Kerosene Vale Ash Repositories

Annual Environmental Management Report

Prepared for Generator Property Management Pty Ltd

October 2024

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Generator Property Management Pty Ltd

E230337 RP#1

October 2024

Version	Date	Prepared by	Reviewed by	Comments
1	30 September 2024	Natalie Devillers	Phil Towler	Initial draft issued to client for review
2	28 October 2024	Natalie Devillers	Phil Towler	Second draft issued to client for review
3	31 October 2024	Natalie Devillers	Phil Towler	Final

Approved by

Phil Towler
Associate Director
31 October 2024

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Executive Summary

Table ES1 Annual Environmental Management Report title block

Name of operation	Kerosene Vale Ash Repository
Operation historically referred to as	• Wallerawang Ash Repository • Lidsdale Ash Dam
Name of operator	Generator Property Management Pty Limited
Development consent/project approval #	07/0005 (Mod 2)
Name of holder of development consent/project approval	Consent lists Proponent as 'Energy Australia' GPM took ownership of the site in 2020
AEMR start date	1 September 2023
AEMR end date	31 August 2024
I, *John Pola,* certify that this audit report is a true and accurate record of the compliance status of Kerosene Vale Ash Repository for the period 1 September 2023 to 31 August 2024 and that I am authorised to make this statement on behalf of Generator Property Management Pty Limited. *Note.* *a). The AEMR 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	John Pola
Title of authorised reporting officer	Manager Safety & Environment
Signature of authorised reporting officer	
Date	28 November 2024

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1 Summary of compliance

Generator Property Management Pty Limited (GPM) own and operate the Kerosene Vale Ash Repositories and surrounds, located at Skelly Road, Lidsdale NSW (the Project Area). This Annual Environment Management Report (AEMR) has been prepared pursuant to Schedule 2, Condition 7.3 of Project Approval 07_0005 and in accordance with the NSW Government's *Post-approval requirements for State significant mining developments, Annual Review Guideline* dated October 2015.

The Project Area consists of:

- the Kerosene Vale Dry Ash Repository (KVAR) and underlying former Kerosene Vale Ash Dam (KVAD)
- Sawyers Swamp Creek Ash Dam (SSCAD)
- The associated heavy vehicle access route
- KVAR and SSCAD private access routes.

A summary of the Kerosene Vale Ash Repository compliance achieved during the reporting period is provided in Table 1.1. There were no non-compliances recorded during the 2023-2024 reporting period (1 September 2023 to 31 August 2024). An extended review of compliance with the Conditions of the Approval (CoA) is presented in Appendix A which satisfies the requirement for a Compliance Tracking Program, in accordance with Condition 4.2 of Project Approval 07_0005.

Table 1.1 Statement of compliance during the 2023-2024 reporting period

Were all conditions of the relevant approval(s) complied with?	
Project Approval #07_0005	Yes

No non-compliances were identified during the AEMR reporting period. Assessment of compliance was conducted using the compliance status key presented in Table 1.2.

Table 1.2 Compliance key status

Risk level	Colour code	Description
High		Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence.
Medium		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-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		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).
Compliant		The intent and all elements of the requirement of the regulatory approval have been complied with.

An acceptable standard of environmental performance has been achieved during the reporting period as evidenced by the following:

- All noise limits were complied with at all sensitive receivers during the reporting period.
- Air quality monitoring results relating to activities at the Kerosene Vale Repository site were below the Operational Environment Management Plan (OEMP) assessment criteria for depositional dust gauges located in the Lidsdale township.
- Surface water quality trends in Lidsdale Cut and the SSCAD are consistent with recent AEMR periods (i.e. 2018 to the current period). The water quality in Dump Creek was consistent with ash affected water during dry conditions. The water quality in Sawyers Swamp Creek downstream of the Site (WX7) is generally consistent with clean water. The water quality in Coxs River is not affected by the inflows from Sawyers Swamp Creek.
- Groundwater quality trends during the AEMR Period were generally consistent with recent AEMR periods (i.e. 2018 to the current period).
- No Asbestos waste was disposed of during the reporting period.
- No known heritage sites associated with the project approval were impacted during the reporting period and no new heritage sites were identified within the reporting period. No new heritage sites were identified during the reporting period.
- Weed management has been ongoing throughout the reporting period. Priority weeds, Pampas Grass and Blackberry, have been targeted and removal of pine trees has commenced to reduce fire safety risks.
- There was only one community complaint received relating to the management of the Project Area.

GPM is committed to the continuous improvement and safe management of the site and propose to:

- Continue to liaise with the EPA and the approved site auditor in regards to the Voluntary Management Proposal (VMP) and detailed site investigation (DSI) outcomes to quantify and control contaminated materials at the site in the next AEMR reporting period.
- Review and update the Operational Environmental Management Plan (OEMP) to ensure care and maintenance of the site reflects current practices and is in line with best practice. The OEMP is in the process of being revised and finalised and is anticipated to be implemented during the 2024-2025 AEMR period.
- Review and update the Construction Environmental Management Plan (CEMP) to ensure construction activities required for the closure of the site are included in the plan and are in accordance with the approval and licence conditions and is anticipated to be implemented during the 2024-2025 AEMR period.
- Ensure that the long term remediation and closure of the site is planned and executed in accordance with the VMP and auditor requirements and in consultation with the local community, including neighbours who adjoin the land holding.
- A Community Consultation Forum has been established and will continue to operate in the 2024-2025 AEMR reporting period. It is intended that this group will meet quarterly with the GPM team and provide feedback on plans related to closure of the site for consideration prior to finalisation.

- An Independent Environmental Representative (ER) was engaged and approved by DPHI during the period to ensure closure works are undertaken in accordance with the approval requirements.

2 Introduction

2.1 Background

The Kerosene Vale Ash Repository is located at Skelly Road, Lidsdale NSW (the Project Area) which is approximately 15 kilometres (km) northwest of Lithgow and 2.5 km north-east of former Wallerawang Power Station (WPS).

The WPS was separated into two separate ownership parcels in 2020 with the land north of the Castlereagh Highway purchased by Generator Property Management (GPM) in September 2020 from EnergyAustralia NSW. GPM continues to operate the site, which comprises an area of approximately 528 hectares (ha) and is situated on Lot 2 in Deposited Plan (DP) 1139928 and Lot 5 DP 1284934.

The Project Area comprises:

- the Kerosene Vale Dry Ash Repository (KVAR) and underlying former Kerosene Vale Ash Dam (KVAD)
- Sawyers Swamp Creek Ash Dam (SSCAD)
- The associated heavy vehicle access route
- KVAR and SSCAD private access routes.

The Project Area has a long history of being used for disposal of powerstation waste from the WPS since the late 1950s, and for disposal of other mining and industrial waste. The Project Area has been historically known as the Wallerawang Ash Repository, and the Lidsdale Ash Dam Area. Since the closure of WPS in 2014, the Kerosene Vale Ash Repository has been placed in care and maintenance. GPM's objectives within the Project Area include management of ongoing regulatory and contractual obligations during decommissioning, demolition, rehabilitation and closure of the site.

2.2 Site history

The original ash placement operations were conducted at the KVAD. The void was filled with ash transported from the WPS as slurry (i.e. wet ash placement). When the KVAD was full, it was capped clay and then ash placement operations began at the SSCAD, which saw wet ash placement take place between 1980 to 2003.

The need to further develop the KVAR area in order to maintain power-generation operations at WPS was identified in 2001. The existing wet ash storage area (i.e. SSCAD) was approaching its design capacity and the placement of dry ash at the KVAR was identified as a viable alternative. The extent of both the KVAR and SSCAD ash placement areas is depicted in Figure 2.1.

Conversion from wet to dry ash placement aimed to minimise environmental and social impacts potentially resulting from heavy metal accumulation. Key benefits of a dry ash handling facility included:

- the potential for ash to be beneficially reused in its dry form
- an approximate 80% decrease in the water required to transport ash
- discharges to the Coxs River are decreased in the long term
- the SSCAD can be progressively rehabilitated
- there would be a decreased flood risk for Kerosene Vale, Kerosene Vale and surrounding areas (Hyder Consulting, 2001).

In 2002, Project Approval was granted by the then Minister of Planning to change from wet to dry ash-producing activities and to use the KVAR area for dry ash storage. On 26 November 2008, Project Approval was granted by the then Minister of Planning for the extension of the existing KVAR area to permit the continued disposal of ash generated by the WPS under Part 3A (now repealed) of the *Environmental Planning and Assessment Act 1979*. The KVAR Stage 1 placement works were completed and capped in February 2009. The KVAR Stage 2 placement works commenced soon after in April 2009. In August 2018, a modification (MOD 1) was approved to allow for the importation of clean fill to the Kerosene Vale Ash Repository (former Wallerawang Ash Repository) from off-site sources outside of the Lithgow Local Government Area (LGA). In October 2023, a modification (MOD 2) was approved to allow for an extension of time by ten years to continue transporting capping material to the project site. This extension of time accounts for the significant volumes of suitable capping material required to fully rehabilitate the Project Area, and the inherent supply limitations of suitable excavated material from large infrastructure projects within a reasonable haulage distance to the site.

The original ash placement strategy, as outlined within the Operation Environmental Management Plan (OEMP) (EnergyAustralia NSW, 2018), was as follows:

- Stage 2A as an extension of Stage 1
- Stage 2B to allow time for the re-alignment of Sawyer's Swamp Creek and for material to be obtained from the pine plantation area to reinforce the stabilisation berm to the north of KVAR Stage 1.
- Stage 2C as a final ash placement area once reinforcements of a proposed stabilisation berm with creek realignment had been carried out.

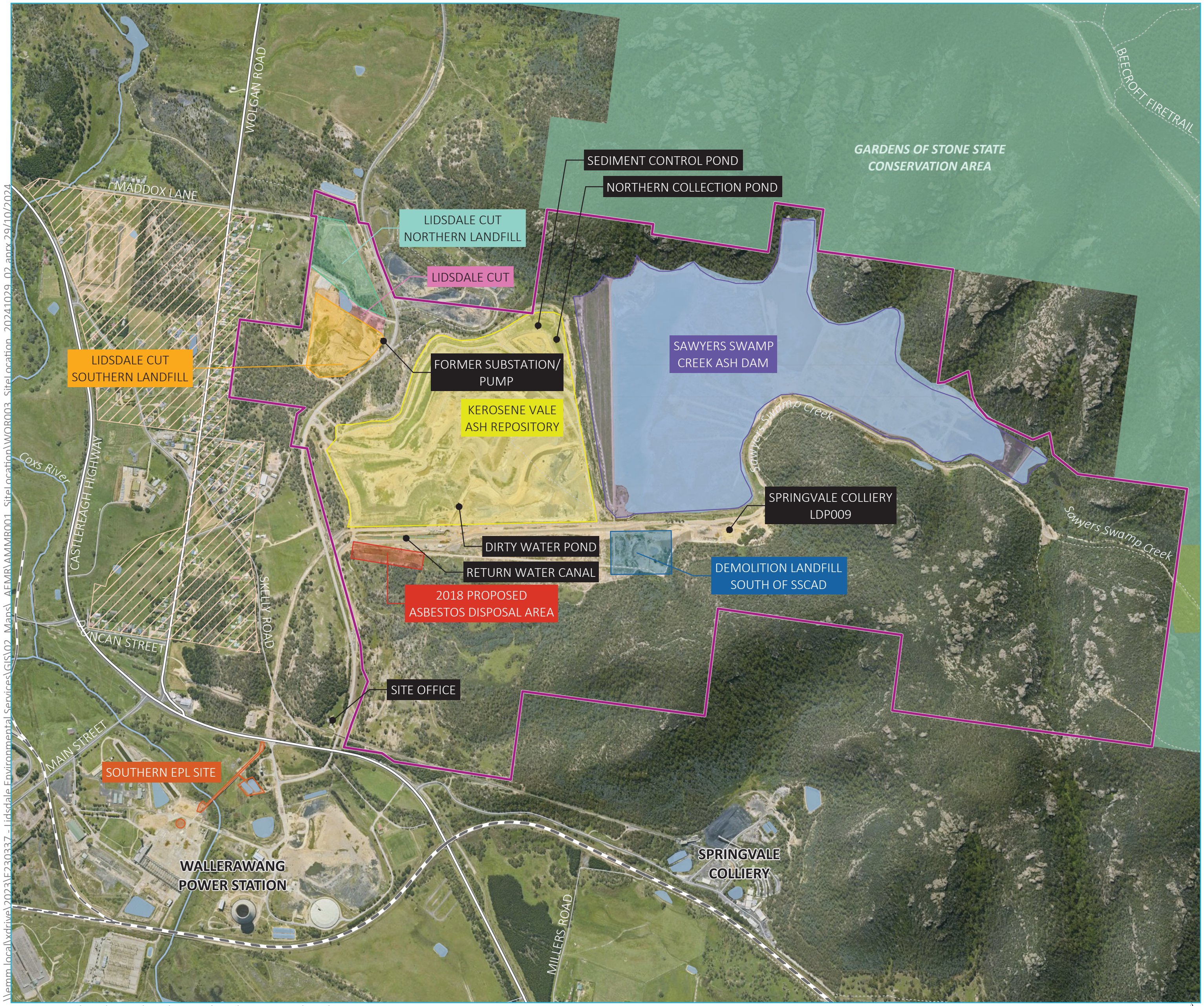
Since the first AEMR was submitted in 2011, the ash placement strategy for KVAR Stage 2 has been updated to reflect changes from the three-stage process outlined above, to a two-staged approach. This change in strategy was in response to Centennial Coal relinquishing their right to extract coal from the areas of mining interest within the KVAR Stage 2 proposal.

WPS ceased energy production in April 2014 with the closure of the WPS outlined in a three-phase plan that involves the decommissioning, deconstruction and repurposing (DDR) of the power station including Kerosene Vale Ash Repository. In 2014 the closure and demolition of the WPS was approved which included the development of an asbestos repository for the disposal of material from WPS. The selected asbestos repository site is located immediately south of the return water canal near the southwestern corner of the KVAR/KVAD.

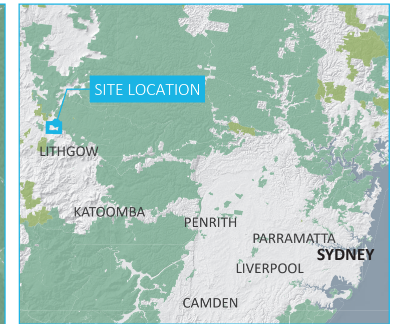
In 2018, approval was granted to import virgin excavated natural material (VENM) and excavated natural material (ENM) to use as capping material from sources outside of the Project Area and Lithgow LGA at the site, pursuant to former section 75W of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).

In 2020 when ownership was transferred to GPM, the Project Area had minimal active management since closure of the WPS, and had been heavily impacted by bushfires in the summer of 2019 and again in 2020. The site has been placed in care and maintenance with no ash received from WPS during the AEMR reporting. Environmental studies and investigations are currently underway to support GPM's safe decommissioning, demolition, rehabilitation and management of ongoing regulatory and contractual obligations associated with the Project Area.

On 22 August 2022, the EPA agreed to a voluntary declaration and declared the site under a Contaminated Land Declaration Notice which declares the Site as significantly contaminated land under division 2 the *Contaminated Land Management Act 1997*. GPM has submitted a VMP to the EPA that establishes a proposed investigation and remediation approach (section 10.1).



Source: EMM (2024); GPM (2023); DCSSS (2024); MetroMap (2024)



KEY

- Site boundary
- Nearest sensitive (residential) receivers
- 2018 proposed asbestos disposal area
- Demolition landfill south of SSCAD
- Kerosene Vale ash repository
- Lidsdale cut northern landfill
- Lidsdale cut southern landfill
- Lidsdale cut
- Sawyers Swamp Creek ash dam
- Southern EPL site

Existing environment

- Rail line
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- Waterbody
- NPWS reserve
- State forest

INSET KEY

- NPWS reserve
- State forest

Site layout and location from previous AEMR

Lidsdale Environmental Services
Annual Environmental Management Report
Figure 2.1

creating opportunities

2.3 Purpose of the AEMR

This AEMR has been prepared to satisfy Schedule 2, Condition 7.3 of Project Approval 07_0005 (see Table 10.1). This report covers the operations and environment and community performance of the site from 1 September 2023 to 31 August 2024 (the AEMR reporting period).

Table 10.1 Relevant condition of PA 07_0005

Condition	Detail	Section where addressed
7.3	The Applicant shall, throughout the life of the project, prepare and submit for the approval of the Secretary, an **Annual Environmental Management Report** (AEMR). The AEMR shall review the performance of the project against the Operation Environmental Management Plan (refer to condition 6.4 of this approval) and the conditions of this approval. The AEMR shall include, but not necessarily be limited to:	This report
7.3 (a)	details of compliance with the conditions of this approval	This table
7.3 (b)	a copy of the Complaints Register (refer to condition 5.4 of this approval) for the preceding twelve-month period (exclusive of personal details), and details of how these complaints were addressed and resolved	Section 8.3.1
7.3 (c)	identification of any circumstances in which the environmental impacts and performance of the project during the year have not been generally consistent with the environmental impacts and performance predicted in the documents listed under condition 1.1 of this approval, with details of additional mitigation measures applied to the project to address recurrence of these circumstances	Section 5
7.3 (d)	results of all environmental monitoring required under conditions 3.3 to 3.8 of this approval, including interpretations and discussion by a suitably qualified person	Noise –Section 5.2 Groundwater – Section 6 Surface water – Section 6 Sawyers Swamp Creet Realignment – 6 Air Quality – Section 5.4
7.3 (e)	a list of all occasions in the preceding twelve-month period when environmental goals/objectives/impact assessment criteria for the project have not been achieved, indicating the reason for failure to meet the criteria and the action taken to prevent recurrence of that type of failure.	Section 9 and Appendix A

The AEMR has been prepared in accordance with the NSW Government's *Post-approval requirements for State significant mining developments Annual Review Guideline, October 2015* and is based on previous investigation data and the latest available information from environmental databases to inform the ongoing management and future remediation of the Project Area.

2.4 Actions required from previous AEMR

No correspondence was received from DPHI regarding the 2022-2023 AEMR within the reporting period, therefore there were no outstanding actions to be addressed within the reporting period.

2.5 Project contacts

The contact details for the Kerosene Vale Ash Repository Areas are:

Mr Paul Glasson

Western Region Manager

M: 0418 708 113

E: paul.glasson@gpmco.com.au

Mr John Pola

Facility Environment & Safety Manager

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3 Approvals

Activities throughout the AEMR reporting period were undertaken in accordance with the Project Approval, OEMP, CEMP and Environmental Protection Licence 21185. The monitoring and management of the environmental aspects, including noise, ecology, air quality, waste, heritage, surfacewater and groundwater are undertaken to ensure regulatory compliance is achieved.

This AEMR has been prepared to address the conditions of the PA 07_0005 and the Statement of Commitments for the AEMR reporting period. The statutory authorities that the project operates in accordance with are outlined in Table 3.1.

Table 3.1 Key consents, leases, licenses and permits

Approval/Lease/Licence	Issue date	Expiry date	Details/comments
Project Approval 07_0005	29 July 2005 (Renewed: 26 November 2008)	Works physically commenced in 2005 prior to GPM ownership in September 2020, therefore Condition 1.4 is satisfied, and there is no expiry date for the consent.	Granted by the Minister for (former) Department of Planning (DoP), Section 75J of the EP&A Act.
	9 August 2018 (MOD 1)	No expiry date	Import of clean fill
	13 October 2023 (MOD 2)	October 2033 for condition 2.36A	Extension Time for import of capping material for 10 years
Environment Protection Licence (EPL) No. 21185	14 September 2023	14 September (annual anniversary date)	Granted by NSW Environment Protection Authority (EPA).
Modification to EPL 21185	27 January 2023	14 September (annual anniversary date)	Variation to Licence No. 21185 was approved on 27 January 2022, to allow for asbestos disposal at the site.
Modification to EPL 21185	18 July 2023	14 September (annual anniversary date)	Variation to Licence No. 21185 was approved on 18 July 2022, to allow for the licence to capture a series of water monitoring and operational conditions, characterisation studies and a Pollution Reduction Program to achieve improved environmental outcomes at the Premises.
Modification to EPL 21185	19 December 2023	14 September (annual anniversary date)	Variation to Licence No. 21185 was approved on 19 December 2023, to updated various conditions associated with water management (further detail provided in section 6.1.2)

3.1 Operational Environmental Management Plan

The OEMP provides a framework for managing environmental aspects associated with the operation of the project as stipulated in the relevant provisions of Project Approval 07_0005, EPL 21185 and Statement of Commitments (SoC) (Parsons Brinckerhoff 2008a).

The OEMP scope covers the routine operations of the site outside the specific construction activities identified in Section 3.2. As part of this OEMP, the implementation of the following plans occurs:

- Operational Noise Management Plan (CNMP)
- Operational Groundwater Management Plan (OGWMP)
- Operational Surface Water Management Plan (OSWMP)
- Operational Air Quality Management Plan (OAQMP)
- Operational Landscape / Revegetation Management Plan (OLRMP)
- Operational Transport Management Plan.

The OEMP is in the process of being revised and finalised following submission to DPHI and is anticipated to be implemented during the 2024-2025 AEMR period once approved.

3.2 Construction Environmental Management Plan

The CEMP outlines the environmental management practices and procedures to be followed during construction, and includes implementation of the following plans as part of the CEMP:

- Construction Traffic Management Plan (CTMP)
- Construction Noise Management Plan (CNMP)
- Construction Erosion and Sediment Control Plan (CESCP).

The CEMP is in the process of being revised and finalised following submission to DPHI and is anticipated to be implemented during the 2024-2025 AEMR period once approved.

A breakdown of the activities covered by each of the management plans is contained in Table 3.2

Table 3.2 Activities covered by the CEMP and OEMP

Environmental Management Plan	Activities covered
OEMP – care and maintenance operations	• ash management • management of on-site water systems • capping material haulage, placement and management • landscaping and revegetation/rehabilitation of the site upgrading and maintaining internal access roads in the project area
CEMP – construction activities	• Sawyers Swamp Creek realignment • construction of stability berms around the perimeter of the KVAR • excavation of the former pine plantation area • sediment controls and surface water dams associated with construction of the KVAR stability berm and realignment of the Sawyers Swamp Creek • establishment of freshwater collection ponds and diversion pipes/drains on the northern edges of SSCAD • rearrangement of water flows around the KVAR • establishment of access roads onto the surface of the SSCAD and associated roads across the dam surface • reinstatement of environmental controls for historic landfill areas including capping of slumped areas, reprofiling for water management and control of sediment runoff during these activities • concurrent construction activities.

4 Operations during reporting period

Due to the closure of WPS in 2014, the Kerosene Vale Ash Repository has been placed in care and maintenance while ongoing investigations and studies are undertaken to inform the safe closure of the site including contamination investigations, remediation, decommissioning, demolition, rehabilitation.

To ensure ongoing compliance when in care and maintenance, GPM manage a team of contractors to undertake regular, ongoing maintenance activities. The contractors primarily maintain surface water management structures, water treatment plants, road and access points, dust suppression measures, vegetation and weed management, rehabilitation and any other care and maintenance works required.

There was no ash delivered or reused during the reporting period. The total ash footprint has remained the same from the previous reporting period. Additional rehabilitation activities were undertaken during the reporting period, more information and photos of these activities have been provided in Chapter 7.

A summary of activities during the reporting period is provided in Table 4.1.

Table 4.1 Operations summary

Activity	Previous reporting period	This reporting period	Next reporting period
Ash delivered to site (T)	0	0	0
Ash reused (T)	0	0	0
Total Ash footprint (ha)	131.7	131.7	131.7
Area capped (ha)	Nil	Nil	Capping to occur following final landform shaping
Stabilisation works on KVAR/KVAD (ha)	17.4	4.8	Subject to availability of materials
Temporary cover application (ha)	13.58	13	Subject to availability of materials

4.1 Operation hours

The normal hours of operation for the site are between 7 am and 10 pm Monday to Sunday, in accordance with Condition 2.8 of PA 07_0005.

No works occurred at the Project Area outside the normal operating hours during the reporting period.

Abnormal or emergency operation hours were not triggered during the reporting period.

4.2 Site activities

The following operational activities have been undertaken during the reporting period:

- installation and extension of leachate collection pipes and transfer pipes around KVAR and Lidsdale Cut
- stabilisation to an area of approximately 10.8 ha
- grass seeding, hydro seeding and hydromulching, mulch application
- irrigation of treated site water on temporary cover areas to gauge responses to site water

- extension of irrigation network on SSCAD to manage un-treated water from the site and reduce reliance on discharge to Cox's River via EPL discharge point
- modifications of the return water canal and
- upgrades to the water chemical dosing plants to remove/reduce metal contaminants in discharge water to meet EPL requirements
- trials of various water treatment methods (including reverse osmosis)
- weed management of various weeds across the site
- repair of damage by wombats on KVAR/KVAD walls and other areas across the Project Area
- review and updating of existing plans for submission and approval of ongoing operations following completion of ash placement activities
- preparation of construction environmental management plans for major upcoming works (Sawyers Swamp Creek relocation, KVAR Stage 2 stability berm, stormwater control dams, spillway adjustments, landform shaping).

4.3 Ash delivery and placement

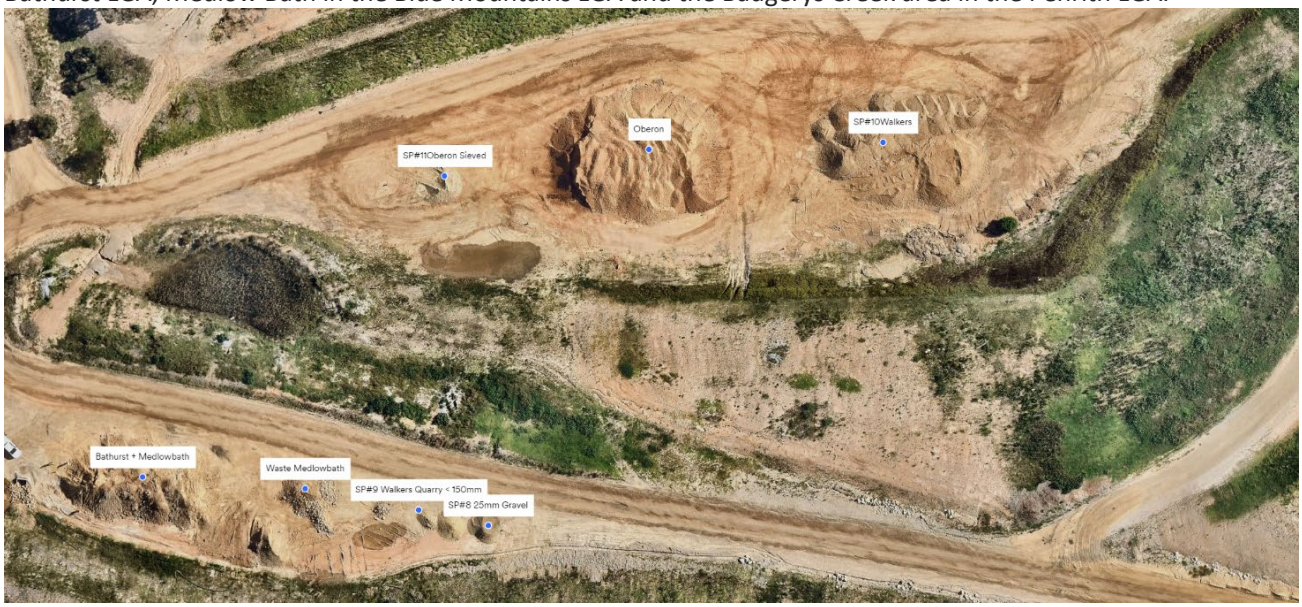
Due to the closure of WPS, no ash has been placed at Kerosene Vale Ash Repository within the reporting period. The ash footprint is understood to be approximately 131.7 ha, within the broader 528 ha total area. There have been no changes to the ash footprint areas during the reporting period. Therefore, the management and mitigation measures specified in the OEMP were assessed to be compliant.

4.4 Import of capping material

Modification 1 to Project Approval 07_0005 was granted in August 2018 for the import of capping material from areas outside of the Lithgow local government area to the Kerosene Vale Ash Repository (formerly Wallerawang Ash Dam Area). Capping material is currently sourced from various locations in the Metropolitan and Central Tablelands regions and comprises of virgin excavated natural material (VENM) and excavated natural material (ENM). A second modification (MOD 2) was approved to allow for an extension of time by ten years to continue transporting capping material to the project site.

Import of ENM and VENM for capping of the ash repositories continued to be undertaken during the reporting period. Capping material was sourced from outside the Lithgow LGA and included Oberon LGA, Vittoria in the

Bathurst LGA, Medlow Bath in the Blue Mountains LGA and the Badgerys Creek area in the Penrith LGA.



Photograph 4.1 Stockpile Management June 2024

Due diligence testing of the ENM/VENM is conducted monthly by an external consultant. The material is tested for a suite of analytes (metals, pH, EC) and hydrocarbons to ensure they meet the NSW EPA Resource Recovery Order and exemptions for Excavated natural material (ENM) and/or the Waste Classification guidelines for Virgin excavated natural material (VENM).

Where materials are not considered to meet these requirements, they are rejected.

Truck numbers are provided in Table 4.2.

Table 4.2 Truck numbers

Month	Number of trips	Average per day	RRO/RRE Material volume received (tonnes*)	Due Diligence tests undertaken
September 2023	689	33	22,048	7
October 2023	730	35	23,360	4
November 2023	454	21	14,528	4
December 2023	53	3	1,696	2
January 2024	361	17	11,552	0
February 2024	170	8	5,440	4
March 2024	412	20	13,184	2
April 2024	489	23	15,648	2
May 2024	567	27	18,144	0
June 2024	540	26	17,280	2
July 2024	564	27	18,048	3
August 2024	486	23	15,552	13

Note: * estimated amounts based on 32 tonnes per delivery

4.5 Asbestos disposal areas

4.5.1 Operational asbestos disposal area

The asbestos disposal area(s) enables disposal of asbestos and asbestos contaminated materials arising from the demolition of WPS, permitted via EPL (21185). Asbestos waste ceased to be received from the demolition of WPS in December 2022 and the main areas are now capped. As the demolition of WPS has not been completed, the likelihood of additional materials requiring disposal is considered to be high. Approved areas have been set aside for this purpose.

4.5.2 Historic disposal areas

The areas around the Lidsdale Cut which potentially stretch across the property boundary to the west are currently under investigation as part of the Detailed Site Investigation under the supervision of an NSW EPA Auditor. These areas have the potential to contain historical waste landfills containing fly ash, asbestos, metals and other waste materials. Other areas within Lidsdale Cut have been identified to contain waste ash and other materials and are actively managed through reshaping and profiling to create stable landforms.

Photograph 4.2 Reprofiling activities at Lidsdale Cut May 2024

5 Environmental management performance

Environmental monitoring for the Kerosene Vale Ash Repository operations is designed to comply with the regulatory requirements specified in Chapter 3, and also to provide an ongoing analysis of the condition of the environment surrounding the Project Area.

Environmental monitoring is performed as part of the monitoring programs at the monitoring locations shown in Figure 5.1. The results are used as indicators of the effectiveness of the environmental controls, and as guidelines for the management and maintenance of key environmental procedures.

Detailed procedures outlining the environmental monitoring, responsibilities of key stakeholders and the impacts to be mitigated can be found within the individual sub-plans of the OEMP, and include:

- Operational Noise and Vibration Management Sub-Plan
- Surface Water Quality Sub-Plan
- Groundwater Management Sub-Plan
- Air Quality Management Sub-Plan
- Landscape and Revegetation Sub-Plan
- Waste Management Sub-Plan.

A summary of the environmental management measures and associated performance is summarised below in Table 5.1. Surface and groundwater monitoring results and performance during the AEMR reporting period is summarised in Chapter 6.1.3 and Appendix C.

Performance against environmental monitoring and compliance requirements are now provided by the ER monthly reports, EPL annual returns and through external consultant and internal reports.

Table 5.1 Environmental performance during AEMR reporting period

Aspect	Approval criteria	Prediction	Kerosene Vale Ash Repository performance during reporting period	Trends/ management implications	Management actions
Noise	All residences $L_{Aeq(15minute)}$ Daytime 40 dB; Evening 40 dB.	LAeq $L_{Aeq(15minute)}$ Location A: 33 dB(A); Location B: 33 dB(A); Location C: 31 dB(A).	**Quarter 4 2023** Day $L_{Aeq(15minute)}$ Location A: <25dB Location B: 27dB Location C:27dB Evening $L_{Aeq(15minute)}$ All locations: Inaudible **Quarter 1 2024** Day $L_{Aeq(15minute)}$ Location A: <25dB Location B: <25dB Location C:28dB Evening $L_{Aeq(15minute)}$ All Location: Inaudible **Quarter 2 2024** Day $L_{Aeq(15minute)}$ Location A: 30dB Location B: <25dB Location C:35dB Evening $L_{Aeq(15minute)}$ All locations: Inaudible	No exceedance of criteria.	Nil additional management actions required.
Ecology	Minimal impacts on ecology of Swayers Swamp Creek following its realignment.	Potential impacts associated with realignment of Swayers Swamp Creek.	Swayers Swamp Creek was not realigned therefore no ecological monitoring is required.	Nil. Sawyers Swamp Creek was not realigned.	Nil additional management actions required
Air quality	Maximum total deposited dust 4 g/m^2/month insoluble solids annual average.	Annual average below 4 g/m^2/month annual average total insoluble solids.	Annual average range 0.4 to 2.2 g/ m^2/month.	Annual average dust levels show a slight decreasing trend.	Nil additional management actions required.
Waste	Waste disposal in accordance with EPL 21185.	Wastes disposed of accordingly.	No waste was received for disposal during the reporting period	Nil -No waste disposed of at the site.	Nil additional management actions required.
Heritage	Minimal impact on heritage values of the area.	Heritage impacts considered to be minimal and are manageable with appropriate and well – established procedures.	No additional heritage sites were identified during the reporting period.	Nil - No additional heritage sites have been identified during the reporting period.	Nil additional management actions required.

Figure 5.1 Environmental monitoring locations

5.1 Meteorology data

A summary of the measured meteorology data recorded for the site and surrounds has been provided below.

5.1.1 Monitoring data resources

There are no official meteorological measurements recorded within the Project Area. Weather monitoring is undertaken at the site however the data is real time only and is not recorded. Meteorological data from the Bureau of Meteorology (BoM) automatic weather station (AWS) at Marrangaroo (Defence) (station 063308), located approximately 6km south-east of the site has been used for this AEMR reporting period.

An automatic weather station has been installed on the site and is under commissioning at the time of this report. The station is proposed to be operational for the next AEMR period.

5.1.2 Overview of data for reporting period

A summary of meteorological data has been compiled from the BoM Marrangaroo AWS for the period between 1 September 2023 and 31 August 2024 and is presented in Table 5.2.

The BoM Marrangaroo AWS recorded a minimum temperature of -6.6°C in September, and a maximum temperature of 34.4°C in December.

The highest total monthly rainfall recorded over the period was in March 2024 with 157.4 mm and the lowest recorded monthly rainfall was in July 2024 with 20.0 mm. Total annual rainfall for the reviewed period was 774.8 mm. It is noted that no rainfall data was available for December 2023.

Table 5.2 Statistics for temperature and rainfall – BoM Marrangaroo AWS – September 2023-August-2024

Month	Minimum temperature (°C)	Maximum temperature (°C)	Total rainfall (mm)	Cumulative Rainfall (mm)
Sep-23	-6.6	27.9	45.6	45.6
Oct-23	-1.9	29.0	104.6	150.2
Nov-23	0.8	31.6	136.4	286.6
Dec-23	5.0	34.4	No data	286.6
Jan-24	6.3	31.5	55.6	342.2
Feb-24	8.1	33.7	39.2	381.4
Mar-24	2.6	30.6	157.4	538.8
Apr-24	-1.4	26.4	68.0	606.8
May-24	-4.9	18.9	65.6	672.4
Jun-24	-5.7	15.5	45.8	718.2
Jul-24	-5.3	15.8	20.0	738.2
Aug-24	-5.4	21.6	36.6	774.8

An annual wind rose created from wind speed and direction data collected at the BoM Marrangaroo AWS from September 2023 to August 2024 is presented in Figure 5.2. The winds recorded were predominately from the easterly and westerly direction. Annual average wind speeds were 1.4 m/s, and the annual average frequency of calm conditions (windspeeds less than 0.5 m/s) were 29.7%.

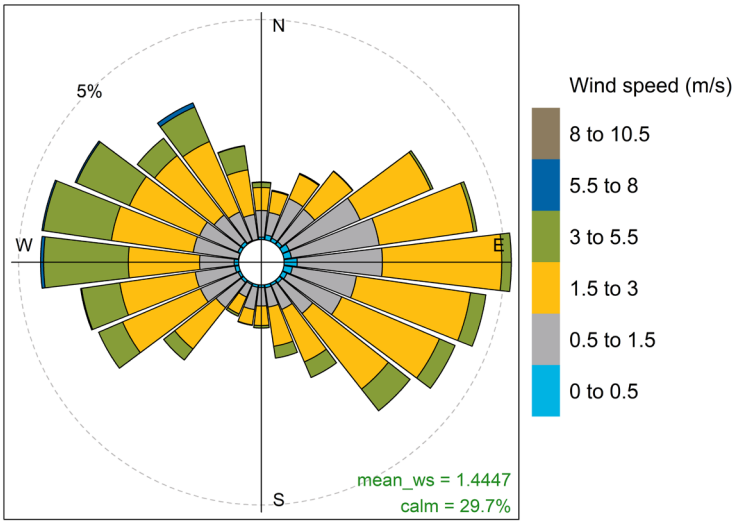


Figure 5.2 Annual wind speed and direction – BoM Marrangaroo AWS – September 2023 – August 2024

Monthly wind roses for the BoM Marrangaroo AWS from September 2023 to August 2024 are presented in Figure 5.3. Monthly average wind speeds ranged from 1.1 m/s to 2.0 m/s. The monthly average frequency of calm conditions ranged from 18.7% to 41.8%. The predominant wind direction patterns recorded during the warmer months (i.e. January, February, March and December) were from the east and south-easterly direction. The dominance of the south-eastly winds reduced between autumn and winter, with an increase in winds from the west to north-west.

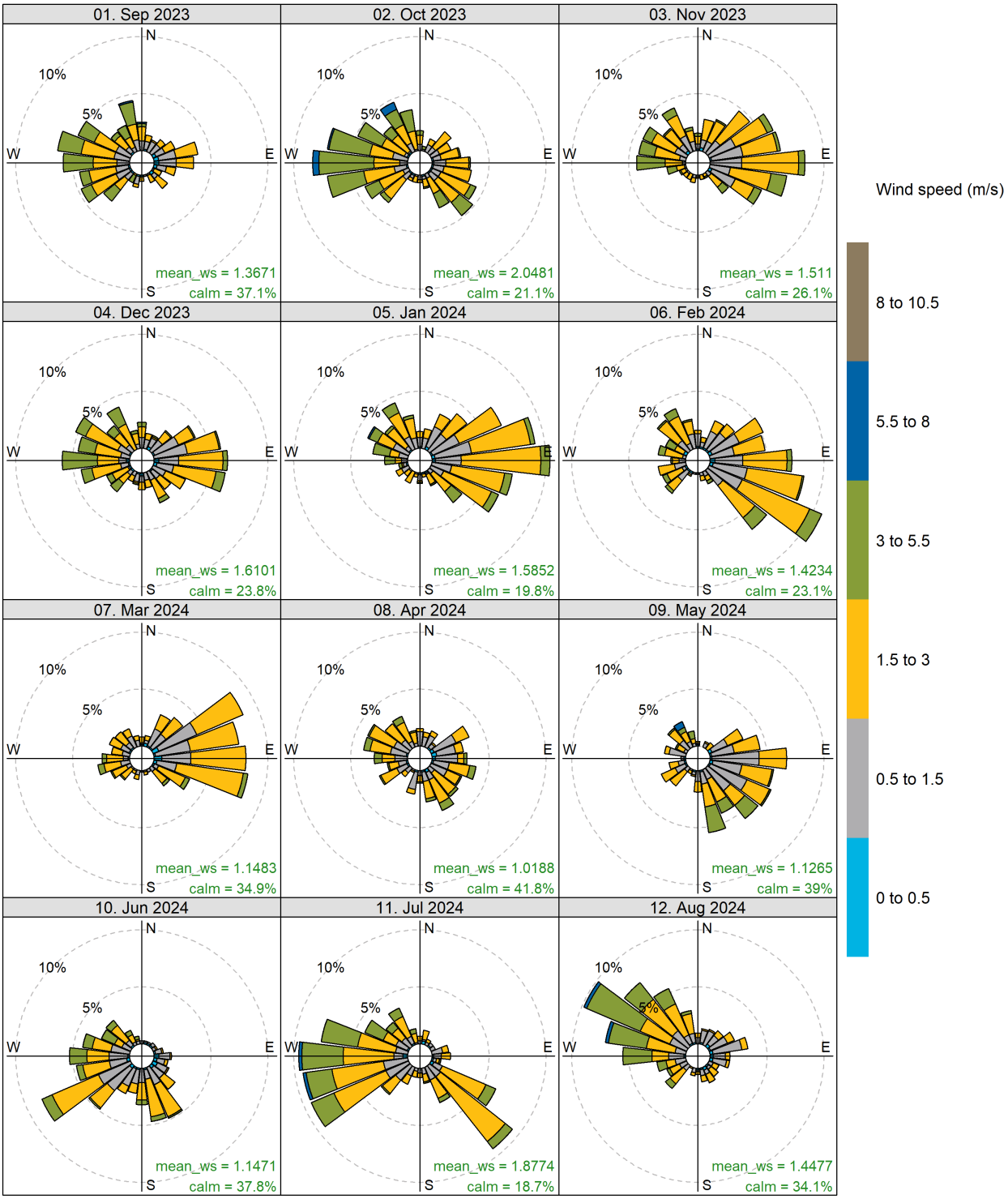


Figure 5.3 **Monthly wind speed and direction – BoM Marrangaroo AWS – September 2023-August 2024**

5.2 Noise monitoring

5.2.1 Environmental management

An Operational Noise and Vibration Management Sub-plan (ONVMSP) is included in the OEMP and has been developed in accordance with Condition 6.5 of PA 07_005. The ONVMSP was originally developed for the KVAR Stage 2 area, however the measures and mitigation measures have continued to be adopted for the entire Project Area post the completion of ash disposal at KVAR Stage 2.

The ONVMSP outlines identified measures to minimise and mitigate noise impacts on surrounding land uses from the proposed works. The level of noise generated during the proposed works program will depend on the location of the receiver, the type and duration of works and intervening topography, between the noise emission source and receiver.

The nearest identified residential receivers are located to the west of the private haul road and ash repository site, in the residential community of Kerosene Vale. The residential receivers are located approximately 300 metres (m) from the private haul road and are identified in Table 5.3 and depicted in Figure 5.1.

Table 5.3 Noise monitoring locations

Monitoring location	Distance to Haulage road (m)
Location A - 60 Skelly Road, Kerosene Vale	300
Location B – Corner Sawyers Road and Skelly Road, Kerosene Vale	270
Location C – End of Neubeck Street, Kerosene Vale	145

During the reporting period compliance monitoring was undertaken as per the requirements outlined in the ONVMSP. The relevant noise criteria from the Project Approval and EPL is summarised below:

> The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed a $LA_{eq\ (15\ minutes)}$ of 40 dBA at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8.
>
> The criterion applies under the following meteorological conditions:
>
> a) Wind speeds up to 3 m/s at 10 m above ground; and/or
>
> b) Temperature inversion conditions of up to 3°C/100 m (or alternatively stability category F temperature inversion conditions) and source to receiver gradient winds up to 2 m/s at 10 m height above ground.

Meteorological data was obtained from the Marrangaroo (Defence) Bureau of Meteorology (BoM) automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured noise levels. Vertical temperature gradient and/or sigma theta data required to determine temperature inversion conditions was not available from this AWS. As the Kerosene Vale Ash Repository area operates solely during the day and evening periods, it was assumed that temperature inversion conditions were not present during monitoring.

5.2.2 Environmental performance

Minor earthworks and maintenance activities were undertaken during the reporting period which may have the potential to cause noise impacts to sensitive receivers (as identified in Figure 5.1). Due to the closure of the WPS, no ash trucks have been hauling to the ash placement area during the reporting period. Trucks delivering capping and other engineering fill materials are active during normal working hours.

Noise monitoring was undertaken by EMM over the reporting period during the day and evening periods of 1-2 November 2023 (Quarter 4), 21 February 2024 (Quarter 1) and 15 May 2024 (Quarter 2). Noise monitoring to Quarter 3 is set to occur mid-September 2024.

A summary of the noise generating activities during each of the reporting periods is provided below in Table 5.4.

Table 5.4 Noise generating activities during the reporting period

Noise monitoring (day and evening)	Noise generating activities
Quarter 4 – 2023	Trucks travelling along the haul road to site were audible during the day at Location A, generating a site only L_{Aeq} of less than 25 dB, Location B, generating a site only L_{Aeq} of 27 dB, and at Location C, generating a site only L_{Aeq} of 27 dB. Noise from road traffic and animals was primarily responsible for generating measured noise levels during the evening period.
Quarter 1 – 2024	Trucks travelling along the haul road to site were audible during the day at Location A and B, generating a site only L_{Aeq} of less than 25 dB and at Location C, generating a site only L_{Aeq} of 28 dB. Noise from road traffic and animals was primarily responsible for generating measured noise levels during the evening period.
Quarter 2 – 2024	Trucks travelling along the haul road to site were audible during the day at Location A, generating a site only L_{Aeq} of 30 dB, Location B, generating a site only L_{Aeq} of less than 25 dB, and at Location C, generating a site only L_{Aeq} of 35 dB. Noise from road traffic was primarily responsible for generating measured noise levels during the evening period. Noise from animals and insects was also noted.

Based on site observations and information reviewed, potential noise impacts from the operation and construction activities at the project are considered to have been effectively mitigated and managed. No noise complaints were received during the reporting period. Monitoring reports are provided in Appendix B.

5.2.3 Reportable incidents

No reportable incidents have been recorded against operation noise for the reporting period.

5.2.4 Further improvements

No exceedances of noise criteria were recorded during the reporting period, as such there no further improvements required.

The scope of the noise monitoring is commensurate with the level of activity at the site.

5.3 Ecological monitoring

Ecological monitoring is required, as part of condition 3.7 of the Project Approval, following a realignment of Sawyers Swamp Creek (SSC). The realignment of SSC will now be completed in two stages:

- Stage 1 - minor works to facilitate construction of the KVAR northern buttress whilst maintaining flow passage for SSC
- Stage 2 - realignment of creek associated with the final landform of the site as a whole. which is dependent upon detailed site investigation associated with contamination studies

Stage 1 SSC realignment, along the northern side of the KVAR, was initially planned to be undertaken during the reporting period to facilitate structural stabilisation works for the Stage 2 KVAR. The realignment is intended to reduce sediment loads and increase filtration/treatment of runoff from the Project Area through establishment of a riparian zone, resulting in "an overall beneficial effect on long term water quality within SSC".

EMM notes that a progressive rehabilitation plan has been developed in consultation with the relevant agencies and submitted to DPHI. Following approval of the plan and tendering, the realignment will commence.

As there has been no realignment of SSC, ecological monitoring required under Condition 3.7 of the Project Approval is not required.

5.4 Air quality monitoring

5.4.1 Environmental management

The Air Quality Monitoring Program, as outlined in the OEMP Air Quality sub-plan (section 6.6), identifies site specific actions to manage dust generated through transportation, stockpiling and placement of materials. These measures include the use of an extensive sprinkler system and water cart applications to control dust from operations within the Project Area and depositional dust gauge monitoring occurs for dust/airborne particulates.

Dust management is included in the responsibilities associated with all activities, as per the Air Quality Monitoring Program, including:

- wash-down of roadways, haul road/s and vehicle access roads
- use of perimeter sprays at the ash placement area
- mobile sprinkler system
- final and temporary capping of ash and other materials
- general maintenance of the Project Area.

i Dust suppression

A dedicated water sprinkler and surface irrigation system is in operation for the site. Water application rates are managed to ensure there are no visible dust emissions from the Project Area.

A water cart is available onsite to undertake additional dust suppression as required. The water used during dust suppression is sourced from the treated water system, no additional clean water is used in this application. Over 165 Megalitres (ML) of water has been used for irrigation/water cart over the AEMR period.

Additionally, the haul road to site has been sealed and a truck wash facility is now available.

ii Dust deposition monitoring

Air quality was monitored at four locations during the AEMR reporting period. The data is collected from the dust gauges and reviewed to ensure compliance with the Project Approval conditions.

The collected data provides an indicative assessment of potential air quality impacts from Project Area and it should be noted that data collected from these locations include dust from all land use practices in the local area.

5.4.2 Environmental performance

i Dust deposition monitoring

Dust gauge data obtained for the reporting period is reviewed to confirm emissions have complied with annual compliance criteria.

Annual average depositional dust data for each of the four dust deposition gauges presented over the AEMR reporting period is presented in Figure 5.4 to Figure 5.7. No exceedances of insoluble matter was recorded at any of the deposition dust gages during the AEMR reporting period.

EMM notes the following inconsistencies with respect to dust deposition monitoring:

- Samples were not obtained from dust disposition gage DG29 or DG31 in December 2023.
- From the samples obtained for the July 2024 period, were analysed for total solids. The amount of insoluble soilds was not able to be determined for these samples.
- Samples obtained in the August 2024 period were not analysed for ash content.

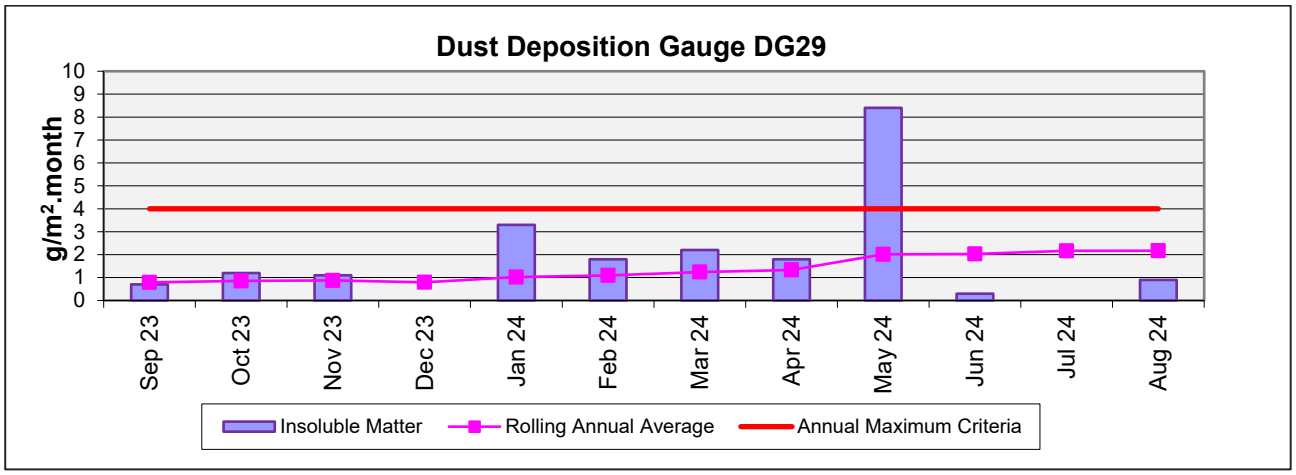


Figure 5.4 Depositional dust summary – Dust Gauge 29

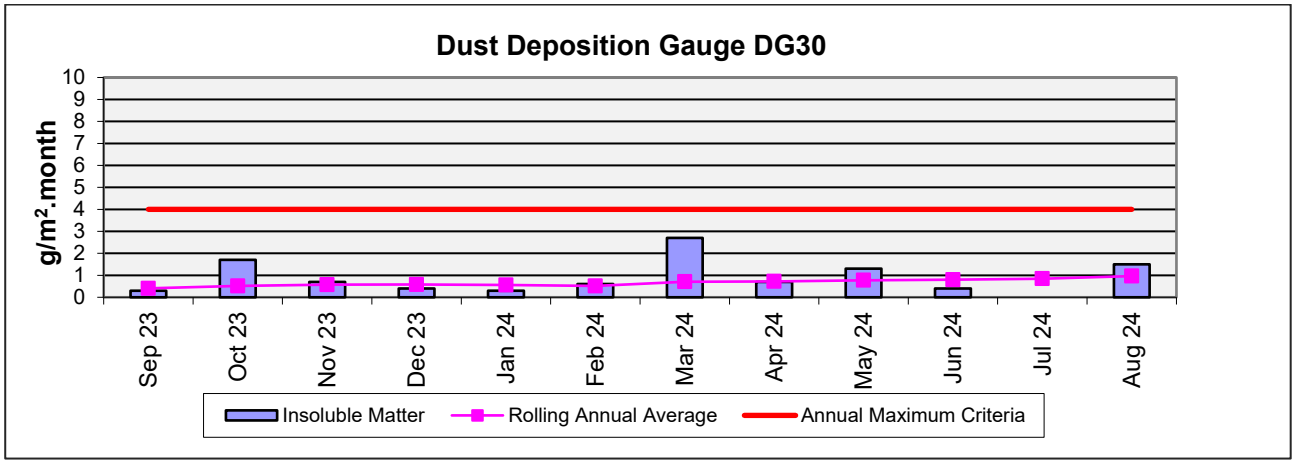


Figure 5.5 Depositional dust summary – Dust Gauge 30

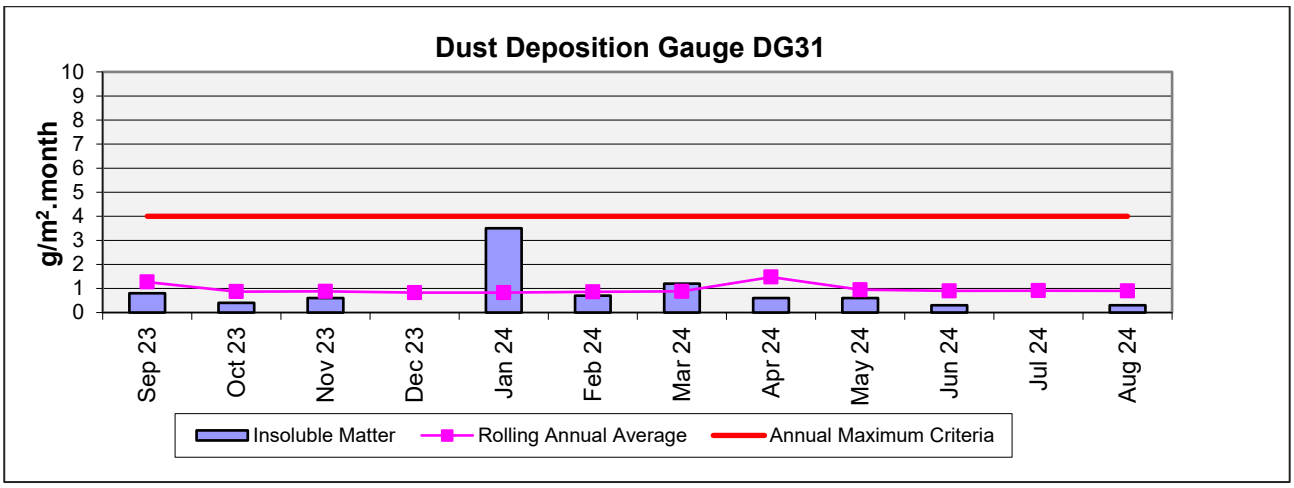


Figure 5.6 **Depositional dust summary – Dust Gauge 31**

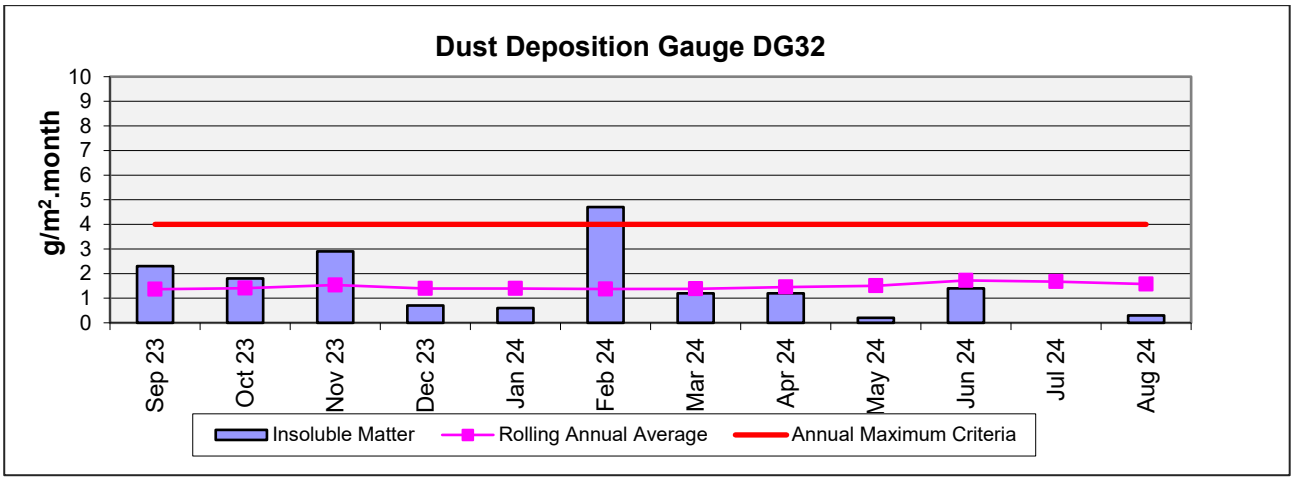


Figure 5.7 **Depositional dust summary – Dust Gauge 32**

5.4.3 Reportable incidents

There were no reportable incidents in relation to air quality management for the reporting period.

5.4.4 Further improvements

GPM will continue to investigate methods that prohibit tampering with dust gauge bottles and vandalism (e.g. stealing or breaking), particularly gauges located near residential areas.

GPM will consider several improvements to the monitoring program, including:

- adding dust observations to the monthly environmental inspection reports
- the addition of written observations of the samples from the laboratory to the monthly depositional dust gauge report to improve the investigation of contaminated samples or elevated dust results.

5.5 Waste

5.5.1 Environmental management

Waste disposal practices are managed in accordance with EPL 21185 and the OEMP Waste management sub-plan (section 6.8 of the OEMP). Waste materials are assessed, classified, managed, and disposed of in accordance with Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (EPA 1999).

GPM and associated contractors are not to cause, permit or allow any waste generated outside the ash repository to be received at the ash repository for storage, treatment, processing, reprocessing or disposal, including no wastes other than those as stated on the licence approval to be kept on the site. Waste generated by site personnel shall (including maintenance wastes such as oils and greases) are collected on a regular basis and recycled or disposed of to an appropriate licenced facility.

All staff and contractors on site are informed of the waste management procedures. Further guidance and detail on specific waste streams and applicable management measures are identified in the OEMP Waste Management sub-plan (section 6.8).

i Asbestos

In accordance with EPL 21185, asbestos waste from the demolition of Wallerawang Power Station may be received and disposed of in the approved asbestos disposal areas (as per the development consents DA 016/19 and MP07-0005).

Asbestos waste from the WPS demolition project was largely complete as of December 2022 and some areas have been capped in accordance with approved plans.

No material was received for disposal during the reporting period.

5.5.2 Environmental performance

Nil other wastes were received and placed at the Kerosene Vale Ash Repository during the reporting period. The activities within the Project Area were deemed to have met compliance obligations for waste management for the reporting period.

5.5.3 Reportable incidents

No reportable incidents have been recorded against waste management for the reporting period.

5.5.4 Further improvements

No further waste management improvements are proposed.

5.6 Heritage

5.6.1 Environmental management

An Environmental Assessment was performed by Parsons Brinckerhoff (2008b) for KVAR Stage 2 and included a preliminary archaeology and heritage assessment. The assessment concluded that the KVAR Stage 2 works pose no threat to the Aboriginal archaeological or heritage values and would not result in any further impact on Aboriginal archaeological potential. Based on these findings, the following statements of commitment, in regard to heritage sites, were made:

- Disturbance to the eastern portion of the ash repository shall be limited to reduce the potential for inadvertent disturbance of the Aboriginal heritage values of the area.
- In the event that any heritage sites or items be discovered during operation, all works likely to affect the area are to cease immediately. The GPM Environmental representative is to be notified immediately and relevant stakeholders including the Office of Environment and Heritage (OEH) Regional Archaeologist, the Bathurst Local Aboriginal Land Council, or the NSW Heritage Office, so that an appropriate course of action can be determined.

The OEMP outlines the management methods and guidance to protect Aboriginal and non-Aboriginal heritage sites in accordance with CoA's 2.37-2.38.

All construction and earthworks personnel are informed on their obligations in respect of the protection of Aboriginal and non-indigenous heritage sites and items as part of the Site induction.

5.6.2 Environmental performance

No known Aboriginal or non-indigenous heritage sites were impacted during the reporting period and no additional sites were discovered or identified.

5.6.3 Reportable incidents

No reportable incidents have been recorded against heritage management for the reporting period.

5.6.4 Further improvements

No additional heritage management improvements are proposed for the next reporting period.

6 Water management

This chapter addresses surface and groundwater management over the AEMR Period. It includes descriptions of:

- the water management system
- water management actions over the period
- environmental performance
- reportable incidents and further improvements.

An Annual Water Quality Review (AWQR) which addresses the surface and groundwater monitoring and reporting requirements is established in the OEMP. The AWQR is provided in Appendix C.

6.1 Environmental management

This section provides an overview of the water management system and describes water management actions and water monitoring undertaken over the AEMR Period.

6.1.1 Water management system

Surface water at the site is described using the following nomenclature:

- **Sawyers Swamp Creek Ash Dam (SSCAD)** is an ash dam that was formed in the Sawyers Swamp Creek valley. It is divided into four sections (A, B, C and D) and has a total area of 82 ha. Each section is separated by earthen embankments. Section A comprises an open water body that is referred to as the SSCAD Pond and has areas of exposed ash. Sections B, C and D are referred to as the Upper Dam. A perched groundwater system exists within the placed ash (the perched SSCAD groundwater system).

  The SSCAD Pond is a large water body and is a central feature of the site's overall water management system. It receives contaminated water from the KVAR/KVAD water management area and the SSCAD embankment drainage system. This assists in minimising incidental surface and groundwater discharges from the site. SSCAD Pond also receives runoff from direct rainfall, a clean water catchment and overflows from the SSCAD Upper Dam (Section B, C and D).

  Water accumulation in the SSCAD Pond is managed via irrigation to exposed ash areas (when possible) and at times via controlled discharges to the Coxs River at a licensed discharge point located within the Power Station site (referred to as LDP3). Controlled discharges are treated in the LDP3 Treatment System which adjusts pH and reduces metal concentrations. Controlled discharges at LDP3 are regulated by EPL no. 21185, which has restrictions on when discharge can occur.

  During wet conditions, clean water runoff and groundwater inflows from the vegetated escarpments located to the north of SSCAD accumulate on the surface of Section B, C and D. Water quality testing has identified this water as being clean (as it has not infiltrated through the ash). Accordingly, during wet conditions, this water is pumped from Section B into Sawyers Swamp Creek. This practice has been successful in preventing overflows of clean water from the Upper Dam into SSCAD Pond. It is noted that GPM are currently constructing gravity operated systems that will minimise the volume of clean water that accumulates on Sections B, C and D (Figure 6.1).

KVAR/KVAD water management area is located to the west (downgradient) of SSCAD. KVAD is the Power Station's original ash dam which was established in an open cut mine void. The KVAR is a dry ash compacted stockpile situated on top of the capped KVAD. A perched groundwater system exists within the KVAD (the perched KVAD groundwater system). The combined area now has a water management system. Surface water runoff and seepage from this area drains to several water storage areas. Captured water that is known to be contaminated is reticulated to Lidsdale Cut (located downgradient of KVAD) where it is pumped to SSCAD Pond. Stormwater that is not ash affected is managed in accordance with the methods described in Managing Urban Stormwater Soils and Construction: Volume 1 (Landcom 2004) and Volume 2E Mines and Quarries (DECC 2008).

- **Sawyers Swamp Creek Diversion** is a clean water system that manages streamflow from Sawyers Swamp Creek and runoff from catchment areas to the south of SSCAD. The system diverts clean water around SSCAD and the KVAR/KVAD water management area. The diversion joins what is thought to be the original Sawyers Swamp Creek channel to the north-west of the Project Area.

- The following ancillary areas are located within the site or are relevant to the Site's overall water management system:

  - **Investigation Area** is a 24-ha area located in the western portion of the site, downgradient from the KVAR/KVAD water management area. Parts of this area have been disturbed by mining that is understood to have occurred prior to the 1950s. There are known deposits of coal ash, chitter and a rubbish dump in this area. Vegetation has re-established within most of the investigation area. GPM are investigating the potential for surface and groundwater contamination to occur from this area as part of the VMP process (see Section 10.1)

  - **Upgradient clean water catchments** refer to clean water catchment areas that are upgradient of either the SSCAD or the Sawyers Swamp Creek Diversion. Runoff from these catchments has potential to interact with the water management system via either direct inflows or system overflows during certain high flow events. Incidental discharge from the water management system (discussed above) may also enter the Sawyers Swamp Creek Diversion at several locations.

  - **Downgradient clean water areas** refer to parts of the site that are not known to have been previously disturbed by mining operations or ash placement and drain away from the water management system.

Figure 6.1 shows the abovementioned features and Figure 5.1 shows the OEMP surface and groundwater monitoring sites.

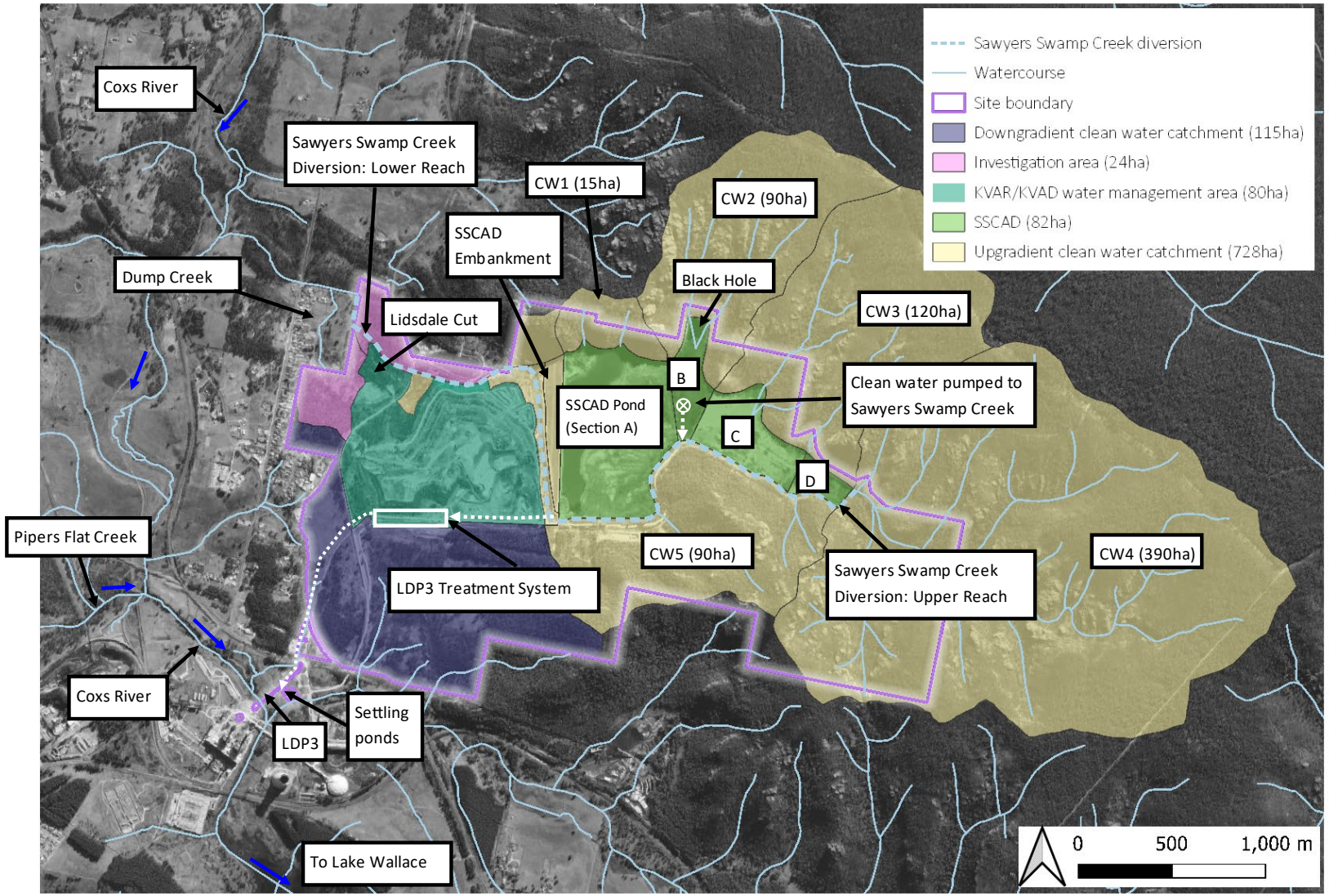


Figure 6.1 Water management features

6.1.2 Water management actions over the period

During the AEMR reporting period, GPM and the EPA have had ongoing discussions regarding water management improvements at the site.

The EPL was varied on 19 December 2023 by the EPA to incorporate the following changes:

- **Condition L2.4** – the concentration limit for sulfate was removed and limits were added for ammonia, cadmium, manganese and turbidity. The concentration limit for suspended solids was reduced from 30 to 20 mg/L.

- **Condition L2.5** – the definition of wet weather discharge was changed from streamflow in the Coxs River being >= 20ML/day to >= 10 ML/day.

- **Condition M2** – surface water monitoring requirements have has been revised so that:

  - weekly monitoring during discharge at EPL point 1 (known as LDP3) is now only required at the following monitoring locations: LDP3, WX9 and WX10A

  - monthly monitoring is undertaken at all other EPL surface water monitoring locations regardless of discharge or weather.

- **Condition U2** – the pollution reduction study focusing on Water Management was revised to:

  - acknowledge that short and medium-term measures have been implemented

  - replace the previous long-term measures with a new requirement to prepare a Water Treatment Management Suitability and Feasibility Assessment by 1 October 2024.

Water management actions undertaken during the reporting period include:

- GPM has installed a new LDP3 treatment system (commissioned in February 2023) and water quality monitoring has confirmed that the new system is removing most of the metal load in untreated water. There may be opportunities to further improve aluminium removal and the consistency and reliability of cobalt, nickel and zinc removal, which will be investigated further moving into the next reporting year.

- Construction of gravity diversion works (referred to as CP1) to transfer clean water runoff that enters the northern portion of SSCAD Section D into the Sawyers Swamp Creek Diversion was completed. Construction of the remainder of SSCAD collection ponds CP 2,3 and 4 continued during the AEMR period. The proposed gravity diversion from the Black Hole (CP3, CP4) to the Sawyers Swamp Creek Diversion was redesigned from a single diversion work to two diversion works that are located slightly upstream of the Black Hole. Works had commenced in 2024

- Works to separate stormwater from contaminated water (i.e. capping of exposed ash in KAVAR Stage 2B) and to reduce stormwater ingress into Lidsdale Cut were completed. A final landform design process for the KVAR/KVAD, Lidsdale Cut and adjacent landfill area was commenced

- The pipeline that reticulates contaminated water from seepage collection points to a central storage (Lidsdale Cut) was completed in the first half of 2023. This system may need to be modified when the KVAD stabilisation berms are constructed in the future. All known seepage discharges that previously entered Sawyers Swamp Creek are now collected and managed in the contaminated water system.

- The EPL was varied on 19 December 2023 to include a requirement to prepare a Water Treatment Management Suitability and Feasibility Assessment by 1 October 2024, as mentioned in the section above. The following actions have or are being implemented to inform this assessment:

    - A trial of irrigating contaminated water from Lidsdale Cut onto the surface of SSCAD Section C commenced in late 2023 (see Photograph 6.1)

    - A pilot scale contaminated water treatment plant was trialled, which includes multiple treatment processes including two-stage reverse osmosis and treated contaminated water from Lidsdale Cut (see Photograph 6.2)

    - It is anticipated that the EPL will be further varied to incorporate additional requirements associated with the implementation of any additional water treatment systems that were identified by the study.

Photograph 6.1 Contaminated water irrigation trail (SSCAD Section C)

Photograph 6.2 **Pilot scale contaminated water treatment plant**

Photograph 6.3 Water Containment Pond 1 in operation – January 2024

6.1.3 Water monitoring over the period

The AWQR addresses the surface and groundwater monitoring and reporting requirements established in the OEMP. Table 6.1 provides a summary of these requirements and notes where each requirement is addressed in the AWQR.

Table 6.1 OEMP – water monitoring and reporting requirements

	Description	OEMP reference	AWQR reference
Surface water			
Monitoring	Monthly water quality monitoring at four locations: • WMS3– Lidsdale cut • WX11 – Dump Creek • WMS1 – Sawyers Swamp Creek Ash Dam • WX7 – Sawyers Swamp Creek, downstream.	Chapter 5 (Environmental Monitoring)	Chapter 4
Analysis	Surface water quality monitoring data is to be assessed against: • Baseline water quality that is provided in Appendix B of the OEMP • Default guideline values (DGV) from ANZECC 2000.	Section 6.4 – Surface water quality sub-plan	Chapter 4
Reporting	The surface water quality monitoring data and associated analysis is to be reported in the AEMR.	Section 6.4 – Surface water quality sub-plan	Chapter 4
Groundwater			
Monitoring	Monthly groundwater quality monitoring at six locations: • D1 – south-east of SSCAD • D2 - south of KVAR • D3 – between SSCAD and KVAR • D4 – north of KVAR • D5 – north-west of KVAD/KVAR • D6 – west of KVAD/KVAR.	Chapter 5 (Environmental Monitoring)	Chapter 5
Analysis	Groundwater quality monitoring data is to be assessed against: • Baseline water quality that is provided in Appendix C of the OEMP • DGVs from ANZECC 2000.	Section 6.5 – Groundwater quality sub-plan	Chapter 5
Reporting	The ground water quality monitoring data and associated analysis is to be reported in the AEMR.	Section 6.5 – Groundwater quality sub-plan	Chapter 5

6.2 Environmental performance

The review of surface water quality data documented in the AWQR concluded that:

- Water quality trends in Lidsdale Cut and the SSCAD are consistent with recent AEMR periods (i.e. 2018 to the current period). Lidsdale Cut and SSCAD are part of the Site's contaminated water management system and hold water that is known to be ash affected.

- The water quality in Dump Creek was consistent with ash affected water during dry conditions. It is interpreted that surface water runoff in the Dump Creek catchment is clean and that seeps of ash affected water may impact water quality during dry conditions when the streamflow is minimal.

- The water quality in Sawyers Swamp Creek downstream of the Site (WX7) is generally consistent with clean water. Within the Site, groundwater contribution to the creek was evident with a variation to water quality monitored in the creek changing from upstream to downstream.

- The water quality in Coxs River is not affected by the inflows from Sawyers Swamp Creek.

The review of groundwater quality data documented in the AWQR concluded that the groundwater quality trends during the AEMR Period were generally consistent with recent AEMR periods (i.e. 2018 to the current period), specifically:

- the groundwater chemistry varied across the eleven groundwater monitoring bores. The salinity levels ranged from 53 to 2,910 µS/cm and pH ranged from 3.7 to 6.5

- the concentrations of several metals that are known to occur in ash affected water (copper, nickel and zinc) exceeded the DGVs at most groundwater monitoring bores. The highest concentrations occurred at WGM1/D6 (located to the west of the KVAR/KVAD), WGM1/D3 (located between SSCAD and KVAR) and WJ_MW03 (located downgradient of KVAD and Lidsdale Cut). The pH at each of these bores was also acidic, varying between 3.9 and 6.5

- the arsenic concentration at WK_MW06 (located to the south of KVAR) remains elevated (0.048 mg/L) relative to the DGV of 0.013 mg/L. Arsenic is not known to occur in ash affected water (EMM 2023a). The arsenic concentration was either below detection or the DGV at all other locations.

Potential groundwater contamination sources, pathways and receptors are being investigated as part of the VMP process.

6.3 Reportable incidents

Two community complaints were raised with respect to water quality. One concerning the turbidity of Sawyers Swamp Creek and another concerning water runoff from Barn Paddock sprinklers. More details on these complaints are provided in Table 8.1 in Section 8.3 below. Neither of these events were considered to be reportable incidents following investigation.

6.4 Further improvements

GPM propose to continue to progressively improve the water management system through implementing the Action Plan commitments throughout the next AEMR reporting period.

7 Landscape and revegetation

7.1 Environmental management

The current scope of landscape and revegetation environmental management is provided in the Landscape and Revegetation sub-plan of the OEMP (section 6.7). The current Landscape and Revegetation Plan is based on an overall requirement to integrate the ash repository into the existing landscape with current activities focussing on care and maintenance of the site. Approximately 13 ha have been shaped and had topsoil applied, seeded and are actively growing. These areas are considered to be land under active rehabilitation.

Further site investigations and environmental studies will be undertaken to inform the safe closure of the Site with the overarching final landform and rehabilitation objectives ensuring the site is safe, stable and non-polluting, and fit for intended land use/s.

7.2 Environmental performance

Current landscape and revegetation activities focus on care and maintenance of the Project Area.

Table 7.1 Rehabilitation status summary

Performance indicator	Completion criteria*	Current status (reporting period)
Visual impact	Measures to reduce the visual impact implemented as soon as practical.	Satisfactory – batters located closest to residents have been revegetated and weeds managed.
	Ash placement will concentrate on the Eastern face of the KVAR Stage 2 ash repository in order to shield the residents from future ash placement activities.	Not Applicable – ash placement no longer performed due to decommissioning of the WPS.
Capping	Ash to be capped to a depth of 0.75 m and contour ripped to preclude soil movement during rainfall or other erosion events.	Satisfactory – no soil loss or erosion identified in capped areas.
	Capping shall be conditioned to facilitate revegetation, which may include the use of cover crop grasses.	Satisfactory – import of capping material must meet ENV and VENM thresholds. Due diligence sampling is undertaken on capping material.
Revegetation	Develop a broad acre planting strategy on slopes at a 1 to 4 ratio.	Satisfactory – As per previous AEMR revegetated areas continue to grow. As areas are shaped and stabilised they are seeded or hydromulched with grass species to ensure stability and integrity of the capping, until final closure planning can be undertaken
	A developed revegetation procedure in place and implemented.	Satisfactory – As per previous AEMR, a Plan has been developed but requires review to ensure it meets the closure requirements of the site. This will be several years as a result of the VMP investigations and the preparation of a RAP.
	Grass cover revegetation to include perennial grasses.	Satisfactory – hydromulch application of proven resilient species underway.

Performance indicator	Completion criteria*	Current status (reporting period)
	Planting of shrubs and trees undertaken using tube stock of local provenance tree species to be performed after establishment of perennial grasses.	No additional planting has been undertaken due to the site declaration and ongoing DSI. Following these investigations remedial actions will be identified and the final landscape options will be updated to reflect the Health and Human Environmental Risk profile of the site.
	Plant establishment (trees and shrubs) to minimise soil loss and erosion.	Satisfactory – No soil loss or erosion identified in revegetated areas.
Irrigation	Irrigation undertaken at establishment and as required thereafter.	Satisfactory – Irrigation performed through the use of fixed sprinklers already installed on and around site. Over 165ML of treated water irrigated in the AEMR period.
Animal control	Threats to vegetation such as grazing by animals managed accordingly.	Satisfactory – No evidence of animal significant grazing on revegetated areas. Site fencing in good order. Wombat exclusion fencing has been successfully installed and maintained around the closed asbestos area.
Rehabilitation	All new batters rehabilitated as soon as practicable.	No new batters have been constructed within the Project Area. The existing KVAR and Lidsdale Cut Landfill berms have been regraded and reseeded to stabilise the slopes and allow maintenance mowing.
	All areas of ash placement that have reached RL 940 m to be rehabilitated or in the process of rehabilitation as per revegetation plan.	GPM are currently maintaining existing rehabilitated areas with additional areas of the site being progressively rehabilitated during the reporting period. Over 13 ha of new areas were stabilised I the reporting period.

**Completion criteria taken from the OEMP Landscape and Revegetation Plan*

7.2.1 Rehabilitation

Additional rehabilitation activities were undertaken during the 2023-2024 reporting period, these included:

- KVAR stage 2 shaping and capping
- Lidsdale Cut landfill area shaping and capping
- Wetland pond sediment basin construction
- preliminary capping and access to SSCAD
- hydromulching of completed shaped and capped area
- Demolition and shaping of former Springvale Water control ponds
- installation and maintenance of erosion and sediment controls.

Photograph 7.1 Hydromulch application November 2023 – Lidsdale Cut

7.2.2 Stabilisation

Stabilisation activities during the AEMR reporting period have included ensuring the ongoing stability of the ash repositories, reshaping the landforms to provide reduced slope angles. Instability of the repositories is caused by steep batter slopes, saturation of exposed ash areas without capping, tree falls from fire and high winds and animal burrows. GPM has engaged technical specialists to design reinforcement options and a final landform and water drainage system to improve long term stability, and thereby facilitate final capping and rehabilitation of the site. Works are now underway and will continue into 2025 to establish a reinforcement berm against the entire KVAR/KVAD which will ensure stability of the repository in the long term. During the reporting period section 5 (otherwise known as Stage 2B) of the stability berm were constructed on the eastern face of the KVAR.

GPM will continue to investigate suitable supply of material for the reinforcement and also investigate soil stabilisation techniques to enhance stability and reduce reliance on a mass earth wall solution.

7.2.3 Weed control

A summary of works completed during the reporting period is included in Table 7.2

The growth of weeds has been an ongoing problem that GPM has continued to resolve through active weed management. Weed treatment throughout the reporting period has targeted pampass grass, blackberry, St John's wort, Sifton bush, purple top, broom, stink wort, cineraria, hemlock, radiata pine, tussock and various broadleaf weeds. Weed spraying is undertaken by a licensed contractor and only conducted during low wind conditions to reduce the potential for impacts from spray drift. Mechanical (manual) removal of vegetation (Pampass Grass) is also undertaken where access permits. A summary of weed control treatments applied is provided in Table 7.2.

Table 7.2 Summary of landscaping, revegetation and weed control during the reporting period

Reporting month	Landscaping, revegetation and rehabilitated area	Weed control
September 2023	Springvale dam area rehabilitation 1.0 ha **Total Area**– 1.0 ha	Nil
October 2023	Lidsdale cut – 2.5 ha – area capped and topsoiled. Awaiting jute mat installation, hydromulch and seeding. KVAD/KVAR – 1 ha – Area has been topsoiled around edges on KVAD. Awaiting seeding. SSCAD – 0.1 ha – area topsoiled at snakepit and seeded. **Total area**– 3.6 ha	1.890 Litres of Apparent Concussion 540K applied to Spear Thistle Prickly Sow Thistle Blackberry Viper Bugloss Purple Viper Bugloss Cotton Burnweed Square Stalked willow herb
November 2023	Lidsdale cut – 2.5 ha –jute mat installed and seeded, hydromulch applied. KVAD/KVAR – 1.9 ha – Area has been topsoiled around edges on KVAD with some areas seeded. **Total area**– 4.4 ha	Part of October report
December 2023	**KVAD/KVAR** – 1.9 ha – Continued from previous month. Area topsoiled around edges on KVAD with some areas seeded. **Total area** – 1.9 ha	Update unavailable
January 2024	RWC north embankment – 0.4 ha – area topsoiled and seeded. **Total area**– 0.4 ha	800 litres of mixed spray (unknown Herbicides) applied to Blackberry and St John's wort on various locations within the Project Area
February 2024	KVAR West Batter 0.6ha – topsoil and seed **Total area**– 0.6 ha	3,855 litres of Ken-Zon & Cemtrol oil utilized on blackberry, St John's wort, blue heliotrope, various broadleaf, biddy bush, cineraria, hemlock, broom, stink wort, and radiata pine in various locations within the Project Area
March 2024	SSCAD South 1.6ha – hydromulch **Total area**– 1.6 ha	5,900 litres of Ken-Zon & Cemtrol oil utilized on blackberry, stinking roger, sweet briar, purple top, St John's wort, various broadleaf, biddy bush, cineraria and broom, in various locations within the Project Area
April 2024	SSCAD South 0.5ha – topsoil and seed **Total area –** 0.6ha	2,900 litres of Ken-Zon & Cemtrol oil utilized on blackberry, stink wort, sweet briar, various broadleaf and biddy bush, in various locations within the Project Area

Reporting month	Landscaping, revegetation and rehabilitated area	Weed control
May 2024	Nil over winter	550 litres of Ken-Zon & Cemtrol oil utilized on biddy bush, blackberry, eucalyptus, stink wort, purple, broadleaf, radiata pine in various locations within the Project Area 5,450 litres of Glyphsate 540, Chemtrol oil & Rhodamine Red Dye utilized on pampas grass and small radiata, at various locations, including the Ash dam Some manual removal of weeds also occurred at various locations
June 2024	Nil over winter	1,100 litres of Ken-Zon & Cemtrol oil utilized on biddy bush, wattle and various broadleaf in various locations within the Project Area 400 litres of Glyphsate 540, Chemtrol oil & Rhodamine Red Dye utilized on pampas grass at the Ash dam MCPA 750 utilized in conjunction with other herbicides on various broadleaf at variation locations.
July 2024	Nil over winter	Weed control herbicides applied to Flax lead fleabane, various broadleaf, skeleton weed, serrated tussock and African lovegrass
August 2024	Nil over winter	Update unavailable

In the next AEMR reporting period GPM will continue to investigate suitable long-term revegetation that excludes tree species as part of the longer-term site management activities, in line with the HHERA conducted as part of the site declaration VMP.

7.2.4 Final landform

No final rehabilitation has occurred due to ongoing contamination investigations under the VMP. Until these investigations are completed a final landform cannot be completed. Works during the reporting period have focussed on containment of the exposed ash areas and asbestos landfill areas to ensure these areas are safe and stable. These containment measures have focussed on shaping the exposed areas and locations with limited cover with imported soil materials (VENM and ENM) to form stable landforms and thus limiting the potential for human health and environmental impacts from the site. Completion of these activities on exposed ash areas in the KVAR stage 2 area and commencement of a stability containment berm has continued throughout the reporting period with these works now largely complete across the entire approval area.

Temporary cover in the form of grasses and mulches has been applied to the newly shaped areas.

7.3 Reportable incidents

No reportable incidents have been recorded against landscape and revegetation management for the reporting period.

7.4 Further improvements

Care and maintenance activities will continue to be undertaken within the Project Area to ensure landscape and revegetation areas progress across the site.

8 Community engagement

8.1 Community consultation group

The requirement for a community consultation group was triggered with the declaration of the site as an area of significant contamination under the *Contaminated and Management Act*, and the preparation of the VMP.

The community consultation group allows community members access to the progress of the remediation and KVAR and allows suggestions on how the site may be used once all remediation is complete. Advertisements were placed in local newspapers, hand delivered to Lidsdale residents, placed on the GPM website, included in news stories on the local television station and posters placed in local shops in Lidsdale, Wallerawang and Portland. As a result, several local residents registered to be included on the committee.

The inaugural community consultation group meeting was held on 20 October 2023 and two meetings were held during the reporting period on 14 March and 24 July 2024.

8.2 Website information

Copies of the following documents are made publicly available on the GPM website (https://gpmco.com.au/environment/):

- Environment Assessment
- Project Approval 07_0005
- Operation Environmental Management Plan
- Annual Environmental Management Reports
- Environment Protection Licence 21185
- Pollution Incident Response Management Plan.

8.3 Community complaints procedure

GPM maintains a Community Information and Complaints Line for the public to report incidents, complaints or enquiries with contact details available on GPM's website.

GPM records the details of all complaints received in a Complaints Register. The register records:

- the date and time of the complaint
- the means by which the complaint was made (e.g. telephone, email, mail, in person)
- any personal details of the complainant that were provided, or if no details were provided a note to that effect
- the nature of the complaint
- the time taken to respond to the complaint
- any investigations and actions taken by GPM and/or the Contractor in relation to the complaint
- any follow-up contacts with, and feedback from, the complainant

- if no action was taken by GPM the Contractor in relation to the complaint, the reason(s) why no action was taken.

The Site Manager and the Facility Environment & Safety Manager ensure that the community relations protocols are communicated to all project personnel involved in the complaints process and that appropriate training covering the protocols is established in site inductions.

The key elements of the on-site complaints' management protocol include the following:

- All persons wishing to register a complaint to operations personnel will be politely directed to the site Manager, in line with GPM complaints procedure.

- The Site Manager will deal with the complaint and take down particulars of the complaint as per the criteria listed on the complaints register. Action will then be taken to resolve the issue whilst ensuring that all correspondence relating to the issue is documented. All attempts will be made to resolve the issue on the same day, however if this is not possible, the complainant will be updated regularly on the progress of the matter where practical.

8.3.1 Community complaints

Complaints received during the AMER 2023/2024 reporting period are summarized in Table 8.1.

Table 8.1 Reportable incidents during the 2023-2024 AEMR reporting period

Date of complaint	Nature of complaint	Actions/Resolution
14 November 2023	Dust and taste of chemicals reaching private dwelling between 10 and 12 October 2024. Complainant noted a lack of dust suppression measures employed, particularly on windy days.	GPM notes that one water cart was out of service due to a failed fill standpipe during 9-13 October 2023. At least one water cart is required in continuous operation every day from 7am to 5:00 pm, with a second cart mobilized on dry windy days. Revegetation and irrigation infrastructure to be installed as soon as practical. Continue of dust monitoring via five depositional dust gages.
13 August 2024	Turbid water in Sawyers Swamp Creek on 25 July and 28 July 2024.	GPM monitoring contractor conducted site surface water sampling on 24 July 2024. Field readings and visual observation indicated turbidity was low in Sawyers Swamp Creek – readings were around 10NTU. On 25 July 2024, the Managing Director and Site Manager led a tour of the site. Creek water flowing through the spillway and towards the toe of the Sawyers Swamp Creek Ash Dam was observed to be generally clear. Turbidity readings recorded in Sawyers Swamp Creek at the western boundary of GPM land were less than 5 NTU. The monitoring station is located some 300 m upstream of the culvert under Wolgan Road. An electrical storm from 1:50 am to 4:10 am on 26 July 2024 yielded 14 mm of rain. Turbidity readings began rising an hour or so after the storm commenced and peaked around 8:00 am and then fell away to around 30 NTU. The six hour gap between the commencement of rainfall and the peak in turbidity indicates that most of the sediment causing the turbidity was carried by runoff from upstream of the diversion of Sawyers Swamp Creek around the Ash Dam. From 5:10 am on 27 July 2024, some 7 mm of rain fell in a little over three hours causing another, smaller spike in turbidity which dissipated by early on 28 July 2024. Sediment controls for disturbed areas are in place across the site (i.e. silt fences, socks, surface mulches, sediment traps) as required. earlier this year, the Care and Maintenance Contractor, along with GPM site supervisory staff received soil & erosion control training based, on the Blue Book, from an external supplier. Mitigation measures are routinely inspected and were found to be working at the time.

Date of complaint	Nature of complaint	Actions/Resolution
13 August 2024	Water runoff from Barn Paddock sprinklers running through private property.	An incident occurred due to PRJH not changing over sprinklers and allowing them to run over the same area for approx. 3 hours. GPM contacted landholder to apologise regarding the nature of the incident. PRJH to complete incident report.

8.3.2 Vegetation management

GPM have continued to undertake extensive vegetation management works around the site and Project Area boundaries to reduce the fire risk to near-by residences and site infrastructure. Work was undertaken in consultation with local residents and stakeholders and in accordance with the RFS requirements.

9 Compliance assessment

Since taking over the site, GPM have engaged a number of consultants and contractors to understand the history and current status to inform the safe closure of the site including decommissioning, demolition, rehabilitation.

During the reporting period in June 2024, GPM engaged an independent environmental representative (ER) under condition Schedule 2 Condition 6.1. The ER undertakes monthly inspections to ensure that all environmental programs are being implemented and that approval conditions are being complied with. The ER monthly report is prepared and provided to DPHI.

As part of each AEMR, a Compliance Assessment against the CoA is conducted. The 2023-2024 Compliance Assessment is available in Appendix A. The Compliance Assessment found the site was Compliant with the CoA for the AEMR Reporting Period.

9.1 Associated studies and investigations

To date, GPM has commissioned the following site studies and investigations:

- Continued engagement of a NSW EPA accredited site auditor to provide independent reviews of investigation, remediation, and validation work undertaken by GPM's consultants
- monthly compliance review and site inspection by an ER
- a progressive rehabilitation plan for Stage 1 SSC realignment has been developed in consultation with the relevant agencies and submitted to DPHI
- Water Quality Discharge Assessments under the EPL were completed
- Water Management Assessments (including a Site Action Plan), submitted to the EPA
- six-monthly Water Quality Monitoring Reports prepared and submitted to EPA
- surface water characterisation report, submitted to the EPA on 30 September 2023
- initial Groundwater Characterisation Report, submitted to the EPA on 30 September 2023
- update of the site weed management program
- assistance with the Department of Agriculture's reinstatement of copper wing butterfly habitat study
- routine dam safety audits of the SSCAD
- independent fortnightly work practice site safety audits.

In addition to the above studies and investigations, GPM has conducted its review of the OEMP and CEMP and is in the process of incorporating and addressing DPHI comments.

10 OEMP and CEMP update and future studies

GPM are currently finalising the updates to the OEMP and CEMP as a result of DPHI comments on the plans which includes a revised water monitoring and analysis approach. It is anticipated that the updated OEMP will be submitted to DPHI for approval and implemented during the 2024-2025 AEMR period.

GPM continues proactive discussions with regulators as to the best management and regulatory approach for the site.

10.1 Contamination declaration

Contamination within the Project Area was notified to the EPA by GPM under section 60 of the CLM Act on 10 March 2021. Following review of available information, EPA advised (on 27 June 2022), that the contamination is significant enough to warrant regulation under the CLM Act. On 22 August 2022, the EPA issued GPM with a Contaminated Land Declaration Notice which declares the site as significantly contaminated land under division 2 the *Contaminated Land Management Act 1997*. GPM has submitted a VMP to the EPA that establishes a proposed investigation and remediation approach. Key elements in determining the extent of remediation required will be the ultimate end use of the property, the extent of any contamination beyond the Project Area boundary and long term stability of the contaminants so they are contained in perpetuity. The following sequence of events were proposed:

- A Sampling, Analysis and Quality Plan (SAQP) was developed to outline the protocols for sampling, analysis, monitoring and reporting to inform the scope of the DSI, in accordance with the NEPM (ASC NEPM 2013) and NSW EPA (2020) guidelines.
- The Detailed Site Investigation (DSI) is ongoing with the objective of identifying the nature and extent of contamination. Intrusive soil investigations have been undertaken at the site for the to meet the objective of the DSI with conversion of multiple boreholes to groundwater wells for groundwater assessment and ongoing groundwater monitoring. The DSI report will include relevant data from the Initial Groundwater Characterisation Report (EMM 2023c) and the Surface Water Characterisation Report.
- A Human Health and Ecological Risk Assessment will be prepared (if required) to identify specific soil and groundwater acceptance criteria for the site and for the remediation works.
- A Remedial Options Assessment (ROA) and Remedial Action Plan(s) (RAP) will be prepared to inform remediation requirements. The site Auditor's endorsement of/or confirmation that she/he has no objection to the ROA and RAP will be obtained and the EPA's approval of the RAP will be obtained.

GPM will continue to liaise with the EPA regarding the VMP in the next AEMR reporting period.

Appendix A

Conditions of Approval Compliance Assessment

EMM
creating opportunities

Compliance Tracking Monitoring

Approval requirement	Requirement	Relevant OEMP Section	Relevant CEMP Section	Relevant Plan of Action or Procedure	Status	Compliance Notes - AEMR 2023-2024
1. ADMINISTRATIVE CONDITIONS						
Terms of Approval						
CoA 1.1-1.3	**1.1 -** The Applicant must carry out the project: a) in compliance with the conditions of this approval; b) in accordance with all written directions of the Secretary; c) generally in accordance with the EA; and d) generally in accordance with the project area.	n/a	n/a	As stated in CoA and responsibility of GPM Staff	Open	All current approvals, permits and in force are reviewed annually as part of the AEMR or folllowing modifications or changes in law. No updateds required.
	1.2 - Consistent with the requirements in this approval, the Secretary may make written directions to the Applicant including in relation to: a) the content of any strategy, study, system, plan, program, review, audit, notification, report or correspondence submitted under or otherwise made in relation to this consent, including those that are required to be, and have been, approved by the Secretary; and b) the implementation of any actions or measures contained in any such document referred to in condition 1.2a).	n/a	n/a	As stated in CoA and responsibility of GPM Staff	Open	None received to date
	1.3 - The conditions of this approval and directions of the Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and the document/s listed in condition 1.1c). In the event of an inconsistency, ambiguity or conflict between any of the document/s listed in condition 1.1c), the most recent document prevails to the extent of the inconsistency, ambiguity or conflict.	n/a	n/a	As stated in CoA and responsibility of GPM Staff	Open	None received to date
Limits of Approval						
CoA 1.4	**1.4 -** This approval shall lapse five years after the date on which it is granted, unless the works that are the subject of this approval are physically commenced on or before that time.	n/a	n/a	As stated in CoA and responsibility of GPM Staff	Closed	Consent issued on 26/11/2008, the project commenced in April 2009.
Statutory requirements						
CoA 1.5	**1.5 -** The Applicant shall ensure that all licences, permits and approvals are obtained as required by law and maintained as required with respect to the project. No condition of this approval removes the obligation for the Applicant to obtain, renew or comply with such licences, permits or approvals.	n/a	n/a	As stated in CoA and responsibility of GPM Staff	Open	All current approvals, permits and in force are reviewed annually as part of the AEMR or folllowing modifications or changes in law. No updates required.
2. SPECIFIC ENVIRONMENTAL CONDITIONS						
Ash Management						
CoA 2.1 - 2.2	**2.1 -** The Applicant shall prepare a long-term ash management strategy including a program for investigation and assessment of alternative ash management measures with a goal of 40% reuse of ash by 31 December 2013. The report shall be submitted to the Secretary within six months of the commencement of operations. The Applicant shall report on the status and outcomes of its investigations to the Secretary every two years from the commencement of the operation of the project, unless otherwise agreed by the Secretary.	1.1 - Background to the Lidsdale Ash repository, 2.2 - Extent of Historical Ash Placement	1.1 - Background to the Lidsdale Ash repository	As per MP07_0005-Mod 1 and Mod 2 EPL 21185 - L4.1 - Excavated Natural material and virgin excavated natural material to be received at the premises for the purposes associated with the capping of the Kerosene Vale Ash Repositories	Closed	Ash reuse not viable, ash disoposal ceased in 2011, WPS closed completely in April 2014, WPS demolished between 2021 and 2023. EPL variation in preparation for other RRO/RRE materials October 2024
	2.2 - To facilitate assessment of the viability of coal resources in the project area and provide a finite opportunity for their extraction, the Applicant shall undertake revised staging of ash placement activities as described in the document referred to in condition 1.1c) of this approval.	1.1 - Background to the Lidsdale Ash repository	1.1 - Background to the Lidsdale Ash repository	-	Closed	Ash placement no longer occurring due to closure of WPS in 2014. Coal mining undertaken by others prior to ash placement.
Noise Impacts - *Construction Hours*						
CoA 2.3-2.6	**2.3 -** Construction activities associated with the project shall only be undertaken during the following hours: a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive; b) 8:00 am to 1:00 pm on Saturdays; and c) at no time on Sundays or public Holidays	2.4 Hours of operation	2.7 - Working Hours	-	Open	Site operating hours in accordance with this requirement
	2.4 - Activities resulting in impulsive or tonal noise emission (such as rock breaking or rock hammering) shall be limited to 8:00 am to 12:00 pm, Monday to Saturday and 2:00 pm to 5:00 pm, Monday to Friday. The Applicant shall not undertake such activities for more than three continuous hours and must provide a minimum one-hour respite period.	2.4.2 Abnormal or emergency operation condtions	2.7 - Working Hours	-	Open	None of these activities were undertaken during this period
	2.5 - Construction outside the hours stipulated in condition 2.3 of this approval is permitted in the following circumstances: a) where construction works do not cause audible noise at any sensitive receiver; or b) for the delivery of materials required outside these hours by the Police or other authorities for safety reasons; or c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.	2.4.2 Abnormal or emergency operation condtions	2.7 - Working Hours	-	Open	No OOHW required or requested during this period
	2.6 - The hours of construction activities specified under condition 2.3 of this approval may be varied with the prior written approval of the Secretary. Any request to alter the hours of construction specified under condition 2.3 shall be: a) considered on a case-by-case basis; b) accompanied by details of the nature and need for activities to be conducted during the varied construction hours; and c) accompanied by any information necessary for the Secretary to reasonably determine that activities undertaken during the varied construction hours will not adversely impact on the acoustic amenity of sensitive receivers in the vicinity of the site.	2.4.2 Abnormal or emergency operation condtions	2.7 - Working Hours	-	Open	No requests of this nature have been made
Noise Impacts - *Construction Noise*						
CoA 2.7	**2.7 -** The construction noise objective for the project is to manage noise from construction activities (as measured by a LA10 (15 minute) descriptor) so as not to exceed the background LA90 noise level by more than 10 dB(A) at any sensitive receiver. Any activities that have the potential for noise emissions that exceed the objective must be identified and managed in accordance with the Construction Noise Management Plan (as referred to under condition 6.3b) of this approval). The Applicant shall implement all reasonable and feasible noise mitigation measures with the aim of achieving the construction noise objective.	n/a	Construction Noise Management Plan 2.10.4 - Environmental monitoring	-	Open	Quartely noise monitoring undertaken, no exceedances recorded
Noise Impacts - *Operational Hours*						
CoA 2.8-2.14	**2.8 -** Operational activities associated with the project shall only be undertaken from 7.00 am to 10.00 pm Monday to Sunday.	2.4 Hours of operation	2.7 - Working Hours	EPL - L6.1	Open	
	2.9 - Within six months of commencement of operation of the project the Applicant shall prepare and submit to the Secretary a review of the logistical arrangements for ash haulage and placement to determine the feasibility of reducing the hours of operation. If, as a result of the review, it is determined that ash haulage and placement times can commence later and/or finish earlier, the Applicant shall aim to observe the reduced hours whenever possible.	2.2 - Extent of stage 2 Ash placement 2.3.2 - Ash Delivery	n/a	**Due to the closure of the WPS, ash is no longer required to be delivered to the Lidsdale Ash Repository**	Closed	Due to the closure of the WPS in 2014, ash is no longer required to be delivered to the Lidsdale Ash Repository. The site has been operational since 2008.
	2.10 - Operations outside the hours stipulated in condition 2.8 of this approval are only permitted in the following emergency situations: a) where it is required to avoid the loss of lives, property and/or to prevent environmental harm; or *b) breakdown of plant and/or equipment at the repository or the Wallerawang Power Station with the effect of limiting or preventing ash storage at the power station outside the operating hours defined in condition 2.8; or* *c) a breakdown of an ash haulage truck(s) preventing haulage during the operating hours stipulated in condition 2.8 combined with insufficient storage capacity at the Wallerawang Power Station to store ash outside of the project operating hours; or* *d) in the event that the National Electricity Market Management Company (NEMMCO), or a person authorised by NEMMCO, directs the Applicant (as a licensee) under the National Electricity Rules to maintain, increase or be available to increase power generation for system security and there is insufficient ash storage capacity at the Wallerawang Power Station to allow for the ash to be stored. In the event of conditions 2.10b) or 2.10c) arising, the Applicant is to take all reasonable and feasible measures to repair the breakdown in the shortest time possible.*	2.4.2 Abnormal or emergency operation condtions	n/a	EPL - L6.2	Open	Only 2.10a remains relevant to this project as all other ash related clauses are no longer occurring. No emergency operations have been required furing the AEMR period.

	2.11 - *In the event that an emergency situation as referred to under condition 2.10b) or 2.10c) occurs more than once in any two month period, the Applicant shall prepare and submit to the Secretary for approval a report including, but not limited to: a) the dates and a description of the emergency situations; b) an assessment of all reasonable and feasible mitigation measures to avoid recurrence of the emergency situations; c) identification of a preferred mitigation measure(s); and d) timing and responsibility for implementation of the mitigation measure(s). The report is to be submitted to the Secretary within 60 days of the second exceedance occurring. The Applicant shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Secretary.*	n/a	n/a	EPL L6.2	Closed	Due to the closure of the WPS in 2014, ash is no longer required to be delivered to the Lidsdale Ash Repository
	2.12 - *The Applicant shall notify the EPA prior to undertaking any emergency ash haulage or placement operations outside of the hours of operation stipulated in condition 2.8 of this approval and keep a log of such operations.*	n/a	n/a	EPL - L6	Closed	Due to the closure of the WPS in 2014, ash is no longer required to be delivered to the Lidsdale Ash Repository
	2.13 *- The Applicant shall notify the Secretary in writing within seven days of undertaking any emergency ash haulage or placement operations outside of the hours of operation stipulated in condition 2.8 of this approval.*	n/a	n/a	EPL - L6	Closed	Due to the closure of the WPS in 2014, ash is no longer required to be delivered to the Lidsdale Ash Repository
	2.14 *- The Applicant shall notify nearby sensitive receivers (as defined in the Operational Noise Management Plan required under condition 6.5a) of this approval) prior to 8.00 pm where it is known that emergency ash haulage or placement operations will be required outside of the hours of operation stipulated in condition 2.8 of this approval.*	n/a	n/a	EPL - L6	Closed	Due to the closure of the WPS in 2014, ash is no longer required to be delivered to the Lidsdale Ash Repository
Noise Impacts - *Operational Noise*						
CoA 2.15-2.18	**2.15** - The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed an LAeq (15 minute) of 40 dB(A) at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8 of this approval. This noise criterion applies under the following meteorological conditions: a) wind speeds up to 3 m/s at 10 metres above ground; and/or b) temperature inversion conditions of up to 3°C/100 m and source to receiver gradient winds of up to 2 m/s at 10 m above ground level. This criterion does not apply where the Applicant and the affected landowner have reached a negotiated agreement in regard to noise, and a copy of the agreement has been forwarded to the Secretary and the EPA.	Noise management plan	n/a	EPL - L5.1-L5.3	Open	Noise limits apply to all operations although ash haulage and placement is no longer occuring. Quartely noise monitoring undertaken, no exceedances recorded
	2.16 - The Applicant shall implement measures to ensure noise attenuation of trucks. These measures may include, but are not necessarily limited to, installation of residential class mufflers, engine shrouds, body dampening, speed limiting, fitting of rubber stoppers to tail gates, limiting the use of compression braking, and ensuring trucks operate in a one-way system at the ash repository where feasible.	Noise management plan	n/a	EPL - L5.2	Open	Truck deliveries still occurred during the period. Trucks are limted to import of quarry and other capping materials approved to be brought to site. Quartely noise monitoring undertaken, no exceedances recorded
	2.17 *- The Applicant shall liaise with the owner/operator of Angus Place Coal Mine with the aim of preparing a protocol which provides for a co-operative approach for the management and mitigation of noise impacts associated with coal and ash truck movements along the private haul road.*	Noise management plan	n/a		Closed	No coal or ash haulage currently being undertaken along this road, Angus Place Colliery in care and maintenance
	2.18 - Where noise monitoring (as required by conditions 3.2 or 3.3 of this approval) identifies any non-compliance with the operational noise criterion specified under condition 2.15 of this approval the Applicant shall prepare and submit to the Secretary for approval a report including, but not limited to: a) an assessment of all reasonable and feasible physical and other mitigation measures for reducing noise at the source including, but not limited to - i) construction of a noise barrier along the haulage road, ii) alternative ash haulage routes, and iii) alternative methods of ash conveyance to the repository; and b) identification of the preferred measure(s) for reducing noise at the source; c) feedback from directly affected property owners and the EPA on the proposed noise mitigation measures; and d) location, type, timing and responsibility for implementation of the noise mitigation measure(s). The report is to be submitted to the Secretary within 60 days of undertaking the noise monitoring which has identified exceedances of the operational noise criterion specified under condition 2.15, unless otherwise agreed to by the Secretary. The Applicant shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Secretary.	Noise management plan	n/a	EPL - L5	Open	Quartely noise monitoring undertaken, no exceedances recorded, no report required to be preapred for this period.
Noise Impacts - *Additional Noise Mitigation Measures*						
CoA 2.19	**2.19** - If, after the implementation of all reasonable and feasible source controls, as identified in the report required by condition 2.18, the noise generated by the project exceeds the criterion stipulated in condition 2.15 at: a) any sensitive receiver in existence at the date of this approval; or b) any residential dwelling for which an approval has been sought or obtained under the Environmental Planning and Assessment Act 1979 no later than six months after the confirmation of operational noise levels; upon receiving a written request from an affected landowner (unless that landowner has acquisition rights under condition 2.20 of this approval and has requested acquisition) the Applicant shall implement additional noise mitigation measures such as double glazing, insulation, air conditioning and or other building acoustic treatments at any residence on the land, in consultation with the landowner. For the purpose of this condition and condition 2.20, confirmation of operational noise levels means: a) completion of the operational noise review required under condition 3.2 of this approval; and b) implementation of any source controls, as required under condition 2.18 of this approval, should the operational noise review indicate noise levels in excess of the operational noise criterion specified in condition 2.15; and c) monitoring of operational noise levels, as required under condition 3.3b) of this approval, following the implementation of any source controls. The additional mitigation measures must be reasonable and feasible. If within three months of receiving this request from the landowner the Applicant and landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Director-General for resolution, whose decision shall be final.	Noise management plan	n/a	-	Open	Quartely noise monitoring undertaken, no exceedances recorded. No written requests received relating to noise.
Noise Impacts - *Land Acquisition Criteria*						
	2.20 - If, after the implementation of all reasonable and feasible source controls, as identified in the report required by condition 2.18, the noise generated by the project exceeds the criterion stipulated in condition 2.15 by more than 5 dB(A): a) at a sensitive receiver in existence at the date of this approval; or b) at any residential dwelling for which an approval has been sought or obtained under the Environmental Planning and Assessment Act 1979 prior to the landholder receiving written notification that they are entitled to land acquisition rights, as per condition 2.25 of this approval; or c) over 25% or more of the area of a vacant allotment in existence at the date of this approval, and where a dwelling is permissible under the Environmental Planning and Assessment Act 1979 at that date, with the exception of land that is currently used for industrial or mining purposes; the Applicant shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 2.22 to 2.24 of this approval. Any landowner that has agreed to, or property that has been the subject of, the application of additional noise mitigation measures under condition 2.19 of this approval waives the right to land acquisition.	Noise management plan	n/a	-	Open	Quartely noise monitoring undertaken, no exceedances recorded. No written requests received relating to noise.

	2.21 - The land acquisition rights under condition 2.20 of this approval do not apply to landowners who have sought approval to subdivide their land after the date of this approval, unless the subdivision is created pursuant to condition 2.24 of this approval.	Noise management plan	n/a		Open	No subdivision of land under this condiion has occurred or been required.
CoA 2.20-2.25	**2.22** - Within three months of receiving a written request from a landowner with acquisition rights under condition 2.20 of this approval, the Applicant shall make a binding written offer to the landowner based on: (a) the current market value of the landowner's interest in the property at the date of this written request, as if the property was unaffected by the project which is the subject of the project application, having regard to the: i) existing and permissible use of the land, in accordance with the applicable planning instruments at the date of the written request; and ii) presence of improvements on the property and/or any approved building or structure which has been physically commenced at the date of the landowner's written request, and is due to be completed subsequent to that date, but excluding any improvements that have resulted from the implementation of condition 2.19 of this approval; (b) the reasonable costs associated with: relocating within the Lithgow local government area, or to any other local government area determined by the Secretary; ii) obtaining legal advice and expert advice for determining the acquisition price of the land, and the terms upon which it is required; and (c) reasonable compensation for any disturbance caused by the land acquisition process. However, if at the end of this period, the Applicant and landowner cannot agree on the acquisition price of the land, and/or the terms upon which the land is to be acquired, then either party may refer the matter to the Secretary for resolution. Upon receiving such a request, the Secretary shall request the President of the NSW Division of the Australian Property Institute to appoint a qualified independent valuer or Fellow of the Institute, to consider submissions from both parties, and determine a fair and reasonable acquisition price for the land, and/or terms upon which the land is to be acquired. Within 14 days of receiving the independent valuer's determination, the Applicant shall make a written offer to purchase the land at a price not less than the independent valuer's determination. If the landowner refuses to accept this offer within six months of the date of the Applicant's offer, the Applicant's obligations to acquire the land shall cease, unless otherwise agreed by the Secretary.	Noise management plan	n/a		Open	No requests received during this period.
	2.23 - The Applicant shall bear the costs of any valuation or survey assessment requested by the independent valuer or the Secretary and the costs of determination referred to above.	Noise management plan	n/a		Open	None required this period
	2.24 - If the Applicant and landowner agree that only part of the land shall be acquired, then the Applicant shall pay all reasonable costs associated with obtaining Council approval for any plan of subdivision (where permissible), and registration of the plan at the Office of the Registrar-General.	Noise management plan	n/a		Open	No requests received during this period.
	2.25 - The Applicant shall provide written notice to all landowners that are entitled to rights under conditions 2.19 and 2.20 within 21 days of determining the landholdings where additional noise mitigation measures or land acquisition apply. For the purpose of condition 2.20b), this condition only applies where operational noise levels have been confirmed in accordance with the definition in condition 2.19.	Noise management plan	n/a		Open	Quartely noise monitoring undertaken, no exceedances recorded. No written requests received relating to noise.
Sawyers Swamp Creek Realignment						
CoA 2.26-2.29	**2.26 -** The Applicant shall prepare and submit to the Secretary for approval a Rehabilitation Plan addressing the restoration of the in-stream area (i.e. bed and bank) of Sawyers Swamp Creek and the associated riparian corridor at least two months prior to the realignment of the creek, unless otherwise agreed by the Secretary. The Plan shall be developed in consultation with, and to the satisfaction of, Fisheries NSW and shall include, but not necessarily be limited to: a) the objectives and outcomes that would be sought through the implementation of the Plan; b) performance criteria for the realigned creek and associated riparian zone against which the impact of the project on the ecological health of Sawyers Swamp Creek will be assessed; c) methodology used in developing the realignment planform; d) details of the final creek realignment including bank, meander, depth and slope characteristics (including pool-riffle sequences), flow and channel capacity characteristics, scour potential, and in-stream vegetation; e) timing of the creek realignment; f) a description of the proposed riparian zone and restoration works along the entire length of the creek realignment, including details of plant species to be used in rehabilitation; g) details of any proposed riparian and in-stream controls to be implemented in the reach upstream of the alignment to ensure the effectiveness of the proposed creek realignment and rehabilitation; h) a description of the initial and ongoing weed control measures; i) the methodology and timing of post realignment monitoring of the hydrology and ecological health of the aquatic and riparian vegetation as required under conditions 3.6 and 3.7 of this approval, respectively; j) mitigation measures to be implemented in the event of an identified decline in ecosystem health as a direct result of the realignment of the creek or construction or operation of the project, including a timetable for implementation; k) program for ongoing maintenance of the realigned creek system and associated riparian zone; l) any compensatory measures to offset the impacts of the project on the aquatic habitat and local waterways, if and as required by Fisheries NSW and m) provisions for periodic reporting of monitoring results to Fisheries NSW. The Applicant shall not commence any construction work that would result in the disturbance of Sawyers Swamp Creek until the Rehabilitation Plan has been approved by the Secretary.	-	-	SSC rehab plan	Open	Plan to be staged, Stage 1 is temporay diversion, Stage 2 is final creek realignment. Staging endorsed by NSW Fisheries and plan under review by DPHI. CEMP and OEMP to be updated once plan approved
	2.27 - The rehabilitation and restoration of Sawyers Swamp Creek and associated riparian zone are to be consistent with the Works and Watercourse Design Guideline (DWE, April 2007) and Guidelines for Controlled Activities: Vegetation Management Plans (DWE, February 2008).	-	-		Open	Plan to be staged, Stage 1 is temporay diversion, Stage 2 is final creek realignment. Staging endorsed by NSW Fisheries and plan under review by DPHI. CEMP and OEMP to be updated once plan approved
	2.28 - A riparian zone consisting of local native plant species shall be established and maintained in and adjacent to Swayers Swamp Creek, for the entirety of the site and be a minimum width of 20 m on both sides of the creek. Seed and propagule sources are to be from local botanical provenance and same general habitat.	-	-		Open	Stage 2 final alignment will include this requirement. Stage 1 under review by DPHI, endorsed by DPI Fisheries
	2.29 - The riparian zone referred to under condition 2.28 of this approval shall be maintained for a period of at least five years after final planting.	-	-		Open	Stage 2 final alignment will include this requirement. Stage 1 under review by DPHI, endorsed by DPI Fisheries
Surface Water Quality - *Water Quality*						
CoA 2.30-2.32	**2.30** - The Applicant shall take all reasonable and feasible measures to prevent discharge of sediments and pollutants from the construction and operation of the project entering waterways.	Appendix E Surface Water Management Plan	3.1.2 - Erosion and sediment control plan	Site Inspection Checklist	Open	Construction plans developed for active works, operational plan updates to be provided when construction complete
	2.31 - Earthworks not associated with the realignment of Sawyers Swamp Creek shall not be undertaken within 50 m of the creek where reasonable and feasible.	n/a	2.10 Monitoring, inspection and auditing		Open	Stability berm around KVAR will be witin 50 m of the Stage 1 diversion, Stage 2 final creek alignment not finalised and Plan awaiting approval see 2.29. No works commenced during this period.
	2.32 - All equipment, machinery and vehicles associated with the construction and operation of the project shall be operated and maintained in a manner that minimises the potential for oil and grease spills/leaks.	Appendix A Site inspection checklist	Appendix B Site inspection checklist		Open	Site Inspection checklist includes these items. Plant pre-start records include this requirement.
Air Quality Impacts						
CoA 2.33-2.34	**2.33** - The Applicant shall construct and operate the project in a manner that minimises dust impacts generated by construction works and operational activities, including wind-blown and traffic-generated dust, on the receiving environment. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, the Applicant shall identify and implement all practicable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.	Air Quality management subplan	See OEMP for monitoring	EPL - O3, EWMS	Open	Air quality monitoring undertaken on a monthly basis. Annual average data show no exceedances of air quality goals as a result of combined operation and construiction activities

	2.34 - The Applicant shall ensure that the load carrying compartment(s) of all *ash* haulage trucks are covered at all times except when loading or unloading ash material.	Operational Transport Plan	Construiction transport management plan	EPL - O3.4	Open	No ash haulage undertaken since 2014. Covering of loads for capping and material haulage still relevant.
Lighting Emissions						
CoA 2.35	**2.35** - The Applicant shall take all practicable measures to mitigate off-site lighting impacts from the project and ensure all external lighting associated with the project complies with *Australian Standard AS4282 1997 – Control of the Obtrusive Effects of Outdoor Lighting.*	5.2 - Environmental monitoirng program	n/a	-	Open	Only security lighting of the premises is operational at night. No light spill noted on recievers in Lidsdale and no complaints received related to lighting.
Construction Traffic and Transport Impacts						
CoA 2.36	**2.36 -** The Applicant shall ensure that construction vehicles associated with the project: a) minimise the use of local roads (though residential streets and town centres) to gain access to the site; b) adhere to any nominated haulage routes identified in the Construction Traffic Management Plan as referred to in condition 6.3a) of this approval; and c) adhere to a Construction Vehicle Code of Conduct prepared to manage driver behaviour along the local road network to address traffic impacts (and associated noise) along nominated haulage routes.	Operational transport management subplan OEMP - 2.3.3 - Capping material delivery	Transport management plan	-	Open	Plans contain these requirements. No issues noted during this period.
Capping Material Transport Impacts						
CoA 2.36A-2.36B	**2.36A** - The Applicant must: (a) not import more than 100 heavy vehicle loads of capping material to the site per day; (b) cover all heavy vehicle loads of capping material; (c) not transport capping material on local roads in the Lithgow local government area; (d) notify the Department before commencing the importation of capping material from sources outside of the Lithgow local government area; and (e) not import capping material to the site for more than 10 years following the date of approval of Modification application 07_0005 Mod 2.	Operational transport management subplan - 2.3.3 - Capping material delivery	Transport management plan	-	Open	Capping materials have been imported to the site during the period. Materials outside of the Lithgow LGA have been received. Truck numbers are tracked and numbers identified are in accordance with this requirement. Capping deliveries have been occuring to the site since 2008 from areas both within and outside of the Lithgow LGA and are noted in AEMR reports.
	2.36B - The Applicant must implement warning signage on the Castlereagh Highway on the approaches to the Castlereagh Highway/Wallerawang Power Station Haul Road intersection prior to importing capping material to the site from sources outside of the Lithgow local government area to the satisfaction of TfNSW.	Operational transport management subplan	Transport management plan	-	Open	Date approved for extension of time is 2033, signage in place as required
Heritage Impacts						
CoA 2.37-2.38	**2.37** - The Applicant shall ensure that all construction personnel are educated on their obligations in respect of the protection of Aboriginal and non-indigenous heritage sites and items.	3.4 - Environment awareness training and site inductions	2.6.2 - toolbox talks training and awareness	Wallerawang Power Station Heritage issues Site induction	Open	Contained in induction materials
	2.38 - If any previously unidentified heritage sites or items (Aboriginal and/or non-indigenous) are discovered during construction works or operational activities, all work likely to affect the heritage sites or item(s) is to cease immediately and the discovery of the objects shall be reported to Heritage NSW or the Department as relevant.	4.1.4 - Relevant legislation, regulations and guidelines	2.9 - Emergency and incident planning	Wallerawang Power Station Heritage issues Site induction	Closed	Contained in induction materials
Waste Management						
CoA 2.39-2.41	**2.39** - All waste materials shall be assessed, classified, managed and disposed of in accordance with the *EPA's Waste Classification Guidelines* (or its latest version).	6.2.1 waste management sub-plan	2.10 Environmental monitoring	EPL - L4.1 Table of approved wastes, Asbestos Management Plan	Open	No wastes disoposed of on site during the reporting period
	2.40 - All waste materials removed from the site shall only be directed to a waste management facility lawfully permitted to accept the materials.	6.2.1 waste management sub-plan	OEMP waste management sub-plan		Open	Only general wastes disposed of to approved landfill sites
	2.41 - The Applicant shall not cause, permit or allow any waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing, or disposal on the site, except as expressly permitted by a licence under the *Protection of the Environment Operations Act 1997,* if such a licence is required in relation to that waste.	6.2.1 waste management sub-plan	OEMP waste management sub-plan	EPL - L4.1, Asbestos Management Plan	Open	No wastes disoposed of on site during the reporting period
3. ENVIRONMENTAL MONITORING						
Construction Noise Monitoring						
CoA 3.1	**3.1** - The Applicant shall prepare and implement a Construction Noise Monitoring Program to confirm the predictions of the noise assessment detailed in the document referred to under condition 1.1 of this approval and assess compliance against the construction noise criterion stipulated in condition 2.7 of this approval. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of the EPA. The monitoring program shall form part of the Construction Noise Management Plan referred to in condition 6.3b) of this approval and must include monitoring of the construction noise generated during: a) the realignment Sawyers Swamp Creek; b) construction of the stabilisation berm; c) *excavation of the former pine plantation area;* d) relocation and construction of surface water management structures; and e) concurrent construction activities.	n/a	2.10.4 Environmental Monitorng, Construction N oise Management Plan	EPL O5, L5	Open	Pine plantation was been removed in 2009. Quarterly monitoring undertaken, no exceednaces reported.
Operational Noise Review						
CoA 3.2	**3.2** - Within 60 days of the commencement of operation of the project, unless otherwise agreed to by the Director-General, the Applicant shall submit for the approval of the Secretary an Operational Noise Review to confirm the operational noise impacts of the project. The Operational Noise Review must be prepared in consultation with, and to the satisfaction of, the EPA. The Review shall: a) identify the appropriate operational noise objectives and level for sensitive receivers; b) describe the methodologies for noise monitoring including the frequency of measurements and location of monitoring sites; c) document the operational noise levels at sensitive receivers as ascertained by the noise monitoring program; d) assess the noise performance of the project against the noise criterion specified in condition 2.15 of this approval and the predicted noise levels as detailed in the report referred to under condition 1.1 of this approval; and e) provide details of any entries in the Complaints Register (as required under condition 5.4 of this approval) relating to noise impacts. Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, the Applicant shall prepare a report as required by condition 2.18 of this approval.	n/a	n/a		Closed	Project commenced operations in 2009, see 3.3
Ongoing Operational Noise Monitoring						
	3.3 - The Applicant shall prepare and implement an Operational Noise Monitoring Program to assess compliance against the operational noise criterion stipulated in condition 2.15 of this approval, throughout the life of the project. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the EPA. The noise monitoring program shall be prepared in accordance with the requirements of the NSW Noise Policy for Industry (EPA, 2017) (or its latest version) and must include, but not be limited to: a) monitoring during ash placement in the far western area of the site adjacent to the haul road; and b) monitoring of the effectiveness of any noise mitigation measures implemented under condition 2.18 of this approval, against the noise criterion specified in					

CoA 3.3	under condition 2.18 of this approval, against the noise criterion specified in condition 2.15 of this approval. Noise from the project is to be measured at the most affected point on or within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise criterion stipulated in condition 2.15 of this approval. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance and the modifying factors shall also be applied to the measured noise levels where applicable in accordance with the NSW Noise Policy for Industry (EPA, 2017) (or its latest version). The Applicant shall forward to the EPA and the Secretary a report containing the results of any non-compliance within 14 days of conducting a noise assessment. Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, approval, the Applicant shall prepare a report as required by condition 2.18 of this approval. The monitoring program shall form part of the Operational Noise Management Plan referred to in condition 6.5a) of this approval.	Noise management subplan	2.10.4 Environmental Monitorng, Construction Noise Management Plan	EPL-L5.2	Open	Construction noise not specifcally covered by this condition, however due to inability to separate construction and operation noise, measurements include compliance with this requirement and EPL L5.2. Quarterly monitoring undertaken, no exceednaces reported.
Groundwater Monitoring						
CoA 3.4	**3.4** - The Applicant shall prepare and implement a Groundwater Monitoring Program to monitor the impacts of ash placement activities on local groundwater quality and hydrology. The Program shall be developed in consultation with, and to the satisfaction of, WaterNSW, and shall describe the location, frequency, rationale and procedures and protocols for collecting groundwater samples as well as the parameters analysed and methods of analysis. The monitoring program shall be ongoing for the life of the project and include, but not be limited to: a) monitoring at established bore sites (or replacement bore sites in the event that existing sites are damaged or lost) as described in the document referred to under condition 1.1 of this approval; and b) a schedule for periodic monitoring of groundwater quality, depth and flow at all monitoring sites, *at an initial frequency of no less than once every month for the first 12 months of operation.* The monitoring program shall form part of the Groundwater Management Plan referred to in condition 6.5b) of this approval.	Groundwater management subplan	n/a	EPL P1.2, M2.2, R4.1 6 monthly report, U1.1 Groundwater characterisation report (Complete), U2.1 (Complete), U2.2 (Complete), U2.3 (Complete), U2.4 (Complete), U2.5 (Complete), U2.6 (Complete), U2.7 Long term measures 1/10/24, U2.8 Completion report 15/10/24	Open	Plans approved, EPL monitoirng and reporting submitted. DSI ongoing under a VMP and review by EPA approved site auditor. Construction and operation not able to be seperated for this element.
Surface Water Quality Monitoring						
CoA 3.5	**3.5 -** The Applicant is to implement a surface water quality monitoring program to monitor the impacts of the ash placement activities on, and the realignment of, Sawyers Swamp Creek. The Program shall be developed in consultation with and to the satisfaction of Fisheries NSW and WaterNSW, and shall describe the location, frequency, rationale and the procedures and protocols for collecting water samples as well as the parameters analysed and methods of analysis. The program shall include, but not necessarily be limited to: a) monitoring at the four existing water quality monitoring sites as described in the document referred to under condition 1.1 of this approval; b) monitoring downstream of the realigned section of Sawyers Swamp Creek; c) monitoring at groundwater discharge points into Sawyers Swamp Creek; d) wet weather monitoring with a minimum of two events recorded within the first 12 months of both the operation of the project and post realignment of Sawyers Swamp Creek; and e) a schedule for periodic monitoring of surface quality at all sites throughout the life of the project, at an initial frequency of *no less than once every month for the first 12 months* and must include, but not be limited to, dissolved oxygen, turbidity, total phosphorus and total nitrogen. The monitoring program shall form part of the Surface Water Management Plan referred to in condition 6.5c) of this approval.	Surface water management plan	n/a	EPL - M2	Open	Monitiorng undertaken as required, Sawyers Swamp Creek realignment not commenced during this period.
Sawyers Swamp Creek Realignment Monitoring						
CoA 3.6-3.7	**3.6** - The Applicant is to implement a Hydrological Monitoring Program to assess and quantify the impacts and effectiveness of the realigned section of Sawyers Swamp Creek in consultation with and to the satisfaction of Fisheries NSW. Monitoring is to be undertaken for a period of five (5) years upon completion of the creek realignment and is to include scour and erosion monitoring. The program must include sampling before and after the realignment works and include a sampling site downstream of the realigned section of creek. In the first 12 months following completion of the realignment, monitoring is to be undertaken at least every three (3) months upon completion of the creek realignment and after any wet weather/bankful flow event. The monitoring program shall form part of the Rehabilitation Plan for the project as referred to in condition 2.26 of this approval.	-	-	n/a at current time as realignment works have not commenced	Open	SSC rehabilitation plan to be staged, review requirements following approval. No work commenced during this period
	3.7 - The Applicant shall prepare an Ecological Monitoring Program, in consultation with, and to the satisfaction of, Fisheries NSW, to monitor and quantify the impacts of the realignment of Sawyers Swamp Creek on the ecology and ecosystems of the creek and the associated riparian environment. The Program shall include, but not necessarily be limited to: a) a sampling, data collection and assessment regime to establish baseline ecological health and for ongoing monitoring of ecological health of the in-stream environment during construction and throughout the life of the project; b) at least one in-stream sampling period prior to the realignment of Sawyers Swamp Creek and at least two (2) sampling periods following the realignment of Sawyers Swamp Creek; and c) an assessment regime for monitoring the ecological health of the riparian environment for a period of at least five (5) years after final planting. The monitoring program shall form part of the Rehabilitation Plan for the project as referred to in condition 2.26 of this approval.	-	-	n/a at current time as realignment works have not commenced	Open	SSC rehabilitation plan to be staged, review requirements following approval. No work commenced during this period
Air Quality Monitoring						
CoA 3.8	**3.8 -** The Applicant shall prepare an Air Quality Monitoring Program, in consultation with, and to the satisfaction of, the EPA. The Program shall include, but not necessarily be limited to, monitoring for dust at the monitoring sites identified in the document referred to under condition 1.1 of this approval. The air quality monitoring program shall be ongoing for the life of the project, including final rehabilitation and stabilisation of the site. The monitoring program shall form part of the Air Quality Management Plan referred to in condition 6.5d) of this approval.	Air quality management subplan	OEMP AQMP	EPL - O3	Open	EIS noted 5 monitoirng sites for ash placement, only 4 exist currently. No ash placement occurring AQMP under revision as a result of this change.
4. COMPLIANCE TRACKING AND MONITORING						
	4.1 - Prior to each of the events listed below, the Applicant shall certify in writing to the satisfaction of the Secretary that it has complied with all conditions of this approval applicable prior to that event: a) commencement of any construction works on the land subject of this approval; and b) commencement of operation of the project.	3.6 - Compliance tracking program - environemntal inspections	2.10.6 - Construction phase compliance tracking	Compliance tracking monitoring spreadsheet	Open	AEMR contains this statement

CoA 4.1-4.4	**4.2** - The Applicant shall develop and implement a Compliance Tracking Program for the project, prior to commencing operations, to track compliance with the requirements of this approval and shall include, but not necessarily limited to: a) provisions for periodic review of the compliance status of the project against the requirements of this approval and the Statement of Commitments detailed in the document referred to in condition 1.1c) of this approval; b) provisions for periodic reporting of the compliance status to the Secretary; c) a program for independent environmental auditing in accordance with the Independent Audit Post Approval Requirements (NSW Government 2020); d) procedures for rectifying any non-compliance identified during environmental auditing or review of compliance; e) mechanisms for recording incidents and actions taken in response to those incidents; f) provisions for reporting incidents to the Secretary during construction and operation; and g) provisions for ensuring all employees, contractors and sub-contractors are aware of, and comply with, the conditions of this approval relevant to their respective activities. The Compliance Tracking Program shall be implemented prior to operation of the project with a copy submitted to the Secretary for approval within four weeks of commencement of the project, unless otherwise agreed by the Secretary.	3.6 - Compliance tracking program - environmental inspections	2.10.6 - Construction phase compliance tracking	Program implemented	Open	ER reviews compliance monthly, AEMR review undertaken by ER
	4.3 - Nothing in this approval restricts the Applicant from utilising any existing compliance tracking programs administrated by the Applicant to satisfy the requirements of condition 4.2. In doing so, the Applicant must demonstrate to the Secretary how these systems address the requirements and/or have been amended to comply with the requirements of the condition.	n/a	n/a	As stated in CoA and responsibility of GPM Staff	Open	ER reviews compliance monthly, AEMR review undertaken by ER
	4.4 - The Applicant shall meet the requirements of the Secretary in respect of the implementation of any measure necessary to ensure compliance with the conditions of this approval, and general consistency with the documents listed under condition 1.1 of this approval.	n/a	n/a	As stated in CoA and responsibility of GPM Staff	Open	ER reviews compliance monthly, AEMR review undertaken by ER
5. COMMUNITY INFORMATION AND COMPLAINTS MANAGEMENT						
Provision of Information						
CoA 5.1-5.2	**5.1** - Prior to the commencement of the project, the Applicant shall establish and maintain a website for the provision of electronic information associated with the project. The Applicant shall, subject to confidentiality, publish and maintain up-to-date information on this website or dedicated pages including, but not necessarily limited to: a) the documents referred to under condition 1.1 of this approval; b) this project approval, Environment Protection Licence and any other relevant environmental approval, licence or permit required and obtained in relation to the project; c) all strategies, plans and programs required under this project approval, or details of where this information can be viewed; d) information on construction and operational progress; e) the outcomes of compliance tracking in accordance with the requirements of this project approval.	3.3.3 - Community and stakeholder communications		https://gpmco.com.au/environment/	Open	Various websites used since approval in 2008. GPM webiste is the current website for the approval. Complaints recorded during the period are included in the AEMR
	5.2 - The Applicant shall make all documents required to be provided under condition 5.1 of this approval publicly available.	3.3.3 - Community and stakeholder communications		https://gpmco.com.au/environment/	Open	Website contains required documents
Complaints and Enquiries Procedure						
CoA 5.3-5.4	**5.3** - Prior to the commencement of the project, the Applicant shall ensure that the following are available for community complaints and enquiries during construction and operation: a) a 24-hour contact number(s) on which complaints and enquiries about construction and operational activities may be registered; b) a postal address to which written complaints and enquiries may be sent; and c) an email address to which electronic complaints and enquiries may be transmitted. The telephone number, postal address and email address shall be published in a newspaper circulating in the local area prior to the commencement of the project. The above details shall also be provided on the website required by condition 5.1 of this approval.	3.5 - Complaints management process	2.8.4 - complaints management	https://gpmco.com.au/contact/	Open	Website contains required documents
	5.4 - The Applicant shall record the details of all complaints received through the means listed under condition 5.3 of this approval in an up-to-date Complaints Register. The Register shall record, but not necessarily be limited to: a) the date and time of the complaint; b) the means by which the complaint was made (e.g. telephone, email, mail, in person); c) any personal details of the complainant that were provided, or if no details were provided a note to that effect; d) the nature of the complaint; e) the time taken to respond to the complaint; f) any investigations and actions taken by the Applicant in relation to the complaint; g) any follow-up contact with, and feedback from, the complainant; and h) if no action was taken by the Applicant in relation to the complaint, the reason(s) why no action was taken. The Complaints Register shall be made available for inspection by the Secretary upon request.	3.5 - Complaints management process	2.8.4 - complaints management	Complaints register	Open	Complaints recorded during the period are included in the AEMR
6. ENVIRONMENTAL MANAGEMENT						
Environmental Representative						
CoA 6.1	**6.1 -** Prior to the commencement of any construction or operational activities, or as otherwise agreed by the Secretary, the Applicant shall nominate for the approval of the Secretary a suitably qualified and experienced Environmental Representative(s) independent of the design, construction and operation personnel. The Applicant shall engage the Environmental Representative(s) during any construction activities, and throughout the life of the project, or as otherwise agreed by the Secretary. The Environmental Representative(s) shall: a) oversee the implementation of all environmental management plans and monitoring programs required under this approval, and advise the Applicant upon the achievement of these plans/programs; b) have responsibility for considering and advising the Applicant on matters specified in the conditions of this approval and the Statement of Commitments in the EA; c) oversee the implementation of the environmental auditing of the project in accordance with the requirements of condition 4.2 of this approval and all relevant project Environmental Management System(s); and d) be given the authority and independence to recommend to the Applicant reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and, failing the effectiveness of such steps, to recommend to the Applicant that relevant activities are to be ceased as soon as reasonably practicable if there is a significant risk that an adverse impact on the environment will be likely to occur.				Open	ER engaged and approved by DPHI. Monthly inspections undertaken and reports provided on DPHI website
Construction Environmental Management						
	6.2 - Prior to the commencement of construction work, the Applicant shall prepare and implement a Construction Environmental Management Plan (CEMP). The CEMP shall outline the environmental management practices and procedures to be followed during construction. The CEMP shall be prepared in accordance with *Guideline for the Preparation of Environmental Management Plans (DIPNR, 2004)* . The Construction Environmental Management Plan for the project (or any stage of the project) shall be submitted to the Secretary for approval at least four weeks prior to the commencement of any construction work associated with the project (or stage as relevant), unless otherwise agreed by the Secretary. Construction shall not commence until written approval has been received from the Secretary.	n/a	CEMP	-	Open	CEMP approved under EA ownership prior to KVAR Stage 2 commencing. CEMP revision in progress, DPHI comments being addressed.

	6.3 - As part of the Construction Environmental Management Plan for the project, the Applicant shall prepare and implement the following plans:	n/a	CEMP	-	Open	CEMP approved under EA ownership prior to KVAR Stage 2 commencing.
CoA 6.2-6.3	**a)** a **Construction Traffic Management Plan**, prepared in consultation with TfNSW, the relevant Council and emergency services to manage the construction traffic impacts of the project, including but not limited to: i) identifying construction vehicle volumes (construction staff vehicles, heavy vehicles and oversized loads) and haulage routes; ii) identifying any road closures and/or traffic detours during the haulage of oversized loads as agreed to by the relevant roads authority; iii) detailing a Construction Vehicle Code of Conduct to set driver behaviour controls to minimise impacts on the land uses along haulage routes (including noise minimisation measures); and iv) complying with the document Procedures for Use in the Preparation of a Traffic Management Plan (RTA, 2001).	n/a	CTMP	Truck movement records, ER monthly report	Open	CTMP prepared under EA ownership prior to KVAR Stage 2 commencing. A revised combined operation and construction TMP has been prepared and is undergoing consultation before submission to DPHI for approval.
	b) a **Construction Noise Management Plan** to detail how construction noise impacts would be minimised and managed. The Strategy shall be developed in consultation with, and to the satisfaction of, the EPA and shall include, but not necessarily be limited to: i) details of construction activities and an indicative schedule for construction works; ii) identification of construction activities that have the potential to generate noise impacts on sensitive receivers, iii) procedures for assessing noise levels at sensitive receivers and compliance; iv) details of the reasonable and feasible actions and measures to be implemented to minimise noise impacts and, if any noise exceedance is detected, how any non-compliance would be rectified; and v) procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity.	n/a	CNMP	-	Open	CNMP prepared under EA ownership prior to KVAR Stage 2 commencing. Quarterly monitoring undertaken, no exceednaces reported.
	c) an **Erosion and Sediment Control Plan** to detail measures to minimise erosion and the discharge of sediment and other pollutants to land and/or water during construction works. The Plan must include, but not necessarily be limited to: i) identification of the construction activities that could cause soil erosion or discharge sediment or water pollutants from the site; ii) a description of the management methods to minimise soil erosion or discharge of sediment or water pollutants from the site, including a strategy to minimise the area of bare surfaces, stabilise disturbed areas, and minimise bank erosion; and iii) demonstration that the proposed erosion and sediment control measures will conform with, or exceed, the relevant requirements of Managing Urban Stormwater: Soils and Construction (Landcom, 2004).	n/a	ESCP	Site Inspection Checklist	Open	ESCP's are developed by site staff and reviewed during quarterly CPESC inspections. Updates are prepared and endorsed by the CPESC. ER monthly inspections and reports cover erosion and sediment matters.
Operational Environmental Management						
	6.4 - The Applicant shall prepare and implement an Operational Environmental Management Plan to detail an environmental management framework, practices and procedures to be followed during operation of the project. The Plan shall be consistent with Guideline for the Preparation of Environmental Management Plans (DIPNR 2004) and shall include, but not necessarily be limited to: a) identification of all statutory and other obligations that the Applicant is required to fulfil in relation to operation of the project, including all approvals, licences, approvals and consultations; b) a description of the roles and responsibilities for all relevant employees (including contractors) involved in the operation of the project; c) overall environmental policies and principles to be applied to the operation of the project; d) standards and performance measures to be applied to the project, and a means by which environmental performance can be periodically reviewed and improved, where appropriate; e) management policies to ensure that environmental performance goals are met and to comply with the conditions of this approval; f) the additional plans listed under condition 6.5 of this approval; g) the environmental monitoring requirements outlined under conditions 3.3 to 3.5 inclusive and 3.8 of this approval. The Plan shall be submitted for the approval of the Secretary no later than four weeks prior to the commencement of operation of the project, unless otherwise agreed by the Secretary. Operation shall not commence until written approval has been received from the Secretary. Nothing in this approval precludes the Applicant from incorporating the requirements of the Operational Environmental Management Plan into existing environmental management systems and plans administered by the Applicant.	OEMP	n/a	-	Open	OEMP prepared under EA ownership prior to KVAR Stage 2 commencing. OEMP and sub plan revision submitted to DPHI and comments being addressed during this period.
	6.5 - As part of the Operation Environmental Management Plan for the project, required under condition 6.4 of this approval, the Applicant shall prepare and implement the following Management Plans:	OEMP	n/a	-	Open	Plans contained in Appendicies
	a) an **Operational Noise Management Plan** to detail measures to mitigate and manage noise during operation of the project. The Plan shall be prepared in consultation with, and to the satisfaction of, the EPA and include, but not necessarily be limited to: i) procedures to ensure that all reasonable and feasible noise mitigation measures are applied during operation of the project; ii) identification of all relevant sensitive receivers and the applicable criteria at those receivers commensurate with the noise limit specified under condition 2.15 of this approval; iii) identification of activities that will be carried out in relation to the project and the associated noise sources; iv) noise monitoring procedures (as referred to in condition 3.3 of this approval) for periodic assessment of noise impacts at the relevant receivers against the noise limits specified under this approval and the predicted noise levels as detailed in the report referred to under condition 1.1 of this approval; v) details of all management methods and procedures that will be implemented to control individual and overall noise emissions from the site during operation; vi) procedures and corrective actions to be undertaken if non-compliance against the operational noise criteria is detected; and vii) provisions for periodic reporting of results to EPA.	Noise and Vibration management sub-plan	n/a	-	Open	ONMP prepared under EA ownership prior to KVAR Stage 2 commencing. Monitoring undertaken quarterly , no exceedances recorded during this period.
	b) a **Groundwater Management Plan** to detail measures to mitigate and manage groundwater impacts. The Plan shall be prepared in consultation with, and to the satisfaction of, WaterNSW and include, but not necessarily be limited to: i) baseline data on groundwater quality, depth and flow in the project area; ii) groundwater objectives and impact assessment criteria; iii) a program to monitor groundwater flows and groundwater quality in the project area as required by condition 3.4 of this approval; iv) a protocol for the investigation of identified exceedances of the groundwater impact assessment criteria; v) a response plan to address potential exceedances and groundwater quality impacts; and vi) provisions for periodic reporting of results to WaterNSW.	Groundwater management sub-plan	n/a	EPL	Open	GMP prepared under EA ownership prior to KVAR Stage 2 commencing.

CoA 6.4-6.5A	**c)** a **Surface Water Management Plan** to outline measures that will be employed to manage water on the site, to minimise soil erosion and the discharge of sediments and other pollutants to lands and/or waters throughout the life of the project. The Plan shall be based on best environmental practice and shall be prepared in consultation with, and to the satisfaction of, WaterNSW and Fisheries NSW. The Plan shall include, but not necessarily be limited to: i) baseline data on the water quality and flow in Sawyers Swamp Creek up ii) to the date of this approval; iii) water quality objectives and impact assessment criteria for Sawyers Swamp Creek; iv) a program to monitor surface water quality in Sawyers Swamp Creek as referred to in condition 3.5 of this approval; v) a protocol for the investigation of identified exceedances in the impact assessment criteria; vi) a response plan to address potential adverse surface water quality exceedances; vii) a site water management strategy identifying clean and dirty water areas for Stages A, B and C of the project and the associated water management measures including erosion and sediment controls and provisions for recycling/reuse of water and the procedures for decommissioning water management structures on the site; and viii) provisions for periodic reporting of results to the Fisheries NSW and WaterNSW.	Surface water management sub-plan	n/a	EPL	Open	SWMP prepared under EA ownership prior to KVAR Stage 2 commencing.
	d) an **Air Quality Management Plan** to outline measures to minimise impacts from the project on local air quality. The Plan shall be prepared in consultation with, and to the satisfaction of, the EPA and include, but not necessarily be limited to: i) baseline data on dust deposition levels; ii) air quality objectives and impact assessment criteria; iii) an air quality monitoring program as referred to in condition 3.8 of this approval; *iv) an assessment of alternative methods of ash placement to minimise the exposure of active placement areas to prevailing winds;* *v) mitigation measures to be incorporated during emplacement activities and haulage of ash;* vi) an operating protocol for the repository irrigation system including activation rates, application rates and area of coverage; vii) a protocol for the investigation of visible emissions from the repository area; viii) a response plan to address visible emissions from the repository area; and ix) provisions for periodic reporting of results to the EPA.	Air quality management subplan	n/a	Site Inspection Checklist	Open	AQMP prepared under EA ownership prior to KVAR Stage 2 commencing.
	e) a **Landscape/Revegetation Plan** to outline measures to minimise the visual impacts of the repository and ensure the long-term stabilisation of the site and compatibility with the surrounding land fabric and land use. The Plan shall include, but not necessarily be limited to: (i) identification of design objectives and standards based on local environmental values, vistas, and land uses; (ii) a description of short- and long-term revegetation measures; (iii) a schedule of species to be used in revegetation; (iv) timing and progressive implementation of revegetation works as placement areas are completed, including landscape plans; and (v) procedures and methods to monitor and maintain revegetated areas during the establishment phase and long-term. Revegetation works must incorporate the use of local native species.	Landscape and revegetation management sub-plan	n/a	-	Open	VMP prepared under EA ownership prior to KVAR Stage 2 commencing.
	f) an **Operational Transport Management Plan** for the project, which must: (i) be prepared in consultation with TfNSW and Council, prior to importing capping material from sources outside of the Lithgow local government area; (ii) detail the route to be used to transport capping material; (ii) detail the route to be used to transport capping material; (iii) detail the measures that would be implemented to minimise traffic safety issues for other road users (including cyclists), including: • notifying the community about project-related traffic impacts; • a procedure to address complaints about project-related traffic; • minimising potential traffic conflicts with school buses and during local school drop-off and pick-up times; • scheduling heavy vehicle movements to minimise convoy length or platoons; • responding to local climate conditions that may affect road safety such as fog, dust, wet weather; and • responding to emergency repair or maintenance requirements; and (iv) include a Driver Code of Conduct, which addresses: • travelling speeds; • driver fatigue; • adherence to the designated transport route; and • safe driving practices.	Operational transport management sub- plan	n/a	-	Open	OTMP prepared under EA ownership prior to KVAR Stage 2 commencing. Revised plan incororates operation and construction. Awaiting DPHI approval follwing consultation.
	6.5A -The Applicant shall update the Operation Environment Management Plan (as referred to in condition 6.4 of this approval) and associated monitoring programs (as referred to in conditions 3.4 to 3.8 inclusive) prior to the importation of capping material to the site from sources outside of the Lithgow local government area, to the satisfaction of the Secretary. The updated plan and associated monitoring programs must reflect all operational activities, monitoring and management practices for the Kerosene Vale Ash Dam and the Sawyers Swamp Creek Ash Dam.	OEMP	n/a	-		OEMP implemented and complaince assessed monthly by ER inspections.
Revision of Strategies, Plans and Programs						
CoA 6.6	**6.6** - Within three months of: a) the submission of an incident report under condition 7.1; b) the submission of an Annual Review under condition 7.3; c) the submission of an Independent Environmental Audit under condition 4.2); or d) the modification of the conditions of this approval (unless the conditions require otherwise), the Applicant must review and, if necessary, revise the studies, strategies or plans required under the conditions of approval to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review Non-Compliance Notification the revised document must be submitted to the Secretary for approval, unless otherwise agreed with the Secretary. *Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.*	OEMP	CEMP			Requirements included in all plans. No triggers this period
7. ENVIRONMENTAL REPORTING						
Incident Notification						
CoA 7.1	**7.1** - The Secretary must be notified in writing via the Major Projects website immediately after the Applicant becomes aware of an incident. The notification must identify the development (including the application number and the name of the development if it has one) and set out the location and nature of the incident. Subsequent notification requirements must be given, and reports submitted in accordance with the requirements set out in Appendix 3.	3.7 - Environmental incident reporting	2.11 Environmental nonconformities	As stated in CoA and responsibility of GPM Staff		No incidents recorded this period
Non Compliance Notification						
CoA 7.2	**7.2** - The Secretary must be notified in writing via the Major Projects website within seven days after the Applicant becomes aware of any non-compliance. A non-compliance notification must identify the development and the application number for it, set out the condition of approval that the development is non-compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance. *Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance*.	3.6.2 - Non compliance	2.11 Environmental nonconformities	As stated in CoA and responsibility of GPM Staff		No notifications required this period
Annual Performance Reporting						

CoA 7.3	**7.3** - The Applicant shall, throughout the life of the project, prepare and submit for the approval of the Secretary, an Annual Environmental Management Report (AEMR). The AEMR shall review the performance of the project against the Operation Environmental Management Plan (refer to condition 6.4 of this approval) and the conditions of this approval. The AEMR shall include, but not necessarily be limited to: a) details of compliance with the conditions of this approval; b) a copy of the Complaints Register (refer to condition 5.4 of this approval) for the preceding twelve-month period (exclusive of personal details), and details of how these complaints were addressed and resolved; c) identification of any circumstances in which the environmental impacts and performance of the project during the year have not been generally consistent with the environmental impacts and performance predicted in the documents listed under condition 1.1 of this approval, with details of additional mitigation measures applied to the project to address recurrence of these circumstances; d) results of all environmental monitoring required under conditions 3.3 to 3.8 of this approval, including interpretations and discussion by a suitably qualified person; and e) a list of all occasions in the preceding twelve-month period when environmental goals/objectives/impact assessment criteria for the project have not been achieved, indicating the reason for failure to meet the criteria and the action taken to prevent recurrence of that type of failure. The Applicant shall submit a copy of the AEMR to the Secretary every year, with the first AEMR to be submitted no later than twelve months after the commencement of operation of the project. The Secretary may require the Applicant to address certain matters in relation to the environmental performance of the project in response to review of the Annual Environmental Report. Any action required to be undertaken shall be completed within such period as the Secretary may require. The Applicant shall make copies of each AEMR available for public inspection on request.	n/a	n/a	Compliant as stated in CoA and responsibility of GPM Staff https://gpmco.com.au/environment/		The AEMR satisfies this condition

Appendix B
Noise reports

EMM
creating opportunities

Kerosene Vale Ash Repository

Environmental noise monitoring - Q1 2024

Prepared for Generator Property Management Pty Ltd

February 2024

Kerosene Vale Ash Repository

Environmental noise monitoring - Q1 2024

Generator Property Management Pty Ltd

E231292 RP1

February 2024

Version	Date	Prepared by	Reviewed by	Comments
1	01/03/2024	Will Moore	Robert Kirwan	Final

Approved by

Robert Kirwan
Associate Acoustical Consultant
1 March 2024

Level 3 175 Scott Street
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1 Introduction

1.1 Background

EMM Consulting Pty Ltd (EMM) was engaged by Generator Property Management Pty Ltd to conduct a quarterly noise survey of construction activities and operations at Kerosene Vale Ash Repository (KVAR, the site) located near Lidsdale, NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

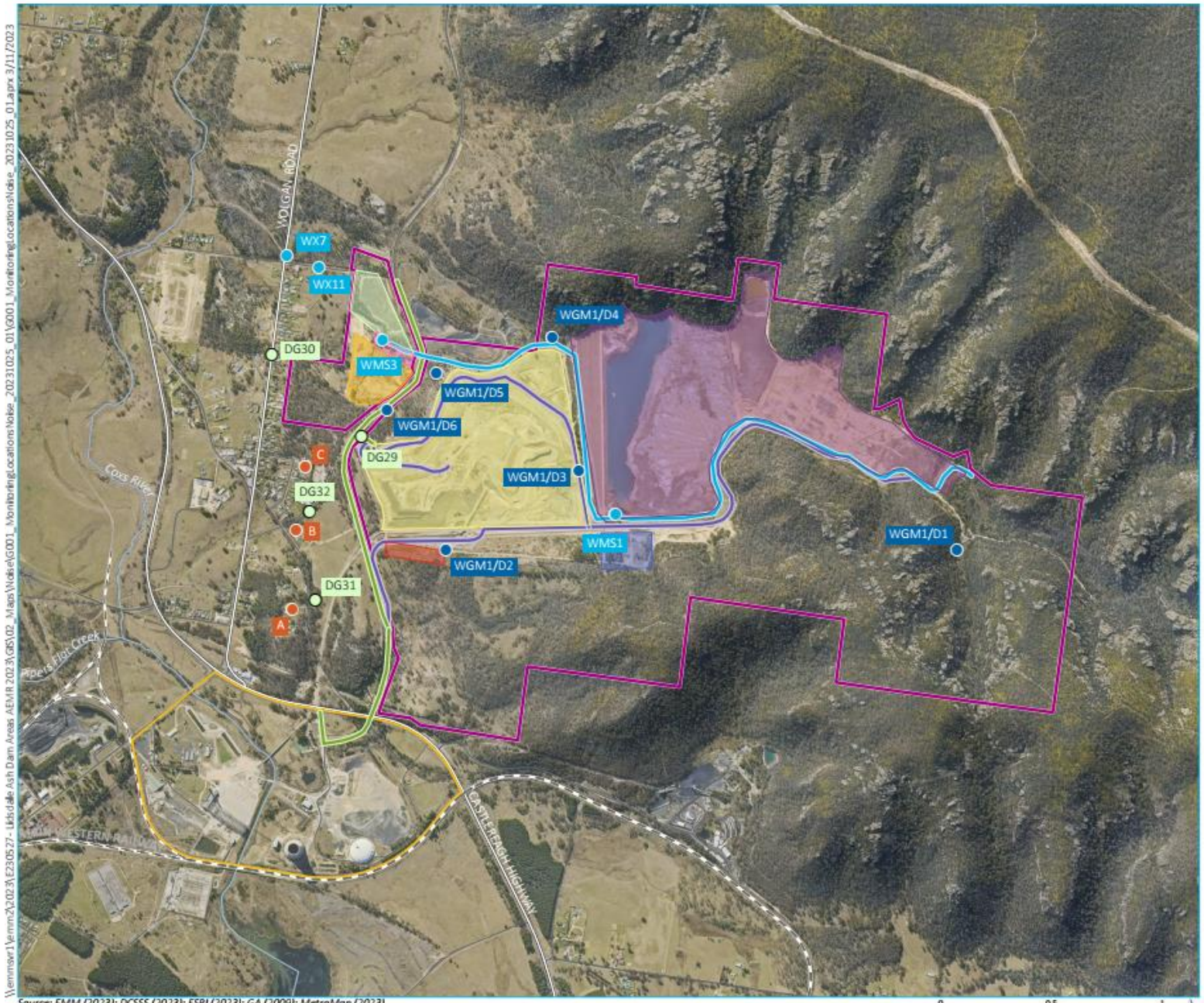
Attended environmental noise monitoring described in this report was done during the day and evening periods of 21 February 2024 at three monitoring locations.

1.2 Attended monitoring locations

Site monitoring locations are detailed in Table 1.1 and shown on Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not necessarily the location of residences.

Table 1.1 Attended noise monitoring locations

Descriptor	Description	Coordinates (MGA 56)	
		Easting	Northing
Location A	Skelly Road, Lidsdale NSW	229052	6301209
Location B	Corner Sawyers Road and Skelly Road, Lidsdale NSW	228899	6301470
Location C	End of Nuebeck Street, Lidsdale NSW	228982	6301813



Environmental Monitoring Locations

Kerosene Vale Ash Repositories
Figure 1.1

1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1 per cent of the time.
$L_{A1,1minute}$	The A-weighted noise level which is exceeded for 1 per cent of the specified time period of 1 minute.
L_{A10}	The A-weighted noise level which is exceeded for 10 percent of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50 per cent of the time, also the median noise level during a measurement period.
L_{A90}	The A-weighted noise level exceeded for 90 percent of the time, also referred to as the "background" noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Development consent

The current development consent for KVAR is MP07_0005 (MOD 1, August 2018). Section 2 of the consent details specific conditions relating to operational and construction noise generated by KVAR. Relevant sections of that document are reproduced in Appendix B.1.

2.2 Environment protection licence

KVAR holds Environment Protection Licence (EPL) No. 21185 issued by the Environment Protection Authority (EPA) most recently on 18 July 2022. Relevant sections of the EPL are reproduced in Appendix B.2.

2.3 Noise management plan

The KVAR Operational Environmental Management Plan (OEMP) was most recently updated in October 2018. Section 6.3 of the OEMP contains a noise and vibration management sub-plan. Appendix A of the OEMP provides the Operational Noise and Vibration Management Plan. Relevant sections of the OEMP are reproduced Appendix B.3.

2.4 Noise limits

2.4.1 Operational noise limits

Operational noise impact limits based on the EPL are shown in Table 2.1.

Table 2.1 Operational noise impact limits, $L_{Aeq,15minute}$ dB

Location	Day	Evening
Location A	40	40
Location B	40	40
Location C	40	40

2.4.2 Construction noise targets

Condition 2.7 of the consent details construction noise objectives as follows:

> The construction noise objective for the project is to manage noise from construction activities (as measured by a $L_{A10,15minute}$ descriptor) so as not to exceed the background L_{A90} noise level by more than 10 dB(A) at any sensitive receiver.

In accordance with condition 3.1 of the consent, construction noise monitoring must occur during the following activities:

a) the realignment of Sawyers Swamp Creek;

b) construction of the stabilisation berm;

c) excavation of the former pine plantation area;

d) relocation and construction of surface water management structures; and

e) concurrent construction activities.

However, due to the difficulty of differentiating noise from construction and operational activities, all noise measured from the site has been assessed against operational noise impact limits as per condition 2.15 of the consent.

2.5 Meteorological conditions

As detailed in the development consent and EPL, noise criteria apply under the following meteorological conditions:

- wind speeds up to 3 m/s at 10 metres height above ground; and/or
- temperature inversion conditions of up to 3°C/100m and source to receiver gradient winds of up to 2 m/s at 10 metres height above ground.

2.6 Additional requirements

The NSW EPA 'Industrial Noise Policy' (INP, 2000) was replaced by the 'Noise Policy for Industry' (NPfI) in October 2017. Noise conditions in the EPL and project approval still reference the INP exclusively, so monitoring has been conducted in accordance with the INP.

For assessment of modifying factors, the NPfI immediately superseded the INP, as outlined in the EPA document 'Implementation and transitional arrangements for the Noise Policy for Industry' (2017). Therefore, assessment and reporting of modifying factors have been done in accordance with Fact Sheet C of the NPfI.

Monitoring and reporting have been done in accordance with the EPA 'Approved methods for the measurement and analysis of environmental noise in NSW' issued in January 2022.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW EPA requirement.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted during the day and evening period at each location. The duration of each measurement was 15 minutes. Atmospheric conditions were measured at each monitoring location.

Measured sound levels from various sources were noted during each measurement, and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15minute}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods, such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate of may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

For this assessment, the measured L_{Amax} has been used as a conservative estimate of $L_{A1,1minute}$. The EPA accepts sleep disturbance analysis based on either the $L_{A1,1minute}$ or L_{Amax} metrics, with the L_{Amax} representing a more conservative assessment of site noise emissions.

3.3 Meteorological data

Meteorological data was obtained from the Bureau of Meteorology (BOM) automatic weather station (AWS) at Marrangaroo which allowed correlation of atmospheric parameters with measured noise levels. Vertical temperature gradient and/or sigma theta data required to determine temperature inversion conditions was not available from this AWS.

As KVAR operates solely during the day and evening periods, it has been assumed that temperature inversion conditions were not present during monitoring.

3.4 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfI. Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable. If applicable, modifying factor penalties have been reported and added to measured site-only L_{Aeq} noise levels.

Low-frequency modifying factor penalties have only been applied to site-only L_{Aeq} levels if the site was the only contributing low-frequency noise source. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfI.

3.5 Instrumentation

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 Attended noise monitoring equipment

Item	Serial number	Calibration due date	Relevant standard
Rion NA-28 sound level meter	30131882	23/01/2025	IEC 61672-1:2002
SVAN SV36 acoustic calibrator	140737	06/09/2025	IEC 60942:2003

4 Results

4.1 Total measured noise levels and atmospheric conditions

Overall noise levels measured at each location during attended measurements are provided in Table 4.1.

Table 4.1 Total measured noise levels, dB – Quarter 1 2024 [1]

Location	Start date and time	L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	L_{Amin}
A	21/02/2024 16:52	72	53	43	46	40	39	37
A	21/02/2024 19:23	64	55	44	43	38	34	31
B	21/02/2024 16:32	62	55	46	44	39	35	32
B	21/02/2024 18:58	72	64	58	56	55	52	49
C	21/02/2024 16:07	55	49	44	40	38	35	31
C	21/02/2024 18:31	62	47	39	37	33	30	27

Notes: 1. Levels in this table are not necessarily the result of activity at site.

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 metres above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height.

Table 4.2 Measured atmospheric conditions – Quarter 1 2024

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction °Magnetic north[1]	Cloud cover 1/8s
A	21/02/2024 16:52	24	1.4	20	5
A	21/02/2024 19:23	23	<0.5	-	5
B	21/02/2024 16:32	25	1.1	130	7
B	21/02/2024 18:58	23	<0.5	-	7
C	21/02/2024 16:07	26	<0.5	130	6
C	21/02/2024 18:31	23	<0.5	-	7

Notes: 1. "-" indicates calm conditions at monitoring location.

4.2 Construction activities

KVAR has advised the following construction activities were occurring during the Quarter 1 2024 noise monitoring survey:

- soil delivery
- vegetation management
- erosion controls
- excavations in KVAR and adjacent ponds
- transfer of materials to SSCAD.

4.3 Site only noise levels

4.3.1 Modifying factors

There were no modifying factors, as defined in the NPfI, applicable during the survey.

4.3.2 Site noise levels

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from the site AWS. Limits are applicable if weather conditions were within specified parameters during each measurement.

Table 4.3 Site noise levels and limits – Quarter 1 2024

Location	Start date and time	Wind speed m/s	Limits apply? [1]	KVAR limit, $L_{Aeq,15minute}$ dB	KVAR level, $L_{Aeq,15minute}$ dB [2]	Exceedance, dB [3]
A	21/02/2024 16:52	3.1	No	40	<25	N/A
A	21/02/2024 19:23	0.0	Yes	40	IA	Nil
B	21/02/2024 16:32	1.7	Yes	40	<25	Nil
B	21/02/2024 18:58	1.1	Yes	40	IA	Nil
C	21/02/2024 16:07	2.5	Yes	40	28	Nil
C	21/02/2024 18:31	1.9	Yes	40	IA	Nil

Notes: 1. Noise emission limits do not apply during periods of rainfall or winds greater than 3 metres per second (at a height of 10 metres).

2. Site-only $L_{Aeq,15minute}$, includes modifying factor penalties if applicable.

3. N/A in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in project approval.

5 Discussion

5.1 Noted noise sources

During attended monitoring, the time variations (temporal characteristics) of noise sources are considered in each measurement via statistical descriptors. From these observations, summaries have been derived for the location and provided in this section. Statistical 1/3 octave-band analysis of environmental noise was conducted, and the following figures display frequency ranges of various noise sources at each location for L_{A1}, L_{A10}, L_{Aeq}, L_{A50}, and L_{A90} descriptors. These figures also provide, graphically, statistical information for these noise levels.

An example is provided as Figure 5.1, where frogs and insects are seen to be generating noise at frequencies above 1000 Hz, while industrial noise is observed at frequencies less than 1000 Hz.

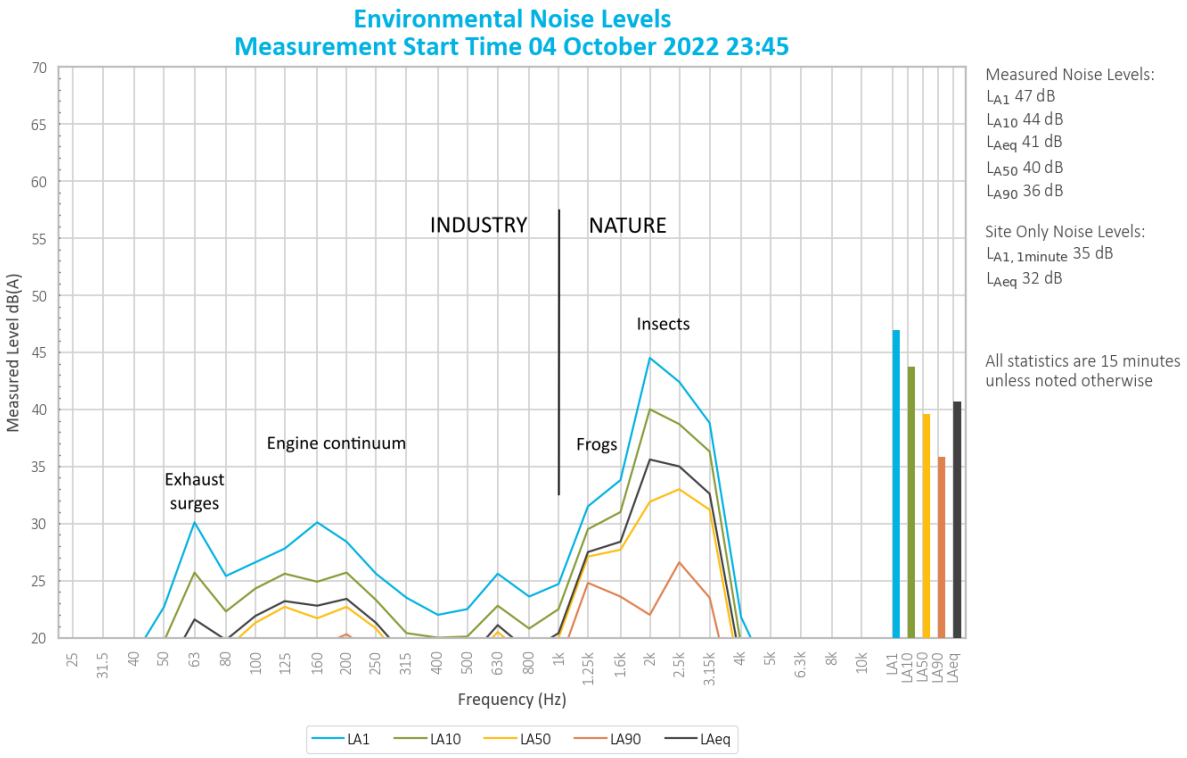


Figure 5.1 Example graph (refer to Section 5.1 for explanatory note)

5.2 Location A – Day

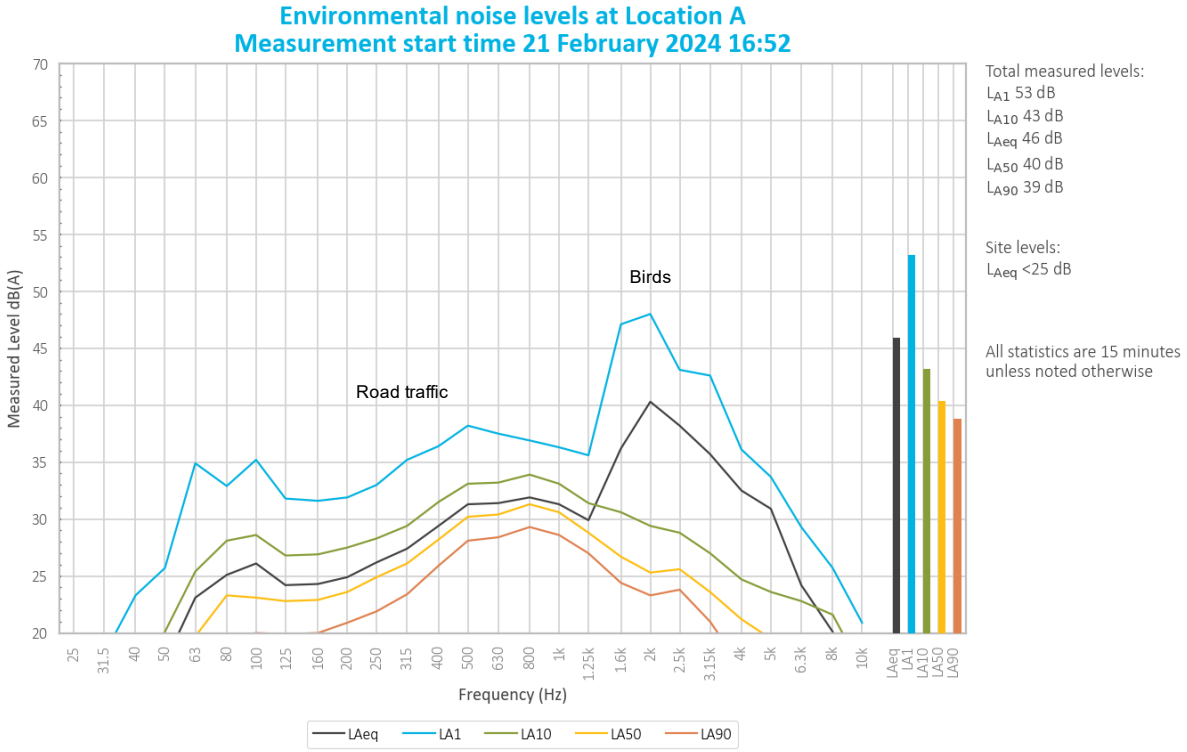


Figure 5.2 Environmental noise levels – Location A

KVAR haul trucks were audible during the measurement, generating a site-only L_{Aeq} of less than 25 dB.

Road traffic primarily generated the L_{A10}, L_{A50} and L_{A90}. Birds primarily generated the measured L_{A1} and L_{Aeq}.

Noise from a breeze in foliage, frogs, insects and local continuum was also noted.

5.3 Location A – Evening

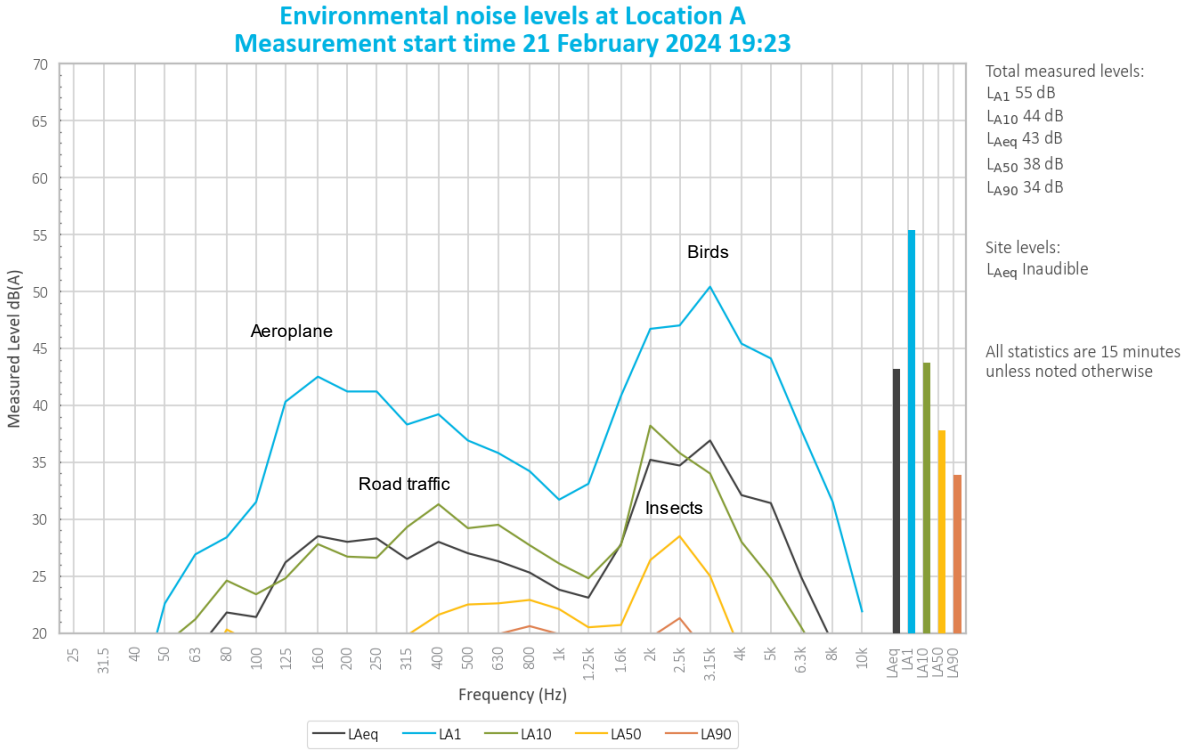


Figure 5.3 Environmental noise levels – Location A

KVAR was inaudible during the measurement.

Birds generated the measured L_{A1}, L_{A10} and L_{Aeq}. Insects generated the measured L_{A50} and L_{A90}.

Noise from an aeroplane and road traffic was also noted.

5.4 Location B – Day

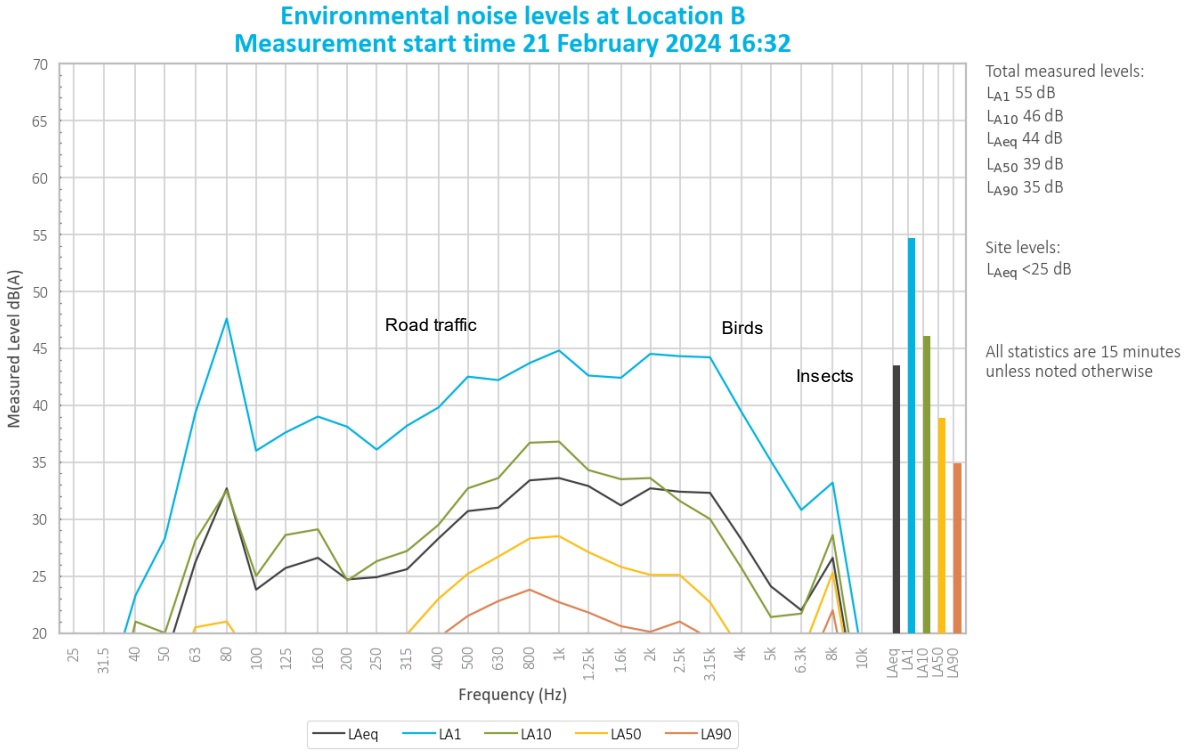


Figure 5.4 Environmental noise levels – Location B

KVAR haul trucks and continuum was audible during the measurement, generating a site-only L_{Aeq} of less than 25 dB. Track noise and reverse alarms were also noted.

Road traffic primarily generated total noise levels. Birds contributed to the measured L_{A1}.

Noise from dogs, frogs and insects was also noted.

5.5 Location B – Evening

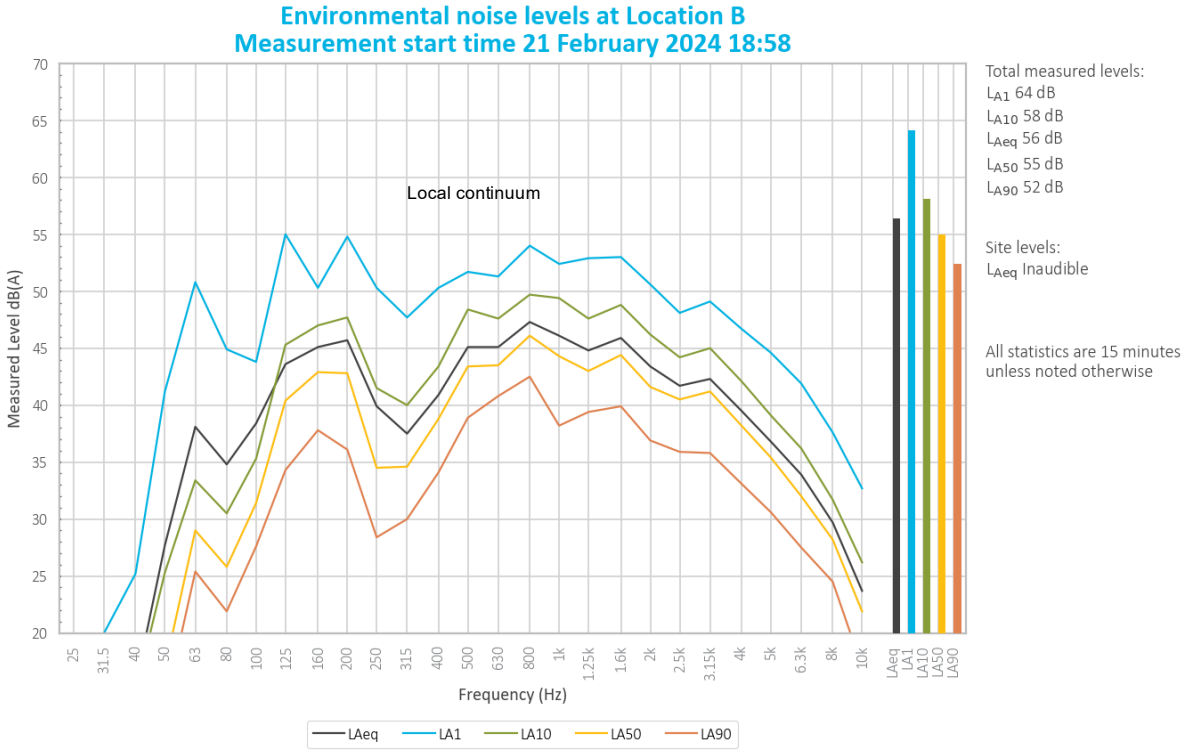


Figure 5.5 Environmental noise levels – Location B

KVAR was inaudible during the measurement.

Local continuum generated total noise levels.

Noise from birds, insects and road traffic was also noted.

5.6 Location C – Day

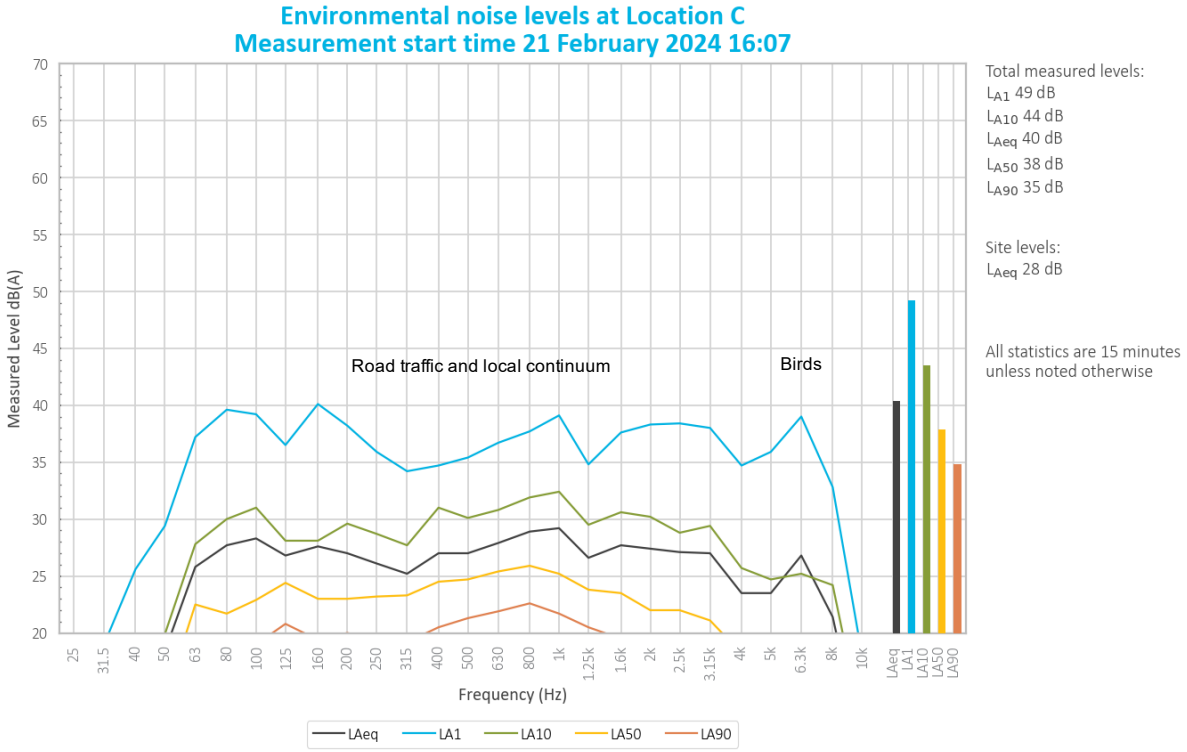


Figure 5.6 Environmental noise levels – Location C

KVAR haul trucks were audible during the measurement, generating a site-only L_{Aeq} of 28 dB.

Local continuum and road traffic generated total noise levels.

Noise from birds, dogs and frogs was also noted.

5.7 Location C – Evening

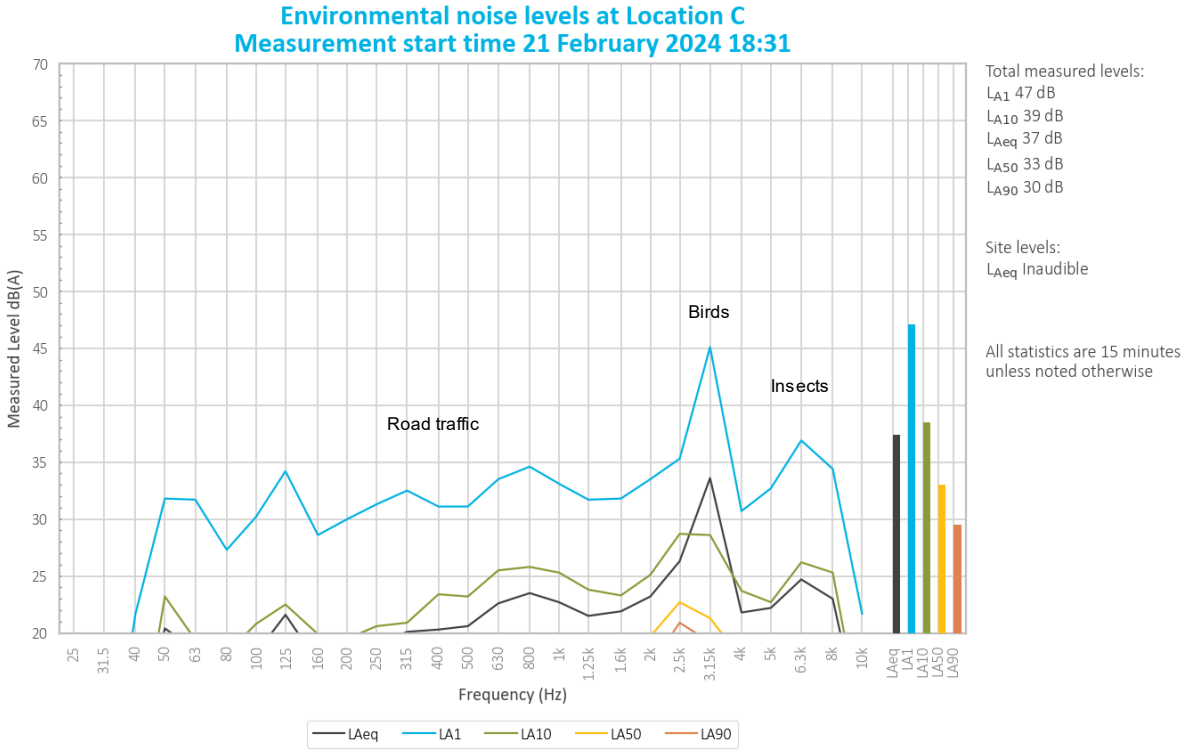


Figure 5.7 Environmental noise levels – Location C

KVAR was inaudible during the measurement.

Road traffic was primarily responsible for generating measured noise levels. Birds generated the measured L_{A1}, L_{A10} and L_{Aeq}.

Noise from dogs and insects was also noted.

6 Summary

EMM was engaged by Generator Property Management Pty Ltd to conduct quarterly noise survey of construction activities and operations at KVAR. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

Attended environmental noise monitoring described in this report was undertaken during the day and evening periods of 21 February 2024 at three monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the Quarter 1 2024 survey.

Appendix A
Noise perception and examples

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A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

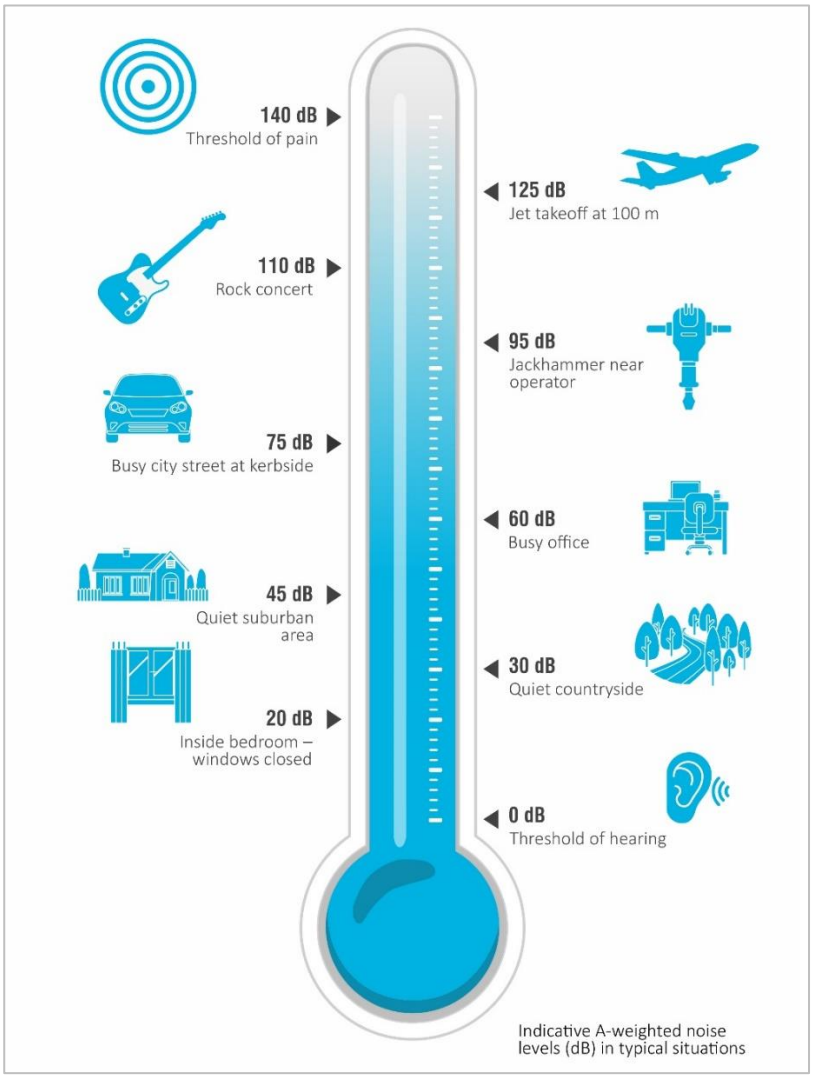

Figure A.1 Common noise levels

Appendix B
Regulator documents

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B.1 Development consent

Noise Impacts

Construction Hours

2.3 Construction activities associated with the project shall only be undertaken during the following hours:

a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive;
b) 8:00 am to 1:00 pm on Saturdays; and
c) at no time on Sundays or public holidays.

2.4 Activities resulting in impulsive or tonal noise emission (such as rock breaking or rock hammering) shall be limited to 8:00 am to 12:00 pm, Monday to Saturday and 2:00 pm to 5:00 pm, Monday to Friday. The Proponent shall not undertake such activities for more than three continuous hours and must provide a minimum one-hour respite period.

2.5 Construction outside the hours stipulated in condition 2.3 of this approval is permitted in the following circumstances:

a) where construction works do not cause audible noise at any sensitive receiver; or
b) for the delivery of materials required outside these hours by the Police or other authorities for safety reasons; or
c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

2.6 The hours of construction activities specified under condition 2.3 of this approval may be varied with the prior written approval of the Secretary. Any request to alter the hours of construction specified under condition 2.3 shall be:

a) considered on a case-by-case basis;
b) accompanied by details of the nature and need for activities to be conducted during the varied construction hours; and
c) accompanied by any information necessary for the Secretary to reasonably determine that activities undertaken during the varied construction hours will not adversely impact on the acoustic amenity of sensitive receivers in the vicinity of the site.

Construction Noise

2.7 The construction noise objective for the project is to manage noise from construction activities (as measured by a $L_{A10\ (15\ minute)}$ descriptor) so as not to exceed the background L_{A90} noise level by more than 10 dB(A) at any sensitive receiver.

Any activities that have the potential for noise emissions that exceed the objective must be identified and managed in accordance with the Construction Noise Management Plan (as referred to under condition 6.3b) of this approval). The Proponent shall implement all reasonable and feasible noise mitigation measures with the aim of achieving the construction noise objective.

Operational Noise

2.15 The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed an $L_{Aeq\ (15\ minute)}$ of 40 dB(A) at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8 of this approval.

This noise criterion applies under the following meteorological conditions:

a) wind speeds up to 3 m/s at 10 metres above ground; and/or
b) temperature inversion conditions of up to 3°C/100 m and source to receiver gradient winds of up to 2 m/s at 10 m above ground level.

This criterion does not apply where the Proponent and the affected landowner have reached a negotiated agreement in regard to noise, and a copy of the agreement has been forwarded to the Secretary and the EPA.

2.16 The Proponent shall implement measures to ensure noise attenuation of trucks. These measures may include, but are not necessarily limited to, installation of residential class mufflers, engine shrouds, body dampening, speed limiting, fitting of rubber stoppers to tail gates, limiting the use of compression braking, and ensuring trucks operate in a one-way system at the ash repository where feasible.

2.17 The Proponent shall liaise with the owner/operator of Angus Place Coal Mine with the aim of preparing a protocol which provides for a co-operative approach for the management and mitigation of noise impacts associated with coal and ash truck movements along the private haul road.

2.18 Where noise monitoring (as required by conditions 3.2 or 3.3 of this approval) identifies any non-compliance with the operational noise criterion specified under condition 2.15 of this approval the Proponent shall prepare and submit to the Secretary for approval a report including, but not limited to:

a) an assessment of all reasonable and feasible physical and other mitigation measures for reducing noise at the source including, but not limited to -
    i) construction of a noise barrier along the haulage road,
    ii) alternative ash haulage routes, and
    iii) alternative methods of ash conveyance to the repository; and
b) identification of the preferred measure(s) for reducing noise at the source;
c) feedback from directly affected property owners and the EPA on the proposed noise mitigation measures; and
d) location, type, timing and responsibility for implementation of the noise mitigation measure(s).

The report is to be submitted to the Secretary within 60 days of undertaking the noise monitoring which has identified exceedances of the operational noise criterion specified under condition 2.15, unless otherwise agreed to by the Secretary. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Secretary.

3. ENVIRONMENTAL MONITORING

Construction Noise Monitoring

3.1 The Proponent shall prepare and implement a **Construction Noise Monitoring** Program to confirm the predictions of the noise assessment detailed in the document referred to under condition 1.1 of this approval and assess compliance against the construction noise criterion stipulated in condition 2.7 of this approval. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the EPA. The monitoring program shall form part of the Construction Noise Management Plan referred to in condition 6.3b) of this approval and must include monitoring of the construction noise generated during:

a) the realignment Sawyers Swamp Creek;
b) construction of the stabilisation berm;
c) excavation of the former pine plantation area;
d) relocation and construction of surface water management structures; and
e) concurrent construction activities.

The Proponent shall forward to the EPA and the Secretary a report containing the results of each noise assessment and describing any non-compliance within 14 days of conducting a noise assessment.

Operational Noise Review

3.2 Within 60 days of the commencement of operation of the project, unless otherwise agreed to by the Director-General, the Proponent shall submit for the approval of the Secretary an **Operational Noise Review** to confirm the operational noise impacts of the project. The Operational Noise Review must be prepared in consultation with, and to the satisfaction of, the EPA. The Review shall:

a) identify the appropriate operational noise objectives and level for sensitive receivers;
b) describe the methodologies for noise monitoring including the frequency of measurements and location of monitoring sites;
c) document the operational noise levels at sensitive receivers as ascertained by the noise monitoring program;
d) assess the noise performance of the project against the noise criterion specified in condition 2.15 of this approval and the predicted noise levels as detailed in the report referred to under condition 1.1 of this approval; and
e) provide details of any entries in the Complaints Register (as required under condition 5.4 of this approval) relating to noise impacts.

Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, the Proponent shall prepare a report as required by condition 2.18 of this approval.

Ongoing Operational Noise Monitoring

3.3 The Proponent shall prepare and implement an **Operational Noise Monitoring Program** to assess compliance against the operational noise criterion stipulated in condition 2.15 of this approval, throughout the life of the project. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the EPA.

The noise monitoring program shall be prepared in accordance with the requirements of the *New South Wales Industrial Noise Policy* (EPA, 2000) and must include, but not be limited to:

a) monitoring during ash placement in the far western area of the site adjacent to the haul road; and

b) monitoring of the effectiveness of any noise mitigation measures implemented under condition 2.18 of this approval, against the noise criterion specified in condition 2.15 of this approval.

Noise from the project is to be measured at the most affected point on or within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise criterion stipulated in condition 2.15 of this approval. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the *NSW Industrial Noise Policy*). The modification factors in Section 4 of the *NSW Industrial Noise Policy* shall also be applied to the measured noise levels where applicable.

The Proponent shall forward to the EPA and the Secretary a report containing the results of any non-compliance within 14 days of conducting a noise assessment.

Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, approval, the Proponent shall prepare a report as required by condition 2.18 of this approval.

The monitoring program shall form part of the Operational Noise Management Plan referred to in condition 6.5a) of this approval.

B.2 Environmental protection licence

L5 Noise limits

L5.1 Operational noise from the Kerosene Vale Ash Repository area must not exceed:

40dB(A) LAeq(15 minute) , at the nearest most affected noise sensitive location.

Note: LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L5.2 To determine compliance with condition(s) L4.1 noise must be measured at, or computed for, the most affected location within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural setting) where the dwelling is more than 30 metres from the boundary. A modifying factor correction must be applied for tonal, impulsive or intermittent noise in accordance with the "Environmental Noise Management - NSW Industrial Noise Policy (January 2000)".

L5.3 The noise emission limits identified in this licence apply under the following meteorological conditions:
a) wind speeds up to 3 m/s at 10 metres height above ground; and/or
b) temperature inversion conditions of up to 30C/100m and source to receiver gradient winds of up to 2 m/s at 10 metres height above ground.

Note: The noise emission limits identified in this licence do not apply at a noise sensitive location, where the licensee and the affected noise sensitive location have reached a negotiated agreement in regards to noise, and a copy of that agreement has been provided to the Environment Protection Authority.

L6 Hours of operation

L6.1 Operational activities associated with the Kerosene Vale Ash Repository must only be carried out between the hours of 0700 and 2200 Monday to Sunday.

L6.2 This condition does not apply to the delivery of material outside the hours of operation permitted by condition L6.1, if that delivery is required by police or other authorities for safety reasons; and/or the operation or personnel or equipment are endangered. In such circumstances, prior notification must be provided to the EPA and affected residents as soon as possible or within a reasonable period in the case of emergency.

B.3 Noise management plan

5.2 Environmental monitoring program

An overview of the environmental monitoring activities that have been specified by the respective sub-plans under Section 6 of the OEMP is provided in Table 5-1. Please refer to specific sub-plans under Section 6 for further details.

Table 5-1 Environmental monitoring program

Potential impact	Locations	Parameters	Frequency	Technique	Reporting	Responsibility	OEMP Sub-plan Reference
Noise – Initial 60 day reporting period	4 main locations adopted for a total of 5 monitoring sites: ▪ Skelly Road ▪ Maddox Lane ▪ Neubeck Street ▪ Wolgan Road. (Refer to Figure 5-1)	L_{Aeq}, L_{A10}, L_{A90} and L_{Amax}	4 separate days – 3 week days and a Sunday	Attended monitoring using hand held sound level meter Monitoring to be continuous throughout full day of operations for each 15 minute period, including 30 mins prior to and following normal operating hours (7am to 10pm). Nearest potentially affected receiver to be monitored at 07.00 and at least once between 20.30 – 22.30.	Report to be submitted to EPA within 1 week of monitoring COMPLETE	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.3 Operational Noise and Vibration Management Plan – Appendix A
Noise - Normal conditions	Minimum of 3 most affected locations as per the 60 day post commissioning assessment. To include periods of ash placement at far western area of the site and where noise mitigation measures are in place. (as per COA 2.15) (Refer to Figure 5-1)	Noise levels shall not exceed an LAeq of 40dB(A) at the nearest most affected receiver	During daytime (7am-6pm) and evening time (6pm-10am) Every 6 months or more frequent if adverse trends are noted	Ongoing attended monitoring using hand held sound level meter.	6 monthly noise monitoring report If non-compliance, report is to be forwarded to DPE and EPA within 14-days of conducting monitoring	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.5 Operational Noise and Vibration Management Plan – Appendix A
Noise - Emergency conditions	At the complainant's property or nearest available representative location.	Noise levels shall not exceed an LAeq of 40dB(A) at the nearest most affected receiver	As required	Attended monitoring using hand held sound level meter	6 monthly noise monitoring report	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.3 Operational Noise and Vibration Management Plan – Appendix A

6.3 Noise and vibration management sub-plan

Targets	▪ Achieve compliance with the noise criterion of L_{Aeq} of 40dB(A) at the nearest most affected receiver during normal operations. ▪ Achieve a significant reduction in the number of noise-related complaints during emergency operations (less than 5 per year, stretch target = zero complaints per year).
Indicators	▪ The number of noise-related complaints. ▪ Noise monitoring data obtained from the sensitive receiver locations ▪ Compliance indicators as assessed by the specialist noise consultant and the Environmental Representative, as required. ▪ Observed and monitored reduction in noise generation due to adaptation where necessary of engineering measures on trucks, the implementation of operating techniques such as limited compression braking and speed limit restrictions.
Supporting documentation	
Appendix A: - KVAR Stage 2 Operations- Operational Noise and Vibration Management Plan Australian Standard AS 2436 – Guide to noise control on construction, maintenance and demolition sites	
Key issues/constraints/strategies	
Wallerawang Ash Repositories activities are not anticipated to result in impacts at the nearest potentially affected receivers. Noise impacts in varying conditions can be assessed and used to predict similar scenarios in the future to determine which measures are most effective and when. Wallerawang Ash Repositories activities are not anticipated to result in perceived vibration-related impacts at the nearest potentially affected receivers. Appendix A provides procedures to be implemented should vibration-related non-conformances occur. A Specialist Consultant will be undertaking the prescribed monitoring and analysis of noise results, as per this plan.	

Appendix C
Calibration certificates

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C.1 Calibration certificates

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23032

Client Details	EMM Consulting Level 3/175 Scott Street Newcastle NSW 2300
Equipment Tested/ Model Number :	Rion NA-28
Instrument Serial Number :	30131882
Microphone Serial Number :	04739
Pre-amplifier Serial Number :	11942
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	24°C	**Ambient Temperature :**	23.5°C
Relative Humidity :	47.3%	**Relative Humidity :**	46.1%
Barometric Pressure :	100.14kPa	**Barometric Pressure :**	100.16kPa

Calibration Technician :	Shaheen Boaz	**Secondary Check:**	Dylan Selge
Calibration Date :	23 Jan 2023	**Report Issue Date :**	25 Jan 2023

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

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PAGE 1 OF 1

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C37305

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek
Type No: SV36 **Serial No:** 140737
Class: 1
Owner: EMM Consulting
Level 3, 175 Scott Street
Newcastle NSW 2300
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details and Class Tolerance overleaf.

CONDITION OF TEST:

Ambient Pressure	1005	hPa ±1 hPa	**Date of Receipt :**	06/09/2023
Temperature	24	°C ±1° C	**Date of Calibration :**	06/09/2023
Relative Humidity	35	% ±5%	**Date of Issue :**	06/09/2023

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: .....

AUTHORISED SIGNATURE: .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Kerosene Vale Ash Repository

Environmental noise monitoring - Q2 2024

Prepared for Generator Property Management Pty Ltd

May 2024

Kerosene Vale Ash Repository

Environmental noise monitoring - Q2 2024

Generator Property Management Pty Ltd

E231292 RP2

May 2024

Version	Date	Prepared by	Reviewed by	Comments
1	21/05/2024	Isaac Hepworth	Robert Kirwan	Final

Approved by

Robert Kirwan
Associate Acoustics Consultant
23 May 2024

Level 3 175 Scott Street
Newcastle NSW 2300

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Appendices

Tables

Figures

1 Introduction

1.1 Background

EMM Consulting Pty Ltd (EMM) was engaged by Generator Property Management Pty Ltd to conduct a quarterly noise survey of construction activities and operations at Kerosene Vale Ash Repository (KVAR, the site) located near Lidsdale, NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

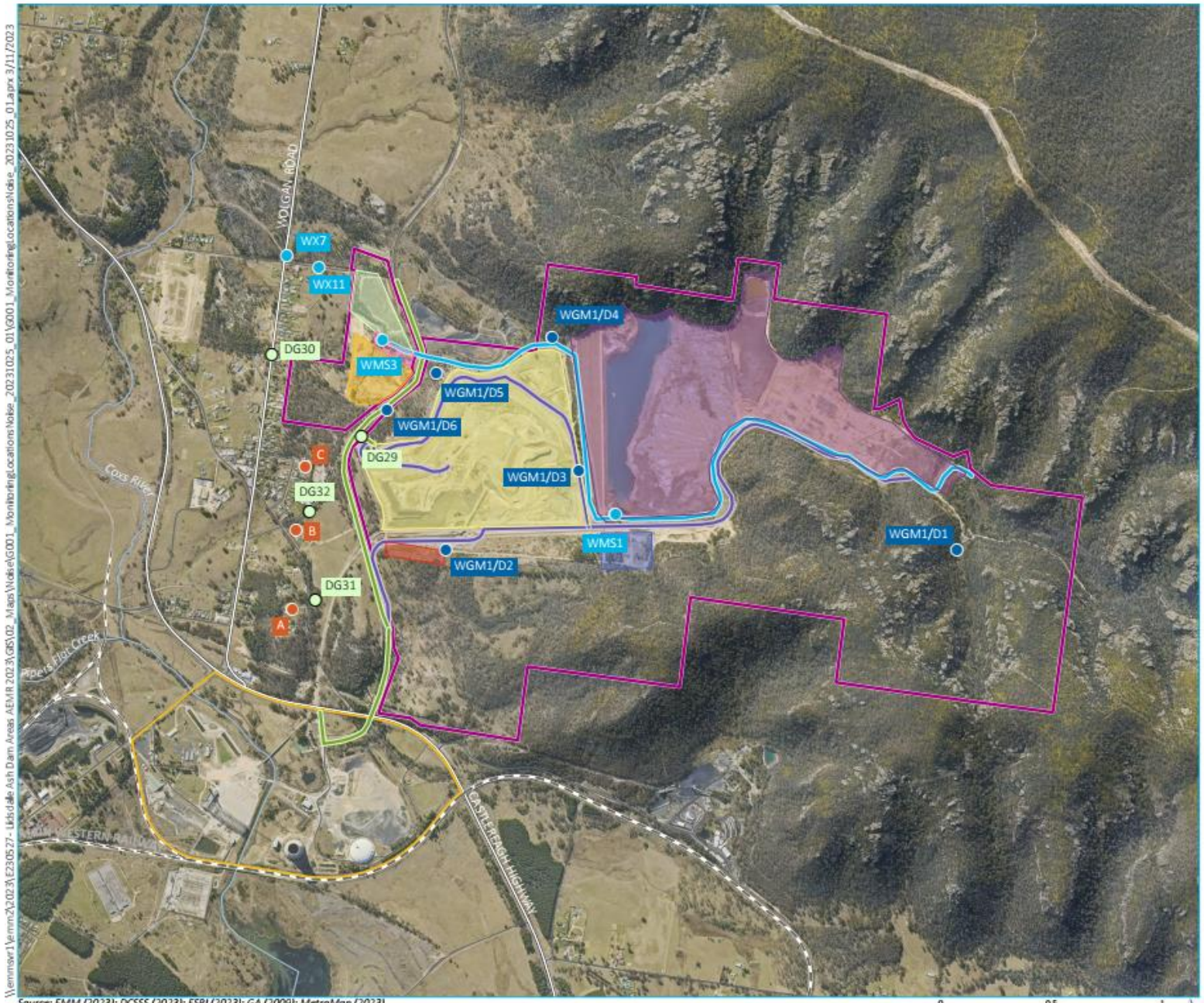
Attended environmental noise monitoring described in this report was done during the day and evening periods of 15 May 2024 at three monitoring locations.

1.2 Attended monitoring locations

Site monitoring locations are detailed in Table 1.1 and shown on Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not necessarily the location of residences.

Table 1.1 Attended noise monitoring locations

Descriptor	Description	Coordinates (MGA 56)	
		Easting	Northing
Location A	Skelly Road, Lidsdale NSW	229052	6301209
Location B	Corner Sawyers Road and Skelly Road, Lidsdale NSW	228899	6301470
Location C	End of Nuebeck Street, Lidsdale NSW	228982	6301813



Environmental Monitoring Locations

Kerosene Vale Ash Repositories
Figure 1.1

1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1 per cent of the time.
$L_{A1,1minute}$	The A-weighted noise level which is exceeded for 1 per cent of the specified time period of 1 minute.
L_{A10}	The A-weighted noise level which is exceeded for 10 percent of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50 per cent of the time, also the median noise level during a measurement period.
L_{A90}	The A-weighted noise level exceeded for 90 percent of the time, also referred to as the "background" noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Development consent

The current development consent for KVAR is MP07_0005 (MOD 1, August 2018). Section 2 of the consent details specific conditions relating to operational and construction noise generated by KVAR. Relevant sections of that document are reproduced in Appendix B.1.

2.2 Environment protection licence

KVAR holds Environment Protection Licence (EPL) No. 21185 issued by the Environment Protection Authority (EPA) most recently on 18 July 2022. Relevant sections of the EPL are reproduced in Appendix B.2.

2.3 Noise management plan

The KVAR Operational Environmental Management Plan (OEMP) was most recently updated in October 2018. Section 6.3 of the OEMP contains a noise and vibration management sub-plan. Appendix A of the OEMP provides the Operational Noise and Vibration Management Plan. Relevant sections of the OEMP are reproduced Appendix B.3.

2.4 Noise limits

2.4.1 Operational noise limits

Operational noise impact limits based on the EPL are shown in Table 2.1.

Table 2.1 Operational noise impact limits, $L_{Aeq,15minute}$ dB

Location	Day	Evening
Location A	40	40
Location B	40	40
Location C	40	40

2.4.2 Construction noise targets

Condition 2.7 of the consent details construction noise objectives as follows:

> The construction noise objective for the project is to manage noise from construction activities (as measured by a $L_{A10,15minute}$ descriptor) so as not to exceed the background L_{A90} noise level by more than 10 dB(A) at any sensitive receiver.

In accordance with condition 3.1 of the consent, construction noise monitoring must occur during the following activities:

a) the realignment of Sawyers Swamp Creek;

b) construction of the stabilisation berm;

c) excavation of the former pine plantation area;

d) relocation and construction of surface water management structures; and

e) concurrent construction activities.

However, due to the difficulty of differentiating noise from construction and operational activities, all noise measured from the site has been assessed against operational noise impact limits as per condition 2.15 of the consent.

2.5 Meteorological conditions

As detailed in the development consent and EPL, noise criteria apply under the following meteorological conditions:

- wind speeds up to 3 m/s at 10 metres height above ground; and/or
- temperature inversion conditions of up to 3°C/100m and source to receiver gradient winds of up to 2 m/s at 10 metres height above ground.

2.6 Additional requirements

The NSW EPA 'Industrial Noise Policy' (INP, 2000) was replaced by the 'Noise Policy for Industry' (NPfI) in October 2017. Noise conditions in the EPL and project approval still reference the INP exclusively, so monitoring has been conducted in accordance with the INP.

For assessment of modifying factors, the NPfI immediately superseded the INP, as outlined in the EPA document 'Implementation and transitional arrangements for the Noise Policy for Industry' (2017). Therefore, assessment and reporting of modifying factors have been done in accordance with Fact Sheet C of the NPfI.

Monitoring and reporting have been done in accordance with the EPA 'Approved methods for the measurement and analysis of environmental noise in NSW' issued in January 2022.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW EPA requirement.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted during the day and evening period at each location. The duration of each measurement was 15 minutes. Atmospheric conditions were measured at each monitoring location.

Measured sound levels from various sources were noted during each measurement, and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15minute}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods, such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate of may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

For this assessment, the measured L_{Amax} has been used as a conservative estimate of $L_{A1,1minute}$. The EPA accepts sleep disturbance analysis based on either the $L_{A1,1minute}$ or L_{Amax} metrics, with the L_{Amax} representing a more conservative assessment of site noise emissions.

3.3 Meteorological data

Meteorological data was obtained from the Bureau of Meteorology (BOM) automatic weather station (AWS) at Marrangaroo which allowed correlation of atmospheric parameters with measured noise levels. Vertical temperature gradient and/or sigma theta data required to determine temperature inversion conditions was not available from this AWS.

As KVAR operates solely during the day and evening periods, it has been assumed that temperature inversion conditions were not present during monitoring.

3.4 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfI. Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable. If applicable, modifying factor penalties have been reported and added to measured site-only L_{Aeq} noise levels.

Low-frequency modifying factor penalties have only been applied to site-only L_{Aeq} levels if the site was the only contributing low-frequency noise source. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfI.

3.5 Instrumentation and personnel

Attended noise monitoring was conducted by Will Moore. Qualifications, experience and demonstration of competence is in accordance with the Approved methods and is available upon request.

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 Attended noise monitoring equipment

Item	Serial number	Calibration due date	Relevant standard
Rion NA-28 sound level meter	30131882	23/01/2025	IEC 61672-1:2002
SVAN SV36 acoustic calibrator	140737	06/09/2024	IEC 60942:2003

4 Results

4.1 Total measured noise levels and atmospheric conditions

Overall noise levels measured at each location during attended measurements are provided in Table 4.1.

Table 4.1 Total measured noise levels, dB – Quarter 2 2024 [1]

Location	Start date and time	L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	L_{Amin}
A	15/05/2024 13:00	61	41	38	37	36	34	33
A	15/05/2024 19:20	46	43	40	38	37	35	33
B	15/05/2024 12:39	58	53	46	44	42	39	35
B	15/05/2024 19:00	55	50	45	41	37	35	33
C	15/05/2024 12:18	50	44	41	38	37	34	31
C	15/05/2024 18:40	48	42	38	36	36	34	32

Notes: 1. Levels in this table are not necessarily the result of activity at site.

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 metres above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height.

Table 4.2 Measured atmospheric conditions – Quarter 2 2024

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction °Magnetic north[1]	Cloud cover 1/8s
A	15/05/2024 13:00	17	1.6	320	2
A	15/05/2024 19:20	10	<0.5	-	0
B	15/05/2024 12:39	19	1.6	320	2
B	15/05/2024 19:00	11	<0.5	-	0
C	15/05/2024 12:18	16	1.0	320	2
C	15/05/2024 18:40	11	<0.5	-	0

Notes: 1. "-" indicates calm conditions at monitoring location.

4.2 Construction activities

KVAR has advised the following construction activities were occurring during the Quarter 2 2024 noise monitoring survey:

- construction of stabilisation berms
- surface water management structures
- concurrent construction activities.

4.3 Site only noise levels

4.3.1 Modifying factors

There were no modifying factors, as defined in the NPfI, applicable during the survey.

4.3.2 Site noise levels

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from the site AWS. Limits are applicable if weather conditions were within specified parameters during each measurement.

Table 4.3 Site noise levels and limits – Quarter 2 2024

Location	Start date and time	Wind speed m/s	Limits apply? [1]	KVAR limit, $L_{Aeq,15minute}$ dB	KVAR level, $L_{Aeq,15minute}$ dB [2]	Exceedance, dB [3]
A	15/05/2024 13:00	1.9	Yes	40	<30	Nil
A	15/05/2024 19:20	0.6	Yes	40	IA	Nil
B	15/05/2024 12:39	1.7	Yes	40	<25	Nil
B	15/05/2024 19:00	0.0	Yes	40	IA	Nil
C	15/05/2024 12:18	1.1	Yes	40	35	Nil
C	15/05/2024 18:40	0.0	Yes	40	IA	Nil

Notes: 1. Noise emission limits do not apply during periods of rainfall or winds greater than 3 metres per second (at a height of 10 metres).

2. Site-only $L_{Aeq,15minute}$, includes modifying factor penalties if applicable.

3. N/A in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in project approval.

5 Discussion

5.1 Noted noise sources

During attended monitoring, the time variations (temporal characteristics) of noise sources are considered in each measurement via statistical descriptors. From these observations, summaries have been derived for the location and provided in this section. Statistical 1/3 octave-band analysis of environmental noise was conducted, and the following figures display frequency ranges of various noise sources at each location for L_{A1}, L_{A10}, L_{Aeq}, L_{A50}, and L_{A90} descriptors. These figures also provide, graphically, statistical information for these noise levels.

An example is provided as Figure 5.1, where frogs and insects are seen to be generating noise at frequencies above 1000 Hz, while industrial noise is observed at frequencies less than 1000 Hz.

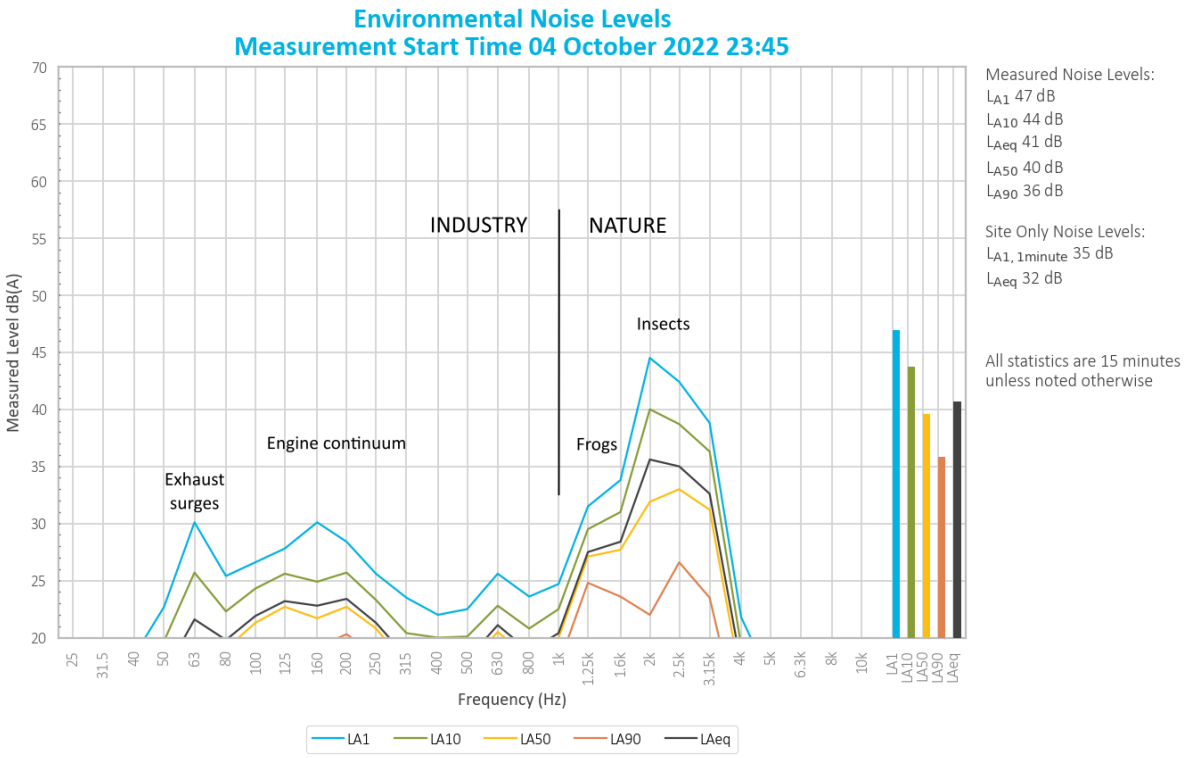


Figure 5.1 Example graph (refer to Section 5.1 for explanatory note)

5.2 Location A – Day

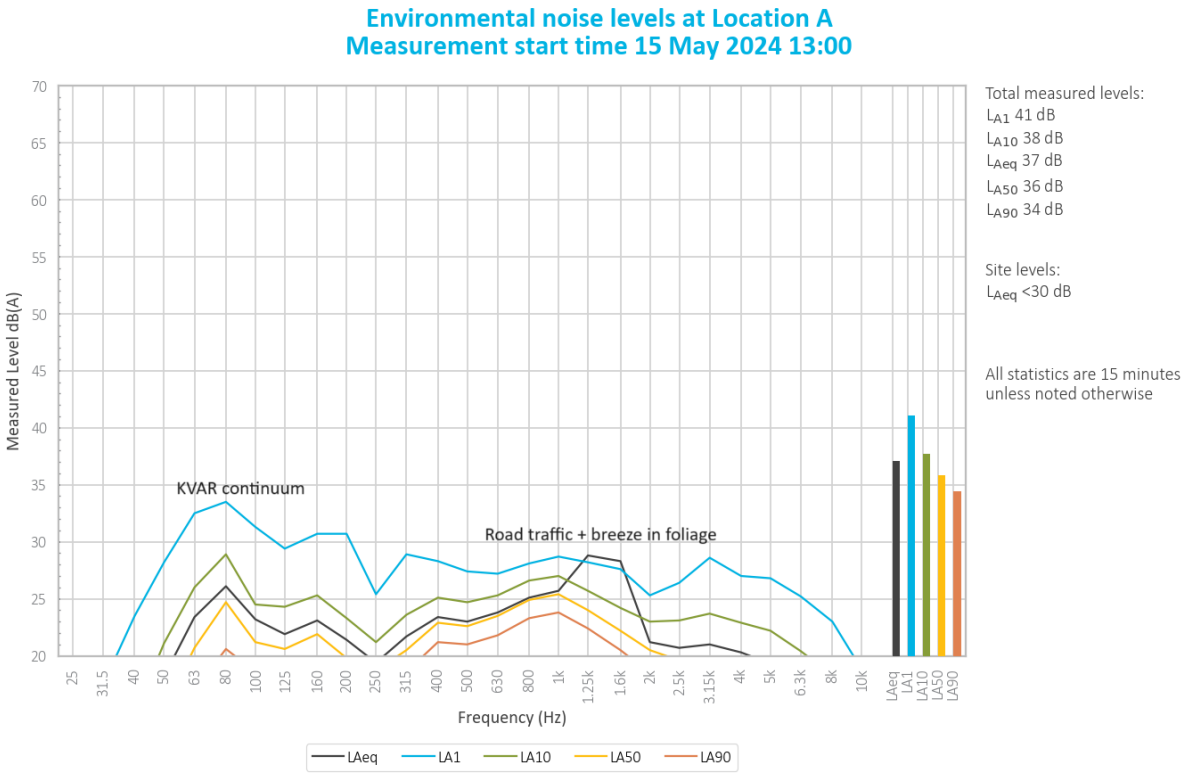


Figure 5.2 Environmental noise levels – Location A

KVAR continuum was audible during the measurement, generating a site-only L_{Aeq} of less than 30 dB.

Breeze in foliage and road traffic primarily generated the total measured noise levels.

Noise from birds was also noted.

5.3 Location A – Evening

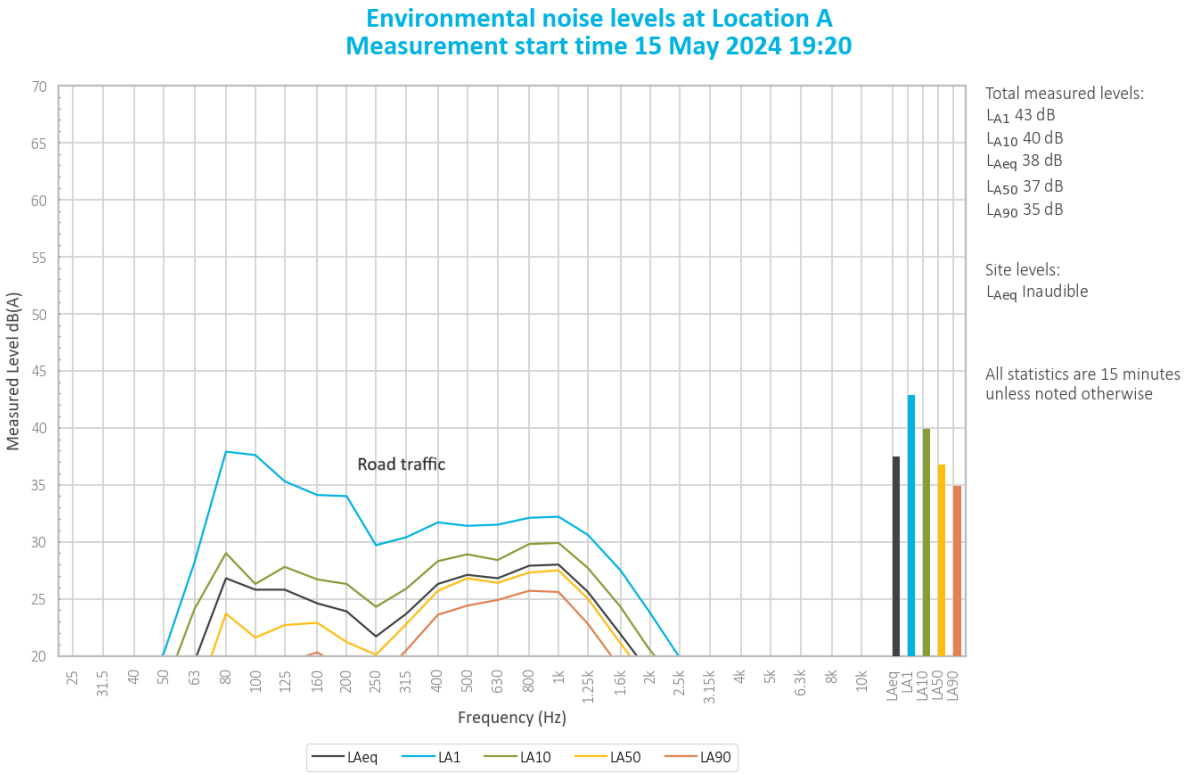


Figure 5.3 Environmental noise levels – Location A

KVAR was inaudible during the measurement.

Road traffic generated total measured noise levels.

Noise from frogs was also noted at low levels.

5.4 Location B – Day

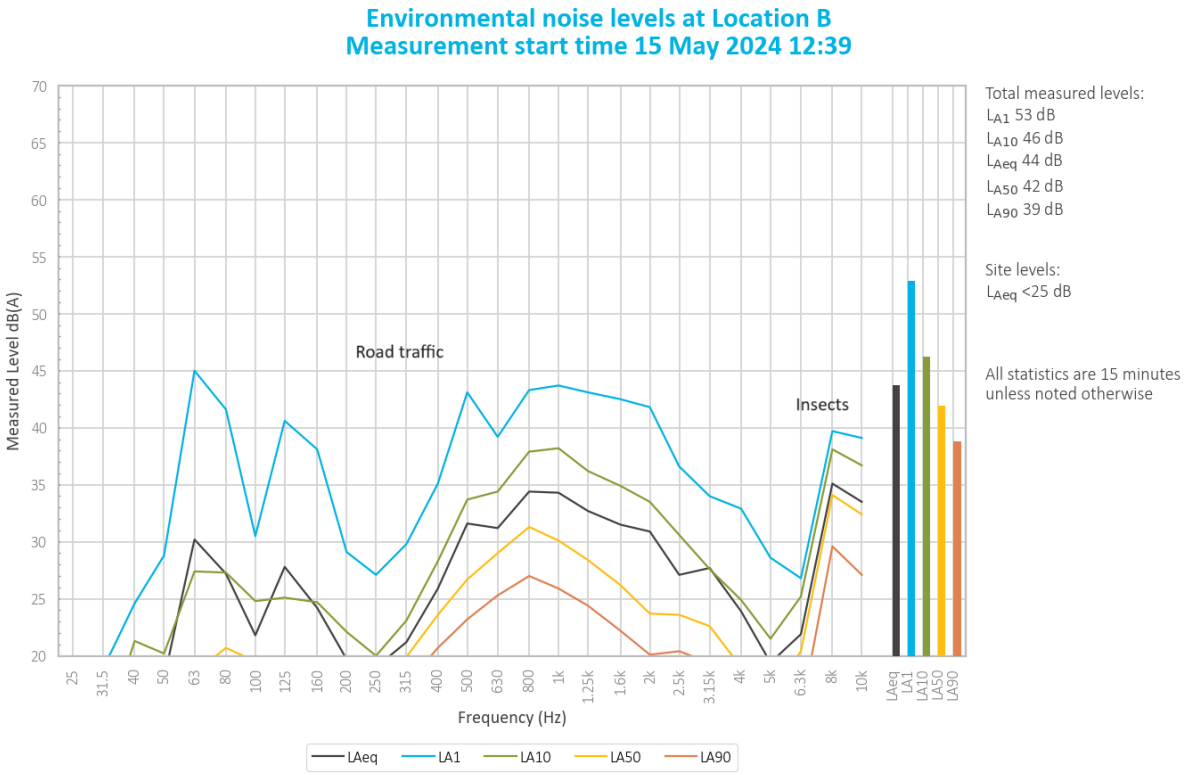


Figure 5.4 Environmental noise levels – Location B

KVAR continuum was audible during the measurement, generating a site-only L_{Aeq} of less than 25 dB. Engine noise was also noted.

Road traffic and insects primarily generated total noise levels.

Noise from dogs and birds was also noted.

5.5 Location B – Evening

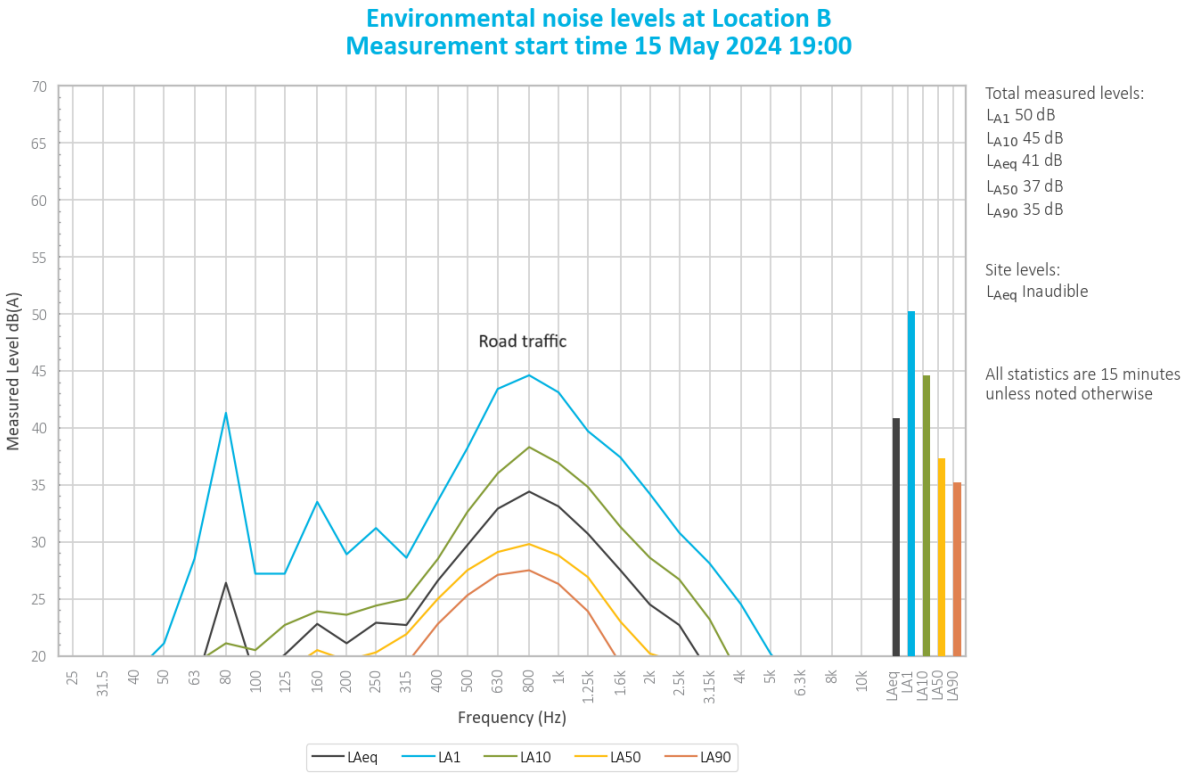


Figure 5.5 Environmental noise levels – Location B

KVAR was inaudible during the measurement.

Road traffic primarily generated total measured noise levels. Noise from a train contributed to the measured L_{A1}.

Noise from frogs was also noted.

5.6 Location C – Day

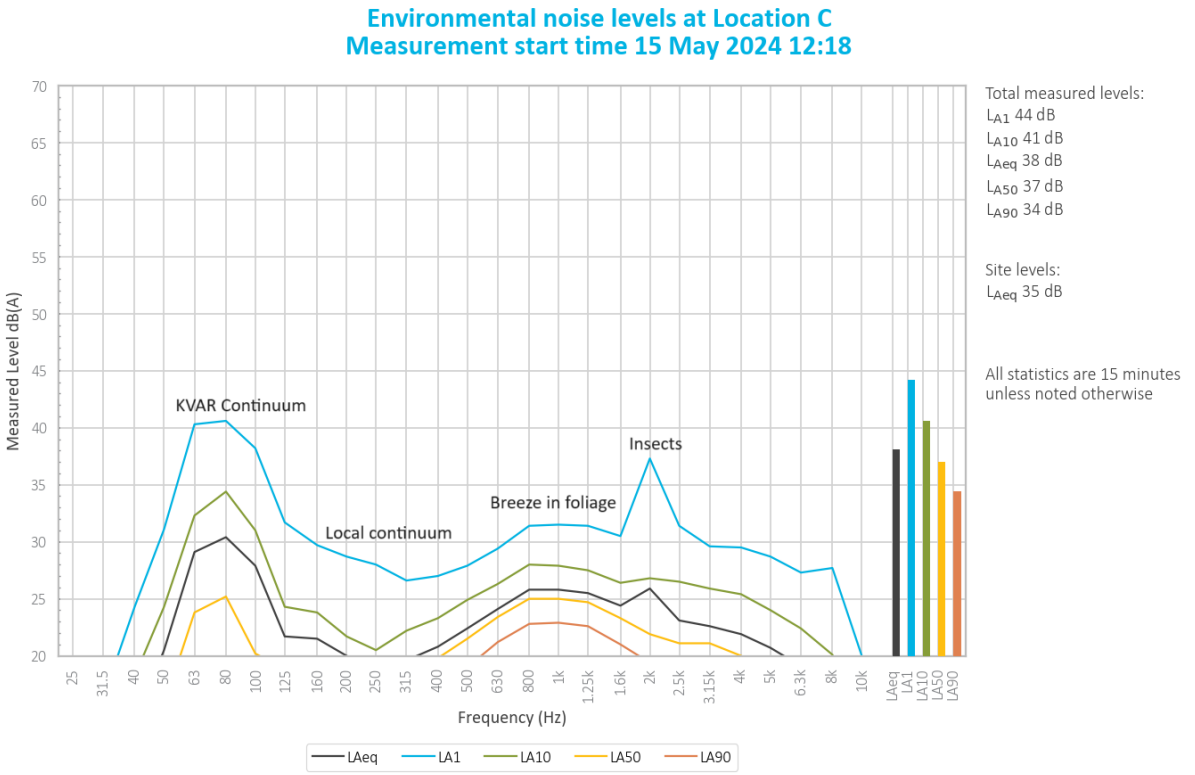


Figure 5.6 Environmental noise levels – Location C

KVAR engine continuum was audible during the measurement, generating a site-only L_{Aeq} of 35 dB. Noise from a reverse quacker was also noted.

KVAR continuum, a local continuum, insects and breeze in foliage primarily total measured noise levels.

Noise from road traffic was also noted.

5.7 Location C – Evening

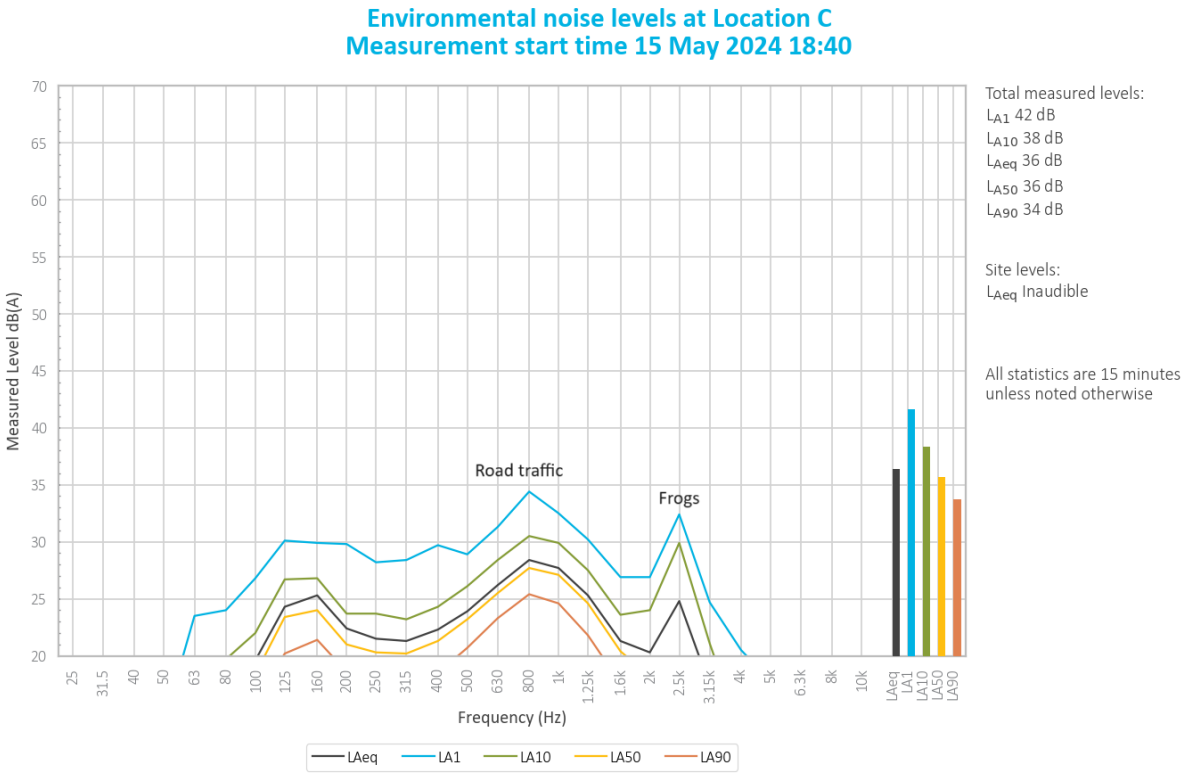


Figure 5.7 Environmental noise levels – Location C

KVAR was inaudible during the measurement.

Noise from road traffic generated total measured noise levels.

Noise from frogs was also noted at low levels.

6 Summary

EMM was engaged by Generator Property Management Pty Ltd to conduct quarterly noise survey of construction activities and operations at KVAR. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

Attended environmental noise monitoring described in this report was undertaken during the day and evening periods of 15 May 2024 at three monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the Quarter 2 2024 survey.

Appendix A
Noise perception and examples

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A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

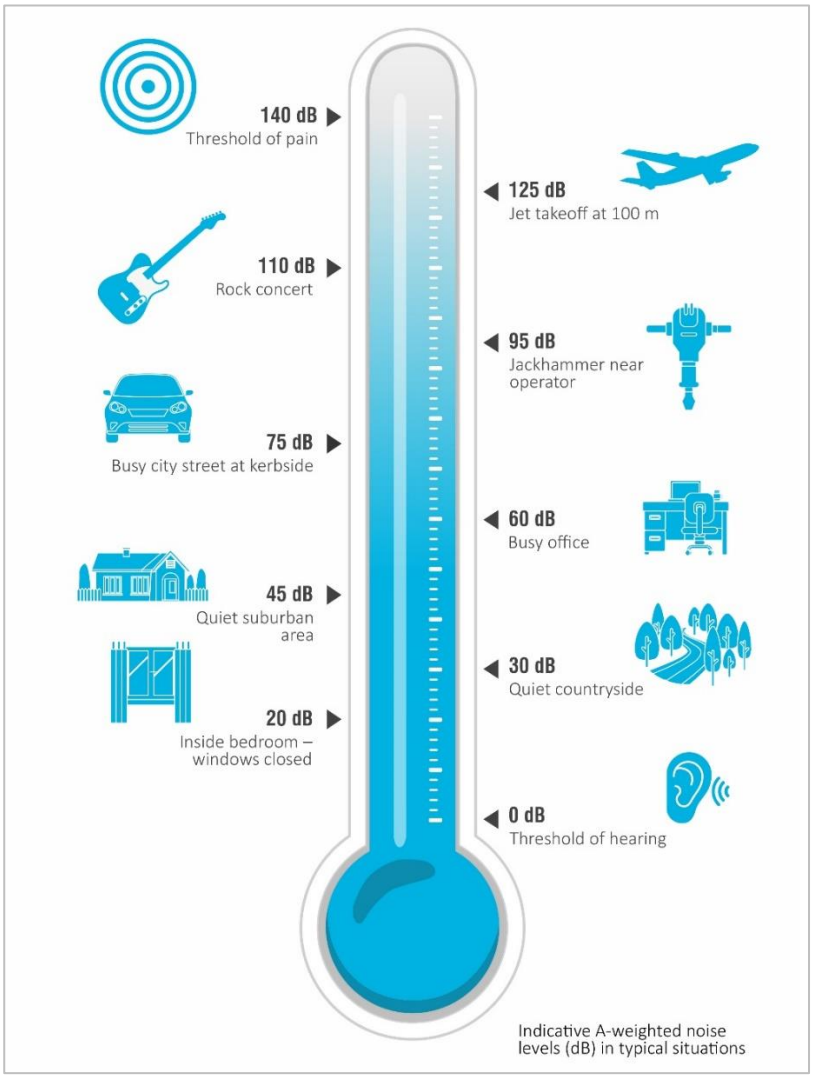

Figure A.1 Common noise levels

Appendix B
Regulator documents

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B.1 Development consent

Noise Impacts

Construction Hours

2.3 Construction activities associated with the project shall only be undertaken during the following hours:

a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive;
b) 8:00 am to 1:00 pm on Saturdays; and
c) at no time on Sundays or public holidays.

2.4 Activities resulting in impulsive or tonal noise emission (such as rock breaking or rock hammering) shall be limited to 8:00 am to 12:00 pm, Monday to Saturday and 2:00 pm to 5:00 pm, Monday to Friday. The Proponent shall not undertake such activities for more than three continuous hours and must provide a minimum one-hour respite period.

2.5 Construction outside the hours stipulated in condition 2.3 of this approval is permitted in the following circumstances:

a) where construction works do not cause audible noise at any sensitive receiver; or
b) for the delivery of materials required outside these hours by the Police or other authorities for safety reasons; or
c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

2.6 The hours of construction activities specified under condition 2.3 of this approval may be varied with the prior written approval of the Secretary. Any request to alter the hours of construction specified under condition 2.3 shall be:

a) considered on a case-by-case basis;
b) accompanied by details of the nature and need for activities to be conducted during the varied construction hours; and
c) accompanied by any information necessary for the Secretary to reasonably determine that activities undertaken during the varied construction hours will not adversely impact on the acoustic amenity of sensitive receivers in the vicinity of the site.

Construction Noise

2.7 The construction noise objective for the project is to manage noise from construction activities (as measured by a $L_{A10\ (15\ minute)}$ descriptor) so as not to exceed the background L_{A90} noise level by more than 10 dB(A) at any sensitive receiver.

Any activities that have the potential for noise emissions that exceed the objective must be identified and managed in accordance with the Construction Noise Management Plan (as referred to under condition 6.3b) of this approval). The Proponent shall implement all reasonable and feasible noise mitigation measures with the aim of achieving the construction noise objective.

Operational Noise

2.15 The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed an $L_{Aeq\ (15\ minute)}$ of 40 dB(A) at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8 of this approval.

This noise criterion applies under the following meteorological conditions:

a) wind speeds up to 3 m/s at 10 metres above ground; and/or
b) temperature inversion conditions of up to 3°C/100 m and source to receiver gradient winds of up to 2 m/s at 10 m above ground level.

This criterion does not apply where the Proponent and the affected landowner have reached a negotiated agreement in regard to noise, and a copy of the agreement has been forwarded to the Secretary and the EPA.

2.16 The Proponent shall implement measures to ensure noise attenuation of trucks. These measures may include, but are not necessarily limited to, installation of residential class mufflers, engine shrouds, body dampening, speed limiting, fitting of rubber stoppers to tail gates, limiting the use of compression braking, and ensuring trucks operate in a one-way system at the ash repository where feasible.

2.17 The Proponent shall liaise with the owner/operator of Angus Place Coal Mine with the aim of preparing a protocol which provides for a co-operative approach for the management and mitigation of noise impacts associated with coal and ash truck movements along the private haul road.

2.18 Where noise monitoring (as required by conditions 3.2 or 3.3 of this approval) identifies any non-compliance with the operational noise criterion specified under condition 2.15 of this approval the Proponent shall prepare and submit to the Secretary for approval a report including, but not limited to:

a) an assessment of all reasonable and feasible physical and other mitigation measures for reducing noise at the source including, but not limited to -
    i) construction of a noise barrier along the haulage road,
    ii) alternative ash haulage routes, and
    iii) alternative methods of ash conveyance to the repository; and
b) identification of the preferred measure(s) for reducing noise at the source;
c) feedback from directly affected property owners and the EPA on the proposed noise mitigation measures; and
d) location, type, timing and responsibility for implementation of the noise mitigation measure(s).

The report is to be submitted to the Secretary within 60 days of undertaking the noise monitoring which has identified exceedances of the operational noise criterion specified under condition 2.15, unless otherwise agreed to by the Secretary. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Secretary.

3. ENVIRONMENTAL MONITORING

Construction Noise Monitoring

3.1 The Proponent shall prepare and implement a **Construction Noise Monitoring** Program to confirm the predictions of the noise assessment detailed in the document referred to under condition 1.1 of this approval and assess compliance against the construction noise criterion stipulated in condition 2.7 of this approval. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the EPA. The monitoring program shall form part of the Construction Noise Management Plan referred to in condition 6.3b) of this approval and must include monitoring of the construction noise generated during:

a) the realignment Sawyers Swamp Creek;
b) construction of the stabilisation berm;
c) excavation of the former pine plantation area;
d) relocation and construction of surface water management structures; and
e) concurrent construction activities.

The Proponent shall forward to the EPA and the Secretary a report containing the results of each noise assessment and describing any non-compliance within 14 days of conducting a noise assessment.

Operational Noise Review

3.2 Within 60 days of the commencement of operation of the project, unless otherwise agreed to by the Director-General, the Proponent shall submit for the approval of the Secretary an **Operational Noise Review** to confirm the operational noise impacts of the project. The Operational Noise Review must be prepared in consultation with, and to the satisfaction of, the EPA. The Review shall:

a) identify the appropriate operational noise objectives and level for sensitive receivers;
b) describe the methodologies for noise monitoring including the frequency of measurements and location of monitoring sites;
c) document the operational noise levels at sensitive receivers as ascertained by the noise monitoring program;
d) assess the noise performance of the project against the noise criterion specified in condition 2.15 of this approval and the predicted noise levels as detailed in the report referred to under condition 1.1 of this approval; and
e) provide details of any entries in the Complaints Register (as required under condition 5.4 of this approval) relating to noise impacts.

Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, the Proponent shall prepare a report as required by condition 2.18 of this approval.

Ongoing Operational Noise Monitoring

3.3 The Proponent shall prepare and implement an **Operational Noise Monitoring Program** to assess compliance against the operational noise criterion stipulated in condition 2.15 of this approval, throughout the life of the project. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the EPA.

The noise monitoring program shall be prepared in accordance with the requirements of the *New South Wales Industrial Noise Policy* (EPA, 2000) and must include, but not be limited to:

a) monitoring during ash placement in the far western area of the site adjacent to the haul road; and

b) monitoring of the effectiveness of any noise mitigation measures implemented under condition 2.18 of this approval, against the noise criterion specified in condition 2.15 of this approval.

Noise from the project is to be measured at the most affected point on or within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise criterion stipulated in condition 2.15 of this approval. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the *NSW Industrial Noise Policy*). The modification factors in Section 4 of the *NSW Industrial Noise Policy* shall also be applied to the measured noise levels where applicable.

The Proponent shall forward to the EPA and the Secretary a report containing the results of any non-compliance within 14 days of conducting a noise assessment.

Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, approval, the Proponent shall prepare a report as required by condition 2.18 of this approval.

The monitoring program shall form part of the Operational Noise Management Plan referred to in condition 6.5a) of this approval.

B.2 Environmental protection licence

L5 Noise limits

L5.1 Operational noise from the Kerosene Vale Ash Repository area must not exceed:

40dB(A) LAeq(15 minute) , at the nearest most affected noise sensitive location.

Note: LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L5.2 To determine compliance with condition(s) L4.1 noise must be measured at, or computed for, the most affected location within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural setting) where the dwelling is more than 30 metres from the boundary. A modifying factor correction must be applied for tonal, impulsive or intermittent noise in accordance with the "Environmental Noise Management - NSW Industrial Noise Policy (January 2000)".

L5.3 The noise emission limits identified in this licence apply under the following meteorological conditions:
a) wind speeds up to 3 m/s at 10 metres height above ground; and/or
b) temperature inversion conditions of up to 30C/100m and source to receiver gradient winds of up to 2 m/s at 10 metres height above ground.

Note: The noise emission limits identified in this licence do not apply at a noise sensitive location, where the licensee and the affected noise sensitive location have reached a negotiated agreement in regards to noise, and a copy of that agreement has been provided to the Environment Protection Authority.

L6 Hours of operation

L6.1 Operational activities associated with the Kerosene Vale Ash Repository must only be carried out between the hours of 0700 and 2200 Monday to Sunday.

L6.2 This condition does not apply to the delivery of material outside the hours of operation permitted by condition L6.1, if that delivery is required by police or other authorities for safety reasons; and/or the operation or personnel or equipment are endangered. In such circumstances, prior notification must be provided to the EPA and affected residents as soon as possible or within a reasonable period in the case of emergency.

B.3 Noise management plan

5.2 Environmental monitoring program

An overview of the environmental monitoring activities that have been specified by the respective sub-plans under Section 6 of the OEMP is provided in Table 5-1. Please refer to specific sub-plans under Section 6 for further details.

Table 5-1 Environmental monitoring program

Potential impact	Locations	Parameters	Frequency	Technique	Reporting	Responsibility	OEMP Sub-plan Reference
Noise – Initial 60 day reporting period	4 main locations adopted for a total of 5 monitoring sites: ▪ Skelly Road ▪ Maddox Lane ▪ Neubeck Street ▪ Wolgan Road. (Refer to Figure 5-1)	L_{Aeq}, L_{A10}, L_{A90} and L_{AmaX}	4 separate days – 3 week days and a Sunday	Attended monitoring using hand held sound level meter Monitoring to be continuous throughout full day of operations for each 15 minute period, including 30 mins prior to and following normal operating hours (7am to 10pm). Nearest potentially affected receiver to be monitored at 07.00 and at least once between 20.30 – 22.30.	Report to be submitted to EPA within 1 week of monitoring COMPLETE	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.3 Operational Noise and Vibration Management Plan – Appendix A
Noise - Normal conditions	Minimum of 3 most affected locations as per the 60 day post commissioning assessment. To include periods of ash placement at far western area of the site and where noise mitigation measures are in place. (as per COA 2.15) (Refer to Figure 5-1)	Noise levels shall not exceed an LAeq of 40dB(A) at the nearest most affected receiver	During daytime (7am-6pm) and evening time (6pm-10am) Every 6 months or more frequent if adverse trends are noted	Ongoing attended monitoring using hand held sound level meter.	6 monthly noise monitoring report If non-compliance, report is to be forwarded to DPE and EPA within 14-days of conducting monitoring	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.5 Operational Noise and Vibration Management Plan – Appendix A
Noise - Emergency conditions	At the complainant's property or nearest available representative location.	Noise levels shall not exceed an LAeq of 40dB(A) at the nearest most affected receiver	As required	Attended monitoring using hand held sound level meter	6 monthly noise monitoring report	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.3 Operational Noise and Vibration Management Plan – Appendix A

6.3 Noise and vibration management sub-plan

Targets	▪ Achieve compliance with the noise criterion of L_{Aeq} of 40dB(A) at the nearest most affected receiver during normal operations. ▪ Achieve a significant reduction in the number of noise-related complaints during emergency operations (less than 5 per year, stretch target = zero complaints per year).
Indicators	▪ The number of noise-related complaints. ▪ Noise monitoring data obtained from the sensitive receiver locations ▪ Compliance indicators as assessed by the specialist noise consultant and the Environmental Representative, as required. ▪ Observed and monitored reduction in noise generation due to adaptation where necessary of engineering measures on trucks, the implementation of operating techniques such as limited compression braking and speed limit restrictions.

Supporting documentation

Appendix A: - KVAR Stage 2 Operations- Operational Noise and Vibration Management Plan

Australian Standard AS 2436 – Guide to noise control on construction, maintenance and demolition sites

Key issues/constraints/strategies

Wallerawang Ash Repositories activities are not anticipated to result in impacts at the nearest potentially affected receivers. Noise impacts in varying conditions can be assessed and used to predict similar scenarios in the future to determine which measures are most effective and when.

Wallerawang Ash Repositories activities are not anticipated to result in perceived vibration-related impacts at the nearest potentially affected receivers. Appendix A provides procedures to be implemented should vibration-related non-conformances occur.

A Specialist Consultant will be undertaking the prescribed monitoring and analysis of noise results, as per this plan.

Appendix C
Calibration certificates

EMM
creating opportunities

C.1 Calibration certificates

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23032

Client Details	EMM Consulting Level 3/175 Scott Street Newcastle NSW 2300
Equipment Tested/ Model Number :	Rion NA-28
Instrument Serial Number :	30131882
Microphone Serial Number :	04739
Pre-amplifier Serial Number :	11942
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	24°C	**Ambient Temperature :**	23.5°C
Relative Humidity :	47.3%	**Relative Humidity :**	46.1%
Barometric Pressure :	100.14kPa	**Barometric Pressure :**	100.16kPa

Calibration Technician :	Shaheen Boaz	**Secondary Check:**	Dylan Selge
Calibration Date :	23 Jan 2023	**Report Issue Date :**	25 Jan 2023

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

PAGE 1 OF 1

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C37305

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer:	Svantek
Type No:	SV36 **Serial No:** 140737
Class:	1
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle NSW 2300
Tests Performed:	Measured Output Pressure level, Frequency & Distortion
Comments:	See Details and Class Tolerance overleaf.

CONDITION OF TEST:

Ambient Pressure	1005	hPa ±1 hPa	**Date of Receipt :**	06/09/2023
Temperature	24	°C ±1° C	**Date of Calibration :**	06/09/2023
Relative Humidity	35	% ±5%	**Date of Issue :**	06/09/2023

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: .....

AUTHORISED SIGNATURE: .....

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
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Canberra City ACT 2601

ADELAIDE
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PERTH
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emmconsulting.com.au

Kerosene Vale Ash Repository

Environmental noise monitoring - Q4 2023

Prepared for Generator Property Management Pty Ltd

November 2023

Kerosene Vale Ash Repository

Environmental noise monitoring - Q4 2023

Generator Property Management Pty Ltd

E221232 RP4

November 2023

Version	Date	Prepared by	Reviewed by	Comments
1	06/11/2023	Will Moore	Tony Welbourne	Final

Approved by

Tony Welbourne
Associate Director
6 November 2023

Level 3 175 Scott Street
Newcastle NSW 2300

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Appendices

Tables

Figures

1 Introduction

1.1 Background

EMM Consulting Pty Ltd (EMM) was engaged by Generator Property Management Pty Ltd to conduct a quarterly noise survey of construction activities and operations at Kerosene Vale Ash Repository (KVAR, the site) located near Lidsdale, NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

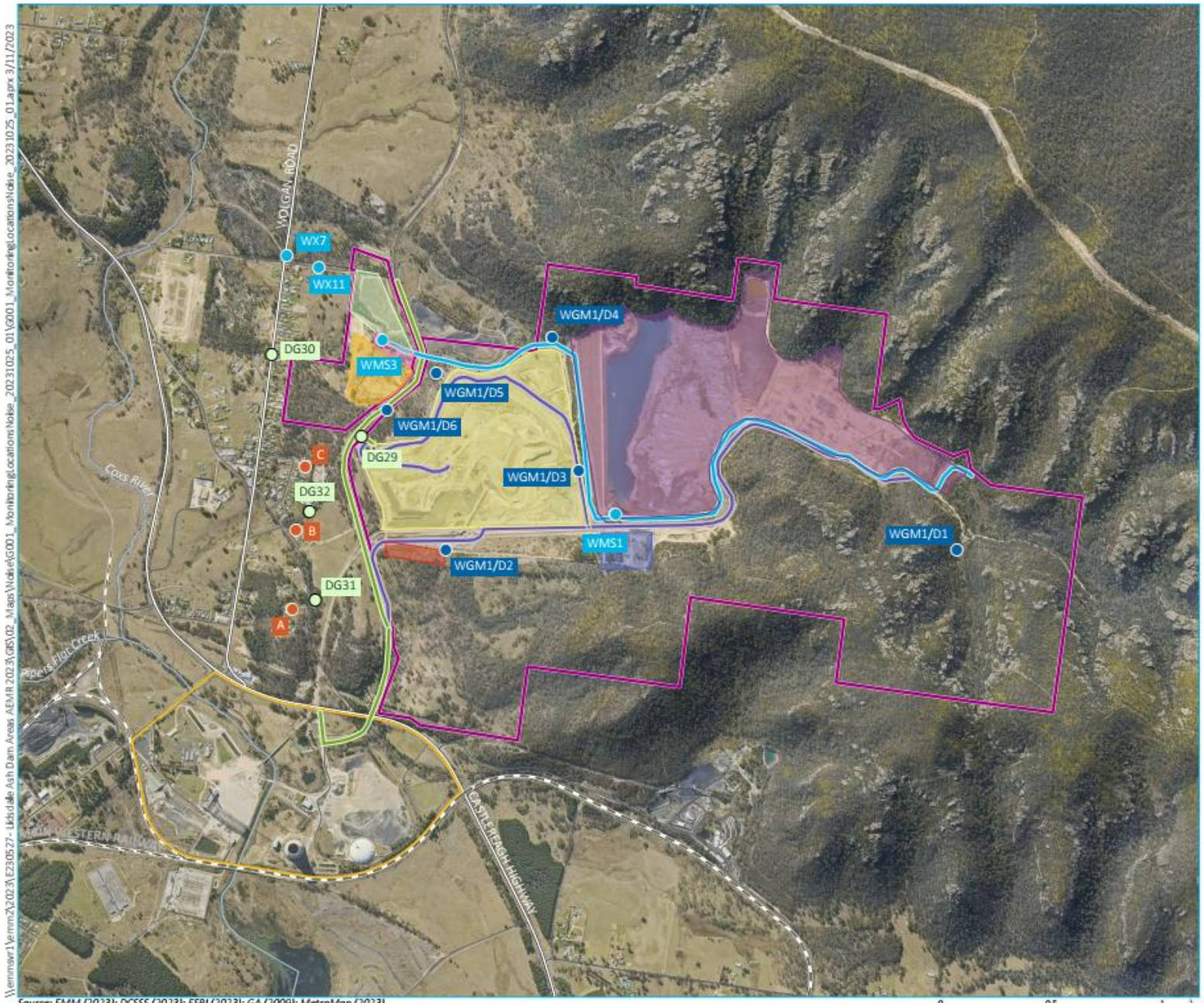
Attended environmental noise monitoring described in this report was done during the day and evening periods of 1/2 November 2023 at three monitoring locations.

1.2 Attended monitoring locations

Site monitoring locations are detailed in Table 1.1 and shown on Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not necessarily the location of residences.

Table 1.1 Attended noise monitoring locations

Descriptor	Description	Coordinates (MGA 56)	
		Easting	Northing
Location A	Skelly Road, Lidsdale NSW	229052	6301209
Location B	Corner Sawyers Road and Skelly Road, Lidsdale NSW	228899	6301470
Location C	End of Nuebeck Street, Lidsdale NSW	228982	6301813



Environmental Monitoring Locations

Kerosene Vale Ash Repositories
Figure 1.1

1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1 per cent of the time.
$L_{A1,1minute}$	The A-weighted noise level which is exceeded for 1 per cent of the specified time period of 1 minute.
L_{A10}	The A-weighted noise level which is exceeded for 10 percent of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50 per cent of the time, also the median noise level during a measurement period.
L_{A90}	The A-weighted noise level exceeded for 90 percent of the time, also referred to as the "background" noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Development consent

The current development consent for KVAR is MP07_0005 (MOD 1, August 2018). Section 2 of the consent details specific conditions relating to operational and construction noise generated by KVAR. Relevant sections of that document are reproduced in Appendix B.1.

2.2 Environment protection licence

KVAR holds Environment Protection Licence (EPL) No. 21185 issued by the Environment Protection Authority (EPA) most recently on 18 July 2022. Relevant sections of the EPL are reproduced in Appendix B.2.

2.3 Noise management plan

The KVAR Operational Environmental Management Plan (OEMP) was most recently updated in October 2018. Section 6.3 of the OEMP contains a noise and vibration management sub-plan. Appendix A of the OEMP provides the Operational Noise and Vibration Management Plan. Relevant sections of the OEMP are reproduced Appendix B.3.

2.4 Noise limits

2.4.1 Operational noise limits

Operational noise impact limits based on the EPL are shown in Table 2.1.

Table 2.1 Operational noise impact limits, $L_{Aeq,15minute}$ dB

Location	Day	Evening
Location A	40	40
Location B	40	40
Location C	40	40

2.4.2 Construction noise targets

Condition 2.7 of the consent details construction noise objectives as follows:

> The construction noise objective for the project is to manage noise from construction activities (as measured by a $L_{A10,15minute}$ descriptor) so as not to exceed the background L_{A90} noise level by more than 10 dB(A) at any sensitive receiver.

In accordance with condition 3.1 of the consent, construction noise monitoring must occur during the following activities:

a) the realignment of Sawyers Swamp Creek;

b) construction of the stabilisation berm;

c) excavation of the former pine plantation area;

d) relocation and construction of surface water management structures; and

e) concurrent construction activities.

However, due to the difficulty of differentiating noise from construction and operational activities, all noise measured from the site has been assessed against operational noise impact limits as per condition 2.15 of the consent.

2.5 Meteorological conditions

As detailed in the development consent and EPL, noise criteria apply under the following meteorological conditions:

- wind speeds up to 3 m/s at 10 metres height above ground; and/or
- temperature inversion conditions of up to 3°C/100m and source to receiver gradient winds of up to 2 m/s at 10 metres height above ground.

2.6 Additional requirements

The NSW EPA 'Industrial Noise Policy' (INP, 2000) was replaced by the 'Noise Policy for Industry' (NPfI) in October 2017. Noise conditions in the EPL and project approval still reference the INP exclusively, so monitoring has been conducted in accordance with the INP.

For assessment of modifying factors, the NPfI immediately superseded the INP, as outlined in the EPA document 'Implementation and transitional arrangements for the Noise Policy for Industry' (2017). Therefore, assessment and reporting of modifying factors have been done in accordance with Fact Sheet C of the NPfI.

Monitoring and reporting have been done in accordance with the EPA 'Approved methods for the measurement and analysis of environmental noise in NSW' issued in January 2022.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW EPA requirement.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted during the day and evening period at each location. The duration of each measurement was 15 minutes. Atmospheric conditions were measured at each monitoring location.

Measured sound levels from various sources were noted during each measurement, and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15minute}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods, such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate of may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

For this assessment, the measured L_{Amax} has been used as a conservative estimate of $L_{A1,1minute}$. The EPA accepts sleep disturbance analysis based on either the $L_{A1,1minute}$ or L_{Amax} metrics, with the L_{Amax} representing a more conservative assessment of site noise emissions.

3.3 Meteorological data

Meteorological data was obtained from the Bureau of Meteorology (BOM) automatic weather station (AWS) at Marrangaroo which allowed correlation of atmospheric parameters with measured noise levels. Vertical temperature gradient and/or sigma theta data required to determine temperature inversion conditions was not available from this AWS.

As KVAR operates solely during the day and evening periods, it has been assumed that temperature inversion conditions were not present during monitoring.

3.4 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfI. Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable. If applicable, modifying factor penalties have been reported and added to measured site-only L_{Aeq} noise levels.

Low-frequency modifying factor penalties have only been applied to site-only L_{Aeq} levels if the site was the only contributing low-frequency noise source. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfI.

3.5 Instrumentation

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 Attended noise monitoring equipment

Item	Serial number	Calibration due date	Relevant standard
Rion NA-28 sound level meter	30131882	23/01/2025	IEC 61672-1:2002
Pulsar 106 acoustic calibrator	78226	24/01/2025	IEC 60942:2003

4 Results

4.1 Total measured noise levels and atmospheric conditions

Overall noise levels measured at each location during attended measurements are provided in Table 4.1.

Table 4.1 Total measured noise levels, dB – Quarter 4 2023 [1]

Location	Start date and time	L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	L_{Amin}
A	01/11/2023 18:40	56	48	42	40	39	37	34
A	02/11/2023 09:40	55	44	38	36	34	32	29
B	01/11/2023 18:20	66	55	46	44	39	35	32
B	02/11/2023 09:20	61	51	45	42	39	35	30
C	01/11/2023 18:00	60	47	41	39	36	34	30
C	02/11/2023 09:00	77	57	45	47	37	32	28

Notes: 1. Levels in this table are not necessarily the result of activity at site.

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 metres above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height.

Table 4.2 Measured atmospheric conditions – Quarter 4 2023

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction °Magnetic north[1]	Cloud cover 1/8s
A	01/11/2023 18:40	15	1.2	100	1
A	02/11/2023 09:40	16	0.8	310	3
B	01/11/2023 18:20	17	1.6	100	1
B	02/11/2023 09:20	16	1.0	310	4
C	01/11/2023 18:00	18	1.8	90	1
C	02/11/2023 09:00	19	0.7	300	7

Notes: 1. "-" indicates calm conditions at monitoring location.

4.2 Construction activities

KVAR has advised the following construction activities were occurring during the Quarter 4 2023 noise monitoring survey:

- construction of surface water management structures

4.3 Site only noise levels

4.3.1 Modifying factors

There were no modifying factors, as defined in the NPfI, applicable during the survey.

4.3.2 Site noise levels

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from the site AWS. Limits are applicable if weather conditions were within specified parameters during each measurement.

Table 4.3 Site noise levels and limits – Quarter 4 2023

Location	Start date and time	Wind speed m/s	Limits apply? [1]	KVAR limit, $L_{Aeq,15minute}$ dB	KVAR level, $L_{Aeq,15minute}$ dB [2]	Exceedance, dB [3]
A	01/11/2023 18:40	1.9	Yes	40	IA	Nil
A	02/11/2023 09:40	1.7	Yes	40	<25	Nil
B	01/11/2023 18:20	3.1	No	40	IA	N/A
B	02/11/2023 09:20	1.9	Yes	40	27	Nil
C	01/11/2023 18:00	4.2	No	40	IA	N/A
C	02/11/2023 09:00	1.9	Yes	40	27	Nil

Notes: 1. Noise emission limits do not apply during periods of rainfall or winds greater than 3 metres per second (at a height of 10 metres).

2. Site-only $L_{Aeq,15minute}$, includes modifying factor penalties if applicable.

3. N/A in exceedance column means criterion was not applicable due to atmospheric conditions outside those specified in project approval.

5 Discussion

5.1 Noted noise sources

During attended monitoring, the time variations (temporal characteristics) of noise sources are considered in each measurement via statistical descriptors. From these observations, summaries have been derived for the location and provided in this section. Statistical 1/3 octave-band analysis of environmental noise was conducted, and the following figures display frequency ranges of various noise sources at each location for L_{A1}, L_{A10}, L_{Aeq}, L_{A50}, and L_{A90} descriptors. These figures also provide, graphically, statistical information for these noise levels.

An example is provided as Figure 5.1, where frogs and insects are seen to be generating noise at frequencies above 1000 Hz, while industrial noise is observed at frequencies less than 1000 Hz.

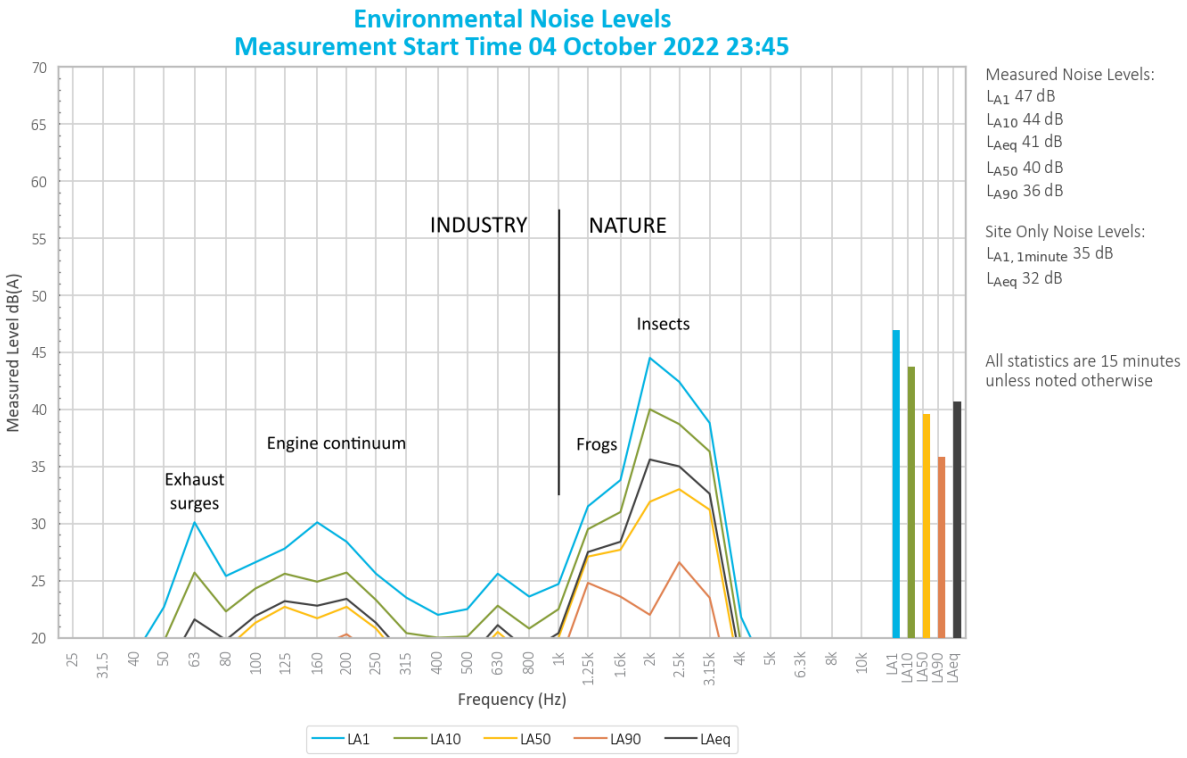


Figure 5.1 Example graph (refer to Section 5.1 for explanatory note)

5.2 Location A – Day

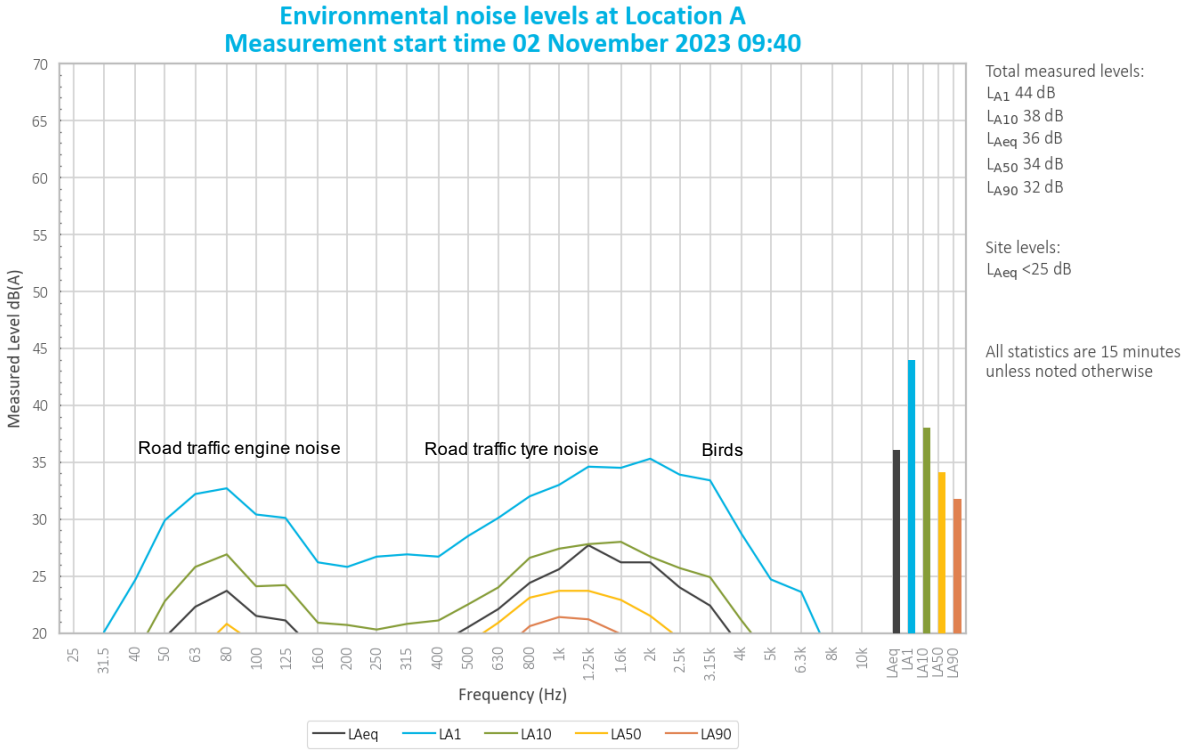


Figure 5.2 Environmental noise levels – Location A

KVAR haul trucks were audible during the measurement, generating a site-only L_{Aeq} of less than 25 dB. Chainsaw noise was also noted.

Road traffic generated measured noise levels.

Noise from birds was also noted.

5.3 Location A – Evening

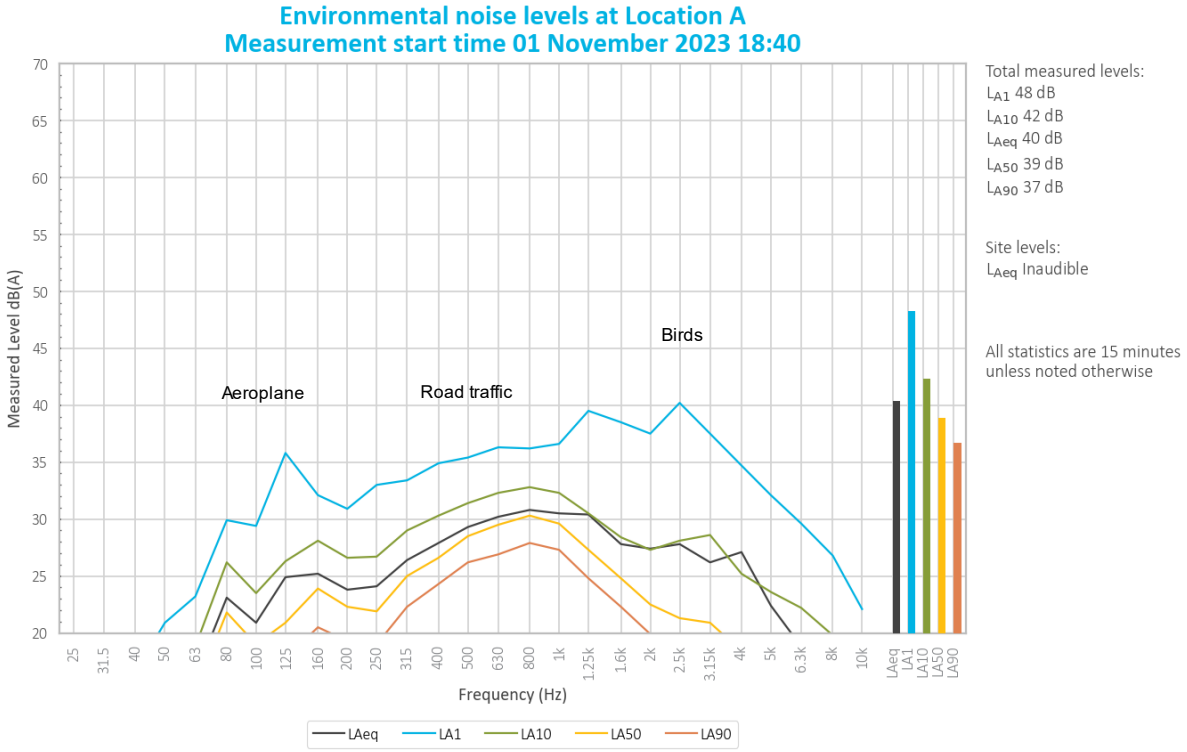


Figure 5.3 Environmental noise levels – Location A

KVAR was inaudible during the measurement.

Road traffic primarily generated measured noise levels. Birds generated the measured L_{A1}.

Noise from an aeroplane was also noted.

5.4 Location B – Day

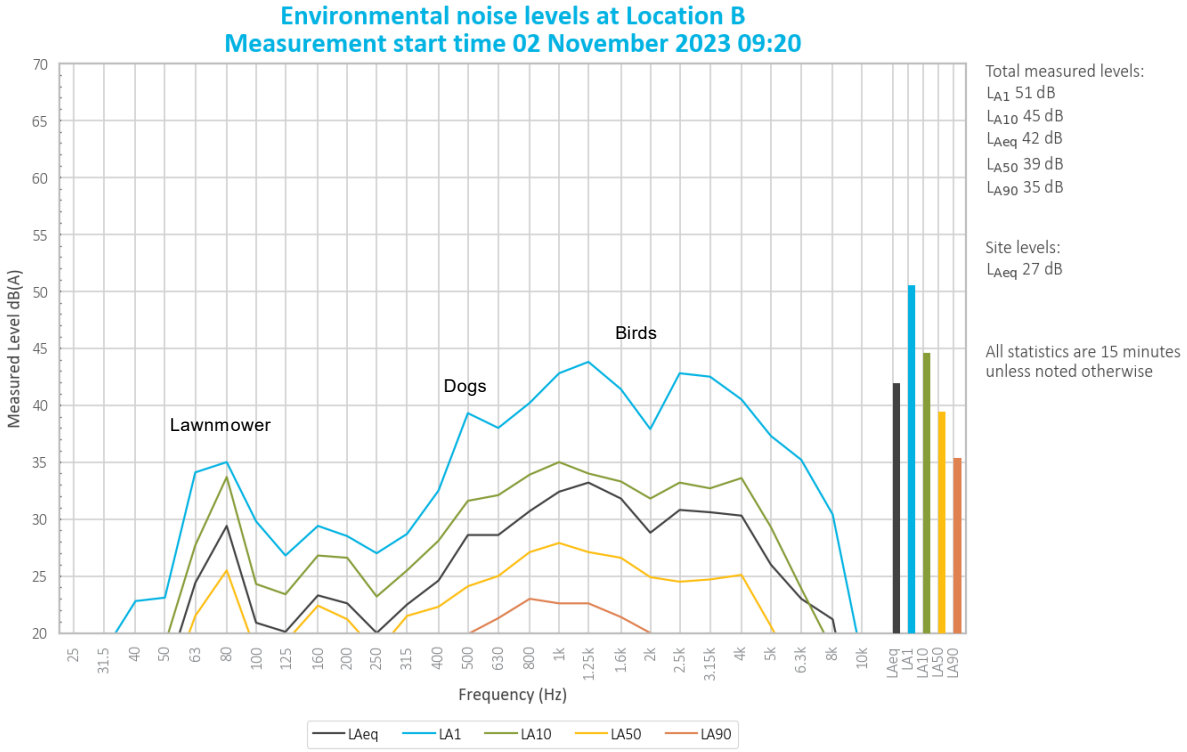


Figure 5.4 Environmental noise levels – Location B

KVAR haul trucks were audible during the measurement, generating a site-only L_{Aeq} of 27 dB.

Birds generated the measured L_{A1}, L_{A10} and L_{Aeq}. Dogs contributed to the L_{A10} and L_{Aeq}. Road traffic generated the measured L_{A50} and L_{A90}.

Noise from a lawnmower was also noted.

5.5 Location B – Evening

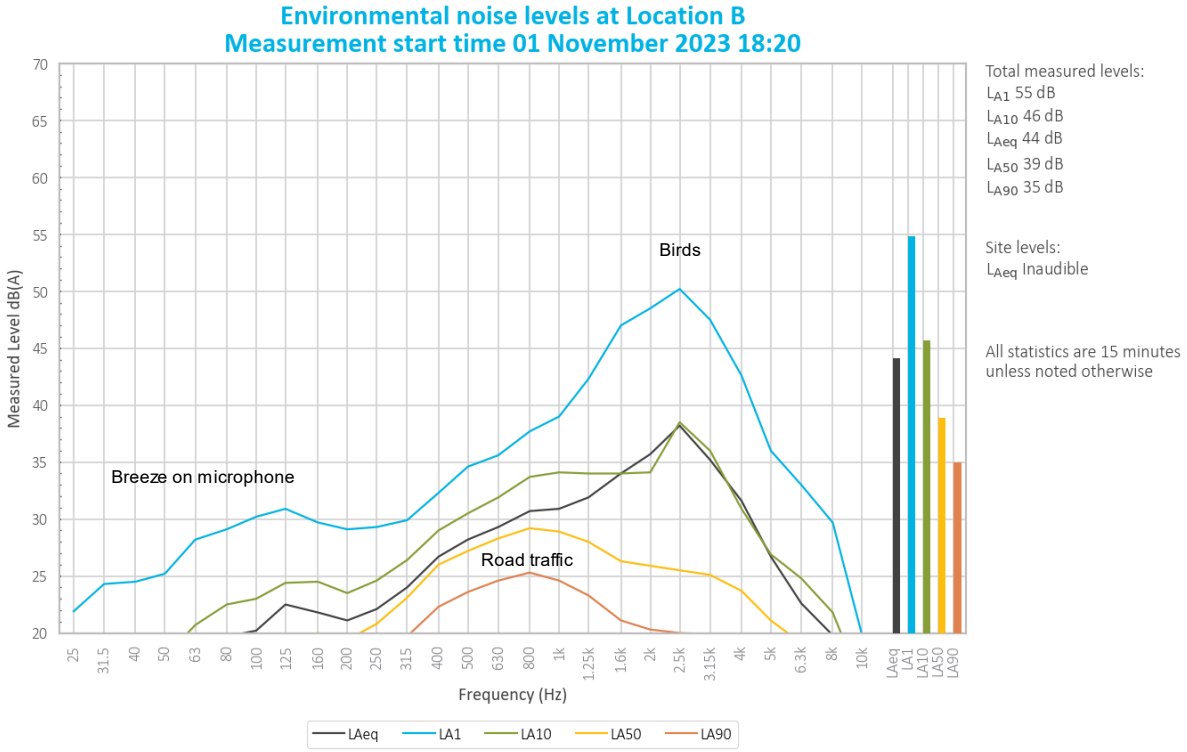


Figure 5.5 Environmental noise levels – Location B

KVAR was inaudible during the measurement.

Birds generated the measured L_{A1}, L_{A10} and L_{Aeq}. Road traffic generated the measured L_{A50} and L_{A90}.

Noise from a breeze on the microphone was also noted.

5.6 Location C – Day

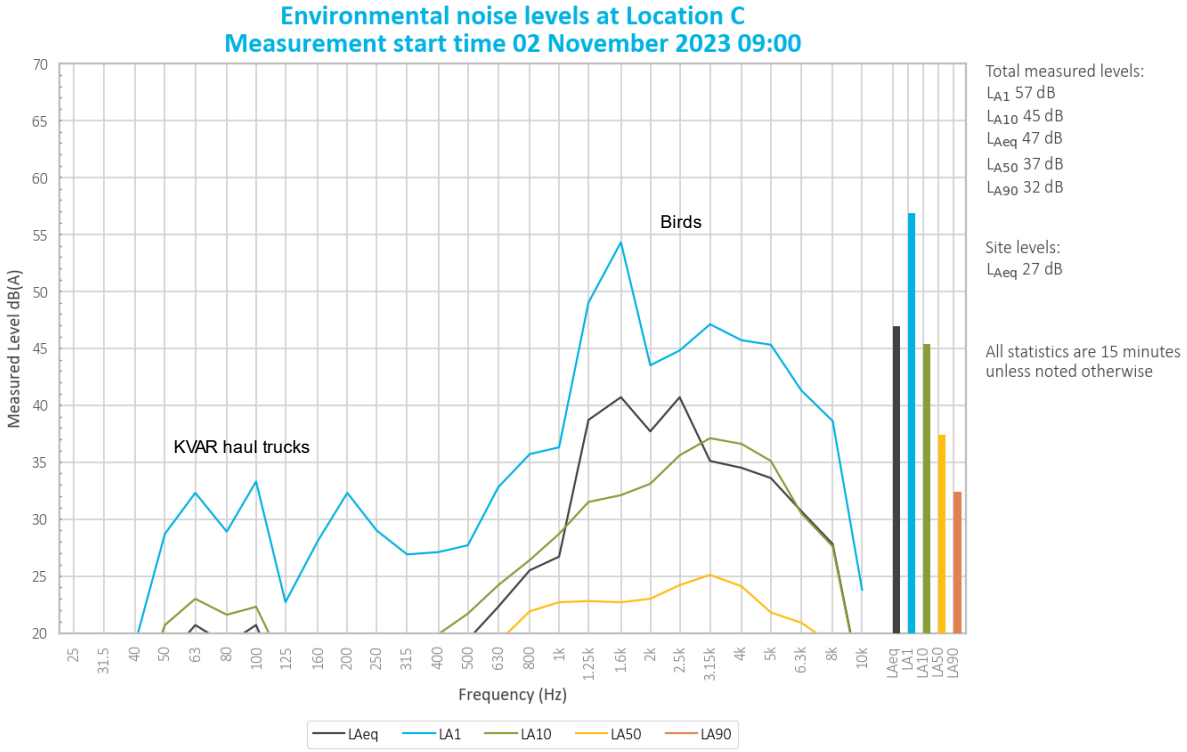


Figure 5.6 Environmental noise levels – Location C

KVAR haul trucks and continuum was audible throughout the measurement, generating a site-only L_{Aeq} of 27 dB.

Birds primarily generated measured noise levels. Road traffic contributed to the measured and L_{A90}.

5.7 Location C – Evening

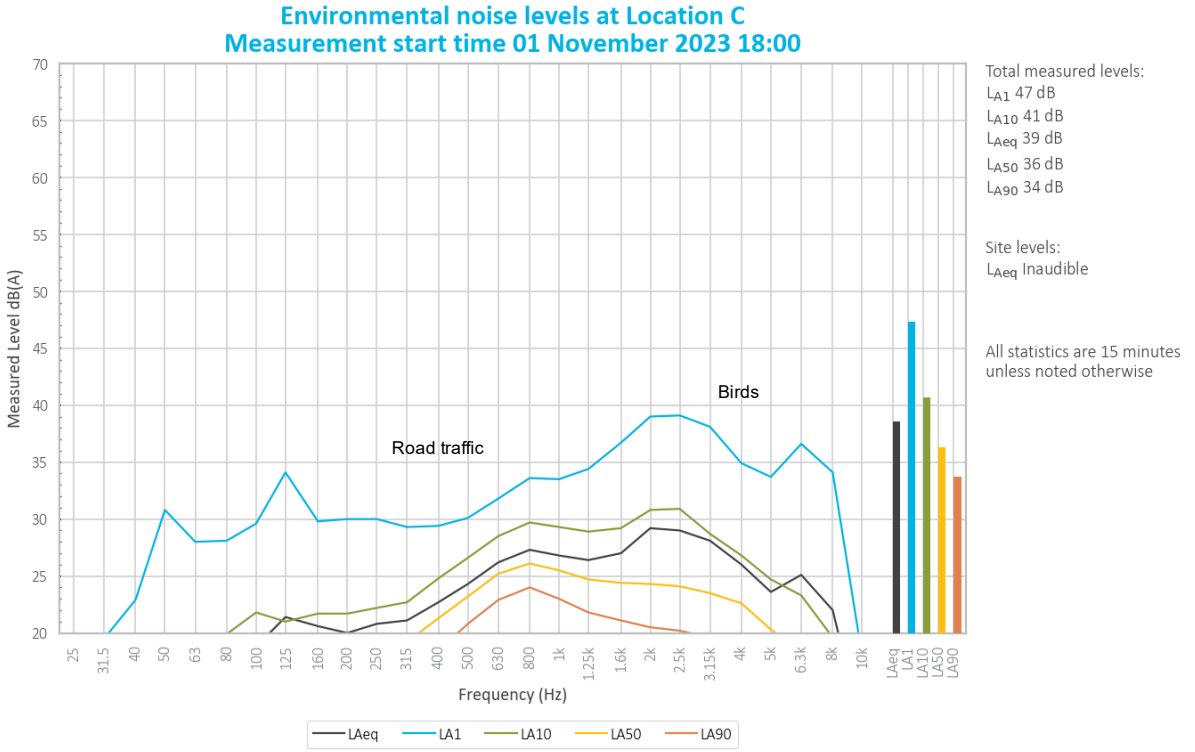


Figure 5.7 Environmental noise levels – Location C

KVAR was inaudible during the measurement.

Road traffic was primarily responsible for generating measured noise levels. Birds generated the measured L_{A1}.

Noise from a breeze on the microphone and dogs was also noted.

6 Summary

EMM was engaged by Generator Property Management Pty Ltd to conduct quarterly noise survey of construction activities and operations at KVAR. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

Attended environmental noise monitoring described in this report was undertaken during the day and evening periods of 1/2 November 2023 at three monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the Quarter 4 2023 survey.

Appendix A
Noise perception and examples

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A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

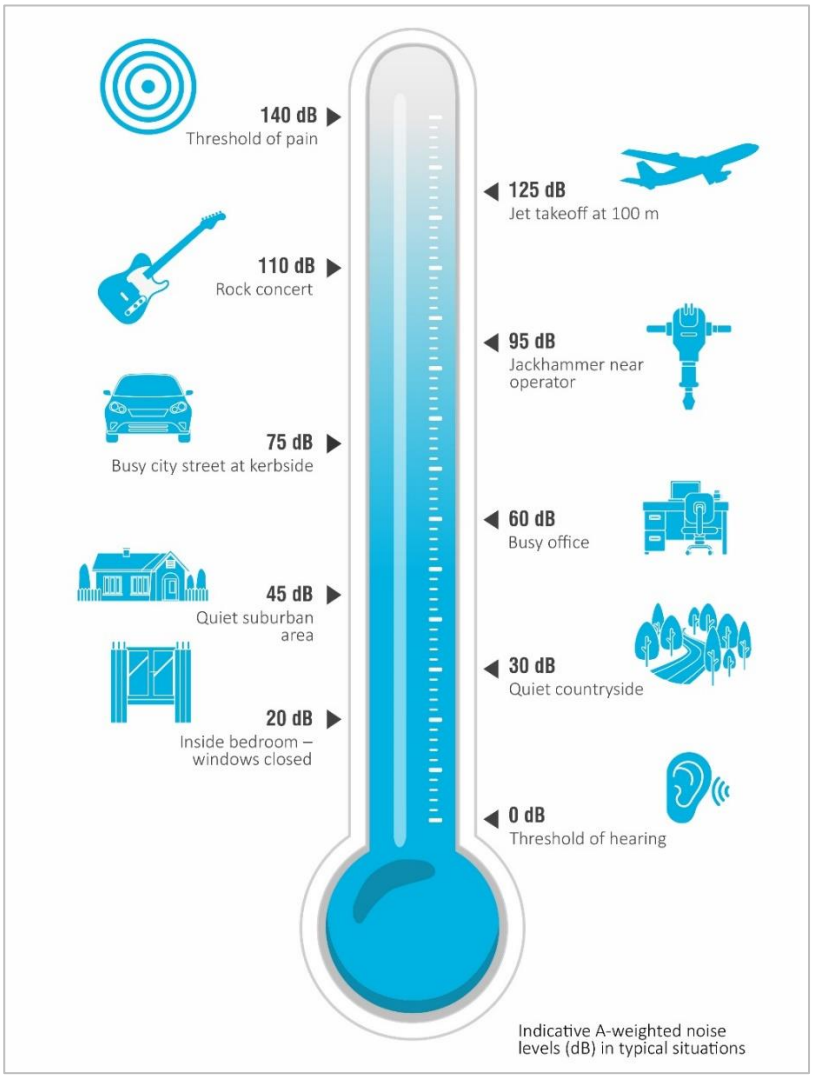

Figure A.1 Common noise levels

Appendix B
Regulator documents

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B.1 Development consent

Noise Impacts

Construction Hours

2.3 Construction activities associated with the project shall only be undertaken during the following hours:

a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive;
b) 8:00 am to 1:00 pm on Saturdays; and
c) at no time on Sundays or public holidays.

2.4 Activities resulting in impulsive or tonal noise emission (such as rock breaking or rock hammering) shall be limited to 8:00 am to 12:00 pm, Monday to Saturday and 2:00 pm to 5:00 pm, Monday to Friday. The Proponent shall not undertake such activities for more than three continuous hours and must provide a minimum one-hour respite period.

2.5 Construction outside the hours stipulated in condition 2.3 of this approval is permitted in the following circumstances:

a) where construction works do not cause audible noise at any sensitive receiver; or
b) for the delivery of materials required outside these hours by the Police or other authorities for safety reasons; or
c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

2.6 The hours of construction activities specified under condition 2.3 of this approval may be varied with the prior written approval of the Secretary. Any request to alter the hours of construction specified under condition 2.3 shall be:

a) considered on a case-by-case basis;
b) accompanied by details of the nature and need for activities to be conducted during the varied construction hours; and
c) accompanied by any information necessary for the Secretary to reasonably determine that activities undertaken during the varied construction hours will not adversely impact on the acoustic amenity of sensitive receivers in the vicinity of the site.

Construction Noise

2.7 The construction noise objective for the project is to manage noise from construction activities (as measured by a $L_{A10\ (15\ minute)}$ descriptor) so as not to exceed the background L_{A90} noise level by more than 10 dB(A) at any sensitive receiver.

Any activities that have the potential for noise emissions that exceed the objective must be identified and managed in accordance with the Construction Noise Management Plan (as referred to under condition 6.3b) of this approval). The Proponent shall implement all reasonable and feasible noise mitigation measures with the aim of achieving the construction noise objective.

Operational Noise

2.15 The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed an $L_{Aeq\ (15\ minute)}$ of 40 dB(A) at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8 of this approval.

This noise criterion applies under the following meteorological conditions:

a) wind speeds up to 3 m/s at 10 metres above ground; and/or
b) temperature inversion conditions of up to 3°C/100 m and source to receiver gradient winds of up to 2 m/s at 10 m above ground level.

This criterion does not apply where the Proponent and the affected landowner have reached a negotiated agreement in regard to noise, and a copy of the agreement has been forwarded to the Secretary and the EPA.

2.16 The Proponent shall implement measures to ensure noise attenuation of trucks. These measures may include, but are not necessarily limited to, installation of residential class mufflers, engine shrouds, body dampening, speed limiting, fitting of rubber stoppers to tail gates, limiting the use of compression braking, and ensuring trucks operate in a one-way system at the ash repository where feasible.

2.17 The Proponent shall liaise with the owner/operator of Angus Place Coal Mine with the aim of preparing a protocol which provides for a co-operative approach for the management and mitigation of noise impacts associated with coal and ash truck movements along the private haul road.

2.18 Where noise monitoring (as required by conditions 3.2 or 3.3 of this approval) identifies any non-compliance with the operational noise criterion specified under condition 2.15 of this approval the Proponent shall prepare and submit to the Secretary for approval a report including, but not limited to:

a) an assessment of all reasonable and feasible physical and other mitigation measures for reducing noise at the source including, but not limited to -
    i) construction of a noise barrier along the haulage road,
    ii) alternative ash haulage routes, and
    iii) alternative methods of ash conveyance to the repository; and
b) identification of the preferred measure(s) for reducing noise at the source;
c) feedback from directly affected property owners and the EPA on the proposed noise mitigation measures; and
d) location, type, timing and responsibility for implementation of the noise mitigation measure(s).

The report is to be submitted to the Secretary within 60 days of undertaking the noise monitoring which has identified exceedances of the operational noise criterion specified under condition 2.15, unless otherwise agreed to by the Secretary. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Secretary.

3. ENVIRONMENTAL MONITORING

Construction Noise Monitoring

3.1 The Proponent shall prepare and implement a **Construction Noise Monitoring** Program to confirm the predictions of the noise assessment detailed in the document referred to under condition 1.1 of this approval and assess compliance against the construction noise criterion stipulated in condition 2.7 of this approval. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the EPA. The monitoring program shall form part of the Construction Noise Management Plan referred to in condition 6.3b) of this approval and must include monitoring of the construction noise generated during:

a) the realignment Sawyers Swamp Creek;
b) construction of the stabilisation berm;
c) excavation of the former pine plantation area;
d) relocation and construction of surface water management structures; and
e) concurrent construction activities.

The Proponent shall forward to the EPA and the Secretary a report containing the results of each noise assessment and describing any non-compliance within 14 days of conducting a noise assessment.

Operational Noise Review

3.2 Within 60 days of the commencement of operation of the project, unless otherwise agreed to by the Director-General, the Proponent shall submit for the approval of the Secretary an **Operational Noise Review** to confirm the operational noise impacts of the project. The Operational Noise Review must be prepared in consultation with, and to the satisfaction of, the EPA. The Review shall:

a) identify the appropriate operational noise objectives and level for sensitive receivers;
b) describe the methodologies for noise monitoring including the frequency of measurements and location of monitoring sites;
c) document the operational noise levels at sensitive receivers as ascertained by the noise monitoring program;
d) assess the noise performance of the project against the noise criterion specified in condition 2.15 of this approval and the predicted noise levels as detailed in the report referred to under condition 1.1 of this approval; and
e) provide details of any entries in the Complaints Register (as required under condition 5.4 of this approval) relating to noise impacts.

Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, the Proponent shall prepare a report as required by condition 2.18 of this approval.

Ongoing Operational Noise Monitoring

3.3 The Proponent shall prepare and implement an **Operational Noise Monitoring Program** to assess compliance against the operational noise criterion stipulated in condition 2.15 of this approval, throughout the life of the project. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the EPA.

The noise monitoring program shall be prepared in accordance with the requirements of the *New South Wales Industrial Noise Policy* (EPA, 2000) and must include, but not be limited to:

a) monitoring during ash placement in the far western area of the site adjacent to the haul road; and

b) monitoring of the effectiveness of any noise mitigation measures implemented under condition 2.18 of this approval, against the noise criterion specified in condition 2.15 of this approval.

Noise from the project is to be measured at the most affected point on or within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise criterion stipulated in condition 2.15 of this approval. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the *NSW Industrial Noise Policy*). The modification factors in Section 4 of the *NSW Industrial Noise Policy* shall also be applied to the measured noise levels where applicable.

The Proponent shall forward to the EPA and the Secretary a report containing the results of any non-compliance within 14 days of conducting a noise assessment.

Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, approval, the Proponent shall prepare a report as required by condition 2.18 of this approval.

The monitoring program shall form part of the Operational Noise Management Plan referred to in condition 6.5a) of this approval.

B.2 Environmental protection licence

L5 Noise limits

L5.1 Operational noise from the Kerosene Vale Ash Repository area must not exceed:

40dB(A) LAeq(15 minute) , at the nearest most affected noise sensitive location.

Note: LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L5.2 To determine compliance with condition(s) L4.1 noise must be measured at, or computed for, the most affected location within the residential boundary, or at the most affected point within 30 metres of a dwelling (rural setting) where the dwelling is more than 30 metres from the boundary. A modifying factor correction must be applied for tonal, impulsive or intermittent noise in accordance with the "Environmental Noise Management - NSW Industrial Noise Policy (January 2000)".

L5.3 The noise emission limits identified in this licence apply under the following meteorological conditions:
a) wind speeds up to 3 m/s at 10 metres height above ground; and/or
b) temperature inversion conditions of up to 30C/100m and source to receiver gradient winds of up to 2 m/s at 10 metres height above ground.

Note: The noise emission limits identified in this licence do not apply at a noise sensitive location, where the licensee and the affected noise sensitive location have reached a negotiated agreement in regards to noise, and a copy of that agreement has been provided to the Environment Protection Authority.

L6 Hours of operation

L6.1 Operational activities associated with the Kerosene Vale Ash Repository must only be carried out between the hours of 0700 and 2200 Monday to Sunday.

L6.2 This condition does not apply to the delivery of material outside the hours of operation permitted by condition L6.1, if that delivery is required by police or other authorities for safety reasons; and/or the operation or personnel or equipment are endangered. In such circumstances, prior notification must be provided to the EPA and affected residents as soon as possible or within a reasonable period in the case of emergency.

B.3 Noise management plan

5.2 Environmental monitoring program

An overview of the environmental monitoring activities that have been specified by the respective sub-plans under Section 6 of the OEMP is provided in Table 5-1. Please refer to specific sub-plans under Section 6 for further details.

Table 5-1 Environmental monitoring program

Potential impact	Locations	Parameters	Frequency	Technique	Reporting	Responsibility	OEMP Sub-plan Reference
Noise – Initial 60 day reporting period	4 main locations adopted for a total of 5 monitoring sites: ▪ Skelly Road ▪ Maddox Lane ▪ Neubeck Street ▪ Wolgan Road. (Refer to Figure 5-1)	L_{Aeq}, L_{A10}, L_{A90} and L_{AmaX}	4 separate days – 3 week days and a Sunday	Attended monitoring using hand held sound level meter Monitoring to be continuous throughout full day of operations for each 15 minute period, including 30 mins prior to and following normal operating hours (7am to 10pm). Nearest potentially affected receiver to be monitored at 07.00 and at least once between 20.30 – 22.30.	Report to be submitted to EPA within 1 week of monitoring COMPLETE	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.3 Operational Noise and Vibration Management Plan – Appendix A
Noise - Normal conditions	Minimum of 3 most affected locations as per the 60 day post commissioning assessment. To include periods of ash placement at far western area of the site and where noise mitigation measures are in place. (as per COA 2.15) (Refer to Figure 5-1)	Noise levels shall not exceed an LAeq of 40dB(A) at the nearest most affected receiver	During daytime (7am-6pm) and evening time (6pm-10am) Every 6 months or more frequent if adverse trends are noted	Ongoing attended monitoring using hand held sound level meter.	6 monthly noise monitoring report If non-compliance, report is to be forwarded to DPE and EPA within 14-days of conducting monitoring	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.5 Operational Noise and Vibration Management Plan – Appendix A
Noise - Emergency conditions	At the complainant's property or nearest available representative location.	Noise levels shall not exceed an LAeq of 40dB(A) at the nearest most affected receiver	As required	Attended monitoring using hand held sound level meter	6 monthly noise monitoring report	Specialist Consultant on behalf of EnergyAustralia NSW	Section 6.3 Operational Noise and Vibration Management Plan – Appendix A

6.3 Noise and vibration management sub-plan

Targets	▪ Achieve compliance with the noise criterion of L_{Aeq} of 40dB(A) at the nearest most affected receiver during normal operations. ▪ Achieve a significant reduction in the number of noise-related complaints during emergency operations (less than 5 per year, stretch target = zero complaints per year).
Indicators	▪ The number of noise-related complaints. ▪ Noise monitoring data obtained from the sensitive receiver locations ▪ Compliance indicators as assessed by the specialist noise consultant and the Environmental Representative, as required. ▪ Observed and monitored reduction in noise generation due to adaptation where necessary of engineering measures on trucks, the implementation of operating techniques such as limited compression braking and speed limit restrictions.
Supporting documentation	
Appendix A: - KVAR Stage 2 Operations- Operational Noise and Vibration Management Plan Australian Standard AS 2436 – Guide to noise control on construction, maintenance and demolition sites	
Key issues/constraints/strategies	
Wallerawang Ash Repositories activities are not anticipated to result in impacts at the nearest potentially affected receivers. Noise impacts in varying conditions can be assessed and used to predict similar scenarios in the future to determine which measures are most effective and when. Wallerawang Ash Repositories activities are not anticipated to result in perceived vibration-related impacts at the nearest potentially affected receivers. Appendix A provides procedures to be implemented should vibration-related non-conformances occur. A Specialist Consultant will be undertaking the prescribed monitoring and analysis of noise results, as per this plan.	

Appendix C
Calibration certificates

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C.1 Calibration certificates

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23032

Client Details	EMM Consulting Level 3/175 Scott Street Newcastle NSW 2300
Equipment Tested/ Model Number :	Rion NA-28
Instrument Serial Number :	30131882
Microphone Serial Number :	04739
Pre-amplifier Serial Number :	11942
Firmware Version :	2.0

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	24°C	**Ambient Temperature :**	23.5°C
Relative Humidity :	47.3%	**Relative Humidity :**	46.1%
Barometric Pressure :	100.14kPa	**Barometric Pressure :**	100.16kPa

Calibration Technician :	Shaheen Boaz	**Secondary Check:**	Dylan Selge
Calibration Date :	23 Jan 2023	**Report Issue Date :**	25 Jan 2023

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13dB*	*Temperature*	*±0.1°C*
1kHz	*±0.13dB*	*Relative Humidity*	*±1.9%*
8kHz	*±0.14dB*	*Barometric Pressure*	*±0.014kPa*
Electrical Tests	*±0.13dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

PAGE 1 OF 1

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Sound Calibrator

IEC 60942:2017

Calibration Certificate

Calibration Number C23033

Client Details EMM Consulting
Level 3/175 Scott Street
Newcastle NSW 2300

Equipment Tested/ Model Number : Pulsar Model 105
Instrument Serial Number : 78226

Atmospheric Conditions
Ambient Temperature : 24.4°C
Relative Humidity : 50.2%
Barometric Pressure : 100.2kPa

Calibration Technician : Shaheen Boaz
Secondary Check: Dylan Selge
Calibration Date : 24 Jan 2023
Report Issue Date : 25 Jan 2023

Approved Signatory : Ken Williams

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
94	1000	94.17	1000.40

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.10dB*	*Temperature*	*±0.1°C*
Frequency	*±0.13%*	*Relative Humidity*	*±1.9%*
Distortion	*±0.20%*	*Barometric Pressure*	*±0.014kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

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Appendix C

Annual water quality review

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Kerosene Vale Ash Repositories

Annual Water Quality Review

Prepared for Generator Property Management Pty Ltd

October 2024

Kerosene Vale Ash Repositories

Annual Water Quality Review

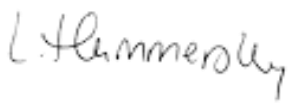
Generator Property Management Pty Ltd

E230337 RP17

October 2024

Version	Date	Prepared by	Reviewed by	Comments
V1	18/10/2024	Jack Mellor & Jonathon Schacht	Lachlan Hammersley	Draft for GPM review
V2	31/10/2024	Jack Mellor & Jonathon Schacht	Lachlan Hammersley	Final

Approved by



Lachlan Hammersley
Associate Water Resources Engineer
31 October 2024

Ground floor 20 Chandos Street
St Leonards NSW 2065
ABN: 28 141 736 558

Executive Summary

ES1 Report context

Generator Property Management Pty Ltd (GPM) own and operate the Kerosene Vale Ash Repositories and surrounds, located at Skelly Road, Lidsdale NSW (the Site). The Site comprises an area of approximately 528 hectares (ha) that has been used for a range of purposes including ash placement from the Wallerawang Power Station (the Power Station) that operated between 1957 to 2014. Prior the 1957, the Site was used for open cut coal mining and some of the voids were subsequently used as landfills. The Site includes:

- the Kerosene Vale Dry Ash Repository (KVAR) and underlying former Kerosene Vale Ash Dam (KVAD
- Sawyers Swamp Creek Ash Dam (SSCAD)
- Lidsdale Cut and adjacent landfills
- demolition landfill south of the SSCAD.

Currently the Site is operated on a care and maintenance arrangement consistent with NSW Planning Approval 07_0005 (MOD2) and Environment Protection Licence (EPL) No. 21185 (the EPL). On 22 August 2022, the EPA issued GPM with a Contaminated Land Declaration Notice which declares the Site as significantly contaminated land under Division 2 the Contaminated Land Management Act 1997. In 2023, GPM worked with the EPA to prepare a Voluntary Management Proposal (VMP) that establishes a proposed investigation and remediation approach.

This report is an annual water quality review (AWQR) that has been developed to support the overarching annual environmental management report (AEMR) for the Site. The AEMR considers the period from 1 September 2023 – 31 August 2024 (the AEMR Period). The AWQR addresses the surface and groundwater monitoring and reporting requirements set out in the Lidsdale Ash Repository: Operation Environment Management Plan (OEMP) prepared by EMM Consulting in 2024. It includes:

- a description of the water management system and the AEMR Period
- a review of surface water quality and ground water quality during the AEMR Period.

ES2 Surface water review summary

The review of surface water quality data concluded that:

- Water quality trends in Lidsdale Cut and the Sawyers Swamp Creek Ash Dam (SSCAD) are consistent with recent AEMR periods (i.e. 2018 to the current period). Lidsdale Cut and SSCAD are part of the Site's contaminated water management system and hold water that is known to be ash affected.
- The water quality in Blackhole appears to be affected by seep(s) of ash affected water when dewatering activities are undertaken (drawdown on perched groundwater table within SSCAD). This was particularly evident in Quarter 4 2023 and into Quarter 1 2024, when dewatering activities ceased and water levels were maintained at a constant set level. All water produced by dewatering the Black Hole was pumped into SSCAD Pond.
- Dump Creek, which contributes to Sawyers Swamp Creek, outside of wet weather generally has standing water but no visible flow. The water quality over the AEMR period was variable with pH, salinity and metal concentrations, in some samples, exceeding Default Guideline Values (DGVs). Water quality results over the AEMR period, similar to Sawyers Swamp Creek, indicated poor water quality conditions during drier

months, where groundwater seepage to the creek is in a higher proportion than better quality surface water.

- Sawyers Swamp Creek was observed to have perennial streamflow therefore ambient water quality conditions were influenced by what portions of groundwater and surface water contributed during the period. Due to the predominately wet conditions in the AEMR period, water quality downstream of the Site in Sawyers Swamp Creek was generally consistent with clean water.

- The water quality in the Coxs River is not affected by the inflows from Sawyers Swamp Creek.

In August 2022 GPM issued a Water Management Assessment (EMM 2022c) to the NSW Environment Protection Authority (EPA). This assessment included an Action Plan that described water management system improvements that were either underway or proposed. The plan included a description of each improvement, expected outcome once implemented and an estimated completion timeframe. GPM continue to progressively improve the water management system through implementing the Action Plan commitments. During the AEMR Period, updated Action Plans were included in Water Quality Monitoring Reports that were submitted to the EPA in March 2024 and September 2024.

ES3 Groundwater review summary

The review of groundwater quality data concluded that:

- groundwater quality trends during the AEMR Period were generally consistent with recent AEMR periods (i.e. 2018 to the current period)

- groundwater quality at monitoring bore WGM1/D3 (located between SSCAD and the KVAR/KVAD) may be degraded, relative to water quality trends at upgradient bores

- groundwater quality at monitoring bore WGM1/D6 (located downgradient of KVAR/KVAD) is consistent with ash affected water

- elevated concentrations of arsenic were reported at WK_MW06 which is consistent with previous results at this location but is an anomaly compared to other groundwater monitoring locations.

Potential groundwater contamination sources, pathways and receptors are being investigated as part of the Voluntary Management Proposal process that GPM has negotiated with the EPA.

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Appendices

Tables

Figures

1 Introduction

1.1 Site background

Generator Property Management Pty Ltd (GPM) own and operate the Kerosene Ash Dam Areas, located at Skelly Road, Lidsdale NSW (the Site). The Site comprises an area of approximately 528 hectares (ha) that has been used for a range of purposes including ash placement from the Wallerawang Power Station (the Power Station) that operated between 1957 to 2014. Prior the 1957, the Site was used for open cut coal mining and some of the voids were subsequently used as landfills.

The Site includes:

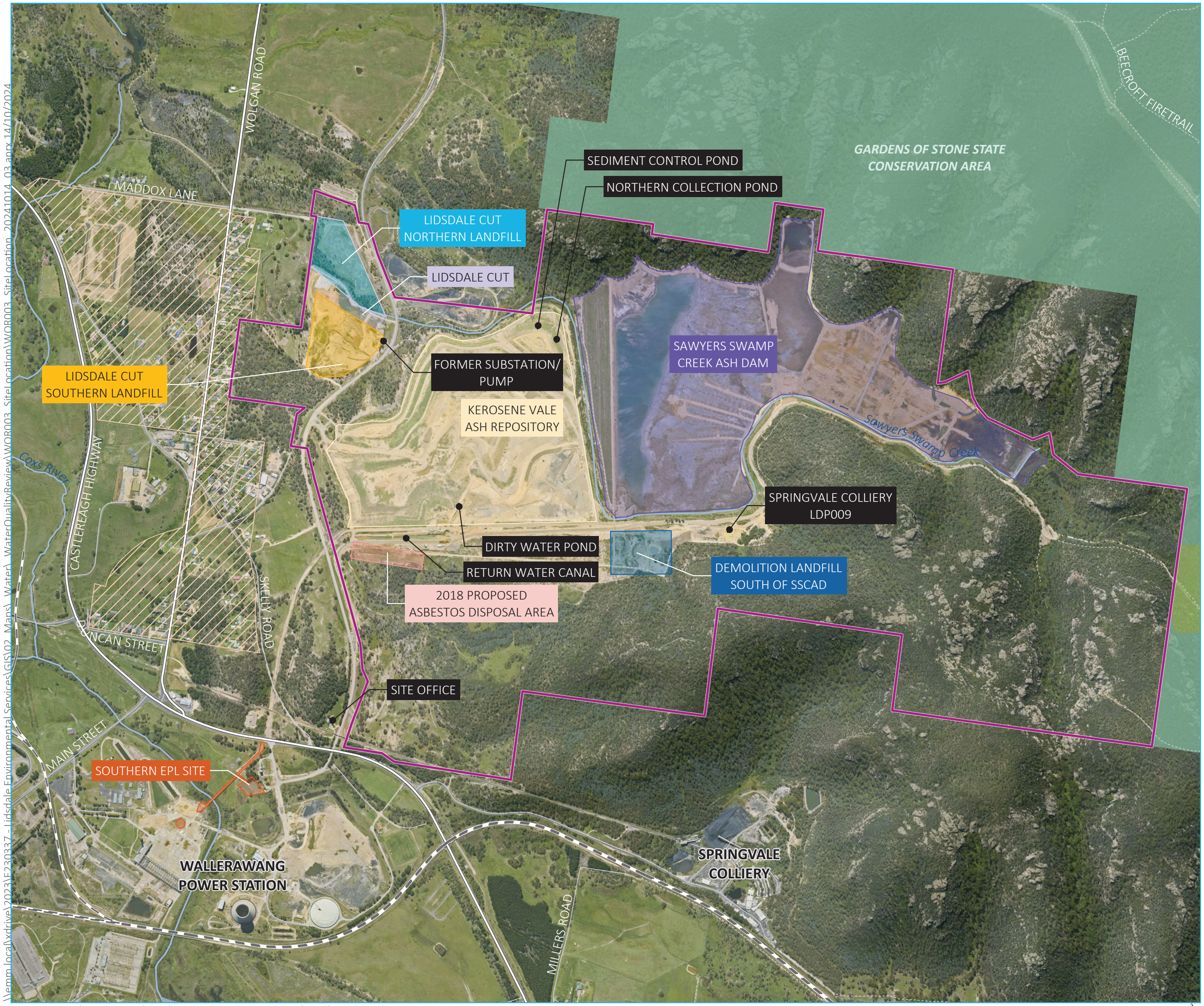
- the Kerosene Vale Dry Ash Repository (KVAR) and underlying former Kerosene Vale Ash Dam (KVAD)
- Sawyers Swamp Creek Ash Dam (SSCAD)
- The associated heavy vehicle access route
- KVAR and SSCAD private access routes.

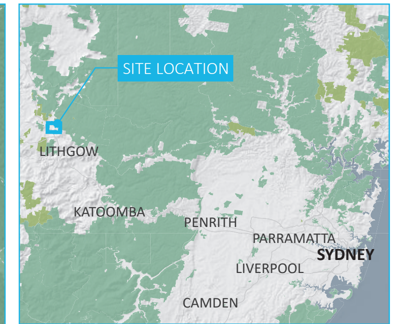
The primary ash repository areas are the KVAR, KVAD water management area and SSCAD. In 2014, the closure and demolition of the Power Station was approved. Currently the Site is operated on a care and maintenance arrangement consistent with NSW Planning Approval 07_0005 (MOD1) and Environment Protection Licence (EPL) No. 21185 (the EPL).

The Power Station was separated into two separate ownership parcels in 2020. GPM commenced ownership and responsibility for the land north of the Castlereagh Highway (referred to as the Kerosene Ash Dam Areas or the Site) in September 2020, taking over from Energy Australia NSW Pty Ltd. GPM's initial focus has been to manage the ongoing regulatory and contractual obligations for the Site. The longer-term objective is to plan for and then undertake the safe closure of the ash dams and repositories and appropriately remediate the balance of the Site for permanent closure.

Contamination at the site was notified to the NSW Environment Protection Authority (EPA) by GPM under section 60 of the Contaminated Land Management Act 1997 (CLM Act) on 10 March 2021. Following review of available information, EPA advised (on 27 June 2022), that the contamination is significant enough to warrant regulation under the CLM Act. Following this determination, the Site has been declared as significantly contaminated land under section 11 of the CLM Act. In 2023, GPM worked with the EPA to prepare a Voluntary Management Proposal (VMP) that establishes a proposed investigation and remediation approach (the VMP process).

Figure 1.1 shows the Site layout, noting the abovementioned features.





Source: EMM (2024); GPM (2023); DCSSS (2024); MetroMap (2024); GA (2009)

0 0.5 1 km

GDA2020 MGA Zone 56

N

KEY

- Site boundary
- Nearest sensitive (residential) receivers

Site layout

- 2018 proposed asbestos disposal area
- Demolition landfill south of SSCAD
- Kerosene Vale ash repository
- Lidsdale cut northern landfill
- Lidsdale cut southern landfill
- Lidsdale cut
- Sawyers Swamp Creek ash dam
- Southern EPL site

Existing environment

- Rail line
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

INSET KEY

- Major road
- NPWS reserve
- State forest

Site location

Lidsdale Environmental Services
Annual Water Quality Review
Figure 1.1

EMM creating opportunities

1.2 Report scope and structure

This report is an annual water quality review (AWQR) that has been developed to support the overarching annual environmental management report (AEMR) for the Site. The AEMR considers the period from 1 September 2023 – 31 August 2024 (the AEMR Period). The AWQR addresses the surface and groundwater monitoring and reporting requirements set out in the Lidsdale Ash Repository: Operation Environment Management Plan (OEMP) prepared by EMM Consulting in 2024.

Table 1.1 provides a summary of these requirements and notes where each requirement is addressed in this report.

This report is structured as follows:

- Chapter 2 describes the water management system
- Chapter 3 describes the AEMR Period
- Chapter 4 reviews surface water quality, and
- Chapter 5 reviews groundwater quality.

Table 1.1 OEMP – water monitoring and reporting requirements

	Description	OEMP reference	Report reference
Surface water			
Monitoring	Monthly monitoring will be undertaken at the following locations: <u>Coxs River:</u> • **WX12** – upstream of Sawyers Swamp Creek confluence • **S1** – downstream of Sawyers Swamp Creek confluence <u>Sawyers Swamp Creek:</u> • **SS5** – upstream of SSCAD • **S6** – downstream of SSCAD, upstream of SSCAD embankment and KVAR / KVAD water management area • **S5** – downstream of SSCAD, SSCAD embankment and the eastern part of KVAR / KVAD water management area • **WX5** – downstream of SSCAD, SSCAD embankment and KVAR / KVAD water management area, adjacent to Lidsdale Cut • **WX7** – downstream of the Site <u>Dump Creek:</u> • **WX11** – immediately upstream of the confluence with Sawyers Swamp Creek <u>Water Management System:</u> • **BLKH** – located in the Blackhole which is a waterbody that has formed adjacent to placed ash in SSCAD section B. • **SSCAD Pond** – a large water body located to the east of the SSCAD embankment. • **Lidsdale Cut** – a former open cut that contaminated water from the KVAR / KVAD Water Management Area is reticulated to. It is noted that additional monitoring within the water management system will be undertaken if specified in SMPs. This monitoring is referred to as Operational Monitoring and will be used to inform the operation of the water management system and therefore does not need to be reported in the AEMR.	Section 4.1 – Surface water quality sub-plan	Chapter 4

	Description	OEMP reference	Report reference
Analysis	Surface water quality results will be compared to: • Guideline Values (GVs) for a slightly-to-moderately disturbed upland river system. • Water quality trends at each sampling location (where available) since July 2019. Earlier data is not considered to be relevant due to the water quality in Sawyers Swamp Creek being strongly influenced by discharges from Springvale Colliery that occurred between 2013 and July 2019. The results will be interpreted by a suitably qualified professional who will describe any deviations from GVs and changes to water quality trends.	Section 4.1 – Surface water quality sub-plan	Chapter 4
Reporting	An Annual Surface Water Quality Review (ASWQR) will be prepared as part of the AEMR. The ASWQR will include: • a description of weather and streamflow conditions over the AEMR period (the period) • a description of the water management system that was operated over the period • all water quality data and analysis.	Section 4.1 – Surface water quality sub-plan	Chapter 4
Groundwater			
Monitoring	6-monthly groundwater quality monitoring at thirteen locations: • WGM1/D1 ^ • WGM1/D2 *^ • WGM1/D3 *^ • WGM1/D4 *^ • WGM1/D5 ^ • WGM1/D6 *^ • WH_MW02 * • WH_MW03 * • WI_MW03 * • WJ_MW03 * • WK_MW01 * • WK_MW04 * • WK_MW06 * ** Sites nominated in EP21185* *^ Current OEMP monitoring and reporting site* *Note that shallow seepage bore sites GW10, GW11, A9(AP09) and A17 (AP17) are not included in the OEMP but should continue to be sampled on a 6-monthly basis*	Appendix B – Groundwater sub-plan	Chapter 5
Analysis	Groundwater quality results will be compared to: • water quality trends at each location (where available) using recent data (since 2019). Earlier data is not considered to be relevant due to the water quality being influenced by discharges from Springvale Colliery that occurred between 2013 and July 2019 • the baseline data (Appendix A) as per the baseline condition as assessed in the Environmental Assessment • the ANZECC 2000 Irrigation and Ecosystem Protection guidelines used as a reference point.	Section 5.1 – Groundwater sub-plan	Chapter 5
Reporting	The groundwater quality monitoring data and associated analysis is to be reported in the AEMR.	Section 5.1 – Groundwater sub-plan	Chapter 5

1.3 EPL requirements and studies

GPM and the EPA have had ongoing discussions regarding water management improvements at the site. In February 2022, GPM prepared a table-form water management Action Plan (the Action Plan) that described water management improvements that were either underway or proposed. In a letter dated 20 May 2022, the EPA advised GPM that the Action Plan is an appropriate means to track progress and facilitate completion of the water management related pollution reduction program that was under discussion at the time.

The EPA varied EPL 21185 on 19 December 2023 to include (among other things):

- **Condition L2.4** – the concentration limit for sulphate was removed and limits were added for ammonia, cadmium, manganese and turbidity. The concentration limit for suspended solids was reduced from 30 to 20 mg/L.

- **Condition L2.5** – the definition of wet weather discharge was changed from streamflow in the Coxs River being >= 20ML/day to >= 10 ML/day.

- **Condition M2** – surface water monitoring requirements have has been revised so that:

  - weekly monitoring during discharge at EPL point 1 (known as LDP3) is now only required at the following monitoring locations: LDP3, WX9 and WX10A

  - monthly monitoring is undertaken at all other EPL surface water monitoring locations regardless of discharge or weather.

  It is noted that there were no changes to the surface water monitoring analytes or any groundwater monitoring requirements.

- **Condition U2** – the pollution reduction study focusing on Water Management was revised to:

  - acknowledge that short and medium-term measures have been implemented

  - replace the previous long-term measures with a new requirement to prepare a Water Treatment Management Suitability and Feasibility Assessment and submit to the EPA by 15 October 2024.

The following sections describe reports that have been submitted to the EPA to address the above conditions.

1.3.1 Water management and discharge impact assessments

A Discharge Water Quality Assessment for LDP3 (DWQA) (EMM 2021) was prepared in 2021 to address special EPL conditions, focusing on interim measures for the site over a two-year period. In August 2022, a Water Management Assessment (EMM 2022a) was submitted to the EPA, including an Action Plan for ongoing and proposed improvements, with a commitment to update the discharge impact assessment after the LDP3 Treatment System upgrade. In October 2022, a Discharge Impact Assessment (EMM 2022b) requested an EPL condition variation to set concentration limits for additional pollutants. Although the LDP3 Treatment System was upgraded in January 2023, a revised discharge impact assessment is still pending. Section 3.2 describes the actions that were implemented, progressed, or completed during the AEMR period.

1.3.2 6-monthly water quality monitoring reports

Condition R4 was added to the EPL when it was varied on 18 July 2022. GPM have prepared a Water Quality Monitoring Report for every six-month period since this date. The latest report issued was number four, which addresses the 6-month period between 18 January 2024 and 17 July 2024. The reports include:

- a description of site conditions and GPM actions over the reporting period, including a progress update on the Action Plan that was provided to the EPA in the Water Management Assessment (EMM 2022), and

- a review of surface and groundwater monitoring data that was collected in accordance with EPL Condition M.

As the purpose of this AWQR is to address OEMP requirements, data from the EPL monitoring program is not reported unless relevant to the OEMP requirements.

1.3.3 Surface and groundwater characterisation report

In September 2023 GPM submitted an Initial Groundwater Characterisation Report (EMM 2023a) and a Surface Water Characterisation Report (EMM 2023b) to the EPA. These reports collectively address EPL Conditions U1 and E1.2.

1.3.4 Voluntary Management Proposal

Contamination at the Site was notified to the EPA by GPM under section 60 of the CLM Act on 10 March 2021. Following review of available information, EPA advised (on 27 June 2022), that the contamination is significant enough to warrant regulation under the CLM Act. On 22 August 2022, the EPA agreed to a voluntary declaration and declared the site under a Contaminated Land Declaration Notice which declares the Site as significantly contaminated land under division 2 of the *Contaminated Land Management Act 1997*. GPM has submitted a VMP to the EPA that establishes a proposed investigation and remediation approach. The following sequence of events are anticipated:

- The Detailed Site Investigation (DSI) will be undertaken with the objective of identifying the nature and extent of contamination. The DSI report will include relevant data from the Initial Groundwater Characterisation Report (EMM 2023a) and the Surface Water Characterisation Report (EMM 2023b).
- A Human Health and Ecological Risk Assessment will be prepared (if required) to identify site specific soil and groundwater acceptance criteria for the Site and for the remediation works.
- A Remedial Options Assessment (ROA) and Remedial Action Plan(s) (RAP) will be prepared to inform remediation requirements. The Site Auditor's endorsement of/or confirmation that she/he has no objection to the ROA and RAP will be obtained and the EPA's approval of the RAP will be obtained.

1.4 OEMP update

The OEMP (including Operational Surface Water Management Plan) has been revised in the AEMR reporting period by EMM. These revisions have updated the approach for annual water quality monitoring results analysis. Once approved by DPHI this will be implemented.

To comply with CoA 6.5c), the results in previous annual water quality monitoring reports have used baseline data from July 2004 to January 2006 at the four surface water monitoring locations as per CoA 3.5. This report has not undertaken a comparison of current water quality against this baseline dataset. This baseline data relates to data collected immediately prior to wet ash placement in SSCAD ceasing. Dry ash was also being placed in Stage 1 of KVAR over the period. Hence, this data is no longer considered representative of pre-disturbance conditions and has little relevance to current site conditions.

2 Water management system overview

Surface water within the Site is described, in this Chapter, uses the following nomenclature:

- The Site's water management system includes:
  - **Sawyers Swamp Creek Ash Dam (SSCAD)** is an ash dam that was formed in the Sawyers Swamp Creek valley. It is divided into four sections (A, B, C and D) and has a total area of 82 ha. Each section is separated by earthen embankments. Section A comprises an open water body that is referred to as the SSCAD Pond and has areas of exposed ash. Sections B, C and D are referred to as the Upper Dam. A perched groundwater system exists within the placed ash (the perched SSCAD groundwater system).

    The SSCAD Pond is a large water body and is a central feature of the Site's overall water management system. It has historically received contaminated water from the KVAR/KVAD water management area and the SSCAD embankment drainage system. This has assisted in minimising incidental surface and groundwater discharges from the Site. SSCAD Pond also receives runoff from direct rainfall, a clean water catchment and overflows from the SSCAD Upper Dam (Section B, C and D). In late 2023, GPM commenced irrigating contaminated water from the KVAR/KVAD water management area and the SSCAD embankment drainage system to SSCAD Section C as part of an irrigation trial.

    Water accumulation in SSCAD Pond is managed via irrigation to exposed ash areas (when possible) and at times via controlled discharges to the Coxs River at a licensed discharge point located within the Power Station site (referred to as LDP3). Controlled discharges are treated in the LDP3 Treatment System which adjusts pH and reduces metal concentrations. Controlled discharges at LDP3 are regulated by EPL no. 21185, which has restrictions on when discharge can occur.

    During wet conditions, clean water runoff and groundwater inflows from the vegetated escarpments located to the north of SSCAD accumulate on the surface of Section B, C and D. Water quality testing has identified this water as being clean (as it has not infiltrated through the ash). Accordingly, during wet conditions, this water is pumped from Section B into Sawyers Swamp Creek. This practice has been successful in preventing overflows of clean water from the Upper Dam into SSCAD Pond. It is noted that GPM are currently constructing gravity operated systems that will minimise the volume of clean water that accumulates on Sections B, and C (refer Figure 2.1). Gravity drainage works in Section D were completed in early 2024 (Section 3.2).

  - **KVAR/KVAD water management area** is located to the west (downgradient) of SSCAD. KVAD is the Power Station's original ash dam which used to be an open cut mine void and KVAR is the dry ash compacted stockpile situated on top of the capped KVAD water management area. The combined area now has an associated water management system. A perched groundwater system exists within the KVAR (the perched KVAR groundwater system). Surface water runoff and seepage from this area drains to several water storage areas. Captured water that is known to be contaminated is pumped to the SSCAD Pond.

  - **Sawyers Swamp Creek Diversion** is a clean water system that manages streamflow from Sawyers Swamp Creek and runoff from catchment areas to the south of SSCAD. The system diverts clean water around SSCAD and the KVAR/KVAD water management area. The diversion eventually joins what is thought to be the original Sawyers Swamp Creek channel to the north-west of the Site.

- The following ancillary areas are located within the Site or are relevant to the Site's water management system:

- **Investigation Area** is a 24-ha area located west of the Site, downgradient from the KVAR / KVAD water management area. Parts of this area have been disturbed by mining that is understood to have occurred prior to the 1950s. There are known deposits of coal ash, chitter and a potential landfill in this area. Vegetation has re-established within most of the investigation area. GPM propose to investigate the potential for surface and groundwater contamination to occur from this area as part of the contaminated land investigations that are a separate process to this OEMP.

- **Upgradient clean water catchments** refer to clean water catchment areas that are upgradient of either the SSCAD or the Sawyers Swamp Creek Diversion. Runoff from these catchments has potential to interact with the Site's water management system via either direct inflows or system overflows during certain high flow events. Incidental discharge from the Site's water management system (discussed above) may also enter the Sawyers Swamp Creek Diversion at several locations.

- **Downgradient clean water** areas refer to parts of the Site that are not known to have been previously disturbed by mining operations or ash placement and drain away from the Site's water management system.

- **Dump Creek** is a first order watercourse that is located to the west of the Site. Parts of the Investigation Area are within the Dump Creek Catchment. There is also potential for some groundwater from the Site to flow to the north-west towards Dump Creek.

Figure 2.1 shows the locations of the above-mentioned water management areas and water management system features.

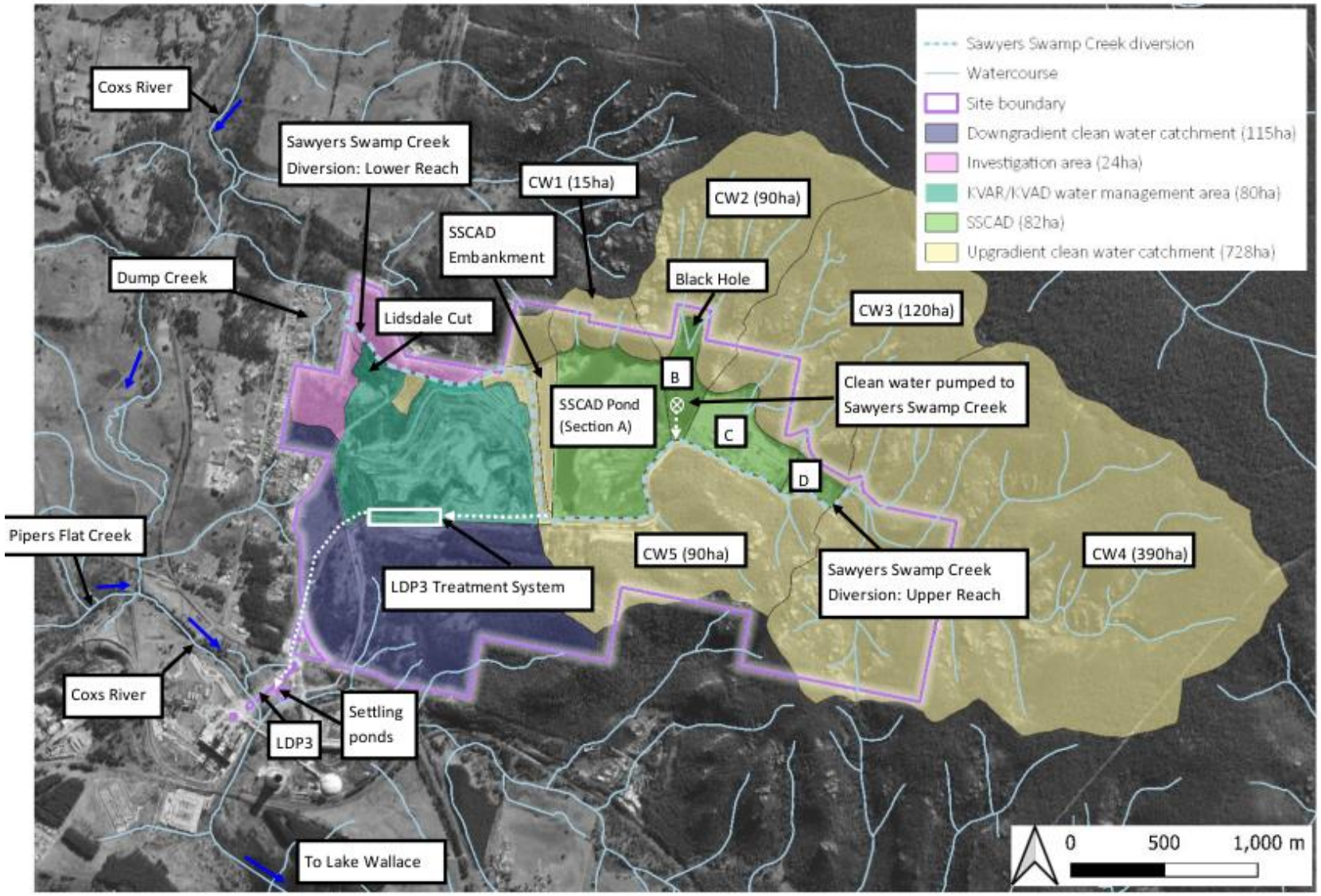


Figure 2.1 Water management areas

3 AEMR Period

This chapter describes the weather and key water management actions undertaken by GPM over the AEMR Period (1 September 2023 to 31 August 2024).

3.1 Weather conditions

Weather during the initial two months and last two months of the AEMR Period was characterised by generally dry conditions, with below median monthly rainfall. The remainder of the Period was characterised by generally wet conditions with above median rainfall occurring in seven of the eight months. The rainfall in April 2024 exceeded the 90th percentile monthly rainfall. Due to the generally wet conditions, surface water and groundwater inflows into the Site's water management system were higher than during the recent dry period (December 2022 to October 2023). Streamflow rates in the receiving waters (Sawyers Swamp Creek and the Coxs River) were also higher.

A total of 843 mm of rainfall was recorded over the AEMR Period at the Bureau of Meteorology (BoM) Station 63132 at Lidsdale (Maddox Lane), which is located 2 km north-west of the Site. Figure 3.1 compares the recorded rainfall (at Lidsdale (Maddox Lane)) to the median and the 90th percentile monthly rainfall calculated from the 60-year gauge record.

As shown in Figure 3.1, rainfall during four months of the monitoring period (November 2023, December 2023, January 2024 and April 2024) was above 100 mm, which is above the monthly median, with April 2024 exceeding the monthly rainfall 90th percentile. These conditions are described in this report as being persistently wet. After May 2024, rainfall exceeded the monthly median in two of four months indicating a variable winter condition in 2024.

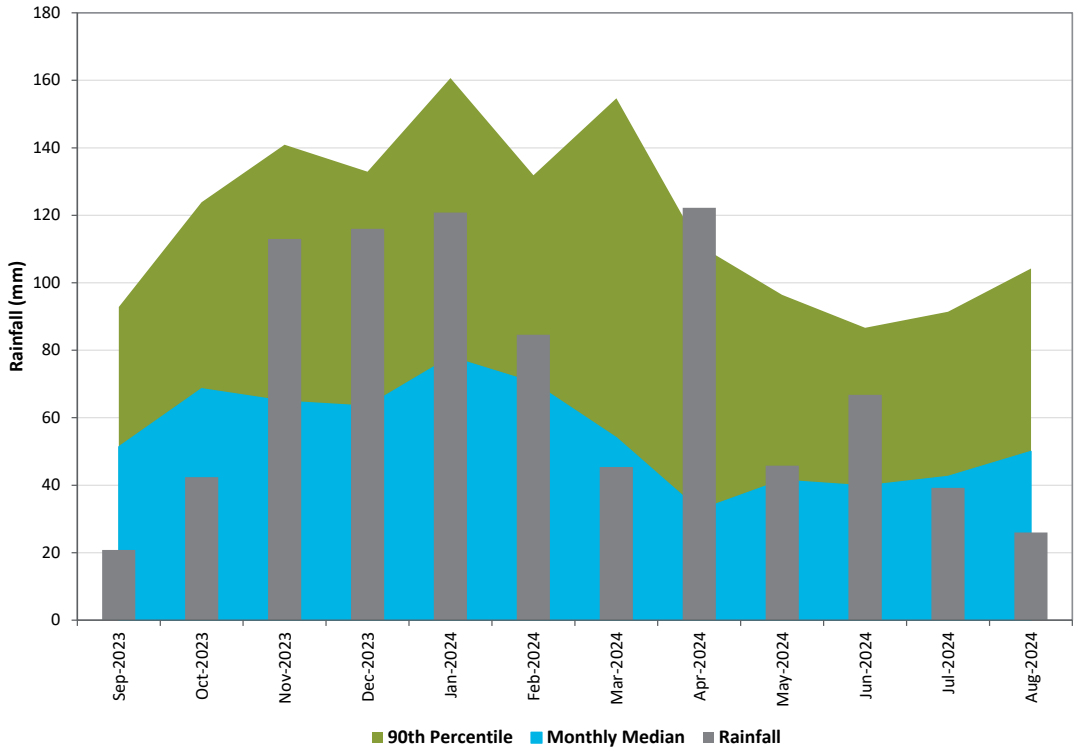


Figure 3.1 Monthly rainfall over the AEMR Period

3.2 Water management actions

GPM have been and continue to progressively improve the water management system to:

- comply with dam safety management obligations
- improve the capture and containment of contaminated water
- improve the treatment of water discharged at LDP3
- reduce the volume of contaminated water that requires management
- improve clean water separation and stormwater management.

These improvements require numerous works at various locations within the Site. Many works have been completed to date which have resulted in significant improvements, with further improvements expected overtime. During the AEMR Period, updated Action Plans were included in Water Quality Monitoring Reports that were submitted to the EPA in March and September 2024. These plans provided an update on the progress of the improvement works, including anticipated implementation timeframes.

The 6 monthly reports (EMM 2024a) have progressively tracked actions for the AWQR period seen in Table 3.1.

Table 3.1 Water management system operations

Water management area	Description of operations during the Current Period
KVAR/KVAD Water Management Area	• All known seepage and subsurface drainage discharges from KVAD were collected in the seepage collection system which reticulates all captured water to Lidsdale Cut. Lidsdale Cut was dewatered to SSCAD, with most water irrigated in a segregated portion of SSCAD Section C as part of the irrigation trial. • Most stormwater runoff from KVAD and KVAR was managed in the stormwater system.
SSCAD embankment drainage system	• Seepage from the SSCAD embankment foundation and abutment drains was collected and pumped into the KVAR/KVAD contaminated water system, which is dewatered to SSCAD.
SSCAD Upper Dam	• Pumping of clean water from the surface of SSCAD Sections B and C into the Sayers Swamp Creek Diversion occurred intermittently during the period. GPM undertook additional monitoring when pumping was occurring. It is noted that this monitoring was in addition to the EPL requirements and is therefore not included in this report. • Construction of the gravity diversion works (referred to as CP1) to transfer clean water runoff that enters the northern portion of SSCAD Section D into the Sayers Swamp Creek Diversion was completed. Construction of other systems for SSCAD Section B and C (CP3,4 and CP2 respecfully) continued during the period. • Construction of gravity diversion dams from the Black Hole to the Sawyers Swamp Creek Diversion (CP3 and CP4) was paused between August 2023 and February 2024 due to an active Sea Eagle nesting site being discovered near the works area. • As noted above, the trial of irrigating contaminated water from Lidsdale Cut onto the surface of SSCAD Section C commenced during the period. It is noted that the irrigation area is segregated from the part of SSCAD Section C where clean water accumulates and is pumped into the Sawyers Swamp Creek Diversion.

Table 3.1 Water management system operations

Water management area	Description of operations during the Current Period
SSCAD Pond	• Water accumulation in SSCAD Pond was managed by evaporation from the pond, irrigation of exposed ash in SSCAD Section A and discharges at LDP3 when the water level was above the safe operating level. 39 ML of treated water from SSCAD Pond was discharged at LDP3 in September 2023 and 188 ML was discharged between mid-February and mid-May 2024. Between end of June and August 2024 an additional 43 ML occurred. The total discharge at LDP3 between September 2023 and August 2024 is 270 ML. • Irrigation of treated water from SSCAD Pond in the western portion of the Site was also undertaken intermittently when the water level in SSCAD Pond was below the safe operating level.
LDP3	• During the AEMR Period, discharge of treated water at LDP3 occurred in 142 out of 365 days. The total discharge at LDP3 between September 2023 and August 2024 was 270 ML. – the minimum streamflow to discharge ratio of 10:1 was generally maintained, and most discharges occurred at a higher ratio (i.e. the discharge rate was less than 10% of the streamflow rate). – discharges only occurred when the Coxs River streamflow was above 20 ML/day, which was the minimum streamflow rate for which discharge could occur prior to the 19 December 2023 EPL variation. • During the period accumulated sludge was removed from the Return Canal and new limestone leaky weirs were installed to improve the containment of sludge.

4 Surface water quality review

This chapter reviews surface water quality data from the OEMP monitoring locations over the AEMR Period. It includes a description of the monitoring requirements and assessment criteria established in the OEMP and presents and discusses the surface water quality data.

4.1 OEMP monitoring requirements

4.1.1 Monitoring requirements

The environmental monitoring plan established in the OEMP identifies 12 surface water monitoring locations. Table 4.1 describes each of these monitoring locations and associated monitoring requirements. Monitoring locations are provided in Figure 4.1.

Table 4.1 Surface water monitoring requirements

Monitoring location	Description	Monitoring frequency	Monitoring analytes
WMS3 – Lidsdale Cut	Lidsdale Cut is one of the storages in the KVAR water management system (see Chapter 2). It receives runoff and collected seepage from the western portion of the KVAR water management area. Lidsdale Cut is dewatered to SSCAD Pond on an as needed basis.	Monthly Monitoring	See Table 4.2
WX11 – Dump Creek	Dump Creek is a 1st order watercourse located to the west (down gradient) of the KVAR water management area (see Figure 4.1). It flows to the north and joins Sawyers Swamp Creek upstream of WX7 (see Figure 4.1).		
WMS1 – Sawyers Swamp Creek Ash Dam	This monitoring location is in the SSCAD Pond (see Figure 4.1).		
WX7 – Sawyers Swamp Creek	WX7 is located on Sawyers Swamp Creek approximately 500 m downstream of the Site.		
WX12 – Upstream of Sawyers Swamp Creek confluence	To characterise the quality of the water in the Coxs River upstream and downstream of the Sawyers Swamp Creek confluence and to enable an assessment of water quality impacts to the Coxs River.		
S1 – Downstream of Sawyers Swamp Creek confluence			
SS5 – Upstream of SSCAD	SS5 is located upstream of SSCAD and is therefore not potentially impacted by the Site's water management system. Water quality data from SS5 can be used to: • identify changes in Swayer Swamp Creek water quality within the Site (i.e. by comparison with downstream samples); and • categorise water quality within the Site's water management system. It is noted that historically S7 has been used as an upstream monitoring location. SS5 replaces S7 as it was recently discovered that S7 is on a tributary to Sawyers Swamp Creek.		

Table 4.1 Surface water monitoring requirements

Monitoring location	Description	Monitoring frequency	Monitoring analytes
S6 – Downstream of SSCAD, upstream of SSCAD embankment and KVAR / KVAD water management area	To identify changes in water quality in the upper reach of the Sawyers Swamp Creek Diversion, which flows to the south of SSCAD.		
S5 - Downstream of SSCAD, SSCAD embankment and the eastern part of KVAR / KVAD water management area	To identify changes in water quality in the Sawyers Swamp Creek Diversion reach, that flows between the SSCAD embankment and the eastern portion of the KVAR/KVAD water management area. This reach may receive seepage from SCCAD and the eastern portion of KVAD.		
WX5 - Downstream of SSCAD, SSCAD embankment and KVAR / KVAD water management area, adjacent to Lidsdale Cut	To identify changes in water quality in the lower reach of the Sawyers Swamp Creek Diversion, which flows past the northern portion of the KVAR/KVAD water management area. This reach of the creek may receive seepage from western and northern portions of KVAD.		
BLKH - Located in the Blackhole which is a waterbody that has formed adjacent to placed ash in SSCAD section B.	To characterise water quality in the Blackhole which receives catchment runoff from the north of the site.		
WMS1 -SSCAD pond	To characterise water quality in SSCAD Pond and comply with CoA 3.5a		

Table 4.2 provides the surface water monitoring analytes that are established in the OEMP.

Table 4.2 Surface water monitoring analytes – OEMP

Category	Analytes[1]
Physico-chemical	pH, electrical conductivity (EC), alkalinity, total dissolved solids, dissolved oxygen, turbidity, total phosphorus, total nitrogen, turbidity, redox, total suspended solids, total hardness, ammonia
Anions	Chloride, fluoride, sulphate
Cations	Sodium, potassium, calcium, magnesium
Metals[2]	Aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, vanadium, zinc

Notes: 1. Sourced from OEMP Table A in Appendix B plus additional analytes noted in the surface and groundwater water quality sub-plans (OEMP Sections 6.4 and 6.5).
2. Refers to total concentrations unless stated as filtered

KEY
- Site boundary
- Stream gauge

EPL routine monitoring network
- Groundwater
- Surface water
- Discharge

Existing environment
- Rail line
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

Source: EMM (2024); GPM (2023); DCSSS (2024); MetroMap (2024)

0 0.5 1 km

GDA2020 MGA Zone 56

N

Surface water monitoring locations

Lidsdale Environmental Services
Annual Water Quality Review
Figure 4.1

EMM creating opportunities

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4.1.2 Assessment criteria

The surface water quality sub-plan (surface water sub plan Section 4.1) specifies that surface water monitoring results are to be compared to:

- Guideline Values (GVs) for a slightly-to-moderately disturbed upland river system. GVs are provided in Appendix A, Table A.2 of the Surface water management sub plan OEMP. The GV are the default values for a slightly-to-moderately disturbed upland river system that are provided in ANZG 2018.

- The 80th percentile values at Sawyers Swamp Creek upstream of SSCAD (monitoring site SS5) have been calculated using data from 22 samples collected between 15 December 2021 to 21 July 2022 (all parameters); plus data from samples collected between 2013 to December 2021 that included pH (51 samples), EC (47 samples), turbidity (48 samples), boron (3 samples), copper (4 samples), manganese (45 samples), vanadium (28 samples) and zinc (28 samples), (note that these samples are in addition to the 22 samples mentioned above).

- Water quality trends at each sampling location (where available) since July 2019. Earlier data is not considered to be relevant due to the water quality in Sawyers Swamp Creek being strongly influenced by discharges from Springvale Colliery that occurred between 2013 and July 2019.

No baseline data for the Coxs River has been provided in the recent OEMP for use in comparisons. To maintain consistency with previous assessments, the comparison data relied on in this document are the DGVs for a slightly-to-moderately disturbed upland river system and ambient conditions monitored in the upstream of Coxs River. This includes:

- The 80th percentile values at Coxs River (monitoring site WX12) have been calculated using data from 22 samples collected between 16 August 2022 to 16 August 2024 (all parameters).

- The Coxs River is known to have water that has a moderate hardness (i.e. Ca CO_3 between 60 – 119 mg/L). Hence, hardness adjustments have been made to the DGVs for lead, cadmium, nickel and zinc using the ANZG 2018 / ANZECC 2000 methodology. In previous reports, a water hardness (mg/L of $CaCo_3$) of 99 was used to calculate the adjusted values. This was the median water hardness calculated from the Coxs River water quality monitoring location WX9 that is upstream of the LDP3 using data from the January 2022 to January 2023. During the current period, the median water hardness (mg/L of $CaCo_3$) at WX9 increased to 140 due to the drier conditions. To maintain consistency with previous reports, hardness adjustments for the Current Period (i.e. this report) were calculated using a water hardness of 99. This is a conservative approach given that using a higher hardness would increase the DGVs.

Table 4.3 describes the surface water assessment criteria for each monitoring location. It is noted that the baseline data is provided as a range.

Table 4.3 Surface water assessment criteria

		Guideline values (GVs)		Sawyers Swamp Creek upstream of SSCAD (SS5)	Coxs River upstream (WX12)[1]
Parameters	**Units**	**DGV**	**Source**	**80th percentile value**	
Physico-chemical parameters					
pH	-	6.5 - 8.0	Default Guideline Value (DGV) for upland river in south-east Australia (Table 3.3.2; ANZECC 2000)	5.5 – 6.8	6.5 – 7.0

		Guideline values (GVs)		Sawyers Swamp Creek upstream of SSCAD (SS5)	Coxs River upstream (WX12)[1]
Parameters	**Units**	**DGV**	**Source**	**80th percentile value**	
EC	µS/cm	350	DGV for NSW upland rivers (Table 3.3.3; ANZECC 2000)	114	1,244
Turbidity	NTU	2 - 25	DGV for upland river in south-east Australia (Table 3.3.2; ANZECC 2000)	26	24
Metals (refers to results from 45 µm filtered samples only)					
Aluminium	mg/L	0.055	Low reliability DGV (pH > 6.5) (ANZG 2018)	0.160	0.030
Antimony	mg/L	0.009	Unknown reliability DGV (ANZG 2018)	<0.001	<0.001
Arsenic	mg/L	0.013	Moderate reliability DGV for As(V) (ANZG 2018)	<0.001	<0.001
Boron	mg/L	0.94	Very high reliability DGV (ANZG 2018)	<0.05	0.025
Cadmium[2]	mg/L	0.0002 (SSC) 0.001 (Coxs R)	Very high reliability DGV (ANZG 2018)	<0.0001	<0.0001
Chromium	mg/L	0.001	Very high reliability DGV for Cr(VI) (ANZG 2018)	<0.001	<0.001
Cobalt	mg/L	0.0014	Unknown reliability DGV (ANZG 2018)	0.005	0.011
Copper	mg/L	0.0014	Very high reliability DGV (ANZG 2018)	<0.001	<0.001
Lead[2]	mg/L	0.0034 (SSC) 0.0155 (Coxs R)	Moderate reliability DGV (ANZG 2018)	<0.001	<0.001
Manganese	mg/L	1.9	Moderate reliability DGV (ANZG 2018)	0.265	0.910
Mercury	mg/L	0.00006	Moderate reliability DGV for 99% species protection level recommended for slightly to moderately disturbed systems due to the potential for bioaccumulation (ANZG 2018)	<0.00004	<0.00005
Molybdenum	mg/L	0.034	Unknown reliability DGV (ANZG 2018)	<0.001	<0.001
Nickel[2]	mg/L	0.011 (SSC) 0.030 (Coxs R)	Low reliability DGV (ANZG 2018)	0.002	0.091
Selenium	mg/L	0.005	Moderate reliability DGV for 99% species protection level recommended for slightly to moderately disturbed systems due to the potential for bioaccumulation (ANZG 2018)	<0.01	<0.001
Silver	mg/L	0.00005	Low reliability DGV (ANZG 2018)	<0.001	<0.001
Vanadium	mg/L	0.006	Unknown reliability DGV (ANZG 2018)	<0.01	<0.001
Zinc[2]	mg/L	0.008 (SSC) 0.022 (Coxs R)	Very high reliability DGV (ANZG 2018)	0.034	0.038

Notes:
1. 80th percentile values subject to update as additional data becomes available
2. Hardness corrected guideline value based on Coxs River having a median water hardness of approximately 99 mg/L as $CaCO_3$.

4.2 Results

Surface water monitoring results for the AEMR Period are presented and discussed in this section. The results for each monitoring location are presented in table form and compared to the assessment criteria established in Section 4.1.2.

Results for key analytes from all surface water monitoring locations are also presented as time-series charts provided in Appendix A. These charts show all results from 1 September 2022 to the end of the AEMR Period and can be used to establish water quality trends (i.e. increasing or decreasing concentrations).

4.2.1 Lidsdale Cut – WMS3

Lidsdale Cut is one of the storages in the KVAR/KVAD water management system (see Figure 4.1). It receives collected seepage from the KVAD and runoff from the western portion of the KVAR/KVAD water management area. Captured water has historically been dewatered via pumping to SSCAD Pond however, following October 2023, this water has now been redirected to an irrigation scheme within Section C of SSCAD. It is noted that in previous AEMR reports, Lidsdale Cut was sampled as WX5 but was changed to WMS3 in 2022 following a review of surface water monitoring locations.

Eight samples were collected from Lidsdale Cut over the AEMR Period. Table 4.4 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that the water quality in Lidsdale Cut has an acidic pH, high salinity and generally high metal concentrations. These characteristics are consistent with ash affected water at the Site and are expected given that Lidsdale Cut receives collected seepage from the KVAD contaminated water management system.

The water quality concentrations of aluminium, cadmium, copper, nickel and zinc exceed the DGV and baseline range. The elevated concentrations of these metals are consistent with water quality in previous AEMR periods (see time-series charts in Appendix A).

The data confirms that the current management approach of dewatering Lidsdale Cut to the SSCAD for ongoing management is appropriate.

Table 4.4 Lidsdale Cut WMS3 – results summary

	Units	DGV	Baseline range[2]	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	5.5 - 6.8	8	**3.1**	**5.0**	**3.7**
EC	µS/cm	350	114	8	**442**	**1,455**	**1,262**
DO	mg/L	-	NM	8	5.7	11.1	7.8
Turbidity	mg/L	-	25	8	1.0	25.0	2.5
Total dissolved solids	NTU	-	NM	8	410	1,300	1,100
Total nitrogen	mg/L	-	NM	8	0.20	1.10	0.75
Total phosphorus	mg/L	-	NM	8	<0.05	<0.05	0.025
Anions							
Chloride	mg/L	-	NM	8	8	29	21
Fluoride	mg/L	-	NM	8	1.3	4.2	3.5

Table 4.4 Lidsdale Cut WMS3 – results summary

	Units	DGV	Baseline range[2]	No. samples	Minimum	Maximum	Median
Sulphate	mg/L	-	NM	8	240	1,100	730
Cations							
Sodium	mg/L	-	NM	8	27	120	91
Potassium	mg/L	-	NM	8	17	55	50
Calcium	mg/L	-	NM	8	30	98	82
Magnesium	mg/L	-	NM	8	14	44	42
Metals[1]							
Aluminium	mg/L	0.055	0.160	8	**3.5**	**19.0**	**12.5**
Antimony	mg/L	0.009	<0.001	8	<0.001	<0.001	0.0005
Arsenic	mg/L	0.013	<0.001	8	<0.001	0.0050	0.0025
Silver	mg/L	0.00005	<0.001	8	<0.001	<0.001	**0.0005**
Barium	mg/L	-	NM	8	0.009	0.077	0.033
Boron	mg/L	0.94	<0.05	8	0.94	**3.30**	**2.50**
Cadmium	mg/L	0.0002	<0.0001	8	**0.0014**	**0.0049**	**0.0021**
Chromium	mg/L	0.001	<0.001	8	0.001	**0.002**	0.001
Copper	mg/L	0.0014	<0.001	8	**0.002**	**0.006**	**0.003**
Iron	mg/L	-	NM	8	0.6	13.0	4.8
Mercury	mg/L	0.00006	<0.00004	8	<0.00005	<0.00005	0.00003
Manganese	mg/L	1.9	0.265	8	1.8	**5.8**	**4.5**
Molybdenum	mg/L	0.034	<0.001	8	<0.001	<0.001	0.001
Nickel	mg/L	0.011	0.002	8	**0.14**	**0.50**	**0.38**
Lead	mg/L	0.0034	NM	8	**0.004**	**0.022**	**0.012**
Selenium	mg/L	0.005	<0.01	8	0.001	0.002	0.001
Zinc	mg/L	0.008	0.034	8	**0.41**	**1.20**	**0.95**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples.
2. The 80th percentile values at Sawyers Swamp Creek upstream of SSCAD (monitoring site SS5) calculated using data from 22 samples collected between 15 December 2021 to 21 July 2022 (all parameters); plus data from samples collected between 2013 to December 2021 that are available for pH (51 samples), EC (47 samples), turbidity (48 samples), boron (3 samples), copper (4 samples), manganese (45 samples), vanadium (28 samples) and zinc (28 samples) - note these samples are in addition to the 22 samples mentioned above.

Table 4.5 SSCAD Pond WMS1– results summary

	Units	DGV	Baseline range[2]	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	5.5 - 6.8	8	**4.2**	**6.2**	**4.7**
EC	µS/cm	350	114	8	**767**	**1,117**	**915**
DO	mg/L	-	NM	8	5.3	12.2	6.75
Turbidity	mg/L	-	25	8	2	28	9
Total dissolved solids	NTU	-	NM	8	730	920	840
Total nitrogen	mg/L	-	NM	8	0.10	0.20	0.05
Total phosphorus	mg/L	-	NM	8	<0.05	<0.05	0.025
Anions							
Chloride	mg/L	-	NM	8	15	48	20
Fluoride	mg/L	-	NM	8	1.6	3.1	2.9
Sulphate	mg/L	-	NM	8	430	570	535
Cations							
Sodium	mg/L	-	NM	8	68	110	90
Potassium	mg/L	-	NM	8	27	45	39
Calcium	mg/L	-	NM	8	48	71	666
Magnesium	mg/L	-	NM	8	17	25	23
Metals[1]							
Aluminium	mg/L	0.055	0.160	8	**1.7**	**11.0**	**8.4**
Antimony	mg/L	0.009	<0.001	8	<0.001	<0.001	0.001
Arsenic	mg/L	0.013	<0.001	8	0.001	0.005	0.003
Silver	mg/L	0.00005	<0.001	8	<0.001	<0.001	**0.001**
Barium	mg/L	-	NM	8	0.029	0.057	0.043
Boron	mg/L	0.94	<0.05	8	**1.7**	**3.2**	**2.9**
Cadmium	mg/L	0.0002	<0.0001	8	**0.002**	**0.004**	**0.003**
Chromium	mg/L	0.001	<0.001	8	<0.001	<0.001	0.001
Copper	mg/L	0.0014	<0.001	8	**0.003**	**0.014**	**0.011**
Iron	mg/L	-	NM	8	0.02	0.35	0.195
Mercury	mg/L	0.00006	<0.00004	8	<0.00005	<0.00005	0.00003
Manganese	mg/L	1.9	0.265	8	**2.4**	**3.5**	**3.1**

Table 4.5 SSCAD Pond WMS1– results summary

	Units	DGV	Baseline range[2]	No. samples	Minimum	Maximum	Median
Molybdenum	mg/L	0.034	<0.001	8	0.001	0.008	0.004
Nickel	mg/L	0.011	0.002	8	**0.12**	**0.22**	**0.17**
Lead	mg/L	0.0034	NM	8	0.001	0.002	0.002
Selenium	mg/L	0.005	<0.01	8	0.001	0.002	0.001
Zinc	mg/L	0.008	0.034	8	**0.26**	**0.57**	**0.4**

4.2.2 SSCAD Pond – WMS1

SSCAD Pond refers to the waterbody that is in the western portion of the SSCAD, adjacent to the dam's embankment. It is a large water body and is a central feature of the Site's overall water management system. Water accumulation in the SSCAD Pond, via localised surface and groundwater, is managed via irrigation to exposed ash areas and at times via controlled discharges into the Coxs River at LDP3, following treatment.

Eight samples were collected from SSCAD Pond, which was renamed as site WMS1 on 16 August 2022. Table 4.5 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range. The results from the eight samples have consistent water quality, which is characterised as having a pH ranging between 4.2 and 6.2 and elevated salinity and metal concentrations. The pH is typically lower than the baseline range. Aluminium, boron, cadmium, copper, manganese, nickel and zinc concentrations, all consistently exceed the respective DGVs. However, the reported metal concentrations have not changed significantly from previous AEMR periods.

Treated water from SSCAD Pond was discharged to the Coxs River via LDP3 over the period. Monitoring of discharges at LDP3 was undertaken in accordance with the requirements of the EPL. This data is not reported in this AWQR as the scope of this review is to address the OEMP. However, the data is provided in the various water quality reports issued to the EPA (see Section 1.3), the EPL annual return and on GPM's website.

Notes: Reported metal concentrations for the current AEMR Period are from filtered samples.

1. **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.
2. The 80th percentile values at Sawyers Swamp Creek upstream of SSCAD (monitoring site SS5) calculated using data from 22 samples collected between 15 December 2021 to 21 July 2022 (all parameters); plus data from samples collected between 2013 to December 2021 that are available for pH (51 samples), EC (47 samples), turbidity (48 samples), boron (3 samples), copper (4 samples), manganese (45 samples), vanadium (28 samples) and zinc (28 samples) - note these samples are in addition to the 22 samples mentioned above.

4.2.3 Dump Creek – WX11

Dump Creek is located to the west (down gradient) of the KVAR/KVAD water management area and flows to the north and joins Sawyers Swamp Creek upstream of WX7 (see Figure 1.1).

11 samples were collected from Dump Creek over the AEMR Period. Table 4.6 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that the water quality in Dump Creek is variable. The pH, salinity and metal concentrations in some samples exceed the DGV and ambient concentrations in Sawyers Swamp Creek at WX7 (see Section 4.2.4) indicating that some ash affected water is seeping via groundwater baseflow into Dump Creek. As some results have water quality that is consistent with clean water, it is interpreted that surface water runoff in the Dump Creek catchment is generally clean and that seep(s) of ash affected water may impact water quality during dry conditions when the streamflow is minimal. The aluminium, copper, manganese, nickel and zinc concentrations

were highest in September 2023 which only recorded 21 mm of rainfall. Metal exceedances were fewer between January and March 2024 which correlated to higher rainfall months.

The time-series results presented in Appendix A shows that the water quality in Dump Creek is generally consistent with the prior AEMR Periods.

Table 4.6 Dump Creek WX11 – results summary

	Units	DGV	Baseline range[2]	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	5.5 - 6.8	11	**5.8**	6.8	**6.3**
EC	µS/cm	350	114	11	260	**871**	**411**
DO	mg/L	-	NM	11	1.3	4.0	2.9
Turbidity	mg/L	-	25	11	2	600	74
Total dissolved solids	NTU	-	NM	11	300	460	360
Total nitrogen	mg/L	-	NM	11	0.2	21.0	2.7
Total phosphorus	mg/L	-	NM	11	<0.05	6.40	0.68
Anions							
Chloride	mg/L	-	NM	11	14	42	24
Fluoride	mg/L	-	NM	11	0.3	0.5	0.4
Sulphate	mg/L	-	NM	11	120	270	190
Cations							
Sodium	mg/L	-	NM	11	29	52	42
Potassium	mg/L	-	NM	11	9	24	11
Calcium	mg/L	-	NM	11	12	32	22
Magnesium	mg/L	-	NM	11	9	19	17
Metals[1]							
Aluminium	mg/L	0.055	0.160	11	0.02	**0.24**	**0.10**
Antimony	mg/L	0.009	<0.001	11	<0.001	<0.001	0.001
Arsenic	mg/L	0.013	<0.001	11	<0.001	0.003	0.001
Silver	mg/L	0.00005	<0.001	11	<0.001	<0.001	0.001
Barium	mg/L	-	NM	11	0.012	0.044	0.025
Boron	mg/L	0.94	<0.05	11	0.33	**0.96**	0.43
Cadmium	mg/L	0.0002	<0.0001	11	0.0001	0.0001	0.0001
Chromium	mg/L	0.001	<0.001	11	<0.001	<0.001	0.001
Copper	mg/L	0.0014	<0.001	11	0.001	**0.024**	**0.002**
Iron	mg/L	-	NM	11	0.1	28.0	3.7

Table 4.6 Dump Creek WX11 – results summary

	Units	DGV	Baseline range[2]	No. samples	Minimum	Maximum	Median
Mercury	mg/L	0.00006	<0.00004	11	<0.00005	<0.00005	0.00003
Manganese	mg/L	1.9	0.265	11	**0.7**	**2.9**	**2.1**
Molybdenum	mg/L	0.034	<0.001	11	<0.001	<0.001	0.001
Nickel	mg/L	0.011	0.002	11	0.009	**0.099**	**0.053**
Lead	mg/L	0.0034	NM	11	0.001	0.001	0.001
Selenium	mg/L	0.005	<0.01	11	<0.001	<0.001	0.001
Zinc	mg/L	0.008	0.034	11	0.006	**0.160**	**0.043**

Notes: Reported metal concentrations for the current AEMR Period are from filtered samples.

1. **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.
2. The 80th percentile values at Sawyers Swamp Creek upstream of SSCAD (monitoring site SS5) calculated using data from 22 samples collected between 15 December 2021 to 21 July 2022 (all parameters); plus data from samples collected between 2013 to December 2021 that are available for pH (51 samples), EC (47 samples), turbidity (48 samples), boron (3 samples), copper (4 samples), manganese (45 samples), vanadium (28 samples) and zinc (28 samples) - note these samples are in addition to the 22 samples mentioned above.

4.2.4 Blackhole – BLKH

Blackhole is a waterbody that has formed adjacent to placed ash in SSCAD Section B. Construction of gravity diversions (CP3 and CP4) from the Blackhole to the Sawyers Swamp Creek Diversion commenced in Autumn 2023 and remains ongoing. The construction activities included dewatering the Blackhole and limited filling to create access to construct CP3 and 4. Dewatering volumes were pumped into SSCAD Pond. Dewatering has now reduced to minimal levels to maintain a steady water level until CP3 and 4 construction recommences.

11 samples were collected from Blackhole over the AEMR Period. Table 4.7 the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that the water quality in Blackhole is variable. The salinity has remained relatively stable and generally below the DGV. The metal concentrations in some samples exceeded both the DGV and typical concentrations at Blackhole indicating that some ash affected water is seeping into Blackhole. Blackhole receives surface water runoff from clean water catchments north of SSCAD. During dewatering activities that significantly reduce the water level (such as those being undertaken during construction activities) within the waterbody, it has become evident that inflows increase from the SSCAD perched groundwater table which can lead to changes in water quality. The highest concentrations of aluminium, boron, cadmium, manganese, nickel and zinc occurred in January 2024, when construction dewatering activities were underway. ….

The time-series results presented in Appendix A shows that the metal concentrations were elevated between Quarter 4 2023 and Quarter 1 2024 which straddles the previous and current AEMR periods. The metal parameters aluminium, cadmium, copper, manganese, nickel and zinc concentrations exceed the DGV and baseline conditions during this period. Boron concentrations remain below the DGV but have consistently been elevated in comparison to the previous AEMR period. Dewatering activities have been continued as required by the operations however, these are currently undertaken only to maintain a steady water level rather than drawdown of stored water levels within the Blackhole waterbody due to the construction being paused. Water quality concentrations have been recovering overtime back to the levels recorded through a majority of 2023.

Table 4.7 Blackhole BLKH – results summary

	Units	DGV	Baseline range[2]	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	5.5 - 6.8	11	**5.7**	7.4	6.5
EC	µS/cm	350	114	11	115	**398**	173
DO	mg/L	-	NM	11	5.3	9.5	6.9
Turbidity	mg/L	-	25	11	8	447	25
Total dissolved solids	NTU	-	NM	11	68	340	110
Total nitrogen	mg/L	-	NM	11	<0.1	0.8	0.4
Total phosphorus	mg/L	-	NM	11	0.05	0.50	0.03
Anions							
Chloride	mg/L	-	NM	11	6	10	8
Fluoride	mg/L	-	NM	11	0.2	0.8	0.3
Sulphate	mg/L	-	NM	11	17	160	30
Cations							
Sodium	mg/L	-	NM	11	8	28	12
Potassium	mg/L	-	NM	11	5	14	7
Calcium	mg/L	-	NM	11	4	22	8
Magnesium	mg/L	-	NM	11	2	10	3
Metals[1]							
Aluminium	mg/L	0.055	0.160	11	0.01	**0.44**	0.02
Antimony	mg/L	0.009	<0.001	11	0.001	0.001	0.001
Arsenic	mg/L	0.013	<0.001	11	0.001	0.001	0.001
Silver	mg/L	0.00005	<0.001	11	<0.001	<0.001	0.001
Barium	mg/L	-	NM	11	0.057	0.140	0.081
Boron	mg/L	0.94	<0.05	11	0.20	0.68	0.23
Cadmium	mg/L	0.0002	<0.0001	11	<0.0001	**0.0012**	0.0001
Chromium	mg/L	0.001	<0.001	11	<0.001	<0.001	0.001
Copper	mg/L	0.0014	<0.001	11	0.001	**0.003**	0.001
Iron	mg/L	-	NM	11	<0.01	3.30	0.06
Mercury	mg/L	0.00006	<0.00004	11	<0.00005	<0.00005	0.00003
Manganese	mg/L	1.9	0.265	11	0.95	**4.30**	**3.40**
Molybdenum	mg/L	0.034	<0.001	11	0.001	0.013	0.002

Table 4.7 Blackhole BLKH – results summary

	Units	DGV	Baseline range[2]	No. samples	Minimum	Maximum	Median
Nickel	mg/L	0.011	0.002	11	0.006	**0.065**	**0.019**
Lead	mg/L	0.0034	NM	11	<0.001	<0.001	0.001
Selenium	mg/L	0.005	<0.01	11	0.001	0.001	0.001
Zinc	mg/L	0.008	0.034	11	0.008	**0.160**	**0.040**

Notes: Reported metal concentrations for the current AEMR Period are from filtered samples.

1. **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.
2. The 80th percentile values at Sawyers Swamp Creek upstream of SSCAD (monitoring site SS5) calculated using data from 22 samples collected between 15 December 2021 to 21 July 2022 (all parameters); plus data from samples collected between 2013 to December 2021 that are available for pH (51 samples), EC (47 samples), turbidity (48 samples), boron (3 samples), copper (4 samples), manganese (45 samples), vanadium (28 samples) and zinc (28 samples) - note these samples are in addition to the 22 samples mentioned above.

4.2.5 Sawyers Swamp Creek

WX7 is located on Sawyers Swamp Creek approximately 500 m downstream of the Site. Sawyers Swamp Creek is a watercourse that flows through the site in a westerly direction and joins the Coxs River approximately 1 km to the west of the site. The creek was diverted from its original alignment early in the site's history due to coal mining and has been further adjusted when the SSCAD was constructed. The diverted creek (the Sawyers Swamp Creek Diversion) is a clean water system that manages the natural streamflow from the creek's catchment. The system diverts clean water around SSCAD and the KVAR/KVAD water management area. The diversion joins what is thought to be the original Sawyers Swamp Creek to the north-west of the site. The alignment of the Sawyers Swamp Creek Diversion is shown in Figure 2.1.

The Sawyers Swamp Creek Diversion receives inflows from the following sources:

- clean water runoff from naturally vegetated catchments to the east and south of the site
- water pumped from the surface of Section B of the SSCAD (wet conditions only)
- stormwater discharges from the KVAR/KVAD water management area (wet conditions only)
- inflows from Dump Creek, which are minor compared to the streamflow in Sawyers Swamp Creek, and
- groundwater inflows, including potential inflows from the perched groundwater systems that are within the ash dams.

The creek has been observed to have a perennial streamflow, indicating that baseflows are maintained by groundwater inflows from the greater catchment. Various groundwater systems (refer to Section 5.1) exist throughout the Site which have different levels of impact from ash emplacements. This means that the ambient water quality can vary based on the groundwater inflow contribution as a percentage of total streamflow and water quality during wet and dry conditions can be markedly different.

Monitoring locations along Sawyers Swamp Creek Diversion, including the number of samples collected at each site are outlined below. Table 4.8 provides the minimum, median, and maximum values for each analyte, comparing them to DGVs and the baseline water quality range:

- **SS5**: Located upstream of SSCAD in a headwater dam to the Sawyers Swamp Creek Diversion and is an upstream reference site that is used to characterise ambient water quality in the Sawyers Swamp Creek Catchment. 11 samples were collected from SS5 over the AEMR Period.

- **S6**: Located on Sawyers Swamp Creek directly downstream from SSCAD pond. 11 samples were collected from S6 over the AEMR Period.
- **S5:** Located on Sawyers Swamp Creek adjacent to KAVAR and downstream to SSCAD pond. 11 samples were collected from S5 over the AEMR Period.
- **WX5:** Located on Sawyers Swamp Creek adjacent to Lidsdale Cut. 11 samples were collected from WX5 over the AEMR Period.
- **WX7:** Located on Sawyers Swamp Creek approximately 500 m downstream of the Site. 11 samples were collected from WX7 over the AEMR Period.

The results indicate the water quality in Sawyers Swamp Creek has a pH that ranges between 5.7 and 8.3, generally low salinity and metal concentrations. These characteristics are consistent with clean water. There was a trend of increasing concentrations of salinity, sulphate, total dissolved solids, turbidity, aluminium, boron, copper, iron, manganese, nickel and zinc between SS5 (upstream of SSCAD) and WX7 (downstream of the Site). The results at WX7 were generally within the DGVs except for aluminium, copper, nickel and zinc.

The time-series results presented in Appendix A shows that the water quality in Sawyers Swamp Creek is consistent with the prior AEMR Periods and varies between wet and dry conditions, with higher salinity and metal concentrations occurring during dry conditions. These results are consistent with historical trends during dry periods and indicate that there is some incidental discharge of ash affected water entering the lower portion of the Sawyers Swamp Creek Diversion. Dump Creek is one known source however there is potential for groundwater sources from both the Site and non-GPM owned land that adjoins the Site. Incidental discharges will be assessed as part of the VMP process.

Table 4.8 Sawyer Swamp Creek – results summary

				SS5			S6			S5			WX5			WX7		
	Units	DGV	Baseline range[2]	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
Physico-chemical parameters																		
pH	-	6.5–8.0	5.5 - 6.8	**5.7**	**8.2**	7.3	**6.0**	7.5	6.5	6.6	7.3	6.8	**6.0**	7.5	6.9	**6.0**	**8.3**	7.0
EC	µS/cm	350	114	69	199	89	10	**359**	99	93	**372**	211	128	321	239	88	332	193
DO	mg/L	-	NM	3.8	9.6	5.6	5.0	9.7	7.1	4.8	11.7	6.5	5.5	11.9	7.5	5.4	10.7	7.6
Turbidity	mg/L	-	25	1	32	3	4	51	7	4	321	13	1	57	7	1	125	8
Total dissolved solids	NTU	-	NM	25	70	43	37	250	57	51	230	85	55	220	130	40	250	120
Total nitrogen	mg/L	-	NM	<0.1	0.3	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	<0.1	0.3	0.1
Total phosphorus	mg/L	-	NM	<0.05	<0.05	<0.05	<0.05	<0.05	0.025	<0.05	<0.05	0.025	<0.05	<0.05	0.025	<0.05	<0.05	<0.05
Anions																		
Chloride	mg/L	-	NM	5	10	7	6	13	9	7	22	10	7	23	11	0.1	0.3	0.2
Fluoride	mg/L	-	NM	<0.1	0.1	<0.1	0.1	0.6	0.1	0.1	0.5	0.1	0.1	0.3	0.2	22	120	46
Sulphate	mg/L	-	NM	11	16	13	10	140	16	11	130	47	19	110	44	9	29	17
Cations																		
Sodium	mg/L	-	NM	6	12	8	6	26	11	8	32	14	8	28	16	3	12	6
Potassium	mg/L	-	NM	1	3	1	1	12	2	2	10	3	2	6	5	2	11	6

Table 4.8 Sawyer Swamp Creek – results summary

				SS5			S6			S5			WX5			WX7		
	Units	DGV	Baseline range[2]	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
Calcium	mg/L	-	NM	1	2	1	1	19	2	2	17	5	2	10	5	2	9	4
Magnesium	mg/L	-	NM	1	2	1	1	8.3	1	2	9	4	2	9	4	2	9	4
Metals[1]																		
Aluminium	mg/L	0.055	0.160	0.02	**0.22**	0.04	<0.01	**0.29**	**0.09**	0.01	**0.22**	0.03	0.01	**1.4**	0.02	0.02	**0.37**	0.05
Antimony	mg/L	0.009	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.013	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	0.002	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Silver	mg/L	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Barium	mg/L	-	NM	0.014	0.044	0.036	0.013	0.076	0.033	0.020	0.092	0.043	0.016	0.071	0.040	0.017	0.071	0.037
Boron	mg/L	0.94	<0.05	0.02	0.08	0.04	0.03	0.70	0.06	0.06	0.53	0.10	0.06	0.24	0.20	0.06	0.28	0.20
Cadmium	mg/L	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	**0.0008**	0.0001	<0.0001	**0.0004**	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.0014	<0.001	<0.001	**0.004**	0.001	0.001	**0.003**	0.001	0.001	**0.002**	0.001	0.001	**0.002**	0.001	<0.001	**0.006**	0.002
Iron	mg/L	-	NM	0.05	0.61	0.13	0.02	0.28	0.11	0.09	6.70	0.24	0.08	0.32	0.12	0.040	0.860	0.210
Mercury	mg/L	0.00006	<0.00004	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.00005	<0.00005	<0.00005	0.00005	<0.00005	<0.00005	0.00005	<0.00005	<0.00005	<0.00005
Manganese	mg/L	1.9	0.265	0.030	0.500	0.130	0.009	**3.600**	0.110	0.100	**2.300**	0.280	0.120	0.800	0.330	0.10	0.77	0.24

Table 4.8 Sawyer Swamp Creek – results summary

				SS5			S6			S5			WX5			WX7		
	Units	DGV	Baseline range[2]	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
Molybdenum	mg/L	0.034	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.001	0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Nickel	mg/L	0.011	0.002	<0.001	0.002	0.002	0.001	**0.051**	0.001	0.001	**0.029**	0.003	0.002	**0.013**	**0.006**	0.003	**0.023**	0.005
Lead	mg/L	0.0034	NM	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Selenium	mg/L	0.005	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.008	0.034	0.004	**0.027**	**0.012**	0.003	**0.110**	**0.014**	0.002	**0.062**	0.010	0.005	**0.032**	**0.015**	0.006	**0.088**	**0.014**

Notes: Reported metal concentrations for the current AEMR Period are from filtered samples.

1. **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.
2. The 80th percentile values at Sawyers Swamp Creek upstream of SSCAD (monitoring site SS5) calculated using data from 22 samples collected between 15 December 2021 to 21 July 2022 (all parameters); plus data from samples collected between 2013 to December 2021 that are available for pH (51 samples), EC (47 samples), turbidity (48 samples), boron (3 samples), copper (4 samples), manganese (45 samples), vanadium (28 samples) and zinc (28 samples) - note these samples are in addition to the 22 samples mentioned above.

4.2.6 Coxs River

The Coxs River is a major tributary to the Hawkesbury-Nepean system. The river flows generally in a southerly direction through parts of the Central Tablelands and Blue Mountains regions of NSW. It has a total catchment area of 1,450 km^2 and ultimately flows into the northern arm of Lake Burragorang (also known as Warragamba Dam). Lake Burragorang is a major water supply dam for the Sydney metropolitan region and is managed by WaterNSW. The Site and LDP3 are in the upper portion of the river's catchment. The catchment area upstream of LDP3 is 178 km^2 and is characterised by a series of valleys that are generally bound by rugged forested escarpments and have cleared valley floors. Key tributaries include Wangcol, Sawyers Swamp, Pipers Flat and Kangaroo Creeks. The river is unregulated and has a variable streamflow regime. Baseflow is known to occur year-round, even during severe droughts such as the 2018–2020 drought (albeit at minimal rates). Seasonally, streamflow is highest in late winter and spring and lowest in late summer and autumn. The streamflow regime fits the definition of a permanent or perennial stream.

The Coxs River flows in a southerly direction past the western and south-western portions of the Site. Inflows into the river from the Site can occur via incidental discharges to Sawyers Swamp Creek and LDP3 discharges.

S1 and WX12 are monitoring locations within the Coxs River. WX12 is located upstream of the Sawyers Swamp Creek confluence and is the upstream reference location. The water quality at WX12 is potentially impacted by anthropogenic influences in the upstream catchment, including coal mining, coal ash dams and agriculture. S1 is located downstream of the Sawyers Swamp Creek confluence, Sawyers Swamp Creek is the only material inflow between WX12 and S1. The water quality in the Coxs River between S1 and LDP3 monitoring points can potentially be impacted by inflows from Pipers Flat creek and stormwater runoff and seepage from the township of Lidsdale. A WaterNSW operated stream gauge (212054) is located immediately downstream of WX9.

17 samples were collected from WX12 and S1 over the AEMR Period. Table 4.9 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range. DGVs had their hardness adjustment applied according to Section 4.1.2.

The results indicate that the water quality in Coxs river is similar at S1 and WX12. Inflows from Sawyers Swamp Creek are generally beneficial for Coxs River water quality. The basis for this is that the concentrations (or values) of all analytes shown in Table 4.8 at Sawyers Swamp Creek (WX7) are either below DGVs and/or are similar to or lower than at the upstream reference location (WX12). The minimum concentration of zinc at WX12 exceeds the DGV whereas it remains below at S1.

The water quality concentrations generally do not exceed the DGV and baseline range, and are consistent with water quality in previous AEMR periods (see time-series charts in Appendix A).

Table 4.9 Coxs River – results summary

				WX12			S1		
	Units	**DGV**	**Baseline range[2]**	**Min**	**Max**	**Median**	**Min**	**Max**	**Median**
Physico-chemical parameters									
pH	-	6.5–8.0	5.6 – 7.0	**6.4**	7.5	6.9	**6.0**	7.2	6.7
EC	µS/cm	350	1,224	**478**	**1,246**	**869**	68	**1,171**	**725**
DO	mg/L	-	NM	5.1	11.5	7.1	5.4	8.9	7.4
Turbidity	mg/L	-	24	4	20	6	2	37	4

Table 4.9 Coxs River – results summary

				WX12			S1		
	Units	**DGV**	**Baseline range[2]**	**Min**	**Max**	**Median**	**Min**	**Max**	**Median**
Total dissolved solids	NTU	-	NM	430	960	695	330	850	555
Total nitrogen	mg/L	-	NM	0.2	0.4	0.2	0.2	0.3	0.2
Total phosphorus	mg/L	-	NM	<0.05	<0.05	<0.05	<0.05	<0.05	0.025
Anions									
Chloride	mg/L	-	NM	32	83	51	25	76	43
Fluoride	mg/L	-	NM	0.1	0.2	0.1	0.1	0.2	0.1
Sulphate	mg/L	-	NM	200	570	360	160	520	280
Cations									
Sodium	mg/L	-	NM	54	170	100	42	140	87
Potassium	mg/L	-	NM	8	19	13	7	17	11
Calcium	mg/L	-	NM	24	69	44	16	58	36
Magnesium	mg/L	-	NM	17	49	31	13	41	26
Metals[1]									
Aluminium	mg/L	0.055	0.030	0.01	**0.09**	0.03	0.01	**0.23**	0.03
Antimony	mg/L	0.009	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver	mg/L	0.00005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	-	0.025	0.016	0.038	0.020	0.016	0.032	0.022
Boron	mg/L	0.94	0.300	0.080	0.340	0.225	0.100	0.290	0.215
Cadmium[2]	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.0014	<0.001	<0.001	**0.002**	0.001	<0.001	**0.002**	0.001
Iron	mg/L	-	0.20	0.09	0.48	0.20	0.08	0.35	0.19
Mercury	mg/L	0.00006	<0.00005	<0.00005	<0.00005	0.00005	<0.00005	<0.00005	<0.00005
Manganese	mg/L	1.90	0.91	0.62	1.60	0.78	0.33	0.63	0.51
Molybdenum	mg/L	0.034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0005

Table 4.9 Coxs River – results summary

				WX12			S1		
	Units	DGV	Baseline range[2]	Min	Max	Median	Min	Max	Median
Nickel[2]	mg/L	0.030	0.091	**0.039**	**0.100**	**0.063**	0.030	**0.073**	**0.047**
Lead[2]	mg/L	0.0155	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001
Selenium	mg/L	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc[2]	mg/L	0.022	0.038	0.009	**0.053**	**0.024**	0.007	**0.033**	**0.018**

Notes: Reported metal concentrations for the current AEMR Period are from filtered samples.

1. **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.
2. DGV indicate analytes with hardness adjustment applied.
3. The 80th percentile values at Coxs River (monitoring site WX12) have been calculated using data from 22 samples collected between 16 August 2022 to 16 August 2024 (all parameters).

4.3 Summary

The surface water quality results for the AEMR Period indicate that:

- Water quality trends in Lidsdale Cut and the SSCAD are consistent with recent AEMR periods (i.e. 2018 to the current period). Lidsdale Cut and SSCAD are part of the Site's contaminated water management system and hold water that is known to be ash affected.
- The water quality in Dump Creek was consistent with ash affected water during dry conditions. It is interpreted that surface water runoff in the Dump Creek catchment is clean and that seep(s) of ash affected water may impact water quality during dry conditions when the streamflow is minimal.
- The water quality in Sawyers Swamp Creek downstream of the Site (WX7) is generally consistent with clean water. Within the Site, groundwater contribution to the creek was evident with a variation to water quality monitored in the creek changing from upstream to downstream.
- The water quality in Coxs River is not affected by the inflows from Sawyers Swamp Creek.

GPM continue to progressively improve the water management system through implementing the Action Plan commitments.

5 Groundwater quality review

This chapter reviews groundwater quality data from the OEMP monitoring locations over the AEMR Period. It includes descriptions of the hydrogeological context of the Site, monitoring requirements and assessment criteria established in the OEMP and presents and discusses the groundwater quality data.

5.1 Hydrogeological context

The three main groundwater systems at the Site are:

- **Perched groundwater systems** – are interpreted to be present in the SSCAD, and within the Kerosene Vale Ash Repositories. The perched groundwater systems present within the Kerosene Vale Ash Repositories has been conceptualised as two separate systems. One perched system is expected within the KVAD, below the capping layer which is drained through a seepage capture system, and one perched system is considered to be above the KVAD capping layer (located within KVAR). The perched groundwater system within SSCAD is connected and controlled by the water level in SSCAD Pond.

  The degree of connectivity between each of the emplacement areas is not known. Groundwater seeps occur around the downgradient edges and through the floors of each of the emplacement area. Groundwater recharge is via rainfall infiltration, possible upgradient groundwater inflows and leakage from any unlined ponds within the fill areas. Seepage collection systems intercept seepage from SSCAD embankment, KVAD and the KVAR. Captured seepage is reticulated via channels and pipelines to Lidsdale Cut or SSCAD Pond for management.

- **Local groundwater system** is hosted by the alluvial/colluvial strata along the original line of Sawyers Swamp Creek. However, there have been extensive modifications to the Site, making it difficult to assess the extent of the remaining alluvium/colluvium. Unconsolidated deposits vary spatially and are thicker in the lower catchment areas of Sawyers Swamp Creek and Dump Creek towards the Coxs River. The groundwater flow direction is to the west, following the local topographic gradient.

  This groundwater system is naturally recharged by rainfall and surface water losses from connected creeks in upper catchment areas. Furthermore, in the upgradient catchment areas where the Banks Wall Sandstone outcrops, spring discharge feeds local watercourses, including Sawyers Swamp Creek and local alluvium. Groundwater discharge is via evapotranspiration and baseflow to streams in lower catchment areas.

- **Regional porous and fractured rock groundwater systems** are hosted by the Illawarra Coal Measures (ICM) sedimentary sequences where multiple groundwater zones occur within the different bedrock geologies. Immediately below the SSCAD and KVAR/KVAD ash emplacement areas, the primary aquifer is within the Lithgow coal seam (or at higher elevations potentially above the Lidsdale coal seam) and the weathered bedrock units.

  Prior to mining and ash emplacement, the groundwater flow direction most likely followed the dip of the coal measure and deeper sandstone strata to the east. However, there is no historical baseline data to confirm this conceptualisation. The current composite groundwater contours suggest that the uppermost regional groundwater flow in the bedrock aquifers follows the topography to the west. Naturally this system is recharged by rainfall across the catchment where the ICM bedrock is exposed at or near surface. Typically, recharge to the regional water table is a very small percentage of rainfall.

5.2 OEMP monitoring requirements

5.2.1 Monitoring locations

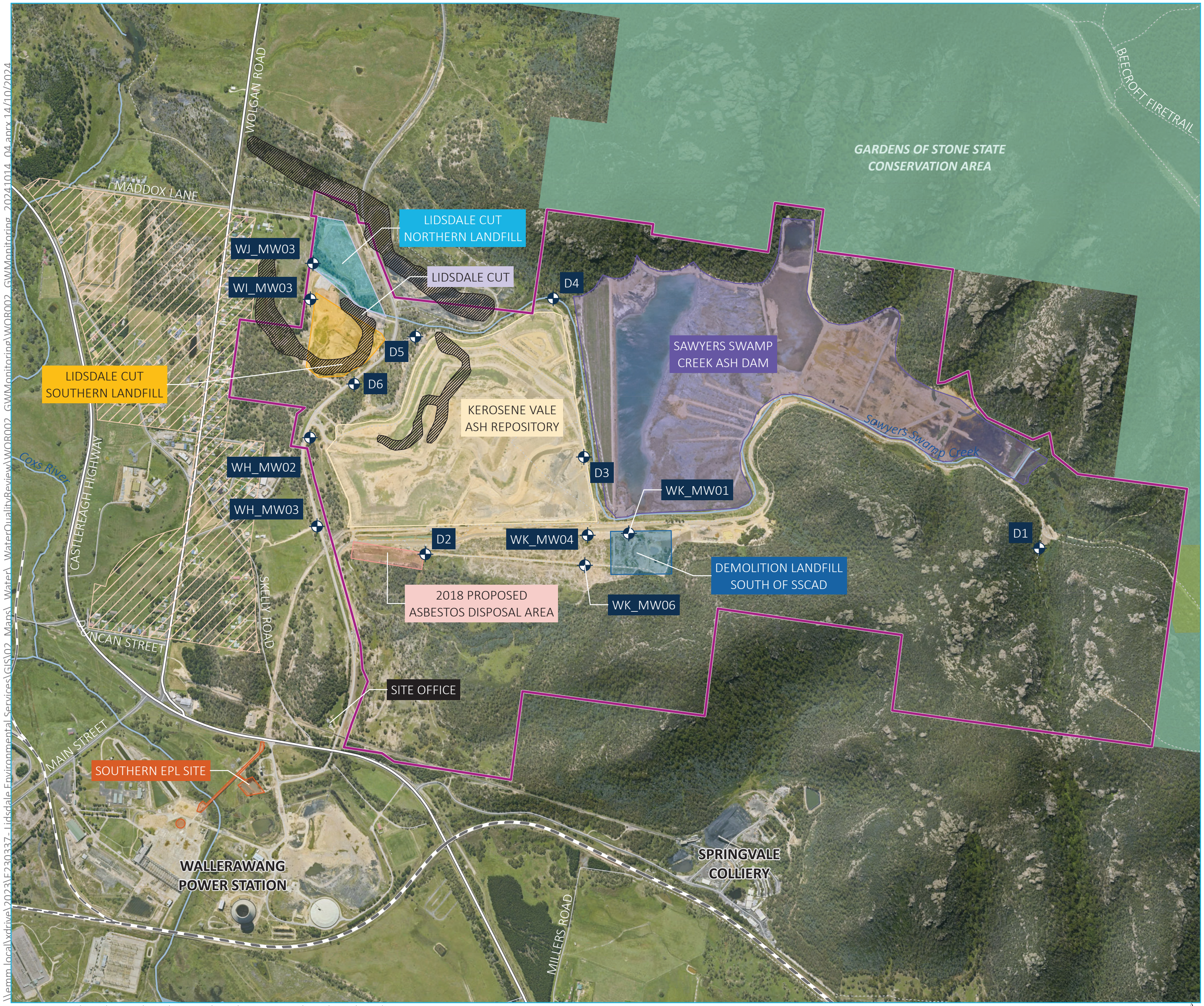
The environmental monitoring plan established in the OEMP identifies 13 groundwater monitoring locations. Table 5.1 describes each of these monitoring locations, their hydrogeological context and associated monitoring requirements. The monitoring locations are shown in Figure 5.1.

Table 5.1 Groundwater monitoring requirements

Monitoring location	Description	Screened lithology and groundwater system	Monitoring frequency	Monitoring analytes
WGM1/D1	Groundwater monitoring bore located to the south-east of SSCAD.	Clayey sand—local groundwater	6-monthly monitoring	See Table 4.2
WGM1/D2	Groundwater monitoring bore located to the south of KVAR/KVAD.	Siltstone/sandstone—regional groundwater		
WGM1/D3	Groundwater monitoring bore located between SSCAD and KVAR/KVAD.	Siltstone/sandstone/coal—regional groundwater		
WGM1/D4	Groundwater monitoring bore located to the north of KVAR/KVAD and immediately to the west of the northern side of the SSCAD embankment.	Weathered sandstone —local groundwater		
WGM1/D5	Groundwater monitoring bore located to the north-west of KVAR/KVAD.	Sandstone/coal—regional groundwater		
WGM1/D6	Groundwater monitoring bore located to the west of KVAR/KVAD.	Sandstone/mudstone/coal—regional groundwater		
WH_MW02	Groundwater monitoring bore located to the west of KVAR/KVAD.	Sandstone – regional groundwater		
WH_MW03	Groundwater monitoring bore located to the south-west of KVAR/KVAD.	Coal/siltstone-regional aquifer		
WI_MW03R[1]	Groundwater monitoring bore located to the north-west of KVAR/KVAD.	Clayey sand – local groundwater		
WJ_MW03	Groundwater monitoring bore located to the north-west of KVAR/KVAD and adjacent to Sawyers Swamp Creek.	Sandstone / siltstone – local groundwater		
WK_MW01	Groundwater monitoring bore located to the south of SSCAD pond	Shale/siltstone-local groundwater		
WK_MW04	Groundwater monitoring bore located to the south-east of KVAR/KVAD.	Shale-local groundwater		
WK_MW06	Groundwater monitoring bore located to the south-east of KVAR/KVAD.	Siltstone/sandstone – regional groundwater		

Notes:

1. WI_MW03 was damaged in November 2023 so a replacement EPL monitoring location was established in April 2024 (WI_MW03R) (EMM 2024b).



Source: EMM (2024); GPM (2023); DCSSS (2024); MetroMap (2024); GA (2009)

0 0.5 1 km
GDA2020 MGA Zone 56
N

KEY
- Nearest sensitive (residential) receiver
- Groundwater routine monitoring network
- Site boundary
- Historical open cut pit

Site layout
- 2018 proposed asbestos disposal area
- Demolition landfill south of SSCAD
- Kerosene Vale ash repository
- Lidsdale cut northern landfill
- Lidsdale cut southern landfill
- Lidsdale cut
- Sawyers Swamp Creek ash dam
- Southern EPL site

Existing environment
- Rail line
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

Groundwater monitoring locations

Lidsdale Environmental Services
Annual Water Quality Review
Figure 5.1

creating opportunities

5.2.2 Monitoring approach

Table 5.2 provides the groundwater analytes that are established in the Groundwater sub-plan OEMP (Table 5 in Appendix B).

Table 5.2 Groundwater monitoring analytes – OEMP

Category	Analytes[1]
Physico-chemical	pH, electrical conductivity (EC), alkalinity, total dissolved solids, dissolved oxygen, turbidity, total phosphorus, total nitrogen, turbidity, redox, total suspended solids, total hardness, ammonia
Anions	Chloride, fluoride, sulphate
Cations	Sodium, potassium, calcium, magnesium
Metals[2]	Aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, vanadium, zinc

Notes: 1. Sourced from OEMP Table B.1 in Appendix B plus additional analytes noted in the surface and groundwater water quality sub-plans.
2. Refers to total concentrations unless stated as filtered

5.2.3 Assessment criteria

The groundwater quality sub-plan (Section 5.1 – Groundwater sub-plan OEMP) specifies that groundwater monitoring results are to be compared to:

- the baseline data (Appendix C – Groundwater sub-plan OEMP)) for the Trigger Action Response Plan (Appendix B Table 7 - Groundwater sub-plan OEMP);
- the ANZG 2018 DGV's used as a reference point.

There are insufficient sample points at monitoring locations WH_MW02, WH_MW03, WI_MW03, WJ_MW03, WK_MW01, WK_MW04, and WK_MW06 to establish a baseline data range for comparison during the AEMR Period. As a result, data from these locations will be compared to the ANZG 2018 DGVs instead.

Table 5.3 describes the groundwater assessment criteria for each monitoring location. It is noted that the baseline data is provided as a range.

Table 5.3 Groundwater assessment criteria

	Units	DGV	Baseline range (Groundwater sub-plan OEMP, Table 7 in Appendix C)					
			WGM1/D1	WGM1/D2	WGM1/D3	WGM1/D4	WGM1/D5	WGM1/D6
Physico-chemical parameters								
pH	-	6.5–8.0	5.5 – 6.0	3.7 – 5.1	5.8 – 6.7	5.0 – 6.6	3.7 – 4.7	3.1 – 5.5
EC	µS/cm	350	90 – 170	278 – 502	332 – 773	492 – 1,331	229 – 634	283 – 1,013
Total dissolved solids	mg/L	-	60 – 302	120 – 315	238 – 538	270 – 1210	170 – 1913	200 – 902
DO	mg/L	-	NM	NM	NM	NM	NM	NM
Turbidity	NTU	25	NM	NM	NM	NM	NM	NM
Total nitrogen	mg/L	0.25	NM	NM	NM	NM	NM	NM
Total phosphorus	mg/L	0.02	NM	NM	NM	NM	NM	NM
Anions								
Chloride	mg/L	-	12 – 37	12 – 104	32 – 140	16 – 86	3 – 26	14 – 118
Fluoride	mg/L	-	0.001– 0.1	0.001 – 0.1	0.05 – 0.2	0.001 – 0.1	0.2 – 0.4	0.001 – 0.2
Sulphate	mg/L	-	3 – 8	57 – 180	54 – 130	77 – 770	86 – 274	89 – 360
Cations								
Sodium	mg/L	-	8 – 19	17 – 58	35 – 96	27 – 91	6 – 55	25 – 58
Potassium	mg/L	-	2 – 10	0.03 – 5	5 – 12	5 – 10	4 – 23	4 – 9
Calcium	mg/L	-	2 – 9	1 – 5	11 – 27	38 – 100	12 – 21	4 – 24
Magnesium	mg/L	-	1 – 5	7 – 22	11 – 30	21 – 73	5 – 24	12 – 29
Metals[1]								

Table 5.3 Groundwater assessment criteria

	Units	DGV	Baseline range (Groundwater sub-plan OEMP, Table 7 in Appendix C)					
			WGM1/D1	WGM1/D2	WGM1/D3	WGM1/D4	WGM1/D5	WGM1/D6
Aluminium	mg/L	0.055	NM	NM	NM	NM	NM	NM
Arsenic	mg/L	0.013	0.001 – 0.001	0.001 – 0.025	0.001 – 0.025	0.001 – 0.025	0.001 – 0.025	0.004 – 0.025
Silver	mg/L	0.00005	0.00025 – 0.00100	0.00025 – 0.00500	0.00025 – 0.00500	0.00025 – 0.00500	0.00100 – 0.00500	0.00100 – 0.00500
Barium	mg/L	-	0.04 – 0.06	0.04 – 0.13	0.05 – 0.13	0.03 – 0.13	0.02 – 0.07	0.02 – 0.07
Boron	mg/L	0.94	0.02 – 0.05	0.01 – 0.15	0.01 – 0.06	0.23 – 1.30	0.08 – 1.10	0.12 – 0.82
Cadmium	mg/L	0.0002	0.0001 – 0.0010	0.0001 – 0.0010	0.0001 – 0.0010	0.0001 – 0.0010	0.0010 – 0.0430	0.0010 – 0.0010
Chromium	mg/L	0.001	0.010 – 0.010	0.001 – 0.010	0.001 – 0.010	0.001 – 0.010	0.005 – 0.010	0.002 – 0.010
Copper	mg/L	0.0014	0.002 – 0.055	0.001 – 0.005	0.001 – 0.006	0.001 – 0.005	0.005 – 0.072	0.002 – 0.010
Iron (filtered)	mg/L	-	0.02 – 4.50	0.03 – 5.70	0.01 – 6.50	22.00 – 71.00	0.06 – 5.32	13.00 – 104.00
Mercury	mg/L	0.00006	0.000025 – 0.0002	0.000025 – 0.0002	0.000025 – 0.0002	0.000025 – 0.0002	0.00005 – 0.0002	0.00005– 0.0002
Manganese	mg/L	1.9	0.046 – 0.2	0.3 – 0.7	0.2 – 1.1	6.0 – 20.0	0.8 – 2.1	0.6 – 4.3
Molybdenum	mg/L	0.034	NM	NM	NM	NM	NM	NM
Nickel	mg/L	0.011	NM	NM	NM	NM	NM	NM
Lead	mg/L	0.0034	0.0005 – 0.0160	0.0020 – 0.0080	0.0005 – 0.0080	0.0005 – 0.0100	0.0050 – 0.0760	0.0020 – 0.0110
Selenium	mg/L	0.005	0.001 – 0.001	0.001 – 0.003	0.001 – 0.003	0.001 – 0.003	0.001 – 0.003	0.001 – 0.003
Zinc	mg/L	0.008	0.030 – 0.240	0.048 – 0.130	0.030 – 0.061	0.020 – 0.090	0.240 – 2.630	0.050 – 0.566

Notes: NM denotes not monitored or not provided in the baseline data set.
1. Assumed baseline data was measured as total concentrations

5.3 Results

Groundwater monitoring results for the AEMR Period are presented and discussed in this section. The results for each monitoring location are presented in table form and compared to the assessment criteria established in Section 5.2.

Results for key analytes from all groundwater monitoring locations are also presented as time-series charts that are provided in Appendix B. These charts show all results from 1 January 2018 to the end of the AEMR Period (recent AEMR periods) and can be used to establish water quality trends (i.e. increasing or decreasing concentrations).

The water quality results for each groundwater monitoring location are presented and discussed in the following sections.

5.3.1 Groundwater monitoring location WGM1/D1

Groundwater monitoring bore WGM1/D1 is located to the south-east of SSCAD (see Figure 5.1). The bore is screened in the local groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the north-west, towards SSCAD (EMM 2023a).

Three samples were collected from D1 over the period with most analytes being sampled on at least two occasions. Table 5.4 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that the groundwater quality has a pH ranging between 4.7 to 5.1 and low salinity, which indicates surface water influences. Metal parameters zinc, copper and aluminium concentrations exceed DGVs but are generally within the baseline range.

The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in recent AEMR periods (i.e. 2018 to the current period).

Table 5.4 Groundwater monitoring location WGM1/D1 – results summary

	Units	DGV	Baseline range[1]	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	5.5 – 6.0	2	**4.7**	**5.4**	**5.1**
EC	µS/cm	350	90 – 170	2	83	134	109
Total dissolved solids	mg/L	-	60 – 302	2	74	87	82
Anions							
Chloride	mg/L	-	12 – 37	2	16	21	19
Fluoride	mg/L	-	0.001 – 0.1	2	<0.1	<0.1	0.1
Sulphate	mg/L	-	3 – 8	2	12	13	13
Cations							
Sodium	mg/L	-	8 – 19	2	12	16	14
Potassium	mg/L	-	2 – 10	2	3	4	4
Calcium	mg/L	-	2 – 9	2	2	2	2

Table 5.4 Groundwater monitoring location WGM1/D1 – results summary

	Units	DGV	Baseline range[1]	No. samples	Minimum	Maximum	Median
Magnesium	mg/L	-	1 – 5	2	2	2	2
Metals[1]							
Aluminium	mg/L	0.055	NM	2	0.050	**0.060**	0.055
Arsenic	mg/L	0.013	0.001 – 0.001	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	0.00025 – 0.00100	2	-	-	-
Barium	mg/L	-	0.04 – 0.06	2	0.04	0.04	0.04
Boron	mg/L	0.94	0.02 – 0.05	2	<0.05	<0.05	0.03
Cadmium	mg/L	0.0002	0.0001 – 0.0010	2	<0.0001	<0.0001	0.0001
Chromium	mg/L	0.001	0.010 – 0.010	2	<0.001	<0.001	0.0005
Copper	mg/L	0.0014	0.002 – 0.055	2	**0.002**	**0.004**	**0.003**
Iron (filtered)	mg/L	-	0.02 – 4.50	2	<0.05	0.09	0.06
Mercury	mg/L	0.00006	0.000025 – 0.0002	-	-	-	-
Manganese	mg/L	1.9	0.046 – 0.2	2	0.0	0.0	0.0
Molybdenum	mg/L	0.034	NM	-	-	-	-
Nickel	mg/L	0.011	NM	2	<0.001	<0.001	0.0005
Lead	mg/L	0.0034	0.0005 – 0.0160	2	<0.001	<0.001	0.0005
Selenium	mg/L	0.005	0.001 – 0.001	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	0.030 – 0.240	2	**0.11**	**0.20**	**0.16**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples. The baseline range assumed to relate to the total metal concentrations.

5.3.2 Groundwater monitoring location WGM1/D2

Groundwater monitoring bore WGM1/D2 is located to the south of KVAR/KVAD (see Figure 5.1). The bore is screened in the regional groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the west (EMM 2023a). As the bore is located near the KVAR and downgradient from SSCAD, there is potential for groundwater quality impacts.

Two samples were collected from WGM1/D2 over the AEMR Period with most analytes being sampled on at least two occasions. Table 5.5 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The groundwater quality is characterised as having a pH that ranges from 3.7 to 3.9 and low salinity. Median concentrations of aluminium, nickel, barium and zinc exceeded DGVs but were generally within the baseline range. These concentrations were significantly higher than concentrations at monitoring bore D1 (which is located upgradient of SSCAD). Accordingly, groundwater at WGM1/D3 may be degraded, relative to baseline water quality.

The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in recent AEMR periods (i.e. 2018 to the current period).

Table 5.5 Groundwater monitoring location WGM1/D2 – results summary

	Units	DGV	Baseline range	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	3.7 – 5.1	2	**3.7**	**4.1**	**3.9**
EC	µS/cm	350	278 – 502	2	**399**	**523**	**461**
Total dissolved solids	mg/L	-	120 – 315	2	340	372	356
Anions							
Chloride	mg/L		12 – 104	2	23	37	30
Fluoride	mg/L		0.001 – 0.1	2	<0.1	<0.1	0.05
Sulphate	mg/L		57 – 180	2	94	174	134
Cations							
Sodium	mg/L	-	17 – 58	2	32	53	43
Potassium	mg/L	-	0.03– 5	2	3	4	4
Calcium	mg/L	-	1 – 5	2	1	2	2
Magnesium	mg/L	-	7 – 22	2	17	18	18
Metals[1]							
Aluminium	mg/L	0.055	NM	2	**0.11**	**0.21**	**0.16**
Arsenic	mg/L	0.013	0.001 – 0.025	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	0.00025 – 0.00500	2	-	-	-
Barium	mg/L	-	0.04 – 0.13	2	0.028	0.03	0.029
Boron	mg/L	0.94	0.01 – 0.15	2	0.07	0.14	0.11
Cadmium	mg/L	0.0002	0.0001 – 0.0010	2	0.0002	0.0002	0.0002
Chromium	mg/L	0.001	0.001 – 0.010	2	<0.001	<0.001	0.0005
Copper	mg/L	0.0014	0.001 – 0.005	2	<0.001	<0.001	0.0005
Iron (filtered)	mg/L	-	0.03 – 5.70	2	<0.05	0.13	0.08
Mercury	mg/L	0.00006	0.000025 – 0.0002	-	-	-	-
Manganese	mg/L	1.9	0.3 – 0.7	2	0.4	0.6	0.5
Molybdenum	mg/L	0.034	NM	-	-	-	-
Nickel	mg/L	0.011	NM	2	**0.044**	**0.058**	**0.051**
Lead	mg/L	0.0034	0.0020 – 0.0080	2	<0.001	0.003	0.0018
Selenium	mg/L	0.005	0.001 – 0.003	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	0.048 – 0.130	2	**0.05**	**0.07**	**0.06**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples. The baseline range assumed to relate to the total metal concentrations.

5.3.3 Groundwater monitoring location WGM1/D3

Groundwater monitoring bore WGM1/D3 is located between SSCAD and KVAR (see Figure 5.1). The bore is screened in the regional groundwater system (Table 5.1). There is potential for groundwater quality impacts at this location due to its proximity to both the KVAR/KVAD and SSCAD.

Two samples were collected from WGM1/D3 over the AEMR Period. Table 5.6 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The groundwater quality is characterised as having a pH that ranges between 5.5 to 5.7 and low salinity. Median concentrations of most metals sampled exceed the DGV and for cadmium, zinc, nickel, copper and aluminium the baseline range was also exceeded at the median concentration. These concentrations were significantly higher than concentrations at monitoring bore WGM1/D1 (which is located upgradient of SSCAD). Accordingly, groundwater at WGM1/D3 may be degraded, relative to baseline water quality.

The time-series charts in Appendix B show an increasing trend in lead, cadmium, and copper concentrations during the AEMR Period, while all other analytes remained generally consistent with water quality from recent AEMR periods (i.e. 2018 to the current period).

Table 5.6 Groundwater monitoring location WGM1/D3 – results summary

	Units	DGV	Baseline range	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	5.8 – 6.7	2	**5.5**	**5.7**	**5.6**
EC	µS/cm	350	332 – 773	2	**561**	**577**	**569**
Total dissolved solids	mg/L	-	238 – 538	2	364	455	410
Anions							
Chloride	mg/L		32 – 140	2	28	38	33
Fluoride	mg/L		0.1 – 0.2	2	0.2	0.3	0.3
Sulphate	mg/L		54 – 130	2	254	273	264
Cations							
Sodium	mg/L	-	35 – 96	2	55	59	57
Potassium	mg/L	-	5 – 12	2	10	10	10
Calcium	mg/L	-	11 – 27	2	39	57	48
Magnesium	mg/L	-	11 – 30	2	22	23	23
Metals[1]							
Aluminium	mg/L	0.055	NM	2	**0.120**	**0.600**	**0.360**
Arsenic	mg/L	0.013	0.001 – 0.025	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	0.00025 – 0.00500	2	-	-	-

Table 5.6 Groundwater monitoring location WGM1/D3 – results summary

	Units	DGV	Baseline range	No. samples	Minimum	Maximum	Median
Barium	mg/L	-	0.05 – 0.13	2	0.02	0.03	0.03
Boron	mg/L	0.94	0.01 – 0.06	2	0.31	0.42	0.37
Cadmium	mg/L	0.0002	0.0001 – 0.0010	2	**0.0005**	**0.0012**	**0.0009**
Chromium	mg/L	0.001	0.001 – 0.010	2	<0.001	<0.001	0.0005
Copper	mg/L	0.0014	0.001 – 0.006	2	<0.001	**0.003**	**0.002**
Iron (filtered)	mg/L	-	0.01 – 6.50	2	0.14	11.70	5.92
Mercury	mg/L	0.00006	0.000025 – 0.0002	-	-	-	-
Manganese	mg/L	1.9	0.2 – 1.1	2	0.8	0.9	0.9
Molybdenum	mg/L	0.034	NM	-	-	-	-
Nickel	mg/L	0.011	NM	2	**0.11**	**0.161**	**0.1355**
Lead	mg/L	0.0034	0.0005 – 0.0080	2	<0.001	<0.001	0.0005
Selenium	mg/L	0.005	0.001 – 0.003	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	0.030 – 0.061	2	**0.077**	**0.134**	**0.106**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples. The baseline range assumed to relate to the total metal concentrations.

5.3.4 Groundwater monitoring location WGM1/D4

Groundwater monitoring bore WGM1/D4 is located to the north-east of the KVAD, to the west of the northern end of the SSCAD embankment and near the Sawyers Swamp Creek Diversion (see Figure 5.1). The bore is shallow and is screened in the local groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the south-west, towards Sawyers Swamp Creek (EMM 2023a). There is potential for groundwater quality impacts at this location due to its proximity to the SSCAD embankment.

Two samples were collected from WGM1/D4 over the AEMR Period with most analytes being tested on both occasions. Table 5.7 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range. The groundwater quality is characterised as having a pH of 6.0 and salinity that is elevated relative to both the DGV and baseline range.

Median concentrations of zinc, nickel and manganese exceeded DGVs with boron also outside the baseline data range. Time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in recent AEMR periods (i.e. 2018 to the current period).

Table 5.7 Groundwater monitoring location WGM1/D4 – results summary

	Units	DGV	Baseline range	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	5.0 – 6.6	2	**6.0**	**6.0**	**6.0**
EC	µS/cm	350	492 – 1,331	2	**663**	**1,480**	**1,072**
Total dissolved solids	mg/L	-	270 – 1210	2	591	962	777
Anions							
Chloride	mg/L		16 – 86	2	32	41	37
Fluoride	mg/L		0.001 – 0.1	2	<0.1	<0.1	0.1
Sulphate	mg/L		77 – 770	2	558	720	639
Cations							
Sodium	mg/L	-	27 – 91	2	105	111	108
Potassium	mg/L	-	5 -10	2	8	8	8
Calcium	mg/L	-	38 – 100	2	70	102	86
Magnesium	mg/L	-	21 – 73	2	46	52	49
Metals[1]							
Aluminium	mg/L	0.055	NM	2	<0.01	<0.01	0.005
Arsenic	mg/L	0.013	0.001 – 0.025	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	0.00025 – 0.00500	-	-	-	-
Barium	mg/L	-	0.03 – 0.13	2	0.02	0.04	0.03
Boron	mg/L	0.94	0.23 – 1.30	2	0.72	**1.11**	0.92
Cadmium	mg/L	0.0002	0.0001 – 0.0010	2	<0.0001	<0.0001	0.0001
Chromium	mg/L	0.001	0.001 – 0.010	2	<0.001	<0.001	0.0005
Copper	mg/L	0.0014	0.001 – 0.005	2	<0.001	<0.001	0.001
Iron (filtered)	mg/L	-	22.0 – 71.0	2	36.4	72.0	54.2
Mercury	mg/L	0.00006	0.000025 – 0.0002	-	-	-	-
Manganese	mg/L	1.9	6.0 – 20.0	2	**5.4**	**6.3**	**5.8**
Molybdenum	mg/L	0.034	NM	-	-	-	-
Nickel	mg/L	0.011	NM	2	**0.029**	**0.036**	**0.033**
Lead	mg/L	0.0034	0.0005 – 0.0100	2	<0.001	<0.001	0.0005
Selenium	mg/L	0.005	0.001 – 0.003	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	0.020 – 0.090	2	**0.02**	**0.05**	**0.03**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples. The baseline range assumed to relate to the total metal concentrations.

5.3.5 Groundwater monitoring location WGM1/D5

Groundwater monitoring bore WGM1/D5 is located to the north-west of the KVAD and is near the Sawyers Swamp Creek Diversion (see Figure 5.1). The bore is screened in the regional groundwater system (see Table 5.1) downgradient of the KVAR/KVAD and SSCAD, but upgradient from Lidsdale Cut. The groundwater flow direction at this bore is interpreted to be to the north-west, away from the KVAR/KVAD (EMM 2023b). There is potential for groundwater quality impacts at this location due to its proximity to the KVAR/KVAD. Previous groundwater assessments (Aurecon 2020) noted that this bore has been known to be dry since July 2019, which is when controlled discharges for Springvale Colliery to Sawyers Swamp Creek ceased.

Two samples were collected from WGM1/D5 over the AEMR Period with most analytes being sampled on at least two occasions. Table 5.8 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The groundwater quality is characterised as having a pH between 5.4 to 5.7 and salinity that is elevated relative to the DGV. Median concentrations of zinc, nickel and silver exceeded DGVs, with manganese and barium generally outside the baseline range. Overall, the groundwater quality is similar to bore D2 suggesting that the groundwater quality at the bore location is not ash affected.

The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in recent AEMR periods (i.e. 2018 to the current period).

Table 5.8 Groundwater monitoring location WGM1/D5 – results summary

	Units	DGV	Baseline range	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	3.7 – 4.7	2	**5.4**	**5.7**	**5.6**
EC	µS/cm	350	229– 634	2	**381**	**642**	**511**
Total dissolved solids	mg/L	-	170–1913	2	247	525	386
Anions							
Chloride	mg/L		3– 26	2	55	67	61
Fluoride	mg/L		0.2 – 0.4	2	0.1	0.1	0.1
Sulphate	mg/L		86–274	1	220	220	220
Cations							
Sodium	mg/L	-	6–55	2	49	57	53
Potassium	mg/L	-	4–23	2	5	6	6
Calcium	mg/L	-	12–21	2	4	28	20
Magnesium	mg/L	-	5–24	2	23	29	26
Metals[1]							

Table 5.8 Groundwater monitoring location WGM1/D5 – results summary

	Units	DGV	Baseline range	No. samples	Minimum	Maximum	Median
Aluminium	mg/L	0.055	NM	2	<0.01	0.02	0.015
Arsenic	mg/L	0.013	0.001 – 0.025	2	<0.001	<0.001	<0.001
Silver	mg/L	0.00005	0.00100 – 0.00500	1	<0.001	<0.001	0.001
Barium	mg/L	-	0.02 – 0.07	2	0.031	0.065	0.048
Boron	mg/L	0.94	0.08 – 1.10	2	0.37	0.52	0.445
Cadmium	mg/L	0.0002	0.0010 – 0.0430	2	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	0.005 – 0.010	2	<0.001	<0.001	<0.001
Copper	mg/L	0.0014	0.005 – 0.072	2	<0.001	<0.001	<0.001
Iron (filtered)	mg/L	-	0.06 – 5.32	2	30.7	42.1	36.4
Mercury	mg/L	0.00006	0.00005 – 0.0002	1	<0.00005	<0.00005	0.00005
Manganese	mg/L	1.9	0.8 – 2.1	2	1.61	1.89	1.75
Molybdenum	mg/L	0.034	NM	1	<0.001	<0.001	<0.0001
Nickel	mg/L	0.011	NM	**2**	**0.032**	**0.032**	**0.032**
Lead	mg/L	0.0034	0.0050 – 0.0760	2	<0.001	<0.001	<0.001
Selenium	mg/L	0.005	0.001 – 0.003	2	<0.01	<0.01	<0.01
Zinc	mg/L	0.008	0.240 – 2.630	2	<0.005	**0.017**	**0.011**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples. The baseline range assumed to relate to the total metal concentrations.

5.3.6 Groundwater monitoring location WGM1/D6

Groundwater monitoring bore WGM1/D6 is located to the west of the KVAR/KVAD (see Table 5.1). The bore is screened in the regional system (see Table 5.1) downgradient of the KVAR/KVAD and SSCAD, but upgradient from Lidsdale Cut. The groundwater flow direction at this bore is interpreted to be to the west, away from the KVAR/KVAD (EMM 2023a). There is potential for groundwater quality impacts at this location due to its proximity to the KVAR/KVAD.

Two samples were collected from WGM1/D6 over the AEMR Period with most analytes being sampled on at least two occasions. Table 5.9 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The groundwater quality is characterised as having a pH ranging between 3.9 to 4.5 and salinity (as indicated by EC) that is elevated relative to the DGV. Median concentrations of most metals sampled exceed the DGV but were generally within the baseline range. The water quality is consistent with ash affected water.

The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in recent AEMR periods (i.e. 2018 to the current period).

Table 5.9 Groundwater monitoring location WGM1/D6 – results summary

	Units	DGV	Baseline range	No. samples	Minimum	Maximum	Median
Physico-chemical parameters							
pH	-	6.5–8.0	3.1 – 5.5	2	**3.9**	**5.1**	**4.5**
EC	µS/cm	350	283 – 1,013	2	**801**	**1016**	**909**
Total dissolved solids	mg/L	-	200 – 902	2	650	663	657
Anions							
Chloride	mg/L		14 – 118	2	22	22	22
Fluoride	mg/L		0.001 – 0.2	2	0.4	0.6	0.5
Sulphate	mg/L		89 – 360	2	435	442	439
Cations							
Sodium	mg/L	-	25 – 58	2	74	85	79.5
Potassium	mg/L	-	4 – 9	2	5	5	5
Calcium	mg/L	-	4 – 24	2	9	9	9
Magnesium	mg/L	-	12 – 29	2	49	52	51
Metals[1]							
Aluminium	mg/L	0.055	NM	2	**3.630**	**4.96**	**4.295**
Arsenic	mg/L	0.013	0.004 – 0.025	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	0.00100 – 0.00500	-	-	-	-
Barium	mg/L	-	0.02 – 0.07	2	0.011	0.019	0.015
Boron	mg/L	0.94	0.12 – 0.82	2	0.3	0.6	0.5
Cadmium	mg/L	0.0002	0.0010 – 0.0010	2	**0.0004**	**0.0007**	**0.0006**
Chromium	mg/L	0.001	0.002 – 0.010	2	<0.001	<0.001	0.0005
Copper	mg/L	0.0014	0.002 – 0.010	2	<0.001	<0.001	0.001
Iron (filtered)	mg/L	-	13 – 104	2	1.7	11.5	6.6
Mercury	mg/L	0.00006	0.0001 – 0.0002	-	-	-	-
Manganese	mg/L	1.9	0.6 – 4.3	2	0.6	1.3	0.9
Molybdenum	mg/L	0.034	NM	-	-	-	-
Nickel	mg/L	0.011	NM	2	**0.426**	**0.447**	**0.437**
Lead	mg/L	0.0034	0.0020 – 0.0110	2	0.002	0.002	0.002
Selenium	mg/L	0.005	0.001 – 0.003	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	0.050 – 0.566	2	**0.88**	**1.29**	**1.09**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes analyte was not monitored

1. Reported metal concentrations for the current AEMR Period are from filtered samples. The baseline range assumed to relate to the total metal concentrations.

5.3.7 Groundwater monitoring location WH_MW02

Groundwater monitoring bore WH_MW02 is located on the down gradient western boundary of KVAR/KVAD (see Figure 5.1). The bore is screened in the regional – upper ICM groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the north-west (EMM 2023a).

Two samples were collected from WH_MW02 over the period with most analytes being sampled on at least two occasions. Table 5.10 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that groundwater pH ranged from 5.6 to 4.9, and salinity was elevated relative to the DGV. Median concentrations of manganese exceeded DGVs, while no other analytes exceeded DGVs during the period. The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in previous 2023 AEMR period.

Table 5.10 Groundwater monitoring location WH_MW02 – results summary

	Units	DGV	No. samples	Minimum	Maximum	Median
Physico-chemical parameters						
pH	-	6.5–8.0	2	**5.6**	**5.9**	**5.7**
EC	µS/cm	350	2	**366**	**476**	**421**
Total dissolved solids*	mg/L	-	2	306	309	308
Anions						
Chloride	mg/L	-	2	28	30	29
Fluoride	mg/L	-	2	<0.1	<0.1	0.1
Sulphate	mg/L	-	2	78	103	91
Cations						
Sodium	mg/L	-	2	18	20	19
Potassium	mg/L	-	2	5	5	5
Calcium	mg/L	-	2	11	13	12
Magnesium	mg/L	-	2	16	17	17
Metals[1]						
Aluminium	mg/L	0.055	2	<0.01	<0.01	0.005
Arsenic	mg/L	0.013	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	-	-	-	-
Barium	mg/L	-	2	0.009	0.022	0.016
Boron	mg/L	0.94	2	<0.05	0.1	0.1
Cadmium	mg/L	0.0002	2	<0.0001	<0.0001	0.0001
Chromium	mg/L	0.001	2	<0.001	<0.001	0.0005

	Units	DGV	No. samples	Minimum	Maximum	Median
Copper	mg/L	0.0014	2	<0.001	<0.001	0.001
Iron	mg/L	-	2	28.7	36.1	32.4
Mercury	mg/L	0.00006	-	-	-	-
Manganese	mg/L	1.9	2	**2.4**	**2.5**	**2.5**
Molybdenum	mg/L	0.034	-	-	-	-
Nickel	mg/L	0.011	2	<0.001	0.003	0.002
Lead	mg/L	0.0034	2	<0.001	<0.001	0.0005
Selenium	mg/L	0.005	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	2	<0.005	<0.005	0.00

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples.

5.3.8 Groundwater monitoring location WH_MW03

Groundwater monitoring bore WH_MW03 is located on the down gradient western boundary of KVAR/KVAD (see Figure 5.1). The bore is screened in the regional – upper ICM groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the north-west (EMM 2023a).

Two samples were collected from WH_MW03 over the period with most analytes being sampled on at least two occasions. Table 5.11 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that groundwater pH ranged from 5.1 to 6.0 and low salinity. Median concentrations of aluminium, nickel, and zinc exceeded DGVs. The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in previous AEMR period.

Table 5.11 Groundwater monitoring location WH_MW03 – results summary

	Units	DGV	No. samples	Minimum	Maximum	Median
Physico-chemical parameters						
pH	-	6.5–8.0	2	**5.1**	**6.0**	**5.5**
EC	µS/cm	350	2	53	299	176
Total dissolved solids*	mg/L	-	2	45	194	120
Anions						
Chloride	mg/L	-	2	12	13	12
Fluoride	mg/L	-	2	0.2	0.3	0.3
Sulphate	mg/L	-	2	88	94	91
Cations						
Sodium	mg/L	-	2	16	16	16
Potassium	mg/L	-	2	5	5	5

	Units	DGV	No. samples	Minimum	Maximum	Median
Calcium	mg/L	-	2	14	18	16
Magnesium	mg/L	-	2	7	11	9
Metals[1]						
Aluminium	mg/L	0.055	2	2	**0.150**	**0.16**
Arsenic	mg/L	0.013	2	2	<0.001	<0.001
Silver	mg/L	0.00005	-	-	-	-
Barium	mg/L	-	2	2	0.072	0.073
Boron	mg/L	0.94	2	2	0.1	0.2
Cadmium	mg/L	0.0002	2	2	0.0001	0.0002
Chromium	mg/L	0.001	2	2	<0.001	<0.001
Copper	mg/L	0.0014	2	2	<0.001	**0.002**
Iron	mg/L	-	2	2	0.1	0.9
Mercury	mg/L	0.00006	-	-	-	-
Manganese	mg/L	1.9	2	2	1.5	1.7
Molybdenum	mg/L	0.034	-	-	-	-
Nickel	mg/L	0.011	2	2	**0.024**	**0.034**
Lead	mg/L	0.0034	2	2	<0.001	<0.001
Selenium	mg/L	0.005	2	2	<0.01	<0.01
Zinc	mg/L	0.008	2	2	**0.06**	**0.08**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples.

5.3.9 Groundwater monitoring location WI_MW03R

Groundwater monitoring bore WI_MW03 is located on the down gradient northwestern boundary of KVAR/KVAD (see Figure 5.1). The bore is screened in the local groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the north-west (EMM 2023a). WI_MW03 was found to be damaged in November 2023 and was replaced in June 2024 and the new borehole is referred to as WI_MW03R.

One sample was collected from WI_MW03R over the period with most analytes being sampled on at least two occasions. Table 5.12 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The groundwater quality is characterised as having a pH of 6.0 and salinity (as indicated by EC) that is elevated relative to both the DGV and baseline range. Median concentrations of nickel, and zinc exceeded DGVs. The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in previous AEMR period.

Table 5.12 Groundwater monitoring location WI_MW03R – results summary

	Units	DGV	No. samples	Minimum	Maximum	Median
Physico-chemical parameters						
pH	-	6.5–8.0	2	**5.9**	**5.9**	**5.9**
EC	µS/cm	350	2	**426**	**426**	**426**
Total dissolved solids*	mg/L	-	2	403	403	403
Anions						
Chloride	mg/L	-	2	9	10	9
Fluoride	mg/L	-	2	0.7	0.7	0.7
Sulphate	mg/L	-	2	-	-	-
Cations						
Sodium	mg/L	-	2	29	29	29
Potassium	mg/L	-	2	14	14	14
Calcium	mg/L	-	2	25	25	25
Magnesium	mg/L	-	2	23	23	23
Metals[1]						
Aluminium	mg/L	0.055	2	0.050	0.050	0.050
Arsenic	mg/L	0.013	2	<0.001	<0.001	<0.001
Silver	mg/L	0.00005	-	-	-	-
Barium	mg/L	-	2	0.036	0.036	0.036
Boron	mg/L	0.94	2	0.62	0.62	0.62
Cadmium	mg/L	0.0002	2	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	2	<0.001	<0.001	<0.001
Copper	mg/L	0.0014	2	<0.001	<0.001	<0.001
Iron	mg/L	-	2	8.7	8.7	8.7
Mercury	mg/L	0.00006	-	-	-	-
Manganese	mg/L	1.9	2	1.5	1.5	1.5
Molybdenum	mg/L	0.034	-	-	-	-
Nickel	mg/L	0.011	2	**0.106**	**0.106**	**0.106**
Lead	mg/L	0.0034	2	<0.001	<0.001	<0.001
Selenium	mg/L	0.005	2	<0.01	<0.01	<0.01
Zinc	mg/L	0.008	2	**0.27**	**0.27**	**0.27**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples.

5.3.10 Groundwater monitoring location WJ_MW03

Groundwater monitoring bore WJ_MW03 is located on the down gradient northwestern boundary of KVAR/KVAD (see Figure 5.1). The bore is screened in the local groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the north-west (EMM 2023a).

Two samples were collected from WJ_MW03 over the period with most analytes being sampled on at least two occasions. Table 5.13 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that groundwater pH ranged from 3.9 to 4.1 and salinity (as indicated by EC) that is elevated relative to both the DGV and baseline range. Median concentrations of nickel, and zinc exceeded DGVs. The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in previous 2023 AEMR period.

Table 5.13 Groundwater monitoring location WJ_MW03 – results summary

	Units	DGV	No. samples	Minimum	Maximum	Median
Physico-chemical parameters						
pH	-	6.5–8.0	2	**3.9**	**4.1**	**4.0**
EC	µS/cm	350	2	**720**	**1,328**	**1,024**
Total dissolved solids*	mg/L	-	2	624	864	744
Anions						
Chloride	mg/L	-	1	0.28	0.28	0.28
Fluoride	mg/L	-	2	122	133	127.5
Sulphate	mg/L	-	2	0.1	0.1	0.075
Cations						
Sodium	mg/L	-	2	425	446	435.5
Potassium	mg/L	-	2	99	106	103
Calcium	mg/L	-	2	10	11	10.5
Magnesium	mg/L	-	2	44	56	50
Metals[1]						
Aluminium	mg/L	0.055	1	0.040	**0.08**	0.050
Arsenic	mg/L	0.013	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	-	-	-	-
Barium	mg/L	-	2	0.036	0.040	0.037
Boron	mg/L	0.94	2	0.6	0.7	0.7
Cadmium	mg/L	0.0002	2	<0.0001	<0.0001	0.0001
Chromium	mg/L	0.001	2	<0.001	<0.001	0.0005
Copper	mg/L	0.0014	2	<0.001	<0.001	0.001

	Units	DGV	No. samples	Minimum	Maximum	Median
Iron	mg/L	-	2	8.1	8.7	8.4
Mercury	mg/L	0.00006	-	-	-	-
Manganese	mg/L	1.9	2	1.5	1.5	1.5
Molybdenum	mg/L	0.034	-	-	-	-
Nickel	mg/L	0.011	2	**0.104**	**0.110**	**0.106**
Lead	mg/L	0.0034	2	<0.001	<0.001	0.0005
Selenium	mg/L	0.005	2	<0.001	<0.01	0.005
Zinc	mg/L	0.008	2	**0.22**	**0.27**	**0.23**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples.

5.3.11 Groundwater monitoring location WK_MW01

Groundwater monitoring bore WK_MW01 is located on the down gradient southern boundary of SCCAD (see Figure 5.1). The bore is screened in the local - upper ICM groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the north-west (EMM 2023a).

Two samples were collected from WK_MW01 over the period with most analytes being sampled on at least two occasions. Table 5.14 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that groundwater pH ranged from 6.4 to 6.5 and salinity (as indicated by EC) that is elevated relative to both the DGV and baseline range. Median concentrations of nickel, and zinc exceeded DGVs. The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in previous 2023 AEMR period.

Table 5.14 Groundwater monitoring location WK_MW01 – results summary

	Units	DGV	No. samples	Minimum	Maximum	Median
Physico-chemical parameters						
pH	-	6.5–8.0	2	**6.4**	**6.5**	**6.4**
EC	µS/cm	350	2	**1,021**	**1,980**	**1,501**
Total dissolved solids*	mg/L	-	2	851	1287	1069
Anions						
Chloride	mg/L	-	2	133	153	143
Fluoride	mg/L	-	2	0.2	0.2	0.2
Sulphate	mg/L	-	2	497	559	528
Cations						
Sodium	mg/L	-	2	92	92	92
Potassium	mg/L	-	2	18	19	19

	Units	DGV	No. samples	Minimum	Maximum	Median
Calcium	mg/L	-	2	150	186	168
Magnesium	mg/L	-	2	104	105	105
Metals[1]						
Aluminium	mg/L	0.055	2	<0.01	<0.01	0.005
Arsenic	mg/L	0.013	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	-	-	-	-
Barium	mg/L	-	2	0.024	0.036	0.030
Boron	mg/L	0.94	2	0.7	0.8	0.8
Cadmium	mg/L	0.0002	2	<0.0001	<0.0001	0.0001
Chromium	mg/L	0.001	2	<0.001	<0.001	0.0005
Copper	mg/L	0.0014	2	<0.001	<0.001	0.001
Iron	mg/L	-	2	0.1	4.1	2.1
Mercury	mg/L	0.00006	-	-	-	-
Manganese	mg/L	1.9	2	0.1	1.1	0.6
Molybdenum	mg/L	0.034	-	-	-	-
Nickel	mg/L	0.011	2	0.008	0.011	0.010
Lead	mg/L	0.0034	2	<0.001	<0.001	0.0005
Selenium	mg/L	0.005	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	2	<0.005	<0.005	0.00

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples.

5.3.12 Groundwater monitoring location WK_MW04

Groundwater monitoring bore WK_MW04 is located on the down gradient southern boundary of KVAR/KVAD (see Figure 5.1). The bore is screened in the local - upper ICM groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the north-west (EMM 2023a).

Two samples were collected from WK_MW04 over the period with most analytes being sampled on at least two occasions. Table 5.15 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The results indicate that groundwater pH ranged from 6.3 to 6.4 and salinity (as indicated by EC) that is elevated relative to both the DGV and baseline range. Median concentrations zinc exceeded DGVs. The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in previous 2023 AEMR period.

Table 5.15 Groundwater monitoring location WK_MW04 – results summary

	Units	DGV	No. samples	Minimum	Maximum	Median
Physico-chemical parameters						
pH	-	6.5–8.0	2	**6.3**	**6.4**	**6.3**
EC	µS/cm	350	2	**888**	**2,910**	**1,899**
Total dissolved solids*	mg/L	-	2	702	1,892	1,297
Anions						
Chloride	mg/L	-	2	614	679	647
Fluoride	mg/L	-	2	0.2	0.2	0.2
Sulphate	mg/L	-	2	109	136	123
Cations						
Sodium	mg/L	-	2	239	247	243
Potassium	mg/L	-	2	17	19	18
Calcium	mg/L	-	2	83	97	90
Magnesium	mg/L	-	2	137	138	138
Metals[1]						
Aluminium	mg/L	0.055	2	<0.01	<0.01	0.005
Arsenic	mg/L	0.013	2	<0.001	<0.001	0.0005
Silver	mg/L	0.00005	-	-	-	-
Barium	mg/L	-	2	0.060	0.063	0.062
Boron	mg/L	0.94	2	<0.05	0.1	0.0
Cadmium	mg/L	0.0002	2	<0.0001	<0.0001	0.0001
Chromium	mg/L	0.001	2	<0.001	<0.001	0.0005
Copper	mg/L	0.0014	2	<0.001	<0.001	0.001
Iron	mg/L	-	2	<0.05	<0.05	0.0
Mercury	mg/L	0.00006	-	-	-	-
Manganese	mg/L	1.9	2	0.3	0.3	0.3
Molybdenum	mg/L	0.034	-	-	-	-
Nickel	mg/L	0.011	2	0.008	0.010	0.009
Lead	mg/L	0.0034	2	<0.001	<0.001	0.0005
Selenium	mg/L	0.005	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	2	**0.03**	**0.03**	**0.03**

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples.

5.3.13 Groundwater monitoring location WK_MW06

Groundwater monitoring bore WK_MW06 is located on the down gradient southern boundary of SCCAD south of WK_MW04 (see Figure 5.1). The bore is screened in the local - upper ICM groundwater system (Table 5.1). The groundwater flow direction at this bore is interpreted to be to the north-west (EMM 2023a).

Two samples were collected from WK_MW06 over the period with most analytes being sampled on at least two occasions. Table 5.16 provides the minimum, median and maximum values for each analyte and compares the results to DGVs and the baseline water quality range.

The groundwater quality is characterised as having a pH of 6.5 and salinity that is elevated relative to both the DGV and baseline range. Median concentrations of arsenic exceeded DGVs. The time-series charts provided in Appendix B indicate that the water quality over the AEMR Period was generally consistent with water quality in previous 2023 AEMR period.

Table 5.16 Groundwater monitoring location WK_MW04 – results summary

	Units	DGV	No. samples	Minimum	Maximum	Median
Physico-chemical parameters						
pH	-	6.5–8.0	2	6.5	6.5	6.5
EC	µS/cm	350	2	**677**	**1,115**	**896**
Total dissolved solids*	mg/L	-	2	618	722	670
Anions						
Chloride	mg/L	-	2	42	46	44
Fluoride	mg/L	-	2	0.3	0.3	0.3
Sulphate	mg/L	-	2	10	13	12
Cations						
Sodium	mg/L	-	2	12	12	12
Potassium	mg/L	-	2	21	22	22
Calcium	mg/L	-	2	118	134	126
Magnesium	mg/L	-	2	46	48	47
Metals[1]						
Aluminium	mg/L	0.055	2	<0.01	<0.01	0.005
Arsenic	mg/L	0.013	2	**0.042**	**0.048**	**0.045**
Silver	mg/L	0.00005	-	-	-	-
Barium	mg/L	-	2	0.664	0.804	0.734
Boron	mg/L	0.94	2	<0.05	<0.05	0.0
Cadmium	mg/L	0.0002	2	<0.0001	<0.0001	0.0001
Chromium	mg/L	0.001	2	<0.001	<0.001	0.0005

	Units	DGV	No. samples	Minimum	Maximum	Median
Copper	mg/L	0.0014	2	<0.001	<0.001	0.001
Iron	mg/L	-	2	1.4	2.2	1.8
Mercury	mg/L	0.00006	-	-	-	-
Manganese	mg/L	1.9	2	0.1	0.1	0.1
Molybdenum	mg/L	0.034	-	-	-	-
Nickel	mg/L	0.011	2	<0.001	<0.001	0.001
Lead	mg/L	0.0034	2	<0.001	<0.001	0.0005
Selenium	mg/L	0.005	2	<0.01	<0.01	0.005
Zinc	mg/L	0.008	2	<0.005	<0.005	0.00

Notes: **Bold** indicates DGV exceeded, underlined indicates baseline range exceeded. NM denotes not monitored or not provided in the baseline data set.

1. Reported metal concentrations for the current AEMR Period are from filtered samples.

5.4 Summary

The groundwater quality results for the AEMR Period indicate that:

- The groundwater chemistry varied across the eleven groundwater monitoring bores. The salinity levels ranged from 53 to 2,910 µS/cm and pH ranged from 3.7 to 6.5. This variability is consistent with expectations given the bores are screened in multiple lithologies (refer to Table 5.1) and is also consistent with the results from the prior AEMR Period (refer to time series graphs provided in Appendix B).
- The concentrations of several metals that are known to occur in ash affected water (copper, nickel and zinc) exceeded the DGVs at most groundwater monitoring bores. The highest concentrations occurred at WGM1/D6 (located to the west of the KVAR/KVAD), WGM1/D3 (located between SSCAD and KVAR) and WJ_MW03 (located downgradient of KVAD and Lidsdale Cut). The pH at each of these bores was also acidic, varying between 3.9 and 6.5. These trends are consistent with previous results of AEMR periods.
- The arsenic concentration at WK_MW06 (located to the south of KVAR) remains elevated (0.048 mg/L) relative to the DGV of 0.013 mg/L. Arsenic is not known to occur in ash affected water (EMM 2023a). The arsenic concentration was either below detection or the DGV at all other locations. The presence of arsenic at WK_MW06 and no other bore is consistent with previous results of AEMR periods.

In summary, the groundwater quality trends during the AEMR Period were generally consistent with recent AEMR periods (i.e. 2018 to the current period).

Potential groundwater contamination sources, pathways and receptors are being investigated as part of the VMP process (see section 1.3.4).

References

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EMM 2023b, *Kerosene Vale Ash Repositories: Surface Water Characterisation Report: EPL Condition E1.2*, prepared for Generator Property Management, EMM Consulting Pty Ltd, Newcastle

EMM 2024a, *Kerosene Vale Ash Repositories and Surrounds: Water quality monitoring report (18 January 2024 to 17 July 2024)* prepared for Generator Property Management, EMM Consulting Pty Ltd, Newcastle

EMM 2024b, *OEMP groundwater compliance report – July 2024*, prepared for Generator Property Management, EMM Consulting Pty Ltd, Sydney

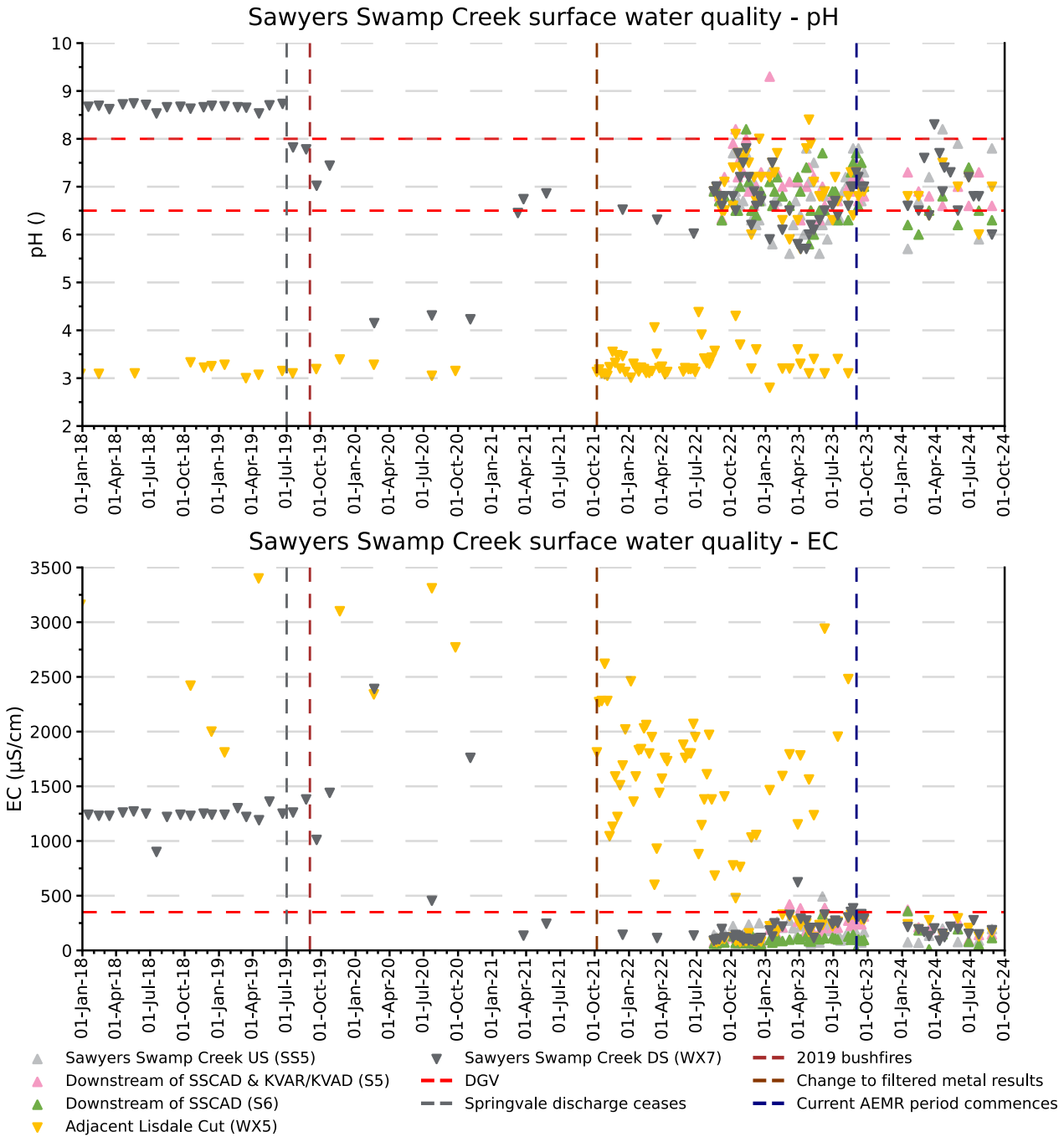
Energy Australia 2018, *Wallerawang Ash Repository, Operational Environmental Management Plan October 2018*, Revision 3

Appendix A
Surface water quality charts

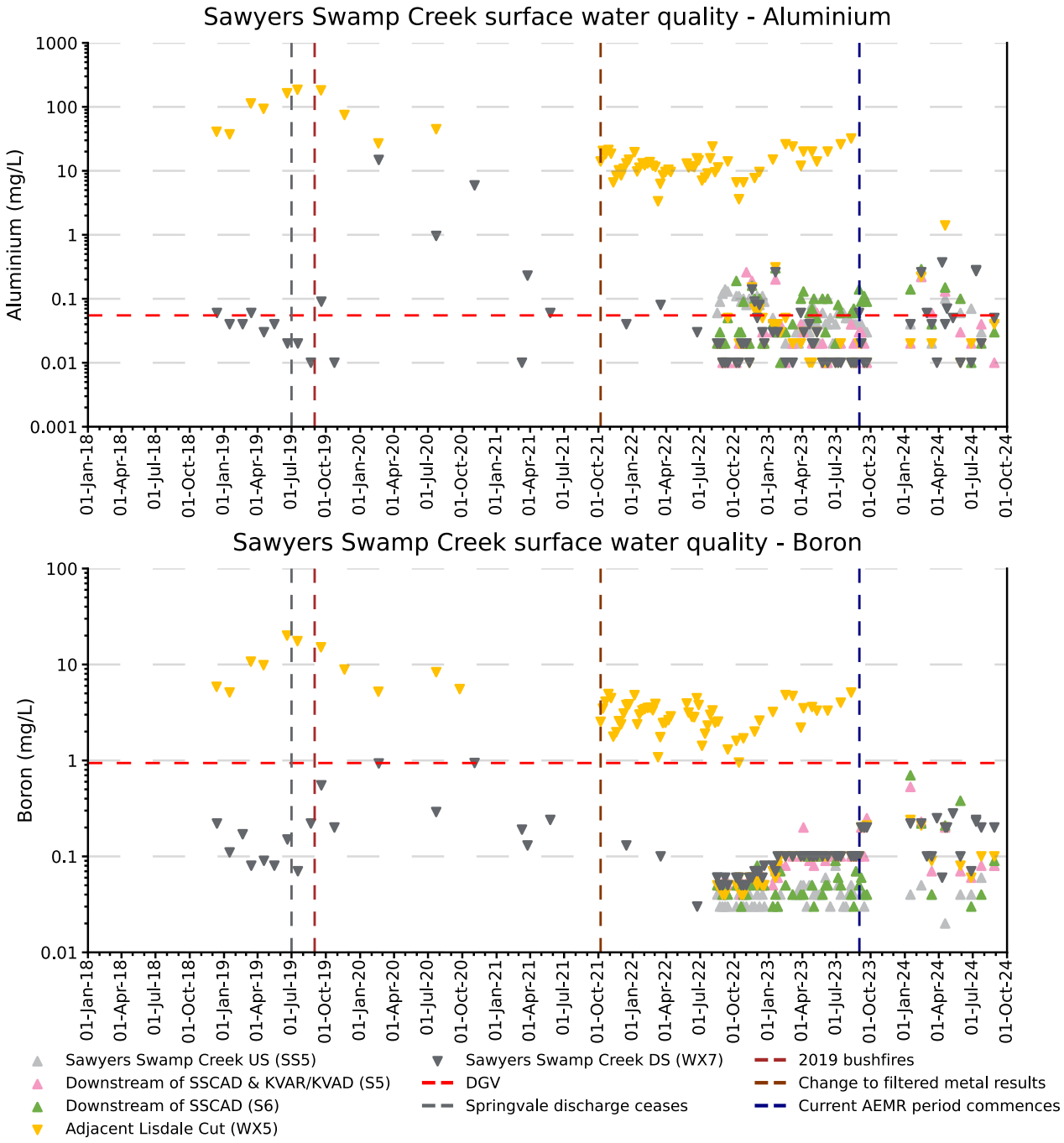
EMM
creating opportunities

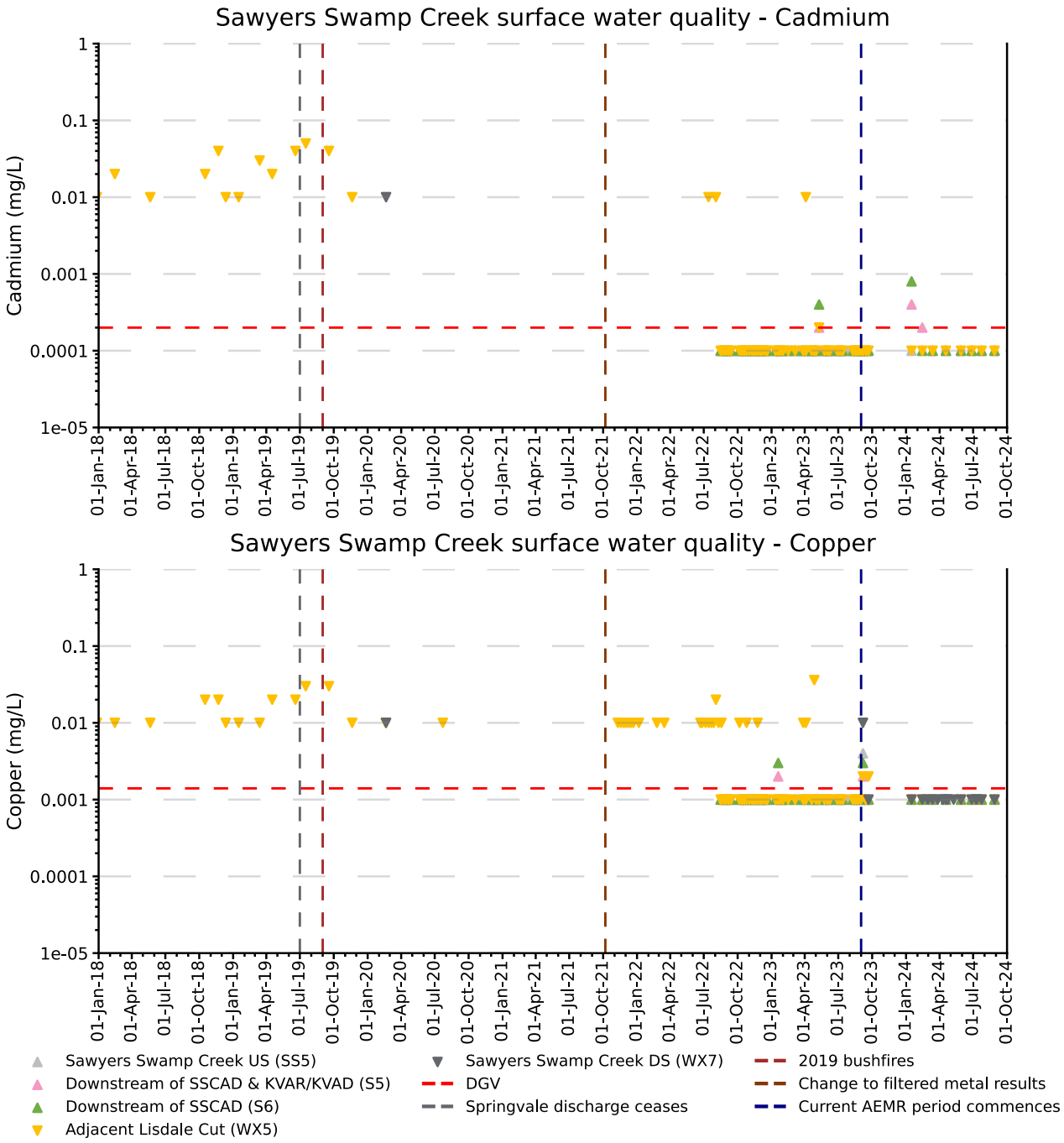
A.1 Sawyer Swamp Creek

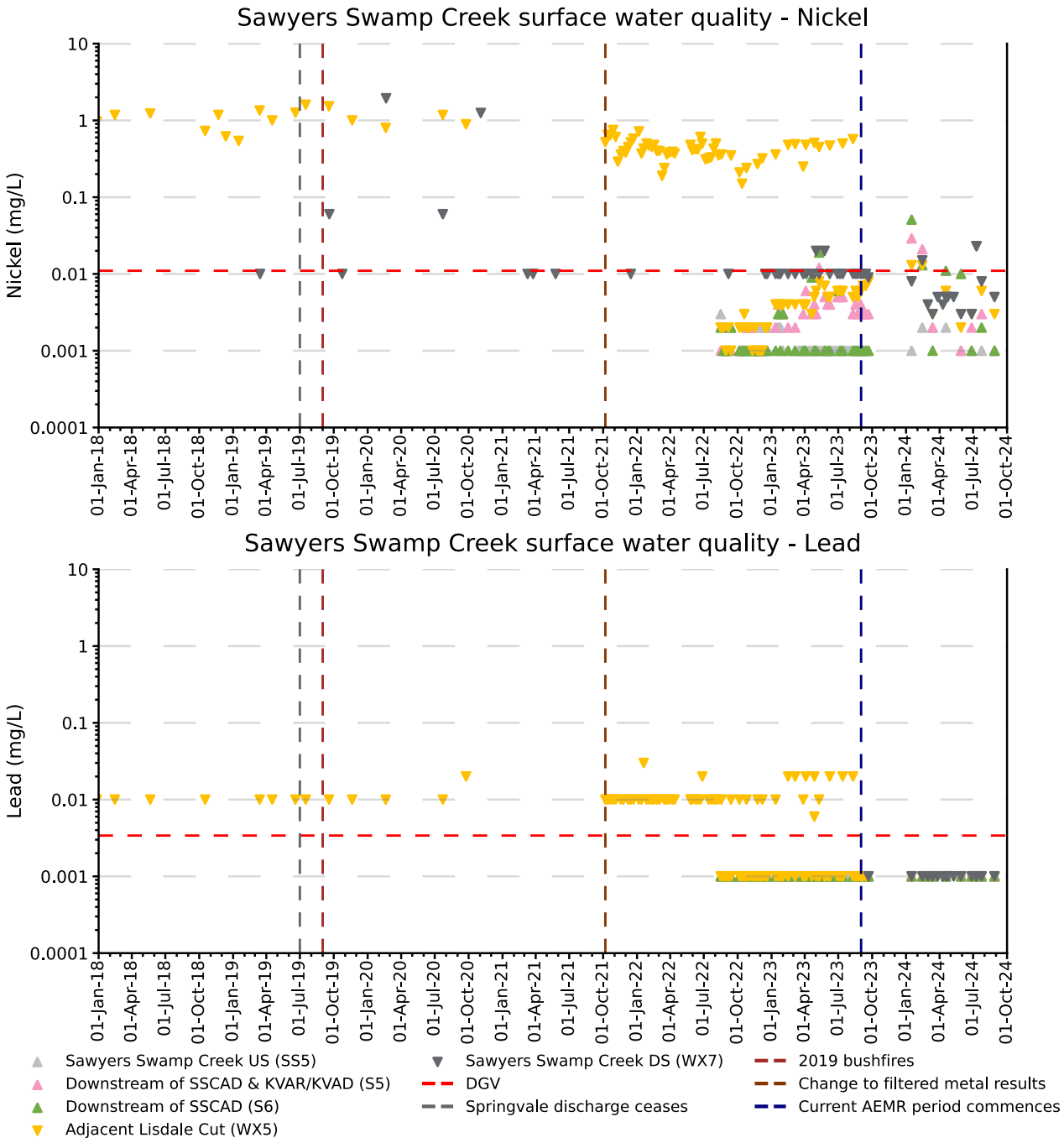
A.1.1 Physico-chemical parameters charts

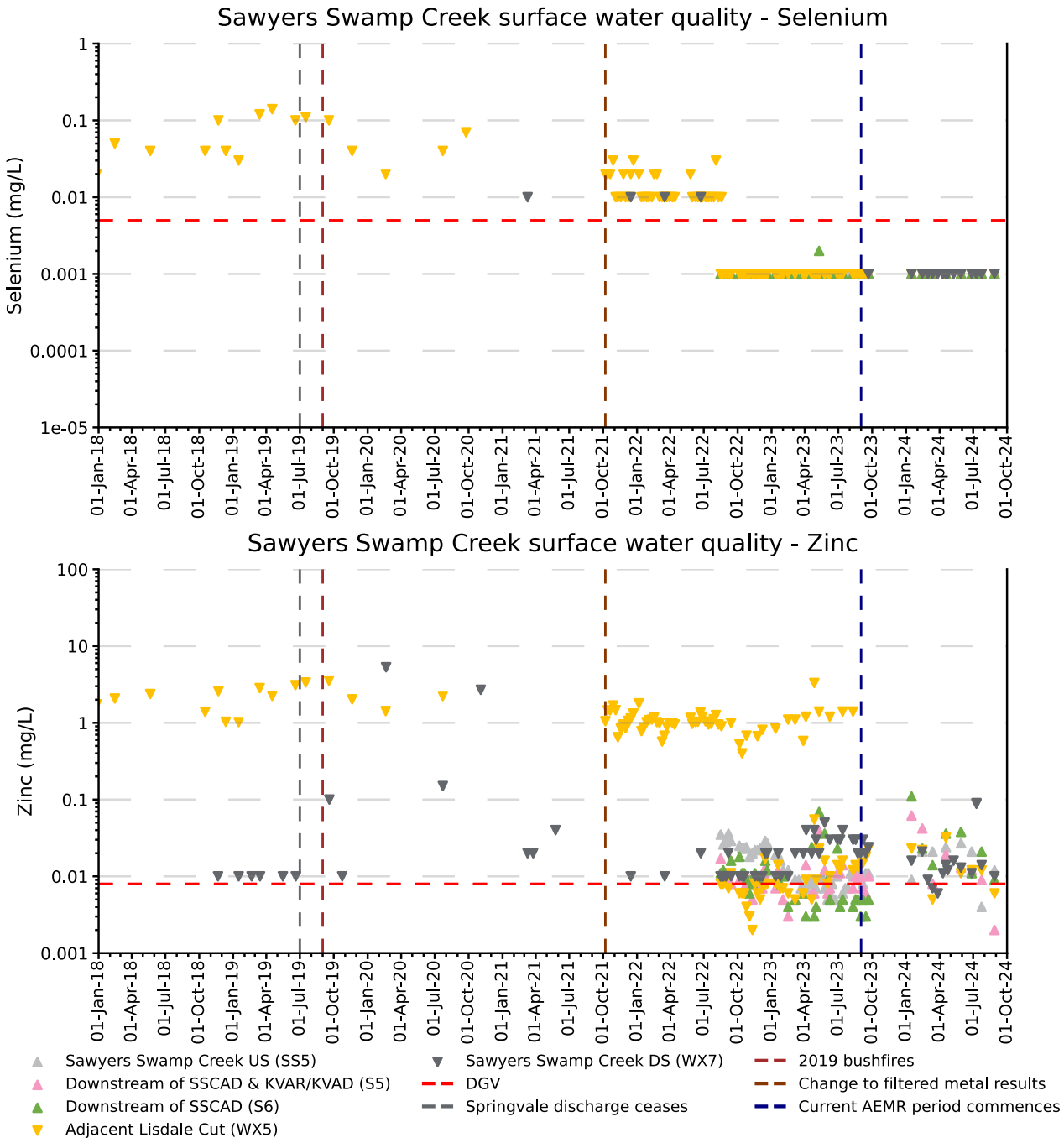


A.1.2 Metal charts



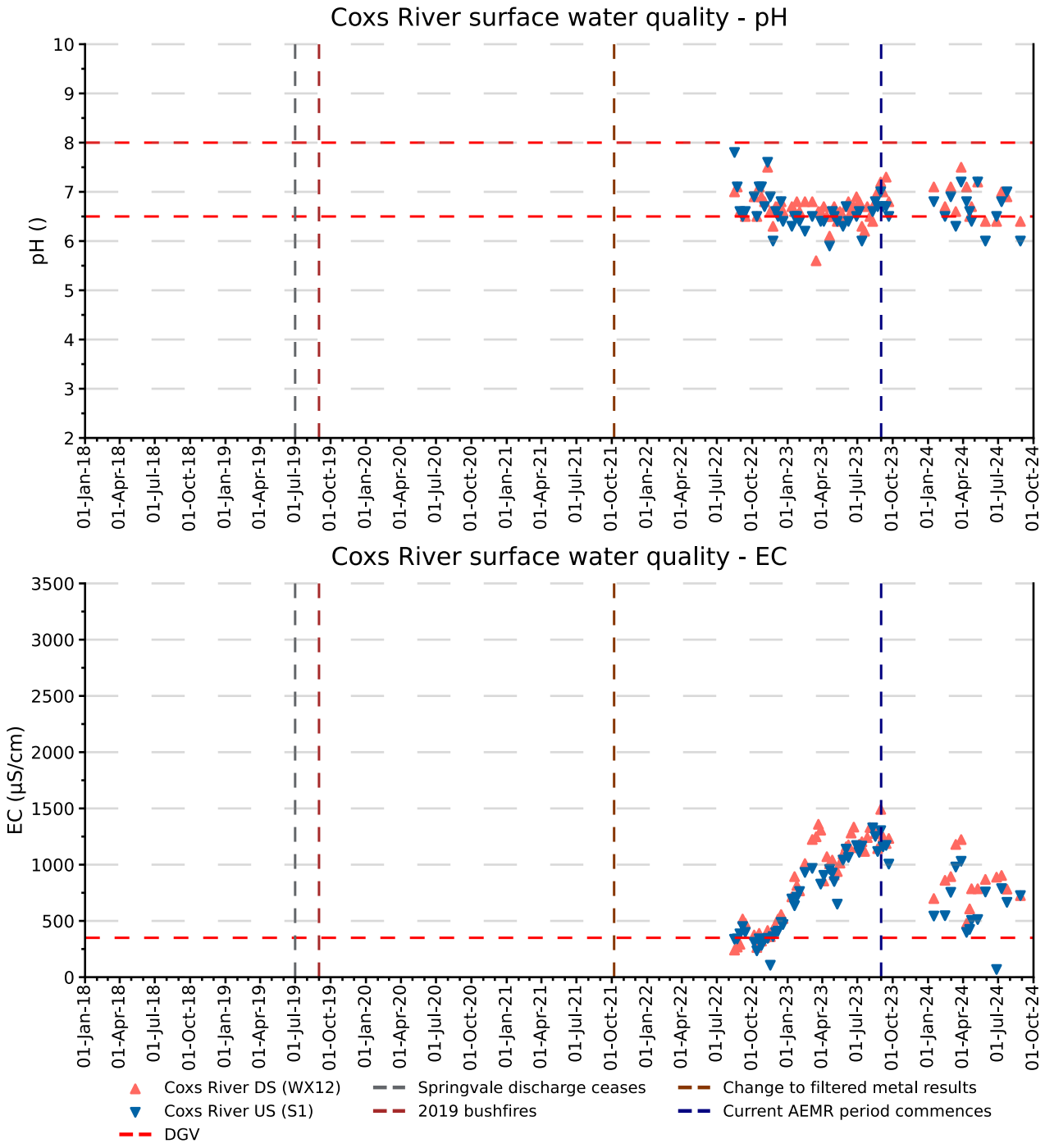

Sawyers Swamp Creek surface water quality - Cadmium
Cadmium (mg/L)
1
0.1
0.01
0.001
0.0001
1e-05
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Sawyers Swamp Creek surface water quality - Copper
Copper (mg/L)
Sawyers Swamp Creek US (SS5)
Downstream of SSCAD & KVAR/KVAD (S5)
Downstream of SSCAD (S6)
Adjacent Lisdale Cut (WX5)
Sawyers Swamp Creek DS (WX7)
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences


Sawyers Swamp Creek surface water quality - Nickel
Nickel (mg/L)
10
1
0.1
0.01
0.001
0.0001
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Sawyers Swamp Creek surface water quality - Lead
Lead (mg/L)
10
1
0.1
0.01
0.001
0.0001
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Sawyers Swamp Creek US (SS5)
Downstream of SSCAD & KVAR/KVAD (S5)
Downstream of SSCAD (S6)
Adjacent Lisdale Cut (WX5)
Sawyers Swamp Creek DS (WX7)
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences

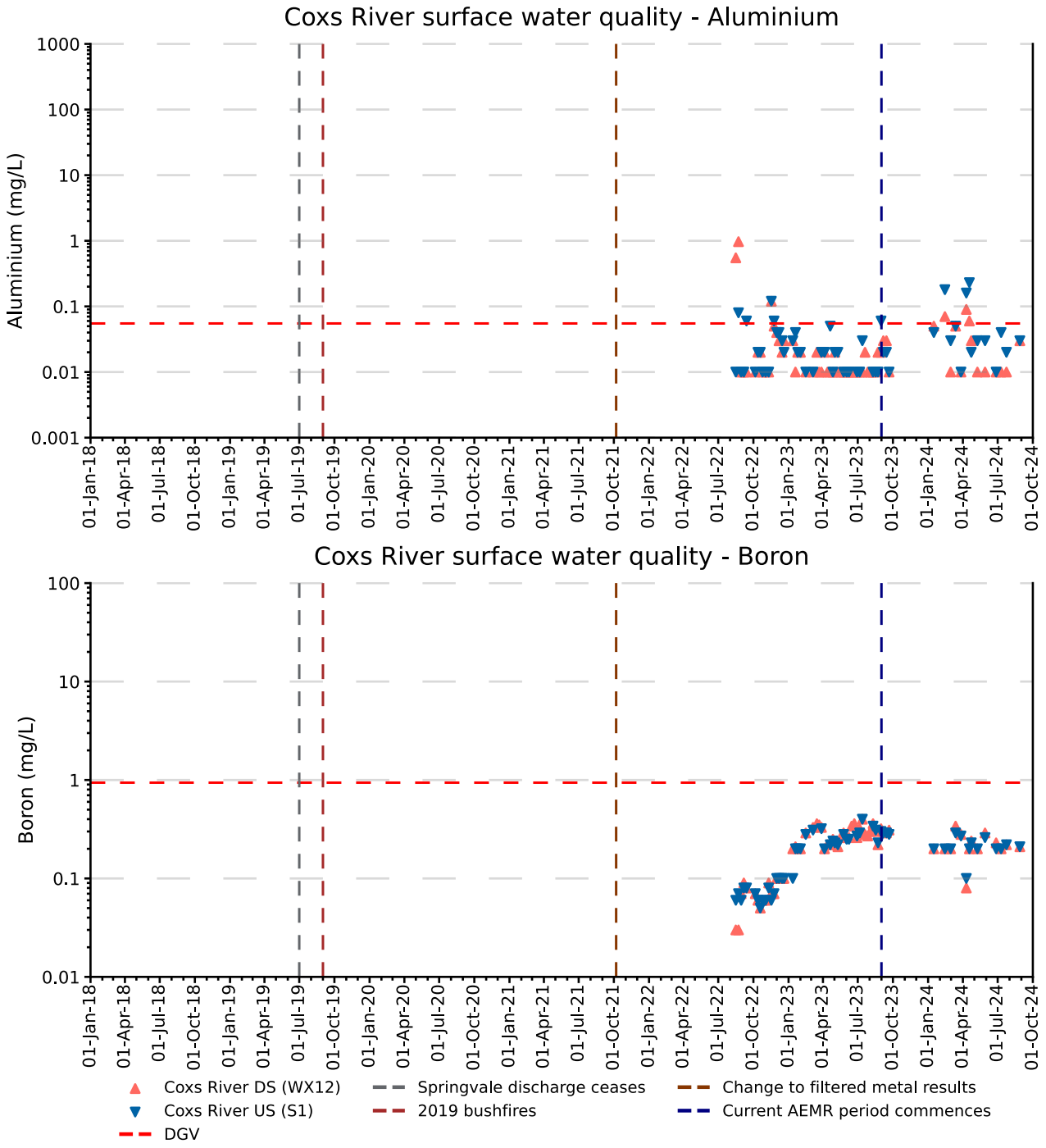

Sawyers Swamp Creek surface water quality - Selenium
Selenium (mg/L)
1
0.1
0.01
0.001
0.0001
1e-05
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Sawyers Swamp Creek surface water quality - Zinc
Zinc (mg/L)
100
10
1
0.1
0.01
0.001
Sawyers Swamp Creek US (SS5)
Downstream of SSCAD & KVAR/KVAD (S5)
Downstream of SSCAD (S6)
Adjacent Lisdale Cut (WX5)
Sawyers Swamp Creek DS (WX7)
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences

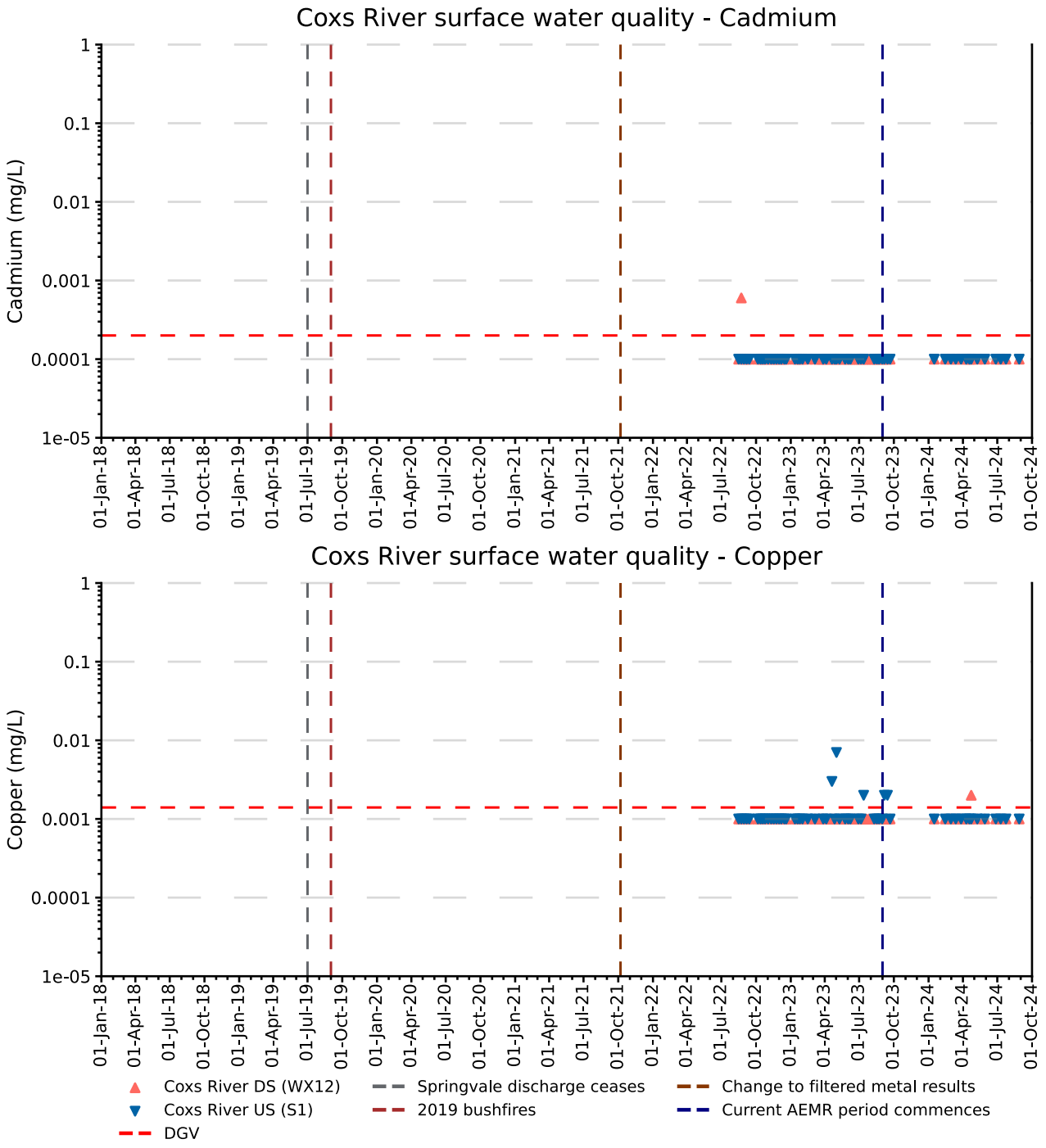
A.2 Coxs River

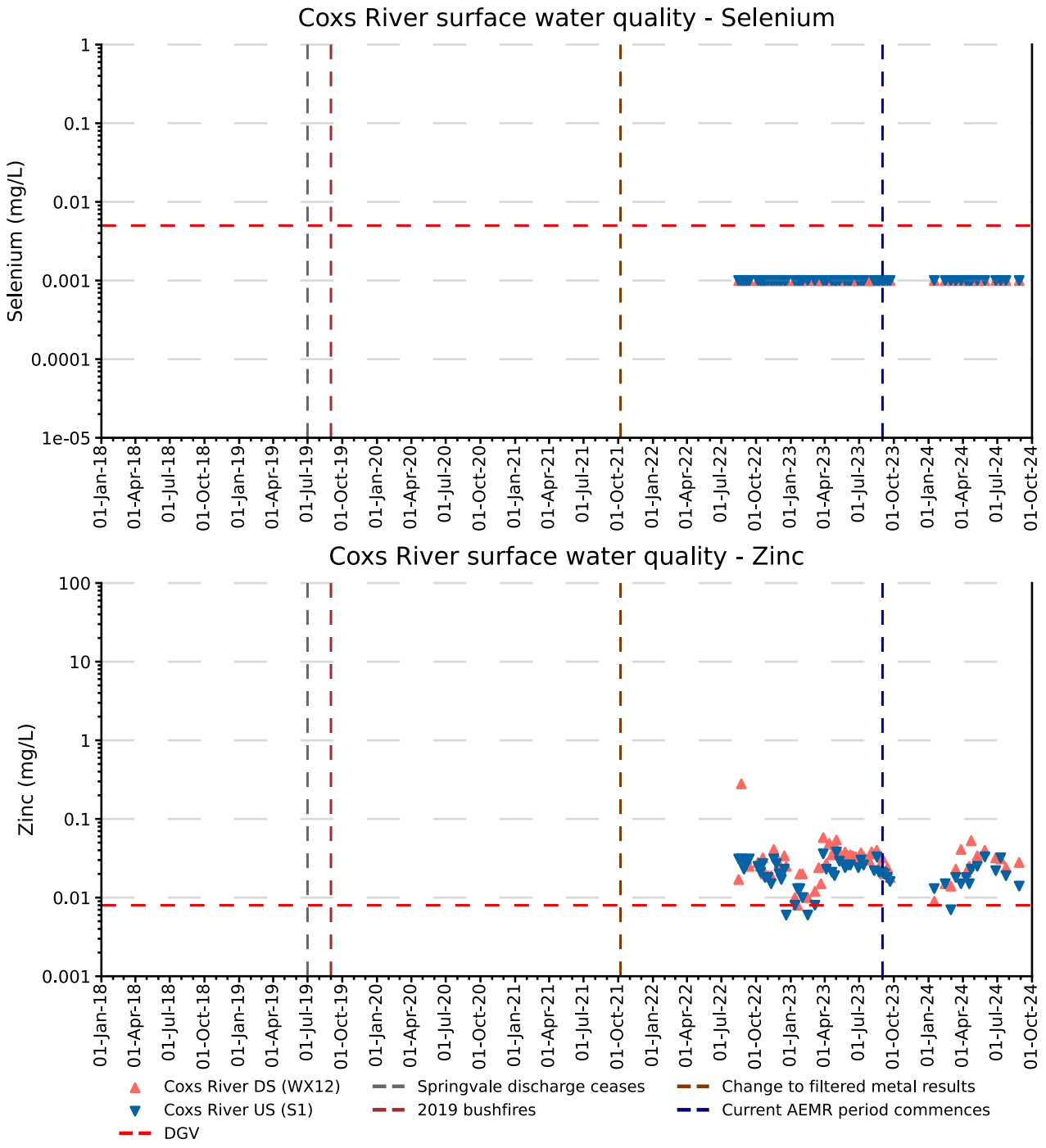
A.2.1 Physico-chemical parameters charts



A.2.2 Metal charts

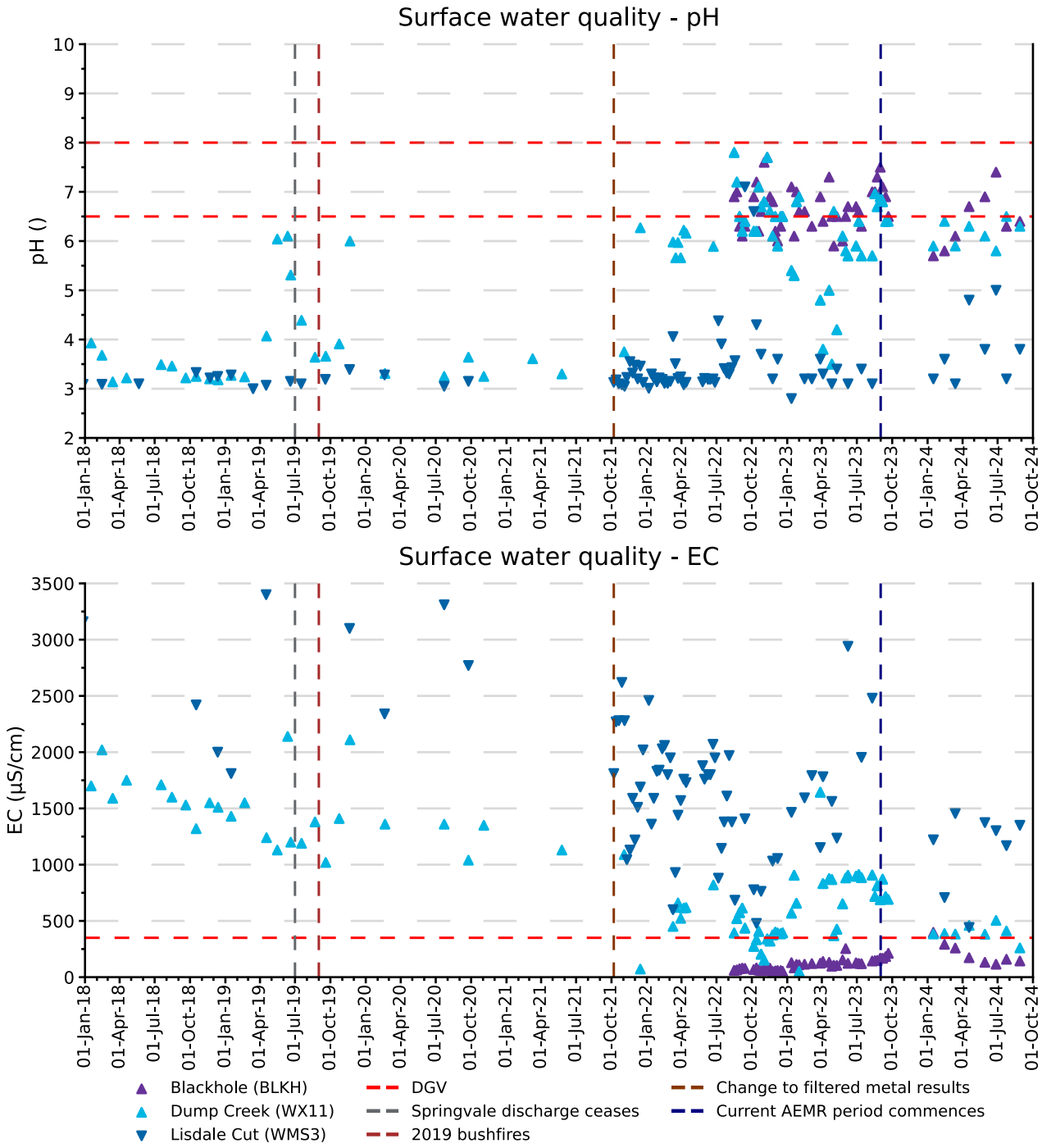



Coxs River surface water quality - Cadmium
Cadmium (mg/L)
1
0.1
0.01
0.001
0.0001
1e-05
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Coxs River surface water quality - Copper
Copper (mg/L)
Coxs River DS (WX12)
Coxs River US (S1)
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences

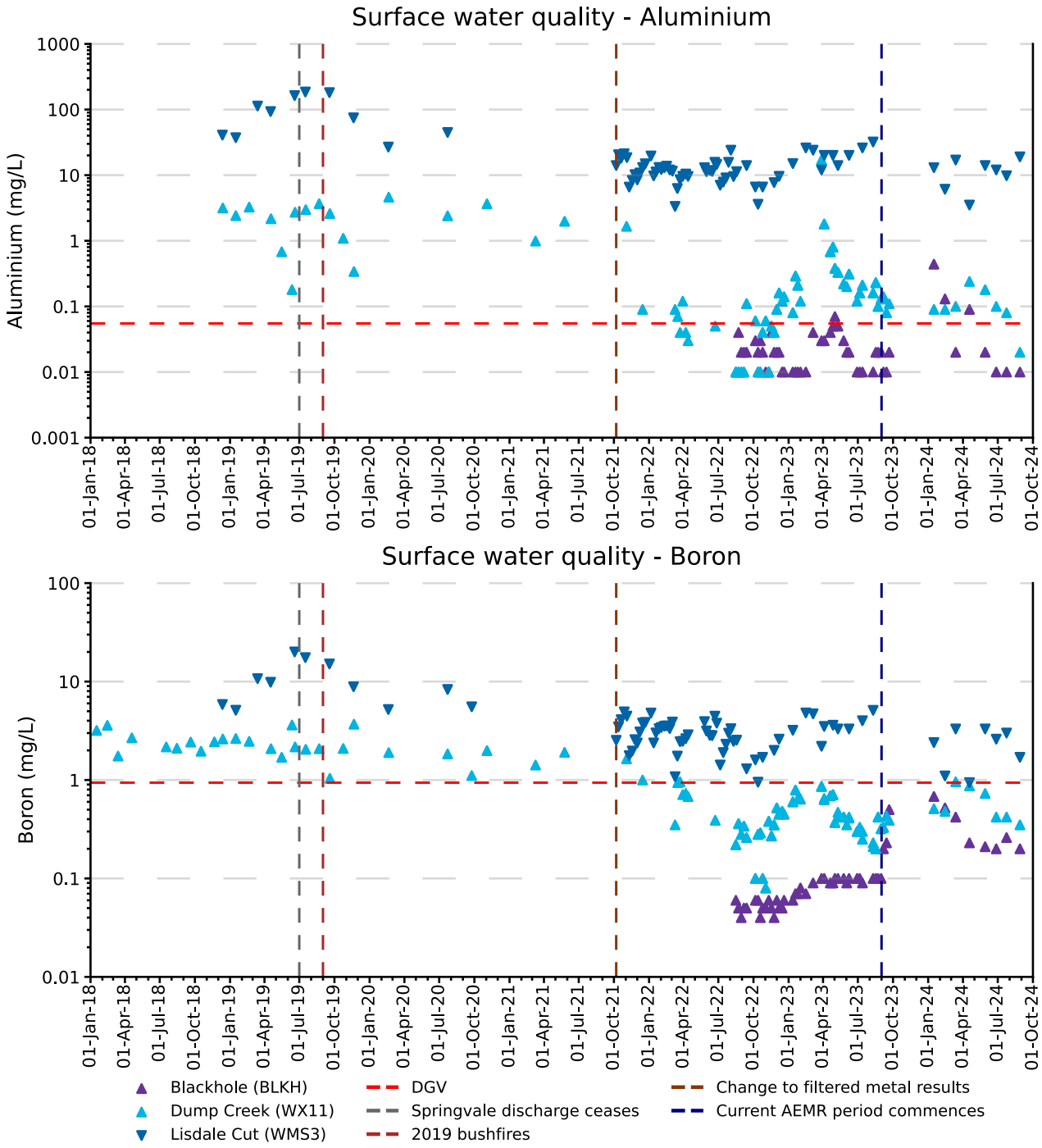

Coxs River surface water quality - Selenium
Selenium (mg/L)
1
0.1
0.01
0.001
0.0001
1e-05
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Coxs River surface water quality - Zinc
Zinc (mg/L)
100
10
1
0.1
0.01
0.001
Coxs River DS (WX12)
Coxs River US (S1)
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences

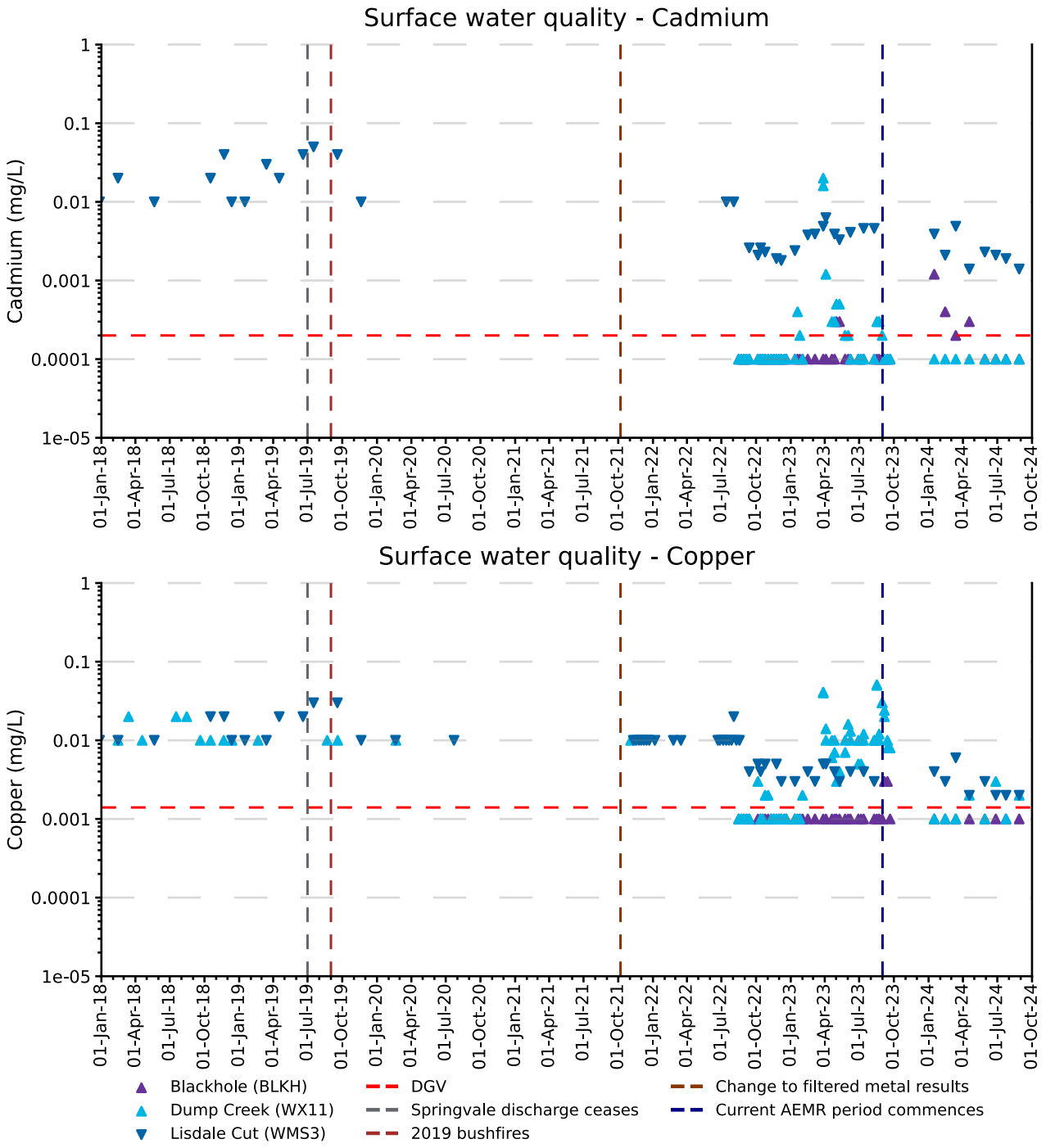
A.3 Water management systems

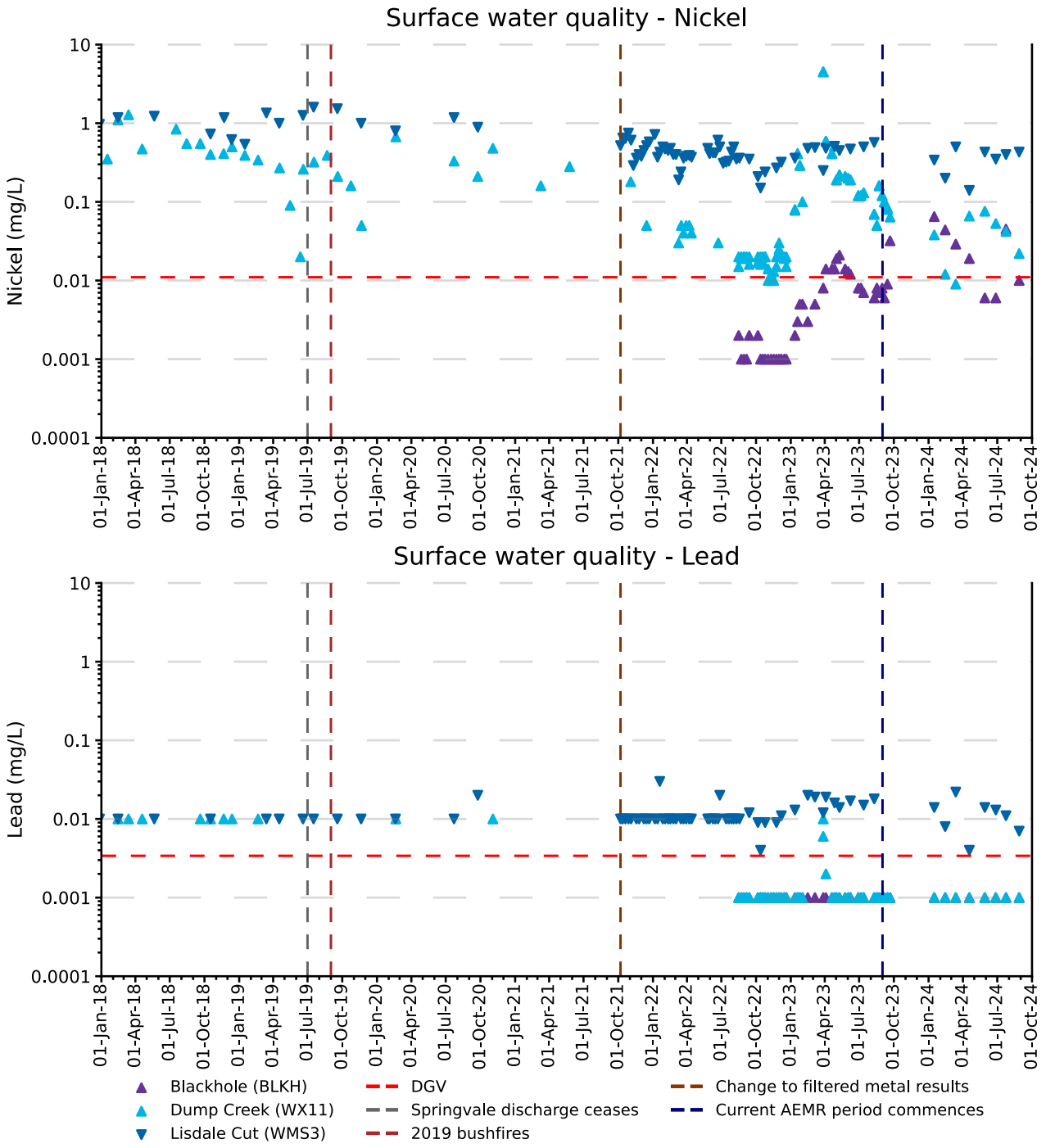
A.3.1 Physico-chemical parameters charts

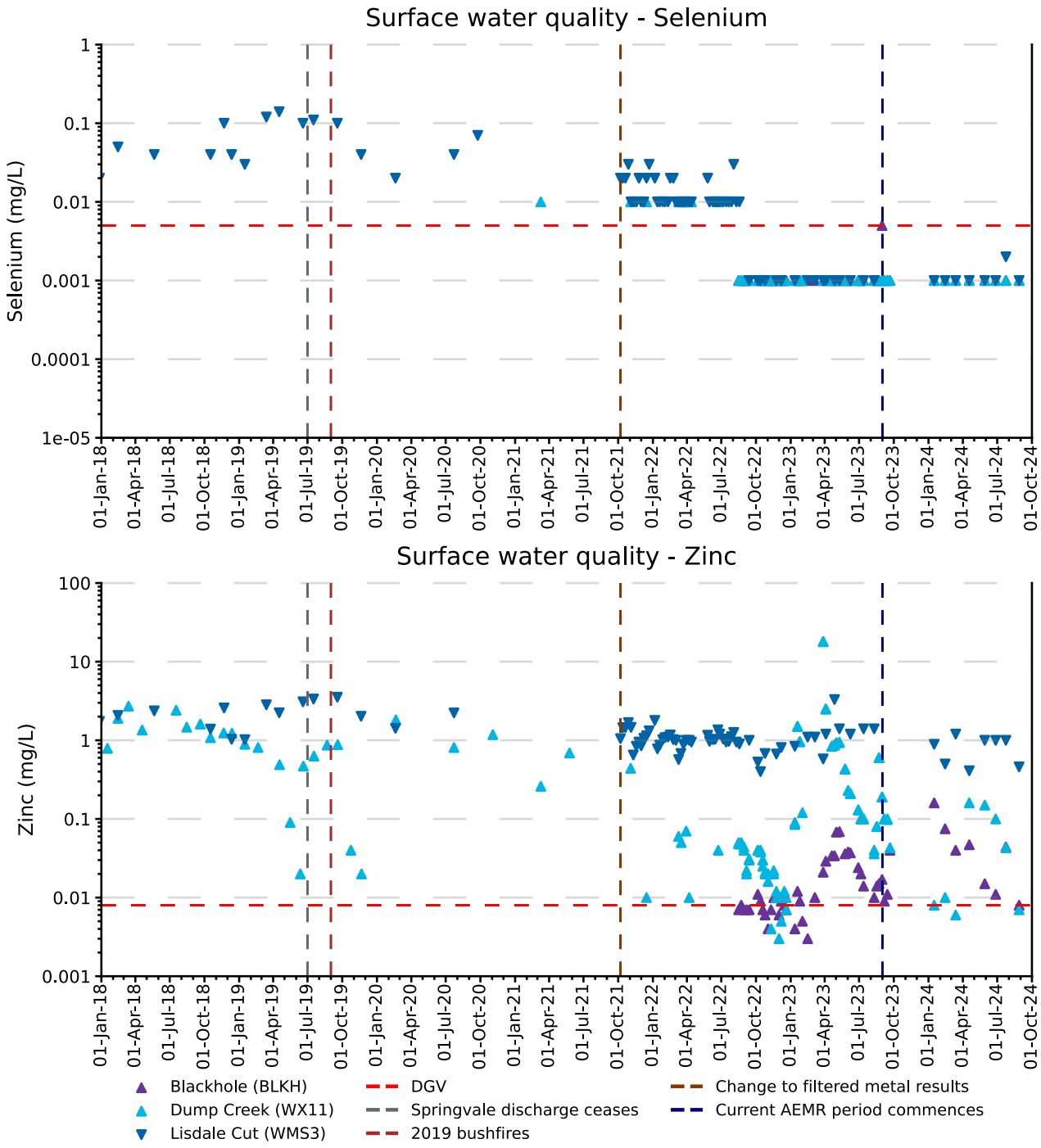


A.3.2 Metals charts




Surface water quality - Cadmium
Cadmium (mg/L)
1
0.1
0.01
0.001
0.0001
1e-05
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Surface water quality - Copper
Copper (mg/L)
Blackhole (BLKH)
Dump Creek (WX11)
Lisdale Cut (WMS3)
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences


Surface water quality - Nickel
Nickel (mg/L)
10
1
0.1
0.01
0.001
0.0001
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Surface water quality - Lead
Lead (mg/L)
Blackhole (BLKH)
Dump Creek (WX11)
Lisdale Cut (WMS3)
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences


Surface water quality - Selenium
Selenium (mg/L)
1
0.1
0.01
0.001
0.0001
1e-05
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Surface water quality - Zinc
Zinc (mg/L)
100
10
1
0.1
0.01
0.001
Blackhole (BLKH)
Dump Creek (WX11)
Lisdale Cut (WMS3)
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences

Appendix B
Groundwater quality charts

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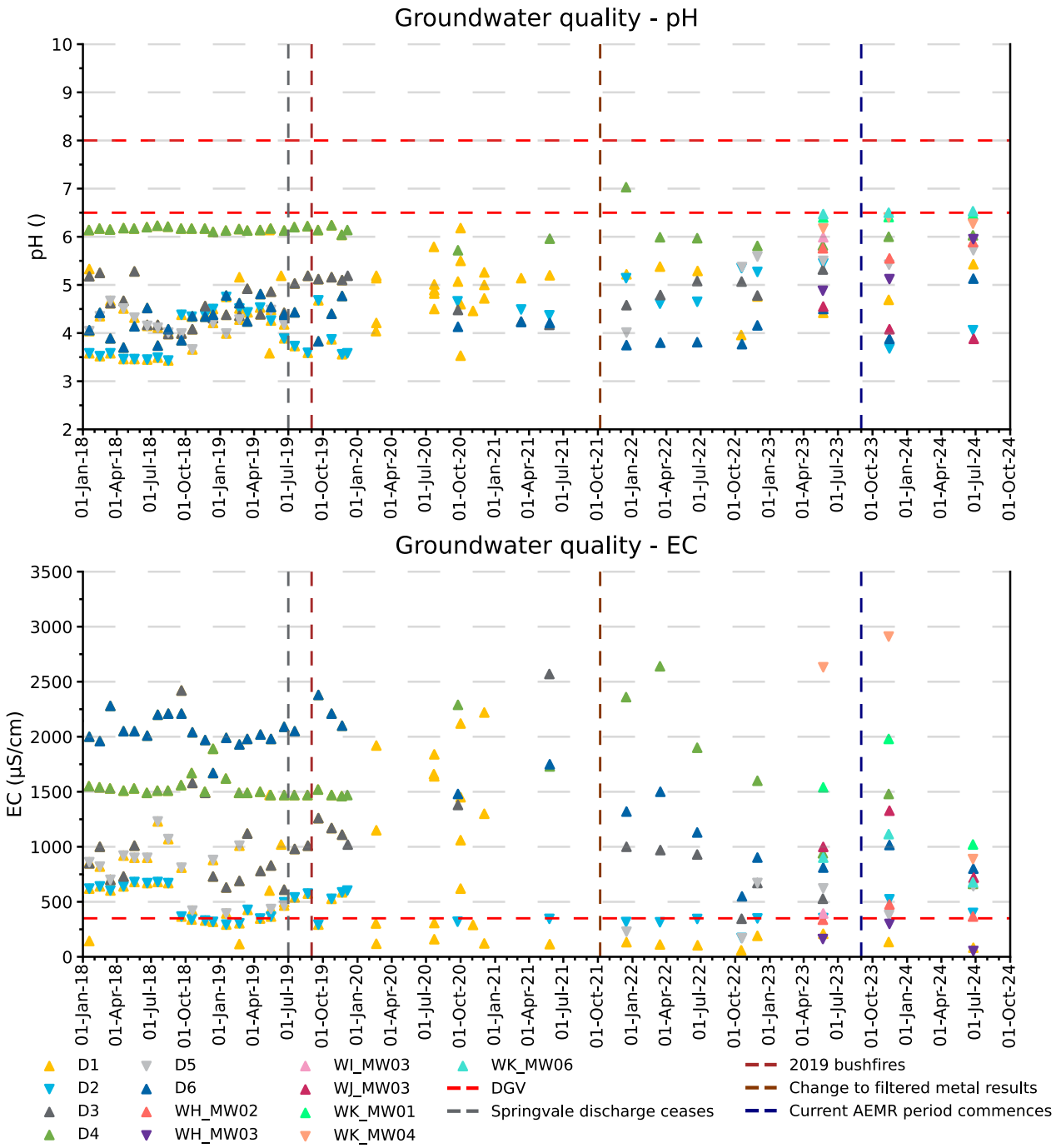
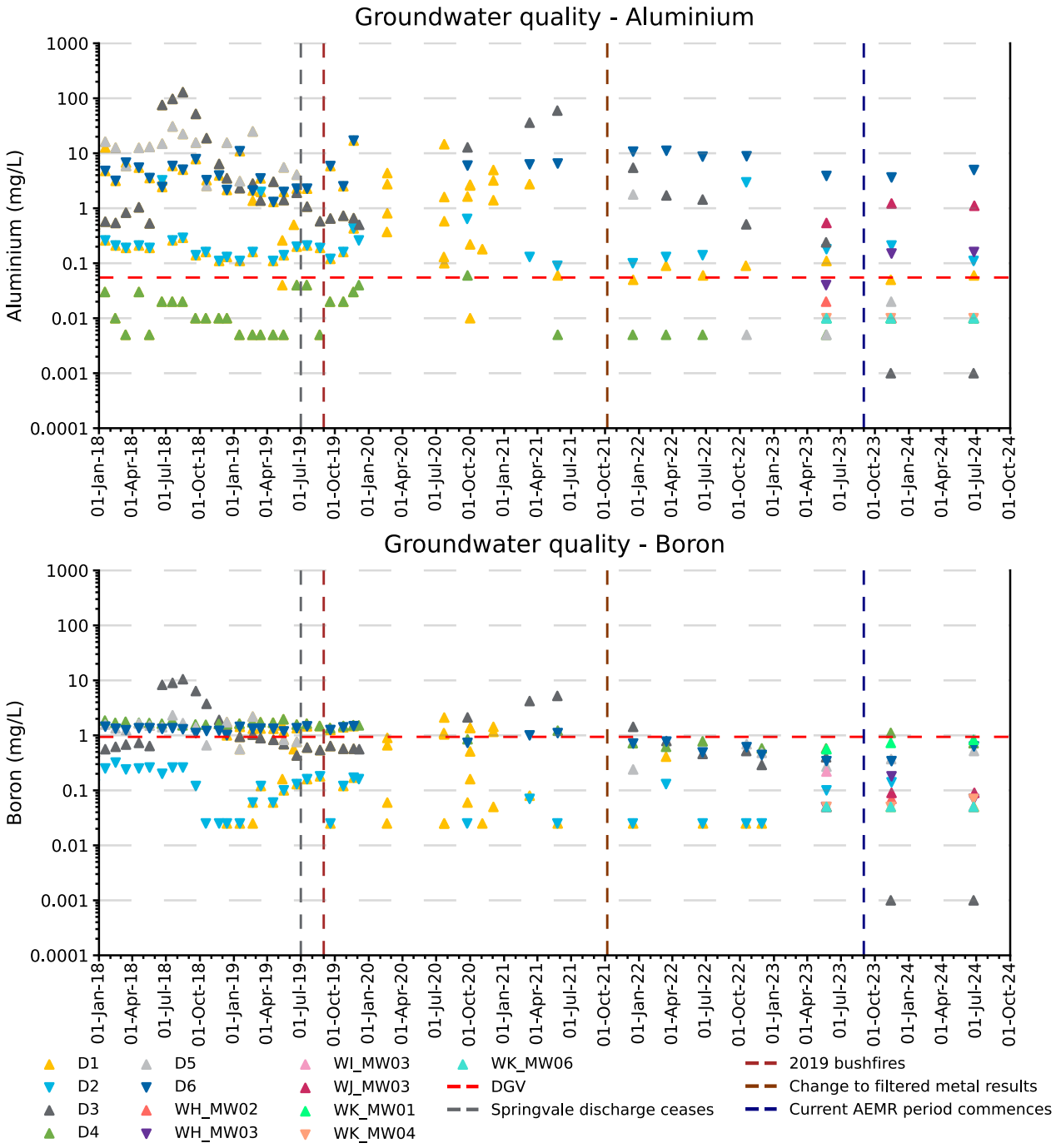
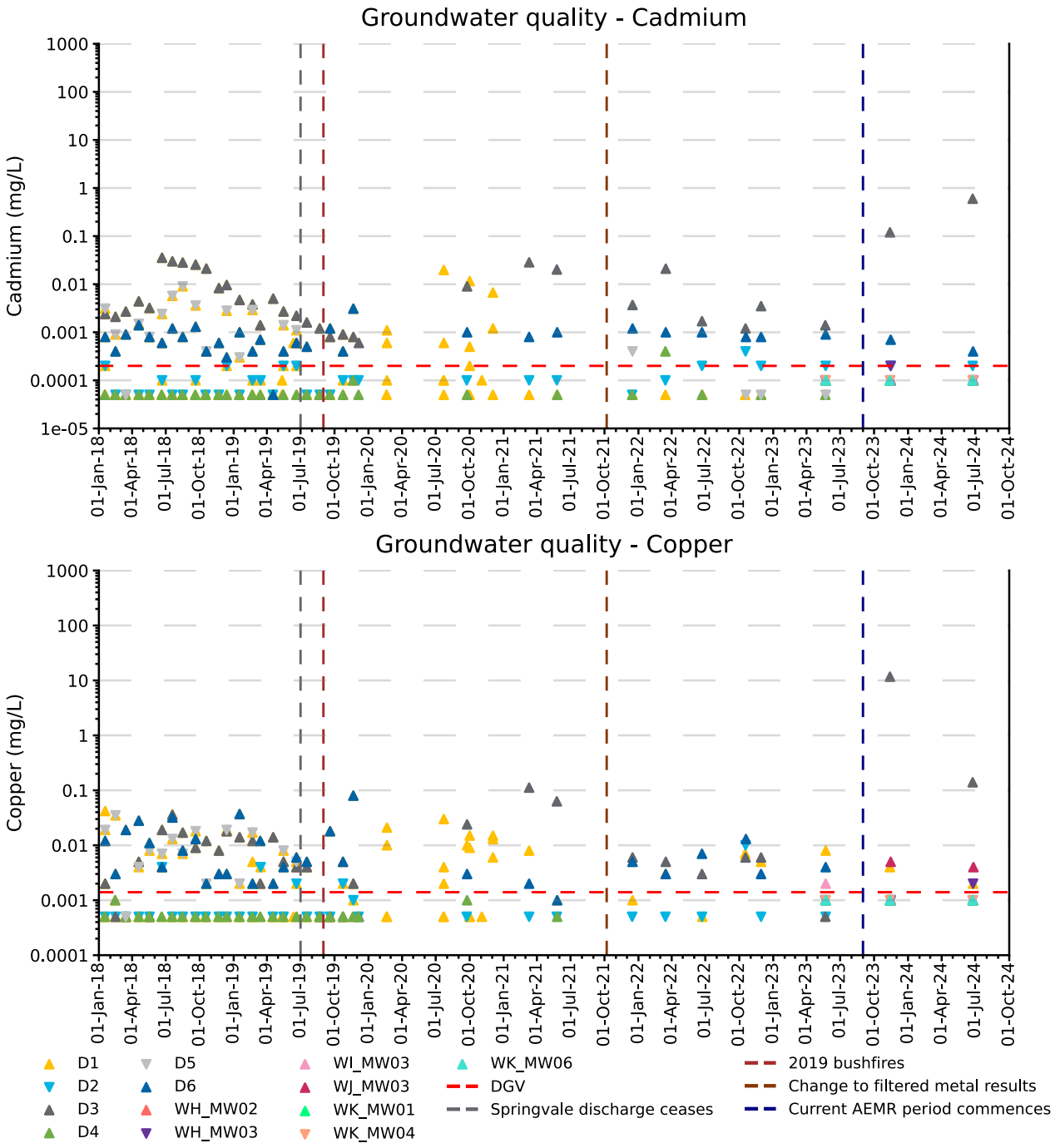
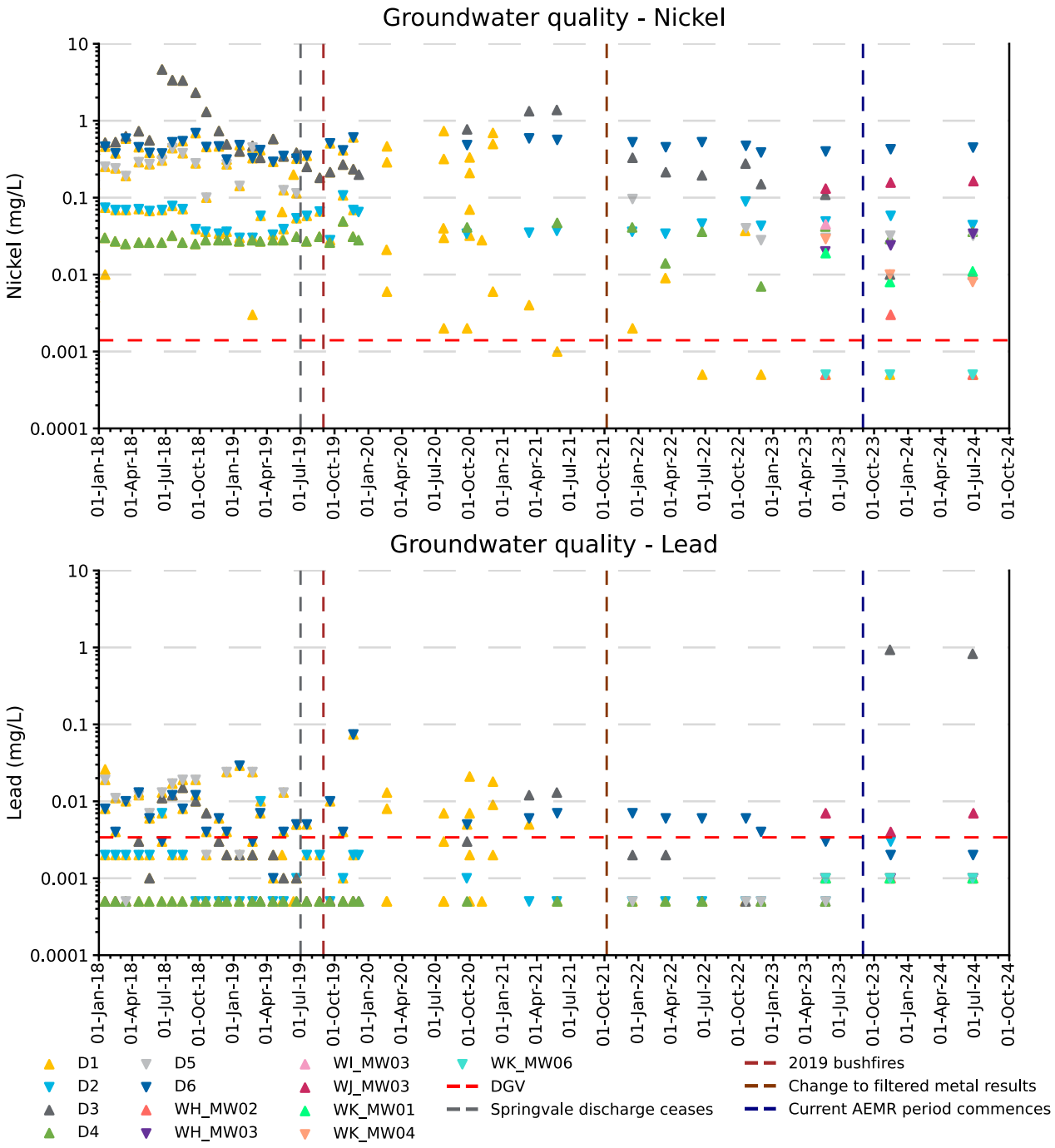
B.1 Physico-chemical parameter chart

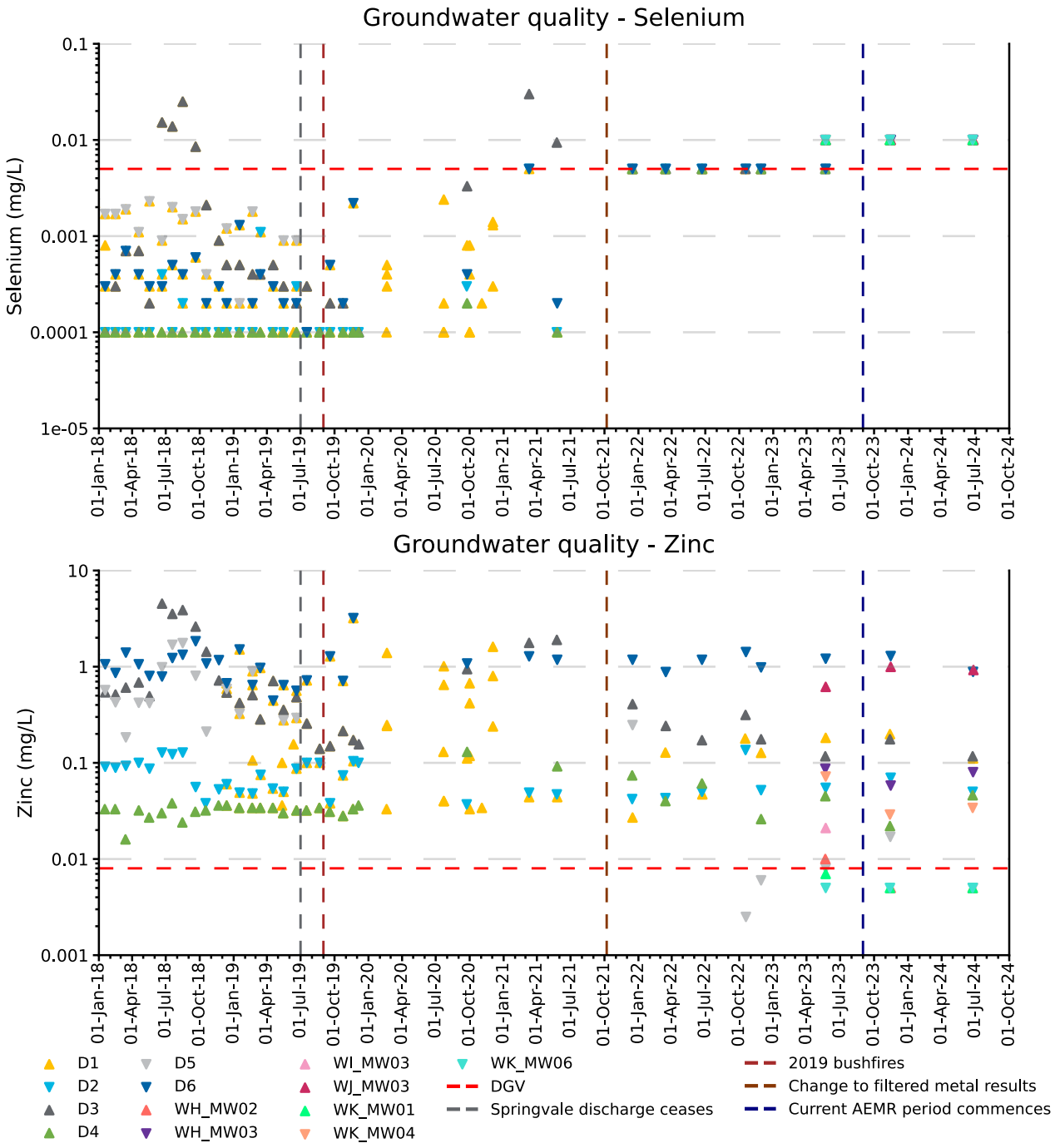


B.2 Metals charts




Groundwater quality - Cadmium
Cadmium (mg/L)
1000
100
10
1
0.1
0.01
0.001
0.0001
1e-05
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Groundwater quality - Copper
Copper (mg/L)
1000
100
10
1
0.1
0.01
0.001
0.0001
D1
D2
D3
D4
D5
D6
WH_MW02
WH_MW03
WI_MW03
WJ_MW03
WK_MW01
WK_MW04
WK_MW06
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences


Groundwater quality - Nickel
Nickel (mg/L)
10
1
0.1
0.01
0.001
0.0001
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Groundwater quality - Lead
Lead (mg/L)
D1
D2
D3
D4
D5
D6
WH_MW02
WH_MW03
WI_MW03
WJ_MW03
WK_MW01
WK_MW04
WK_MW06
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences


Groundwater quality - Selenium
Selenium (mg/L)
0.1
0.01
0.001
0.0001
1e-05
01-Jan-18
01-Apr-18
01-Jul-18
01-Oct-18
01-Jan-19
01-Apr-19
01-Jul-19
01-Oct-19
01-Jan-20
01-Apr-20
01-Jul-20
01-Oct-20
01-Jan-21
01-Apr-21
01-Jul-21
01-Oct-21
01-Jan-22
01-Apr-22
01-Jul-22
01-Oct-22
01-Jan-23
01-Apr-23
01-Jul-23
01-Oct-23
01-Jan-24
01-Apr-24
01-Jul-24
01-Oct-24
Groundwater quality - Zinc
Zinc (mg/L)
10
1
0.1
0.01
0.001
D1
D2
D3
D4
D5
D6
WH_MW02
WH_MW03
WI_MW03
WJ_MW03
WK_MW01
WK_MW04
WK_MW06
DGV
Springvale discharge ceases
2019 bushfires
Change to filtered metal results
Current AEMR period commences

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