs, which vary materially.

Comparison to SSD EIS Predictions

The SSD EIS predictions were estimated using site specific fugitive emissions used in previous assessments of site. Estimates of quantities and materials used with the potential to emit greenhouse gases were based on a conservative upper limit of the assumed maximum production throughout the life of the Project.

Any inconsistencies observed between the SSD EIS predictions are likely to be due to the inherent uncertainty associated with predictive modelling (e.g. activities may not occur in the same location, or

at the same magnitude, as anticipated when developing predictive models). Further, the sensitive receptors (residences) are generally not located immediately adjacent the nearest monitoring sites (e.g. monitoring sites may be located closer to mining activity).

Greenhouse Gas Emissions

The 2024 ROM coal production and diesel consumption were lower than SSD EIS predictions, however fuel oil and grease consumption was slightly higher than predictions. Fugitive emissions were higher however this is due to the default emissions factor being used and not the site specific factor as shown in Tables 19 and 20. The lower production rate can be attributed to the NGERS reporting period being the 2024 financial year as production operations decreased at the end of 2023 due to consent conditions.

Oil and grease consumption and emissions were less than predicted assessment.

For an open cut coal mine, the predicted fugitive greenhouse gas emissions are calculated by multiplying the estimated ROM coal production by an emissions factor.

The SSD EIS used the site-specific fugitive emissions factor developed in 2012 (Rio Tinto, 2012). In 2022, MACH Energy commissioned CoalBed Energy Consultants to re-evaluate the fugitive emission factor based on the revised GWP of methane. In conducting this work, the revised estimated fugitive emission factor was determined to be approximately 0.020 tCO_2-e/ROM t (CoalBed Energy Consultants, 2022).

In accordance with *Method 1 National Greenhouse and Energy Reporting (Measurement) Determination 2008*, the fugitive greenhouse gas emissions reported by the MPO via NGERs were estimated using default emission factors from the National Greenhouse Accounts Factors (NGA Factors).

For open cut coal mines in NSW, the default emission factor is 0.061 (tCO_2-e/ROM t) in the NGA Factors 2024. This NGA default factor is significantly higher than the site-specific factor (i.e. 0.020 tCO_2-e/ROM t) calculated by CoalBed Energy Consultants 2022.

The differences in the fugitive emission estimates between SSD EIS and MACH Energy NGERs reporting arise primarily due to differing methodologies and associated emission factors being employed under the differing regulatory systems (i.e. NGERs reporting under the *Commonwealth National Greenhouse and Energy Reporting Act 2007* using NGA default emission factors, and environmental assessment under the NSW *Environmental Planning and Assessment Act 1979* using site-specific emissions data), plus periodic revisions to the GWP of methane, which is a large component of the fugitive emissions from coal mines.

The MPO fugitive Scope 1 emissions for 2024 (Table 19) were lower than the performance measures set out in Table 4 of Development Consent SSD 10418.

Table 19
MPO Emissions Summary Financial Year 2024

Financial Year	ROM (t)	Diesel Consumption (kL)	Fuel Oil/Petroleum Based Oils and Greases Consumption (kL)	Fugitive Scope 1 emissions (t CO_2-e)	Diesel Scope 1 emissions (t CO_2-e)	Fuel Oil/Petroleum Based Oils and Greases Scope 1 emissions (t CO_2-e)
2024	7,662,358[2]	45,486.02	1027.25	196,934[1]	123,255	505

Note:

t = tonnes; kL = kilolitres and tCO_2-e = tonne of Carbon Dioxide equivalent.

[1] Fugitive emission factor was 0.061 (DCCEEW, 2021).

[2] ROM (t) based on the 2024 NGER which is reported for the financial year (not calendar year).

Table 20
SSD EIS Prediction Emissions Summary 2023 and 2024

SSD EIS Prediction Year	ROM (t)	Diesel Consumption (kL)	Fuel Oil/Petroleum Based Oils and Greases Consumption (kL)	Fugitive Scope 1 emissions (t CO_2-e)	Diesel Scope 1 emissions (t CO_2-e)	Fuel Oil/Petroleum Based Oils and Greases Scope 1 emissions (t CO_2-e)
2023	10,500,000	68,000	895	126,000	184,000	2,000
2024	10,500,000	70,000	932	126,000	191,000	3,000

Note:

[1] Fugitive emission factor was 0.012, calculated inclusive of a GWP for methane of 21 (Rio Tinto, 2012).

Air Quality Review

TAS was commissioned by MACH Energy to complete an air quality review at the MPO for 2024. The air quality review is provided in Appendix D.

The review concluded that the MPO was fully compliant with the relevant air quality criteria (Condition 20, Schedule 3 of Development Consent DA 92/97 and Condition B28, Schedule 2 of Development Consent SSD 10418).

A review of the MPO operations during "adverse conditions" indicate that MPO activities were carried out in accordance with the requirements of EPL 20850 Condition O3.

The comparison of the measured results to the model predictions shows that the annual average measured levels in 2024 generally aligned with the modelling predictions.

5.4.4 Implemented or Proposed Management Actions

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

Dust generating activities were discontinued on three occasions during 2024 in accordance with Conditions O3.4 and O3.5 of EPL 20850. These have been reviewed in the TAS report in Appendix D.

All appropriate steps to reduce dust generation were undertaken in accordance with the MPO AQGGMP, consistent with Condition 23, Schedule 3 of Development Consent DA 92/97 and Condition B32, Schedule 2 of Development Consent SSD 10418. MACH Energy will continue to implement these dust mitigation measures.

A review of the effectiveness of air quality management systems has undertaken throughout the reporting period. Reviews were undertaken in response to air quality complaints, and during the development of the annual report. Reviews have determined that the current measures being implemented, including reactive management measures have effectively managed air quality at the operations.

Per EPL Condition O3.4, MPO must cease all dust generating activities during adverse wind and PM10 conditions. The TAS report presents a log of times when adverse conditions occurred, when dust generating activities were ceased in accordance with EPL Condition O3.4 and when activities were resumed. The data indicate that there were three days when adverse conditions occurred during 2024. As full summary and review of these are included in the TAS report.

5.5 BIODIVERSITY

A BioMP was prepared by MACH Energy in accordance with Condition 32, Schedule 3 of Development Consent DA 92/97 and Condition B63, Schedule 2 of Development Consent SSD 10418. The BioMP was approved on 5 November 2024.

5.5.1 Approval Criteria and Management Plan Requirements

MACH Energy implements biodiversity management actions in accordance with the approved BioMP. In order to ensure appropriate management actions are applied, and to evaluate the vegetation and fauna habitat condition at the MPO, the BioMP implements a Biodiversity Monitoring Program. The program includes the following components to maintain the remnant vegetation across the MPO area:

- tree clearing supervision;
- fauna relocation / spotter catcher;
- weed monitoring;
- vertebrate pest monitoring;
- monitoring of access; and
- rehabilitation monitoring.

5.5.2 Implemented or Proposed Management Actions

In 2024, the following biodiversity related management actions were undertaken:

- Weed control measures carried out on various properties within MPO and adjoining properties. Weeds found on the properties were sprayed or manually removed.
- Pest control measures implemented on various properties within the MPO and adjoining properties. This included various pig control programs throughout 2024.
- Pre-clearance surveys undertaken by MACH Energy Environmental Advisor and/or an ecologist consultant including:
  - surveys for the ongoing mining operation.
  - habitat tree pre-clearance survey for the construction works that impacted habitat trees.
- Clearing supervision was undertaken by a MACH Energy Environmental Advisor and/or an ecologist consultant (Atlantech), which included fauna management (i.e. spotter catching) and habitat tree felling supervision.
- Annual, bi-annual and regular monitoring was carried out by MACH Energy.

Biodiversity Offsets

The MPO Development Consent DA 92/97 was granted in December 1999, prior to the implementation of offsetting policies in NSW. While no biodiversity offsets were required for the original development under Development Consent DA 92/97, biodiversity offsets were established for the existing / approved MPO under the Commonwealth approval (EPBC 2011/5795).

The Development Consent SSD 10418 commenced in February 2024 and the Commonwealth Approval of EPBC 2020/8735 was granted on 24 September 2024. The EPBC 2020/8735 conditions of approval relate to the disturbance associated with the Northern Link Road.

As of 31 December 2024, MACH Energy is continuing to work with DCCEEW to finalise a Conservation Agreement (under Part 14 of the EPBC Act) to secure the BMAs.

The BMAs are managed by MACH Energy in accordance with an offset management plan, approved by DCCEEW in 2015 and varied from time to time to reflect management updates from MACH Energy and requests from DCCEEW.

MACH Energy has been progressing the biodiversity stewardship agreement with the NSW Government. The application to establish a biodiversity stewardship agreement that would meet the requirements of EPBC 2011/5795 was lodged on 30 March 2023 with the NSW Credit Supply Taskforce (now Nature Markets and Offsets [NMO]). The application has been revised on a number of occasions

during the 2024 reporting period to address comments from NMO, and it is expected to be finalised in 2025.

5.6 HERITAGE

MACH Energy manages Aboriginal heritage on-site in accordance with Aboriginal Heritage Impact Permits (AHIPs) (i.e. AHIPs #C0002053, #C0002092 and #C0004783) issued by Heritage NSW within the NSW Department of Premier and Cabinet (now DCCEEW), and in accordance with the approved ACHMP, prepared in accordance with Condition 36, Schedule 3 of Development Consent DA 92/97 and Condition B69, Schedule 2 of Development Consent SSD 10418.

MACH Energy manages any non-Aboriginal cultural heritage items in accordance with the approved HHMP, prepared in accordance with Condition B73, Schedule 2 of Development Consent SSD 10418.

5.6.1 Approval Criteria and Management Plan Requirements

During the reporting period, all Aboriginal and non-Aboriginal heritage management activities were carried out in accordance with both the ACHMP and HHMP. The ACHMP contains a range of management measures related to recording and surface collection, archaeological excavation, artefact analysis, artefact management, archaeological salvage, archaeological monitoring, and an Aboriginal Heritage Conservation Strategy.

The HHMP details a range of management measures related to photographic/archival recording, archaeological investigation of potential human burial sites, protection and management for items located outside of the approved disturbance area.

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:

- Surface salvage collection for Aboriginal artefacts within AHIP #C0002092 area was undertaken in November 2024 for the Northern Link Road. Further surveys for Northern Link Road will extend into 2025.
- Annual meeting with Registered Aboriginal Parties (RAPs) was undertaken to provide a general update on the management of Aboriginal heritage in October 2024.
- Aboriginal Objects Due Diligence Assessments were undertaken for the following work by Niche Environment:
    - Pastime and Negoa Properties
    - Geotech Exploration of Northern Link Road
      Exploration and Drilling Works for Northern Link Road
- Annual inspection of Aboriginal cultural heritage sites in December 2024.
- Formal replacement of Aboriginal Heritage Conservation Areas B and C with Ascot Farm and the Munmurra River Grinding Groove site, in consultation with Heritage NSW and the RAPs. The ACHMP has been updated to reflect the formal replacement of Aboriginal Heritage Conservation Areas B and C.
- Upgrade of Ascot Farm as a ‘Keeping Place’ to extend into 2025.
- Ongoing conservation management works at the Negoa Homestead.
- Update of the MPO Aboriginal Site Database and Geographic Information System (GIS) data.
- The security of Aboriginal Heritage Conservation Area A is still ongoing, in consultation with DPHI

and any updates will be reported in the next reporting period.

- Photographic/archival recording of the relevant historic heritage sites listed in the HHMP, prior to disturbance.

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

- Next Annual RAPs meeting to be scheduled for August 2025.
- Annual inspection of Aboriginal cultural heritage sites.
- Ongoing due diligence surveys and surface salvages as required including Northern Infrastructure Work (NIW) areas.
- Ongoing archaeological surveys of historical heritage Northern Infrastructure Work (NIW) areas.
- Continuation of consultation regarding the formal replacement of Aboriginal Heritage Conservation Areas B and C.
- Continue to undertake appropriate conservation management works at the Negoa Homestead.
- Ongoing photographic/archival recording of the relevant historic heritage sites listed in the HHMP, prior to disturbance.

5.7 EXPLORATION

MACH Energy concluded a pre-production drilling program in October 2024 within the proposed three-year mining footprint, with 103 boreholes being drilled in ML 1645 and ML 1709 during program. Drilling was undertaken using the water injection method, which generates minimal dust and noise emissions. The boreholes were located within the open cut/overburden emplacement area footprint and involved open hole (non-core) and cored drilling.

5.8 WASTE

Operational waste data was collected during the reporting period by the waste contractor and is presented in Table 21. No waste tyre in-pit burial campaigns were undertaken during the reporting period.

Due to the major infrastructure projects that have been undertaken onsite during the reporting period, all waste levels have increased between 2023 and 2024, this includes the volume of recycled waste which increased significantly.

The WasteMP contains management measures on waste storage, segregation, transport and disposal, as well as provisions for waste monitoring. The latest version of the WasteMP was approved by DPE (now DPHI) on 14 January 2019.

FEA (Fines Emplacement Area) review of facility, management and storage capacity by consultant engineer found that there is sufficient storage capacity remaining for ongoing deposition during construction of the new wall lift (ATC Williams, 2025).

Table 21
MPO Waste Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
General Waste (t)	34.86	54.01	80.76	130.31	117.59	33.84	40.86	62.63	32.41	71.72	18.28	49.84	727.11
ACM[1] (t)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recycled Waste (t)	274.22	387.91	218.23	264.77	291.29	273.78	273.17	261.67	276.43	291.05	256.20	283.56	3352.28
Liquid Effluent (kL)	198.98	320.80	163.07	169.50	184.80	161.00	100.45	187.00	175.00	160.50	207.00	223.00	2251.1

Note:

[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.

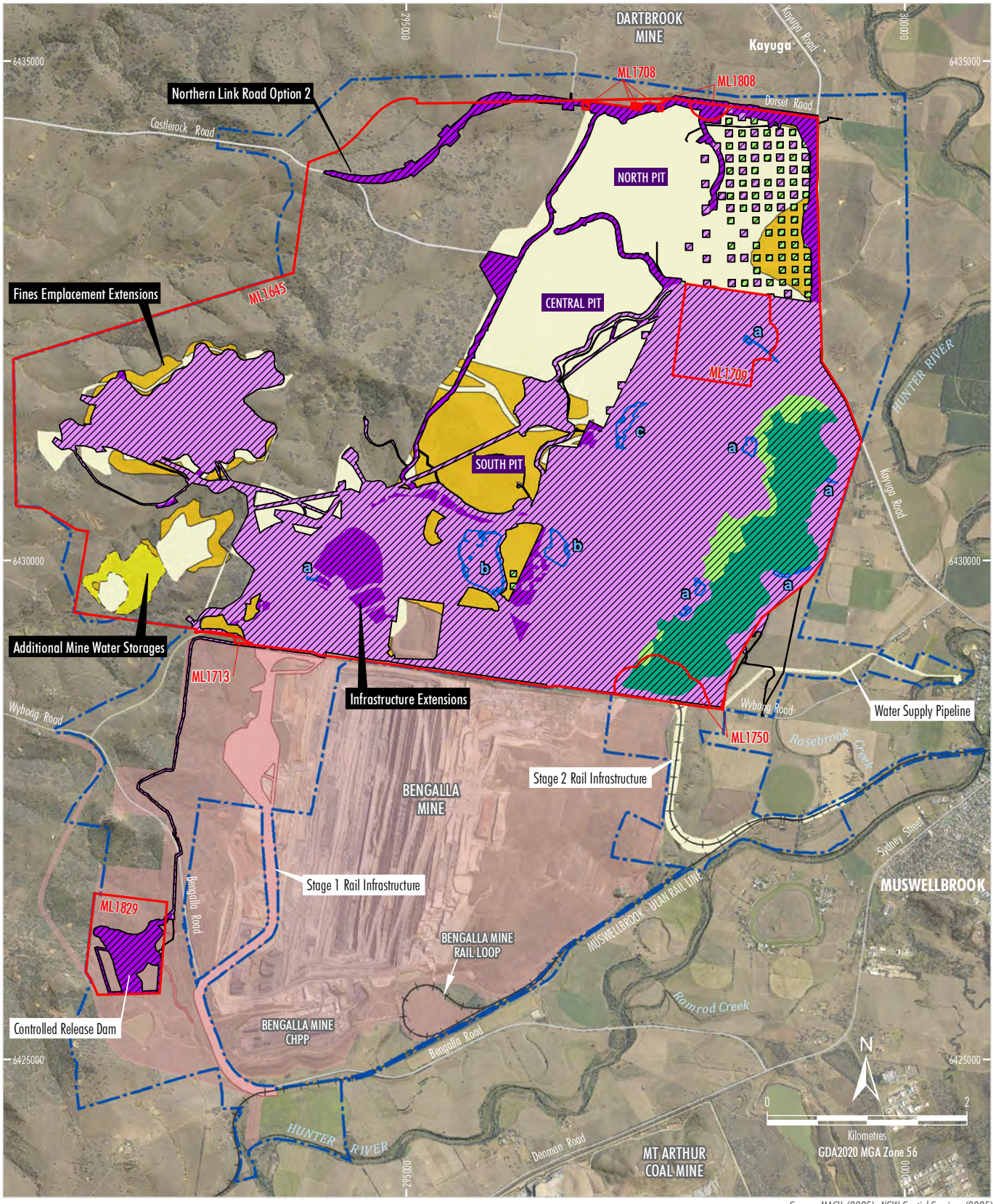
5.9 TOPSOIL MANAGEMENT

MACH Energy currently estimates that approximately 1,677,598 cubic metres (m^3) of topsoil is required for final landform rehabilitation and therefore, MACH Energy is aiming to directly apply or stockpile this amount prior to mine closure. During the reporting period, topsoil stockpiles were located adjacent to active disturbance areas and areas to be rehabilitated, as shown on Figure 6. A total of approximately 1,126,408 m^3 of topsoil was stored in stockpiles at the end of the reporting period. This, in accordance with the currently approved RMP, is approximately 1,292,755 m^3 less than the volumes anticipated at the end of August 2023. However, sufficient soil resources are available for final landform rehabilitation. A topsoil register with individual volumes for each stockpile is kept and maintained on-site.

Topsoil was stripped ahead of disturbance activities and where possible, placed onto rehabilitation areas immediately. Where it was impractical to respread topsoil immediately it was stockpiled, and sign posted. The stockpiles were then shaped, ripped and direct seeded with a species mix containing sterile pasture species, native grass and shrub tree seed to maintain seed reserves and microbial soil associations.

Between 2020 and 2022, MACH Energy engaged the University of Newcastle to design and undertake a topsoil stockpile research trial to assess the effectiveness of the MPO's 'Soil Stockpile Management' practices and the 'Soil Replacement on Rehabilitation Areas' practices as outlined in the RMP. The trial involved comparison of microbes and soil at one 5 m high trial topsoil stockpile and at six other 3 m high control topsoil stockpiles. The study is now complete and the results indicate no quantifiable difference between the five-metre trial site and the three-metre stockpiles. The majority of soil properties (both chemical and physical) have no correlation with stockpile depth across all sample sites. Exchangeable nutrient and micronutrients were found to vary greatly across the site. Total carbon was significantly lower at the 5 m trial stockpile at Pit E. No correlations between total carbon and depth were observed across the site however, this may be more a function of a pre-stripped soil heath than a result of greater stockpile depths. Soil microbial biomass was shown to have a significant linear decrease with increasing stockpile depth at four of the six stockpiles. As vegetation is re-established and the soil ecosystem continues to develop it is expected that soil quality will improve across both control and trial sites. The 5 m high trial topsoil stockpile remains in place.

The Australian Coal Association Research Program (ACARP) Tailings to Topsoil research project described in the RMP was continued during the reporting period in collaboration with the University of Newcastle. The project aims to optimise existing tailings processes and technologies and provide a commercially viable system for tailings utilisation. The results of the project will be reported once complete.



MAC-18-03A AR2024_207B

LEGEND

- Railway
- Development Application Area (SSD 10418)
- Mining Lease Boundary (Mount Pleasant Operation)
- Project Continuation of Existing/Approved Surface Development (DA92/97) [1]
- Bengalla Mine Approved Disturbance Boundary (SSD-5170)
- Existing/Approved Mount Pleasant Operation Infrastructure within Bengalla Mine Approved Disturbance Boundary (SSD-5170) [1]
- Development Footprint 1 (Stage 1) - General Extension Areas [1]
- Development Footprint 1 (Stage 2) - Mine Water Dam 3 [1]
- Foward Program 2025 Footprint
- End 2024 Active Mining Disturbance Area
- 2025 Forecast Disturbance Area
- End 2024 Rehabilitation Area
- 2025 Forecast Rehabilitation Area
- a — End 2024 Topsoil Stockpile Location (3 m)
- b — End 2024 Topsoil Stockpile Location (3 - 5 m)
- c — End 2024 Topsoil Stockpile Location (5 m)

NOTES

[1] Excludes some incidental Project components such as water management infrastructure, access tracks, topsoil stockpiles, power supply, temporary offices, other ancillary works and construction disturbance.

Source: MACH (2025); NSW Spatial Services (2025); Department of Planning and Environment (2016)
Orthophoto: MACH (Dec 2024)

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Topsoil Stockpile Locations

Figure 6

5.10 VISUAL AMENITY AND LIGHTING

Following approval of MOD 6 (6 November 2023), in accordance with Schedule 5, Condition 4 of Development Consent DA 92/97, a review and revision of the VIMP was undertaken in consultation with MSC. The VIMP was updated to incorporate the management measures for the design of the re-transmission facility and submitted to DPE (now DPHI) on 22 December 2023. The updated VIMP was approved by DPHI on 15 March 2024 (Version 3).

A revised VIMP (Version 4) was prepared by MACH Energy in accordance with Condition B77, Schedule 2 of Development Consent SSD 14018, and approved on 20 December 2024. This Annual Review reports against the currently approved VIMP (20 December 2024).

The VIMP describes MACH Energy's management approach to minimising visual amenity and lighting impacts on surrounding receivers.

Visual landscaping activities were undertaken during the reporting period. This included tree planting of approximately 5,000 tubestock during 2024 in the following areas:

- south east of the tailings dam (Broomfield 3);
- tree screen located along Wybong Road (Scrivens);
- riparian section of Sandy Creek (Broomfield 2);
- general maintenance of the previous tree screen and infill planting areas.

Cardboard tree guards were trialled as an alternative to plastic sleeves. The results of the trial showed a similar survival rate of seedlings between the cardboard and plastic guards.

During the reporting period, contractors were employed to undertake maintenance of visual landscaping including watering, weeding, slashing, and re-tying more mature trees that are exposed to wind to stakes.

Four visual-related complaints were received by MACH Energy during 2024, in comparison to the eight visual-related complaints received in 2023 (see Complaints Summary 2024: https://machenergyaustralia.com.au/mount-pleasant/documentation/). Investigations were triggered in response to the complaints. Following the investigations, the External Relations Manager made further contact with the complainant to provide an update on how the issue was addressed by MACH Energy.

5.11 CONTAMINATED LAND

No contaminated land was found during the reporting period.

5.12 SPONTANEOUS COMBUSTION MANAGEMENT

Inspections of coal stockpiles for spontaneous combustion were undertaken regularly.

A total of six complaints that mentioned odour in relation to spontaneous combustion were received by MACH Energy during 2024, this is an increase compared to the three received in 2023 (see Complaints Summary 2024: https://machenergyaustralia.com.au/mount-pleasant/documentation/). In response to each complaint, an investigation was triggered. Following the investigation, the External Relations Manager made further contact with the complainant to provide an update on how MACH Energy has addressed the issue of the complaint.

5.13 Geochemistry

During the 2022 reporting period, KCB was commissioned by MACH Energy to provide support for the ongoing geochemical assessment of the overburden tailings and coal rejects on site. KCB undertook additional Acid Mine Drainage (AMD) test assessments to further increase the understanding of potential AMD risk at MPO and validate the sites ongoing WasteMP. Consistent with the previous geochemical characterisation completed at the MPO (RGS, 2020; KCB, 2021), most samples representing overburden and interburden materials were classified as Non-Acid Forming (NAF) material. However, there are some uncertainties in AMD classification for overburden Potentially Acid Forming (PAF) samples (KCB, 2022).

In 2024, the following management actions were undertaken in relation to waste rock management:

- Covering PAF interburden material with NAF waste material within timeframes determined by the relative reactivity of the material.
- Ensuring that PAF material is not emplaced within 10 m of the outer surface of the final landform by maintaining two separate types of waste emplacement areas (Unrestricted emplacement areas and NAF Only areas).
- Regularly reviewing the designation between the Unrestricted and NAF only emplacement areas within the waste rock emplacement (the “PAF line”).
- Periodically adjusting the “PAF line” based on the latest geomorphic landform designs to maintain a minimum of 10 m of NAF cover over Unrestricted waste disposal areas.

6 WATER MANAGEMENT

A WMP was prepared by MACH Energy in accordance with Condition B52, Schedule 2 of Development Consent SSD 10418, which was approved on 2 August 2024. This Annual Review reports against the currently approved WMP.

The WMP includes the following monitoring network (Figure 7):

- 14 surface water monitoring locations (W1 – W17);
- nine stream health monitoring locations (HR1 – HR6, DB, MC and SC);
- groundwater monitoring bores covering all major hydrogeological units; and
- Water discharge/ monitoring Point 16 (Hunter River Salinity Trading Scheme [HRSTS]) from EPL 20850.

All construction work associated with MOD 4 were completed prior to the reporting period. Mining activities in 2024 were undertaken in accordance with the erosion and sediment control provisions of the approved WMP.

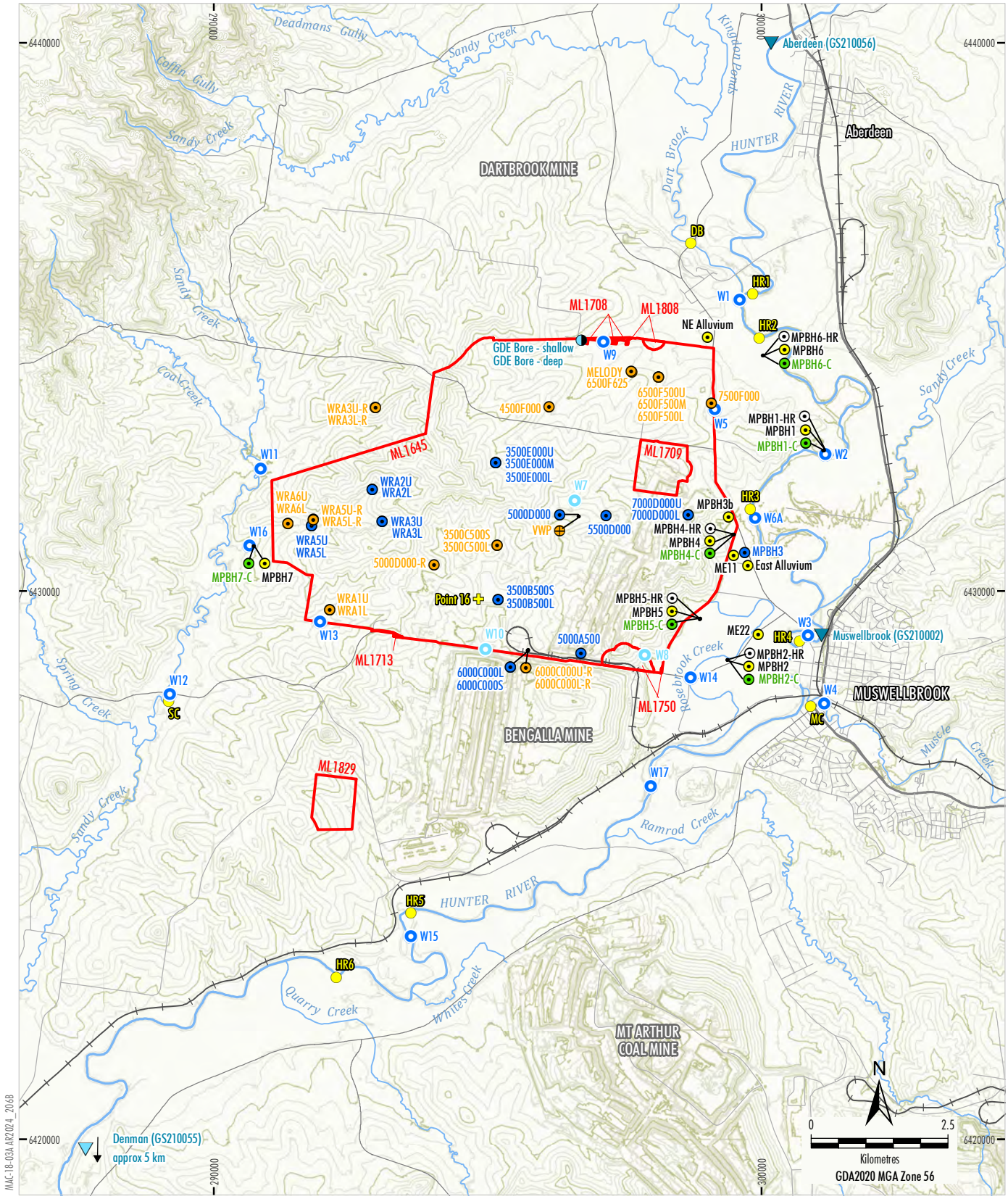
There were no water discharge events from the MPO in 2024. Any future discharges of mine water will be undertaken in accordance with Condition 26, Schedule 3 of Development Consent DA 92/97, Condition B49, Schedule 2 of Development Consent SSD 10418, Development Consent SSD-5170 (i.e. Bengalla Mine's Development Consent) and EPL 20850.

On the 27 August 2024 MACH lodged a variation of the EPL 20850 and approval was received on the 4 December 2024. The variation included the following changes related to water management:

- updated premises boundary to accurately represent the interim discharge pipeline with Bengalla Coal Mine under the HRSTS;

removal of outdated licensed monitoring Point 12 and Point 14; and

administrative amendments to monitoring conditions against Licensed discharge monitoring Point 16.



Source: MACH (2025); NSW Spatial Services (2025); NSW Department of Primary Industries - Water (2016)

LEGEND

- Mining Lease Boundary
- Contour (10 m Intervals)
- DCCEEW Water Gauging Station

Surface Water Monitoring

- Stream Health Monitoring Site
- Surface Water Monitoring Site
- Historical Surface Water Monitoring Site
- Water Discharge/Monitoring Point (EPL 20850)

Mount Pleasant Monitoring

- GDE Bore
- Vibrating Wire Piezometer
- Standpipe
- Standpipe - Alluvium
- Standpipe - Interburden
- Standpipe - Coal Seam
- Standpipe - Historical

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Surface Water and Groundwater Monitoring Locations

Figure 7

6.1 SURFACE WATER

6.1.1 Approval Criteria

Surface Water Quality

Surface water monitoring is undertaken monthly and/or event based at 14 locations (Figure 7) for pH, electrical conductivity (EC), total suspended solids (TSS) and total dissolved solids (TDS), with additional monitoring conducted if triggered by a rain event. Water samples are also collected annually at these sites for laboratory analysis.

Monitoring data has not been collected at the Hunter River site W6 since 2011 due to the riverbank being too steep at this location to allow safe access. As such, water monitoring at site W6 has been discontinued and monitoring is undertaken at the new monitoring site W6A.

Establishment of the baseline conditions of key watercourses prior to the commencement of coal extraction was undertaken through surface water monitoring. Monitoring data has been reviewed against site-specific surface water quality triggers. 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) guidelines have been superseded by the *Australian New Zealand Guidelines* (ANZG 2018). Surface water quality triggers have been developed using the ANZG (2018) / ANZECC & ARMCANZ (2000) guidelines in conjunction with baseline data collected at the site.

Trigger levels have not been established for sites upstream of the MPO (i.e. W1, W4 and W11) because these cannot be affected by the MPO. Site specific trigger levels have been developed for sites W2 and W6 as indicator sites. Site W6 contains sufficient data to develop trigger levels although there was insufficient data to develop TDS trigger levels for this site. Sites W5, W9, W13 and W16 are located on ephemeral drainage lines which are frequently dry and do not have sufficient data to develop site-specific trigger levels. There was insufficient data to develop trigger levels for site W14 due to dry conditions. ANZG (2018) / 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.

W17 has been assigned preliminary trigger values from the Bengalla Water Management Plan (Bengalla Mining Company [BMC], 2017). MACH Energy has established preliminary triggers at this site as it is the only site downstream of MPO's footprint on the Hunter River that is not also downstream of the Bengalla Mine footprint. MACH Energy therefore considers this site particularly important for assessing potential surface water impacts associated with the MPO (i.e. in the absence of any potential influence from Bengalla Mine).

Mangoola Coal Operations Pty Ltd has established triggers on Sandy Creek, downstream of the MPO. A description of these triggers and how they were derived is contained in the Mangoola Coal Surface Water Monitoring Plan (MCO, 2018).

The updated site-specific trigger levels are listed in Table 22.

Table 22
Surface Water Quality Trigger Levels

Site	pH	EC (µS/cm)	TSS (mg/L)
	20th – 80th Percentile Trigger Levels**	80th Percentile Trigger Level	80th Percentile Trigger Level
Site Specific Reference / Trigger Levels			
Hunter River			
W1 (reference site)	6.5 – 8.2	529	18
W2	6.5 – 8.3	539	18
W6*	6.5 – 8.4	496	19
W17#	6.5 – 8.1	650	40
W15	6.5 – 8	460	23
Sandy Creek			
W11 (reference site)	6.5 – 8	7,050	10
W12	6.5 – 8.1	6,420	30
Muscle Creek			
W4 (reference site)	6.5 – 8	2,480	11

* Due to safe access no longer being available at site W6, triggers developed for this site will now be used at the new monitoring location W6A, approximately 500 m downstream of W6.

** Where the 20th – 80th percentile trigger values were within the default trigger levels, the default trigger levels were adopted. Default triggers are based on ANZECC & ARMCANZ (2000) guideline values for upland rivers in south-east Australia.

Trigger values have been sourced from the Bengalla Water Management Plan (BMC, 2017), which have been established from baseline data for monitoring sites adjacent to W17 (e.g. Bengalla sites W01, W02 and W03 [Figure 4]), as well as the ANZECC & ARMCANZ (2000) guideline.

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:

- 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;
- the same has not occurred at the relevant upstream reference site(s); 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.

Stream Health

Stream health monitoring continued during the reporting period at six sites outlined in the WMP located on the Hunter River (HR1, HR2, HR3, HR4, HR5 and HR6), as well as three additional sites located on Sandy Creek (SC), Dart Brook (DB) and Muscle Creek (MC) (Figure 7).

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. Two rounds of monitoring were undertaken during the reporting period, in May 2024 (autumn) and October 2024 (spring).

Stream health trigger levels and stream health investigation protocol were revised as part of the WMP update in 2024. The updated trigger levels are outlined in Table 23.

Table 23
Stream Health Trigger Levels

Historical Site ID	Updated Site ID*	Baseline Band of Impairment Score	O/E Taxa^
Reference Site			
W1	HR1	C	0.41
W1	HR2	B	0.59
Hunt 506	MC	B	0.55
Hunt 585	DB	B	0.66
Potential Impact Site			
Hunt 854	HR3	B	0.64
W15	HR5	B	0.61
SW17	HR6	B	0.73
Sandy 1	SC	B	0.61

O/E = Observed/Expected.

^ Derived from the Spring 2017 monitoring round.

*As part of 2024 WMP update HR4 was removed from scope.

Should a measured band of impairment score at a particular downstream monitoring site degrade below the baseline band level outlined in Table 23, and the band level at a corresponding upstream monitoring site remain the same for two successive monitoring rounds, the stream health investigation protocol (refer to the SGWRP) 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, W15 and W17);
- monitoring in Sandy, Muscle and Rosebrook Creeks (sites W4, W11, W12, W13, W14 and W16); and
- monitoring in other ephemeral creeks and gullies.

When there is no data available (e.g. due to prolonged dry conditions), charts are not presented in the following sub-sections.

Additional event-based monitoring was carried out in January, resulting in multiple monitoring records instead of one (5 January and 30 January).

Hunter River

Monitored pH values for the Hunter River monitoring sites during the reporting period are shown in Chart 11. Additionally, a comparison between 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 pH values is provided in Chart 12.

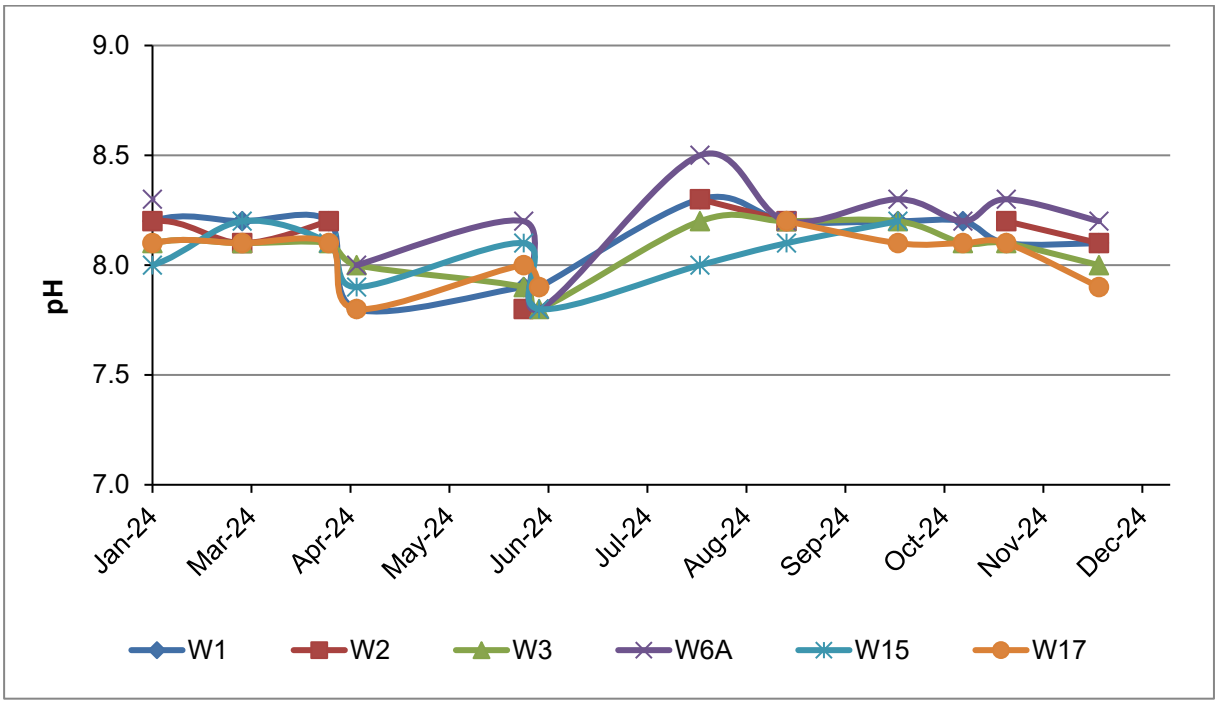

Chart 11: Hunter River pH Levels 2024

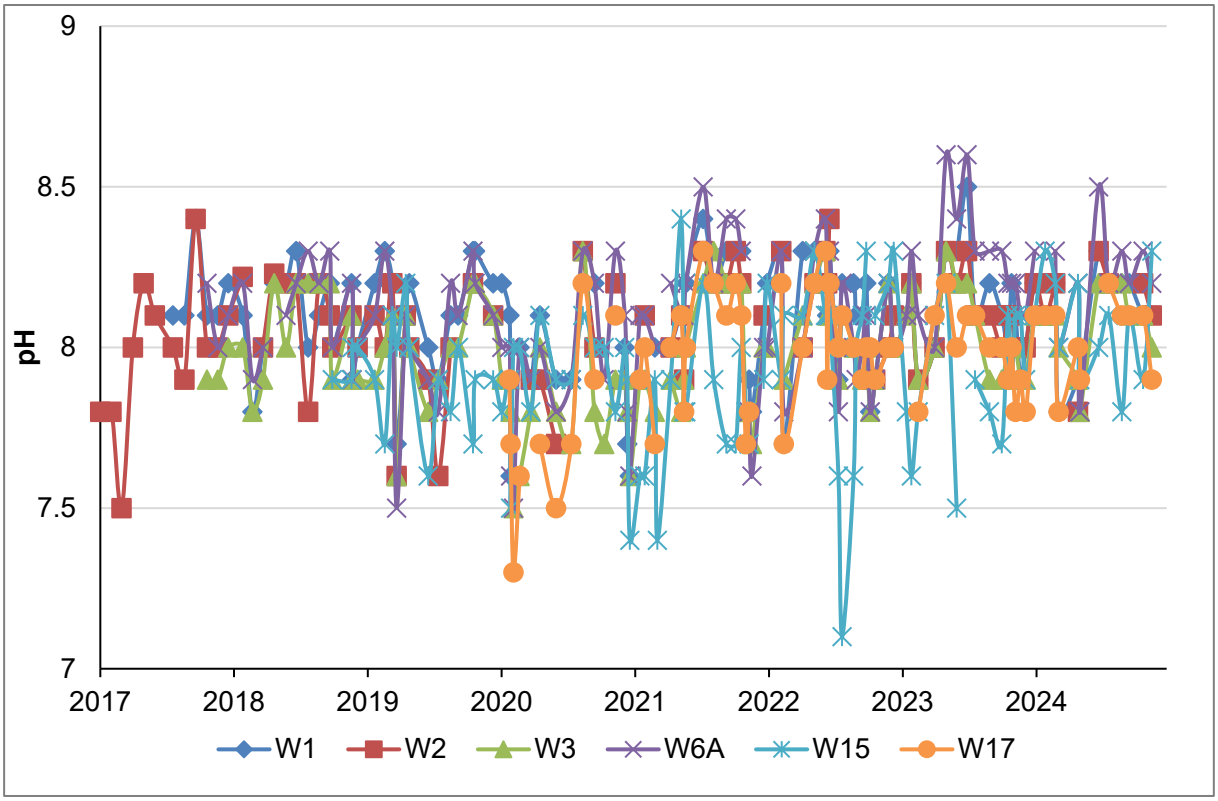

Chart 12: Hunter River pH Levels 2017 – 2024

Monitored EC values for the Hunter River monitoring sites during the reporting period are shown in Chart 13. Additionally, a comparison between 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 EC values is provided in Chart 14.

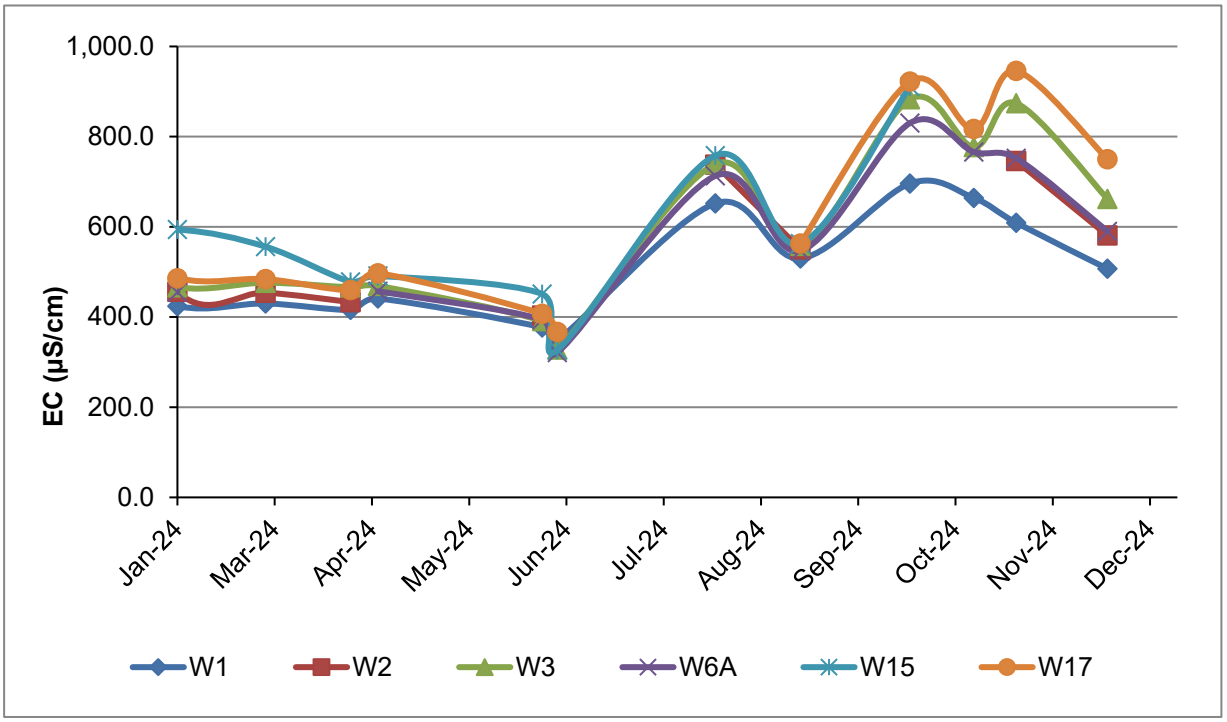

Chart 13: Hunter River EC Levels 2024

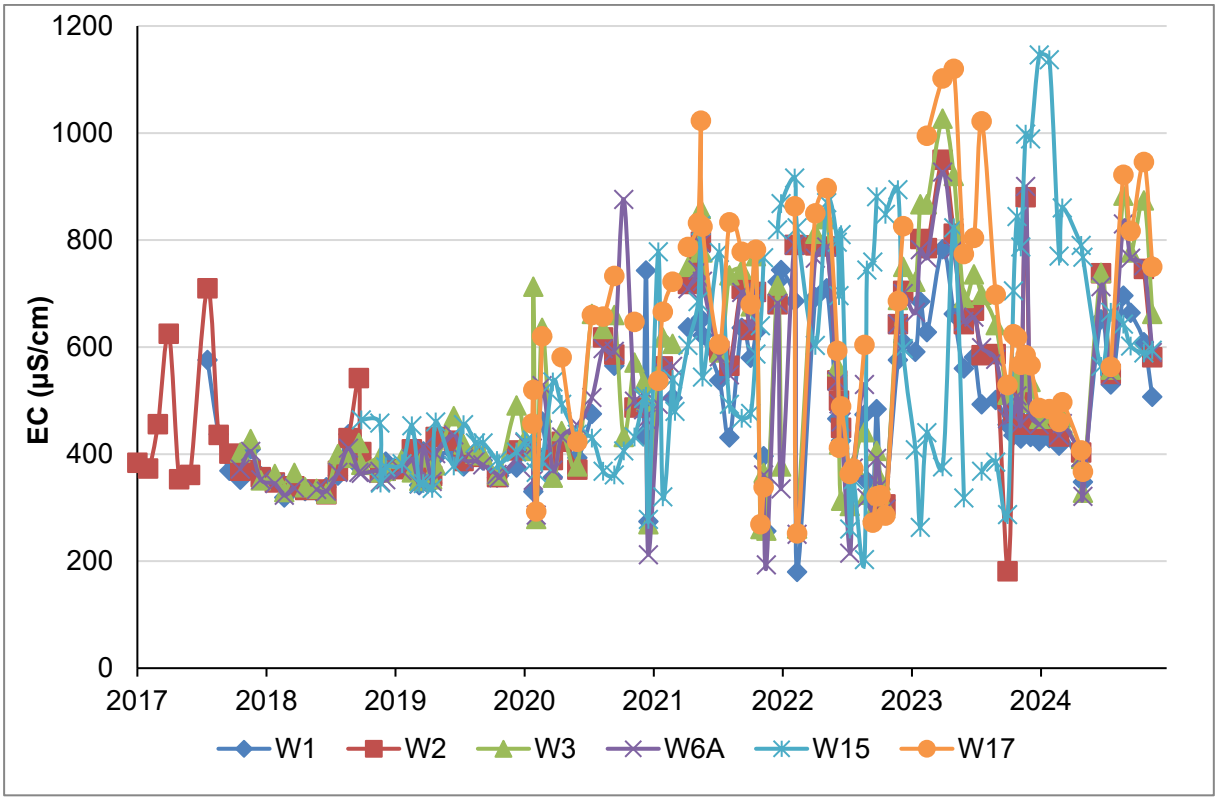

Chart 14: Hunter River EC Levels 2017 – 2024

Monitored TSS values for the Hunter River monitoring sites during the reporting period are shown in Chart 15. Additionally, a comparison between 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 TSS values is provided in Chart 16.

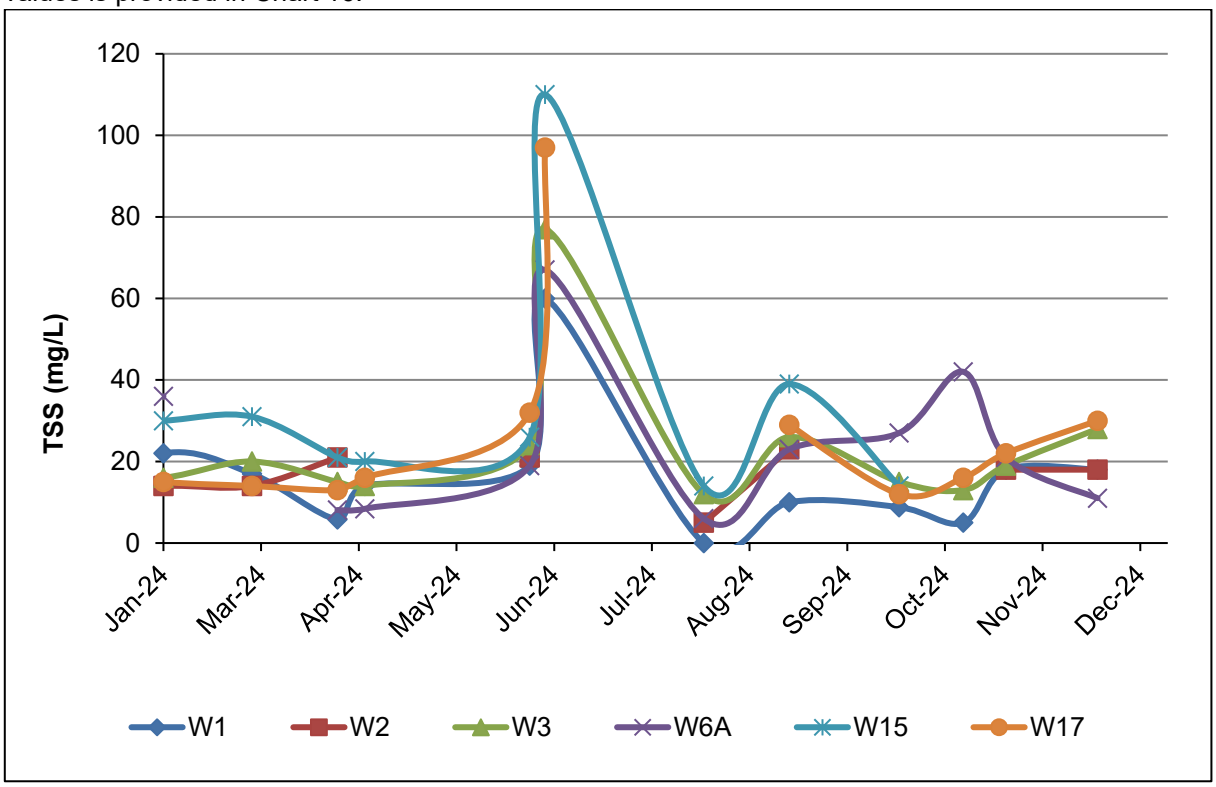

Chart 15: Hunter River TSS Levels 2024

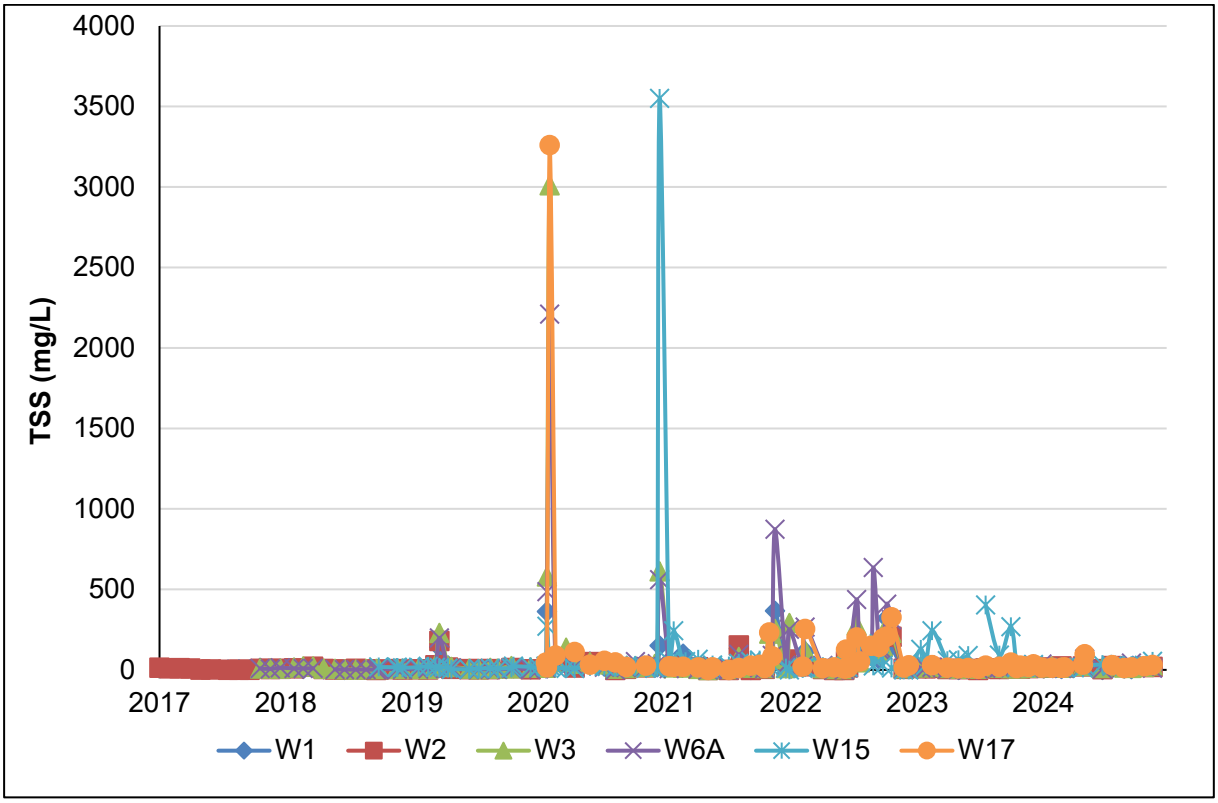

Chart 16: Hunter River TSS Levels 2017 – 2024

Monitored TDS values for the Hunter River monitoring sites during the reporting period are shown in Chart 17. Additionally, a comparison between 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 TDS values is provided in Chart 18.

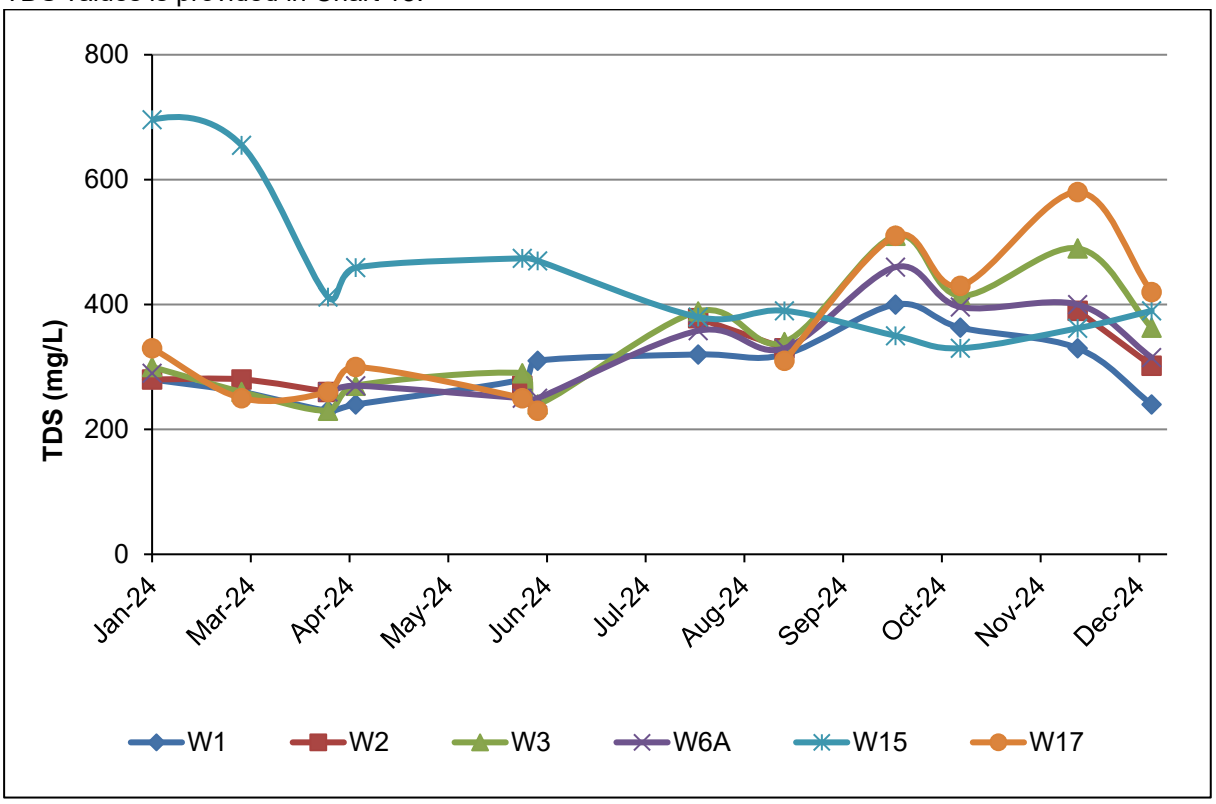

Chart 17: Hunter River TDS Levels 2024

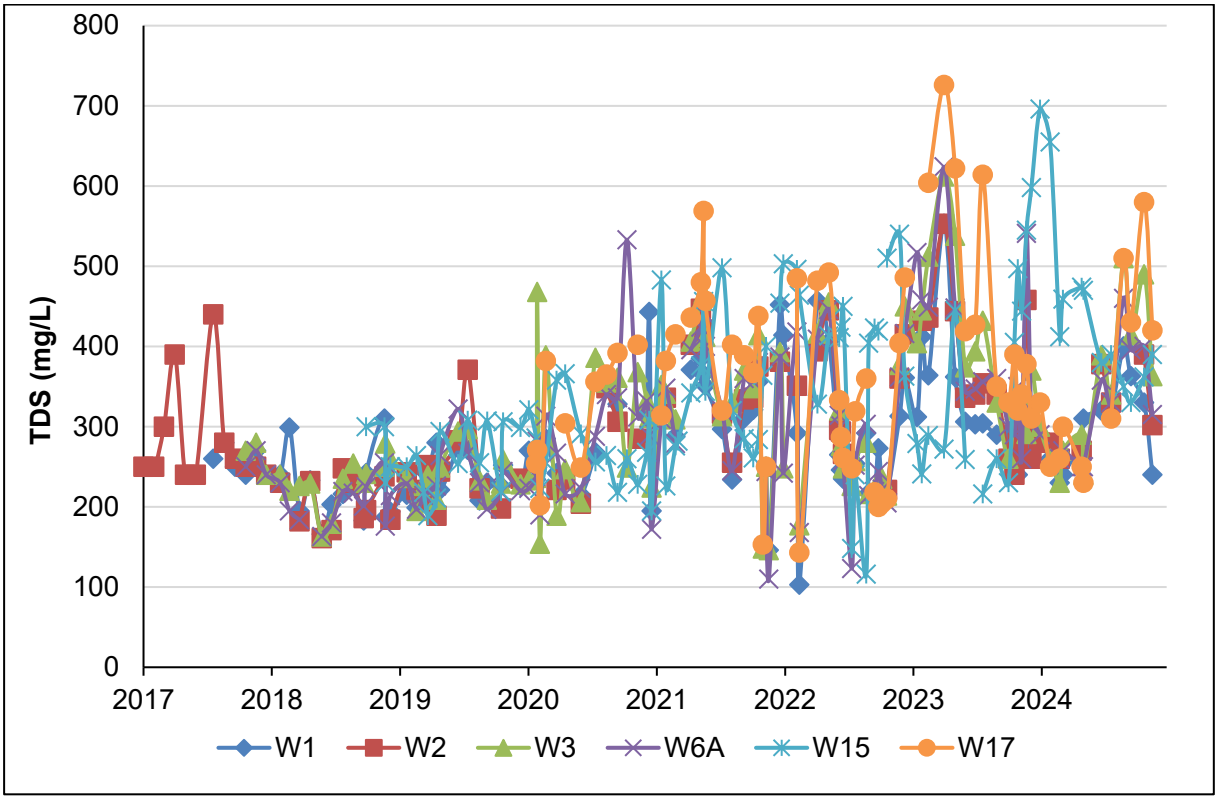

Chart 18: Hunter River TDS Levels 2017 – 2024

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 19. Additionally, a comparison between 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 pH values is provided in Chart 20.

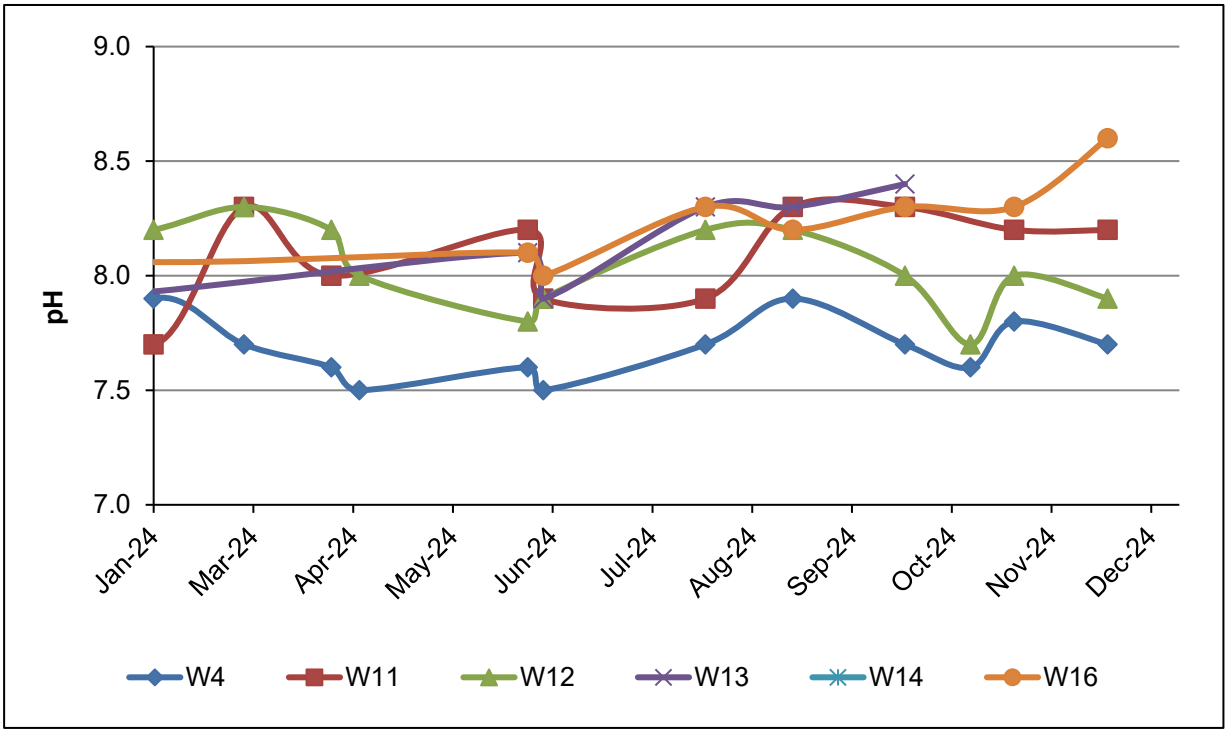

Chart 19: Sandy, Muscle and Rosebrook Creeks pH Levels 2024

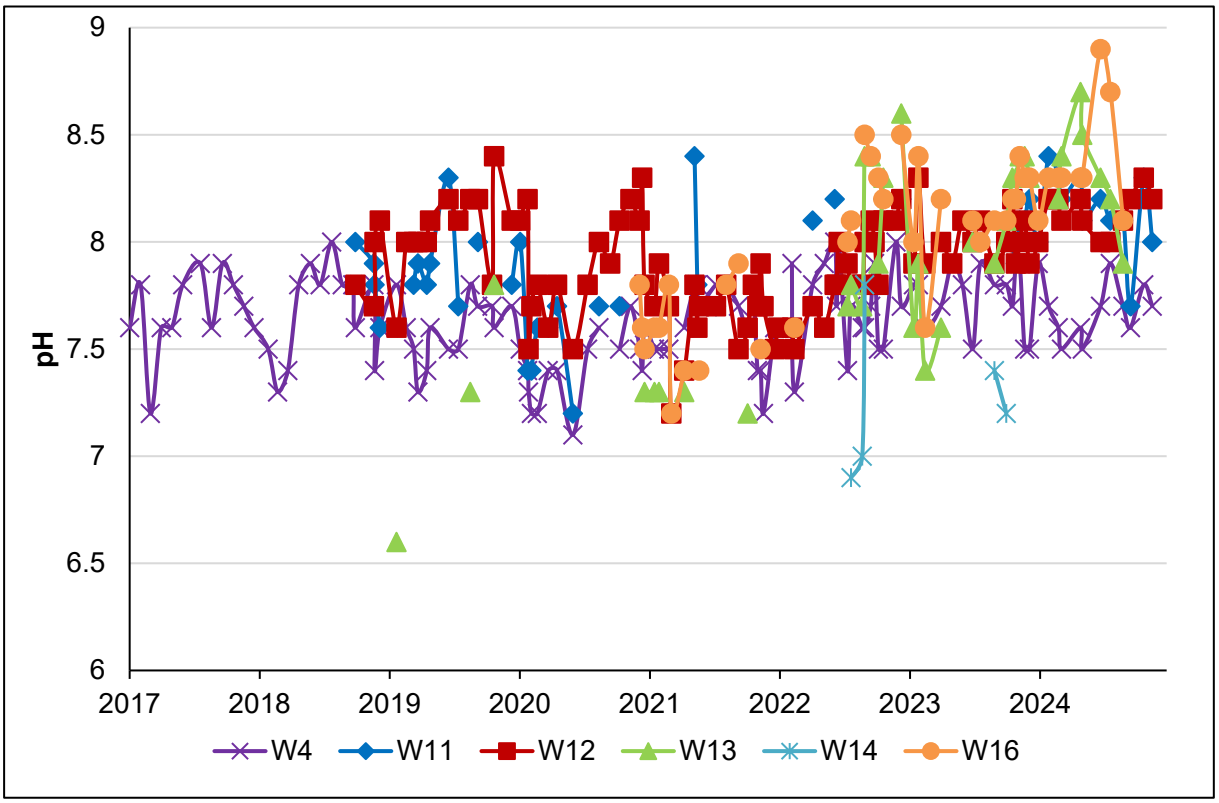

Chart 20: Sandy, Muscle and Rosebrook Creeks pH Levels 2017 – 2024

Monitored EC values for the Sandy, Muscle and Rosebrook Creek monitoring sites during the reporting period are shown in Chart 21. Additionally, a comparison between 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 EC values is provided in Chart 22.

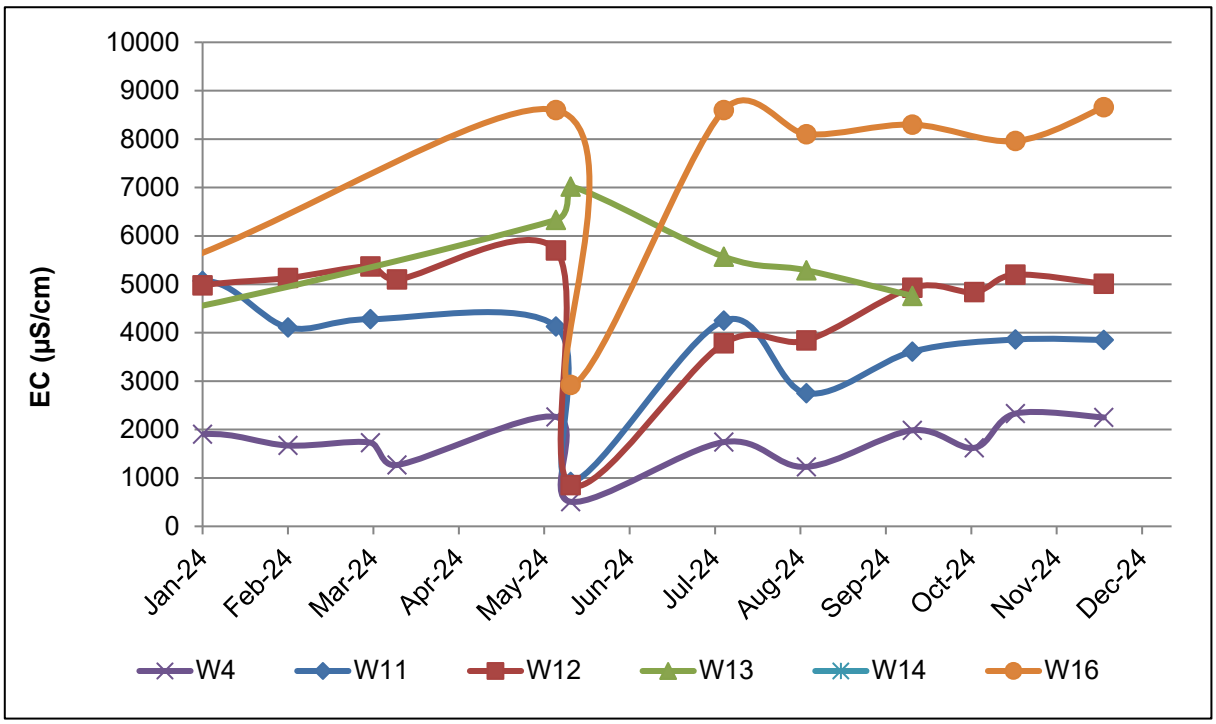

Chart 21: Sandy, Muscle and Rosebrook Creeks EC Levels 2024

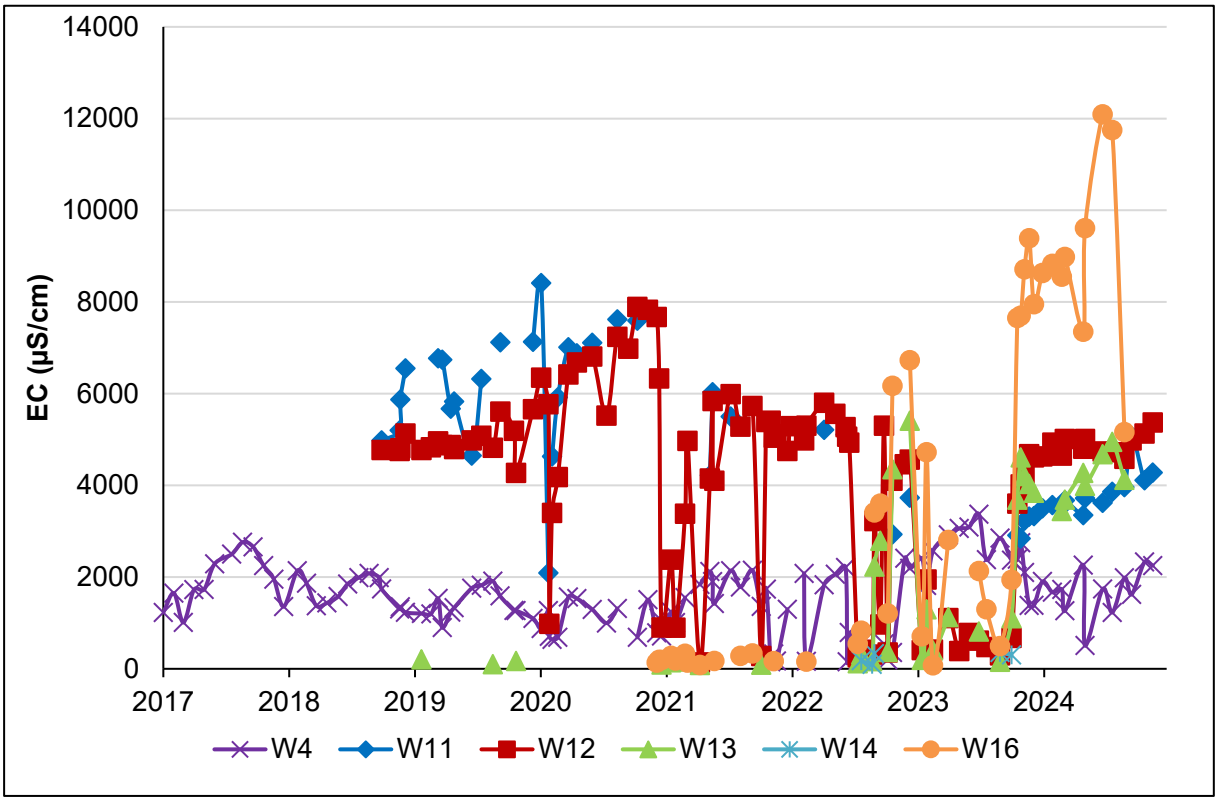

Chart 22: Sandy, Muscle and Rosebrook Creeks EC Levels 2017 – 2024

Monitored TSS values for the Sandy, Muscle and Rosebrook Creek monitoring sites during the reporting period are shown in Chart 23. Additionally, a comparison between 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 TSS values is provided in Chart 24.

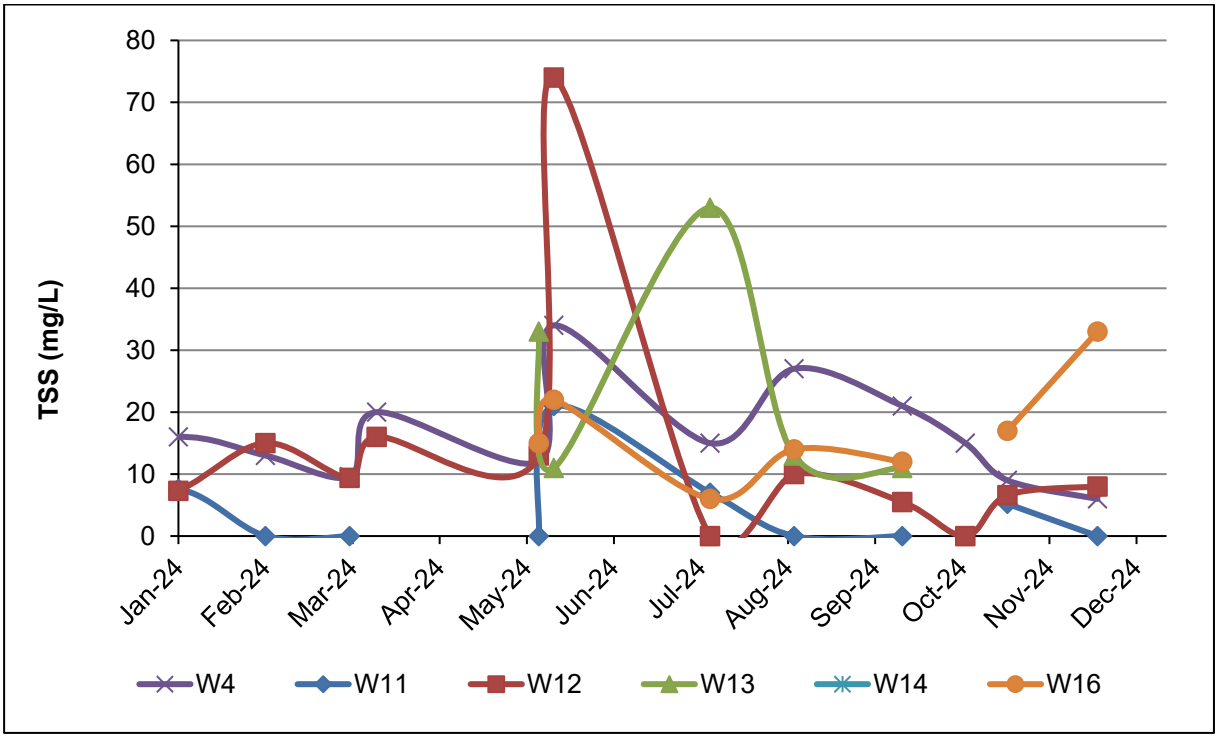

Chart 23: Sandy, Muscle and Rosebrook Creeks TSS Levels 2024

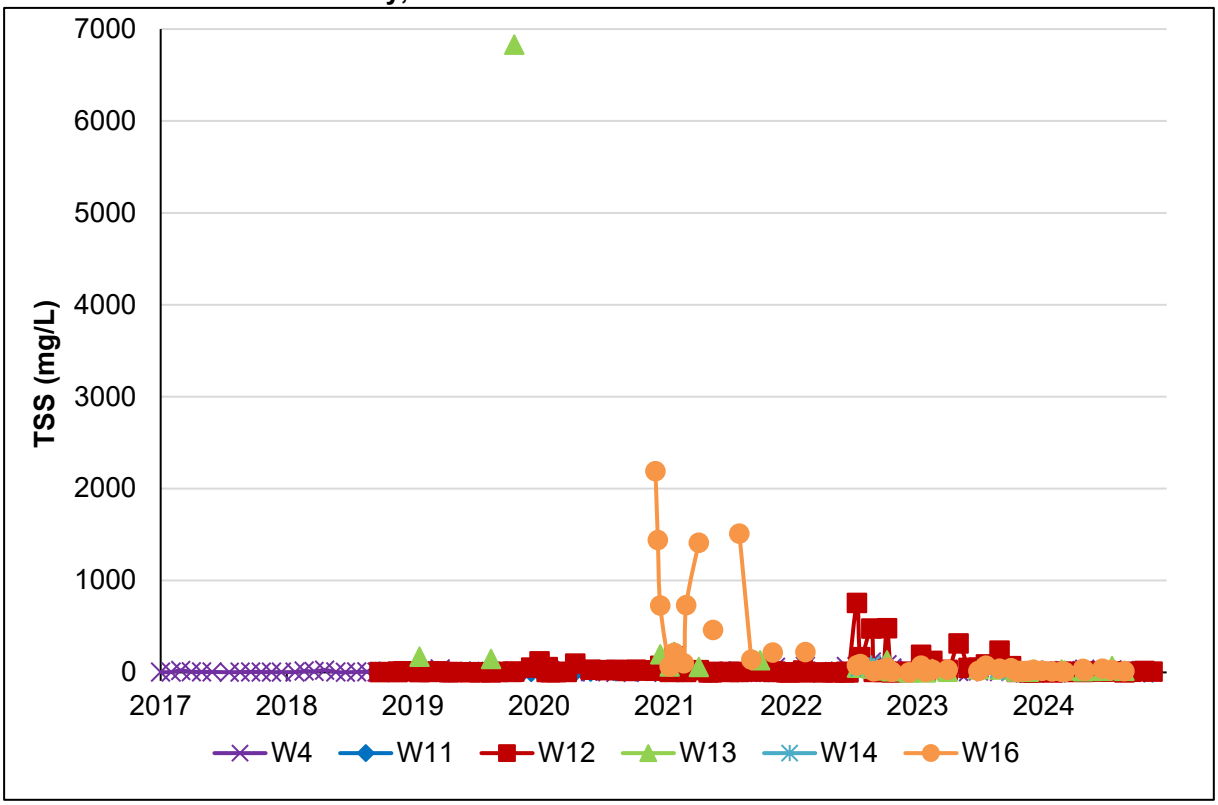

Chart 24: Sandy, Muscle and Rosebrook Creeks TSS Levels 2017 - 2024

Monitored TDS values for the Sandy, Muscle and Rosebrook Creek monitoring sites during the reporting period are shown in Chart 25. Additionally, a comparison between 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 TDS values is provided in Chart 26.

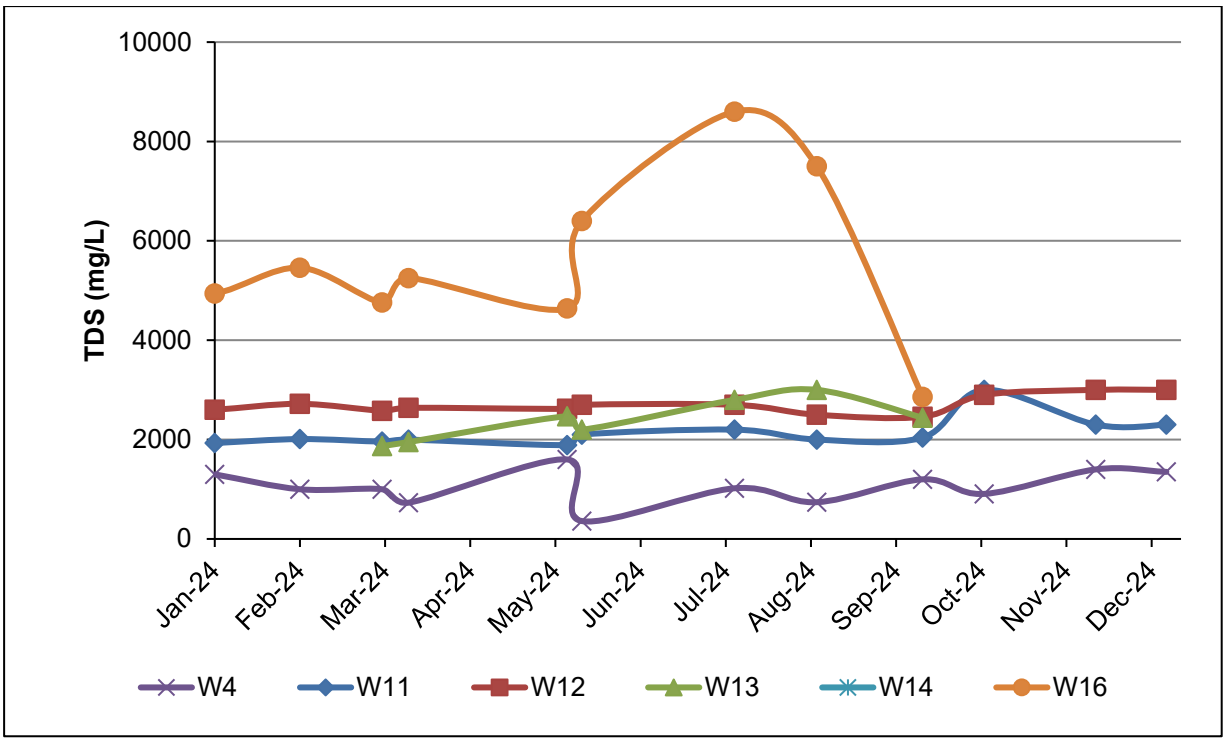

Chart 25: Sandy, Muscle and Rosebrook Creeks TDS Levels 2024

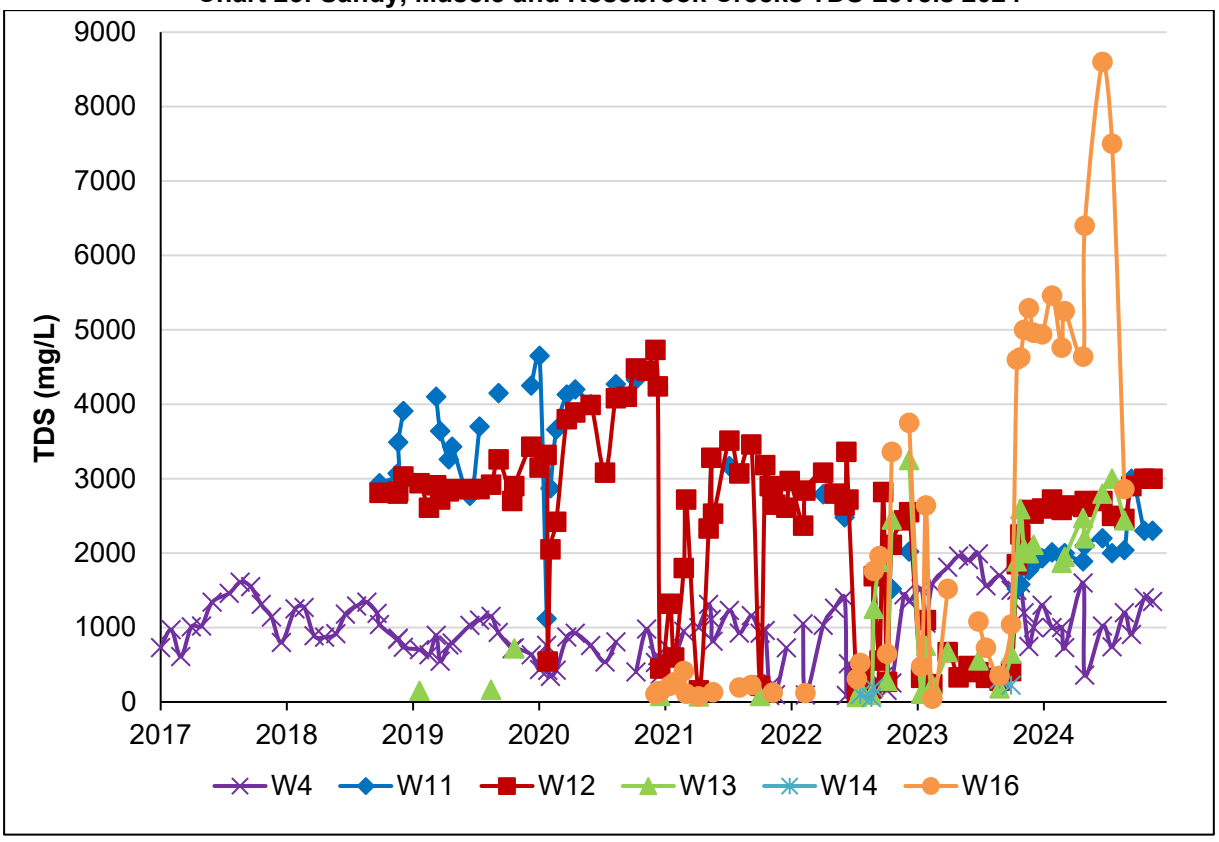

Chart 26: Sandy, Muscle and Rosebrook Creeks TDS Levels 2017–2024

6.1.3 Trends and Key Management Implications

Surface Water Monitoring

Hunter River Sites (W1, W2, W3, W6A, W15 & W17)

During the reporting period, pH levels at the Hunter River sites ranged from 7.8 to 8.5. There were no exceedances of the trigger level for three consecutive sampling events, A comparison with 2017, 2018, 2019, 2020, 2021, 2022, 2023 and 2024 pH levels show that pH levels have stayed consistently between 7.1 and 8.6 to date.

Monitoring site W3 is located adjacent to DCCEEW – Water Gauging Station and is only monitored intermittently for laboratory purposes. EC values generally increased over the reporting period at all sites, before decreasing in late-2024. Sites W2, W6A, W15 and W17 all recorded a number of EC readings above their relevant EC trigger levels. Elevated EC levels above the trigger level were also recorded at the upstream reference site W1 over the same period, therefore an investigation was not triggered.

TSS levels for sites W2, W6A, W15 and W4 exceeded the trigger levels on a number of occasions during the reporting period. TSS values at monitoring site W6A exceeded the trigger level on four consecutive occasions. This site has frequently shown elevated readings historically.

TDS levels for all Hunter River sites generally fluctuated between approximately 230 mg/L and 696 mg/L.

Sandy, Muscle and Rosebrook Creek Sites (W4, W11, W12, W13, W14 & W16)

Monitored pH values during the reporting period at the Sandy, Muscle and Rosebrook Creek sites ranged from 7.5 to 8.3. Monitoring sites W4 and W11 remained generally consistent during the reporting period and monitoring site W14 was dry. Only site W4 has been consistently measured for water quality since 2017. Monitoring since 2017 shows generally consistent values of pH for site W4.

EC monitoring results remained generally consistent during the reporting period at all sites except for W16, which increased early 2024 and remained elevated until December 2024. All sites also experienced a drop in EC during the June monitoring round. The monitored EC levels for the sites were generally consistent with the levels recorded between 2017 – 2023, apart from monitoring site W16 which has experienced elevated EC since 2023, but does not have site-specific trigger levels.

TSS values were generally consistent in sites W11 and W12 during the reporting period except for a spike in W12 recorded during the June monitoring round. Monitoring sites W13 and W16 showed slightly elevated TSS readings on multiple occasions throughout the year. No exceedances of the TSS trigger levels were recorded.

TDS values generally stayed consistent throughout the reporting period at the Sandy, Muscle and Rosebrook Creek sites, and generally correlated with the trend recorded for EC levels at the sites. Monitoring site W16 recorded elevated TDS between June and August 2024, with levels returning back down in September.

The 2017 – 2024 trends for pH and TSS for site W4 were generally consistent with observations made in the EIS (ERM Mitchell McCotter, 1997). EC and TDS levels at site W4 have increased since recordings made in the EIS. This site is located on Muscle Creek within Muswellbrook, upstream of the MPO and therefore any increase is not associated with MPO activities. 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;

MACH Energy, 2018; MACH Energy, 2019; MACH Energy, 2020; MACH Energy, 2021; MACH Energy 2022).

Stream Health Monitoring

The Autumn and Spring 2024 Stream Health Monitoring Reports were prepared following the May and October 2024 monitoring rounds. The key findings of the reports were as follows:

- Examination of results from the 2024 autumn and spring surveys found no measurable changes that could be indicative of an impact associated with the MPO.
- Overall, the species composition of assemblages has been comparable with that observed by previous surveys.
- Macroinvertebrate assemblages at the sites sampled have consistently (i.e. before and during mining activities at the MPO) been dominated by pollution tolerant taxa.
- No threatened species of fish listed under the NSW *Fisheries Management Act, 1994* or the *Environment Protection and Biodiversity Conservation Act, 1999* have been observed.

The stream health trigger levels established within the WMP were exceeded on each sampling occasion since 2017. These consecutive exceedances trigger the stream health investigation protocol in accordance with the Surface and Groundwater Response Protocol (SGWRP). However, as stated in the Stream Health Monitoring Reports prepared by Bio-Analysis Pty Ltd, the investigation is not considered warranted as:

- the trigger levels developed within the SWMP are based on historical data presented in Hose and Turak (2004), which were collected on one sampling occasion at the sites;
- no discharges from MPO in accordance with EPL 20850 have occurred throughout the monitoring period;
- external influences including rural and urban run-off and flow regulations are likely to have impacted aquatic biota within the monitoring sites since the baseline survey was carried out; and
- seasonal variation of the structure of assemblages of macroinvertebrates occurred (Stark and Phillips, 2009).

MACH Energy will continue to monitor stream health during autumn and spring in future monitoring periods. Revised stream health trigger levels and the stream health investigation protocol were revised as part of the WMP update and approved on 2 August 2024 (Section 2.1). This Annual Review reports against the new trigger levels and updated stream health investigation protocol.

6.2 GROUNDWATER

6.2.1 Approval Criteria and Management Plan Requirements

The updated MPO Groundwater Management Plan was approved in August 2024.

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

Groundwater monitoring includes:

- manually monitoring of 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 to prompt investigations and appropriate responses, identified in trigger action response protocols, to prevent exceedance of the performance criteria. Groundwater trigger levels have been developed for the MPO based on the *NSW Aquifer Interference Policy* and *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council [ANZECC] and Agriculture and Resource Management Council of Australia and New Zealand [ARMCANZ], 2000).

MPO evaluates the environmental performance of the MPO against the predictions of impacts made by the contemporary groundwater modelling (AGE Consultants, 2020).

In accordance with the *NSW Aquifer Interference Policy*, groundwater trigger levels have been developed with consideration for potential effects of mining on:

- the groundwater supply of potentially affected landowners;
- High Priority groundwater dependent ecosystems (GDEs); and
- High Priority culturally significant sites.

As there are no High Priority GDEs or High Priority culturally significant sites in the vicinity of the MPO described in the relevant water sharing plans, groundwater trigger levels have only been developed for the groundwater bores of potentially affected landowners. Trigger action response protocols have been developed for GDEs.

Groundwater level triggers have been established to monitor for potential impacts on the alluvial groundwater system to the east associated with the Hunter River. Water level triggers have been developed for the alluvial monitoring bores listed in Table 24 in order to identify trends that could potentially lead to a private bore being impacted (i.e. experiencing greater than 2 m drawdown) and to manage drawdown risks to GDEs.

The water level triggers for MPBH1, MPBH2 and MPBH3b have been calculated based on the criteria "*less than or equal to a 10% cumulative variation in the water table*" which is represented by the minimum recorded saturated thickness of the aquifer. The saturated thickness of the aquifer was calculated from the alluvium thickness at the locations of each bore and the deepest recorded groundwater level in the bore (the deepest recorded level accounts for climate variability over the period of record as none of the bore data shows evidence of mine-related impacts).

The water level trigger for MPBH7 is the base of the screened interval. This level is approximately 1.3m below the maximum recorded groundwater level in the bore and is similar in magnitude to the 10% GDE trigger value adopted for MPBH1, MPBH2 and MPBH3b.It is not appropriate to adopt a trigger level for MPBH7 based on the criteria "*less than or equal to a 10% cumulative variation in the water table*" as this value would be greater than the base of the screened interval.

Table 24
Groundwater Triggers – Water Level

Bore	Deepest recorded GWL (mbgl)	Trigger Level (mbgl)	Method
MPBH1	10.22	10.7	10% GDE trigger
MPBH2	13.32	13.59	10% GDE trigger
MPBH3b	12.60	13.04	10% GDE trigger
MPBH7	8.82	10.10	Base of screened interval

Note: mbgl = metres below ground level.

ANZECC & ARMCANZ (2000) recommends that wherever possible site-specific data be used to define trigger values for physical and chemical factors which can adversely impact the environment, rather than using default trigger values for pH triggers however, a single trigger range of 6 - 8.5 was applied to all bores. This decision was made as the proposed 20th to 80th percentile trigger ranges proved to be too narrow to allow inaccuracy in pH measurement. The adopted range of 6 – 8.5 pH units is consistent with the pH recommended by ANZECC & ARMCANZ (2000) to prevent corrosion of infrastructure associated with the groundwater, as well as the recommend range for drinking water as outlined in the Australian Drinking Water Quality Guidelines (National Health and Medical Research Council [NHMRC] & National Resource Management Ministerial Council [NRMMC], 2011).

Baseline groundwater monitoring results indicate that baseline values of EC in the vicinity of the MPO vary across a wide range and can be outside of the ANZECC & ARMCANZ (2000) guideline values for ecosystem protection. Therefore, site-specific trigger levels based on the baseline data have been developed for monitoring the effect of the MPO.

The *NSW Aquifer Interference Policy* sets out the minimal impact considerations for aquifer interference activities for groundwater sources, including:

Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.

The water sharing plans that regulate groundwater use in the vicinity of the MPO do not describe beneficial use categories for the groundwater sources. However, the National Land and Water Resources Audit (Murray Darling Basin Commission, 2005) specified groundwater quality ranges for beneficial use categories based on salinity.

Beneficial use categories have been assigned to each monitoring bore based on its 80th percentile baseline EC and the EC ranges specified in Table 25, with the exception of bores 5500D000, 6500F500L and 4500F000. These bores have been experiencing sustained increases in salinity since approximately 2012, leading to data collected since 2016-2017 being greater than the beneficial use category that would be otherwise designated by their respective 80th percentile EC value. Salinity in bores 5500D000,

and 4500F000 stabilised around 2017, however, data indicates that bore 6500F500L is still becoming progressively more saline. It is believed that the salinity recorded at these bores indicates a new equilibrium and EC is not expected to return to values recorded pre-2012. Therefore, the beneficial use category allocated to these three bores has been assigned to complement the more saline measurements recorded in the previous two years and do not necessarily reflect the 80th percentile baseline EC value.

Should a measured EC value exceed the upper limit and/or a pH value be outside of the beneficial use quality range at a particular bore for three successive monitoring rounds, the groundwater investigation protocol, as detailed in Section 9.2, would be initiated.

The water quality triggers for each bore are presented in Table 25.

Sufficient data is not yet available to develop baseline trigger ranges for the new bores that have been established to the east and west of the MPO. The trigger ranges for the bores will be established once sufficient data becomes available.

Table 25
Groundwater Triggers – Water Quality

Site	pH		pH Trigger Range	EC		
	20th %ile	80th %ile		80th %ile (µS/cm)	Beneficial Use Category	Trigger (µS/cm)
3500B500U	7.2	9.6*	6 – 8.5	3,530	Irrigation	7,800
3500B500L	7.1	7.4		5,826	Irrigation	7,800
3500C500U	7.1	7.4		5,664	Irrigation	7,800
3500C500L	7.2	7.4		5,590	Irrigation	7,800
4500F000	6.5	6.9		6,904	Saline	22,000
5000D000	6.7	7.0		703	Potable	800
5500D000	6.4	6.9		1,570	Irrigation	7,800
6000C000U	6.4	7.1		4,984	Irrigation	7,800
6000C000L	7.0	7.2		5,474	Irrigation	7,800
6500F500U	6.8	7.0		5,778	Irrigation	7,800
6500F500M	6.9	7.2		2,804	Irrigation	7,800
6500F500L	6.5	7.0		1,526	Irrigation	7,800
6500F625	6.7	7.0		4,086	Irrigation	7,800
7000D000U	6.6	7.6		6,730	Irrigation	7,800
7000D000L	6.6	6.8		1,370	Marginal Potable	2,350
7500F000	6.7	7.6		5,918	Irrigation	7,800
WRA1U	-	-		-	-	-
WRA1L	7.2	7.7		4,496	Irrigation	7,800
WRA2U	6.7	7.0		4,108	Irrigation	7,800
WRA2L	7.0	7.3		6,086	Irrigation	7,800
WRA3U	7.1	7.5		9,020	Saline	22,000
WRA3L	6.6	6.9		16,734	Saline	22,000
WRA5U	7.1	7.4		4,772	Irrigation	7,800
WRA5L	7.1	7.8		7,034	Irrigation	7,800
WRA6U	6.8	7.0		11,240	Saline	22,000
WRA6L	7.2	7.7		5,970	Irrigation	7,800
MPBH1	6.8	7.1		590	Potable	800
MPBH2	6.8	7.1		930	Marginal Potable	930**
MPBH3	6.6	6.9		1,083	Marginal Potable	1,083**
MPBH3b	7.4	7.7		4,420	Irrigation	7,800
MPBH4 (formerly A1)^	6.9	7.0		6,220	Irrigation	7,800
MPBH5 (formerly B1)^	-	-		-	-	-
Melody Bore^	-	-		-	-	-

Notes:

* pH values for bore 3500B500S exceed the pH trigger range of 6 – 8.5 however, this bore was mined through in August 2018.

** Existing 80th percentile values have been adopted for these bores given the baseline water quality is close to potable and these sites are representative of the Hunter River alluvium.

^ Sufficient data is not yet available to develop baseline trigger ranges for new bores MPBH5, or Melody Bore. This table will be revised with the appropriate values once the data becomes available. For more information on these bores refer to the WMP.

6.2.2 Performance During the Reporting Period

MPO continuously monitors groundwater levels and quality through an extensive network of observation bores. This network spans the Hunter River alluvium, regolith, and Permian interburden/coal seams within the MPO region. Monitoring bores within the Hunter River alluvium are typically shallow (<20 m), reflecting the limited depth of the local alluvial deposits. In contrast, the Permian strata are evaluated through bores installed at various depths throughout the geological sequence. The nearby Bengalla Mine also operates its own groundwater monitoring network, with both sites sharing groundwater data. Appendix A of the 2024 Annual Groundwater Report (AGE)(Appendix E) summarises the current and historical MPO groundwater monitoring network.

The key aspects of the MPO monitoring network, are as follows:

- The network is divided into three areas: Central, Eastern, and Western.
- The Central network monitors groundwater in the coal seams and interburden units near the open-cut pits.
- The Eastern network monitors groundwater in the alluvial aquifer associated with the Hunter River through seven bores (i.e., MPBH1–MPBH6 and MPBH3b).
- The Western network monitors groundwater in the alluvium/regolith, including one bore (MPBH7) associated with the Hunter River alluvium, as well as the underlying Permian strata within drainage lines that discharge westward, such as Sandy Creek.

Table 26
Results of Standing Water Level (mBGL)

Bore ID	Aquifer/Unit	Trigger level (m BGL)	Water level (m BGL)			
			Q1	Q2	Q3	Q4
MPO Central Domain						
3500C500L	Mount Arthur Seam	NA	24.56	24.9	25.65	25.79
3500C500U	Warkworth Seam	NA	24.9	25.35	24.53	24.73
4500F000	Vaux Seam	NA	21.5	21.68	21.58	ND
5000D000	Wynn/Edderton Seams	NA	126.15	129.07	ND	ND
5500D000	Interburden #7/Wynn Seam	NA	39.3	39.93	40.49	40.94
6500F500L	Maitland Group	NA	52.39	50.15	49.69	50.46
6500F500M	Interburden #6/Wynn Seam	NA	52.86	50.93	50.67	51.35
6500F500U	Interburden #4/Broonie Seam	NA	30.24	30.25	32.22	31.92
6500F625	Permian	NA	15.5	15.78	15.93	16.04
7500F000	Edderton Seam	NA	35.68	35.59	35.79	35.98
Melody	Unknown	NA	13.07	13.09	12.81	13.05
MPO Wastern Domain						
MPBH1	Hunter Alluvium	10.7	9.54	9.63	9.37	9.74
MPBH1-C	Coal Seam	NA	9.453	9.533	9.203	9.623
MPBH1-HR	Interburden	NA	25	21.89	38.34	34.69
MPBH2	Hunter Alluvium	13.59	11.39	11.57	11.64	11.74
MPBH2-C	Coal Seam	NA	11.38	11.57	11.64	11.74
MPBH2-HR	Interburden	NA	11.40	11.55	11.69	11.76
MPBH3b	Hunter Alluvium	13.04	11.81	11.91	11.81	11.83
MPBH4	Hunter Alluvium	NA	12.15	12.19	12.09	12.12
MPBH4-C	Coal Seam	NA	10.80	10.87	10.79	10.84
MPBH4-HR	Interburden	NA	49.88	49.86	50.03	49.89
MPBH5-C	Coal Seam	NA	10.81	11.02	11.70	11.36
MPBH5-HR	Interburden	NA	11	11.21	11.34	11.42
MPBH6	Hunter Alluvium	NA	9.351	9.431	9.251	9.411
MPBH6-C	Coal Seam	NA	10.95	11.09	11.05	10.84
MPBH6-HR	Interburden	NA	10.36	10.43	10.20	10.30
MPO Western Domain						
MPBH7	Hunter Alluvium	10.1	5.56	5.66	4.42	4.95
MPBH7-C	Coal Seam	NA	16.56	15.27	15.05	17.66
WRA1L	Warkworth/Permian	NA	2.92	3.69	3.37	1.98
WRA6L	Warkworth/Permian	NA	0.56	0.2	0.12	0.36
WRA6U	Alluvium/Regolith	NA	1.06	0.84	0.75	0.88

Table 27
Results of Standing Water Level (m AHD)

Bore ID	Aquifer/Unit	Trigger level (m AHD)	Water level (m AHD)			
			Q1	Q2	Q3	Q4
MPO Central Domain						
3500C500L	Mount Arthur Seam	NA	215.18	214.84	214.09	213.95
3500C500U	Warkworth Seam	NA	214.9	214.45	215.27	215.07
4500F000	Vaux Seam	NA	195.62	195.44	195.54	ND
5000D000	Wynn/Edderton Seams	NA	114.89	111.97	ND	ND
5500D000	Interburden #7/Wynn Seam	NA	182.97	182.34	181.78	181.33
6500F500L	Maitland Group	NA	136.54	138.78	139.24	138.47
6500F500M	Interburden #6/Wynn Seam	NA	136.07	138	138.26	137.58
6500F500U	Interburden #4/Broonie Seam	NA	158.69	158.68	156.71	157.01
6500F625	Permian	NA	178.17	177.89	177.74	177.63
7500F000	Edderton Seam	NA	147.95	148.04	147.84	147.65
Melody	Unknown	NA	179.232	179.212	179.49	179.25
MPO Eastern Domain						
MPBH1	Hunter Alluvium	136.16	137.32	137.23	137.49	137.12
MPBH1-C	Coal Seam	NA	143.49	143.41	143.74	143.32
MPBH1-HR	Interburden	NA	127.92	131.03	114.58	118.23
MPBH2	Hunter Alluvium	131.84	134.04	133.86	133.79	133.69
MPBH2-C	Coal Seam	NA	133.92	133.73	133.66	133.56
MPBH2-HR	Interburden	NA	134.05	133.90	133.74	133.69
MPBH3b	Hunter Alluvium	137.04	138.27	138.17	138.27	138.25
MPBH4	Hunter Alluvium	NA	136.67	136.63	136.73	136.7
MPBH4-C	Coal Seam	NA	138.23	138.16	138.24	138.19
MPBH4-HR*	Interburden	NA	49.89	49.87	50.04	49.90
MPBH5-C	Coal Seam	NA	134.44	134.23	133.55	133.89
MPBH5-HR	Interburden	NA	134.41	134.2	134.07	133.99
MPBH6	Hunter Alluvium	NA	147.71	147.63	147.81	147.65
MPBH6-C	Coal Seam	NA	146.15	146.01	146.05	146.26
MPBH6-HR	Interburden	NA	146.72	146.65	146.88	146.78
MPO Western Domain						
MPBH7	Hunter Alluvium	185.42	189.96	189.86	191.10	190.57
MPBH7-C	Coal Seam	NA	178.52	179.81	180.03	177.42
WRA1L	Warkworth/Permian	NA	214.56	213.79	214.11	215.5
WRA6L	Warkworth/Permian	NA	210.94	211.3	211.38	211.14
WRA6U	Alluvium/Regolith	NA	210.36	210.58	210.67	210.54

Notes: m AHD = metres above Australian Height Datum; NA = Not Assigned; ND = No Data.

* The values for bore MPBH4-HR are presented in metres below ground level (m BGL) due to the absence of ground elevation data for this bore.

Table 28
Summary of measured EC and pH in MPO monitoring bores during the reporting period

Bore ID	Aquifer/Unit	pH						EC (µS/cm)				
		Lower trigger	Upper Trigger	Q1	Q2	Q3	Q4	Trigger	Q1	Q2	Q3	Q4
MPO Central Domain												
3500C500L	Mount Arthur Seam	6	8.5	7.6	7.5	7.6	7.5	7800	4190	3750	3810	3890
3500C500U	Warkworth Seam	6	8.5	6.9	6.9	6.9	7.1	7800	12000	12030	12160	8270
4500F000	Vaux Seam	6	8.5	6.8	6.9	6.8	ND	22000	8440	8640	8130	ND
5500D000	Interburden #7/Wynn Seam	6	8.5	7	7.1	7	6.9	7800	4390	4210	4380	4350
6500F500L	Maitland Group	6	8.5	7.2	7.6	7.2	7.2	7800	2840	2610	2430	2530
6500F500M	Interburden #6/Wynn Seam	6	8.5	7.3	7.3	7.3	7.3	7800	2910	2510	2450	2610
6500F500U	Interburden #4/Broonie Seam	6	8.5	6.7	6.8	6.8	6.8	7800	5390	5560	4860	4920
6500F625	Permian	6	8.5	6.9	7	7	6.9	7800	4050	3610	3850	4310
7500F000	Edderton Seam	6	8.5	7.8	7.8	7.8	7.7	7800	6320	6450	6270	6350
Melody	Unknown	6	8.5	6.9	6.9	6.9	6.9	NA	5470	5620	5400	5810
MPO Eastern Domain												
MPBH1	Hunter Alluvium	6	8.5	6.9	7	7.1	7	800	612	644	622	640
MPBH1-C	Coal Seam	NA	NA	8.6	8	7.9	8.7	NA	1390	793	821	1510
MPBH1-HR	Interburden	NA	NA	7.8	8	8.1	8	NA	1592	1521	1506	1565
MPBH2	Hunter Alluvium	6	8.5	6.9	6.9	7	6.8	930	1237	1290	1205	1291
MPBH2-C	Coal Seam	NA	NA	10.7	7.1	8.2	7.7	NA	1726	1304	1072	1078
MPBH2-HR	Interburden	NA	NA	7.50	7.90	7.90	7.5	NA	1108	1247.00	1361.00	1229.00
MPBH3b	Hunter Alluvium	6	8.50	7.40	7.80	7.80	7.8	7800	5720	5660.00	5540.00	5590.00
MPBH4	Hunter Alluvium	6	8.5	7.1	7	6.9	7	7800	5030	5550	5570	5640
MPBH4-C	Coal Seam	NA	NA	7.9	8	8	8	NA	5090	4950	4860	4970
MPBH4-HR	Interburden	NA	NA	7.30	7.30	7.30	7.2	NA	5720	5740.00	5690.00	5500.00
MPBH5-C	Coal Seam	NA	NA	10.30	9.20	9.30	9.8	NA	609	1388.00	761.00	919.00
MPBH5-HR	Interburden	NA	NA	7.60	7.40	7.60	7.5	NA	850	797.00	843.00	856.00

Bore ID	Aquifer/Unit	pH						EC (µS/cm)				
		Lower trigger	Upper Trigger	Q1	Q2	Q3	Q4	Trigger	Q1	Q2	Q3	Q4
MPBH6	Hunter Alluvium	NA	NA	7.1	7.1	7.1	7	NA	1081	1257	1194	1250
MPBH6-C	Coal Seam	NA	NA	7.7	7.3	7.1	7	NA	5510	3190	2780	2730
MPBH6-HR	Interburden	NA	NA	7.40	7.30	7.30	7.3	NA	4950	6140.00	3580.00	4760.00
MPO Western Domain												
MPBH7	Hunter Alluvium	NA	NA	7.00	7.20	7.00	7	NA	11220	10860.00	10580.00	9770.00
MPBH7-C	Coal Seam	NA	NA	7.00	7.20	7.10	7	NA	10410	10780.00	10800.00	10280.00
WRA1L	Warkworth/Permian	6	8.50	7.10	7.10	7.20	7.1	7800	3550	3730.00	3180.00	3050.00
WRA6L	Warkworth/Permian	6	8.5	6.9	7	7	7	7800	6140	6840	6010	5700
WRA6U	Alluvium/Regolith	6	8.5	6.8	7	6.7	6.9	22000	8500	8950	8970	8660

Notes: NA = Not Assigned; ND = No Data.

MPO engaged groundwater specialist Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) to prepare a groundwater report covering the 2024 calendar year, The Mt Pleasant Groundwater Report for the 2024 Calendar Year (AGE 2025) is attached as Appendix E and provides the following:

- comprehensive review of the groundwater monitoring results at the MPO over the past year, which includes a comparison of the results to evaluate compliance against:
    - relevant statutory requirements, limits or performance measures/criteria;
    - monitoring results of the previous years;
    - relevant predictions in the Mount Pleasant Operation EIS and MOD 1, MOD 2, MOD 3 and MOD 4 EAs (prior to the surrender of Development Consent DA 92/97); and
    - relevant predictions in the SSD EIS.
- identifies any groundwater-related non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
- identifies any trends in the groundwater monitoring data over the life of the MPO;
- identifies any discrepancies between the predicted and actual groundwater impacts of the MPO, and analyses the potential cause of any significant discrepancies; and
- describes what groundwater-related measures will be implemented over the next year to improve the environmental performance of the MPO.
- Review of observed groundwater levels against the groundwater model predictions
    - determine when water levels deviate significantly from that predicted by the model and the reason for this deviation.
    - consider of the impact of mining, and other factors that could result in varying water levels including climatic conditions, rainfall recharge and pumping from privately-owned bores and/or other mining operations.

In summary, the AGE Report (2025) concluded that during the reporting period, 29 out of 31 designated bores achieved 100% water level measurement data recovery, while two bores recorded recovery rates of 50% and 75%. The lower data recovery in these bores was due to their removal from the monitoring network (e.g., bore 5000D000) or being deemed unsafe for sampling (e.g., bore 4500F000). In addition, water quality was measured at 30 bores, all of which achieved full data recovery.

Groundwater levels in the Hunter River Alluvium have remained stable throughout the year, with minimal fluctuations observed in response to rainfall events. This indicates that the alluvial aquifer is primarily sustained by losses from the surface water system rather than direct recharge from precipitation. Furthermore, water levels in the Hunter River are significantly influenced by the controlled releases from Glenbawn Dam. During significant rainfall periods, discharge volumes from the dam are typically reduced, further affecting river water levels and, consequently, the adjacent alluvial aquifer.

Groundwater behaviour in the Permian measures within the Western Domain showed variability across different locations. At monitoring sites like WRA5, water levels in both the regolith and underlying strata were similar, indicating hydraulic connectivity with minimal vertical gradients. In contrast, at sites like WRA3 and, to a lesser extent, WRA6, significant differences in groundwater levels were observed, suggesting limited connectivity and stronger vertical gradients. The groundwater flow through the regolith was found to follow the natural topography, with moderate flow expected. While the regolith has the potential to create hydraulic connectivity between the alluvium and mine workings, its generally dry, thin nature, combined with its separation from the open-cut pits by a drainage divide, restricts any direct interaction.

In the mixed interburden and coal units, groundwater levels have remained relatively stable over time, without any noticeable drawdown linked to either the mining activities at the MPO or operations at nearby mines such as Dartbrook or Bengalla. This indicates that these areas are not significantly impacted by groundwater changes due to the mining operations in the region.

The measured drawdown across the monitoring bores ranged from -47.46 m at 5000D000 to 21.23 m at 5500D000. These variations reflect differences in groundwater behaviour across the different domains

and strata over the reporting period. The study also highlights that the drawdown is not uniform across the network, with some regions experiencing more significant impacts than others, depending on their proximity to mining activities and geological features.

Electrical conductivity (EC) measurements from monitoring bores within the Hunter River alluvium adjacent to the MPO indicate a gradient from fresh to saline groundwater conditions. MPBH1 recorded the lowest EC value at 559 µS/cm (fresh water), while MPBH7 exhibited the highest at 11,729 µS/cm (saline). Bores MPBH2, MPBH3, and MPBH6 fall within the lower brackish range, while MPBH3b and MPBH4 are classified as moderately saline. In the Western Domain, groundwater shows the highest EC levels across the monitoring network. Regolith bores in this domain range from brackish to moderately saline, with median EC values ranging from 1,702 µS/cm at WRA2U to 10,273 µS/cm at WRA6U. In contrast, the Permian measures in this domain show a broader range, with EC values spanning from 3,594 µS/cm (moderately saline) at WRA1L to 15,607 µS/cm (saline) at WRA3L. EC measurements in the Central Domain for Permian measures have been intermittent, with fluctuations over time. These values range from 773 µS/cm (brackish) at bore 5000D000 to 5,625 µS/cm (moderately saline) at bore 3500B500L. Median pH across the Central, Eastern, and Western domains is 7.4, indicating predominantly neutral groundwater conditions. However, pH values varied significantly, ranging from slightly acidic (5.7 at WRA5U) to highly alkaline (12.4 at 7000D000U). Most pH measurements fell within the neutral to slightly alkaline range, with considerable local variations influenced by specific geological and hydrological factors at each monitoring location.

The major ion chemistry of 30 groundwater samples collected across the MPO was analysed using a Piper plot. The analysis revealed significant variability in the geochemical composition of groundwater within the Permian strata, particularly the coal measures. The dominant ions in these areas were sodium, potassium, and chloride, classifying the groundwater as a sodium chloride type. In contrast, groundwater in the alluvial deposits exhibited a magnesium carbonate type profile due to high concentrations of magnesium (Mg^{2+}) and bicarbonate (HCO_3^-) ions.

Water level data from key monitoring bores, such as MPBH1, MPBH2, MPBH3b, and MPBH7, consistently remained below the trigger levels specified in the Water Management Plan (WMP) throughout the monitoring period, including 2024. However, EC measurements at 3500C500U and MPBH2 exceeded their respective trigger levels during 2024, with the average EC at 3500C500U recorded at 11,115 µS/cm (43% higher than its trigger level of 7,800 µS/cm), and MPBH2 at 1,256 µS/cm (35% higher than its trigger level of 930 µS/cm). As the EC measurement values in these bores have exceeded the EC trigger level for three successive monitoring rounds, a further investigation is required, and the groundwater investigation protocol outlined in Section 9.2 of the Groundwater Management Plan (GMP) within the WMP must be followed.. Importantly, no monitoring bores exceeded the pH trigger levels (6 – 8.5) as defined in the WMP during 2024.

To validate the groundwater model in accordance with the GMP section of WMP, a comprehensive comparison was made between newly collected monitoring data and the previous model calibration conducted in 2020. This validation process involved assessing water level measurements from 45 monitoring bores within the MPO, covering a time span from 2003 to 2024. While the RMS and SRMS values for the post-2020 dataset showed a slight reduction in model accuracy, the results still meet the acceptable standards outlined in the Australian Groundwater Modelling Guidelines. The global SRMS value of 5.73% falls below the recommended 10% benchmark, indicating that the model is adequately calibrated for its intended purpose and does not require immediate recalibration.

Simulated drawdown predictions indicate limited groundwater impacts in the alluvium surrounding the MPO, with minimal drawdown in the Hunter River alluvium due to the majority of the target seams subcropping to the west. The predicted drawdown in the Edderton Seam is constrained to the north and south by the concurrent drawdowns from neighbouring mines, and to the east by the subcrop, further limiting its extent.

The analysis of the difference between the simulated and measured heads in 2024, calculated at various monitoring bores, reveals a range of residual head differences. These differences range from -24.75 m at bore 3500C500L to 45.86 m at 5000D000. Out of 45 model-data comparisons, 73% exhibit a difference of less than 10 m between the simulated and observed heads, demonstrating a generally good alignment between the model and the observed data.

6.3 HUNTER RIVER SALINITY TRADING SCHEME DISCHARGES

MACH Energy has a total of 70 credits under the HRSTS, however no discharges to the Hunter River occurred during the reporting period.

6.4 WATER TAKE

A total of 2,011 megalitres (ML) of water was taken from Hunter Regulated River Water Source for use at the MPO during the water reporting period (1 July 2023 – 30 June 2024) (Table 29). No other water sources were used within the reporting period. This was 1,409ML more than the previous water reporting period. MACH Energy holds a number of water licences as detailed in Section 2, of these there are licence allocations that are dedicated to the mining operations and others to Agriculture uses, though these may be interchange between purposes from time-to-time dependant on climatic conditions and operational needs. The water take from the Hunter Regulated River Water Source was less than the MPO total entitlement (3,758 ML) and less than the allocated mining operation use for the 2023-2024 water year (2,104 ML)(Table 29).

A total of 4 ML of water was taken from groundwater sources. Volumes were determined using the site Goldsim water model. Water take from groundwater sources were less than the total MPO Sydney Basin - North Coast Groundwater Source entitlement (730ML).

Table 29
MPO Water Take Licence Summary

		2023-2024			
WALs	**Licence**	**Allocation**	**Loading**	**Carryover**	**Total**
General Security		**ML**		**ML**	**ML**
639	20AL200447	134.0	100%	33.5	167.5
41438	20AL219053	455.0	100%	113.8	568.8
High Security					
638	20AL200446	225.0	100%		225.0
879	20AL201050	243.0	100%		243.0
1113	20AL201612	366.0	100%		366.0
880	20AL201052	124.0	100%		124.0
Term - General Security					
20AL200042-71T	20AL200447	100.2	100%		100.2
20AL213262-71T	20AL200447	100.0	100%		100.0
20AL2212803-71T	20AL200447	141.3	100%		141.3
20AL201133-71T	20AL200447	68.5	100%		68.5
	TOTAL	**1,957.0**		**147.3**	**2,104.3**
			Total Usage 2023-2024		**2,011**

Note:
1. A full listing of all MACH Energy Water Licences is shown in Section 2: Approvals, this table presents only those licences that were used to supply water from the Hunter River to the operations in the 2023-2024 water year.
2. Several temporary licences were also used during the reporting period, Term- General Security transferred to 20AL200447.

6.5 SITE WATER BALANCE

The Site Water Balance for the reporting period (i.e. 1 January 2024 to 31 December 2024) is provided in Table 30 in comparison to the 2023 Site Water Balance.

The CHPP water demand increased from the previous reporting year this aligns with an increase in production and washed coal for the 2024 period. Surface water runoff decreased compared to the 2023 reporting period, this is due to improvements made to data inputs to the Goldsim model for the 2024 period, improving the accuracy of the model.

2024 model improvements include;

Installation of additional flow meters

Implementation of improved methods for the calculation of dry tailings

Goldsim water balance to be representative of current mine plan, catchment areas, new dam and water infrastructure, dam storages.

The recorded site water balance for the reporting period was generally consistent with SSD EIS predictions.

Table 30
MPO Annual Water Balance

	2023	2024
Water Sources	**Volume (ML/yr)**	**Volume (ML/yr)**
Surface Water Runoff	1633[1]	985[1]
Groundwater	2[1]	4[1]
Fine Rejects Bleed Water	995[1]	1011[1]
Hunter River Pumping (via WALs)	1079	1460 [2]
Water Usage	**Volume (ML/yr)**	**Volume (ML/yr)**
CHPP Demand	2808	3186
Dust Suppression (Stockpiles)	ND	184
Dust Suppression (Haul Roads)	126	695
Vehicle Wash Demand	88	66
Water Loss	**Volume (ML/yr)**	**Volume (ML/yr)**
Discharge to Hunter River (via HRSTS)	0	0
Evaporation	1637[1]	1816[1]
Entrainment	ND	1989[1]
Non Sediment Dam Spillage	0	0
Sediment Dam Spillage	0	0

Note: ML/yr = Megalitres per year. ND = No Data

1 This volume is a modelled output

2 This figure does not match the water take reported in the above section as water take is based on a water year July-June, the water balance is based on a calendar year Jan-Dec.

7 REHABILITATION

Proposed rehabilitation activities for the MPO are defined in the RMP and associated Annual Rehabilitation Report and Forward Program, which has been developed to meet the requirements for an RMP (Condition 56, Schedule 3 of Development Consent DA 92/97).

On 1 August 2022, an RMP along with the supporting Annual Rehabilitation Report and Forward Program was prepared and submitted in accordance with the NSW Resource Regulator Form and Way – *Rehabilitation Management Plan for Large Mines* (July 2021), under amendment to the *Mining Regulation 2016* under the *Mining Act 1992*. The RMP and associated Annual Rehabilitation Report and Forward Program replaced the MOP (1 July 2021 – 30 June 2023). This Annual Review reports against the RMP and Annual Rehabilitation Report and Forward Program.

Table 31 summarises the approximate disturbance and rehabilitation areas from the 2023 and 2024 reporting periods and provides an estimate of the forecast areas for the 2025 reporting period. The Forward Program 2024 rehabilitation target was achieved during the reporting period.

Table 31
Rehabilitation Status

Mine Area Type	Previous Reporting Period (ha Actual)	This Reporting Period (ha Actual)	Next Reporting Period (ha Forecast)
	2023	2024	2025
Total Mine Footprint[1,4,6]	1,286	1,581	1,927
Total Active Disturbance[2,4,6]	1,131	1,147	1,384
Land being prepared for Rehabilitation[3]	18.5	22.2	37.8
Land under active rehabilitation[4]	155	173	210.8
Completed rehabilitation[5]	0	0	0

1 Total mine footprint includes all areas within a mining lease that either have posed 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 the NSW Resources Regulator Form and Way – *Rehabilitation Management Plan for Large Mines [July 2021]* Guidelines).

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, overburden emplacements (active/unshaped/in or out-of-pit), and the FEA (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 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 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 the DRG that the area has successfully met the rehabilitation land use objectives and completion criteria.

6 Includes topsoil stockpiles.

Rehabilitation of the Eastern Out of Pit Emplacement continued in 2024. An additional 22.2 ha was rehabilitated (Plate 2), which included:

- bulk and detailed re-shaping of overburden material to final landform;
- installation of habitat features such as habitat/stag trees, log piles and rock piles across the rehabilitation area;
- topsoil spreading to a minimum depth of 100 mm;
- gypsum application at a rate of 10 tonnes per hectare (t/ha);
- deep ripping/tining along the contour of the final landform to a depth of 500 mm;
- planting of tubestock including ground, middle and upper stratum species of relevant target PCTs;
- direct/hand seeding of endangered ecological community tree/shrub/grass indicative species plus an additional grass cover crop; and
- planting of approximately 100 native trees per ha.

Rehabilitation areas were subject to ongoing weed and pest control measures throughout the reporting period to facilitate and promote successful vegetation establishment.



Plate 1: Eastern Out of Pit Emplacement Rehabilitation

Figure 2 shows the extent of active disturbance and rehabilitated areas at the end of the reporting period, as well as the forecast disturbance areas proposed in 2025.

The final land use goals for the MPO (as outlined within the current RMP and Forward Program) are as follows:

- successful design and rehabilitation of landforms to ensure structural stability, revegetation success and containment of wastes; and
- post-mining land use compatible with surrounding land uses.

The conceptual final landform across the MPO is an undulating, free draining and a less 'engineered' landform with an optimum post-mining land capability that supports low and high intensity agricultural land uses as well as grassland and woodland vegetation communities, as per the approved MOD 6 and current RMP. The MSC, the community and other stakeholders have indicated their preference for a landform that further integrates with the surrounding landscape. The MSC also indicated a preference for intensive agricultural/industrial post-mining land uses that provide employment for the local community.

The overarching objective for rehabilitation of the FEA is to establish a safe, stable and non-polluting landform with a sustainable surface cover that minimises erosion (to prevent exposure of the underlying fines material) and sustains grassland vegetation in the long-term. During the reporting period, MACH Energy operated the FEA using sub-aerial deposition which involves an extended period of air drying that maximises in-situ tailings densities, and in turn, maximises the storage efficiency of the facility as well as providing a more competent fines surface for future rehabilitation purposes.

7.1 EROSION AND SEDIMENT MANAGEMENT

General erosion and sediment management measures were undertaken during the reporting period in accordance with the erosion and sediment control provisions of the approved WMP and included:

- installation and management of sediment fencing around disturbance areas of soil stockpiles and sediment dams;
- implementation and management of progressive erosion and sediment control measures during the completion of civil construction works, including:
  - use of sediment fences and filters to intercept and filter small volumes of non-concentrated construction runoff;
  - construction of rock check dams across swales and diversion channels to reduce the velocity of flow;
  - use of sediment basins to capture sediment and associated pollutants in construction runoff; and
  - use of scour protections where feasible;
- construction of diversion drains and bunds;
- regular inspections of the completed dams and erosion and sediment control structures; and
- sowing of all verges and drains.

The inspection covered various dams, crossings, CHPP, main access road, MIA carpark, and a topsoil stockpile area.

7.2 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 that 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, a range of activities were undertaken in respect to fire preparation in accordance with the Bushfire Management Plan, including:

- community consultation with neighbouring landholders and lessees;
- maintenance of property, boundary and roadside firebreaks and fire access trails;
- updating signage along the fire trail;
- monthly inspections of the firebreaks and firefighting equipment at MPO during the fire season;
- Site visit with the NSW Rural Fire Service to drive the fire trail with the local fire truck; and
- the use of livestock to reduce pasture-based fuel loads on land suitable for grazing.

7.3 REHABILITATION MONITORING

The 2024 rehabilitation monitoring program was undertaken between 8 and 12 April 2024 and included monitoring of analogue and the MPO rehabilitation sites (Umwelt, 2024). The 2024 rehabilitation monitoring program was undertaken generally in accordance with the MPO Rehabilitation Monitoring Manual (Ausecology, 2021). The MPO adopts a systems-based approach to rehabilitation monitoring (e.g. use of Ecosystem Function Analysis [Tongway and Ludwig, 2011] and floristic and biometric surveys) to determine progress towards a self-sustaining ecosystem, including comparison to the analogue sites.

The rehabilitation research program at the MPO aims to incorporate management practices that have resulted from industry research into the establishment of woodland and grassland communities across mined landscapes, in particular in the Hunter Valley region.

MACH Energy is collaborating with the University of Newcastle on several rehabilitation related research projects including:

- Tailings to Topsoil – a research project that aims to convert fines material into suitable topsoil material; and
- Rehabilitated Landform Erosion Monitoring – a research project that aims to improve geomorphic

landform design modelling through analysis of rehabilitation monitoring data.

During the reporting period, the aforementioned projects were ongoing. The tailings to topsoil research project is discussed further in Section 5.9.

Further information regarding MPO rehabilitation monitoring methodologies is provided in the RMP and associated Annual Rehabilitation Report and Forward Program.

7.4 LAND MANAGEMENT

Landscape management included removal, erection and general maintenance of fence lines in the MPO.

During the reporting period, extensive tree planting was undertaken along the different site owned properties for visual tree screening in accordance with the VIMP, to assist in shielding the site as outlined in Section 5.10. General maintenance of these areas was also carried out throughout the reporting period.

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.

8 COMMUNITY

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

MACH Energy released a community newsletter in April and December 2024 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

Several 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 (https://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, environmental complaints register (which is updated monthly), previous community newsletters, a new Projects Tab, and the CCC meeting minutes.

MACH Energy maintains a Community Hotline (1800 886 889), which is dedicated to the receipt of community complaints. The Community Hotline is publicly advertised in a variety of MACH Energy's public communication tools and is available during operating hours (i.e., 24/7), to receive any complaints. 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 because of the communication. A separate General Enquiries Hotline (1800 931 872) and Blasting Hotline (1800 931 873) have been in

operation since 2018 and provide callers with general information about MACH Energy and blasting times and location.

A total of 60 community complaints were received during the reporting period (see Complaints Summary 2024: https://machenergyaustralia.com.au/mount-pleasant/documentation/) compared with 44 complaints received during the last reporting period 2023 and 119 complaints received during the 2022 reporting period. The community complaints for the reporting period related to:

- Air quality (11).
- noise (29).
- blasting (10).
- visual (4); and
- others (6) (related to odour).

Most complaints were received via the Community Hotline; however, some complaints were made directly to the External Relations Manager, the Environmental Superintendent, the DPHI, and the EPA. The total number of complaints has increased during the reporting period compared to 2023, likely due to the expansion of the MPO to the northwest and visible to residents in the Village of Kayuga. Most complaints were recorded from one complainant in Kayuga Village.

Chart 27 shows the total number of complaints since 2017. Chart 28 shows the total number of complaints by location and type during the reporting period.

The highest number of complaints received in 2024 were related to noise.

Complaints regarding blasting also increased in 2024 in comparison to 2023. This can be attributed to the advancement of mining operations west in the higher areas of the operation, away from the community of Muswellbrook.

Thorough investigations were undertaken in response to all complaints. For noise, air quality and blasting related complaints, real-time monitors were reviewed, and alarms were examined. Following the investigation, the External Relations Manager contacted the complainant in a timely manner to describe the MPO activities that may have been causing the issue and the response/s from MACH Energy. Activities were modified or ceased where necessary.

8.2 CONSULTATION AND ENGAGEMENT

A CCC is administered by MACH Energy, with a membership comprised of an independent chair, and appropriate representation from MACH Energy and the general community. The CCC is operated in general accordance with the *Community Consultative Committee Guideline* (DPE, June 2023).

In 2024 the CCC met four times, March, June, September, and December. The March and June meetings were held at University of Newcastle Upper Hunter Campus, the September meeting was held at Muswellbrook Sustainability Hub and December meeting held on site at MPO and included a site tour of the mine and tailings storage facility (plate 3). These meetings provided regular updates about the MPO, as well as an avenue to discuss aspects of the MPO that concerned community stakeholders. General discussions from these meetings related to:

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

The December CCC meeting included a site tour of the mining operations and tailings storage facility.

During the year the CCC members visited MACH's Nursery and Bioenergy Crop Trial. The Bioenergy Crop Trial is a project undertaken by MACH with the NSW Department of Primary Industries. The project has been underway for the past four years on MACH owned land. The trial consisted of eight replicates with eight species per replicate and 100 trees per plot (plate 4).

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 2024 CCC meetings are provided on the MACH Energy website (https://machenergyaustralia.com.au/mount-pleasant/documentation/).



Plate 2: The CCC visiting the Fines Emplacement Area.



Plate 3: The CCC visit the Warrawee Nursery (October 2024).

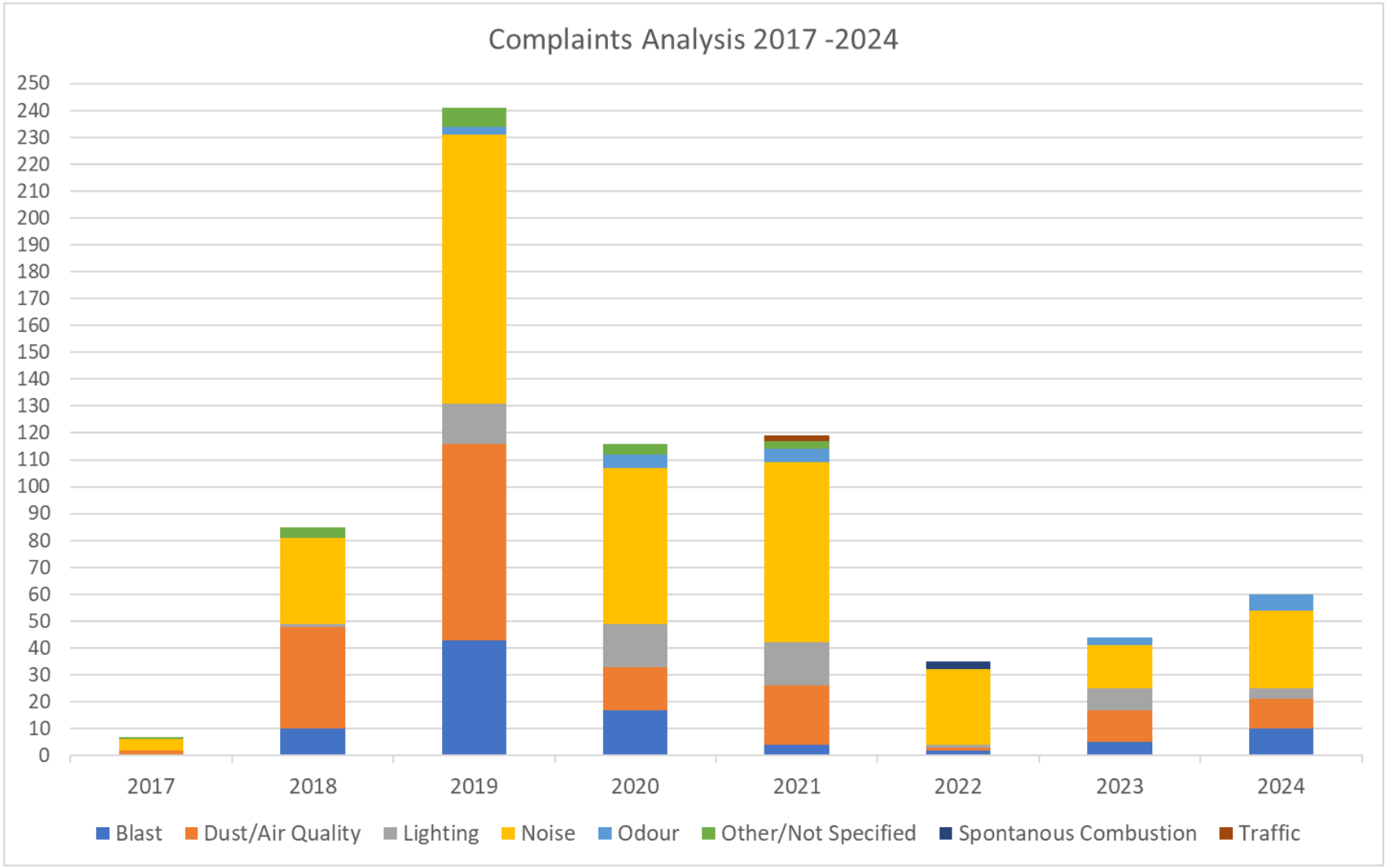

Chart 27: Complaints Analysis 2017-2024

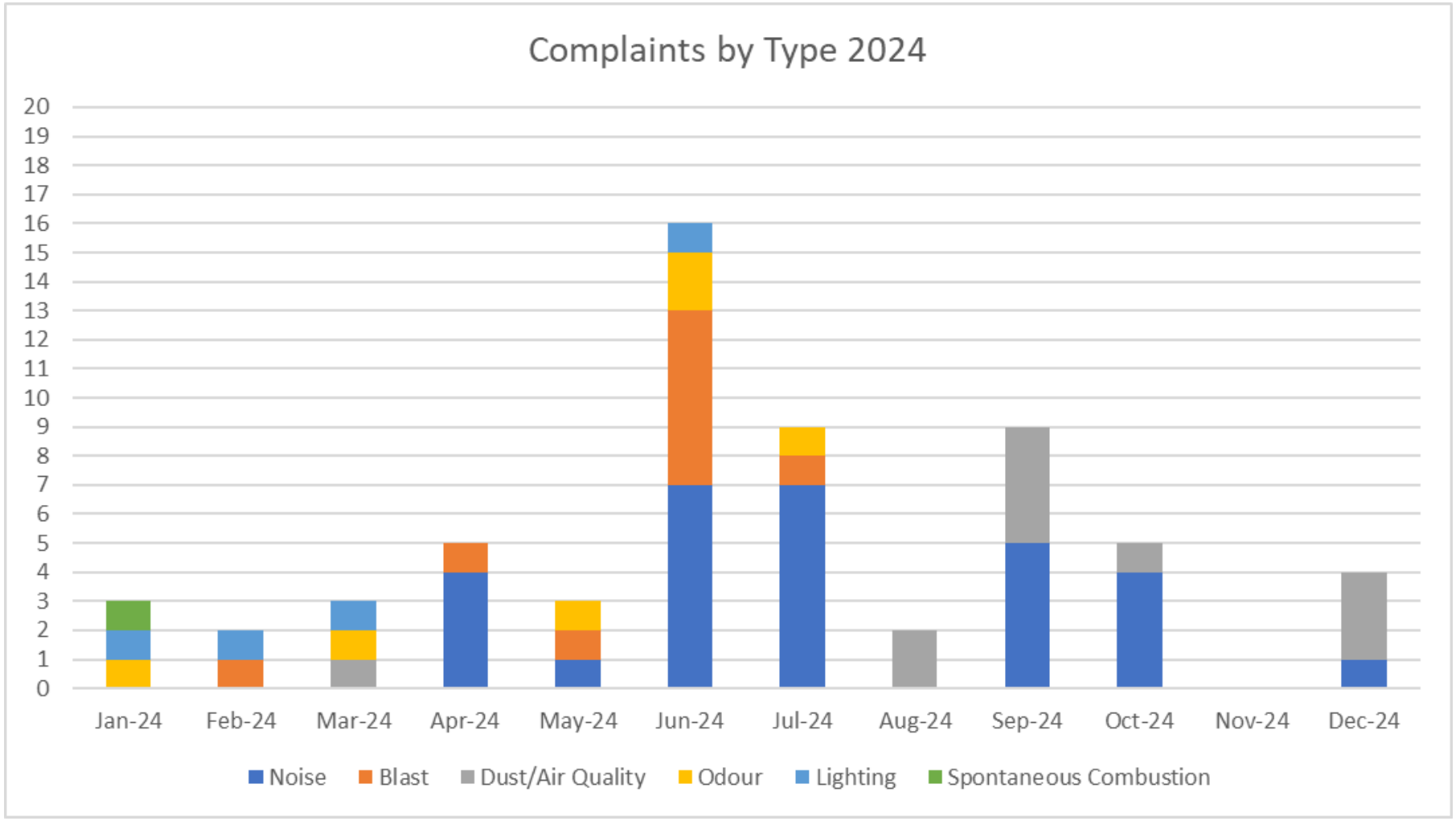

Chart 28: Complaints by Type 2024

8.3 COMMUNITY DEVELOPMENT

MACH Energy has continued the operation of 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 $5 million into projects that benefit the Upper Hunter Valley Aboriginal community.

MPO representatives have joined the existing ACDF community members to administer funds, manage its current projects and to seek-out new partnerships. An example of some of the key partnerships that were maintained during the reporting period as part of the ACDF are presented in Table 32.
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Table 32
Aboriginal Community Development Fund Partnerships

Partner	Description
The Gundi Program	The Gundi Program was launched in 2011. The construction of a Cultural Space and Yarning Circle was completed in 2022. The facilities will be used for all inmates to come together. Gundi aims to help Aboriginal inmates gain trades skills in custody and secure jobs once released. The Gundi Program builds housing for remote communities, offices, and abolition blocks for many local companies. The Gundi Program provides building qualifications and work experience for inmates whilst in custody. Approximately 80 inmates have participated in the Gundi Program to date.
Aboriginal Youth Empowerment Program	The Aboriginal Youth Empowerment Program sees the continuation of the employment of an Aboriginal Youth Program Mentor. Now in its third year, the Mentor works with Singleton and Muswellbrook Policy Citizen Youth Clubs (PCYC) local schools and organisations to assist the youth in the Upper Hunter region. Among many tasks, the mentor weekly activity programs, in consultation with local stakeholders and Aboriginal community members, identifies and addresses key issues for the youth. This includes personal safety, belonging and cultural sensitivity.
"Ka-wul" – Aboriginal Educational & Cultural Resource Centre Program - Singleton High School	Ka-wul Aboriginal Education & Cultural Resource Centre program (or Ka-wul); located on the grounds of Singleton High School (SHS); is an Aboriginal & Torres Strait Islander program dedicated to supporting SHS Aboriginal students & their families, non-Aboriginal students, staff and the wider communities- Singleton Local Government Area (LGA) and Upper Hunter Valley Aboriginal Community (UHVAC). Ka-wul is one of three programs making up SHS Aboriginal Education, it is the overarching and the oldest established First Nations People program offered at SHS alongside Kayu Kumpa and Clontarf. While Kayu Kumpa and Clontarf are offered, both are gendered specific programs with limited enrolments governed by staffing ratios. While Ka-wul supports all students focusing on culture, identity, education, and leadership skills.



Plate 4: NAIDOC Recognition at Mount Pleasant

8.4 RELATIONSHIPS WITH LOCAL ABORIGINAL COMMUNITY

MACH Energy works closely with the local Aboriginal community, including undertaking regular consultation with the RAPs. MACH Energy maintains a contact register, containing up to date contact details for the 88 RAPs, and is committed to maintaining ongoing consultation with these RAPs throughout the life of the MPO.

As outlined in Section 5.6.2, during 2024 archaeological salvages were carried out under AHIP #C0002092, AHIP #C0002053 and AHIP #C0004783 in accordance with the ACHMP. RAPs had a strong presence in these salvage activities.

8.5 OTHER CONTRIBUTIONS TO COMMUNITY

Community sponsorships have increased throughout 2024 and include Westpac Rescue Helicopter – Annual Charity Golf Day, Annual Rescue Ball, NAIDOC Week and Community Activities, NAIDOC Small Schools Events, Kayuga Rural Fire Service and Muswellbrook Fire & Rescue Santa Run.

Sport sponsorships include Merriwa Polocrosse, Scone Netball Rep Team, Singleton Strikers Football Club, Merriwa Rugby League Football Club, Scone Junior Rugby Union Club, Upper Hunter Show, Lake Glenbawn Family Carp Muster, Aberdeen Golf Club, Muswellbrook Chamber of Commerce Nostalgia Festival, The Antique Truck and Machinery Club, Aberdeen Pony Club, The Australian Photographic Society Muswellbrook, Muswellbrook Netball Association, Denman Tennis Club, Denman Rugby League Football Club, Aberdeen Rugby League Football Club, Scone Rugby Union Football Club, Bunnan Polocrosse Association, Sandy Hollow Charity Motorfest, Sandy Hollow Charity Horse Ride, Merriwa Pony Club, Scone Campdraft and Rodeo Association, Aberdeen Bushman's Campdraft and Roughrider Association, Cassilis Public School, Merriwa Polocrosse Club, Muswellbrook Polocrosse Club, Merriwa Race Club, Merriwa Festival of the Fleeces, Aberdeen Public School, The Brook Cricket Club, King of the Ranges Stockman's Challenge, Muswellbrook Junior Cricket Club, Denman Pony Club, CWA Singleton and Gundy RFS.

School sponsorships for End of Year Presentations included Muswellbrook High School, Muswellbrook Primary School, St James Muswellbrook, Aberdeen Primary School and Denman Primary School.

MPO also run a number of tours and events for the year including, International Women's Day, International Men's Day, R U OK? Day and three Upper Hunter Mining Dialogue school mine tours for local primary and high school students. (plate 6)



Plate 5: Upper Hunter Mining Dialogue School Mine Tour 2024

9 INDEPENDENT ENVIRONMENTAL AUDIT

An IEA was commenced during the reporting period in accordance with Condition 9, Schedule 5 of Development Consent DA 92/97 and Condition D13, Schedule 2 of the Development Consent SSD 10418.

The IEA considered compliance from 9 March 2023 (day after the previous 2023 IEA) to 14 November 2024. MACH Energy commissioned RPS Consulting Pty Ltd (RPS) to complete the IEA, which was undertaken on-site from 12 – 14 November 2024.

The audit report was not completed within the reporting period. The findings of the Audit will be reported in the 2025 Annual Review and communicated separately as required once received and approved.

As requested by the DPE (now DPHI) as an action from the 2023 Annual Review (refer to Section 4), Table 33 includes recommendations from the 2023 IEA which were assessed in 2024 as ongoing, yet to be completed or completed.

Table 33
Summary of ongoing 2023 Independent Environmental Audit Recommendations and MACH Energy Responses

Item No.	Audit Recommendation	MACH Energy 2024 Response	Forecast Completion
Development Consent DA 92/97			
2023 IEA Recommendations			
EPL 20850 O6.1	REC 19: Include the waste management requirements of EPL 20850 Condition O6.1 in the Thiess Mount Pleasant Handling and Disposal of Waste Procedure.	This recommendation will be addressed with the next version of the Thiess Mount Pleasant Handling and Disposal of Waste Procedure.	June 2025
AQGHGMP	REC 17: Site personnel to ensure that water sprays on materials/when loading or unloading materials are being applied per the AQGHGMP to minimise dust during tipping as far as possible. The measures in the AQGHGMP relating to this should be reviewed for effectiveness.	At the time of the observation, wheel generated dust emissions were not considered excessive. However, the observed emissions were in the 'Dust emissions are increasing, and operators should consider if further action to reduce dust is required' category, as per EPA's Dust Assessment Handbook.	Completed
RMP (Version 2)	REC 9: Update Table 2-1 of the RMP to include Schedule 3, Condition 54 of DA 92/97.	This recommendation will be addressed with the next revision of the RMP.	June 2025
-	REC 8: Ensure all chemicals/hydrocarbons are appropriately stored in bunded areas.	MACH Energy have commissioned a capital expenditure project to upgrade the MIA infrastructure. This will be completed in early 2025. The new design will address issues with chemical and hydrocarbon storage by increasing bunded storage areas.	June 2025

10 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

10.1 ENVIRONMENTAL INCIDENTS

There were no reportable incidents during the reporting period.

MACH Energy responded to 18 separate requests for further information from the EPA during the 2024 reporting period related to a community complaints about noise (Section 5.2), dust related to blasting (Section 5.3) and odour related to spontaneous combustion (5.12).

10.2 NON-COMPLIANCES

A summary of non-compliances and potential non-compliances during the reporting period (i.e. 1 January – 31 December 2024), and, if applicable, the actions taken in response to the non-compliances, are outlined in Table 34.

Table 34
Compliance Summary

Approval Document Reference	Observation	Action/Comment
Development Consent SSD 10418 Condition B52 (iv) Development Consent DA 92/97 Schedule 3, Condition 28	The following was noted from the 2024 IEA: The GWMP commits to including reporting on elevation at each bore with water levels being presented in Australian Height Datum (AHD) and depth in the Annual Review. Water levels are presented in depth (as meter below ground level) only in the 2023 Annual Review.	Results have been presented in both depth and AHD in the 2024 Annual Review and water levels will be presented in depth and AHD in future Annual Reviews. Further consideration will be made at the time of the next GWMP review to determine if it is appropriate to remove this requirement. There is not time frame associated with this action.
Development Consent SSD 10418 Condition B55 and Condition B56	A 500 m² disturbance for mining laydown purposes occurred on 2 October 2024 without the required credit retirement within the Stage 1 Project Area of MACH Energy.	Relevant regulators were immediately advised of the occurrence. A refresher training module on Ground Disturbance Permits (GDPs) was issued in the LAAMP system for contractors to complete through Theiss onboarding. MACH Energy worked with Theiss to demarcate the disturbance area with clear signage. MACH Energy understand that Credits must be retired prior to any disturbance of Stage 1 and 2 areas.
EPL 20850 Condition M2.1 and M2.2	Incomplete data capture at EPL Point 1 (A-PF2) and Point 2 (A-PF5). PM10 not monitored continuously at EPL Point 1 and Point 2.	To prevent recurrence of non-compliance and increase valid data capture, MACH Energy has a specialist consultant contracted to perform daily system checks on the monitoring units. Regular maintenance and calibration are also carried out in accordance with the manufacturer's guidelines. New Pilas Fidas systems will be installed in the next reporting period.
EPL 20850 Condition M4.1	Meteorological data at EPA 4 and 11 was not captured continuously between January and August 2024.	To prevent recurrence of non-compliance and increase valid data capture, MACH Energy has a specialist consultant contracted to perform daily system checks on the meteorological monitoring units. Regular maintenance and calibration are also carried out in accordance with the manufacturer's guidelines.

Approval Document Reference	Observation	Action/Comment
EPL 20850 Condition M9.1	EPL 20850, Condition M9.1 requires the licensee to record the average PM_{10} concentration at EPA Monitoring Points 1 (A-PF2) and 2 (A-PF5) at intervals of 10 minutes. PM_{10} has shown to be recorded at intervals of 10 minutes for the majority of the reporting period however there are some periods where PM_{10} was not recorded for all 10 minute intervals.	To prevent recurrence of non-compliance and increase valid data capture, MACH Energy has a specialist consultant contracted to perform daily system checks on the PM10 air quality monitoring units. Regular maintenance and calibration are also carried out in accordance with the manufacturer's guidelines. In addition, MACH Energy is investigating alternative unit types to replace Palas Fidas instrument at Monitoring Point 2 to ensure capture of PM10 data.
Mining Lease (ML) Standard Conditions Condition 16 (3)(b)	The Mining Lease Standard Condition states that if a document is published on the website of the holder of the mining lease, the holder must ensure that it is published; for a forward program or an annual rehabilitation report, within 14 days after it is given to the Secretary or amended. The MACH Energy Forward Program 2024 – 2026 was submitted 28 March 2024 and uploaded to the website 15 June 2024, two months late. The Rehabilitation Report 2023 was submitted 29 March 2024 and uploaded 17 April 2024, 3 days late from the 14 day time period.	MACH Energy will input the Mining Lease Standard Conditions of Schedule 8A of the Mining Regulation 2016 into the MPO compliance register to track compliance actions against all of the conditions.

11 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Key activities to be completed during the next reporting period include:

- operations will continue to comply with the requirements of both Development Consent SSD 10418 and Development Consent DA 92/97 (until its surrender);
- continued civil works associated with water management and infrastructure maintenance;
- continued consultation regarding the Aboriginal Heritage Conservation Areas;
- continued collaboration with the University of Newcastle on various rehabilitation related research projects as described in Section 7.3; commencement of the FEA Stage 3 Lift Project to increase the capacity for fines deposition;
- increased production in accordance with Development Consent SSD 10418;
- secure and retire biodiversity credits for the Northern Link Road and relevant portions of the Development Footprint 1 under Development Consent SSD 10418;
- commission new Realtime Dust monitors to ensure continuous air quality data collection; and
- continued upgrade of the nursery facility to supply local tubestock.

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APPENDIX A

NOISE MONITORING SUMMARY 2024

Table A1
$L_{Aeq,15minute}$ Attended Noise Monitoring Summary 2024

Monitoring Location/Period		Jan[1]	Feb[2]	Mar[3]	Apr[4]	May[5]	Jun[6]	Jul[7]	Aug[8]	Sep[9]	Oct[10]	Nov[11]	Dec[12]
N-AT1	Night	IA	IA	31	IA	IA	IA	IA	IA	IA	IA	IA	IA
N-AT2	Night	IA	28	IA	IA	22	20	IA	23	IA	27	22	IA
N-AT3	Night	IA	IA	IA	22	IA	IA	IA	IA	IA	30	26	IA
N-AT4	Night	IA	IA	22	IA	IA	29	IA	28	IA	IA	29	IA
N-AT5	Night	IA	IA	32	31	IA	28	25	23	30	IA	23	IA
N-AT6	Night	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N-AT7	Night	-	IA	IA	IA	IA	IA	33	IA	IA	IA	IA	IA
N-AT8	Night	-	34	39	41	IA	41	39	34	38	35	33	54

Note:

dBA = A-weighted decibels.

IA = Inaudible.

Indicates criteria were not applicable due to meteorological conditions at the time of measurement.

Bold values indicate exceedance of criterion.

Measurements undertaken on the following dates:

[1]: 11 and 12 January. [2]: 20 and 21 February. [3]: 19 and 20 March. [4]: 29 and 30 April. [5]: 27 and 28 May. [6]: 24 and 25 June. [7]: 24 and 25 July. [8]: 22 and 23 August. [9]: 24 and 25 September. [10]: 29 and 30 October. [11]: 27 November.[12]: 19 December.

Table A2
$L_{A1,1minute}$ Attended Noise Monitoring Summary 2024

Monitoring Location/Period		Jan[1]	Feb[2]	Mar[3]	Apr[4]	May[5]	Jun[6]	Jul[7]	Aug[8]	Sep[9]	Oct[10]	Nov[11]	Dec[12]
N-AT1	Night	IA	IA	37	IA	IA	IA	IA	IA	IA	IA	IA	IA
N-AT2	Night	IA	33	IA	IA	25	26	IA	25	IA	31	26	IA
N-AT3	Night	IA	IA	IA	26	IA	IA	IA	IA	IA	35	29	IA
N-AT4	Night	IA	IA	29	IA	IA	36	IA	32	IA	IA	35	IA
N-AT5	Night	IA	IA	36	37	IA	34	29	27	36	IA	26	IA
N-AT6	Night	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N-AT7	Night	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N-AT8	Night	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA

Note:

dBA = A-weighted decibels.

IA = Inaudible.

Indicates criteria were not applicable due to meteorological conditions at the time of measurement.

Bold values indicate exceedance of criterion.

Measurements undertaken on the following dates:

[1]: 11 and 12 January. [2]: 20 and 21 February. [3]: 19 and 20 March. [4]: 29 and 30 April. [5]: 27 and 28 May. [6]: 24 and 25 June. [7]: 24 and 25 July. [8]: 22 and 23 August. [9]: 24 and 25 September. [10]: 29 and 30 October. [11]: 27 November.[12]: 19 December.

Table A3
Cumulative Mining Noise Monitoring Summary 2024

Monitoring Location/Period		Jan[1]	Feb[2]	Mar[3]	Apr[4]	May[5]	Jun[6]	Jul[7]	Aug[8]	Sep[9]	Oct[10]	Nov[11]	Dec[12]
N-AT1	Night	IA	IA	31	IA	IA	IA	IA	IA	IA	IA	IA	39
N-AT2	Night	IA	28	IA	IA	22	20	IA	23	IA	27	22	IA
N-AT3	Night	IA	IA	IA	22	IA	IA	IA	IA	IA	30	26	IA
N-AT4	Night	IA	IA	22	IA	IA	29	IA	28	IA	IA	29	IA
N-AT5	Night	IA	IA	32	31	IA	28	25	23	30	IA	23	IA
N-AT6	Night	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	25
N-AT7	Night	-	IA	IA	IA	IA	IA	33	IA	IA	IA	IA	IA
N-AT8	Night	-	34	39	41	IA	41	39	34	38	35	33	54

Note:

dBA = A-weighted decibels.

IA = Inaudible.

Nil = Only one source of noise present, or MPO did not contribute to total mining noise levels.

Indicates criteria were not applicable due to meteorological conditions at the time of measurement.

Bold values indicate exceedance of criterion.

Measurements undertaken on the following dates:

[1]: 11 and 12 January. [2]: 20 and 21 February. [3]: 19 and 20 March. [4]: 29 and 30 April. [5]: 27 and 28 May. [6]: 24 and 25 June. [7]: 24 and 25 July. [8]: 22 and 23 August. [9]: 24 and 25 September. [10]: 29 and 30 October. [11]: 27 November.[12]: 19 December.

APPENDIX B

BLASTING SUMMARY 2024

MPO Blast Monitoring Summary – 2024

Date Fired	Time Fired	Vibration (mm/s) BVOA	Overpressure (dBL) BVOA	Vibration (mm/s) BVOC	Overpressure (dBL) BVOC	Vibration (mm/s) BVO2	Overpressure (dBL) BVO2	Blast Fume Complaint
Thursday 4/1/2024	13:00	0.640 mm/s	105.4 DBL	0.380 mm/s	100.5 DBL	0.150 mm/s	98.6 DBL	N
Thursday 11/1/2024	14:22	1.510 mm/s	106 DBL	2.040 mm/s	107.1 DBL	1.770 mm/s	96.8 DBL	N
Wednesday 17/1/2024	13:03	0.280 mm/s	98 DBL	0.140 mm/s	101.5 DBL	0.230 mm/s	94.8 DBL	N
Thursday 18/1/2024	15:10	0.520 mm/s	99 DBL	0.270 mm/s	99.5 DBL	0.320 mm/s	104.1 DBL	N
Wednesday 24/1/2024	13:04	0.280 mm/s	95 DBL	0.180 mm/s	96.8 DBL	0.360 mm/s	95 DBL	N
Wednesday 31/1/2024	13:25	0.390 mm/s	89.2 DBL	0.210 mm/s	86.3 DBL	0.390 mm/s	89.2 DBL	N
Thursday 1/2/2024	13:09	0.490 mm/s	97.2 DBL	0.250 mm/s	89.3 DBL	0.410 mm/s	87.2 DBL	N
Wednesday 7/2/2024	11:20	0.810 mm/s	95.6 DBL	0.440 mm/s	88.2 DBL	0.410 mm/s	88.8 DBL	N
Thursday 8/2/2024	13:02	0.320 mm/s	99.1 DBL	0.210 mm/s	92.2 DBL	0.120 mm/s	101.3 DBL	N
Friday 16/2/2024	12.42	2.030 mm/s	106 DBL	1.070 mm/s	104.1 DBL	0.490 mm/s	97 DBL	Y
Thursday 22/2/2024	1.36	0.930 mm/s	100.7 DBL	0.970 mm/s	91.8 DBL	0.650 mm/s	92 DBL	N
Wednesday 28/2/2024	15:07	0.130 mm/s	101.4 DBL	0.080 mm/s	94 DBL	0.060 mm/s	94.7 DBL	N
Tuesday 5/3/2024	13:06	3.850 mm/s	109 DBL	1.550 mm/s	97.3 DBL	0.790 mm/s	103.8 DBL	N
Friday 8/3/2024	10:09	1.100 mm/s	108.2 DBL	0.700 mm/s	100.2 DBL	0.640 mm/s	100.2 DBL	N
Tuesday 12/3/2024	12:14	0.730 mm/s	98.800 mm/s	0.330 mm/s	86.1 DBL	0.480 mm/s	92.4 DBL	N
Thursday 14/3/2024	13:02	0.570 mm/s	99.9 DBL	0.370 mm/s	95.6 DBL	0.670 mm/s	95.4 DBL	Y
Wednesday 20/3/2024	15:06	0.410 mm/s	96.7 DBL	0.180 mm/s	92.7 DBL	0.210 mm/s	96.3 DBL	N
Thursday 21/3/2024	13:11	0.530 mm/s	100.8 DBL	0.260 mm/s	102.3 DBL	0.430 mm/s	96.7 DBL	N
Wednesday 27/3/2024	13:04	0.720 mm/s	107.3 DBL	0.390 mm/s	101.1 DBL	0.180 mm/s	104 DBL	N
Thursday 28/3/2024	13:07	0.300 mm/s	104.7 DBL	0.150 mm/s	93.4 DBL	0.280 mm/s	100 DBL	N
Wednesday 3/4/2024	12:04	1.080 mm/s	101.5 DBL	1.250 mm/s	95.3 DBL	0.940 mm/s	96.5 DBL	N
Wednesday 10/4/2024	13:04	0.870 mm/s	96.7 DBL	0.700 mm/s	93 DBL	0.750 mm/s	92.9 DBL	Y
Friday 12/4/2024	11:03	0.960 mm/s	112.9 DBL	0.830 mm/s	106.8 DBL	0.440 mm/s	100.8 DBL	N
Thursday 18/4/2024	12:04	6.070 mm/s	103.2 DBL	2.010 mm/s	96 DBL	0.560 mm/s	102.1 DBL	N
Friday 19/4/2024	10:07	0.510 mm/s	97.5 DBL	0.320 mm/s	88.9 DBL	0.220 mm/s	93.8 DBL	N
Monday 22/4/2024	15:03	1.060 mm/s	107.7 DBL	0.900 mm/s	102.5 DBL	0.490 mm/s	91 DBL	N
Wednesday 24/4/2024	12:17	0.230 mm/s	104 DBL	0.150 mm/s	102.2 DBL	0.290 mm/s	103.7 DBL	N
Wednesday 1/5/2024	13:00	0.880 mm/s	97.9 DBL	0.740 mm/s	93.1 DBL	1.020 mm/s	101.4 DBL	N
Friday 3/5/2024	12:00	0.560 mm/s	98.4 DBL	0.400 mm/s	90.9 DBL	0.350 mm/s	32.6 DBL	N
Friday 10/5/2024	12:05	0.520 mm/s	98.2 DBL	0.430 mm/s	96.7 DBL	0.440 mm/s	97.4 DBL	Y
Tuesday 14/5/2024	12:40	0.040 mm/s	86 DBL	0.010 mm/s	76.4 DBL	0.180 mm/s	87.4 DBL	N
Friday 17/5/2024	9.56	2.960 mm/s	113.3 DBL	1.400 mm/s	104 DBL	0.950 mm/s	104.6 DBL	N
Wednesday 22/5/2024	13:18	0.680 mm/s	94.7 DBL	0.530 mm/s	86.1 DBL	0.450 mm/s	89.4 DBL	N

Date Fired	Time Fired	Vibration (mm/s) BVOA	Overpressure (dBL) BVOA	Vibration (mm/s) BVOC	Overpressure (dBL) BVOC	Vibration (mm/s) BVO2	Overpressure (dBL) BVO2	Blast Fume Complaint
Tuesday 28/5/2024	13:42	0.680 mm/s	103.4 DBL	0.430 mm/s	101.8 DBL	0.420 mm/s	93.8 DBL	Y
Thursday 30/5/2024	9:09	0.680 mm/s	113.9 DBL	0.260 mm/s	106.2 DBL	0.390 mm/s	110.3 DBL	N
Friday 31/5/2024	12:10	0.190 mm/s	110.1 DBL	0.080 mm/s	94.8 DBL	0.080 mm/s	111.3 DBL	N
Thursday 6/6/2024	13:04	1.360 mm/s	104.8 DBL	0.510 mm/s	95.9 DBL	0.760 mm/s	104 DBL	N
Thursday 13/6/2024	14:51	1.330 mm/s	101.4 DBL	1.440 mm/s	90.2 DBL	0.610 mm/s	103.1 DBL	Y
Thursday 20/6/2024	9:12	0.380 mm/s	105.1 DBL	0.240 mm/s	98.8 DBL	0.440 mm/s	99.3 DBL	Y
Monday 24/6/2024	13:10	0.600 mm/s	100.8 DBL	0.490 mm/s	94.2 DBL	0.750 mm/s	95 DBL	N
Wednesday 26/6/2024	13:09	0.670 mm/s	106.7 DBL	0.390 mm/s	107.2 DBL	0.300 mm/s	104 DBL	N
Thursday 4/7/2024	15:14	0.420 mm/s	95 DBL	0.600 mm/s	105.9 DBL	0.770 mm/s	95.4 DBL	N
Monday 8/7/2024	15:25	6.090 mm/s	107.8 DBL	2.640 mm/s	98.5 DBL	2.660 mm/s	104.3 DBL	N
Friday 12/7/2024	9:08	4.770 mm/s	102.8 DBL	1.660 mm/s	90.4 DBL	0.680 mm/s	101.9 DBL	Y
Wednesday 17/7/2024	15:47	1.210 mm/s	103.8 DBL	0.630 mm/s	94.9 DBL	0.660 mm/s	98.4 DBL	N
Monday 22/7/2024	13:10	0.840 mm/s	98.1 DBL	0.580 mm/s	85.8 DBL	0.920 mm/s	98 DBL	N
Wednesday 24/7/2024	13:30	0.220 mm/s	98.8 DBL	0.140 mm/s	94.9 DBL	0.560 mm/s	97.9 DBL	N
Friday 26/7/2024	9:17	0.210 mm/s	100.4 DBL	0.180 mm/s	90.6 DBL	0.130 mm/s	99.6 DBL	N
Wednesday 31/7/2024	13:11	0.820 mm/s	96.7 DBL	0.720 mm/s	91.7 DBL	0.750 mm/s	95.8 DBL	N
Thursday 1/8/2024	14:02	0.130 mm/s	93.6 DBL	0.110 mm/s	86.5 DBL	0.140 mm/s	88.4 DBL	N
Friday 2/8/2024	10:28	0.650 mm/s	103 DBL	0.350 mm/s	95.1 DBL	0.240 mm/s	92.5 DBL	N
Monday 5/8/2024	13:07	0.130 mm/s	98 DBL	0.100 mm/s	89.7 DBL	0.240 mm/s	97.4 DBL	N
Thursday 8/8/2024	12:57	1.650 mm/s	105.6 DBL	0.760 mm/s	99.2 DBL	0.420 mm/s	96.4 DBL	N
Wednesday 14/8/2024	13:52	1.120 mm/s	99.9 DBL	0.650 mm/s	92.4 DBL	0.470 mm/s	92 DBL	N
Tuesday 20/8/2024	13:08	0.380 mm/s	103.8 DBL	0.200 mm/s	94.6 DBL	0.200 mm/s	96.2 DBL	N
Thursday 22/8/2024	13:13	0.370 mm/s	101.3 DBL	0.300 mm/s	90.8 DBL	0.510 mm/s	101.3 DBL	N
Monday 26/8/2024	13:56	0.230 mm/s	99.2 DBL	0.160 mm/s	103.5 DBL	0.170 mm/s	94.2 DBL	N
Thursday 29/8/2024	13:13	0.280 mm/s	101.2 DBL	0.180 mm/s	96.3 DBL	0.210 mm/s	100.4 DBL	N
Tuesday 3/9/2024	13:06	0.180 mm/s	98 DBL	0.140 mm/s	96.3 DBL	0.200 mm/s	94 DBL	N
Friday 6/9/2024	9:19	0.710 mm/s	101 DBL	0.500 mm/s	106 DBL	0.610 mm/s	103.1 DBL	Y
Monday 9/9/2024	15:00	0.350 mm/s	96.9 DBL	0.230 mm/s	97.4 DBL	0.500 mm/s	102.7 DBL	N
Thursday 12/9/2024	10:00	0.690 mm/s	103.4 DBL	0.640 mm/s	100 DBL	0.800 mm/s	103.9 DBL	N
Friday 13/9/2024	11:40	0.290 mm/s	100 DBL	0.190 mm/s	95.6 DBL	0.250 mm/s	108.2 DBL	N
Wednesday 18/9/2024	15:00	0.830 mm/s	95.9 DBL	0.420 mm/s	99.4 DBL	0.730 mm/s	106 DBL	N
Friday 20/9/2024	11:00	0.420 mm/s	94.7 DBL	0.360 mm/s	103.3 DBL	0.280 mm/s	104.6 DBL	Y
Tuesday 24/9/2024	13:00	0.240 mm/s	94.1 DBL	0.270 mm/s	88.6 DBL	0.480 mm/s	95.5 DBL	N
Thursday 26/9/2024	15:29	0.200 mm/s	108 DBL	0.110 mm/s	89.2 DBL	0.310 mm/s	96.9 DBL	N

Date Fired	Time Fired	Vibration (mm/s) BVOA	Overpressure (dBL) BVOA	Vibration (mm/s) BVOC	Overpressure (dBL) BVOC	Vibration (mm/s) BVO2	Overpressure (dBL) BVO2	Blast Fume Complaint
Thursday 3/10/2024	12:02	4.270 mm/s	107.3 DBL	1.970 mm/s	102.4 DBL	0.730 mm/s	96.5 DBL	N
Friday 4/10/2024	11:07	0.280 mm/s	96.5 DBL	0.180 mm/s	86.5 DBL	0.170 mm/s	94.7 DBL	N
Thursday 10/10/2024	9:30	0.450 mm/s	92.8 DBL	0.280 mm/s	90.4 DBL	0.450 mm/s	92.8 DBL	N
Monday 14/10/2024	14:56	0.340 mm/s	95.4 DBL	0.260 mm/s	84.5 DBL	0.440 mm/s	96.5 DBL	N
Thursday 17/10/2024	3:33	0.940 mm/s	99.9 DBL	0.220 mm/s	92.4 DBL	0.220 mm/s	92.4 DBL	N
Tuesday 22/10/2024	13:07	0.070 mm/s	94.5 DBL	0.060 mm/s	88.9 DBL	0.060 mm/s	88.6 DBL	N
Thursday 24/10/2024	16:49	0.510 mm/s	104.7 DBL	0.340 mm/s	107 DBL	0.200 mm/s	104.9 DBL	N
Thursday 31/10/2024	13:02	0.460 mm/s	91.8 DBL	0.490 mm/s	96.6 DBL	0.600 mm/s	94 DBL	Y
Tuesday 5/11/2024	13:14	0.580 mm/s	106.5 DBL	0.620 mm/s	104.8 DBL	0.620 mm/s	104.8 DBL	N
Tuesday 12/11/2024	15:11	0.600 mm/s	102.4 DBL	0.540 mm/s	97.1 DBL	0.410 mm/s	102.2 DBL	N
Thursday 14/11/2024	13:09	0.320 mm/s	99.4 DBL	0.300 mm/s	102.9 DBL	0.460 mm/s	99.9 DBL	N
Wednesday 20/11/2024	13:14	0.040 mm/s	91.4 DBL	0.030 mm/s	106.1 DBL	0.050 mm/s	91.5 DBL	N
Friday 22/11/2024	9:02	0.540 mm/s	104.9 DBL	0.520 mm/s	95.8 DBL	0.220 mm/s	94.1 DBL	N
Thursday 28/11/2024	15:40	0.720 mm/s	105.2 DBL	0.610 mm/s	98.8 DBL	0.870 mm/s	98.5 DBL	N
Wednesday 4/12/2024	12:56	0.510 mm/s	99.9 DBL	0.330 mm/s	96.5 DBL	0.430 mm/s	100.3 DBL	N
Friday 13/12/2024	14:47	0.520 mm/s	93.8 DBL	0.470 mm/s	104.8 DBL	0.260 mm/s	100.2 DBL	Y
Friday 13/12/2024	13:30	1.020 mm/s	103 DBL	1.190 mm/s	91.6 DBL	0.590 mm/s	96.9 DBL	Y
Wednesday 18/12/2024	15:40	0.490 mm/s	96.7 DBL	0.370 mm/s	107.9 DBL	0.420 mm/s	111.3 DBL	N
Friday 20/12/2024	10:01	0.680 mm/s	95.7 DBL	0.690 mm/s	88.2 DBL	0.620 mm/s	90.9 DBL	N
Tuesday 24/12/2024	9:12	0.320 mm/s	94.3 DBL	0.210 mm/s	87.1 DBL	0.790 mm/s	92.8 DBL	N

APPENDIX C

RAIL MOVEMENT SUMMARY 2024

MPO Rail Movement Summary – 2024

Month	Total Tonnage Transported From MPO (t)
Jan	657,525
Feb	614,124
Mar	812,918
Apr	714,690
May	630,628
Jun	635,952
Jul	471,777
Aug	514,314
Sep	795,867
Oct	691,363
Nov	657,552
Dec	683,660
Total	**7,880,370**

Q1			Q2			Q3			Q4		
Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight
Wed 3 Jan 00:35	Wed 3 Jan 02:05	4239	Mon 1 Apr 00:57	Mon 1 Apr 03:57	9196	Fri 5 Jul 09:27	Fri 5 Jul 10:57	9294	Fri 4 Oct 17:57	Fri 4 Oct 20:57	4295
Wed 3 Jan 15:56	Wed 3 Jan 18:56	8480	Sun 31 Mar 21:42	Mon 1 Apr 00:42	8547	Sun 7 Jul 06:36	Sun 7 Jul 08:06	8620	Fri 4 Oct 21:12	Sat 5 Oct 00:12	8574
Thu 4 Jan 01:25	Thu 4 Jan 04:25	8491	Mon 1 Apr 04:12	Mon 1 Apr 07:12	8577	Mon 8 Jul 02:57	Mon 8 Jul 04:27	4264	Sat 5 Oct 02:27	Sat 5 Oct 03:57	9322
Thu 4 Jan 16:40	Thu 4 Jan 19:40	8546	Mon 1 Apr 11:55	Mon 1 Apr 14:55	9022	Mon 8 Jul 06:25	Mon 8 Jul 07:55	4264	Sat 5 Oct 05:02	Sat 5 Oct 06:32	8492
Thu 4 Jan 20:25	Thu 4 Jan 23:25	9245	Mon 1 Apr 15:10	Mon 1 Apr 18:10	8332	Tue 9 Jul 05:06	Tue 9 Jul 06:36	4264	Sat 5 Oct 08:37	Sat 5 Oct 11:37	9318
Fri 5 Jan 09:35	Fri 5 Jan 12:35	8621	Mon 1 Apr 18:25	Mon 1 Apr 21:25	8370	Tue 9 Jul 15:46	Tue 9 Jul 17:16	4264	Sat 5 Oct 19:05	Sat 5 Oct 22:05	4266
Fri 5 Jan 14:05	Fri 5 Jan 17:05	8678	Tue 2 Apr 04:50	Tue 2 Apr 06:20	4250	Thu 11 Jul 03:55	Thu 11 Jul 05:25	4264	Sat 5 Oct 23:37	Sun 6 Oct 01:07	4286
Sat 6 Jan 03:15	Sat 6 Jan 06:15	8630	Tue 2 Apr 14:45	Tue 2 Apr 17:45	8468	Fri 12 Jul 04:57	Fri 12 Jul 06:27	4264	Sun 6 Oct 01:22	Sun 6 Oct 04:22	8490
Sat 6 Jan 08:25	Sat 6 Jan 11:25	8471	Tue 2 Apr 21:15	Wed 3 Apr 00:15	8446	Sat 13 Jul 12:35	Sat 13 Jul 14:05	4264	Sun 6 Oct 05:42	Sun 6 Oct 08:42	9222
Sun 7 Jan 01:25	Sun 7 Jan 04:25	8617	Sat 6 Apr 06:45	Sat 6 Apr 09:45	8457	Sun 14 Jul 02:25	Sun 14 Jul 03:55	4264	Sun 6 Oct 11:26	Sun 6 Oct 14:26	4288
Sun 7 Jan 12:05	Sun 7 Jan 15:05	9030	Sat 6 Apr 14:35	Sat 6 Apr 17:35	8646	Sun 14 Jul 20:55	Sun 14 Jul 22:25	4264	Sun 6 Oct 14:41	Sun 6 Oct 16:11	8682
Sun 7 Jan 22:05	Mon 8 Jan 01:05	8418	Sun 7 Apr 01:46	Sun 7 Apr 04:46	8491	Mon 15 Jul 00:19	Mon 15 Jul 03:19	4264	Sun 6 Oct 16:26	Sun 6 Oct 19:26	9385
Mon 8 Jan 03:06	Mon 8 Jan 06:06	9050	Sun 7 Apr 07:05	Sun 7 Apr 10:05	8602	Mon 15 Jul 18:06	Mon 15 Jul 19:36	4264	Sun 6 Oct 21:40	Sun 6 Oct 23:10	8499
Mon 8 Jan 09:35	Mon 8 Jan 12:35	9037	Sun 7 Apr 20:45	Sun 7 Apr 23:45	8598	Tue 16 Jul 00:24	Tue 16 Jul 03:24	8550	Mon 7 Oct 12:35	Mon 7 Oct 14:05	4302
Tue 9 Jan 01:35	Tue 9 Jan 04:35	8581	Mon 8 Apr 00:55	Mon 8 Apr 03:55	8568	Tue 16 Jul 09:25	Tue 16 Jul 10:55	4264	Mon 7 Oct 22:06	Tue 8 Oct 01:06	8662
Tue 9 Jan 09:55	Tue 9 Jan 12:55	9287	Mon 8 Apr 04:10	Mon 8 Apr 07:10	8600	Tue 16 Jul 11:36	Tue 16 Jul 14:36	8410	Tue 8 Oct 01:21	Tue 8 Oct 04:21	4295
Tue 9 Jan 16:25	Tue 9 Jan 19:25	8469	Mon 8 Apr 07:25	Mon 8 Apr 10:25	8648	Tue 16 Jul 15:25	Tue 16 Jul 18:25	4264	Tue 8 Oct 07:25	Tue 8 Oct 08:55	4303
Wed 10 Jan 11:55	Wed 10 Jan 14:55	9266	Mon 8 Apr 21:47	Tue 9 Apr 00:47	8457	Tue 16 Jul 18:40	Tue 16 Jul 21:40	8611	Tue 8 Oct 12:25	Tue 8 Oct 15:25	8482
Wed 10 Jan 16:10	Wed 10 Jan 19:10	7969	Tue 9 Apr 01:02	Tue 9 Apr 04:02	8581	Wed 17 Jul 12:35	Wed 17 Jul 14:05	8436	Tue 8 Oct 16:00	Tue 8 Oct 19:00	8486
Wed 10 Jan 18:36	Wed 10 Jan 21:36	8571	Tue 9 Apr 05:55	Tue 9 Apr 08:55	8536	Thu 18 Jul 02:26	Thu 18 Jul 05:26	8455	Tue 8 Oct 19:40	Tue 8 Oct 22:40	4292

Q1			Q2			Q3			Q4		
Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight
Thu 11 Jan 07:45	Thu 11 Jan 10:45	9275	Tue 9 Apr 13:19	Tue 9 Apr 16:19	8467	Thu 18 Jul 20:45	Thu 18 Jul 22:15	4264	Tue 8 Oct 23:20	Wed 9 Oct 02:20	8539
Thu 11 Jan 15:56	Thu 11 Jan 18:56	7910	Wed 10 Apr 01:48	Wed 10 Apr 04:48	8539	Thu 18 Jul 22:30	Fri 19 Jul 01:30	8423	Wed 9 Oct 05:45	Wed 9 Oct 08:45	8448
Fri 12 Jan 00:35	Fri 12 Jan 03:35	9304	Wed 10 Apr 05:03	Wed 10 Apr 08:03	8409	Fri 19 Jul 09:26	Fri 19 Jul 12:26	4264	Wed 9 Oct 14:38	Wed 9 Oct 16:08	8639
Fri 12 Jan 06:55	Fri 12 Jan 09:55	8572	Wed 10 Apr 08:25	Wed 10 Apr 11:25	8586	Fri 19 Jul 22:55	Sat 20 Jul 01:55	8384	Wed 9 Oct 16:28	Wed 9 Oct 19:28	9404
Fri 12 Jan 10:10	Fri 12 Jan 13:10	8620	Wed 10 Apr 14:25	Wed 10 Apr 17:25	8464	Sat 20 Jul 03:12	Sat 20 Jul 04:42	8424	Wed 9 Oct 19:52	Wed 9 Oct 21:22	8666
Fri 12 Jan 15:45	Fri 12 Jan 18:45	9315	Wed 10 Apr 23:55	Thu 11 Apr 02:55	8205	Sat 20 Jul 11:55	Sat 20 Jul 13:25	9186	Wed 9 Oct 23:07	Thu 10 Oct 02:07	4326
Sat 13 Jan 08:25	Sat 13 Jan 11:25	8545	Thu 11 Apr 21:00	Fri 12 Apr 00:00	9090	Sat 20 Jul 17:10	Sat 20 Jul 20:10	4264	Thu 10 Oct 02:57	Thu 10 Oct 05:57	9363
Sat 13 Jan 20:15	Sat 13 Jan 23:15	8578	Fri 12 Apr 00:26	Fri 12 Apr 03:26	8639	Sat 20 Jul 20:40	Sat 20 Jul 22:10	4235	Thu 10 Oct 12:35	Thu 10 Oct 14:05	4289
Sat 13 Jan 23:35	Sun 14 Jan 02:35	9335	Fri 12 Apr 04:56	Fri 12 Apr 07:56	8474	Sun 21 Jul 02:10	Sun 21 Jul 03:40	9111	Thu 10 Oct 17:35	Thu 10 Oct 20:35	8716
Sun 14 Jan 04:35	Sun 14 Jan 07:35	8484	Fri 12 Apr 11:55	Fri 12 Apr 14:55	8424	Sun 21 Jul 04:35	Sun 21 Jul 07:35	4264	Thu 10 Oct 22:02	Fri 11 Oct 01:02	8683
Sun 14 Jan 07:50	Sun 14 Jan 10:50	8557	Fri 12 Apr 19:15	Fri 12 Apr 22:15	8640	Sun 21 Jul 14:35	Sun 21 Jul 16:05	4221	Fri 11 Oct 01:22	Fri 11 Oct 02:52	4282
Sun 14 Jan 11:05	Sun 14 Jan 14:05	8641	Sat 13 Apr 10:05	Sat 13 Apr 13:05	8591	Sun 21 Jul 19:29	Sun 21 Jul 22:29	8586	Fri 11 Oct 03:31	Fri 11 Oct 05:01	8659
Mon 15 Jan 03:35	Mon 15 Jan 06:35	8635	Sat 13 Apr 23:30	Sun 14 Apr 02:30	9329	Sun 21 Jul 23:55	Mon 22 Jul 01:25	4264	Fri 11 Oct 09:55	Fri 11 Oct 12:55	9394
Mon 15 Jan 14:35	Mon 15 Jan 17:35	8633	Sun 14 Apr 06:45	Sun 14 Apr 09:45	8359	Mon 22 Jul 08:45	Mon 22 Jul 10:15	8630	Fri 11 Oct 13:20	Fri 11 Oct 16:20	4273
Mon 15 Jan 17:50	Mon 15 Jan 20:50	8558	Sun 14 Apr 22:55	Mon 15 Apr 01:55	8451	Mon 22 Jul 13:05	Mon 22 Jul 16:05	4264	Fri 11 Oct 17:37	Fri 11 Oct 19:07	4279
Mon 15 Jan 23:55	Tue 16 Jan 02:55	8734	Mon 15 Apr 04:15	Mon 15 Apr 07:15	8329	Mon 22 Jul 16:20	Mon 22 Jul 17:50	4289	Fri 11 Oct 19:22	Fri 11 Oct 22:22	8637
Tue 16 Jan 15:25	Tue 16 Jan 18:25	8573	Mon 15 Apr 12:35	Mon 15 Apr 15:35	8468	Mon 22 Jul 20:45	Mon 22 Jul 23:45	8457	Sat 12 Oct 05:32	Sat 12 Oct 08:32	9290
Tue 16 Jan 18:40	Tue 16 Jan 21:40	9135	Mon 15 Apr 20:45	Mon 15 Apr 23:45	8446	Tue 23 Jul 00:35	Tue 23 Jul 02:05	4273	Sat 12 Oct 09:35	Sat 12 Oct 12:35	4259
Tue 16 Jan 22:15	Wed 17 Jan 01:15	8496	Tue 16 Apr 00:00	Tue 16 Apr 03:00	8498	Tue 23 Jul 07:45	Tue 23 Jul 09:15	8454	Sat 12 Oct 13:57	Sat 12 Oct 16:57	8582
Wed 17 Jan 01:45	Wed 17 Jan 04:45	8426	Tue 16 Apr 03:35	Tue 16 Apr 06:35	8559	Tue 23 Jul 09:30	Tue 23 Jul 12:30	4264	Sat 12 Oct 17:12	Sat 12 Oct 20:12	8586
Wed 17 Jan 05:00	Wed 17 Jan 08:00	8507	Tue 16 Apr 07:25	Tue 16 Apr 10:25	8439	Tue 23 Jul 14:35	Tue 23 Jul 16:05	4264	Sat 12 Oct 20:27	Sat 12 Oct 21:57	8511
Wed 17 Jan 12:40	Wed 17 Jan 15:40	8442	Tue 16 Apr 15:25	Tue 16 Apr 18:25	8397	Tue 23 Jul 18:56	Tue 23 Jul 20:26	8442	Sun 13 Oct 06:55	Sun 13 Oct 09:55	8599
Wed 17 Jan 19:15	Wed 17 Jan 22:15	8471	Tue 16 Apr 19:15	Tue 16 Apr 22:15	8502	Tue 23 Jul 23:25	Wed 24 Jul 02:25	4311	Sun 13 Oct 10:10	Sun 13 Oct 13:10	8702
Thu 18 Jan 21:00	Fri 19 Jan 00:00	8496	Wed 17 Apr 03:46	Wed 17 Apr 06:46	8516	Wed 24 Jul 02:40	Wed 24 Jul 05:40	4264	Sun 13 Oct 14:07	Sun 13 Oct 17:07	4265
Fri 19 Jan 02:16	Fri 19 Jan 05:16	9313	Wed 17 Apr 07:45	Wed 17 Apr 10:45	8486	Wed 24 Jul 08:55	Wed 24 Jul 10:25	8423	Sun 13 Oct 19:59	Sun 13 Oct 21:29	8676
Fri 19 Jan 07:45	Fri 19 Jan 10:45	8491	Wed 17 Apr 19:15	Wed 17 Apr 22:15	8567	Wed 24 Jul 11:55	Wed 24 Jul 14:55	9102	Sun 13 Oct 21:44	Mon 14 Oct 00:44	8679
Fri 19 Jan 20:45	Fri 19 Jan 23:45	8360	Thu 18 Apr 06:05	Thu 18 Apr 09:05	8501	Wed 24 Jul 19:15	Wed 24 Jul 20:45	4296	Mon 14 Oct 01:06	Mon 14 Oct 02:36	8444
Sat 20 Jan 00:28	Sat 20 Jan 03:28	8514	Thu 18 Apr 21:05	Fri 19 Apr 00:05	8501	Thu 25 Jul 21:35	Fri 26 Jul 00:35	8442	Mon 14 Oct 09:26	Mon 14 Oct 12:26	4281
Sat 20 Jan 04:47	Sat 20 Jan 07:47	9097	Fri 19 Apr 02:36	Fri 19 Apr 05:36	8596	Fri 26 Jul 00:50	Fri 26 Jul 03:50	4284	Mon 14 Oct 14:35	Mon 14 Oct 16:05	8479
Sat 20 Jan 08:02	Sat 20 Jan 11:02	8437	Fri 19 Apr 08:55	Fri 19 Apr 11:55	9248	Fri 26 Jul 06:27	Fri 26 Jul 09:27	8483	Mon 14 Oct 20:45	Mon 14 Oct 23:45	4273
Sat 20 Jan 12:35	Sat 20 Jan 15:35	8374	Fri 19 Apr 15:51	Fri 19 Apr 18:51	8637	Fri 26 Jul 19:15	Fri 26 Jul 20:45	9233	Tue 15 Oct 04:06	Tue 15 Oct 05:36	8488
Sat 20 Jan 16:20	Sat 20 Jan 19:20	8530	Sat 20 Apr 04:45	Sat 20 Apr 07:45	8633	Sat 27 Jul 01:35	Sat 27 Jul 04:35	9218	Tue 15 Oct 11:25	Tue 15 Oct 14:25	4255
Sun 21 Jan 04:06	Sun 21 Jan 07:06	8628	Sat 20 Apr 10:05	Sat 20 Apr 13:05	8479	Sat 27 Jul 06:36	Sat 27 Jul 08:06	4262	Tue 15 Oct 13:40	Tue 15 Oct 15:10	8697
Sun 21 Jan 07:21	Sun 21 Jan 10:21	9252	Sun 21 Apr 01:25	Sun 21 Apr 04:25	9217	Sat 27 Jul 14:35	Sat 27 Jul 17:35	9185	Tue 15 Oct 17:47	Tue 15 Oct 19:17	4247
Sun 21 Jan 17:35	Sun 21 Jan 20:35	8516	Sun 21 Apr 04:40	Sun 21 Apr 07:40	8557	Sun 28 Jul 01:05	Sun 28 Jul 02:35	4307	Tue 15 Oct 19:32	Tue 15 Oct 22:32	8519
Sun 21 Jan 23:55	Mon 22 Jan 02:55	8537	Sun 21 Apr 07:55	Sun 21 Apr 10:55	8591	Sun 28 Jul 02:50	Sun 28 Jul 05:50	8447	Wed 16 Oct 11:11	Wed 16 Oct 12:41	4293
Mon 22 Jan 03:10	Mon 22 Jan 06:10	8521	Sun 21 Apr 20:15	Sun 21 Apr 23:15	8482	Sun 28 Jul 07:35	Sun 28 Jul 10:35	4269	Wed 16 Oct 23:40	Thu 17 Oct 02:40	4298
Mon 22 Jan 16:16	Mon 22 Jan 19:16	8524	Mon 22 Apr 11:55	Mon 22 Apr 14:55	8527	Sun 28 Jul 11:35	Sun 28 Jul 13:05	8435	Fri 18 Oct 09:55	Fri 18 Oct 12:55	8500
Mon 22 Jan 20:45	Mon 22 Jan 23:45	8445	Mon 22 Apr 15:25	Mon 22 Apr 18:25	8642	Sun 28 Jul 13:20	Sun 28 Jul 16:20	9148	Fri 18 Oct 14:05	Fri 18 Oct 15:35	4296
Tue 23 Jan 02:15	Tue 23 Jan 05:15	9175	Mon 22 Apr 20:45	Mon 22 Apr 23:45	8570	Sun 28 Jul 19:05	Sun 28 Jul 22:05	4318	Fri 18 Oct 19:46	Fri 18 Oct 22:46	8675
Tue 23 Jan 06:05	Tue 23 Jan 09:05	8471	Tue 23 Apr 02:47	Tue 23 Apr 05:47	8505	Sun 28 Jul 22:20	Sun 28 Jul 23:50	9350	Sat 19 Oct 18:15	Sat 19 Oct 19:45	8539

Q1			Q2			Q3			Q4		
Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight
Wed 24 Jan 04:15	Wed 24 Jan 07:15	8604	Tue 23 Apr 19:15	Tue 23 Apr 22:15	8479	Mon 29 Jul 03:35	Mon 29 Jul 06:35	8622	Sun 20 Oct 09:45	Sun 20 Oct 12:45	4277
Wed 24 Jan 07:30	Wed 24 Jan 10:30	8582	Tue 23 Apr 22:30	Wed 24 Apr 01:30	8436	Mon 29 Jul 07:05	Mon 29 Jul 08:35	4264	Sun 20 Oct 13:20	Sun 20 Oct 16:20	8642
Thu 25 Jan 15:56	Thu 25 Jan 18:56	8470	Wed 24 Apr 08:25	Wed 24 Apr 11:25	8389	Mon 29 Jul 08:50	Mon 29 Jul 11:50	8598	Sun 20 Oct 17:55	Sun 20 Oct 19:25	4264
Fri 26 Jan 11:55	Fri 26 Jan 14:55	8593	Wed 24 Apr 19:15	Wed 24 Apr 22:15	8531	Mon 29 Jul 15:55	Mon 29 Jul 18:55	4264	Mon 21 Oct 08:25	Mon 21 Oct 11:25	9216
Sat 27 Jan 08:25	Sat 27 Jan 11:25	8500	Wed 24 Apr 23:10	Thu 25 Apr 02:10	8606	Mon 29 Jul 23:05	Tue 30 Jul 02:05	8630	Mon 21 Oct 20:29	Mon 21 Oct 21:59	8510
Sun 28 Jan 22:55	Mon 29 Jan 01:55	8540	Thu 25 Apr 09:45	Thu 25 Apr 12:45	8478	Tue 30 Jul 03:42	Tue 30 Jul 06:42	8621	Mon 21 Oct 22:14	Tue 22 Oct 01:14	4248
Mon 29 Jan 04:15	Mon 29 Jan 07:15	8582	Thu 25 Apr 15:56	Thu 25 Apr 18:56	8442	Tue 30 Jul 14:20	Tue 30 Jul 17:20	8606	Tue 22 Oct 02:26	Tue 22 Oct 05:26	8508
Mon 29 Jan 19:05	Mon 29 Jan 22:05	8600	Thu 25 Apr 19:11	Thu 25 Apr 22:11	8555	Wed 31 Jul 04:35	Wed 31 Jul 07:35	8680	Tue 22 Oct 16:55	Tue 22 Oct 18:25	4274
Tue 30 Jan 00:55	Tue 30 Jan 03:55	8499	Fri 26 Apr 00:26	Fri 26 Apr 03:26	8340	Wed 31 Jul 16:25	Wed 31 Jul 19:25	8625	Wed 23 Oct 06:05	Wed 23 Oct 09:05	8643
Tue 30 Jan 04:10	Tue 30 Jan 07:10	8537	Fri 26 Apr 04:15	Fri 26 Apr 07:15	8371	Wed 31 Jul 19:40	Wed 31 Jul 22:40	9384	Wed 23 Oct 17:25	Wed 23 Oct 18:55	8713
Tue 30 Jan 07:25	Tue 30 Jan 10:25	8613	Fri 26 Apr 20:55	Fri 26 Apr 23:55	9138	Wed 31 Jul 22:55	Thu 1 Aug 01:55	8666	Thu 24 Oct 02:36	Thu 24 Oct 05:36	4259
Tue 30 Jan 12:27	Tue 30 Jan 13:57	4234	Sat 27 Apr 00:10	Sat 27 Apr 03:10	8495	Thu 1 Aug 12:35	Thu 1 Aug 15:35	8557	Thu 24 Oct 07:45	Thu 24 Oct 10:45	8528
Tue 30 Jan 23:55	Wed 31 Jan 02:55	8558	Sat 27 Apr 11:55	Sat 27 Apr 14:55	8409	Thu 1 Aug 16:06	Thu 1 Aug 19:06	9425	Thu 24 Oct 11:46	Thu 24 Oct 13:16	4288
Wed 31 Jan 04:35	Wed 31 Jan 06:05	4183	Sat 27 Apr 20:45	Sat 27 Apr 23:45	9051	Fri 2 Aug 00:47	Fri 2 Aug 02:17	8575	Thu 24 Oct 15:56	Thu 24 Oct 18:56	8517
Wed 31 Jan 07:06	Wed 31 Jan 10:06	8536	Sun 28 Apr 02:17	Sun 28 Apr 05:17	8361	Fri 2 Aug 15:05	Fri 2 Aug 18:05	9181	Thu 24 Oct 22:16	Fri 25 Oct 01:16	8538
Wed 31 Jan 20:50	Wed 31 Jan 22:20	4183	Sun 28 Apr 05:32	Sun 28 Apr 08:32	8435	Tue 6 Aug 18:00	Tue 6 Aug 21:00	4282	Fri 25 Oct 19:05	Fri 25 Oct 22:05	4256
Wed 31 Jan 23:55	Thu 1 Feb 02:55	8586	Sun 28 Apr 15:56	Sun 28 Apr 18:56	8308	Tue 6 Aug 21:15	Wed 7 Aug 00:15	8565	Fri 25 Oct 23:25	Sat 26 Oct 02:25	9412
Thu 1 Feb 09:05	Thu 1 Feb 12:05	8534	Mon 29 Apr 02:06	Mon 29 Apr 05:06	8388	Wed 7 Aug 03:05	Wed 7 Aug 06:05	9444	Sat 26 Oct 06:20	Sat 26 Oct 09:20	8550
Fri 2 Feb 01:16	Fri 2 Feb 02:46	4139	Mon 29 Apr 06:05	Mon 29 Apr 09:05	8455	Wed 7 Aug 07:55	Wed 7 Aug 10:55	8693	Sat 26 Oct 14:35	Sat 26 Oct 17:35	8566
Fri 2 Feb 07:15	Fri 2 Feb 10:15	8477	Mon 29 Apr 13:05	Mon 29 Apr 16:05	8597	Wed 7 Aug 11:10	Wed 7 Aug 14:10	8529	Sun 27 Oct 07:05	Sun 27 Oct 10:05	9147
Fri 2 Feb 17:35	Fri 2 Feb 19:05	4172	Tue 30 Apr 04:07	Tue 30 Apr 07:07	8563	Thu 8 Aug 18:20	Thu 8 Aug 21:20	8607	Sun 27 Oct 15:15	Sun 27 Oct 18:15	8514
Sat 3 Feb 02:05	Sat 3 Feb 05:05	8442	Tue 30 Apr 14:35	Tue 30 Apr 17:35	8384	Fri 9 Aug 02:55	Fri 9 Aug 05:55	8372	Sun 27 Oct 23:55	Mon 28 Oct 02:55	8655
Sat 3 Feb 17:45	Sat 3 Feb 20:45	8321	Tue 30 Apr 23:55	Wed 1 May 02:55	8527	Fri 9 Aug 16:25	Fri 9 Aug 19:25	8605	Mon 28 Oct 09:45	Mon 28 Oct 12:45	9278
Sun 4 Feb 00:35	Sun 4 Feb 02:05	4204	Wed 1 May 09:07	Wed 1 May 10:37	4310	Sat 10 Aug 03:35	Sat 10 Aug 06:35	8345	Mon 28 Oct 13:00	Mon 28 Oct 16:00	9245
Sun 4 Feb 09:15	Sun 4 Feb 12:15	8455	Wed 1 May 10:52	Wed 1 May 13:52	8468	Sat 10 Aug 07:35	Sat 10 Aug 10:35	8494	Mon 28 Oct 16:15	Mon 28 Oct 19:15	8538
Sun 4 Feb 14:05	Sun 4 Feb 15:35	4192	Wed 1 May 14:07	Wed 1 May 17:07	8585	Sat 10 Aug 22:35	Sun 11 Aug 01:35	8358	Mon 28 Oct 19:30	Mon 28 Oct 22:30	8635
Mon 5 Feb 00:55	Mon 5 Feb 02:25	4180	Thu 2 May 22:18	Thu 2 May 23:48	4306	Sun 11 Aug 06:55	Sun 11 Aug 09:55	8454	Tue 29 Oct 12:05	Tue 29 Oct 15:05	8652
Mon 5 Feb 04:45	Mon 5 Feb 07:45	8458	Fri 3 May 00:03	Fri 3 May 03:03	9357	Sun 11 Aug 12:15	Sun 11 Aug 15:15	8379	Tue 29 Oct 22:05	Wed 30 Oct 01:05	8515
Mon 5 Feb 17:10	Mon 5 Feb 20:10	8518	Fri 3 May 05:24	Fri 3 May 06:54	4317	Sun 11 Aug 19:59	Sun 11 Aug 22:59	8380	Wed 30 Oct 12:27	Wed 30 Oct 15:27	8682
Mon 5 Feb 20:45	Mon 5 Feb 23:45	8681	Fri 3 May 12:35	Fri 3 May 14:05	4264	Sun 11 Aug 23:55	Mon 12 Aug 02:55	8466	Wed 30 Oct 16:35	Wed 30 Oct 19:35	8655
Fri 9 Feb 16:00	Fri 9 Feb 19:00	9191	Fri 3 May 22:15	Sat 4 May 01:15	8350	Mon 12 Aug 06:05	Mon 12 Aug 09:05	8334	Wed 30 Oct 21:35	Thu 31 Oct 00:35	8497
Fri 9 Feb 20:55	Fri 9 Feb 23:55	8503	Sat 4 May 01:30	Sat 4 May 04:30	8653	Mon 12 Aug 10:30	Mon 12 Aug 13:30	9300	Thu 31 Oct 04:35	Thu 31 Oct 07:35	8607
Sat 10 Feb 00:55	Sat 10 Feb 03:55	8559	Sat 4 May 06:35	Sat 4 May 09:35	9322	Mon 12 Aug 20:55	Mon 12 Aug 23:55	8598	Thu 31 Oct 13:05	Thu 31 Oct 16:05	8563
Sat 10 Feb 08:46	Sat 10 Feb 11:46	8526	Sun 5 May 07:25	Sun 5 May 08:55	4267	Tue 13 Aug 03:15	Tue 13 Aug 06:15	8537	Sat 2 Nov 23:25	Sun 3 Nov 02:25	8682
Sat 10 Feb 13:05	Sat 10 Feb 14:35	4214	Sun 5 May 17:34	Sun 5 May 20:34	8562	Tue 13 Aug 09:34	Tue 13 Aug 12:34	8517	Sun 3 Nov 06:55	Sun 3 Nov 09:55	8455
Sat 10 Feb 15:25	Sat 10 Feb 18:25	8378	Sun 5 May 21:35	Mon 6 May 00:35	8676	Tue 13 Aug 14:06	Tue 13 Aug 15:36	8617	Sun 3 Nov 12:31	Sun 3 Nov 15:31	8400
Sat 10 Feb 21:05	Sat 10 Feb 22:35	4196	Mon 6 May 09:40	Mon 6 May 12:40	9364	Wed 14 Aug 04:35	Wed 14 Aug 07:35	8672	Sun 3 Nov 23:55	Mon 4 Nov 02:55	8474
Sun 11 Feb 05:25	Sun 11 Feb 06:55	4206	Mon 6 May 14:35	Mon 6 May 17:35	8449	Wed 14 Aug 11:55	Wed 14 Aug 14:55	4243	Mon 4 Nov 05:10	Mon 4 Nov 08:10	8449
Sun 11 Feb 07:10	Sun 11 Feb 10:10	8486	Mon 6 May 23:55	Tue 7 May 02:55	8603	Wed 14 Aug 15:26	Wed 14 Aug 16:56	9431	Mon 4 Nov 09:05	Mon 4 Nov 12:05	8406
Sun 11 Feb 12:35	Sun 11 Feb 15:35	8415	Tue 7 May 09:16	Tue 7 May 10:46	4231	Wed 14 Aug 21:45	Wed 14 Aug 23:15	8669	Mon 4 Nov 14:05	Mon 4 Nov 15:35	9269
Sun 11 Feb 18:55	Sun 11 Feb 20:25	4235	Tue 7 May 12:05	Tue 7 May 15:05	9100	Fri 16 Aug 11:47	Fri 16 Aug 13:17	4256	Mon 4 Nov 16:05	Mon 4 Nov 19:05	8476

Q1			Q2			Q3			Q4		
Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight
Mon 12 Feb 00:55	Mon 12 Feb 02:25	4192	Tue 7 May 15:20	Tue 7 May 18:20	8545	Sat 17 Aug 10:47	Sat 17 Aug 12:17	4255	Mon 4 Nov 19:20	Mon 4 Nov 22:20	8616
Mon 12 Feb 03:35	Mon 12 Feb 06:35	8434	Tue 7 May 19:15	Tue 7 May 22:15	8442	Sun 18 Aug 02:47	Sun 18 Aug 04:17	4277	Mon 4 Nov 23:00	Tue 5 Nov 00:30	4247
Mon 12 Feb 17:25	Mon 12 Feb 18:55	4227	Tue 7 May 23:06	Wed 8 May 00:36	4291	Sun 18 Aug 16:57	Sun 18 Aug 18:27	4279	Tue 5 Nov 00:55	Tue 5 Nov 03:55	9285
Tue 13 Feb 07:25	Tue 13 Feb 10:25	8571	Wed 8 May 07:26	Wed 8 May 10:26	9119	Mon 19 Aug 09:07	Mon 19 Aug 10:37	4285	Tue 5 Nov 06:10	Tue 5 Nov 09:10	8582
Tue 13 Feb 14:05	Tue 13 Feb 15:35	4206	Wed 8 May 11:16	Wed 8 May 14:16	8594	Tue 20 Aug 06:05	Tue 20 Aug 07:35	4278	Tue 5 Nov 10:57	Tue 5 Nov 13:57	4245
Tue 13 Feb 22:55	Wed 14 Feb 00:25	4190	Wed 8 May 16:25	Wed 8 May 17:55	4274	Tue 20 Aug 16:07	Tue 20 Aug 17:37	4262	Tue 5 Nov 14:37	Tue 5 Nov 16:07	8429
Wed 14 Feb 06:05	Wed 14 Feb 09:05	8516	Thu 9 May 00:06	Thu 9 May 03:06	8515	Tue 20 Aug 20:45	Tue 20 Aug 23:45	4277	Tue 5 Nov 16:56	Tue 5 Nov 18:26	8622
Wed 14 Feb 11:55	Wed 14 Feb 14:55	8526	Thu 9 May 03:21	Thu 9 May 06:21	8576	Wed 21 Aug 09:45	Wed 21 Aug 11:15	4281	Tue 5 Nov 18:55	Tue 5 Nov 21:55	8461
Thu 15 Feb 02:38	Thu 15 Feb 04:08	4172	Thu 9 May 06:36	Thu 9 May 09:36	8592	Wed 21 Aug 23:55	Thu 22 Aug 02:55	8526	Tue 5 Nov 22:10	Wed 6 Nov 01:10	4227
Thu 15 Feb 06:37	Thu 15 Feb 09:37	8610	Thu 9 May 11:18	Thu 9 May 12:48	4346	Thu 22 Aug 04:35	Thu 22 Aug 06:05	4270	Wed 6 Nov 08:07	Wed 6 Nov 11:07	4259
Thu 15 Feb 21:35	Fri 16 Feb 00:35	8524	Thu 9 May 17:25	Thu 9 May 20:25	8415	Thu 22 Aug 09:57	Thu 22 Aug 12:57	8549	Wed 6 Nov 11:57	Wed 6 Nov 14:57	9201
Fri 16 Feb 02:08	Fri 16 Feb 05:08	9145	Fri 10 May 00:47	Fri 10 May 02:17	4227	Thu 22 Aug 19:15	Thu 22 Aug 20:45	4286	Wed 6 Nov 17:25	Wed 6 Nov 18:55	8518
Fri 16 Feb 09:28	Fri 16 Feb 10:58	4214	Fri 10 May 02:32	Fri 10 May 05:32	8405	Fri 23 Aug 15:25	Fri 23 Aug 16:55	8457	Wed 6 Nov 23:40	Thu 7 Nov 02:40	9255
Fri 16 Feb 19:21	Fri 16 Feb 22:21	8523	Fri 10 May 07:26	Fri 10 May 10:26	9226	Fri 23 Aug 22:45	Sat 24 Aug 01:45	4290	Thu 7 Nov 21:00	Fri 8 Nov 00:00	8516
Sat 17 Feb 01:35	Sat 17 Feb 04:35	8400	Fri 10 May 16:56	Fri 10 May 19:56	8637	Sat 24 Aug 02:00	Sat 24 Aug 05:00	4293	Fri 8 Nov 00:15	Fri 8 Nov 01:45	4249
Sat 17 Feb 08:46	Sat 17 Feb 11:46	8598	Fri 10 May 21:35	Sat 11 May 00:35	9244	Sat 24 Aug 05:15	Sat 24 Aug 06:45	9453	Fri 8 Nov 02:41	Fri 8 Nov 05:41	9192
Sat 17 Feb 12:46	Sat 17 Feb 15:46	8556	Sat 11 May 02:37	Sat 11 May 05:37	8460	Sat 24 Aug 11:20	Sat 24 Aug 14:20	8659	Fri 8 Nov 06:14	Fri 8 Nov 07:44	8493
Sat 17 Feb 16:20	Sat 17 Feb 17:50	4226	Sat 11 May 12:26	Sat 11 May 15:26	9349	Sat 24 Aug 17:35	Sat 24 Aug 20:35	4294	Fri 8 Nov 15:56	Fri 8 Nov 18:56	4280
Sat 17 Feb 20:45	Sat 17 Feb 23:45	8396	Sun 12 May 15:48	Sun 12 May 18:48	8453	Sun 25 Aug 00:15	Sun 25 Aug 03:15	8702	Fri 8 Nov 22:47	Sat 9 Nov 01:47	8479
Sun 18 Feb 02:17	Sun 18 Feb 05:17	8571	Mon 13 May 03:35	Mon 13 May 06:35	8663	Sun 25 Aug 11:45	Sun 25 Aug 13:15	8531	Sat 9 Nov 07:35	Sat 9 Nov 10:35	4257
Sun 18 Feb 15:35	Sun 18 Feb 18:35	9240	Mon 13 May 11:55	Mon 13 May 14:55	9242	Sun 25 Aug 13:30	Sun 25 Aug 16:30	8480	Sat 9 Nov 10:50	Sat 9 Nov 13:50	9216
Sun 18 Feb 21:45	Sun 18 Feb 23:15	4259	Tue 14 May 05:05	Tue 14 May 08:05	8582	Sun 25 Aug 15:45	Sun 25 Aug 19:30	4245	Sat 9 Nov 20:45	Sat 9 Nov 22:15	8498
Mon 19 Feb 05:05	Mon 19 Feb 08:05	8595	Tue 14 May 23:55	Wed 15 May 02:55	8637	Sun 25 Aug 23:25	Mon 26 Aug 02:25	8618	Sun 10 Nov 02:05	Sun 10 Nov 03:35	8467
Mon 19 Feb 15:45	Mon 19 Feb 17:15	4183	Wed 15 May 04:40	Wed 15 May 07:40	9268	Mon 26 Aug 02:40	Mon 26 Aug 05:40	4239	Sun 10 Nov 11:06	Sun 10 Nov 14:06	8470
Mon 19 Feb 17:30	Mon 19 Feb 20:30	8584	Wed 15 May 09:06	Wed 15 May 12:06	8467	Mon 26 Aug 05:55	Mon 26 Aug 07:25	8617	Sun 10 Nov 15:56	Sun 10 Nov 17:26	4261
Tue 20 Feb 02:30	Tue 20 Feb 05:30	8567	Wed 15 May 12:44	Wed 15 May 15:44	8483	Mon 26 Aug 11:46	Mon 26 Aug 13:16	8626	Sun 10 Nov 20:00	Sun 10 Nov 23:00	4267
Tue 20 Feb 06:05	Tue 20 Feb 09:05	8473	Thu 16 May 02:15	Thu 16 May 05:15	9256	Mon 26 Aug 13:31	Mon 26 Aug 16:31	4294	Mon 11 Nov 12:36	Mon 11 Nov 15:36	8492
Tue 20 Feb 12:15	Tue 20 Feb 15:15	8562	Thu 16 May 08:25	Thu 16 May 11:25	8628	Tue 27 Aug 09:15	Tue 27 Aug 12:15	4290	Mon 11 Nov 15:51	Mon 11 Nov 18:51	4271
Tue 20 Feb 22:55	Wed 21 Feb 00:25	4212	Thu 16 May 22:15	Fri 17 May 01:15	8412	Tue 27 Aug 17:55	Tue 27 Aug 19:25	9355	Mon 11 Nov 20:19	Mon 11 Nov 21:49	9389
Wed 21 Feb 06:30	Wed 21 Feb 09:30	9121	Fri 17 May 14:06	Fri 17 May 17:06	8366	Tue 27 Aug 20:25	Tue 27 Aug 23:25	8654	Tue 12 Nov 02:26	Tue 12 Nov 05:26	8631
Wed 21 Feb 11:55	Wed 21 Feb 14:55	8398	Sat 18 May 02:06	Sat 18 May 05:06	8445	Wed 28 Aug 11:35	Wed 28 Aug 13:05	4289	Tue 12 Nov 11:26	Tue 12 Nov 12:56	9227
Wed 21 Feb 15:10	Wed 21 Feb 18:10	8358	Sat 18 May 05:21	Sat 18 May 08:21	8475	Wed 28 Aug 14:45	Wed 28 Aug 17:45	8550	Tue 12 Nov 14:45	Tue 12 Nov 17:45	4268
Wed 21 Feb 19:05	Wed 21 Feb 20:35	4208	Sat 18 May 12:35	Sat 18 May 15:35	9249	Wed 28 Aug 20:45	Wed 28 Aug 22:15	4290	Tue 12 Nov 18:00	Tue 12 Nov 21:00	8474
Wed 21 Feb 22:05	Thu 22 Feb 01:05	9105	Sat 18 May 19:05	Sat 18 May 22:05	8484	Wed 28 Aug 23:35	Thu 29 Aug 02:35	8518	Tue 12 Nov 21:15	Wed 13 Nov 00:15	4244
Thu 22 Feb 17:25	Thu 22 Feb 20:25	8247	Sun 19 May 01:25	Sun 19 May 04:25	8490	Thu 29 Aug 13:19	Thu 29 Aug 16:19	4291	Wed 13 Nov 00:51	Wed 13 Nov 02:21	8414
Thu 22 Feb 20:40	Thu 22 Feb 23:40	8526	Sun 19 May 09:16	Sun 19 May 12:16	8532	Thu 29 Aug 20:45	Thu 29 Aug 22:15	8548	Wed 13 Nov 09:05	Wed 13 Nov 13:05	9120
Fri 23 Feb 09:15	Fri 23 Feb 12:15	8315	Sun 19 May 12:46	Sun 19 May 15:46	8576	Fri 30 Aug 01:12	Fri 30 Aug 04:12	8632	Wed 13 Nov 14:23	Wed 13 Nov 17:23	9106
Fri 23 Feb 14:35	Fri 23 Feb 17:35	8523	Sun 19 May 20:15	Sun 19 May 23:15	9284	Fri 30 Aug 08:55	Fri 30 Aug 11:55	4244	Wed 13 Nov 19:15	Wed 13 Nov 20:45	4149
Fri 23 Feb 17:50	Fri 23 Feb 20:50	8526	Mon 20 May 08:55	Mon 20 May 11:55	8433	Fri 30 Aug 14:57	Fri 30 Aug 17:57	8632	Wed 13 Nov 21:36	Wed 13 Nov 23:06	8584
Fri 23 Feb 21:35	Sat 24 Feb 00:35	8313	Mon 20 May 15:25	Mon 20 May 18:25	8388	Fri 30 Aug 19:20	Fri 30 Aug 20:50	8620	Thu 14 Nov 01:55	Thu 14 Nov 04:55	9131
Sat 24 Feb 03:35	Sat 24 Feb 06:35	8428	Fri 24 May 15:56	Fri 24 May 18:56	9194	Sat 31 Aug 12:35	Sat 31 Aug 15:35	8626	Thu 14 Nov 08:55	Thu 14 Nov 11:55	4248

Q1			Q2			Q3			Q4		
Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight
Sat 24 Feb 07:05	Sat 24 Feb 10:05	8570	Fri 24 May 20:55	Fri 24 May 23:55	8621	Sat 31 Aug 20:15	Sat 31 Aug 23:15	4266	Thu 14 Nov 12:35	Thu 14 Nov 14:05	4267
Sat 24 Feb 10:20	Sat 24 Feb 13:20	8453	Sat 25 May 08:03	Sat 25 May 11:03	8623	Sun 1 Sep 12:35	Sun 1 Sep 15:35	8682	Thu 14 Nov 14:35	Thu 14 Nov 17:35	9344
Sat 24 Feb 15:56	Sat 24 Feb 18:56	8631	Sun 26 May 07:35	Sun 26 May 10:35	8680	Sun 1 Sep 23:55	Mon 2 Sep 01:25	8596	Thu 14 Nov 22:55	Fri 15 Nov 00:25	8501
Sat 24 Feb 21:35	Sun 25 Feb 00:35	8514	Sun 26 May 12:07	Sun 26 May 15:07	8565	Mon 2 Sep 05:34	Mon 2 Sep 07:04	8691	Fri 15 Nov 00:40	Fri 15 Nov 03:40	4243
Sun 25 Feb 05:36	Sun 25 Feb 08:36	8567	Sun 26 May 21:35	Mon 27 May 00:35	8699	Mon 2 Sep 11:47	Mon 2 Sep 14:47	4260	Fri 15 Nov 03:55	Fri 15 Nov 06:55	8368
Sun 25 Feb 10:16	Sun 25 Feb 13:16	8551	Mon 27 May 06:05	Mon 27 May 09:05	8639	Mon 2 Sep 15:02	Mon 2 Sep 16:32	4264	Fri 15 Nov 09:27	Fri 15 Nov 12:27	4246
Sun 25 Feb 15:56	Sun 25 Feb 18:56	8278	Mon 27 May 12:35	Mon 27 May 15:35	8554	Mon 2 Sep 17:19	Mon 2 Sep 20:19	8622	Fri 15 Nov 14:06	Fri 15 Nov 15:36	8391
Sun 25 Feb 20:15	Sun 25 Feb 23:15	8564	Tue 28 May 00:55	Tue 28 May 03:55	9374	Mon 2 Sep 22:55	Tue 3 Sep 01:55	4309	Sat 16 Nov 11:45	Sat 16 Nov 14:45	8452
Sun 25 Feb 23:55	Mon 26 Feb 02:55	8704	Tue 28 May 07:45	Tue 28 May 10:45	8621	Tue 3 Sep 03:06	Tue 3 Sep 06:06	9412	Sat 16 Nov 23:25	Sun 17 Nov 00:55	8389
Mon 26 Feb 14:35	Mon 26 Feb 17:35	8409	Tue 28 May 12:44	Tue 28 May 15:44	8670	Tue 3 Sep 06:21	Tue 3 Sep 09:21	8492	Sun 17 Nov 01:30	Sun 17 Nov 04:30	4266
Mon 26 Feb 19:15	Mon 26 Feb 22:15	8505	Tue 28 May 20:04	Tue 28 May 23:04	8488	Tue 3 Sep 10:19	Tue 3 Sep 11:49	8655	Sun 17 Nov 11:36	Sun 17 Nov 13:06	8348
Tue 27 Feb 07:15	Tue 27 Feb 10:15	8287	Wed 29 May 02:06	Wed 29 May 05:06	8648	Tue 3 Sep 13:17	Tue 3 Sep 16:17	8582	Sun 17 Nov 13:21	Sun 17 Nov 16:21	4249
Tue 27 Feb 10:30	Tue 27 Feb 13:30	8510	Wed 29 May 06:15	Wed 29 May 09:15	8501	Tue 3 Sep 20:55	Tue 3 Sep 23:55	4341	Sun 17 Nov 17:11	Sun 17 Nov 20:11	9321
Wed 28 Feb 00:55	Wed 28 Feb 03:55	8505	Thu 30 May 15:36	Thu 30 May 17:06	4252	Wed 4 Sep 00:35	Wed 4 Sep 03:35	8663	Sun 17 Nov 20:45	Sun 17 Nov 22:15	4247
Wed 28 Feb 14:35	Wed 28 Feb 17:35	8605	Thu 30 May 21:46	Thu 30 May 23:16	4183	Wed 4 Sep 05:34	Wed 4 Sep 07:04	8671	Mon 18 Nov 00:55	Mon 18 Nov 03:55	8520
Wed 28 Feb 20:25	Wed 28 Feb 23:25	8544	Fri 31 May 00:06	Fri 31 May 03:06	9369	Wed 4 Sep 17:25	Wed 4 Sep 18:55	8690	Mon 18 Nov 04:10	Mon 18 Nov 05:40	9111
Thu 29 Feb 22:55	Fri 1 Mar 01:55	8705	Fri 31 May 04:15	Fri 31 May 07:15	8602	Wed 4 Sep 20:55	Wed 4 Sep 23:55	4301	Mon 18 Nov 11:45	Mon 18 Nov 13:15	4263
Fri 1 Mar 09:35	Fri 1 Mar 12:35	8687	Fri 31 May 13:16	Fri 31 May 14:46	4190	Thu 5 Sep 21:35	Thu 5 Sep 23:05	4310	Fri 22 Nov 08:05	Fri 22 Nov 11:05	8365
Fri 1 Mar 19:15	Fri 1 Mar 22:15	8682	Fri 31 May 15:56	Fri 31 May 18:56	8443	Thu 5 Sep 23:30	Fri 6 Sep 02:30	9412	Fri 22 Nov 15:56	Fri 22 Nov 18:56	4251
Sat 2 Mar 13:05	Sat 2 Mar 16:05	8587	Fri 31 May 22:16	Sat 1 Jun 01:16	8460	Fri 6 Sep 06:45	Fri 6 Sep 09:45	4283	Fri 22 Nov 20:45	Fri 22 Nov 23:45	4262
Sat 2 Mar 18:35	Sat 2 Mar 21:35	8617	Sat 1 Jun 02:06	Sat 1 Jun 03:36	4276	Fri 6 Sep 12:15	Fri 6 Sep 15:15	8671	Sat 23 Nov 00:00	Sat 23 Nov 03:00	8548
Sun 3 Mar 09:45	Sun 3 Mar 12:45	8509	Sat 1 Jun 04:05	Sat 1 Jun 07:05	8539	Fri 6 Sep 16:01	Fri 6 Sep 17:31	8679	Sat 23 Nov 03:47	Sat 23 Nov 06:47	8504
Sun 3 Mar 13:05	Sun 3 Mar 16:05	8632	Sat 1 Jun 07:20	Sat 1 Jun 10:20	8606	Sat 7 Sep 01:40	Sat 7 Sep 04:40	8628	Sat 23 Nov 09:25	Sat 23 Nov 12:25	8557
Sun 3 Mar 23:05	Mon 4 Mar 02:05	8737	Sat 1 Jun 12:35	Sat 1 Jun 15:35	8495	Sat 7 Sep 12:15	Sat 7 Sep 15:15	4293	Sat 23 Nov 13:15	Sat 23 Nov 14:45	8482
Mon 4 Mar 06:56	Mon 4 Mar 09:56	8738	Sat 1 Jun 15:56	Sat 1 Jun 17:26	4262	Sat 7 Sep 19:25	Sat 7 Sep 20:55	9412	Sat 23 Nov 15:00	Sat 23 Nov 18:00	8462
Mon 4 Mar 12:35	Mon 4 Mar 15:35	8687	Sat 1 Jun 19:25	Sat 1 Jun 22:25	9328	Sun 8 Sep 05:11	Sun 8 Sep 06:41	8516	Sat 23 Nov 23:25	Sun 24 Nov 02:25	8453
Tue 5 Mar 05:45	Tue 5 Mar 08:45	8553	Sun 2 Jun 01:25	Sun 2 Jun 02:55	4286	Sun 8 Sep 07:35	Sun 8 Sep 10:35	4207	Sun 24 Nov 02:40	Sun 24 Nov 05:40	4243
Tue 5 Mar 09:25	Tue 5 Mar 12:25	8491	Mon 3 Jun 21:35	Tue 4 Jun 00:35	0	Sun 8 Sep 18:56	Sun 8 Sep 20:26	4222	Sun 24 Nov 09:46	Sun 24 Nov 12:46	8511
Tue 5 Mar 17:36	Tue 5 Mar 20:36	8335	Tue 4 Jun 03:15	Tue 4 Jun 06:15	0	Sun 8 Sep 20:41	Sun 8 Sep 23:41	8518	Sun 24 Nov 13:01	Sun 24 Nov 16:01	8406
Wed 6 Mar 06:05	Wed 6 Mar 09:05	8493	Tue 4 Jun 10:19	Tue 4 Jun 11:49	9241	Mon 9 Sep 01:35	Mon 9 Sep 04:35	4332	Mon 25 Nov 03:35	Mon 25 Nov 06:35	8718
Wed 6 Mar 12:35	Wed 6 Mar 15:35	8462	Tue 4 Jun 15:52	Tue 4 Jun 18:52	8576	Mon 9 Sep 06:47	Mon 9 Sep 09:47	8448	Mon 25 Nov 11:05	Mon 25 Nov 14:05	8588
Thu 7 Mar 02:11	Thu 7 Mar 05:11	8592	Tue 4 Jun 23:31	Wed 5 Jun 02:31	4268	Mon 9 Sep 11:46	Mon 9 Sep 13:16	8443	Mon 25 Nov 19:15	Mon 25 Nov 22:15	9230
Thu 7 Mar 04:26	Thu 7 Mar 07:26	8555	Wed 5 Jun 04:45	Wed 5 Jun 07:45	8437	Mon 9 Sep 15:52	Mon 9 Sep 18:52	8671	Tue 26 Nov 13:15	Tue 26 Nov 16:15	8520
Thu 7 Mar 17:45	Thu 7 Mar 20:45	8467	Wed 5 Jun 19:35	Wed 5 Jun 22:35	8470	Mon 9 Sep 19:40	Mon 9 Sep 22:40	4288	Wed 27 Nov 07:15	Wed 27 Nov 10:15	8427
Thu 7 Mar 21:05	Fri 8 Mar 00:05	8564	Thu 6 Jun 00:40	Thu 6 Jun 03:40	9094	Mon 9 Sep 23:09	Tue 10 Sep 02:09	8669	Wed 27 Nov 14:04	Wed 27 Nov 17:04	8441
Fri 8 Mar 06:56	Fri 8 Mar 09:56	9261	Thu 6 Jun 03:55	Thu 6 Jun 06:55	8498	Tue 10 Sep 02:25	Tue 10 Sep 03:55	9423	Thu 28 Nov 22:55	Fri 29 Nov 01:55	9186
Fri 8 Mar 15:56	Fri 8 Mar 18:56	8463	Thu 6 Jun 07:25	Thu 6 Jun 08:55	9288	Tue 10 Sep 04:35	Tue 10 Sep 07:35	8692	Fri 29 Nov 08:11	Fri 29 Nov 11:11	9185
Fri 8 Mar 19:15	Fri 8 Mar 22:15	8569	Thu 6 Jun 11:16	Thu 6 Jun 14:16	8613	Tue 10 Sep 08:46	Tue 10 Sep 10:16	4276	Sat 30 Nov 18:10	Sat 30 Nov 21:10	8416
Fri 8 Mar 22:30	Sat 9 Mar 01:30	8343	Thu 6 Jun 14:35	Thu 6 Jun 17:35	4228	Tue 10 Sep 12:05	Tue 10 Sep 15:05	8635	Sat 30 Nov 21:35	Sun 1 Dec 00:35	8318
Sat 9 Mar 07:45	Sat 9 Mar 10:45	8283	Thu 6 Jun 17:56	Thu 6 Jun 20:56	8662	Tue 10 Sep 15:20	Tue 10 Sep 18:20	4281	Sun 1 Dec 15:56	Sun 1 Dec 17:26	8341
Sat 9 Mar 11:00	Sat 9 Mar 14:00	8393	Fri 7 Jun 01:46	Fri 7 Jun 04:46	8635	Wed 11 Sep 04:35	Wed 11 Sep 06:05	9365	Sun 1 Dec 18:25	Sun 1 Dec 21:25	8501

Q1			Q2			Q3			Q4		
Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight
Sat 9 Mar 22:35	Sun 10 Mar 01:35	8543	Fri 7 Jun 07:15	Fri 7 Jun 10:15	8500	Wed 11 Sep 06:25	Wed 11 Sep 09:25	8659	Mon 2 Dec 08:41	Mon 2 Dec 11:41	9191
Sun 10 Mar 10:24	Sun 10 Mar 13:24	8437	Fri 7 Jun 11:46	Fri 7 Jun 13:16	8606	Wed 11 Sep 15:15	Wed 11 Sep 16:45	4284	Mon 2 Dec 19:15	Mon 2 Dec 20:45	4264
Sun 10 Mar 14:35	Sun 10 Mar 17:35	8427	Fri 7 Jun 14:05	Fri 7 Jun 17:05	9363	Wed 11 Sep 21:05	Thu 12 Sep 00:05	9212	Mon 2 Dec 21:00	Tue 3 Dec 00:00	8303
Sun 10 Mar 18:25	Sun 10 Mar 21:25	8475	Sat 8 Jun 00:25	Sat 8 Jun 03:25	4264	Thu 12 Sep 00:20	Thu 12 Sep 03:20	4308	Tue 3 Dec 07:36	Tue 3 Dec 09:06	8515
Sun 10 Mar 23:00	Mon 11 Mar 02:00	9258	Sat 8 Jun 03:46	Sat 8 Jun 06:46	8523	Thu 12 Sep 04:35	Thu 12 Sep 07:35	8581	Tue 3 Dec 09:21	Tue 3 Dec 12:21	4249
Mon 11 Mar 11:45	Mon 11 Mar 14:45	8311	Sat 8 Jun 08:25	Sat 8 Jun 11:25	8413	Thu 12 Sep 07:50	Thu 12 Sep 09:20	8608	Tue 3 Dec 16:05	Tue 3 Dec 19:05	8492
Mon 11 Mar 19:05	Mon 11 Mar 22:05	8260	Sat 8 Jun 12:40	Sat 8 Jun 15:40	8525	Thu 12 Sep 09:45	Thu 12 Sep 12:45	8652	Tue 3 Dec 23:46	Wed 4 Dec 01:16	4239
Tue 12 Mar 02:10	Tue 12 Mar 05:10	8030	Sat 8 Jun 16:20	Sat 8 Jun 19:20	8436	Thu 12 Sep 20:25	Thu 12 Sep 21:55	4271	Wed 4 Dec 04:57	Wed 4 Dec 07:57	8492
Tue 12 Mar 12:05	Tue 12 Mar 15:05	8345	Sat 8 Jun 22:35	Sun 9 Jun 01:35	8466	Fri 13 Sep 09:15	Fri 13 Sep 12:15	8699	Wed 4 Dec 23:40	Thu 5 Dec 02:40	8475
Tue 12 Mar 15:20	Tue 12 Mar 18:20	8541	Sun 9 Jun 05:35	Sun 9 Jun 08:35	8549	Fri 13 Sep 16:20	Fri 13 Sep 19:20	4258	Fri 6 Dec 01:12	Fri 6 Dec 02:42	4256
Tue 12 Mar 19:15	Tue 12 Mar 22:15	8658	Sun 9 Jun 12:05	Sun 9 Jun 15:05	8576	Fri 13 Sep 22:05	Fri 13 Sep 23:35	8579	Fri 6 Dec 02:57	Fri 6 Dec 04:27	8244
Wed 13 Mar 09:45	Wed 13 Mar 12:45	9331	Sun 9 Jun 17:25	Sun 9 Jun 20:25	8393	Sat 14 Sep 02:38	Sat 14 Sep 05:38	8643	Fri 6 Dec 16:07	Fri 6 Dec 19:07	8511
Wed 13 Mar 19:15	Wed 13 Mar 22:15	9284	Sun 9 Jun 20:40	Sun 9 Jun 23:40	8556	Sat 14 Sep 08:36	Sat 14 Sep 11:36	4264	Sat 7 Dec 03:35	Sat 7 Dec 05:05	4267
Wed 13 Mar 23:26	Thu 14 Mar 02:26	9308	Mon 10 Jun 04:15	Mon 10 Jun 07:15	8553	Sat 14 Sep 14:35	Sat 14 Sep 16:05	8670	Sat 7 Dec 06:35	Sat 7 Dec 09:35	4275
Thu 14 Mar 06:21	Thu 14 Mar 10:51	8518	Mon 10 Jun 08:55	Mon 10 Jun 11:55	8472	Sat 14 Sep 23:27	Sun 15 Sep 00:57	8657	Sat 7 Dec 17:35	Sat 7 Dec 20:35	8552
Thu 14 Mar 11:36	Thu 14 Mar 14:36	8010	Mon 10 Jun 21:35	Tue 11 Jun 00:35	8545	Sun 15 Sep 01:25	Sun 15 Sep 04:25	4278	Sun 8 Dec 02:06	Sun 8 Dec 05:06	4139
Thu 14 Mar 14:51	Thu 14 Mar 17:51	8566	Tue 11 Jun 03:05	Tue 11 Jun 06:05	8525	Sun 15 Sep 07:55	Sun 15 Sep 10:55	4303	Sun 8 Dec 06:23	Sun 8 Dec 07:53	8313
Fri 15 Mar 02:57	Fri 15 Mar 05:57	8562	Tue 11 Jun 08:35	Tue 11 Jun 11:35	9252	Sun 15 Sep 11:45	Sun 15 Sep 13:15	8565	Sun 8 Dec 09:17	Sun 8 Dec 10:47	8519
Fri 15 Mar 06:12	Fri 15 Mar 09:12	7805	Tue 11 Jun 16:25	Tue 11 Jun 19:25	8576	Sun 15 Sep 13:30	Sun 15 Sep 16:30	8624	Sun 8 Dec 20:15	Sun 8 Dec 23:15	8483
Fri 15 Mar 10:47	Fri 15 Mar 13:47	8623	Wed 12 Jun 04:35	Wed 12 Jun 07:35	8560	Sun 15 Sep 21:06	Sun 15 Sep 22:36	4273	Mon 9 Dec 00:55	Mon 9 Dec 02:25	4251
Fri 15 Mar 15:06	Fri 15 Mar 18:06	8529	Wed 12 Jun 08:55	Wed 12 Jun 10:25	8441	Sun 15 Sep 22:55	Mon 16 Sep 01:55	8646	Mon 9 Dec 08:55	Mon 9 Dec 10:25	4266
Fri 15 Mar 20:25	Fri 15 Mar 23:25	8590	Wed 12 Jun 10:40	Wed 12 Jun 13:40	9269	Mon 16 Sep 07:27	Mon 16 Sep 08:57	4285	Mon 9 Dec 10:40	Mon 9 Dec 13:40	8489
Sat 16 Mar 04:45	Sat 16 Mar 07:45	8436	Wed 12 Jun 15:27	Wed 12 Jun 18:27	4286	Mon 16 Sep 12:35	Mon 16 Sep 15:35	8639	Mon 9 Dec 19:05	Mon 9 Dec 22:05	4233
Sat 16 Mar 15:56	Sat 16 Mar 18:56	8611	Wed 12 Jun 19:05	Wed 12 Jun 20:35	8572	Mon 16 Sep 19:25	Mon 16 Sep 22:25	4290	Tue 10 Dec 05:55	Tue 10 Dec 07:25	4240
Sat 16 Mar 20:15	Sat 16 Mar 23:15	9293	Fri 14 Jun 03:36	Fri 14 Jun 05:06	8536	Tue 17 Sep 02:06	Tue 17 Sep 03:36	8686	Tue 10 Dec 07:40	Tue 10 Dec 10:40	8546
Sat 16 Mar 23:30	Sun 17 Mar 02:30	8516	Fri 14 Jun 19:15	Fri 14 Jun 20:45	4264	Tue 17 Sep 14:35	Tue 17 Sep 16:05	8700	Tue 10 Dec 12:05	Tue 10 Dec 15:05	8525
Sun 17 Mar 05:25	Sun 17 Mar 08:25	8667	Sat 15 Jun 01:55	Sat 15 Jun 04:55	4264	Tue 17 Sep 16:25	Tue 17 Sep 19:25	4283	Tue 10 Dec 15:20	Tue 10 Dec 18:20	4274
Sun 17 Mar 14:05	Sun 17 Mar 17:05	9350	Sat 15 Jun 14:35	Sat 15 Jun 16:05	4264	Tue 17 Sep 19:40	Tue 17 Sep 22:40	4280	Tue 10 Dec 23:21	Wed 11 Dec 02:21	8485
Sun 17 Mar 21:35	Mon 18 Mar 00:35	8672	Sat 15 Jun 17:35	Sat 15 Jun 20:35	8463	Tue 17 Sep 23:25	Wed 18 Sep 02:25	8634	Wed 11 Dec 09:45	Wed 11 Dec 11:15	8491
Mon 18 Mar 02:05	Mon 18 Mar 05:05	7852	Sun 16 Jun 08:25	Sun 16 Jun 11:25	4264	Wed 18 Sep 03:00	Wed 18 Sep 06:00	8694	Wed 11 Dec 12:55	Wed 11 Dec 14:25	8453
Mon 18 Mar 11:55	Mon 18 Mar 14:55	8452	Sun 16 Jun 15:56	Sun 16 Jun 17:26	9133	Wed 18 Sep 07:15	Wed 18 Sep 10:15	8680	Thu 12 Dec 01:55	Thu 12 Dec 04:55	8472
Mon 18 Mar 19:05	Mon 18 Mar 22:05	8565	Sun 16 Jun 20:15	Sun 16 Jun 23:15	9153	Wed 18 Sep 14:42	Wed 18 Sep 17:42	8723	Thu 12 Dec 16:05	Thu 12 Dec 19:05	4268
Tue 19 Mar 00:45	Tue 19 Mar 03:45	8585	Mon 17 Jun 13:05	Mon 17 Jun 14:35	4264	Wed 18 Sep 21:05	Thu 19 Sep 00:05	9424	Fri 13 Dec 00:06	Fri 13 Dec 01:36	4281
Tue 19 Mar 05:00	Tue 19 Mar 08:00	7904	Mon 17 Jun 21:35	Mon 17 Jun 23:05	8630	Thu 19 Sep 00:41	Thu 19 Sep 02:11	8665	Fri 13 Dec 01:51	Fri 13 Dec 04:51	8474
Tue 19 Mar 12:05	Tue 19 Mar 15:05	8509	Mon 17 Jun 23:20	Tue 18 Jun 02:20	4264	Thu 19 Sep 02:41	Thu 19 Sep 05:41	8703	Fri 13 Dec 14:06	Fri 13 Dec 15:36	8705
Tue 19 Mar 16:25	Tue 19 Mar 19:25	8557	Tue 18 Jun 07:15	Tue 18 Jun 10:15	4264	Thu 19 Sep 05:56	Thu 19 Sep 08:56	4295	Fri 13 Dec 18:45	Fri 13 Dec 21:45	4285
Wed 20 Mar 06:05	Wed 20 Mar 09:05	8541	Tue 18 Jun 11:25	Tue 18 Jun 12:55	8510	Thu 19 Sep 09:12	Thu 19 Sep 12:12	9362	Sat 14 Dec 02:10	Sat 14 Dec 05:10	8487
Wed 20 Mar 15:15	Wed 20 Mar 16:45	4253	Tue 18 Jun 20:45	Tue 18 Jun 22:15	9230	Thu 19 Sep 12:27	Thu 19 Sep 15:27	8547	Sat 14 Dec 08:25	Sat 14 Dec 11:25	4277
Wed 20 Mar 21:35	Thu 21 Mar 00:35	7907	Tue 18 Jun 22:30	Wed 19 Jun 01:30	4264	Thu 19 Sep 17:25	Thu 19 Sep 20:25	8700	Sat 14 Dec 12:46	Sat 14 Dec 14:16	8404
Thu 21 Mar 21:00	Fri 22 Mar 00:00	7713	Wed 19 Jun 09:42	Wed 19 Jun 12:42	4219	Thu 19 Sep 21:35	Thu 19 Sep 23:05	8664	Sat 14 Dec 14:31	Sat 14 Dec 17:31	8472
Fri 22 Mar 09:35	Fri 22 Mar 12:35	7731	Wed 19 Jun 14:16	Wed 19 Jun 15:46	8560	Thu 19 Sep 23:31	Fri 20 Sep 02:31	9383	Sun 15 Dec 00:35	Sun 15 Dec 02:05	8445

Q1			Q2			Q3			Q4		
Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight
Fri 22 Mar 14:35	Fri 22 Mar 17:35	8380	Wed 19 Jun 16:01	Wed 19 Jun 19:01	8459	Fri 20 Sep 03:05	Fri 20 Sep 04:35	4291	Sun 15 Dec 03:35	Sun 15 Dec 06:35	4271
Sat 23 Mar 00:25	Sat 23 Mar 01:55	4231	Wed 19 Jun 19:41	Wed 19 Jun 21:11	4296	Fri 20 Sep 06:27	Fri 20 Sep 09:27	8550	Sun 15 Dec 09:45	Sun 15 Dec 12:45	8273
Sat 23 Mar 02:10	Sat 23 Mar 05:10	8526	Thu 20 Jun 16:57	Thu 20 Jun 19:57	8580	Fri 20 Sep 14:35	Fri 20 Sep 16:05	4290	Sun 15 Dec 17:55	Sun 15 Dec 19:25	4198
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Sat 23 Mar 12:35	Sat 23 Mar 15:35	8438	Fri 21 Jun 06:15	Fri 21 Jun 07:45	9267	Sat 21 Sep 07:15	Sat 21 Sep 08:45	4274	Mon 16 Dec 07:25	Mon 16 Dec 08:55	8406
Sat 23 Mar 15:56	Sat 23 Mar 18:56	8330	Fri 21 Jun 08:00	Fri 21 Jun 11:00	4262	Sun 22 Sep 12:15	Sun 22 Sep 13:45	8318	Mon 16 Dec 17:25	Mon 16 Dec 18:55	4254
Sat 23 Mar 23:36	Sun 24 Mar 01:06	4238	Fri 21 Jun 16:25	Fri 21 Jun 19:25	4263	Mon 23 Sep 06:05	Mon 23 Sep 07:35	4248	Mon 16 Dec 21:35	Mon 16 Dec 23:05	8402
Sun 24 Mar 06:37	Sun 24 Mar 08:07	4217	Fri 21 Jun 20:45	Fri 21 Jun 22:15	9310	Mon 23 Sep 13:17	Mon 23 Sep 14:47	4283	Tue 17 Dec 04:05	Tue 17 Dec 07:05	4227
Sun 24 Mar 09:26	Sun 24 Mar 12:26	8464	Fri 21 Jun 22:30	Sat 22 Jun 00:00	8516	Mon 23 Sep 22:55	Tue 24 Sep 00:25	4285	Tue 17 Dec 10:19	Tue 17 Dec 11:49	4267
Sun 24 Mar 12:56	Sun 24 Mar 15:56	8423	Sat 22 Jun 02:27	Sat 22 Jun 03:57	4264	Tue 24 Sep 04:47	Tue 24 Sep 07:47	4272	Tue 17 Dec 16:05	Tue 17 Dec 17:35	4259
Sun 24 Mar 17:25	Sun 24 Mar 20:25	8663	Sat 22 Jun 04:37	Sat 22 Jun 07:37	4282	Tue 24 Sep 09:17	Tue 24 Sep 12:17	4282	Tue 17 Dec 23:55	Wed 18 Dec 02:55	8385
Mon 25 Mar 00:35	Mon 25 Mar 02:05	4169	Sat 22 Jun 07:52	Sat 22 Jun 10:52	4259	Tue 24 Sep 12:35	Tue 24 Sep 14:05	9366	Wed 18 Dec 03:10	Wed 18 Dec 06:10	4254
Mon 25 Mar 04:45	Mon 25 Mar 07:45	8395	Sat 22 Jun 15:00	Sat 22 Jun 16:30	8429	Tue 24 Sep 14:20	Tue 24 Sep 17:20	8619	Wed 18 Dec 08:35	Wed 18 Dec 10:05	4251
Mon 25 Mar 15:36	Mon 25 Mar 17:06	4193	Sat 22 Jun 20:45	Sat 22 Jun 23:45	8388	Tue 24 Sep 17:57	Tue 24 Sep 19:27	4316	Wed 18 Dec 12:35	Wed 18 Dec 15:35	8263
Mon 25 Mar 19:15	Mon 25 Mar 22:15	8516	Sun 23 Jun 00:15	Sun 23 Jun 03:15	4276	Wed 25 Sep 02:16	Wed 25 Sep 05:16	8554	Wed 18 Dec 22:55	Thu 19 Dec 01:55	8480
Tue 26 Mar 06:05	Tue 26 Mar 09:05	8589	Sun 23 Jun 09:37	Sun 23 Jun 12:37	8435	Wed 25 Sep 05:31	Wed 25 Sep 08:31	4284	Thu 19 Dec 21:00	Thu 19 Dec 22:30	4286
Tue 26 Mar 14:45	Tue 26 Mar 17:45	8503	Sun 23 Jun 13:15	Sun 23 Jun 14:45	8544	Wed 25 Sep 08:46	Wed 25 Sep 11:46	8616	Fri 20 Dec 01:35	Fri 20 Dec 04:35	9218
Tue 26 Mar 19:52	Tue 26 Mar 21:22	4206	Sun 23 Jun 15:37	Sun 23 Jun 18:37	8439	Wed 25 Sep 21:47	Thu 26 Sep 00:47	8528	Fri 20 Dec 05:46	Fri 20 Dec 08:46	8377
Tue 26 Mar 23:25	Wed 27 Mar 02:25	8460	Sun 23 Jun 20:55	Sun 23 Jun 22:25	4297	Fri 27 Sep 00:56	Fri 27 Sep 02:26	8623	Fri 20 Dec 18:49	Fri 20 Dec 21:49	4293
Wed 27 Mar 08:46	Wed 27 Mar 11:46	8568	Sun 23 Jun 22:40	Mon 24 Jun 01:40	8581	Fri 27 Sep 19:15	Fri 27 Sep 20:45	8638	Sat 21 Dec 02:55	Sat 21 Dec 05:55	9136
Wed 27 Mar 13:05	Wed 27 Mar 16:05	8523	Mon 24 Jun 02:26	Mon 24 Jun 05:26	4268	Sat 28 Sep 00:25	Sat 28 Sep 03:25	4306	Sun 22 Dec 02:17	Sun 22 Dec 05:17	8266
Wed 27 Mar 21:45	Thu 28 Mar 00:45	8537	Mon 24 Jun 14:35	Mon 24 Jun 16:05	9322	Sat 28 Sep 07:57	Sat 28 Sep 10:57	4272	Sun 22 Dec 05:32	Sun 22 Dec 07:02	9151
Thu 28 Mar 02:36	Thu 28 Mar 05:36	8532	Mon 24 Jun 16:25	Mon 24 Jun 19:25	8411	Sat 28 Sep 12:35	Sat 28 Sep 14:05	8555	Sun 22 Dec 12:35	Sun 22 Dec 15:35	8509
Thu 28 Mar 07:25	Thu 28 Mar 10:25	8557	Mon 24 Jun 19:40	Mon 24 Jun 22:40	4304	Sat 28 Sep 18:57	Sat 28 Sep 21:57	8525	Sun 22 Dec 16:25	Sun 22 Dec 19:25	8244
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Fri 29 Mar 09:35	Fri 29 Mar 12:35	8479	Tue 25 Jun 17:25	Tue 25 Jun 20:25	8619	Sun 29 Sep 11:16	Sun 29 Sep 12:46	9050	Mon 23 Dec 00:55	Mon 23 Dec 02:25	8293
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Sat 30 Mar 00:25	Sat 30 Mar 01:55	4268				Sun 29 Sep 19:29	Sun 29 Sep 22:29	4310	Mon 23 Dec 07:56	Mon 23 Dec 09:26	4108
Sat 30 Mar 02:10	Sat 30 Mar 03:40	4215				Sun 29 Sep 23:13	Mon 30 Sep 00:43	8521	Mon 23 Dec 11:06	Mon 23 Dec 12:36	4383
Sat 30 Mar 04:45	Sat 30 Mar 07:45	8524				Mon 30 Sep 02:26	Mon 30 Sep 05:26	8550	Mon 23 Dec 15:25	Mon 23 Dec 18:25	8492
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Sat 30 Mar 16:55	Sat 30 Mar 18:25	4292				Mon 30 Sep 09:17	Mon 30 Sep 12:17	9240	Tue 24 Dec 09:05	Tue 24 Dec 10:35	4117
Sat 30 Mar 18:55	Sat 30 Mar 21:55	8413							Tue 24 Dec 16:25	Tue 24 Dec 19:25	8489
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Sun 31 Mar 04:06	Sun 31 Mar 05:36	4212							Wed 25 Dec 07:45	Wed 25 Dec 10:45	4257
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									Wed 25 Dec 20:25	Wed 25 Dec 23:25	4251
									Thu 26 Dec 00:35	Thu 26 Dec 02:05	8290
									Thu 26 Dec 06:25	Thu 26 Dec 07:55	4293
									Thu 26 Dec 16:07	Thu 26 Dec 17:37	8321
									Thu 26 Dec 17:57	Thu 26 Dec 20:57	4275

Q1			Q2			Q3			Q4		
Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight	Train Movement In	Train Movement Out	Total Weight
									Fri 27 Dec 00:05	Fri 27 Dec 03:05	4250
									Fri 27 Dec 08:55	Fri 27 Dec 10:25	4271
									Fri 27 Dec 11:16	Fri 27 Dec 14:16	7783
									Fri 27 Dec 19:25	Fri 27 Dec 22:25	8270
									Sat 28 Dec 12:52	Sat 28 Dec 15:52	4240
									Sun 29 Dec 00:15	Sun 29 Dec 03:15	8537
									Sun 29 Dec 04:15	Sun 29 Dec 05:45	8443
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									Mon 30 Dec 00:55	Mon 30 Dec 03:55	8293
									Mon 30 Dec 04:10	Mon 30 Dec 07:10	4244
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									Mon 30 Dec 11:02	Mon 30 Dec 14:02	8365
									Mon 30 Dec 14:35	Mon 30 Dec 17:35	8277
									Tue 31 Dec 01:45	Tue 31 Dec 04:45	4259
									Tue 31 Dec 05:05	Tue 31 Dec 08:05	9125
									Tue 31 Dec 14:54	Tue 31 Dec 17:54	8717
									Tue 31 Dec 18:09	Tue 31 Dec 21:09	8745

APPENDIX D

MOUNT PLEASANT OPERATION – 2024 ANNUAL AIR QUALITY REVIEW

TODOROSKI AIR SCIENCES
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31 March 2025

Andrew Raal
Senior Environmental Advisor
MACH Energy Australia
Via email: andrew.raal@machenergy.com.au

RE: Mount Pleasant Operation – 2024 Annual Air Quality Review

Dear Andrew,
Todoroski Air Sciences have conducted a review and analysis of the annual average deposited dust, TSP, PM_{10} and $PM_{2.5}$ levels recorded at Mount Pleasant Operation (MPO) in 2024.

Annual air quality criteria

As per consent DA 92/97 Schedule 3 Condition 20 "*Except for the air-affected land referred to in Table 1, the Applicant must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the development do not exceed the criteria listed in Tables 8, 9 or 10 at any residence on privately-owned land.*" The criteria from Tables 8 to 10 are set out below:

Table 8: Long term criteria for particulate matter

Pollutant	Averaging period	[d]Criterion
Total suspended particulate (TSP) matter	Annual	[a]90 µg/m³
Particulate matter < 10 µm (PM_{10})	Annual	[a]25 µg/m³
Particulate matter < 2.5 µm ($PM_{2.5}$)	Annual	[a]8 µg/m³

Table 9: Short term criteria for particulate matter

Pollutant	Averaging period	[d]Criterion
Particulate matter < 10 µm (PM_{10})	24 hour	[b]50 µg/m³
Particulate matter < 2.5 µm ($PM_{2.5}$)	24 hour	[b]25 µg/m³

Table 10: Long term criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c] Deposited dust	Annual	[b]2 g/m²/month	[a]4 g/m²/month

Notes to Tables 8-10:
[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources)
[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own)
[c] 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
[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed to by the Secretary.

When the measured cumulative annual average deposited dust level at compliance monitors is below the criterion of 4g/m^2/month in Table 10, it is inferred that compliance is achieved. If this criterion is exceeded, the applicant must demonstrate compliance with the maximum increase in the deposited dust level of 2g/m^2/month.

As per consent SSD 10418 Part B Condition B20 "*Except for the air quality affected land in condition C1, the Application must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the development do not cause exceedances of the criteria listed in Table 3 at any residence on privately-owned land.* The criteria from Tables 3 are set out below:

Table 3: Air quality criteria

Pollutant	*Averaging period*	*Criterion*
Particulate matter < 10 µm (PM_{10})	*Annual*	*[a,c] 25 µg/m³*
	24 hour	*[b] 50 µg/m³*
Particulate matter < 2.5 µm ($PM_{2.5}$)	*Annual*	*[a,c] 8 µg/m³*
	24 hour	*[b] 25 µg/m³*
Total suspended particulate (TSP) matter	*Annual*	*[a,c] 90 µg/m³*

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).
[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).
[c] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed to by the Planning Secretary.

Dust Deposition

This review has analysed dust deposition data recorded at the MPO monitors for the 2024 year. The MPO dust deposition monitoring data for 2024 are presented in **Table 1**.

Table 1: Deposited dust monthly average compliance monitoring data for 2024 (g/m^2/month)

Date	D1	D3a	D4	D5a	D6	D7b	D8	D9a	D10	D11	D12	D13	D14
Jan	2.2	1.6	1.5	1.4	2.0	6.9	3.6	4.1	0.5	3.6	1.4	1.1	2.2
Feb	1.7	1.9	2.0	2.2	1.7	4.3	6.3	4.1	2.0	4.1	1.6	1.7	2.9
Mar	1.3	0.9	0.8	1.4	2.1	11.1	7.2	6.9	1.2	3.2	0.8	1.7	4.2
Apr	2.0	0.7	0.9	1.6	1.5	18.1	5.0	3.7	0.9	5.0	1.0	1.6	3.2
May	1.7	0.6	0.9	1.6	0.7	25.1c	3.5	4.0	0.6	3.7	0.7	1.0	1.8
Jun	4.1	1.5	1.5	2.9	2.4	13.3	5.0	2.2	1.4	2.8	0.8	1.7	2.9
Jul	1.2	0.8	0.2	1.5	1.3	6.8	2.2	1.4	0.3	1.5	0.1	0.5	1.2
Aug	3.1	0.9	0.6	2.3	1.7	13c	4.4	4.4	0.9	3.5	0.6	0.9	2.4
Sep	1.3	1.4	0.5	3.6	1.8	7.3	2.3	1.3	0.7	-	0.5	0.7	1.9
Oct	1.3	0.9	0.9	1.3	1.0	4.9	3.0	2.2	0.7	1.8	0.5	1.2	2.2
Nov	2.2	1.9	2.1	2.9	2.8	6.8	7.1	4.3	2.7	3.7	1.4	2.4	6.2
Dec	3.8	2.4c	1.8	2.3	4.1	6.8	5.0	2.5	4.4c	3.8	2.1	2.5	5.0
Annual average	2.2	1.2	1.1	2.1	1.9	**8.6**	**4.6**	3.4	1.1	3.1	1.0	1.4	3.0
Compliance monitor?	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes

c – contaminated – no sample, dust gauge smashed

Figure 1 presents a plan of the dust gauge monitoring locations for both compliance and non-compliance monitors in the area around MPO and the 2024 annual average deposited dust levels. The figure includes annual windrose plots of the meteorological data collected at the M-WM1, M-WM2, M-WS4 and M-WM5 stations during 2024. In general, winds were predominately from the southeast and northwest quadrants.

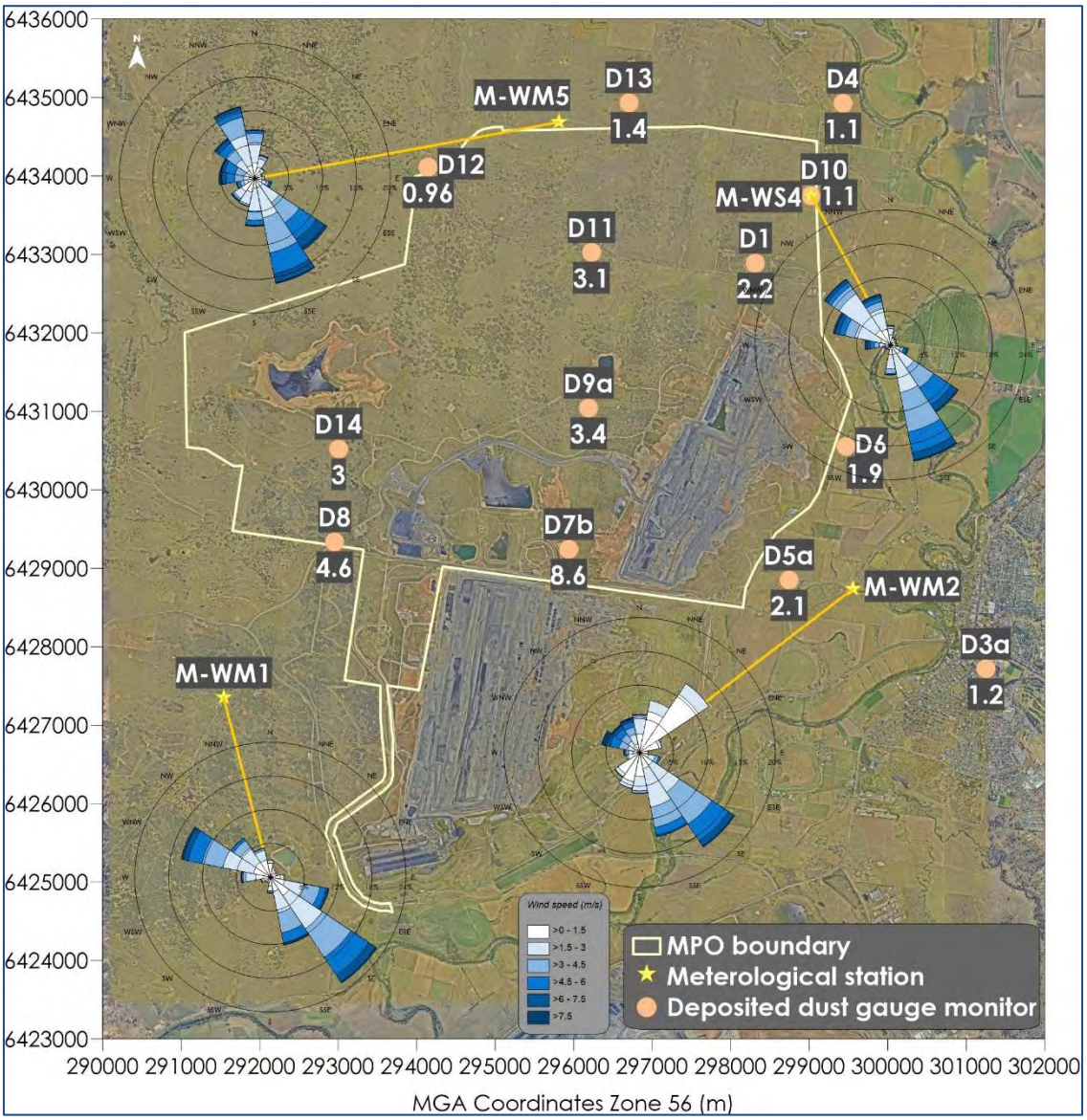

Figure 1: Annual average deposited dust results for 2024

The D7 and D8 monitors recorded levels above 4g/m^2/month in 2024. Per the MPO Air Quality and Greenhouse Gas Management Plan (AQGHGMP) (**MACH Energy, 2024**), "Site D7b and D8 are not used to assess compliance against the deposited dust criteria as the monitors are located in close proximity to the northern boundary of a neighbouring mining operation open cut pit, and there are no privately-owned receivers in the vicinity of these monitoring locations."

The data indicate that the annual average deposited dust levels measured at the MPO monitors representative of residences on privately-owned land, were below the cumulative criterion of 4g/m^2/month in 2024. As such, it is considered that compliance with the relevant criterion in Table 10 of DA 92/97 Schedule 3 Condition 20 is achieved.

Annual Average TSP

This review has analysed the TSP monitoring data recorded at the MPO High Volume Air Sampler (HVAS) monitors in 2024. **Table 2** presents a summary of the annual average TSP monitoring data for the area around MPO in 2024.

Table 2: Annual average TSP monitoring data for 2024

Location	Annual average TSP level - all days (µg/m³)
HVAS APF-2	46.3
HVAS APF-4	32.9
HVAS APF-5	44.5

Figure 2 presents the 24-hour average TSP levels for 2024.

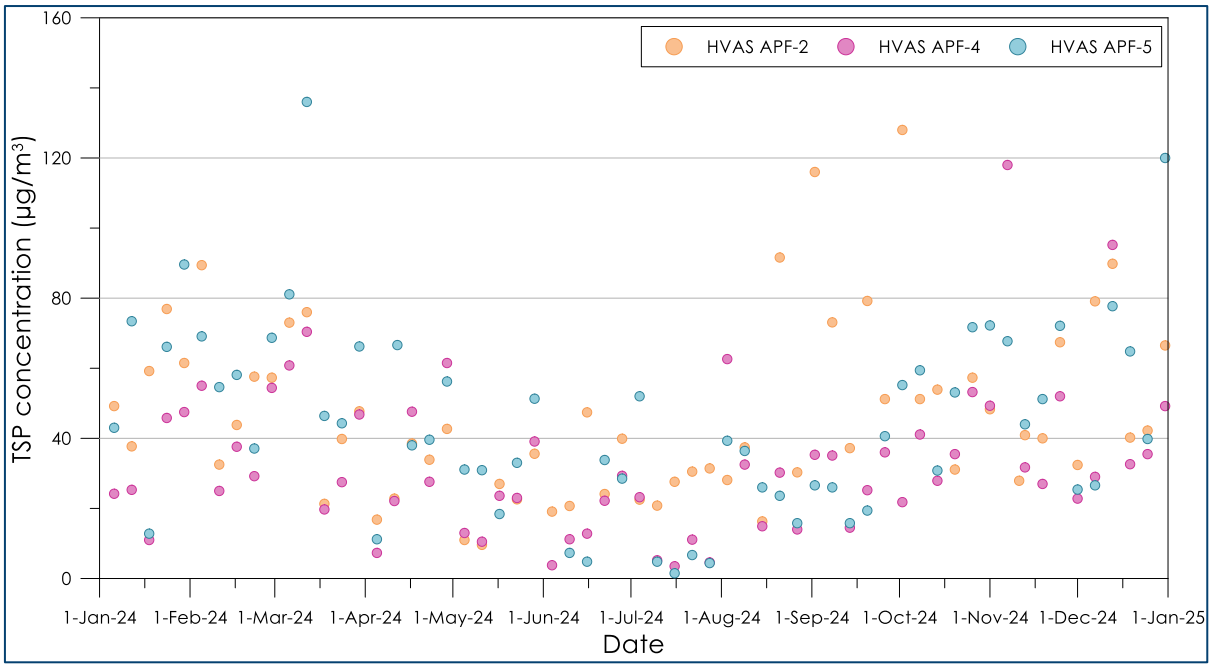

Figure 2: 24-hour average TSP HVAS records for 2024

Figure 3 presents a plan of the HVAS monitoring locations in the area around MPO and the 2024 annual average TSP levels. The figure includes annual windrose plots of the meteorological data collected at the M-WM1, M-WM2, M-WS4 and M-WM5 stations during 2024.

The data show that the annual average TSP levels for all the MPO HVAS monitors are below the relevant criterion of 90µg/m³. As such, it is considered that compliance with the relevant criterion in Table 8 of DA 92/97 Schedule 3 Condition 20 and Table 8 of SSD 10418 Part B Condition B20 is achieved.

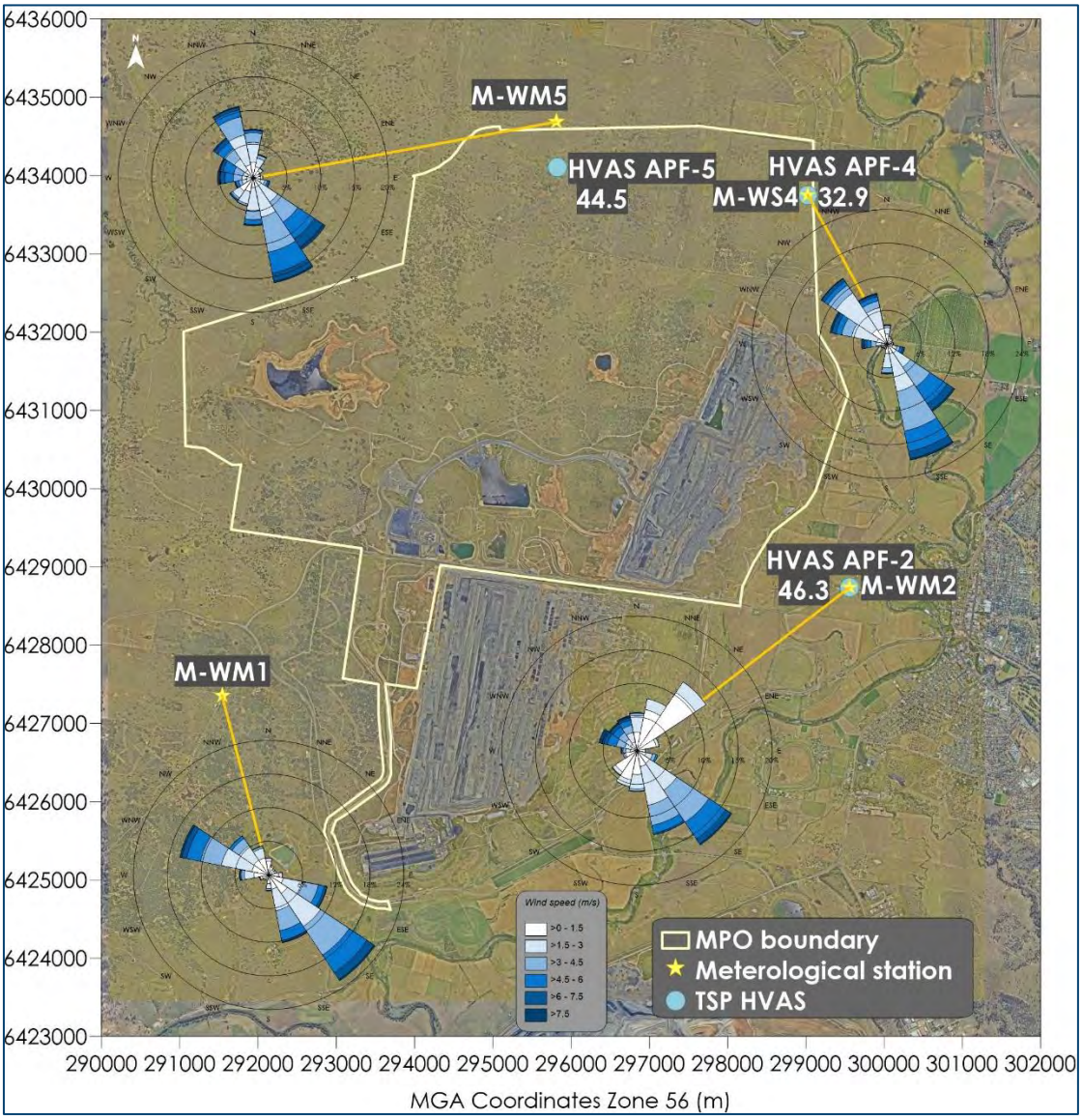

Figure 3: Annual average TSP results for 2024

Annual Average PM_{10}

This review has analysed the annual average PM_{10} monitoring data recorded at the MPO Palas Fidas monitors in 2024.

Table 3 presents a summary of the PM_{10} data availability for the MPO Palas Fidas monitors in 2024. It is noted that there was insufficient data (less than 75% per quarter) to calculate a valid annual average PM_{10} level at the APF-2, APF-4 and APF-5 monitors in 2024 however for the purpose of this review an average of the available data has been presented. It is understood that the MPO Palas Fidas monitors have reached the end of their life and are in the process of being replaced. Supplementary monitoring data has been obtained from EBAM monitors co-located with the APF-2 and APF-5 monitors where available during 2024.

Table 3: Quarterly PM_{10} monitoring data availability days for 2024

Location	Q1	Q2	Q3	Q4	Total
APF-2	40 (44%)	49 (54%)	21 (23%)	76 (83%)	186 (51%)
APF-2 with supplementary EBAM data	69 (76%)	91 (100%)	92 (100%)	90 (98%)	342 (94%)
APF-4	78 (86%)	91 (100%)	78 (85%)	33 (36%)	280 (77%)
APF-5	36 (40%)	37 (41%)	78 (85%)	84 (91%)	235 (64%)
APF-5 with supplementary EBAM data	54 (59%)	37 (41%)	78 (85%)	84 (91%)	253 (69%)

Table 4 presents a summary of the annual average PM_{10} monitoring data for the area around MPO in 2024. The table includes the annual averages calculated with supplementary EBAM data where available for periods when the Palas Fidas monitors were not recording valid data.

Table 4: Annual average PM_{10} monitoring data for 2024

Location	Annual average PM_{10} (µg/m³)
APF-2	14.9
APF-4	14.7*
APF-5	14.6*
Muswellbrook	18.5
Muswellbrook NW	16.3

*Insufficient data (<75% data availability per quarter) for an annual average calculation

Figure 4 presents a plan of the monitoring locations in the area around MPO and the measured 2024 annual average PM_{10} levels.

The annual average PM_{10} levels at the MPO Palas Fidas and DCCEEW monitors were below the relevant criterion of 25µg/m³ in 2024 and as such, it is considered that compliance with the relevant criterion in Table 8 of DA 92/97 Schedule 3 Condition 20 and Table 8 of SSD 10418 Part B Condition B20 has been achieved.

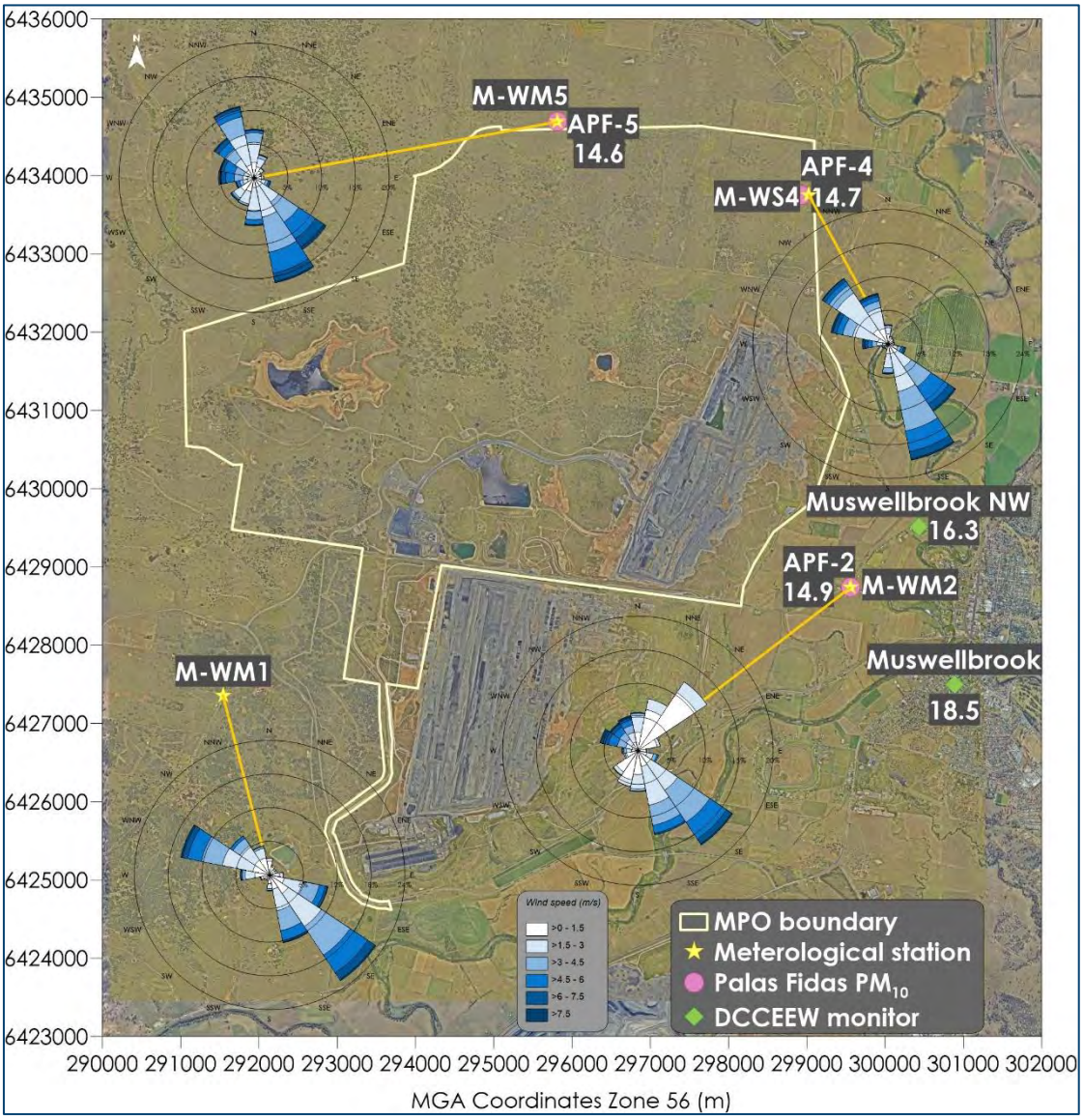

Figure 4: Annual average PM_{10} results for 2024

24-hour Average PM_{10}

This review has analysed the 24-hour average PM_{10} monitoring data recorded at the MPO Palas Fidas monitors in 2024.

Figure 5 presents the 24-hour average PM_{10} levels around MPO for 2024. As noted above, the MPO Palas Fidas monitors have reached the end of their life and are in the process of being replaced.

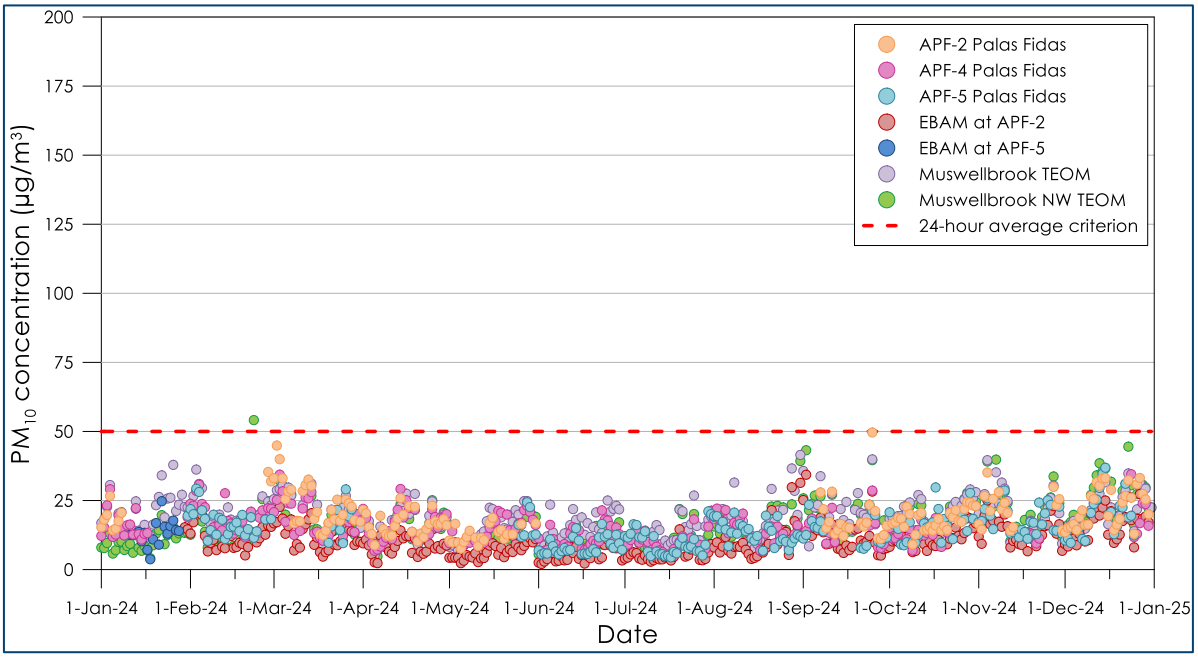

Figure 5: 24-hour average PM_{10} records for 2024

Table 5 presents a summary of the 24-hour average PM_{10} monitoring data for the area around MPO in 2024.

The data indicate that the 24-hour average PM_{10} levels were generally low throughout 2024. There was one day at the DCCEEW Muswellbrook NW monitors with 24-hour average PM_{10} levels above 50µg/m^3 in 2024.

It is noted that in the March 2024 monthly environmental monitoring report, MPO reported two 24-hour average levels greater than 50µg/m^3 at A-PF2 on 30/03/2024 and 31/03/2024. The data were reviewed for these days, and it is considered that the extremely high hourly PM_{10} levels recorded are invalid as they do not appear to be realistic (levels of this magnitude were not recorded at the co-located EBAM monitor or other surrounding monitors during this period) and are considered likely to be caused by moisture or some other form of contamination.

Table 5: 24-hour average PM_{10} monitoring data for 2024

Location	Maximum 24-hour PM_{10} (µg/m^3)	Number of 24-hour PM_{10} levels above criterion (50µg/m^3)
APF-2	49.6	0
APF-4	34.5	0
APF-5	36.9	0
Muswellbrook	41.5	0
Muswellbrook NW	54.1	1

Table 6 presents a summary of MPO's estimated maximum contributions to the elevated 24-hour average PM_{10} levels recorded at the monitors during 2024. The contribution from MPO to the monitors was determined to be the total level recorded at the monitor at the times in which the monitor would have been downwind of the mine minus the background concentration (i.e. contribution = downwind level – upwind level).

On 23/02/2024, elevated PM_{10} levels were recorded during the early morning hours at Muswellbrook NW. The wind direction data recorded at Muswellbrook NW during this period indicate that Muswellbrook NW was not downwind of MPO.

Whilst MPO was not upwind per the weather data measured at Muswellbrook NW, as a conservative worst-case scenario, Muswellbrook NW was considered to be downwind of MPO for each hour of the day on 23/02/2024 based on the wind direction data at any of the stations in the MPO air quality monitoring network, including the DCCEEW Muswellbrook and Muswellbrook NW stations. (We note that winds from the northwest were recorded at other monitoring stations in the vicinity of MPO at this time).

Table 6: Estimated maximum potential contribution of MPO to the elevated PM_{10} levels

Date	Monitor	Recorded 24-hour average PM_{10} level ($\mu g/m^3$)	Percentage of time downwind	Estimated maximum contribution to 24-hour average PM_{10} level ($\mu g/m^3$)
23/02/2024	Muswellbrook NW	54.1	76%	41.0

For each of the elevated 24-hour average PM_{10} levels in the MPO monitoring network in 2024, the estimated maximum possible incremental contribution from MPO was 41.0 $\mu g/m^3$, which is less than 50g/m^3. MPO is therefore considered compliant with DA 92/97 Schedule 3 Condition 20 Table 9 and Table 8 of SSD 10418 Part B Condition B20.

Annual Average $PM_{2.5}$

This review has analysed the annual average $PM_{2.5}$ monitoring data recorded at the MPO Palas Fidas monitors in 2024.

Table 7 presents a summary of the $PM_{2.5}$ data availability for the MPO Palas Fidas monitors in 2024. It is noted that there was insufficient data (less than 75% per quarter) to calculate a valid annual average $PM_{2.5}$ level at the APF-2, APF-4 and APF-5 monitors in 2024 however for the purpose of this review an average of the available data has been presented. It is understood that the MPO Palas Fidas monitors have reached the end of their life and are in the process of being replaced. Note that there was no supplementary $PM_{2.5}$ monitoring in 2024.

Table 7: Quarterly $PM_{2.5}$ monitoring data availability days for 2024

Location	Q1	Q2	Q3	Q4	Total
APF-2	40 (44%)	49 (54%)	21 (23%)	76 (83%)	186 (51%)
APF-4	78 (86%)	91 (100%)	78 (85%)	33 (36%)	280 (77%)
APF-5	36 (40%)	37 (41%)	78 (85%)	84 (91%)	235 (64%)

Table 8 includes a summary of the annual average $PM_{2.5}$ monitoring data for the area around MPO in 2024.

Table 8: Annual average $PM_{2.5}$ monitoring data for 2024

Location	Annual average $PM_{2.5}$ ($\mu g/m^3$)
APF-2	6.4*
APF-4	5.7*
APF-5	5.2*
Muswellbrook	7.1

*Insufficient data (<75% data availability per quarter) for an annual average calculation

Figure 6 presents a plan of the monitoring locations in the area around MPO and the measured 2024 annual average $PM_{2.5}$ levels.

The annual average $PM_{2.5}$ levels at the MPO Palas Fidas and DCCEEW monitors were below the relevant criterion of 8µg/m³ in 2024 and as such it is considered that compliance with the relevant criterion in Table 8 of DA 92/97 Schedule 3 Condition 20 and Table 8 of SSD 10418 Part B Condition B20 has been achieved.

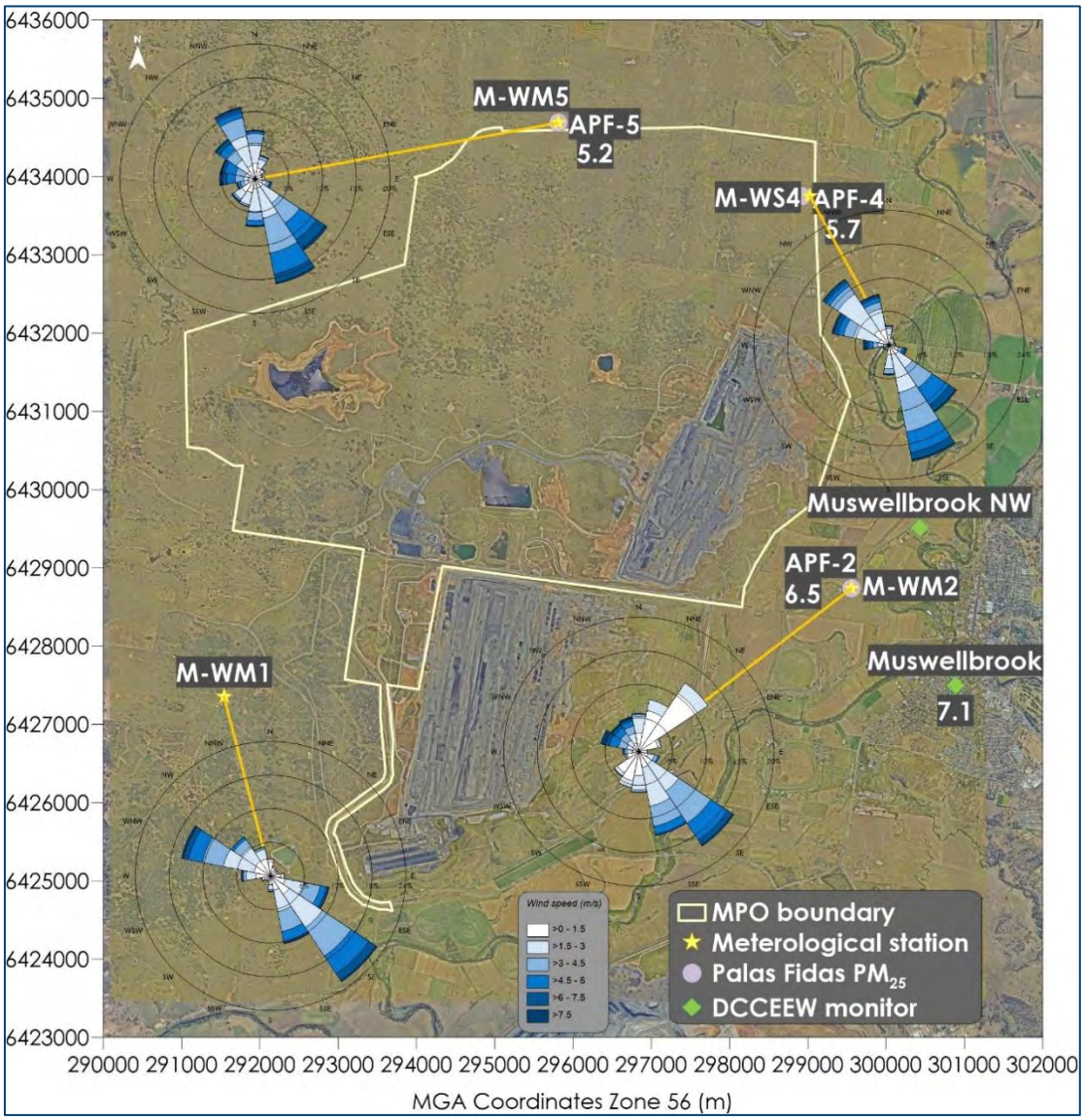

Figure 6: Annual average $PM_{2.5}$ results for 2024

24-hour Average $PM_{2.5}$

This review has analysed the 24-hour average $PM_{2.5}$ monitoring data recorded at the MPO Palas Fidas monitors in 2024.

Figure 7 presents the 24-hour average $PM_{2.5}$ levels around MPO for 2024. As noted above, the MPO Palas Fidas monitors have reached the end of their life and are in the process of being replaced.

The DCCEEW Muswellbrook monitor recorded significantly higher levels than the Palas Fidas monitors in winter, likely due to domestic wood heater smoke near the monitor.

Table 9 includes a summary of the 24-hour average $PM_{2.5}$ monitoring data for the area around MPO in 2024. The data indicate that the 24-hour average $PM_{2.5}$ levels were generally low throughout 2024. All 24-hour average $PM_{2.5}$ levels recorded around MPO were below the 25µg/m^3 criterion in 2024. MPO is therefore considered compliant with DA 92/97 Schedule 3 Condition 20 Table 9 and Table 8 of SSD 10418 Part B Condition B20.

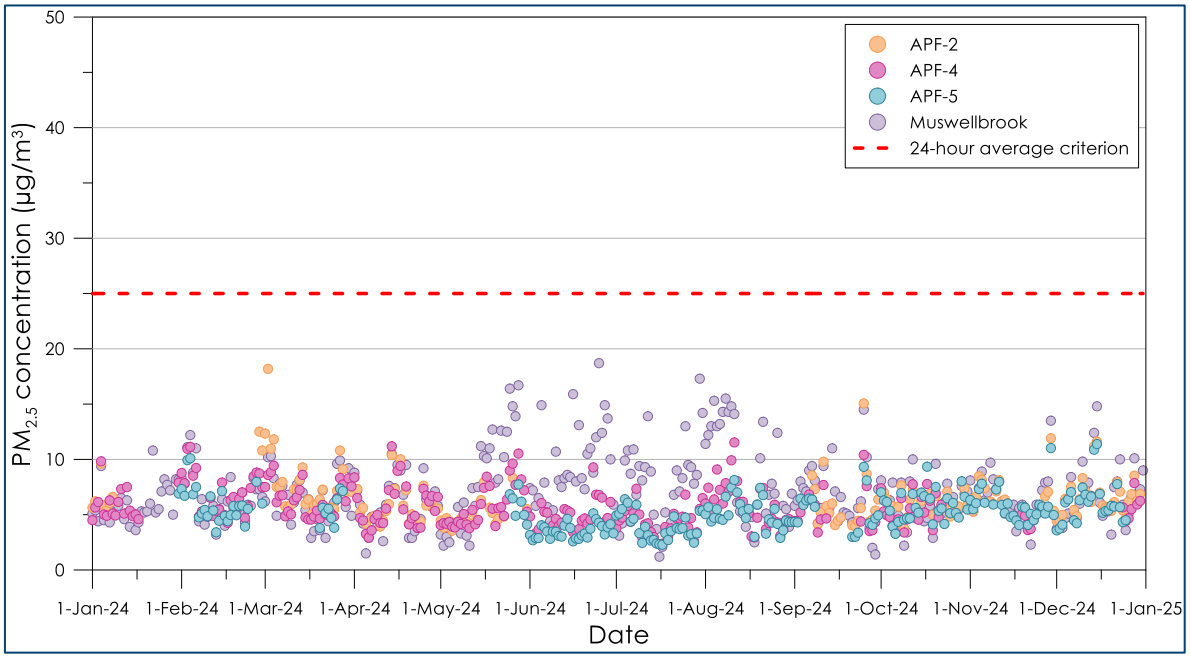

Figure 7: 24-hour average $PM_{2.5}$ records for 2024

Table 9: 24-hour average $PM_{2.5}$ monitoring data for 2024

Location	Maximum 24-hour $PM_{2.5}$ (µg/m^3)	Number of 24-hour $PM_{2.5}$ levels above criterion (25µg/m^3)
APF-2	18.2	0
APF-4	11.5	0
APF-5	11.4	0
Muswellbrook	18.7	0

Adverse conditions

Adverse conditions during 2024 per EPL 20850 have been reviewed. Adverse conditions are defined as being the occurrence of both:

- adverse wind conditions – the 1-hour average wind direction between 250 degrees and 340 degrees (inclusive) measured at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitor
- adverse PM_{10} conditions - rolling 24-hour average PM_{10} concentration of equal to or greater than 44 µg/m^3 measured at the Muswellbrook NW Upper Hunter Air Quality Monitoring Network monitoring station

At times when there is no access to the meteorological data or PM_{10} data from the Muswellbrook NW monitoring station, data from the M-WM2 and A-PF2 monitors are instead used to determine adverse wind and PM_{10} conditions.

Per EPL Condition O3.4, MPO must cease all dust generating activities during adverse wind and PM_{10} conditions. **Table 10** presents a log of times when adverse conditions occurred, when dust generating activities were ceased in accordance with EPL Condition O3.4 and when activities were resumed. The data indicate that there were three days when adverse conditions occurred during 2024.

Per EPL Condition 3.6, shutdown of dust generating activities must be completed within 1 hour of receiving data that triggers action required by EPL Condition O3.4. The data indicate that MPO responded to the alerts by ceasing dust generating activities in this timeframe (noting that the hourly average data for the first adverse condition hour is calculated at the end of that hourly period and that there is an approximate 30 to 45 minute delay in getting the data from the DCCEEW Muswellbrook NW monitoring station).

The condition appears intended to limit off-site dust due to activities on the site. The condition uses rolling 24-hr average data (that is available up to 45 minutes after the event) and due to this will not always meet its aim. For example, when winds change, the condition can be triggered by dust sources unrelated to MPO, or due to high particulate levels the day before. The condition assumes that if the wind is from the site and the rolling 24-hour average dust level is elevated, then MPO is the cause of the elevated levels, and that action is needed. However, this assumption is incorrect because the rolling 24-hour average value is affected by dust received in the previous 23 hours, when winds may have been from other directions (other sources). However, there will be times when the condition does work, and activities may need to be curtailed to keep dust levels low.

It is noted that on 3/09/2024 operations were ceased for a 5-minute period. Adverse wind and dust conditions occurred for the hour from 9 to 10 am on this day. On the previous day, there was a period of very low readings followed by more elevated reading from the middle of the day. The adverse dust condition did not occur on the previous day (at the time of elevated readings) due to the prior period of very low dust followed by the more elevated dust readings. On 3/09/2024, as the rolling 24-hour average PM_{10} concentration progressed over time, the trigger occurred at a time of with moderately low dust levels (27.4 µg/m^3) because even lower dust concentrations from 24 hours prior were now no longer in the rolling 24-hour period (causing it to become higher, despite the moderately low dust concentrations downwind of the MPO at that time). The period of elevated 1-hour average dust concentrations had ended the day before, approximately 12 hours before the time of the trigger which initiated the shutdown. The 24-hour average PM_{10} level at Muswellbrook

NW on 2/09/2024 was 43.2 µg/m^3 and on 3/09/2024 was significantly below 50µg/m^3 with a level of 21.5µg/m^3 indicating that a shutdown on this day would not have been necessary.

The meteorological conditions recorded at EPA Monitoring Point 4 (M-WS4) and the PM_{10} monitoring data recorded at EPA Monitoring Points 1 (A-PF2) and 2 (A-PF5) for the relevant periods are provided in **Appendix A**. It is noted that PM_{10} data from A-PF2 and A-PF5 are not always available during the relevant periods required to be provided per EPL Condition 5.3. As such, where available, the 1-hour average EBAM data has been provided in **Appendix A**. It is understood that MPO is in the process of updating the monitors to improve the data capture rates and ensure there is data for an upwind/downwind contribution analysis.

Table 10: Adverse conditions log

Date & time when adverse conditions occurred	Date & time when dust generating activities were ceased	Date & time when dust generating activities were resumed
23/02/2024 10:00 – 14:00	23/02/2024 12:25	23/02/2024 15:25
3/09/2024 1:00 – 2:00* & 9:00 – 10:00	3/09/2024 11:25	3/09/2024 11:30
24/12/2024 9:00 – 11:00	24/12/2024 11:20	24/12/2024 12:20

Note - dates and times are presented in local time

*The validated data show that one hour with a rolling 24-hour average PM_{10} level of 44.1µg/m^3, marginally above the threshold of 44.0µg/m^3. As the trigger must be based on real-time unvalidated data, it appears the real-time data feed for MPO showed slightly lower results and thus did not trigger an adverse condition for this hour.

As identified in **Table 5**, there was one day, 23/02/2024, during the review period when the 24-hour average PM_{10} level was greater than 50µg/m^3 at the Muswellbrook NW DCCEEW monitoring station. The data indicate that elevated PM_{10} levels occurred during the early morning hours on 23/02/2024. Per the wind direction data recorded at Muswellbrook NW, the Muswellbrook NW monitor would not have been downwind of MPO during this early morning period and thus "adverse conditions" alerts were not triggered at this time. However, based on the wind direction data from other monitoring stations in the vicinity of MPO, the indication is that winds were from the northwest and thus Muswellbrook NW may have been downwind of MPO at this time.

The contribution assessment presented in **Table 6** conservatively assumes that Muswellbrook NW was downwind of MPO for each hour of the day on 23/02/2024 when any of the stations in the MPO air quality monitoring network (including the DCCEEW Muswellbrook and Muswellbrook NW stations) recorded winds from 250 degrees to 340 degrees (inclusive).

Based on this conservative analysis, MPO did not contribute more than 50µg/m^3 to the 24-hour average level measured at Muswellbrook NW on 23/02/2024 and is thus compliant with Table 9 of DA 92/97 Schedule 3 Condition 20 and Table 8 of SSD 10418 Part B Condition B20.

Comparison between measured data and modelled results

The MPO 2024 air quality monitoring data has been compared with modelling predictions for "Scenario 1" per the *Mount Pleasant Optimisation Project Air Quality Impact Assessment* (**Todoroski Air Sciences, 2020**). It is understood the "Scenario 1" modelling scenario is generally representative of the operations in 2024.

Figure 8 presents the measured 2024 annual average deposited dust data superimposed over the dispersion modelling contours for "Scenario 1". The measured and predicted data in the figure include dust levels from MPO and other sources. The measured annual average deposited dust levels in 2024 are generally consistent the predicted levels for the "Scenario 1" modelling scenario. It is noted that D7b and D8, which are not

compliance monitoring locations, recorded higher values in 2024 than that predicted in the "Scenario 1" modelling.

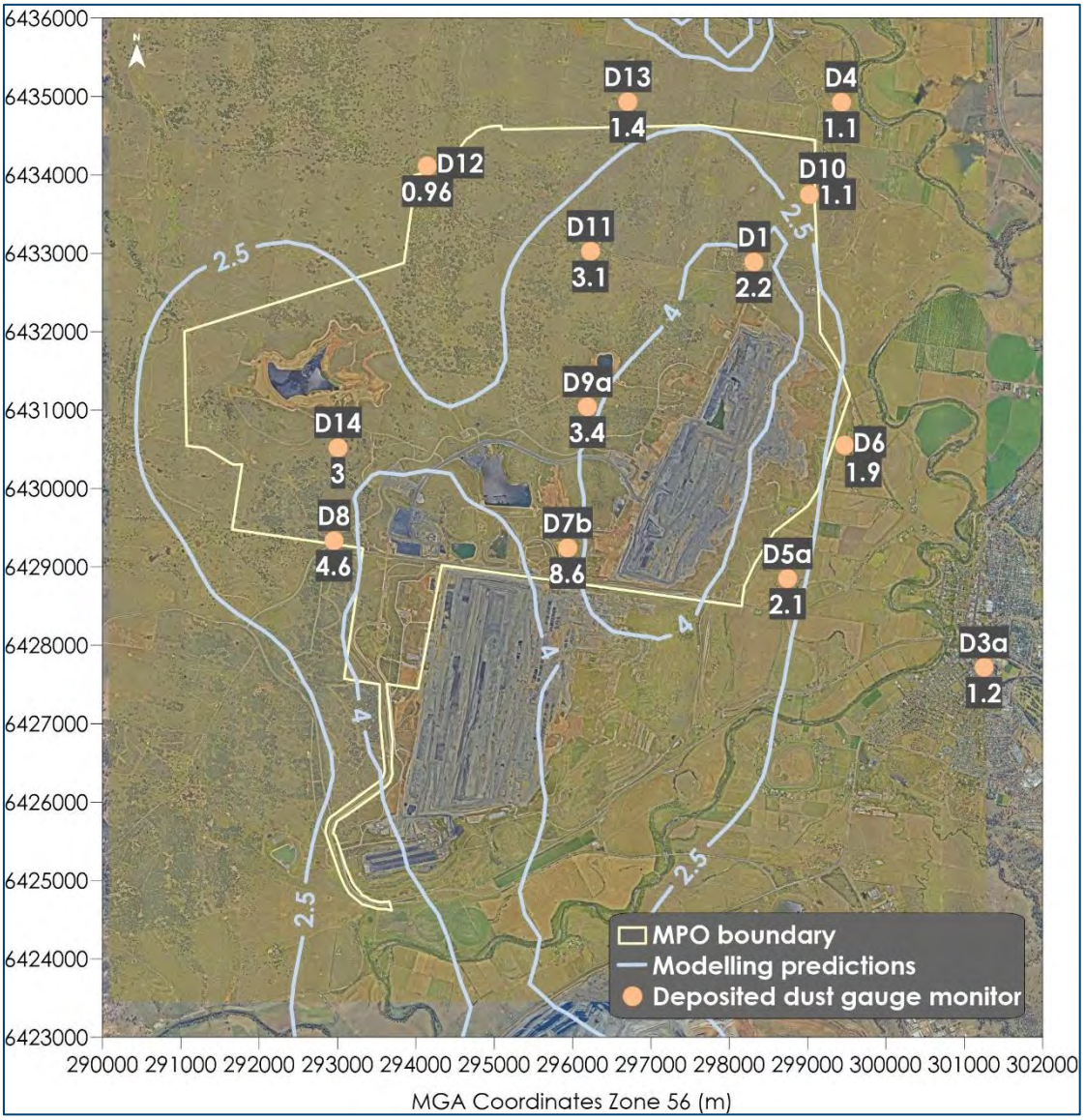

Figure 8: Annual average deposited dust monitoring data for 2024 superimposed over the predicted cumulative deposited dust annual average modelling contour (MPO plus other sources) (Source: Todoroski Air Sciences, 2020).

Figure 9 presents the measured 2024 annual average TSP data superimposed over the dispersion modelling contours for "Scenario 1". The measured and predicted data in the figure include dust levels from MPO and other sources. The measured annual average TSP levels in 2024 are generally lower than the predicted levels for the "Scenario 1" modelling scenario.

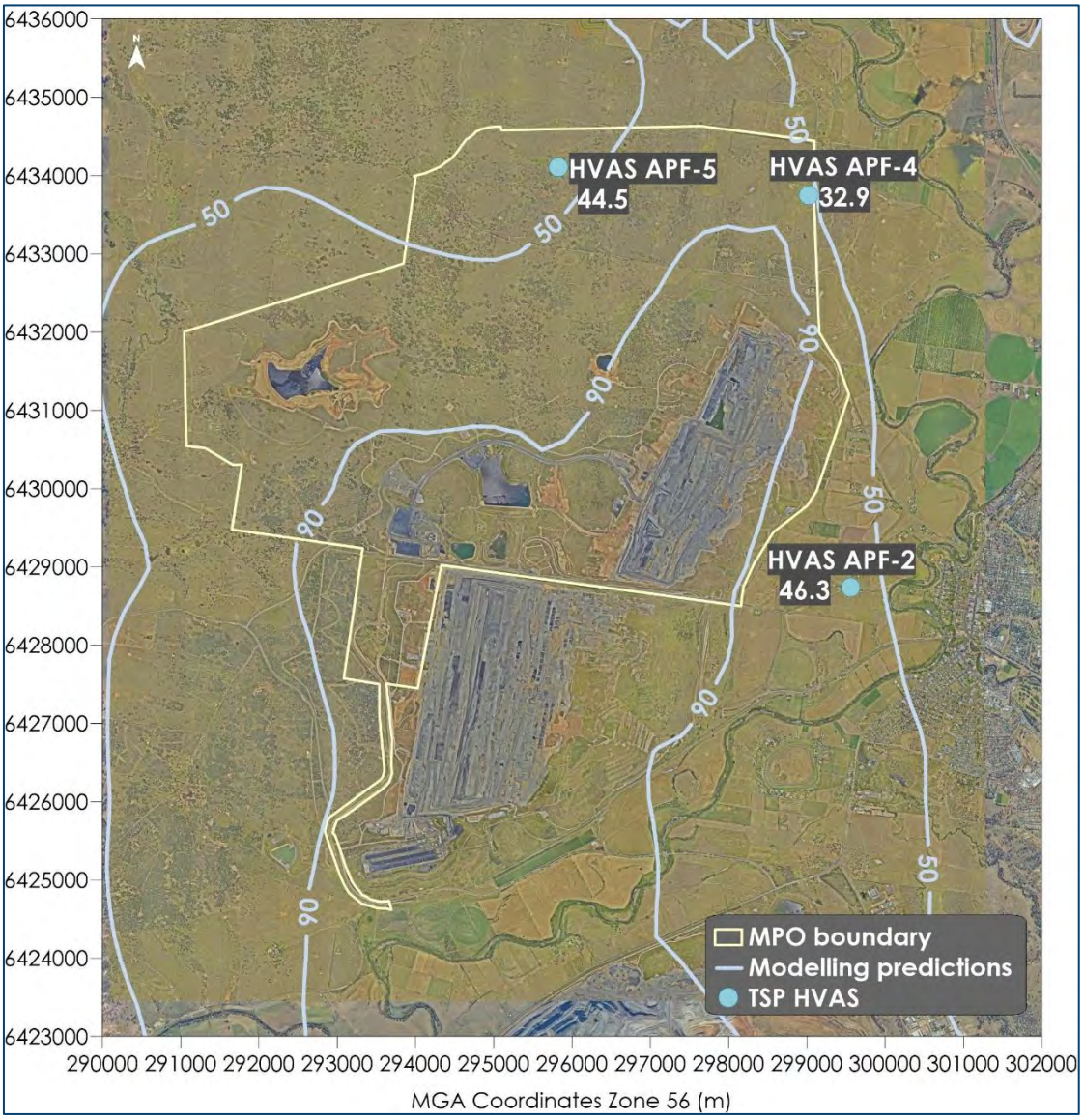

Figure 9: Annual average TSP monitoring data for 2024 superimposed over the predicted cumulative TSP annual average modelling contour (MPO plus other sources) (Source: Todoroski Air Sciences, 2020).

Figure 10 presents the measured 2024 annual average PM_{10} data superimposed over the dispersion modelling contours for "Scenario 1". The measured and predicted data in the figure include dust levels from MPO and other sources. The measured annual average PM_{10} levels in 2024 are generally consistent with the predicted levels for the "Scenario 1" modelling scenario.

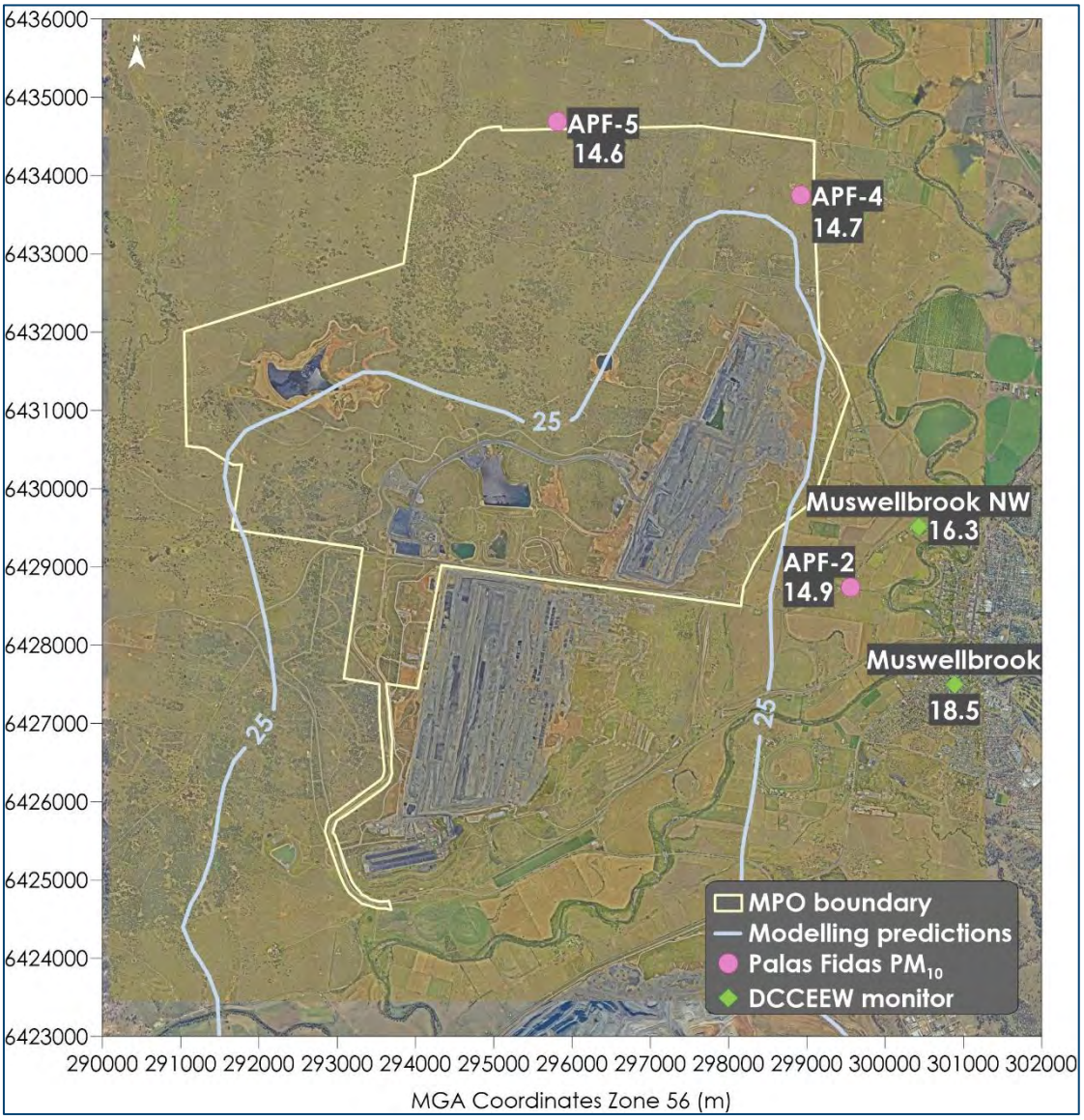

Figure 10: Annual average PM_{10} monitoring data for 2024 superimposed over the predicted cumulative PM_{10} annual average modelling contour (MPO plus other sources) (Source: Todoroski Air Sciences, 2020).

Figure 11 presents the measured 2024 annual average $PM_{2.5}$ data superimposed over the dispersion modelling contours for "Scenario 1". The measured and predicted data in the figure include dust levels from MPO and other sources. The measured annual average $PM_{2.5}$ levels in 2024 are slightly higher than the predicted levels for the "Scenario 1" modelling scenario, particularly at the Muswellbrook and APF-2 monitors, which is likely due to wood heater smoke from the Muswellbrook township.

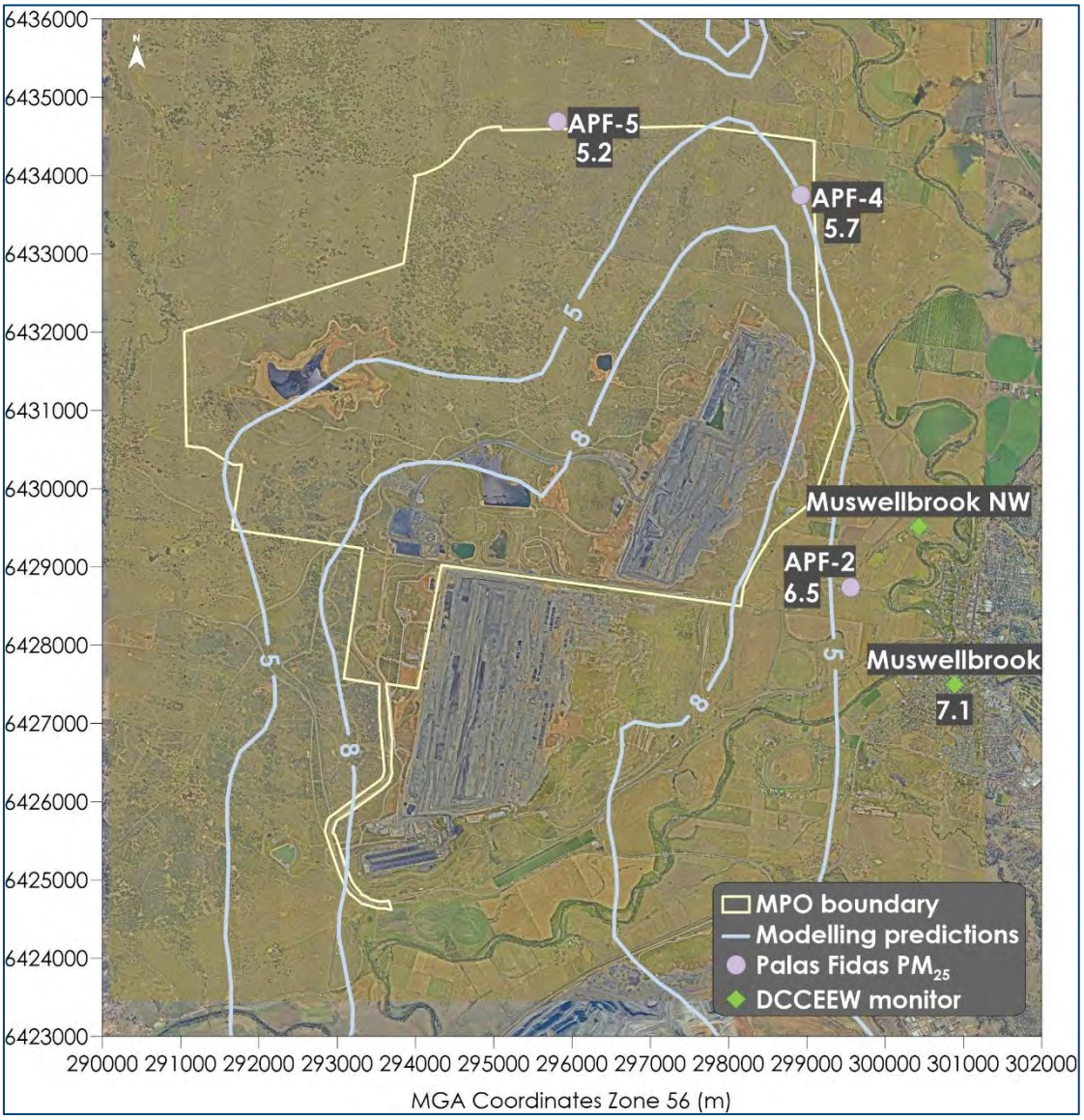

Figure 11: Annual average $PM_{2.5}$ monitoring data for 2024 superimposed over the predicted cumulative $PM_{2.5}$ annual average modelling contour (MPO plus other sources) (Source: Todoroski Air Sciences, 2020).

Conclusions

Data capture rates for the Palas Fidas monitors in the MPO monitoring network were generally poor in 2024. It is understood that the Palas Fidas monitors are approaching the end of their lives which may be impacting data availability and that MPO is in the process of replacing the monitors. Supplementary monitoring data has been obtained from EBAM monitors co-located with the APF-2 and APF-5 monitors where available during 2024.

The available data indicate that compliance with the relevant annual criteria for TSP, PM_{10} and $PM_{2.5}$ was achieved as per Table 8 in DA 92/97 Schedule 3 Condition 20 and Table 8 of SSD 10418 Part B Condition B20 in 2024.

The available data indicate that compliance with the relevant annual average criteria for deposited dust was achieved in 2024 at the MPO monitors representative of residences on privately-owned land per Table 10 in DA 92/97 Schedule 3 Condition 20 and Table 8 of SSD 10418 Part B Condition B20.

There was one elevated 24-hour average PM_{10} level recorded by the MPO monitoring network in 2024. The estimated contribution from MPO on this occasion was found to be less than 50µg/m³. All 24-hour average $PM_{2.5}$ levels recorded across the MPO monitoring network in 2024 were below the 25µg/m³ criterion. Therefore, compliance with the 24-hour average criterion for PM_{10} and $PM_{2.5}$ was achieved as per Table 9 in DA 92/97 Schedule 3 Condition 20 and Table 8 of SSD 10418 Part B Condition B20 in 2024.

MPO is therefore considered compliant with the air quality criteria per DA 92/97 Schedule 3 Condition 20 and SSD 10418 Part B Condition B20 in 2024.

A review of the MPO operations during "adverse conditions" indicate that MPO activities were carried out in accordance with the requirements of EPL 20850 Condition O3.

The comparison of the measured results to the model predictions shows that the annual average measured levels in 2024 generally aligned with the modelling predictions.

Please feel free to contact us in relation to any aspect of this analysis.

Yours faithfully,
Todoroski Air Sciences



Katie Trahair



Dan Kjellberg

References

MACH Energy (2024)

"Mount Pleasant Operation Air Quality and Greenhouse Gas Management Plan", MACH Energy Australia Pty Ltd, November 2024.

Todoroski Air Sciences (2020)

"Mount Pleasant Optimisation Project Air Quality Impact Assessment", Todoroski Air Sciences, December 2020.

Appendix A

Table A-1: 10-minute average meteorological data – M-WS4 – 22/02/2024 to 24/02/2024

Date & time	Wind speed (m/s)	Wind direction (°)	Sigma theta (°)	Temperature at 2m (°C)	Temperature at 10m (°C)	Relative humidity (%)	Solar radiation (W/m²)	Rain (mm)
22/02/2024 00:00	3.8	176.8	5.7				-2.7	0.0
22/02/2024 00:10	4.0	177.2	6.3				-2.6	0.0
22/02/2024 00:20	3.9	179.0	5.6				-2.7	0.0
22/02/2024 00:30	3.6	182.3	7.8				-2.7	0.0
22/02/2024 00:40	2.7	184.3	9.5				-2.8	0.0
22/02/2024 00:50	2.7	182.8	8.6				-2.8	0.0
22/02/2024 01:00	2.7	177.5	7.6				-2.6	0.0
22/02/2024 01:10	2.1	181.9	7.2				-2.4	0.0
22/02/2024 01:20	2.0	184.1	9.6				-2.5	0.0
22/02/2024 01:30	2.3	178.5	6.1				-2.5	0.0
22/02/2024 01:40	1.8	178.9	6.2				-2.5	0.0
22/02/2024 01:50	2.5	177.3	3.9				-2.5	0.0
22/02/2024 02:00	2.0	178.9	7.2				-2.4	0.0
22/02/2024 02:10	1.8	177.4	8.0				-2.5	0.0
22/02/2024 02:20	2.0	175.8	5.6				-2.5	0.0
22/02/2024 02:30	1.8	176.1	5.4				-2.5	0.0
22/02/2024 02:40	1.7	173.3	6.3				-2.5	0.0
22/02/2024 02:50	1.6	175.2	7.0				-2.7	0.0
22/02/2024 03:00	1.1	187.4	8.3				-2.4	0.0
22/02/2024 03:10	1.3	171.6	10.9				-2.1	0.0
22/02/2024 03:20	1.2	151.9	13.1				-2.1	0.0
22/02/2024 03:30	1.4	150.4	12.8				-2.1	0.0
22/02/2024 03:40	1.1	147.5	10.1				-2.2	0.0
22/02/2024 03:50	1.6	157.7	10.9				-2.0	0.0
22/02/2024 04:00	1.6	159.7	10.3				-1.9	0.0
22/02/2024 04:10	0.8	147.5	27.8				-1.8	0.0
22/02/2024 04:20	1.1	106.7	14.2				-1.5	0.0
22/02/2024 04:30	1.1	49.0	10.8				-1.1	0.0
22/02/2024 04:40	1.7	12.6	7.7				-0.8	0.0
22/02/2024 04:50	1.5	24.0	8.0				-1.2	0.0
22/02/2024 05:00	1.5	18.5	8.8				-1.4	0.0
22/02/2024 05:10	0.9	357.5	14.8				-1.3	0.0
22/02/2024 05:20	0.9	2.9	12.7				-1.3	0.0
22/02/2024 05:30	0.6	320.5	23.9				-1.2	0.0
22/02/2024 05:40	0.8	23.5	13.2				-0.6	0.0
22/02/2024 05:50	0.3	77.6	26.3				1.0	0.0
22/02/2024 06:00	0.7	92.6	15.7				4.7	0.0
22/02/2024 06:10	0.8	109.7	12.0				9.7	0.0
22/02/2024 06:20	0.2	79.3	33.0				17.1	0.0
22/02/2024 06:30	0.3	110.7	21.1				32.4	0.0
22/02/2024 06:40	0.6	156.3	12.3				45.4	0.0
22/02/2024 06:50	0.4	145.4	23.0				64.2	0.0
22/02/2024 07:00	0.5	110.6	16.9				83.6	0.0
22/02/2024 07:10	0.4	151.5	22.5				87.3	0.0
22/02/2024 07:20	0.3	142.0	42.9				123.7	0.0
22/02/2024 07:30	0.7	291.2	18.3				156.9	0.0

22/02/2024 07:40	0.9	28.1	21.0				179.1	0.0
22/02/2024 07:50	1.1	34.4	22.4				246.2	0.0
22/02/2024 08:00	1.3	29.1	24.0				293.0	0.0
22/02/2024 08:10	0.6	81.4	34.1				262.7	0.0
22/02/2024 08:20	1.1	148.0	31.9				515.7	0.0
22/02/2024 08:30	1.4	136.6	21.6				505.0	0.0
22/02/2024 08:40	1.6	121.7	21.1				570.1	0.0
22/02/2024 08:50	1.2	145.9	24.5				587.5	0.0
22/02/2024 09:00	1.5	150.5	24.9				401.2	0.0
22/02/2024 09:10	2.0	156.3	20.6				720.3	0.0
22/02/2024 09:20	1.0	120.7	55.7				742.6	0.0
22/02/2024 09:30	1.2	184.1	30.4				740.2	0.0
22/02/2024 09:40	0.7	228.2	52.1				730.1	0.0
22/02/2024 09:50	0.5	131.4	41.4				765.2	0.0
22/02/2024 10:00	1.1	131.3	46.8				793.2	0.0
22/02/2024 10:10	1.1	122.0	38.5				817.0	0.0
22/02/2024 10:20	1.2	67.7	38.2				853.0	0.0
22/02/2024 10:30	2.0	101.2	31.3				861.0	0.0
22/02/2024 10:40	1.7	94.9	34.2				872.0	0.0
22/02/2024 10:50	1.9	148.2	23.6				890.0	0.0
22/02/2024 11:00	2.1	133.3	20.8				907.0	0.0
22/02/2024 11:10	1.8	114.8	22.6				917.0	0.0
22/02/2024 11:20	2.2	138.7	25.4				929.0	0.0
22/02/2024 11:30	1.5	165.0	31.4				934.0	0.0
22/02/2024 11:40	2.1	166.1	28.1				943.0	0.0
22/02/2024 11:50	1.5	146.3	25.9				945.0	0.0
22/02/2024 12:00	2.5	151.1	17.2				956.0	0.0
22/02/2024 12:10	2.6	129.4	25.4				953.0	0.0
22/02/2024 12:20	2.2	156.2	27.9				950.0	0.0
22/02/2024 12:30	2.5	135.6	21.2				944.0	0.0
22/02/2024 12:40	2.0	152.5	27.6				934.0	0.0
22/02/2024 12:50	1.5	130.3	46.7				923.0	0.0
22/02/2024 13:00	2.9	120.3	17.1				916.0	0.0
22/02/2024 13:10	2.6	113.4	18.2				906.0	0.0
22/02/2024 13:20	2.7	142.7	19.0				896.0	0.0
22/02/2024 13:30	2.2	163.3	18.6				891.0	0.0
22/02/2024 13:40	2.3	162.1	16.5				888.0	0.0
22/02/2024 13:50	2.5	157.7	12.5				711.1	0.0
22/02/2024 14:00	1.4	174.6	29.1				637.4	0.0
22/02/2024 14:10	1.8	133.7	16.6				702.7	0.0
22/02/2024 14:20	2.0	141.1	12.9				204.2	0.0
22/02/2024 14:30	0.7	113.1	40.1				167.7	0.0
22/02/2024 14:40	2.0	127.2	12.2				310.9	0.0
22/02/2024 14:50	1.2	102.1	16.0				111.4	0.0
22/02/2024 15:00	0.8	134.4	18.6				197.1	0.0
22/02/2024 15:10	1.5	124.0	26.8				733.0	0.0
22/02/2024 15:20	1.2	41.5	33.8				272.5	0.0
22/02/2024 15:30	1.7	44.6	26.9				202.7	0.0
22/02/2024 15:40	1.5	116.0	36.8				139.0	0.0
22/02/2024 15:50	1.1	143.7	14.8				152.2	0.0
22/02/2024 16:00	1.7	162.0	5.7				109.4	0.0
22/02/2024 16:10	1.6	134.3	13.7				347.3	0.0

22/02/2024 16:20	1.2	121.1	22.6				466.6	0.0
22/02/2024 16:30	1.2	74.2	39.2				288.8	0.0
22/02/2024 16:40	2.2	51.3	11.4				130.5	0.0
22/02/2024 16:50	1.5	87.5	14.8				153.7	0.0
22/02/2024 17:00	1.0	103.4	24.1				80.9	0.0
22/02/2024 17:10	1.1	155.6	10.7				68.9	0.0
22/02/2024 17:20	2.0	164.7	3.6				84.2	0.0
22/02/2024 17:30	1.8	163.5	4.6				81.0	0.0
22/02/2024 17:40	1.6	162.2	3.7				68.2	0.0
22/02/2024 17:50	0.9	142.0	15.8				52.4	0.0
22/02/2024 18:00	0.8	140.8	9.7				28.3	0.0
22/02/2024 18:10	0.6	129.3	13.3				16.3	0.0
22/02/2024 18:20	0.2	84.3	41.9				9.0	0.0
22/02/2024 18:30	1.1	118.7	8.6				4.4	0.0
22/02/2024 18:40	0.8	138.8	14.1				1.3	0.0
22/02/2024 18:50	1.7	146.5	13.6				-1.2	0.0
22/02/2024 19:00	2.0	129.6	9.1				-2.2	0.0
22/02/2024 19:10	1.8	128.5	10.4				-2.6	0.0
22/02/2024 19:20	1.6	150.0	10.9				-2.6	0.0
22/02/2024 19:30	2.3	159.0	7.3				-2.7	0.0
22/02/2024 19:40	2.8	165.7	4.4				-3.6	0.0
22/02/2024 19:50	2.0	157.5	7.9				-3.3	0.0
22/02/2024 20:00	1.4	136.7	9.4				-3.6	0.0
22/02/2024 20:10	1.2	121.5	7.6				-4.1	0.0
22/02/2024 20:20	1.4	312.3	34.2				-3.1	0.0
22/02/2024 20:30	1.6	318.8	12.8				-4.5	0.0
22/02/2024 20:40	2.4	339.1	11.7				-2.7	0.0
22/02/2024 20:50	2.3	338.8	12.0				-3.5	0.0
22/02/2024 21:00	2.3	347.8	12.4				-3.4	0.0
22/02/2024 21:10	3.0	342.8	9.2				-2.6	0.0
22/02/2024 21:20	3.9	344.4	8.6				-3.2	0.0
22/02/2024 21:30	4.3	354.8	7.9				-3.5	0.0
22/02/2024 21:40	4.6	354.7	9.4				-3.9	0.0
22/02/2024 21:50	3.4	16.6	10.5				-2.8	0.0
22/02/2024 22:00	3.1	19.4	7.9				-2.5	0.0
22/02/2024 22:10	3.7	354.5	8.5				-3.0	0.0
22/02/2024 22:20	3.7	346.8	12.4				-3.6	0.0
22/02/2024 22:30	4.8	357.9	8.5				-3.7	0.0
22/02/2024 22:40	5.1	357.7	8.9				-1.9	0.0
22/02/2024 22:50	4.0	347.0	9.8				-1.8	0.0
22/02/2024 23:00	3.4	340.2	9.6				-2.8	0.0
22/02/2024 23:10	3.2	342.7	8.7				-3.0	0.0
22/02/2024 23:20	3.6	346.7	8.5				-4.1	0.0
22/02/2024 23:30	4.0	353.5	6.4				-4.6	0.0
22/02/2024 23:40	3.9	8.3	13.6				-4.0	0.0
22/02/2024 23:50	3.9	11.0	5.7				-2.8	0.0
23/02/2024 00:00	3.9	13.6	5.9				-3.1	0.0
23/02/2024 00:10	3.7	7.1	6.3				-3.3	0.0
23/02/2024 00:20	3.4	4.2	5.5				-3.1	0.0
23/02/2024 00:30	3.2	12.7	6.3				-3.1	0.0
23/02/2024 00:40	1.5	340.6	19.6				-3.0	0.0
23/02/2024 00:50	1.3	286.0	30.9				-3.5	0.0

23/02/2024 01:00	1.7	319.3	17.1				-3.8	0.0
23/02/2024 01:10	1.7	310.6	13.3				-3.9	0.0
23/02/2024 01:20	2.2	282.3	6.1				-3.8	0.0
23/02/2024 01:30	2.0	293.1	10.7				-4.0	0.0
23/02/2024 01:40	1.8	304.9	6.7				-3.9	0.0
23/02/2024 01:50	2.1	301.5	6.2				-3.6	0.0
23/02/2024 02:00	1.9	331.5	9.8				-3.7	0.0
23/02/2024 02:10	1.9	315.9	11.9				-3.1	0.0
23/02/2024 02:20	1.6	298.7	11.8				-3.2	0.0
23/02/2024 02:30	2.2	263.0	6.9				-3.6	0.0
23/02/2024 02:40	1.8	277.6	11.0				-4.2	0.0
23/02/2024 02:50	2.2	291.0	10.0				-4.3	0.0
23/02/2024 03:00	2.0	292.1	8.3				-4.1	0.0
23/02/2024 03:10	2.1	304.9	9.9				-4.4	0.0
23/02/2024 03:20	1.9	330.5	15.1				-3.9	0.0
23/02/2024 03:30	1.5	332.7	16.2				-3.7	0.0
23/02/2024 03:40	2.0	325.2	8.5				-3.4	0.0
23/02/2024 03:50	1.9	316.7	7.7				-3.0	0.0
23/02/2024 04:00	2.1	325.7	8.6				-3.1	0.0
23/02/2024 04:10	2.0	307.1	8.1				-3.4	0.0
23/02/2024 04:20	2.2	296.1	9.6				-3.6	0.0
23/02/2024 04:30	2.1	307.5	18.3				-3.6	0.0
23/02/2024 04:40	2.2	296.3	7.4				-3.4	0.0
23/02/2024 04:50	2.3	281.4	8.2				-3.6	0.0
23/02/2024 05:00	2.5	294.6	6.1				-4.0	0.0
23/02/2024 05:10	2.4	312.2	7.0				-4.1	0.0
23/02/2024 05:20	2.2	302.5	3.2				-3.5	0.0
23/02/2024 05:30	2.1	298.3	5.0				-3.1	0.0
23/02/2024 05:40	2.0	297.1	4.5				-1.2	0.0
23/02/2024 05:50	1.9	294.8	8.1				3.5	0.0
23/02/2024 06:00	1.8	286.3	6.6				11.1	0.0
23/02/2024 06:10	1.5	297.2	16.7				28.4	0.0
23/02/2024 06:20	1.5	310.1	6.4				50.5	0.0
23/02/2024 06:30	1.4	303.0	14.0				77.1	0.0
23/02/2024 06:40	1.3	292.2	13.3				106.6	0.0
23/02/2024 06:50	1.4	313.1	13.6				139.3	0.0
23/02/2024 07:00	2.0	0.6	15.5				173.5	0.0
23/02/2024 07:10	3.4	11.7	8.1				209.9	0.0
23/02/2024 07:20	3.2	9.9	7.8				246.9	0.0
23/02/2024 07:30	3.7	14.7	8.4				282.2	0.0
23/02/2024 07:40	3.6	9.2	13.5				318.2	0.0
23/02/2024 07:50	4.1	8.6	12.5				355.2	0.0
23/02/2024 08:00	4.6	10.5	10.3				392.3	0.0
23/02/2024 08:10	4.9	359.4	11.2				428.0	0.0
23/02/2024 08:20	5.3	358.0	12.6				466.7	0.0
23/02/2024 08:30	6.1	1.9	11.6				503.0	0.0
23/02/2024 08:40	5.5	357.4	12.7				538.3	0.0
23/02/2024 08:50	5.7	332.1	12.6				572.3	0.0
23/02/2024 09:00	6.5	326.0	12.5				610.2	0.0
23/02/2024 09:10	5.5	320.3	12.3				640.9	0.0
23/02/2024 09:20	5.0	324.6	9.9				672.0	0.0
23/02/2024 09:30	4.8	323.8	12.4				702.7	0.0

23/02/2024 09:40	5.8	324.9	12.3				733.1	0.0
23/02/2024 09:50	6.7	331.7	8.9				761.8	0.0
23/02/2024 10:00	5.8	327.9	9.7				786.0	0.0
23/02/2024 10:10	5.9	327.6	11.6				811.0	0.0
23/02/2024 10:20	6.6	341.7	10.0				835.0	0.0
23/02/2024 10:30	6.9	334.1	11.7				855.0	0.0
23/02/2024 10:40	6.3	340.4	11.7				871.0	0.0
23/02/2024 10:50	6.5	345.0	13.2				889.0	0.0
23/02/2024 11:00	6.5	336.9	10.6				905.0	0.0
23/02/2024 11:10	5.9	328.0	13.0				917.0	0.0
23/02/2024 11:20	6.0	340.0	14.6				925.0	0.0
23/02/2024 11:30	6.5	333.9	15.5				946.0	0.0
23/02/2024 11:40	6.7	350.7	11.5				954.0	0.0
23/02/2024 11:50	7.0	334.5	12.7				953.0	0.0
23/02/2024 12:00	7.4	349.2	10.8				922.0	0.0
23/02/2024 12:10	7.1	335.3	13.5				986.0	0.0
23/02/2024 12:20	7.4	335.1	16.0				974.0	0.0
23/02/2024 12:30	6.8	326.9	13.8				916.0	0.0
23/02/2024 12:40	6.6	333.1	13.3				819.0	0.0
23/02/2024 12:50	6.7	339.6	16.2				777.0	0.0
23/02/2024 13:00	5.7	321.3	16.9				667.3	0.0
23/02/2024 13:10	8.8	288.6	16.8				183.9	2.6
23/02/2024 13:20	0.8	27.2	35.9				580.7	0.4
23/02/2024 13:30	0.2	194.7	69.9				837.0	0.0
23/02/2024 13:40	2.0	296.7	52.6				777.1	0.0
23/02/2024 13:50	3.9	319.9	11.2				212.7	0.0
23/02/2024 14:00	5.4	302.1	6.2				192.2	0.0
23/02/2024 14:10	4.6	318.9	18.1				869.0	0.0
23/02/2024 14:20	3.6	336.9	12.9				407.9	0.0
23/02/2024 14:30	3.1	354.4	8.5				313.6	0.0
23/02/2024 14:40	5.7	342.4	11.4				263.7	0.0
23/02/2024 14:50	6.9	346.6	9.2				221.8	0.0
23/02/2024 15:00	4.0	349.2	14.4				175.6	0.0
23/02/2024 15:10	4.7	1.2	11.3				152.0	0.6
23/02/2024 15:20	6.2	344.2	13.5				164.3	1.2
23/02/2024 15:30	9.5	11.4	19.6				673.4	4.2
23/02/2024 15:40	2.5	37.2	19.8				476.2	0.0
23/02/2024 15:50	1.2	12.0	9.7				365.6	0.0
23/02/2024 16:00	2.9	0.3	11.5				309.3	0.0
23/02/2024 16:10	4.4	351.0	11.2				114.2	0.0
23/02/2024 16:20	3.8	13.3	9.7				131.5	0.0
23/02/2024 16:30	1.2	268.3	19.3				62.7	0.0
23/02/2024 16:40	4.2	230.4	15.4				52.3	0.0
23/02/2024 16:50	3.2	215.0	6.6				108.8	0.0
23/02/2024 17:00	1.6	152.5	24.5				137.8	0.0
23/02/2024 17:10	3.4	118.1	9.7				88.5	0.0
23/02/2024 17:20	1.4	157.7	19.6				45.5	0.0
23/02/2024 17:30	1.9	120.0	28.7				25.3	0.0
23/02/2024 17:40	3.6	206.9	15.9				4.7	0.0
23/02/2024 17:50	3.3	183.5	10.2				7.6	0.0
23/02/2024 18:00	2.2	160.5	15.5				37.2	2.0
23/02/2024 18:10	4.7	101.8	7.0				39.8	0.4

23/02/2024 18:20	5.2	79.1	7.2				15.9	0.0
23/02/2024 18:30	4.6	62.6	6.6				7.5	0.0
23/02/2024 18:40	3.6	43.1	11.2				1.6	0.0
23/02/2024 18:50	3.1	17.8	11.2				-0.7	0.0
23/02/2024 19:00	2.0	39.7	18.4				-2.7	0.0
23/02/2024 19:10	1.1	254.1	45.1				-1.0	0.0
23/02/2024 19:20	2.4	301.0	11.5				-0.8	0.0
23/02/2024 19:30	3.9	334.6	12.4				-1.0	0.0
23/02/2024 19:40	6.1	359.1	13.2				1.6	0.2
23/02/2024 19:50	3.8	32.3	21.9				-0.7	0.2
23/02/2024 20:00	1.6	329.8	25.4				-2.9	0.0
23/02/2024 20:10	3.3	354.5	11.9				-3.0	0.0
23/02/2024 20:20	2.8	341.3	11.4				-2.4	0.0
23/02/2024 20:30	3.4	6.3	12.8				-3.3	0.0
23/02/2024 20:40	3.4	5.8	13.1				-3.7	0.0
23/02/2024 20:50	4.1	347.4	11.5				-3.5	0.0
23/02/2024 21:00	4.1	357.6	9.4				-2.5	0.0
23/02/2024 21:10	3.5	346.4	13.5				-1.7	0.0
23/02/2024 21:20	4.0	10.8	10.6				-1.5	0.0
23/02/2024 21:30	4.1	11.7	5.8				-1.8	0.0
23/02/2024 21:40	3.0	31.3	11.8				-1.6	0.0
23/02/2024 21:50	3.9	3.8	10.9				-2.1	0.0
23/02/2024 22:00	3.6	345.4	11.6				-2.0	0.2
23/02/2024 22:10	3.3	329.9	13.0				-2.0	0.0
23/02/2024 22:20	2.6	318.0	7.6				-2.2	0.0
23/02/2024 22:30	0.9	292.9	28.6				-2.1	0.0
23/02/2024 22:40	0.4	69.7	41.4				-2.1	0.0
23/02/2024 22:50	1.6	119.2	25.5				-2.0	0.0
23/02/2024 23:00	2.5	117.5	14.6				-2.6	0.0
23/02/2024 23:10	2.1	161.1	9.1				-2.8	0.0
23/02/2024 23:20	3.2	157.9	7.9				-1.7	0.0
23/02/2024 23:30	4.8	164.0	4.4				-1.0	0.0
23/02/2024 23:40	4.5	171.3	5.9				-1.6	0.0
23/02/2024 23:50	4.5	174.4	7.7				-1.6	0.0
24/02/2024 00:00	5.3	172.1	5.6				-1.3	0.0
24/02/2024 00:10	4.5	173.1	8.9				-1.4	0.0
24/02/2024 00:20	4.6	170.2	6.9				-1.4	0.0
24/02/2024 00:30	4.4	173.3	8.3				-1.8	0.0
24/02/2024 00:40	4.4	176.8	7.0				-2.1	0.0
24/02/2024 00:50	5.6	169.3	6.0				-2.1	0.0
24/02/2024 01:00	5.0	174.1	8.9				-1.9	0.0
24/02/2024 01:10	5.2	171.5	5.5				-2.2	0.0
24/02/2024 01:20	4.7	169.2	4.6				-2.0	0.0
24/02/2024 01:30	4.5	169.5	7.4				-2.0	0.0
24/02/2024 01:40	4.9	168.1	8.5				-2.1	0.0
24/02/2024 01:50	4.8	166.0	4.8				-2.0	0.0
24/02/2024 02:00	5.4	169.7	6.5				-2.1	0.0
24/02/2024 02:10	4.9	164.2	4.8				-2.1	0.0
24/02/2024 02:20	5.0	166.0	5.5				-2.2	0.0
24/02/2024 02:30	5.0	160.4	5.8				-1.6	0.0
24/02/2024 02:40	5.0	160.1	7.5				-1.5	0.0
24/02/2024 02:50	3.9	159.2	8.7				-1.5	0.0

24/02/2024 03:00	4.5	166.0	6.5				-1.3	0.0
24/02/2024 03:10	4.8	167.6	6.7				-1.2	0.0
24/02/2024 03:20	4.1	160.7	6.3				-1.3	0.0
24/02/2024 03:30	4.3	159.2	7.9				-1.5	0.0
24/02/2024 03:40	3.0	154.1	12.6				-2.0	0.0
24/02/2024 03:50	3.0	171.2	7.6				-2.3	0.0
24/02/2024 04:00	2.4	180.7	6.4				-2.5	0.0
24/02/2024 04:10	3.5	173.6	6.0				-2.5	0.0
24/02/2024 04:20	4.0	168.8	4.6				-2.3	0.0
24/02/2024 04:30	3.5	170.8	5.6				-2.3	0.0
24/02/2024 04:40	3.8	171.4	4.6				-2.7	0.0
24/02/2024 04:50	3.6	170.7	5.5				-2.6	0.0
24/02/2024 05:00	3.6	170.5	4.8				-2.2	0.0
24/02/2024 05:10	4.2	163.5	4.8				-2.1	0.0
24/02/2024 05:20	3.6	160.3	6.6				-1.7	0.0
24/02/2024 05:30	4.3	160.8	8.6				-1.4	0.0
24/02/2024 05:40	4.1	151.3	11.0				-0.6	0.0
24/02/2024 05:50	4.1	157.8	8.2				2.1	0.0
24/02/2024 06:00	3.6	152.9	11.8				4.7	0.0
24/02/2024 06:10	5.8	161.4	9.1				7.5	0.0
24/02/2024 06:20	6.9	163.9	7.2				16.8	0.0
24/02/2024 06:30	6.8	161.2	6.0				24.2	0.0
24/02/2024 06:40	6.2	166.1	6.4				39.3	0.0
24/02/2024 06:50	5.1	170.2	7.5				20.4	0.0
24/02/2024 07:00	6.0	163.1	7.5				18.2	0.0
24/02/2024 07:10	5.8	161.5	7.6				24.6	0.0
24/02/2024 07:20	5.6	158.4	4.9				39.4	0.2
24/02/2024 07:30	5.5	162.2	9.2				39.0	0.0
24/02/2024 07:40	5.2	165.0	6.5				44.4	0.0
24/02/2024 07:50	4.5	161.7	7.2				47.9	0.0
24/02/2024 08:00	5.0	162.9	10.1				38.0	0.0
24/02/2024 08:10	5.4	158.5	6.6				47.7	0.0
24/02/2024 08:20	5.4	162.9	8.7				48.3	0.0
24/02/2024 08:30	5.4	164.6	6.6				51.4	0.0
24/02/2024 08:40	4.0	160.7	6.6				76.0	0.0
24/02/2024 08:50	4.8	166.6	12.4				98.3	0.0
24/02/2024 09:00	5.7	162.8	6.7				112.2	0.0
24/02/2024 09:10	4.8	152.6	10.6				182.7	0.0
24/02/2024 09:20	3.8	146.2	12.0				178.8	0.0
24/02/2024 09:30	4.6	151.5	12.1				243.5	0.0
24/02/2024 09:40	6.7	160.7	5.6				218.2	0.0
24/02/2024 09:50	6.5	159.6	6.5				126.9	0.0
24/02/2024 10:00	5.7	163.0	5.5				107.2	0.0
24/02/2024 10:10	5.2	158.7	7.3				115.5	0.0
24/02/2024 10:20	4.0	157.6	10.5				132.6	0.0
24/02/2024 10:30	6.1	166.2	7.2				136.5	0.0
24/02/2024 10:40	6.2	165.5	5.5				103.6	0.0
24/02/2024 10:50	6.2	164.1	6.2				164.9	0.0
24/02/2024 11:00	6.3	160.5	5.9				315.4	0.0
24/02/2024 11:10	6.0	165.3	10.8				260.5	0.0
24/02/2024 11:20	5.8	166.6	6.5				266.5	0.0
24/02/2024 11:30	5.8	161.0	7.5				276.2	0.0

24/02/2024 11:40	5.9	161.6	7.2				267.6	0.0
24/02/2024 11:50	5.8	161.1	9.2				347.6	0.0
24/02/2024 12:00	6.8	161.0	7.7				499.5	0.0
24/02/2024 12:10	6.3	157.7	8.7				438.2	0.0
24/02/2024 12:20	6.5	153.4	7.8				379.7	0.0
24/02/2024 12:30	5.9	160.1	6.9				302.4	0.0
24/02/2024 12:40	7.4	169.2	7.3				226.2	0.0
24/02/2024 12:50	7.4	167.7	5.9				264.5	0.0
24/02/2024 13:00	7.5	168.5	5.0				302.9	0.0
24/02/2024 13:10	7.8	164.7	7.9				212.6	0.0
24/02/2024 13:20	7.9	161.9	4.7				254.4	0.0
24/02/2024 13:30	7.1	168.6	6.0				172.8	0.0
24/02/2024 13:40	6.9	170.9	6.1				157.9	0.0
24/02/2024 13:50	7.7	169.3	5.4				132.3	0.0
24/02/2024 14:00	7.8	165.5	6.4				94.4	0.0
24/02/2024 14:10	7.6	162.7	6.5				116.6	0.0
24/02/2024 14:20	7.5	161.3	5.8				202.8	0.0
24/02/2024 14:30	7.1	165.2	8.1				161.0	0.0
24/02/2024 14:40	6.7	164.7	8.2				105.7	0.0
24/02/2024 14:50	7.9	163.9	6.9				148.7	0.0
24/02/2024 15:00	7.9	162.3	7.1				223.9	0.0
24/02/2024 15:10	8.6	161.8	6.2				151.6	0.0
24/02/2024 15:20	8.8	158.6	8.1				293.0	0.0
24/02/2024 15:30	5.7	150.6	9.3				254.2	0.0
24/02/2024 15:40	6.5	153.7	10.1				181.3	0.0
24/02/2024 15:50	7.6	159.3	6.7				129.0	0.0
24/02/2024 16:00	5.5	154.1	7.9				207.8	0.0
24/02/2024 16:10	7.7	159.3	5.5				212.9	0.0
24/02/2024 16:20	7.8	162.1	7.5				196.9	0.0
24/02/2024 16:30	5.7	155.8	9.3				131.2	0.0
24/02/2024 16:40	5.9	156.6	8.9				79.0	0.0
24/02/2024 16:50	6.8	163.1	6.9				87.6	0.0
24/02/2024 17:00	6.6	161.9	6.0				77.7	0.0
24/02/2024 17:10	6.4	151.6	9.4				88.0	0.0
24/02/2024 17:20	5.6	145.2	9.1				64.6	0.0
24/02/2024 17:30	5.3	153.9	9.0				73.4	0.0
24/02/2024 17:40	6.1	151.1	7.2				79.9	0.0
24/02/2024 17:50	5.6	153.3	9.1				64.7	0.0
24/02/2024 18:00	6.3	154.9	10.2				59.6	0.0
24/02/2024 18:10	7.1	159.1	6.8				38.9	0.0
24/02/2024 18:20	5.9	155.0	8.5				25.8	0.0
24/02/2024 18:30	4.4	149.9	10.1				13.3	0.0
24/02/2024 18:40	4.6	155.1	9.8				5.7	0.0
24/02/2024 18:50	5.6	151.8	9.5				4.4	0.0
24/02/2024 19:00	6.1	150.5	8.8				-0.1	0.0
24/02/2024 19:10	6.0	157.4	9.4				-0.8	0.0
24/02/2024 19:20	6.6	162.5	5.9				-0.6	0.0
24/02/2024 19:30	5.9	160.7	7.4				-1.1	0.0
24/02/2024 19:40	5.4	161.8	6.6				-1.3	0.0
24/02/2024 19:50	5.9	161.9	5.1				-1.5	0.0
24/02/2024 20:00	4.5	157.6	9.2				-1.3	0.0
24/02/2024 20:10	4.1	157.1	9.8				-1.2	0.0

24/02/2024 20:20	4.4	157.7	7.6				-1.0	0.0
24/02/2024 20:30	5.8	164.1	4.9				-0.7	0.0
24/02/2024 20:40	6.2	163.7	5.8				-0.8	0.0
24/02/2024 20:50	6.7	165.4	4.8				-1.4	0.0
24/02/2024 21:00	5.8	164.1	5.2				-1.7	0.0
24/02/2024 21:10	6.1	162.3	5.4				-1.7	0.0
24/02/2024 21:20	5.2	158.9	9.0				-2.2	0.0
24/02/2024 21:30	5.5	158.7	8.7				-1.6	0.0
24/02/2024 21:40	5.6	160.3	6.1				-1.9	0.0
24/02/2024 21:50	5.3	165.2	5.6				-2.0	0.0
24/02/2024 22:00	5.5	162.4	6.7				-0.9	0.0
24/02/2024 22:10	5.3	159.7	5.6				-1.3	0.0
24/02/2024 22:20	5.0	159.3	6.4				-1.3	0.0
24/02/2024 22:30	4.3	157.3	6.2				-1.7	0.0
24/02/2024 22:40	3.8	161.1	6.6				-1.6	0.0
24/02/2024 22:50	3.4	163.4	5.4				-1.4	0.0
24/02/2024 23:00	3.2	170.9	8.1				-1.3	0.0
24/02/2024 23:10	2.8	180.1	8.1				-1.0	0.0
24/02/2024 23:20	2.7	185.6	9.8				-1.2	0.0
24/02/2024 23:30	3.4	173.4	8.0				-1.3	0.0
24/02/2024 23:40	3.4	177.6	7.4				-1.3	0.0
24/02/2024 23:50	3.2	178.6	8.2				-1.2	0.0

Table A-2: 10-minute average meteorological data – M-WS4 – 2/09/2024 to 4/09/2024

Date & time	Wind speed (m/s)	Wind direction (°)	Sigma theta (°)	Temperature at 2m (°C)	Temperature at 10m (°C)	Relative humidity (%)	Solar radiation (W/m²)	Rain (mm)
2/09/2024 00:00	2.5	295.8	8.1	17.5	19.8	43.1	0.3	0.0
2/09/2024 00:10	2.2	298.9	14.0	16.5	18.8	48.2	-0.1	0.0
2/09/2024 00:20	3.0	289.7	7.6	17.0	18.7	45.6	1.1	0.0
2/09/2024 00:30	1.7	295.5	29.8	15.9	18.0	49.4	0.0	0.0
2/09/2024 00:40	0.8	7.6	21.1	13.6	15.8	65.1	-1.3	0.0
2/09/2024 00:50	1.2	12.8	17.3	13.1	14.1	73.1	-0.5	0.0
2/09/2024 01:00	1.4	3.8	14.1	13.2	14.0	75.7	1.2	0.0
2/09/2024 01:10	2.1	339.8	7.0	13.3	13.9	75.7	1.7	0.0
2/09/2024 01:20	2.8	343.3	8.4	13.6	14.4	74.1	2.1	0.0
2/09/2024 01:30	3.7	344.4	6.4	13.5	14.4	74.0	1.6	0.0
2/09/2024 01:40	3.1	336.5	8.8	13.5	14.4	74.3	1.6	0.0
2/09/2024 01:50	2.4	315.0	11.2	13.3	13.8	74.8	0.8	0.0
2/09/2024 02:00	2.6	301.7	8.9	12.9	13.4	76.9	1.1	0.0
2/09/2024 02:10	3.1	298.8	7.0	12.9	13.3	76.6	1.4	0.0
2/09/2024 02:20	3.1	294.1	5.3	12.8	13.7	75.3	1.8	0.0
2/09/2024 02:30	3.3	294.9	4.7	13.4	14.3	71.4	1.9	0.0
2/09/2024 02:40	3.1	299.4	8.2	13.6	14.3	70.1	1.4	0.0
2/09/2024 02:50	3.2	291.8	6.1	13.2	14.0	70.9	1.2	0.0
2/09/2024 03:00	3.3	296.8	7.3	13.3	13.9	72.7	1.3	0.0
2/09/2024 03:10	2.9	306.6	6.6	13.4	13.8	73.0	1.4	0.0
2/09/2024 03:20	2.6	310.3	3.7	13.6	14.1	71.9	1.5	0.0
2/09/2024 03:30	3.0	309.9	6.1	13.5	14.0	71.8	1.3	0.0
2/09/2024 03:40	3.2	299.7	10.0	13.1	13.8	72.9	1.2	0.0
2/09/2024 03:50	3.3	291.2	8.3	13.2	13.7	72.9	1.3	0.0

2/09/2024 04:00	3.1	288.0	12.3	13.4	14.2	71.5	1.5	0.0
2/09/2024 04:10	3.1	290.5	10.3	13.8	14.4	70.1	1.5	0.0
2/09/2024 04:20	2.9	296.8	10.3	13.6	14.5	70.5	1.2	0.0
2/09/2024 04:30	3.0	293.8	10.1	13.6	14.4	70.7	1.3	0.0
2/09/2024 04:40	2.7	291.5	9.2	13.7	14.3	70.1	1.2	0.0
2/09/2024 04:50	2.6	300.3	24.5	13.9	14.5	69.8	1.4	0.0
2/09/2024 05:00	2.8	310.7	18.1	14.2	15.6	67.1	2.2	0.0
2/09/2024 05:10	2.4	308.8	16.2	14.1	15.2	68.1	1.0	0.0
2/09/2024 05:20	3.1	300.5	21.9	15.0	17.2	60.8	2.8	0.0
2/09/2024 05:30	2.7	300.1	21.4	16.3	18.4	52.0	1.6	0.0
2/09/2024 05:40	3.2	301.9	12.9	17.1	19.3	45.3	1.7	0.0
2/09/2024 05:50	3.8	299.4	10.1	17.3	19.7	42.0	0.8	0.0
2/09/2024 06:00	3.7	299.7	7.3	18.2	20.2	35.8	0.9	0.0
2/09/2024 06:10	3.7	306.0	11.4	18.3	20.0	35.3	2.1	0.0
2/09/2024 06:20	4.3	309.8	10.4	18.0	19.8	35.9	6.3	0.0
2/09/2024 06:30	4.6	314.4	7.4	18.8	20.1	31.1	12.5	0.0
2/09/2024 06:40	4.3	317.1	8.6	18.8	20.0	29.7	21.0	0.0
2/09/2024 06:50	4.2	319.1	8.4	18.8	19.8	29.9	43.1	0.0
2/09/2024 07:00	3.9	325.9	13.1	18.7	19.7	30.4	74.4	0.0
2/09/2024 07:10	4.0	322.8	9.2	19.4	20.2	26.9	106.2	0.0
2/09/2024 07:20	4.0	331.1	7.8	19.3	19.8	28.9	138.7	0.0
2/09/2024 07:30	4.9	336.7	13.1	19.6	20.1	26.4	174.1	0.0
2/09/2024 07:40	5.1	340.3	6.8	20.2	20.4	24.9	209.6	0.0
2/09/2024 07:50	6.2	349.0	7.7	20.4	20.5	25.9	245.3	0.0
2/09/2024 08:00	6.9	342.6	5.8	20.6	20.6	26.4	281.5	0.0
2/09/2024 08:10	7.0	343.8	7.9	20.7	20.6	28.3	315.6	0.0
2/09/2024 08:20	7.3	346.4	6.0	21.0	20.9	27.8	349.7	0.0
2/09/2024 08:30	7.0	350.8	8.1	21.3	21.1	27.6	384.4	0.0
2/09/2024 08:40	7.0	348.7	8.4	21.6	21.5	26.6	415.9	0.0
2/09/2024 08:50	6.9	348.0	9.9	21.9	21.7	26.5	446.4	0.0
2/09/2024 09:00	6.0	333.5	7.7	22.3	21.9	25.5	476.7	0.0
2/09/2024 09:10	5.8	332.6	9.7	22.6	22.1	26.1	506.1	0.0
2/09/2024 09:20	4.6	333.8	9.1	23.2	22.8	23.5	533.6	0.0
2/09/2024 09:30	5.2	304.6	12.9	24.1	23.7	15.8	563.3	0.0
2/09/2024 09:40	6.9	309.7	9.6	24.3	24.0	13.0	594.2	0.0
2/09/2024 09:50	7.6	306.2	13.5	24.5	24.2	11.6	621.2	0.0
2/09/2024 10:00	9.1	299.5	10.2	24.7	24.4	10.9	645.9	0.0
2/09/2024 10:10	9.1	296.3	9.9	24.8	24.5	10.7	664.9	0.0
2/09/2024 10:20	10.9	294.5	6.7	24.8	24.6	9.7		0.0
2/09/2024 10:30	10.1	298.0	10.8	25.0	24.7	10.0		0.0
2/09/2024 10:40	10.2	295.8	9.6	25.1	24.7	10.4	717.8	0.0
2/09/2024 10:50	9.7	291.9	9.1	25.2	24.8	11.1	731.4	0.0
2/09/2024 11:00	11.3	288.6	10.1	25.2	24.8	11.3	742.5	0.0
2/09/2024 11:10	13.5	278.9	8.5	25.1	24.6	11.2	756.5	0.0
2/09/2024 11:20	12.6	281.8	9.4	25.0	24.6	11.2	767.8	0.0
2/09/2024 11:30	12.1	284.7	8.9	25.1	24.7	11.8	776.0	0.0
2/09/2024 11:40	11.6	274.6	6.3	25.2	24.7	12.3	781.2	0.0
2/09/2024 11:50	12.7	276.2	8.3	24.9	24.4	12.3	786.3	0.0
2/09/2024 12:00	12.4	277.1	7.6	25.0	24.5	13.0	786.9	0.0
2/09/2024 12:10	12.7	281.1	9.0	24.8	24.3	13.5	785.1	0.0
2/09/2024 12:20	11.7	270.6	8.9	24.9	24.4	12.8	782.0	0.0
2/09/2024 12:30	11.9	268.8	7.2	24.9	24.3	13.3	775.6	0.0

2/09/2024 12:40	10.7	270.3	7.5	24.9	24.3	14.2	766.2	0.0
2/09/2024 12:50	11.6	282.0	5.9	25.1	24.5	14.4	759.2	0.0
2/09/2024 13:00	11.1	283.9	11.4	25.0	24.6	14.0	751.7	0.0
2/09/2024 13:10	10.4	275.6	8.6	24.9	24.5	13.6	741.0	0.0
2/09/2024 13:20	11.5	269.6	8.9	24.9	24.3	13.9	727.6	0.0
2/09/2024 13:30	13.1	269.7	7.1	24.6	24.1	13.1	713.8	0.0
2/09/2024 13:40	13.0	270.2	8.2	24.5	24.0	13.5	698.3	0.0
2/09/2024 13:50	12.9	271.2	9.6	24.4	24.0	14.3	679.2	0.0
2/09/2024 14:00	13.0	281.8	6.2	24.3	23.9	15.7	658.0	0.0
2/09/2024 14:10	14.9	273.5	7.0	24.0	23.6	15.7	636.7	0.0
2/09/2024 14:20	15.6	278.6	6.4	23.6	23.3	16.1	612.8	0.0
2/09/2024 14:30	14.4	283.8	5.7	23.3	23.1	17.7	587.5	0.0
2/09/2024 14:40	13.4	278.3	6.3	23.2	22.9	19.5	559.9	0.0
2/09/2024 14:50	12.2	268.6	6.8	23.2	22.8	20.1	533.0	0.0
2/09/2024 15:00	10.7	271.3	9.1	23.0	22.7	21.8	501.4	0.0
2/09/2024 15:10	11.8	279.8	8.1	22.9	22.7	23.1	473.0	0.0
2/09/2024 15:20	12.4	275.3	6.0	22.6	22.3	22.2	443.3	0.0
2/09/2024 15:30	11.5	270.8	6.3	22.5	22.3	22.5	411.0	0.0
2/09/2024 15:40	13.8	271.9	4.7	22.1	21.8	22.8	378.9	0.0
2/09/2024 15:50	10.9	284.7	8.4	21.8	21.7	24.3	344.6	0.0
2/09/2024 16:00	11.3	279.6	7.1	21.8	21.6	24.4	310.7	0.0
2/09/2024 16:10	10.3	274.8	7.3	21.4	21.3	23.6	276.3	0.0
2/09/2024 16:20	10.7	272.4	8.3	21.0	21.0	23.0	243.3	0.0
2/09/2024 16:30	11.0	270.9	6.7	20.6	20.6	24.4	207.6	0.0
2/09/2024 16:40	8.8	268.6	9.4	20.3	20.4	24.2	172.8	0.0
2/09/2024 16:50	10.4	269.3	7.3	20.0	20.2	24.4	138.4	0.0
2/09/2024 17:00	9.8	275.2	7.3	19.6	19.9	25.6	104.0	0.0
2/09/2024 17:10	10.2	279.7	7.3	19.2	19.5	26.4	72.0	0.0
2/09/2024 17:20	11.2	279.0	8.2	19.0	19.3	26.2	46.2	0.0
2/09/2024 17:30	9.0	278.9	5.9	18.6	19.0	27.0	22.8	0.0
2/09/2024 17:40	8.6	277.7	6.8	18.2	18.8	27.1	9.5	0.0
2/09/2024 17:50	5.8	277.0	8.3	17.9	18.5	27.8	3.6	0.0
2/09/2024 18:00	5.4	271.3	8.3	17.5	18.2	28.8	0.9	0.0
2/09/2024 18:10	5.0	275.5	6.3	16.9	17.9	30.6	-0.1	0.0
2/09/2024 18:20	4.6	269.6	6.3	16.6	17.6	31.0	-0.2	0.0
2/09/2024 18:30	4.3	280.2	6.9	16.1	17.2	32.3	-0.2	0.0
2/09/2024 18:40	2.5	280.6	7.3	15.5	16.8	34.1	-0.4	0.0
2/09/2024 18:50	0.3	121.6	49.9	15.8	16.5	33.5	-0.8	0.0
2/09/2024 19:00	0.4	46.4	68.9	15.3	16.3	34.6	0.3	0.0
2/09/2024 19:10	2.5	271.1	26.1	16.0	16.8	30.2	1.5	0.0
2/09/2024 19:20	2.8	279.8	17.5	15.6	16.7	30.1	0.4	0.0
2/09/2024 19:30	2.7	304.1	8.6	14.8	16.1	32.6	-0.2	0.0
2/09/2024 19:40	3.6	289.1	7.6	14.5	15.8	33.1	0.3	0.0
2/09/2024 19:50	2.9	286.1	8.3	14.2	15.8	33.1	0.2	0.0
2/09/2024 20:00	3.3	282.2	9.9	14.5	15.8	31.4	0.2	0.0
2/09/2024 20:10	2.6	297.4	9.3	14.3	15.7	31.2	0.1	0.0
2/09/2024 20:20	2.3	301.0	6.9	14.2	15.3	31.4	-0.1	0.0
2/09/2024 20:30	2.6	304.4	5.5	13.6	14.7	34.1	0.0	0.0
2/09/2024 20:40	2.6	287.9	10.7	12.8	14.3	37.0	0.0	0.0
2/09/2024 20:50	3.0	294.6	5.8	12.8	14.3	36.3	0.3	0.0
2/09/2024 21:00	2.6	287.9	9.2	12.8	14.2	35.1	0.2	0.0
2/09/2024 21:10	3.6	269.9	10.3	13.0	14.5	33.2	0.7	0.0

2/09/2024 21:20	3.4	281.1	4.8	12.9	14.7	32.6	0.2	0.0
2/09/2024 21:30	2.5	289.8	10.5	12.9	14.4	31.8	0.0	0.0
2/09/2024 21:40	2.8	286.0	5.8	12.9	14.2	30.9	0.3	0.0
2/09/2024 21:50	2.6	279.3	11.2	12.8	14.0	30.1	0.0	0.0
2/09/2024 22:00	2.4	294.4	11.6	12.9	14.2	28.6	0.4	0.0
2/09/2024 22:10	2.8	351.6	9.8	12.4	13.9	30.0	0.0	0.0
2/09/2024 22:20	3.5	345.3	5.6	11.7	12.9	33.7	-0.1	0.0
2/09/2024 22:30	4.2	334.5	5.3	11.8	13.2	34.2	0.5	0.0
2/09/2024 22:40	3.7	322.2	9.2	12.1	13.3	33.9	0.3	0.0
2/09/2024 22:50	4.2	315.2	5.0	12.4	13.3	32.6	0.4	0.0
2/09/2024 23:00	4.6	306.1	7.2	12.1	13.3	33.3	0.3	0.0
2/09/2024 23:10	4.8	297.1	8.2	12.2	13.3	32.7	0.3	0.0
2/09/2024 23:20	4.7	296.6	5.2	12.4	13.5	31.3	0.4	0.0
2/09/2024 23:30	4.6	286.5	8.3	12.2	13.4	31.8	0.0	0.0
2/09/2024 23:40	3.1	277.1	10.4	11.9	13.2	32.7	-0.2	0.0
2/09/2024 23:50	3.2	278.5	6.1	11.0	12.6	35.2	-0.3	0.0
3/09/2024 00:00	2.7	281.1	5.1	10.8	12.1	35.4	-0.2	0.0
3/09/2024 00:10	2.8	295.7	7.9	10.9	12.3	34.6	0.5	0.0
3/09/2024 00:20	2.6	292.0	7.4	11.2	12.4	33.0	0.4	0.0
3/09/2024 00:30	2.2	307.3	10.4	11.2	12.4	32.9	0.3	0.0
3/09/2024 00:40	1.5	305.4	9.0	11.3	12.0	32.8	0.0	0.0
3/09/2024 00:50	2.0	307.6	6.2	11.2	11.9	32.9	0.5	0.0
3/09/2024 01:00	2.5	300.8	7.8	10.6	11.6	35.2	0.2	0.0
3/09/2024 01:10	3.0	284.3	8.7	10.0	11.3	37.4	0.2	0.0
3/09/2024 01:20	3.1	287.6	5.1	8.7	10.7	43.9	0.1	0.0
3/09/2024 01:30	2.7	294.3	9.3	9.0	10.8	42.5	0.5	0.0
3/09/2024 01:40	2.4	292.7	5.6	9.1	10.6	41.8	0.3	0.0
3/09/2024 01:50	3.0	290.4	4.6	9.4	10.9	40.6	1.0	0.0
3/09/2024 02:00	2.7	292.0	6.2	9.8	11.1	39.0	0.6	0.0
3/09/2024 02:10	2.4	300.1	5.6	10.0	11.1	38.5	0.3	0.0
3/09/2024 02:20	2.5	294.4	6.6	10.1	11.1	38.1	0.4	0.0
3/09/2024 02:30	3.4	280.8	7.1	9.5	11.0	40.1	0.3	0.0
3/09/2024 02:40	2.8	280.0	4.1	9.2	10.8	41.9	0.2	0.0
3/09/2024 02:50	2.7	277.3	8.4	9.4	10.5	40.2	0.1	0.0
3/09/2024 03:00	3.0	269.3	4.6	9.2	10.6	41.1	0.4	0.0
3/09/2024 03:10	2.3	275.1	10.0	9.2	11.0	41.0	0.6	0.0
3/09/2024 03:20	1.3	307.3	9.1	9.1	10.4	41.4	-0.4	0.0
3/09/2024 03:30	1.8	307.9	4.8	8.5	10.1	43.6	0.4	0.0
3/09/2024 03:40	2.0	329.7	7.8	8.5	10.0	44.1	0.5	0.0
3/09/2024 03:50	2.3	324.9	7.3	8.2	9.9	46.2	0.8	0.0
3/09/2024 04:00	2.8	286.4	6.1	8.3	10.1	46.0	0.8	0.0
3/09/2024 04:10	2.7	267.6	6.1	8.6	10.6	43.2	0.9	0.0
3/09/2024 04:20	2.1	275.6	6.5	9.0	10.6	41.2	0.1	0.0
3/09/2024 04:30	2.4	259.7	7.3	9.1	10.4	41.5	0.3	0.0
3/09/2024 04:40	3.0	255.5	8.5	9.2	10.5	41.7	0.8	0.0
3/09/2024 04:50	1.3	24.2	38.6	8.2	9.6	45.3	-0.6	0.0
3/09/2024 05:00	1.0	59.2	22.6	6.6	7.6	53.5	-1.3	0.0
3/09/2024 05:10	1.2	55.3	20.1	7.5	8.8	50.2	1.3	0.0
3/09/2024 05:20	0.9	255.3	57.0	8.0	9.5	47.8	1.7	0.0
3/09/2024 05:30	1.2	271.0	14.8	9.2	10.1	41.2	1.5	0.0
3/09/2024 05:40	1.3	20.3	21.2	8.5	9.3	43.7	0.3	0.0
3/09/2024 05:50	1.6	15.1	13.1	7.7	8.6	47.3	0.6	0.0

3/09/2024 06:00	0.9	338.8	42.0	7.5	8.3	49.2	1.0	0.0
3/09/2024 06:10	1.2	252.8	28.4	8.7	9.6	43.5	4.2	0.0
3/09/2024 06:20	1.0	265.2	26.7	9.3	10.1	41.0	7.9	0.0
3/09/2024 06:30	2.2	305.5	8.7	6.4	8.0	53.2	12.6	0.0
3/09/2024 06:40	2.0	347.0	12.7	7.3	8.6	51.1	23.6	0.0
3/09/2024 06:50	1.4	312.1	26.4	7.5	8.4	49.5	46.9	0.0
3/09/2024 07:00	1.6	269.1	14.8	7.8	8.6	49.3	77.6	0.0
3/09/2024 07:10	1.1	346.1	18.7	8.3	8.7	49.9	108.3	0.0
3/09/2024 07:20	1.4	356.9	12.6	8.6	8.7	50.1	141.9	0.0
3/09/2024 07:30	1.5	336.7	12.8	8.8	8.8	49.8	176.6	0.0
3/09/2024 07:40	1.4	21.1	17.1	9.2	9.0	51.0	211.9	0.0
3/09/2024 07:50	1.1	354.9	19.1	9.6	9.4	49.5	247.2	0.0
3/09/2024 08:00	1.5	352.0	17.7	10.6	10.3	46.4	282.6	0.0
3/09/2024 08:10	1.4	9.1	20.7	11.0	10.7	47.7	318.0	0.0
3/09/2024 08:20	1.7	354.7	16.0	11.8	11.5	44.2	353.1	0.0
3/09/2024 08:30	2.0	357.0	19.3	12.5	12.0	39.6	387.7	0.0
3/09/2024 08:40	1.7	340.9	20.0	12.7	12.3	36.8	420.9	0.0
3/09/2024 08:50	1.3	354.0	32.5	13.0	12.5	35.8	452.7	0.0
3/09/2024 09:00	1.9	345.6	19.4	13.1	12.7	35.8	485.2	0.0
3/09/2024 09:10	1.5	1.3	25.7	13.6	13.1	35.4	516.3	0.0
3/09/2024 09:20	1.5	17.1	36.8	13.9	13.4	34.9	543.8	0.0
3/09/2024 09:30	2.1	23.1	16.8	14.3	13.7	34.8	574.1	0.0
3/09/2024 09:40	2.2	83.7	23.9	14.2	13.5	34.4	600.4	0.0
3/09/2024 09:50	1.3	67.9	47.8	14.1	13.6	33.7	623.8	0.0
3/09/2024 10:00	1.2	25.5	30.7	14.6	14.0	33.3	644.8	0.0
3/09/2024 10:10	2.0	42.7	21.4	14.8	14.2	33.9	669.1	0.0
3/09/2024 10:20	1.4	2.7	28.5	15.1	14.5	31.4		0.0
3/09/2024 10:30	2.0	72.7	19.7	15.2	14.6	30.5		0.0
3/09/2024 10:40	1.0	49.4	46.1	15.2	14.7	28.4	717.0	0.0
3/09/2024 10:50	2.3	55.8	33.8	16.0	15.1	29.1	735.8	0.0
3/09/2024 11:00	1.9	13.0	37.3	16.0	15.2	28.7	749.5	0.0
3/09/2024 11:10	1.5	1.7	28.9	15.8	15.1	26.7	758.3	0.0
3/09/2024 11:20	2.2	63.7	18.8	16.2	15.4	26.8	765.2	0.0
3/09/2024 11:30	1.8	61.0	24.6	16.2	15.5	26.2	773.1	0.0
3/09/2024 11:40	1.8	35.1	25.6	16.6	15.8	26.0	776.9	0.0
3/09/2024 11:50	1.3	51.5	60.9	16.2	15.6	25.4	779.5	0.0
3/09/2024 12:00	1.6	127.7	34.4	16.4	15.8	24.9	781.3	0.0
3/09/2024 12:10	0.6	134.4	63.7	16.8	16.1	23.5	776.3	0.0
3/09/2024 12:20	1.4	71.5	32.2	16.9	16.1	23.8	773.5	0.0
3/09/2024 12:30	1.5	26.8	50.1	17.1	16.5	24.0	768.5	0.0
3/09/2024 12:40	1.4	353.7	45.0	17.2	16.3	23.8	764.7	0.0
3/09/2024 12:50	2.1	336.1	28.2	17.3	16.5	23.8	757.4	0.0
3/09/2024 13:00	1.4	305.3	18.0	17.2	16.7	22.0	747.2	0.0
3/09/2024 13:10	0.3	17.3	65.8	17.2	16.9	19.5	729.7	0.0
3/09/2024 13:20	1.4	36.9	37.5	17.9	17.3	20.4	716.6	0.0
3/09/2024 13:30	2.6	145.1	20.1	18.1	17.5	18.5	704.7	0.0
3/09/2024 13:40	1.2	153.9	35.3	18.0	17.5	17.3	689.7	0.0
3/09/2024 13:50	0.9	106.4	35.0	18.1	17.6	17.7	664.6	0.0
3/09/2024 14:00	2.5	142.2	35.9	18.7	18.0	18.4	648.4	0.0
3/09/2024 14:10	1.5	121.1	28.1	18.2	17.8	17.3	626.7	0.0
3/09/2024 14:20	0.9	50.3	50.3	18.4	18.0	17.6	601.2	0.0
3/09/2024 14:30	2.0	117.1	16.5	18.7	18.3	18.0	581.3	0.0

3/09/2024 14:40	1.6	101.7	30.3	18.9	18.4	18.4	552.2	0.0
3/09/2024 14:50	2.0	106.7	23.0	18.8	18.4	18.0	528.7	0.0
3/09/2024 15:00	2.6	101.3	18.2	18.9	18.4	18.8	499.6	0.0
3/09/2024 15:10	2.3	117.5	19.7	18.8	18.3	17.4	470.5	0.0
3/09/2024 15:20	1.6	101.0	20.0	18.7	18.3	16.9	437.8	0.0
3/09/2024 15:30	2.6	94.8	11.9	18.6	18.3	16.6	404.5	0.0
3/09/2024 15:40	2.2	96.1	14.7	18.7	18.3	17.3	369.6	0.0
3/09/2024 15:50	2.4	107.3	10.7	18.6	18.3	17.3	337.3	0.0
3/09/2024 16:00	1.9	131.2	14.9	18.5	18.3	17.1	305.0	0.0
3/09/2024 16:10	1.9	97.3	8.0	18.5	18.3	17.2	271.4	0.0
3/09/2024 16:20	1.9	97.5	12.9	18.3	18.2	18.0	237.3	0.0
3/09/2024 16:30	2.1	102.3	10.3	18.1	18.2	19.1	202.2	0.0
3/09/2024 16:40	2.6	106.2	6.2	17.7	17.9	21.5	169.3	0.0
3/09/2024 16:50	2.1	113.5	8.2	17.2	17.6	22.6	134.8	0.0
3/09/2024 17:00	2.4	98.6	5.1	17.1	17.7	22.0	101.8	0.0
3/09/2024 17:10	2.4	99.0	5.4	16.7	17.7	21.9	68.3	0.0
3/09/2024 17:20	2.3	107.7	7.5	16.6	17.5	21.3	35.4	0.0
3/09/2024 17:30	2.1	98.5	8.9	16.0	17.2	21.9	19.9	0.0
3/09/2024 17:40	1.6	83.2	5.0	16.0	16.7	23.5	8.6	0.0
3/09/2024 17:50	1.4	101.1	6.4	16.0	16.7	23.4	3.7	0.0
3/09/2024 18:00	1.3	111.6	6.5	15.9	16.6	23.4	1.3	0.0
3/09/2024 18:10	1.1	107.1	8.7	15.9	16.4	23.4	0.2	0.0
3/09/2024 18:20	1.5	104.7	6.2	15.7	16.2	23.4	0.5	0.0
3/09/2024 18:30	1.4	110.6	9.6	15.5	16.1	23.8	0.3	0.0
3/09/2024 18:40	1.5	126.8	10.0	15.2	15.8	23.9	0.2	0.0
3/09/2024 18:50	1.6	106.2	7.7	15.1	15.8	24.0	0.8	0.0
3/09/2024 19:00	1.2	130.9	11.1	15.0	15.4	24.5	0.0	0.0
3/09/2024 19:10	1.2	117.6	14.4	14.4	14.8	26.5	0.0	0.0
3/09/2024 19:20	1.2	137.5	17.2	13.3	13.7	31.0	-0.2	0.0
3/09/2024 19:30	1.7	154.6	9.6	13.7	14.2	29.5	0.9	0.0
3/09/2024 19:40	3.0	158.3	6.3	12.8	13.7	33.3	0.4	0.0
3/09/2024 19:50	2.6	174.9	6.4	12.2	13.5	36.5	0.5	0.0
3/09/2024 20:00	2.8	167.0	8.5	12.4	13.5	36.6	0.6	0.0
3/09/2024 20:10	3.0	170.5	8.4	12.0	13.0	40.6	0.1	0.0
3/09/2024 20:20	2.8	176.7	5.8	12.0	12.7	42.6	0.2	0.0
3/09/2024 20:30	2.7	173.0	8.1	11.9	12.6	43.8	0.3	0.0
3/09/2024 20:40	2.8	174.6	6.5	11.6	12.5	45.4	0.3	0.0
3/09/2024 20:50	2.6	173.7	8.7	11.7	12.4	45.2	0.3	0.0
3/09/2024 21:00	2.6	170.5	6.9	11.4	12.2	47.2	0.3	0.0
3/09/2024 21:10	1.9	171.1	8.3	11.5	12.1	46.8	0.2	0.0
3/09/2024 21:20	1.7	166.3	10.8	10.8	11.7	49.3	0.2	0.0
3/09/2024 21:30	0.4	85.1	48.2	9.0	10.6	55.7	-1.1	0.0
3/09/2024 21:40	1.2	20.7	22.6	7.6	8.8	61.8	-0.8	0.0
3/09/2024 21:50	1.4	350.4	9.6	8.1	9.2	60.3	1.2	0.0
3/09/2024 22:00	1.5	358.5	7.7	8.6	9.2	55.4	1.1	0.0
3/09/2024 22:10	1.4	347.6	14.5	8.5	9.3	56.2	1.2	0.0
3/09/2024 22:20	1.8	310.8	7.3	7.9	8.5	58.8	0.3	0.0
3/09/2024 22:30	1.5	335.8	16.9	7.8	8.5	59.5	0.8	0.0
3/09/2024 22:40	1.8	329.5	6.8	6.8	7.3	65.4	0.2	0.0
3/09/2024 22:50	2.3	314.9	4.8	6.7	7.6	66.8	1.2	0.0
3/09/2024 23:00	2.2	301.7	2.7	7.0	7.7	65.0	1.0	0.0
3/09/2024 23:10	2.1	296.4	4.6	7.3	7.9	62.9	1.2	0.0

3/09/2024 23:20	1.5	309.3	11.6	7.6	8.0	61.8	0.9	0.0
3/09/2024 23:30	1.4	303.5	7.8	7.4	7.7	62.5	0.5	0.0
3/09/2024 23:40	1.7	302.8	6.9	7.1	7.4	64.8	0.5	0.0
3/09/2024 23:50	1.8	298.2	4.8	6.9	7.2	66.4	0.6	0.0
4/09/2024 00:00	1.3	294.5	3.5	6.7	7.2	67.0	0.8	0.0
4/09/2024 00:10	1.1	301.4	3.4	6.5	7.2	68.3	0.9	0.0
4/09/2024 00:20	1.0	297.6	7.5	6.6	7.2	68.7	1.2	0.0
4/09/2024 00:30	1.2	321.9	5.1	6.5	7.3	68.7	1.4	0.0
4/09/2024 00:40	1.4	317.8	4.3	6.4	7.3	69.2	1.2	0.0
4/09/2024 00:50	1.4	314.6	4.9	5.7	6.9	73.2	0.7	0.0
4/09/2024 01:00	1.5	305.0	4.6	5.5	6.5	74.5	0.5	0.0
4/09/2024 01:10	1.9	320.7	4.1	5.4	6.2	76.1	0.9	0.0
4/09/2024 01:20	2.2	322.4	7.4	5.1	5.6	75.9	0.4	0.0
4/09/2024 01:30	2.4	309.8	6.5	4.7	5.2	77.2	0.7	0.0
4/09/2024 01:40	2.6	302.9	5.3	4.6	5.2	78.3	1.1	0.0
4/09/2024 01:50	2.3	304.9	4.8	4.8	5.3	77.2	1.1	0.0
4/09/2024 02:00	1.9	316.3	4.3	4.6	5.0	77.5	0.5	0.0
4/09/2024 02:10	2.3	309.3	3.6	4.4	4.9	78.7	0.9	0.0
4/09/2024 02:20	2.3	306.8	4.6	4.5	5.1	78.1	1.3	0.0
4/09/2024 02:30	2.1	308.3	4.2	4.6	5.1	77.2	1.0	0.0
4/09/2024 02:40	2.3	317.1	5.6	4.3	4.7	78.1	0.8	0.0
4/09/2024 02:50	2.2	328.4	5.2	3.8	4.3	79.4	0.5	0.0
4/09/2024 03:00	2.4	321.8	5.8	3.3	3.7	81.2	0.5	0.0
4/09/2024 03:10	2.7	312.5	4.8	3.1	3.8	83.3	1.3	0.0
4/09/2024 03:20	2.3	319.2	4.8	3.1	3.6	84.3	1.0	0.0
4/09/2024 03:30	2.4	314.4	5.0	3.0	3.5	84.6	1.2	0.0
4/09/2024 03:40	2.4	312.5	4.0	3.1	3.7	85.6	1.3	0.0
4/09/2024 03:50	1.9	320.9	5.8	3.1	3.5	85.7	0.8	0.0
4/09/2024 04:00	2.6	312.5	4.2	2.8	3.2	87.0	1.2	0.0
4/09/2024 04:10	3.1	301.2	5.0	2.6	3.4	88.7	1.4	0.0
4/09/2024 04:20	3.1	301.1	4.1	2.9	3.7	88.8	0.9	0.0
4/09/2024 04:30	2.7	303.0	5.4	3.0	3.7	86.7	0.6	0.0
4/09/2024 04:40	3.0	304.1	4.0	3.0	3.7	85.1	1.0	0.0
4/09/2024 04:50	3.3	299.8	2.3	3.0	3.8	84.5	1.1	0.0
4/09/2024 05:00	3.3	302.3	2.0	3.2	3.9	83.8	1.2	0.0
4/09/2024 05:10	2.7	300.1	5.4	3.3	4.0	83.1	1.1	0.0
4/09/2024 05:20	2.4	308.8	5.3	3.2	3.8	83.1	1.0	0.0
4/09/2024 05:30	2.4	318.9	4.3	3.2	3.8	82.8	1.2	0.0
4/09/2024 05:40	2.1	326.1	4.3	3.0	3.6	83.3	0.7	0.0
4/09/2024 05:50	2.0	328.2	5.8	2.6	3.1	84.9	0.6	0.0
4/09/2024 06:00	2.1	320.7	6.1	2.3	2.8	86.8	1.5	0.0
4/09/2024 06:10	2.1	317.1	2.7	2.2	2.9	89.0	4.3	0.0
4/09/2024 06:20	2.2	319.5	3.6	2.4	2.8	90.8	9.7	0.0
4/09/2024 06:30	2.2	324.6	6.5	2.3	2.8	91.2	22.3	0.0
4/09/2024 06:40	2.2	323.2	6.0	2.3	2.9	90.2	34.5	0.0
4/09/2024 06:50	2.0	317.7	4.8	2.4	3.0	89.6	63.7	0.0
4/09/2024 07:00	1.4	324.4	5.9	3.0	3.6	89.6	92.1	0.0
4/09/2024 07:10	1.0	322.8	4.1	3.6	3.7	87.0	115.6	0.0
4/09/2024 07:20	1.1	316.6	7.3	4.2	4.0	84.3	121.3	0.0
4/09/2024 07:30	1.4	317.6	11.4	4.6	4.3	82.2	179.5	0.0
4/09/2024 07:40	1.4	317.1	13.7	5.0	4.7	78.5	217.0	0.0
4/09/2024 07:50	1.1	16.0	21.8	5.3	4.9	78.0	267.8	0.0

4/09/2024 08:00	1.5	355.5	18.0	5.1	4.8	77.1	263.6	0.0
4/09/2024 08:10	1.8	345.5	11.8	5.9	5.5	76.2	329.3	0.0
4/09/2024 08:20	1.7	322.7	12.6	6.6	6.2	71.4	343.9	0.0
4/09/2024 08:30	1.4	310.8	13.6	7.2	6.9	68.6	394.5	0.0
4/09/2024 08:40	1.4	325.2	19.9	8.0	7.6	66.7	429.3	0.0
4/09/2024 08:50	1.3	338.4	25.9	8.8	8.2	63.6	461.7	0.0
4/09/2024 09:00	1.3	333.5	16.9	9.3	8.8	59.6	512.1	0.0
4/09/2024 09:10	0.9	337.8	30.7	10.0	9.6	57.2	486.5	0.0
4/09/2024 09:20	0.9	345.4	31.7	10.8	10.3	52.9	522.7	0.0
4/09/2024 09:30	0.7	8.2	41.9	11.2	10.7	50.3	496.4	0.0
4/09/2024 09:40	1.1	352.2	24.8	11.9	11.4	48.6	606.0	0.0
4/09/2024 09:50	1.0	335.9	36.0	12.3	12.0	46.4	622.9	0.0
4/09/2024 10:00	1.0	333.8	27.5	12.8	12.5	45.2	614.4	0.0
4/09/2024 10:10	1.5	333.0	26.9	13.5	13.1	44.9	672.2	0.0
4/09/2024 10:20	1.8	8.3	22.8	13.9	13.4	44.4		0.0
4/09/2024 10:30	2.0	18.4	17.7	14.8	14.0	42.7		0.0
4/09/2024 10:40	2.3	25.5	15.5	15.3	14.4	39.9	729.6	0.0
4/09/2024 10:50	1.9	21.9	23.9	15.6	14.7	37.0	744.6	0.0
4/09/2024 11:00	1.8	347.2	25.6	15.8	15.2	35.0	757.6	0.0
4/09/2024 11:10	2.1	16.5	19.0	16.1	15.4	34.6	769.6	0.0
4/09/2024 11:20	1.9	347.3	26.6	16.8	15.9	34.4	779.0	0.0
4/09/2024 11:30	1.8	354.8	22.6	17.1	16.4	33.7	785.0	0.0
4/09/2024 11:40	1.9	13.4	20.2	17.6	16.9	34.3	790.4	0.0
4/09/2024 11:50	1.8	340.8	27.3	18.3	17.5	34.5	794.3	0.0
4/09/2024 12:00	2.3	356.7	21.0	19.0	18.1	30.6	794.2	0.0
4/09/2024 12:10	1.3	341.9	40.8	19.4	18.5	29.2	791.7	0.0
4/09/2024 12:20	0.9	319.0	47.6	19.6	18.9	27.1	785.4	0.0
4/09/2024 12:30	1.6	354.3	23.9	20.3	19.4	24.8	780.8	0.0
4/09/2024 12:40	1.4	326.8	31.0	20.8	20.0	23.8	776.9	0.0
4/09/2024 12:50	1.7	311.4	15.5	21.0	20.2	22.5	765.9	0.0
4/09/2024 13:00	0.9	323.3	44.8	21.2	20.5	21.2	753.1	0.0
4/09/2024 13:10	1.6	330.7	22.7	21.8	21.0	21.4	738.7	0.0
4/09/2024 13:20	0.8	11.8	56.4	21.7	21.0	21.0	725.1	0.0
4/09/2024 13:30	0.9	246.6	43.1	21.9	21.3	21.1	705.7	0.0
4/09/2024 13:40	0.7	271.6	63.3	21.8	21.3	21.1	685.7	0.0
4/09/2024 13:50	0.2	304.1	92.2	22.1	21.5	21.0	666.8	0.0
4/09/2024 14:00	1.9	146.9	25.8	22.2	21.5	24.9	643.3	0.0
4/09/2024 14:10	2.2	144.5	18.2	21.9	21.3	26.6	620.0	0.0
4/09/2024 14:20	1.7	106.6	15.4	22.1	21.5	25.5	598.8	0.0
4/09/2024 14:30	1.8	99.4	20.5	22.1	21.6	24.3	574.1	0.0
4/09/2024 14:40	1.9	97.1	13.9	22.3	21.8	24.8	549.2	0.0
4/09/2024 14:50	1.3	97.0	31.9	22.5	21.9	23.3	521.8	0.0
4/09/2024 15:00	1.4	58.4	20.6	22.7	22.0	22.9	495.4	0.0
4/09/2024 15:10	1.4	54.2	29.2	23.0	22.4	22.3	465.9	0.0
4/09/2024 15:20	1.8	145.9	18.5	22.7	22.2	23.5	433.7	0.0
4/09/2024 15:30	1.8	164.7	16.3	22.4	22.0	24.9	404.2	0.0
4/09/2024 15:40	1.8	149.1	12.0	22.4	22.0	24.5	374.1	0.0
4/09/2024 15:50	1.1	130.1	16.8	22.4	22.0	25.2	341.1	0.0
4/09/2024 16:00	1.2	136.8	16.9	22.4	22.1	24.5	309.2	0.0
4/09/2024 16:10	1.4	171.1	12.8	22.2	22.0	25.4	275.1	0.0
4/09/2024 16:20	1.3	157.5	17.9	22.0	21.8	25.2	242.1	0.0
4/09/2024 16:30	1.0	148.3	17.1	21.9	21.9	24.7	206.5	0.0

4/09/2024 16:40	1.2	162.4	15.8	21.9	21.9	24.9	171.3	0.0
4/09/2024 16:50	0.8	143.5	24.4	21.7	21.7	24.4	136.5	0.0
4/09/2024 17:00	1.0	144.0	6.8	21.8	21.8	24.5	103.5	0.0
4/09/2024 17:10	0.9	157.1	13.7	21.7	21.8	23.8	63.2	0.0
4/09/2024 17:20	0.6	165.2	19.8	21.5	21.6	23.7	35.0	0.0
4/09/2024 17:30	0.3	57.3	22.9	21.5	21.9	22.3	21.1	0.0
4/09/2024 17:40	0.5	7.9	17.1	21.3	21.8	21.5	8.7	0.0
4/09/2024 17:50	0.5	329.1	28.0	20.7	21.1	23.8	3.7	0.0
4/09/2024 18:00	0.3	30.8	27.2	20.8	21.1	23.6	1.5	0.0
4/09/2024 18:10	0.9	305.8	17.9	20.2	20.5	22.6	1.5	0.0
4/09/2024 18:20	0.4	13.9	37.0	19.9	20.2	22.4	0.8	0.0
4/09/2024 18:30	0.8	345.9	16.3	19.3	19.8	25.2	1.1	0.0
4/09/2024 18:40	1.4	310.8	9.1	18.5	19.3	22.4	1.0	0.0
4/09/2024 18:50	1.7	335.5	9.0	17.8	18.4	23.4	0.0	0.0
4/09/2024 19:00	2.2	323.0	6.1	16.8	17.2	30.2	-0.4	0.0
4/09/2024 19:10	2.5	304.3	5.1	16.2	17.0	31.8	0.4	0.0
4/09/2024 19:20	2.5	301.8	5.4	16.3	16.9	28.9	0.3	0.0
4/09/2024 19:30	2.8	304.9	4.9	15.8	16.7	29.1	0.2	0.0
4/09/2024 19:40	2.3	317.1	6.4	15.6	16.4	28.9	0.0	0.0
4/09/2024 19:50	1.7	342.6	13.2	14.7	15.3	31.9	-0.9	0.0
4/09/2024 20:00	2.8	344.2	7.4	13.4	14.4	38.9	0.0	0.0
4/09/2024 20:10	3.8	335.4	7.5	13.2	14.2	41.6	0.6	0.0
4/09/2024 20:20	3.5	309.2	7.2	13.3	14.2	41.6	0.4	0.0
4/09/2024 20:30	3.6	301.3	6.7	12.8	14.0	43.9	0.3	0.0
4/09/2024 20:40	3.4	295.1	6.4	12.2	13.5	45.3	0.1	0.0
4/09/2024 20:50	3.5	297.2	7.4	12.3	13.6	44.7	0.5	0.0
4/09/2024 21:00	3.7	301.5	6.6	12.1	13.2	44.6	0.3	0.0
4/09/2024 21:10	3.6	295.2	6.9	11.8	13.0	45.0	0.2	0.0
4/09/2024 21:20	3.5	293.6	6.6	11.6	12.8	46.1	0.2	0.0
4/09/2024 21:30	3.6	301.4	4.9	11.6	12.8	44.6	0.3	0.0
4/09/2024 21:40	3.4	301.2	4.8	11.5	12.8	44.1	0.3	0.0
4/09/2024 21:50	3.6	305.6	4.9	11.6	12.7	42.6	0.2	0.0
4/09/2024 22:00	3.5	301.7	5.5	11.4	12.5	42.6	0.2	0.0
4/09/2024 22:10	3.6	297.1	7.0	11.1	12.3	43.3	0.2	0.0
4/09/2024 22:20	3.8	292.8	5.6	10.6	12.0	45.5	0.3	0.0
4/09/2024 22:30	3.8	298.0	5.7	10.6	12.0	46.8	0.5	0.0
4/09/2024 22:40	3.9	299.6	5.6	10.7	12.0	47.7	0.6	0.0
4/09/2024 22:50	3.8	302.9	5.0	10.7	12.0	46.2	0.5	0.0
4/09/2024 23:00	3.3	306.7	3.6	11.0	11.9	43.9	0.2	0.0
4/09/2024 23:10	3.5	302.6	4.6	10.7	11.6	44.5	0.2	0.0
4/09/2024 23:20	3.5	302.6	5.2	10.5	11.3	46.1	0.2	0.0
4/09/2024 23:30	3.4	302.8	4.9	10.4	11.2	46.6	0.4	0.0
4/09/2024 23:40	3.3	298.9	4.5	10.2	11.1	47.2	0.4	0.0
4/09/2024 23:50	3.0	286.4	6.1	10.2	11.2	46.7	0.7	0.0

Table A-3: 10-minute average meteorological data – M-WS4 – 23/12/2024 to 24/12/2024

Date & time	Wind speed (m/s)	Wind direction (°)	Sigma theta (°)	Temperature at 2m (°C)	Temperature at 10m (°C)	Relative humidity (%)	Solar radiation (W/m²)	Rain (mm)
23/12/2024 00:00	1.7	313.9	4.4	22.5	23.2	72.4	8.6	0.0
23/12/2024 00:10	1.1	259.4	15.4	22.5	23.4	73.0	8.4	0.0

23/12/2024 00:20	0.6	75.5	33.3	22.1	22.8	72.8	7.5	0.0
23/12/2024 00:30	0.9	47.9	6.0	21.4	21.9	75.1	7.6	0.0
23/12/2024 00:40	1.8	359.9	12.7	21.0	21.5	78.7	8.2	0.0
23/12/2024 00:50	2.2	321.9	4.2	21.0	21.7	83.6	8.5	0.0
23/12/2024 01:00	2.4	292.3	7.7	20.9	21.6	85.5	8.4	0.0
23/12/2024 01:10	2.6	278.4	5.0	20.8	21.5	87.1	8.2	0.0
23/12/2024 01:20	2.5	276.6	3.7	20.8	21.5	87.8	8.4	0.0
23/12/2024 01:30	2.5	268.1	7.1	21.1	21.8	89.1	8.5	0.0
23/12/2024 01:40	0.5	229.1	44.4	20.6	21.7	86.9	7.9	0.0
23/12/2024 01:50	1.1	23.1	18.9	19.8	20.7	86.6	7.4	0.0
23/12/2024 02:00	1.0	17.1	6.4	20.0	20.6	90.7	8.4	0.0
23/12/2024 02:10	1.3	8.7	9.4	19.8	20.4	92.6	8.4	0.0
23/12/2024 02:20	0.9	31.5	16.5	20.0	20.6	95.4	8.5	0.0
23/12/2024 02:30	2.4	319.5	12.3	19.7	20.3	96.4	8.4	0.0
23/12/2024 02:40	3.3	284.1	7.7	18.9	19.8	96.7	8.5	0.0
23/12/2024 02:50	3.1	263.6	7.1	19.5	20.1	98.5	8.6	0.0
23/12/2024 03:00	2.3	286.8	8.0	19.7	20.5	98.5	8.5	0.0
23/12/2024 03:10	2.1	290.2	9.9	19.6	20.5	98.5	8.5	0.0
23/12/2024 03:20	1.9	341.3	7.3	19.3	20.1	98.5	8.3	0.0
23/12/2024 03:30	2.1	347.1	9.0	18.8	19.5	98.5	8.0	0.0
23/12/2024 03:40	2.5	304.5	8.5	18.4	19.3	98.5	7.9	0.0
23/12/2024 03:50	2.8	290.3	5.2	18.3	19.1	98.4	8.2	0.0
23/12/2024 04:00	3.3	286.7	6.6	18.3	19.3	96.7	8.4	0.0
23/12/2024 04:10	3.4	278.5	4.5	18.7	19.8	96.0	8.6	0.0
23/12/2024 04:20	2.3	298.3	8.3	19.0	20.0	96.3	8.5	0.0
23/12/2024 04:30	2.0	302.7	7.3	19.3	20.0	95.9	8.3	0.0
23/12/2024 04:40	2.2	295.3	10.1	19.2	20.0	92.9	8.5	0.0
23/12/2024 04:50	2.0	310.8	7.5	18.9	19.7	84.6	9.3	0.0
23/12/2024 05:00	2.6	329.1	5.8	18.4	19.2	81.1	15.9	0.0
23/12/2024 05:10	2.1	312.8	7.5	18.2	18.9	79.9	29.7	0.0
23/12/2024 05:20	2.1	331.5	7.4	18.1	18.7	80.3	52.8	0.0
23/12/2024 05:30	1.5	338.8	19.0	18.5	19.0	81.0	73.4	0.0
23/12/2024 05:40	1.8	310.3	10.8	18.9	20.2	80.3	92.7	0.0
23/12/2024 05:50	1.6	322.3	8.9	19.8	20.8	74.5	53.3	0.0
23/12/2024 06:00	1.3	333.3	12.4	19.5	19.6	73.6	55.9	0.0
23/12/2024 06:10	1.3	295.0	13.6	19.5	19.6	75.4	127.2	0.0
23/12/2024 06:20	2.2	261.1	6.5	20.0	20.2	75.9	162.7	0.0
23/12/2024 06:30	2.5	277.2	11.9	21.8	22.1	62.7	262.3	0.0
23/12/2024 06:40	2.2	301.3	11.1	23.1	23.0	49.0	291.0	0.0
23/12/2024 06:50	2.2	316.1	13.0	24.6	24.3	42.5	333.3	0.0
23/12/2024 07:00	3.3	306.9	7.2	26.7	26.3	16.3	380.6	0.0
23/12/2024 07:10	4.5	296.8	10.3	27.8	27.3	6.5	408.3	0.0
23/12/2024 07:20	5.4	287.7	10.3	28.5	27.9	2.6	447.9	0.0
23/12/2024 07:30	8.0	275.3	6.8	29.0	28.3		498.2	0.0
23/12/2024 07:40	7.3	269.1	7.9	29.6	28.6		564.8	0.0
23/12/2024 07:50	8.1	265.0	8.1	29.6	28.6		554.1	0.0
23/12/2024 08:00	8.9	270.6	7.0	29.3	28.3		626.5	0.0
23/12/2024 08:10	8.0	265.7	7.9	29.3	28.3		630.5	0.0
23/12/2024 08:20	7.7	258.3	9.7	29.7	28.5		690.4	0.0
23/12/2024 08:30	8.1	268.2	7.5	30.0	28.7		725.7	0.0
23/12/2024 08:40	7.4	258.9	11.8	30.0	28.8		762.3	0.0
23/12/2024 08:50	8.9	267.4	7.0	30.0	28.6		787.1	0.0

23/12/2024 09:00	8.9	274.4	6.6	30.1	28.7		819.0	0.0
23/12/2024 09:10	8.4	266.5	7.8	30.2	28.7		850.0	0.0
23/12/2024 09:20	9.0	266.8	6.7	30.1	28.7		884.0	0.0
23/12/2024 09:30	9.3	273.7	7.5	30.7	29.3		915.0	0.0
23/12/2024 09:40	9.2	263.4	9.7	30.5	29.1		942.0	0.0
23/12/2024 09:50	10.4	274.0	7.4	30.5	29.0		968.0	0.0
23/12/2024 10:00	9.0	266.1	9.9	30.9	29.4		984.0	0.0
23/12/2024 10:10	8.1	260.0	9.9	31.2	29.5		1006.0	0.0
23/12/2024 10:20	7.3	255.8	12.1	30.7	29.1		1031.0	0.0
23/12/2024 10:30	7.1	252.9	13.4	30.4	28.9		1045.0	0.0
23/12/2024 10:40	7.6	252.2	13.2	30.6	29.0		1062.0	0.0
23/12/2024 10:50	7.3	262.3	13.0	30.7	28.9		1078.0	0.0
23/12/2024 11:00	8.7	269.5	9.4	30.8	29.1		1091.0	0.0
23/12/2024 11:10	9.0	275.1	9.9	30.7	28.9		1102.0	0.0
23/12/2024 11:20	8.5	265.2	11.3	30.9	29.3		1111.0	0.0
23/12/2024 11:30	8.7	269.4	10.3	30.8	29.0		1124.0	0.0
23/12/2024 11:40	9.6	269.3	11.1	31.1	29.3		1133.0	0.0
23/12/2024 11:50	9.8	272.5	11.5	30.9	29.3		1133.0	0.0
23/12/2024 12:00	8.3	265.0	11.0	31.0	29.3		1131.0	0.0
23/12/2024 12:10	9.0	259.7	10.8	31.0	29.2		1125.0	0.0
23/12/2024 12:20	8.5	262.1	10.4	31.0	29.1		1122.0	0.0
23/12/2024 12:30	7.5	268.8	18.2	30.8	29.2		1112.0	0.0
23/12/2024 12:40	8.7	250.6	12.2	31.0	29.3		1115.0	0.0
23/12/2024 12:50	9.5	280.2	9.1	30.7	29.0		1105.0	0.0
23/12/2024 13:00	8.6	266.5	15.7	30.5	29.0		1097.0	0.0
23/12/2024 13:10	7.5	259.7	8.7	30.9	29.3		1089.0	0.0
23/12/2024 13:20	7.0	267.0	7.1	30.9	29.2		1073.0	0.0
23/12/2024 13:30	7.1	267.5	14.0	31.0	29.2		1058.0	0.0
23/12/2024 13:40	7.7	252.6	13.4	30.8	29.1		1040.0	0.0
23/12/2024 13:50	8.8	259.1	10.3	31.2	29.5		1033.0	0.0
23/12/2024 14:00	8.1	263.0	11.7	31.0	29.4		1017.0	0.0
23/12/2024 14:10	7.1	271.4	16.0	31.1	29.4		996.0	0.0
23/12/2024 14:20	7.7	281.5	13.2	30.6	29.0		973.0	0.0
23/12/2024 14:30	4.9	293.4	18.0	30.6	29.2		943.0	0.0
23/12/2024 14:40	6.9	261.6	11.6	30.6	29.2		918.0	0.0
23/12/2024 14:50	6.1	276.7	16.0	30.5	29.2		890.0	0.0
23/12/2024 15:00	6.9	261.9	12.9	30.7	29.2		864.0	0.0
23/12/2024 15:10	6.7	260.0	11.3	30.9	29.4		838.0	0.0
23/12/2024 15:20	5.3	254.1	14.6	30.0	28.8		806.0	0.0
23/12/2024 15:30	6.0	270.9	13.4	30.2	29.0		775.5	0.0
23/12/2024 15:40	6.3	282.5	15.1	30.2	28.9		737.9	0.0
23/12/2024 15:50	7.3	281.5	11.8	30.1	28.9		707.7	0.0
23/12/2024 16:00	3.5	255.0	25.7	30.1	29.2		638.6	0.0
23/12/2024 16:10	5.3	259.1	20.4	30.2	29.3		635.1	0.0
23/12/2024 16:20	5.8	280.7	11.1	29.9	29.0		597.3	0.0
23/12/2024 16:30	6.7	256.3	7.9	29.9	29.0		565.2	0.0
23/12/2024 16:40	6.3	264.1	9.8	29.9	29.1		515.0	0.0
23/12/2024 16:50	6.3	272.3	8.2	29.5	28.8		488.2	0.0
23/12/2024 17:00	5.9	263.8	8.5	29.5	28.9		447.4	0.0
23/12/2024 17:10	4.2	272.0	14.2	29.3	28.8		404.7	0.0
23/12/2024 17:20	3.9	267.1	14.9	29.3	29.0		367.6	0.0
23/12/2024 17:30	5.1	260.7	8.3	29.2	28.9		333.1	0.0

23/12/2024 17:40	5.3	254.7	10.8	28.8	28.7		293.4	0.0
23/12/2024 17:50	4.5	248.1	12.4	28.5	28.5		253.5	0.0
23/12/2024 18:00	5.5	260.8	9.8	28.2	28.2		215.5	0.0
23/12/2024 18:10	6.2	265.7	7.3	27.8	27.9		180.4	0.0
23/12/2024 18:20	6.1	266.3	5.9	27.4	27.7		148.0	0.0
23/12/2024 18:30	4.9	265.9	5.8	26.9	27.3		115.7	0.0
23/12/2024 18:40	5.1	261.4	5.8	26.4	26.9		86.3	0.0
23/12/2024 18:50	5.4	260.6	5.4	25.9	26.6		61.2	0.0
23/12/2024 19:00	4.9	261.8	4.6	25.4	26.2		30.0	0.0
23/12/2024 19:10	4.6	264.0	5.4	24.5	25.6		13.1	0.0
23/12/2024 19:20	3.8	259.9	7.6	24.1	25.3		8.4	0.0
23/12/2024 19:30	3.9	259.5	6.1	23.8	25.0		7.0	0.0
23/12/2024 19:40	4.1	256.7	7.2	23.3	24.5		6.1	0.0
23/12/2024 19:50	3.7	253.7	6.8	23.0	24.3		5.9	0.0
23/12/2024 20:00	4.0	258.2	4.9	22.7	24.1		5.8	0.0
23/12/2024 20:10	4.0	261.6	5.9	22.2	23.7		5.4	0.0
23/12/2024 20:20	4.0	255.7	7.8	22.6	23.8		5.7	0.0
23/12/2024 20:30	4.1	256.7	6.6	22.2	23.6		5.5	0.0
23/12/2024 20:40	4.4	255.4	7.7	22.0	23.1		5.4	0.0
23/12/2024 20:50	4.2	251.5	10.1	22.2	23.0		5.8	0.0
23/12/2024 21:00	3.9	253.6	11.1	22.3	23.1		5.8	0.0
23/12/2024 21:10	3.7	254.4	8.1	22.1	22.9		5.4	0.0
23/12/2024 21:20	3.9	253.5	7.0	21.9	22.7		5.5	0.0
23/12/2024 21:30	3.5	250.4	8.1	21.8	22.6		5.6	0.0
23/12/2024 21:40	3.3	248.1	10.5	21.7	22.5		5.5	0.0
23/12/2024 21:50	3.3	241.2	10.5	21.6	22.4		5.6	0.0
23/12/2024 22:00	3.8	241.4	9.7	21.6	22.3		6.2	0.0
23/12/2024 22:10	4.2	238.7	7.8	21.4	22.2		6.1	0.0
23/12/2024 22:20	2.4	222.1	12.7	21.0	21.8		5.5	0.0
23/12/2024 22:30	1.6	222.5	14.3	20.7	21.5		5.9	0.0
23/12/2024 22:40	1.3	197.0	14.5	20.5	21.3		6.1	0.0
23/12/2024 22:50	1.0	163.2	14.5	19.9	20.8		5.4	0.0
23/12/2024 23:00	1.8	154.6	16.7	19.1	19.8		4.9	0.0
23/12/2024 23:10	2.0	161.9	28.4	18.7	19.8		5.6	0.0
23/12/2024 23:20	1.5	205.6	16.1	19.6	20.6		6.1	0.0
23/12/2024 23:30	1.6	169.0	26.9	19.9	20.7		6.0	0.0
23/12/2024 23:40	1.8	166.0	18.1	19.3	20.4		5.2	0.0
23/12/2024 23:50	1.9	178.9	11.1	19.3	20.4		5.2	0.0
24/12/2024 00:00	1.9	195.3	14.0	19.4	20.5		5.6	0.0
24/12/2024 00:10	1.9	187.2	10.7	19.7	20.4		5.6	0.0
24/12/2024 00:20	1.8	183.0	10.4	19.0	20.1		5.2	0.0
24/12/2024 00:30	1.9	194.6	15.4	19.0	20.2		5.8	0.0
24/12/2024 00:40	1.5	196.1	9.7	18.8	19.9		5.3	0.0
24/12/2024 00:50	1.5	194.1	8.2	18.7	19.7		5.5	0.0
24/12/2024 01:00	1.0	207.1	36.0	17.7	19.0		5.3	0.0
24/12/2024 01:10	0.5	63.7	34.5	15.7	17.1		3.7	0.0
24/12/2024 01:20	1.3	81.1	9.8	15.1	16.5		5.7	0.0
24/12/2024 01:30	1.3	91.5	8.8	14.5	15.4		11.1	0.0
24/12/2024 01:40	0.5	92.0	27.2	15.0	16.0		21.1	0.0
24/12/2024 01:50	1.0	330.9	12.2	15.3	16.5		67.6	0.0
24/12/2024 02:00	0.7	328.4	6.3	15.8	17.1		227.1	0.0
24/12/2024 02:10	0.7	312.4	7.3	16.4	17.4		36.4	0.0

24/12/2024 02:20	0.6	283.6	13.7	16.8	17.4		28.7	0.0
24/12/2024 02:30	1.3	275.2	7.7	16.7	17.5		27.9	0.0
24/12/2024 02:40	1.3	236.2	9.1	16.9	18.1		18.2	0.0
24/12/2024 02:50	1.0	214.4	20.9	17.7	18.3		13.8	0.0
24/12/2024 03:00	1.3	13.8	12.8	11.9	13.8		12.9	0.0
24/12/2024 03:10	2.2	321.1	3.5	12.4	13.9		48.8	0.0
24/12/2024 03:20	2.1	302.2	5.8	13.0	14.7		54.6	0.0
24/12/2024 03:30	2.2	291.5	9.2	13.3	14.5		54.3	0.0
24/12/2024 03:40	2.3	288.5	5.7	13.7	14.6		54.5	0.0
24/12/2024 03:50	2.2	286.9	7.4	13.9	14.6		54.0	0.0
24/12/2024 04:00	2.0	284.4	9.6	14.0	14.6		53.8	0.0
24/12/2024 04:10	2.1	299.1	6.6	13.8	14.3		53.5	0.0
24/12/2024 04:20	2.1	299.4	9.0	13.3	13.9		53.9	0.0
24/12/2024 04:30	1.8	321.1	18.0	12.9	13.6		53.8	0.0
24/12/2024 04:40	1.2	333.4	16.4	11.6	12.8		54.2	0.0
24/12/2024 04:50	1.9	324.3	12.0	12.2	13.1		58.1	0.0
24/12/2024 05:00	2.0	318.7	15.9	12.3	13.3		63.7	0.0
24/12/2024 05:10	2.1	292.5	11.1	12.6	13.6		75.9	0.0
24/12/2024 05:20	1.5	298.6	20.8	12.7	13.8		96.6	0.0
24/12/2024 05:30	2.2	270.5	8.3	12.8	13.4		115.5	0.0
24/12/2024 05:40	1.3	287.9	41.5	13.1	13.5		136.1	0.0
24/12/2024 05:50	1.3	276.7	13.0	13.4	13.5		164.2	0.0
24/12/2024 06:00	0.9	292.0	17.9	14.3	14.2		200.7	0.0
24/12/2024 06:10	1.0	336.2	21.5	15.0	14.8		241.1	0.0
24/12/2024 06:20	1.1	330.6	19.0	15.6	15.3		363.4	0.0
24/12/2024 06:30	1.6	327.5	9.9	15.9	15.5		271.5	0.0
24/12/2024 06:40	1.9	350.8	14.1	16.7	16.5		313.6	0.0
24/12/2024 06:50	2.2	345.6	13.5	17.5	17.2		355.0	0.0
24/12/2024 07:00	2.0	341.3	13.2	18.2	17.8		395.5	0.0
24/12/2024 07:10	1.8	358.1	31.2	18.7	18.2		433.0	0.0
24/12/2024 07:20	1.8	349.6	18.3	19.2	18.7		470.7	0.0
24/12/2024 07:30	1.5	356.4	27.8	19.8	19.2		508.5	0.0
24/12/2024 07:40	1.1	3.4	39.0	20.2	19.9		544.6	0.0
24/12/2024 07:50	2.1	231.9	37.5	20.8	20.1		583.4	0.0
24/12/2024 08:00	1.9	244.2	24.8	21.0	20.3		612.4	0.0
24/12/2024 08:10	1.5	230.6	37.5	21.2	20.6		658.4	0.0
24/12/2024 08:20	1.9	190.5	22.2	21.6	20.9		699.0	0.0
24/12/2024 08:30	2.2	189.9	33.7	21.7	20.9		724.0	0.0
24/12/2024 08:40	2.0	207.4	30.7	22.1	21.1		749.6	0.0
24/12/2024 08:50	1.5	140.3	51.0	22.3	21.3		802.0	0.0
24/12/2024 09:00	1.2	209.1	39.1	22.3	21.4		826.0	0.0
24/12/2024 09:10	1.9	259.0	28.8	22.7	21.8		855.0	0.0
24/12/2024 09:20	0.7	135.0	51.2	22.4	21.8		892.0	0.0
24/12/2024 09:30	2.3	157.1	26.1	23.2	22.5		920.0	0.0
24/12/2024 09:40	2.2	153.8	30.0	23.0	22.1		949.0	0.0
24/12/2024 09:50	1.7	255.8	25.8	23.5	22.5		971.0	0.0
24/12/2024 10:00	1.9	319.5	19.6	23.7	22.8		994.0	0.0
24/12/2024 10:10	2.0	275.2	46.8	24.2	23.2		1016.0	0.0
24/12/2024 10:20	1.0	302.8	35.5	24.2	23.0		1042.0	0.0
24/12/2024 10:30	0.6	296.8	85.2	24.6	23.6		1060.0	0.0
24/12/2024 10:40	0.7	302.3	77.0	25.2	24.0		1069.0	0.0
24/12/2024 10:50	2.4	215.3	23.2	25.0	24.0		1078.0	0.0

24/12/2024 11:00	1.5	186.6	51.5	25.1	24.1		1100.0	0.0
24/12/2024 11:10	2.4	241.3	22.2	25.6	24.3		1109.0	0.0
24/12/2024 11:20	0.6	189.2	55.6	26.3	25.1		1119.0	0.0
24/12/2024 11:30	2.7	179.7	16.9	26.6	25.3		1122.0	0.0
24/12/2024 11:40	0.6	133.5	69.7	26.5	25.4		1128.0	0.0
24/12/2024 11:50	1.6	177.0	39.0	26.5	25.3		1131.0	0.0
24/12/2024 12:00	3.0	134.5	20.6	27.0	25.9		1133.0	0.0
24/12/2024 12:10	2.6	135.7	27.8	27.8	26.5		1126.0	0.0
24/12/2024 12:20	3.7	133.7	11.9	27.1	26.0		1126.0	0.0
24/12/2024 12:30	2.1	115.5	28.1	26.5	25.5		1112.0	0.0
24/12/2024 12:40	2.4	175.7	28.4	27.5	26.5		1109.0	0.0
24/12/2024 12:50	3.5	143.3	15.0	27.9	26.8		1102.0	0.0
24/12/2024 13:00	2.3	125.2	50.2	27.2	26.1		1084.0	0.0
24/12/2024 13:10	1.6	123.8	59.1	27.3	26.3		1070.0	0.0
24/12/2024 13:20	2.6	128.2	24.8	28.0	26.9		1052.0	0.0
24/12/2024 13:30	1.3	182.1	76.0	27.3	26.8		1039.0	0.0
24/12/2024 13:40	2.0	136.7	51.1	28.2	27.2		1030.0	0.0
24/12/2024 13:50	2.0	127.6	31.3	28.9	27.8		1014.0	0.0
24/12/2024 14:00	1.3	205.3	52.7	28.7	27.9		980.0	0.0
24/12/2024 14:10	0.3	298.2	54.2	28.6	27.7		952.0	0.0
24/12/2024 14:20	3.4	97.7	18.0	28.5	27.6		939.0	0.0
24/12/2024 14:30	1.7	63.5	46.5	28.6	27.8		912.0	0.0
24/12/2024 14:40	0.6	152.1	75.2	28.8	28.0		878.0	0.0
24/12/2024 14:50	3.9	130.0	20.5	29.4	28.5		856.0	0.0
24/12/2024 15:00	1.6	111.1	40.9	28.9	28.3		821.0	0.0
24/12/2024 15:10	2.8	163.5	19.5	29.4	28.6		796.0	0.0
24/12/2024 15:20	3.1	154.4	15.8	29.4	28.6		765.4	0.0
24/12/2024 15:30	3.1	151.8	19.3	29.3	28.5		731.6	0.0
24/12/2024 15:40	3.1	150.2	27.6	29.1	28.5		694.7	0.0
24/12/2024 15:50	3.0	124.8	21.0	29.2	28.5		665.1	0.0
24/12/2024 16:00	2.6	141.7	20.6	29.1	28.4		632.8	0.0
24/12/2024 16:10	3.5	116.5	12.6	29.3	28.6		593.9	0.0
24/12/2024 16:20	1.8	141.1	20.8	29.1	28.6		552.6	0.0
24/12/2024 16:30	3.6	130.9	15.4	29.4	28.8		522.7	0.0
24/12/2024 16:40	4.5	130.1	12.2	29.3	28.7		495.2	0.0
24/12/2024 16:50	5.6	117.4	6.3	29.0	28.6		457.7	0.0
24/12/2024 17:00	5.4	122.0	8.0	28.6	28.1		419.9	0.0
24/12/2024 17:10	4.4	129.6	6.3	28.6	28.2		381.3	0.0
24/12/2024 17:20	4.7	130.2	10.4	28.4	28.1		342.1	0.0
24/12/2024 17:30	5.9	133.3	9.1	27.7	27.4		305.0	0.0
24/12/2024 17:40	5.9	125.2	8.9	27.1	26.9		267.2	0.0
24/12/2024 17:50	5.2	125.3	8.6	26.5	26.4		230.2	0.0
24/12/2024 18:00	6.2	122.9	8.7	26.0	25.9		194.9	0.0
24/12/2024 18:10	6.2	134.4	7.3	25.4	25.4		159.5	0.0
24/12/2024 18:20	6.5	134.0	7.4	24.7	24.7		126.0	0.0
24/12/2024 18:30	6.8	135.3	8.3	24.0	24.1		93.7	0.0
24/12/2024 18:40	5.2	132.4	9.8	23.5	23.7		64.2	0.0
24/12/2024 18:50	6.1	136.1	6.6	23.0	23.2		39.2	0.0
24/12/2024 19:00	5.8	138.7	6.3	22.5	22.8		18.3	0.0
24/12/2024 19:10	6.1	140.9	6.9	22.1	22.4		10.2	0.0
24/12/2024 19:20	6.3	146.2	5.2	21.5	21.9		7.8	0.0
24/12/2024 19:30	6.8	145.3	4.2	21.0	21.4		6.8	0.0

24/12/2024 19:40	6.9	150.0	4.8	20.8	21.2		6.6	0.0
24/12/2024 19:50	7.0	153.3	4.9	20.5	20.9		6.4	0.0
24/12/2024 20:00	7.5	152.2	5.9	20.2	20.7		6.5	0.0
24/12/2024 20:10	7.5	154.2	5.0	20.0	20.3		6.4	0.0
24/12/2024 20:20	7.6	157.1	4.6	19.8	20.1		6.5	0.0
24/12/2024 20:30	7.7	153.6	4.0	19.5	19.8		6.3	0.0
24/12/2024 20:40	8.4	153.5	4.0	19.2	19.4		6.2	0.0
24/12/2024 20:50	7.5	152.5	5.7	18.9	19.2		6.2	0.0
24/12/2024 21:00	7.7	152.9	4.6	18.7	19.0		6.3	0.0
24/12/2024 21:10	7.0	153.0	6.6	18.6	18.8		6.2	0.0
24/12/2024 21:20	7.4	154.6	4.8	18.4	18.6		6.2	0.0
24/12/2024 21:30	7.1	153.0	5.9	18.2	18.5		6.2	0.0
24/12/2024 21:40	6.2	151.0	6.8	18.1	18.3		6.1	0.0
24/12/2024 21:50	6.1	147.7	7.2	17.9	18.1		6.0	0.0
24/12/2024 22:00	6.7	143.9	5.8	17.8	18.1		6.3	0.0
24/12/2024 22:10	5.8	142.4	7.3	17.6	17.9		6.1	0.0
24/12/2024 22:20	5.7	144.2	5.3	17.5	17.8		6.1	0.0
24/12/2024 22:30	5.6	141.9	7.0	17.3	17.7		6.2	0.0
24/12/2024 22:40	5.6	138.7	4.7	17.3	17.7		6.3	0.0
24/12/2024 22:50	5.2	140.8	5.5	17.3	17.7		6.3	0.0
24/12/2024 23:00	5.9	142.1	5.8	17.3	17.7		6.4	0.0
24/12/2024 23:10	5.8	142.6	5.2	17.2	17.7		6.3	0.0
24/12/2024 23:20	5.2	142.6	7.1	17.2	17.6		6.3	0.0
24/12/2024 23:30	4.8	140.8	5.1	17.0	17.5		6.0	0.0
24/12/2024 23:40	4.2	150.4	6.7	16.8	17.4		6.2	0.0
24/12/2024 23:50	4.0	162.1	8.3	16.9	17.4		6.3	0.0
25/12/2024 00:00	3.1	169.1	9.2	16.8	17.3		6.0	0.0
25/12/2024 00:10	2.9	176.5	10.3	16.7	17.1		5.9	0.0
25/12/2024 00:20	2.8	176.3	8.9	16.5	16.9		6.1	0.0
25/12/2024 00:30	4.0	161.2	8.4	16.1	16.5		6.1	0.0
25/12/2024 00:40	5.3	146.1	5.8	16.1	16.6		6.7	0.0
25/12/2024 00:50	4.4	137.5	5.9	16.2	16.7		6.5	0.0
25/12/2024 01:00	5.2	136.0	4.6	16.4	16.9		6.7	0.0
25/12/2024 01:10	6.9	142.0	5.1	16.0	16.6		6.4	0.0
25/12/2024 01:20	6.0	149.6	4.4	15.4	16.1		6.2	0.0
25/12/2024 01:30	4.2	148.7	4.6	15.4	16.0		6.3	0.0
25/12/2024 01:40	3.1	156.6	6.1	15.5	16.0		6.4	0.0
25/12/2024 01:50	2.8	160.8	9.9	15.7	16.3		6.7	0.0
25/12/2024 02:00	3.1	157.4	8.4	15.6	16.2		6.3	0.0
25/12/2024 02:10	3.5	154.8	7.3	15.7	16.4		6.6	0.0
25/12/2024 02:20	4.4	153.7	4.6	15.9	16.6		6.9	0.0
25/12/2024 02:30	4.6	156.3	4.6	15.9	16.6		6.4	0.0
25/12/2024 02:40	4.4	151.2	4.3	15.8	16.6		6.5	0.0
25/12/2024 02:50	3.6	155.4	7.3	15.8	16.5		6.3	0.0
25/12/2024 03:00	3.6	163.0	5.6	15.9	16.5		6.3	0.0
25/12/2024 03:10	3.2	165.8	7.0	15.9	16.5		6.3	0.0
25/12/2024 03:20	3.2	165.3	8.1	15.7	16.3		6.2	0.0
25/12/2024 03:30	3.3	163.6	6.7	15.7	16.2		6.3	0.0
25/12/2024 03:40	2.3	170.9	8.0	15.6	16.3		6.2	0.0
25/12/2024 03:50	2.3	175.8	6.7	15.6	16.2		6.3	0.0
25/12/2024 04:00	2.2	171.2	7.3	15.6	16.2		6.4	0.0
25/12/2024 04:10	2.0	171.8	9.5	15.5	16.2		6.5	0.0

25/12/2024 04:20	1.0	178.8	14.4	15.6	16.1		6.0	0.0
25/12/2024 04:30	0.9	224.8	15.9	14.9	15.7		6.3	0.0
25/12/2024 04:40	1.3	182.3	9.8	15.2	15.9		7.9	0.0
25/12/2024 04:50	0.6	156.8	22.1	14.8	15.6		8.7	0.0
25/12/2024 05:00	1.0	160.2	16.4	14.3	15.3		14.0	0.0
25/12/2024 05:10	0.8	338.2	35.6	13.9	14.6		25.5	0.0
25/12/2024 05:20	1.3	343.7	14.7	13.4	14.1		46.6	0.0
25/12/2024 05:30	1.0	355.2	16.7	13.6	14.0		67.4	0.0
25/12/2024 05:40	0.7	339.2	20.2	13.6	13.6		84.8	0.0
25/12/2024 05:50	1.2	331.0	15.3	13.7	13.6		109.6	0.0
25/12/2024 06:00	1.4	346.4	10.9	13.7	13.6		140.0	0.0
25/12/2024 06:10	1.6	326.5	11.5	14.1	13.9		175.2	0.0
25/12/2024 06:20	1.2	355.0	16.1	14.7	14.5		212.3	0.0
25/12/2024 06:30	1.7	1.8	11.7	15.5	15.2		251.3	0.0
25/12/2024 06:40	2.3	354.3	16.1	15.8	15.5		291.2	0.0
25/12/2024 06:50	2.2	339.4	15.3	16.4	16.1		331.6	0.0
25/12/2024 07:00	1.7	340.4	17.1	17.1	16.6		371.0	0.0
25/12/2024 07:10	1.3	340.2	18.5	17.5	17.1		409.9	0.0
25/12/2024 07:20	1.2	351.9	26.2	18.2	17.8		449.3	0.0
25/12/2024 07:30	1.3	14.1	35.6	19.0	18.5		489.6	0.0
25/12/2024 07:40	0.7	60.0	30.6	19.5	19.0		528.2	0.0
25/12/2024 07:50	0.6	22.8	62.3	19.9	19.5		564.7	0.0
25/12/2024 08:00	1.1	73.2	51.7	20.4	19.8		603.6	0.0
25/12/2024 08:10	0.7	21.9	63.4	20.9	20.4		639.4	0.0
25/12/2024 08:20	0.5	31.1	33.6	21.8	21.1		674.1	0.0
25/12/2024 08:30	1.4	49.4	21.4	21.7	21.0		711.0	0.0
25/12/2024 08:40	2.2	51.8	16.2	22.1	21.2		747.0	0.0
25/12/2024 08:50	1.6	35.9	34.1	22.3	21.7		780.4	0.0
25/12/2024 09:00	1.5	22.2	35.7	22.8	22.0		811.0	0.0
25/12/2024 09:10	1.1	105.3	55.0	23.4	22.8		840.0	0.0
25/12/2024 09:20	2.7	104.4	19.9	23.8	22.7		874.0	0.0
25/12/2024 09:30	2.0	128.4	27.4	23.9	22.8		903.0	0.0
25/12/2024 09:40	2.1	99.9	29.8	24.3	23.2		929.0	0.0
25/12/2024 09:50	1.9	114.7	33.4	24.9	23.6		954.0	0.0
25/12/2024 10:00	2.0	167.3	31.6	25.2	24.3		974.0	0.0
25/12/2024 10:10	1.9	118.5	36.1	25.5	24.6		996.0	0.0
25/12/2024 10:20	1.0	133.6	57.6	25.5	24.6		1014.0	0.0
25/12/2024 10:30	1.8	109.5	48.1	26.8	25.5		1030.0	0.0
25/12/2024 10:40	1.0	131.2	61.0	26.9	25.7		1047.0	0.0
25/12/2024 10:50	2.8	137.5	25.0	27.3	26.2		1059.0	0.0
25/12/2024 11:00	2.5	150.4	27.4	27.3	25.9		1078.0	0.0
25/12/2024 11:10	1.7	143.4	42.7	27.5	26.6		1085.0	0.0
25/12/2024 11:20	2.2	165.6	57.1	27.9	26.8		1095.0	0.0
25/12/2024 11:30	2.6	171.2	23.4	28.3	27.0		1103.0	0.0
25/12/2024 11:40	3.0	160.2	29.1	28.8	27.5		1108.0	0.0
25/12/2024 11:50	2.4	144.3	39.0	28.8	27.7		1111.0	0.0
25/12/2024 12:00	3.0	173.7	15.4	29.4	28.0		1111.0	0.0
25/12/2024 12:10	1.9	130.5	33.5	29.8	28.5		1109.0	0.0
25/12/2024 12:20	2.4	155.2	26.5	30.5	29.3		1108.0	0.0
25/12/2024 12:30	2.2	145.6	19.4	29.7	28.5		1092.0	0.0
25/12/2024 12:40	2.4	118.5	31.0	30.5	29.5		1079.0	0.0
25/12/2024 12:50	3.1	145.4	22.1	30.7	29.6		1072.0	0.0

25/12/2024 13:00	2.0	210.0	33.8	30.7	29.6		1062.0	0.0
25/12/2024 13:10	2.3	112.7	18.9	30.8	29.6		1038.0	0.0
25/12/2024 13:20	1.7	135.7	62.3	30.8	29.7		1056.0	0.0
25/12/2024 13:30	2.5	144.4	24.8	31.0	29.9		1042.0	0.0
25/12/2024 13:40	0.5	95.4	74.4	31.0	30.1		1020.0	0.0
25/12/2024 13:50	2.2	125.6	24.3	31.8	30.7		1005.0	0.0
25/12/2024 14:00	1.1	188.6	64.7	31.3	30.4		981.0	0.0
25/12/2024 14:10	1.5	166.8	31.2	31.1	30.2		958.0	0.0
25/12/2024 14:20	0.9	250.0	76.5	31.0	30.3		928.0	0.0
25/12/2024 14:30	0.7	15.9	65.8	32.1	31.3		905.0	0.0
25/12/2024 14:40	2.6	146.6	29.9	32.3	31.3		884.0	0.0
25/12/2024 14:50	2.0	170.3	21.5	31.6	30.8		861.0	0.0
25/12/2024 15:00	1.7	133.7	43.6	31.9	31.0		833.0	0.0
25/12/2024 15:10	1.9	149.5	15.2	31.7	31.1		800.0	0.0
25/12/2024 15:20	3.1	132.8	11.4	32.3	31.4		769.1	0.0
25/12/2024 15:30	1.4	90.4	34.6	32.0	31.2		733.5	0.0
25/12/2024 15:40	1.3	62.0	50.8	32.2	31.4		700.3	0.0
25/12/2024 15:50	1.9	77.8	18.7	32.5	31.6		665.4	0.0
25/12/2024 16:00	1.9	130.6	31.1	32.5	31.8		632.5	0.0
25/12/2024 16:10	1.4	148.7	35.0	31.9	31.3		598.3	0.0
25/12/2024 16:20	1.4	228.3	23.7	32.2	31.6		560.5	0.0
25/12/2024 16:30	2.4	179.0	12.7	32.2	31.8		524.8	0.0
25/12/2024 16:40	1.3	176.2	23.7	32.3	31.7		487.0	0.0
25/12/2024 16:50	2.1	155.5	26.3	32.1	31.7		449.8	0.0
25/12/2024 17:00	1.7	192.9	17.6	31.9	31.6		411.7	0.0
25/12/2024 17:10	1.4	142.0	32.3	31.9	31.6		370.1	0.0
25/12/2024 17:20	1.8	100.8	16.4	31.8	31.5		334.1	0.0
25/12/2024 17:30	1.6	118.4	26.7	31.8	31.6		295.3	0.0
25/12/2024 17:40	3.2	89.0	9.1	31.6	31.5		262.1	0.0
25/12/2024 17:50	2.6	99.1	18.1	31.3	31.3		226.7	0.0
25/12/2024 18:00	2.6	103.0	10.5	31.0	31.1		190.8	0.0
25/12/2024 18:10	3.1	98.5	10.3	30.8	31.0		157.3	0.0
25/12/2024 18:20	3.0	89.6	5.9	30.2	30.7		123.5	0.0
25/12/2024 18:30	3.9	81.7	4.9	29.7	30.3		92.9	0.0
25/12/2024 18:40	3.2	90.6	8.3	29.2	30.0		63.8	0.0
25/12/2024 18:50	2.4	96.4	5.9	28.9	29.6		38.7	0.0
25/12/2024 19:00	2.3	97.0	6.7	28.6	29.3		17.3	0.0
25/12/2024 19:10	2.3	98.8	5.1	28.2	29.0		9.1	0.0
25/12/2024 19:20	2.4	111.0	6.2	27.7	28.9		7.0	0.0
25/12/2024 19:30	2.4	108.1	6.2	27.4	28.6		5.4	0.0
25/12/2024 19:40	2.5	113.0	7.2	27.0	28.4		5.1	0.0
25/12/2024 19:50	2.9	124.8	13.8	26.9	28.2		4.8	0.0
25/12/2024 20:00	5.7	159.0	5.4	26.0	26.6		4.0	0.0
25/12/2024 20:10	5.7	161.7	5.4	25.2	25.4		4.3	0.0
25/12/2024 20:20	5.6	162.4	5.9	24.7	25.0		4.7	0.0
25/12/2024 20:30	5.5	159.4	7.8	24.3	24.5		4.6	0.0
25/12/2024 20:40	5.3	152.9	6.6	23.8	24.0		4.3	0.0
25/12/2024 20:50	5.9	153.5	4.5	23.2	23.6		4.1	0.0
25/12/2024 21:00	6.1	155.1	6.6	22.9	23.2		4.2	0.0
25/12/2024 21:10	6.3	156.2	7.7	22.6	22.8		4.2	0.0
25/12/2024 21:20	6.3	157.1	6.1	22.4	22.7		4.7	0.0
25/12/2024 21:30	6.2	156.2	7.5	22.2	22.4		4.9	0.0

25/12/2024 21:40	5.9	156.7	6.4	21.9	22.1		4.7	0.0
25/12/2024 21:50	6.4	156.0	5.3	21.7	22.0		4.9	0.0
25/12/2024 22:00	6.2	156.5	5.5	21.4	21.7		4.8	0.0
25/12/2024 22:10	5.9	158.7	4.9	21.2	21.5		4.7	0.0
25/12/2024 22:20	5.6	159.0	7.1	21.0	21.3		4.6	0.0
25/12/2024 22:30	5.1	162.4	8.2	20.6	20.9		4.6	0.0
25/12/2024 22:40	5.6	161.0	6.6	20.4	20.7		4.7	0.0
25/12/2024 22:50	5.0	160.5	6.9	20.2	20.6		4.8	0.0
25/12/2024 23:00	5.4	158.5	5.7	20.0	20.4		4.9	0.0
25/12/2024 23:10	4.8	161.4	6.5	19.9	20.2		4.9	0.0
25/12/2024 23:20	5.0	159.8	5.5	19.7	20.1		5.0	0.0
25/12/2024 23:30	5.3	158.8	6.6	19.6	19.9		5.0	0.0
25/12/2024 23:40	5.2	157.1	5.9	19.4	19.8		4.9	0.0
25/12/2024 23:50	4.8	162.8	5.4	19.3	19.7		4.9	0.0

Table A-4: 10-minute average Palas Fidas PM_{10} data – 22/02/2024 to 24/02/2024

Date & time	A-PF2 PM_{10} (µg/m³)	A-PF5 PM_{10} (µg/m³)
22/02/2024 00:00		9.9
22/02/2024 00:10		9.9
22/02/2024 00:20		9.1
22/02/2024 00:30		9.2
22/02/2024 00:40		9.8
22/02/2024 00:50		9.5
22/02/2024 01:00		10.2
22/02/2024 01:10		11.0
22/02/2024 01:20		10.9
22/02/2024 01:30		11.4
22/02/2024 01:40		11.0
22/02/2024 01:50		9.6
22/02/2024 02:00		9.0
22/02/2024 02:10		9.4
22/02/2024 02:20		10.6
22/02/2024 02:30		11.6
22/02/2024 02:40		11.4
22/02/2024 02:50		11.2
22/02/2024 03:00		10.9
22/02/2024 03:10		11.0
22/02/2024 03:20		11.6
22/02/2024 03:30		11.7
22/02/2024 03:40		12.3
22/02/2024 03:50		12.2
22/02/2024 04:00		12.2
22/02/2024 04:10		13.0
22/02/2024 04:20		13.3
22/02/2024 04:30		12.2
22/02/2024 04:40		12.8
22/02/2024 04:50		13.0
22/02/2024 05:00		13.9
22/02/2024 05:10		16.3
22/02/2024 05:20		19.1
22/02/2024 05:30		18.2

22/02/2024 05:40		17.9
22/02/2024 05:50		18.5
22/02/2024 06:00		18.3
22/02/2024 06:10		18.2
22/02/2024 06:20		16.5
22/02/2024 06:30		15.7
22/02/2024 06:40		16.4
22/02/2024 06:50		16.5
22/02/2024 07:00		15.8
22/02/2024 07:10		14.0
22/02/2024 07:20		14.1
22/02/2024 07:30		15.1
22/02/2024 07:40		16.1
22/02/2024 07:50		15.7
22/02/2024 08:00		16.8
22/02/2024 08:10		14.6
22/02/2024 08:20		12.6
22/02/2024 08:30		11.9
22/02/2024 08:40		12.6
22/02/2024 08:50		13.5
22/02/2024 09:00		13.7
22/02/2024 09:10		12.9
22/02/2024 09:20		12.6
22/02/2024 09:30		12.8
22/02/2024 09:40		12.9
22/02/2024 09:50		13.5
22/02/2024 10:00		14.2
22/02/2024 10:10		14.1
22/02/2024 10:20		14.2
22/02/2024 10:30		15.4
22/02/2024 10:40		15.3
22/02/2024 10:50		16.3
22/02/2024 11:00		19.1
22/02/2024 11:10		68.1
22/02/2024 11:20		130.3
22/02/2024 11:30		51.6
22/02/2024 11:40		22.2
22/02/2024 11:50		23.5
22/02/2024 12:00		24.7
22/02/2024 12:10		24.2
22/02/2024 12:20		27.3
22/02/2024 12:30		31.2
22/02/2024 12:40		37.8
22/02/2024 12:50		40.2
22/02/2024 13:00		38.1
22/02/2024 13:10		38.2
22/02/2024 13:20		38.5
22/02/2024 13:30		45.7
22/02/2024 13:40		46.3
22/02/2024 13:50		44.9
22/02/2024 14:00		40.5
22/02/2024 14:10		37.6

22/02/2024 14:20		34.4
22/02/2024 14:30		35.6
22/02/2024 14:40		35.1
22/02/2024 14:50		31.1
22/02/2024 15:00		32.4
22/02/2024 15:10		32.2
22/02/2024 15:20		35.9
22/02/2024 15:30		35.7
22/02/2024 15:40		32.8
22/02/2024 15:50		32.4
22/02/2024 16:00		30.4
22/02/2024 16:10		30.5
22/02/2024 16:20		29.1
22/02/2024 16:30		22.7
22/02/2024 16:40		18.3
22/02/2024 16:50		17.4
22/02/2024 17:00		17.5
22/02/2024 17:10		19.6
22/02/2024 17:20		20.8
22/02/2024 17:30		22.5
22/02/2024 17:40		29.4
22/02/2024 17:50		32.2
22/02/2024 18:00		24.5
22/02/2024 18:10		20.9
22/02/2024 18:20		20.3
22/02/2024 18:30		20.6
22/02/2024 18:40		21.3
22/02/2024 18:50		23.7
22/02/2024 19:00		26.6
22/02/2024 19:10		28.8
22/02/2024 19:20		30.1
22/02/2024 19:30		29.9
22/02/2024 19:40		31.9
22/02/2024 19:50		29.2
22/02/2024 20:00		25.2
22/02/2024 20:10		24.8
22/02/2024 20:20		26.1
22/02/2024 20:30		29.8
22/02/2024 20:40		30.2
22/02/2024 20:50		27.6
22/02/2024 21:00		19.0
22/02/2024 21:10		12.8
22/02/2024 21:20		11.4
22/02/2024 21:30		11.0
22/02/2024 21:40		9.7
22/02/2024 21:50		11.2
22/02/2024 22:00		13.1
22/02/2024 22:10		12.5
22/02/2024 22:20		10.8
22/02/2024 22:30		9.7
22/02/2024 22:40		9.6
22/02/2024 22:50		10.0

22/02/2024 23:00		10.1
22/02/2024 23:10		11.0
22/02/2024 23:20		12.1
22/02/2024 23:30		12.7
22/02/2024 23:40		12.3
22/02/2024 23:50		10.6
23/02/2024 00:00		10.7
23/02/2024 00:10		11.3
23/02/2024 00:20		10.8
23/02/2024 00:30		11.5
23/02/2024 00:40		11.9
23/02/2024 00:50		11.6
23/02/2024 01:00		11.6
23/02/2024 01:10		12.6
23/02/2024 01:20		12.3
23/02/2024 01:30		11.0
23/02/2024 01:40		11.0
23/02/2024 01:50		11.8
23/02/2024 02:00		11.9
23/02/2024 02:10		12.7
23/02/2024 02:20		12.2
23/02/2024 02:30		12.2
23/02/2024 02:40		12.8
23/02/2024 02:50		11.2
23/02/2024 03:00		10.0
23/02/2024 03:10		10.4
23/02/2024 03:20		10.2
23/02/2024 03:30		9.2
23/02/2024 03:40		10.2
23/02/2024 03:50		10.8
23/02/2024 04:00		11.1
23/02/2024 04:10		11.1
23/02/2024 04:20		11.2
23/02/2024 04:30		11.1
23/02/2024 04:40		11.5
23/02/2024 04:50		11.9
23/02/2024 05:00		11.9
23/02/2024 05:10		11.2
23/02/2024 05:20		13.3
23/02/2024 05:30		13.2
23/02/2024 05:40		12.7
23/02/2024 05:50		12.4
23/02/2024 06:00		12.7
23/02/2024 06:10		13.8
23/02/2024 06:20		11.8
23/02/2024 06:30		10.2
23/02/2024 06:40		10.3
23/02/2024 06:50		11.1
23/02/2024 07:00		11.4
23/02/2024 07:10		12.8
23/02/2024 07:20		13.2
23/02/2024 07:30		15.0

23/02/2024 07:40		16.0
23/02/2024 07:50		15.4
23/02/2024 08:00		14.1
23/02/2024 08:10		13.9
23/02/2024 08:20		13.9
23/02/2024 08:30		13.9
23/02/2024 08:40		13.2
23/02/2024 08:50		13.5
23/02/2024 09:00		14.5
23/02/2024 09:10		12.5
23/02/2024 09:20		11.1
23/02/2024 09:30		10.4
23/02/2024 09:40		10.7
23/02/2024 09:50		11.3
23/02/2024 10:00		11.1
23/02/2024 10:10		11.9
23/02/2024 10:20		12.7
23/02/2024 10:30		14.8
23/02/2024 10:40		14.9
23/02/2024 10:50		13.0
23/02/2024 11:00		12.0
23/02/2024 11:10		12.9
23/02/2024 11:20		11.3
23/02/2024 11:30		11.9
23/02/2024 11:40		12.9
23/02/2024 11:50		12.1
23/02/2024 12:00		12.9
23/02/2024 12:10		12.9
23/02/2024 12:20		11.5
23/02/2024 12:30		11.8
23/02/2024 12:40		10.1
23/02/2024 12:50		11.1
23/02/2024 13:00		11.9
23/02/2024 13:10		16.7
23/02/2024 13:20		29.5
23/02/2024 13:30		23.0
23/02/2024 13:40		14.3
23/02/2024 13:50		12.1
23/02/2024 14:00		11.6
23/02/2024 14:10		12.5
23/02/2024 14:20		9.5
23/02/2024 14:30		8.5
23/02/2024 14:40		10.2
23/02/2024 14:50		13.8
23/02/2024 15:00		13.7
23/02/2024 15:10		12.7
23/02/2024 15:20		14.4
23/02/2024 15:30		19.8
23/02/2024 15:40		19.4
23/02/2024 15:50		13.4
23/02/2024 16:00		11.2
23/02/2024 16:10		12.4

23/02/2024 16:20		14.2
23/02/2024 16:30		14.2
23/02/2024 16:40		18.0
23/02/2024 16:50		36.9
23/02/2024 17:00		42.8
23/02/2024 17:10		22.9
23/02/2024 17:20		16.7
23/02/2024 17:30		17.9
23/02/2024 17:40		19.5
23/02/2024 17:50		24.9
23/02/2024 18:00		16.3
23/02/2024 18:10		17.7
23/02/2024 18:20		18.6
23/02/2024 18:30		15.2
23/02/2024 18:40		13.3
23/02/2024 18:50		13.8
23/02/2024 19:00		13.7
23/02/2024 19:10		13.3
23/02/2024 19:20		11.4
23/02/2024 19:30		11.3
23/02/2024 19:40		10.2
23/02/2024 19:50		11.0
23/02/2024 20:00		12.9
23/02/2024 20:10		12.0
23/02/2024 20:20		11.3
23/02/2024 20:30		11.3
23/02/2024 20:40		11.6
23/02/2024 20:50		12.4
23/02/2024 21:00		10.9
23/02/2024 21:10		10.7
23/02/2024 21:20		11.2
23/02/2024 21:30		12.3
23/02/2024 21:40		12.1
23/02/2024 21:50		11.9
23/02/2024 22:00		11.3
23/02/2024 22:10		12.4
23/02/2024 22:20		13.1
23/02/2024 22:30		12.9
23/02/2024 22:40		12.5
23/02/2024 22:50		12.5
23/02/2024 23:00		13.8
23/02/2024 23:10		12.7
23/02/2024 23:20		14.5
23/02/2024 23:30		15.3
23/02/2024 23:40		15.5
23/02/2024 23:50		17.4
24/02/2024 00:00		16.2
24/02/2024 00:10		17.0
24/02/2024 00:20		19.6
24/02/2024 00:30		21.5
24/02/2024 00:40		21.9
24/02/2024 00:50		21.1

24/02/2024 01:00		19.8
24/02/2024 01:10		18.5
24/02/2024 01:20		19.2
24/02/2024 01:30		20.0
24/02/2024 01:40		17.8
24/02/2024 01:50		16.4
24/02/2024 02:00		16.6
24/02/2024 02:10		18.1
24/02/2024 02:20		19.5
24/02/2024 02:30		19.4
24/02/2024 02:40		19.2
24/02/2024 02:50		18.8
24/02/2024 03:00		19.4
24/02/2024 03:10		20.1
24/02/2024 03:20		20.1
24/02/2024 03:30		21.4
24/02/2024 03:40		21.3
24/02/2024 03:50		21.5
24/02/2024 04:00		20.3
24/02/2024 04:10		20.2
24/02/2024 04:20		21.3
24/02/2024 04:30		22.8
24/02/2024 04:40		24.9
24/02/2024 04:50		25.7
24/02/2024 05:00		23.9
24/02/2024 05:10		23.1
24/02/2024 05:20		21.6
24/02/2024 05:30		21.7
24/02/2024 05:40		22.7
24/02/2024 05:50		22.8
24/02/2024 06:00		23.1
24/02/2024 06:10		23.5
24/02/2024 06:20		19.0
24/02/2024 06:30		14.1
24/02/2024 06:40		13.9
24/02/2024 06:50		14.5
24/02/2024 07:00		13.9
24/02/2024 07:10		13.7
24/02/2024 07:20		13.0
24/02/2024 07:30		11.6
24/02/2024 07:40		9.5
24/02/2024 07:50		8.7
24/02/2024 08:00		9.1
24/02/2024 08:10		8.7
24/02/2024 08:20		8.2
24/02/2024 08:30		8.1
24/02/2024 08:40		8.6
24/02/2024 08:50		8.0
24/02/2024 09:00		9.2
24/02/2024 09:10		10.5
24/02/2024 09:20		9.2
24/02/2024 09:30		7.9

24/02/2024 09:40		8.5
24/02/2024 09:50		9.3
24/02/2024 10:00		9.8
24/02/2024 10:10		9.6
24/02/2024 10:20		10.6
24/02/2024 10:30		8.9
24/02/2024 10:40		8.2
24/02/2024 10:50		7.7
24/02/2024 11:00		7.4
24/02/2024 11:10		8.1
24/02/2024 11:20		7.4
24/02/2024 11:30		7.3
24/02/2024 11:40		7.7
24/02/2024 11:50		7.6
24/02/2024 12:00		6.8
24/02/2024 12:10		6.4
24/02/2024 12:20		6.2
24/02/2024 12:30		6.1
24/02/2024 12:40		7.3
24/02/2024 12:50		9.6
24/02/2024 13:00		8.0
24/02/2024 13:10		7.3
24/02/2024 13:20		7.7
24/02/2024 13:30		6.6
24/02/2024 13:40		6.3
24/02/2024 13:50		6.4
24/02/2024 14:00		6.8
24/02/2024 14:10		6.7
24/02/2024 14:20		6.0
24/02/2024 14:30		6.2
24/02/2024 14:40		7.3
24/02/2024 14:50		7.7
24/02/2024 15:00		8.2
24/02/2024 15:10		7.3
24/02/2024 15:20		5.7
24/02/2024 15:30		5.3
24/02/2024 15:40		5.8
24/02/2024 15:50		6.1
24/02/2024 16:00		6.4
24/02/2024 16:10		7.4
24/02/2024 16:20		8.0
24/02/2024 16:30		7.7
24/02/2024 16:40		9.2
24/02/2024 16:50		10.1
24/02/2024 17:00		9.7
24/02/2024 17:10		10.1
24/02/2024 17:20		10.1
24/02/2024 17:30		9.2
24/02/2024 17:40		9.3
24/02/2024 17:50		10.5
24/02/2024 18:00		10.5
24/02/2024 18:10		11.0

24/02/2024 18:20		11.7
24/02/2024 18:30		12.0
24/02/2024 18:40		12.2
24/02/2024 18:50		11.7
24/02/2024 19:00		11.2
24/02/2024 19:10		10.7
24/02/2024 19:20		11.6
24/02/2024 19:30		12.5
24/02/2024 19:40		12.4
24/02/2024 19:50		13.0
24/02/2024 20:00		13.4
24/02/2024 20:10		14.4
24/02/2024 20:20		15.4
24/02/2024 20:30		15.6
24/02/2024 20:40		14.6
24/02/2024 20:50		13.6
24/02/2024 21:00		14.0
24/02/2024 21:10		15.1
24/02/2024 21:20		15.7
24/02/2024 21:30		15.1
24/02/2024 21:40		14.2
24/02/2024 21:50		14.3
24/02/2024 22:00		13.9
24/02/2024 22:10		14.4
24/02/2024 22:20		14.5
24/02/2024 22:30		13.7
24/02/2024 22:40		13.7
24/02/2024 22:50		14.4
24/02/2024 23:00		15.4
24/02/2024 23:10		15.6
24/02/2024 23:20		13.4
24/02/2024 23:30		13.2
24/02/2024 23:40		13.9
24/02/2024 23:50		15.5

Table A-5: 10-minute average Palas Fidas PM_{10} data – 2/09/2024 to 4/09/2024

Date & time	A-PF2 PM_{10} (µg/m^3)	A-PF5 PM_{10} (µg/m^3)
2/09/2024 00:00		9.1
2/09/2024 00:10		9.4
2/09/2024 00:20		10.6
2/09/2024 00:30		11.3
2/09/2024 00:40		11.5
2/09/2024 00:50		13.7
2/09/2024 01:00		13.4
2/09/2024 01:10		13.8
2/09/2024 01:20		14.1
2/09/2024 01:30		13.6
2/09/2024 01:40		12.0
2/09/2024 01:50		12.3
2/09/2024 02:00		11.3
2/09/2024 02:10		10.8

2/09/2024 02:20		13.1
2/09/2024 02:30		12.7
2/09/2024 02:40		12.4
2/09/2024 02:50		11.9
2/09/2024 03:00		10.5
2/09/2024 03:10		11.1
2/09/2024 03:20		11.2
2/09/2024 03:30		11.8
2/09/2024 03:40		11.1
2/09/2024 03:50		9.7
2/09/2024 04:00		9.8
2/09/2024 04:10		10.2
2/09/2024 04:20		10.5
2/09/2024 04:30		10.3
2/09/2024 04:40		11.2
2/09/2024 04:50		11.0
2/09/2024 05:00		12.3
2/09/2024 05:10		12.0
2/09/2024 05:20		10.7
2/09/2024 05:30		10.8
2/09/2024 05:40		10.8
2/09/2024 05:50		10.0
2/09/2024 06:00		9.5
2/09/2024 06:10		8.7
2/09/2024 06:20		9.5
2/09/2024 06:30		8.8
2/09/2024 06:40		8.4
2/09/2024 06:50		9.0
2/09/2024 07:00		9.6
2/09/2024 07:10		10.1
2/09/2024 07:20		10.4
2/09/2024 07:30		11.3
2/09/2024 07:40		12.1
2/09/2024 07:50		11.8
2/09/2024 08:00		10.4
2/09/2024 08:10		9.7
2/09/2024 08:20		11.2
2/09/2024 08:30		11.9
2/09/2024 08:40		11.4
2/09/2024 08:50		10.5
2/09/2024 09:00		9.7
2/09/2024 09:10		11.4
2/09/2024 09:20		12.7
2/09/2024 09:30		15.1
2/09/2024 09:40		10.2
2/09/2024 09:50		10.7
2/09/2024 10:00		11.2
2/09/2024 10:10		12.2
2/09/2024 10:20		19.9
2/09/2024 10:30		18.4
2/09/2024 10:40		17.2
2/09/2024 10:50		12.7

2/09/2024 11:00		10.5
2/09/2024 11:10		13.4
2/09/2024 11:20		13.8
2/09/2024 11:30		12.7
2/09/2024 11:40		12.4
2/09/2024 11:50		13.4
2/09/2024 12:00		16.6
2/09/2024 12:10		18.5
2/09/2024 12:20		16.3
2/09/2024 12:30		11.9
2/09/2024 12:40		13.2
2/09/2024 12:50		14.2
2/09/2024 13:00		15.6
2/09/2024 13:10		14.5
2/09/2024 13:20		13.2
2/09/2024 13:30		14.8
2/09/2024 13:40		15.9
2/09/2024 13:50		13.7
2/09/2024 14:00		14.4
2/09/2024 14:10		14.8
2/09/2024 14:20		16.4
2/09/2024 14:30		19.0
2/09/2024 14:40		16.3
2/09/2024 14:50		14.1
2/09/2024 15:00		13.9
2/09/2024 15:10		13.4
2/09/2024 15:20		14.8
2/09/2024 15:30		13.9
2/09/2024 15:40		15.8
2/09/2024 15:50		17.5
2/09/2024 16:00		16.3
2/09/2024 16:10		15.1
2/09/2024 16:20		13.8
2/09/2024 16:30		13.2
2/09/2024 16:40		13.0
2/09/2024 16:50		14.0
2/09/2024 17:00		13.6
2/09/2024 17:10		14.1
2/09/2024 17:20		15.3
2/09/2024 17:30		15.2
2/09/2024 17:40		15.6
2/09/2024 17:50		16.2
2/09/2024 18:00		17.9
2/09/2024 18:10		18.5
2/09/2024 18:20		18.0
2/09/2024 18:30		16.4
2/09/2024 18:40		15.6
2/09/2024 18:50		17.3
2/09/2024 19:00		18.9
2/09/2024 19:10		19.4
2/09/2024 19:20		19.1
2/09/2024 19:30		17.6

2/09/2024 19:40		17.7
2/09/2024 19:50		17.6
2/09/2024 20:00		18.8
2/09/2024 20:10		17.9
2/09/2024 20:20		17.6
2/09/2024 20:30		18.8
2/09/2024 20:40		19.7
2/09/2024 20:50		19.6
2/09/2024 21:00		19.9
2/09/2024 21:10		20.0
2/09/2024 21:20		19.5
2/09/2024 21:30		17.7
2/09/2024 21:40		17.4
2/09/2024 21:50		16.3
2/09/2024 22:00		15.9
2/09/2024 22:10		18.1
2/09/2024 22:20		16.9
2/09/2024 22:30		15.6
2/09/2024 22:40		16.6
2/09/2024 22:50		17.0
2/09/2024 23:00		17.4
2/09/2024 23:10		17.4
2/09/2024 23:20		16.9
2/09/2024 23:30		16.3
2/09/2024 23:40		16.7
2/09/2024 23:50		16.2
3/09/2024 00:00		16.6
3/09/2024 00:10		14.7
3/09/2024 00:20		16.0
3/09/2024 00:30		16.8
3/09/2024 00:40		14.9
3/09/2024 00:50		14.6
3/09/2024 01:00		15.0
3/09/2024 01:10		15.6
3/09/2024 01:20		15.5
3/09/2024 01:30		15.7
3/09/2024 01:40		16.8
3/09/2024 01:50		16.1
3/09/2024 02:00		15.5
3/09/2024 02:10		15.6
3/09/2024 02:20		15.1
3/09/2024 02:30		15.6
3/09/2024 02:40		17.3
3/09/2024 02:50		17.3
3/09/2024 03:00		16.5
3/09/2024 03:10		15.1
3/09/2024 03:20		14.2
3/09/2024 03:30		16.0
3/09/2024 03:40		17.4
3/09/2024 03:50		17.1
3/09/2024 04:00		15.4
3/09/2024 04:10		14.0

3/09/2024 04:20		14.6
3/09/2024 04:30		14.5
3/09/2024 04:40		14.8
3/09/2024 04:50		14.5
3/09/2024 05:00		15.0
3/09/2024 05:10		15.0
3/09/2024 05:20		15.5
3/09/2024 05:30		15.0
3/09/2024 05:40		14.2
3/09/2024 05:50		13.5
3/09/2024 06:00		14.2
3/09/2024 06:10		13.7
3/09/2024 06:20		12.1
3/09/2024 06:30		13.5
3/09/2024 06:40		14.1
3/09/2024 06:50		13.1
3/09/2024 07:00		14.9
3/09/2024 07:10		14.3
3/09/2024 07:20		12.4
3/09/2024 07:30		13.4
3/09/2024 07:40		14.9
3/09/2024 07:50		14.7
3/09/2024 08:00		14.6
3/09/2024 08:10		15.1
3/09/2024 08:20		15.8
3/09/2024 08:30		14.8
3/09/2024 08:40		13.5
3/09/2024 08:50		11.8
3/09/2024 09:00		10.8
3/09/2024 09:10		11.7
3/09/2024 09:20		12.3
3/09/2024 09:30		12.0
3/09/2024 09:40		10.9
3/09/2024 09:50		11.0
3/09/2024 10:00		11.5
3/09/2024 10:10		12.0
3/09/2024 10:20		13.2
3/09/2024 10:30		14.6
3/09/2024 10:40		16.0
3/09/2024 10:50		16.4
3/09/2024 11:00		15.8
3/09/2024 11:10		15.6
3/09/2024 11:20		14.8
3/09/2024 11:30		13.3
3/09/2024 11:40		13.9
3/09/2024 11:50		15.8
3/09/2024 12:00		13.8
3/09/2024 12:10		13.3
3/09/2024 12:20		13.6
3/09/2024 12:30		13.4
3/09/2024 12:40		12.4
3/09/2024 12:50		13.1

3/09/2024 13:00		13.8
3/09/2024 13:10		14.1
3/09/2024 13:20		16.2
3/09/2024 13:30		16.3
3/09/2024 13:40		17.1
3/09/2024 13:50		16.3
3/09/2024 14:00		16.7
3/09/2024 14:10		16.5
3/09/2024 14:20		16.2
3/09/2024 14:30		15.5
3/09/2024 14:40		43.9
3/09/2024 14:50		46.7
3/09/2024 15:00		17.8
3/09/2024 15:10		16.2
3/09/2024 15:20		15.3
3/09/2024 15:30		16.2
3/09/2024 15:40		16.7
3/09/2024 15:50		15.2
3/09/2024 16:00		13.7
3/09/2024 16:10		14.0
3/09/2024 16:20		13.9
3/09/2024 16:30		13.8
3/09/2024 16:40		13.4
3/09/2024 16:50		14.0
3/09/2024 17:00		12.4
3/09/2024 17:10		12.3
3/09/2024 17:20		13.7
3/09/2024 17:30		12.6
3/09/2024 17:40		14.5
3/09/2024 17:50		18.8
3/09/2024 18:00		16.6
3/09/2024 18:10		14.2
3/09/2024 18:20		12.7
3/09/2024 18:30		13.6
3/09/2024 18:40		15.1
3/09/2024 18:50		17.4
3/09/2024 19:00		16.0
3/09/2024 19:10		15.6
3/09/2024 19:20		16.1
3/09/2024 19:30		15.3
3/09/2024 19:40		15.5
3/09/2024 19:50		16.5
3/09/2024 20:00		15.2
3/09/2024 20:10		15.5
3/09/2024 20:20		17.5
3/09/2024 20:30		19.3
3/09/2024 20:40		21.3
3/09/2024 20:50		24.5
3/09/2024 21:00		27.6
3/09/2024 21:10		28.3
3/09/2024 21:20		28.4
3/09/2024 21:30		27.5

3/09/2024 21:40		28.0
3/09/2024 21:50		25.3
3/09/2024 22:00		22.4
3/09/2024 22:10		24.3
3/09/2024 22:20		27.1
3/09/2024 22:30		23.7
3/09/2024 22:40		24.5
3/09/2024 22:50		26.5
3/09/2024 23:00		28.2
3/09/2024 23:10		26.4
3/09/2024 23:20		25.4
3/09/2024 23:30		24.3
3/09/2024 23:40		24.0
3/09/2024 23:50		24.1
4/09/2024 00:00		23.2
4/09/2024 00:10		22.7
4/09/2024 00:20		23.5
4/09/2024 00:30		24.8
4/09/2024 00:40		28.0
4/09/2024 00:50		34.8
4/09/2024 01:00		39.7
4/09/2024 01:10		37.9
4/09/2024 01:20		32.5
4/09/2024 01:30		26.0
4/09/2024 01:40		24.4
4/09/2024 01:50		20.7
4/09/2024 02:00		18.5
4/09/2024 02:10		19.6
4/09/2024 02:20		19.2
4/09/2024 02:30		20.2
4/09/2024 02:40		21.5
4/09/2024 02:50		20.6
4/09/2024 03:00		15.8
4/09/2024 03:10		13.7
4/09/2024 03:20		15.3
4/09/2024 03:30		15.6
4/09/2024 03:40		16.7
4/09/2024 03:50		16.9
4/09/2024 04:00		19.0
4/09/2024 04:10		19.1
4/09/2024 04:20		17.9
4/09/2024 04:30		17.6
4/09/2024 04:40		16.9
4/09/2024 04:50		16.3
4/09/2024 05:00		16.5
4/09/2024 05:10		16.2
4/09/2024 05:20		15.9
4/09/2024 05:30		15.6
4/09/2024 05:40		15.7
4/09/2024 05:50		15.7
4/09/2024 06:00		15.4
4/09/2024 06:10		15.9

4/09/2024 06:20		16.3
4/09/2024 06:30		14.7
4/09/2024 06:40		16.9
4/09/2024 06:50		18.9
4/09/2024 07:00		16.9
4/09/2024 07:10		14.7
4/09/2024 07:20		15.5
4/09/2024 07:30		16.5
4/09/2024 07:40		14.8
4/09/2024 07:50		13.2
4/09/2024 08:00		14.0
4/09/2024 08:10		13.6
4/09/2024 08:20		12.8
4/09/2024 08:30		12.9
4/09/2024 08:40		13.2
4/09/2024 08:50		13.0
4/09/2024 09:00		12.6
4/09/2024 09:10		12.5
4/09/2024 09:20		12.8
4/09/2024 09:30		13.7
4/09/2024 09:40		14.0
4/09/2024 09:50		14.7
4/09/2024 10:00		17.0
4/09/2024 10:10		16.4
4/09/2024 10:20		13.3
4/09/2024 10:30		12.1
4/09/2024 10:40		13.1
4/09/2024 10:50		13.9
4/09/2024 11:00		13.6
4/09/2024 11:10		11.9
4/09/2024 11:20		12.6
4/09/2024 11:30		13.7
4/09/2024 11:40		13.5
4/09/2024 11:50		13.5
4/09/2024 12:00		13.1
4/09/2024 12:10		13.9
4/09/2024 12:20		12.6
4/09/2024 12:30		12.3
4/09/2024 12:40		12.8
4/09/2024 12:50		13.7
4/09/2024 13:00		14.1
4/09/2024 13:10		12.2
4/09/2024 13:20		13.1
4/09/2024 13:30		14.0
4/09/2024 13:40		12.9
4/09/2024 13:50		13.7
4/09/2024 14:00		23.5
4/09/2024 14:10		42.8
4/09/2024 14:20		44.6
4/09/2024 14:30		33.9
4/09/2024 14:40		26.4
4/09/2024 14:50		22.8

4/09/2024 15:00		20.8
4/09/2024 15:10		18.9
4/09/2024 15:20		18.1
4/09/2024 15:30		25.9
4/09/2024 15:40		27.0
4/09/2024 15:50		26.3
4/09/2024 16:00		27.7
4/09/2024 16:10		31.1
4/09/2024 16:20		30.3
4/09/2024 16:30		27.8
4/09/2024 16:40		28.7
4/09/2024 16:50		31.3
4/09/2024 17:00		36.3
4/09/2024 17:10		34.8
4/09/2024 17:20		31.8
4/09/2024 17:30		31.9
4/09/2024 17:40		25.3
4/09/2024 17:50		20.8
4/09/2024 18:00		22.2
4/09/2024 18:10		21.7
4/09/2024 18:20		20.9
4/09/2024 18:30		20.5
4/09/2024 18:40		15.4
4/09/2024 18:50		10.1
4/09/2024 19:00		13.9
4/09/2024 19:10		19.1
4/09/2024 19:20		18.3
4/09/2024 19:30		16.3
4/09/2024 19:40		14.2
4/09/2024 19:50		14.3
4/09/2024 20:00		16.7
4/09/2024 20:10		22.0
4/09/2024 20:20		22.8
4/09/2024 20:30		20.0
4/09/2024 20:40		17.2
4/09/2024 20:50		17.5
4/09/2024 21:00		17.6
4/09/2024 21:10		15.7
4/09/2024 21:20		16.9
4/09/2024 21:30		17.9
4/09/2024 21:40		15.0
4/09/2024 21:50		13.2
4/09/2024 22:00		13.1
4/09/2024 22:10		13.4
4/09/2024 22:20		12.4
4/09/2024 22:30		12.3
4/09/2024 22:40		11.9
4/09/2024 22:50		11.7
4/09/2024 23:00		12.4
4/09/2024 23:10		12.1
4/09/2024 23:20		11.6
4/09/2024 23:30		10.5

4/09/2024 23:40		10.2
4/09/2024 23:50		10.9

Table A-6: 10-minute average Palas Fidas PM_{10} data – 23/12/2024 to 25/12/2024

Date & time	A-PF2 PM_{10} (µg/m^3)	A-PF5 PM_{10} (µg/m^3)
23/12/2024 00:00	21.8	
23/12/2024 00:10	23.0	
23/12/2024 00:20	22.8	
23/12/2024 00:30	19.4	
23/12/2024 00:40	19.8	
23/12/2024 00:50	19.2	
23/12/2024 01:00	19.3	
23/12/2024 01:10	20.7	
23/12/2024 01:20	19.4	
23/12/2024 01:30	21.6	
23/12/2024 01:40	17.9	
23/12/2024 01:50	16.2	
23/12/2024 02:00	16.5	
23/12/2024 02:10	20.6	
23/12/2024 02:20	21.2	
23/12/2024 02:30	18.3	
23/12/2024 02:40	15.9	
23/12/2024 02:50	19.6	
23/12/2024 03:00	29.5	
23/12/2024 03:10	31.1	
23/12/2024 03:20	28.8	
23/12/2024 03:30	26.9	
23/12/2024 03:40	25.6	
23/12/2024 03:50	25.9	
23/12/2024 04:00	26.2	
23/12/2024 04:10	26.2	
23/12/2024 04:20	29.2	
23/12/2024 04:30	30.2	
23/12/2024 04:40	29.1	
23/12/2024 04:50	26.7	
23/12/2024 05:00	26.3	
23/12/2024 05:10	28.2	
23/12/2024 05:20	30.8	
23/12/2024 05:30	27.9	
23/12/2024 05:40	27.1	
23/12/2024 05:50	27.2	
23/12/2024 06:00	26.9	
23/12/2024 06:10	26.7	
23/12/2024 06:20	26.1	
23/12/2024 06:30	29.7	
23/12/2024 06:40	32.5	
23/12/2024 06:50	33.4	
23/12/2024 07:00	40.8	
23/12/2024 07:10	52.2	
23/12/2024 07:20	54.4	

23/12/2024 07:30	54.7	
23/12/2024 07:40	34.1	
23/12/2024 07:50	30.8	
23/12/2024 08:00	35.6	
23/12/2024 08:10	34.2	
23/12/2024 08:20	34.9	
23/12/2024 08:30	34.1	
23/12/2024 08:40	38.3	
23/12/2024 08:50	38.1	
23/12/2024 09:00	28.3	
23/12/2024 09:10		
23/12/2024 09:20	32.9	
23/12/2024 09:30	38.4	
23/12/2024 09:40	40.2	
23/12/2024 09:50	41.9	
23/12/2024 10:00	47.2	
23/12/2024 10:10	50.9	
23/12/2024 10:20	53.9	
23/12/2024 10:30	53.9	26.0
23/12/2024 10:40	44.2	27.3
23/12/2024 10:50	46.8	29.3
23/12/2024 11:00	47.9	29.0
23/12/2024 11:10	57.0	29.8
23/12/2024 11:20	59.8	26.7
23/12/2024 11:30	50.2	24.1
23/12/2024 11:40	51.6	23.4
23/12/2024 11:50	41.2	24.3
23/12/2024 12:00	41.6	26.1
23/12/2024 12:10	43.4	22.9
23/12/2024 12:20	40.1	24.1
23/12/2024 12:30	40.2	27.0
23/12/2024 12:40	40.6	26.8
23/12/2024 12:50	33.7	24.2
23/12/2024 13:00	33.8	24.0
23/12/2024 13:10	31.0	26.4
23/12/2024 13:20	28.9	25.2
23/12/2024 13:30	31.8	24.3
23/12/2024 13:40	33.3	24.2
23/12/2024 13:50	30.7	23.6
23/12/2024 14:00	27.7	21.7
23/12/2024 14:10	22.3	16.3
23/12/2024 14:20	22.4	15.5
23/12/2024 14:30	24.7	16.0
23/12/2024 14:40	27.4	15.2
23/12/2024 14:50	25.7	17.8
23/12/2024 15:00	21.9	17.2
23/12/2024 15:10	20.3	13.2
23/12/2024 15:20	19.3	12.0
23/12/2024 15:30	19.0	11.5
23/12/2024 15:40	20.8	12.2
23/12/2024 15:50	25.0	13.4
23/12/2024 16:00	21.2	15.1

23/12/2024 16:10	17.7	14.6
23/12/2024 16:20	14.5	14.0
23/12/2024 16:30	12.4	13.0
23/12/2024 16:40	17.1	11.2
23/12/2024 16:50	23.4	12.1
23/12/2024 17:00	17.5	11.7
23/12/2024 17:10	18.9	10.5
23/12/2024 17:20	20.4	10.4
23/12/2024 17:30	19.5	9.1
23/12/2024 17:40	22.3	9.1
23/12/2024 17:50	21.7	9.3
23/12/2024 18:00	17.4	8.2
23/12/2024 18:10	13.1	7.9
23/12/2024 18:20	14.0	8.8
23/12/2024 18:30	17.1	8.3
23/12/2024 18:40	18.2	7.7
23/12/2024 18:50	18.2	8.3
23/12/2024 19:00	22.5	8.2
23/12/2024 19:10	25.7	7.9
23/12/2024 19:20	27.1	8.3
23/12/2024 19:30	26.8	7.8
23/12/2024 19:40	29.2	8.1
23/12/2024 19:50	33.7	10.1
23/12/2024 20:00	45.4	11.2
23/12/2024 20:10	49.0	9.9
23/12/2024 20:20	31.6	11.3
23/12/2024 20:30	36.6	11.1
23/12/2024 20:40	63.2	10.6
23/12/2024 20:50	48.9	9.3
23/12/2024 21:00	40.9	10.5
23/12/2024 21:10	60.0	10.8
23/12/2024 21:20	75.2	11.0
23/12/2024 21:30	102.6	10.8
23/12/2024 21:40	115.9	10.3
23/12/2024 21:50	73.1	9.9
23/12/2024 22:00	37.1	10.2
23/12/2024 22:10	30.9	12.4
23/12/2024 22:20	39.4	14.0
23/12/2024 22:30	27.7	14.3
23/12/2024 22:40	24.3	17.6
23/12/2024 22:50	20.6	27.1
23/12/2024 23:00	27.6	54.7
23/12/2024 23:10	37.2	67.4
23/12/2024 23:20	35.5	43.1
23/12/2024 23:30	28.2	51.0
23/12/2024 23:40	33.3	71.3
23/12/2024 23:50	35.1	67.2
24/12/2024 00:00	33.6	80.1
24/12/2024 00:10	35.6	155.6
24/12/2024 00:20	32.9	250.6
24/12/2024 00:30	33.7	211.8
24/12/2024 00:40	33.8	130.4

24/12/2024 00:50	36.4	192.7
24/12/2024 01:00	42.4	259.4
24/12/2024 01:10	41.4	205.1
24/12/2024 01:20	35.2	130.8
24/12/2024 01:30	37.0	94.7
24/12/2024 01:40	41.1	66.0
24/12/2024 01:50	39.1	67.9
24/12/2024 02:00	35.7	74.7
24/12/2024 02:10	34.7	83.2
24/12/2024 02:20	38.0	83.6
24/12/2024 02:30	36.2	78.5
24/12/2024 02:40	37.4	103.5
24/12/2024 02:50	41.0	138.4
24/12/2024 03:00	40.2	109.2
24/12/2024 03:10	38.0	60.3
24/12/2024 03:20	37.9	39.1
24/12/2024 03:30	36.0	37.1
24/12/2024 03:40	35.9	31.9
24/12/2024 03:50	36.2	33.3
24/12/2024 04:00	38.7	31.9
24/12/2024 04:10	37.0	26.7
24/12/2024 04:20	42.4	25.5
24/12/2024 04:30	47.2	23.5
24/12/2024 04:40	47.2	25.8
24/12/2024 04:50	47.1	24.3
24/12/2024 05:00	52.5	22.5
24/12/2024 05:10	37.8	21.5
24/12/2024 05:20	30.2	24.3
24/12/2024 05:30	30.4	22.8
24/12/2024 05:40	33.6	20.8
24/12/2024 05:50	35.1	20.3
24/12/2024 06:00	34.0	20.1
24/12/2024 06:10	32.4	21.0
24/12/2024 06:20	32.4	21.0
24/12/2024 06:30	28.4	19.9
24/12/2024 06:40	27.0	21.6
24/12/2024 06:50	27.0	23.6
24/12/2024 07:00	29.4	23.3
24/12/2024 07:10	29.0	21.4
24/12/2024 07:20	29.4	21.5
24/12/2024 07:30	38.5	23.0
24/12/2024 07:40	47.7	21.6
24/12/2024 07:50	49.8	20.4
24/12/2024 08:00	43.2	19.3
24/12/2024 08:10	32.7	21.3
24/12/2024 08:20	27.5	17.8
24/12/2024 08:30	27.2	23.6
24/12/2024 08:40	27.7	54.6
24/12/2024 08:50	27.2	35.8
24/12/2024 09:00	24.3	22.6
24/12/2024 09:10	23.9	23.9
24/12/2024 09:20	25.5	19.4

24/12/2024 09:30	25.2	24.6
24/12/2024 09:40	25.9	28.4
24/12/2024 09:50	28.7	27.7
24/12/2024 10:00	32.3	19.0
24/12/2024 10:10	30.7	17.3
24/12/2024 10:20	33.8	18.3
24/12/2024 10:30	32.3	17.0
24/12/2024 10:40	28.1	15.6
24/12/2024 10:50	32.1	26.4
24/12/2024 11:00	31.1	33.1
24/12/2024 11:10	30.4	25.8
24/12/2024 11:20	27.4	23.0
24/12/2024 11:30	20.7	24.5
24/12/2024 11:40	19.9	25.1
24/12/2024 11:50	20.3	21.0
24/12/2024 12:00	23.9	18.5
24/12/2024 12:10	24.4	19.2
24/12/2024 12:20	25.8	21.8
24/12/2024 12:30	23.0	23.4
24/12/2024 12:40	23.3	21.3
24/12/2024 12:50	23.5	24.5
24/12/2024 13:00	25.6	20.3
24/12/2024 13:10	22.8	20.7
24/12/2024 13:20	20.0	25.1
24/12/2024 13:30	19.2	22.9
24/12/2024 13:40	20.2	22.8
24/12/2024 13:50	22.3	20.7
24/12/2024 14:00	17.9	20.9
24/12/2024 14:10	16.8	22.5
24/12/2024 14:20	21.9	22.4
24/12/2024 14:30	27.6	19.6
24/12/2024 14:40	29.6	17.0
24/12/2024 14:50	32.6	22.6
24/12/2024 15:00	34.8	24.5
24/12/2024 15:10	27.8	24.2
24/12/2024 15:20	28.5	23.3
24/12/2024 15:30	27.0	22.8
24/12/2024 15:40	25.6	25.0
24/12/2024 15:50	28.1	24.6
24/12/2024 16:00	24.6	20.6
24/12/2024 16:10	21.4	23.6
24/12/2024 16:20	19.6	22.8
24/12/2024 16:30	24.5	19.0
24/12/2024 16:40	28.1	13.8
24/12/2024 16:50	18.1	13.2
24/12/2024 17:00	19.6	17.2
24/12/2024 17:10	19.1	13.1
24/12/2024 17:20	17.8	10.0
24/12/2024 17:30	20.5	14.0
24/12/2024 17:40	20.5	16.1
24/12/2024 17:50	16.9	15.8
24/12/2024 18:00	17.2	14.5

24/12/2024 18:10	16.6	13.2
24/12/2024 18:20	15.7	13.8
24/12/2024 18:30	15.2	14.2
24/12/2024 18:40	15.4	15.2
24/12/2024 18:50	16.9	15.8
24/12/2024 19:00	16.7	14.1
24/12/2024 19:10	13.2	12.9
24/12/2024 19:20	13.0	19.0
24/12/2024 19:30	13.4	19.2
24/12/2024 19:40	13.6	14.6
24/12/2024 19:50	11.9	12.7
24/12/2024 20:00	11.8	13.4
24/12/2024 20:10	12.4	10.4
24/12/2024 20:20	11.1	10.1
24/12/2024 20:30	10.9	10.3
24/12/2024 20:40	12.7	12.6
24/12/2024 20:50	13.1	11.6
24/12/2024 21:00	12.6	11.1
24/12/2024 21:10	11.5	11.4
24/12/2024 21:20	12.1	10.1
24/12/2024 21:30	13.0	10.7
24/12/2024 21:40	13.4	11.1
24/12/2024 21:50	13.7	11.6
24/12/2024 22:00	13.3	11.3
24/12/2024 22:10	12.6	10.9
24/12/2024 22:20	12.2	10.8
24/12/2024 22:30	11.8	11.2
24/12/2024 22:40	12.3	11.0
24/12/2024 22:50	11.7	12.4
24/12/2024 23:00	11.9	16.1
24/12/2024 23:10	11.8	13.6
24/12/2024 23:20	11.7	11.7
24/12/2024 23:30	11.6	10.4
24/12/2024 23:40	13.1	11.0
24/12/2024 23:50	12.5	11.4
25/12/2024 00:00	12.2	11.6
25/12/2024 00:10	13.9	13.5
25/12/2024 00:20	13.1	14.7
25/12/2024 00:30	12.5	14.0
25/12/2024 00:40	13.0	12.0
25/12/2024 00:50	15.2	11.2
25/12/2024 01:00	16.6	12.6
25/12/2024 01:10	17.1	12.7
25/12/2024 01:20	16.6	12.2
25/12/2024 01:30	16.2	16.3
25/12/2024 01:40	16.0	19.8
25/12/2024 01:50	14.7	15.1
25/12/2024 02:00	16.8	13.8
25/12/2024 02:10	15.7	13.2
25/12/2024 02:20	12.5	13.0
25/12/2024 02:30	13.0	14.6
25/12/2024 02:40	13.5	14.7

25/12/2024 02:50	14.7	12.7
25/12/2024 03:00	15.8	13.4
25/12/2024 03:10	16.6	13.3
25/12/2024 03:20	17.2	14.2
25/12/2024 03:30	17.2	15.3
25/12/2024 03:40	16.9	14.0
25/12/2024 03:50	15.5	14.1
25/12/2024 04:00	14.8	14.5
25/12/2024 04:10	15.9	15.8
25/12/2024 04:20	15.0	15.4
25/12/2024 04:30	13.8	17.0
25/12/2024 04:40	14.2	19.4
25/12/2024 04:50	14.4	19.0
25/12/2024 05:00	15.1	17.9
25/12/2024 05:10	14.9	17.1
25/12/2024 05:20	14.4	22.4
25/12/2024 05:30	15.7	39.9
25/12/2024 05:40	16.6	26.4
25/12/2024 05:50	18.3	15.6
25/12/2024 06:00	24.9	14.1
25/12/2024 06:10	20.8	14.7
25/12/2024 06:20	20.6	15.6
25/12/2024 06:30	20.9	14.4
25/12/2024 06:40	17.3	16.3
25/12/2024 06:50	17.1	17.2
25/12/2024 07:00	17.6	16.5
25/12/2024 07:10	18.0	16.6
25/12/2024 07:20	18.5	16.8
25/12/2024 07:30	18.4	16.4
25/12/2024 07:40	18.4	16.4
25/12/2024 07:50	19.2	15.7
25/12/2024 08:00	19.4	15.5
25/12/2024 08:10	17.9	14.6
25/12/2024 08:20	18.0	14.3
25/12/2024 08:30	17.4	13.2
25/12/2024 08:40	18.6	13.5
25/12/2024 08:50	18.5	14.0
25/12/2024 09:00	17.4	12.7
25/12/2024 09:10	15.8	13.3
25/12/2024 09:20	16.3	14.6
25/12/2024 09:30	16.1	13.2
25/12/2024 09:40	16.4	12.4
25/12/2024 09:50	16.1	12.8
25/12/2024 10:00	15.3	11.8
25/12/2024 10:10	15.1	11.5
25/12/2024 10:20	15.5	12.3
25/12/2024 10:30	13.3	13.1
25/12/2024 10:40	12.1	13.5
25/12/2024 10:50	11.0	12.3
25/12/2024 11:00	11.5	10.3
25/12/2024 11:10	12.2	10.3
25/12/2024 11:20	11.9	10.6

25/12/2024 11:30	12.7	11.1
25/12/2024 11:40	12.1	10.2
25/12/2024 11:50	10.9	10.9
25/12/2024 12:00	11.2	11.2
25/12/2024 12:10	10.4	10.2
25/12/2024 12:20	9.3	9.6
25/12/2024 12:30	9.7	9.4
25/12/2024 12:40	10.5	9.7
25/12/2024 12:50	9.8	9.0
25/12/2024 13:00	8.7	8.2
25/12/2024 13:10	9.1	8.5
25/12/2024 13:20	9.0	7.9
25/12/2024 13:30	8.6	6.9
25/12/2024 13:40	9.2	6.6
25/12/2024 13:50	8.6	6.2
25/12/2024 14:00	8.1	5.8
25/12/2024 14:10	7.4	6.1
25/12/2024 14:20	7.3	7.0
25/12/2024 14:30	7.7	6.9
25/12/2024 14:40	7.9	6.8
25/12/2024 14:50	8.3	6.3
25/12/2024 15:00	7.5	6.0
25/12/2024 15:10	7.2	5.9
25/12/2024 15:20	6.7	6.3
25/12/2024 15:30	6.5	6.8
25/12/2024 15:40	7.2	6.9
25/12/2024 15:50	7.1	6.1
25/12/2024 16:00	7.1	6.9
25/12/2024 16:10	7.1	7.0
25/12/2024 16:20	7.2	7.1
25/12/2024 16:30	8.1	6.7
25/12/2024 16:40	8.8	6.1
25/12/2024 16:50	10.2	6.8
25/12/2024 17:00	8.0	6.9
25/12/2024 17:10	8.0	6.5
25/12/2024 17:20	8.0	6.3
25/12/2024 17:30	7.5	6.4
25/12/2024 17:40	8.3	7.1
25/12/2024 17:50	7.5	7.2
25/12/2024 18:00	7.1	7.9
25/12/2024 18:10	8.2	8.2
25/12/2024 18:20	8.9	8.5
25/12/2024 18:30	8.0	9.7
25/12/2024 18:40	7.5	10.8
25/12/2024 18:50	8.1	8.4
25/12/2024 19:00	8.6	8.6
25/12/2024 19:10	8.3	10.0
25/12/2024 19:20	8.7	9.1
25/12/2024 19:30	8.3	9.4
25/12/2024 19:40	10.2	9.9
25/12/2024 19:50	13.5	12.7
25/12/2024 20:00	12.7	13.8

25/12/2024 20:10	12.6	11.9
25/12/2024 20:20	13.9	11.7
25/12/2024 20:30	13.2	10.5
25/12/2024 20:40	12.3	10.2
25/12/2024 20:50	11.7	11.4
25/12/2024 21:00	12.3	10.6
25/12/2024 21:10	12.2	9.2
25/12/2024 21:20	12.8	10.8
25/12/2024 21:30	12.9	10.3
25/12/2024 21:40	13.9	10.1
25/12/2024 21:50	13.7	9.9
25/12/2024 22:00	14.5	9.2
25/12/2024 22:10	16.1	9.5
25/12/2024 22:20	15.2	10.9
25/12/2024 22:30	13.8	10.7
25/12/2024 22:40	13.1	10.4
25/12/2024 22:50	13.0	11.0
25/12/2024 23:00	12.3	10.9
25/12/2024 23:10	14.0	11.0
25/12/2024 23:20	14.2	10.8
25/12/2024 23:30	13.5	11.1
25/12/2024 23:40	13.5	11.3
25/12/2024 23:50	13.9	11.2

Table A-7: 1-hour average EBAM PM_{10} data

Date & time	EBAM at A-PF2 PM_{10} (µg/m³)	Date & time	EBAM at A-PF2 PM_{10} (µg/m³)	Date & time	EBAM at A-PF2 PM_{10} (µg/m³)
22/02/2024 00:00	8	2/09/2024 00:00	11	23/12/2024 00:00	19
22/02/2024 01:00	3	2/09/2024 01:00	5	23/12/2024 01:00	7
22/02/2024 02:00	13	2/09/2024 02:00	5	23/12/2024 02:00	26
22/02/2024 03:00	4	2/09/2024 03:00	5	23/12/2024 03:00	4
22/02/2024 04:00	3	2/09/2024 04:00	2	23/12/2024 04:00	7
22/02/2024 05:00	6	2/09/2024 05:00	3	23/12/2024 05:00	31
22/02/2024 06:00	8	2/09/2024 06:00	7	23/12/2024 06:00	12
22/02/2024 07:00	4	2/09/2024 07:00	2	23/12/2024 07:00	9
22/02/2024 08:00	11	2/09/2024 08:00	24	23/12/2024 08:00	41
22/02/2024 09:00	4	2/09/2024 09:00	10	23/12/2024 09:00	37
22/02/2024 10:00	4	2/09/2024 10:00	5	23/12/2024 10:00	43
22/02/2024 11:00	11	2/09/2024 11:00	86	23/12/2024 11:00	60
22/02/2024 12:00	11	2/09/2024 12:00	117	23/12/2024 12:00	40
22/02/2024 13:00	55	2/09/2024 13:00	55	23/12/2024 13:00	28
22/02/2024 14:00	44	2/09/2024 14:00	135	23/12/2024 14:00	56
22/02/2024 15:00	21	2/09/2024 15:00	68	23/12/2024 15:00	23
22/02/2024 16:00	9	2/09/2024 16:00	41	23/12/2024 16:00	9
22/02/2024 17:00	22	2/09/2024 17:00	77	23/12/2024 17:00	31
22/02/2024 18:00	18	2/09/2024 18:00	28	23/12/2024 18:00	7
22/02/2024 19:00	9	2/09/2024 19:00	12	23/12/2024 19:00	8
22/02/2024 20:00	20	2/09/2024 20:00	27	23/12/2024 20:00	19
22/02/2024 21:00	17	2/09/2024 21:00	17	23/12/2024 21:00	22
22/02/2024 22:00	8	2/09/2024 22:00	17	23/12/2024 22:00	22
22/02/2024 23:00	15	2/09/2024 23:00	48	23/12/2024 23:00	79

23/02/2024 00:00	3	3/09/2024 00:00	28	24/12/2024 00:00	11
23/02/2024 01:00	5	3/09/2024 01:00	14	24/12/2024 01:00	10
23/02/2024 02:00	9	3/09/2024 02:00	28	24/12/2024 02:00	36
23/02/2024 03:00	13	3/09/2024 03:00	24	24/12/2024 03:00	15
23/02/2024 04:00	4	3/09/2024 04:00	8	24/12/2024 04:00	11
23/02/2024 05:00	31	3/09/2024 05:00	12	24/12/2024 05:00	28
23/02/2024 06:00	11	3/09/2024 06:00	7	24/12/2024 06:00	20
23/02/2024 07:00	11	3/09/2024 07:00	6	24/12/2024 07:00	8
23/02/2024 08:00	39	3/09/2024 08:00	18	24/12/2024 08:00	37
23/02/2024 09:00	21	3/09/2024 09:00	3	24/12/2024 09:00	26
23/02/2024 10:00	7	3/09/2024 10:00	7	24/12/2024 10:00	15
23/02/2024 11:00	21	3/09/2024 11:00	35	24/12/2024 11:00	41
23/02/2024 12:00	12	3/09/2024 12:00	11	24/12/2024 12:00	18
23/02/2024 13:00	7	3/09/2024 13:00	7	24/12/2024 13:00	10
23/02/2024 14:00	18	3/09/2024 14:00	13	24/12/2024 14:00	32
23/02/2024 15:00	10	3/09/2024 15:00	18	24/12/2024 15:00	11
23/02/2024 16:00	5	3/09/2024 16:00	6	24/12/2024 16:00	11
23/02/2024 17:00	23	3/09/2024 17:00	17	24/12/2024 17:00	33
23/02/2024 18:00	12	3/09/2024 18:00	18	24/12/2024 18:00	13
23/02/2024 19:00	5	3/09/2024 19:00	6	24/12/2024 19:00	6
23/02/2024 20:00	5	3/09/2024 20:00	29	24/12/2024 20:00	26
23/02/2024 21:00	2	3/09/2024 21:00	7	24/12/2024 21:00	7
23/02/2024 22:00	3	3/09/2024 22:00	7	24/12/2024 22:00	4
23/02/2024 23:00	-1	3/09/2024 23:00	23	24/12/2024 23:00	9
24/02/2024 00:00	9	4/09/2024 00:00	7	25/12/2024 00:00	3
24/02/2024 01:00	6	4/09/2024 01:00	8	25/12/2024 01:00	5
24/02/2024 02:00	26	4/09/2024 02:00	11	25/12/2024 02:00	14
24/02/2024 03:00	14	4/09/2024 03:00	7	25/12/2024 03:00	7
24/02/2024 04:00	9	4/09/2024 04:00	7	25/12/2024 04:00	3
24/02/2024 05:00	30	4/09/2024 05:00	6	25/12/2024 05:00	18
24/02/2024 06:00	18	4/09/2024 06:00	6	25/12/2024 06:00	5
24/02/2024 07:00	8	4/09/2024 07:00	7	25/12/2024 07:00	4
24/02/2024 08:00	21	4/09/2024 08:00	4	25/12/2024 08:00	17
24/02/2024 09:00	3	4/09/2024 09:00	6	25/12/2024 09:00	16
24/02/2024 10:00	2	4/09/2024 10:00	4	25/12/2024 10:00	6
24/02/2024 11:00	7	4/09/2024 11:00	19	25/12/2024 11:00	23
24/02/2024 12:00	5	4/09/2024 12:00	12	25/12/2024 12:00	10
24/02/2024 13:00	2	4/09/2024 13:00	7	25/12/2024 13:00	6
24/02/2024 14:00	8	4/09/2024 14:00	19	25/12/2024 14:00	15
24/02/2024 15:00	2	4/09/2024 15:00	38	25/12/2024 15:00	6
24/02/2024 16:00	1	4/09/2024 16:00	14	25/12/2024 16:00	5
24/02/2024 17:00	5	4/09/2024 17:00	31	25/12/2024 17:00	8
24/02/2024 18:00	8	4/09/2024 18:00	18	25/12/2024 18:00	5
24/02/2024 19:00	2	4/09/2024 19:00	8	25/12/2024 19:00	2
24/02/2024 20:00	17	4/09/2024 20:00	36	25/12/2024 20:00	3
24/02/2024 21:00	5	4/09/2024 21:00	7	25/12/2024 21:00	-1
24/02/2024 22:00	7	4/09/2024 22:00	6	25/12/2024 22:00	1
24/02/2024 23:00	22	4/09/2024 23:00	6	25/12/2024 23:00	8

APPENDIX E

MOUNT PLEASANT OPERATION – 2024 ANNUAL GROUNDWATER REPORT

Australasian Groundwater & Environmental Consultants

Report on

Mt Pleasant Groundwater Report for the 2024 Calendar Year

Prepared for
MACH Mount Pleasant Operations Pty Ltd

Project No. MPO5007.001
March 2025

ageconsultants.com.au

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Table of contents

1 Introduction 1
1.1 Objectives and scope of work 1
2 Review groundwater monitoring data 3
2.1 Groundwater monitoring network 3
2.2 Data recovery 5
2.3 Groundwater levels 5
2.3.1 Hunter River alluvium 5
2.3.2 Permian measures and regolith – Western Domain 6
2.3.3 Permian measures – Central Domain 8
2.4 Drawdown 11
2.5 Groundwater quality and beneficial use 15
2.5.1 Salinity and pH 15
2.5.2 Major ions 25
2.6 Trigger exceedances 26
3 Assess numerical model predictions 28
3.1 Model grid 28
3.2 Model layer 30
3.3 Timing 30
3.4 Recharge 31
3.5 Evapotranspiration 31
3.6 Water courses and surface drainage 32
3.7 Mining 32
3.7.1 Bengalla Mine and Mt Arthur Coal Mine open cut 32
3.7.2 Dartbrook Mine 32
3.8 Hydraulic and storage properties 33
3.9 Groundwater model validation 34
3.10 Groundwater model predictions 36
4 Summary and conclusions 41
5 References 43

Table of contents

List of figures

Figure 1.1 Regional Location 2
Figure 2.1 MPO groundwater monitoring network 4
Figure 2.2 Water levels – Hunter River alluvium 6
Figure 2.3 Water levels – MPO Western Domain Permian measures 7
Figure 2.4 Water levels – MPO Western Domain regolith 8
Figure 2.5 Water levels – MPO Central Domain Permian measures 9
Figure 2.6 Groundwater level changes (drawdown) within the MPO Central Domain 12
Figure 2.7 Groundwater level changes (drawdown) within the MPO Eastern Domain 13
Figure 2.8 Groundwater level changes (drawdown) within the MPO Western Domain 14
Figure 2.9 Electrical conductivity (EC) – Hunter River alluvium 16
Figure 2.10 Electrical conductivity (EC) – MPO Western Domain Permian measures 17
Figure 2.11 Electrical conductivity (EC) – MPO Western Domain regolith 17
Figure 2.12 Electrical conductivity (EC) – MPO Central Domain Permian measures 18
Figure 2.13 pH – Hunter River alluvium 19
Figure 2.14 pH– MPO Western Domain regolith and Permian measures 20
Figure 2.15 pH– MPO Western Domain regolith 21
Figure 2.16 pH – MPO Central Domain Permian measures 22
Figure 2.17 2024 Piper plot of groundwater composition from the MPO monitoring bores 26
Figure 3.1 Model extent and mesh 29
Figure 3.2 Simulated-observed head comparison 35
Figure 3.3 Model prediction of cumulative drawdown at the end of 2024 for alluvium/regolith (Layers 1 and 2) 38
Figure 3.4 Model prediction of cumulative drawdown at the end of 2024 for Edderton Seam (Layers 18) 39
Figure 3.5 Modelled versus measured head in 2024 40

Table of contents

List of tables

Table 2.1 Groundwater monitoring data recovery 5
Table 2.2 Summary of measured water levels in MPO monitoring bores during the reporting period .. 10
Table 2.3 Summary of measured EC and pH in MPO monitoring bores during the reporting period ... 23
Table 3.1 Model layers 30
Table 3.2 Calibrated recharge rate and percentage for each zone 31
Table 3.3 Evapotranspiration rooting zones 31
Table 3.4 River (RIV) cell parameters 32
Table 3.5 Hydraulic properties assigned to the spoil material 32
Table 3.6 Fracture zone multipliers for Wynn and Kayuga longwall mining at Dartbrook Mine 33
Table 3.7 Calibrated hydraulic and storage properties 34
Table 3.8 Summary of statistical measures for data before and after 2020 36

List of appendices

Appendix A Details of the monitoring bore network
Appendix B Measured water level hydrographs
Appendix C Field measured electrical conductivity (EC) time series
Appendix D Field measured pH time series
Appendix E Water quality laboratory results
Appendix F Model-data comparison hydrographs

Mt Pleasant Groundwater Report for the 2024 Calendar Year

1 Introduction

The Mount Pleasant Operation (MPO) is situated approximately three kilometres northwest of Muswellbrook, in the Upper Hunter Valley of New South Wales (NSW) (Figure 1.1). Development Consent for the MPO (DA 92/97) was granted on 22 December 1999, under the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). In addition, the MPO received approval under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) in 2012 (EPBC 2011/5795).

MACH Energy Australia Pty Ltd (MACH Energy) acquired the MPO from Coal and Allied Operations Pty Ltd on 4 August 2016. Construction activities at the MPO commenced in November 2016, followed by the start of mining operations in October 2017, in accordance with Development Consent DA 92/97 and EPBC 2011/5795. The MPO is managed by MACH Mount Pleasant Operations Pty Ltd as an agent for the unincorporated Mount Pleasant Joint Venture, comprising MACH Energy (95% ownership) and J.C.D. Australia Pty Ltd (5% ownership), collectively referred to as MACH hereafter.

The Project was approved by the NSW Independent Planning Commission on 6 September 2022. Appendix 2 of Development Consent SSD 10418 illustrates the General Project Arrangement for 2026, 2028, 2031, 2034, 2041, 2044 and 2047, as well as staging of Project disturbance areas, and the indicative mine infrastructure area layout. The most resent modification, Modification 6 (MOD6), was submitted to modify Development Consent DA 92/97 and was approved on 6 November 2023. MOD6 allows for the construction and operation of a re-transmission facility including a tower or mast, shed, and associated transmission infrastructure to re-transmit local digital television signals from the Broadcast Australia site at Rossgole Lookout. Appendix 2 of the modified Development Consent DA 92/97 illustrates the Revised Approved Surface Disturbance Plan.

Development Consent DA 92/97 permits the construction and operation of an open-cut coal mine, coal preparation plant, transport and rail loading facilities, and associated infrastructure at the MPO. The consent allows operations to run 24 hours a day, seven days a week, with the extraction of up to 197 million tonnes (Mt) of run-of-mine (ROM) coal over a 21-year period, at a maximum rate of 10.5 Mt of ROM coal per year.

MACH has requested Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) to prepare a groundwater report covering the 2024 calendar year, to be included in the Annual Review.

1.1 Objectives and scope of work

The objective of this project is to prepare a groundwater report for inclusion in the 2024 Annual Review. To achieve this, we propose the following tasks:

- Task 1 – Review groundwater monitoring data;
- Task 2 – Assess numerical model predictions; and
- Task 3 – Prepare a comprehensive report.

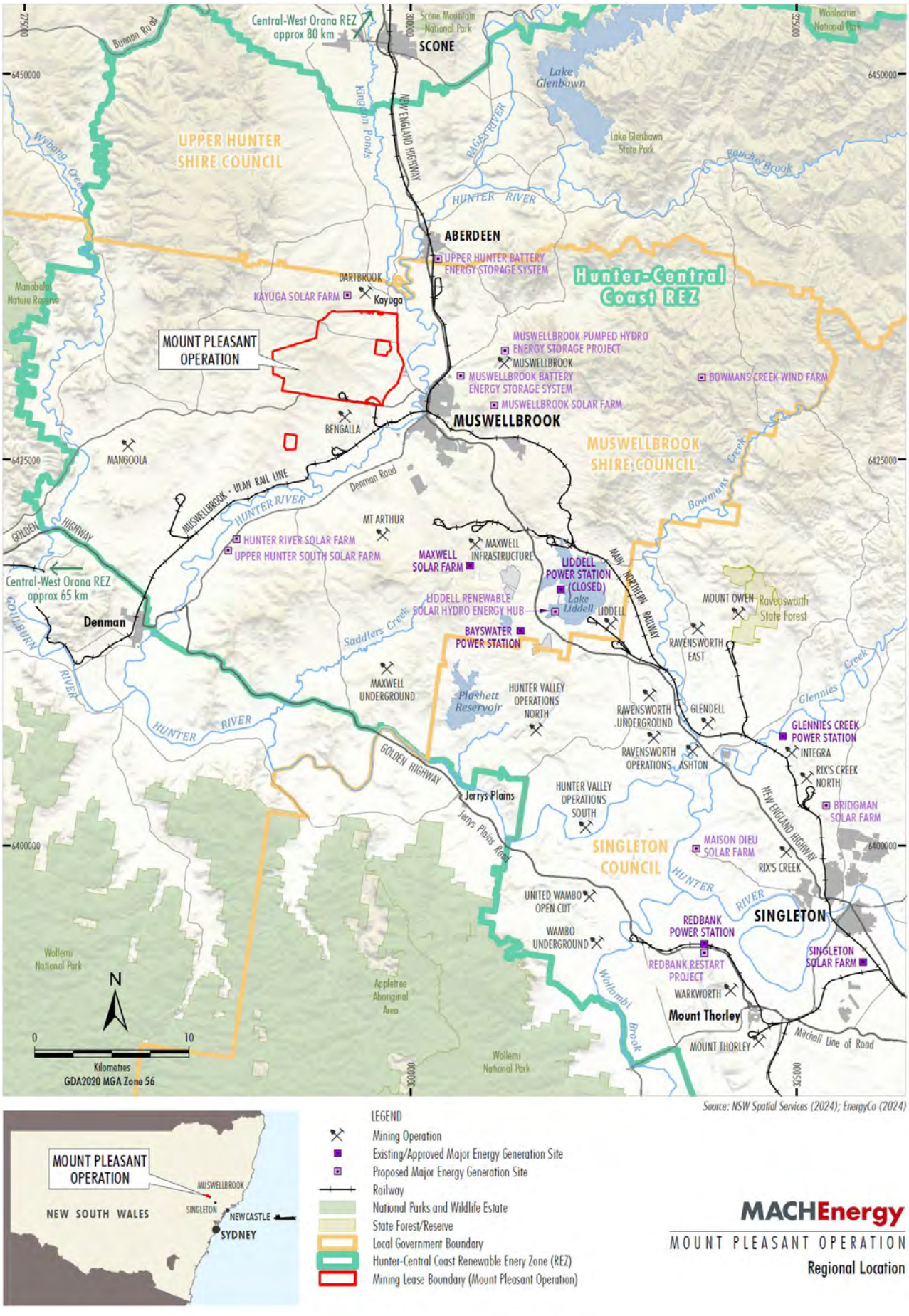


Figure 1.1 Regional Location

2 Review groundwater monitoring data

2.1 Groundwater monitoring network

MPO continuously monitors groundwater levels and quality through an extensive network of observation bores. This network spans the Hunter River alluvium, regolith, and Permian interburden/coal seams within the MPO region. Monitoring bores within the Hunter River alluvium are typically shallow (<20 m), reflecting the limited depth of the local alluvial deposits. In contrast, the Permian strata are evaluated through bores installed at various depths throughout the geological sequence. The locations of both existing MPO monitoring bores and those planned for installation are shown in Figure 2.1. The nearby Bengalla Mine also operates its own groundwater monitoring network, with both sites sharing groundwater data. Appendix A summarises the current and historical MPO groundwater monitoring network.

The key aspects of the MPO monitoring network, as illustrated in Figure 2.1, are as follows:

- The network is divided into three areas: Central, Eastern, and Western.
- The Central network monitors groundwater in the coal seams and interburden units near the open-cut pits.
- The Eastern network monitors groundwater in the alluvial aquifer associated with the Hunter River through seven bores (i.e., MPBH1–MPBH6 and MPBH3b).
- The Western network monitors groundwater in the alluvium/regolith, including one bore (MPBH7) associated with the Hunter River alluvium, as well as the underlying Permian strata within drainage lines that discharge westward, such as Sandy Creek.

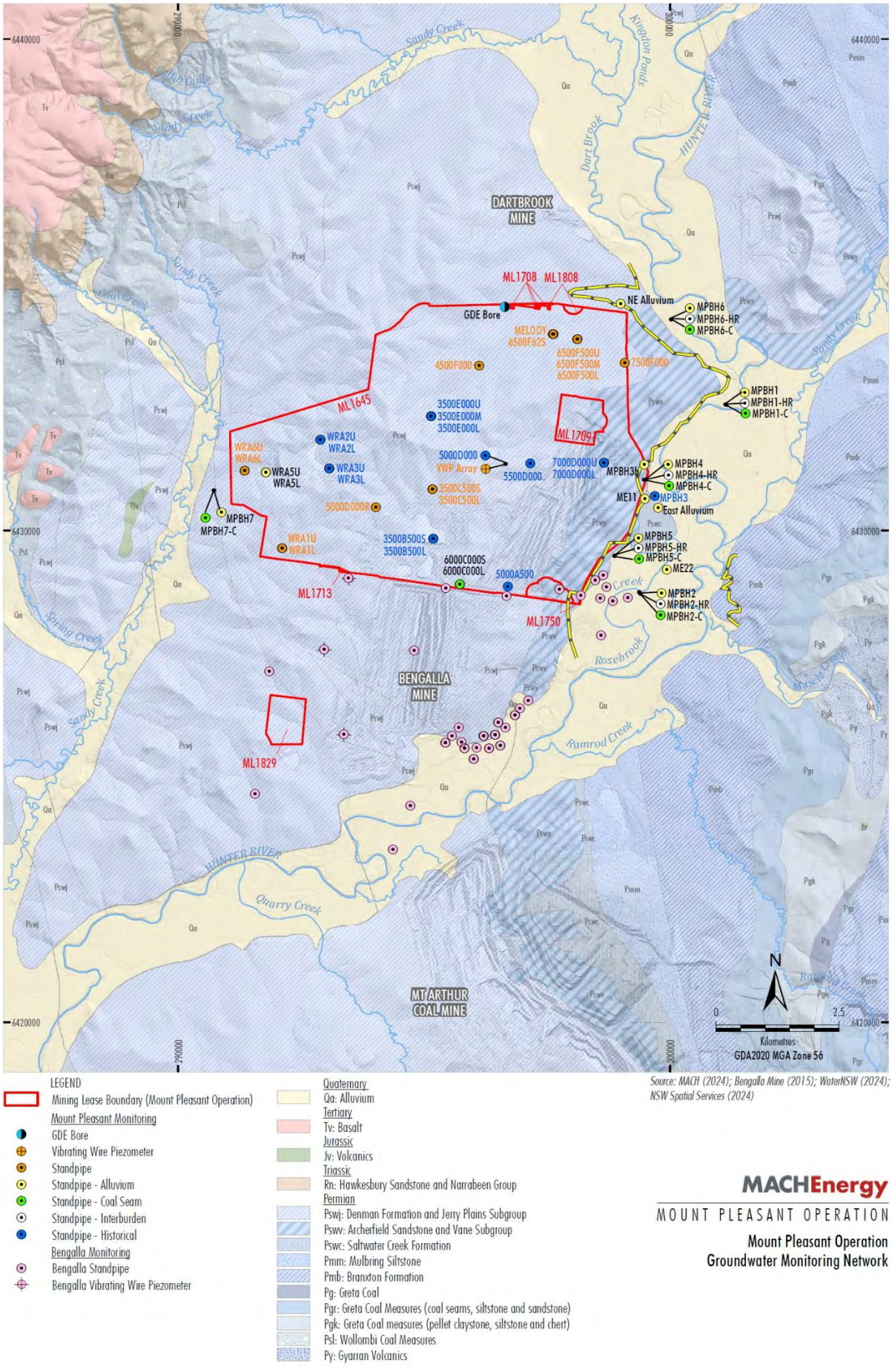


Figure 2.1 MPO groundwater monitoring network

2.2 Data recovery

The MPO Water Management Plan (MACH Energy, 2025; WMP) outlines the monitoring frequency and trigger levels for both groundwater level and groundwater quality within the monitoring network. This includes water quality monitoring at 30 bores and water level monitoring at 31 sites.

During the reporting period, groundwater levels were monitored at 29 of the 31 designated bores. Bores with less than 100% data recovery are listed in Table 2.1. The poor data recovery in these bores is attributed to their removal from the monitoring network (e.g., bore 5000D000) or being deemed unsafe for sampling (e.g., bore 4500F000). All bores designated for water quality monitoring recorded field measurements of pH and electrical conductivity throughout the reporting period.

Table 2.1 Groundwater monitoring data recovery

Bore ID	Aquifer/Unit	Data recovery (%)	Comment
5000D000	Wynn/Edderton Seams	50	Measured water level in Q1 and Q2 2024. Removed from the monitoring plan.
4500F000	Vaux Seam	75	Measured water level in Q1, Q2, and Q3 2024. Unsafe to access for sampling in Q4 2024.

2.3 Groundwater levels

Groundwater levels for the WMP bore network, as shown in Figure 2.1, are summarised in this section. Details of the monitoring bores are provided in Appendix A. Hydrographs for all bores are presented in Appendix B, with trigger levels included where a trigger level was set for the corresponding bores. The hydrographs also display the cumulative rainfall departure (CRD), which is calculated by cumulatively summing the difference between actual monthly rainfall and the long-term average monthly rainfall. A rising CRD indicates above-average rainfall, while a declining CRD signifies below-average rainfall. CRD trends are relevant because groundwater hydrographs, particularly for shallow aquifers, tend to follow similar patterns—declining groundwater levels during periods of below-average rainfall and rising levels during periods of above-average rainfall.

Long-term rainfall data used to generate the CRD were sourced from the Scientific Information for Land Owners (SILO) database (https://www.longpaddock.qld.gov.au/silo/). SILO, operated by the Queensland Department of Environment, Science and Innovation (DESI), integrates data from the Bureau of Meteorology (BoM) to produce high-quality climate datasets. By interpolating data from neighbouring BoM stations, SILO generates a continuous daily time series. The long-term rainfall dataset used in this report was obtained from a point at latitude -32.25, longitude 150.85, which is located within the project site.

2.3.1 Hunter River alluvium

Figure 2.2 presents groundwater levels in the Hunter River alluvium, measured from 2003 to 2025 at eight monitoring bores: MPBH1-MPBH7, and MPBH3b (refer to Figure 2.1). Additionally, the figure includes the CRD, derived from SILO data as described earlier. The data indicate that groundwater levels in the alluvium remain generally stable, showing minimal response to rainfall events. This stability suggests that the alluvial aquifer in this area is primarily sustained by losses from the surface water system rather than direct recharge from precipitation. It is important to note that water levels in the Hunter River are significantly influenced by controlled releases from Glenbawn Dam. During periods of significant rainfall, discharge volumes from the dam are typically reduced, further impacting river water levels and, consequently, the adjacent alluvial aquifer.

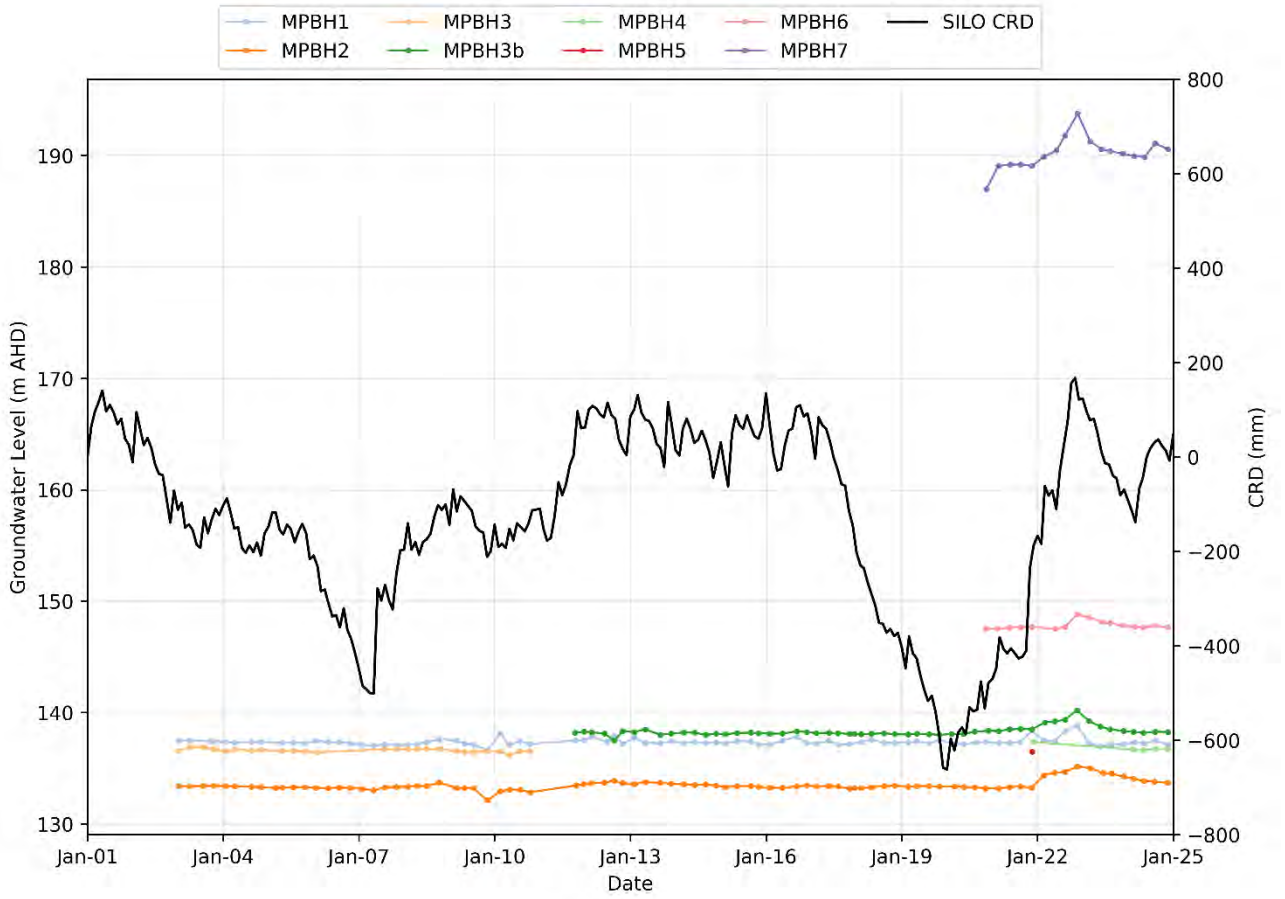


Figure 2.2 Water levels – Hunter River alluvium

2.3.2 Permian measures and regolith – Western Domain

Monitoring bores in the Western Domain of the MPO (WRA1, WRA2, WRA3, WRA5, and WRA6) (see Figure 2.1) are located within shallow Permian measures. These bores are nested, with separate piezometers installed in both the regolith and the underlying unweathered Permian strata. The upper piezometer (U) in the bores is screened within the regolith (i.e., weathered rock), while the lower piezometer (L) is positioned in either Permian interburden or coal seams, beneath the weathered zone. It should be noted that WRA2 has been blocked since November 2018, while WRA3 and WRA5 were decommissioned in November 2022 and August 2021, respectively. Additionally, WRA1U has remained dry since August 2023.

Figure 2.3 and Figure 2.4 show water level in Permian measures and regolith in the MPO Western Domain, respectively. As illustrated in Figure 2.3 and Figure 2.4, groundwater levels in these units vary by location. At sites such as WRA5, water levels in the regolith and the underlying strata are similar, indicating hydraulic connectivity and minimal vertical gradients. In contrast, locations like WRA3—and to a lesser extent, WRA6—show more pronounced differences in water levels, suggesting limited connectivity and stronger vertical gradients. Figure 2.3 and Figure 2.4 also presents the CRD. A comparison with the CRD indicates that groundwater levels in the monitored strata respond weakly to rainfall variations. Groundwater flow through the regolith is expected to be moderate, following the natural topography. While the regolith has the potential to establish hydraulic connectivity between the alluvium and the mine workings, it is generally dry, thin, and topographically separated from the open-cut pits by a drainage divide, which restricts direct interaction.

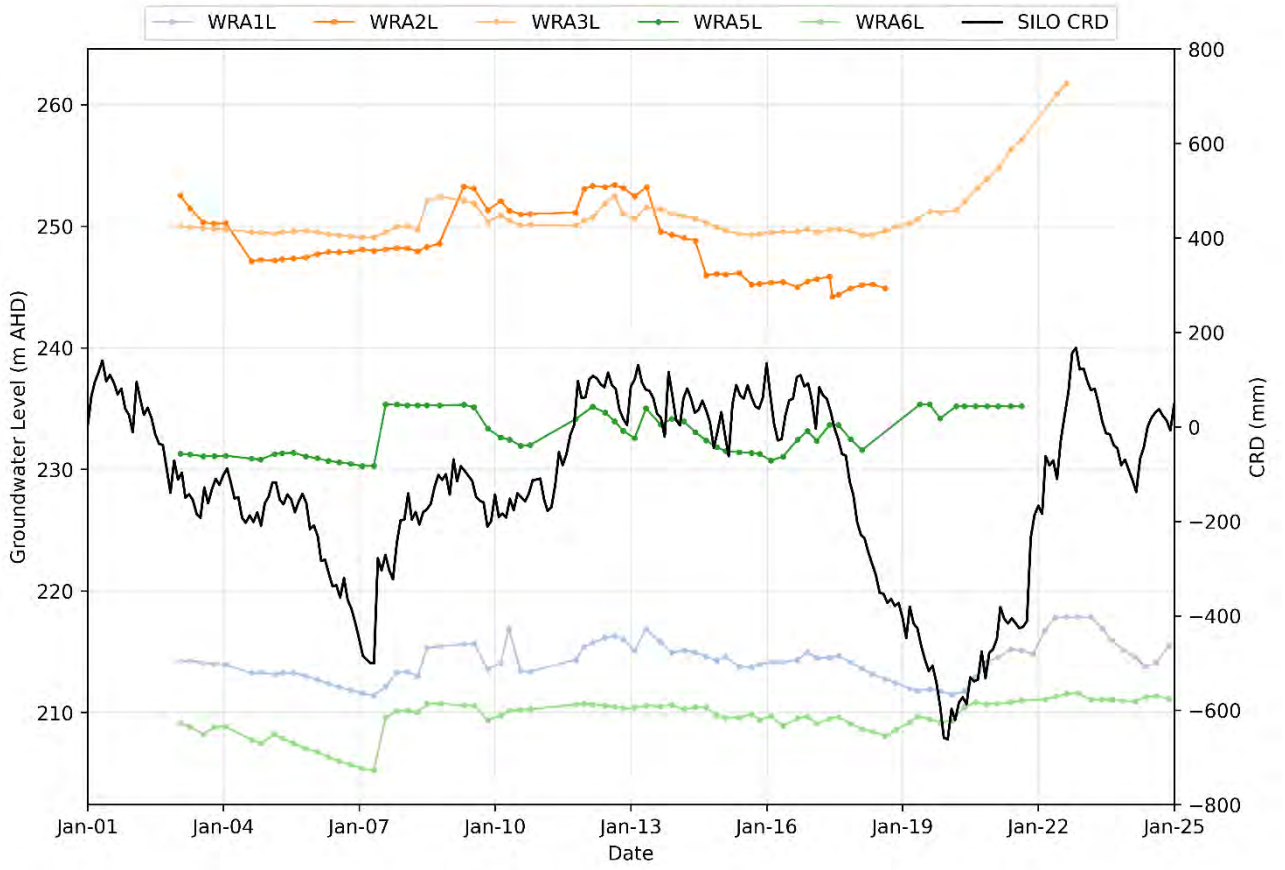


Figure 2.3 Water levels – MPO Western Domain Permian measures

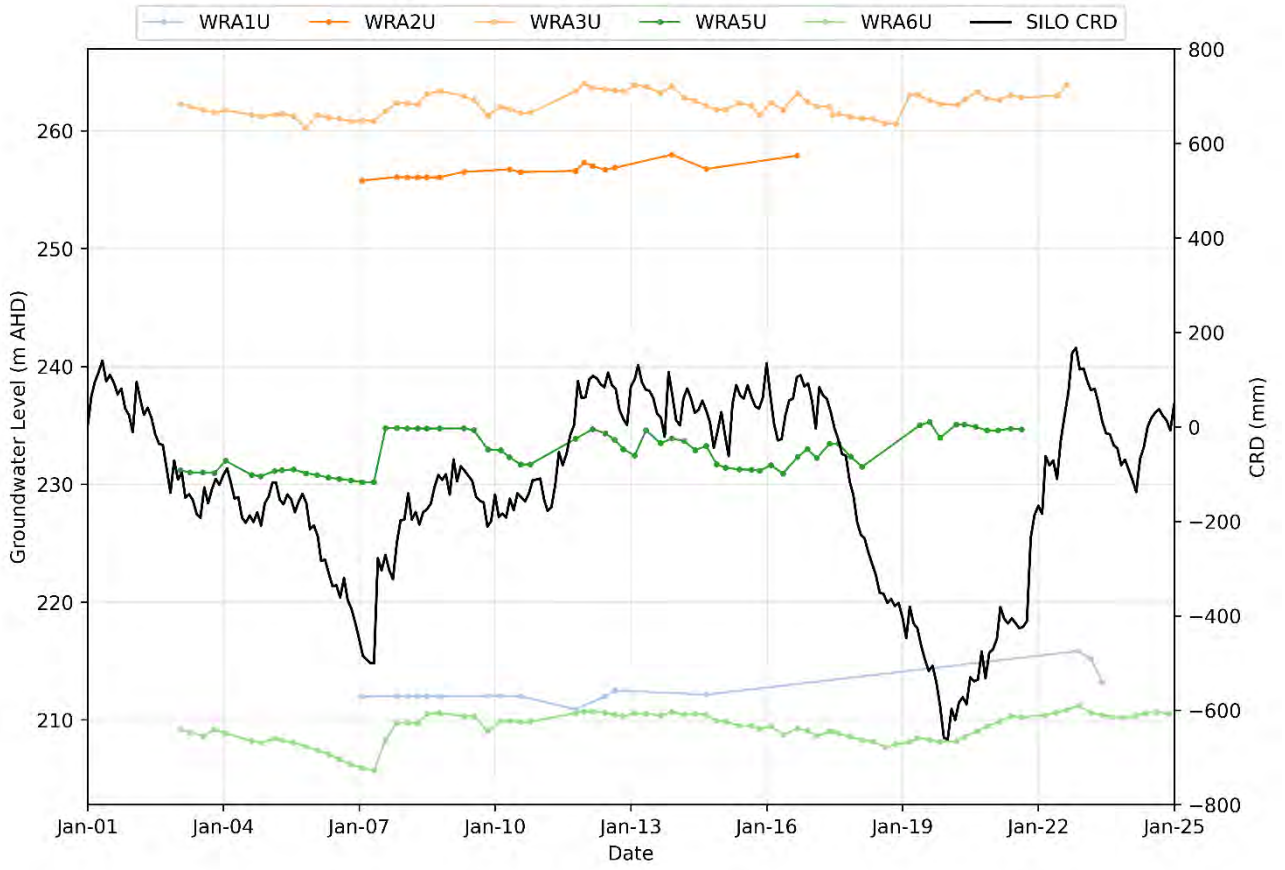


Figure 2.4 Water levels – MPO Western Domain regolith

2.3.3 Permian measures – Central Domain

Groundwater in the Central Domain of the MPO, located north and west of the open-cut pits, is monitored through a network of eleven bores (see Figure 2.1). These bores target Permian measures, including interburden, coal seams, and the underlying Maitland Group (6500F500L and 7000D000L). Details on the Permian strata in which these bores are screened are provided in Appendix A. Five locations—3500B500, 3500C500, 6000C000, 6500F500, and 7000D000—contain nested monitoring bores, each with an upper piezometer (U) and a lower piezometer (L). Water level observations for these bores are presented in Figure 2.5.

Figure 2.5 indicates that, except for a decline at 3500C500L, water levels within the upper interburden units (3500C500U) have remained relatively stable over the recorded period. In general, these water levels exhibit minimal response to rainfall variations, as illustrated by the CRD. A notable feature in Figure 2.4 is the sudden decline in groundwater elevation at 5000D000 and 5500D000, and to a lesser extent, at 6500F00U. While the drop in groundwater levels at 6500F00U roughly coincides with the onset of a below-average rainfall period in 2017, the declines at 5000D000 and 5500D000 do not occur until late 2019—almost two years after the start of this dry period. Additionally, groundwater level recovery in these bores does not align with the onset of above-average rainfall recorded from early 2020 onward. Instead, recovery trends become evident from May 2021 at 5500D000 and from June 2022 at 6500F00U. Prior to 2017, groundwater levels in these bores showed little to no correlation with the CRD.

Groundwater levels in the mixed interburden and coal units (6500F500U, 6500F500M, and 7000D000U) have remained relatively stable over time. These bores do not exhibit clear signs of drawdown associated with mining activities at MPO or with operations at the nearby Dartbrook or Bengalla Mines.



Figure 2.5 Water levels – MPO Central Domain Permian measures

The measured water levels in MPO monitoring bores over the reporting period, along with corresponding trigger levels where a trigger level was set, are summarised in Table 2.2. Water level trigger levels have been established in the WMP for MPBH1, MPBH2, MPBH3b, and MPBH7.

Table 2.2 Summary of measured water levels in MPO monitoring bores during the reporting period

Bore ID	Aquifer/Unit	Trigger level (m AHD)	Water level (m AHD)			
			Q1	Q2	Q3	Q4
MPO Central Domain						
3500C500L	Mount Arthur Seam	NA	215.18	214.84	214.09	213.95
3500C500U	Warkworth Seam	NA	214.90	214.45	215.27	215.07
4500F000	Vaux Seam	NA	195.62	195.44	195.54	ND
5000D000	Wynn/Edderton Seams	NA	114.89	111.97	ND	ND
5500D000	Interburden #7/Wynn Seam	NA	182.97	182.34	181.78	181.33
6500F500L	Maitland Group	NA	136.54	138.78	139.24	138.47
6500F500M	Interburden #6/Wynn Seam	NA	136.07	138.00	138.26	137.58
6500F500U	Interburden #4/Broonie Seam	NA	158.69	158.68	156.71	157.01
6500F625	Permian	NA	178.17	177.89	177.74	177.63
7500F000	Edderton Seam	NA	147.95	148.04	147.84	147.65
Melody	Unknown	NA	179.232	179.212	179.49	179.25
MPO Eastern Domain						
MPBH1	Hunter Alluvium	136.16	137.32	137.23	137.49	137.12
MPBH1-C	Coal Seam	NA	143.49	143.41	143.74	143.32
MPBH1-HR	Interburden	NA	127.92	131.03	114.58	118.23
MPBH2	Hunter Alluvium	131.84	134.04	133.86	133.79	133.69
MPBH2-C	Coal Seam	NA	133.92	133.73	133.66	133.56
MPBH2-HR	Interburden	NA	134.05	133.90	133.74	133.69
MPBH3b	Hunter Alluvium	137.04	138.27	138.17	138.27	138.25
MPBH4	Hunter Alluvium	NA	136.67	136.63	136.73	136.70
MPBH4-C	Coal Seam	NA	138.23	138.16	138.24	138.19
MPBH4-HR*	Interburden	NA	49.89	49.87	50.04	49.90
MPBH5-C	Coal Seam	NA	134.44	134.23	133.55	133.89
MPBH5-HR	Interburden	NA	134.41	134.2	134.07	133.99
MPBH6	Hunter Alluvium	NA	147.71	147.63	147.81	147.65
MPBH6-C	Coal Seam	NA	146.15	146.01	146.05	146.26
MPBH6-HR	Interburden	NA	146.72	146.65	146.88	146.78
MPO Western Domain						
MPBH7	Hunter Alluvium	185.42	189.96	189.86	191.10	190.57
MPBH7-C	Coal Seam	NA	178.52	179.81	180.03	177.42
WRA1L	Warkworth/Permian	NA	214.56	213.79	214.11	215.50
WRA6L	Warkworth/Permian	NA	210.94	211.30	211.38	211.14
WRA6U	Alluvium/Regolith	NA	210.36	210.58	210.67	210.54

Notes: m AHD = metres above Australian Height Datum; NA = Not Assigned; ND = No Data.

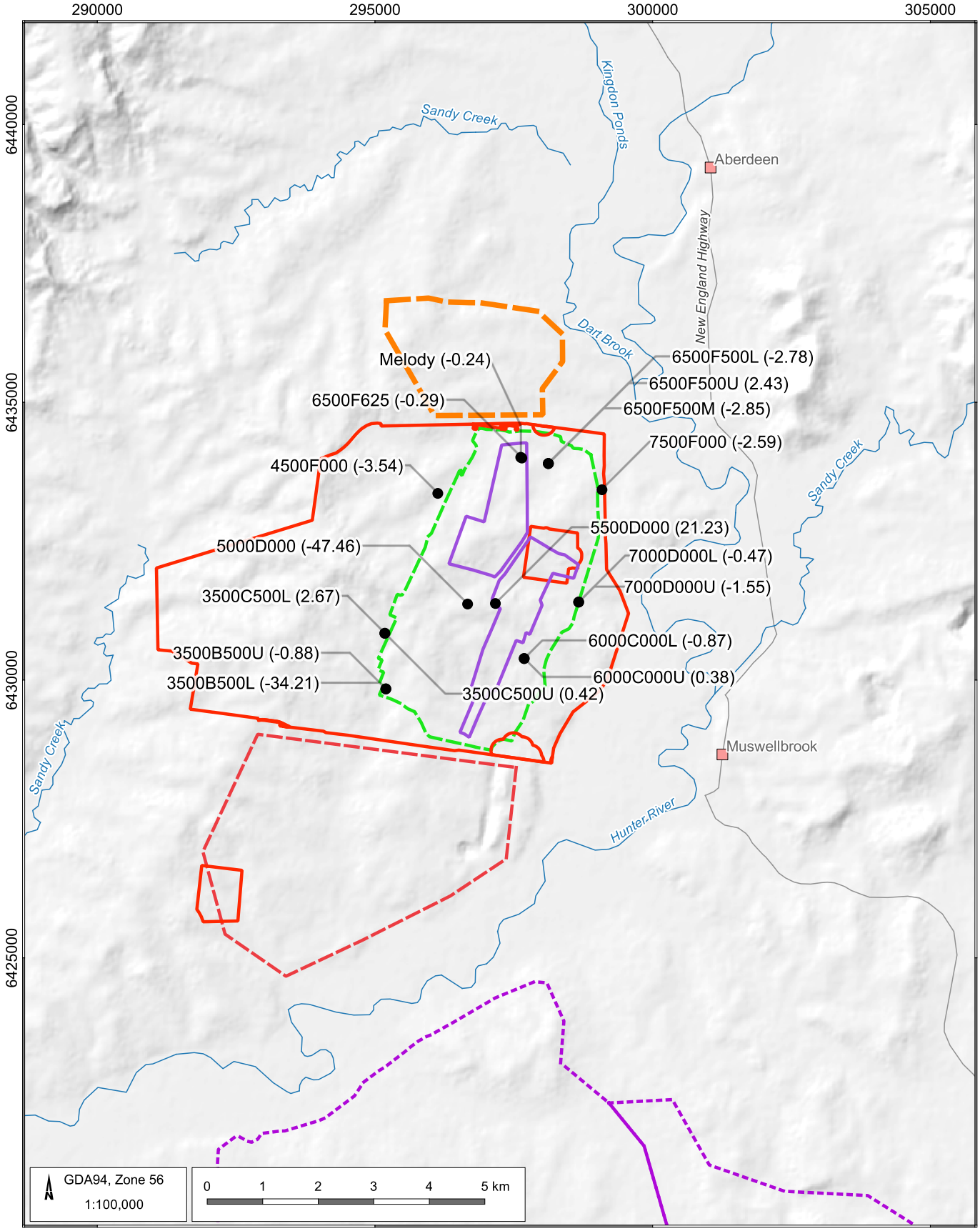
* The values for bore MPBH4-HR are presented in metres below ground level (m BGL) due to the absence of ground elevation data for this bore.

2.4 Drawdown

The total drawdown is determined by subtracting the first measured groundwater level from the last measured groundwater level at each monitoring bore, as detailed in Appendix A. It is important to note that the drawdown calculation spans different time periods, ranging from 2011 to 2024, depending on data availability. A negative value indicates a decline in groundwater levels, while a positive value signifies a rise in water levels over the measurement period.

Figure 2.6 illustrates the changes in groundwater levels within the MPO Central Domain, Figure 2.7 depicts the changes in groundwater levels within the MPO Eastern Domain, and Figure 2.8 shows the changes in groundwater levels in the MPO Western Domain. These figures provide a visual representation of how groundwater levels have fluctuated across the different domains over the monitoring period.

The measured total drawdown in the Hunter River alluvium (MPBH1-MPBH7, and MPBH3b) ranges from -0.35 m at MPBH1 to 3.58 m at MPBH7. In the MPO Western Domain, which includes regolith and Permian measures (WRA1, WRA2, WRA3, WRA5, WRA6, and MPBH7), drawdown in the regolith ranges from 1.18 m at WRA1U to 3.48 m at WRA5U. In contrast, drawdown in the Permian measures varies from -7.64 at WRA2L to 11.72 m at WRA3L. In the MPO Central Domain, which targets Permian measures (3500B500, 3500C500, 4500F000, 5000D000, 5500D000, 6000C000, 6500F500, 6500F625, 7000D000, and Melody), drawdown ranges from -47.46 m at 5000D000 to 21.23 m at 5500D000. These variations reflect differences in groundwater behaviour across the different domains and strata over the monitoring period.



LEGEND

- Populated place
- Drainage
- Road
- Bengalla Project Extent
- Dartbrook Project Extent
- MPO Pit Extent
- Project Boundary
- Pit Floor Extent
- MAC Pit Extent

Mt Pleasant Groundwater Report for the 2024 Calendar Year (MPO5007.001)

Groundwater level changes (drawdown) within the MPO Central Domain

AGE

DATE 18/03/2025

FIGURE No: **2.6**

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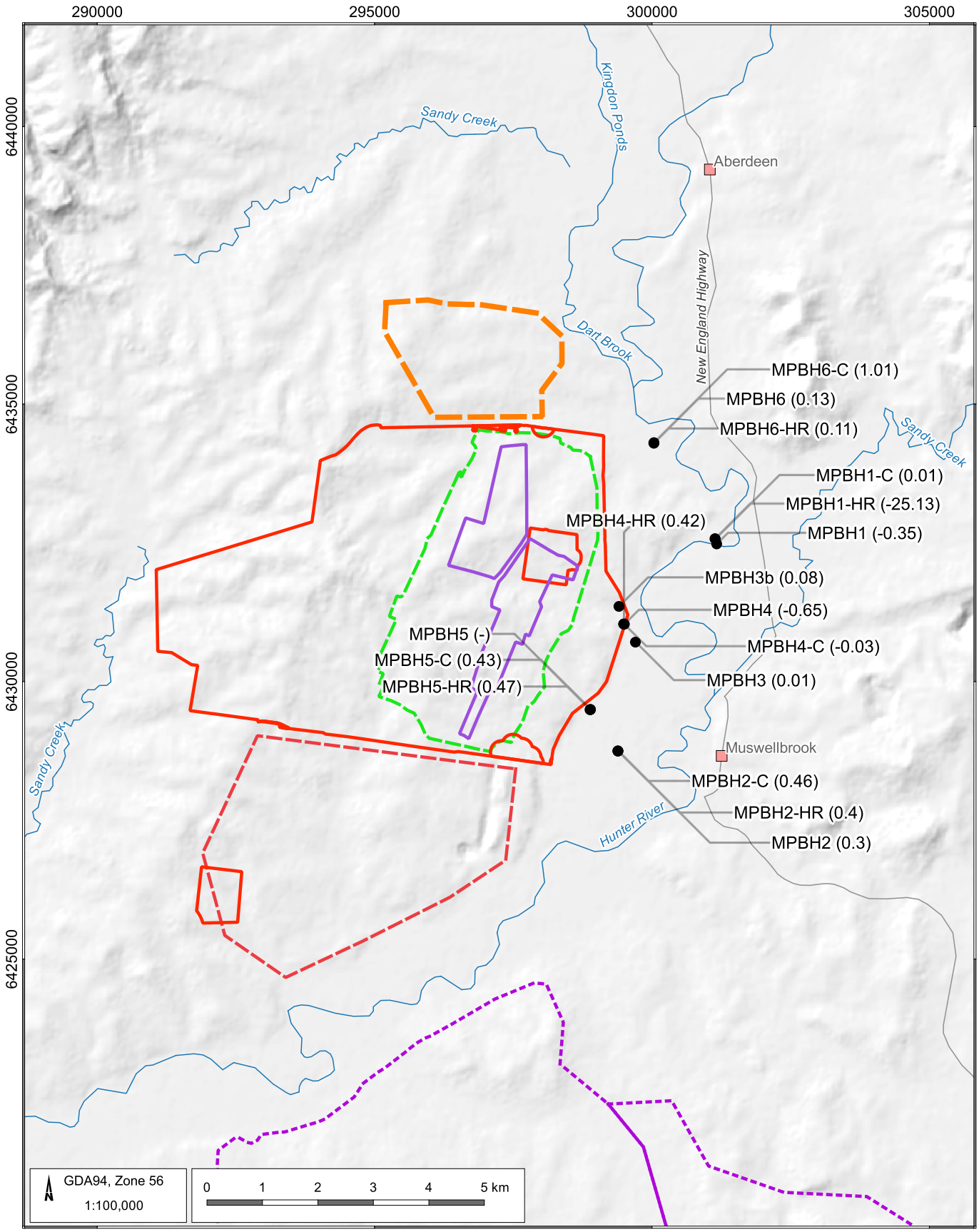

LEGEND

- Populated place
- Drainage
- Road
- Bengalla Project Extent
- Dartbrook Project Extent
- MPO Pit Extent
- Project Boundary
- Pit Floor Extent
- MAC Pit Extent

Mt Pleasant Groundwater Report for the 2024 Calendar Year (MPO5007.001)

Groundwater level changes (drawdown) within the MPO Eastern Domain

AGE

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FIGURE No: **2.7**

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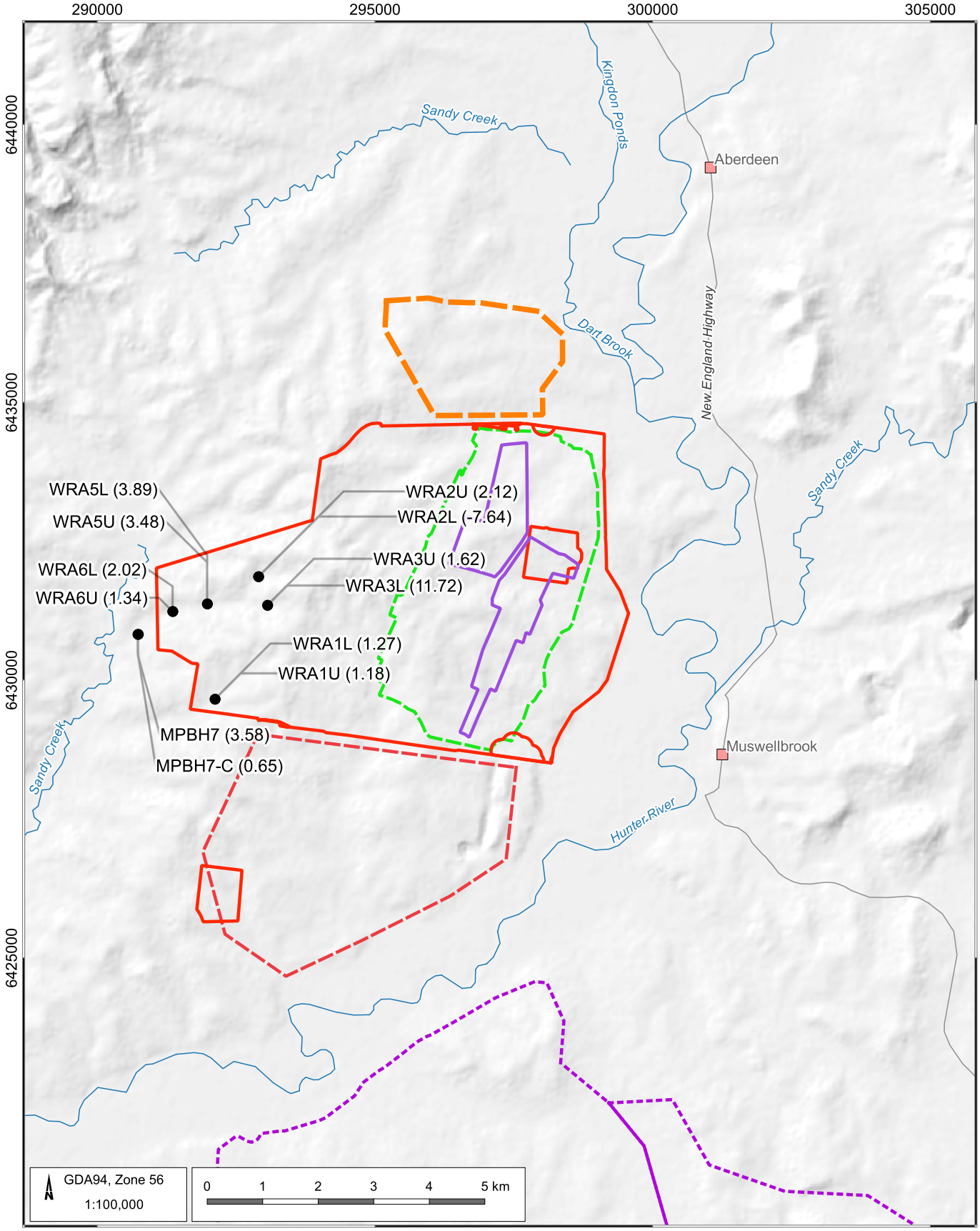

LEGEND

- Populated place
- Drainage
- Road
- Bengalla Project Extent
- Dartbrook Project Extent
- MPO Pit Extent
- Project Boundary
- Pit Floor Extent
- MAC Pit Extent

Mt Pleasant Groundwater Report for the 2024 Calendar Year (MPO5007.001)

Groundwater level changes (drawdown) within the MPO Western Domain

AGE

DATE 18/03/2025

FIGURE No: **2.8**

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G:\Projects\MPO5007.001 Mount Pleasant GW Model Validation\3_GIS\Workspaces\999_Working\02.05_MPO5007_Drawdown in Central domain.qgz

2.5 Groundwater quality and beneficial use

2.5.1 Salinity and pH

This section outlines the groundwater quality within the Quaternary alluvium and Permian measures. Salinity, which is the primary limitation for groundwater use, is typically measured by Total Dissolved Solids (TDS) concentrations. TDS levels are commonly classified on a scale from fresh to extremely saline. The Food and Agriculture Organisation of the United Nations (FAO, 2013) provides a useful classification system for salinity based on TDS concentrations, as outlined below:

- Fresh water: <500 mg/L (approximately 750 µS/cm).
- Brackish (slightly saline): 500 to 1,500 mg/L (approximately 750 to 2,250 µS/cm).
- Moderately saline: 1,500 to 7,000 mg/L (approximately 2,250 to 10,500 µS/cm).
- Saline: 7,000 to 15,000 mg/L (approximately 10,500 to 22,400 µS/cm).
- Highly saline: 15,000 to 35,000 mg/L (approximately 22,400 to 55,250 µS/cm).
- Brine: >35,000 mg/L (approximately 55,250 µS/cm).

As mentioned in Section 2.1, MACH operates a groundwater monitoring network at the MPO, as depicted in Figure 2.1 and detailed in Appendix A. Thirty monitoring bores are sampled quarterly for the measurement of field parameters, including pH and electrical conductivity (EC). Since EC is proportional to the total dissolved ions in a water sample, it can be used to estimate TDS concentrations by multiplying the EC value by 0.67 (ANZG, 2019). Figure 2.9, Figure 2.10 and Figure 2.12 display the ranges in groundwater EC recorded across the MPO monitoring bore network.

Figure 2.9 presents the EC measured at monitoring bores within the Hunter River alluvium adjacent to the MPO. The EC at MPBH1 (average 559 µS/cm) indicates fresh water. The EC at MPBH2 (average 884 µS/cm), MPBH3 (average 983 µS/cm), and MPBH6 (average 1,152 µS/cm) are higher, placing them in the lower range of the “brackish” category . In contract, EC levels at MPBH3b (average 4,346 µS/cm), MPBH4 (average 5,738 µS/cm), and MPBH7 (average 11,729 µS/cm) are significantly higher than those in other alluvial bores, classifying them as “moderately saline” (for to MPBH3b and MPBH4) to “saline” (for MPBH7).

Figure 2.10 and Figure 2.11 present the measured groundwater EC within the Permian measures and regolith of the Western Domain monitoring network, respectively. This network consists of bores located near minor drainage features that discharge into Sandy Creek. Notably, groundwater in this area exhibits the highest EC levels among all MPO monitoring bores. EC values in the regolith of this domain range from brackish to moderately saline, with median EC varying between 1,702 µS/cm (brackish) at WRA2U and 10,273 µS/cm (moderately saline) at WRA6U. In contrast, the bores targeting the Permian measures have median EC values ranging from 3,594 µS/cm (moderately saline) at WRA1L to 15,607 µS/cm (saline) at WRA3L.

Groundwater EC measurements in the Permian measures of the Central Domain monitoring bores have been intermittent, as illustrated in Figure 2.12. EC levels in these bores fluctuate over time, with occasional sudden changes recorded throughout the monitoring period. The average EC values range from 773 µS/cm (brackish) at 5000D000 to 5,625 µS/cm (moderately saline) at 3500B500L.

Figure 2.13 to Figure 2.16 illustrate the range of groundwater pH levels recorded across the MPO monitoring bore network. The calculated median pH across the Central, Eastern, and Western monitoring domains is 7.4, indicating generally neutral groundwater conditions. However, pH values vary significantly, ranging from 5.7 (slightly acidic) at WRA5U to 12.4 (highly alkaline) at 7000D000U.

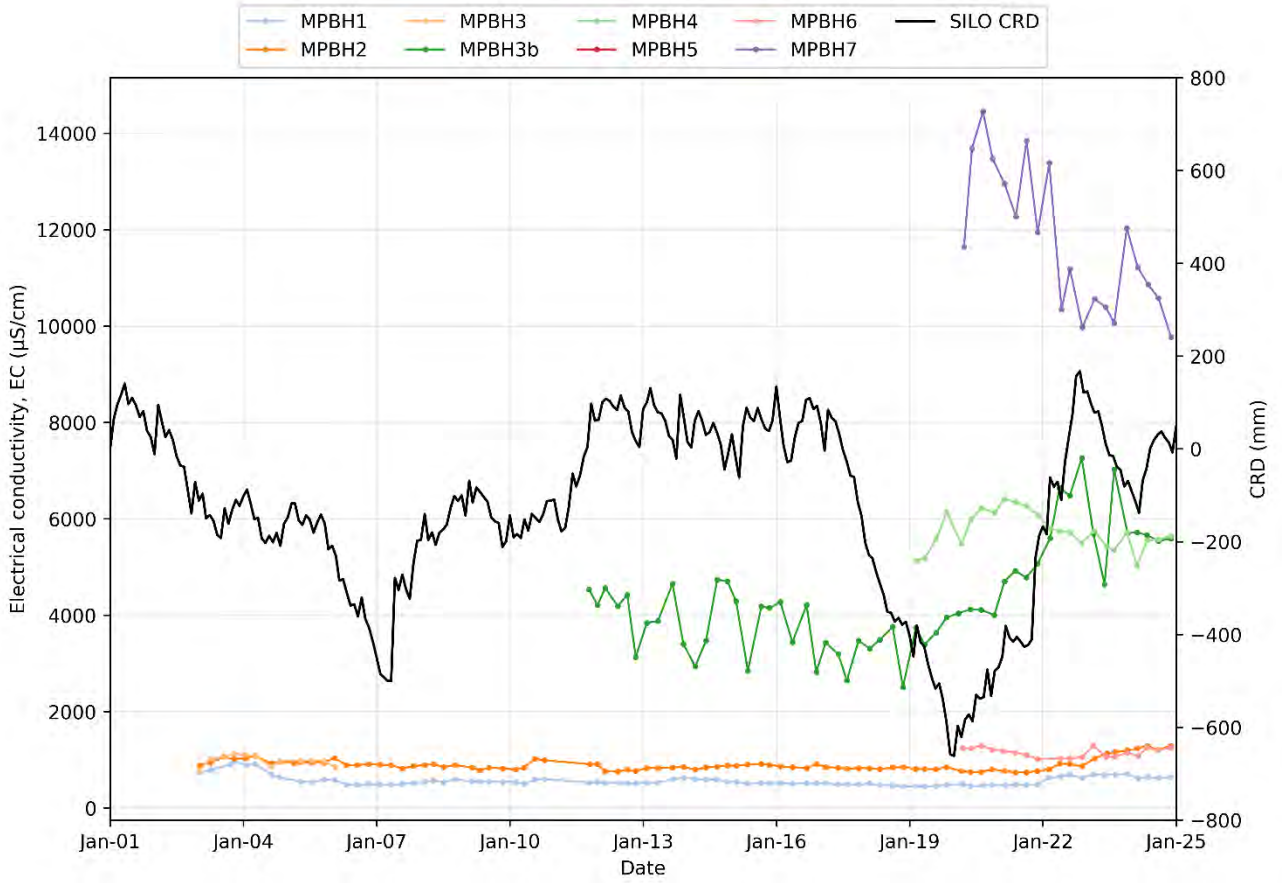


Figure 2.9 Electrical conductivity (EC) – Hunter River alluvium

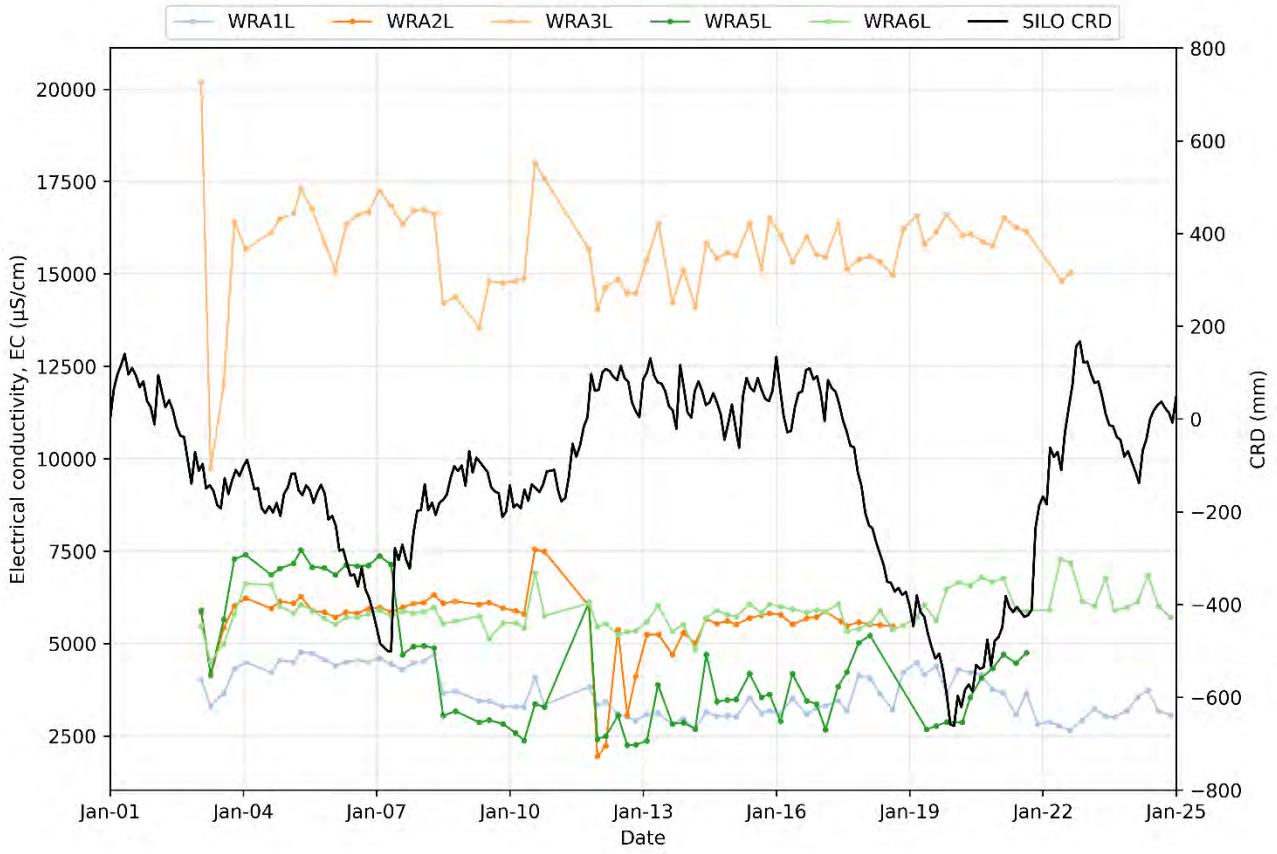


Figure 2.10 Electrical conductivity (EC) – MPO Western Domain Permian measures

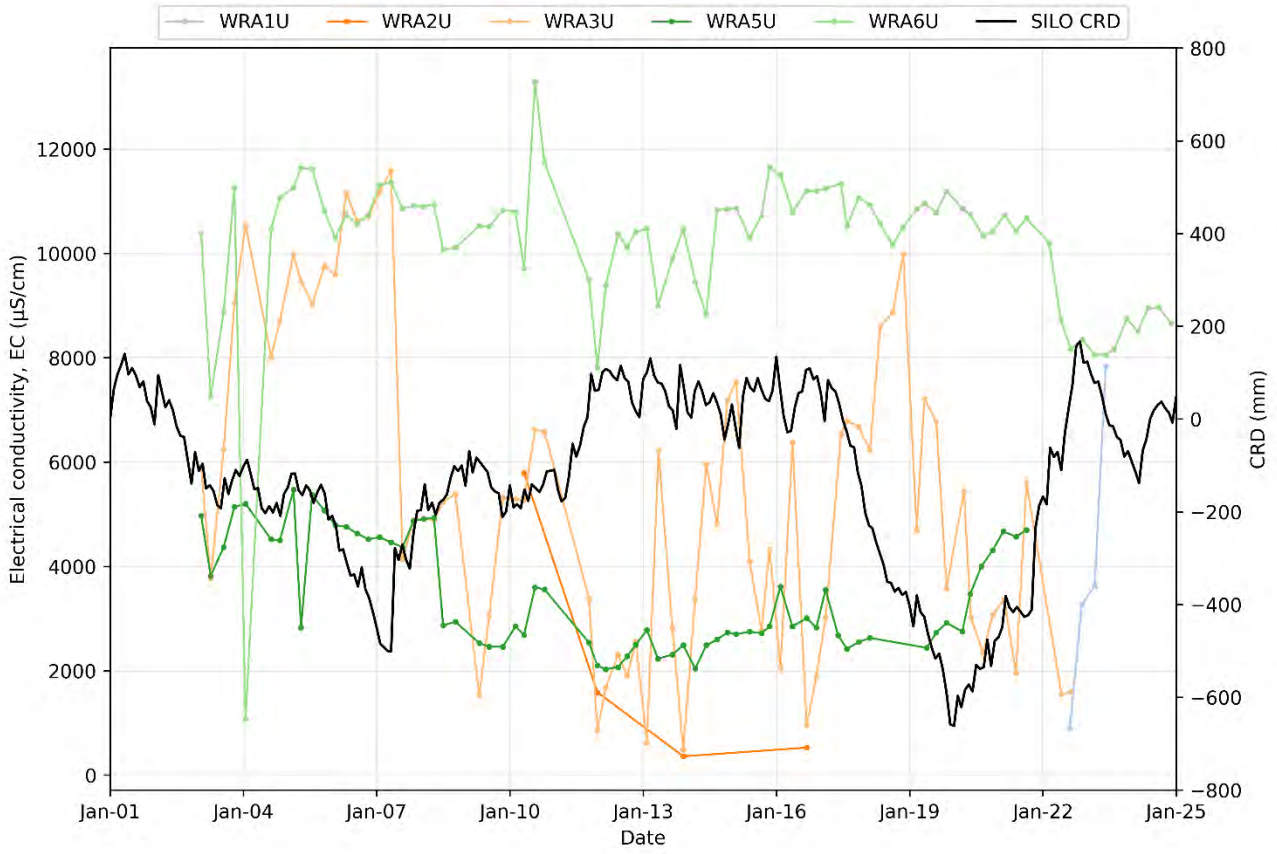


Figure 2.11 Electrical conductivity (EC) – MPO Western Domain regolith

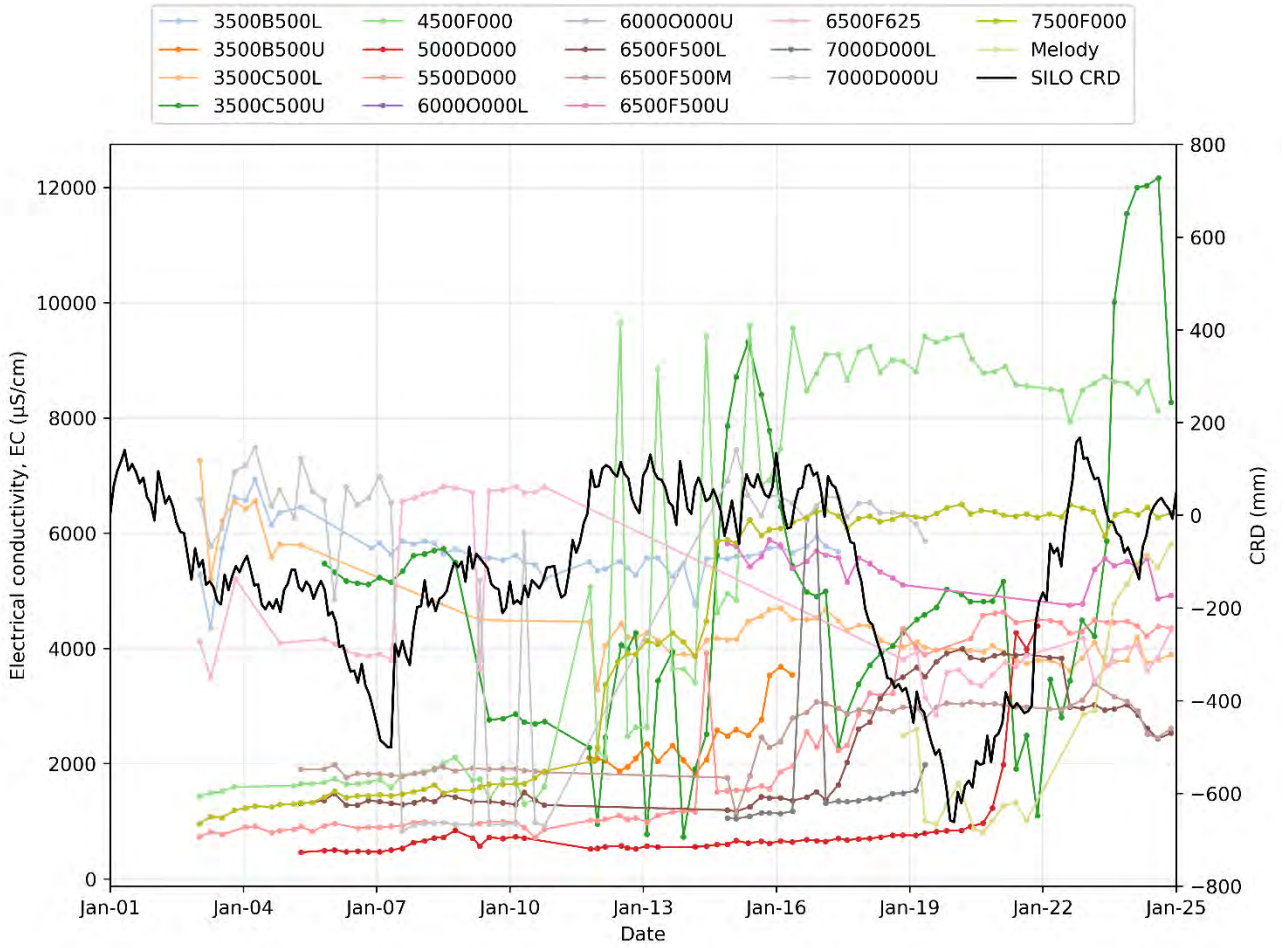


Figure 2.12 Electrical conductivity (EC) – MPO Central Domain Permian measures

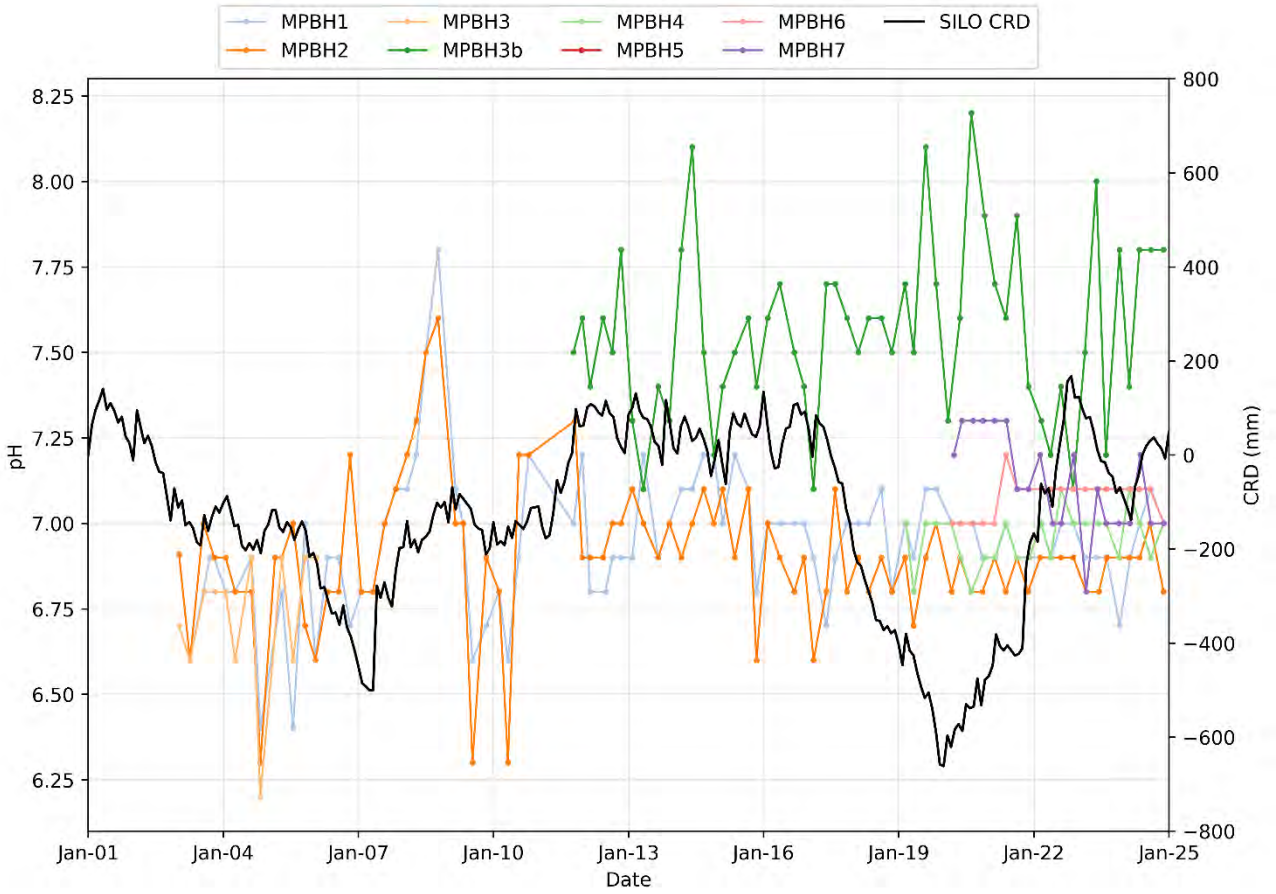


Figure 2.13 pH – Hunter River alluvium

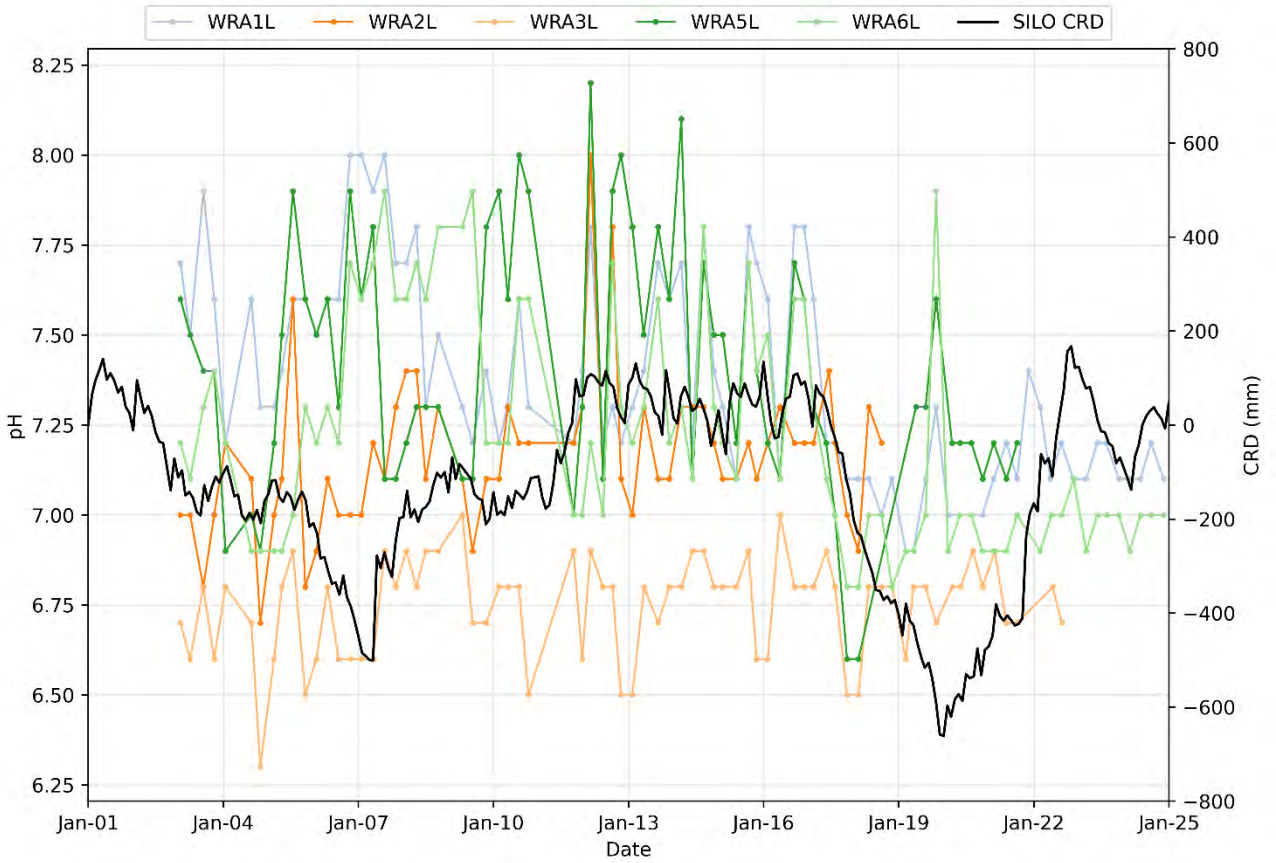


Figure 2.14 pH– MPO Western Domain regolith and Permian measures

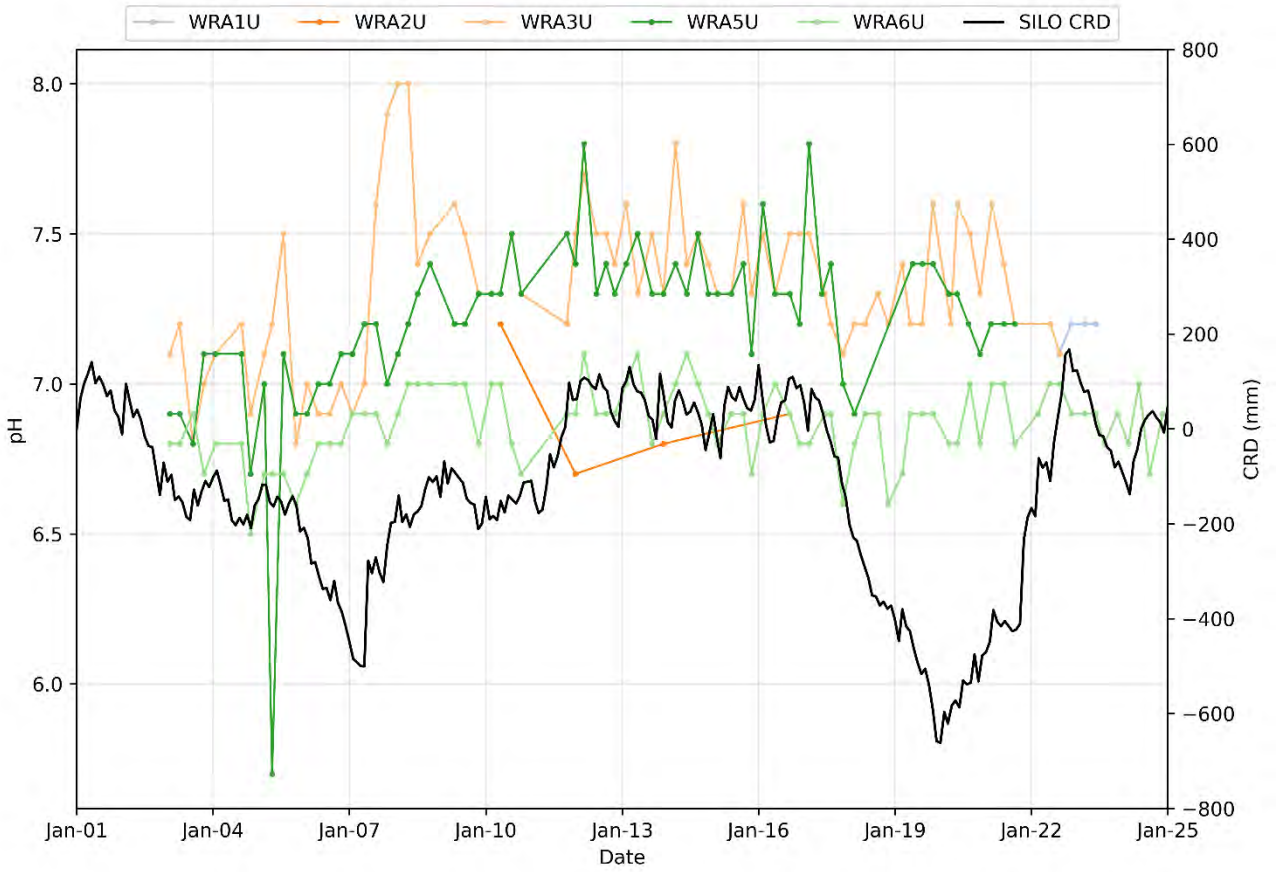


Figure 2.15 pH– MPO Western Domain regolith

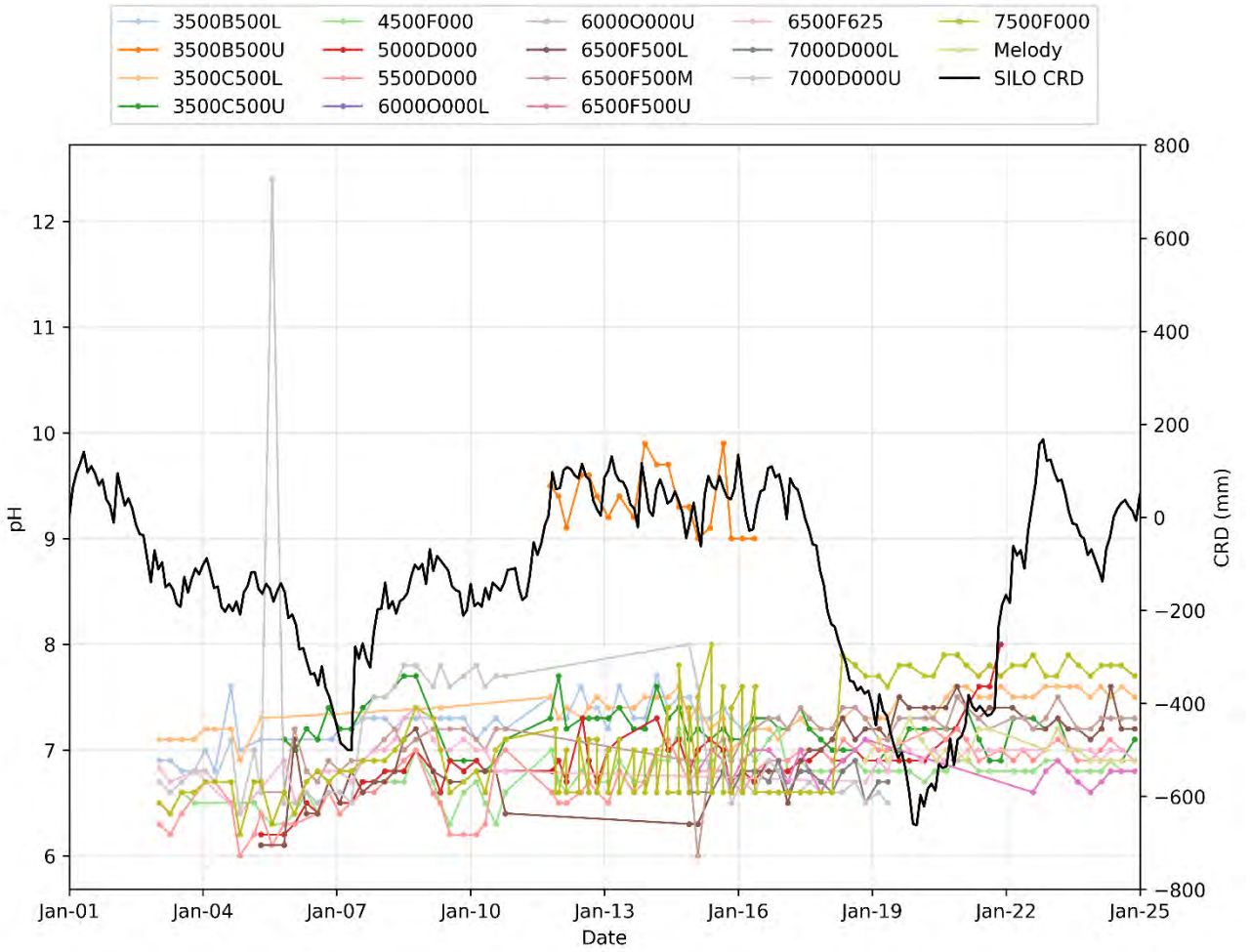


Figure 2.16 pH – MPO Central Domain Permian measures

The measured EC and pH in MPO monitoring bores over the reporting period, along with their corresponding trigger levels established in the WMP, are summarised in Table 2.3.

The measured EC values across the MPO monitoring bore network in 2024 exhibit significant variability between domains. In the Hunter River alluvium, EC ranges from 612 µS/cm (fresh water) at MPBH1 to 11,220 µS/cm (saline) at MPBH7. In the Western Domain, EC in the regolith was only measured at WRA6U, ranging from 8,500 µS/cm (moderately saline) to 8,970 µS/cm (moderately saline). For the Permian measures in this domain, EC values were measured at WRA1L and WRA6L, ranging from 3,050 µS/cm (brackish) at WRA1L to 6,840 µS/cm (brackish) at WRA6L. In the Central Domain, EC in the Permian measures varies from 2,430 µS/cm (brackish) at bore 6500F500L to a maximum of 12,160 µS/cm (moderately saline) at 3500C500U, indicating variability in salinity levels.

In the Hunter River alluvium, pH levels range from 6.8 at MPBH1 to 7.8 at MPBH3b, reflecting near-neutral to slightly alkaline conditions. In the Western Domain, pH in the regolith was only measured at WRA6U, ranging from 6.7 to 7.0. For the Permian measures in this domain, pH values were recorded at WRA1L and WRA6L, varying from 6.9 at WRA6L to 7.2 at WRA1L, suggesting minor fluctuations in acidity. In the Central Domain, pH in the Permian measures ranges from 6.7 at bore 6500F500U to a maximum of 7.8 at 7500F000.

Table 2.3 Summary of measured EC and pH in MPO monitoring bores during the reporting period

Bore ID	Aquifer/Unit	pH						EC (µS/cm)				
		Lower trigger	Upper Trigger	Q1	Q2	Q3	Q4	Trigger	Q1	Q2	Q3	Q4
MPO Central Domain												
3500C500L	Mount Arthur Seam	6	8.5	7.6	7.5	7.6	7.5	7,800	4,190	3,750	3,810	3,890
3500C500U	Warkworth Seam	6	8.5	6.9	6.9	6.9	7.1	7,800	12,000	12,030	12,160	8,270
4500F000	Vaux Seam	6	8.5	6.8	6.9	6.8	ND	22,000	8,440	8,640	8,130	ND
5500D000	Interburden #7/Wynn Seam	6	8.5	7.0	7.1	7.0	6.9	7,800	4,390	4,210	4,380	4,350
6500F500L	Maitland Group	6	8.5	7.2	7.6	7.2	7.2	7,800	2,840	2,610	2,430	2,530
6500F500M	Interburden #6/Wynn Seam	6	8.5	7.3	7.3	7.3	7.3	7,800	2,910	2,510	2,450	2,610
6500F500U	Interburden #4/Broonie Seam	6	8.5	6.7	6.8	6.8	6.8	7,800	5,390	5,560	4,860	4,920
6500F625	Permian	6	8.5	6.9	7.0	7.0	6.9	7,800	4,050	3,610	3,850	4,310
7500F000	Edderton Seam	6	8.5	7.8	7.8	7.8	7.7	7,800	6,320	6,450	6,270	6,350
Melody	Unknown	6	8.5	6.9	6.9	6.9	6.9	NA	5,470	5,620	5,400	5,810
MPO Eastern Domain												
MPBH1	Hunter Alluvium	6	8.5	6.9	7.0	7.1	7.0	800	612	644	622	640
MPBH1-C	Coal Seam	NA	NA	8.6	8.0	7.9	8.7	NA	1,390	793	821	1,510
MPBH1-HR	Interburden	NA	NA	7.8	8.0	8.1	8.0	NA	1,592	1,521	1,506	1,565
MPBH2	Hunter Alluvium	6	8.5	6.9	6.9	7.0	6.8	930	1,237	1,290	1,205	1,291
MPBH2-C	Coal Seam	NA	NA	10.7	7.1	8.2	7.7	NA	1,726	1,304	1,072	1,078
MPBH2-HR	Interburden	NA	NA	7.5	7.9	7.9	7.5	NA	1,108	1,247	1,361	1,229
MPBH3b	Hunter Alluvium	6	8.5	7.4	7.8	7.8	7.8	7,800	5,720	5,660	5,540	5,590
MPBH4	Hunter Alluvium	6	8.5	7.1	7.0	6.9	7.0	7,800	5,030	5,550	5,570	5,640
MPBH4-C	Coal Seam	NA	NA	7.9	8.0	8.0	8.0	NA	5,090	4,950	4,860	4,970
MPBH4-HR	Interburden	NA	NA	7.3	7.3	7.3	7.2	NA	5,720	5,740	5,690	5,500

Bore ID	Aquifer/Unit	pH						EC (µS/cm)				
		Lower trigger	Upper Trigger	Q1	Q2	Q3	Q4	Trigger	Q1	Q2	Q3	Q4
MPBH5-C	Coal Seam	NA	NA	10.3	9.2	9.3	9.8	NA	609	1,388	761	919
MPBH5-HR	Interburden	NA	NA	7.6	7.4	7.6	7.5	NA	850	797	843	856
MPBH6	Hunter Alluvium	NA	NA	7.1	7.1	7.1	7.0	NA	1,081	1,257	1,194	1,250
MPBH6-C	Coal Seam	NA	NA	7.7	7.3	7.1	7.0	NA	5,510	3190	2780	2730
MPBH6-HR	Interburden	NA	NA	7.4	7.3	7.3	7.3	NA	4,950	6140	3580	4760
MPO Western Domain												
MPBH7	Hunter Alluvium	NA	NA	7.0	7.2	7.0	7.0	NA	1,1220	10,860	10,580	9,770
MPBH7-C	Coal Seam	NA	NA	7.0	7.2	7.1	7.0	NA	1,0410	10,780	10,800	10,280
WRA1L	Warkworth/Permian	6	8.5	7.1	7.1	7.2	7.1	7,800	3,550	3,730	3,180	3,050
WRA6L	Warkworth/Permian	6	8.5	6.9	7.0	7.0	7.0	7,800	6,140	6,840	6,010	5,700
WRA6U	Alluvium/Regolith	6	8.5	6.8	7.0	6.7	6.9	22,000	8,500	8,950	8,970	8,660

Notes: NA = Not Assigned.
ND = No Data.
= EC exceedance.

2.5.2 Major ions

The analysis of dissolved ions in groundwater provides valuable insights into its chemical composition, which can be used to classify different types of groundwater. The presence and concentration of various ions are influenced by factors such as the groundwater's origin, its interactions with the surrounding aquifer materials, and processes like the dissolution and precipitation of minerals. By examining the major ions in a groundwater sample, it becomes possible to classify the water chemically, which in turn helps in developing conceptual models of groundwater systems.

The major ion chemistry of 30 groundwater samples collected at the MPO in 2024 was analysed using a Piper plot (Figure 2.17), a graphical method that represents the proportions of major cations and anions in groundwater. The Piper plot consists of two tri-linear diagrams: the lower-left plot shows the relative concentrations of cations ($Na^+ + K^+$, Ca^{2+}, Mg^{2+}), while the lower-right plot illustrates the relative concentrations of anions ($HCO_3^- + CO_3^{2-}$, Cl^-, SO_4^{2-}). These individual ion concentrations are then projected onto a third rhombohedral plot located at the top, which classifies the groundwater sample into a specific water type based on its overall chemical composition. This method provides a clear visual representation of the chemical characteristics of groundwater, aiding in the classification and interpretation of different water types across the monitoring network.

The review of the Piper plot reveals significant variability in the geochemical composition of groundwater within the Permian strata, including the coal measures. Despite this variability, a consistent trend is observed, with the water predominantly dominated by sodium, potassium, and chloride ions. This composition classifies the groundwater as a sodium chloride type. In contrast, groundwater in the alluvial deposits exhibits a distinct geochemical profile, primarily characterised by a magnesium carbonate type water. This is mainly due to the high concentrations of magnesium (Mg^{2+}) and bicarbonate (HCO_3^-) ions observed in the samples, suggesting a different hydrochemical influence compared to the Permian strata.

A summary of the quarterly water quality laboratory results for the year 2024 is presented in Appendix E.

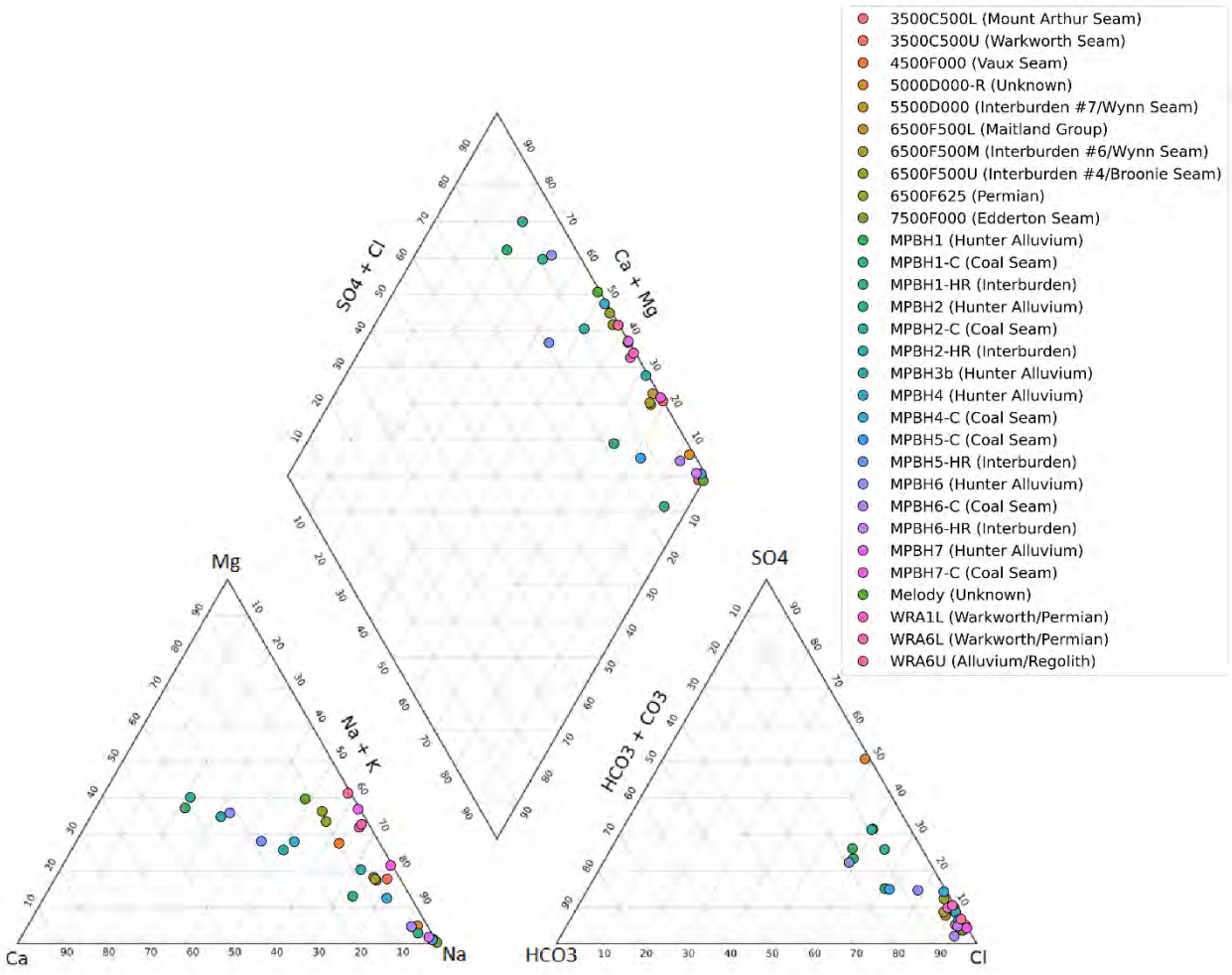


Figure 2.17 2024 Piper plot of groundwater composition from the MPO monitoring bores

2.6 Trigger exceedances

WMP (MACH Energy, 2025) specified groundwater level triggers for alluvium system. Groundwater level triggers have been established to monitor potential impacts on the alluvial groundwater system near the Hunter River. These triggers are designed to detect trends that could lead to a private bore experiencing more than 2 m of drawdown and to manage drawdown risks to groundwater-dependent ecosystems (GDEs). Water level triggers for the alluvial monitoring bores (MPBH1, MPBH2, MPBH3b, MPBH7) as listed in Table 2.2, have been calculated using the criteria of "less than or equal to a 10% cumulative variation in the water table". This is based on the minimum recorded saturated thickness of the aquifer, which was derived from the alluvium thickness and the deepest recorded groundwater level in each bore. The deepest recorded level reflects climate variability, with no evidence of mine-related impacts in the bore data. For MPBH7, the water level trigger is set at the base of the screened interval, approximately 1.3 m below the maximum recorded groundwater level.

As shown in Table 2.2 and the hydrographs in Appendix B, water levels in bores MPBH1, MPBH2, MPBH3b, and MPBH7 have not exceeded the trigger levels specified in the Water Management Plan (WMP) throughout the monitoring period, including in 2024.

ANZECC & ARMCANZ (2000) recommends using site-specific data for defining environmental trigger values, but a single pH range of 6 – 8.5 was suggested in WMP (MACH Energy, 2025) across all bores due to inaccuracies in the proposed percentile ranges. This pH range aligns with ANZECC & ARMCANZ (2000) guidelines to prevent infrastructure corrosion and the Australian Drinking Water Quality Guidelines (NHMRC & NRMMC, 2011). Baseline monitoring shows that EC values near the MPO vary widely. Therefore, site-specific EC trigger levels have been developed (MACH Energy, 2025) based on baseline data to monitor the MPO's impact. The pH and EC trigger levels for the MPO monitoring bores are provided in Table 2.3.

As shown in Table 2.3 and the EC time series plots in Appendix C, the measured EC for all monitoring bores during the 2024 period remained below their respective EC trigger levels (as specified in the WMP), except for 3500C500U and MPBH2, where EC measurements consistently exceeded their trigger levels throughout 2024. The average EC for 3500C500U in 2024 was 11,115 µS/cm, approximately 43% higher than its trigger level of 7,800 µS/cm. For MPBH2, the average EC for 2024 was 1,256 µS/cm, which is 35% higher than its trigger level of 930 µS/cm. As the EC measurement values in these bores have exceeded the EC trigger level for three successive monitoring rounds, a further investigation is required, and the groundwater investigation protocol outlined in Section 9.2 of the Groundwater Management Plan (GMP) within the WMP must be followed. Additionally, as shown in Table 2.3 and the pH time series plot in Appendix D, none of the monitoring bores exceeded their pH trigger levels (6 – 8.5, as specified in the WMP) during 2024.

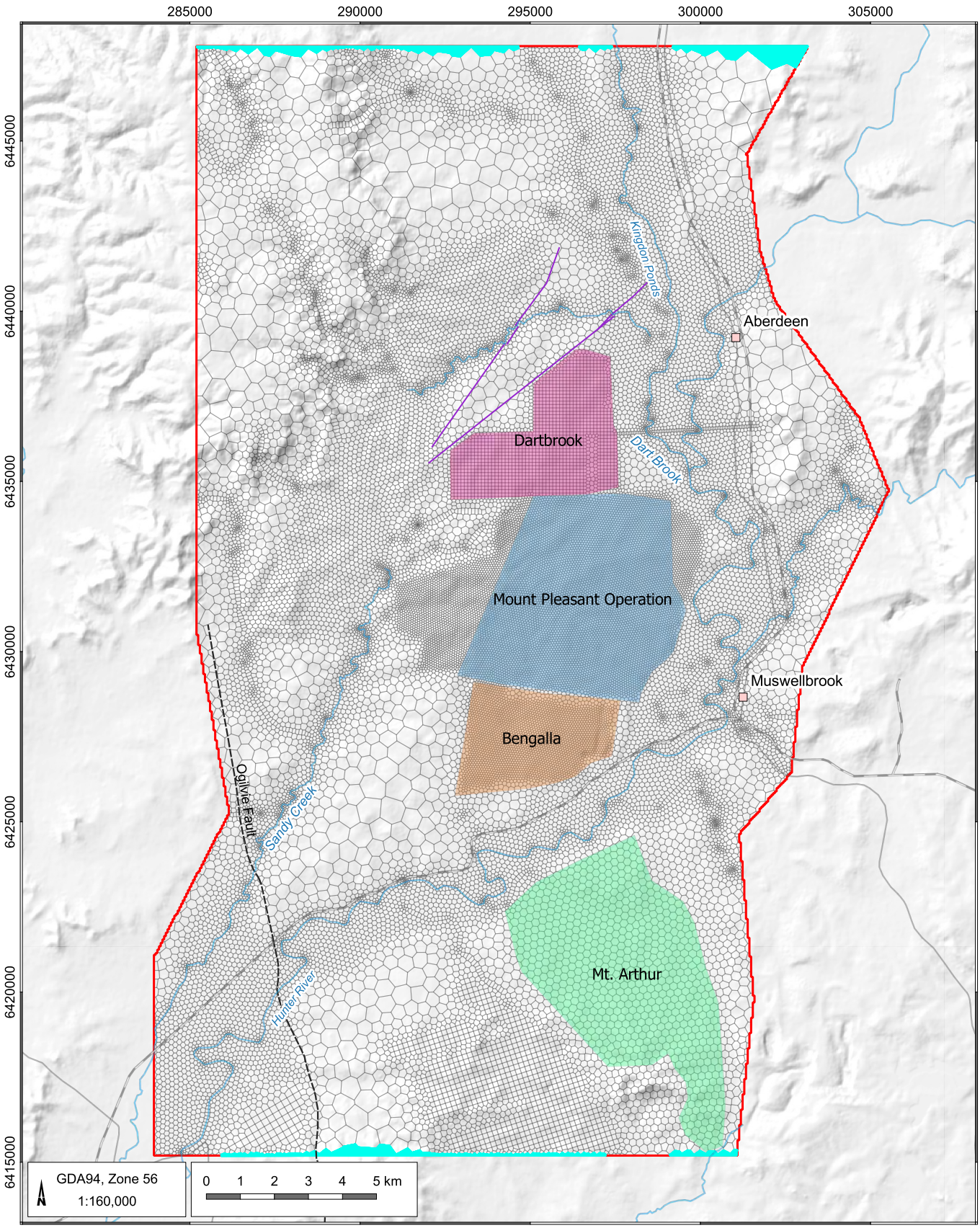
3 Assess numerical model predictions

The previous 3D numerical groundwater flow model, developed for the Groundwater Impact Assessment (GIA) of the Mount Pleasant Optimisation Project (AGE, 2020), was verified. The model was developed using the MODFLOW-USG code, and a summary of its key components is provided in this section.

3.1 Model grid

The model grid covers the MPO and surrounding mining operations, including Bengalla Mine, Dartbrook Mine, and Mt Arthur Coal Mine, with a domain approximately 19 km wide (west to east) and 30 km long (north to south), as shown in Figure 3.1. The active model extends to the outcrop of Maitland Group units to the east, which is the unit below the deepest seam at the MPO. The Mount Ogilvie fault is simulated as a no-flow boundary in the southwest. The nearest model edge to the MPO is 9 km, ensuring that boundary conditions do not affect key predicted impacts.

Boundary conditions include a General Head Boundary (GHB) for coal seams at the northern and southern extents, allowing water transfer into and out of the model domain, while other boundaries are no-flow. The model is discretised into 20 layers with 32,915 cell nodes per layer. Cell sizes vary for detail, with smaller cells in areas of open-cut and underground mining (100 m × 100 m to 300 m × 100 m), streams, alluvial flood plains (100 m × 100 m to 200 m × 200 m), and the Dartbrook Mine Hunter Tunnel (100 m × 100 m), while peripheral areas have larger cells (up to 700 m). The model layers represent major hydrostratigraphic units, including shallow geological units, coal seams, and interburden.



LEGEND

- Populated place
- Road
- Rail
- Olgilvie Fault
- Major Dyke
- Drainage
- Grid
- Bengalla
- Dartbrook
- Mount Pleasant Operation
- Mt. Arthur
- General head boundary
- No-Flow Boundary

Mt Pleasant Groundwater Report for the 2024 Calendar Year (MPO5007.001)

Model extent and mesh

AGE

DATE 10/03/2025

FIGURE No: **3.1**

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Source: 1 second SRTM Derived DEM-S - © Commonwealth of Australia (Geoscience Australia) 2011.; GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.;
G:\Projects\MPO5007.001 Mount Pleasant GW Model Validation\3_GIS\Workspaces\999_Working\03.01_MPO5007_Model extent and mesh.qgz

3.2 Model layer

The model uses 20 layers to represent key hydrostratigraphic horizons, ranging from the Quaternary alluvium to deeper Permian formations. These layers were based on horizons from the MPO site geological model, using drill hole data from exploration drilling, and were extrapolated beyond the geological model's limits using publicly available data and expert judgment. The model layering is summarized in Table 3.1.

All model cells within each layer are active and assigned to a single hydrostratigraphic unit. In areas where a hydrostratigraphic unit sub-crops or disappears, the layer's thickness is reduced to 5 cm. To improve geological representation, hydraulic properties have been assigned from the underlying major unit where the targeted hydrostratigraphic unit does not exist.

Table 3.1 Model layers

Layer	Representative aquifer/Unit
1 and 2	Surficial alluvium and weathered zone/regolith
2	Weathered overburden
3	Overburden
4	Warkworth Seam
5	Interburden 1
6	Mount Arthur Seam (and Kayuga Seam at Dartbrook Mine)
7	Interburden 2
8	Piercefield Seam
9	Interburden 3
10	Vaux Seam
11	Interburden 4
12	Broonie Seam
13	Interburden 5
14	Bayswater Seam
15	Interburden 6
16	Wynn Seam
17	Interburden 7
18	Edderton Seam
19	Vane Subgroup/Saltwater Creek Formation
20	Maitland Group and older units

3.3 Timing

The numerical groundwater model simulates groundwater flow from 1990 to 3049 with the following time periods:

- Last day of 1990 – steady-state stress period representing pre-mining conditions;
- 1991 to the end of 2010 – 21 annual stress periods;
- 2011 to the end of 2017 – 24 quarterly stress periods;
- 2018 to the end of 2048 – 31 annual stress periods;
- 2049 to 3049 – recovery stress periods of progressively increasing length; and
- The last stress period is a steady-state stress period representing post-mining equilibrium conditions.

Quarterly stress periods were introduced to better capture seasonal variability in recharge and the progression of mining activities at Bengalla Mine and Mt Arthur Coal Mine.

3.4 Recharge

The MODFLOW-USG recharge package (RCH) was used to simulate deep drainage from diffuse rainfall. The primary recharge mechanism to the groundwater system is the infiltration of rainfall through the soil profile, followed by deep drainage to the underlying groundwater systems. To simplify the model, MODFLOW-USG options were selected to exclude flow through the vadose zone, as there were no available parameters to accurately represent unsaturated flow.

The rainfall data was obtained from the nearby BoM stations: Muswellbrook (St Heliers) (BoM station 061374) and Muswellbrook (Spring Creek, Castle Vale) (BoM station 061192). The average (mean) annual rainfall at Muswellbrook (Spring Creek, Castle Vale) was approximately 678.5 mm.

The model domain was divided into three zones, each representing areas where factors affecting recharge were considered consistent. This division was mainly based on the locations of various geological outcrops and the potential for recharge in those areas. Table 3.2 presents the calibrated recharge rates for each geological unit.

Table 3.2 Calibrated recharge rate and percentage for each zone

Zone	Diffuse recharge rate – transient			
	% of annual rainfall	Min (mm/year)	Mean (mm/year)	Max (mm/year)
Alluvium	3.20%	12.4	23.9	28.4
Triassic Sandstone	2.80%	10.9	20.9	24.8
Permian	0.5%	1.9	3.7	4.4

3.5 Evapotranspiration

Evapotranspiration from shallow water tables was modelled using the evapotranspiration (EVT) package in MODFLOW-USG, applied to the uppermost model cells (Layer 1). Evapotranspiration occurs when the water table is close enough to the surface, within the extinction depth, below which evapotranspiration ceases. The effect is incorporated into the net recharge rate. A maximum evaporation rate of 600 mm/year is assigned at the surface, decreasing linearly with depth to zero at the extinction depth. These depths were derived from the plant rooting depths of dominant species in the vegetation communities. Table 3.3 presents evapotranspiration rooting zones, including the vegetation zone and rooting depth.

Table 3.3 Evapotranspiration rooting zones

Vegetation zone	Rooting depth (m)
Open grassland	1
Open/grassy woodland	2.5
Forest	**5**

3.6 Water courses and surface drainage

Groundwater interaction with surface drainage was modelled using the river (RIV) package in MODFLOW-USG. Major streams near the MPO, such as the Hunter River and Dart Brook, have river stage elevations interpolated between gauging stations to assign water depths, replicating the consistent flow and allowing for recharge from these streams. Minor, ephemeral watercourses, which only flow briefly after rainfall, were simulated with a river depth of zero, meaning groundwater is only removed as baseflow when groundwater levels are high enough. River cells in the model were assigned to either Layer 1 (where alluvium exists) or Layer 2 (where Layer 1 is absent). Table 3.4 summarises the river cell parameters in the model.

Table 3.4 River (RIV) cell parameters

River No	River name	K_v (m/day)	Width (m)	Water depth (m)	Bed thickness (m)
1	Hunter River	0.05	20	Steady state (1–2 m) Transient (historical monthly average)	1
2	Dart Brook	0.05	10	Steady state (0.7 m) Transient (historical monthly average)	1
3	Sandy Creek	1	5	0	1
4	Other creeks	1	5	0	1

Note: K_v = Vertical hydraulic conductivity.

3.7 Mining

The MPO is located between several coal mines in the Hunter region, including Bengalla, Mt Arthur Coal, and Dartbrook Mines, requiring consideration of cumulative impacts. The Mount Ogilvie Thrust Fault, located west of the MPO, offsets coal seams against lower permeability interburden, significantly reducing the potential for cumulative impacts between the MPO and Mangoola Coal.

3.7.1 Bengalla Mine and Mt Arthur Coal Mine open cut

The model used the drain (DRN) package to simulate open-cut mining for Bengalla and Mt Arthur Coal Mines, with drain cells assigned to all model layers within the pit shell. Water removal was based on the head difference and conductance. Backfilling with spoil was modelled by adjusting permeability and storage properties using the MODFLOW-USG Time-Variant Materials (TVM) package, with increased recharge simulated using the MODFLOW-USG RCH package. Table 3.5 outlines the hydraulic properties and recharge rates for the spoil.

Table 3.5 Hydraulic properties assigned to the spoil material

K_h (m/day)	K_v (m/day)	S_y (-)	S_s (m^{-1})	Recharge
0.3	0.1	0.1	1×10-5	2% rainfall

Notes: K_h = Horizontal hydraulic conductivity; K_v = Vertical hydraulic conductivity; S_y = Specific yield; S_s = Specific storage.

3.7.2 Dartbrook Mine

Underground mining at Dartbrook Mine was simulated using the DRN package, with drain cells applied to the Wynn and Kayuga / Mt Arthur seams. The model replicated mining progression by gradually adding drain cells. It also simulated changes to aquifer properties due to longwall mining using the TVM package. Hydraulic conductivities were enhanced in the deformation zone above the mined seams using multipliers, with values decreasing with distance from the mined seam. The maximum height of cracking was calculated using the Ditton/Merrick equation. Table 3.6 shows the fractured zone multipliers for the Wynn and Kayuga seams.

Table 3.6 Fracture zone multipliers for Wynn and Kayuga longwall mining at Dartbrook Mine

Lithology	Layer	Median height above seam (m)	K_h multiplier	K_v multiplier
Wynn Seam				
Alluvium and Regolith	1	285	2	3
Alluvium and Weathered Overburden	2	283		
Overburden	3	283		3
Warkworth Seam	4	283		
Interburden 1	5	260		
Kayuga / Mount Arthur Seam	6	234		
Interburden 2	7	190		5
Piercefield Seam	8	145		
Interburden 3	9	127		
Vaux Seam	10	109		
Interburden 4	11	82	6	20
Broonie Seam	12	56		
Interburden 5	13	48		
Bayswater Seam	14	39		75
Interburden 6	15	19	68	115
Wynn Seam	16	0	83	152
Kayuga Seam				
Alluvium and Regolith	1	2	2	3
Alluvium and Weathered Overburden	2	0		
Overburden	3	0		
Warkworth Seam	4	23		47
Interburden 1	5	24	3	73
Kayuga / Mount Arthur Seam	6	0	10	115

Notes: K_h = Horizontal hydraulic conductivity; K_v = Vertical hydraulic conductivity.

3.8 Hydraulic and storage properties

Table 3.7 presents the calibrated hydraulic conductivity values for each hydrostratigraphic unit in the model domain, representing the base case for each layer. Table 3.7 summarises the calibrated values for specific storage and specific yield. Unlike hydraulic conductivities, the storage parameters are uniform across the whole model domain at each layer. Specific yield is only relevant in the model where the layers become unconfined, so the parameter is not necessarily utilised in the deeper model layers. Specific storage is only applied where the model layers are confined.

Table 3.7 Calibrated hydraulic and storage properties

Model layer	Lithology	K_h (m/day)	K_v:K_h	S_y (-)	S_s (m^{-1})
1 and 2	Alluvium and regolith	4.61	0.2	7.0×10^{-2}	1.3×10^{-5}
2	Weathered overburden	0.01	0.6	3.2×10^{-2}	3.3×10^{-6}
3	Overburden	0.01	0.003	1.7×10^{-3}	2.3×10^{-7}
4	Warkworth Seam	0.28	0.005	3.8×10^{-3}	5.0×10^{-6}
5	Interburden 1	0.03	0.001	1.1×10^{-2}	7.6×10^{-7}
6	Mount Arthur Seam	0.05	0.006	1.1×10^{-3}	5.0×10^{-6}
7	Interburden 2	0.02	0.008	1.3×10^{-3}	6.7×10^{-7}
8	Piercefield Seam	0.05	0.003	1.6×10^{-4}	2.3×10^{-7}
9	Interburden 3	0.01	0.008	1.3×10^{-4}	3.0×10^{-6}
10	Vaux Seam	0.05	0.008	1.3×10^{-4}	2.2×10^{-6}
11	Interburden 4	0.003	0.003	1.6×10^{-4}	1.1×10^{-6}
12	Broonie Seam	0.14	0.005	1.0×10^{-4}	1.8×10^{-6}
13	Interburden 5	0.02	0.005	2.1×10^{-4}	2.8×10^{-7}
14	Bayswater Seam	0.05	0.002	1.2×10^{-4}	2.3×10^{-7}
15	Interburden 6	0.03	0.003	1.0×10^{-4}	2.3×10^{-7}
16	Wynn Seam	0.14	0.002	2.4×10^{-3}	3.1×10^{-7}
17	Interburden 7	0.05	0.001	1.0×10^{-4}	2.3×10^{-7}
18	Edderton Seam	0.06	0.001	6.3×10^{-3}	2.3×10^{-7}
19	Vane Subgroup/Saltwater Creek Formation	0.02	0.001	1.0×10^{-4}	2.5×10^{-6}
20	Maitland Group and older units	0.06	0.03	4.6×10^{-4}	2.7×10^{-6}

Notes: K_h = Horizontal hydraulic conductivity; K_v = Vertical hydraulic conductivity; S_y = Specific yield; S_s = Specific storage.

3.9 Groundwater model validation

This section aims to validate the model in accordance with the requirements of the GMP within the WMP (MACH Energy, 2025), which specifies that model predictions and performance should be included in the Annual Review. It is important to note that only the data from the MPO monitoring bore network was used for this model validation, and not all the data used in the AGE 2020 model calibration (i.e., Bengalla, Dartbrook, Mt. Arthur data). The full dataset can be used for the comprehensive peer review required every three years under the Development Consent DA 92/97.

To validate the model, a comprehensive comparison was conducted using newly collected monitoring data obtained since the previous model calibration in 2020. The validation process involved assessing water level measurements from 45 monitoring bores located within the MPO, as detailed in Appendix A. This dataset spans from 2003 to 2024, providing an extended timeframe beyond the data utilised in the 2020 model calibration. By incorporating more recent observations and updates to mine progression, the validation aimed to assess the model's accuracy in simulating groundwater conditions and identifying any deviations or trends that may have emerged since the last calibration.

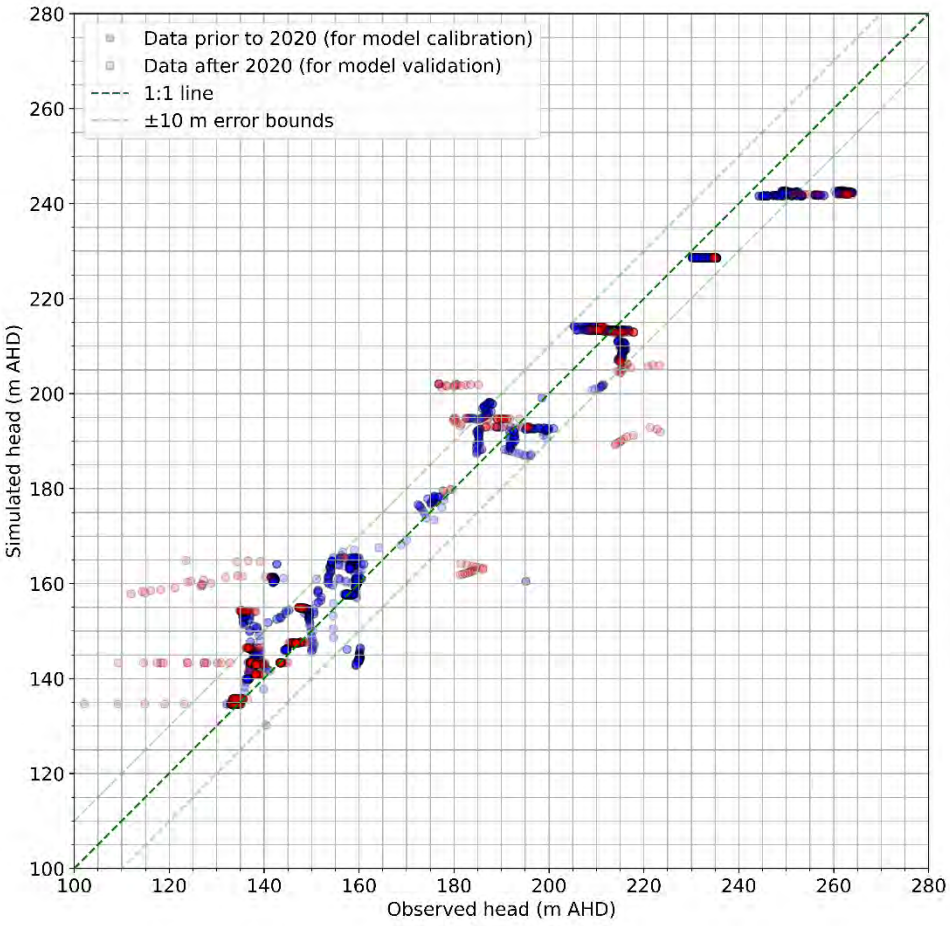


Figure 3.2 Simulated-observed head comparison

The deviation of data points from an exact match between modelled and observed heads is represented by the root mean squared (RMS) error, calculated as follows:

$$RMS = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(h_o - h_s)^2}$$

Where h_o and h_s represent the observed and simulated heads at n different locations and times, respectively.

Calculating the RMS error allows for the derivation of the scaled RMS (SRMS) error, which serves as a measure of goodness of fit in evaluating the quality of model predictions (Barnett et al., 2012). The SRMS is defined as the RMS error divided by the range of observed groundwater levels, calculated as follows:

$$SRMS = \frac{100}{\Delta h}\sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(w_i(h_o - h_s)\right)^2}$$

Where Δh represents the range of measured heads across the model domain, and w_i is a weighting factor between 0 and 1, calculated at each location by $1/\sqrt{m}$, with m being the number of data points for that location. However, a weighting factor of 1 was assumed here to calculate the natural (unweighted) residual.

Table 3.8 provides a summary of the statistical measurements, including number of data point, range of observation head, RMS and SRMS errors. These measurements are evaluated based on three data sets: the previous data, the new data, and a combined dataset incorporating both the old and new data. This comparison helps assess the impact of the updated data on overall statistical accuracy.

Table 3.8 Summary of statistical measures for data before and after 2020

Dataset	Number of data points	Min observed head (m AHD)	Max observed head (m AHD)	RMS (m)	SRMS (%)
Prior 2020	2,180	132.11	264.02	8.41	6.38
After 2020	518	102.14	263.90	12.3	7.57
All	2,698	102.14	264.02	9.27	5.73

Notes: Min = minimum; Max = maximum; m AHD = metres Australian Height Datum; RMS = root mean squared error; SRMS = scaled root mean squared error.

According to Table 3.8, the number of data points used for calculating statistical measures in the model-data comparison for this study is one-fifth of that used in the previous model calibration (AGE, 2020). However, the updated dataset covers a wider range of observed head values, from 102.14 m AHD to 263.9 m AHD, whereas the observed head range in the 2020 dataset was between 132.11 m AHD and 264.02 m AHD. The RMS and SRMS values for the post-2020 dataset was 12.3 m and 7.57%, respectively, compared to 8.41 m and 6.38% for the pre-2020 dataset, indicating a slight reduction in model accuracy for the post-2020 dataset.

Globally, considering both the pre- and post-2020 datasets, the RMS value was 9.27 m, showing a slight increase compared to the RMS of the pre-2020 dataset (8.41 m), which represents a 10% increase. Meanwhile, the global SRMS value was 5.73%, reflecting a 10% reduction compared to the SRMS of the pre-2020 dataset (6.38%). This SRMS value falls below the 10% benchmark recommended in the Australian Groundwater Modelling Guidelines (Barnett et al., 2012), indicating that the model calibration meets acceptable standards. These results suggest that the model, derived from the AGE 2020 model, remains adequately calibrated for its intended purpose, and further calibration is not necessary at this stage.

Additional validation of the model's performance was conducted by analysing hydrographs, provided in Appendix F, which illustrate both model-predicted and observed groundwater levels at monitoring points within the model domain. While some discrepancies exist between the predicted and observed values, the model effectively captures the overall groundwater level trends, particularly in areas where monitoring data indicates significant drawdown due to mine dewatering. In cases where deviations are observed, the model tends to predict a greater decline in groundwater levels than what has been measured. This is likely due to the use of conservative assumptions in the model, as well as the simplified model layering, which may overestimate vertical hydraulic connectivity compared to actual site conditions.

Overall, the model demonstrates a robust capacity to simulate regional groundwater behaviour and mine-related impacts. While some localised differences between observed and simulated values exist, these are within acceptable limits given the inherent uncertainties in groundwater modelling. The model is therefore deemed reliable for decision-making and impact assessments within the MPO and surrounding areas.

3.10 Groundwater model predictions

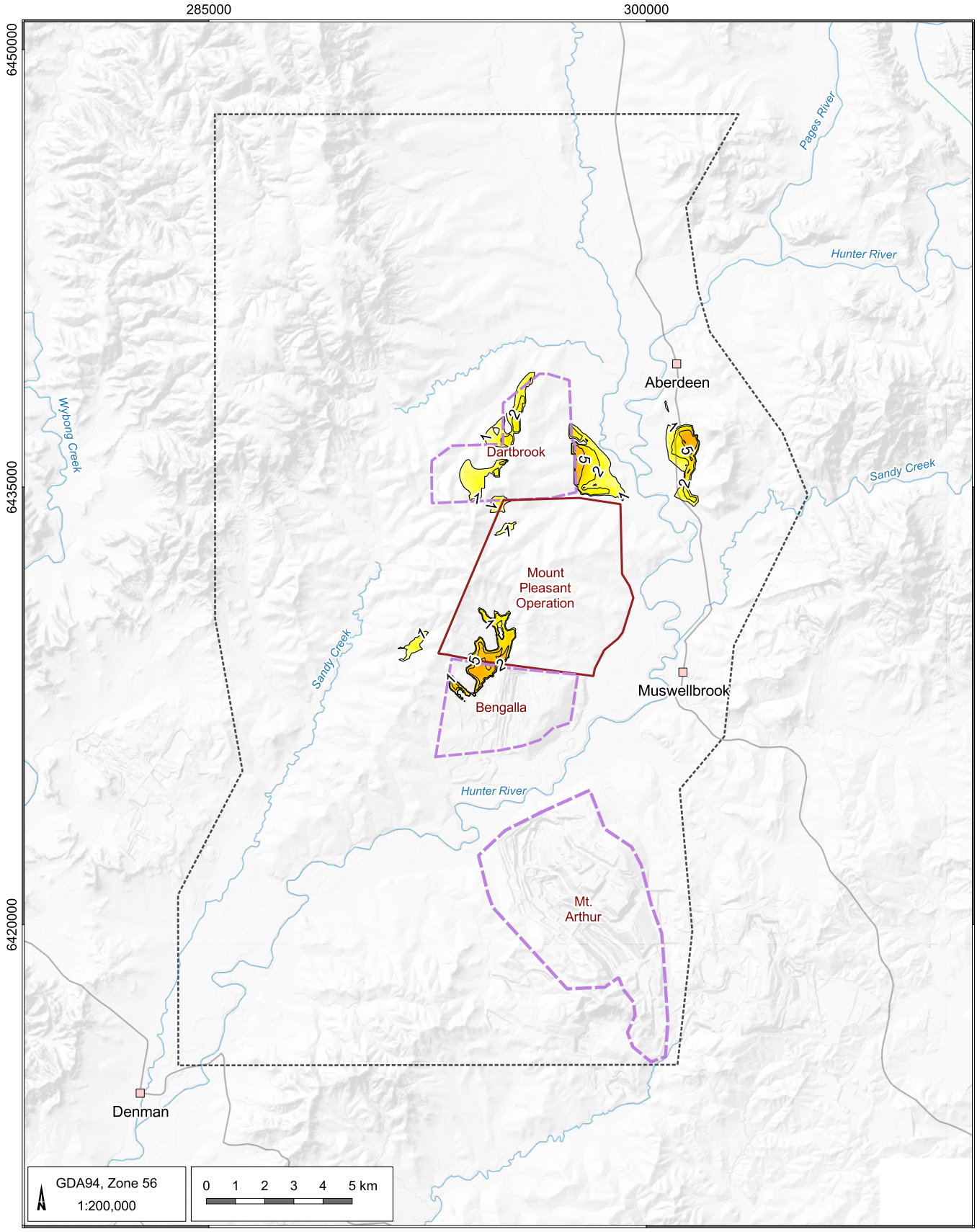
The following subsections provide a detailed description of the model predictions for the calendar year 2024. These predictions focus on the cumulative drawdown, which was calculated as the difference between two distinct scenarios. The first scenario includes the full range of mining activities as active within the model, while the second scenario assumes no mining activities are occurring. Both scenarios were evaluated using the numerical groundwater model outlined in this section. The predicted drawdown contours represent a composite of the maximum drawdown values anticipated for each model cell over the operational life of the mining project. These contours reflect the highest drawdown value predicted at any given time within each cell during the entire operational period. However, it is important to note that the actual timing and duration of the maximum predicted drawdown within each cell will vary. This variation is largely influenced by the proximity and intensity of mining activities throughout the life of the MPO, which can cause fluctuations in the timing and extent of the drawdown effects.

Drawdown maps for the alluvium and regolith (Layers 1 and 2), as well as for the Edderton Seam (Layer 18), are presented at the end of the calendar year 2024. These maps are shown in Figure 3.3 and Figure 3.4, respectively, illustrating the predicted changes in groundwater levels within these layers.

The simulated drawdown, as presented in Figure 3.3, indicates that groundwater impacts in the alluvium to the north and south of the MPO are limited. In particular, the predicted drawdown in the Hunter River alluvium is minimal, as the majority of the target seams subcrop to the west of the alluvial extent. This reduces the impact of mining activities on this area, as the influence on groundwater levels is less pronounced. To the north, however, the Edderton Seam subcrops closer to the alluvium associated with the Hunter River, with the seam extending beneath the alluvial layer. This proximity results in a minor predicted drawdown in the northern portion of the MPO, primarily due to the interaction between mining activities and the underlying groundwater system in this region.

As shown in Figure 3.4, the predicted drawdown in the Edderton Seam is predominantly constrained to the north and south by concurrent drawdowns from neighbouring mining operations. To the east, the drawdown is limited by the subcrop, which is clearly visible in the contour maps. Furthermore, the subcrop extending beneath the Alluvium to the north-east of the MPO is also apparent in the extent of the drawdown contours, helping to further define the boundaries of the predicted drawdown in this region. This spatial interaction emphasises the influence of surrounding geological features and mining activities on the groundwater system.

The difference between the simulated head and the measured head in 2024, as calculated at the monitoring bores, is presented in Figure 3.5. A positive value indicates that the model overestimates the head at a given location, while a negative value suggests that the model underestimates the head. The details of the simulated head and drawdown corresponding to each monitoring bore are provided in Appendix A. The residual head between the model and observed data ranges from -24.75 m at monitoring bore 3500C500L to 45.86 m at 5000D000. Out of 45 model-data comparisons, 73% show a difference of less than 10 m between the simulated and observed heads. The maximum deviations between the model and observed data occur at the following monitoring bores: 3500C500, 5000D000, 5500D000, 6000C000, 6500F500M, MPBH1-HR, WRA2U, WRA3, and MPBH7-C.



LEGEND

- Populated place
- Drainage
- Road
- Drawdown contour (m)
- Mount Pleasant Operation
- Surrounding mines
- Model boundary

Drawdown (m)

1	50
2	100
5	200
10	500
20	

Mt Pleasant Groundwater Report for the 2024 Calendar Year (MPO5007.001)

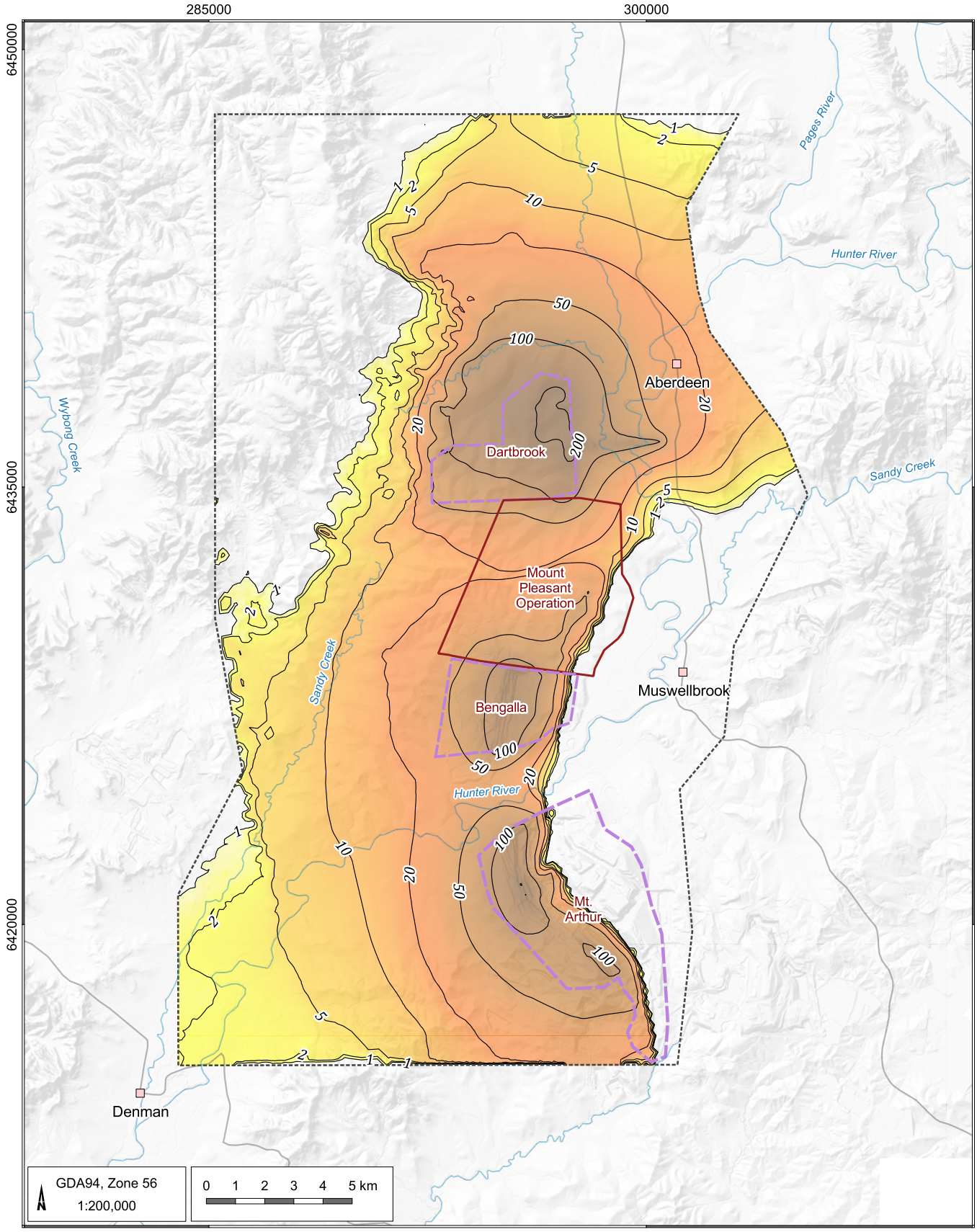
Model prediction of cumulative drawdown at the end of 2024 for alluvium/regolith (Layers 1 and 2)

AGE

DATE 06/03/2025

FIGURE No: **3.3**

©2025 Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) - www.ageconsultants.com.au
Source: 1 second SRTM Derived DEM-S - © Commonwealth of Australia (Geoscience Australia) 2011.; GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.; G:\Projects\MPO5007.001 Mount Pleasant GW Model Validation\3_GIS\Workspaces\999_Working\03.03_MPO5007_Predicted drawdown in alluvium - regolith (Layer 2) at end of 2024.qgz



LEGEND

- Populated place
- Drainage
- Road
- Drawdown contour (m)
- Mount Pleasant Operation
- Surrounding mines
- Model boundary

Drawdown (m)

1, 2, 5, 10, 20, 50, 100, 200, 500

Mt Pleasant Groundwater Report for the 2024 Calendar Year (MPO5007.001)

Model prediction of cumulative drawdown at the end of 2024 for Edderton Seam (Layers 18)

AGE

DATE 06/03/2025

FIGURE No: **3.4**

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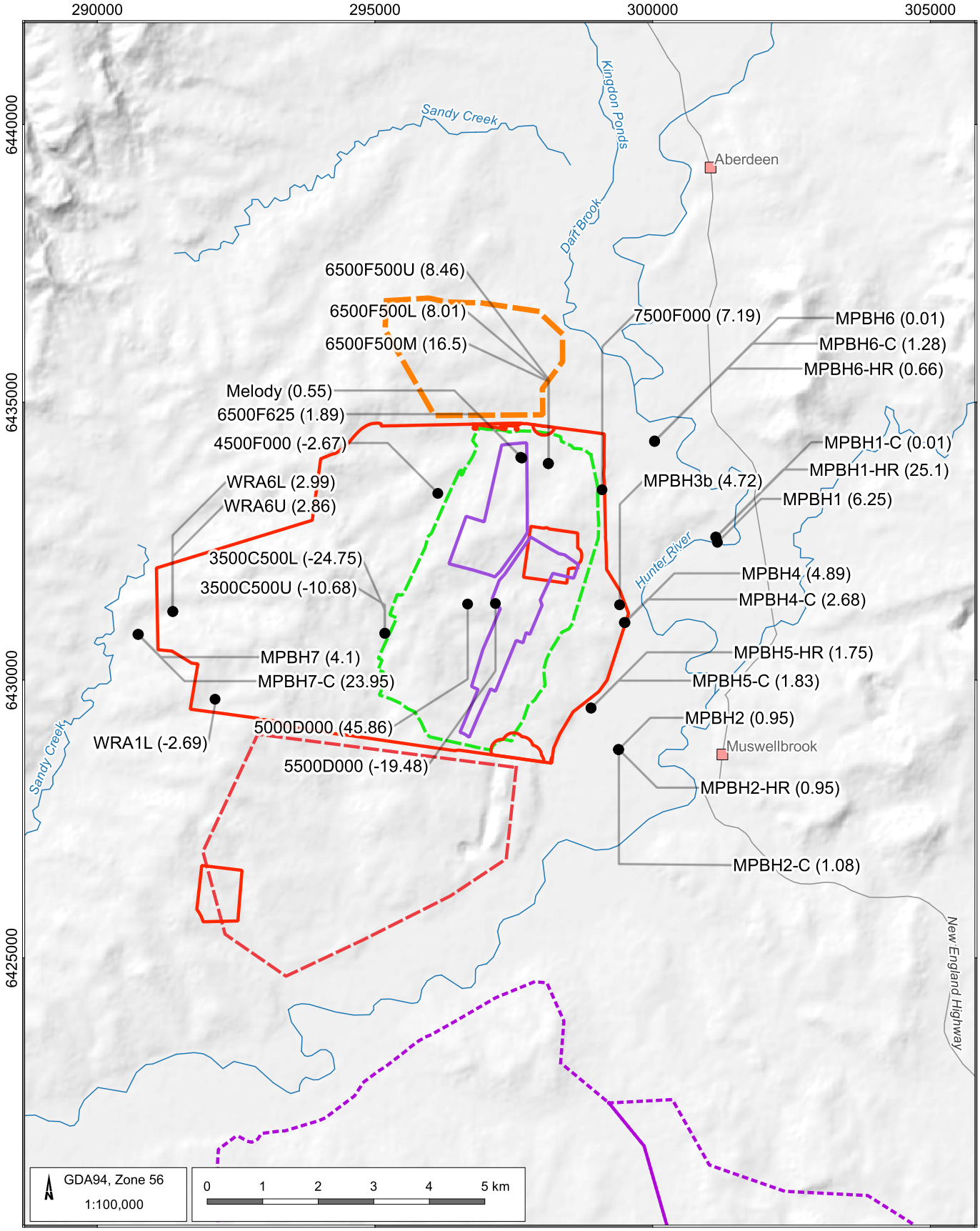
Source: 1 second SRTM Derived DEM-S - © Commonwealth of Australia (Geoscience Australia) 2011.; GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.; G:\Projects\MPO5007.001 Mount Pleasant GW Model Validation\3_GIS\Workspaces\999_Working\03.03_MPO5007_Predicted drawdown in alluvium - regolith (Layer 2) at end of 2024.qgz



LEGEND

- Populated place
- Drainage
- Road
- Bengalla Project Extent
- Dartbrook Project Extent
- MPO Pit Extent
- Project Boundary
- Pit Floor Extent
- MAC Pit Extent

Mt Pleasant Groundwater Report for the 2024 Calendar Year (MPO5007.001)

Modelled versus measured head in 2024

AGE

DATE 17/03/2025

FIGURE No: **3.5**

©2025 Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) - www.ageconsultants.com.au
Source: 1 second SRTM Derived DEM-S - © Commonwealth of Australia (Geoscience Australia) 2011.; GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.;
G:\Projects\MPO5007.001 Mount Pleasant GW Model Validation\3_GIS\Workspaces\999_Working\03.05_MPO5007_Residual_2024.qgz

4 Summary and conclusions

This report presents a detailed review of groundwater monitoring data collected from the MPO monitoring network during the calendar year 2024. The MPO monitoring network is divided into three primary domains: Central Domain, Eastern Domain, and Western Domain. During the reporting period, 29 out of 31 designated bores achieved 100% water level measurement data recovery, while two bores recorded recovery rates of 50% and 75%. The lower data recovery in these bores was due to their removal from the monitoring network (e.g., bore 5000D000) or being deemed unsafe for sampling (e.g., bore 4500F000). In addition, water quality was measured at 30 bores, all of which achieved full data recovery.

Groundwater levels in the Hunter River Alluvium have remained stable throughout the year, with minimal fluctuations observed in response to rainfall events. This indicates that the alluvial aquifer is primarily sustained by losses from the surface water system rather than direct recharge from precipitation. Furthermore, water levels in the Hunter River are significantly influenced by the controlled releases from Glenbawn Dam. During significant rainfall periods, discharge volumes from the dam are typically reduced, further affecting river water levels and, consequently, the adjacent alluvial aquifer.

Groundwater behaviour in the Permian measures within the Western Domain showed variability across different locations. At monitoring sites like WRA5, water levels in both the regolith and underlying strata were similar, indicating hydraulic connectivity with minimal vertical gradients. In contrast, at sites like WRA3 and, to a lesser extent, WRA6, significant differences in groundwater levels were observed, suggesting limited connectivity and stronger vertical gradients. The groundwater flow through the regolith was found to follow the natural topography, with moderate flow expected. While the regolith has the potential to create hydraulic connectivity between the alluvium and mine workings, its generally dry, thin nature, combined with its separation from the open-cut pits by a drainage divide, restricts any direct interaction.

In the mixed interburden and coal units, groundwater levels have remained relatively stable over time, without any noticeable drawdown linked to either the mining activities at the MPO or operations at nearby mines such as Dartbrook or Bengalla. This indicates that these areas are not significantly impacted by groundwater changes due to the mining operations in the region.

The measured drawdown across the monitoring bores ranged from -47.46 m at 5000D000 to 21.23 m at 5500D000. These variations reflect differences in groundwater behaviour across the different domains and strata over the reporting period. The study also highlights that the drawdown is not uniform across the network, with some regions experiencing more significant impacts than others, depending on their proximity to mining activities and geological features.

Electrical conductivity (EC) measurements from monitoring bores within the Hunter River alluvium adjacent to the MPO indicate a gradient from fresh to saline groundwater conditions. MPBH1 recorded the lowest EC value at 559 µS/cm (fresh water), while MPBH7 exhibited the highest at 11,729 µS/cm (saline). Bores MPBH2, MPBH3, and MPBH6 fall within the lower brackish range, while MPBH3b and MPBH4 are classified as moderately saline. In the Western Domain, groundwater shows the highest EC levels across the monitoring network. Regolith bores in this domain range from brackish to moderately saline, with median EC values ranging from 1,702 µS/cm at WRA2U to 10,273 µS/cm at WRA6U. In contrast, the Permian measures in this domain show a broader range, with EC values spanning from 3,594 µS/cm (moderately saline) at WRA1L to 15,607 µS/cm (saline) at WRA3L. EC measurements in the Central Domain for Permian measures have been intermittent, with fluctuations over time. These values range from 773 µS/cm (brackish) at bore 5000D000 to 5,625 µS/cm (moderately saline) at bore 3500B500L. Median pH across the Central, Eastern, and Western domains is 7.4, indicating predominantly neutral groundwater conditions. However, pH values varied significantly, ranging from slightly acidic (5.7 at WRA5U) to highly alkaline (12.4 at 7000D000U). Most pH measurements fell within the neutral to slightly alkaline range, with considerable local variations influenced by specific geological and hydrological factors at each monitoring location.

The major ion chemistry of 30 groundwater samples collected across the MPO was analysed using a Piper plot. The analysis revealed significant variability in the geochemical composition of groundwater within the Permian strata, particularly the coal measures. The dominant ions in these areas were sodium, potassium, and chloride, classifying the groundwater as a sodium chloride type. In contrast, groundwater in the alluvial deposits exhibited a magnesium carbonate type profile due to high concentrations of magnesium (Mg^{2+}) and bicarbonate (HCO_3^-) ions.

Water level data from key monitoring bores, such as MPBH1, MPBH2, MPBH3b, and MPBH7, consistently remained below the trigger levels specified in the Water Management Plan (WMP) throughout the monitoring period, including 2024. However, EC measurements at 3500C500U and MPBH2 exceeded their respective trigger levels during 2024, with the average EC at 3500C500U recorded at 11,115 µS/cm (43% higher than its trigger level of 7,800 µS/cm), and MPBH2 at 1,256 µS/cm (35% higher than its trigger level of 930 µS/cm). As the EC measurement values in these bores have exceeded the EC trigger level for three successive monitoring rounds, a further investigation is required, and the groundwater investigation protocol outlined in Section 9.2 of the Groundwater Management Plan (GMP) within the WMP must be followed.. Importantly, no monitoring bores exceeded the pH trigger levels (6 – 8.5) as defined in the WMP during 2024.

To validate the groundwater model in accordance with the GMP section of WMP, a comprehensive comparison was made between newly collected monitoring data and the previous model calibration conducted in 2020. This validation process involved assessing water level measurements from 45 monitoring bores within the MPO, covering a time span from 2003 to 2024. While the RMS and SRMS values for the post-2020 dataset showed a slight reduction in model accuracy, the results still meet the acceptable standards outlined in the Australian Groundwater Modelling Guidelines. The global SRMS value of 5.73% falls below the recommended 10% benchmark, indicating that the model is adequately calibrated for its intended purpose and does not require immediate recalibration.

Simulated drawdown predictions indicate limited groundwater impacts in the alluvium surrounding the MPO, with minimal drawdown in the Hunter River alluvium due to the majority of the target seams subcropping to the west. The predicted drawdown in the Edderton Seam is constrained to the north and south by the concurrent drawdowns from neighbouring mines, and to the east by the subcrop, further limiting its extent.

The analysis of the difference between the simulated and measured heads in 2024, calculated at various monitoring bores, reveals a range of residual head differences. These differences range from -24.75 m at bore 3500C500L to 45.86 m at 5000D000. Out of 45 model-data comparisons, 73% exhibit a difference of less than 10 m between the simulated and observed heads, demonstrating a generally good alignment between the model and the observed data.

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Appendix A

Details of the monitoring bore network

Bore ID	Easting† (m)	Northing† (m)	Casing elevation (m AHD)	Ground elevation (m AHD)	Bore depth/Screened interval (m)	Aquifer/Unit	First record				Last record				Measured total drawdown (m)‡	Simulated total drawdown (m)‡
							Date	Measured		Simulated	Date	Measured		Simulated		
								WL (m BGL)	WL (m AHD)	WL (m AHD		WL (m BGL)	WL (m AHD	WL (m AHD)		
MPO Central Domain																
3500B500L	295194.4	6429840.4	203.90	203.40	Depth 175.36	Bayswater Seam	08-Jan-03	33.39	170.01	169.10	25-May-17	67.60	135.80	137.14	-34.21	-31.96
3500B500U	295194.4	6429840.4	203.80	203.40	Depth 21.43	Interburden #1	14-Oct-11	17.80	185.60	192.55	11-May-16	18.68	184.72	187.51	-0.88	-5.05
3500C500L	295176.1	6430842.6	240.62	239.74	Depth 86.77	Mount Arthur Seam	08-Jan-03	28.46	211.28	201.92	19-Nov-24	25.79	213.95	189.20	2.67	-12.71
3500C500U	295175.8	6430840.4	240.40	239.80	Screen 55.00 - 61.00	Warkworth Seam	28-Oct-05	25.15	214.65	211.24	19-Nov-24	24.73	215.07	204.39	0.42	-6.85
4500F000	296129.5	6433360.3	218.10	217.12	Depth 121.24	Vaux Seam	08-Jan-03	18.04	199.08	192.33	01-Aug-24	21.58	195.54	192.87	-3.54	0.54
5000D000	296666.3	6431368.4	241.94	241.04	Depth 171.35	Wynn/Edderton Seams	24-Feb-05	81.61	159.43	156.97	02-May-24	129.07	111.97	157.83	-47.46	0.86
5500D000	297166.7	6431378.1	222.98	222.27	Screen 130.00 - 136.00	Interburden #7/Wynn Seam	08-Jan-03	62.17	160.10	162.98	19-Nov-24	40.94	181.33	161.86	21.23	-1.13
6000C000L	297685.1	6430387.0	180.70	180.30	Depth 20.69	Interburden #2	08-Jan-03	20.03	160.27	146.49	14-Dec-17	20.90	159.40	142.78	-0.87	-3.72
6000C000U	297685.1	6430387.0	180.70	180.30	Depth 51.27	Wynn Seam	27-Oct-11	38.85	141.45	161.38	14-Dec-17	38.48	141.82	160.33	0.37	-1.05
6500F500L	298120.4	6433897.8	189.85	188.93	Depth 115.20	Maitland Group	20-Apr-05	47.68	141.25	141.65	19-Nov-24	50.46	138.47	146.47	-2.78	4.82
6500F500M	298120.4	6433897.8	189.85	188.93	Depth 77.30	Interburden #6/Wynn Seam	20-Apr-05	48.50	140.43	130.20	19-Nov-24	51.35	137.58	154.08	-2.85	23.88
6500F500U	298120.4	6433897.8	189.85	188.93	Depth 35.10	Interburden #4/Broonie Seam	20-Apr-05	34.35	154.58	148.68	19-Nov-24	31.92	157.01	165.47	2.43	16.79
6500F625	297643.2	6433996.6	193.67	193.67	Depth 36.30	Permian	08-Jan-03	15.75	177.92	178.45	19-Nov-24	16.04	177.63	179.52	-0.29	1.07
7000D000L	298666.5	6431403.6	162.70	162.40	Depth 98.73	Maitland Group	25-Nov-14	17.53	144.87	146.29	07-May-19	18.00	144.40	146.03	-0.47	-0.27
7000D000U	298666.5	6431403.6	162.70	162.40	Depth 12.89	Interburden #7/Edderton Seams	08-Jan-03	3.44	158.96	157.85	07-May-19	4.99	157.41	157.78	-1.55	-0.07
7500F000	299086.5	6433425.8	184.61	183.63	Depth 182.80	Edderton Seam	08-Jan-03	33.39	150.24	150.00	19-Nov-24	35.98	147.65	154.84	-2.59	4.84
Melody	297623.5	6434009.3	192.73	192.30	Depth 43.80	Unknown	01-Aug-24	12.81	179.49	179.80	19-Nov-24	13.05	179.25	179.80	-0.24	0.00
MPO Eastern Domain																
MPBH1	301165	6432480	ND	146.86	Screen 12.60 – 18.60	Hunter Alluvium	08-Jan-03	9.39	137.46	143.36	20-Nov-24	9.74	137.11	143.36	-0.35	0.00
MPBH1-C	301140.3	6432568.8	153.57	152.94	Screen 68.77 – 74.77	Coal Seam	28-Sep-20	9.63	143.31	143.33	20-Nov-24	9.62	143.32	143.33	0.01	0.00
MPBH1-HR	301134.2	6432574.3	153.51	152.92	Screen 48.80 – 50.80	Interburden	17-Sep-20	9.56	143.36	143.32	20-Nov-24	34.69	118.23	143.32	-25.13	0.00
MPBH2	299383.3	6428749.4	146.15	145.43	Screen 11.50 – 17.5	Hunter Alluvium	08-Jan-03	12.04	133.39	134.66	19-Nov-24	11.74	133.69	134.64	0.30	-0.02
MPBH2-C	299383.40	6428749.42	146.04	145.30	Screen 66.5 – 76.5	Coal Seam	17-Sep-20	12.20	133.10	134.64	19-Nov-24	11.74	133.56	134.64	0.46	0.00
MPBH2-HR	299385.5	6428747.7	146.109	145.45	Screen 46.2 – 52.2	Interburden	17-Sep-20	12.16	133.29	134.64	19-Nov-24	11.76	133.69	134.64	0.40	0.00
MPBH3	299700.0	6430710.0	ND	148.52	Depth 14.00	Hunter Alluvium	08-Jan-03	11.98	136.54	139.94	12-May-16	11.97	136.55	139.92	0.01	-0.02
MPBH3b	299478.91	6431350.65	150.51	150.08	Depth 14.00	Hunter Alluvium	12-Oct-11	11.91	138.17	142.92	19-Nov-24	11.83	138.25	142.97	0.08	0.05
MPBH4	299500.9	6431034.3	149.62	148.82	Screen 6.00 – 12.00	Hunter Alluvium	25-Nov-21	11.47	137.35	141.58	19-Nov-24	12.12	136.70	141.58	-0.65	0.00
MPBH4-C	299489.0	6431036.5	149.89	149.03	Screen 71.90 – 81.90	Coal Seam	30-Nov-20	10.82	138.21	140.87	19-Nov-24	10.84	138.19	140.86	-0.02	-0.01
MPBH4-HR	299489.0	6431036.5	ND	ND	Screen 45.15 – 51.15	Interburden	30-Nov-20	50.30	ND	ND	19-Nov-24	49.89	ND	ND	0.41	ND

Bore ID	Easting† (m)	Northing† (m)	Casing elevation (m AHD)	Ground elevation (m AHD)	Bore depth/Screened interval (m)	Aquifer/Unit	First record				Last record				Measured total drawdown (m)‡	Simulated total drawdown (m)‡
							Date	Measured		Simulated	Date	Measured		Simulated		
								WL (m BGL)	WL (m AHD)	WL (m AHD		WL (m BGL)	WL (m AHD	WL (m AHD)		
MPBH5	298881.7	6429492.1	145.92	145.32	Screen 5.80 – 8.80	Hunter Alluvium	18-Nov-21	8.83	136.49	135.72	18-Nov-21	8.83	136.49	135.72	ND	ND
MPBH5-C	298881.73	6429492.17	145.82	145.25	Screen 27.50 – 33.50	Coal Seam	13-Nov-20	11.79	133.46	135.71	19-Nov-24	11.36	133.89	135.71	0.43	0.00
MPBH5-HR	298889.2	6429495.9	146.02	145.41	Screen 19.50 – 22.50	Interburden	10-Nov-20	11.89	133.52	135.73	19-Nov-24	11.42	133.99	135.73	0.47	0.00
MPBH6	300032.9	6434295.0	157.85	157.06	Screen 10.63 – 16.63	Hunter Alluvium	11-Nov-20	9.54	147.52	147.65	20-Nov-24	9.41	147.65	147.65	0.13	0.00
MPBH6-C	300034.1	6434304.4	157.87	157.1	Screen 105.68 – 115.68	Coal Seam	11-Nov-20	11.85	145.25	147.54	20-Nov-24	10.84	146.26	147.54	1.01	-0.01
MPBH6-HR	300033.6	6434299.3	157.82	157.07	Screen 58.40 – 64.40	Interburden	11-Nov-20	10.41	146.67	147.43	20-Nov-24	10.30	146.77	147.43	0.11	0.00
MPO Western Domain																
MPBH7	290737.9	6430822.8	196.41	195.52	Screen 4.10 – 10.10	Hunter Alluvium	13-Nov-20	8.53	186.99	194.68	20-Nov-24	4.95	190.57	194.67	3.58	-0.01
MPBH7-C	290729.1	6430821.3	195.65	195.07	Screen 71.45 – 74.45	Coal Seam	09-Nov-20	18.31	176.77	202.06	20-Nov-24	17.66	177.42	201.36	0.65	-0.70
WRA1L	292118.4	6429654.5	217.93	217.48	Depth 19.40	Warkworth/Permian	20-Jan-03	3.25	214.23	213.42	20-Nov-24	1.98	215.50	212.81	1.27	-0.61
WRA1U	292119.8	6429655.1	218.59	217.59	Depth 6.50	Alluvium/Regolith	25-Jan-07	5.60	211.99	213.42	01-Jun-23	4.42	213.17	212.93	1.18	-0.49
WRA2L	292903.0	6431860.0	ND	262.28	Depth 18.95	Warkworth/Permian	20-Jan-03	9.74	252.54	241.74	15-Aug-18	17.38	244.90	241.59	-7.64	-0.16
WRA2U	292903.0	6431860.0	ND	262.28	Depth 5.50	Alluvium/Regolith	25-Jan-07	6.50	255.78	241.81	07-Sep-16	4.38	257.90	241.69	2.12	-0.11
WRA3L	293065.0	6431345.0	ND	266.10	Depth 22.19	Warkworth/Permian	20-Jan-03	16.08	250.02	242.71	17-Aug-22	4.36	261.74	241.91	11.72	-0.80
WRA3U	293065.0	6431345.0	ND	266.10	Depth 6.75	Alluvium/Regolith	20-Jan-03	3.82	262.28	242.72	17-Aug-22	2.20	263.90	241.92	1.62	-0.80
WRA5L	291980.0	6431370.0	ND	234.66	Screen 13.40 – 19.30	Warkworth/Permian	20-Jan-03	3.36	231.30	228.60	19-Aug-21	-0.53	235.19	228.53	3.89	-0.07
WRA5U	291980.0	6431370.0	ND	234.66	Screen 1.64 – 7.64	Alluvium/Regolith	20-Jan-03	3.48	231.18	228.61	19-Aug-21	0.00	234.66	228.54	3.48	-0.07
WRA6L	291357.8	6431234.3	212.11	211.50	Depth 9.27	Warkworth/Permian	20-Jan-03	2.38	209.12	214.17	20-Nov-24	0.36	211.14	214.12	2.02	-0.05
WRA6U	291356.6	6431233.0	212.45	211.42	Depth 18.98	Alluvium/Regolith	20-Jan-03	2.22	209.20	213.40	20-Nov-24	0.88	210.54	213.39	1.34	-0.01

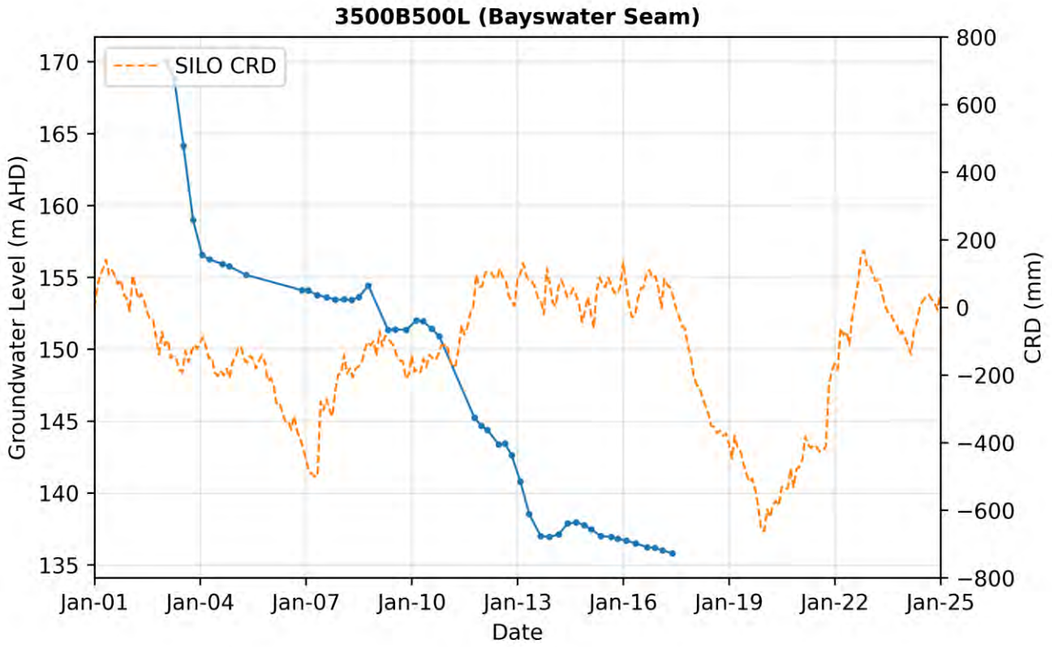
Notes: m AHD = meters Australian Height Datum; m BGL= meters Below Ground Level; WL = Water Level; ND = No Data.

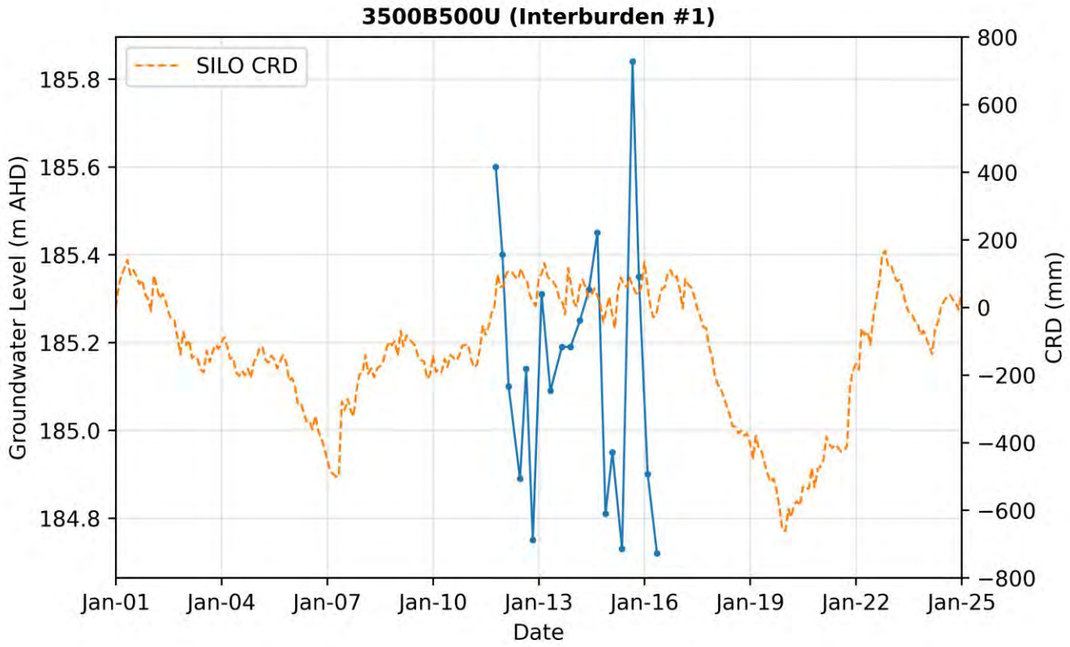
† Easting and Northing coordinates are based on the GDA94, Zone 56 coordinate system.

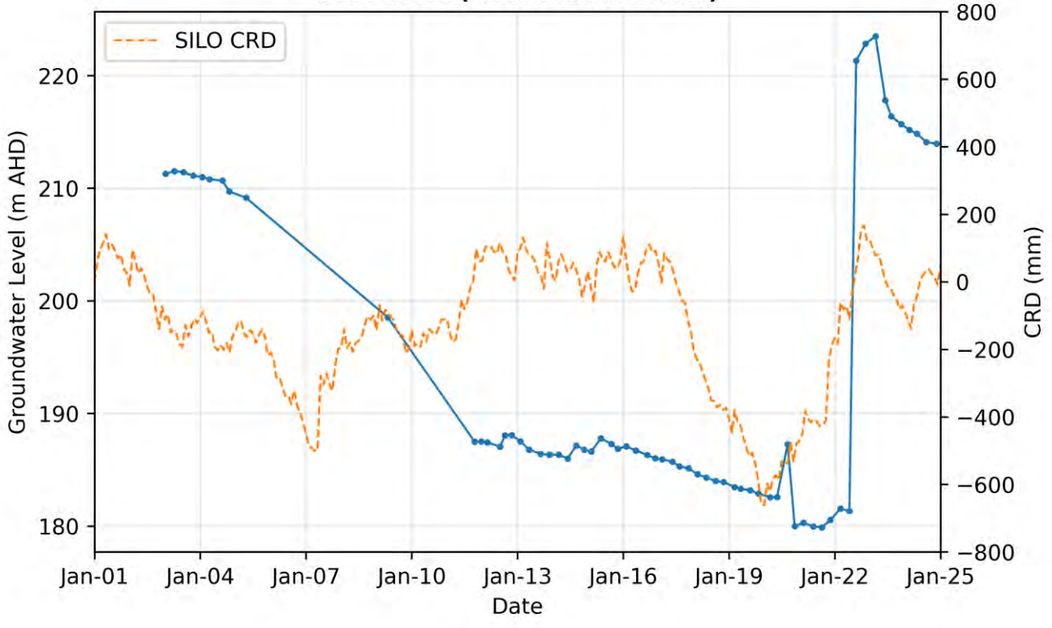
‡. Drawdown is calculated as the difference between the last water level and the first water level. A positive number indicates an increase in head, while a negative number indicates a decline.

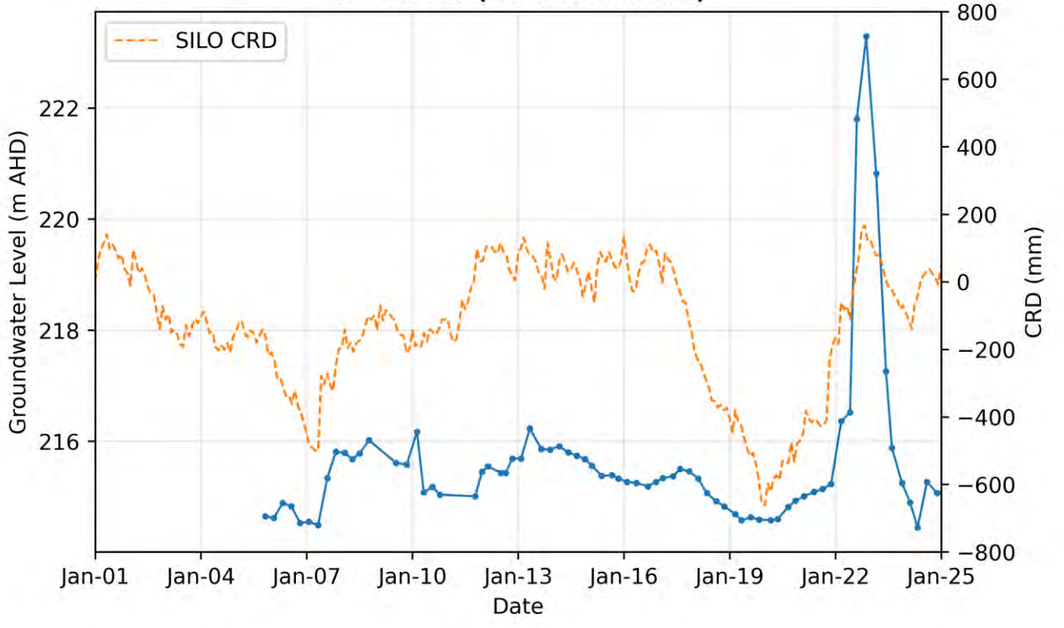
Appendix B

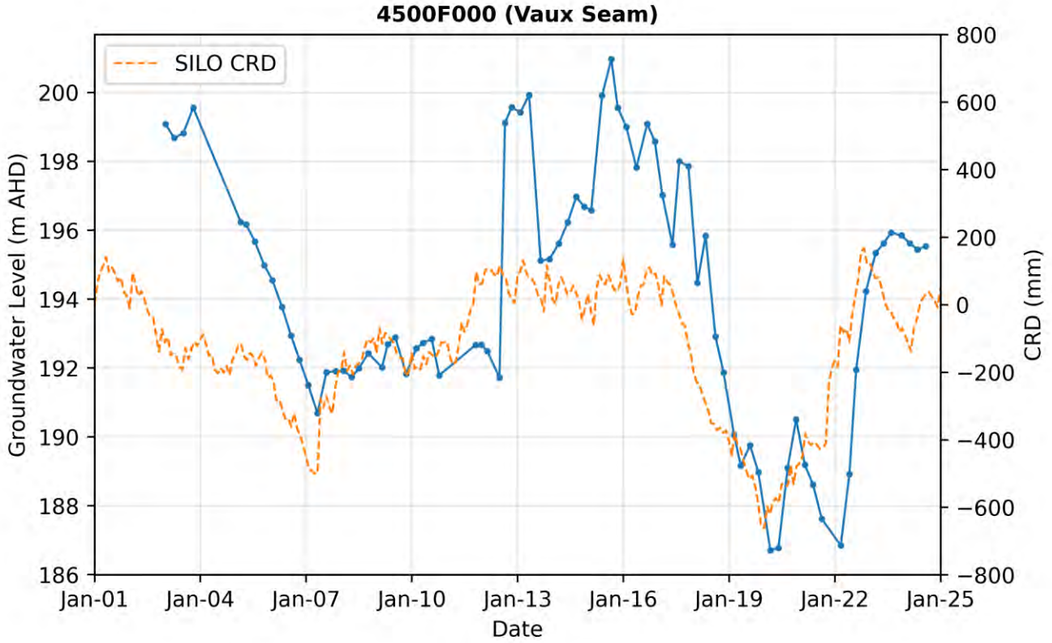
Measured water level hydrographs

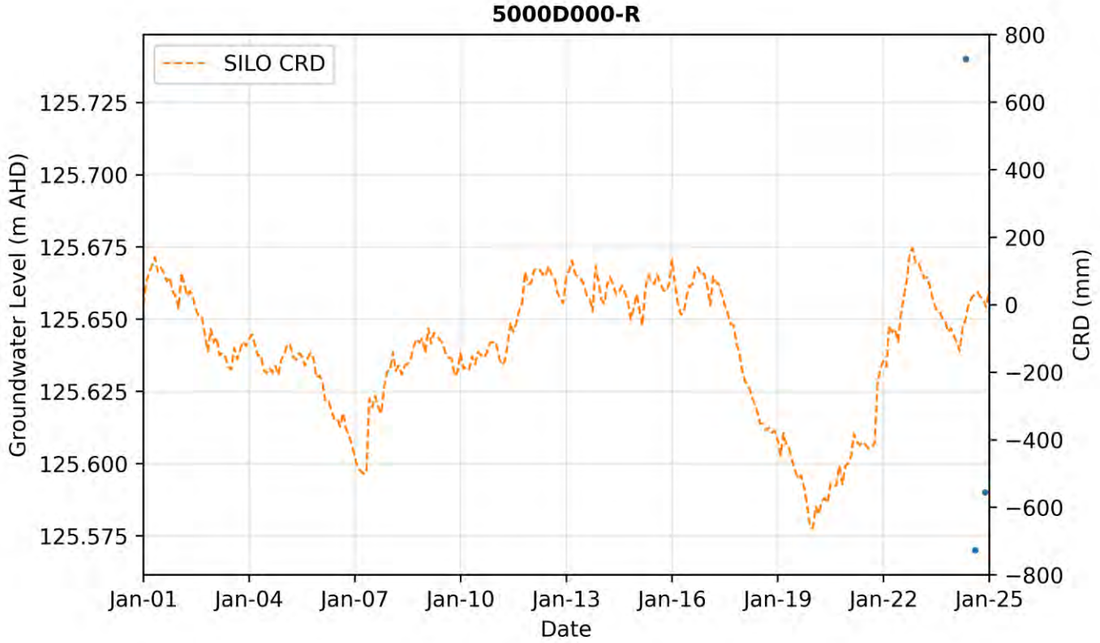

3500B500L (Bayswater Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
170
165
160
155
150
145
140
135
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

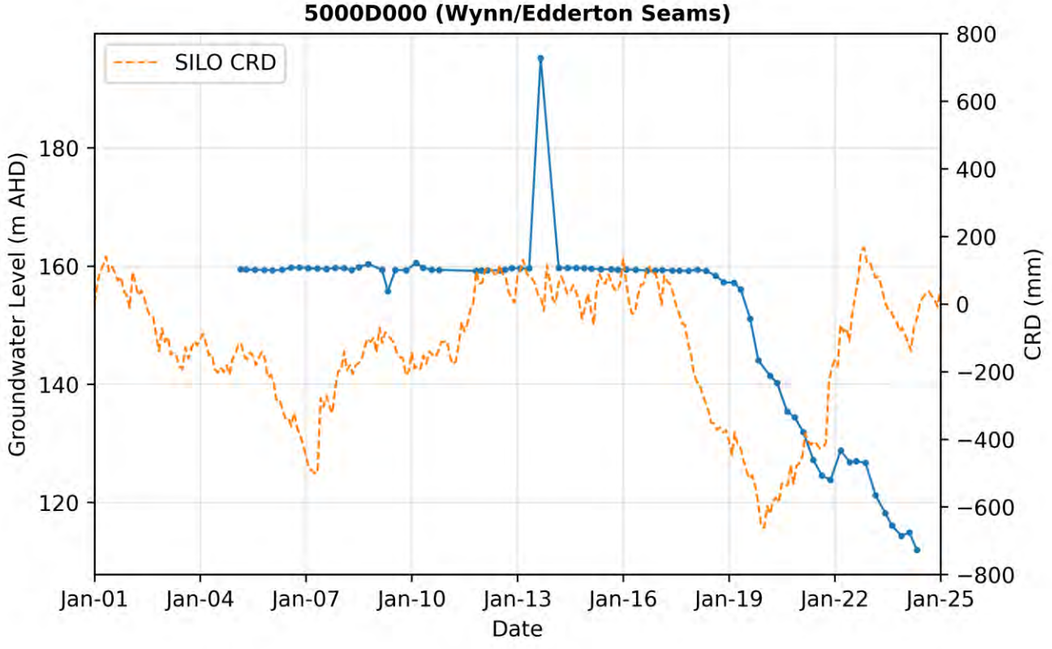

3500B500U (Interburden #1)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
185.8
185.6
185.4
185.2
185.0
184.8
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

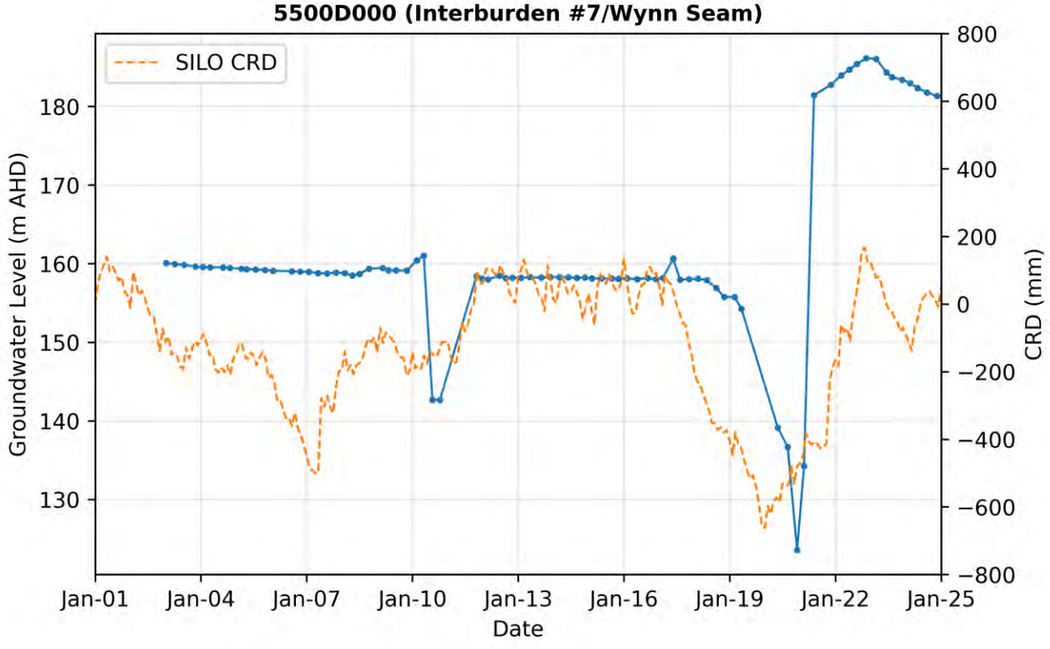

3500C500L (Mount Arthur Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
220
210
200
190
180
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

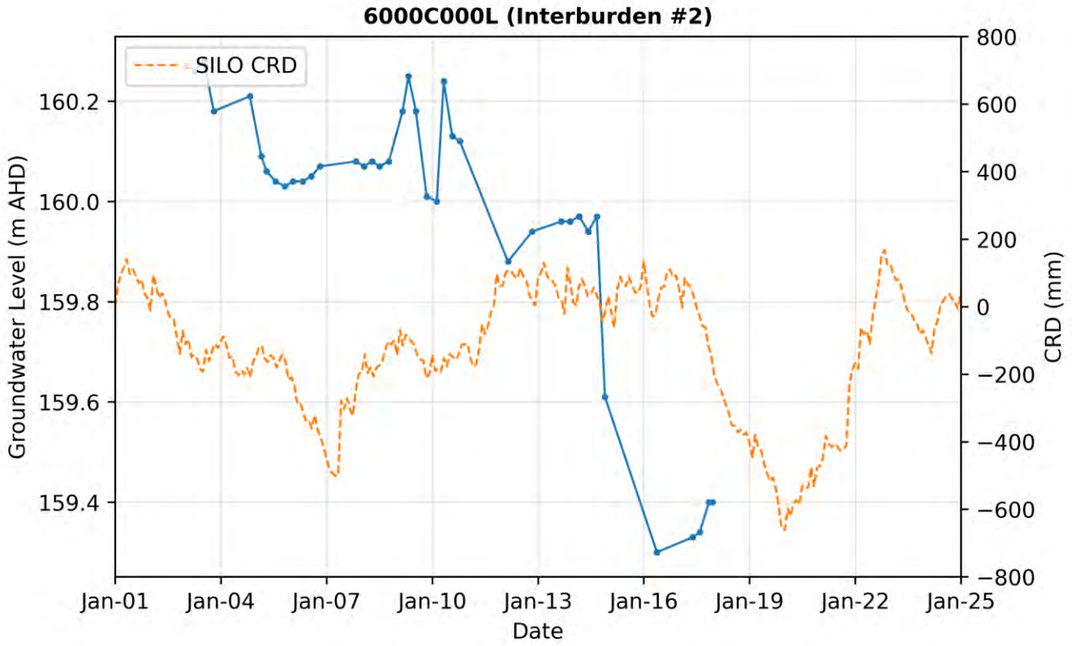

3500C500U (Warkworth Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
222
220
218
216
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

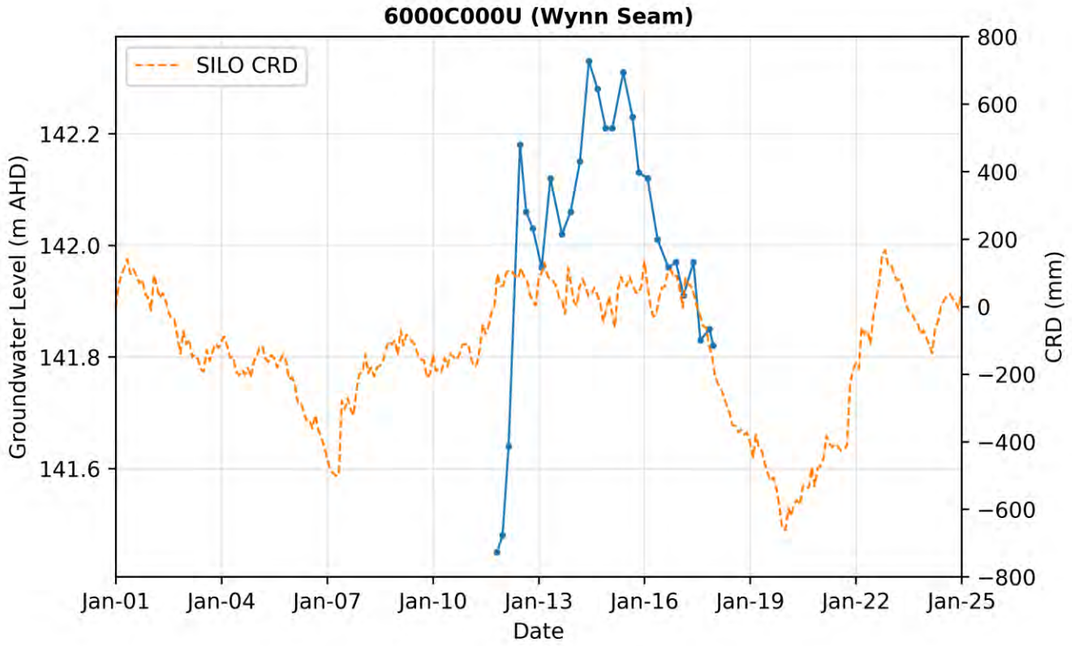

4500F000 (Vaux Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
200
198
196
194
192
190
188
186
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

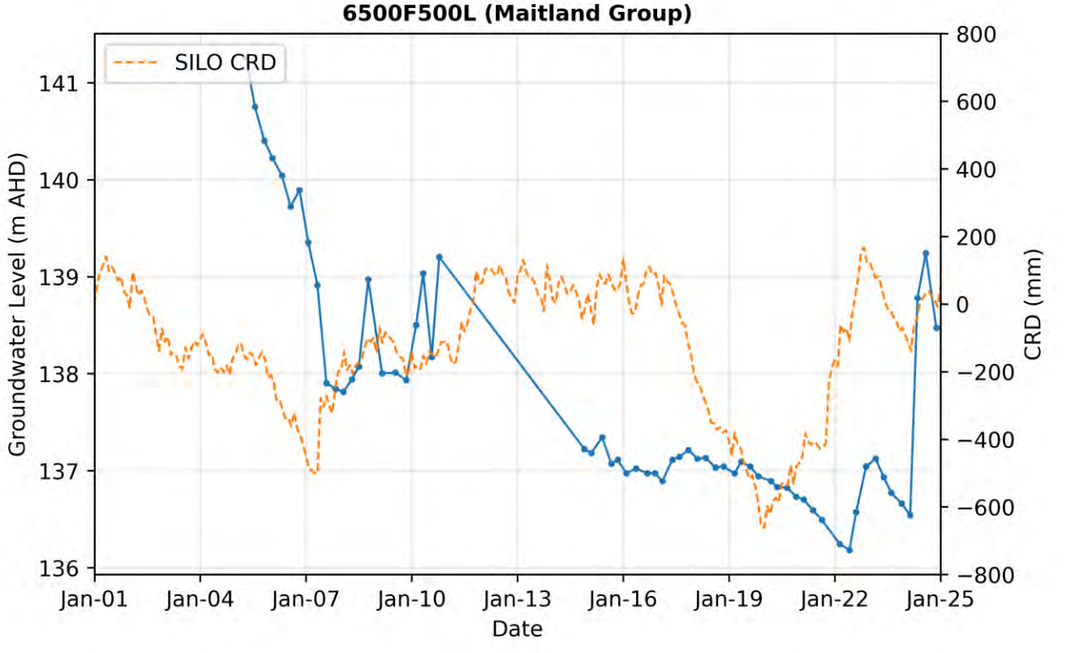

5000D000-R
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
125.725
125.700
125.675
125.650
125.625
125.600
125.575
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

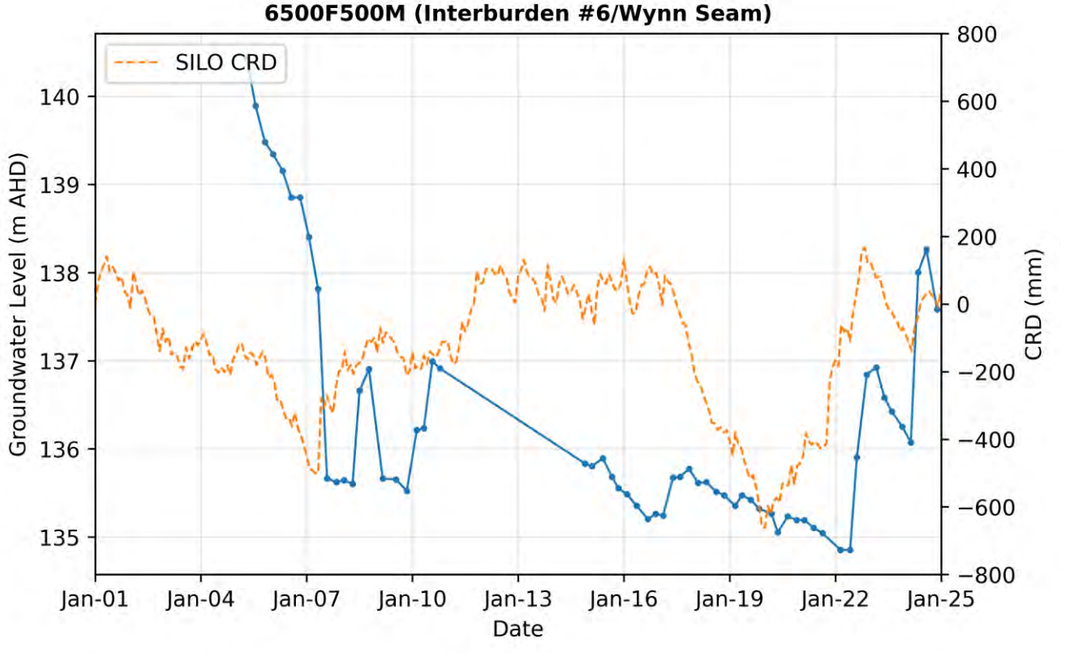

5000D000 (Wynn/Edderton Seams)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
180
160
140
120
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

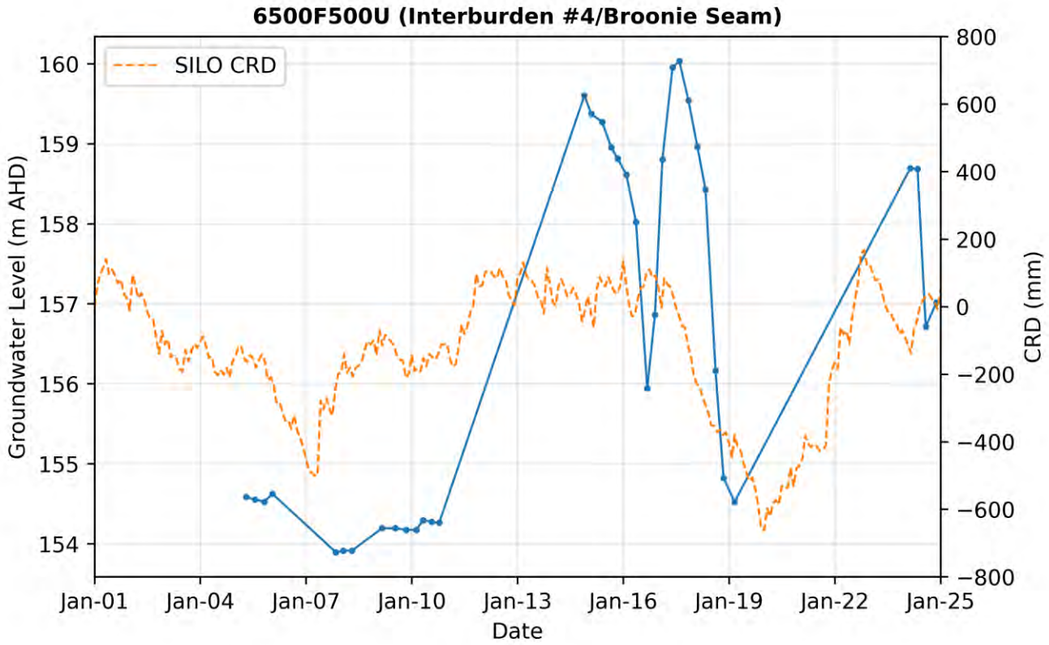

5500D000 (Interburden #7/Wynn Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
180
170
160
150
140
130
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

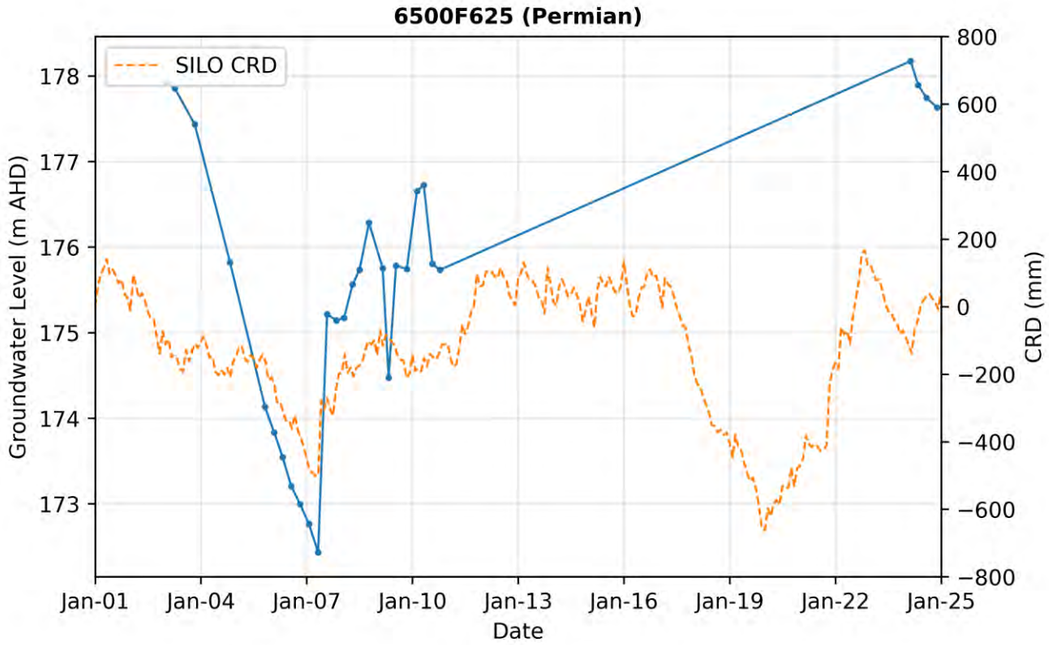

6000C000L (Interburden #2)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
160.2
160.0
159.8
159.6
159.4
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

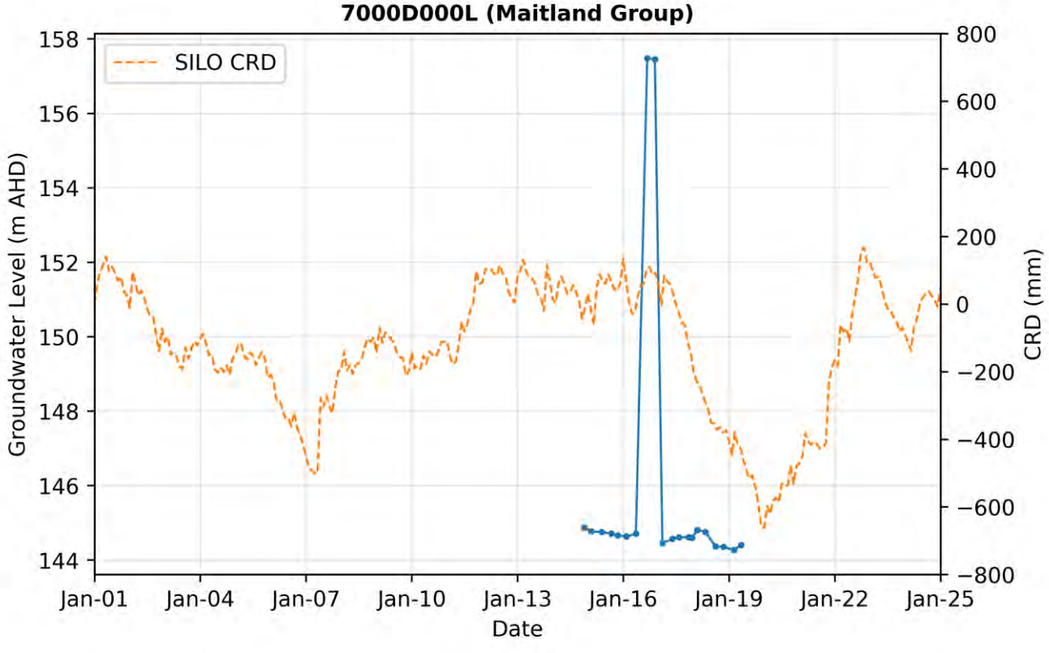

6000C000U (Wynn Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
142.2
142.0
141.8
141.6
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

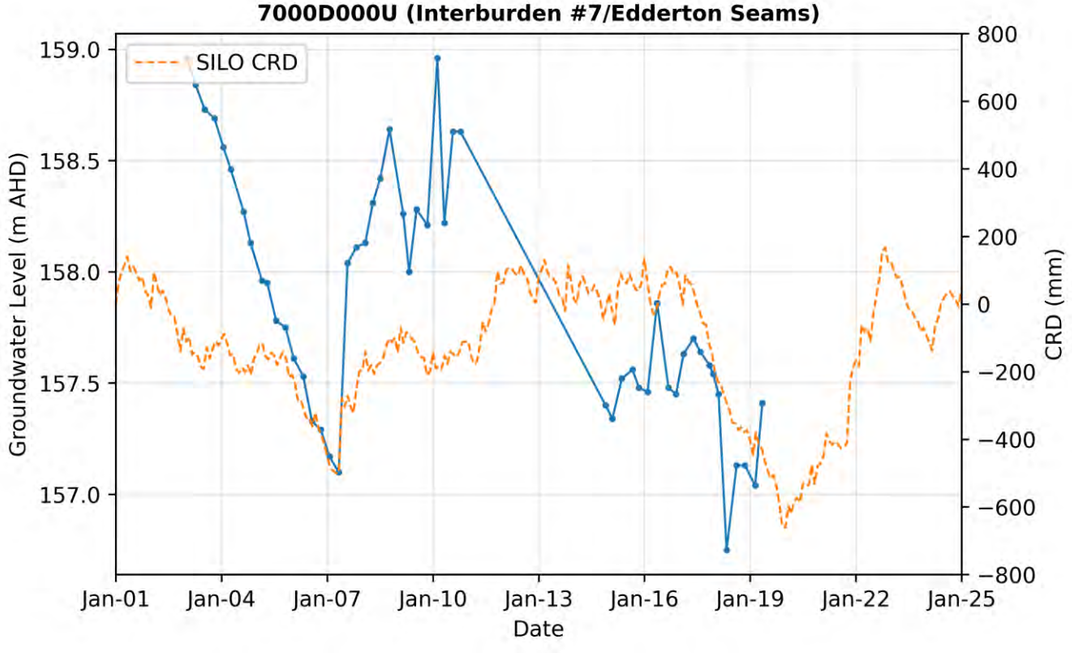

6500F500L (Maitland Group)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
141
140
139
138
137
136
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

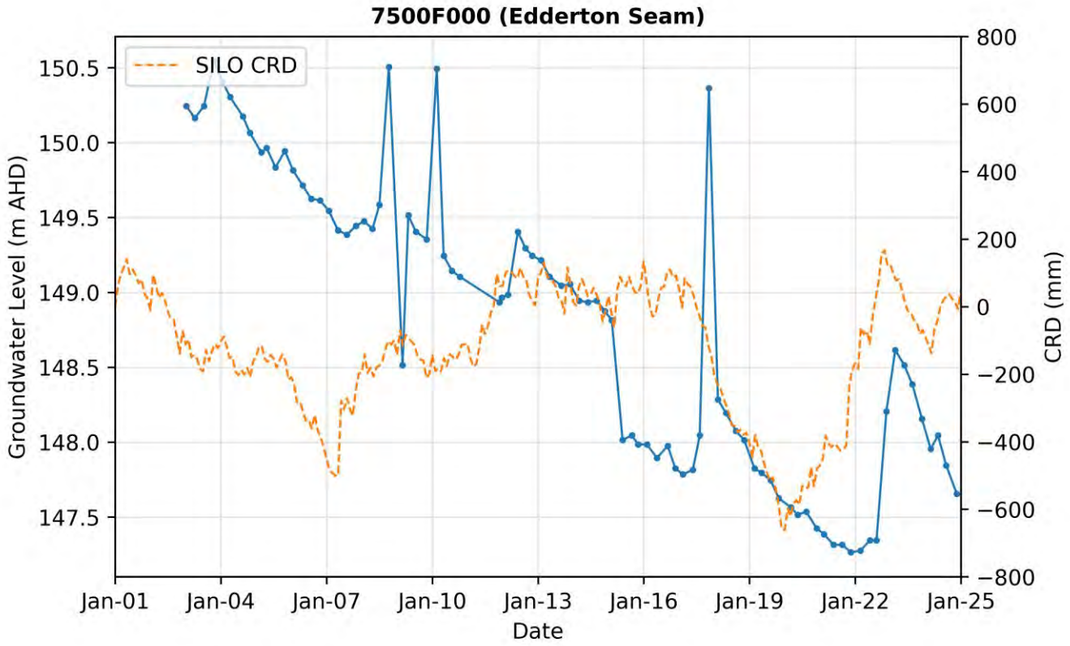

6500F500M (Interburden #6/Wynn Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
140
139
138
137
136
135
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

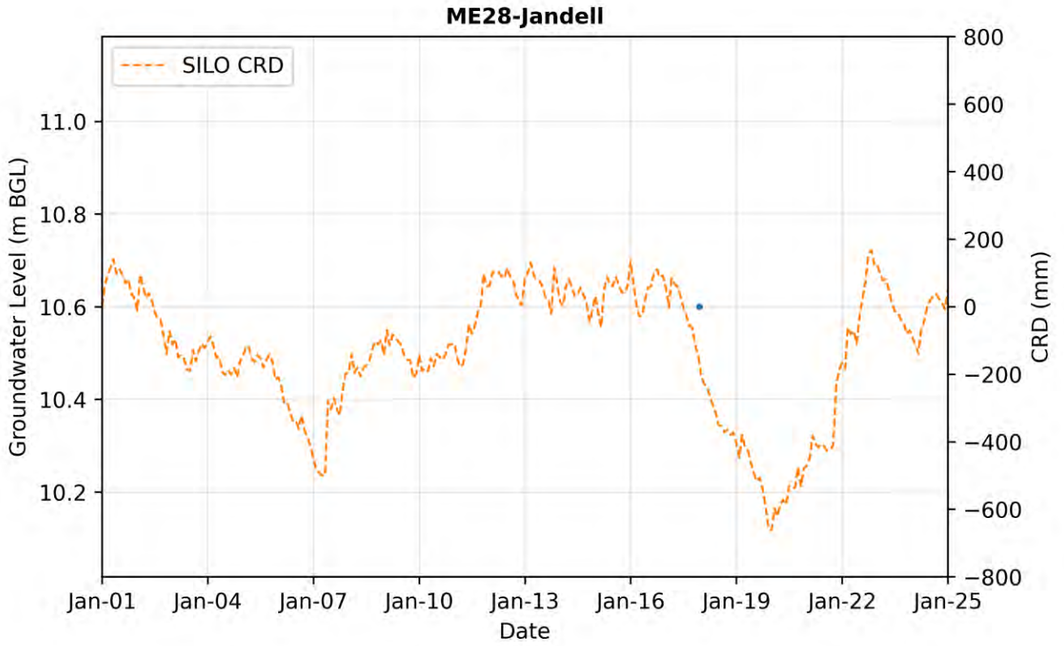

6500F500U (Interburden #4/Broonie Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
160
159
158
157
156
155
154
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

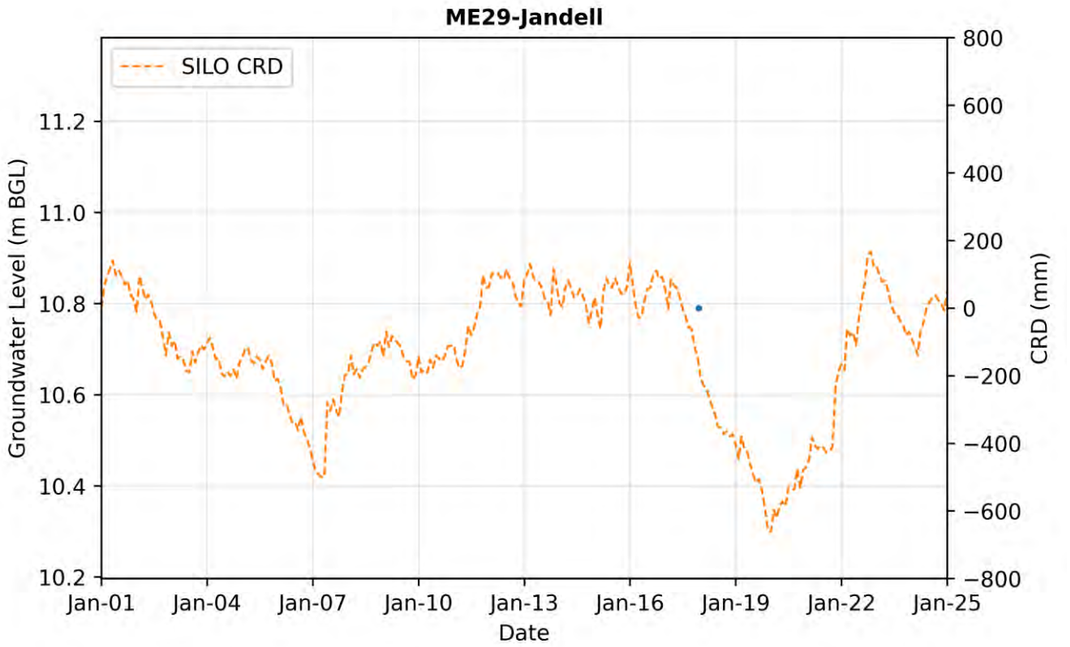

6500F625 (Permian)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
178
177
176
175
174
173
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

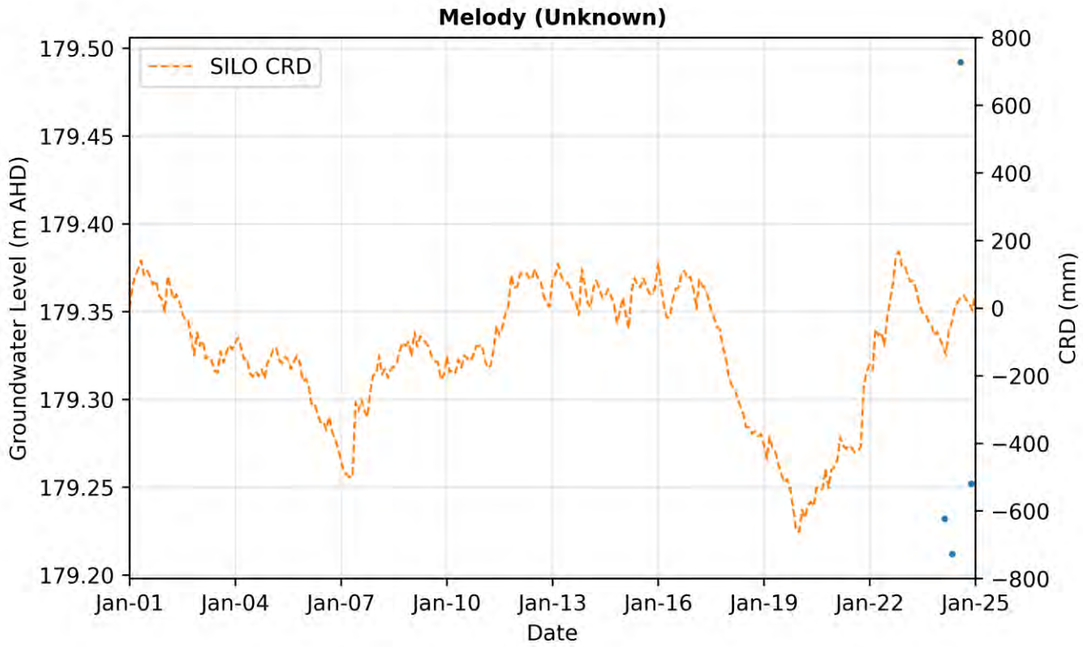

7000D000L (Maitland Group)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
158
156
154
152
150
148
146
144
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

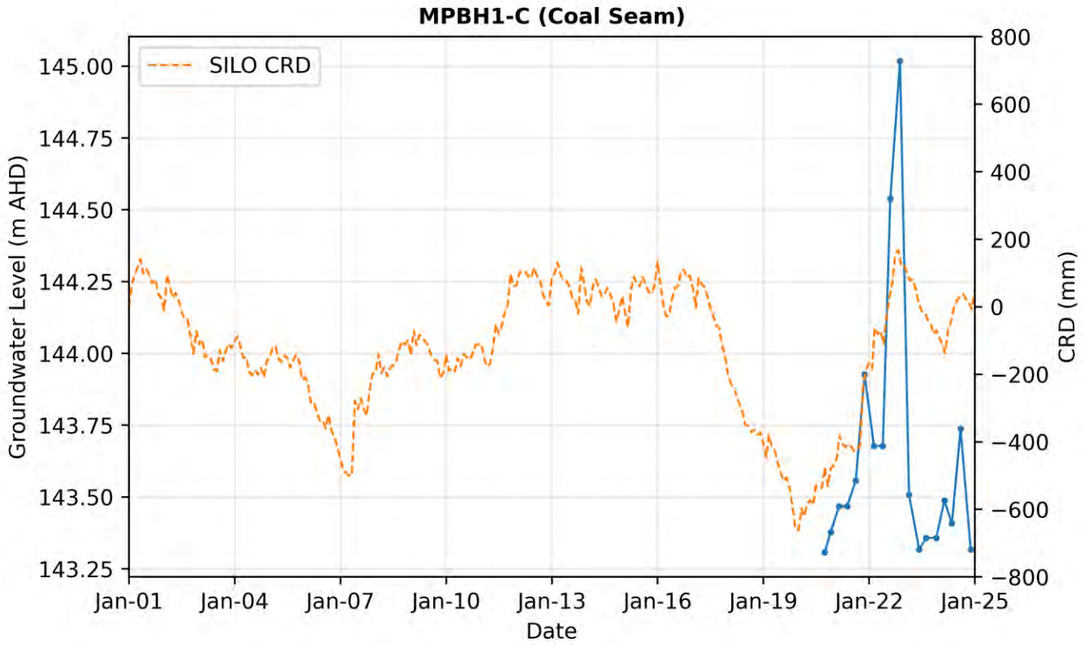

7000D000U (Interburden #7/Edderton Seams)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
159.0
158.5
158.0
157.5
157.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

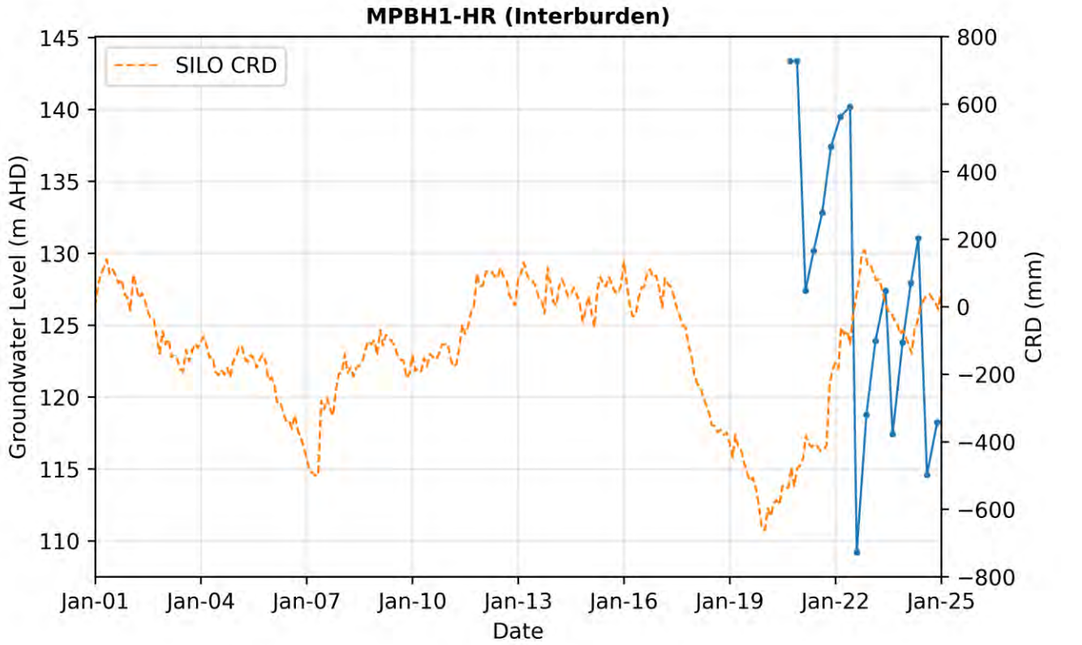

7500F000 (Edderton Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
150.5
150.0
149.5
149.0
148.5
148.0
147.5
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

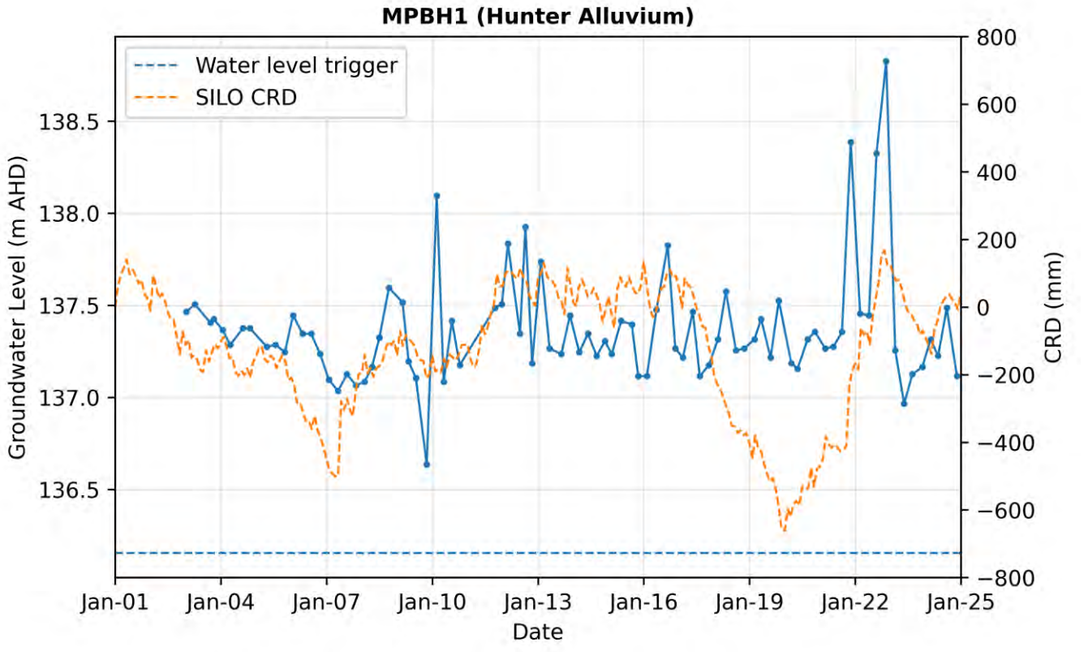

ME28-Jandell
SILO CRD
Groundwater Level (m BGL)
CRD (mm)
Date
11.0
10.8
10.6
10.4
10.2
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


ME29-Jandell
SILO CRD
Groundwater Level (m BGL)
CRD (mm)
Date
11.2
11.0
10.8
10.6
10.4
10.2
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


Melody (Unknown)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
179.50
179.45
179.40
179.35
179.30
179.25
179.20
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


MPBH1-C (Coal Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
145.00
144.75
144.50
144.25
144.00
143.75
143.50
143.25
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


MPBH1-HR (Interburden)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
145
140
135
130
125
120
115
110
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


MPBH1 (Hunter Alluvium)
Water level trigger
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
138.5
138.0
137.5
137.0
136.5
800
600
400
200
0
−200
−400
−600
−800
Jan-01
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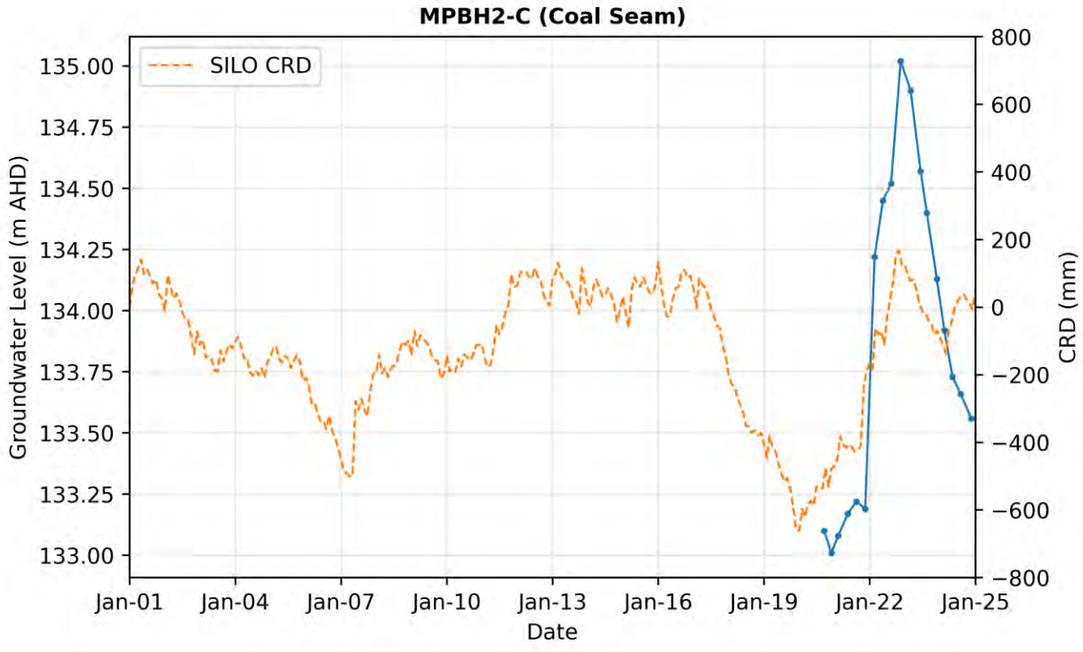
Jan-22
Jan-25


MPBH2-C (Coal Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
135.00
134.75
134.50
134.25
134.00
133.75
133.50
133.25
133.00
800
600
400
200
0
−200
−400
−600
−800
Jan-01
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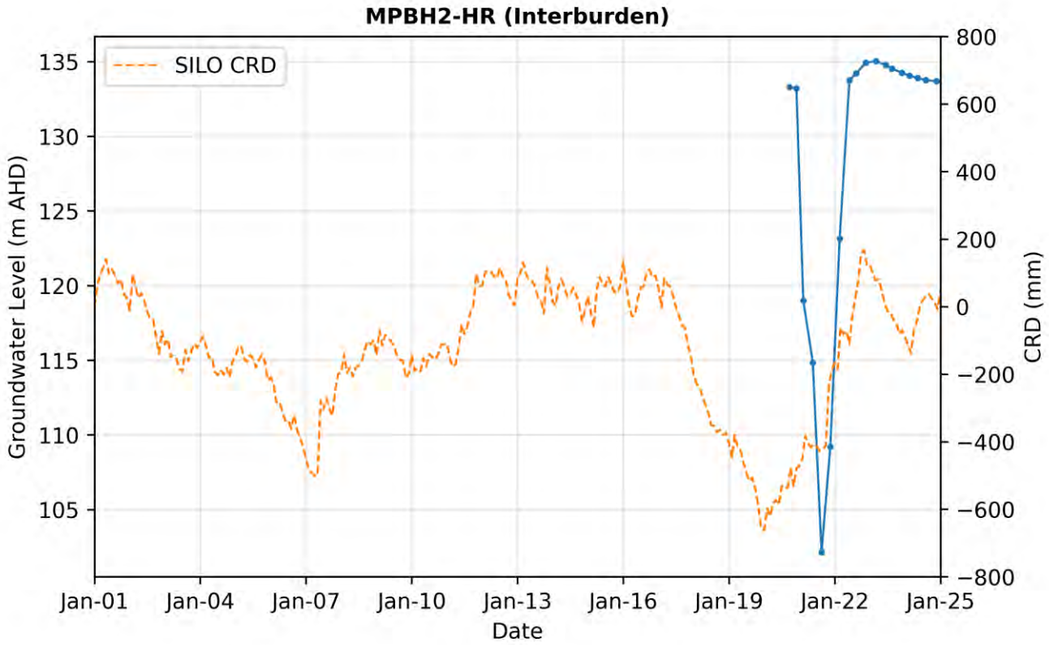
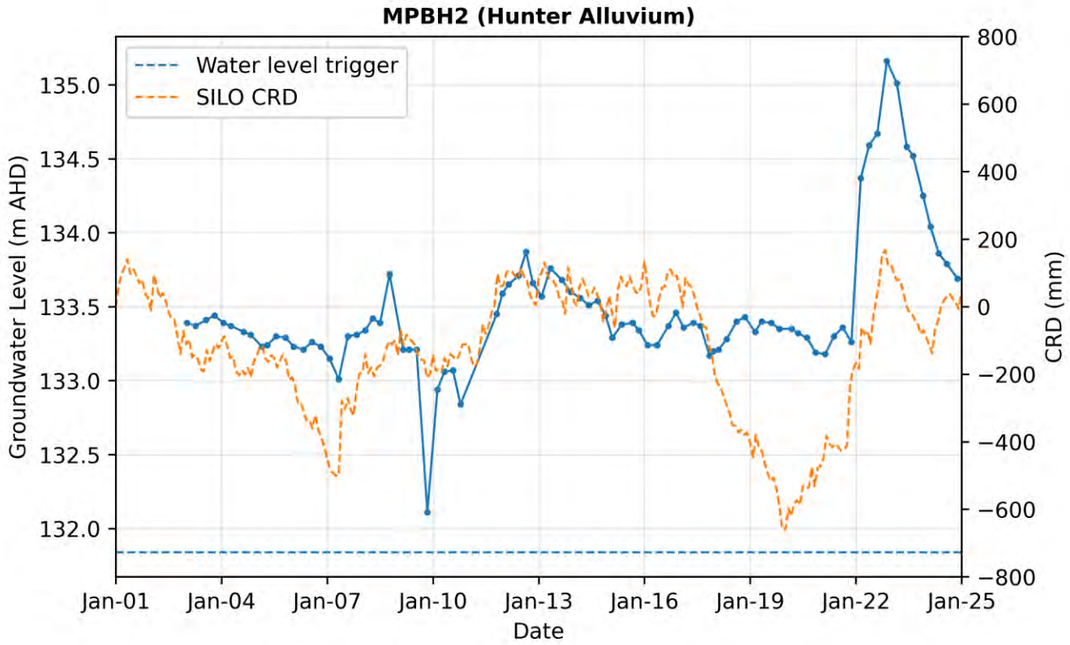
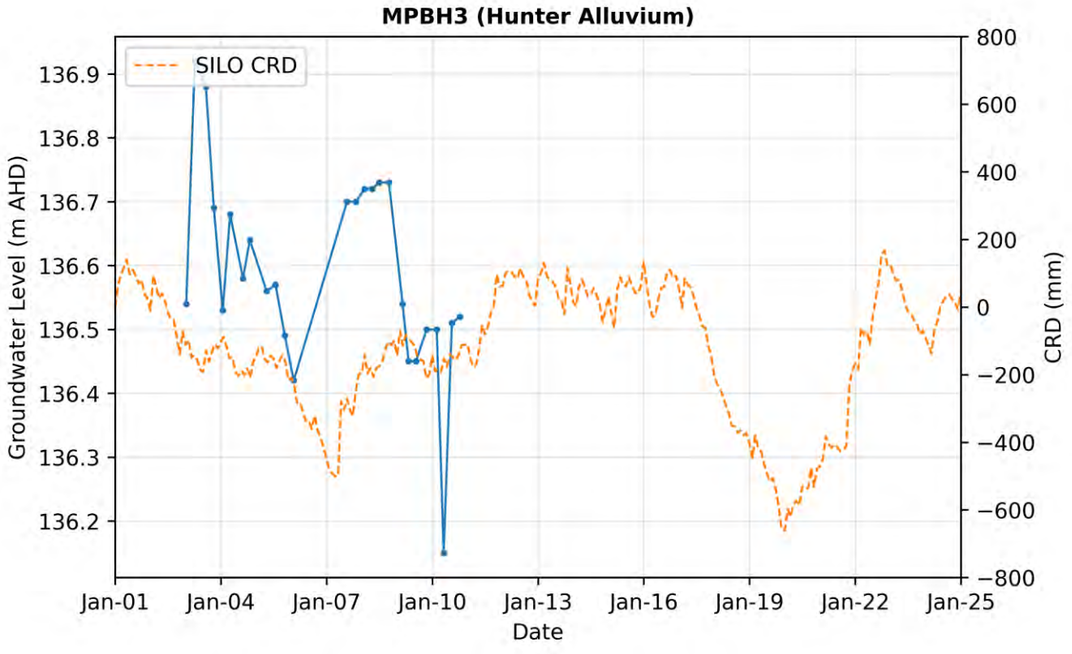
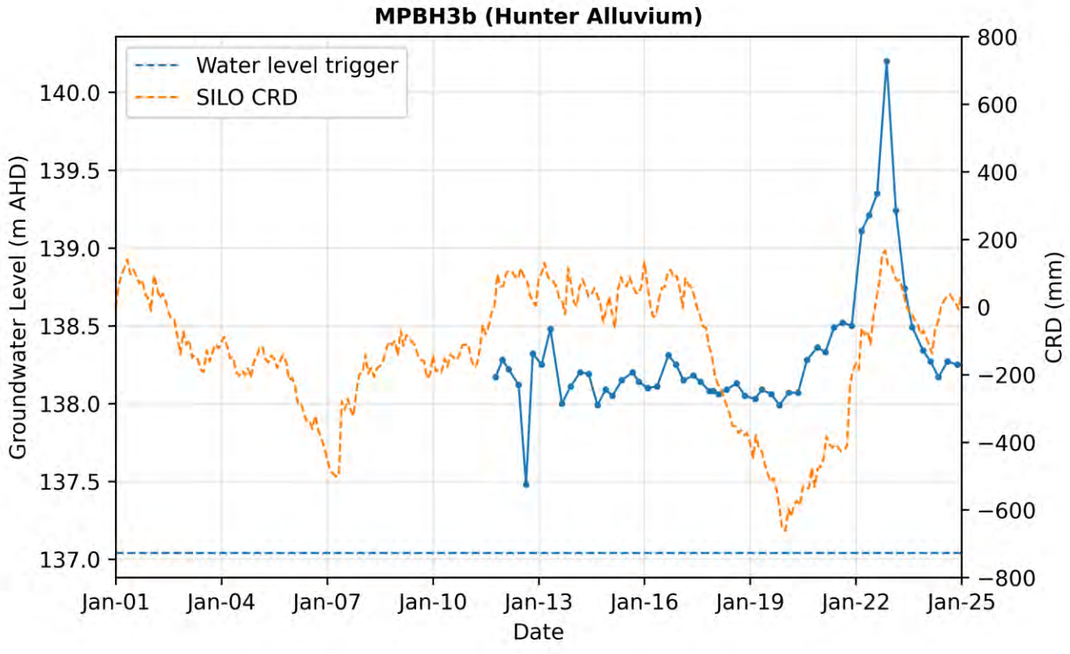
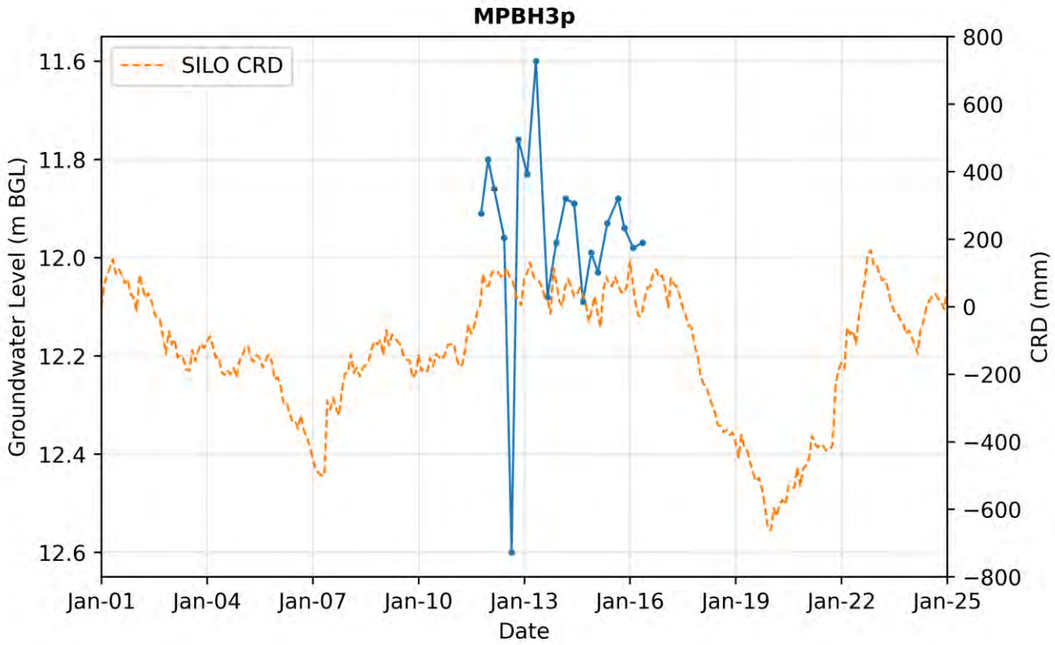
Jan-16
Jan-19
Jan-22
Jan-25

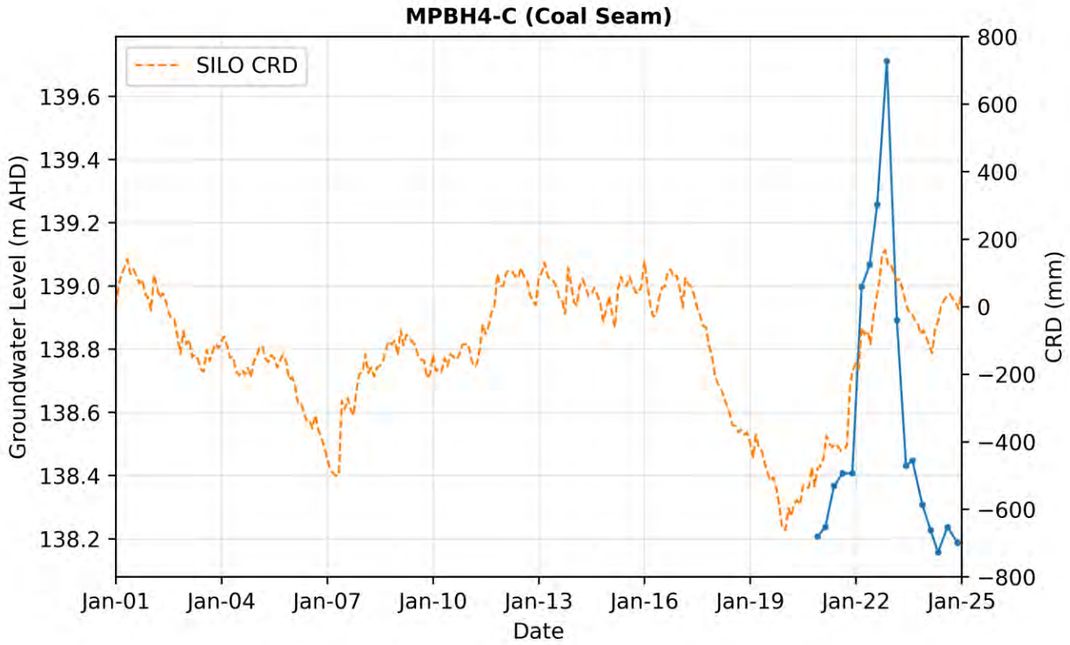

MPBH2-HR (Interburden)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
135
130
125
120
115
110
105
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

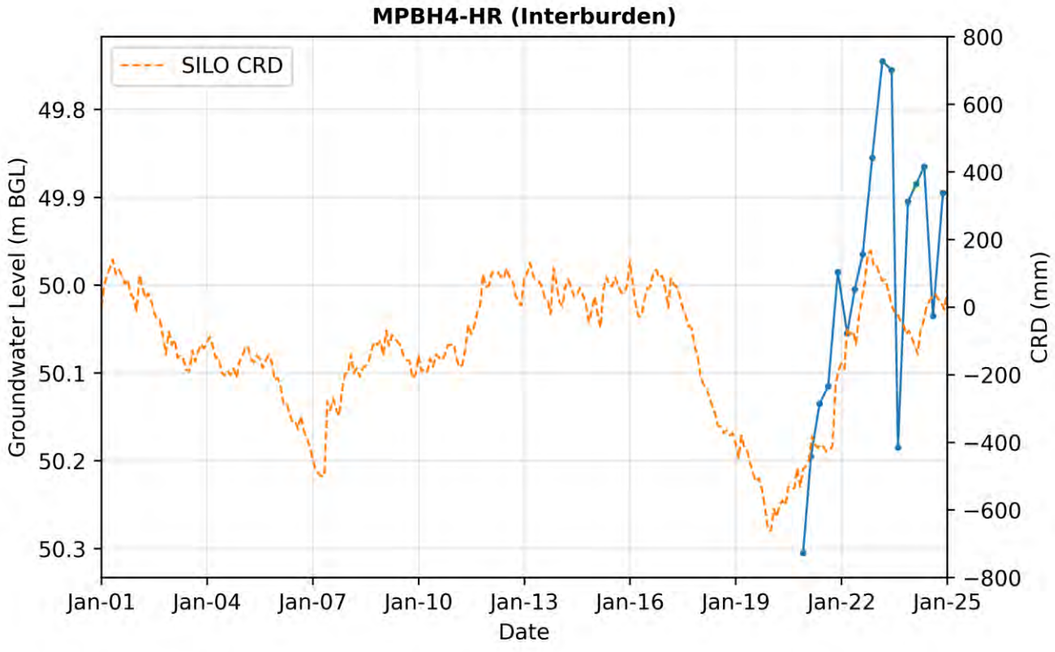

MPBH2 (Hunter Alluvium)
Water level trigger
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
135.0
134.5
134.0
133.5
133.0
132.5
132.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

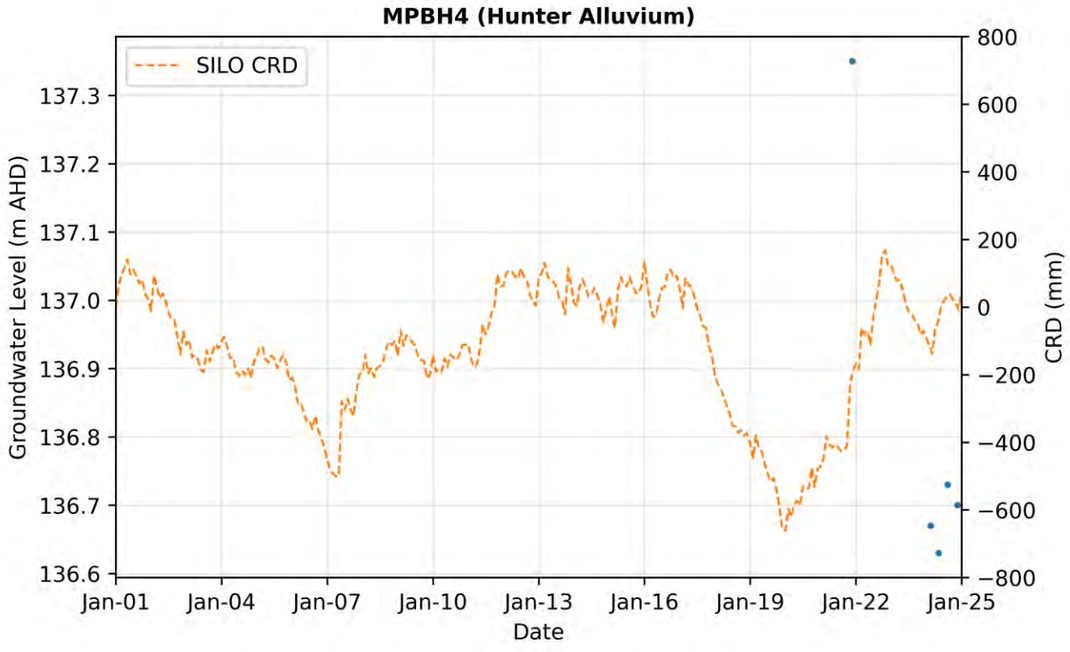

MPBH3 (Hunter Alluvium)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
136.9
136.8
136.7
136.6
136.5
136.4
136.3
136.2
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

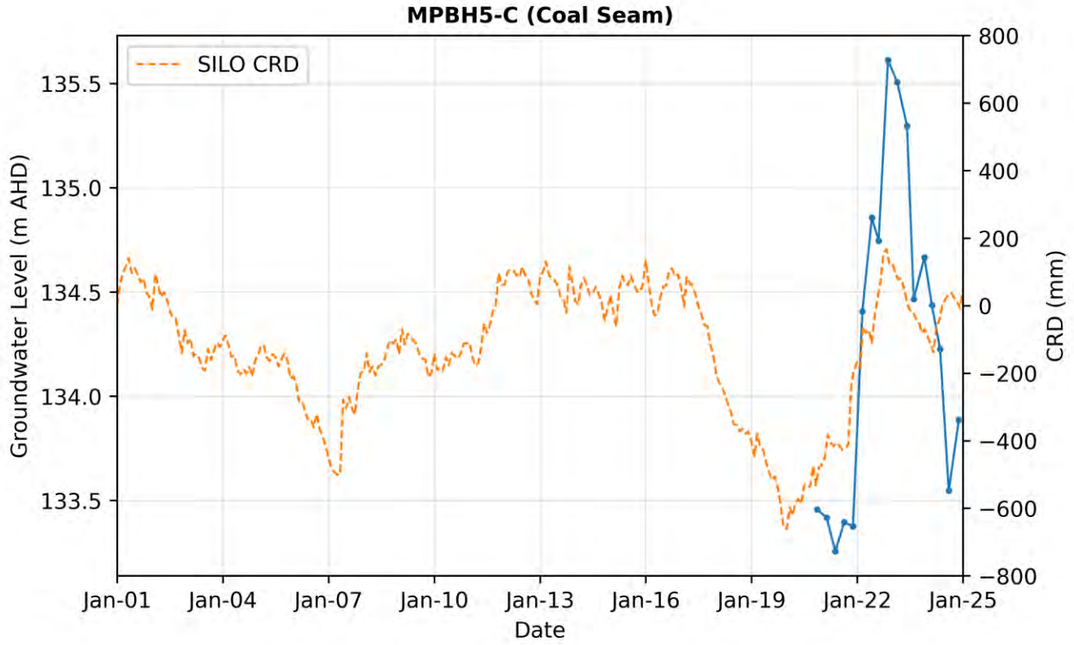

MPBH3b (Hunter Alluvium)
Water level trigger
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
140.0
139.5
139.0
138.5
138.0
137.5
137.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

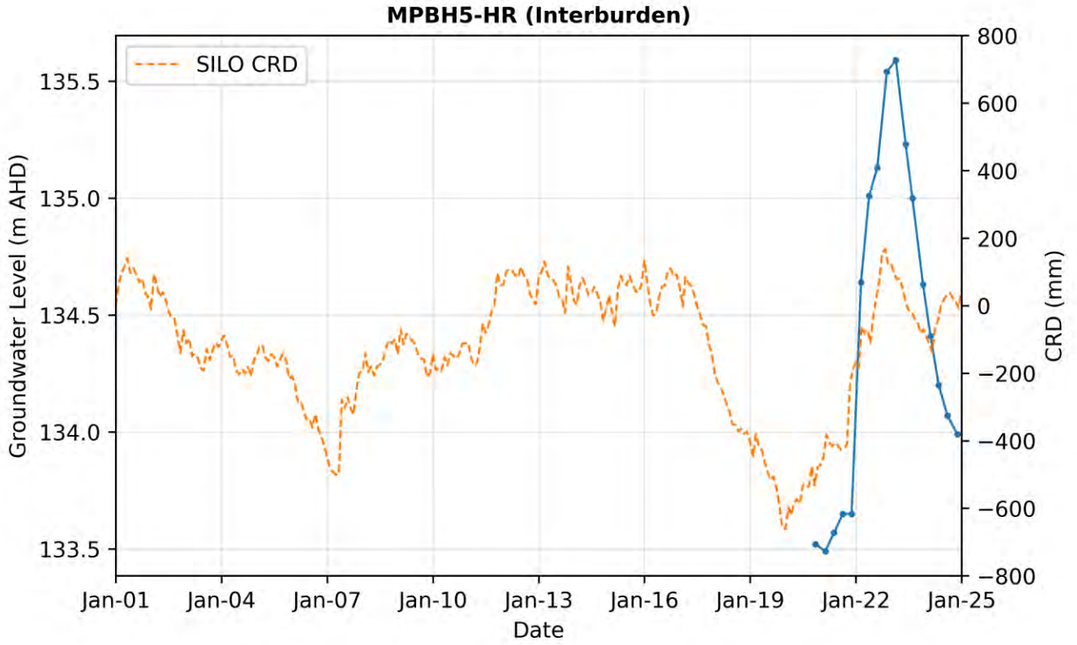

MPBH3p
SILO CRD
Groundwater Level (m BGL)
CRD (mm)
Date
11.6
11.8
12.0
12.2
12.4
12.6
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


MPBH4-C (Coal Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
139.6
139.4
139.2
139.0
138.8
138.6
138.4
138.2
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

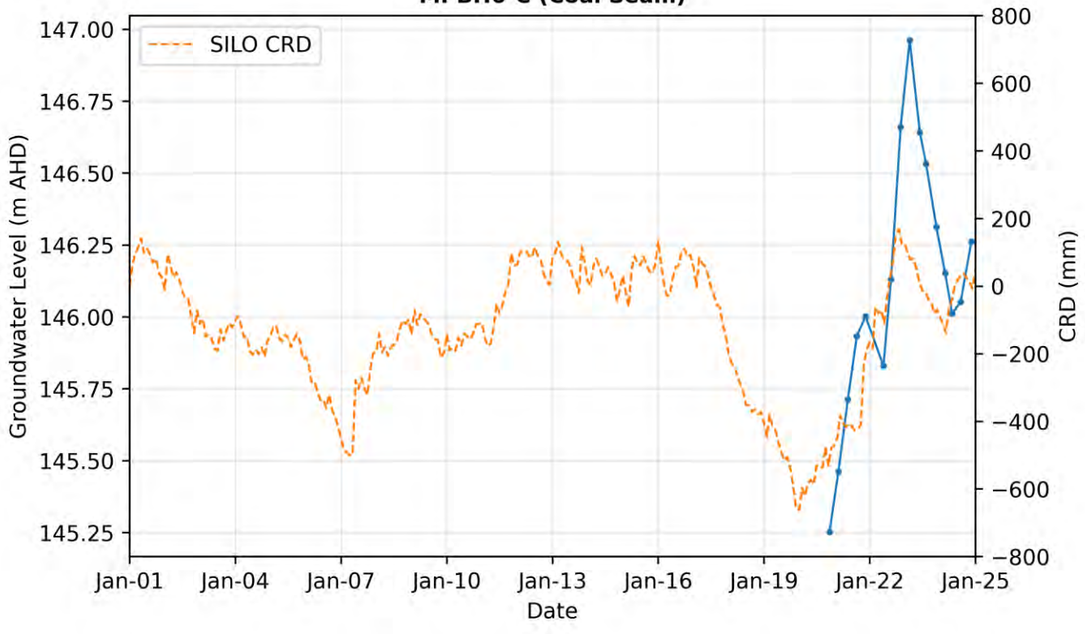

MPBH4-HR (Interburden)
SILO CRD
Groundwater Level (m BGL)
CRD (mm)
Date
49.8
49.9
50.0
50.1
50.2
50.3
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

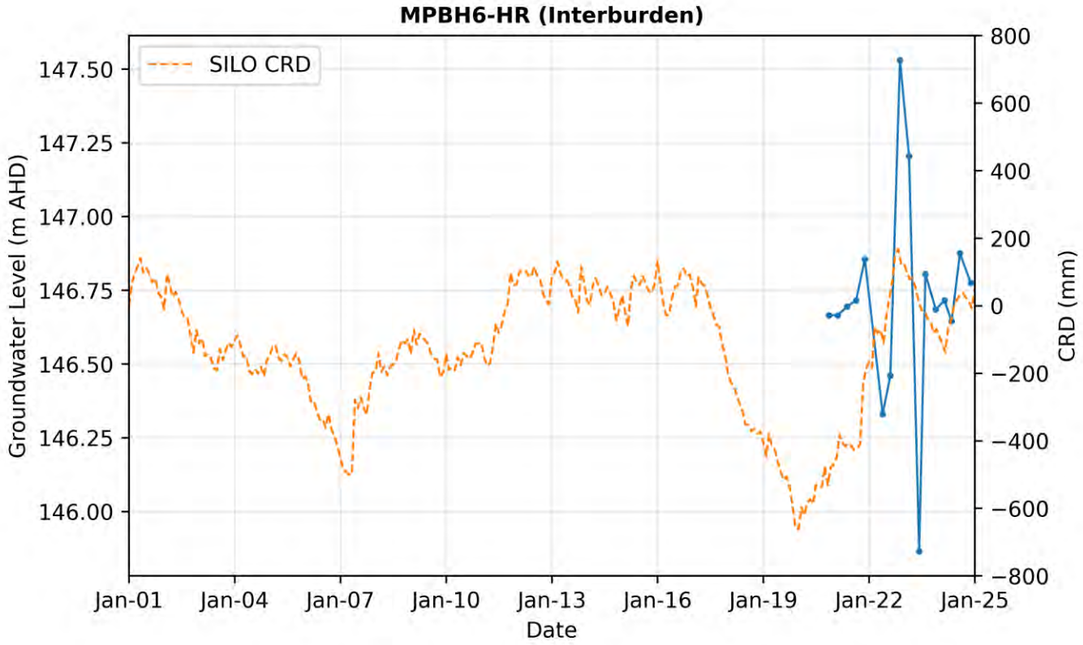

MPBH4 (Hunter Alluvium)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
137.3
137.2
137.1
137.0
136.9
136.8
136.7
136.6
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

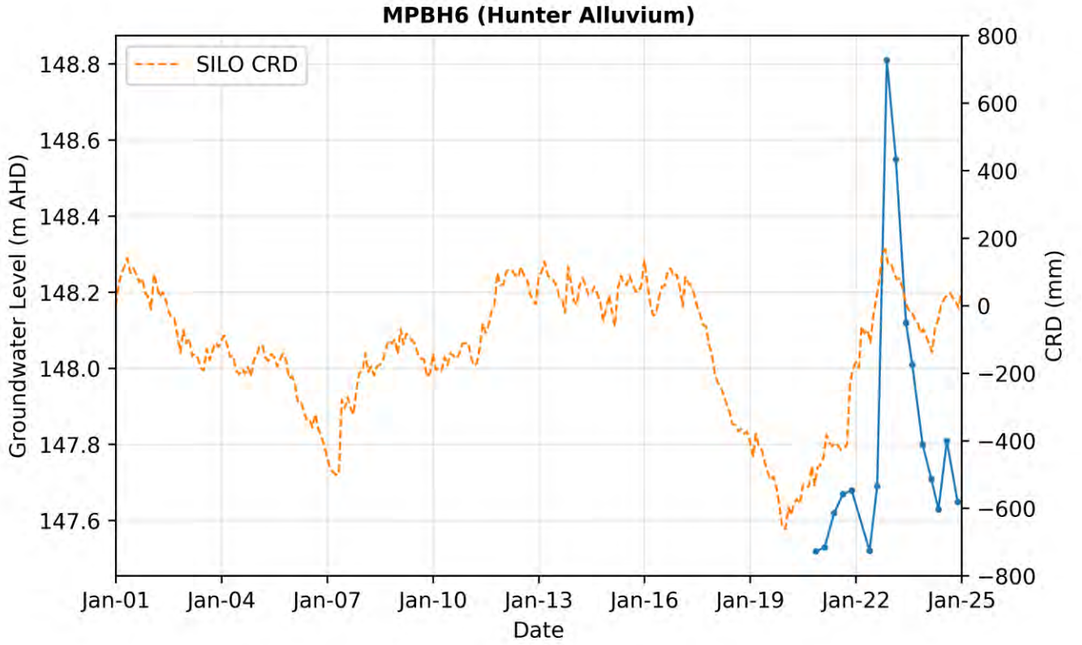

MPBH5-C (Coal Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
135.5
135.0
134.5
134.0
133.5
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

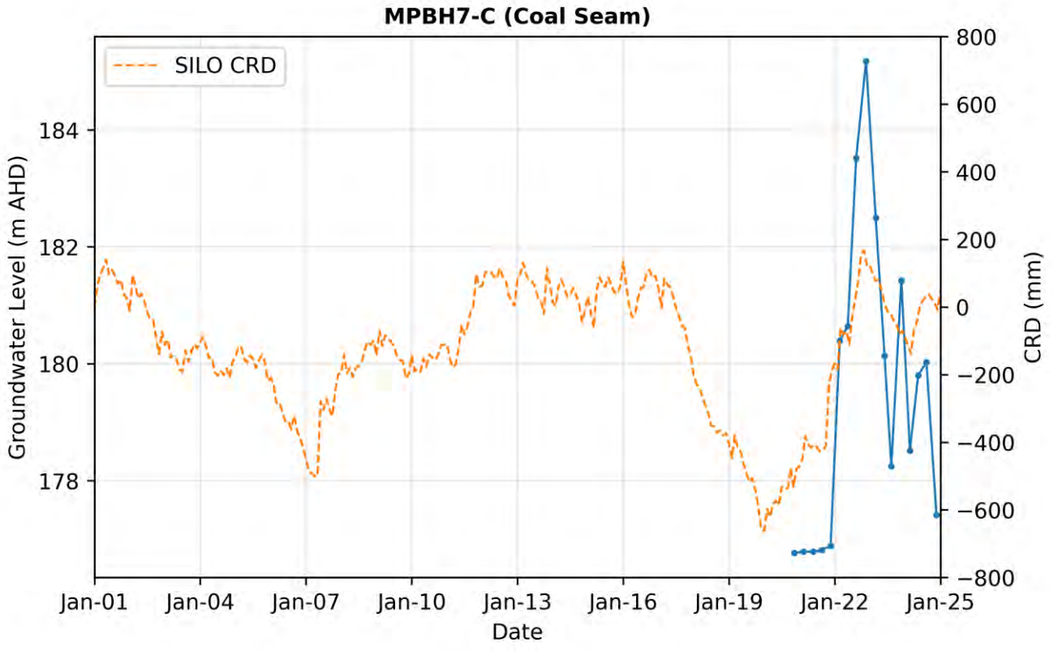

MPBH5-HR (Interburden)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
135.5
135.0
134.5
134.0
133.5
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

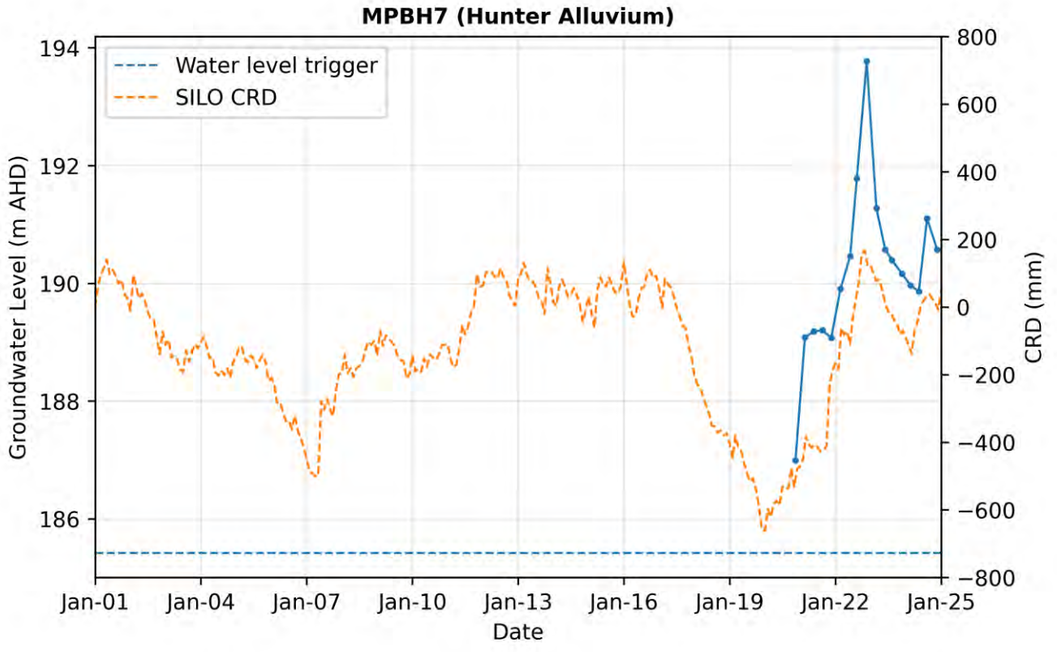

MPBH5 (Hunter Alluvium)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
142
140
138
136
134
132
130
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

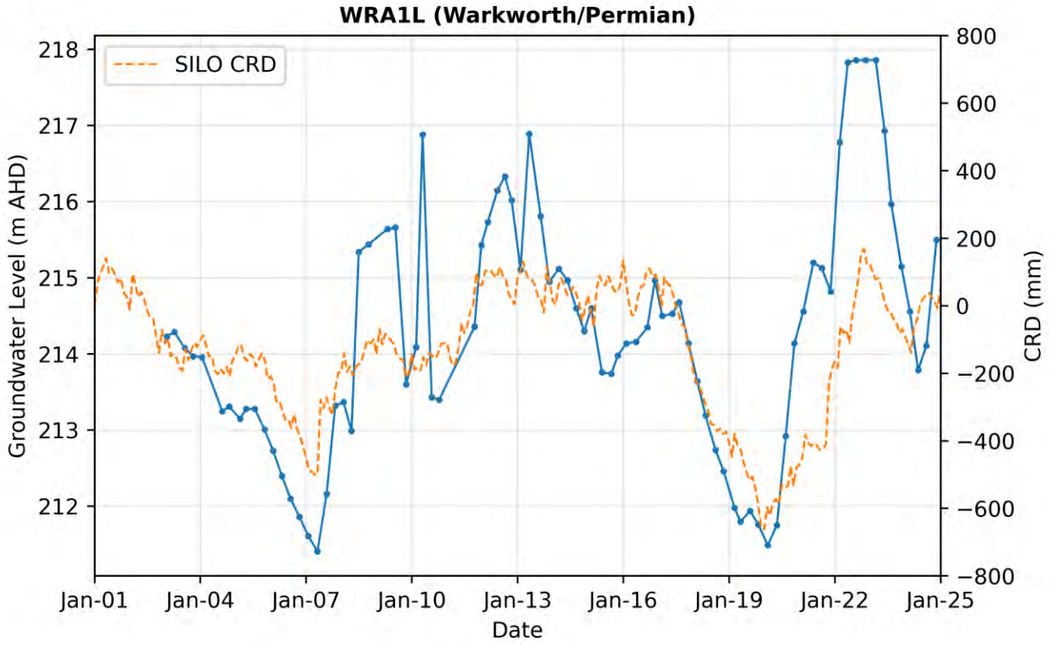

MPBH6-C (Coal Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
147.00
146.75
146.50
146.25
146.00
145.75
145.50
145.25
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

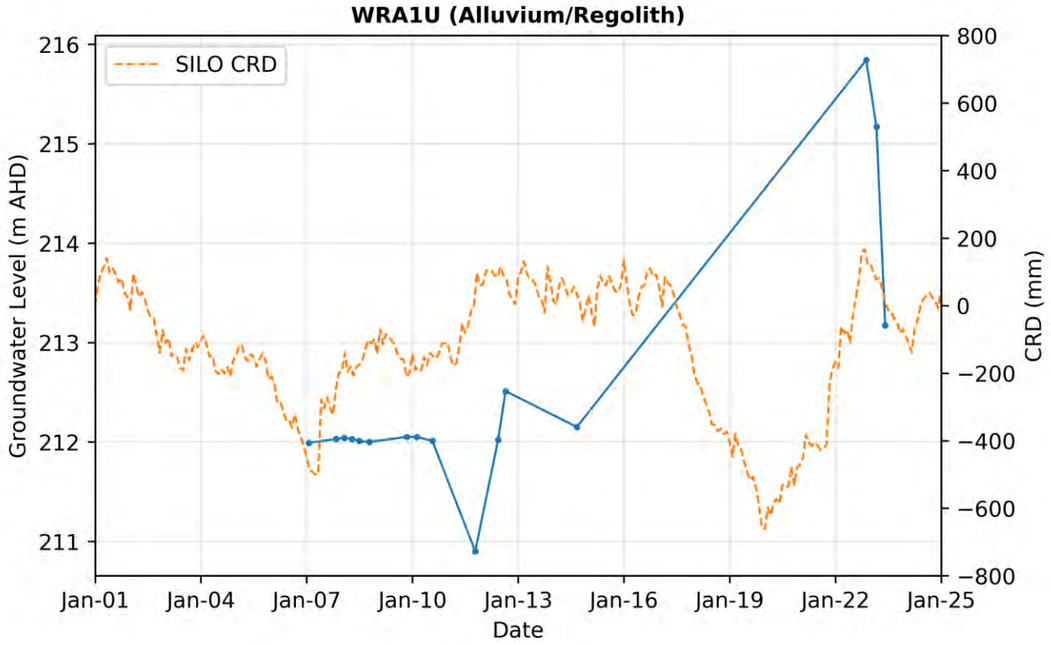

MPBH6-HR (Interburden)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
147.50
147.25
147.00
146.75
146.50
146.25
146.00
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

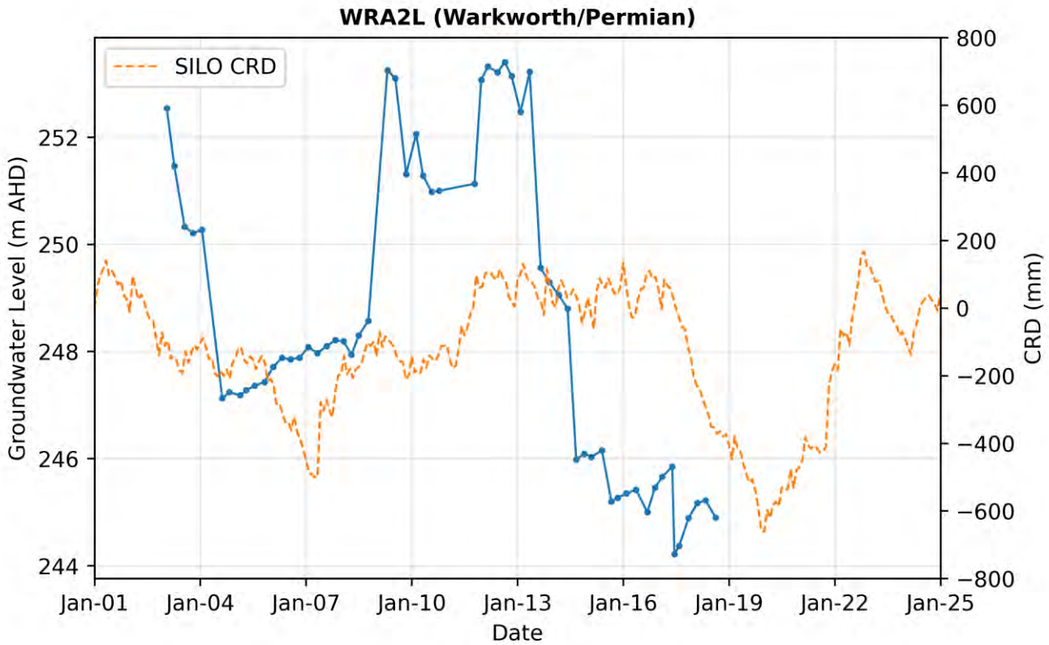

MPBH6 (Hunter Alluvium)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
148.8
148.6
148.4
148.2
148.0
147.8
147.6
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

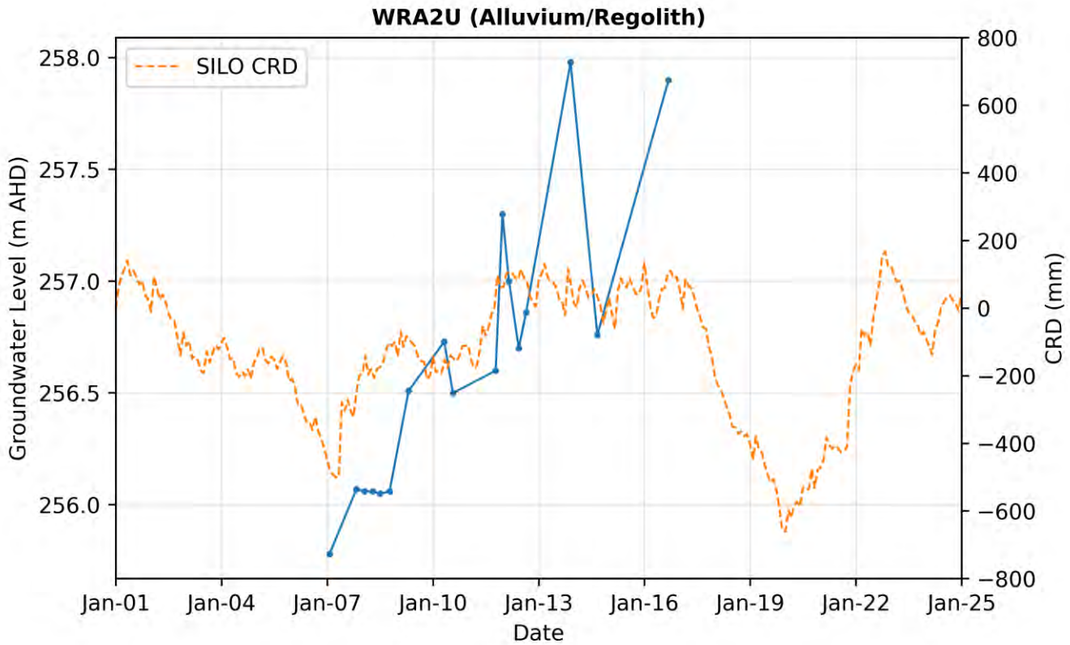

MPBH7-C (Coal Seam)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
184
182
180
178
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

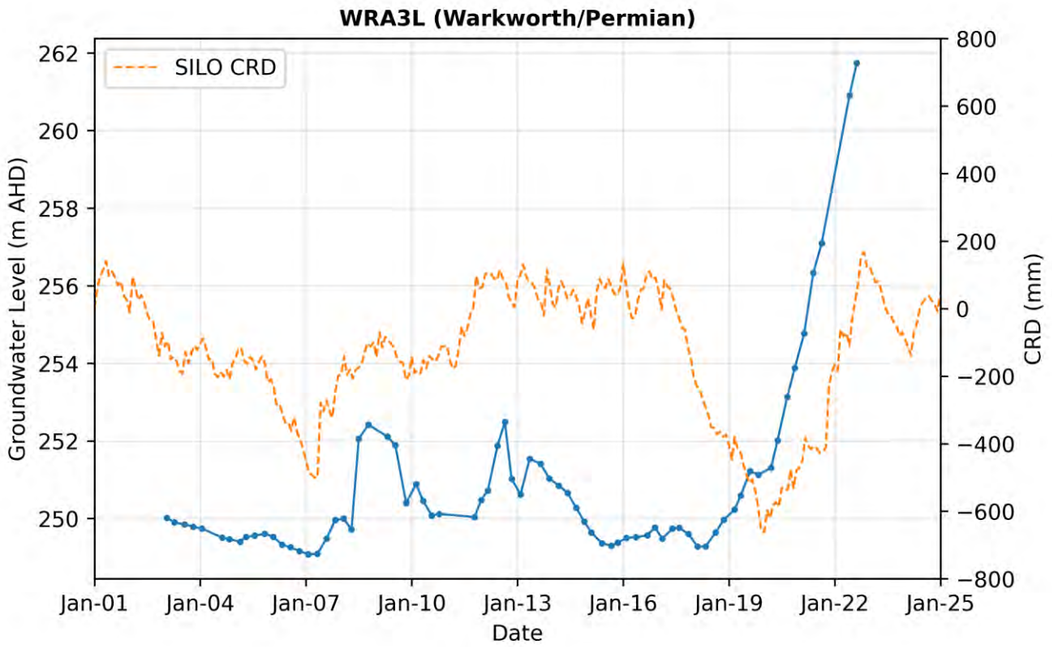

MPBH7 (Hunter Alluvium)
Water level trigger
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
194
192
190
188
186
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

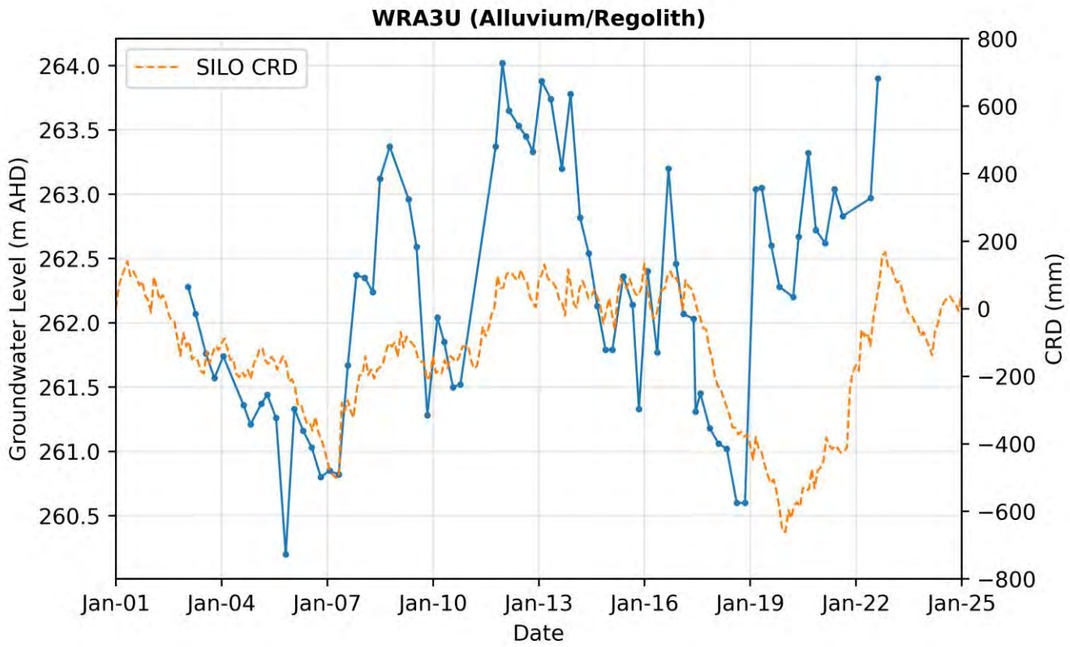

WRA1L (Warkworth/Permian)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
218
217
216
215
214
213
212
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

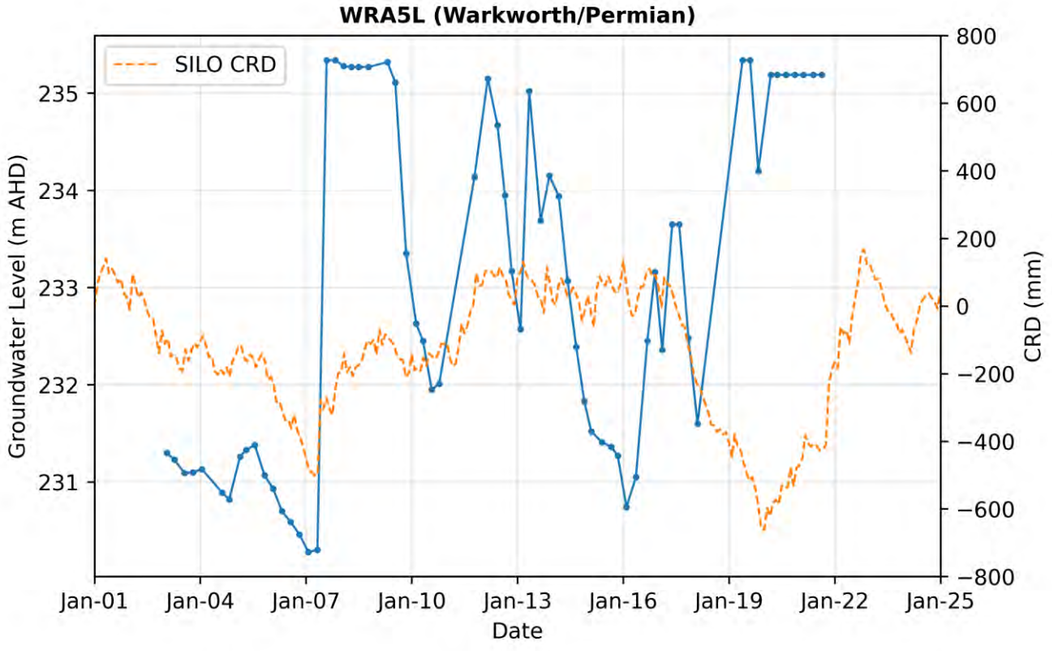

WRA1U (Alluvium/Regolith)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
216
215
214
213
212
211
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

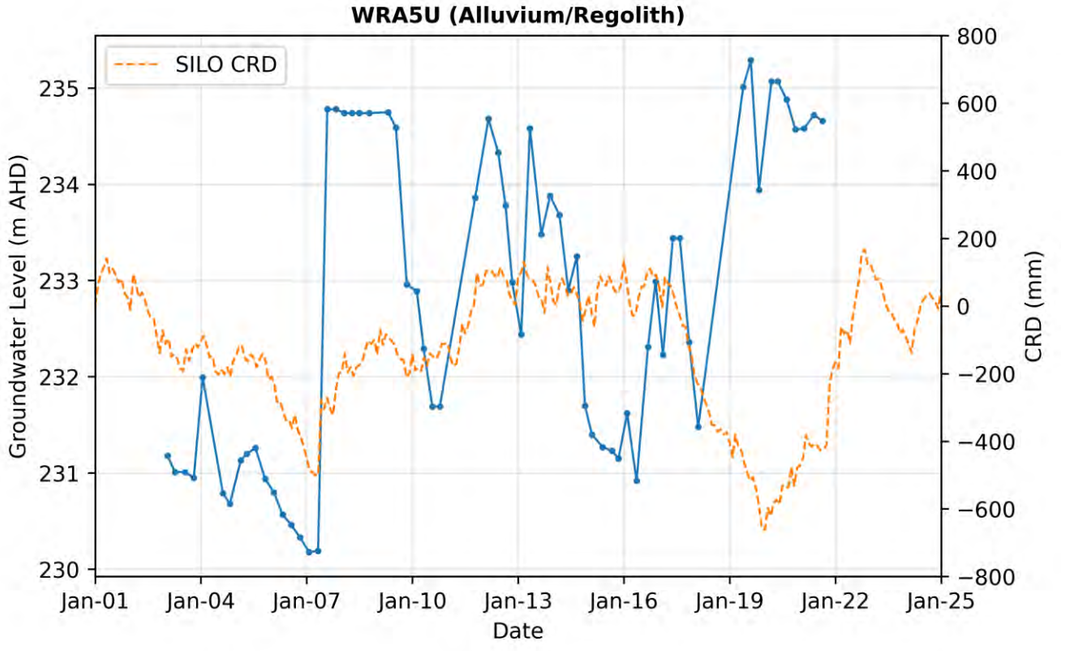

WRA2L (Warkworth/Permian)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
252
250
248
246
244
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

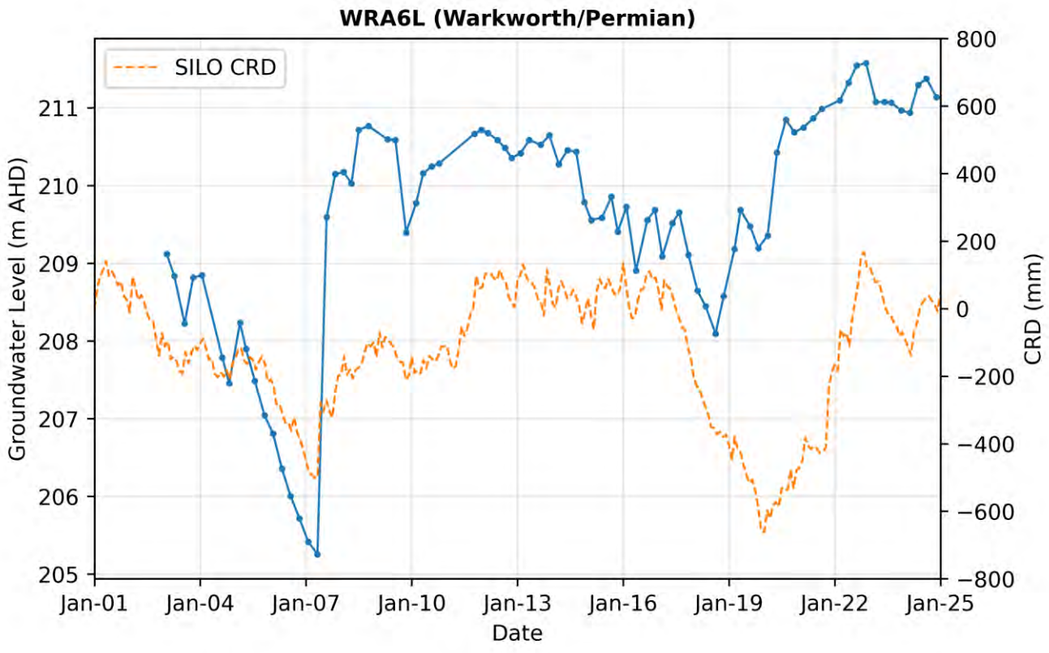

WRA2U (Alluvium/Regolith)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
258.0
257.5
257.0
256.5
256.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

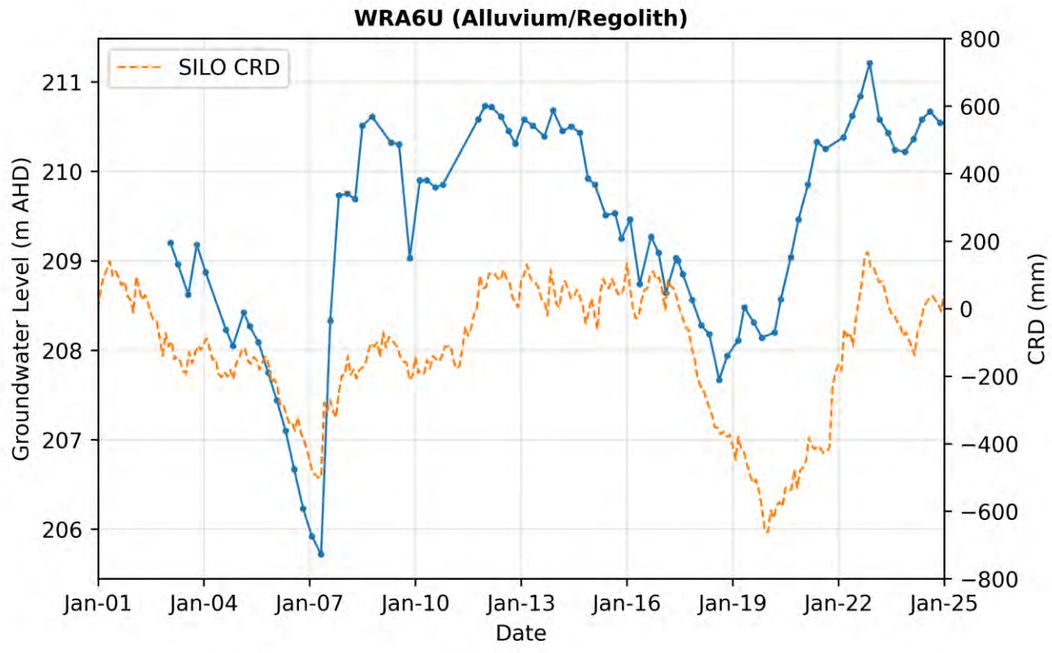

WRA3L (Warkworth/Permian)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
262
260
258
256
254
252
250
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA3U (Alluvium/Regolith)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
264.0
263.5
263.0
262.5
262.0
261.5
261.0
260.5
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA5L (Warkworth/Permian)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
235
234
233
232
231
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

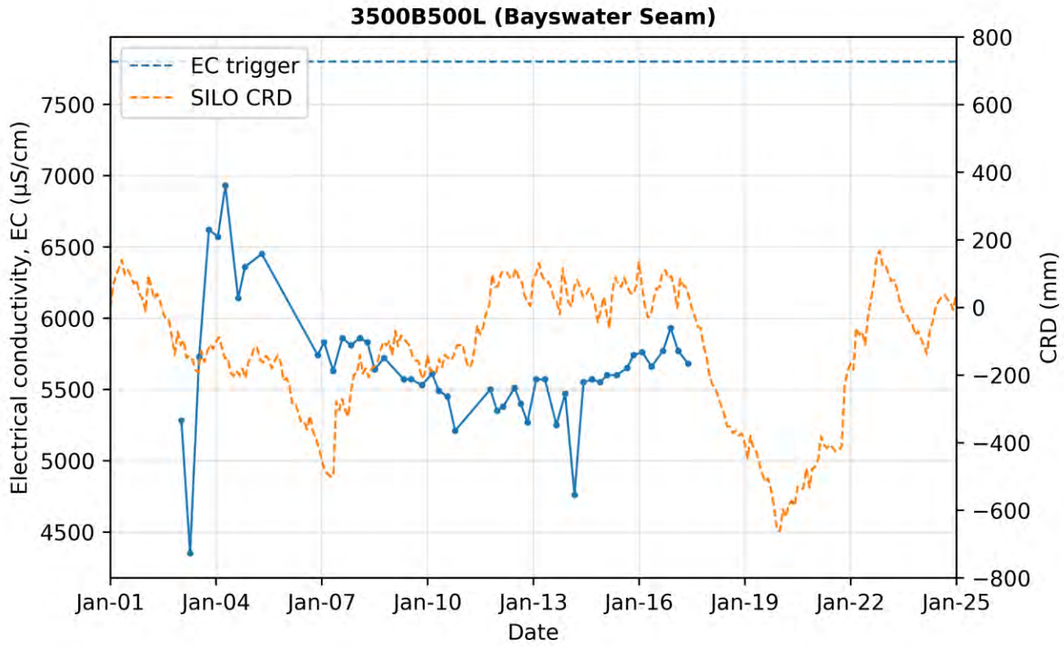

WRA5U (Alluvium/Regolith)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
235
234
233
232
231
230
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

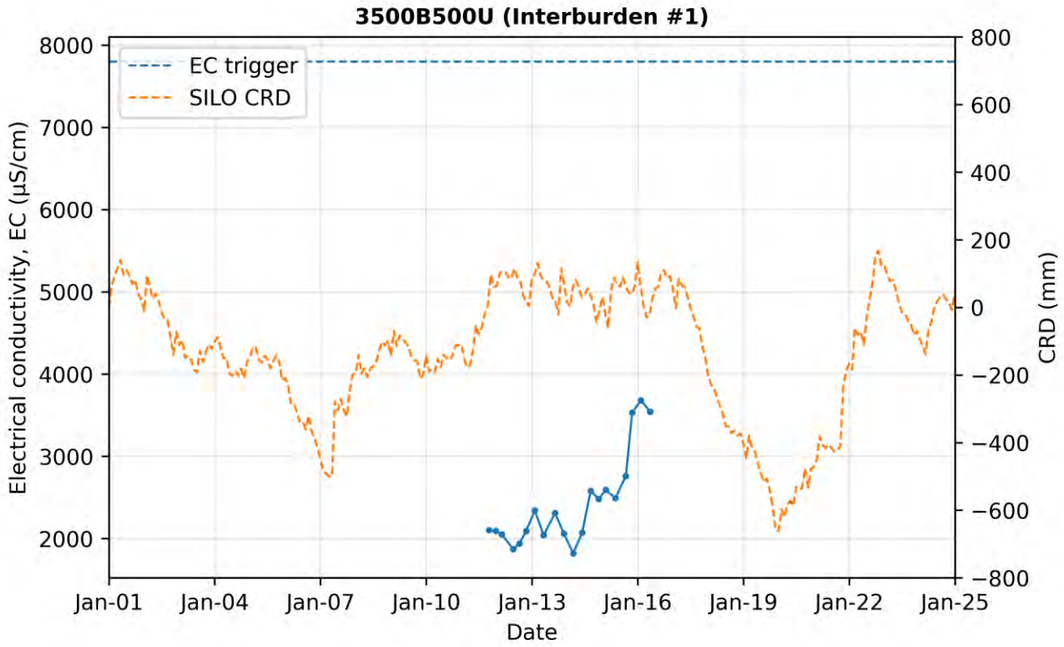

WRA6L (Warkworth/Permian)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
205
206
207
208
209
210
211
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

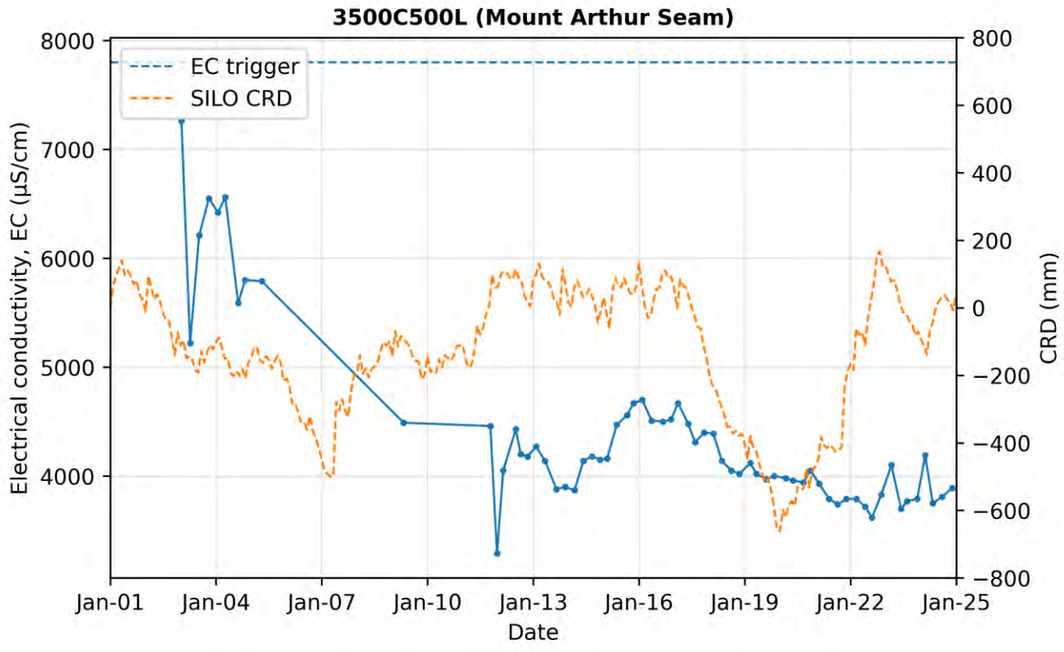

WRA6U (Alluvium/Regolith)
SILO CRD
Groundwater Level (m AHD)
CRD (mm)
Date
206
207
208
209
210
211
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

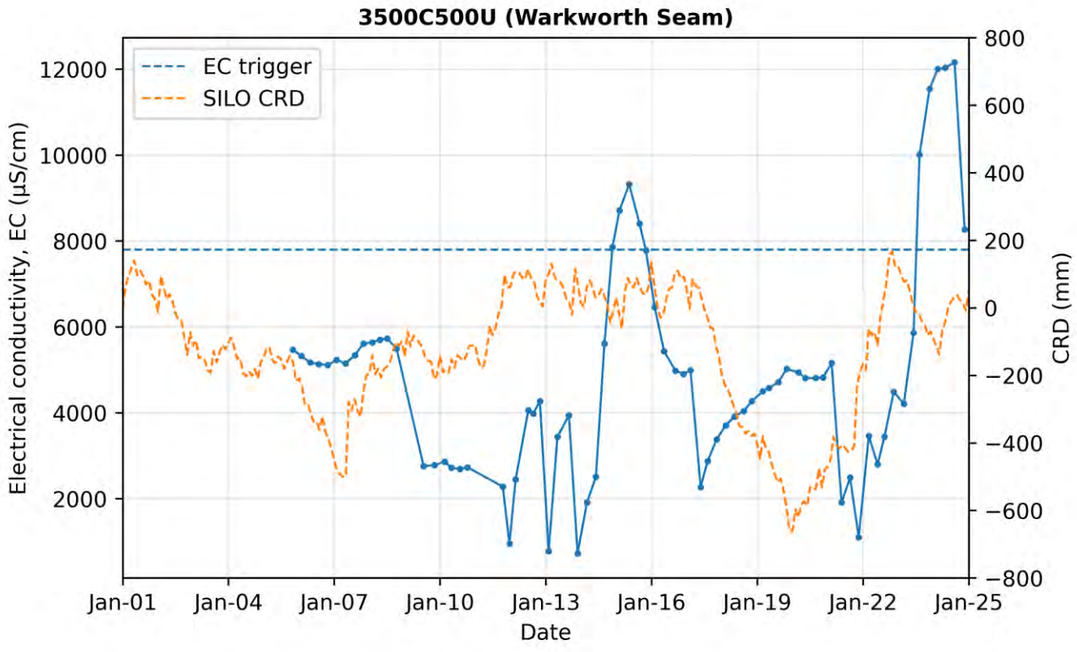
Appendix C

Field measured electrical conductivity (EC) time series


3500B500L (Bayswater Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


3500B500U (Interburden #1)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


3500C500L (Mount Arthur Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


3500C500U (Warkworth Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
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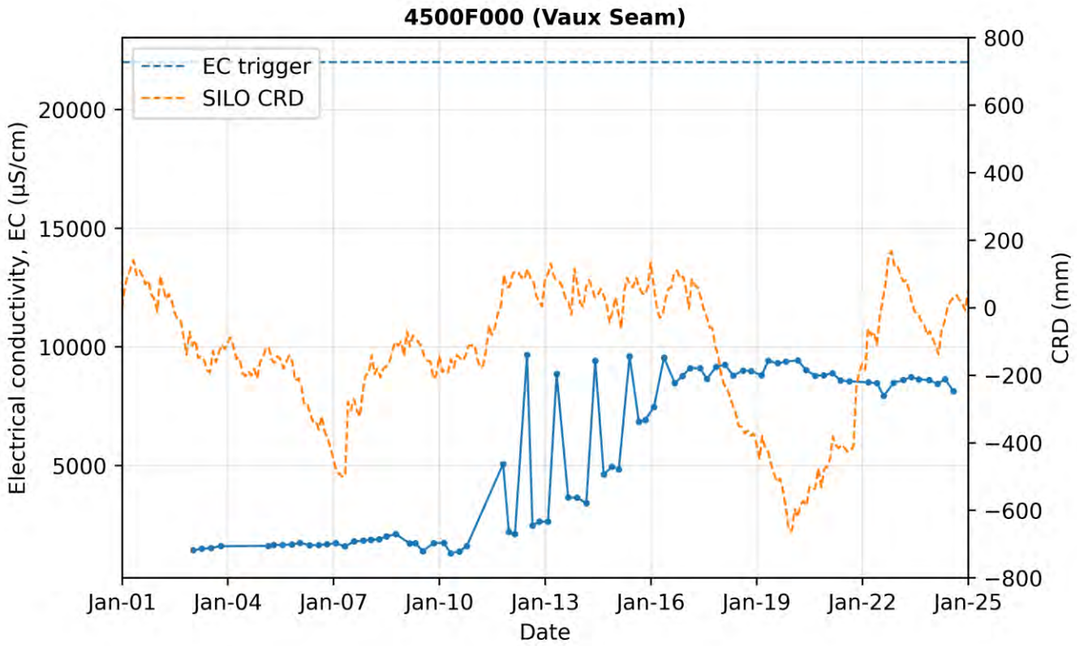
4500F000 (Vaux Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
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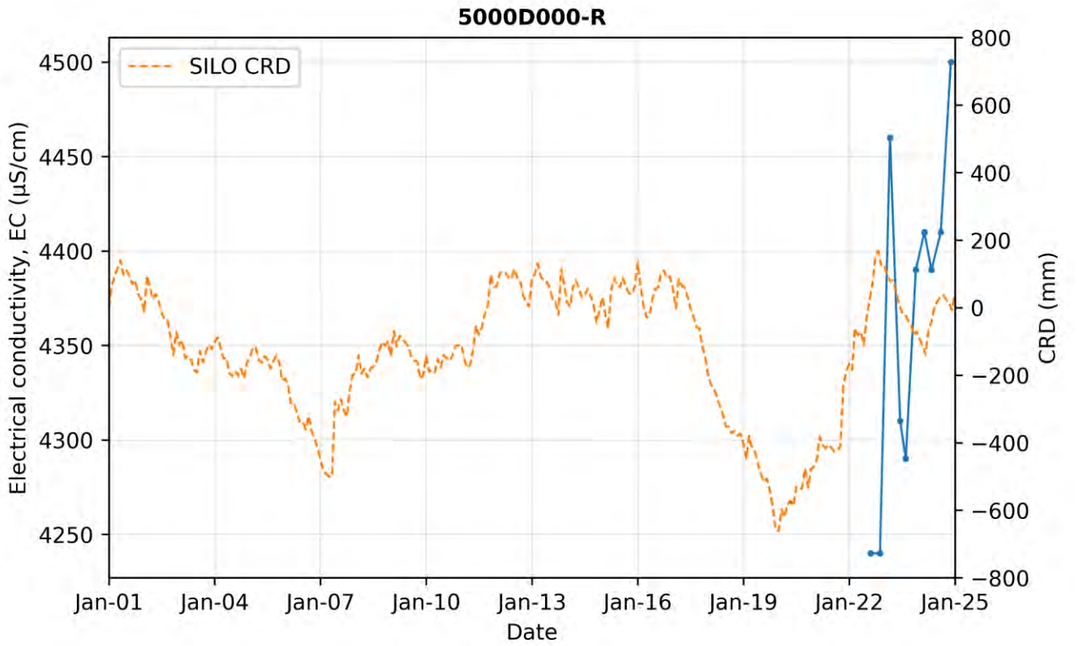
Jan-25


5000D000-R
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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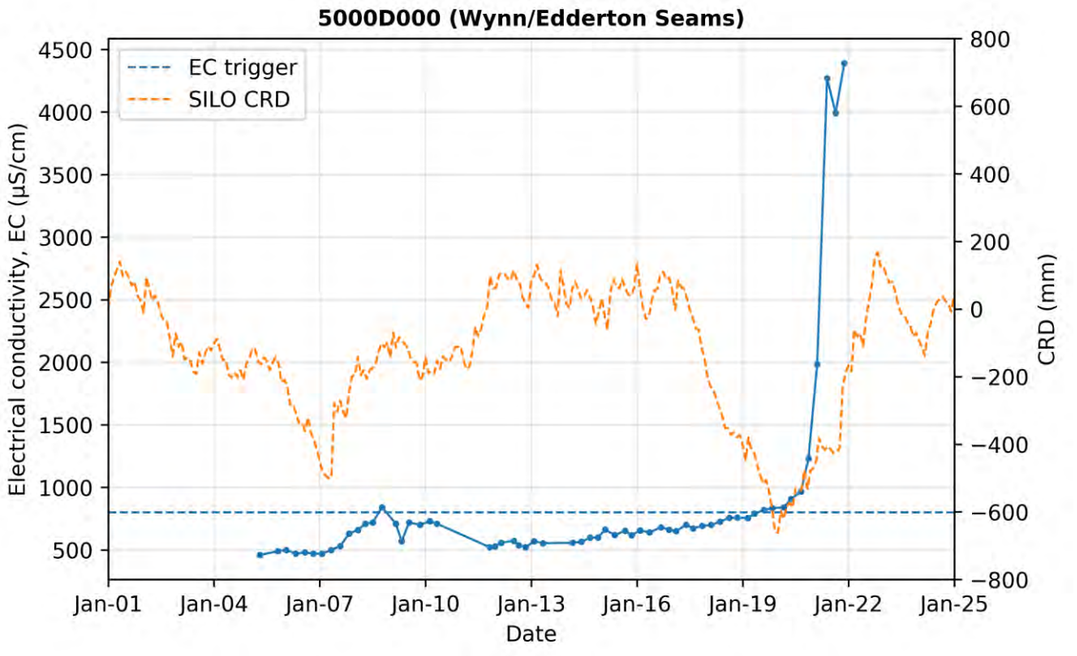
Jan-25


5000D000 (Wynn/Edderton Seams)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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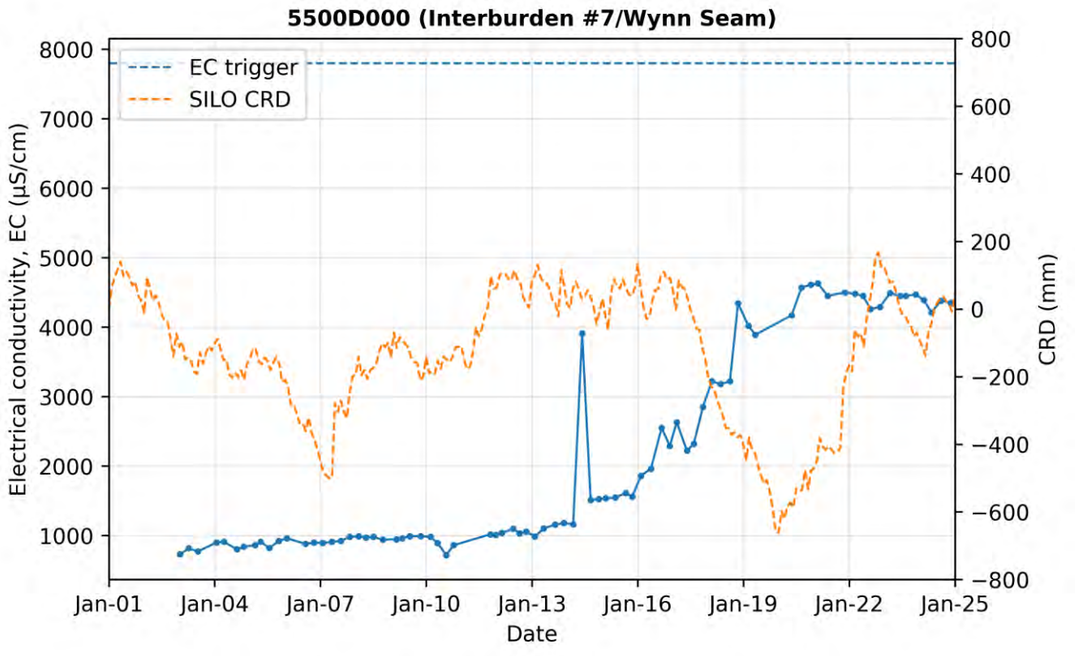
Jan-25


5500D000 (Interburden #7/Wynn Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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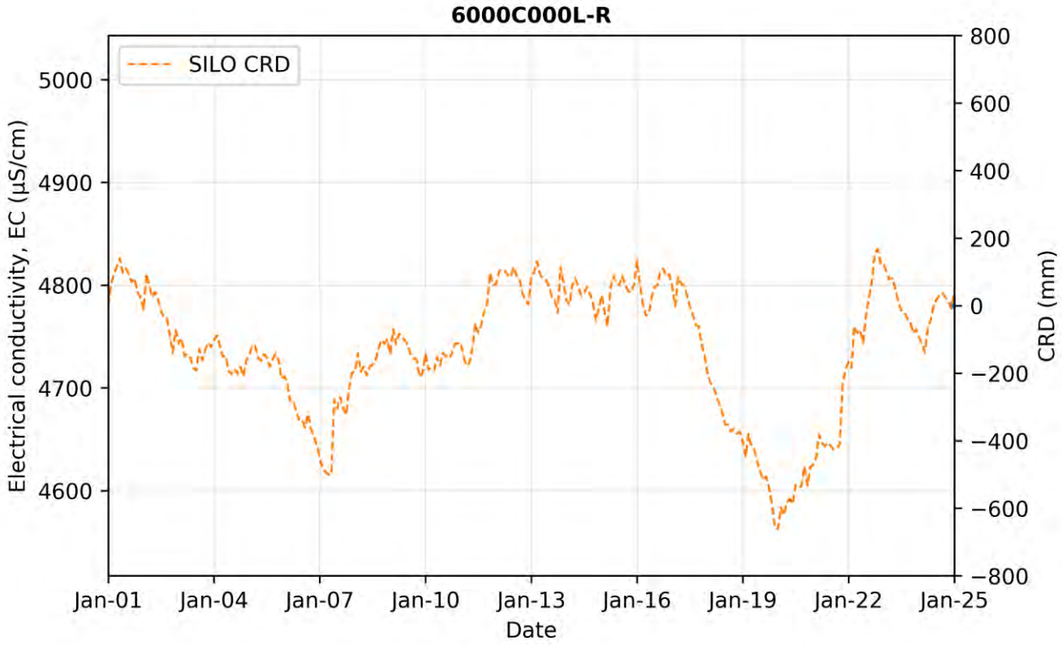
6000C000L-R
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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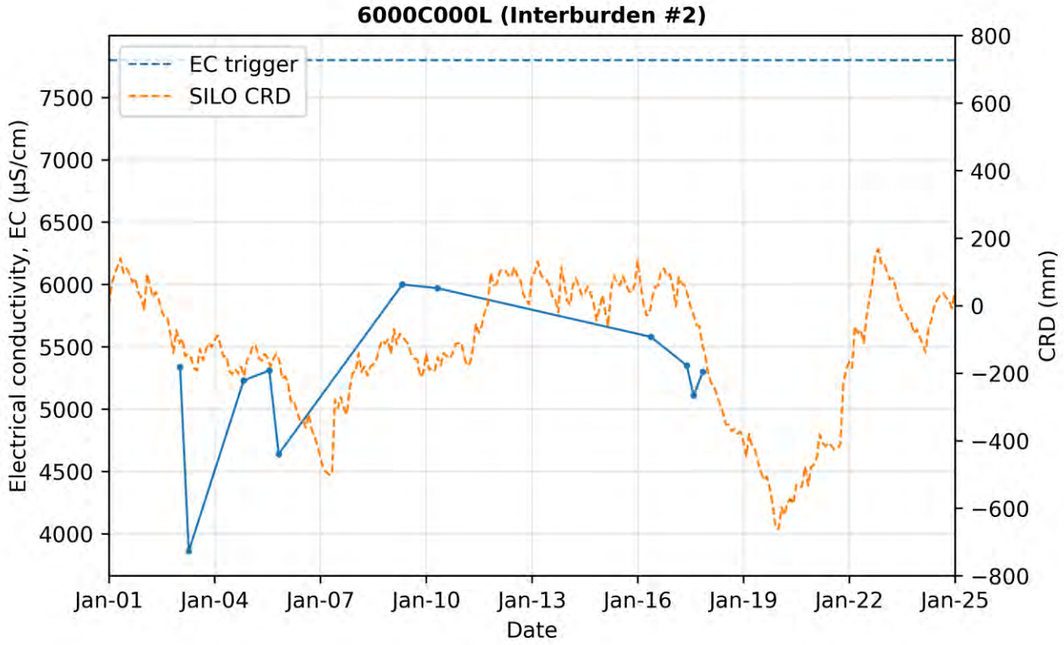
6000C000L (Interburden #2)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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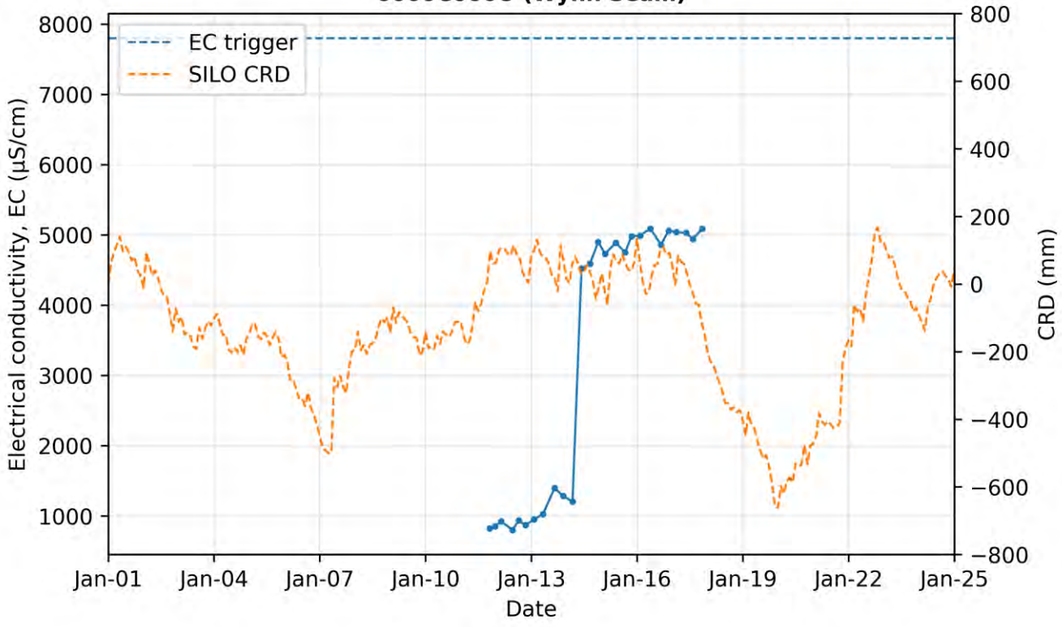
Jan-25


6000C000U (Wynn Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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Jan-22
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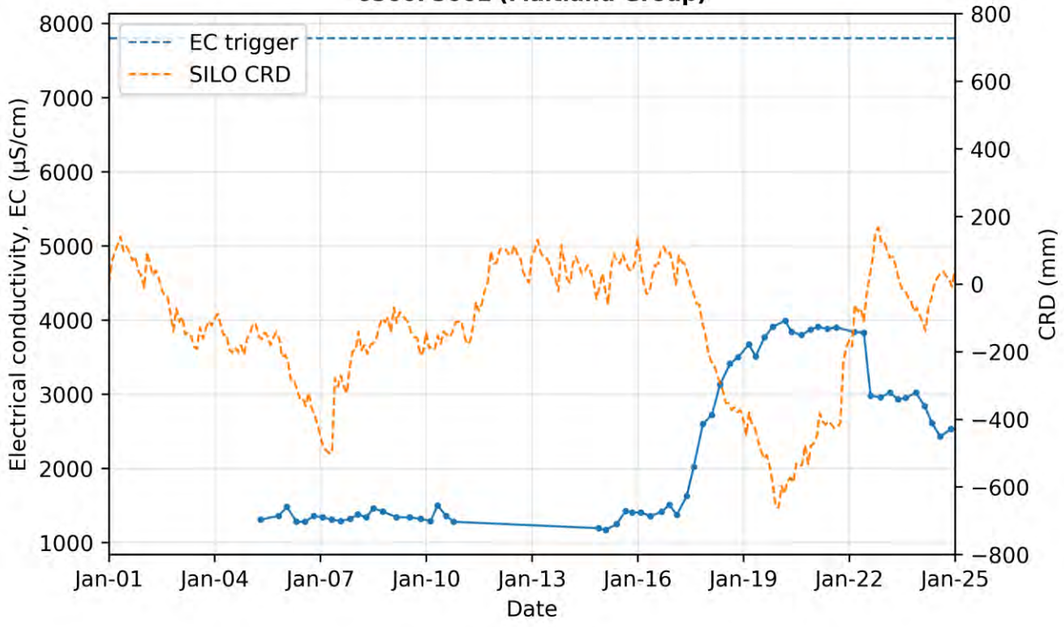
6500F500L (Maitland Group)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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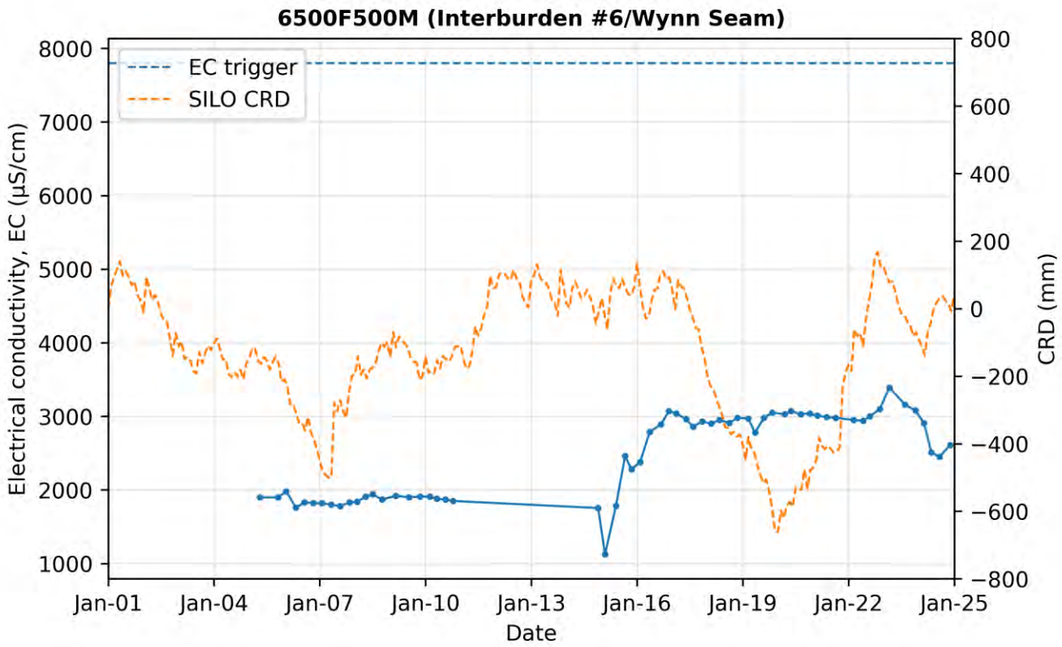
Jan-22
Jan-25


6500F500M (Interburden #6/Wynn Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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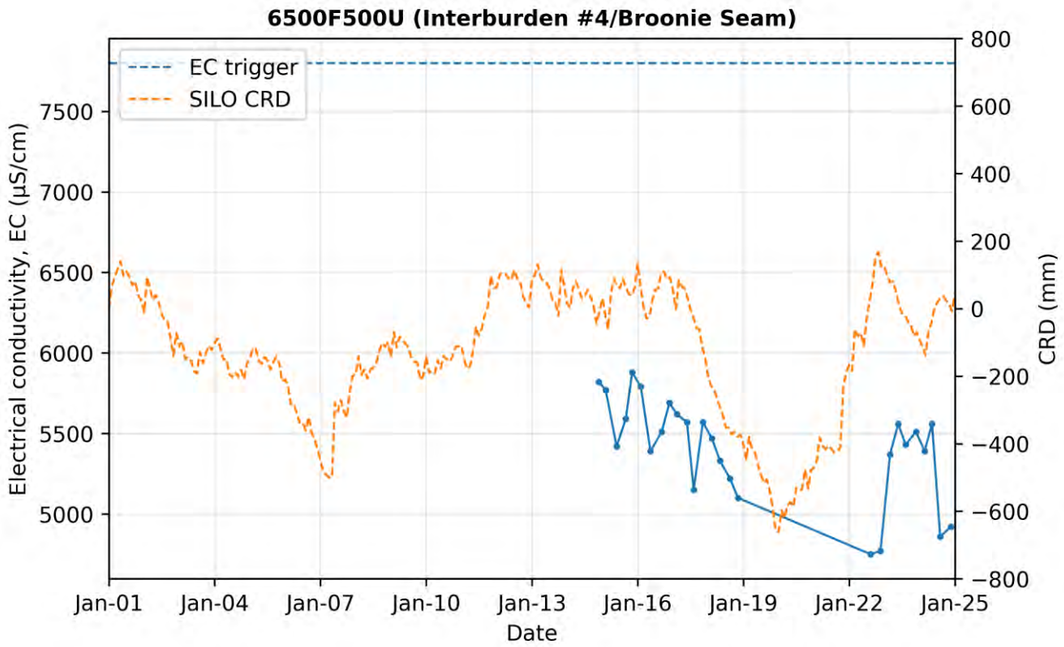
Jan-22
Jan-25


6500F500U (Interburden #4/Broonie Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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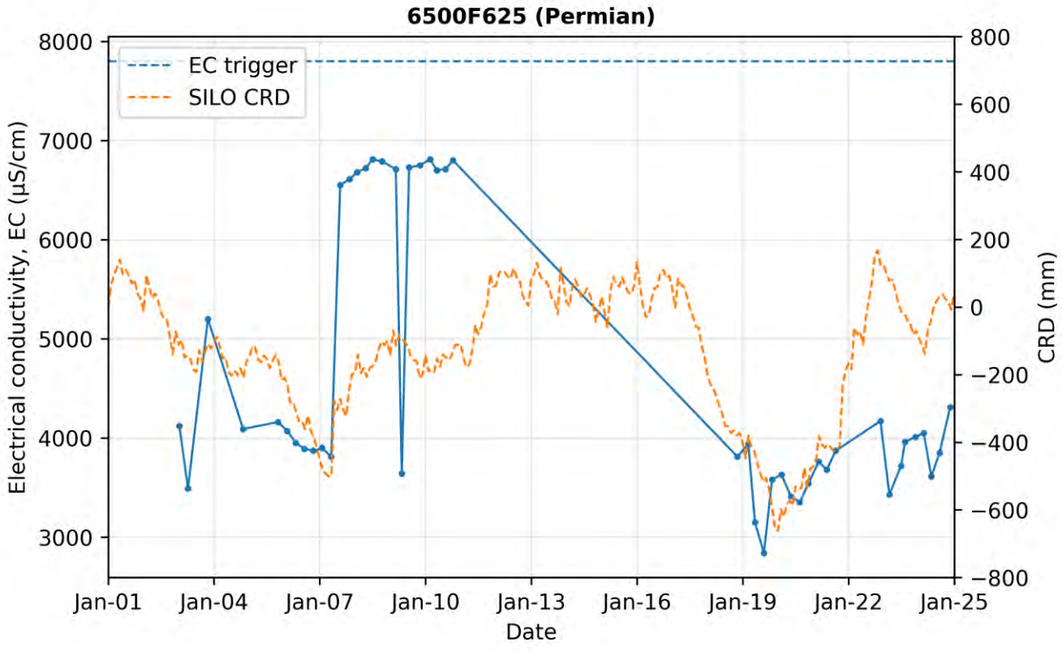
Jan-22
Jan-25


6500F625 (Permian)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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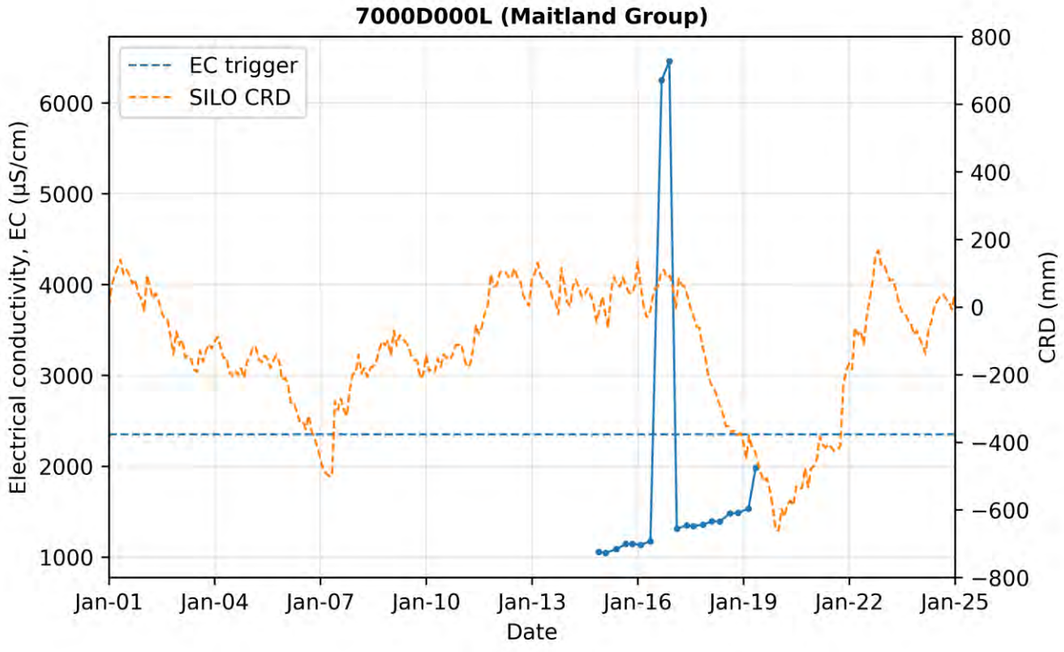
Jan-22
Jan-25


7000D000L (Maitland Group)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
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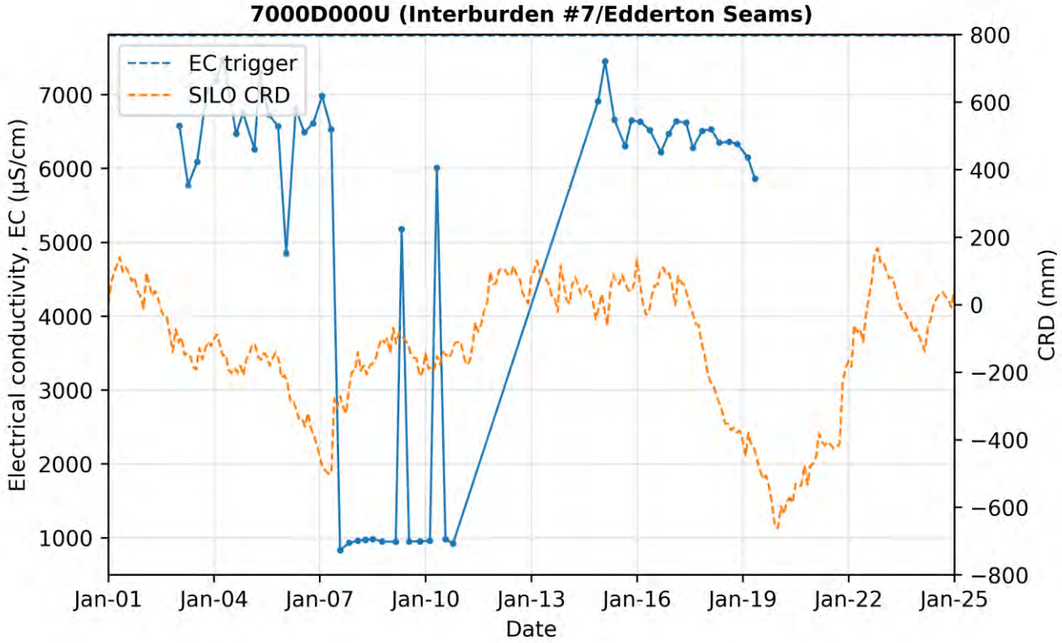
Jan-22
Jan-25


7000D000U (Interburden #7/Edderton Seams)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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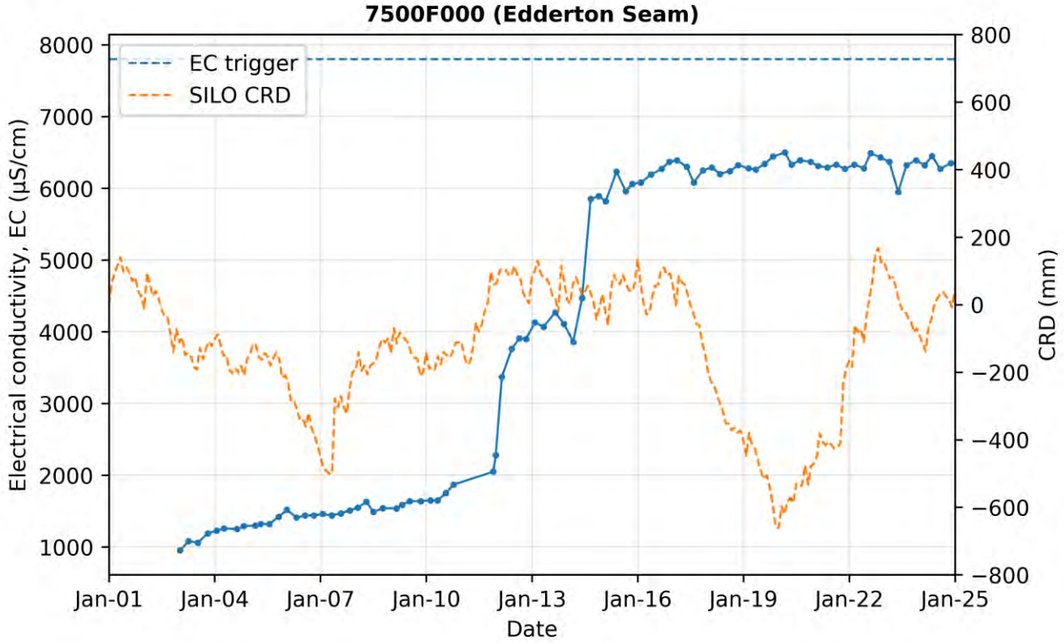
7500F000 (Edderton Seam)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
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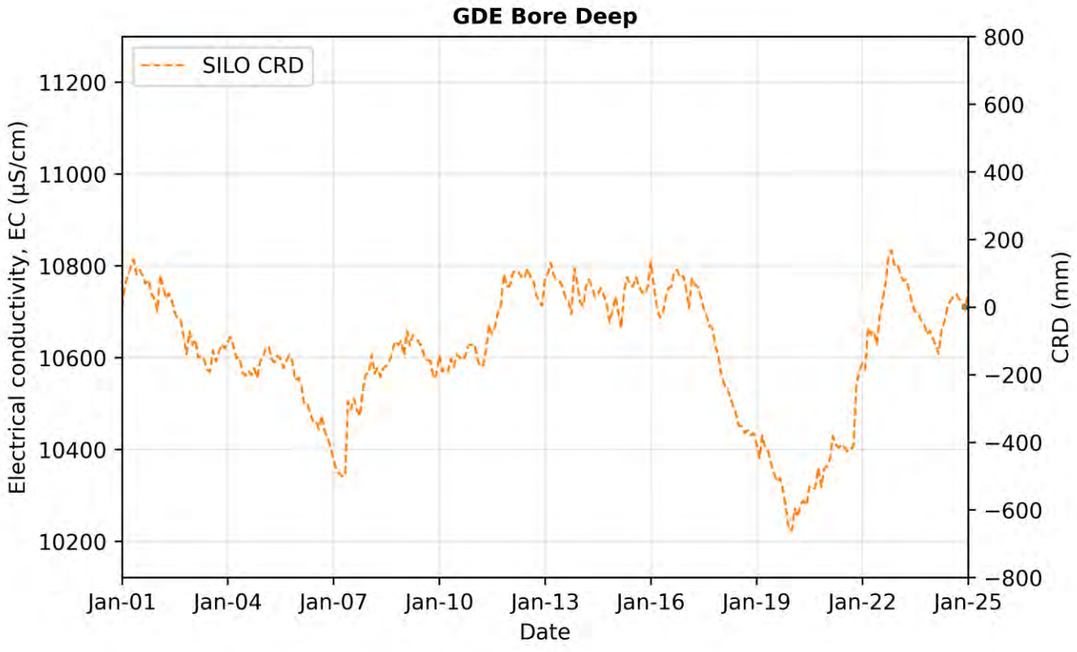
GDE Bore Deep
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
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Jan-22
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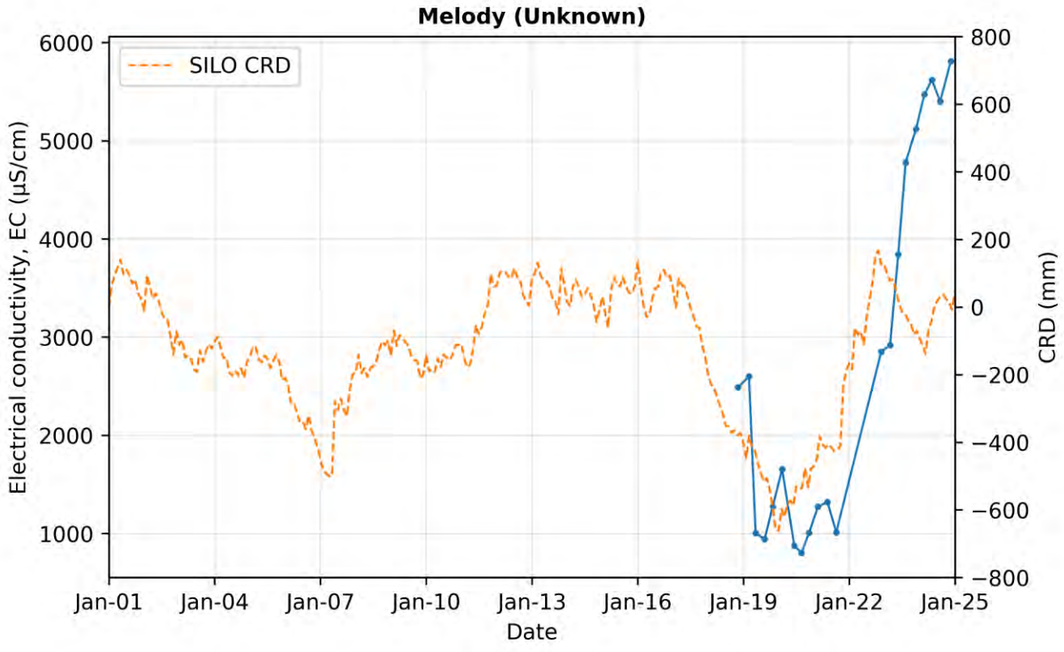
Melody (Unknown)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
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Jan-07
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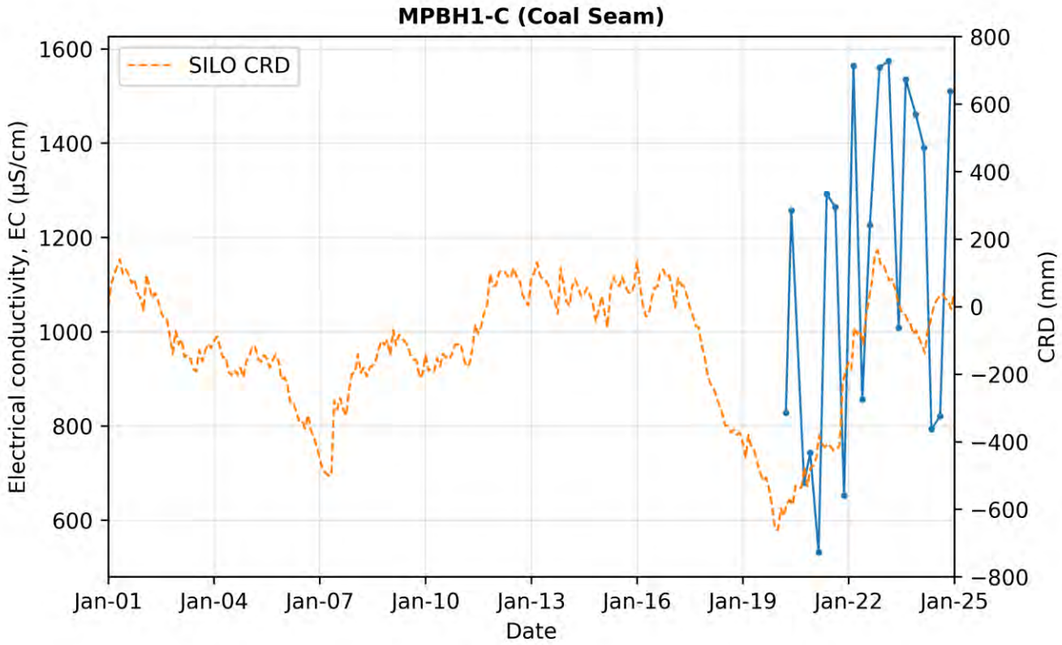
Jan-22
Jan-25


MPBH1-C (Coal Seam)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
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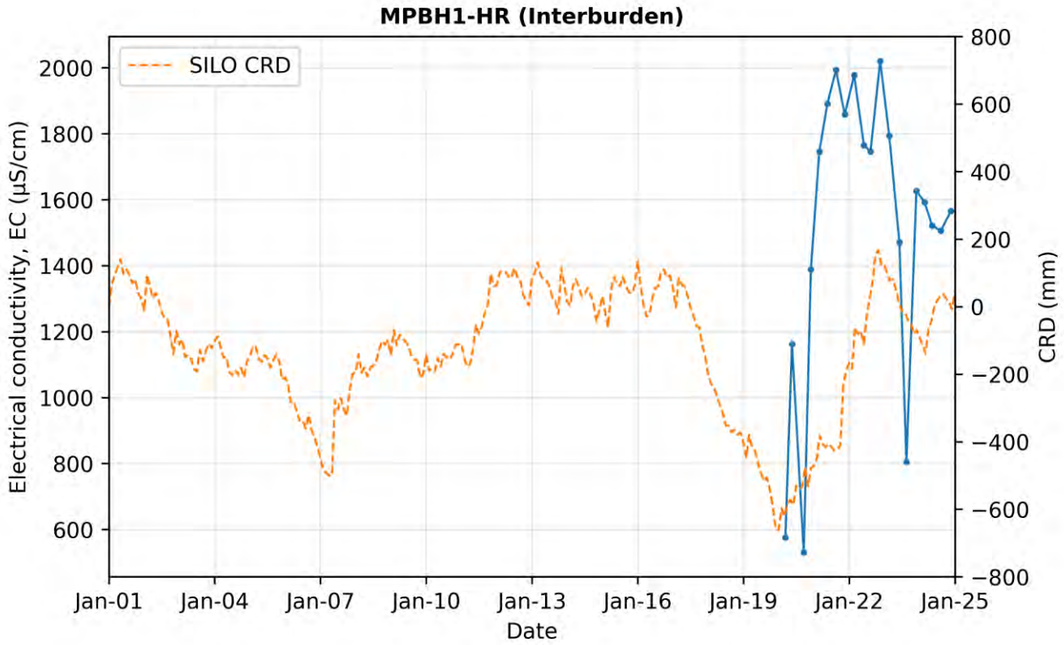
Jan-22
Jan-25


MPBH1-HR (Interburden)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
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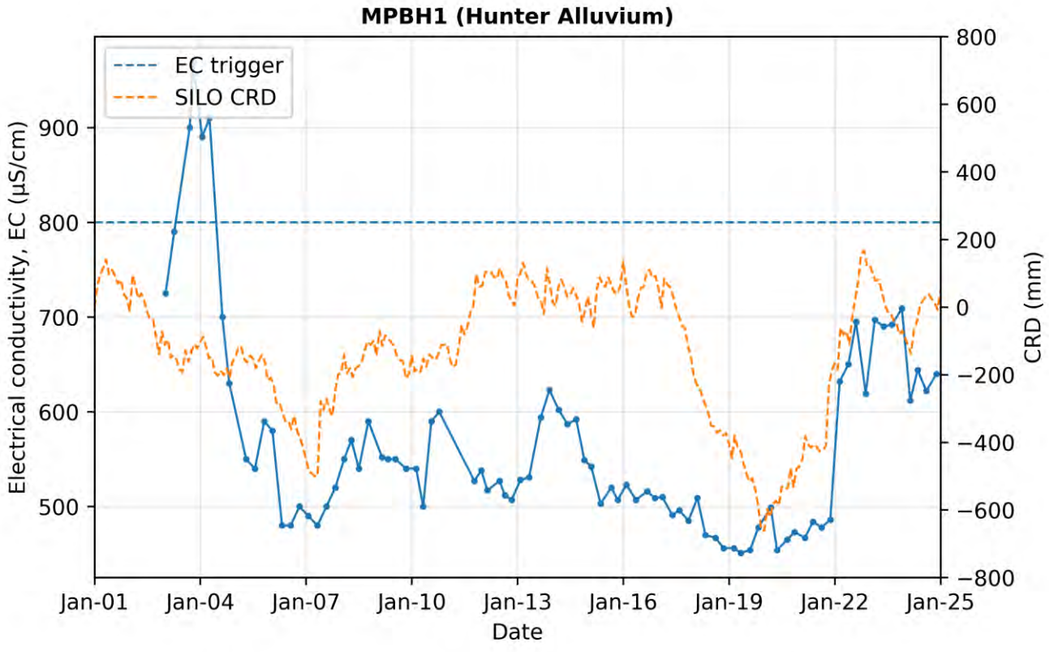
Jan-22
Jan-25


MPBH1 (Hunter Alluvium)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
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Jan-07
Jan-10
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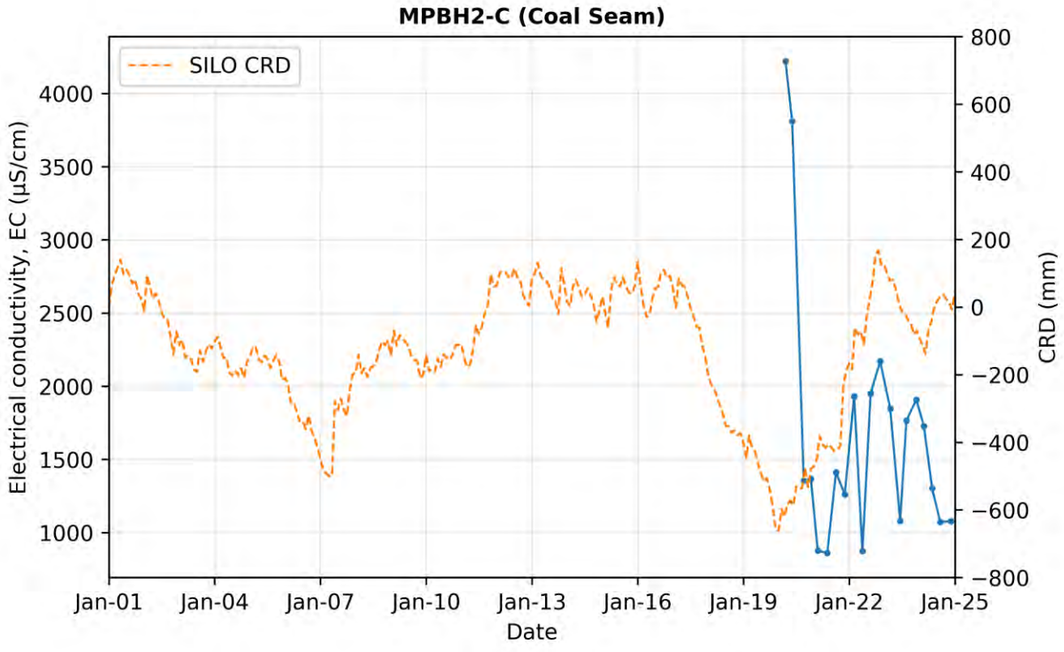
Jan-22
Jan-25


MPBH2-C (Coal Seam)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
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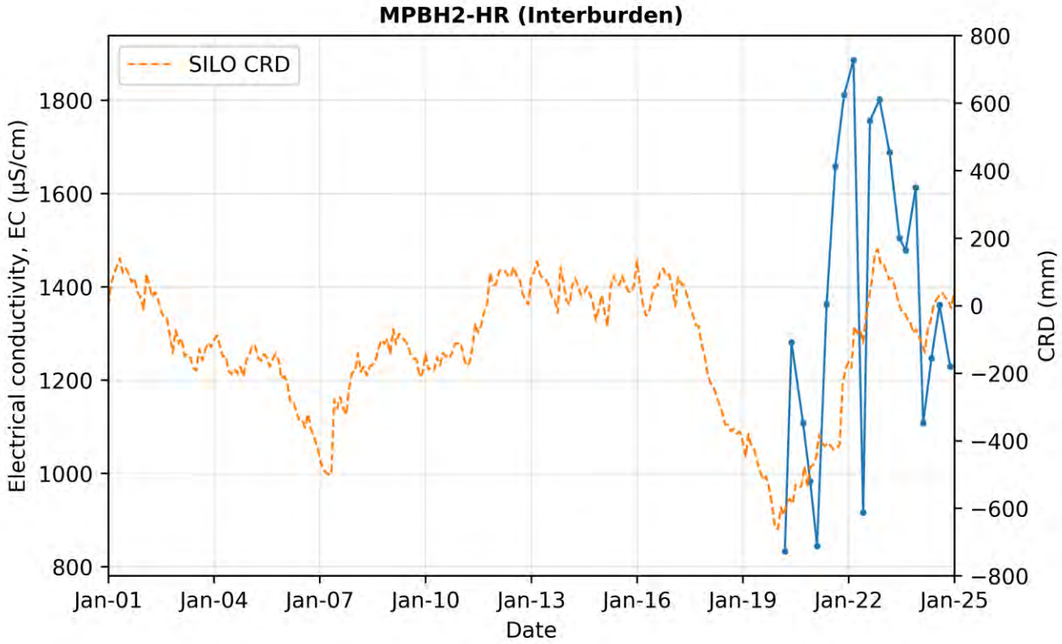
Jan-19
Jan-22
Jan-25


MPBH2-HR (Interburden)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
800
1000
1200
1400
1600
1800
−800
−600
−400
−200
0
200
400
600
800
Jan-01
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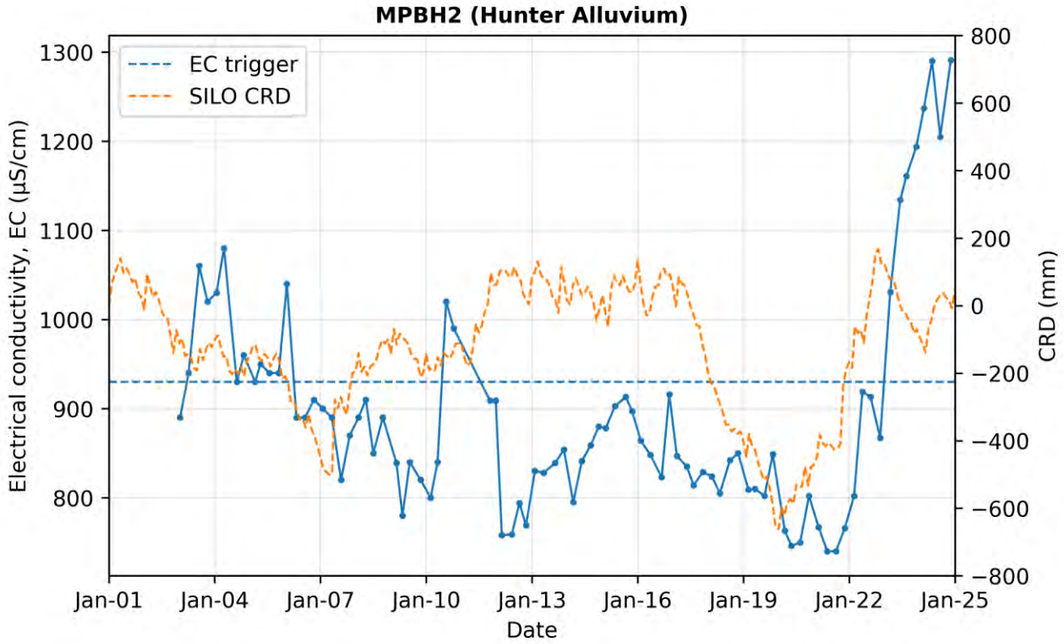
Jan-22
Jan-25


MPBH2 (Hunter Alluvium)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
800
900
1000
1100
1200
1300
−800
−600
−400
−200
0
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800
Jan-01
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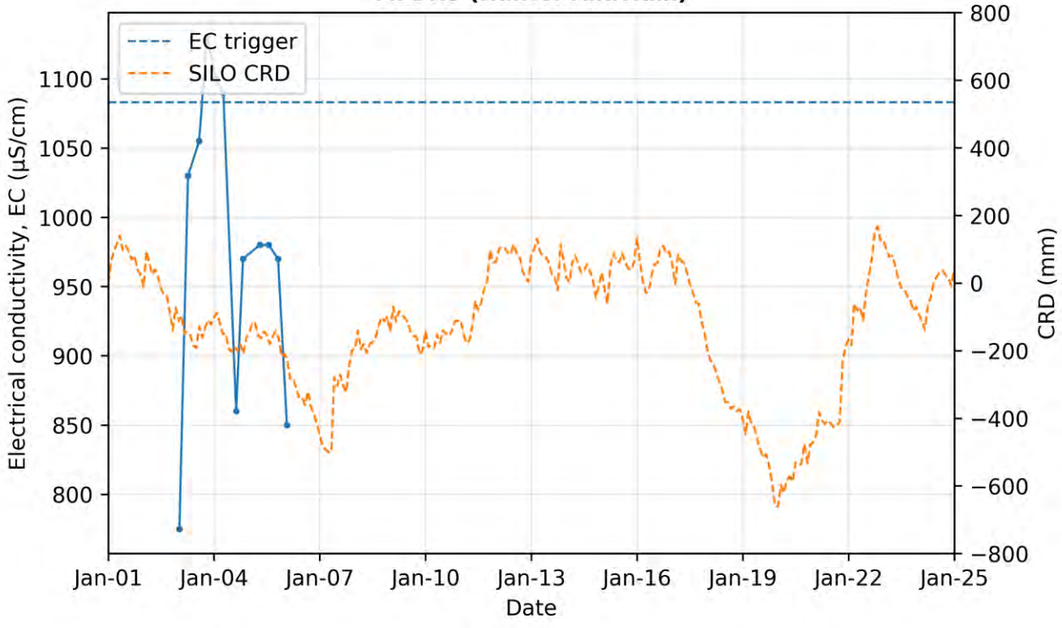
Jan-25


MPBH3 (Hunter Alluvium)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
800
850
900
950
1000
1050
1100
−800
−600
−400
−200
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Jan-01
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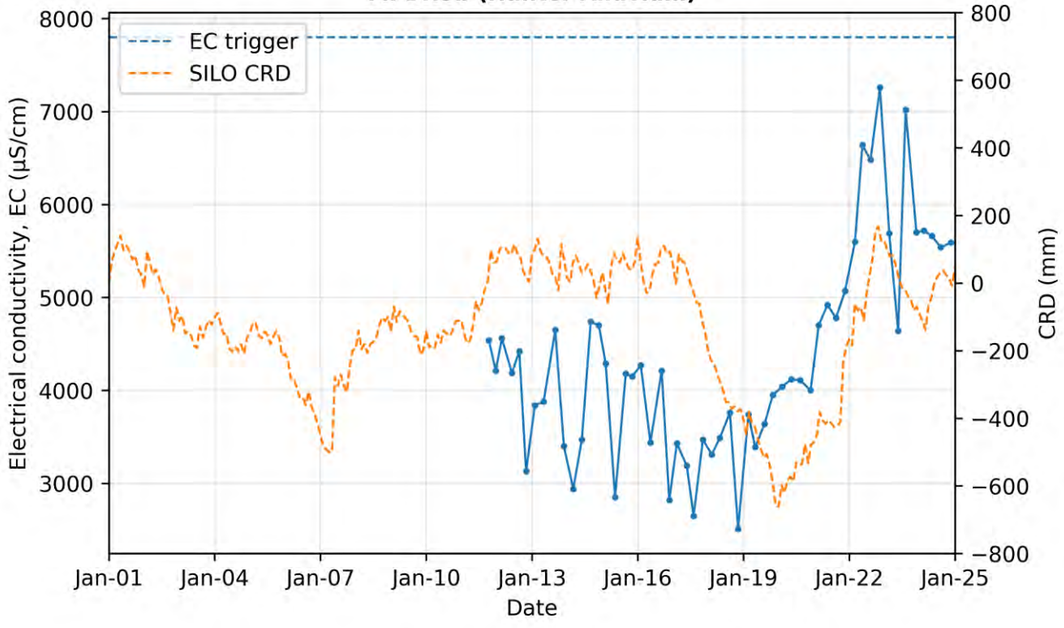
MPBH3b (Hunter Alluvium)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
3000
4000
5000
6000
7000
8000
−800
−600
−400
−200
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800
Jan-01
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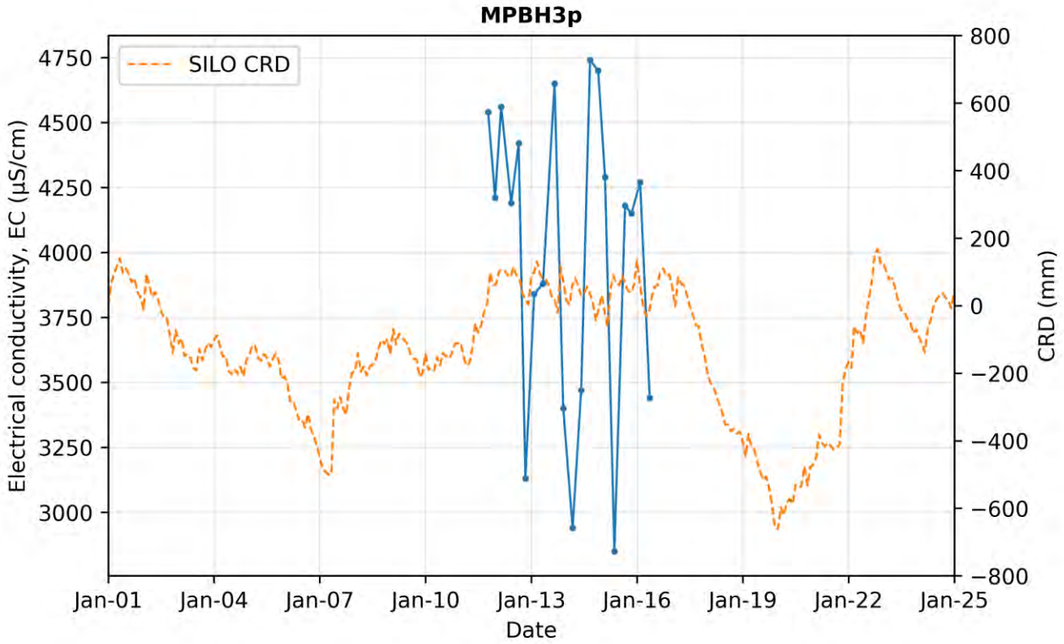
Jan-25


MPBH3p
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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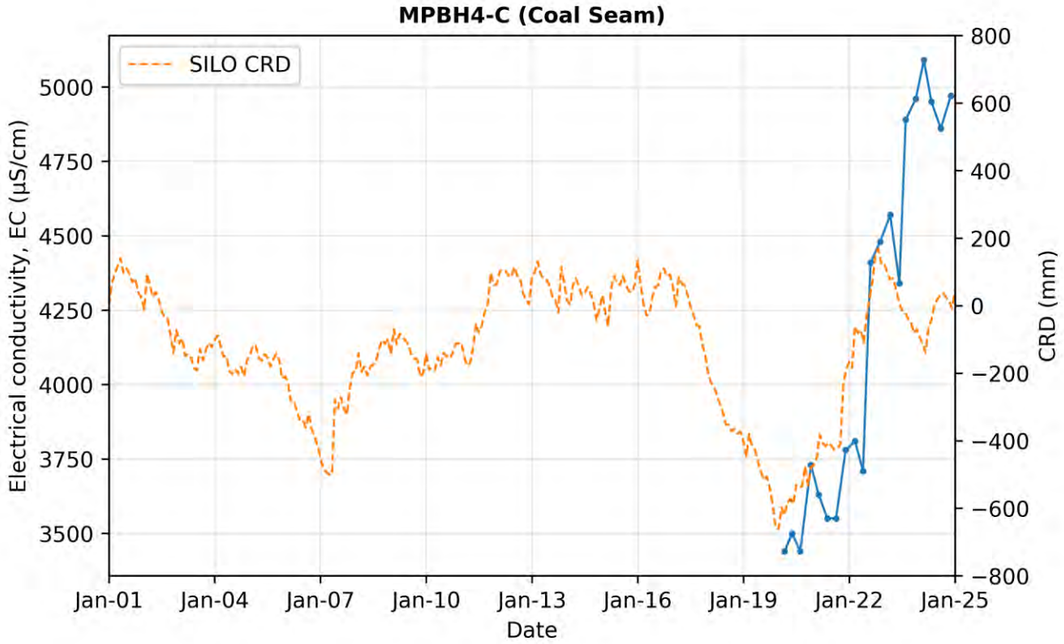
Jan-25


MPBH4-C (Coal Seam)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
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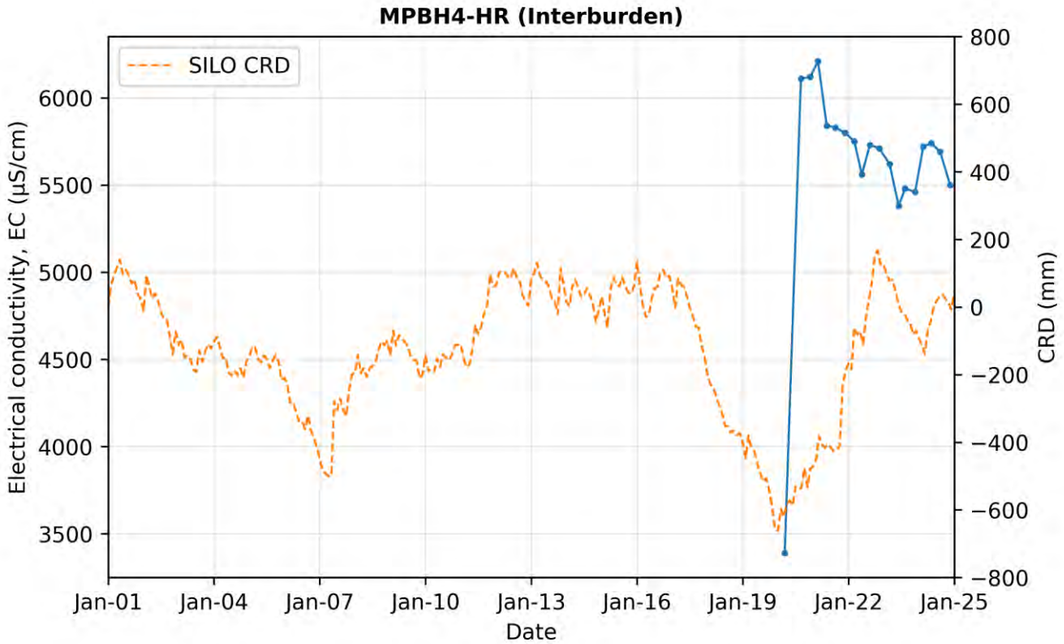
Jan-25


MPBH4-HR (Interburden)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
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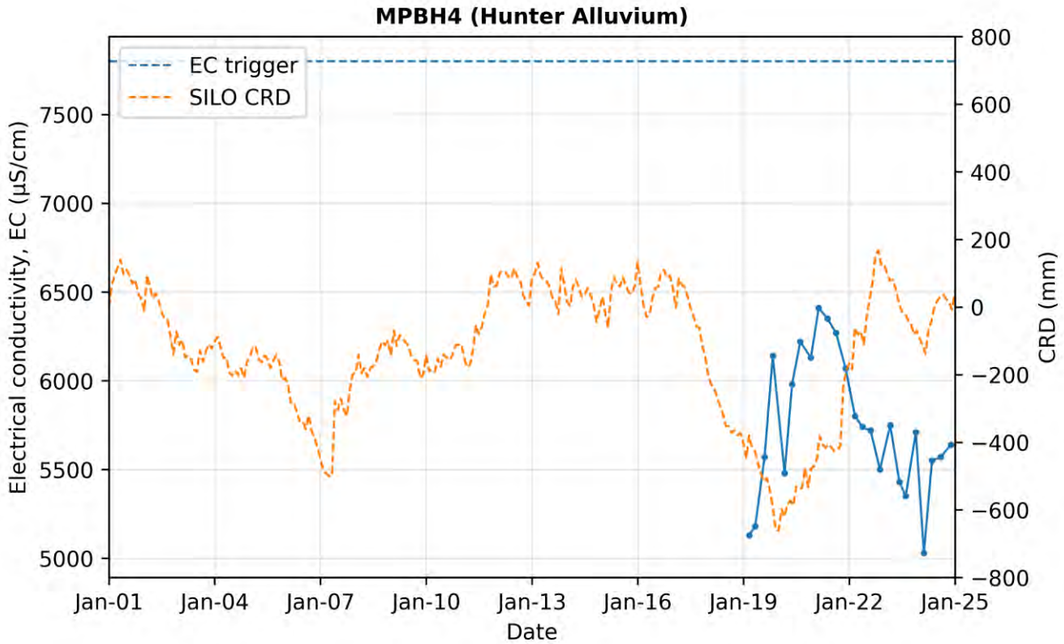
Jan-22
Jan-25


MPBH4 (Hunter Alluvium)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
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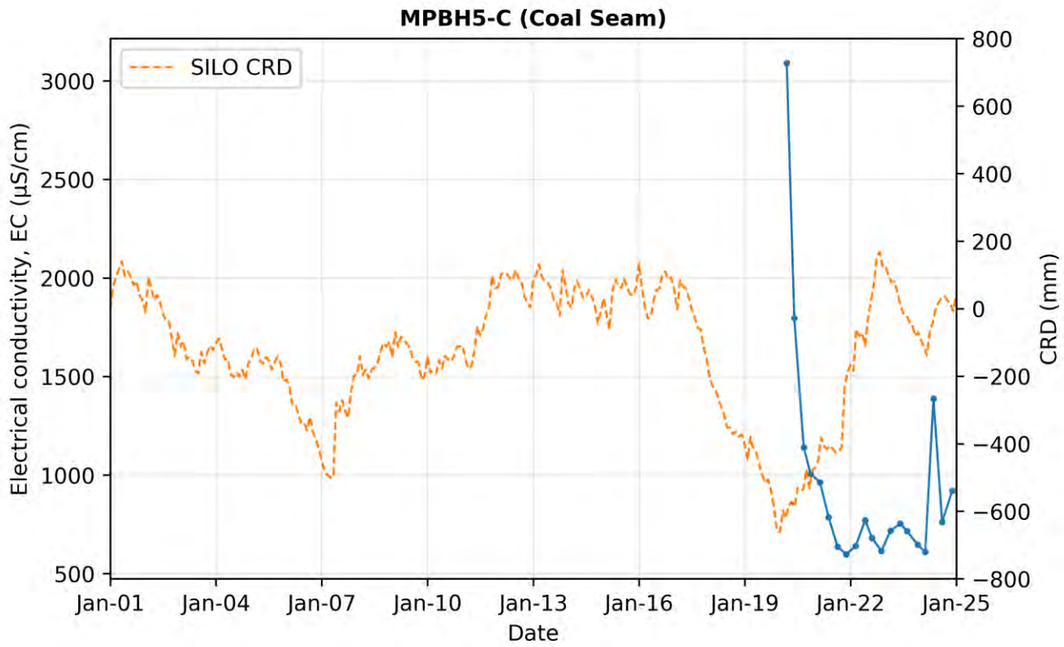
Jan-22
Jan-25


MPBH5-C (Coal Seam)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
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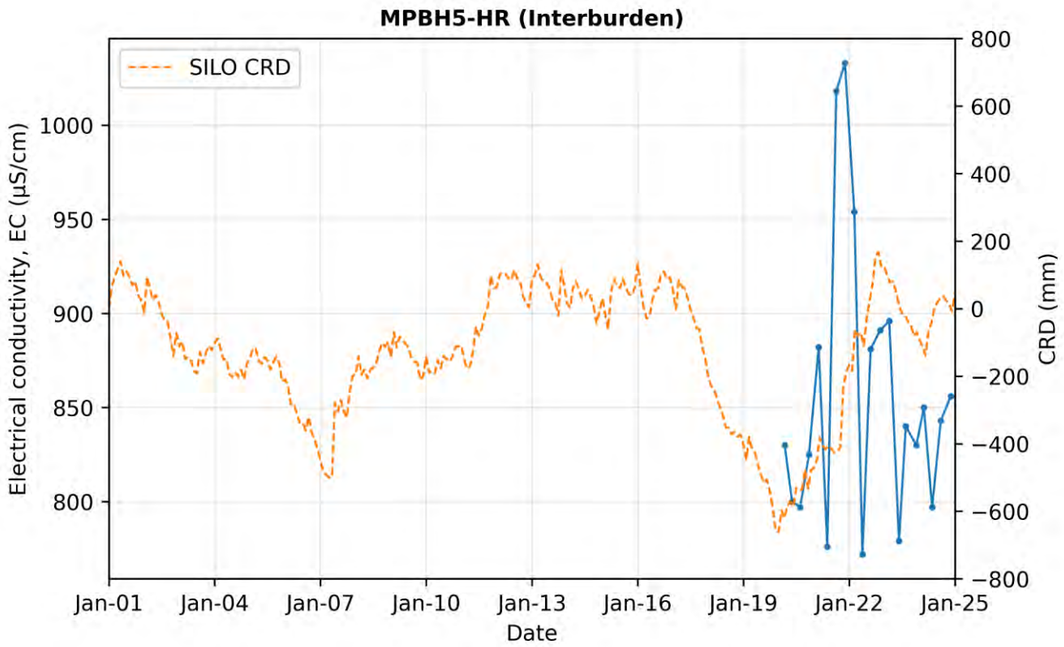
Jan-19
Jan-22
Jan-25


MPBH5-HR (Interburden)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
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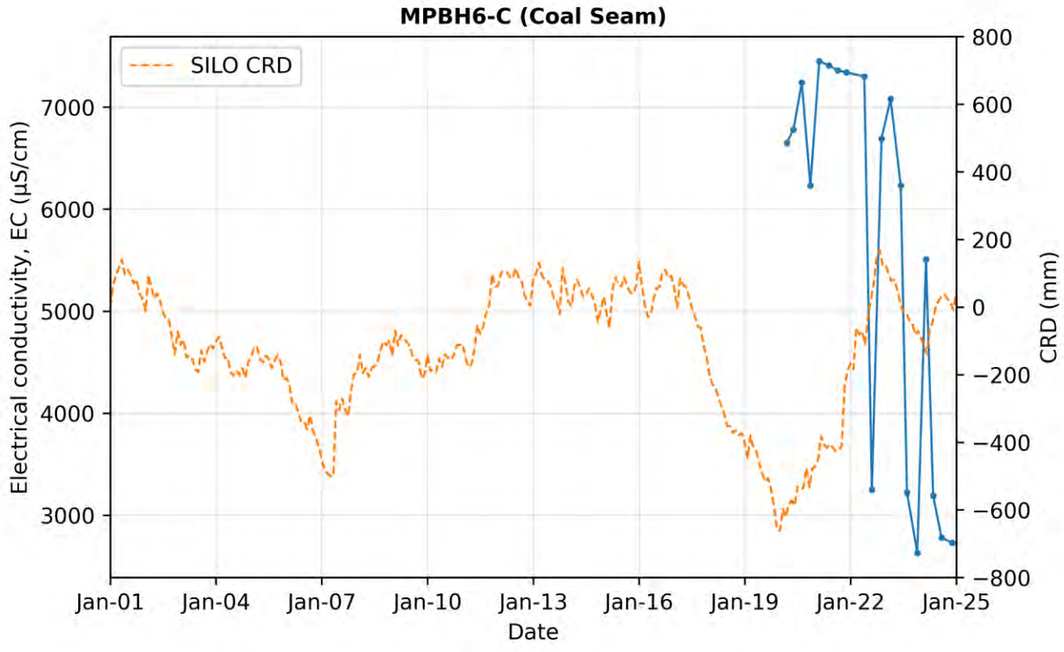
Jan-19
Jan-22
Jan-25


MPBH6-C (Coal Seam)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
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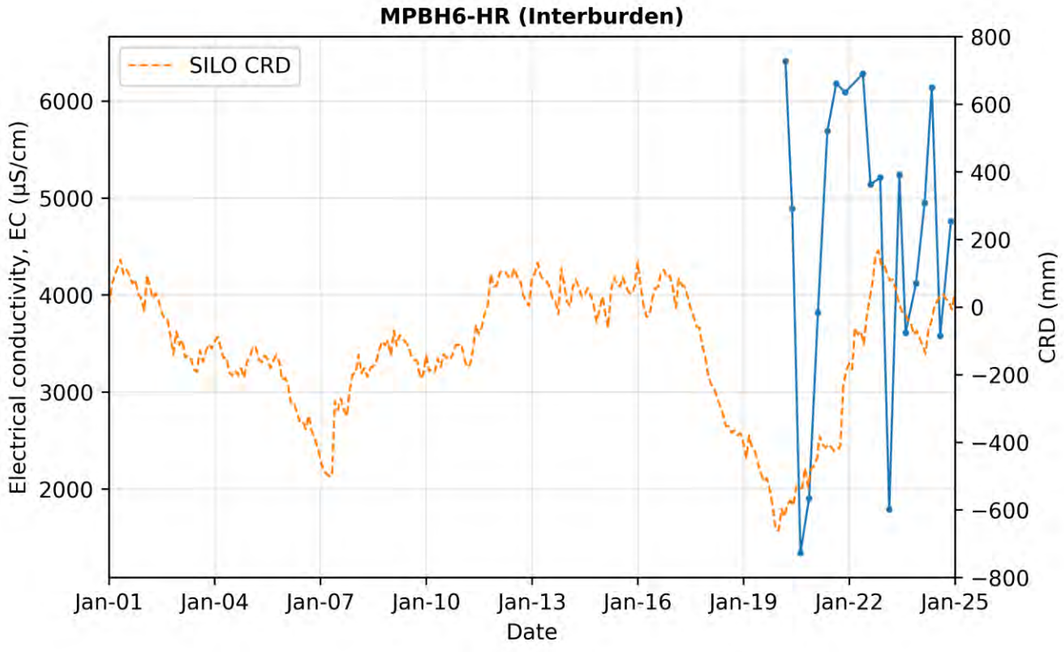
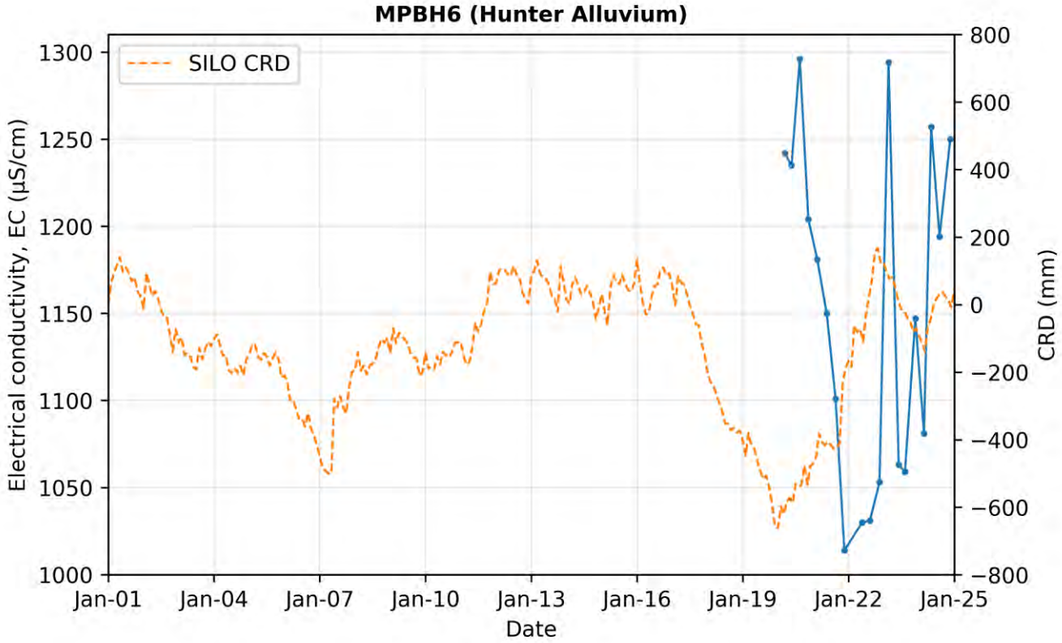
Jan-19
Jan-22
Jan-25


MPBH6-HR (Interburden)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


MPBH6 (Hunter Alluvium)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
1300
1250
1200
1150
1100
1050
1000
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
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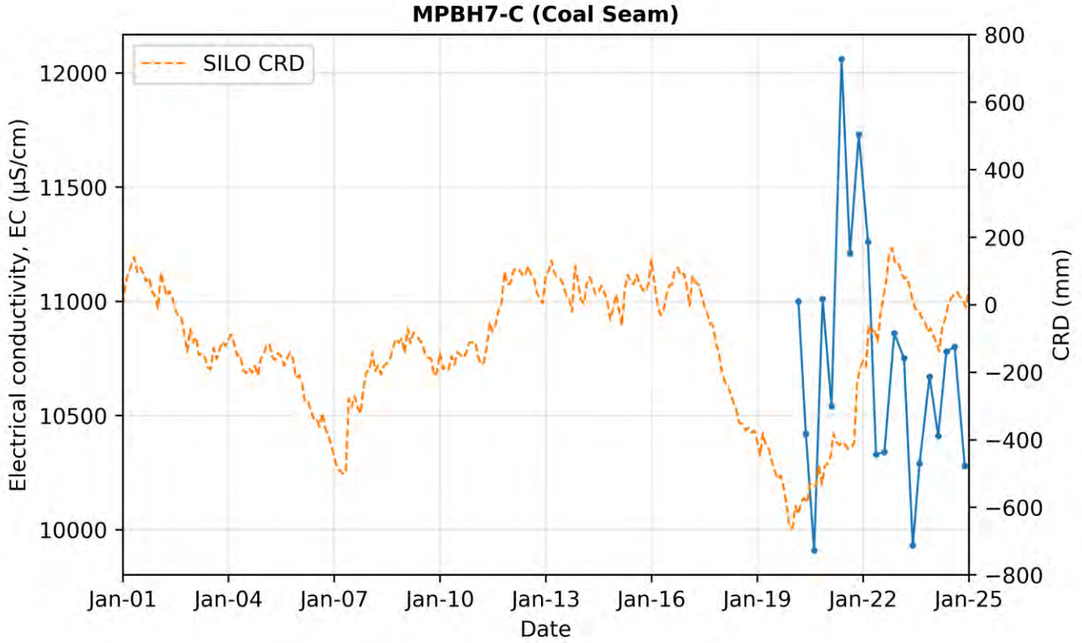
Jan-25


MPBH7-C (Coal Seam)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
12000
11500
11000
10500
10000
800
600
400
200
0
−200
−400
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Jan-01
Jan-04
Jan-07
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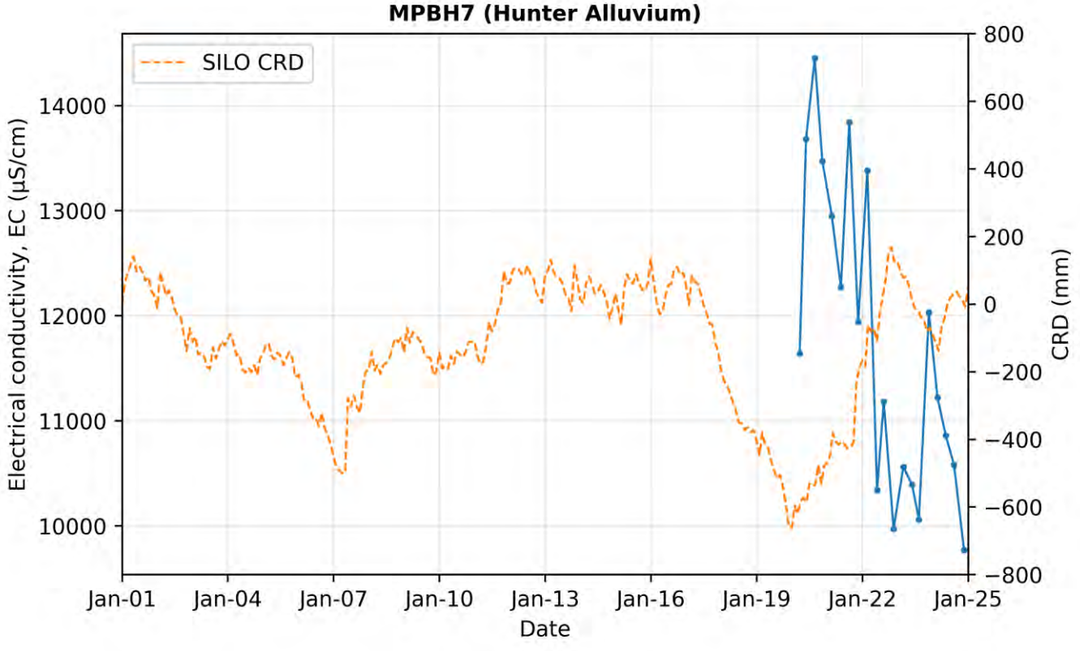
Jan-25


MPBH7 (Hunter Alluvium)
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
14000
13000
12000
11000
10000
800
600
400
200
0
−200
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Jan-01
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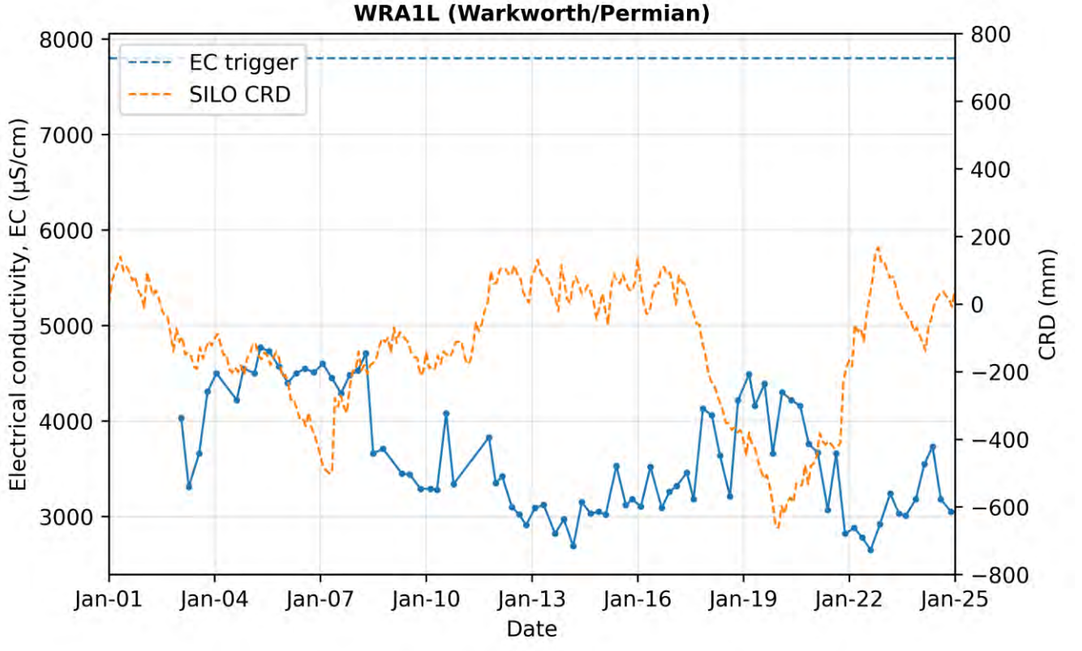
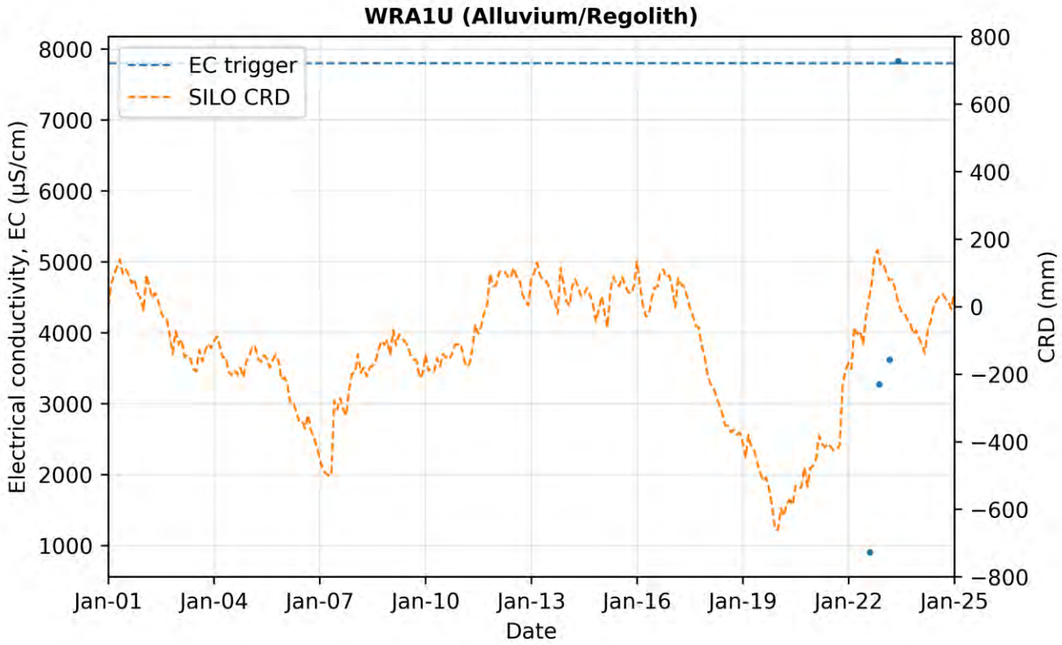
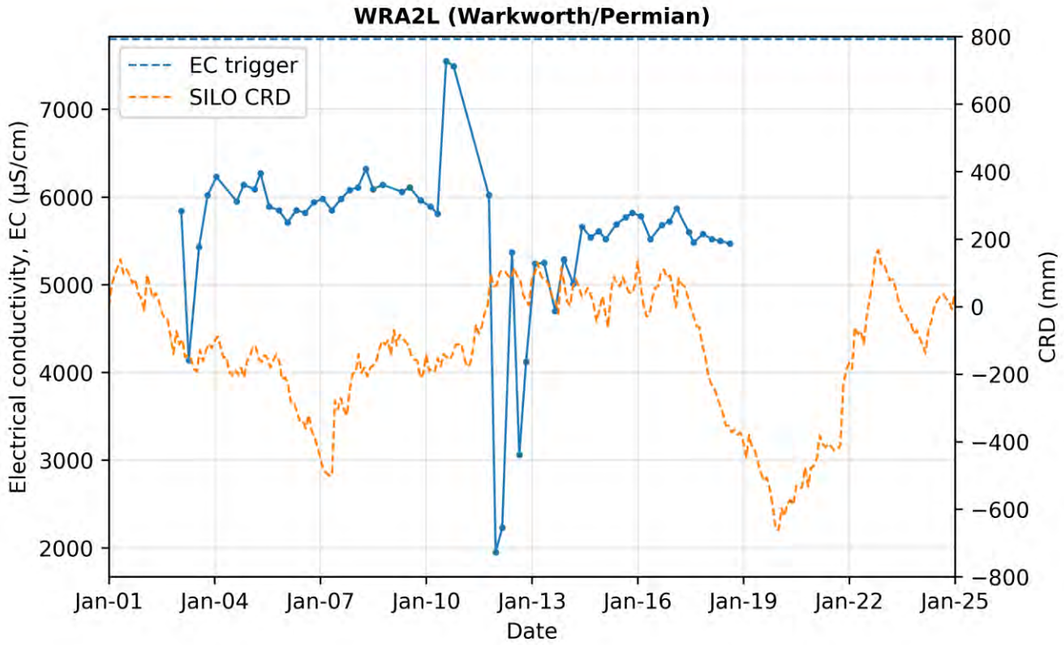
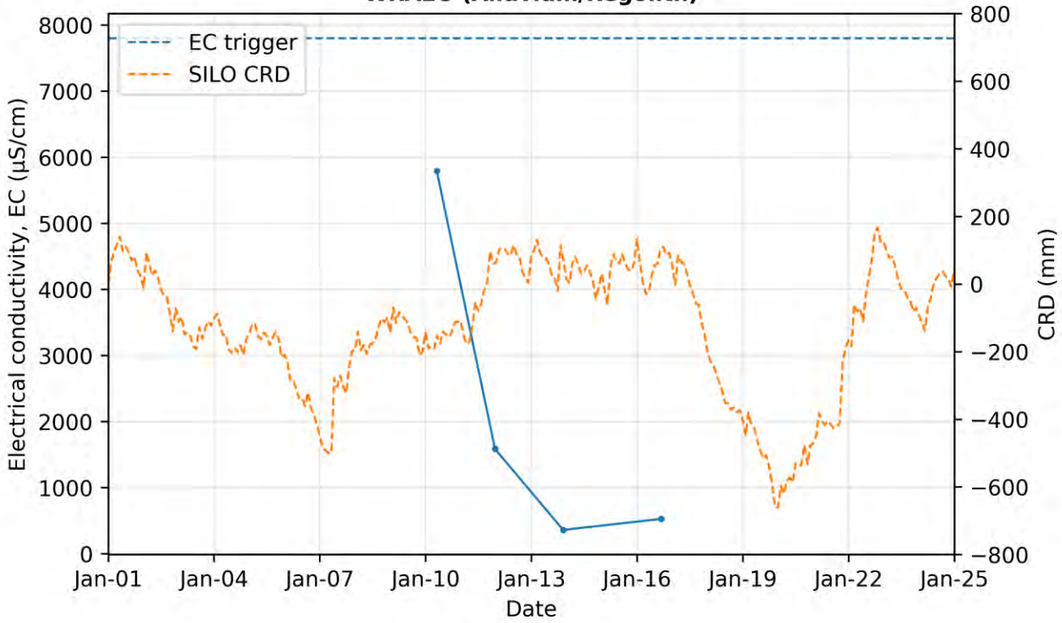
Jan-25

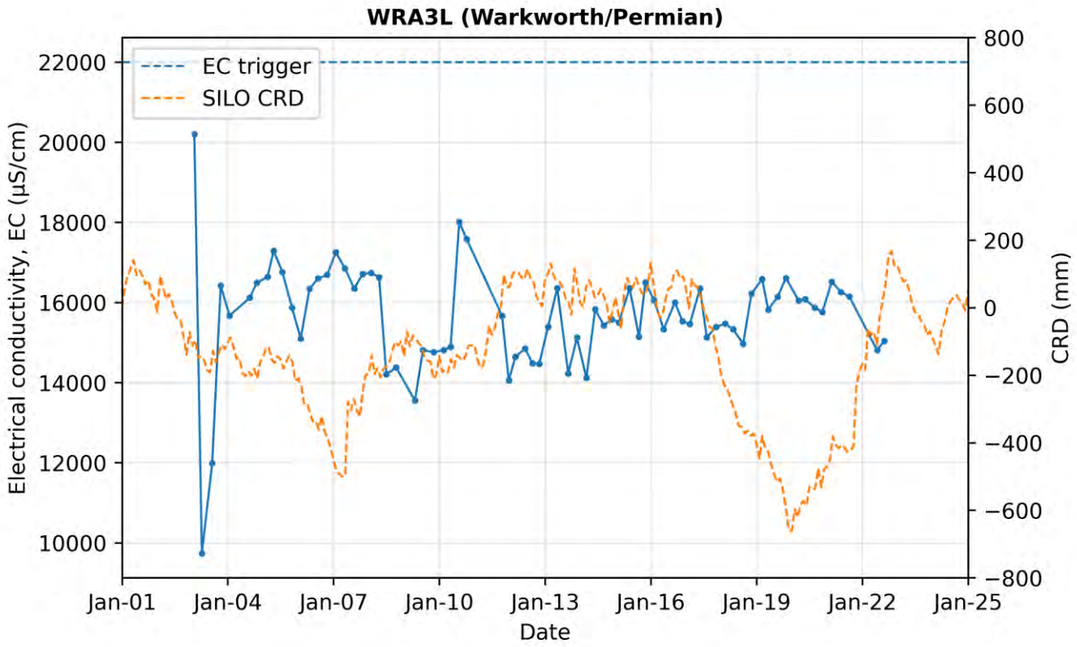

WRA1L (Warkworth/Permian)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
8000
7000
6000
5000
4000
3000
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

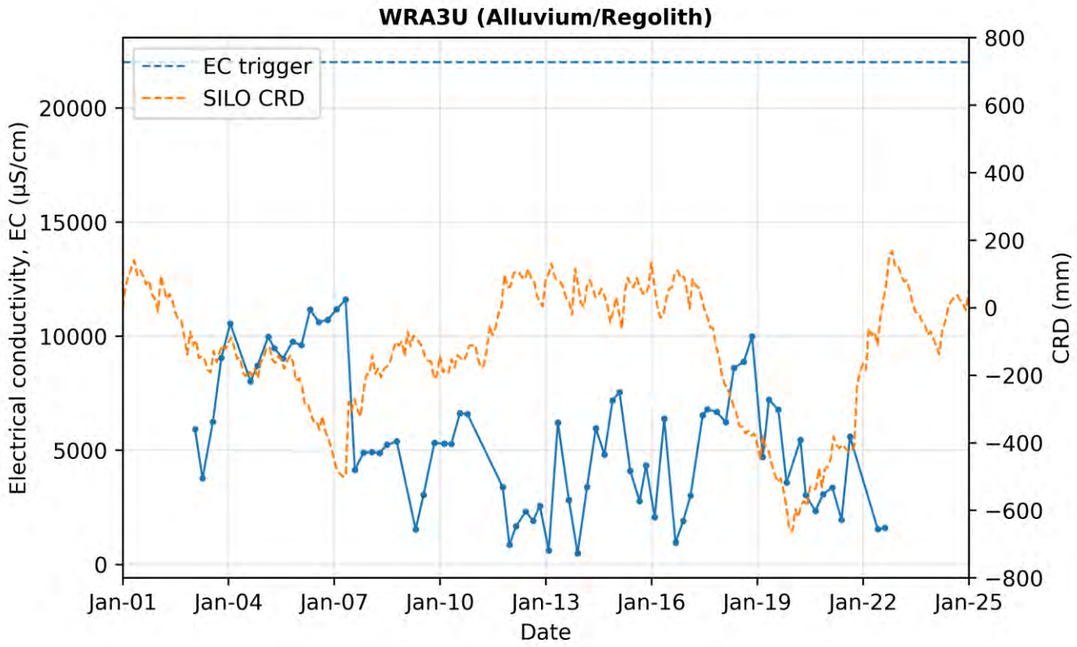

WRA1U (Alluvium/Regolith)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA2L (Warkworth/Permian)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

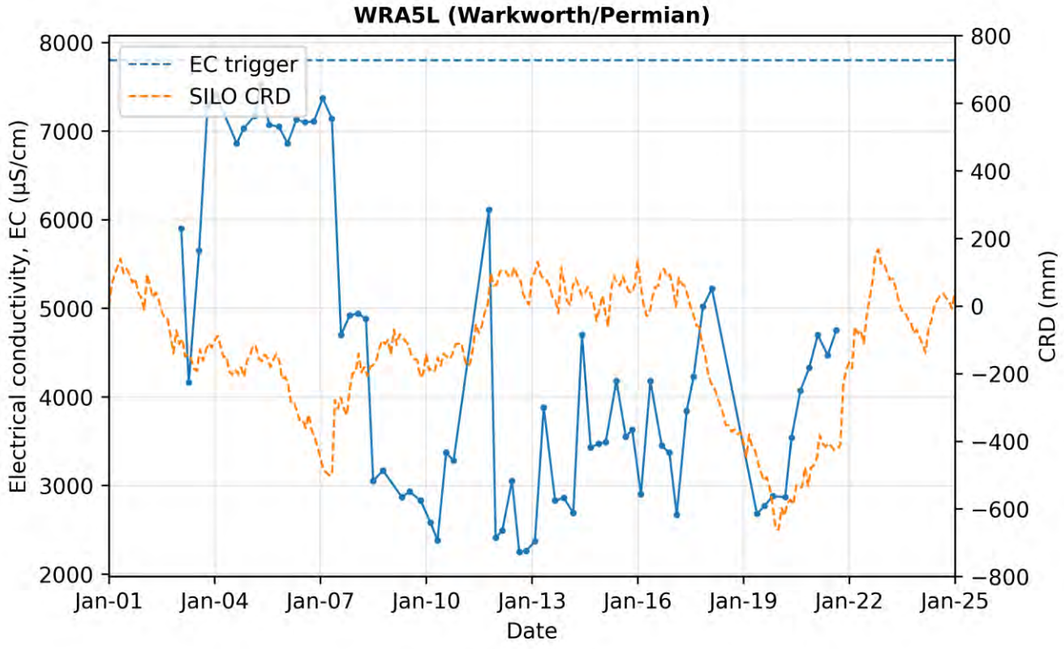

WRA2U (Alluvium/Regolith)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA3L-R
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

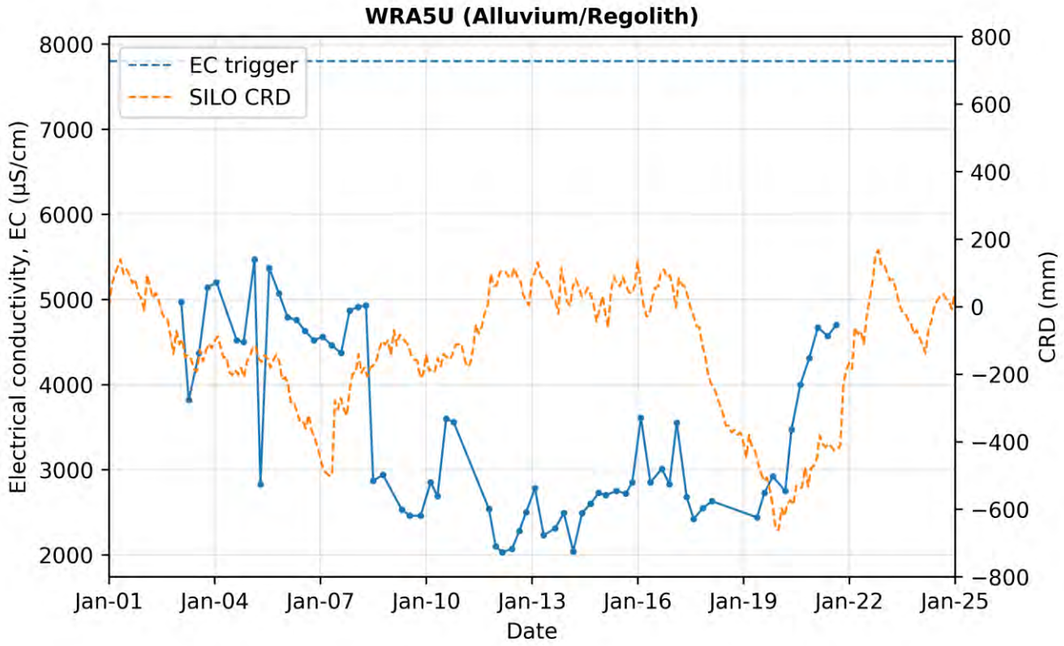

WRA3L (Warkworth/Permian)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

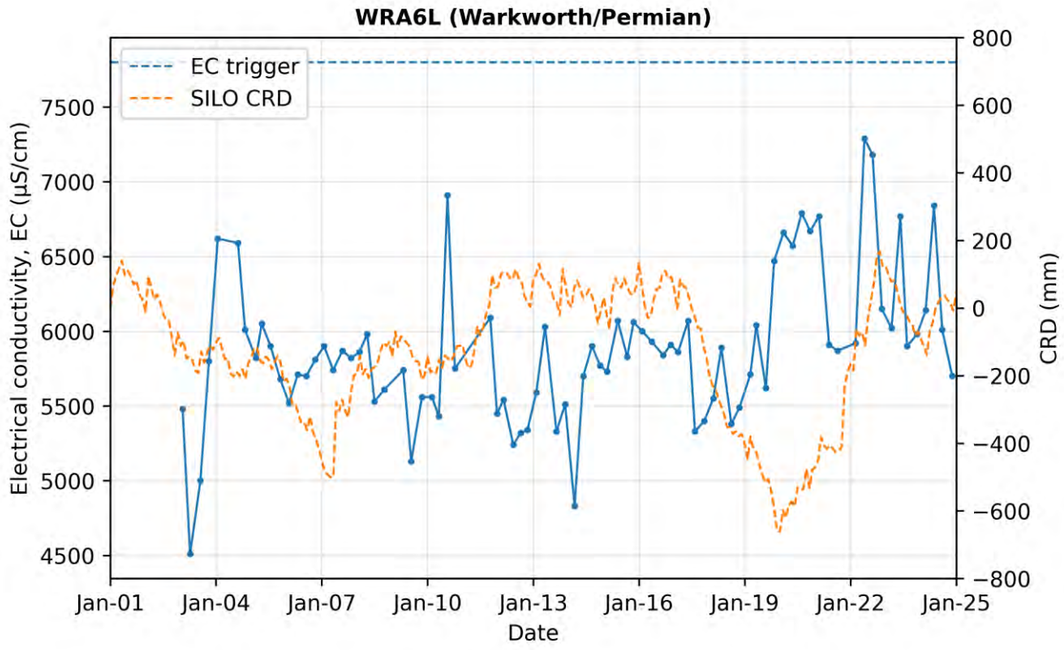

WRA3U (Alluvium/Regolith)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

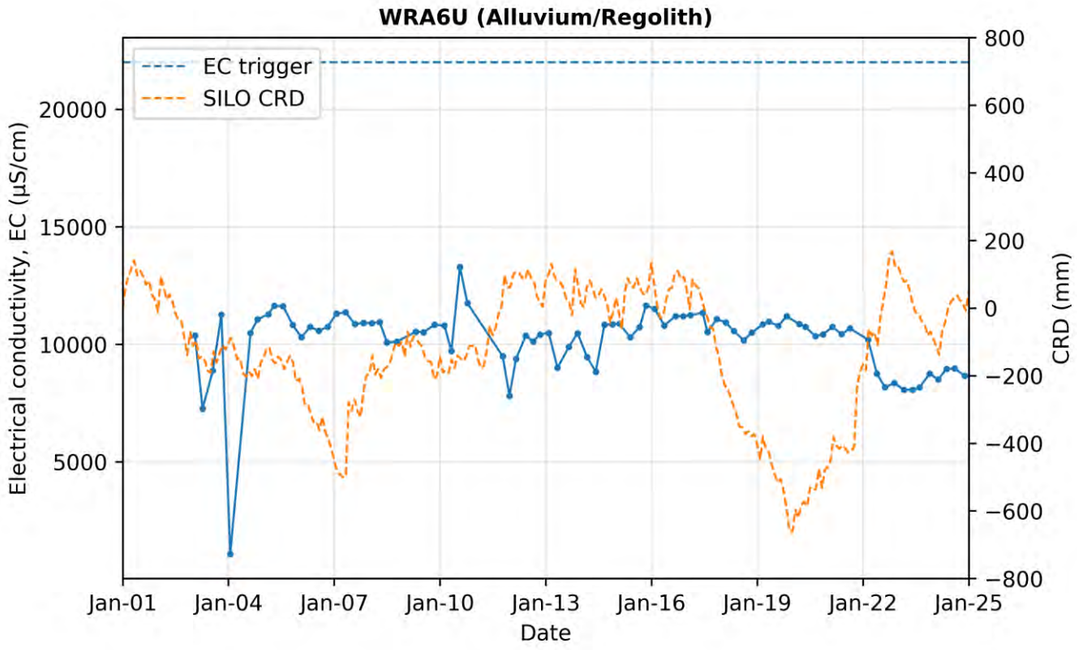

WRA5L-R
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA5L (Warkworth/Permian)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA5U-R
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

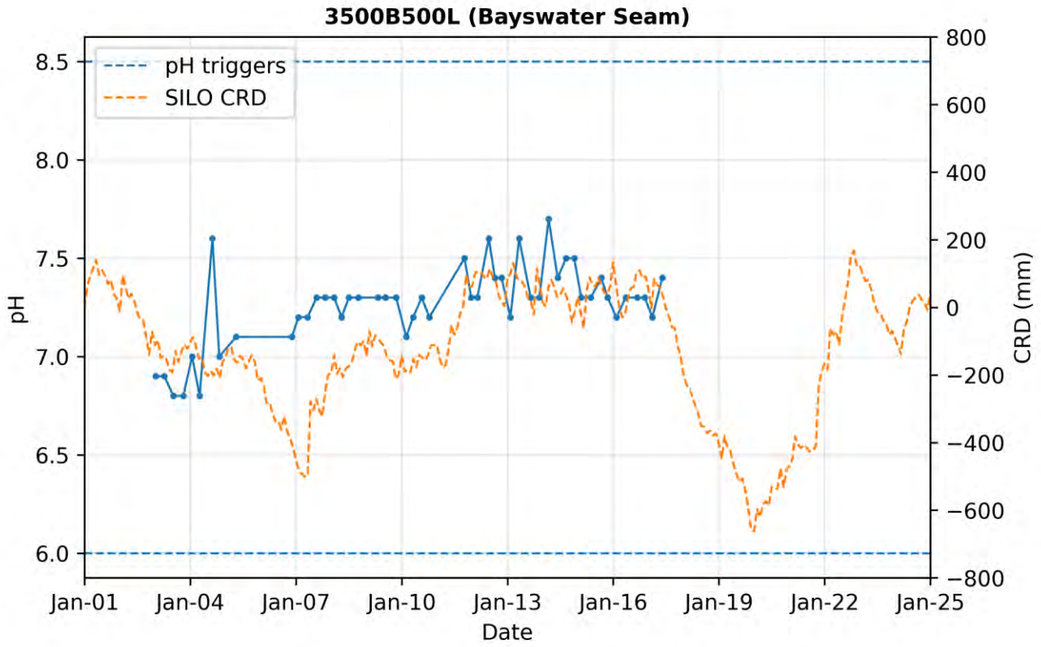

WRA5U (Alluvium/Regolith)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

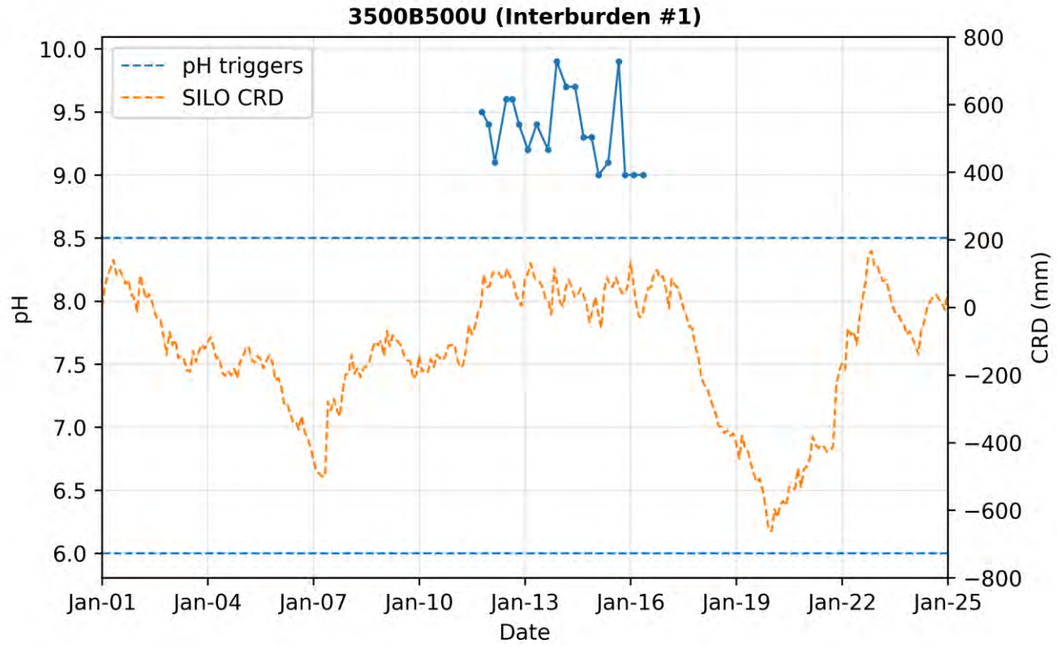

WRA6L (Warkworth/Permian)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

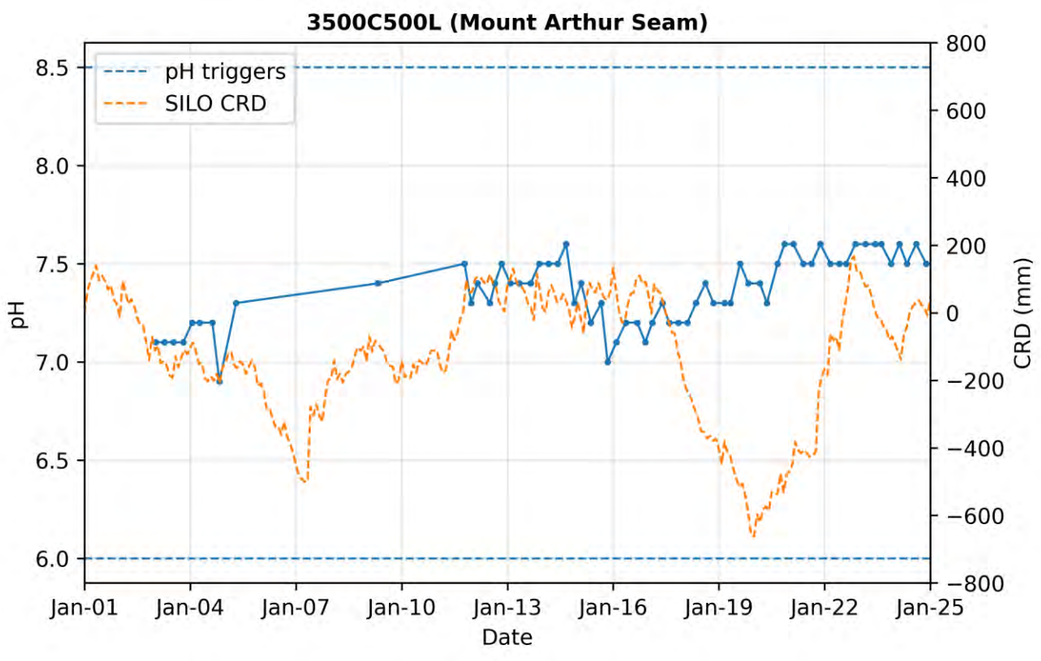

WRA6U (Alluvium/Regolith)
EC trigger
SILO CRD
Electrical conductivity, EC (µS/cm)
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

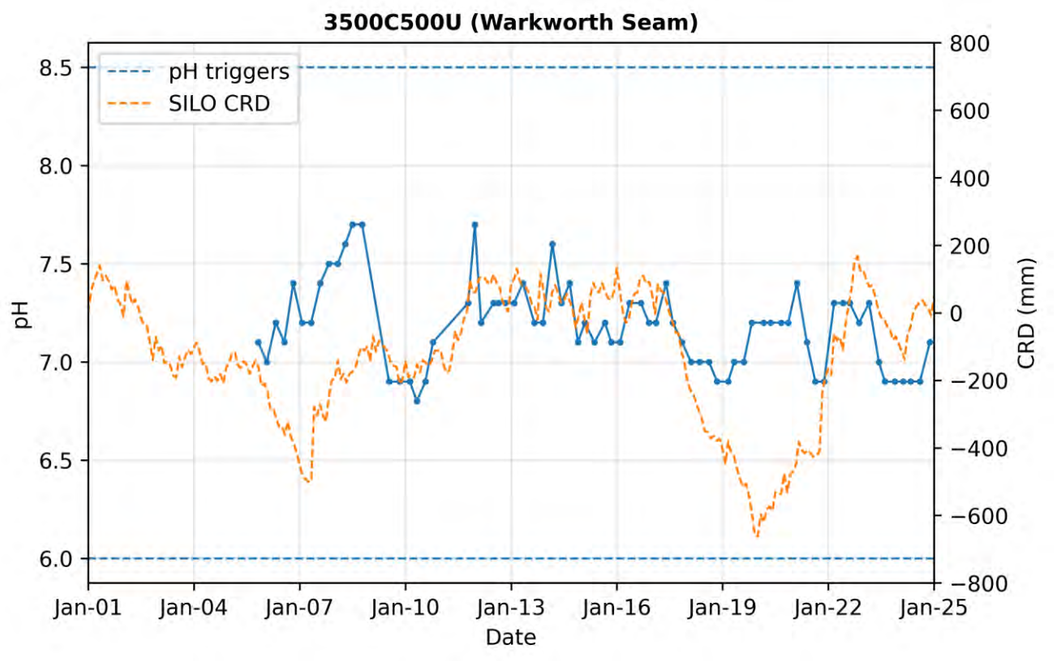
Appendix D

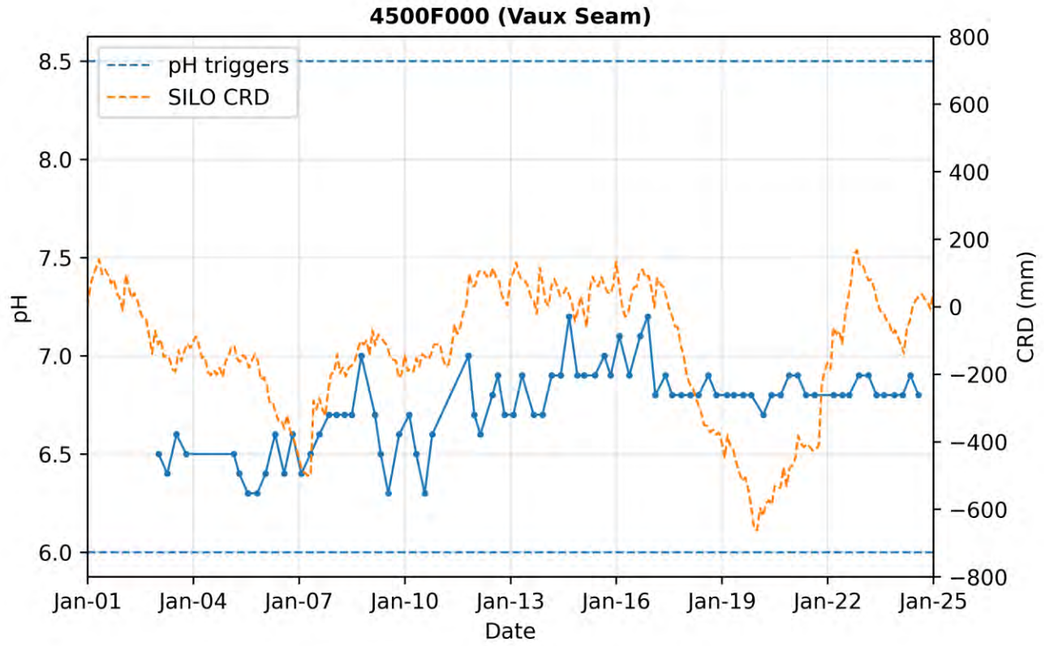
Field measured pH time series

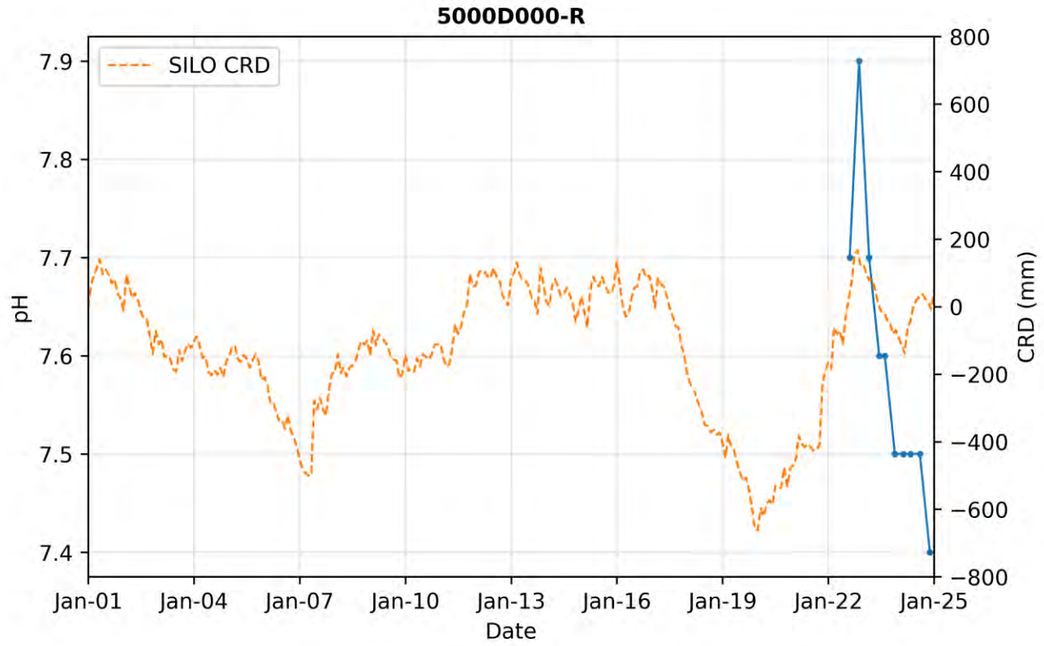

3500B500L (Bayswater Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

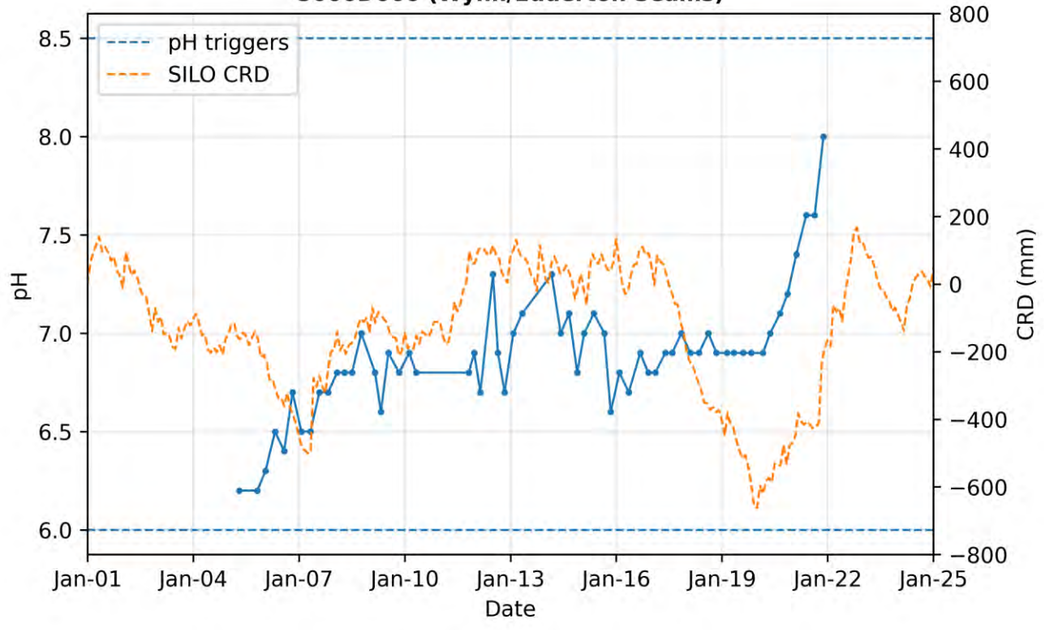

3500B500U (Interburden #1)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

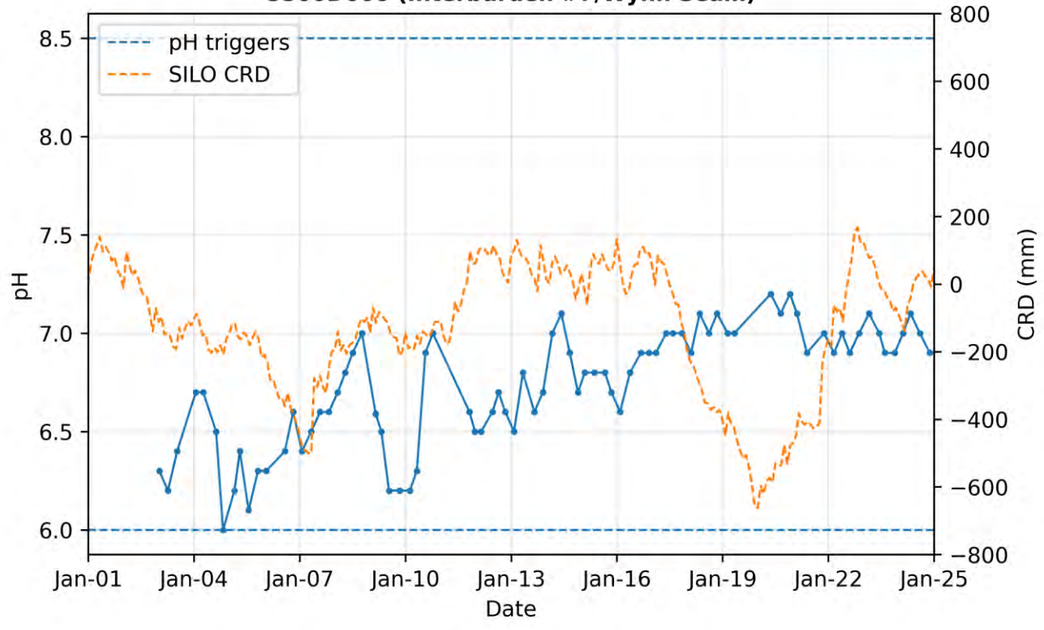

3500C500L (Mount Arthur Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

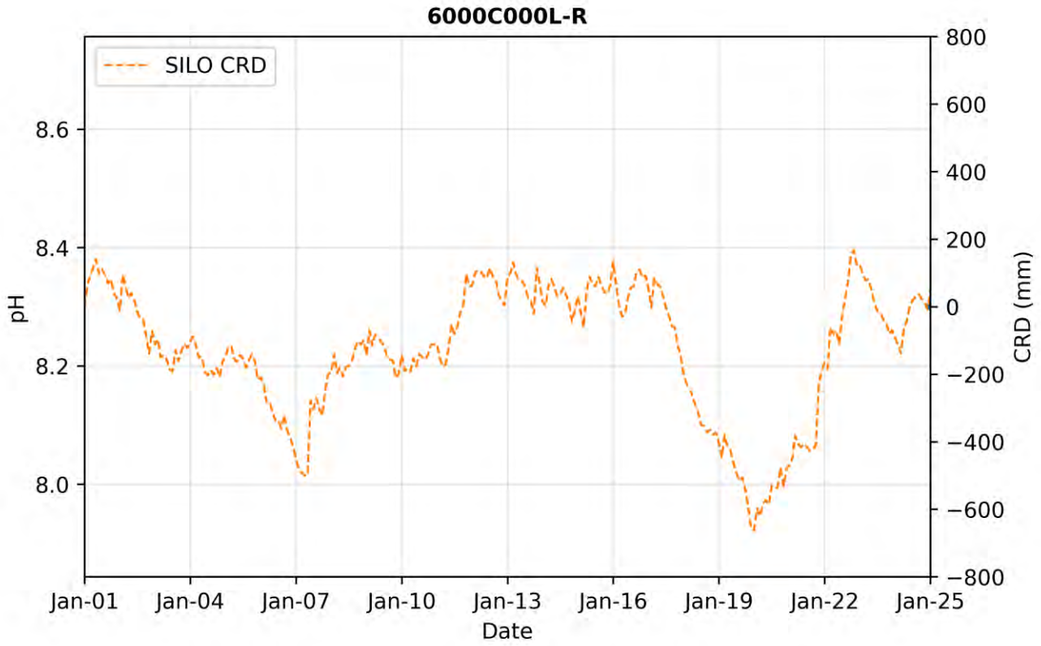

3500C500U (Warkworth Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

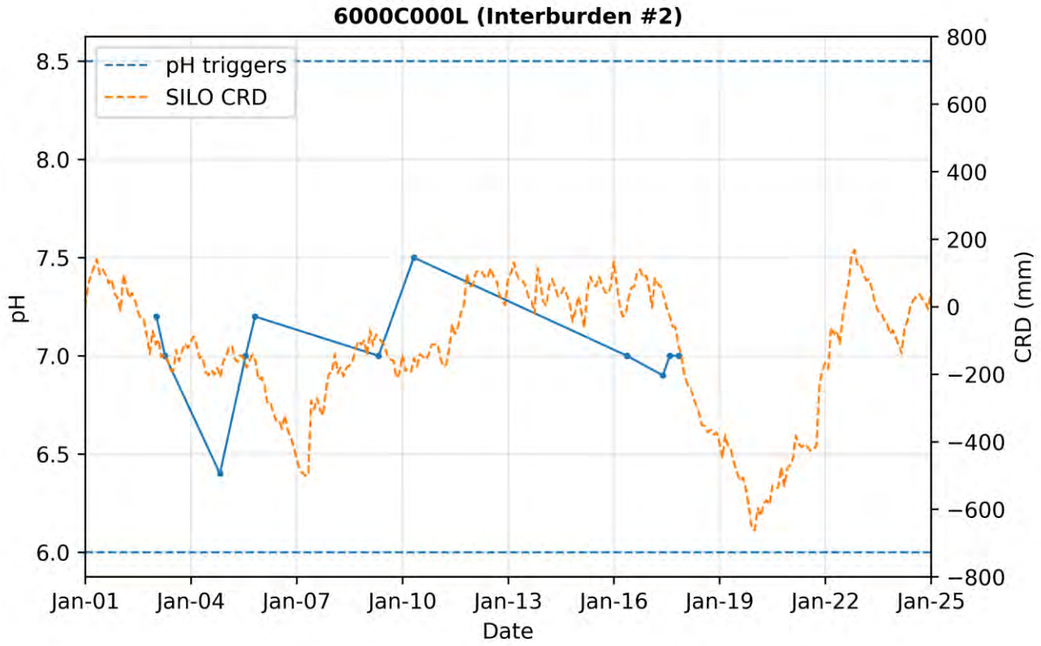

4500F000 (Vaux Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

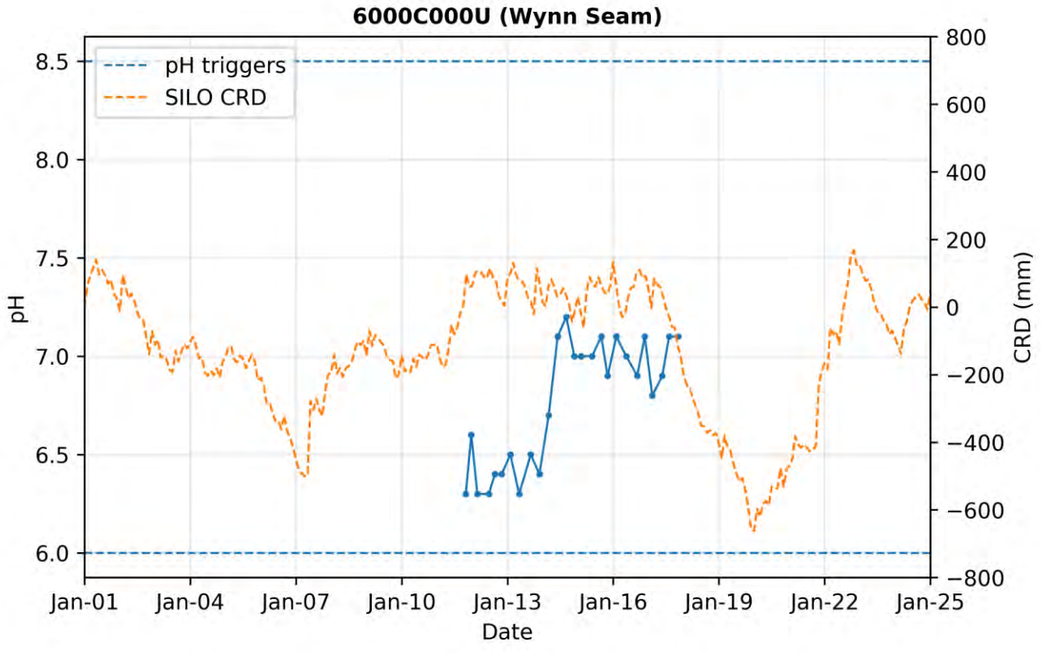

5000D000-R
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

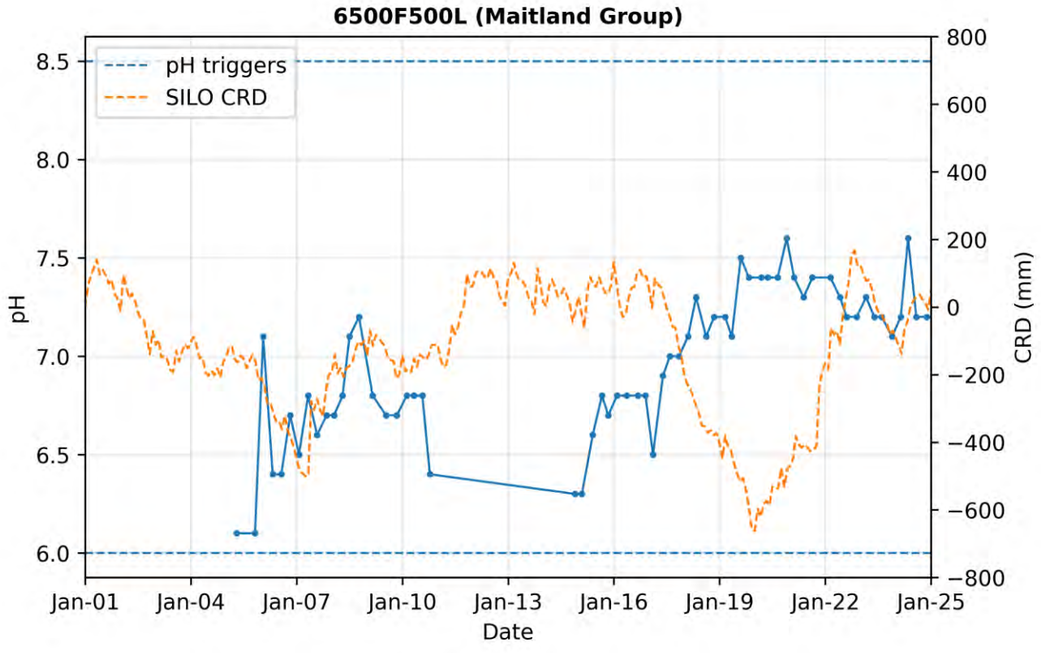

5000D000 (Wynn/Edderton Seams)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

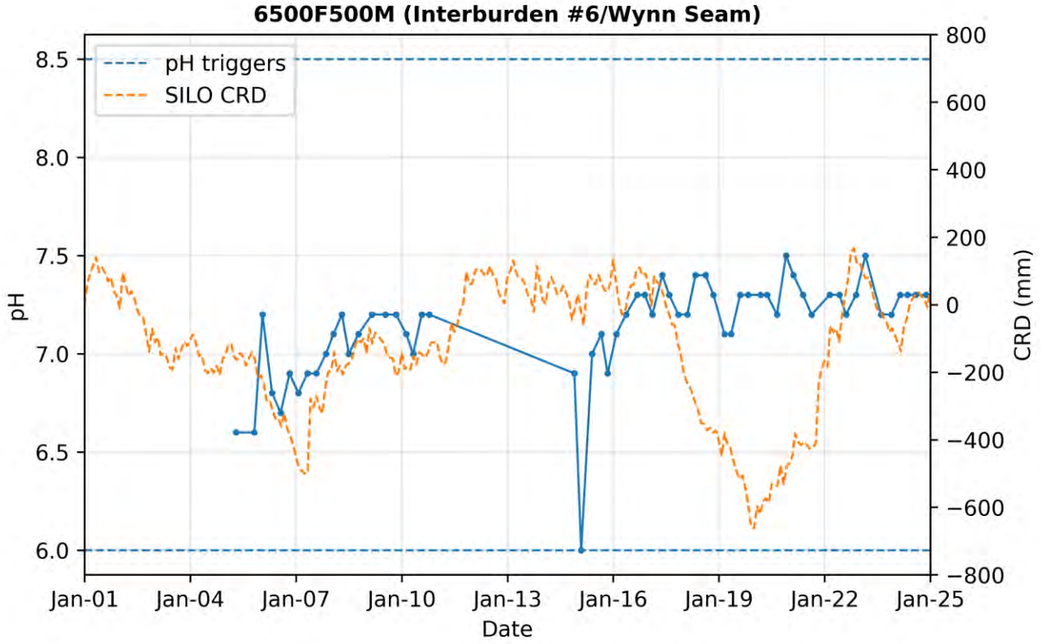

5500D000 (Interburden #7/Wynn Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

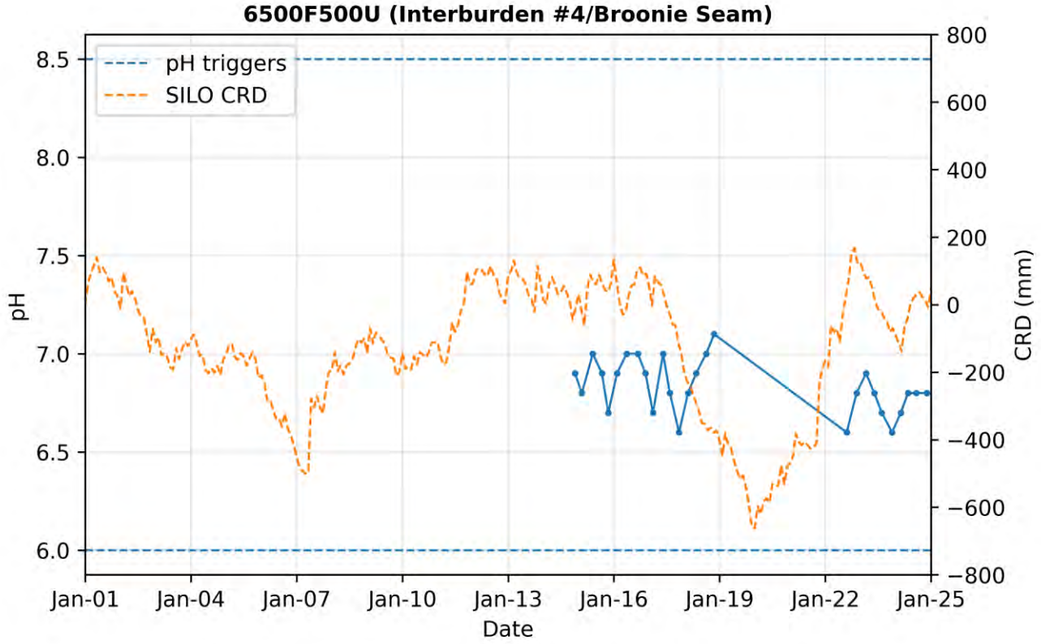

6000C000L-R
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25
8.6
8.4
8.2
8.0
800
600
400
200
0
−200
−400
−600
−800

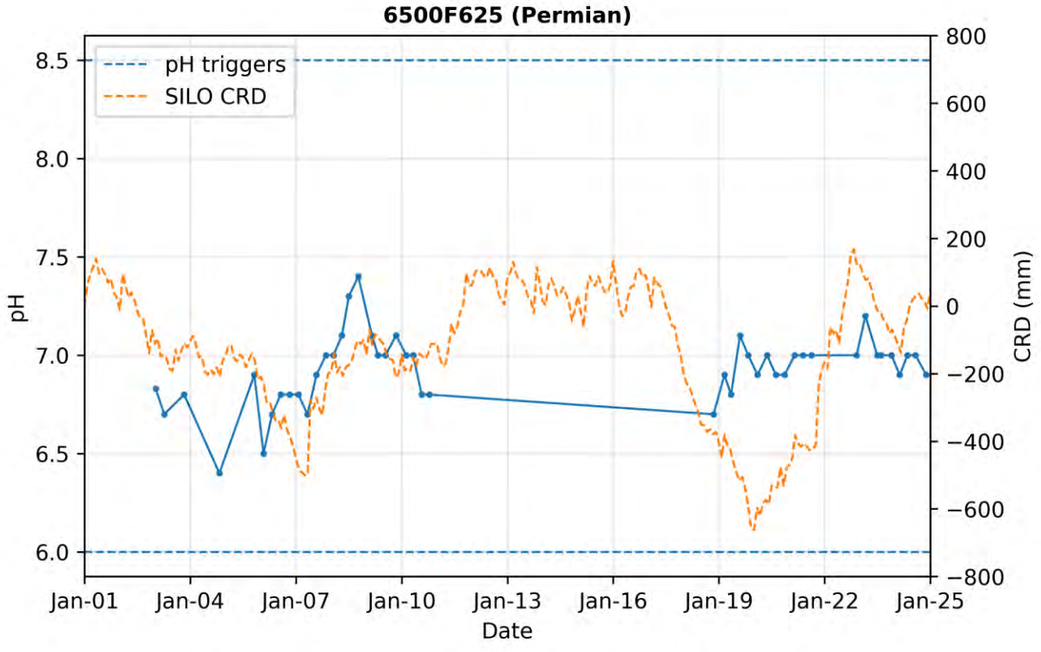

6000C000L (Interburden #2)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800

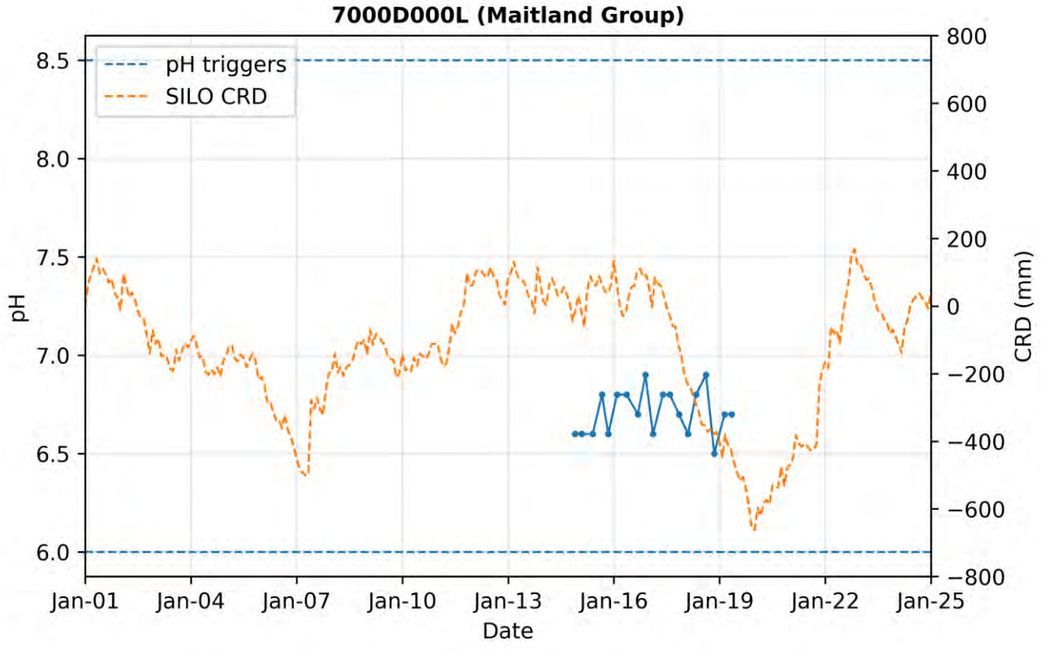

6000C000U (Wynn Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800

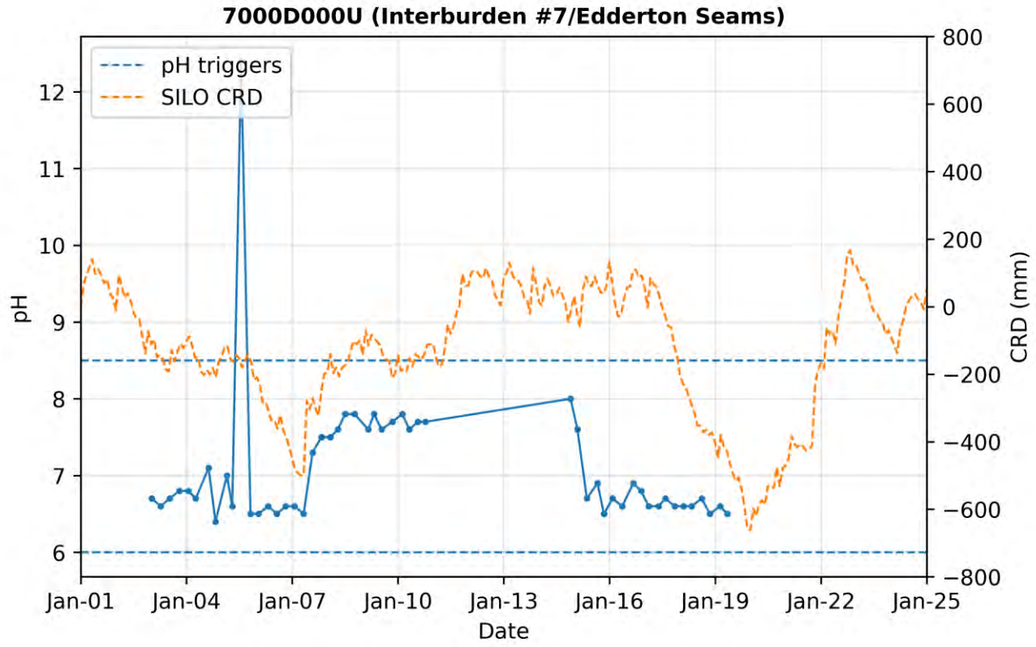

6500F500L (Maitland Group)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800

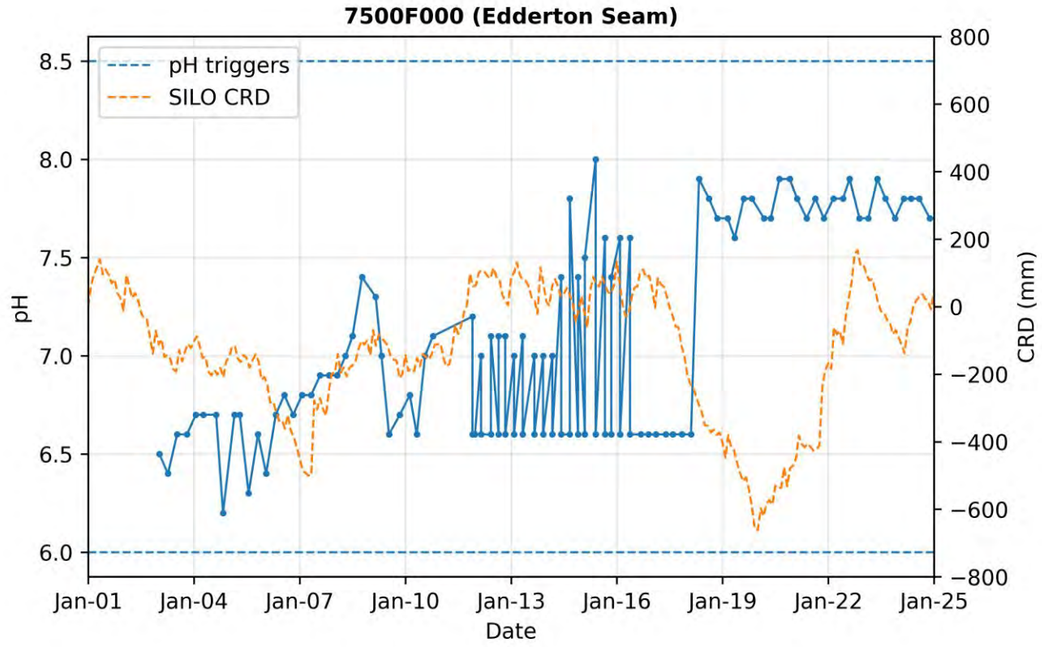

6500F500M (Interburden #6/Wynn Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


6500F500U (Interburden #4/Broonie Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


6500F625 (Permian)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


7000D000L (Maitland Group)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


7000D000U (Interburden #7/Edderton Seams)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


7500F000 (Edderton Seam)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
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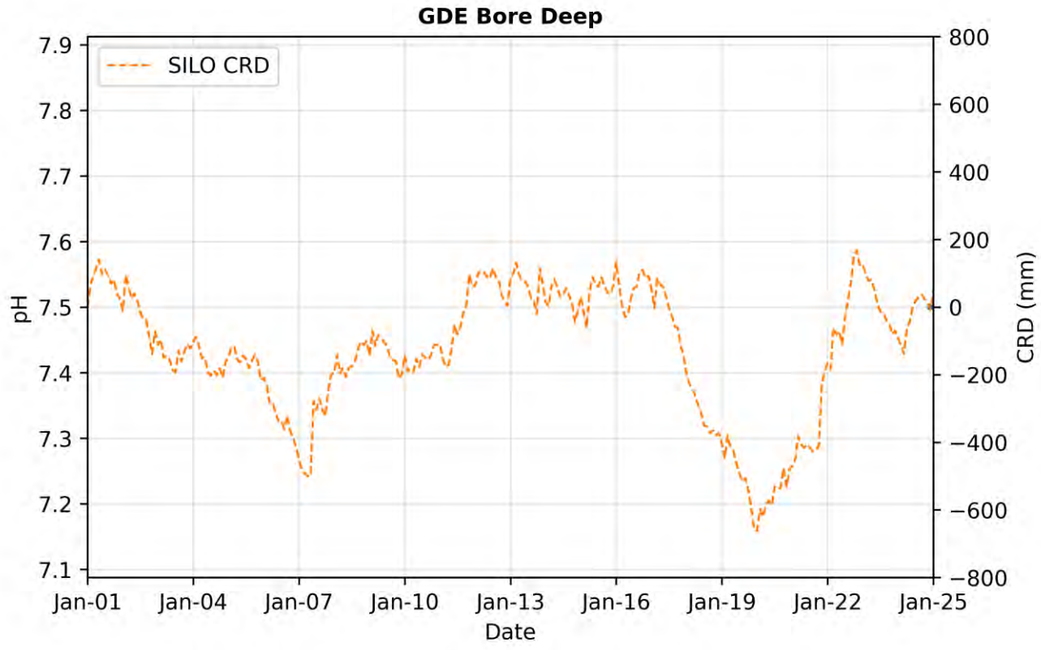
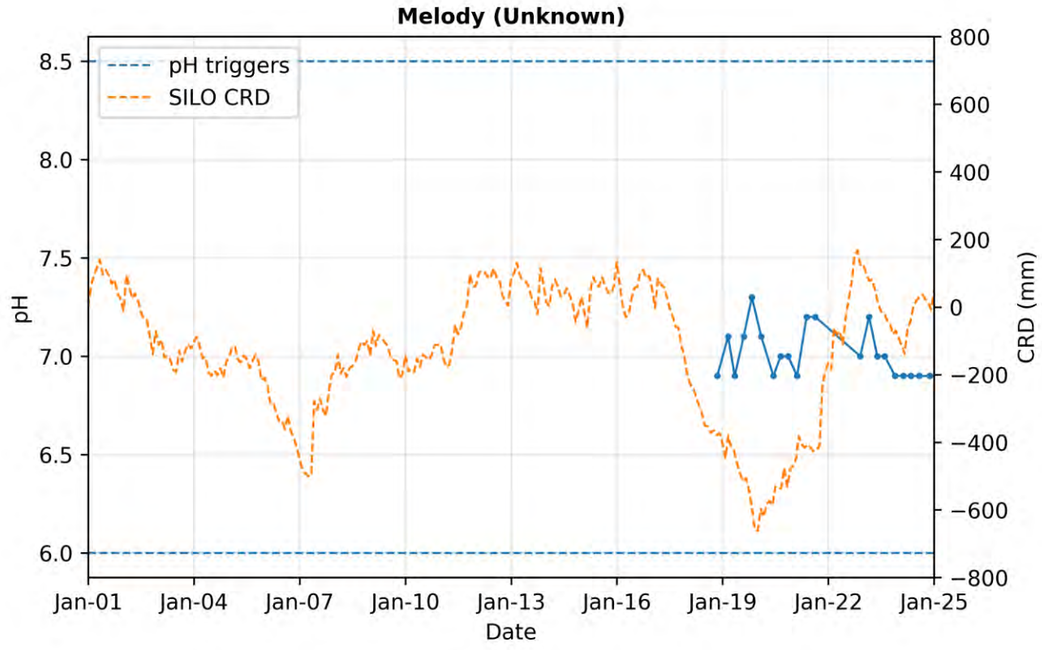
Jan-16
Jan-19
Jan-22
Jan-25


GDE Bore Deep
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


Melody (Unknown)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
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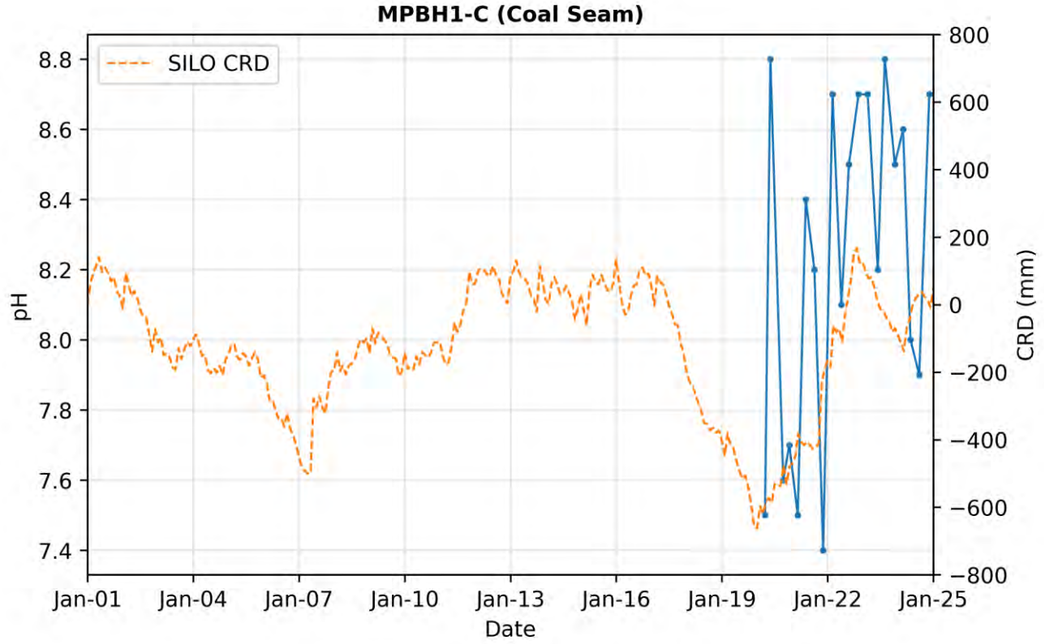
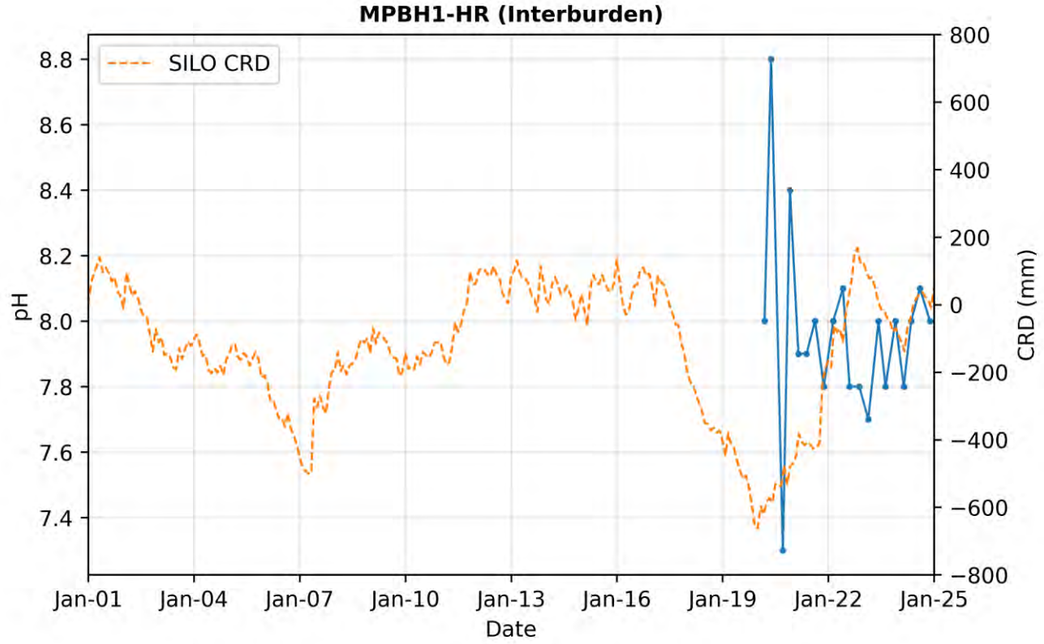
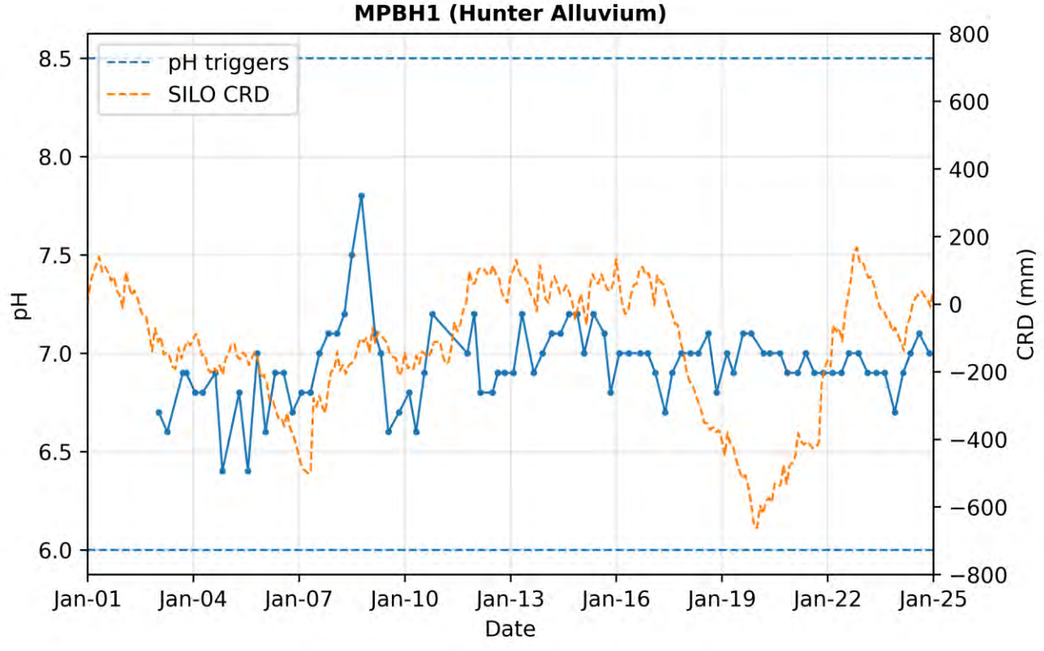
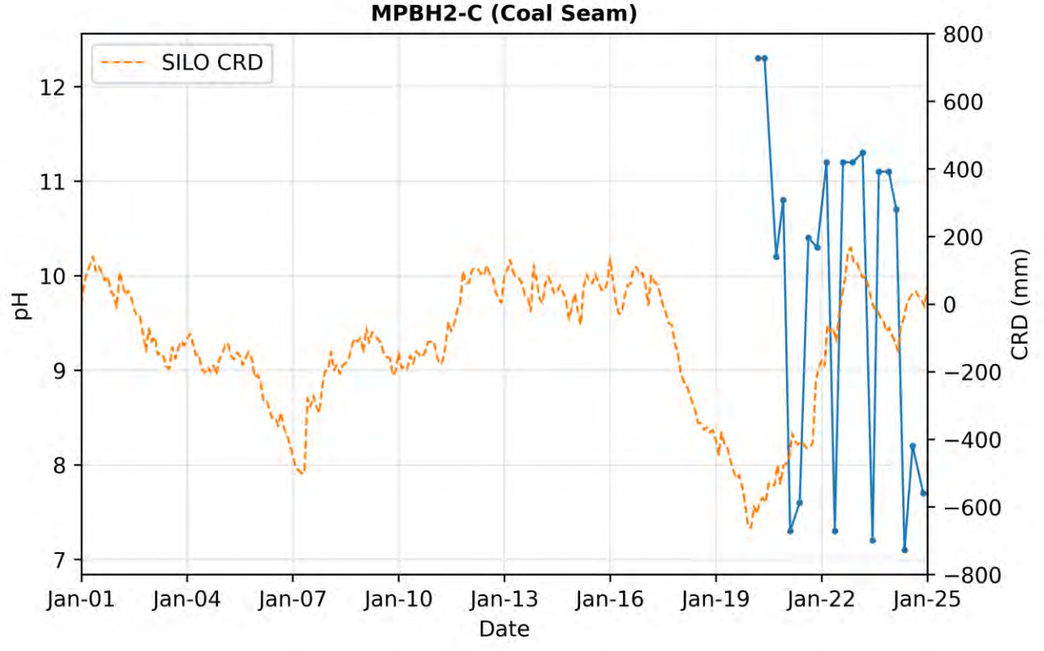
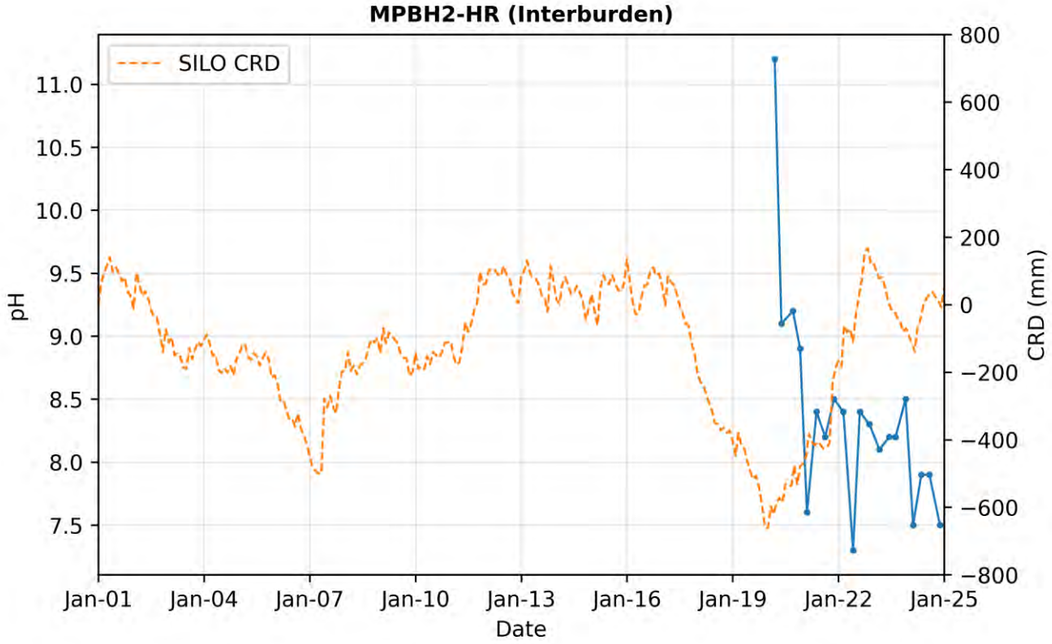
Jan-19
Jan-22
Jan-25

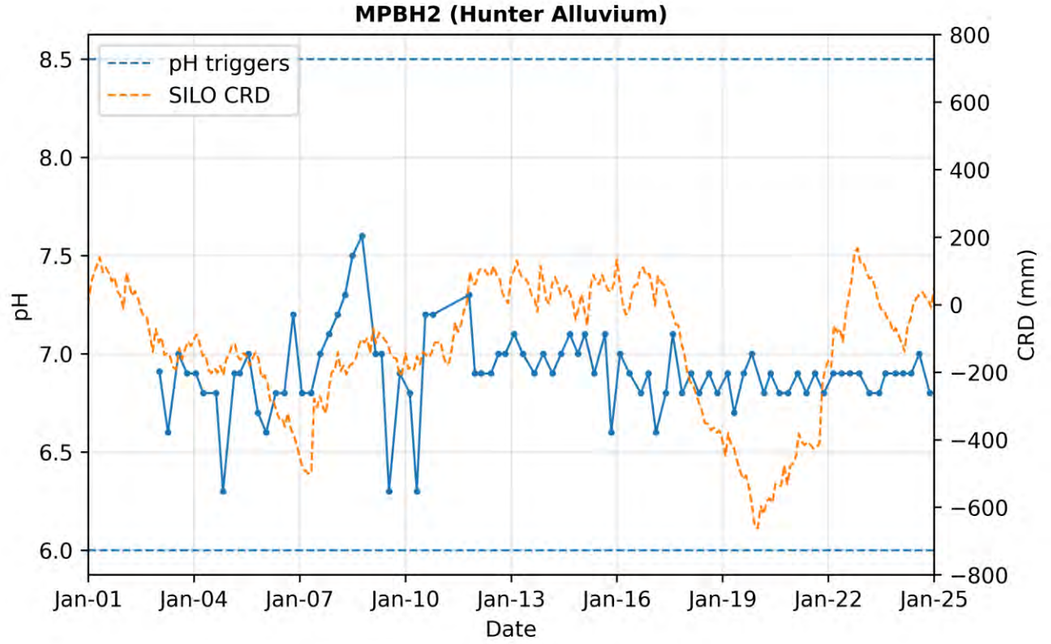

MPBH1-C (Coal Seam)
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

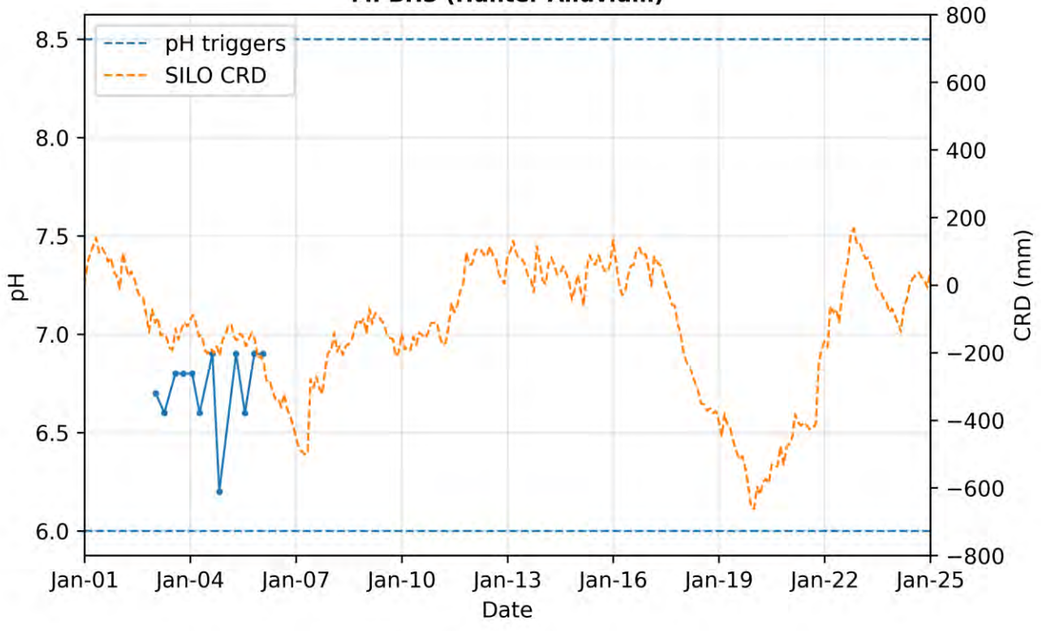

MPBH1-HR (Interburden)
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

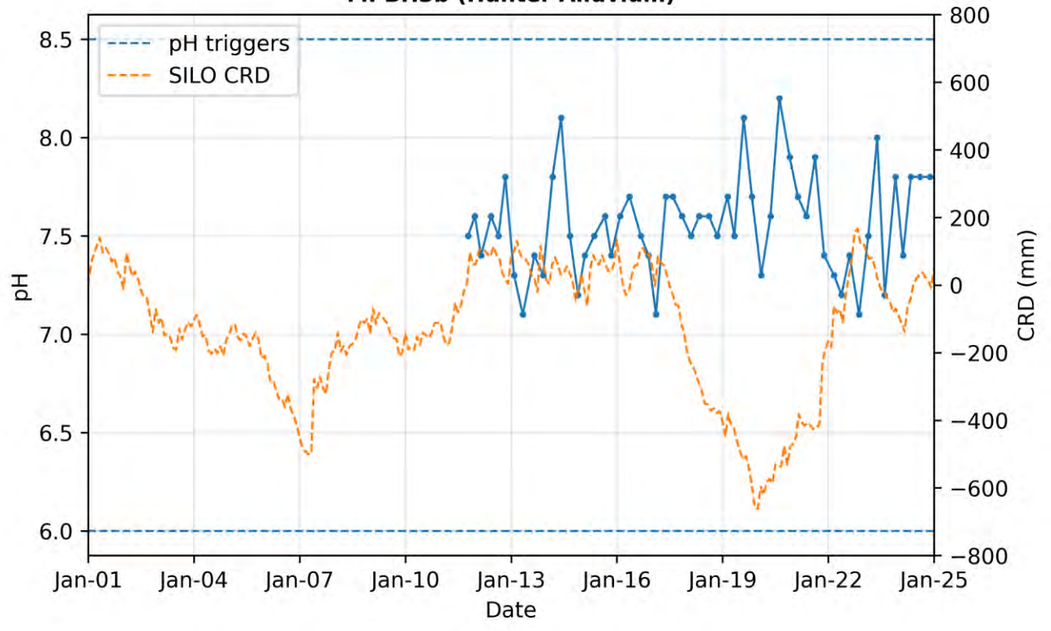

MPBH1 (Hunter Alluvium)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

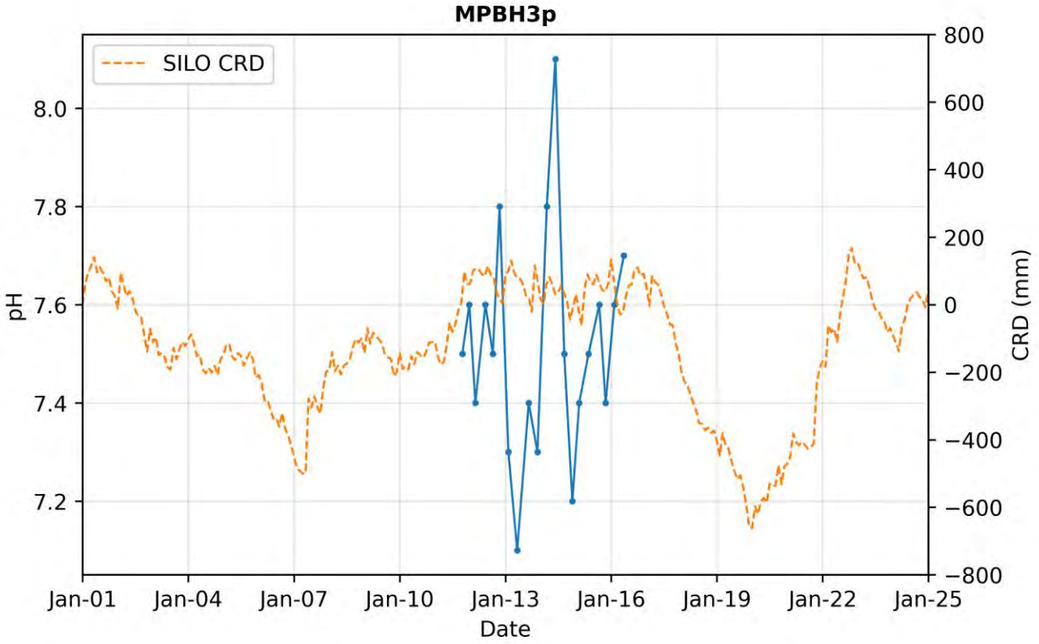

MPBH2-C (Coal Seam)
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

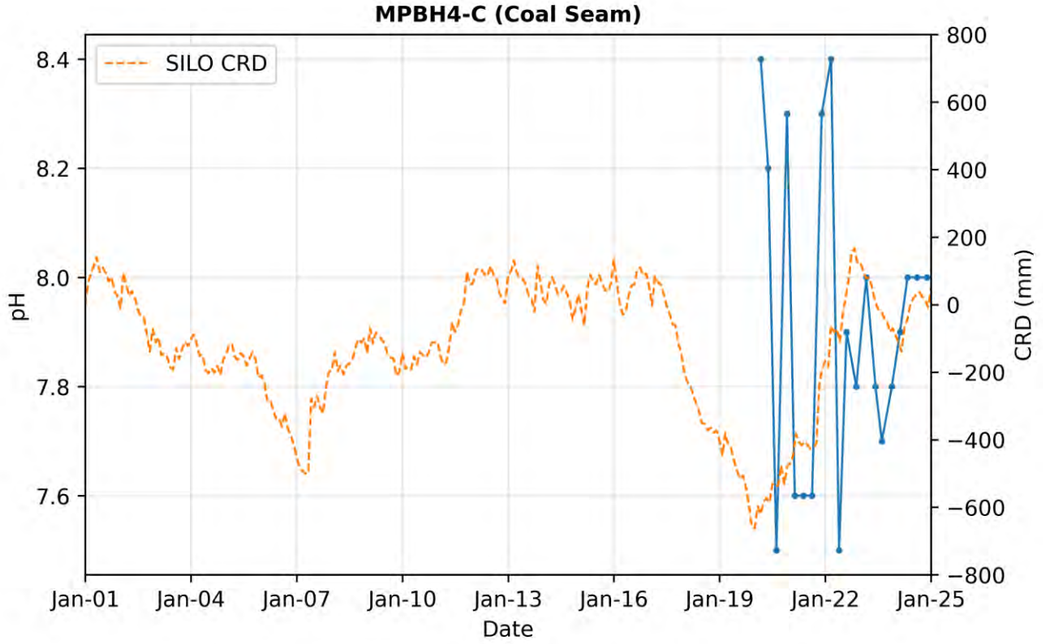

MPBH2-HR (Interburden)
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

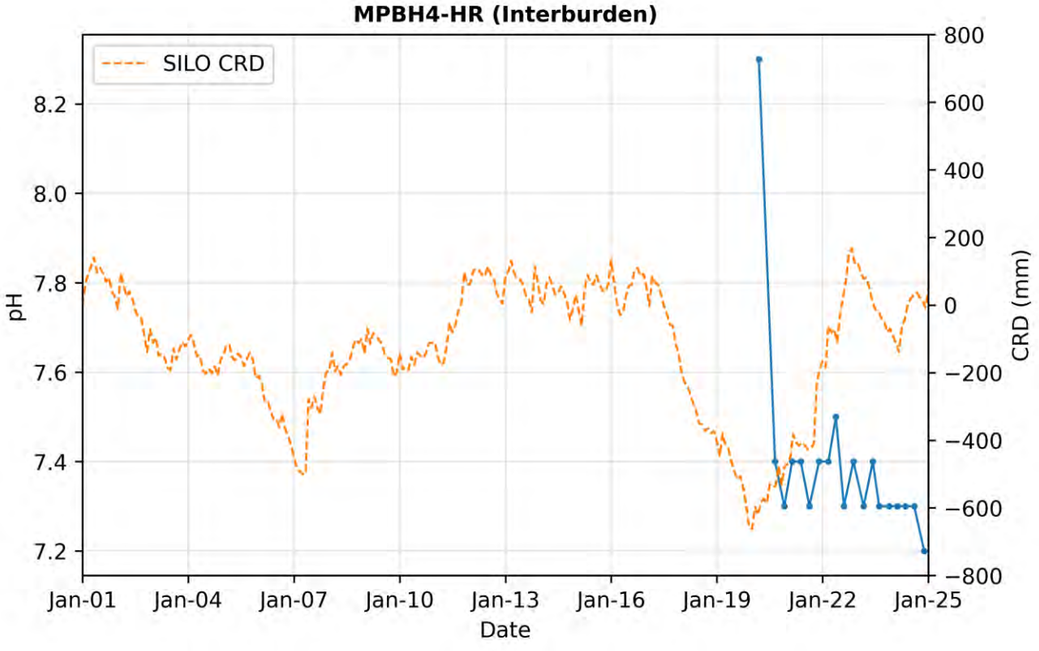

MPBH2 (Hunter Alluvium)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

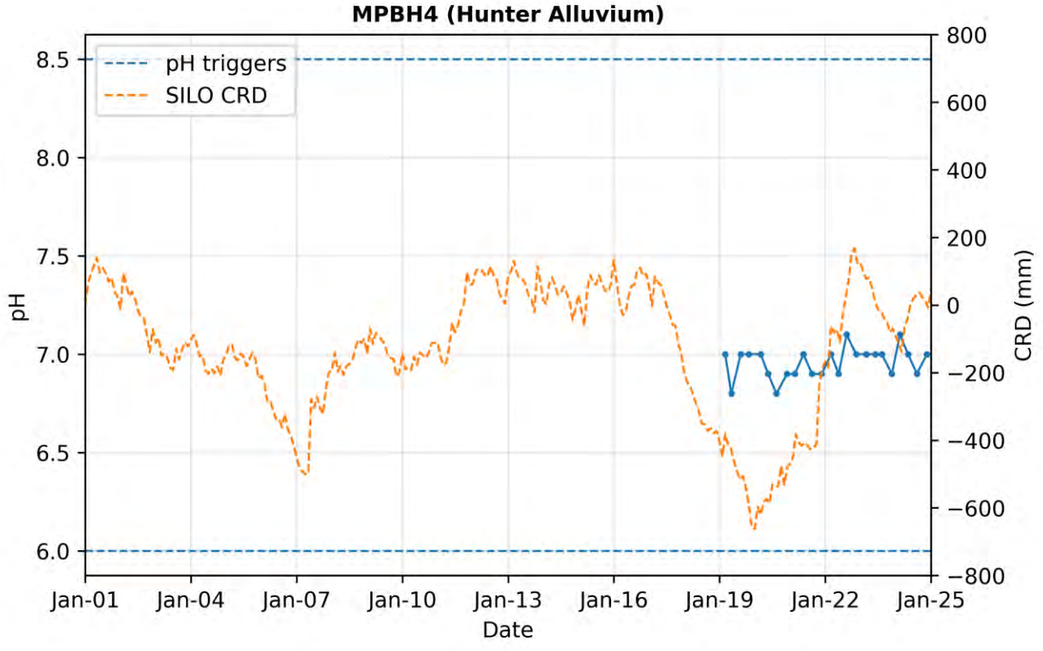

MPBH3 (Hunter Alluvium)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

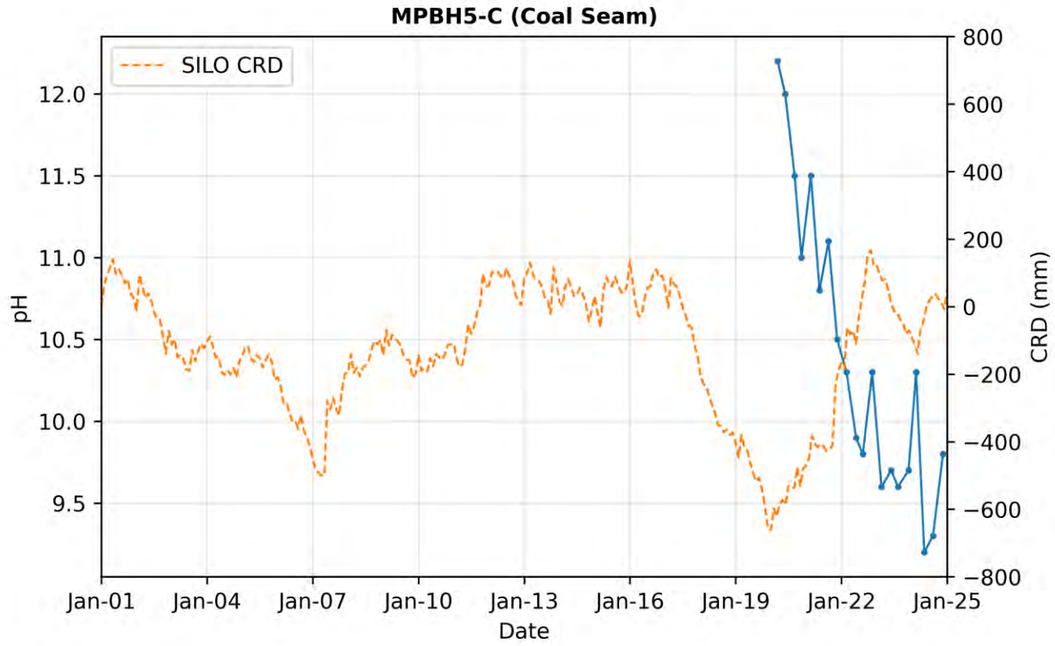

MPBH3b (Hunter Alluvium)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

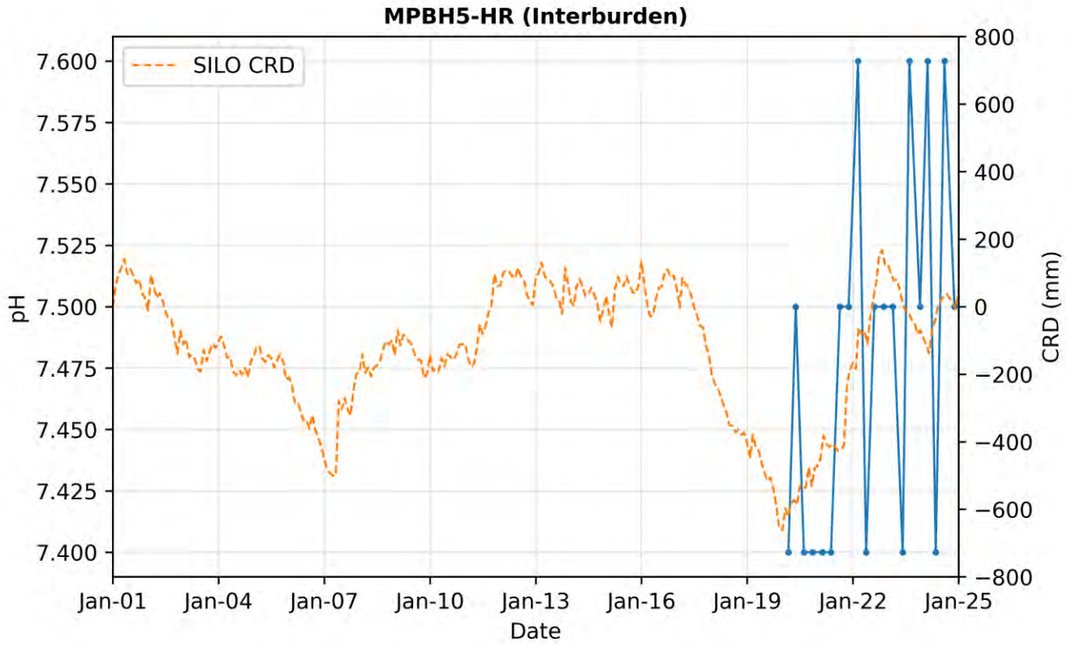

MPBH3p
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25
8.0
7.8
7.6
7.4
7.2
800
600
400
200
0
−200
−400
−600
−800

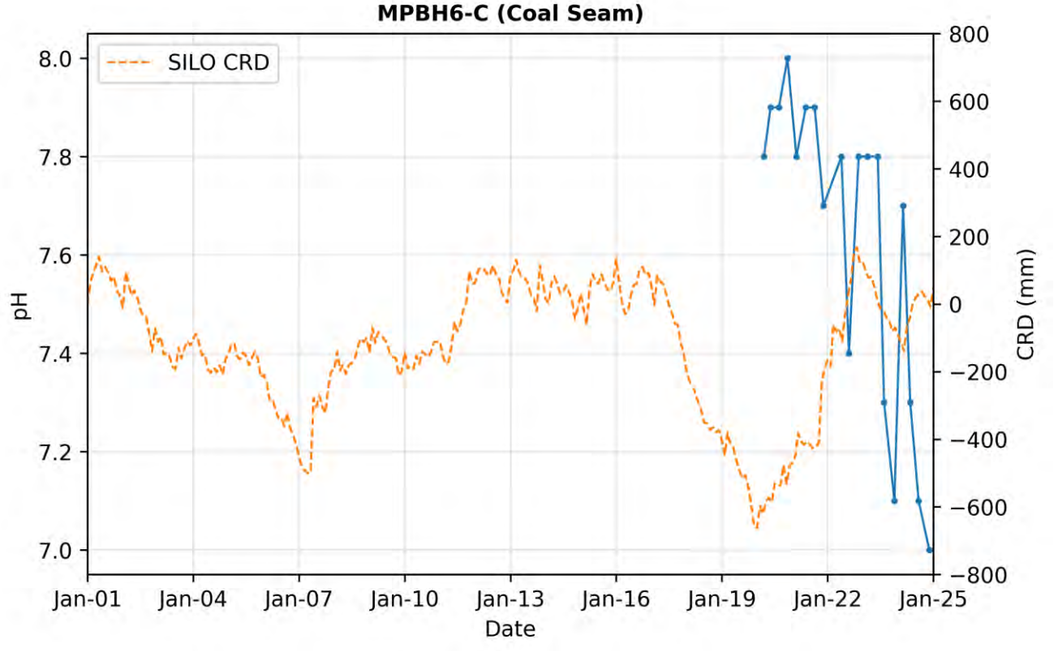

MPBH4-C (Coal Seam)
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25
8.4
8.2
8.0
7.8
7.6
800
600
400
200
0
−200
−400
−600
−800

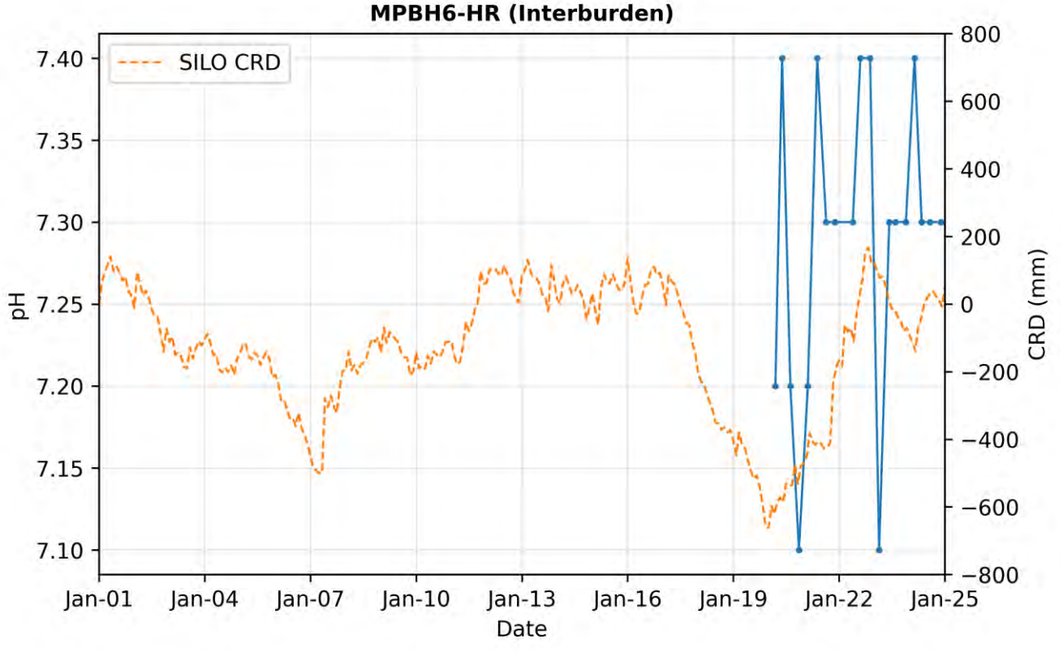

MPBH4-HR (Interburden)
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25
8.2
8.0
7.8
7.6
7.4
7.2
800
600
400
200
0
−200
−400
−600
−800

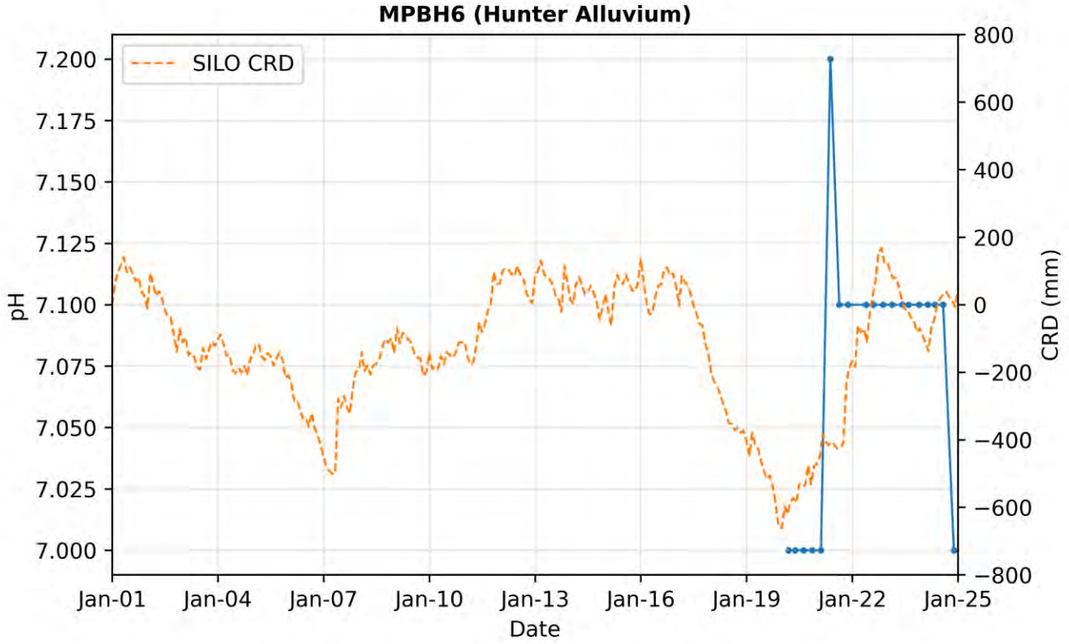

MPBH4 (Hunter Alluvium)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800

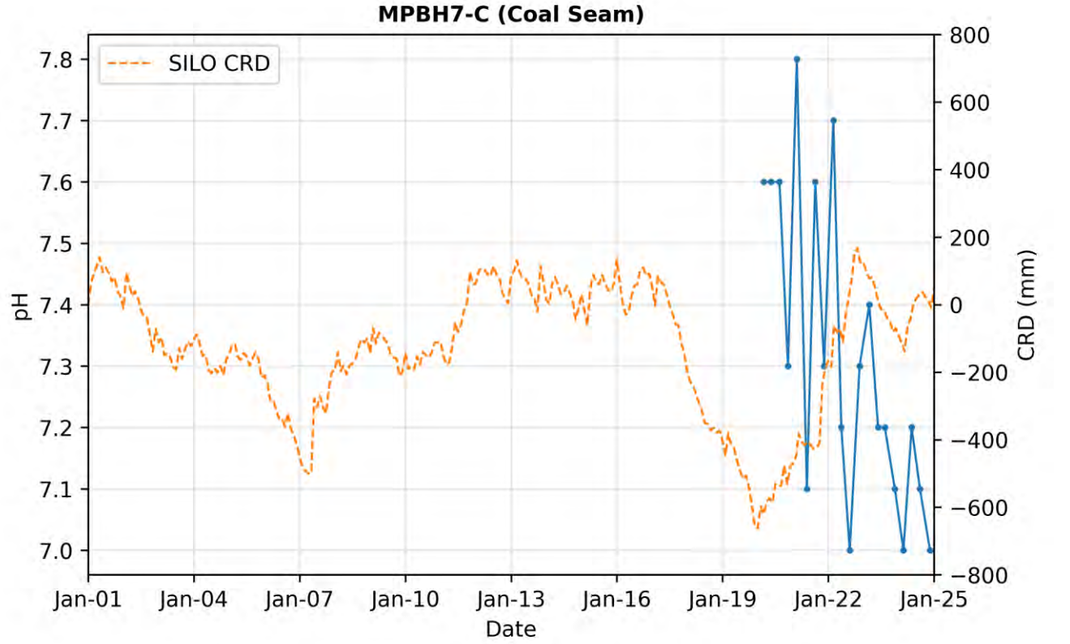

MPBH5-C (Coal Seam)
SILO CRD
pH
CRD (mm)
Date
12.0
11.5
11.0
10.5
10.0
9.5
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

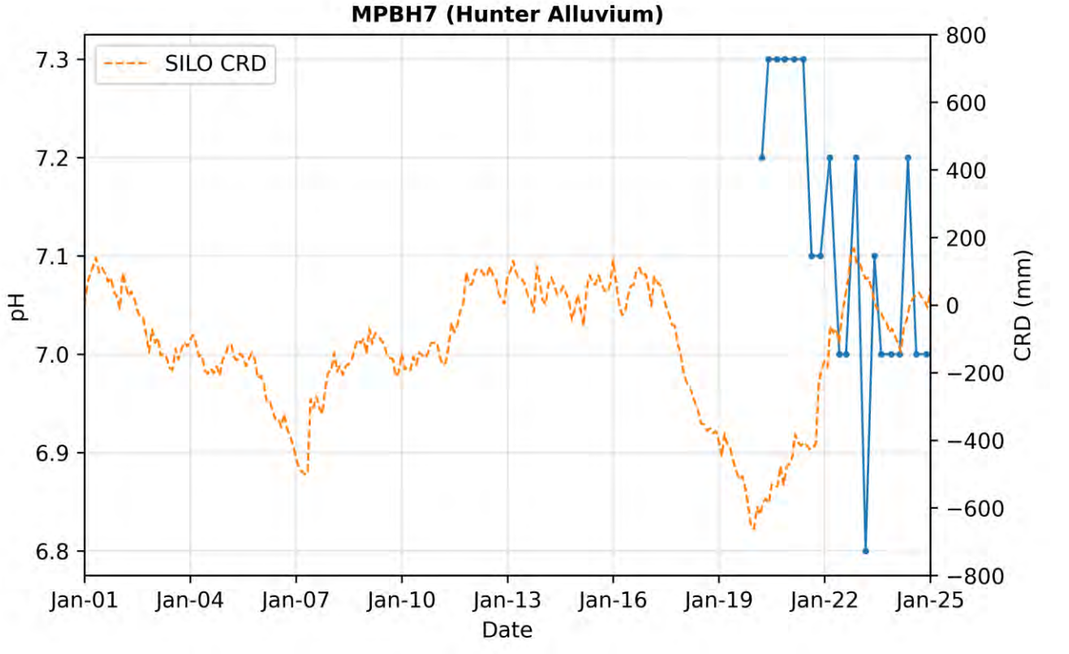

MPBH5-HR (Interburden)
SILO CRD
pH
CRD (mm)
Date
7.600
7.575
7.550
7.525
7.500
7.475
7.450
7.425
7.400
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

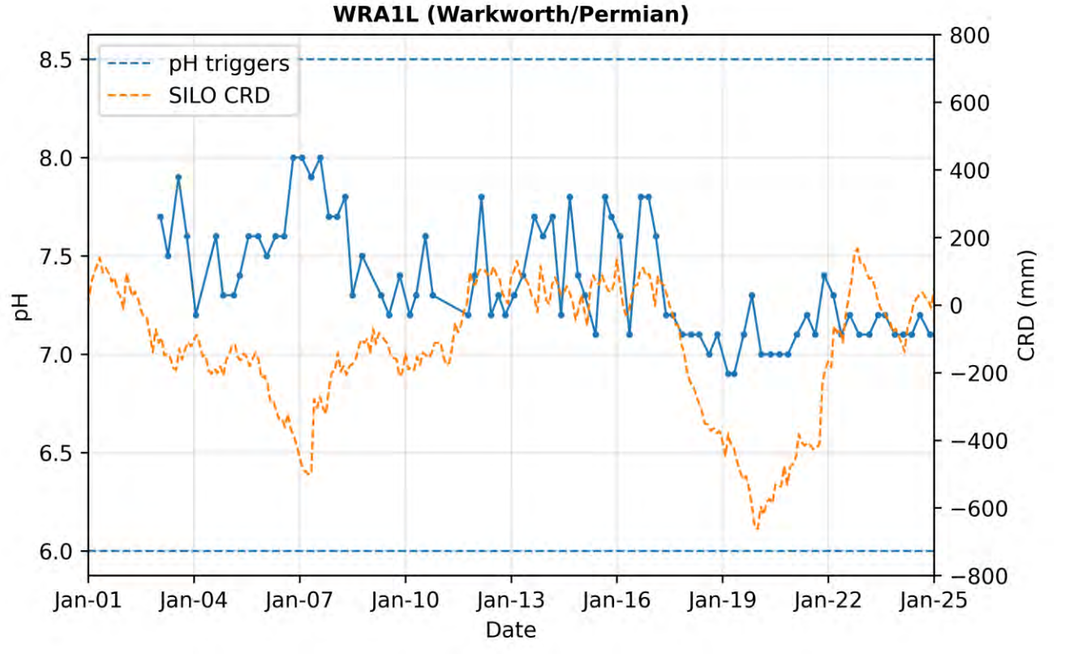

MPBH6-C (Coal Seam)
SILO CRD
pH
CRD (mm)
Date
8.0
7.8
7.6
7.4
7.2
7.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

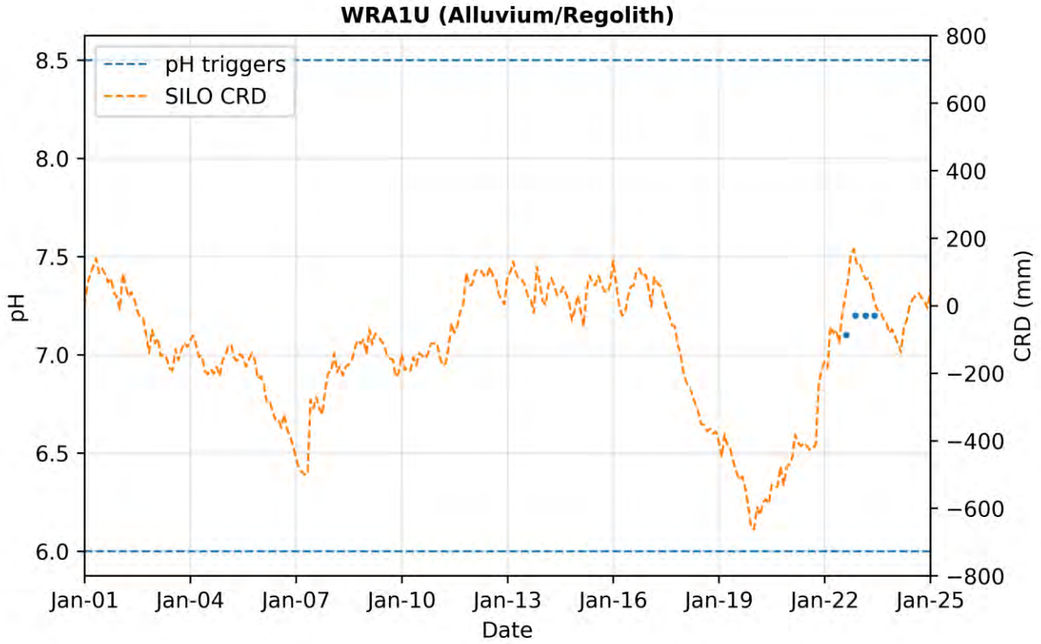

MPBH6-HR (Interburden)
SILO CRD
pH
CRD (mm)
Date
7.40
7.35
7.30
7.25
7.20
7.15
7.10
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

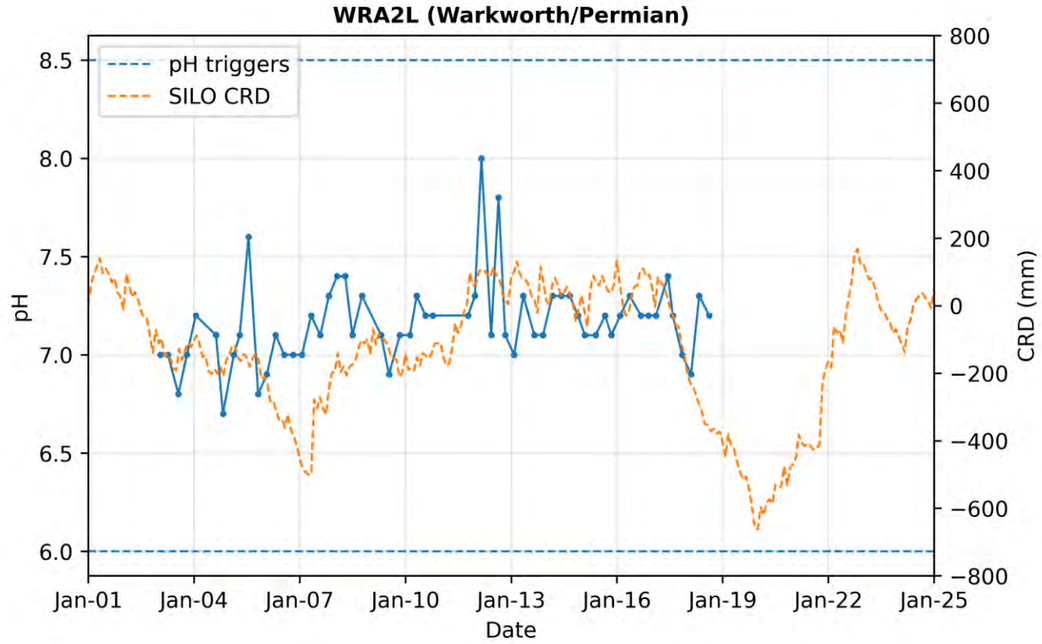

MPBH6 (Hunter Alluvium)
SILO CRD
pH
CRD (mm)
Date
7.200
7.175
7.150
7.125
7.100
7.075
7.050
7.025
7.000
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

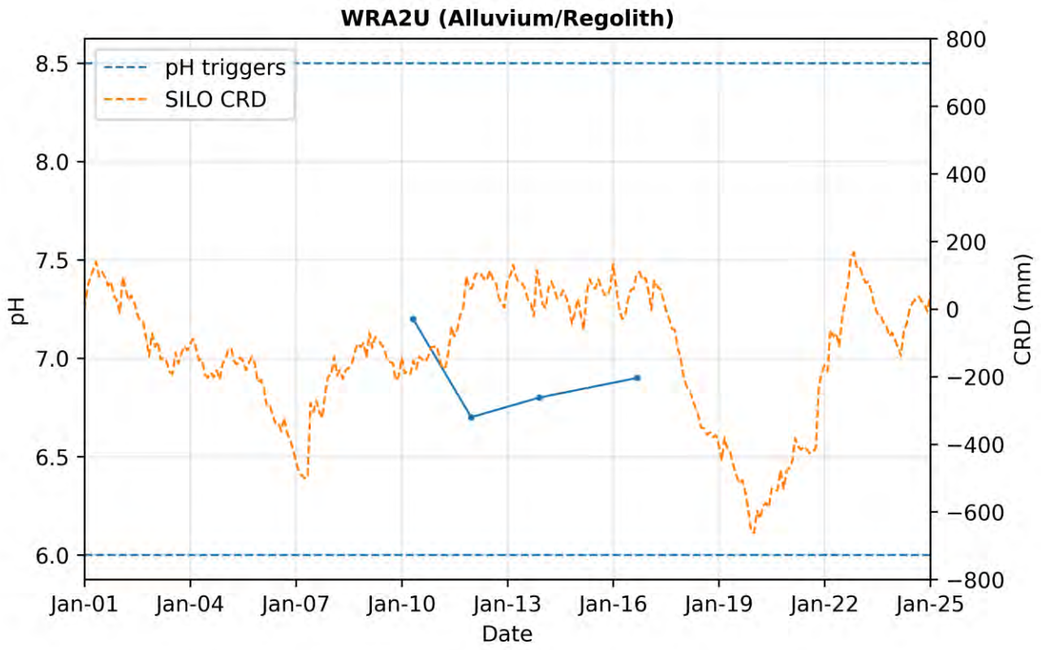

MPBH7-C (Coal Seam)
SILO CRD
pH
CRD (mm)
Date
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

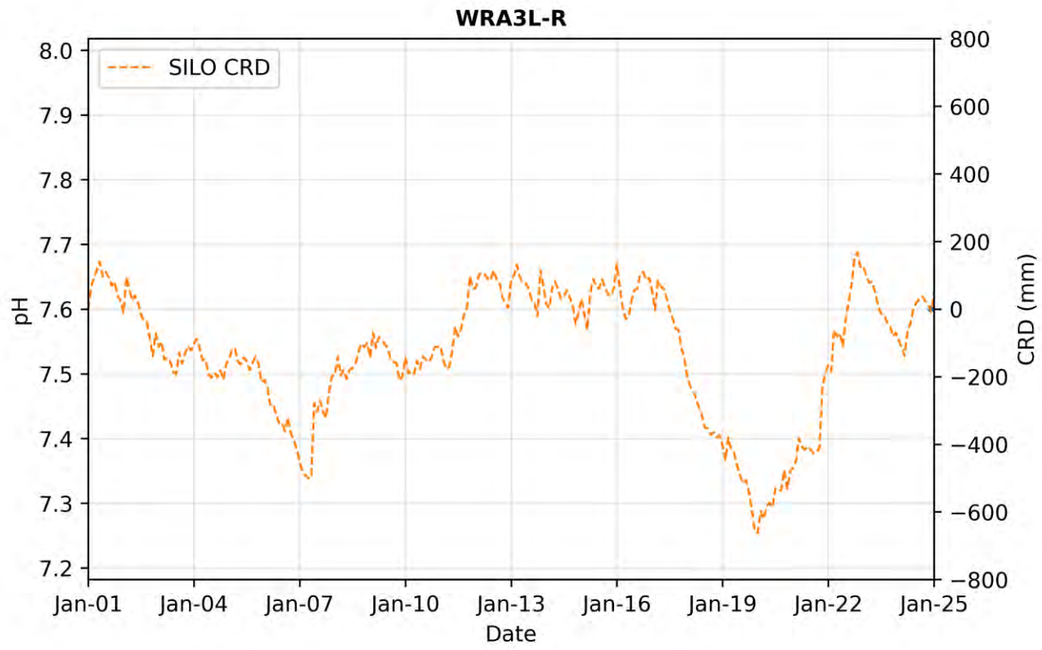

MPBH7 (Hunter Alluvium)
SILO CRD
pH
CRD (mm)
Date
7.3
7.2
7.1
7.0
6.9
6.8
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

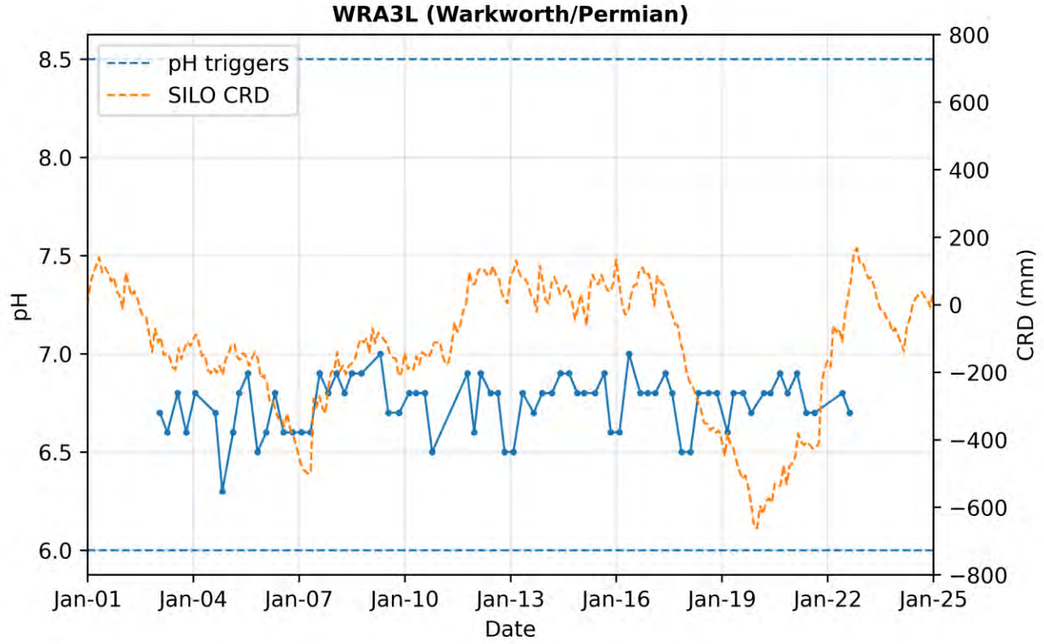

WRA1L (Warkworth/Permian)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

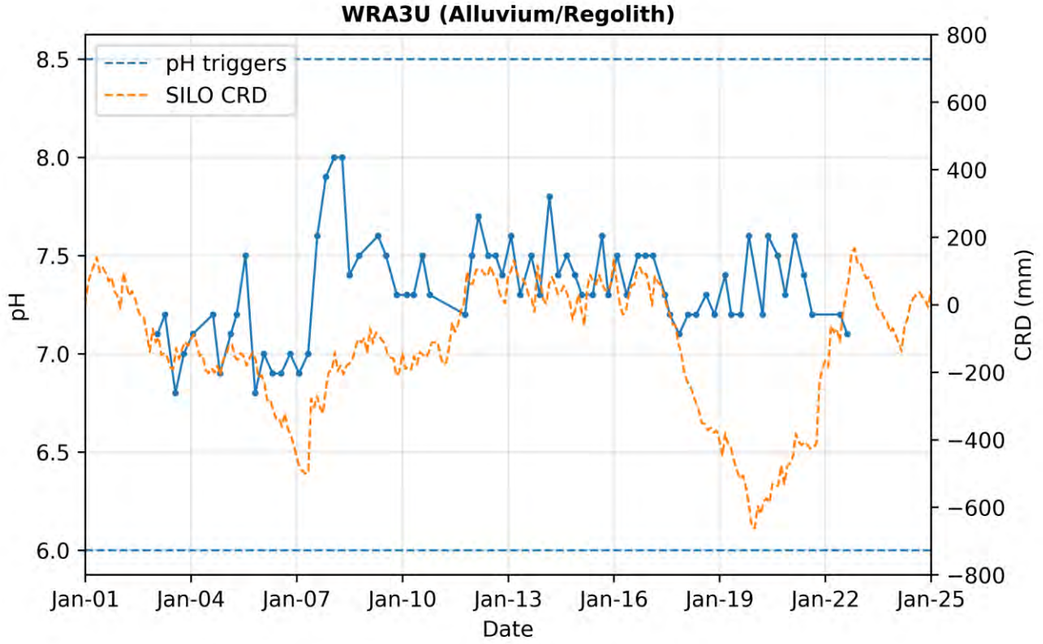

WRA1U (Alluvium/Regolith)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA2L (Warkworth/Permian)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

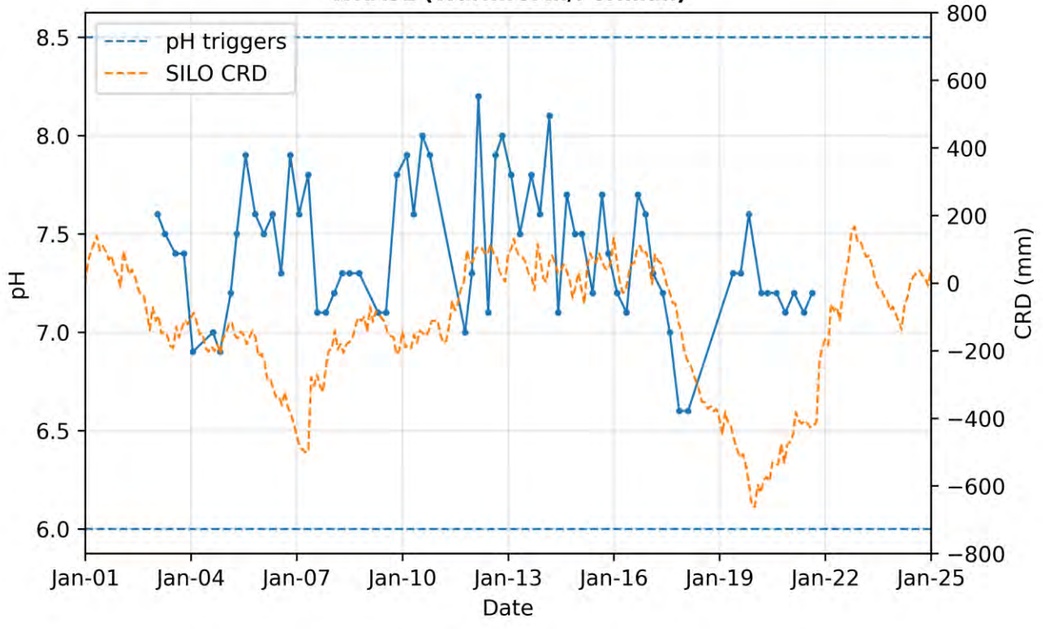

WRA2U (Alluvium/Regolith)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

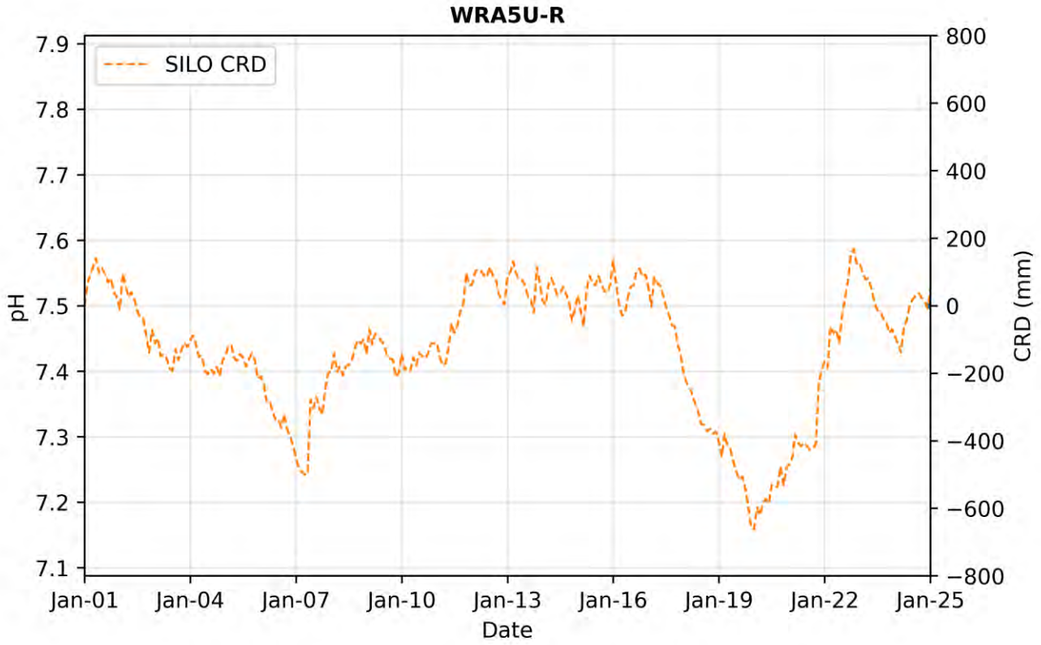

WRA3L-R
SILO CRD
pH
CRD (mm)
Date
8.0
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

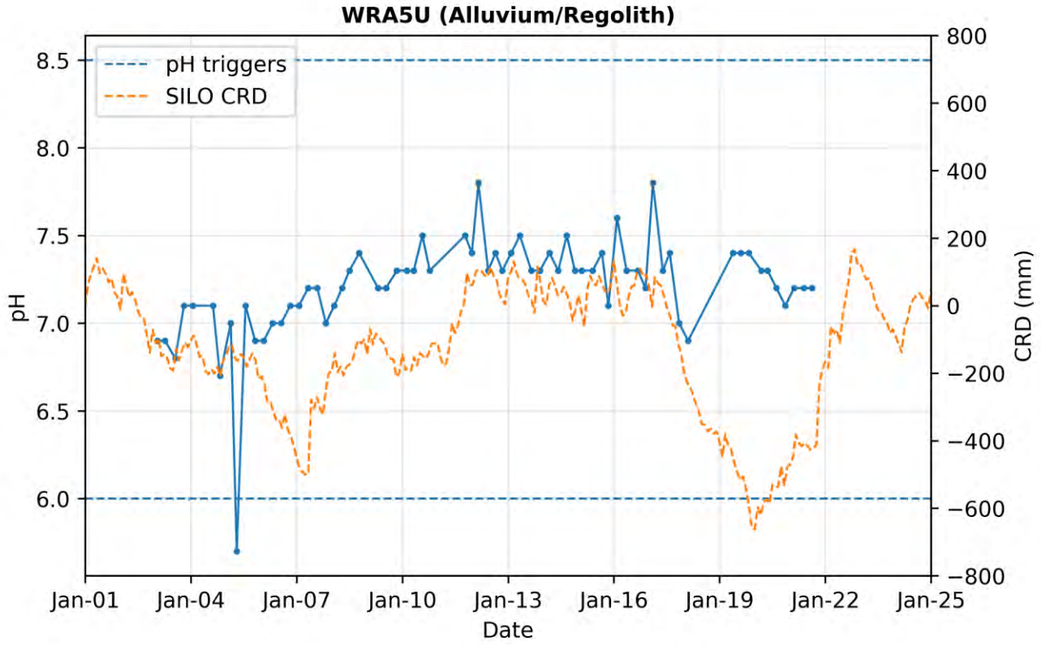

WRA3L (Warkworth/Permian)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

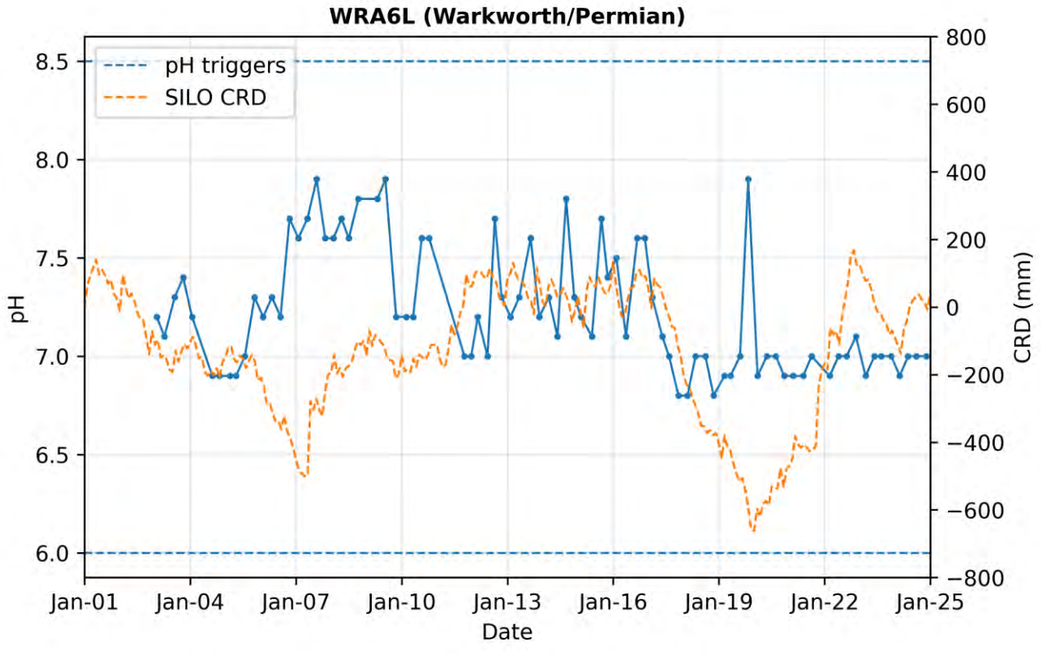

WRA3U (Alluvium/Regolith)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

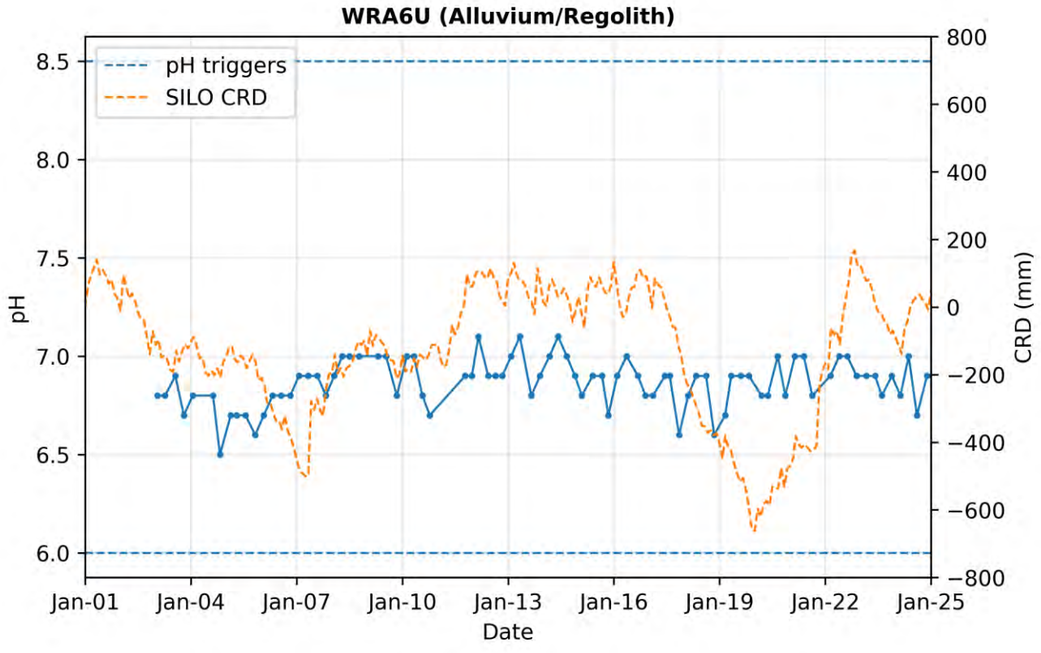

WRA5L-R
SILO CRD
pH
CRD (mm)
Date
7.4
7.3
7.2
7.1
7.0
6.9
6.8
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA5L (Warkworth/Permian)
pH triggers
SILO CRD
pH
CRD (mm)
Date
8.5
8.0
7.5
7.0
6.5
6.0
800
600
400
200
0
−200
−400
−600
−800
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA5U-R
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA5U (Alluvium/Regolith)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA6L (Warkworth/Permian)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25


WRA6U (Alluvium/Regolith)
pH triggers
SILO CRD
pH
CRD (mm)
Date
Jan-01
Jan-04
Jan-07
Jan-10
Jan-13
Jan-16
Jan-19
Jan-22
Jan-25

Appendix E

Water quality laboratory results

Bore ID	pH Field				EC Field (µS/cm)				Total Dissolved Solids (mg/L)				Dissolved Iron (mg/L)				Sulfate as SO4 (mg/L)				Chloride (mg/L)			
	24-Q24	min	max	mean	24-Q24	min	max	mean	24-Q24	min	max	mean	24-Q24	min	max	mean	24-Q24	min	max	mean	24-Q24	min	max	mean
3500C500L	7.50	6.90	7.60	7.36	3750	3290	7260	4347	2200	1960	2710	2371	0.69	0.05	0.69	0.16	36	7	823	101	470	21	876	573
3500C500U	6.90	6.80	7.70	7.21	12030	726	12160	4759	7600	1220	7600	3079	0.14	0.05	1.52	0.45	250	16	389	123	3400	8	3400	944
4500F000	6.90	6.30	7.20	6.74	8640	1300	9650	4999	5100	5070	6380	5544	0.08	0.05	0.29	0.18	300	23	1070	399	2000	30	3058	2028
5000D000-R	7.50	7.40	7.90	7.59	4390	4240	4500	4364	3100	2780	3100	2940	0.09	0.09	0.12	0.11	680	680	684	682	470	470	514	492
5500D000	7.10	6.00	7.20	6.71	4210	720	4630	1870	2500	871	2730	1933	0.08	0.05	0.40	0.10	100	2	178	60	710	35	904	487
6500F500L	7.60	6.10	7.60	6.90	2610	1170	3990	2038	1300	705	2250	1576	0.07	0.05	0.18	0.08	<40	1	82	32	330	135	967	540
6500F500M	7.30	6.00	7.50	7.10	2510	1126	3390	2334	1400	1090	1970	1596	0.13	0.05	0.13	0.06	45	26	45	40	330	210	710	489
6500F500U	6.80	6.60	7.10	6.84	5560	4750	5880	5461	3200	3090	3290	3201	0.07	0.07	0.27	0.17	200	160	260	197	1300	1300	1458	1385
6500F625	7.00	6.40	7.40	6.95	3610	2840	6810	5002	1800	1740	2540	1972	0.05	0.05	0.13	0.07	130	74	142	99	660	636	1030	753
7500F000	7.80	6.20	8.00	7.06	6450	955	6500	3874	3800	2450	5690	3829	0.50	0.05	0.87	0.25	<40	1	519	52	750	1	1020	706
Melody	6.90	6.90	7.30	7.01	5620	802	5810	2765	3500	444	3500	1279	0.05	0.05	0.30	0.08	140	19	140	49	1400	17	1400	379
MPBH1	7.00	6.40	7.80	6.96	644	451	970	559	310	255	392	318	0.05	0.05	<0.05	0.05	30	14	42	22	48	19	63	34
MPBH1-C	8.00	7.40	8.80	8.23	793	532	1574	1127	490	314	1740	621	0.05	0.05	0.15	0.06	25	12	113	47	46	32	74	52
MPBH1-HR	8.00	7.30	8.80	7.96	1521	531	2020	1527	830	320	2170	1043	0.05	0.05	0.06	0.05	20	20	344	147	68	28	101	68
MPBH2	6.90	6.30	7.60	6.93	1290	740	1291	884	820	438	820	545	0.05	0.05	<0.05	0.05	66	32	69	44	91	36	98	55
MPBH2-C	7.10	7.10	12.30	9.83	1304	861	4220	1693	690	544	1440	838	0.05	0.05	0.12	0.06	63	58	102	70	87	68	320	166
MPBH2-HR	7.90	7.30	11.20	8.37	1247	833	1886	1373	640	402	1290	728	0.05	0.05	<0.05	0.05	54	20	73	54	99	65	178	119
MPBH3b	7.80	7.10	8.20	7.56	5660	2510	7260	4346	3300	1700	3960	2358	0.05	0.05	<0.05	0.05	180	23	1040	185	1400	62	1630	779
MPBH4	7.00	6.80	7.10	6.96	5550	5030	6410	5738	2800	2800	4370	3594	0.17	0.17	0.79	0.48	300	216	356	309	1300	1110	1460	1353
MPBH4-C	8.00	7.50	8.40	7.92	4950	3440	5090	4183	2900	1880	2900	2166	0.06	0.05	1.05	0.35	97	32	97	64	1000	735	1070	856
MPBH5-C	9.20	9.20	12.20	10.41	1388	598	3090	962	680	432	906	566	0.05	0.05	<0.05	0.05	63	26	68	54	220	90	220	139
MPBH5-HR	7.40	7.40	7.60	7.48	797	772	1033	858	470	432	528	466	0.13	0.13	0.20	0.15	22	22	29	24	42	42	55	47
MPBH6	7.10	7.00	7.20	7.07	1257	1014	1296	1152	700	552	896	696	0.05	<0.05	<0.05	0.05	41	41	55	48	160	114	162	151
MPBH6-C	7.30	7.00	8.00	7.63	3190	2630	7450	5635	1900	1900	4700	4121	0.13	0.08	0.18	0.13	9	1	52	17	290	290	846	698
MPBH6-HR	7.30	7.10	7.40	7.29	6140	1341	6410	4587	3700	719	4070	2837	0.09	0.05	1.81	0.34	<40	1	40	23	560	184	745	506
MPBH7	7.20	6.80	7.30	7.12	10860	9770	14450	11729	6900	6390	8640	7238	0.50	0.05	0.50	0.14	200	200	311	253	3200	3030	3710	3312
MPBH7-C	7.20	7.00	7.80	7.32	10780	9910	12060	10729	8200	6050	8330	7216	0.14	0.05	0.14	0.07	180	1	230	103	2900	925	2970	1898
WRA1L	7.10	6.90	8.00	7.41	3730	2650	4770	3594	2400	1600	2420	2004	0.05	0.05	<0.05	0.05	86	61	796	143	560	21	843	571
WRA6L	7.00	6.80	7.90	7.28	6840	4510	7290	5824	4000	2700	4070	3507	0.05	0.05	<0.05	0.05	260	170	1030	272	1600	23	1810	1322
WRA6U	7.00	6.50	7.10	6.88	8950	1080	13290	10273	5400	4060	7230	6003	0.50	0.05	2.50	0.41	220	220	2940	497	2200	24	3280	2545

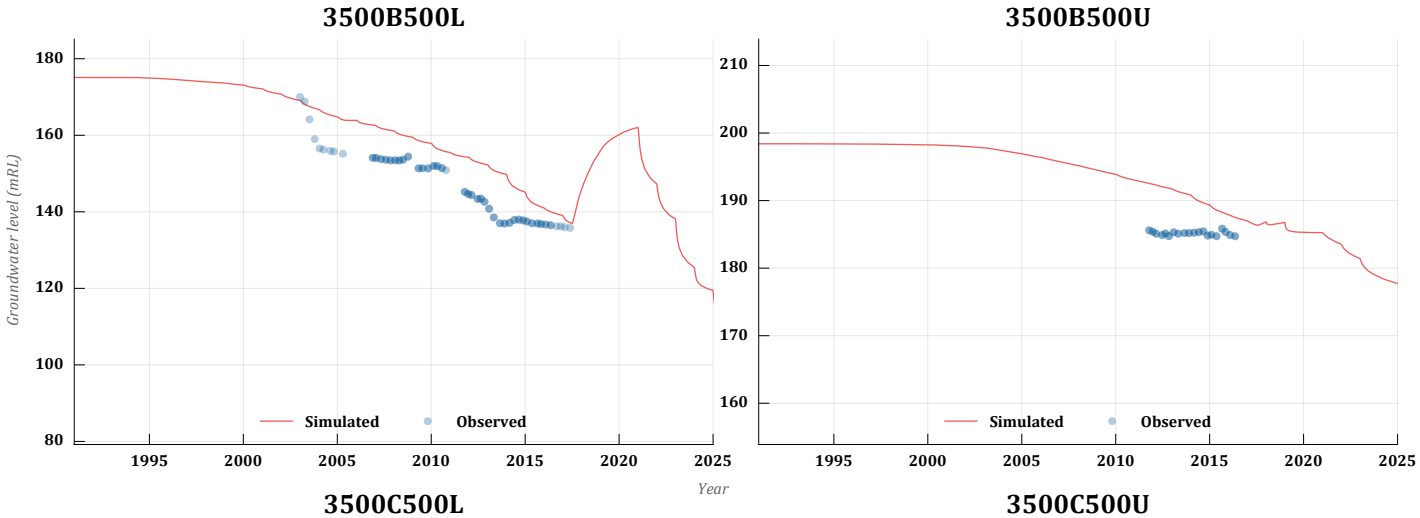
Note: min, max, and mean represent the minimum, maximum, and average values of the parameter across all available data.

Bore ID	Calcium (mg/L)				Magnesium (mg/L)				Potassium (mg/L)				Sodium (mg/L)				Carbonate Alkalinity as CaCO3 (mg/L)				Bicarbonate Alkalinity as CaCO3 (mg/L)			
	24-Q24	min	max	mean	24-Q24	min	max	mean	24-Q24	min	max	mean	24-Q24	min	max	mean	24-Q24	min	max	mean	24-Q24	min	max	mean
3500C500L	5	5	712	78	6	4	908	100	4	0	866	81	860	8	966	733	<20	0	74	10	1300	774	1300	1159
3500C500U	83	10	626	90	260	21	536	118	17	1	682	69	2200	6	2200	847	<20	0	24	4	1600	546	1600	1020
4500F000	180	51	2440	380	300	170	1100	373	12	0	1430	136	1300	9	1630	1201	<20	0	20	2	1300	940	1360	1239
5000D000-R	23	19	23	21	26	18	26	22	12	8	12	10	930	907	930	919	<20	1	20	11	870	783	870	827
5500D000	54	21	70	47	93	22	161	67	15	0	29	12	730	9	856	469	<20	0	20	2	1200	260	1290	741
6500F500L	31	30	44	37	53	26	54	40	10	6	26	13	440	100	789	500	<20	0	20	2	810	261	966	668
6500F500M	32	32	65	43	54	29	130	57	7	6	25	11	440	180	628	478	<20	0	20	2	790	545	852	748
6500F500U	110	110	130	116	250	200	260	237	12	10	15	13	710	540	750	678	<20	0	20	3	860	804	866	838
6500F625	75	69	102	83	150	136	171	151	10	7	12	9	480	416	531	463	<20	1	20	3	780	670	871	789
7500F000	5	5	878	109	3	2	257	62	4	0	512	50	1600	11	1690	1154	<20	0	62	6	2500	301	2700	1837
Melody	140	46	140	74	280	49	280	100	10	4	10	6	650	62	650	220	<20	1	20	3	880	409	880	571
MPBH1	56	24	72	44	30	20	45	26	1	0	22	3	32	2	32	25	<20	0	20	2	250	185	260	209
MPBH1-C	25	2	54	29	14	1	24	15	1	1	4	2	150	31	300	142	<20	1	27	7	420	232	475	338
MPBH1-HR	12	9	43	19	6	3	20	9	1	1	2	2	370	34	396	260	<20	1	20	5	730	208	730	423
MPBH2	110	43	110	71	68	32	72	46	1	0	28	3	68	1	68	35	<20	0	20	2	460	262	460	314
MPBH2-C	97	2	97	39	59	1	59	20	1	1	2	1	100	74	518	243	<20	1	573	158	470	1	470	215
MPBH2-HR	67	2	85	33	43	1	43	16	2	1	4	2	160	48	339	175	<20	1	79	27	490	9	566	321
MPBH3b	96	39	707	105	140	49	887	125	4	0	687	43	940	3	1060	655	<20	0	56	7	890	615	1010	799
MPBH4	230	225	350	271	190	179	229	207	5	5	7	6	670	488	713	664	<20	1	20	3	810	660	831	760
MPBH4-C	9	6	146	69	6	5	101	42	3	2	5	3	1000	381	1000	666	<20	1	20	6	800	467	800	625
MPBH5-C	17	4	70	19	21	1	21	4	2	2	8	4	260	142	260	184	<20	41	222	100	160	1	160	53
MPBH5-HR	50	48	64	51	30	28	31	29	1	1	2	2	89	81	96	88	<20	1	20	3	380	346	381	361
MPBH6	81	66	89	79	55	43	58	51	1	1	1	1	95	76	102	92	<20	1	20	3	340	322	444	384
MPBH6-C	28	9	28	15	19	5	19	9	6	4	7	5	700	700	1860	1589	<20	1	39	8	1200	1200	3280	2591
MPBH6-HR	20	20	74	40	15	12	55	27	8	3	9	6	1500	140	1700	1031	<20	1	63	11	2900	485	3000	1941
MPBH7	19	16	35	26	560	462	589	531	33	33	38	34	1800	1620	2000	1806	<20	1	20	5	1300	1300	1690	1480
MPBH7-C	16	15	21	18	290	24	321	144	26	20	27	23	2000	1700	2990	2406	<20	1	20	3	1400	1220	4520	2963
WRA1L	23	16	161	33	150	103	664	183	12	0	14	11	580	14	687	500	<20	0	20	2	910	768	1110	937
WRA6L	29	22	196	42	290	180	1050	314	16	0	19	15	1100	16	1100	877	<20	0	20	2	950	871	1750	1121
WRA6U	19	19	533	66	490	409	1480	615	30	0	51	34	1300	33	1640	1326	<20	0	20	2	1500	1220	1770	1525

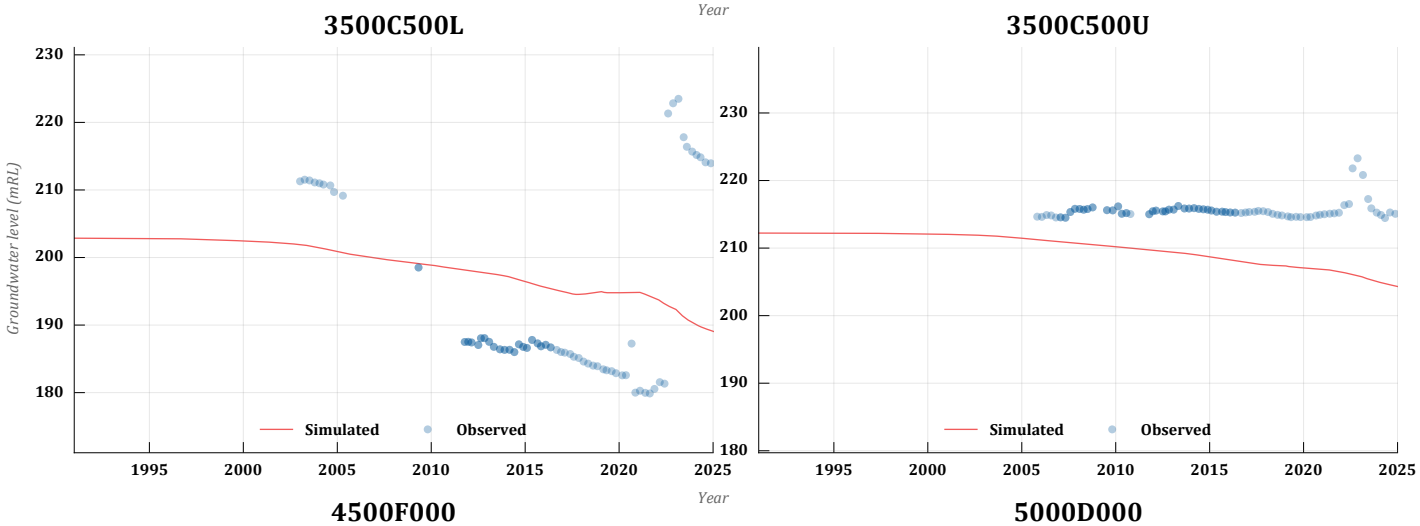
Note: min, max, and mean represent the minimum, maximum, and average values of the parameter across all available data.

Appendix F

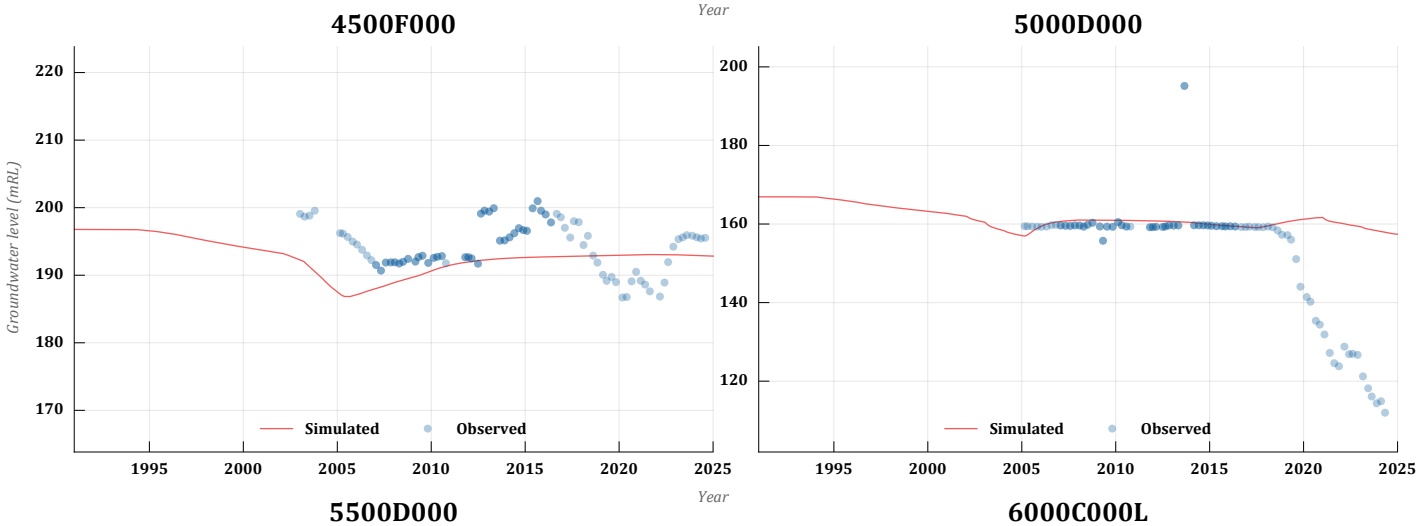
Model-data comparison hydrographs


3500B500L
Groundwater level (mRL)
180
160
140
120
100
80
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

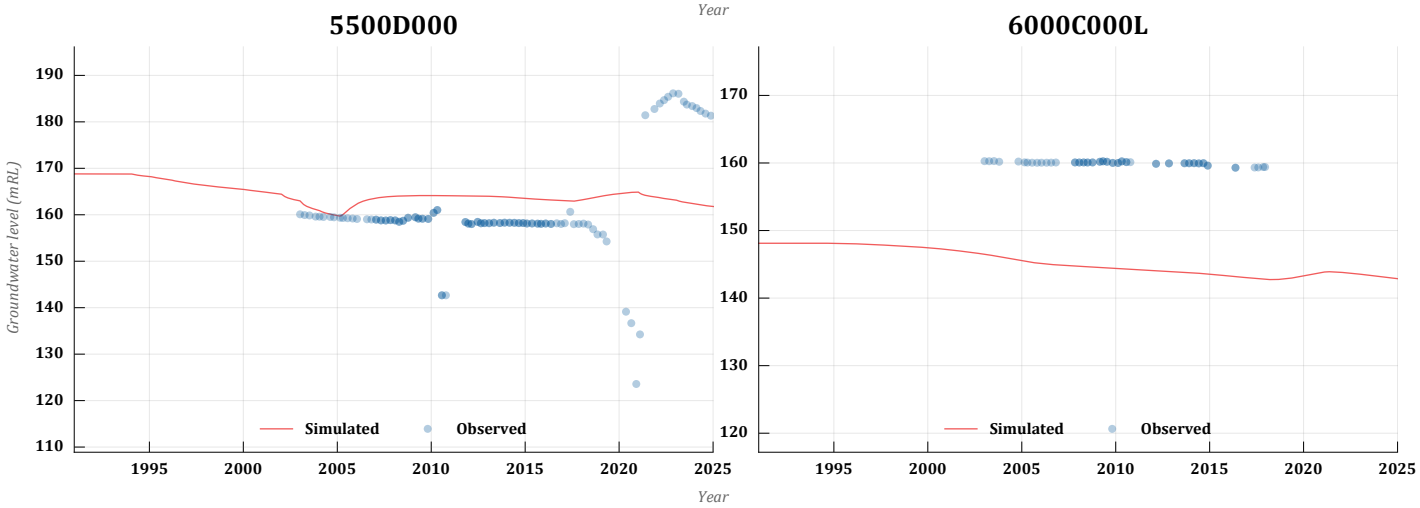
3500B500U
210
200
190
180
170
160
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025


3500C500L
Groundwater level (mRL)
230
220
210
200
190
180
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

3500C500U
230
220
210
200
190
180
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025


4500F000
Groundwater level (mRL)
220
210
200
190
180
170
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

5000D000
200
180
160
140
120
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025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Groundwater level (mRL)
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180
170
160
150
140
130
120
110
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

6000C000L
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160
150
140
130
120
Simulated
Observed
1995
2000
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2010
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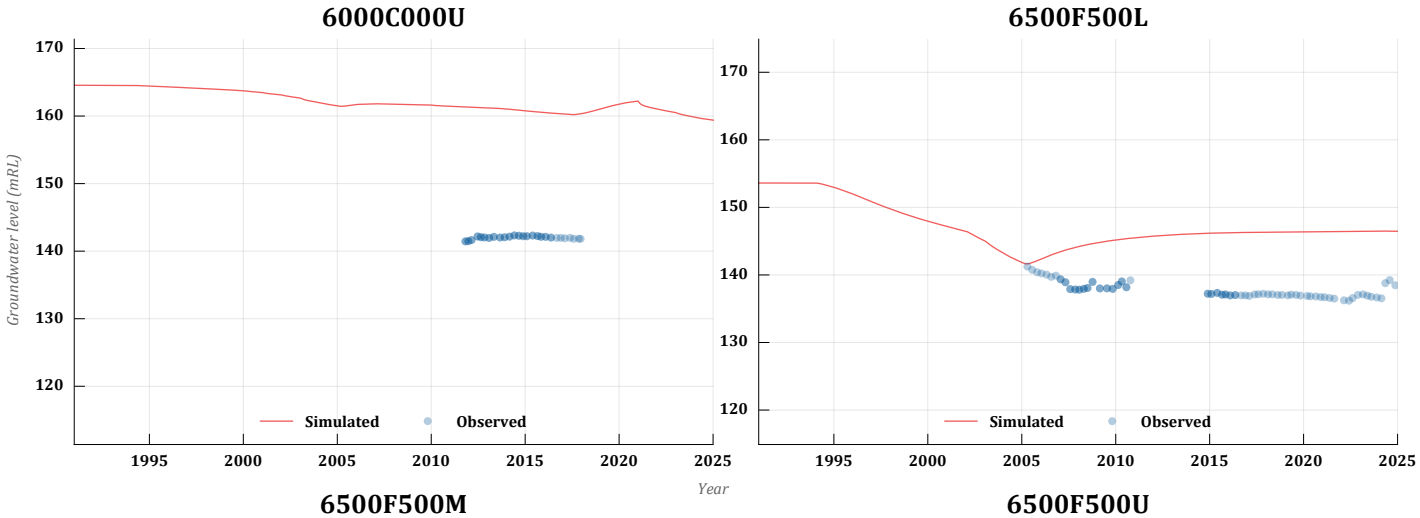
2020
2025


6000C000U
Groundwater level (mRL)
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160
150
140
130
120
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

6500F500L
Groundwater level (mRL)
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160
150
140
130
120
Simulated
Observed
1995
2000
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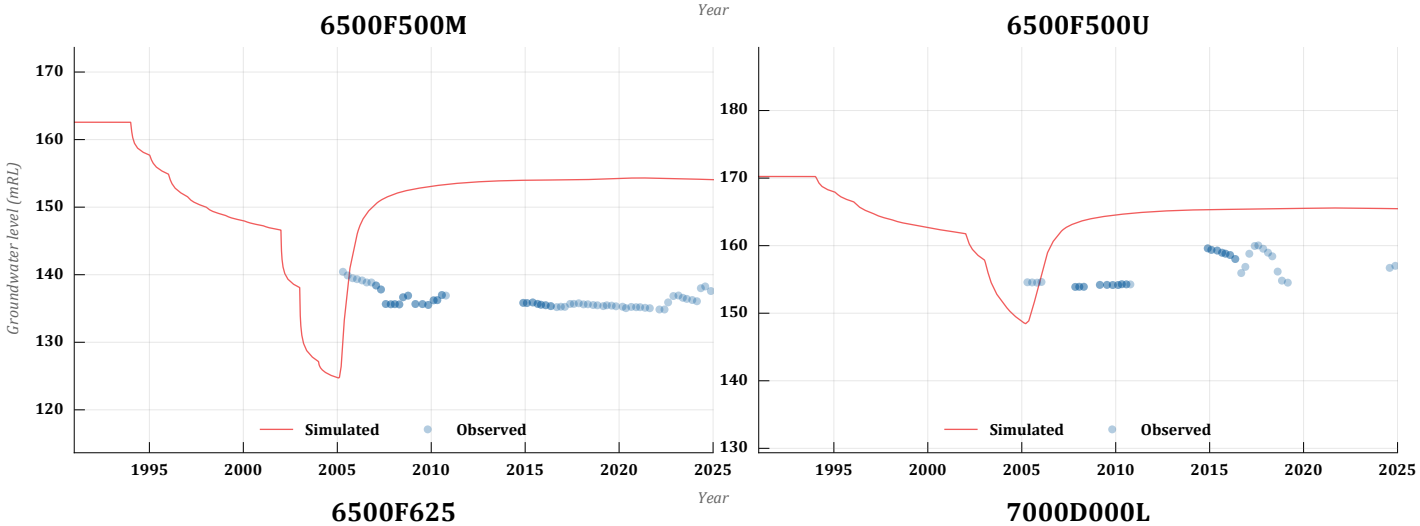
2010
2015
2020
2025
Year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Groundwater level (mRL)
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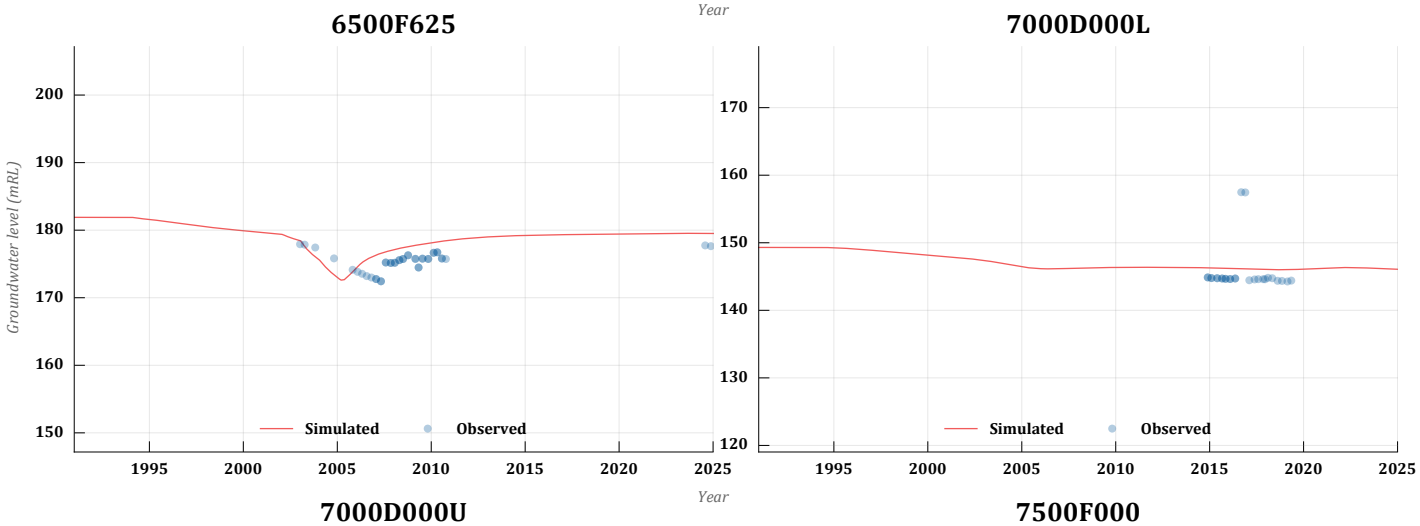
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

6500F500U
Groundwater level (mRL)
180
170
160
150
140
130
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year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Groundwater level (mRL)
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Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

7000D000L
Groundwater level (mRL)
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150
140
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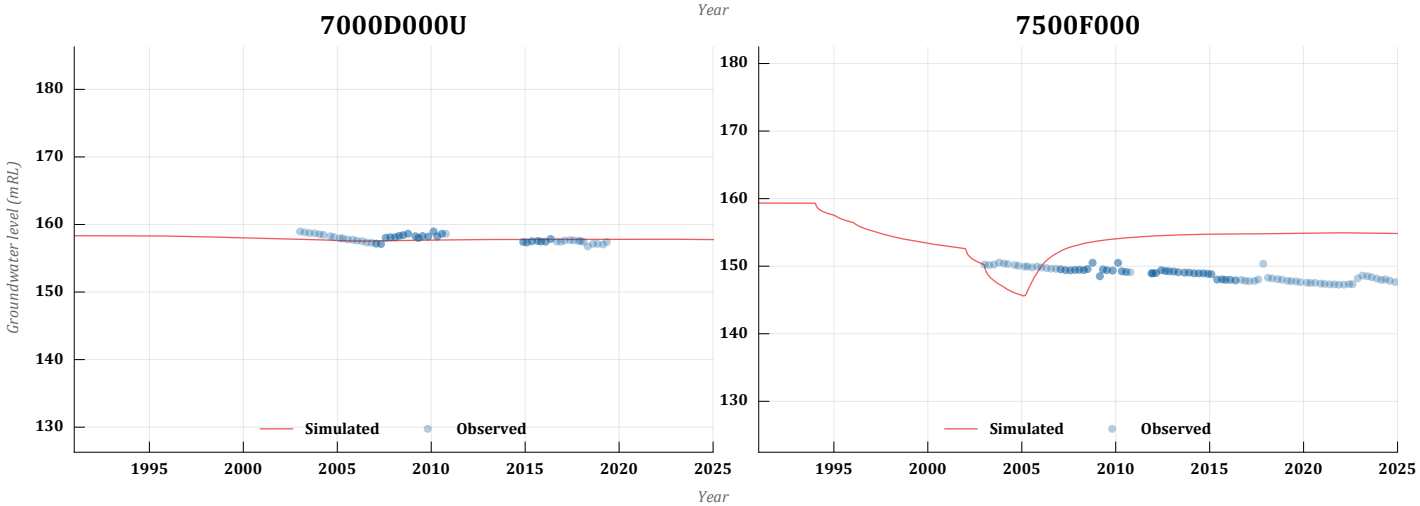
120
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year


7000D000U
Groundwater level (mRL)
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170
160
150
140
130
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

7500F000
Groundwater level (mRL)
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170
160
150
140
130
Simulated
Observed
1995
2000
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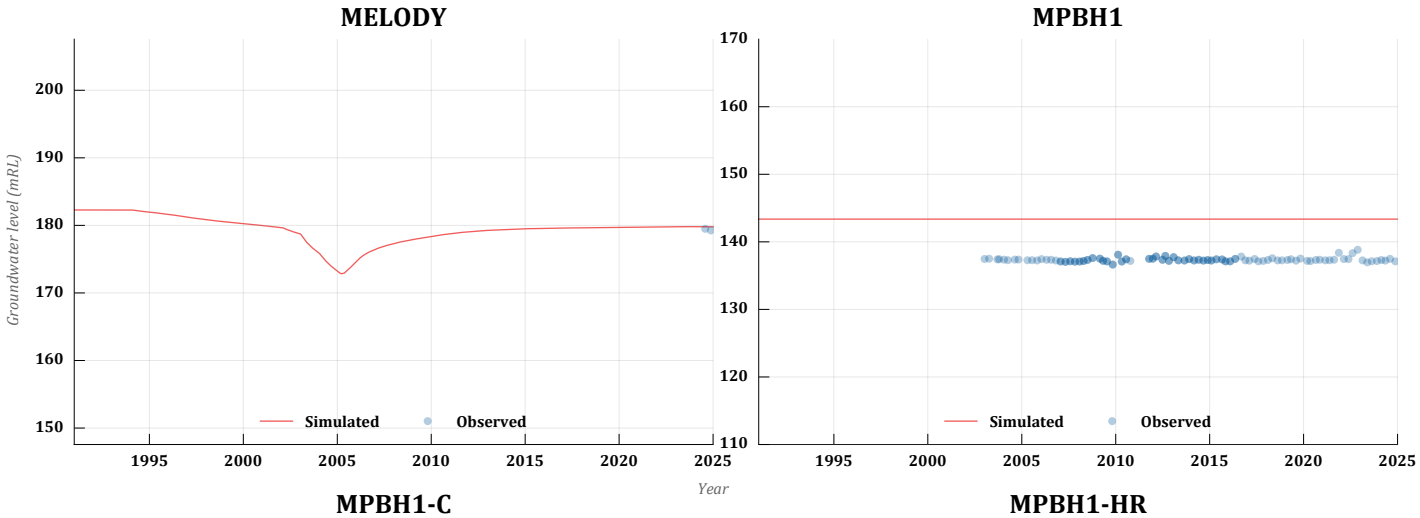
2015
2020
2025
Year


MELODY
Groundwater level (mRL)
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190
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170
160
150
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

MPBH1
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Simulated
Observed
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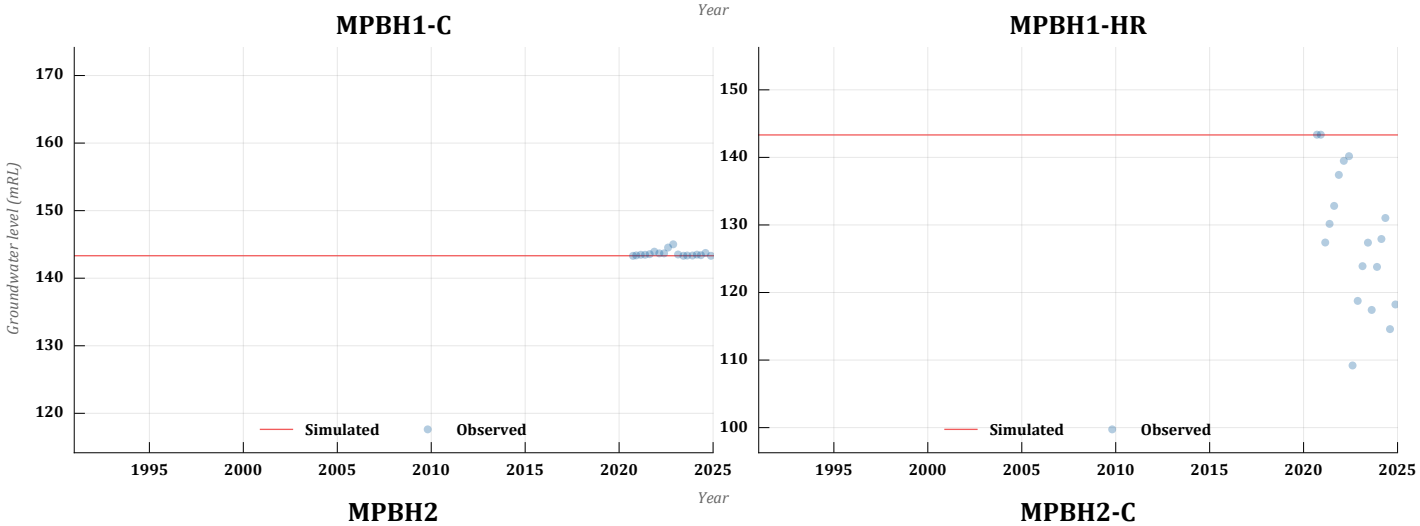
2010
2015
2020
2025


MPBH1-C
Groundwater level (mRL)
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160
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140
130
120
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

MPBH1-HR
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140
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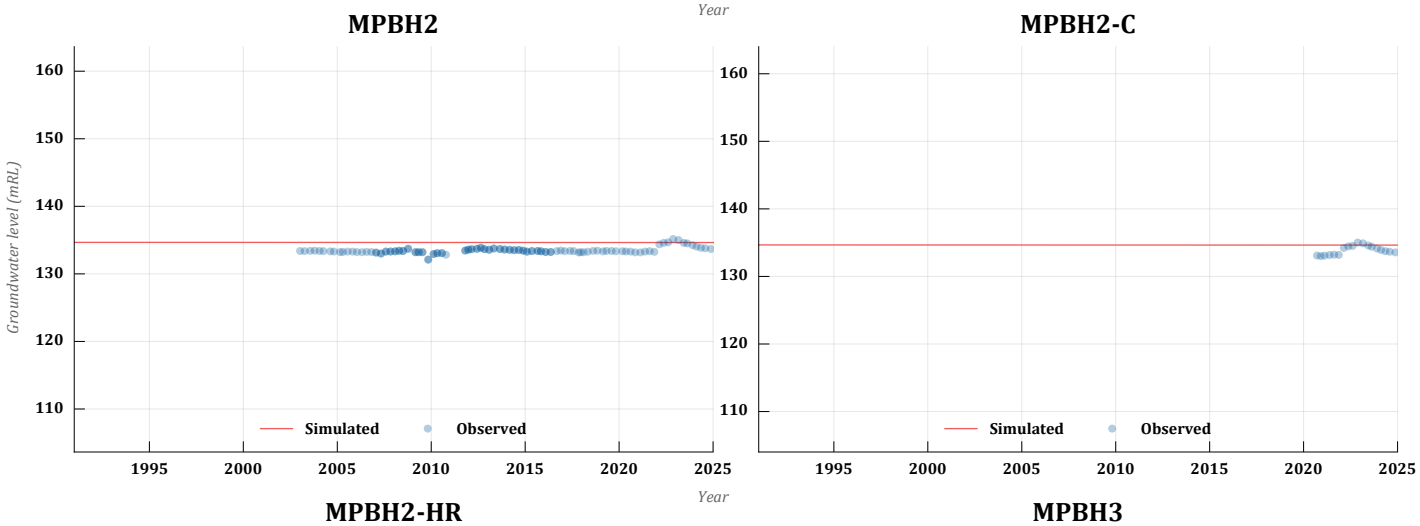
120
110
100
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025


MPBH2
Groundwater level (mRL)
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140
130
120
110
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

MPBH2-C
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130
120
110
Simulated
Observed
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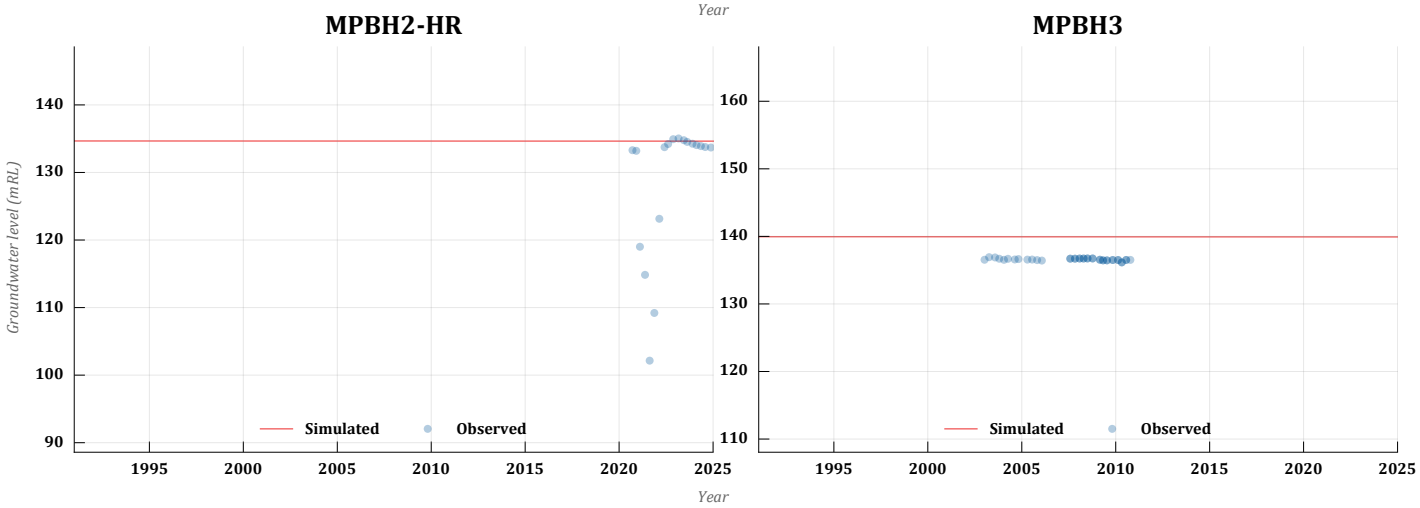
2005
2010
2015
2020
2025


MPBH2-HR
Groundwater level (mRL)
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120
110
100
90
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

MPBH3
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120
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Simulated
Observed
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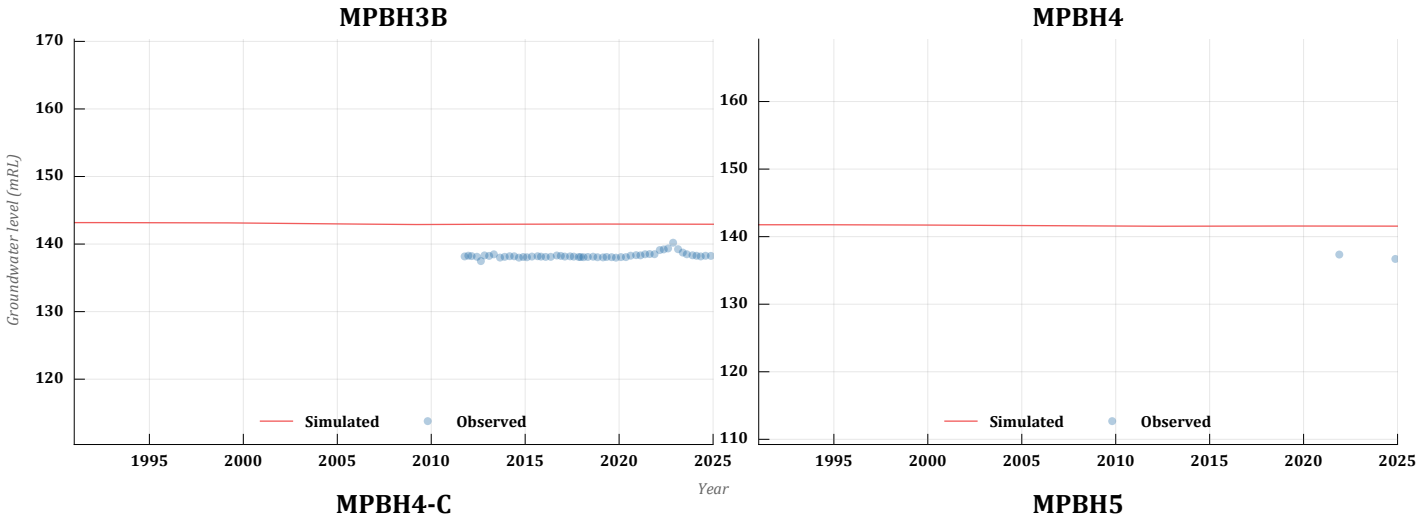
2010
2015
2020
2025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Groundwater level (mRL)
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130
120
Simulated
Observed
1995
2000
2005
2010
2015
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2025
Year

MPBH4
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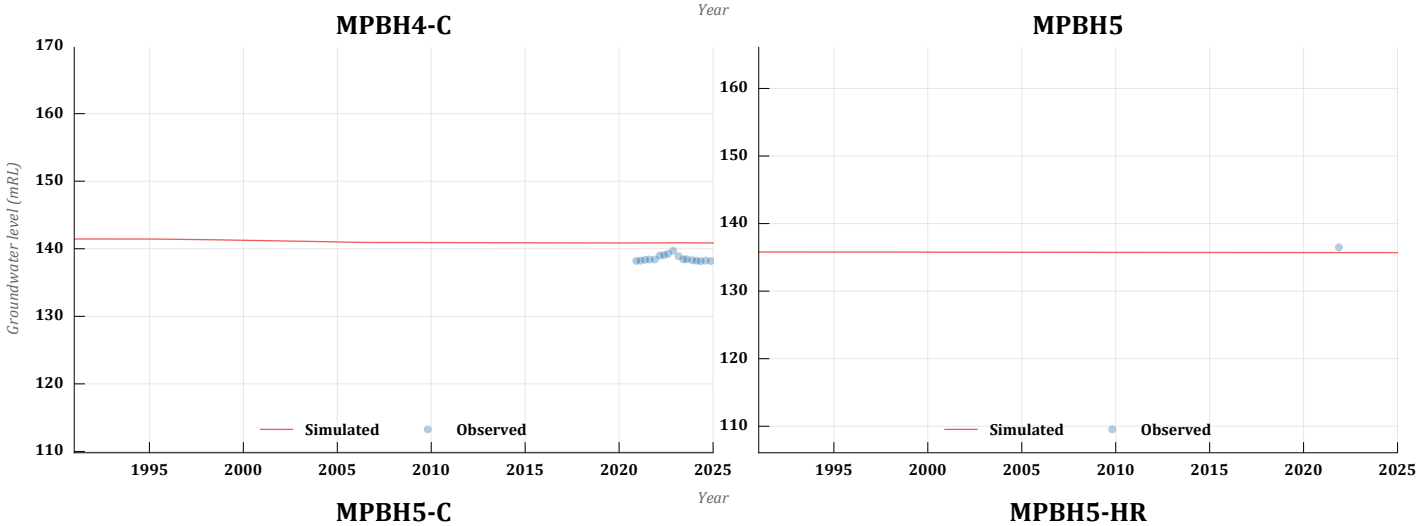
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Groundwater level (mRL)
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Simulated
Observed
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2000
2005
2010
2015
2020
2025
Year

MPBH5
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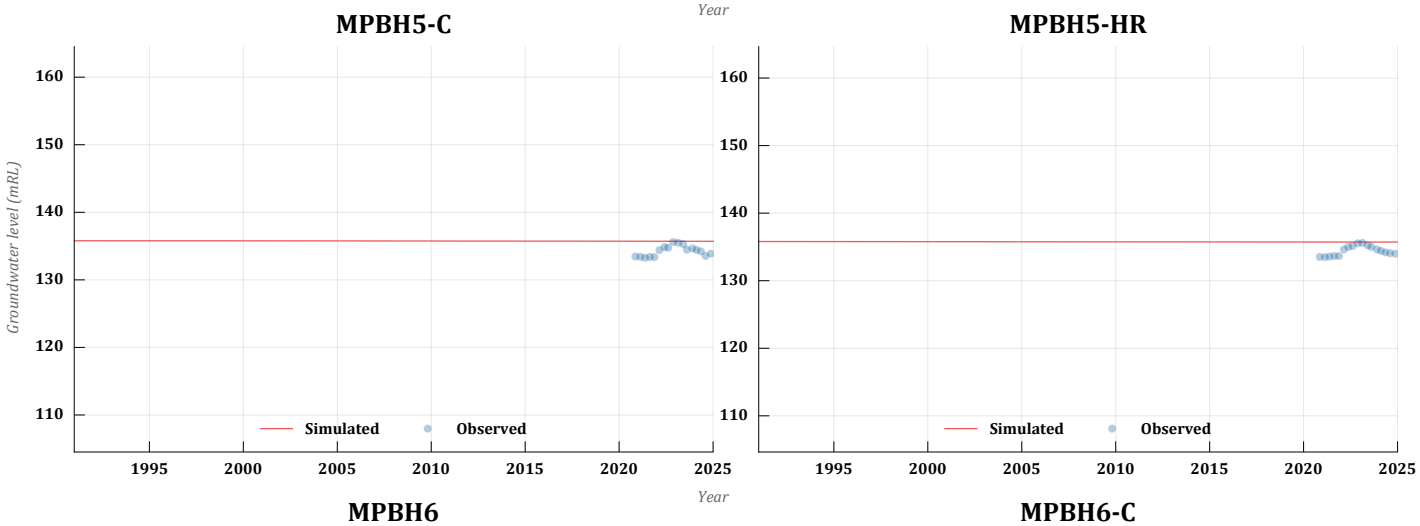
2015
2020
2025


MPBH5-C
Groundwater level (mRL)
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130
120
110
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

MPBH5-HR
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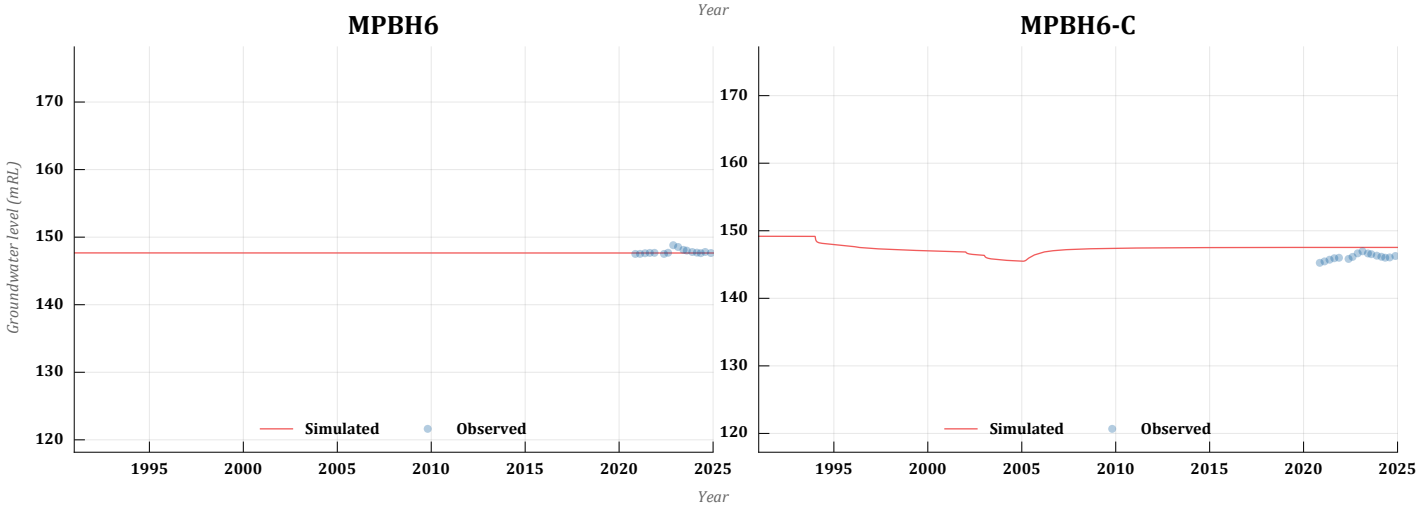
2025


MPBH6
Groundwater level (mRL)
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120
Simulated
Observed
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2000
2005
2010
2015
2020
2025
Year

MPBH6-C
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Simulated
Observed
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2010
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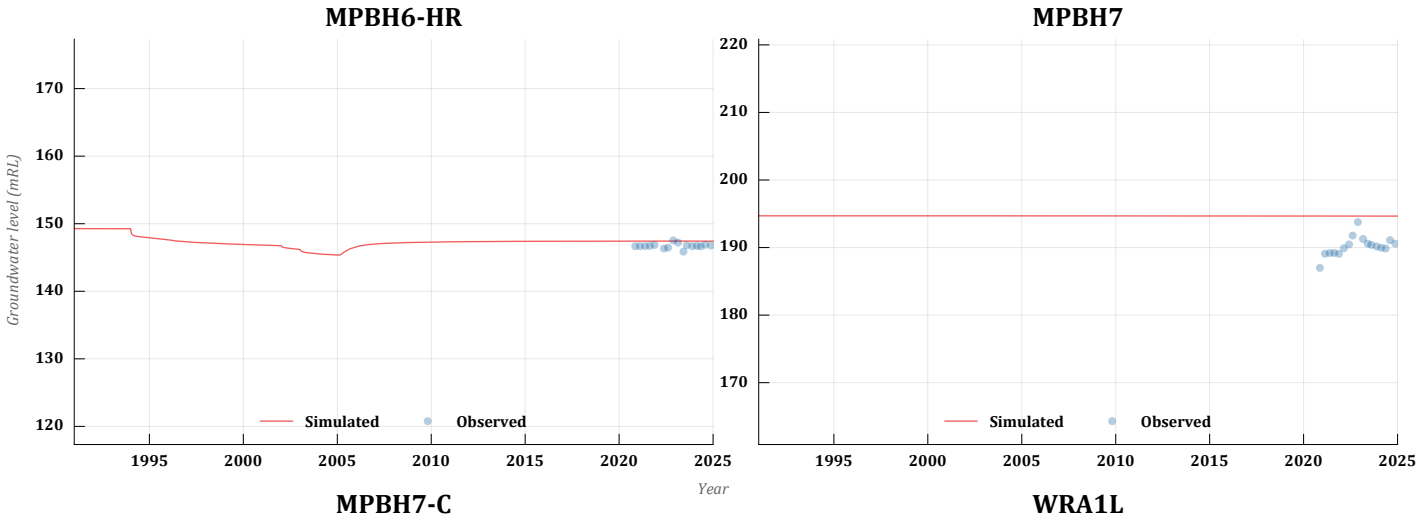
2025


MPBH6-HR
Groundwater level (mRL)
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120
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

MPBH7
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190
180
170
Simulated
Observed
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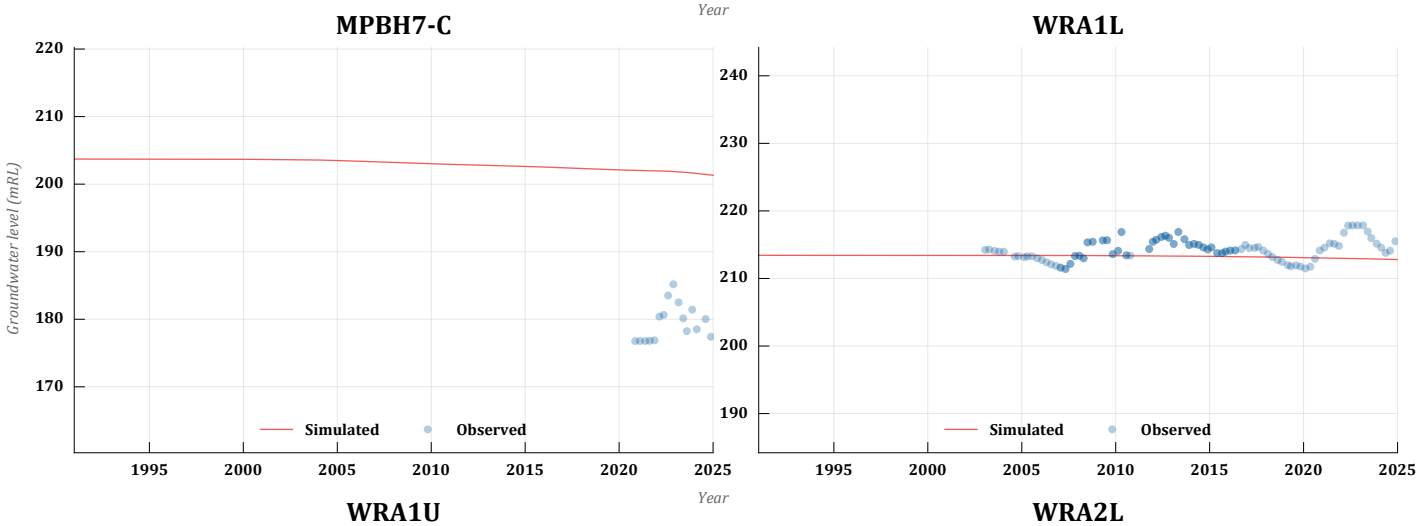
2010
2015
2020
2025


MPBH7-C
Groundwater level (mRL)
220
210
200
190
180
170
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

WRA1L
240
230
220
210
200
190
Simulated
Observed
1995
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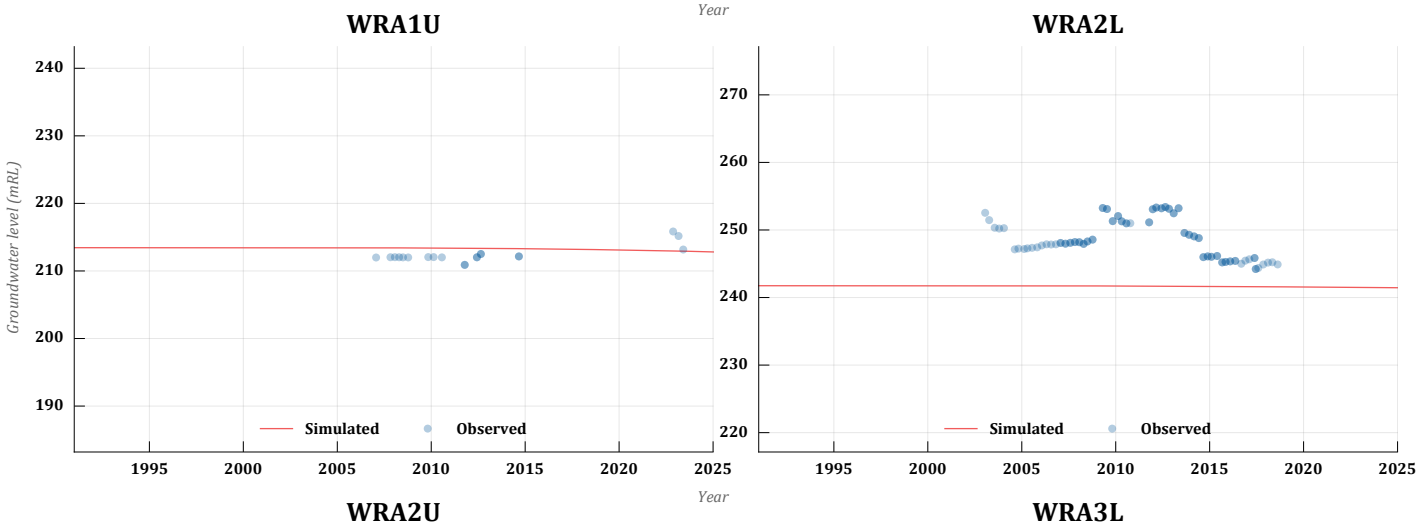
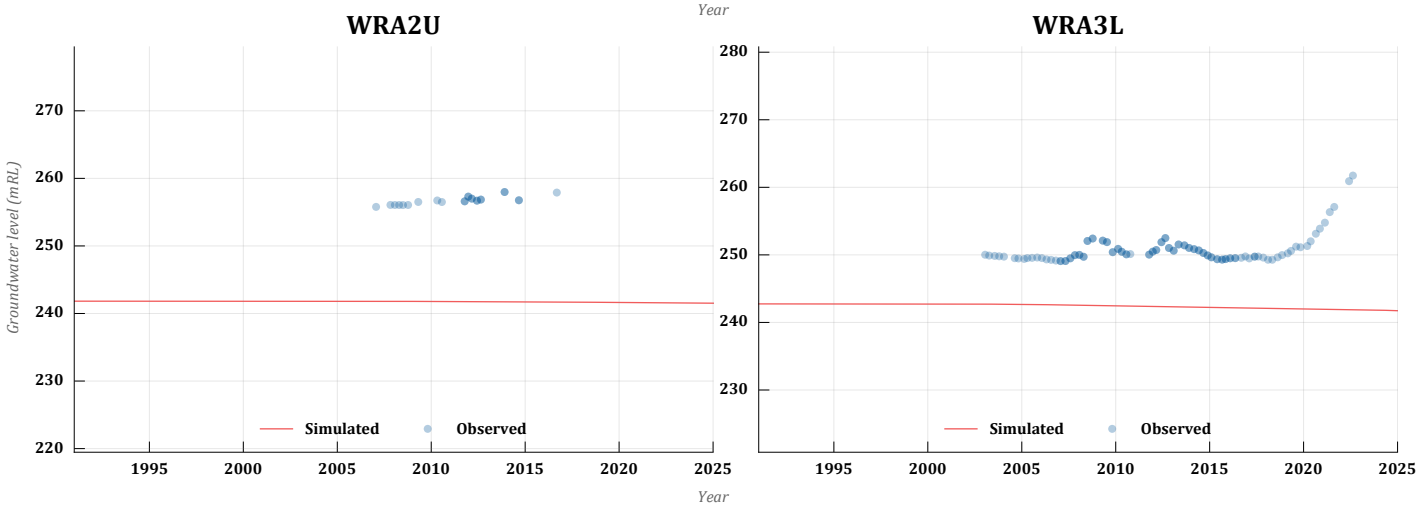
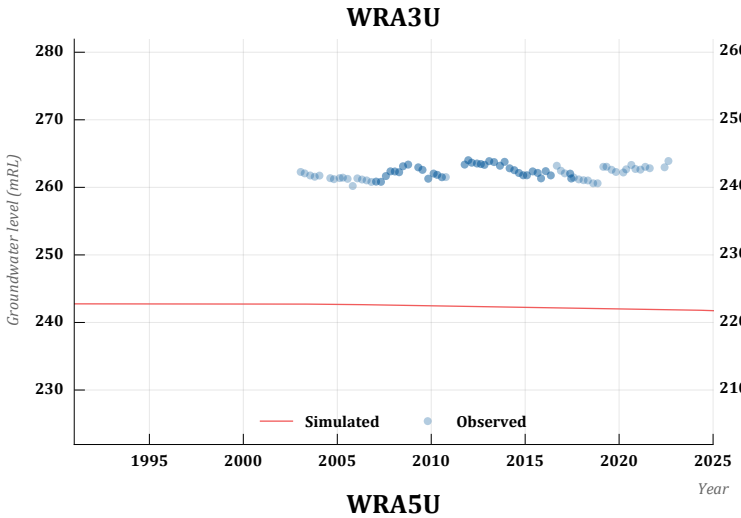
2005
2010
2015
2020
2025

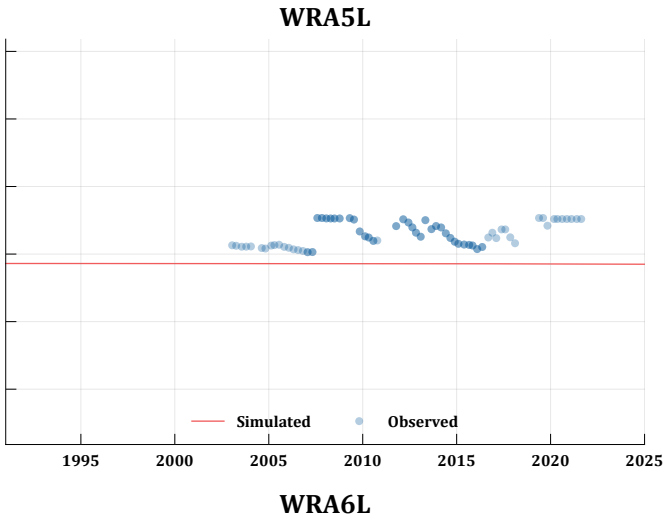

WRA1U
Groundwater level (mRL)
240
230
220
210
200
190
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

WRA2L
270
260
250
240
230
220
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025


WRA2U
Groundwater level (mRL)
270
260
250
240
230
220
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

WRA3L
280
270
260
250
240
230
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025


WRA3U
Groundwater level (mRL)
280
270
260
250
240
230
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year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240
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210
Simulated
Observed
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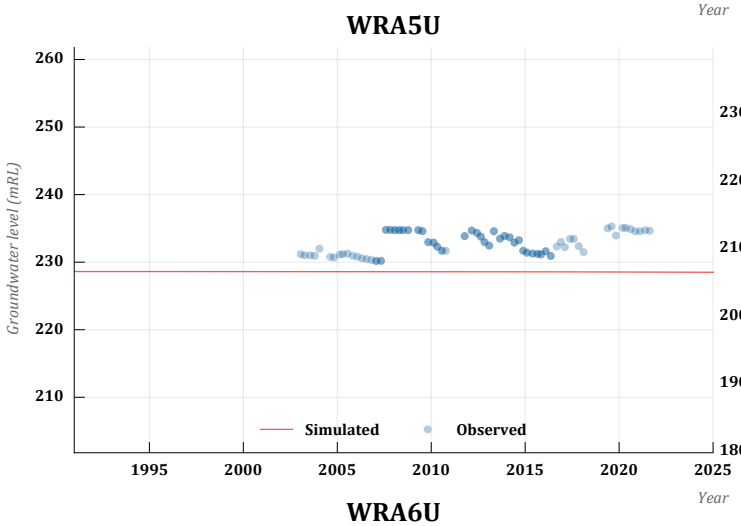
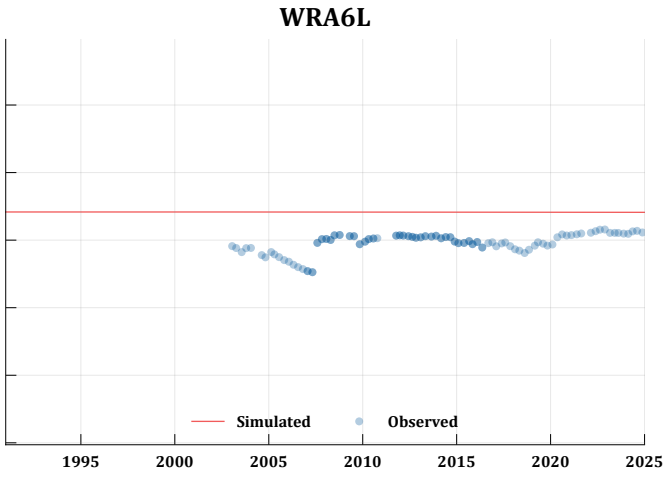
2000
2005
2010
2015
2020
2025


WRA5U
Groundwater level (mRL)
260
250
240
230
220
210
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year


WRA6L
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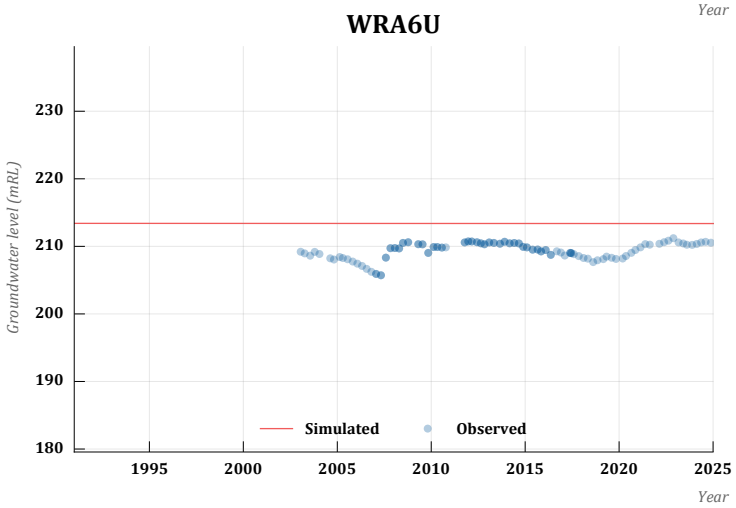
220
210
200
190
180
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025


WRA6U
Groundwater level (mRL)
230
220
210
200
190
180
Simulated
Observed
1995
2000
2005
2010
2015
2020
2025
Year

Thank you for having myself up to assist with this project was great to see its progress underway.

Please find attached regarding pre-clearance inspection completed for the Northern Link Road.

Summary as follows:

- **Date**: 15th August 2025.
- **Time**: Survey was conducted Diurnal 7am-4pm.
- **Weather**: Weather was partially cloudy but mostly sunny, with very low wind present and no rain observed.
- **Vegetation**: Most of the area was scattered open woodland. Dominant tree species included the *Eucalyptus melliodora* (Yellow Box), *Eucalyptus moluccana,* (Grey Box), with sporadic *Corymbia maculata* (Spotted Gum), *Brachychiton populneus* (Kurrajong) and *Eucalyptus crebra* (Narrow-leaved Ironbark).
- **Habitat trees identified**: 90 in total as per GIS provided in GDA2020 format. All have been marked with pink 'H' in spray paint and pink flagging tape.
- **Weed species present**: weed cover is <5% of the area, with the majority being general pasture weeds. Some priority weeds observed included Galenia, African boxthorn, Prickly pear, and Fireweed.
- **Fauna present**: Eastern Grey Kangaroos, Sulphur Crested Cockatoos, Pied Butcher Birds, Eastern Rosella, Galah, Magpie, Crow, Magpie Lark, Noisy Miner, Spotted Pardalote and Welcome Sparrow sighted within, or travelling through area. No nests or burrows were observed.
- **Other items noted**:
    - Various redundant internal fencing within GDP area.

Recommendations:

- Weed management of topsoil stockpiles to prevents priority weeds (scattered throughout and amongst habitat tree stands) from re-populating.
- Having a present Ecologist/Fauna Spotter Catcher present to ensure fauna safety and relocation is undertaken as required.

I have attached some indicative photos of habitat trees/stags found within the area. Many of these are very viable habitat for larger nesting parrots or marsupials and are likely to have them present.

If you would like all the images (as there are quite a few) please let me know and we can organise getting them to you when onsite or through a larger allowance file transfer system (like WeTransfer).

Anything else please let me know.

Jonathan Kool
Environmental Consultant, Atlantech

MACH ENERGY- Mount Pleasant Operation

15/08/2025 Pre-Clearance Inspection

ATLANTECH



Northern Link Road Footprint

Habitat Tree

0 0.4 0.8 1.6 Kilometers

Date Created: 21/08/2025
Map Created By: S de Wet
Map Size: A4 Portrait
Coordinate System: GDA2020 MGA Zone 56
Map Reference: ATLGIS25-028_A4-2

Figure 1


DIRECTION
338 deg(T)
294241 6433890
ACCURACY 4 m
DATUM GDA2020
1
2025-08-15
08:03:32+10:00


DIRECTION
261 deg(T)
294735 6433795
ACCURACY 3 m
DATUM GDA2020
13
2025-08-15
08:52:12+10:00

MOUNT PLEASANT OPERATION

MOUNT PLEASANT OPTIMISATION PROJECT

EPBC APPROVAL 2020/8735

2024/2025 ANNUAL COMPLIANCE REPORT

Attachment 2

Schedule of Plans

Mount Pleasant Operation - EPBC Approval (2020/8735) EMP Register
24/11/2025

Plan	EPBC Condition Number	State Development Consent[1] Condition Number	Version Number (Latest Approved)	Latest Submission Date	Latest Approval Date	Due Date for Next Review
Biodiversity Management Plan	5	B63	2	11 August 2025	5 November 2024	11 August 2026
Rehabilitation Management Plan	5	B92	4	-	16 September 2025	11 August 2026
Rehabilitation Strategy	5	B89	4	18 July 2025	23 July 2025	-
Water Management Plan	8, 9, 19	B52	3	11 August 2025	7 February 2025	11 August 2026
Impact Response Plan	14	-	Not yet triggered[2]	-	-	As required

Notes

1 SSD-10418 issued under the NSW *Environmental Planning and Assessment Act 1979*.

2 MACH Energy Australia Pty Ltd (MACH) has not yet predicted or detected a reaching of a performance measure as defined under the conditions of EPBC 2020/8735. On this basis, the need to prepare an Impact Response Plan has not yet been triggered.