RAVENSWORTH
OPEN CUT

GLENCORE

Ravensworth Operations

Annual Review 2023

Name of Operation	Ravensworth Operations
Name of Operator	Ravensworth Operations Pty Limited
Development Consent/ Project Approval #	PA 09_0176 and DA 104/96
Holder of Development Consent/ Project Approval	Ravensworth Operations Pty Limited
Ravensworth Operations Titles/ Mining Leases	ML1325, ML 1357, ML1393, ML1484, ML 1485, ML1502, ML 1576, ML 1669, ML 1683, CL 378, CL 380, CL 580, CCL 723, CCL 739, A385
Ravensworth Underground Mine Titles/ Mining Leases	ML 1348, ML 1349, ML 1398, ML 1416, ML 1477, ML 1495, ML 1506, ML 1564, ML 1580, ML 1581, ML 1591, ML 1595, ML 1625, ML 1667, ML 1668, ML1669, EL7799, ML1868
Name of holder of Mining Lease	Ravensworth Operations Pty Ltd (primary authorisation holder), Cumnock No.1 Colliery Pty Limited, Resource Pacific Pty Limited, AGL Macquarie Pty Limited, Glencore Newpac Pty Limited.
Water Licence #	WAL #: 9049; 9050; 41496; 41505; 41554; 1046; 1325; 8964; 13102; 41529; 10771; 816; 41507; 41530; 41531
Name of holder of Water Licence #	Ravensworth Operations Pty Ltd / Cumnock No1 Colliery Pty Ltd / Resource Pacific Pty Ltd
RMP previous revision date:	2 August 2022 (Ravensworth Operations) and 20 October 2023 (Ravensworth Underground Mine)
Annual Review start date	1 January 2023
Annual Review end date	31 December 2023

I, Klay Marchant, certify that this audit report is a true and accurate record of the compliance status of Ravensworth Operations for the period 1 January 2023 to 31 December 2023 and that I am authorised to make this statement on behalf of Ravensworth Operations.

Notes.

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

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

Name of authorise reporting officer	Klay Marchant
Title of authorise reporting officer	Environment and Community Manager
Signature of authorised reporting officer	
Date	27 March 2024

Table of Contents

1. Statement of Compliance

A summary of compliance at Ravensworth Operations is provided in ***Table 1-1***.

Table 1-1 – Statement of Compliance

Document	Compliant
Approvals	
PA 09_0176 (MOD 3)	NO
DA 104/96 (MOD 10)	YES
EPBC 2010_5839	YES
Licences	
EPL 2652	NO
Water Licences	YES
Leases	
ML# 1325	YES
ML# 1348	YES
ML# 1349	YES
ML# 1357	YES
ML# 1393	YES
ML# 1398	YES
ML# 1416	YES
ML# 1477	YES
ML# 1484	YES
ML# 1485	YES
ML# 1495	YES
ML# 1502	YES
ML# 1506	YES
ML# 1564	YES
ML# 1576	YES
ML# 1580	YES
ML# 1581	YES

Document	Compliant
ML# 1591	YES
ML# 1595	YES
ML# 1625	YES
ML# 1667	YES
ML# 1668	YES
ML# 1669	YES
ML# 1683	YES
CL# 380	YES
CL# 378	YES
CL# 580	YES
CCL# 723	YES
CCL# 739	YES
AUTH0385	YES
EL7799	YES

The non-compliances during the 2023 reporting period are discussed further in ***Section 11***. The non-compliances categories are described in ***Table 1-2***. A summary of the non-compliances with Project Approval (PA) 09_0176, EPL 2652 and relevant mining leases during the reporting period have been summarised in ***Table 1-3*** (below) There were no non-compliances reported for Development Application (DA) 104/96.

Table 1-2 – Statement of Compliance Key

Risk Level	Colour code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless for the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: Potential for serious environmental consequences, but it is unlikely to occur; or Potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: Potential for moderate environmental consequences, but it is unlikely to occur; or Potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

Table 1-3 – Summary of Non-Compliances

Relevant approval	Condition #	Condition description	Compliance Status	Comment	Where addressed in the Annual Review
PA 09_0176	Schedule 3, Condition 20	Air Quality Criteria All reasonable and feasible avoidance and mitigation measures are undertaken so that particulate matter emissions generated by the Ravensworth mine complex do not exceed the criteria listed in Table 10 (short term PM10 criterion) at any residence on privately-owned land or on more than 25 percent of any privately-owned land.	**Low Non-Compliant**	PM_{10} 24 hour criterion of 50 µg/m^3 was exceeded once at TEOM G1 on 20/09/2023. PM_{10} 24 hour criterion of 50 µg/m^3 was exceeded twice at TEOM G2 on 12/10/2023, and 19/12/2023.	**Section 6.3.2.1 and Section 11 Appendix D, Table D.6**
PA 09_0176	Schedule 3, Condition 24	Air Quality and Greenhouse Gas Management Plan Prepare an Air Quality and Greenhouse Gas Management Plan for the Ravensworth mine complex to the satisfaction of the Planning Secretary. This plan must: (a) be prepared in consultation with EPA, and be submitted to the Planning Secretary for approval by the end of June 2011; (b) describe the measures that would be implemented to ensure compliance with the relevant conditions of this consent, including a real-time air quality management system that employs both reactive and proactive mitigation measures; (c) include an air quality monitoring program that: • uses a combination of real-time monitors, high volume samplers and dust deposition gauges to evaluate the performance of the Ravensworth mine complex; and • includes a protocol for determining exceedances of the relevant conditions of this consent; and (d) include a protocol that has been prepared in consultation with the owners of nearby mines to minimise the cumulative air quality impacts of the mines.	**Administrative Non-Complaint**	Non Complaint for Condition c) Air Quality Monitoring Program. Following a review of real-time monitoring data on 138 occasions the daily 24-hour result was deemed invalid. TEOM G1 recorded 9 invalid 24-hour samples during 2023 reporting period TEOM G2 recorded 129 invalid 24-hour samples during 2023 reporting period. Failed components of TEOM G2 is scheduled to be replaced in 2024.	Section 6.3.2.1 and Section 11
EPL 2652	M2.2	Air Monitoring Requirements Continuously monitor PM10 at Point 9 and 10 (TEOM G1 and G2)	**Non-compliant**	Continuous PM_{10} data was not acquired. Invalid or missed samples were caused by routine, non-routine maintenance, and monitoring unit faults.	Section 6.3.2.1 and Section 11

2. Introduction

Ravensworth Operations comprises the following operations:

- Ravensworth Open Cut (ROC) (PA 09_0176 (MOD 4); and
- Ravensworth Coal Handling and Preparation Plant (RCHPP) (PA 09_0176).

This Annual Review also reports on Ravensworth Underground Mine (RUM) (DA 104/96 (MOD 10)).

Figure 2.1 shows the layout of the Ravensworth Operations and ***Figure 2.2*** shows the regional context.

This Annual Review is for the reporting period 1 January 2023 to 31 December 2023. It includes PA 09_0176 (Ravensworth Operations), DA104/96 (RUM), various mining leases, and associated environmental management plans for the Ravensworth Operations. The project approval and mining lease boundaries are shown on ***Figure 2.3***.

2.1.1 Ravensworth Operations

Ravensworth Operations

Ravensworth Operations is owned and operated by Ravensworth Operations Pty Limited, which is managed by Glencore Coal Assets Australia (GCAA). An Environmental Assessment (EA) was submitted for the Ravensworth Operations Project in February 2010. The EA was approved by the former Department of Planning, Infrastructure and Environment (DPIE) on 11 February 2011 (PA 09_0176). The approval granted the expansion of existing approved mining operations at ROC and enabled the consolidation of existing approvals for open cut mining and infrastructure (RCHPP). The single project approval has enabled the amalgamation of operational aspects of the mining operations, which has facilitated a consistent and integrated approach to environmental management and mine planning. Details of modifications to PA 09_0176 are included in ***Section 3.1***.

RCHPP

Coal from Ravensworth Operations is stored at the Run of Mine (ROM) coal stockpile where it is managed by RCHPP (PA 09-0176). Coal is fed into one of the three modules (20 Mt/year) at a rate of up to 3,600 tonnes per hour prior to being loaded onto trains.

The RCHPP also receives product coal from Muswellbrook Coal Company.

2.1.2 Ravensworth Underground Mine

RUM is owned by Resource Pacific Pty Limited and GCAA oversees the management.

The area of land within the approved RUM development consent boundaries is owned by RUM, AGL Macquarie, Daracon, Ravensworth Operations Pty Limited, Glendell, and I. Bowman Pty Ltd.

RUM operated under development consent DA 104/96 dated 20 November 1996.

RUM was placed in Care and Maintenance in October 2014 and commenced closure activities during 2023.

The RUM and Ashton Underground Mine share a common mining lease boundary and are approved to extract coal from similar coal seams. During 2021, a tenth modification (DA 104/96 MOD10) was submitted and approved by (Department of Planning and Environment) DPE on 6 July 2022 with the purpose of allowing Ashton Coal Operations Limited (ACOL - who operate Ashton Underground Mine) to access and extract approved but unmined coal resources at RUM and integrate part of the approved RUM with the Ashton Coal Project. Further details are included in **Section 3.1**.

2.2 Mine Contacts

Mine contact details for Ravensworth Operations and RUM are shown in **Table 2-1**.

Table 2-1 - Mine Contacts

Name	Title	Contact Details
Ravensworth Operations	General Enquiries	Phone: 1800 620 553 Phone: (02) 6570 0700 Address: Lemington Road, Off New England Highway Ravensworth, via Singleton, NSW 2330 Postal: PO Box 294, Muswellbrook, NSW 2333 *https://www.glencore.com.au/operations-and-projects/coal/current-operations/ravensworth-operations*
RUM	General Enquiries	Phone: 1800 620 553 Address: Liddell Station Rd, Ravensworth NSW 2330 Postal: PO Box 528 Singleton 2330 *https://www.glencore.com.au/operations-and-projects/coal/past-operations/ravensworth-underground*
Thomas Hubert	Operations Manager	Phone : (02) 6570 0736 E-mail : *thomas.hubert@glencore.com.au*
Klay Marchant	Environment and Community Manager	Phone : (02) 6570 0700 Email : *Klay.Marchant@glencore.com.au*

Figure 2-1 – Ravensworth Complex Layout

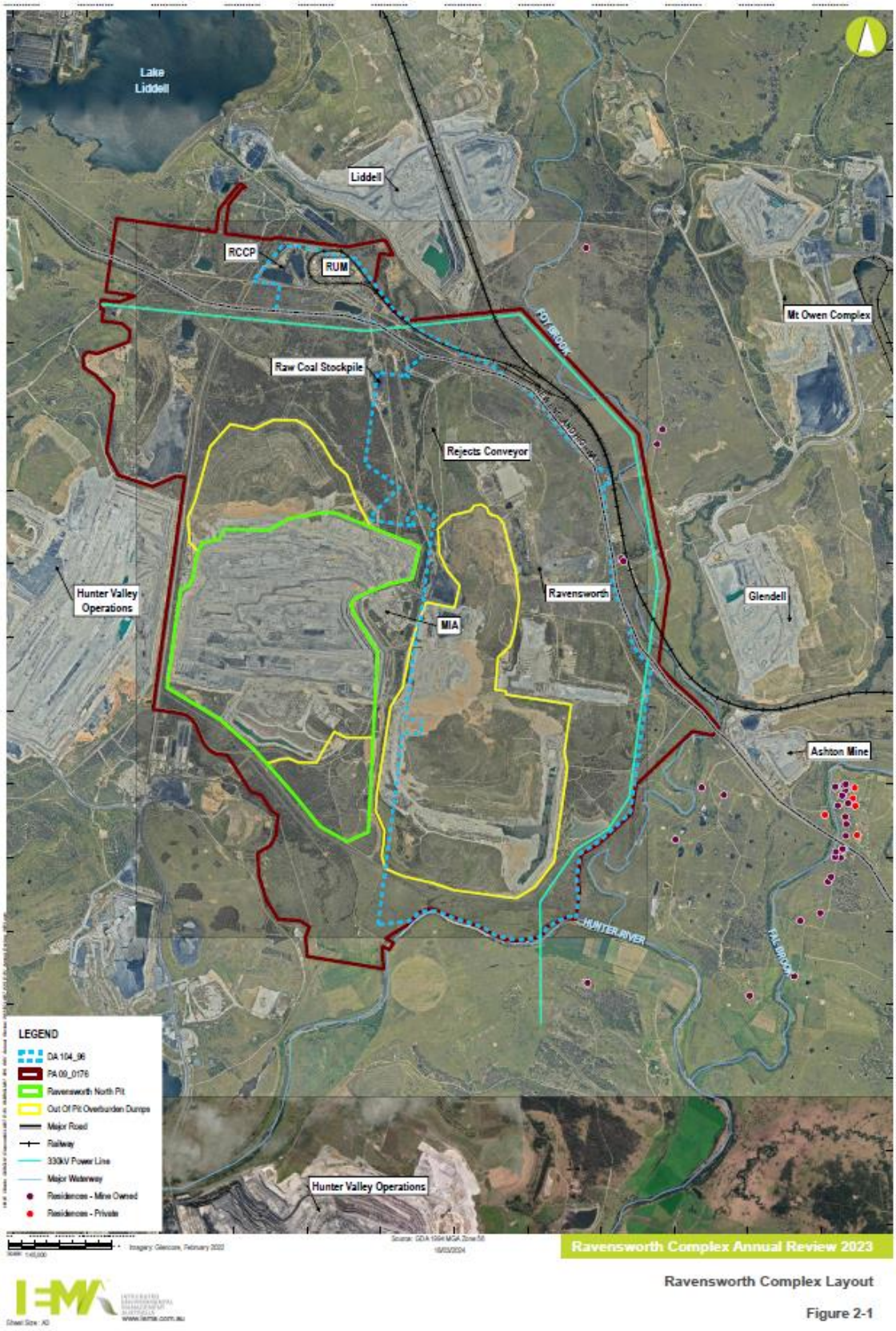


Figure 2-2 – Regional Context

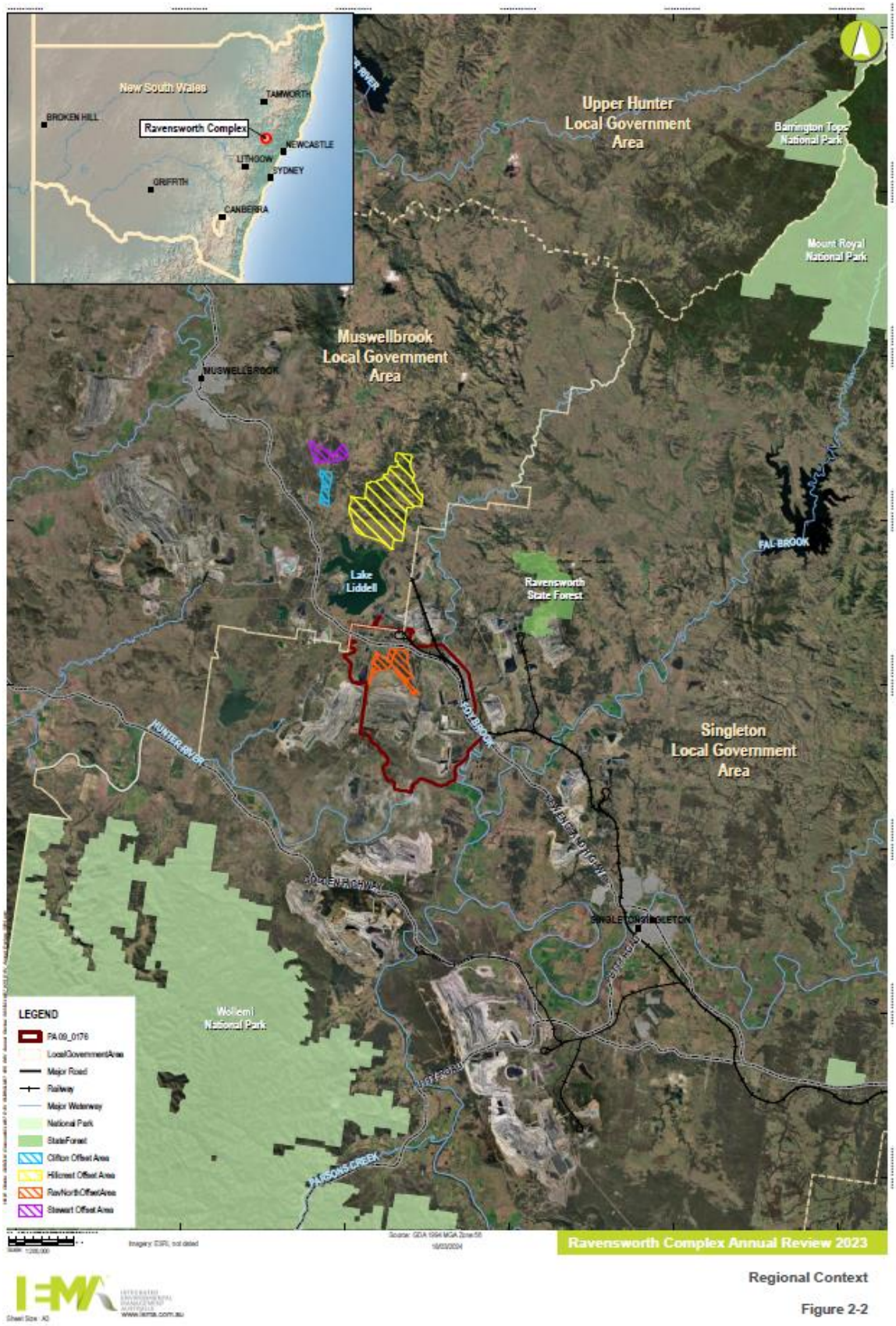
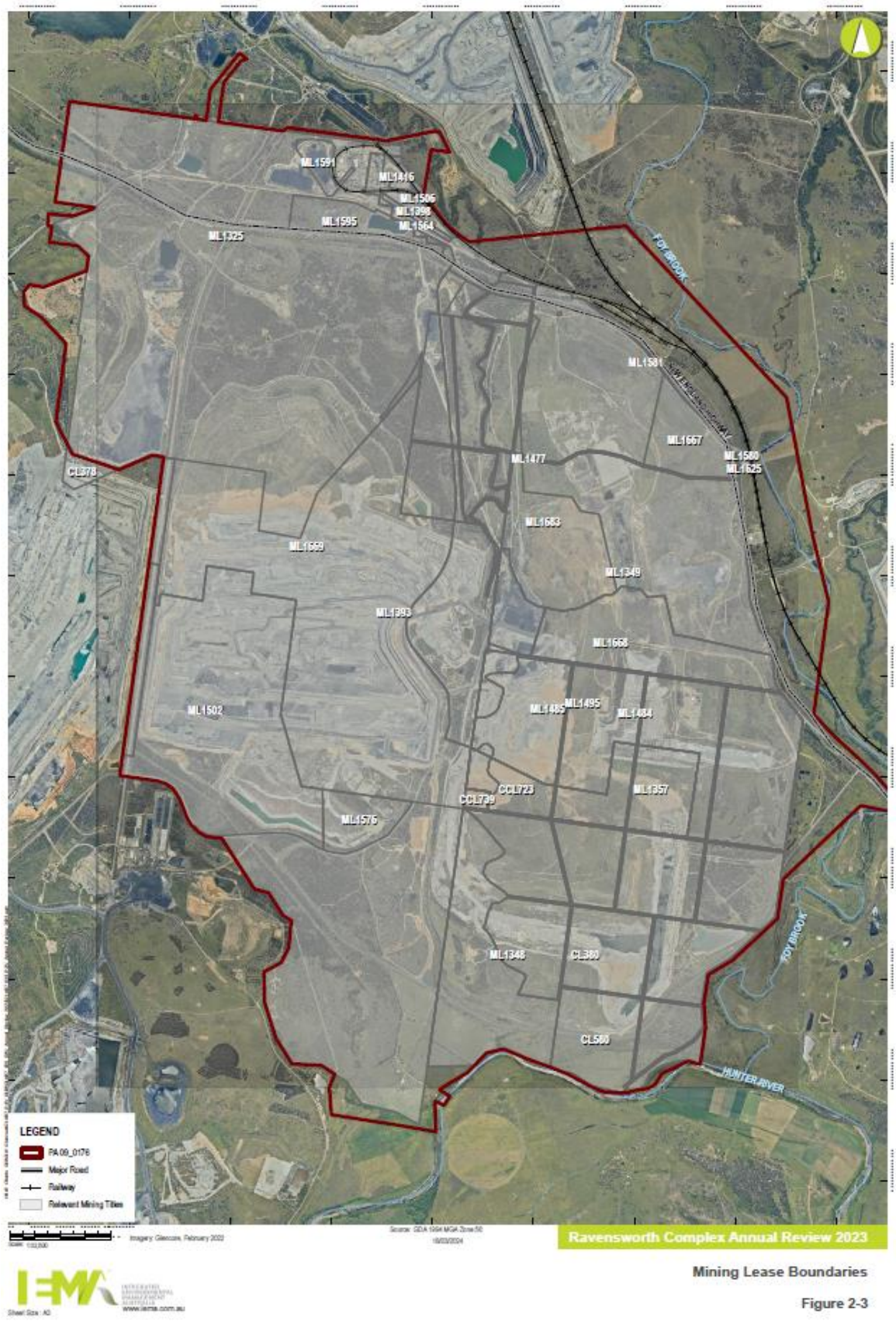


Figure 2-3 – Mining Lease Boundaries



3. Approvals

Operations at Ravensworth Operations and RUM are regulated by a range of leases, licences and approvals which are summarised below.

3.1 Project Approval

Ravensworth Operations is managed under Project Approval PA 09_0176 (MOD 3, granted on 11 February 2011). A separate approval applies to RUM DA 104/96 (MOD 10, granted 6 July 2022).

This Annual Review has been completed to fulfil the requirements of Schedule 5, Condition 3 of PA 09_0176 and Schedule 4, Condition 2 of DA 104/96. ***Table 3-1*** below outlines the project approvals relevant to Ravensworth Complex.

Table 3-1 – Ravensworth Complex Approvals and Modifications

Approval	Title	Date Granted
Ravensworth Operations		
09_0176	Original Approval	11 February 2011
09_0176 Mod 1	Extraction of approximately 2.7 million tonnes of coal in the Narama West mining area.	16 August 2013
09_0176 Mod 2	Allow for an increase in final landform heights to accommodate a more stable free flowing natural landform.	19 December 2014
09_0176 Mod 3	Construction and operation of a tailings pipeline from the RCHPP at Ravensworth Operations to the Mount Owen West Pit Void.	16 February 2016
09_0176 Mod 4	Construction and operation of a tailings pipeline from the RCHPP at Ravensworth Operations to Liddell Mine	15 May 2023
RUM		
104/96	Original Approval	20 November 1999
104/96 Mod 1	Modification to road haulage conditions	6 January 1998
104/96 Mod 2	Reject emplacement and water management system changes	5 March 2001
104/96 Mod 3	Installation of Substation	11 February 2007
104/96 Mod 4	Solcenic Borehole and Storage Tanks	11 February 2007
104/96 Mod 5	Ventilation Shaft, electricity supply and underground workings	4 July 2007
104/96 Mod 6	Tailings Water Recovery Dam	21 May 2008
104/96 Mod 7	Mining method, water, and waste management	3 July 2009
104/96 Mod 8	Extension to LWs 6 to 10 and additional gas management infrastructure	5 January 2011
104/96 Mod 9	Liddell Seam Project	20 June 2013
104/96 Mod 10	Ravensworth Ashton Integration	6 July 2022

The RUM Ashton Coal Project (104/96 MOD 10) involves:

- Allowing access for Ashton to extract a portion of the Ravensworth Underground Mine (RUM) coal reserves;
- Connection of the existing Ashton and Ravensworth underground workings;
- Transfer of ROM coal from RUM to the Ashton CHPP;
- Minor changes to the configuration of the Pikes Gully and Middle Liddell Seam Longwalls;
- Extension of mining operations until 31 December 2032; and
- Other administrative changes to facilitate ACOL management and responsibility for a portion of the RUM consent area.

3.2 Licences

The following sections discuss Licences relevant to this report.

3.2.1 Environment Protection Licence

Aspects of environmental monitoring and reporting at Ravensworth Operations is managed under Environment Protection Licence (EPL) 2652 (anniversary date 12 January). Monitoring results are reported to the EPA as part of this Annual Review, and monitoring data is available on the Ravensworth Operations website.

There have been no variations to EPL 2652 since the previous reporting period.

Environmental monitoring and reporting activities undertaken at Ravensworth Operations as required under EPL 2652, are discussed in **Section 6**.

3.2.2 Surface and Groundwater Licences

Ravensworth Operations and RUM hold several surface water and groundwater licences, which regulate surface water and groundwater extraction and monitoring. Further details regarding these licences are provided in ***Section 7.4*** and ***7.5.***

3.3 Other Approvals

3.3.1 Management Plans

The status of relevant management plans as of 31 December 2023 are summarised in ***Table 3-2***. In accordance with Schedule 5, Condition 4 of PA 09_0176, Ravensworth Operations and RUM will review, and if necessary, revise, the strategies, plans, and programs required under the consent within three months of this Annual Review, to the satisfaction of the Secretary of the DPE.

Table 3-2 – Management Plan Status

Document	Reference	Revision Date
Ravensworth Operations		
Ravensworth Complex Environmental Management Strategy (EMS)	PA 09_0176 Schedule 5, Condition 1	15 June 2022
Pollution Incident Response Management Plan (PIRMP)	Pollution Incident Response Management Plan	1 December 2022
Ravensworth Complex Noise Management Plan (NMP)	PA 09_0176 Schedule 3 Condition 9	10 September 2018
Ravensworth Complex Blast Management Plan (BMP)	PA 09_0176 Schedule 3 Condition 17	20 December 2022
Ravensworth Complex Air Quality and Greenhouse Gas Management Plan (AQGGMP)	PA 09_0176 Schedule 3 Condition 24	21 March 2022
Ravensworth Complex Water Management Plan (WMP)	PA 09_0176 Schedule 3 Condition 31	9 February 2024
Ravensworth Open Cut Biodiversity Offset Management Plan (BOMP)	PA 09_0176 Schedule 3 Condition 31	1 October 2023
Ravensworth Open Cut Rehabilitation Management Plan (RMP)	PA 09_0176 Schedule 3 Condition 41	2 August 2022
Ravensworth Complex Heritage Management Plan (HMP)	PA 09_0176 Schedule 3 Condition 42	1 November 2022
Aboriginal Cultural Heritage Management Plan (ACHMP)	PA 09_0176 Schedule 3 Condition 42	17 November 2022
RUM		
Ravensworth Underground Air Quality and Greenhouse Gas Management Plan	DA 104/96, Schedule 2, Condition 14	Covered under Ravensworth Operations Management Plans.
Biodiversity, Rehabilitation and Land Management Plan	DA 104/96, Schedule 2, Conditions 4, 7. Mining leases	
Lighting Management Plan	DA 104/96, Schedule 2, Condition 5.	
Bushfire Risk Hazard Reduction Management Plan	DA 104/96, Schedule 2, Condition 6.	
Ravensworth Underground Mine RMP	DA 104/96	20 October 2023

3.3.2 Rehabilitation Management Plan

As of 1 July 2022, Ravensworth Operations and RUM each operate under a Rehabilitation Management Plan (RMP) in accordance with the Resources Regulator guidelines. The RMP covers aspects including mine closure planning and execution, stakeholder consultation, environmental management, post mining land use, status of closure, performance indicators and rehabilitation objectives, criteria, and implementation.

4. Operations During the Reporting Period

4.1 Mining Operations

Schedule 2, Condition 6 of PA 09_0176 stipulates that no more than 16 Mt of ROM coal will be produced through open cut mining in a calendar year and a maximum 21 Mt of ROM coal produced by Ravensworth Operations and RUM per calendar year.

During the reporting period, 64,737 kbcm of overburden was mined in Ravensworth North Pit to allow the extraction of 13.49 Mt ROM coal which is within the annual limits. RUM has remained in care and maintenance from October 2014.

A summary of coal production is outlined in ***Table 4-1***.

Table 4-1 – Coal Production and Waste Summary

Material	Approval Limit	Previous Reporting Period (2022)	This reporting period (2023)	Next reporting period (2024 budget)
Ravensworth North				
Prime Overburden (kbcm)	n/a	58,846	64,737	63,833
ROM coal (Mt)	16[1]	12.8	13.5	13.2
Saleable Product (Mt)	20[2]	8.4	8.7	8.6
RUM				
ROM Coal (Mt)	21[1]	0	0	0
Product Coal (Mt)	0	0	0	0
RCHPP				
Coarse Waste Reject (Mt)	n/a	2.6	3.08	2.9
Fine Waste Reject (Mt) (dry)	n/a	1.7	1.7	1.6

[1]Approval limit of 16 Mt applies to ROC mining operations. A combined limit of 21 Mt applies to ROC and RUM(schedule 2 condition 6 of PA09_0176).
[2]Restricted product coal transport to/from RCHPP/RCT to a maximum of 20 Mt (schedule 2 condition 7b of PA09_0176).

4.2 Exploration

No exploration was carried out at Ravensworth Operations or RUM during 2023.

4.3 Construction

Construction of the new Mine Access Road was completed at Ravensworth Operations during 2023.

No construction was carried out at RUM in 2023.

4.4 Land Preperation

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

Land disturbed in preparation for rehabilitation is discussed in **Section 8**.

No land preparation was carried out at RUM in 2023.

4.5 Mineral Processing

The following subsections discuss mineral processing activities at Ravensworth operations. No processing activities were undertaken at RUM in 2023.

4.5.1 Rejects Emplacement and Tailings

Coarse Rejects

Rejects are conveyed from the RCHPP to a reject bin, where they are collected by haul trucks. The haul trucks transport rejects via internal haul roads for co-disposing in the overburden emplacement areas in accordance with regulatory approvals. During this reporting period 308Mt of coarse rejects produced by the RCHPP (refer ***Table 4-1***).

Tailings

During 2023, tailings were emplaced into both the Mount Owen West Pit Void through the Greater Ravensworth Area Water and Tailings Strategy (GRAWTS) and the Ravensworth Cumnock Tailings storage facility. During this reporting period 1.7Mt of fine tailings reject produced by the RCHPP (refer ***Table 4-1***).

4.5.2 Train and Conveyor Movements

Product coal is transported to the port of Newcastle by rail only. RCHPP train movements are summarised in ***Table 4-2*** below. All totals are compliant with the conditions set out in Schedule 2, Condition 7 of PA 09_0176, which specify that no more than 18 train movements (average) will occur each day, and no more than 20 million tonnes of product coal will be transported to/ from the RCHPP/RCT. Records of all train movements are provided in ***Appendix A -.***

Table 4-2 - RCHPP Train Movements 2023

Train Movements	Total
Annual Average Daily Train Movements	2.6 movements per day
Max Daily Train Movements	6 max movements per day
Total Train Movements	964 total train movements
Average Train Tonnage	9,051 tonnes
Total product coal loaded from RCHPP	8,778,034 tonnes

4.6 Waste Management

Waste is managed in accordance with the Ravensworth Operations (including RUM) EMS and EPL 2652. The EMS has been developed in accordance with the requirements of the Protection of the Environment Operations Act 1997 (POEO Act).

4.6.1 Waste Management and Reporting

The disposal of waste generated on the site is undertaken in accordance with existing regulatory guidelines and established site procedures. Ravensworth Operations and RUM review waste minimisation strategies on an as needs basis. RUM is currently in active decommissioning, as such RUM recycled 10,298t of waste, which is significantly larger than previous years. ***Table 4-3*** provides waste generation for the Ravensworth Operations and RUM since 2020.

Table 4-3 – Waste Disposal and Recycling at the Ravensworth Operations and RUM

Site	Waste Disposed offsite (t)	Waste recycled (t)	Total waste produced (t)	Waste Recycled (%)
ROC 2023	488	2,015	2,503	81
ROC 2022	362	2,529	2,892	87
ROC 2021	397	2,659	3,055	87
ROC 2020	559	2,983	3,542	84
RCHPP 2023	100	225	325	69
RCHPP 2022	96	233	329	71
RCHPP 2021	126	424	549	77
RCHPP 2020	157	263	420	63
RUM 2023	2	10,298	10,300	99
RUM 2022	6	1	7	15
RUM 2021	4	10	13	73
RUM 2020	5	39	44	89

4.7 Product Coal

A total of 8.77 Mt of product coal was transported to the Port of Newcastle from the RCHPP in 2023.

4.8 Decomissioning

No decommissioning was undertaken at Ravensworth Operations in 2023.

Decommissioning work commenced at RUM during 2022, 2023 decommissioning works at RUM included:

- Demolition of associated infrastructure, and filling of Vent Shaft 1, 2, 3 and 4.
- Demolition of associated infrastructure, and filling of the drift
- Demolition of pit top facilities including conveyors, reclaim tunnel, workshop, administration building.

4.9 Next Reporting Period

4.9.1 Mining

During 2024, coal extraction will continue in the Ravensworth North Pit. Forecast production for 2024 is predicted as 13.2Mt of ROM coal and 8.6Mt of product coal. Mining in 2024 will remain the same as in 2023 with the equivalent mining equipment, personnel, and mining techniques to be utilised in-pit. Ravensworth North will continue progressing in accordance with the mine plan, RMP and Annual Forward Program.

4.9.2 Exploration

There is no proposed exploration activity for 2024.

4.9.3 Construction

Infrastructure associated with the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS) Stage 2 activities are proposed for 2024.

4.9.4 Coarse Rejects and Tailings Disposal

During 2024 coarse rejects will continue to be co-disposed of in overburden emplacement waste areas in accordance with current statutory approval. Tailings will be disposed of in onsite tailings storage facilities or disposed of via the GRAWTS network.

5. Actions Required from Previous Annual Review

5.1 DPE Actions from Previous Annual Review

A letter was received from the DPE dated 11 September 2023 stating the Annual Review for the period 1 January 2022 to 31 December 2022 satisfied the reporting requirements of PA 09_0176 and DA 104/96. No further action or information was requested.

6. Environmental Management and Performance

6.1 Noise

6.1.1 Environmental Management

Noise monitoring and management is outlined in the Ravensworth Complex *Noise Management Plan* which is available on the Ravensworth Operations website.

Noise monitoring consists of both attended and unattended monitoring to meet the requirements of the PA 09_0176, DA 104/96 and EPL 2652. Noise monitoring locations, as discussed in the *Noise Management Plan* are shown on ***Figure 6.1***.

In addition to conducting noise monitoring, Ravensworth Operations continues to implement a number of mitigation strategies to minimise potential noise impact on nearby receivers and to comply with the relevant conditions of the Project Approvals.

6.1.2 Environmental Monitoring Results

Results from the Reporting Period

Noise monitoring results for the reporting period are provided in ***Appendix B*** **-**(Table B.1-B.12). Relevant noise criteria, as outlined in PA 09_0176 Schedule 3 Conditions 2, 3 and 4, DA 104/96 Condition 12 and EPL 2652 Condition L5 are combined in ***Table 6-1*** and ***Table 6-2.***

The 2023 attended noise monitoring program was conducted on a monthly basis; there were no exceedances (non-compliances) of noise approval criteria at any location during the reporting period. Site 7/R7 is monitored on a quarterly basis for RUM and there were no exceedances during 2023 monitoring.

Table 6-1 - Noise Criteria dB(A) and performance for 2023 reporting period

Monitoring Location	Receiver Location	Receiver	Day (LAeq (15min))	Evening (LAeq (15min))	Night (LAeq (15min))	Night (LA1 (1min))	Performance during Reporting Period (*Appendix B*)
-	R1	34 – Stapleton[1]	48	48	48	49	Not applicable as owned by Ravensworth Operations
Site 2	R2	3 – A Bowman	35	35	35	45	Compliant
		13 – A Bowman	38	38	38	45	Compliant
Site 3	R3	Camberwell Village Central 12 – Yates, 21 – Miller, 27 Chisholm	37	37	37	45	Compliant
Site 5		38 - Ninness	36	36	36	45	Compliant
Site 6	R4	Camberwell Village North	35	35	35	45	Compliant

Monitoring Location	Receiver Location	Receiver	Day (LAeq (15min))	Evening (LAeq (15min))	Night (LAeq (15min))	Night (LA1 (1min))	Performance during Reporting Period (*Appendix B*)
Site 7	R7	Spiteri	35	35	35	45	Compliant
-	-	All other privately-owned land	35	35	35	45	Compliant

[1] *Property owned by Ravensworth Operations*

Ravensworth Operations and RUM implement all reasonable and feasible measures to ensure that the noise generated by the Ravensworth Operations and RUM, combined with the noise generated by other mines, does not exceed the criteria shown in ***Table 6-1***, at any residence on privately-owned land or on more than 25% of any privately-owned land. ***Table 6-2*** provides a summary of the cumulative noise criteria and performance for 2023.

Table 6-2 - Cumulative noise criteria dB(A) LAeq (period) from PA 09_0176 and performance for 2023 reporting period

Receiver Location	Day	Evening	Night	Performance during Reporting Period (*Appendix B*)
R3 and R4 – Camberwell Village	55	45	40	Compliant
All other privately owned land	50	45	40	Compliant

Comparison with Predictions

As indicated by the results in ***Appendix B***, all noise monitoring results were within predicted levels for the reporting period.

Long Term Trend Analysis

The results are generally consistent with prior years. Noise results over the last six years have been reported within approved noise criteria.

6.1.3 Key Performance and Management Issues

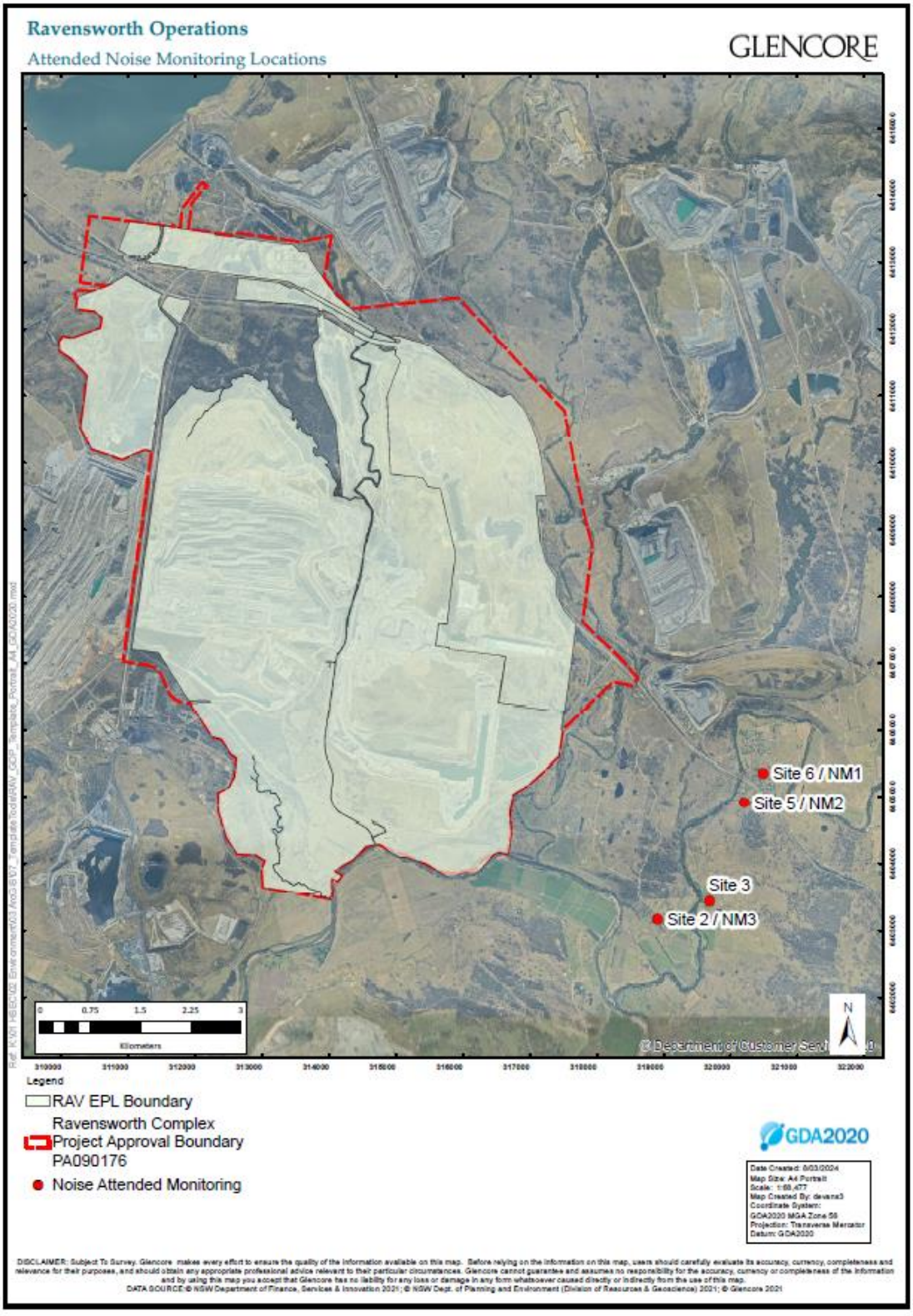
There were no performance or management issues in relation to operational noise during the reporting period.

6.1.4 Proposed Improvements

Ravensworth Operations and RUM will continue to use site procedures, processes, and systems to manage noise.

The *Noise Management Plan* was submitted in 2022 to reflect the changes to EPL 2652 noise monitoring conditions. Approval of *Noise Management Plan* pending at the time of this Annual Review.

Figure 6-1 – Monthly Attended Noise Monitoring Locations, Spectrum Acoustics 2023


Ravensworth Operations
Attended Noise Monitoring Locations
GLENCORE
Site 6 / NM1
Site 5 / NM2
Site 3
Site 2 / NM3
0 0.75 1.5 2.25 3
Kilometers
N
Legend
RAV EPL Boundary
Ravensworth Complex
Project Approval Boundary
PA090176
Noise Attended Monitoring
GDA2020
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6.2 Blasting and Vibration

6.2.1 Environmental Management

Blasting at Ravensworth is undertaken in accordance with the Ravensworth Complex *Blast Management Plan* (BMP) (2022), which was developed in accordance with Schedule 3, Condition 17 of PA 09_0176 and is available on the website. Ravensworth Operations has a number of procedures in place to manage the impacts of blasting including overpressure, vibration, fume, and dust.

6.2.2 Environmental Monitoring Results

Results from the Reporting Period

A summary of blasting results obtained during the reporting period is provided as ***Table 6-3*** (below) and ***Appendix C -.***

During the reporting period there were 221 blasts. No blasts exceeded the overpressure or vibration approval criteria outlined within Schedule 3, Condition 10 of PA 09_0176 or the BMP.

Table 6-3 – Blasting Criteria and Performance for 2023 Reporting Period

Location	**Approval Criteria** Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance	**Environmental Performance in this Reporting Period.**
Residence[a] on privately owned land and Camberwell church	120	10	0%	Compliant
	115	5	Compliant	Compliant
Ravensworth Public School and Chain of Ponds Hotel	133	10	Compliant	Compliant
Ravensworth Homestead	126	10	Compliant	Compliant
Aboriginal axe grinding groove site (REA86)	-	[c]175	0%	Compliant
1,000ML dam wall and proposed dam wall	-	[b] 25	0%	NA
Conveyors, including the Hunter Valley Operations conveyor	-	[b] 100	0%	Compliant
Main Northern Railway culverts and bridges	-	[b] 25	0%	NA
Transmission lines	-	[b] 50	0%	NA
Ashton underground mine	-	[b] 6	0%	NA

a Unless otherwise agreed with the relevant owner/s of the residence, and the Proponent has advised the Department in writing of the terms of this agreement.

b Unless otherwise agreed with relevant infrastructure provider, owner, or the regulator (in relation to the dams), and the Proponent has advised the Department in writing of the terms of this agreement.

c Subject to meeting incremental limits under condition 10A (PA_0176).

Comparison with Predictions

The Ravensworth Operations Project Environmental Assessment (Umwelt, 2010) assessed the impacts of blasting. The assessment determined vibration and airblast (overpressure) criteria that applied to infrastructure and heritage sites that may be affected by the operations. These criteria are provided in the blast result tables, included in ***Appendix C***.

During the reporting period both blast vibration and overpressure were generally consistent with EA predictions.

Long Term Trend Analysis

Since 2014, there have been no blast exceedances.

6.2.3 Key Performance and Management Issues

One blast complaint was received during the reporting period. Further details of these complaints are included in ***Section 9.2***.

6.2.4 Proposed Improvements

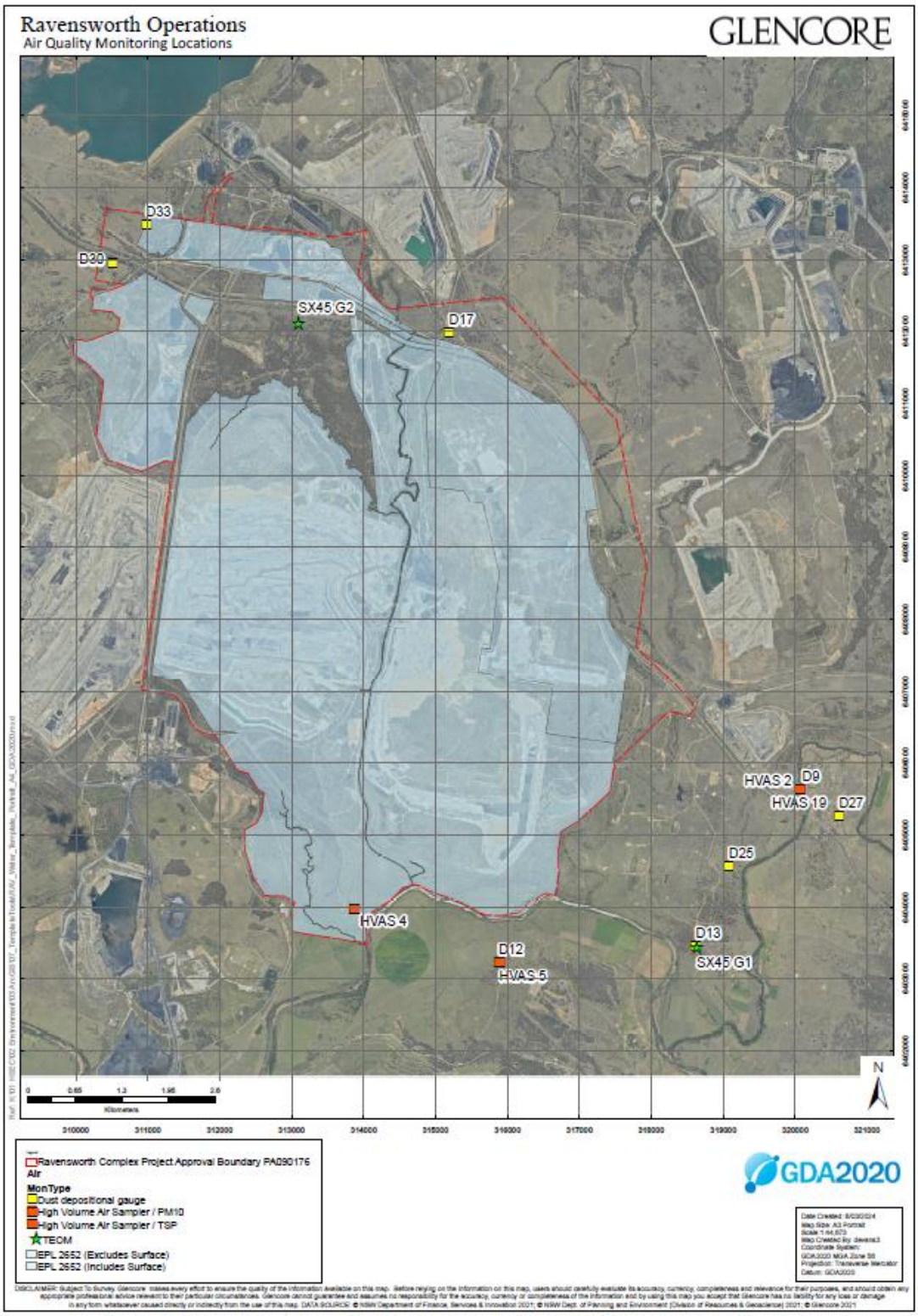
Ravensworth Operations will continue to use site procedures, processes, and systems to manage blast impacts.

6.3 Air Quality

6.3.1 Environmental Management

Ravensworth Operations operates in accordance with the approved *Air Quality and Greenhouse Gas Management Plan* (AQGGMP), which is available on the Ravensworth Operations website, and describes air quality management and monitoring requirements associated with the mine. **Figure 6-2** displays the locations of the air quality monitors.

Figure 6-2 – Air Quality Monitoring Locations



6.3.2 Environmental Monitoring Results

Results from the Reporting Period

An overview of environmental performance for air quality based on TSP, PM_{10}, and depositional dust monitoring data is provided in ***Tables 6.4*** – ***6.6***. See ***Appendix D*** -for further detail on exceedance dates and results. The air quality criteria and notes can be found in Schedule 3, Condition 20 of PA 09_0176. Note that no dates within 2023 were declared as extraordinary events.

Table 6-4 – Long term criteria for particulate matter

Pollutant	Averaging period	Approval Criteria Criterion	Environmental Performance this Reporting Period
Total suspended particulate (TSP) matter	Annual	90 µg/m³	Compliant
Particulate matter < 10 µm (PM_{10})	Annual	30 µg/m³	Compliant

Note: TSP and PM_{10} performance based on HVAS data

Table 6-5 – Short term criterion for particulate matter

Pollutant	Averaging period	Approval Criteria *Criterion	Environmental Performance this Reporting Period
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m³	Non-Compliant

Note: PM_{10} performance based on TEOM and HVAS data

Tapered Element Oscillating Microbalance (TEOM)

Ravensworth Operations has two TEOM monitors to record particulate matter (**Figure 6-2**).

TEOM SX45-G1

The rolling annual average for PM_{10} was below the 30 µg/m³ PA 09_0176 criteria, with a result of 21.4 µg/m³. The PM_{10} 24-hour criterion of 50 µg/m³ was exceeded once at TEOM G1 on 20/09/2023.

Additionally, TEOM G1 was unable to collect data for the required 24-hour period nine (9) times.

TEOM SX45-G2

The rolling annual average for PM_{10} was below the 30 µg/m³ PA 09_0176 criteria, with a result of 20.1 µg/m³.

Throughout the reporting period, there was 129 invalidated or missed samples due to mechanical failure. A replacement TEOM unit will be installed in early 2024. Due to the multiple missed samples, average PM_{10} results for TEOM G2 should be excluded from future long term trends.

It is noted that there were 138 missed samples from both the TEOM G1 and TEOM G2 during the 2023 reporting period due to a mechanical fault (primarily from TEOM G2). Missing samples are acknowledged, however not considered a non-compliance for air quality monitoring for the purpose of this Annual Review.

These missed samples are reported in the Annual Return and this Annual Review as an administrative non-compliance due to the implementation of the Air Quality Management Plan.

On 13/03/2023 Ravensworth Operations notified the Department of a short-term exceedance occurring on 11/03/2023. Following notification a review of the TEOM data deemed that the data captured was invalid.

On 02/10/2023 Ravensworth Operations notified the Department of a short-term exceedance occurring on 01/10/2023. A review of the TEOM data deemed that the data captured was invalid.

The TEOM D2 PM_{10} 24-hour criterion of 50 µg/m^3 was exceeded twice during the 2023 reporting period on 12/10/2023 and 19/12/2023. The G1 and G2 24-hour average PM_{10} data for 2023 is provided in ***Appendix D*** **-.**

Dust Deposition

Table 6-6 – Long term criteria for deposited dust

Pollutant	Approval Criteria			Environmental Performance this reporting period
	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level	
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month	Compliant

Note: Deposited dust results are used for internal management purposes only.

Annual average deposited dust results were below 4 g/m^2/month at every offsite monitoring location during 2023. Results are summarised below:

- The 2023 annual average was lower than the 2022 annual average at D9, D13, D12, and D27 (1.5, 2.2, 1.5, and 1.3 g/m^2/month respectively);
- Annual depositional dust averages for the 2023 period did not exceed the PA 09_0176 maximum increase in deposited dust level criteria of 2 g/m^2/month.

Comparison with Predictions

Air quality predictions against the 2010 EA are outlined in ***Table 6.7 - 6.9***. Cumulative predictions consider the contribution of other mines in the area as well as other local sources of dust.

Comparisons of dust deposition levels (Year 10) predicted in the 2010 EA and 2022 measured averages are shown for privately owned and mine owned offsite residences in ***Table 6-7***.

All 2023 annual results are greater than the EA predicted values for dust depositional gauges but are within the 4 g/m^2/month criteria and is discussed below.

Table 6-7 - ROC Dust Deposition EA Prediction Comparison - Privately Owned and Mine Owned Residences

Monitor	EA Residence ID	Year 10 Prediction		2023 Results
		Ravensworth Contribution	Cumulative	
D9	40B	0.3	0.7	1.5
D12[1]	34	0.3	0.9	1.5
D13	3	0.4	0.8	2.2
D27	5Z / 12	0.2	0.7	1.3

[1]Mine owned residence.

High Volume Air Sampler (HVAS)

Ravensworth Complex operates four HVAS to monitor particulate matter. HVAS 19 did not recorded any short term 24-hour PM_{10} exceedances in 2023.

HVAS TSP and PM_{10}

Comparisons of HVAS, TSP, and PM_{10} levels (Year 10) predicted in the 2010 EA and 2023 measured averages are shown for privately owned and mine owned residences in ***Table 6.8*** and ***Table 6.9***.

All 2023 HVAS annual results are greater than the predicted values for both PM_{10} and TSP at privately owned residences.

Table 6-8 - ROC HVAS TSP and PM_{10} EA Prediction Comparison - Privately Owned Residences

Monitor	EA ID	Year 10 Prediction				2023 Results	
		Ravensworth Contribution (PM_{10})	Cumulative (PM_{10})	Ravensworth Contribution (TSP)	Cumulative (TSP)	PM_{10}	TSP
HVAS 2 / HVAS 19	45	6	14	5	41	17.5	47.6

Table 6-9 - ROC HVAS TSP EA Prediction Comparison - Mine Owned Residence

Monitor	EA ID	Year 10 Prediction		2023 Results
		Ravensworth Contribution (TSP)	Cumulative (TSP)	
HVAS 5	34	22	56	60.6

Long Term Trend Analysis

2023 experienced significantly less rainfall than in previous years resulting in an increase in dust levels across the region. There were five reportable exceedances of PM_{10} 24-hour criterion in 2023, up from the one exceedance in 2022.

The TEOM G1 PM_{10} annual average of 20.81µg/m^3 was higher than the 2022 average result of 13.21µg/m^3 and 2021 annual average of 17.88 µg/m^3. There were 8 missed samples, with three reportable 24-hour exceedances in 2023.

The TEOM G2 PM_{10} annual average of 20.05µg/m^3 was higher than the 2022 average result of 13.29 µg/m^3 as well as the 2021 average result of 15.76µg/m^3. There were 124 missed or invalid samples, with two reportable 24-hour exceedances in 2023.

HVAS 19 PM_{10} annual average of 17.5 µg/m^3 was higher than the 2022 average results of 13.8 µg/m^3.

6.3.3 Key Performance and Management Issues

There were no complaints related to air quality in the 2023 reporting period.

6.3.4 Proposed Improvements

The sites will continue to use site procedures, processes, and systems to manage dust.

Replacement of TEOM G2 is expected to occur in early 2024.

6.4 Biodiversity

6.4.1 Environmental Management

Biodiversity is managed in accordance with the *Ravensworth Open Cut Biodiversity Offset Management Plan* which has been developed and approved in accordance with Schedule 3, Condition 24 of PA 09_0176. The *Biodiversity Offset Management Plan* covers the management of biodiversity at Ravensworth Operations and RUM and within the biodiversity offset areas (BOAs) and is available on the website.

Ravensworth Operations and RUM aim to mitigate effects of mining activities on native vegetation communities, fauna habitat and fauna species by planning and implementing programmes to maintain and improve the biological value of land. The programs are not only for rehabilitation areas but include other potentially degraded sites across the Ravensworth Operations and RUM holdings.

A large area has been offset as part of the establishment of Ravensworth North. This has involved the establishment, protection, and enhancement of Offset Areas by an Implementation Program, which was approved in 2013. This will provide for the long-term conservation of a range of significant ecological features.

6.4.2 Biodiversity Offset Areas – Overview

Ravensworth Operations owns and manages four BOAs required under NSW Project Approval (PA 09_0176) and the Federal EPBC Approval (2010/5389). The offset areas are managed in accordance with the Ravensworth Open Cut Offset Area Management Programme (OAMP). A spatial summary of these offset areas is described in **Table 6-10** and shown in ***Figure 6-3***.

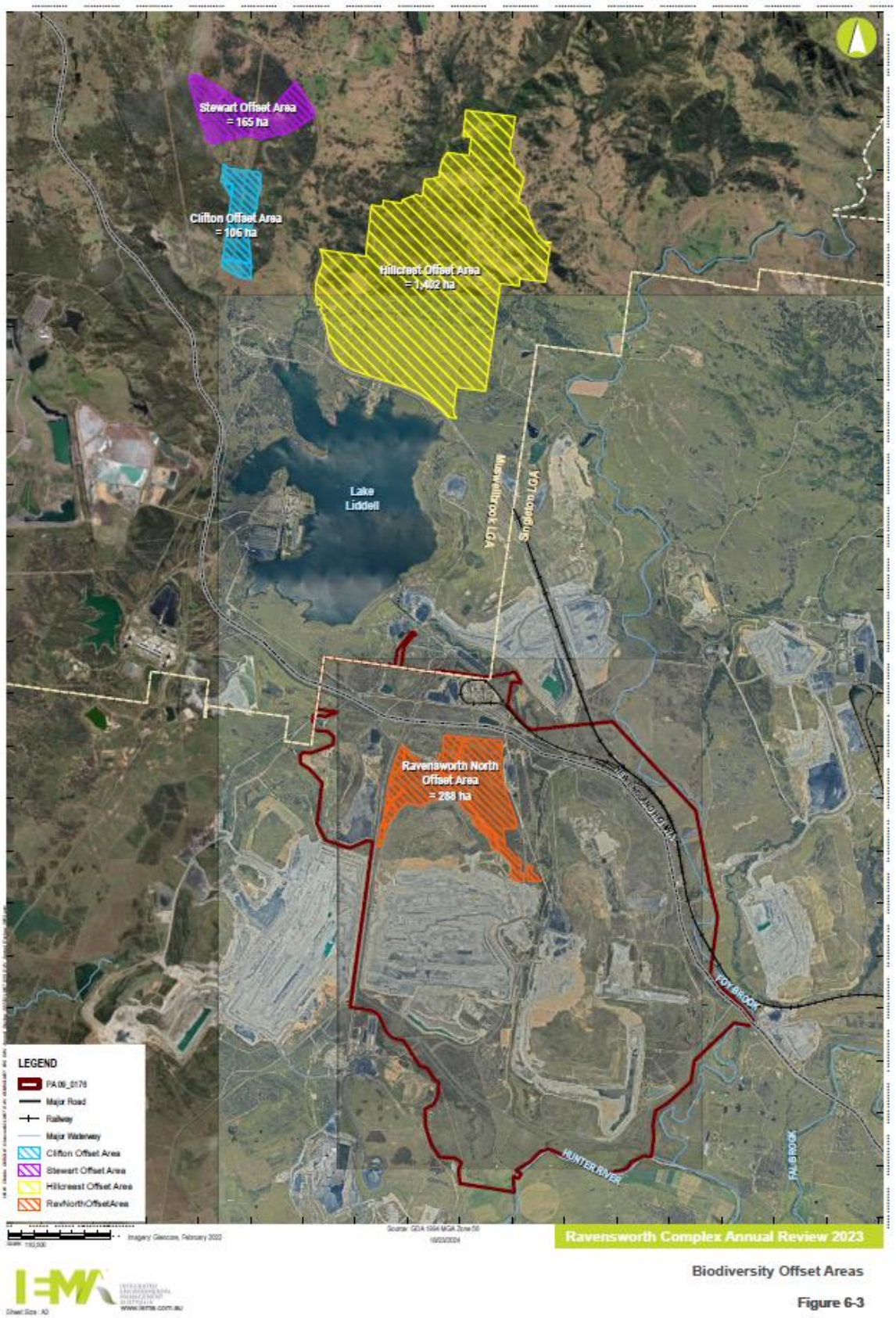
Table 6-10 - Location and size of Ravensworth Operations Offset Areas

Name	Size (ha)	Location Description
Ravensworth North Offset Area (RNOA)	288	Immediately North of Ravensworth North Open Cut Disturbance Area
Hillcrest Offset Area (HOA)	1402	Approx. 6km North of Ravensworth Complex
Clifton Offset Area (COA)	106	Approx. 7.5km North of Ravensworth Complex
Stewart Offset Area	165	Approx. 10km North of Ravensworth Complex

In accordance with the Biodiversity Offset Management Plan (Ravensworth Open Cut, 2022), and the OAMP (Ravensworth Open Cut, 2019) Ravensworth Operations utilises suitably qualified and accredited ecologists to undertake an annual biodiversity monitoring program across all BOAs.

Biodiversity monitoring is undertaken at the BOAs on an annual basis. Monitoring involves vegetation condition assessments and fauna monitoring at twenty-eight permanent monitoring locations across all Biodiversity Offset Areas (BOAs). The results of the 2023 monitoring program are discussed in the following sections.

Figure 6-3 – Biodiversity Offset Areas



Biodiversity Offset Areas

Figure 6-3

BOA Monitoring Results

Monitoring events are typically completed during early Summer to maintain consistency in data comparisons; monitoring was undertaken during the following dates,

- 29th to the 30th of August 2023;
- 6th to the 10th of November 2023; and
- 4th to the 9th of December 2023.

In accordance with the Conservation Agreements, an annual monitoring event must be conducted, and reporting submitted by the 30 December of that year. There were no limitations to completing the conservation agreement monitoring during 2023.

Fauna

Four threatened bird species were observed in 2023,

- Grey-crowned Babbler (*Pomatostomus temporalis*);
- Varied Sitella (*Daphoenositta chrysoptera*);
- White-bellied Sea-eagle (*Haliaeetus leucogaste*r); and
- Flame Robin (*Petroica phoenicea*).

The White-bellied Sea-eagle and Flame Robin have not previously been recorded on across any of the BOAs. As in previous years, targeted surveys were unsuccessful for the regent honeyeater and swift parrot. It was noted that there was limited flowering of eucalypts at the time monitoring was conducted. As vegetation cover increases in grasslands, it is anticipated a greater diversity of birds will be recorded over time. Surveys for the Green and Golden Bell Frog was unsuccessful in 2023.

Flora

Only a small portion of the BOAs have had active regeneration works with revegetation being delayed during 2023 due to supply of tube stock and below average rainfall.

Exotic plants were noted to have decreased in most overall BOAs. Competition with regenerated native grasses and groundcover likely aided the reduction in exotic species as well as management interventions, such as spot spraying, of exotic species.

6.4.3 Key Performance and Management Issues

Weeds and pests continue to be a focus of management within the BOA areas. **Section 6.10** discusses the weed and pest management undertaken during 2023 both within the mining lease boundaries and in the BOAs.

No incidents occurred in the BOAs during the reporting period.

6.4.4 Proposed Improvements

The site's biodiversity and offset areas will continue to be managed consistent with Ravensworth Open Cut Biodiversity Management Plan. Pest and weed management will continue to be undertaken at the BOAs during 2023, as discussed in ***Section 6.10***.

The continued use of methods such as direct seeding, brush-matting, planting of fast-growing pioneer species and soil amelioration will be undertaken (where possible) to speed up the recovery of vegetation communities within the BOAs and enhance regeneration success of grassland areas.

6.5 Erosion and Sediment Control

6.5.1 Environmental Management

Ravensworth Operations and RUM manages erosion and sediment control on site in accordance with the approved Erosion and Sediment Control Plan (ESCP), which is included in the Water Management Plan (WMP).

6.5.2 Environmental Monitoring Results and Works Undertaken

During the reporting period there were minor upgrades to erosion and sediment controls at site and maintenance of existing erosion and sediment control measures (e.g. desilting of dams).

6.5.3 Key Performance and Management Issues

Erosion is actively managed with appropriate controls. Erosion maintenance works are undertaken on an annual basis.

6.5.4 Proposed Improvements

Erosion monitoring will continue to be undertaken during 2024, along with maintenance and upgrades to erosion and sediment controls, as required.

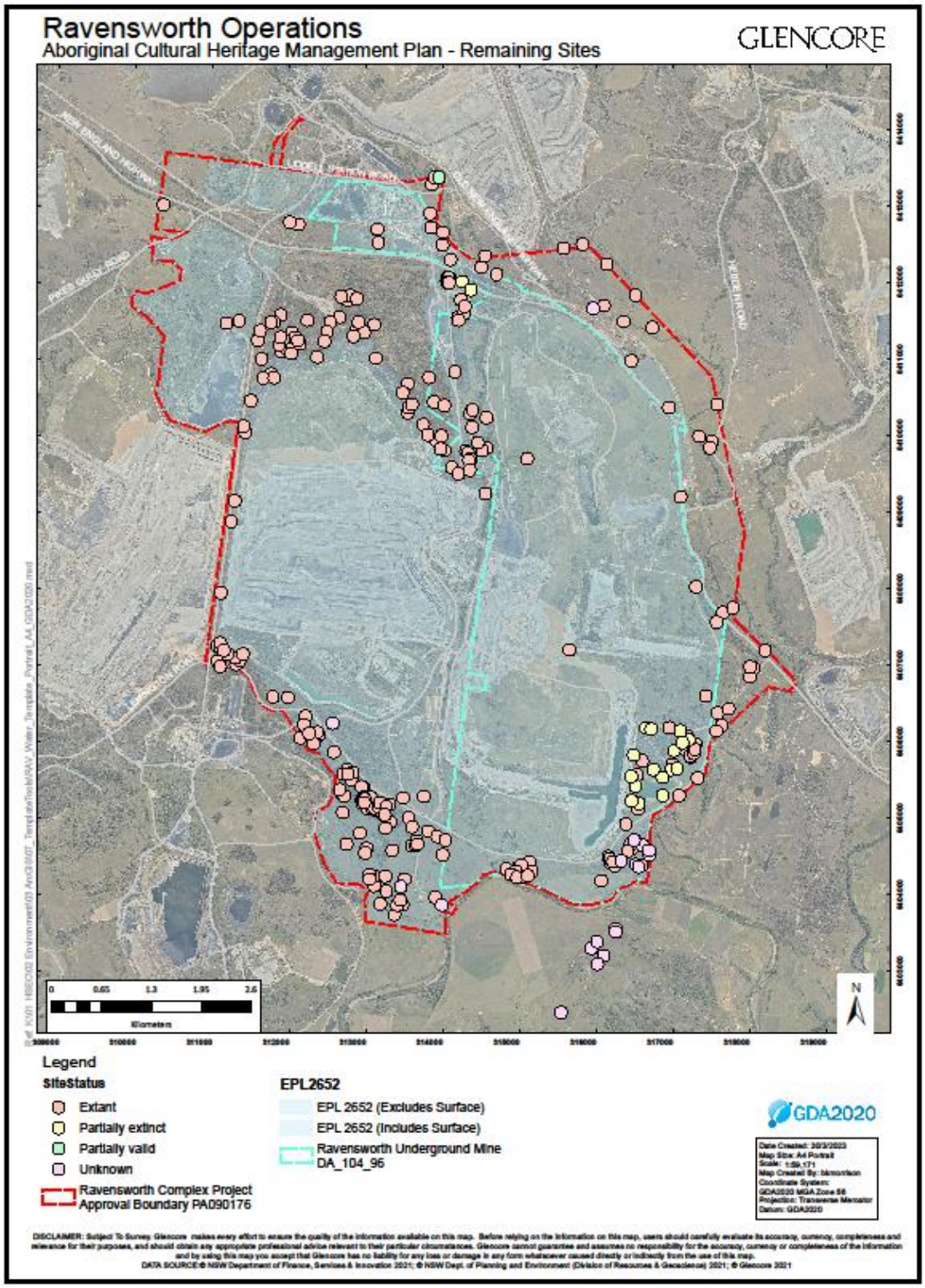
6.6 Aboriginal Heritage

6.6.1 Environmental Management

Aboriginal and Cultural Heritage at Ravensworth Operations is managed in accordance with the *Aboriginal Cultural Heritage Management Plan* (ACHMP). Remaining archaeological (Aboriginal heritage) sites within the Ravensworth Operations and RUM Approval boundary (PA 09_0176) are shown on ***Figure 6-4***.

A monitoring program is undertaken for Aboriginal heritage sites that are not directly impacted by approved mining activities, in accordance with the Ravensworth Complex ACHMP. Monitoring is conducted annually. Results from the monitoring program are discussed below.

Figure 6-4 – Archaeological Sites Monitored Oz Ark Environment and Heritage, 2023



6.6.2 Environmental Monitoring Results

The Annual Site Monitoring program was undertaken in December 2023, and was attended by Registered Aboriginal Parties.

21 sites were monitored for site condition, and photographic monitoring was completed at 11 different sites. The 2023 program managed to visually inspect the condition of all monitoring sites.

The 2023 monitoring program demonstrated that:

- Most sites at Ravensworth Operations have been impacted by erosion; most commonly sheet wash erosion. A small number of sites have on-going impacts from extensive gully erosion.
- No sites have been impacted by non-natural activities.
- Revegetation is occurring at many sites, and this will slow or halt erosion, particularly sheet wash erosion. However, due to the lack of topsoil at many areas of erosion, this revegetation will take time to establish itself naturally across eroded areas.
- At most sites where hay bales have been installed there is clear evidence of a build-up of sediment on the upslope side that encourages vegetation growth. This demonstrates that hay bales are an effective, non-invasive method to control worsening erosion. However, the hay bales require replacement periodically.

Aboriginal sites at Ravensworth Operations are fenced and signed. No impacts other than natural deterioration were noted at any of the monitored sites and it is noted that the fencing program has aided the lack of inadvertent impacts to sites.

6.6.3 Key Performance and Management Issues

There were no complaints or incidents involving Aboriginal heritage sites.

A salvage of Aboriginal heritage items was undertaken 5 – 7 December 2023 at three sites.

It was recommended that haybales be installed at three (3) sites to help curtail erosion through non-invasive means, by reducing the flow of water and promoting vegetation growth. It was noted that many sites at Ravensworth Operations are not monitored annually. Changing sites will allow a broader range of sites to be appropriately managed.

Ravensworth Operations and RUM will continue to manage erosion as recommended for the 2024 monitoring program.

6.6.4 Proposed Improvements

In addition to updated fencing and signage, Ravensworth Operations will continue to hold the monitoring program site inspections annually in accordance with the project ACHMP.

6.7 European Heritage

The Oaklands homestead is located adjacent to the Ravensworth Operations. Ravensworth Operations have committed to the following heritage management measures in the *Heritage Management Plan,* which is available on the website:

- Manage blasting practices to meet relevant blast impact assessment criteria at listed heritage sites / items;
- Structural assessment of the Oakland's complex buildings at key stages of the mining process was undertaken. This complex has been now removed from monitoring (structural assessment inspections) and is subject to annual pest inspections only; and
- An annual inspection of the Oaklands homestead for pests and the ingress of pest is undertaken.

6.7.1 Environmental Monitoring Results

An annual inspection for pests within the Oaklands homestead site was undertaken.

6.7.2 Key Performance and Management Issues

There were no management issues related to European heritage at the Ravensworth Complex during 2023.

6.7.3 Proposed Improvements

European heritage will continue to be managed in accordance with the *Heritage Management Plan* in 2024.

6.8 Meteorological Monitoring

Ravensworth Operations has a weather station onsite to measure atmospheric conditions, including wind speed, wind direction, sigma-theta, humidity, rainfall, and temperature in accordance with EPL 2652. This allows up to date predictions to be made on the impact of weather conditions on mining operations. No missed weather samples were recorded in 2023.

A summary of results is provided in ***Appendix E -***.

6.8.1 Average Temperature and Wind Speed

Throughout the reporting period the average mean wind speed was 2.01 m/s.

Temperature ranged from -1.1°C to 40.9 °C. The mean air temperature (at 10m) was 18.7°C.

6.8.2 Rainfall

During the reporting period a total rainfall of 524mm was recorded, a decrease from the 2022 period where 1153 mm was recorded, and also 2021 which recorded 1042.4 mm. May recorded the driest month for the year, with just 1.6mm of rainfall. February recorded the wettest month, recording 106.2mm of rainfall. Since 2010, the rolling average rainfall has been 678mm.

6.9 Weed and Pest Management

6.9.1 Environmental Management Activities and Monitoring Results

Weed Management Activities

Monthly environmental inspections at Ravensworth Operations and RUM are used to identify areas of weed infestations as well as review the success of previous weed control programs. Weed infestations were recorded in the sites GIS database.

A summary of weed control activities undertaken at Ravensworth Complex and BOAs in 2023 is presented in ***Table 6-11***. Weed control was predominantly conducted in rehabilitation pasture areas, buffer lands and BOA's. Methods included:

- Application of herbicides via spraying;
- Cut and paste;
- Selective culling; and
- Mechanical removal.

Table 6-11 - Weed Control at the Ravensworth Operations, RUM and in BOAs during the Reporting Period

Location	Target Species
Western Emplacement Area Rehabilitation	• Galenia • Pampas Grass • South African Pigeon Grass • Acacia salinga
Eastern Emplacement Area Rehabilitation	• Galenia • African Boxthorn • Acacia Saligna
Southern Emplacement Area Rehabilitation	• Acacia Saligna • Galenia • South African Pigeon Grass • African Boxthorn
Cumnock Rehabilitation	• Acacia Saligna • Coolatai Grass • Rhodes Grass • Setaria
Ravensworth North Offset Area	• Common Prickly Pear • Fireweed • Galenia
Clifton Offset Area	• Common Prickly Pear • Galenia
Stewart Offset Area	• Fireweed
Hillcrest Offset Area	• Trailing Lantana • Galenia • Coolatai Grass • Formosan Lily

Feral and Pest Animal Management

Feral species were recorded in the RNOA, HOA, and SOA during the monitoring program; however, targeted surveys were not undertaken and therefore there are no measured densities. The observed feral species include:

- Dog *(Canis lupus familiaris)* – Stewart Offset Area;
- European rabbit *(Oryctolagus cuniculus)* – Ravensworth North Biodiversity Offset Area and Hillcrest Offset Area; and
- Wild pig *(Sus scrofa)* - Ravensworth North Offset Area.

Observations suggest that pest species abundances were slightly lower in 2023. This was particularly evident with feral pigs, with a notably decreased extent of their impact. European rabbits were observed on hillcrest on just one occasion.

Wild Dogs and Foxes

The management strategy for feral animals continued with baiting programs conducted during the reporting period. The programs were carried out by an experienced consultant and adhered to all best practice guidelines set by NSW Environment, Energy and Science and the Local Land Service.

Feral animal control continued to focus on fox and wild dog eradication across all the BOAs. Seven wild dogs were recorded on Hicrest Offset Area, and one dog recorded on Stewart Offset Area and Clifton Offset Area. Although fox and wild dog management has been a recommendation in the past, given there are not significant numbers of threatened species (such as koalas) that need to be protected, continued management of wild dogs is not discussed in the recommendations. Similar recommendations made previously, fox and cat management may be a more beneficial to fauna populations within all BOAs.

Other Animals

A pig poison baiting program was implemented during 2023 which trapped 10 pigs.

A Pindone Rabbit Control Program was conducted seeing a considerable reduction in rabbit numbers recorded during post program monitoring.

6.9.2 Key Performance and Management Issues

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

6.9.3 Proposed Improvements

Throughout 2024 weed monitoring will continue to be undertaken, as well as weed and pest management as required.

6.10 Visual and Lighting

6.10.1 Environmental Management

Ravensworth Operations employs various management strategies for mitigating and minimising its impacts on the visual amenity from community locations and public roads.

6.10.2 Environmental Monitoring Results

No lighting surveys were undertaken during the reporting period as there was no change to visual impacts at the site.

6.10.3 Key Performance and Management Issues

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

6.10.4 Proposed Improvements

There are no proposed visual and lighting improvements for 2024.

6.11 Spontaneous Combustion, Methane Drainage and Ventilation

6.11.1 Environmental Management

Ravensworth Operations

Management of spontaneous combustion is undertaken in accordance with the Ravensworth Complex Spontaneous Combustion Principal Hazard Management Plan. The plan addresses the placement of carbonaceous materials to ensure the potential for spontaneous combustion is minimised. The document identifies potential sources of carbonaceous material at the mine and details methods to be used when handling and disposing. A specific training module has been developed to communicate the requirements of this procedure to appropriate personnel.

RUM

No methane drainage or ventilation activities have taken place at RUM.

6.11.2 Environmental Monitoring Results

Monitoring is conducted in accordance with the *Spontaneous Combustion Principal Hazard Management Plan*.

6.11.3 Key Performance and Management Issues

No significant spontaneous combustion events occurred during the reporting period.

6.11.4 Proposed Improvements

Improvements to spontaneous combustion, methane drainage and ventilation are not proposed for the 2024 period. Current management activities are deemed sufficient.

6.12 Bushfire Management

6.12.1 Environmental Management

Slashing of grasses is conducted on a regular basis within road verges, infrastructure areas, and sensitive and high-risk growth areas to mitigate bushfire fuels.

The *Ravensworth Complex Bushfire Management Plan* outlines the key mitigation measures for managing bushfire risk at Ravensworth Operations.

6.12.2 Environmental Monitoring Results

There were two bushfire events onsite during 2023, these fires did not progress to the BOAs. The annual inspection of bushfire management in the offset areas was undertaken in September by BEMC (2023).

6.12.3 Key Performance and Management Issues

In response to the reported bushfire events, the Ravensworth Complex Bushfire Management Plan (reviewed annually) is being revised.

6.12.4 Proposed Improvements

The Ravensworth Offset Area Management Program specifies various bushfire management strategies and monitoring requirements. A review of the Bushfire Management documentation has been completed to inform an annual review that included:

- Visually inspect all areas to ensure fuel levels are at or below the recommended level. This will include the designated SFAZs.
- Inspection of all roads and trials to ensure adequate fire fighter access is maintained.
- Identification of any other bushfire hazards or matters affecting bushfire management for the sites.

6.13 Mine Subsidence

6.13.1 Environmental Management

RUM has a Subsidence Management Plan (SMP) to ensure adequate management of any subsidence impacts associated with surface cracking, erosion, slope instability, land degradation and spontaneous combustion due to longwall mining.

Visual subsidence monitoring is undertaken, and subsidence repairs are completed in accordance with the SMP.

Key ongoing subsidence management measures include as required:

- Six monthly subsidence inspections;
- Repair of subsidence damage and filling of subsidence cracks if required; and
- Subsidence reporting to the Resource Regulator if new subsidence impacts are identified through the visual inspection.

6.13.2 Environmental Monitoring Results

RUM has been in care and maintenance since 2014 therefore, underground mining activities occurred during the reporting period. Visual subsidence inspections were undertaken as part of the ongoing Environmental Monitoring Inspections in 2023.

Monitoring did not identify any subsidence related issues.

6.13.3 Key Performance and Management Issues

No remedial repair works were required during the reporting period.

6.13.4 Proposed Improvements

Six-monthly inspections will continue, and any maintenance required will be completed in accordance with the SMP during 2024.

6.14 Hydrocarbon and Chemical Management

6.14.1 Environmental Management

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

Hydrocarbon contaminated waste material within pit, hardstand and truck wash areas is bio remediated and disposed onsite. The site has been designed to prevent contamination and the storage and handling of chemicals is undertaken in accordance with Australian Standards and relevant guidelines.

Hydrocarbon contaminated water is contained and separated in the site's industrial oil water separators where treated water is recycled for reuse and separated oil is disposed of offsite by the licensed waste contractor. In the event of accidental contamination of onsite dams, contaminated water is contained and transported offsite for treatment by a licensed waste contractor.

6.14.2 Environmental Monitoring Results

The bioremediation area is tested once cells are full and dry or inspection deems testing necessary. The required cells were tested in both April and October 2023.

6.14.3 Key Performance and Management Issues

There were no reportable spills during the reporting period. Contaminated material was taken to the onsite bioremediation area and or disposed of in accordance with the Waste Management Plan.

There were no significant issues regarding the storage of chemicals throughout the reporting period.

6.14.4 Proposed Improvements

Hydrocarbon spills will continue to be managed in accordance with *AS1940-2017 The Storage and Handling of Flammable and Combustible liquids*, with any spills cleaned up and contaminated material sent to the bioremediation area.

6.15 Greenhouse Gas and Energy

6.15.1 GHG Environmental Management

The Ravensworth Complex is committed to reducing GHG emissions from its operation. The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (Cth) provides methods and criteria for calculating GHG emissions and energy data under the NGER Act. Each reporting year technical guidelines based on the Determination are developed, reflecting improvements in estimation methods and in response to industry feedback. On the 14 May 2021 the Commonwealth Clean Energy Regulator issued new Transitional Safeguard Baselines for the Ravensworth Open Cut and the Ravensworth Underground.

6.15.2 GHG Environmental Monitoring Results

Results from the Reporting Period

Ravensworth Operations and RUM report greenhouse gas emissions (GHG) in accordance with National Energy and Greenhouse Gases (NGER) legislation. Each financial year Ravensworth Operations is required to submit to the federal government the emissions from their NGERs registered facility. Also, because Ravensworth Operations emits over 100kt of CO2e- each year, Ravensworth is registered as a Safeguard facility and therefore also had a Safeguard baseline. Emissions above the baseline for that year need to be offset by retiring Australian Carbon credit Units (ACCUs). The NGERs reporting year is based on a financial year, not a calendar year such as this Annual Review. In order to prevent incompatible public reporting, the values in this report also cover a financial year. The following table contains the Scope 1 (direct emissions from the mining activities during the year), and Scope 2 emissions (electricity consumption by the mine during the year).

Glencore Coal Australia open cut and underground sites minimise emissions from diesel and electricity consumption by:

- Optimisation of mining practices e.g. haulage planning, blast design, conveying arrangements.
- Optimisation of engine performance e.g. studies undertaken in collaboration with OEMs to enhance fuel efficiency and emissions reduction.
- New fleet is purchased with the most fuel-efficient engines available.
- Ongoing monitoring of potential biofuel and fuel additive opportunities.
- Ongoing monitoring and assessment of emerging technologies.

Scope 1 and Scope 2 emissions during the FY23 reporting period are presented in **Table 6-12**.

Table 6-12 - GHG Emissions Summary 2023

Emission Source	**T CO_2 -e**
Ravensworth Open Cut	
Scope 1 Emissions	327,434
Scope 2 Emissions	10,317
RUM	
Scope 1 Emissions	92,239
Scope 2 Emissions	1,419
RCHPP (including Cumnock)	
Scope 1 Emissions	3,506
74,594	70,348
TOTAL	**509,509**

Comparison with Predictions

The combined Ravensworth Open Cut and Ravensworth RUM Safeguard Baselines is 519,060 T CO2 -e. Actual GHG emissions for 2023 were 509,509T CO2-e.

This is an increase from the 2022 emissions of 409,321T C02-e.

6.15.3 Key Performance and Management Issues

There were no significant issues regarding GHG throughout the reporting period.

6.15.4 Proposed Improvements

Ravensworth Operations and RUM is a part of the wider coal assets held by Glencore across Australia. GCAA are themselves a part of the global Glencore mining portfolio. In line with the ambitions of the 1.5^{o}C scenarios set out by the IPCC, Glencore target a short-term reduction of 15% by 2026 and a medium-term 50% reduction of our total (Scope 1, 2 and 3) emissions by 2035 on 2019 levels. Post 2035, Glencore's ambition is to achieve, with a supportive policy environment, net zero total emissions by 2050.

Glencore incorporates energy costs and our carbon footprint into our annual planning process. Commodity departments, such as Glencore Coal Assets Australia, are required to provide energy and GHG emissions forecasts for each asset over the forward planning period and provide details of emissions reduction projects.

In the case of Ravensworth Operations and RUM this includes involvement with GCAA when considering available GHG abatement technology and mine planning to optimise efficiency (which usually translates into reduced fuel consumption).

7. Water Management

7.1 Water Balance

The overall water balance for the Ravensworth Complex in 2023 is presented below in ***Table 7-1*.**

Ravensworth Operations water balance assessment for 2023 produced a net inventory change over the year of 4,072 ML, which is lower compared to the recorded change in inventory of 4,383 ML. This resulted in a water balance error of approximately 2% deficit, which is well within the acceptable limit for Glencore WAF reporting. This suggests that all inflow and outflows of the mine water system have been accounted for. The minor balance error is likely attributed to estimated or calculated water streams where exact monitoring is impracticable (e.g. groundwater inflow calculations, runoff estimates, etc.).

Table 7-1 – Ravensworth Complex 2023 Water Balance

Item	Volume (ML)
Inflows	
Rainfall Runoff	2,232
Groundwater Inflow	2,108
ROM Coal Moisture	1,039
From Mount Owen Complex (MOC)	78
From Liddell Coal Operations (LOC)	357
Potable Supply	5
From Hunter River	94
Total Inflows	5,909
Outflows	
Evaporation	603
Dust Suppression / Wash bay	621
CHPP Supply	6,649
Product Coal Moisture	1,330
Coarse Rejects Moisture	
Tailings Water	
To MOC	3
To LOC	0
Other Third-party supply (to HVO, Oaklands Property)	0
HRSTS Discharges to the Hunter River	5,498
Uncontrolled Release	34.7
Total Outflows	**12,839**
Inflow – Outflow	**-4,072**
Recorded Stored on Site at Start of Annual Review Period	12,839
Recorded Stored on Site and End of Annual Review Period	8,456
Change in Storage	**-4,382.58**
Error	**-2%**

7.2 Water Take

Ravensworth Complex holds water access licences (WALs) WAL 9049, WAL 10771, WAL 1046, WAL 13102, WAL 9050, WAL 8964, WAL 816, and WAL 1325 that allow for extraction of water from the Hunter River and Glennies Creek.

Ravensworth Complex 2023 (2022-2023) water year surface water extraction and licence entitlement is recorded in ***Table 7-2.*** The extraction of surface water was undertaken in compliance with the conditions of the relevant licences.

Table 7-2 – Licenced surface water usage for the 2022-2023 water year

WAL / Reference Number	Water Source / Management Zone	Category	Entitlement (ML) [1]	Extracted Volume (ML)	Linked to
WAL 9049 / 20AL200743	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	High Security	0	0	20WA200745
WAL 10771 / 20AL200462	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	High Security	25	11.9	20WA200463
WAL 1046 / 20AL201444	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	High Security	3	0	20CA203133
WAL 13102 / 20AL203412	Hunter River Regulated/Zone 1a (Hunter River from Glenbawn Dam to Goulburn River Junction)	High Security	15	0	20CA203133
WAL 9050 / 20AL200744	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	General Security	500	95.4	20WA200745 20WA200463
WAL 8964 / 20AL203224	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	General Security	1,590	0[1]	20CA203133

WAL / Reference Number	Water Source / Management Zone	Category	Entitlement (ML) [1]	Extracted Volume (ML)	Linked to
WAL 816 / 20AL200890	Hunter River Regulated/ Management Zone 3a (Glennies Creek)	General Security	20	0	20WA200891
WAL 1325 / 20AL203042	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	Supplementary	13	0	20CA203133

1. ***Excluding any potential carry over***
2. ***Water allocation transferred to another licence.***

Ravensworth Complex currently holds six water licences that allow the extraction of groundwater WAL 41496, WAL 41505, WAL 41554, WAL 41507, WAL 41530, and WAL 41531.

Ravensworth Complex groundwater extraction and licence entitlements are recorded in ***Table 7-3***. A total of 2,790.9 ML of groundwater was extracted in 2023 in accordance with the conditions of all relevant licences.

Table 7-3 - Licenced groundwater usage for 2023

WAL / Reference Number	Water Source	Entitlement (ML)[1]	Reported Usage (ML)	Linked to
WAL 41496 20AL216920	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	2520	2020.3	20MW065021
WAL 41505 20AL217052	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	300	0	20MW065021
WAL 41554 20AL219016	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	50	0	20MW065021
WAL 41507 20AL217068	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	576	624.6	20MW065021
WAL 41530 20AL218992	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	100	0	20MW065014

WAL / Reference Number	Water Source	Entitlement (ML)[1]	Reported Usage (ML)	Linked to
WAL 41531 20AL218993	SYDNEY BASIN-NORTH COAST GROUNDWATER SOURCE	150	146	20MW065014

1. Excluding any potential carry over

7.3 Water Supply, Use and Discharges

7.3.1 ROC

The ROC water management system comprises a range of infrastructure including water storages, pipes, and pumps for water transfers (within the mine complex and between external water sources and sinks) and instrumentation for flow and level measurement.

Surplus surface water at ROC is transferred to the RCHPP or discharged from the Narama In-pit Storage Dam to the Hunter River via Bowmans Creek under the conditions of ROC EPL No. 2652 and the Hunter River Salinity Trading Scheme (HRSTS) or transferred to other Glencore mine sites under the Greater Ravensworth Water and Tailings Scheme (GRAWTS). The GRAWTS between other Glencore sites transfers water to the Narama Void, which can then be transferred via pipeline to Narama In pit Storage Dam and is the primary discharge point for the Complex.

7.4 Surface Water Monitoring

The following sections discuss surface water monitoring for the reporting period with results presented in ***Appendix F.***

7.4.1 Environmental Management

Surface water management across the Ravensworth Complex is undertaken in accordance with the Ravensworth Complex *Water Management Plan*. This plan has been developed and approved by the DPE in accordance with *Schedule 3, Condition 31* of PA 09_0176.

The Ravensworth Complex *Water Management Plan* outlines the interactions of the water management system across the sites that form part of the Ravensworth Complex.

Water quality sampling is undertaken monthly in Bowmans Creek, Bayswater Creek, and Emu Creek. Water quality monitoring is undertaken in Davis Creek and Pikes Creek every second month.

Ravensworth Complex undertakes stream health and channel stability monitoring in Bayswater Creek, Emu Creek, Bowmans Creek, Davis Creek, and Pikes Creek. This monitoring involves site inspections and stability assessments, macro invertebrate sampling and water quality monitoring at seven sites across the Complex. The results are compared to reference sites located in the Stewart and Clifton Offset Areas (control sites).

7.4.2 Environmental Monitoring Results

Surface Water Quality Monitoring Results

Water quality results (pH, EC, TDS and TSS) for the Ravensworth Complex sampling program reported by Glencore 2023 are presented in **Appendix F (*Tables B-1-B-6 and Figures B.1 – B40)*** along with analysis (mean and standard deviation) and time-series charts. Monitoring locations are shown on ***Figure 7-1***.

Impact assessment criteria (IAC), also referred to as 'trigger values', for pH, EC, TSS and TDS have been determined for specific receiving water monitoring locations as part of the *Ravensworth Complex Water Management Plan*. All surface water quality data collected as part of the monitoring program were assessed against the IAC (specific to each monitoring location) to identify deviations from the baseline water quality conditions, as shown in ***Appendix F***. Exceedances of IAC value were investigated in accordance with the *Water Management Plan.*

Conclusions drawn from internal investigations were related to the ephemeral nature of the creeks, with samples being taken from pooled water which are unrepresentative of normal water quality. No further mitigation measures were required for any surface water quality result in 2023.

Channel Stability

An annual report on stream flow events occurring in Davis and Bayswater Creeks was prepared for the 2023 reporting period. Originally three flow monitoring stations comprised this investigation, but Emu Creek was decommissioned in March 2022 due to the incorporation into the mining activity area with the installation of a flood levee. Stream height and theoretical flows were recorded for the two monitoring stations, Davis, and Bayswater Creek, along with Bowman's and Pike Creek.

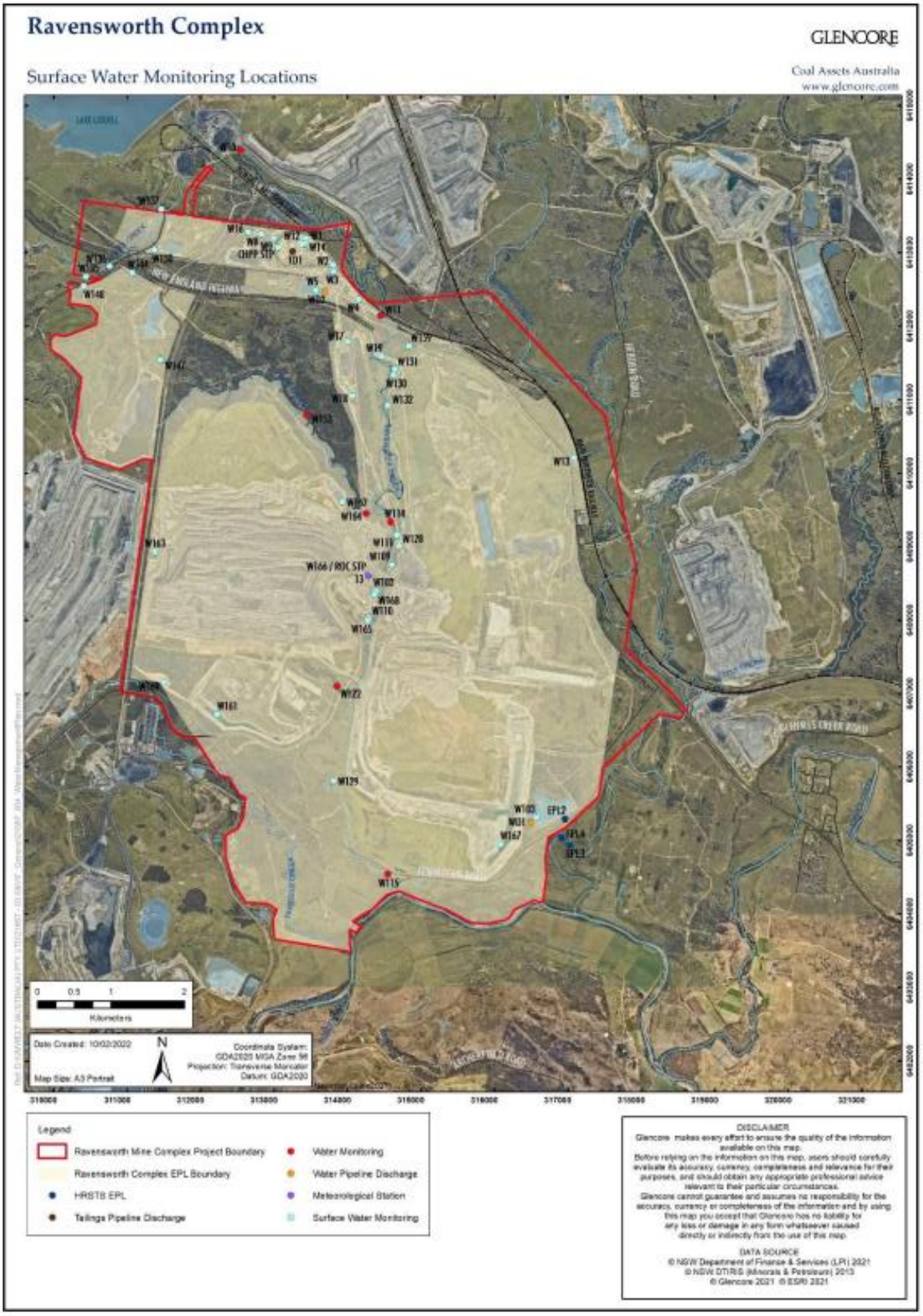
Bayswater Creek (BWC-AQ2) was the only monitoring site that retained water during both autumn and spring. The water level was significantly reduced compared to last year, forming large stagnant, highly turbid pools. The substrate consisted predominantly of silt.

Davies Creek (DAC-AQ1) had water present in autumn and was dry in spring, following the same pattern as seen in the other monitoring sites. The water levels in autumn were significantly reduced compared to in 2022 and existed as standing stagnant pools. No flow was also observed in autumn.

Regarding stream stability, the photographic record suggests that the streams have remained relatively stable over the monitored period, similar to the 2022 period. Subsequent flow events in 2021 and 2022 along Bayswater Creek have caused degradation to the drop structure located downstream, which has been included in the photographic record to monitor damage since 2015. Some minor bank erosion observed immediately upstream of site as with previous seasons, partially healed over as a result of regeneration of fringing vegetation

Cross and long section surveys be re-done with a view to generate up to date theoretical flow curves which better represent any probable flow along each creek. (AECOM, 2023).

Figure 7-1- Surface Water Monitoring Locations


Ravensworth Complex
GLENCORE
Surface Water Monitoring Locations
Coal Assets Australia
www.glencore.com
W166 / ROC STP
EPL2
EPL4
EPL3
0 0.5 1 2
Kilometers
Date Created: 10/02/2022
Map Size: A3 Portrait
N
Coordinate System: GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020
Legend
Ravensworth Mine Complex Project Boundary
Ravensworth Complex EPL Boundary
HRSTS EPL
Tailings Pipeline Discharge
Water Monitoring
Water Pipeline Discharge
Meteorological Station
Surface Water Monitoring
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DATA SOURCE
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Stream Health Monitoring

Stream health and channel stability monitoring for ROC is undertaken as detailed in the *Ravensworth Open Cut Stream Health Monitoring Program Autumn and Spring 2023* (10/02/2023 FINAL). The monitoring plan enables ROC to monitor stream health, channel stability and identify changes that may be attributable to the mining activities, to fulfil the requirements of Section 6.1.2 (Channel Stability and Stream Health) of the *Plan for Ravensworth Complex Water Management* (Glencore 2020). This plan was developed to facilitate the compliance of ROC with the instrument of approval (09_0176) which was granted on 11 February 2011, as well as the Environmental Protection Licence associated with the mine's operation.

Monitoring is undertaken at Bayswater Creek, Bowman's Creek, Pikes Creek, and Davis Creek on a biannual basis. Additionally, control sites are monitored across four waterways located within the Glencore Coal offset areas; Cuan Creek, Wybong Creek, Unnamed Creek 1, and Unnamed Creek 2, to differentiate potential impacts from environmentally driven variations. The monitoring program assesses macroinvertebrate community assemblages, water quality and overall catchment-riparian health using NSW Australian River Assessment System (AUSRIVAS) and Stream Invertebrate Grade Number Average Level version 2 (SIGNAL 2) sampling and analyses, HABSCORE assessments, and physicochemical surface water quality testing.

The HABSCORE provides a relative indicator of stream health at dry and wet sites. The AUSRIVAS (Signal2) provides an indication of the macroinvertebrate community's overall tolerance to pollution or disturbance. HABSCORE assessments for monitoring sites during the 2023 surveys indicated that habitat has declined slightly since the previous iteration of this program (Biosis 2023a), with the results clustering within the marginal and sub-optimal categories. Several sites were dry due to the diminished rainfall recorded during the 2023 monitoring year, particularly in spring with only one monitoring site able to be sampled. Past data confirms that declines in habitat and water availability are typically associated with low rainfall and drought conditions, as observed during the 2023 monitoring. The results of the monitoring program; Habscores, Signal2 and erosion and stability observations are provided in *Ravensworth Open Cut Stream Health Monitoring Program 2023* (26/02/2024 FINAL).

The AUSRIVAS and SIGNAL 2 analyses for surveyable sites showed that sites have been in poor condition since the commencement of baseline monitoring. The 2023 results displayed slight improvements in the macroinvertebrate community structures and overall creek condition, likely due to the lasting effects of the sustained rainfall recorded throughout 2021 and 2022. Year to year fluctuations in these metrics are observed across both monitoring and control sites and therefore are likely associated with changes in water availability and environmental conditions, most obviously during the most intense period of the recent drought in 2019. All recorded Band scores and SIGNAL 2 scores for monitoring sites during the 2023 season occurred within the range of previous results.

Comparison of Stream Health

Water quality parameters recorded at the 2023 monitoring were compared against the Ravensworth Complex adopted impact assessment criteria (Umwelt, 2014) listed in ***Table 7-4***.

Table 7-4 - Adopted Impact Assessment Criteria

Site	pH	Oxygen % saturation	Maximum Conductivity (µs/cm)
Bayswater Creek (BWC) sites	6.5 – 8.0 (all conditions)	85 – 110 (all conditions)	2100 (all conditions)
Other monitoring sites	6.5 – 8.0 (flow) 6.5 – 8.4 (no flow)	85 – 110 (all conditions)	2100 (flow) 6100 (no flow)

The recorded non-conformities were comparable to those previously recorded during the monitoring program in 2022. Most sites (both monitoring and control) recorded dissolved oxygen levels below accepted thresholds, as seen in previous monitoring years. These low values are likely a result of reduced water movement and turbulence due to the below average rainfall experienced during the current monitoring period.\

Additionally, exceedances for pH readings were observed in both control and monitoring sites. Due to both control and monitoring sites experiencing this, it is inferred that this is a result of environmental impacts, such as the extensive rainfall observed in 2022. Therefore, it is inferred that these results are likely to be reflective of the background pH levels in the landscape resulting from the geology of the locality. As such this data does not indicate any acute stream health issues that may significantly impair stream health or confound the biological analyses detailed in the following section.

Overall, the results were consistent with those of previous monitoring years, with no significant impacts from mining observed.

Table 7-5 - Stream Health at Ravensworth Complex for 2022 and 2023

Site		2022 Erosion / Stability Observations	HABSCORE		Signal2		HABSCORE		Signal2	
			Autumn 2022	Spring 2022	Autumn 2022	Spring 2022	Autumn 2023	Spring 2023	Autumn 2023	Spring 2023
BWC-AQ2	Bayswater Creek Mid 1	Minor bank erosion upstream. Recovering with groundcover vegetation cover improving.	49	79	3.06	Dry	51 (S)	46 (M)	3.73	3.00
BWC-AQ3	Bayswater Creek Mid 2	Significant erosion at points where ephemeral tributaries join with Bayswater Creek.	36	70	3.55	Dry	46 (M)	39 (M)	Dry	Dry
BWC-AQ4	Bayswater Creek D/S	Minor erosion of channel edges around the gabion and rip-rap erosion prevention structures.	43	51	3.47	Dry	36 (M)	34 (M)	3.50	Dry
DAC-AQ1	Davis Creek U/S	Moderate undercutting and general erosion of banks, somewhat stabilised with vegetation.	54	72	3.59	Dry	64 (S)	51 (S)	3.06	Dry
DAC-AQ2	Davis Creek D/S	Significant erosion where ephemeral tributaries meet Davis Creek.	43	49	Dry	Dry	35 (M)	34 (M)	Dry	Dry

O=optimal; S=suboptimal; M=marginal; P=poor. insufficient water to collect macroinvertebrate sample, sites were inaccessible or AUSRIVAS error.

Long Term Trend Analysis

Despite environmental fluctuations in water availability, monitoring sites and control sites overall have remained in a relatively stable but poor condition since the stream health monitoring program incorporated control sites in autumn 2013. No significant difference has been observed between monitoring sites and the control sites in stream health and stability. Stream health at all sites are still in the same poor condition observed at the commencement of the stream-health monitoring project in 2012. From historical records, based on the parameters recorded at monitoring and control sites, it appears that mining activities have minimal impact on stream health within the Ravensworth Complex area.

Most monitoring sites recorded scores in 2023 that were lower when compared to those from 2022. The decline in habitat quality and availability is likely due the ephemeral nature of these creeks and to the reduction in the water availability compared to in 2022.

7.4.3 Key Performance and Management Issues

Biosis (2024) concluded that the 2023 monitoring results are considered predominantly normal for the locality and no impacts to stream health as a result of mine operation have been detected.

AECOM (2023) concluded that the volume and frequency of rainfall during the monitoring period is reflected in the size, number and when the recorded flow events occurred along each creek. The total amount of rainfall recorded (524.0mm) for the monitoring period from 1 January to 31 December 2023 was less than half of the rainfall recoded during the same period in 2022 (1153.8mm).

the photographic record suggests that the streams have remained relatively stable over the monitored period AECOM (2023).

Monitoring of surface water will continue to ensure stream health, stability, and flow, and further the reliability of the dataset for accurate conclusion on mining impacts.

7.4.4 Proposed Improvements

Stream health and stream flow/channel stability will continue to be monitored during the 2024 reporting period.

7.5 Groundwater Management

The following sections discuss groundwater management, monitoring, and compliance for the 2023 reporting period with results presented in ***Appendix F***

7.5.1 Environmental Management

The Ravensworth Complex *Water Management Plan* was prepared to satisfy the requirements of the Project Approval PA 09_0176 *Schedule 3, Condition 31*.

During 2022 a formal review of the depressurisation of coal measures and comparison of responses with the aquifer model predictions was undertaken by AGE (2022) as required by *Condition 6.8.4* of PA 09_0176 Statement of Commitments. It was concluded that the model continues to provide a relatively conservative prediction of impact for the Ravensworth operations. Further calibration of the groundwater model is not considered to be necessary at this stage to establish the level of impact due to Ravensworth Operations.

7.5.2 Environmental Monitoring Results

Results from the Reporting Period

During the 2023 monitoring period, the groundwater management monitoring report included review of monthly monitoring of water levels, quarterly monitoring of pH and EC, and annual monitoring of inorganic species (speciation data). The results are provided in ***Appendix F -Table D.1*** to ***Table D.5*** and monitoring locations shown on ***Figure 7-2***.

All monitoring data collected as part of this program is assessed against established IAC to:

- Determine whether groundwater extraction volumes are within WAL limits and are comparable with modelled predictions;
- Identify deviations from the baseline water quality conditions; and
- Identify deviations from the baseline groundwater level trends.

Groundwater Quality

Results for pH, EC, and speciation 2022 data for all current and decommissioned monitoring bores are presented in ***Appendix F*** (***Table D.2*** to ***Table D.55, Figure D1*** to ***Figure G32***) with the exceedances of IAC ranges identified in red text.

Overall, groundwater quality results of 2023 were within historical ranges and the adopted IAC, with observed exceedances being minor in nature and consistent with historical trends. It is recommended that IAC trigger values be reviewed to capture the water quality parameters of the site more accurately.

Groundwater Levels

Groundwater levels are included in *Error! Reference source not found.* ***Table E.1 and Figure E.1***

Alluvium and Underlying Weather Coal Measures

Quarterly monitoring of groundwater from the alluvium has been undertaken since 2009 at the monitoring location NPZ5B P2 and near Bayswater Creek upstream of the confluence with Emu Creek.

It is noted that NPZ7 Small, located near the Hunter River, is listed as a monitoring bore for the Hunter River alluvium in the site WMP (ROC, 2022), however, an investigation of groundwater trigger exceedances undertaken by Umwelt in 2021 confirmed that the bore is monitoring weathered Permian coal measures underlying the Hunter River alluvium. Appendix F, Section 3.3.2 Details the Alluvium and Underlying Weather Coal Measures during the 2023 reporting period.

Bayswater Seam

Monitoring of groundwater quality in the Bayswater Seam occurs at NPZ7 Tall. Water quality results for NPZ7 Tall monitoring bore are shown in ***Appendix F (Table D.1 to Table D.5)***.

The exceedance investigation (Engeny, 2024) recommended that the condition of NPZ7 Tall be assessed for the potential influence of local rainfall recharge on water quality results. It is also recommended that the IAC trigger values be updated to reflect typical site conditions once an appropriate sample count has been attained.

Broonies Seam

Monitoring of groundwater quality in the Broonies Seam is undertaken at NPZ6 (Tall) and NPZ5B P1. Water quality results for NPZ5B P1 and NPZ6 Tall are presented in ***Appendix F (Table D.1 to Table D.5)***.

Each of the analyte/ parameter values recorded were within historical ranges for the site, and do not significantly vary from the values observed throughout 2022. The pH results are consistent across 2022 and 2023, and the specification results have been slightly higher in 2023 than in 2022. The exceedance investigation (Engeny, 2024) stated that no specific actions are required for the site as the analyte/ parameter results are consistent with climatic conditions. However, it is recommended that the groundwater triggers are reassessed to account for the site's variability.

Lemington Seam

Monitoring of groundwater quality in the Lemington Seam occurs at NPZ1 Tall and NPZ2 Tall. The ranges in water quality for each monitoring bore are shown in ***Appendix F (Table D.1 to Table D.5)***.

Pikes Gully Seams

Monitoring of groundwater quality in the Pikes Gully Seam is undertaken at CS4641C which lies within the Lower Pikes Gully Seam. The range in water quality for CS4641C is presented in ***Appendix F (Table D.1 to Table D.5)***.

Two samples were taken in 2023 with no speciation data available. Both pH readings were below the IAC trigger level (both readings at 7.9), and both EC readings exceeding the IAC trigger level, with values of 9,110 µS/cm and 8,980 µS/cm. The pH values have been consistently below the IAC trigger level and 2023 results have not deviated from typical trends or the values recorded throughout 2022. EC values have also stayed within typical historical ranges. As such, the exceedance investigation (Engeny, 2024) recommended that the groundwater trigger values be revised.

Liddell Seam

Monthly monitoring of groundwater levels within the Liddell Seam was undertaken at the Coffey Dam Borehole in 2023 and is presented in ***Appendix F (Table D.1 to Table D.5).***

The 2023 results are consistent with the values recorded throughout 2022, and do not deviate significantly from historical trends. The exceedance investigation (Engeny, 2023) identified that exceedances are likely related to the declining water levels, which is in line with the EA impact predictions.

Groundwater Depressurisation

In addition to the above, groundwater level is recorded in 8 locations (RNW1, RNW2, RNW3, RNW4, RNW5, RNW6, RNW7 and RNW8) at 6-hour or 12-hour intervals using vibrating wire piezometers to

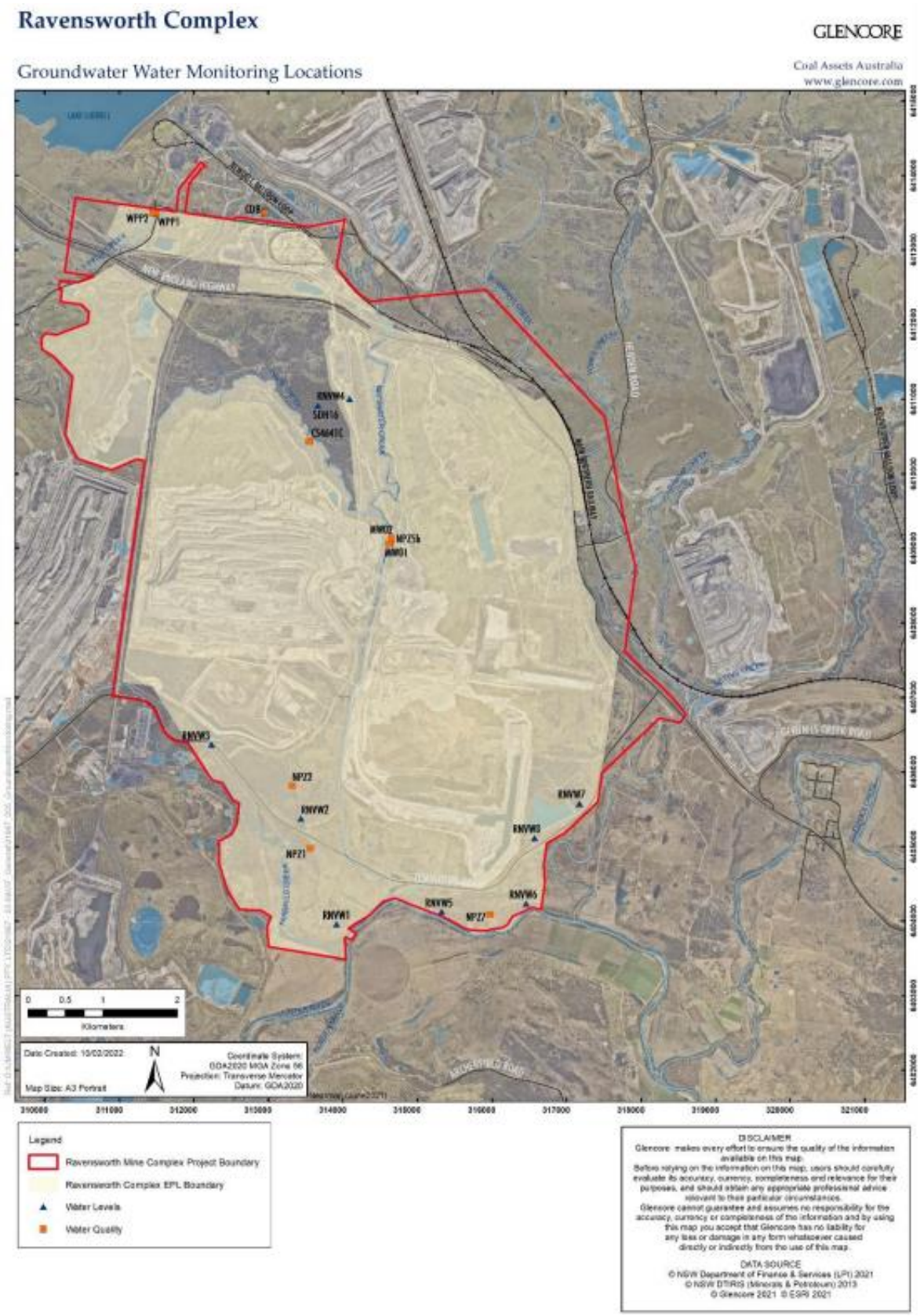
identify the groundwater pressure response to mining operations. Historical water level results are presented in ***Appendix F*** (***Figure E.1***) and discussed in detail below. All monitoring bores indicate depressurisation at some depths; however, depressurisation was typically to a lesser degree than predicted in the Ravensworth Project groundwater model results presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2020). AGE (2023) concluded that the groundwater model continues to predict groundwater impacts with satisfactory accuracy, and that no further calibration of the model is required at this stage. A review of groundwater model predictions will be undertaken again in 2024.

A review of groundwater pressure results identified the following:

- **RNVW1** – Results show depressurisation during 2023 at depths of 150 mbgl, 190 mbgl, 240 mbgl and 270 mbgl (refer to ***Appendix F, Figure E.2****)* but to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in *Ravensworth Operations – Review of Groundwater Model Predictions* (AGE, 2023). Historically depressurisation at a depth of 109 mbgl was also observed with the degree of depressurisation exceeding that predicted by the groundwater model. However, 2023 results indicate pressure recovery at this depth. Results at depths of 48 mbgl and 68 mbgl remain relatively constant.
- **RNVW2** – Results for bore RNVW2 (refer to ***Appendix F, Figure E.3****)* show continued depressurisation at depths of 239 mbgl and 238 mbgl. Recovery has been observed at depths of 305 mbgl, 140 mbgl and 85 mbgl, and stabilisation is observed at depths of 180 mbgl, and 43 mbgl. Depressurisation at depths of 239 mbgl occurs to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2023). The groundwater model for the Ravensworth Project also predicted depressurisation at a depth of 140 mbgl for RNVW2, however, results over recent years indicate pressure recovery at this depth.
- **RNVW3** – Results for RNVW3 (refer to ***Appendix F, Figure E.4)*** indicate ongoing depressurisation at depths of 254 mbgl, 210 mbgl, and 180 mbgl. Stabilisation is observed at 143 mbgl, and recovery is observed at depths of 103 mbgl and 61 mbgl.
- **RNVW4** – Results for RNVW4 (refer to ***Appendix F, Figure E.5)*** show ongoing depressurisation at all depths. The depressurisation observed is typically to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2023).
- **RNVW5** – Results for RNVW5 (refer to ***Appendix F, Figure E.6***), indicate minimal or no depressurisation for the 2023 monitoring period. It is noted that the RNVW5 instrument is currently outputting zero readings on channels 1 (depth of 19 mbgl), 6 (depth of 279 mbgl) and 7 (depth of 350 mbgl) and therefore no observations of depressurisation at these depths can be made. It also only began outputting results at channel 3 (depth of 87 mbgl) in 2023 and therefore trend analysis cannot be made at this depth.
- **RNVW6** – Results for RNVW6 (refer to ***Appendix F, Figure E.7***) show slight depressurisation since 2021 at a depth of 265 mbgl. Results previously indicated depressurisation at depths of 19 mbgl and 66 mbgl in excess of those predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2023). However, pressures have now recovered at both of these depths.

- **RNVW7** – Results for RNVW7 (refer to ***Appendix F, Figure E.8)*** show ongoing depressurisation at depths from 287 mbgl to 302 mbgl which is consistent with groundwater model predictions for the Ravensworth Project. It is noted that channel 1 (depth of 83 mbgl) appears to be outputting erroneous results and therefore no observations of depressurisation at this depth can be made.
- **RNVW8** – Vibrating wire piezometer for RNVW8 was removed in June 2020, however, appears to be reinstated in November 2023 (refer to results shown in **Appendix F, Figure E.9**). The results indicate pressure recovery since the previous 2020 reading and overall depressurisation remains to a lesser degree than predicted in the Ravensworth Project groundwater model results as reported in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2023).

Figure 7-2 – Groundwater Monitoring Locations



8. Rehabilitation

8.1 Rehabilitation Performance

8.1.1 Rehabilitation Status at the End of the Reporting Period

Rehabilitation and disturbance areas at Ravensworth Operations and RUM are summarised in ***Table 8-1***. A total of 23.5 Ha of new disturbance associated with the progression of the Ravensworth North pit occurred during the reporting period. A total of 55.8 ha was prepared for rehabilitation in 2023 and 13.3 Ha of previously rehabilitated land was re-disturbed at Ravensworth Operations.

Figure 8-1 includes a map of areas disturbed and rehabilitated during 2023. Photographs of rehabilitation are also provided.

Table 8-1 - Ravensworth Complex 2023 Rehabilitation and Disturbance

Mine Area Type	Previous Reporting Period (Actual) - 2022	This Reporting Period (Actual) 2023	Next Reporting Period (Forecast) - 2024
Total Mine Footprint (Ha)	2697.2	2720.1	2714.17
Disturbance (Ha)	1677.0	1689.9	1593.5
Land Being Prepared for Rehabilitation (Ha)	55.0	55.0	54.3
Land under Active Rehabilitation (Ha)	1020.1	1075.1	1075.6
Completed Rehabilitation (Ha)[1]	0	0	0

Note 1 – Completed Rehabilitation is classified as being signed off

Photo 1 – Rehabilitation Progress 2023. 7 South Rehabilitation Area

Photo 2 – Rehabilitation Progress 2023. 7 South Rehabilitation Area

Photo 3 – Rehabilitation Progress 2023. 9 South Rehabilitation Area

Photo 4 – Rehabilitation Progress 2023. 9 South Rehabilitation Area

Photo 5 – Rehabilitation Progress 2023. 7 South Rehabilitation Area

Photo 6 – Rehabilitation Progress 2023. 7 South Rehabilitation Area

Photo 7 – Rehabilitation Progress 2023. 9 South Rehabilitation Area

Figure 8-1 – 2023 Rehabilitation and Disturbance (Ravensworth Operations)

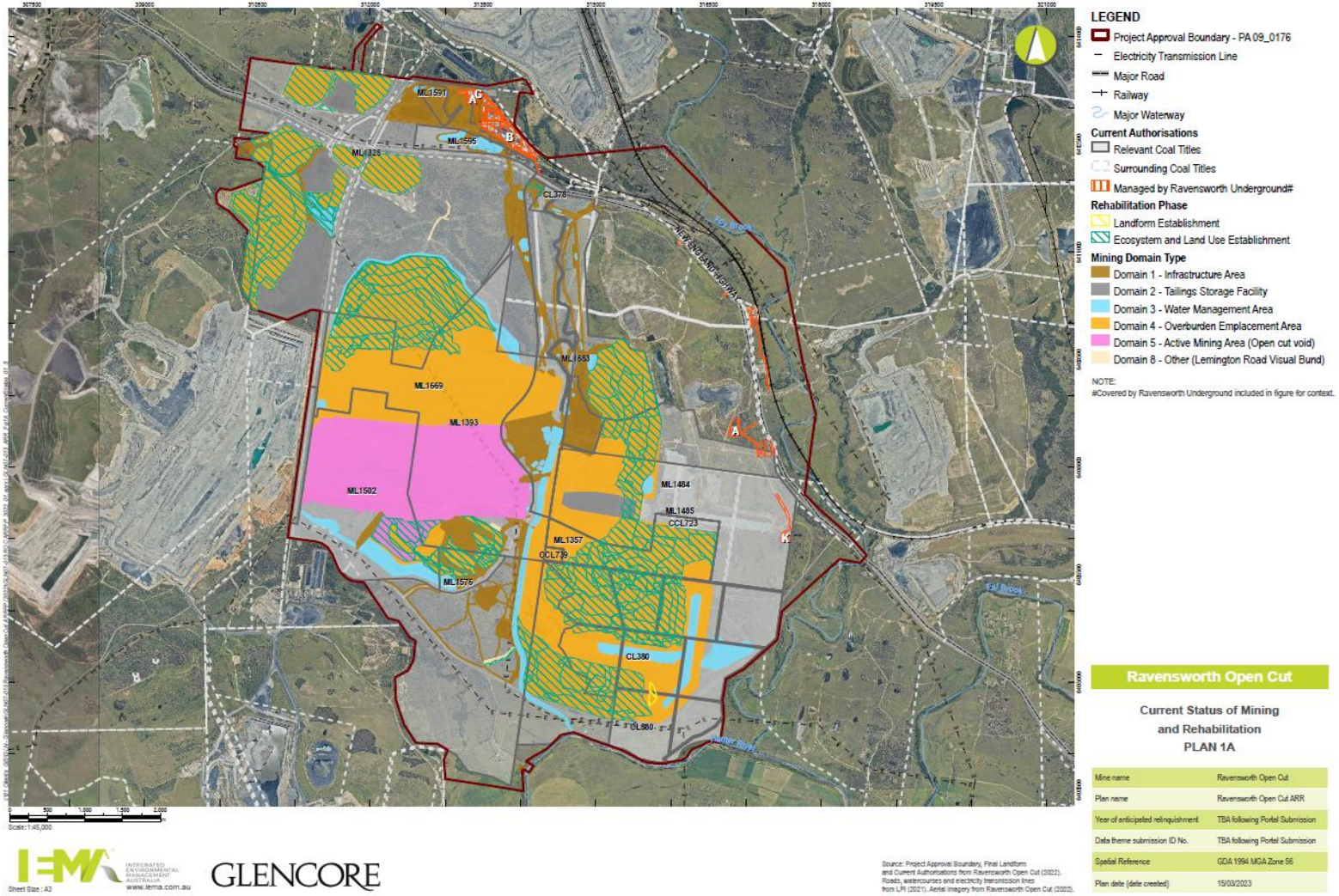
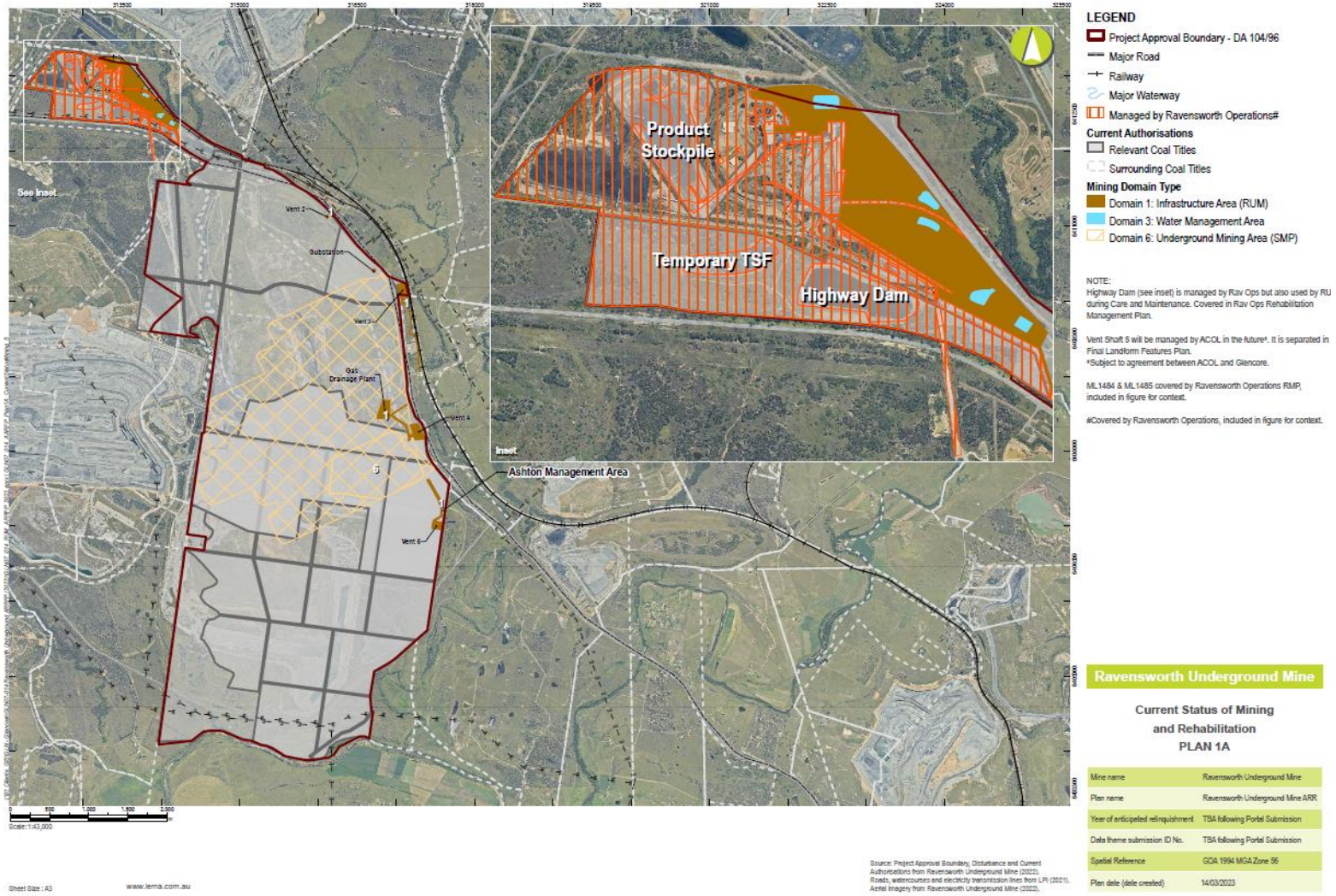


Figure 8-2 – 2023 Rehabilitation and Disturbance (RUM)



8.1.2 Summary of Rehabilitation Monitoring

During the reporting period long-term rehabilitation monitoring and a rehabilitation walkover assessment was conducted to compare current conditions of the rehabilitation with closure criteria outlined in the RMP. This information developed management recommendations to guide the rehabilitation towards targeted Ecological Communities and final landform criteria.

Rehabilitation Monitoring

The Ravensworth Annual Rehabilitation Monitoring Program was completed by a specialist consultant during October and November 2023. This program assessed a total of 16 rehab blocks and 48 transects/plots (including 2 reference monitoring locations), which accounts for an area of approximately 410 ha of rehabilitation.

9 initial establishment phase blocks were assessed in 2023. These 9 blocks consisted of 2 blocks of pasture rehabilitation (54.2 ha, 2 monitoring sites) and 7 native woodland blocks (183.3 ha, 5 monitoring sites).

Fauna Monitoring

Fauna monitoring in rehabilitation is required every three years. Fauna monitoring was previously completed in 2014, 2017, and 2020. 2023 Fauna Monitoring surveys were carried out between the 6th and 12th November 2023. PIR Cameras and Anabats were also used.

Rehabilitation Maintenance

Ongoing maintenance of rehabilitation areas focused on weed management of previously completed rehabilitation.

In addition, approximately 43 ha of rehabilitation maintenance was completed on the southeastern slopes of Narama rehabilitation. Work included removing established stands of acacia saligna, repairing erosion, reconstructing drainage structures, and re-seeding the area with pasture rehabilitation species.

Cumnock

Rehabilitation works at Cumnock were generally undertaken between 2009 and 2011 using a combination of direct seeding and tubestock planting methods, and including a range of understorey, shrub, and tree species (including non-endemic species). This included use of Rhodes grass as the rehabilitation status/landform at time of Ravensworth North Project was pasture.

The implementation of the Cumnock Rehabilitation Plan was continued in 2023. Works undertaken in 2023 include:

- Grazing of 24 ha;
- Selective culling of Sugar gums;
- Mulching of 6 ha of Acacia saligna;
- Planting of 9,418 tubestock (native species); and
- preparation and seeding of 32 20x20m plots (native species); and spraying for invasive grasses and weeds.

The progress and success of completed restoration works is monitored.

2024 Rehabilitation Maintenance

During the next reporting period, Ravensworth will continue to develop and implement a rehabilitation maintenance strategy to progress rehabilitation to final landform consistent with final land use objectives. In 2024 Ravensworth will complete ongoing maintenance in previously rehabilitated areas. Priority actions for rehabilitation maintenance include:

- Erosion repairs;
- Control of priority weed species as identified during rehabilitation monitoring and inspections;
- Increasing lower-storey species richness in areas where priority weed grasses are absent (or following weed suppression) through hand seeding or tubestock planting;
- Increasing tree densities of rehabilitated areas through supplementary seeding and or tube stock planting; and
- Increasing habitat potential through adding rocks, logs, woody debris, and next boxes to rehabilitation areas for fauna.

A Rehabilitation Maintenance Strategy is currently being developed to address priority areas.

2024 Rehabilitation Maintenance Repairs

During the next reporting period, Ravensworth Operations will continue to develop and implement a rehabilitation maintenance strategy to progress rehabilitation to final landform consistent with final land use objectives. In 2023 Ravensworth Complex will complete ongoing maintenance in previously rehabilitated areas. Priority actions for rehabilitation maintenance include:

- Erosion repairs;
- Control of priority weed species as identified during rehabilitation monitoring and inspections;
- Increasing lower-storey species richness in areas where priority weed grasses are absent (or following weed suppression) through hand seeding or tubestock planting;
- Increasing tree densities of rehabilitated areas through supplementary seeding and or tube stock planting; and
- Increasing habitat potential through adding rocks, logs, woody debris, and next boxes to rehabilitation areas for fauna.

No rehabilitation was completed at RUM during 2023. Rehabilitation will commence during 2024.

A Rehabilitation Maintenance Strategy is currently being developed to address priority areas.

8.2 Rehabilitation Trials and Research

8.2.1 Rehabilitation Trial Results

No rehabilitation trials were undertaken at the Ravensworth Operations and RUM in 2023.

8.3 Next Reporting Period

Rehabilitation activities proposed in 2023 include:

- Rehabilitation of 55 Ha;
- Maintenance works as outlined in Section 8.3.3;
- Crash grazing using cattle at Cumnock;
- Ongoing inspections and long-term rehabilitation monitoring; and
- Continued pest and weed management across Ravensworth Complex and in offset areas.

9. Community Relations

9.1 Employment Status

At the end of the reporting period, the Ravensworth Operations and RUM had approximately 713 full time employees and contractors.

9.2 Complaints

A complaints register is maintained and available on the Ravensworth Operations Website.

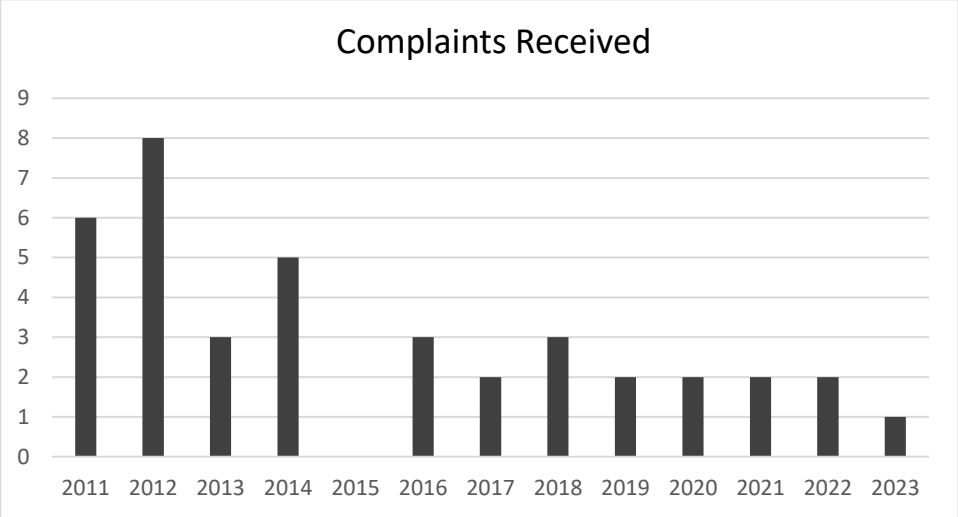
There was one complaint received during the 2023 reporting period for the Ravensworth Complex which was related to a singular blast event undertaken at 16:06 on the 18th August 2023.

This was investigated and blast was noted to be within acceptable criteria described in PA 09_0176.

9.2.1 Complaint Trend Analysis

Trend analysis on complaints by year since 2011 in ***Figure 9-1*** shows that annual complaints numbers have been stable since 2016.

Figure 9-1 – Complaints Received



9.3 Community Engagement

The Stakeholder Engagement Plan contains a *Community Investment Plan* which outlines key projects to be undertaken by the Ravensworth Complex throughout the year.

Community/stakeholder related activities undertaken during the reporting period include:

- Community Consultative Committee Meetings;
- Distribution of community newsletters;
- Mine tour/career talks with local primary schools and apprentices;

- Active participation in Wild Dog Groups and the LLS; and
- Direct engagement with nearby landholders.

During 2023, the Ravensworth Operations continued to foster positive relationships with the local community through engagement and ongoing financial support provided to a range of community groups and events, including, but not limited to:

- Singleton Heights Family Community Connections Program;
- Singleton High School ;
- Singleton Primary School;
- Big Yellow Bus;
- Upper Hunter Conservatorium of Music;
- Singleton Neighbourhood Centre;
- Singleton Theatrical Society;
- Hunter River Community School; and
- Upper Hunter Homelessness Support Service.

9.4 Community Consultative Committee

The Ravensworth Operations maintains a close partnership with the local community. The Community Consultative Committee (CCC) includes Glencore representatives and local community members. This provides a formal forum for interaction between the community, mine management and relevant government departments. The Ravensworth Complex CCC held meetings in February, May, August, November 2023. The community representatives may share information from meetings with the rest of the community and relate any items for discussion at the CCC meetings.

The following key topics were discussed at the CCC meetings:

- Discussion of previous meeting minutes;
- Update on mining and processing activities at the Ravensworth Operations;
- Update on closure activities at RUM;
- Update on key environment and community aspects, including monitoring results and incidents;
- Update on safety performance; and
- Update on community support programs.

Minutes from the CCC meetings are posted on Ravensworth Complex's website: *https://www.glencore.com.au/operations-and-projects/coal/current-operations/ravensworth-operations/community-documents*.

9.5 Community Newsletter

Ravensworth Operations circulates a community newsletter every six months to neighbouring residents, its employees, CCC members and other stakeholders and are on the Ravensworth Operations website. The newsletter provides information about the operational progress of the Ravensworth Operations, environmental and safety performance, plus other news of community interest.

10. Independent Audit

In accordance with Schedule 5, Condition 8 of PA 09_0176 and Schedule 4, Condition 7 of DA 104/96, an Independent Environmental Audit (IEA) is required every 3 years. An IEA was last undertaken in 2021. The next IEA will be completed in 2024.

11. Environmental Incidents and Non-Compliances

All 2023 incidents, non-compliances and exceedances related to PA 09_0176, DA 104/96 and EPL 2652 are summarised ***Table 11-1.***

Table 11-1 – Incidents, Non-compliances, and Exceedances

Date	Incident Summary
19 December 2023	Above 50ug/m3 PM_{10} Dust exceedance at Cumnock D2 Monitor due to local bushfire.
12 October 2023	TEOM 24hr dust exceedance - SX45D2 - Cumnock
01 October 2023	TEOM 24hr dust exceedance - SX45D2 – Cumnock. Following review of data, it was determined that insufficient valid data captured in the 24hour period, therefore result was deemed invalid.
20 September 2023	TEOM 24hr dust exceedance - SX45D1 - Bowman
11 March 2023	TEOM 24hr dust exceedance - SX45D2 – Cumnock. Following review of data, it was determined that insufficient valid data captured in the 24hour period, therefore result was deemed invalid.
Date	**Incident Summary**
Throughout Period	Air Quality Criteria – Schedule 3, Condition 20 PM10 24-hour criterions of above 50 µg/m3 was recorded multiple times during the reporting period
Throughout Period	Air Quality and Greenhouse Gas Management Plan - Schedule 3, Condition 24 Administrative Non-Compliant: Following a review of real-time monitoring data on 138 occasions the daily 24-hour result was deemed invalid. TEOM G1 recorded 9 invalid 24-hour samples during 2023 reporting period TEOM G2 recorded 129 invalid 24-hour samples during 2023 reporting period.
Throughout Period	Air Monitoring Requirements – M2.2 Continuous PM10 data was not acquired. Invalid or missed samples were caused by routine, non-routine maintenance, and monitoring unit faults.

Document Information

11.1 Related Documents

Table 0-1 – Related documents

Number	Title
Management plans (glencore.com.au)	Ravensworth Underground Mine Rehabilitation Management Plan (2 August 2022)
Management plans (glencore.com.au)	Ravensworth Operations Rehabilitation Management Plan (2 August 2022)

11.2 Reference Information

Table 0-2 – Reference information

Reference	Title
NSW Government (2015)	Post-approval requirements for State significant mining developments – Annual Review Guideline
AECOM (2023)	Annual report on stream flow events occurring in Emu, Davis, and Bayswater Creeks for the period inclusive of 1 January to 31 December 2021 plus comments on stream stability in relation to the above creeks with the addition of Bowmans and Pikes Creeks
AGE (2023)	Ravensworth Operations – Review of Groundwater Model Predictions
Biodiversity Australia (2023)	Ravensworth Annual Conservation Agreement Biodiversity Offset Monitoring Report 2022, Glencore Ravensworth Coal Mine
Biosis (2023)	Ravensworth Open Cut Stream Health Monitoring Program: Autumn and Spring 2021.
BEMC (2023)	Annual Offset Area Bushfire Compliance Report 2022
Engeny Water Management (2024)	Ravensworth Complex 2023 Annual Review Surface Water and Groundwater Management and Monitoring Report
Koru Environmental (2020)	Cumnock Rehabilitation Remediation Plan
Koru Environmental (2023a)	Rehabilitation Monitoring 2023, Ravensworth Operations
OzArk Environment and Heritage (2023)	2023 Archaeological Monitoring Report, Ravensworth Operations
Spectrum Acoustics (2023)	Attended Noise Monitoring (12 separate reports)

Reference	Title
Umwelt (2010)	The Ravensworth Operations Project Environmental Assessment

Appendix A - Train Movements

Table A.1 Records of all Train Movements, Ravensworth 2023

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
Train Index	Load Finish Date	Load Time Complete	Net Weight (t)
1	1/01/2023	5:53:09 AM	9,193.39
2	1/01/2023	11:15:53 AM	9,254.60
3	1/01/2023	8:34:28 PM	9,313.39
4	1/01/2023	11:58:29 PM	8,994.00
5	2/01/2023	6:34:57 AM	9,025.41
6	2/01/2023	11:23:35 AM	8,976.00
7	2/01/2023	8:10:00 PM	9,463.45
8	2/01/2023	11:05:00 PM	9,003.80
9	3/01/2023	3:58:00 AM	9,241.39
10	3/01/2023	7:10:06 AM	9,403.85
11	3/01/2023	2:47:21 PM	9,318.19
12	3/01/2023	12:51:15 AM	9,017.60
13	4/01/2023	5:18:12 AM	9,331.52
14	4/01/2023	1:08:37 PM	9,018.42
15	4/01/2023	10:44:29 PM	9,021.47
16	5/01/2023	10:11:47 AM	9,052.07
17	5/01/2023	2:48:15 AM	9,117.41
18	6/01/2023	10:27:31 AM	9,101.19
19	6/01/2023	2:08:19 PM	8,981.14
20	6/01/2023	10:51:27 PM	9,065.44
21	7/01/2023	3:40:36 AM	9,075.72
22	7/01/2023	8:31:33 AM	9,176.65
23	7/01/2023	3:37:00 PM	9,040.31
24	7/01/2023	6:49:57 PM	9,195.40
25	8/01/2023	5:54:28 AM	9,062.40
26	8/01/2023	11:10:03 AM	9,189.39
27	8/01/2023	8:59:56 PM	9,229.80
28	8/01/2023	12:31:43 AM	9,361.28
29	9/01/2023	4:49:14 AM	9,206.20
30	9/01/2023	12:54:57 AM	9,364.20
31	10/01/2023	5:03:00 AM	9,229.39
32	10/01/2023	11:03:50 PM	9,223.40
33	11/01/2023	3:46:00 AM	8,900.00

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
34	11/01/2023	7:48:26 AM	9,189.32
35	11/01/2023	9:04:00 PM	9,254.21
36	11/01/2023	1:53:00 AM	9,295.12
37	12/01/2023	11:56:02 AM	9,261.39
38	12/01/2023	2:59:24 PM	9,238.74
39	12/01/2023	9:34:25 PM	9,183.59
40	13/01/2023	8:42:05 AM	9,183.40
41	13/01/2023	1:20:13 PM	9,123.52
42	13/01/2023	5:52:07 PM	9,375.19
43	14/01/2023	3:22:40 AM	9,295.28
44	14/01/2023	4:04:26 PM	9,144.12
45	14/01/2023	8:15:40 PM	9,154.19
46	15/01/2023	3:15:12 AM	9,100.20
47	15/01/2023	2:28:50 PM	9,294.08
48	15/01/2023	10:58:52 PM	9,146.52
49	16/01/2023	2:06:44 PM	9,020.80
50	16/01/2023	10:06:34 PM	9,215.19
51	17/01/2023	3:27:11 AM	9,363.81
52	19/01/2023	1:11:43 AM	9,052.10
53	19/01/2023	6:28:55 PM	9,259.50
54	20/01/2023	4:48:17 AM	9,214.90
55	20/01/2023	9:52:48 AM	9,066.94
56	20/01/2023	1:07:03 PM	9,196.59
57	20/01/2023	8:34:29 PM	9,043.19
58	21/01/2023	12:07:38 PM	8,961.99
59	21/01/2023	2:54:29 PM	9,201.19
60	22/01/2023	3:19:00 AM	9,253.00
61	22/01/2023	9:49:21 AM	9,211.68
62	23/01/2023	2:18:00 AM	8,994.14
63	23/01/2023	8:53:06 AM	9,035.28
64	23/01/2023	4:33:12 PM	9,035.94
65	23/01/2023	2:27:50 AM	9,090.80
66	24/01/2023	9:44:22 AM	9,253.50
67	24/01/2023	8:14:36 PM	9,296.90
68	25/01/2023	2:10:53 AM	9,264.01
69	25/01/2023	10:34:06 AM	8,978.34
70	25/01/2023	5:20:15 PM	9,124.10
71	25/01/2023	11:25:34 PM	9,151.41
72	25/01/2023	2:16:50 AM	9,249.48
73	26/01/2023	12:00:38 PM	9,116.57
74	26/01/2023	3:20:32 PM	8,956.25

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
75	26/01/2023	12:42:44 AM	9,168.41
76	26/01/2023	3:59:48 AM	9,220.90
77	27/01/2023	9:31:23 AM	9,331.67
78	27/01/2023	5:07:30 PM	9,371.14
79	28/01/2023	4:00:16 AM	9,095.74
80	28/01/2023	1:09:31 PM	9,272.68
81	28/01/2023	9:21:17 PM	9,079.85
82	28/01/2023	12:55:19 AM	9,399.79
83	29/01/2023	10:15:15 AM	9,207.86
84	30/01/2023	4:31:18 AM	9,112.65
85	30/01/2023	6:41:00 PM	9,023.14
86	30/01/2023	9:55:00 PM	9,174.05
87	31/01/2023	9:47:00 PM	8,879.74
88	1/02/2023	8:38:48 AM	9,046.01
89	1/02/2023	9:31:37 PM	9,023.74
90	2/02/2023	9:53:51 AM	9,125.14
91	2/02/2023	5:43:14 PM	9,274.79
92	3/02/2023	5:44:02 AM	9,215.81
93	3/02/2023	6:04:55 PM	9,311.90
94	4/02/2023	2:44:48 AM	9,345.61
95	5/02/2023	6:27:47 AM	9,337.19
96	5/02/2023	3:38:20 PM	9,027.00
97	5/02/2023	2:04:16 AM	9,329.25
98	6/02/2023	5:20:39 AM	9,419.41
99	6/02/2023	9:15:50 AM	9,208.70
100	10/02/2023	9:38:06 AM	9,254.61
101	10/02/2023	1:23:55 PM	9,305.50
102	10/02/2023	9:13:44 PM	9,293.01
103	11/02/2023	12:38:36 PM	9,021.05
104	11/02/2023	8:51:31 PM	9,141.10
105	12/02/2023	5:21:17 AM	9,259.04
106	12/02/2023	9:08:57 AM	9,020.30
107	12/02/2023	11:20:46 PM	9,129.34
108	13/02/2023	3:02:48 AM	9,080.88
109	13/02/2023	8:34:13 AM	9,286.41
110	13/02/2023	11:45:02 AM	9,311.54
111	13/02/2023	4:12:59 PM	9,285.84
112	13/02/2023	11:53:54 PM	9,335.99
113	14/02/2023	4:07:01 AM	9,378.81
114	14/02/2023	7:57:51 AM	9,356.01
115	14/02/2023	12:54:25 PM	9,284.48

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
116	14/02/2023	4:58:27 PM	9,277.54
117	15/02/2023	3:17:16 AM	9,420.79
118	15/02/2023	6:54:42 PM	9,125.50
119	15/02/2023	11:08:03 PM	9,093.52
120	16/02/2023	5:16:45 AM	9,283.68
121	16/02/2023	7:34:09 PM	9,426.02
122	17/02/2023	5:30:06 AM	9,144.22
123	17/02/2023	6:33:41 PM	9,371.22
124	18/02/2023	9:40:10 AM	8,946.80
125	18/02/2023	2:39:22 PM	9,519.41
126	18/02/2023	7:29:00 PM	9,260.48
127	19/02/2023	6:06:53 AM	9,492.74
128	19/02/2023	10:48:50 AM	9,242.68
129	19/02/2023	7:55:00 PM	9,270.45
130	19/02/2023	11:13:51 PM	9,178.60
131	20/02/2023	7:26:28 PM	9,283.85
132	21/02/2023	5:15:53 AM	9,261.54
133	21/02/2023	11:11:43 AM	9,414.62
134	21/02/2023	2:15:28 AM	9,119.56
135	22/02/2023	7:41:51 PM	9,685.92
136	23/02/2023	10:52:32 PM	9,571.31
137	24/02/2023	2:21:14 PM	8,996.05
138	24/02/2023	7:31:39 PM	8,894.94
139	25/02/2023	5:09:15 AM	8,891.70
140	25/02/2023	3:52:00 PM	8,991.05
141	25/02/2023	6:40:12 PM	8,892.74
142	25/02/2023	1:01:01 AM	9,176.00
143	26/02/2023	4:43:32 AM	9,368.85
144	26/02/2023	12:20:00 PM	9,167.80
145	26/02/2023	3:21:00 PM	9,187.60
146	26/02/2023	7:11:18 PM	9,204.16
147	27/02/2023	3:14:15 AM	9,385.59
148	28/02/2023	5:31:52 PM	9,169.97
149	28/02/2023	8:55:00 PM	9,296.65
150	28/02/2023	3:25:00 AM	9,356.00
151	1/03/2023	6:25:28 AM	9,245.79
152	1/03/2023	8:31:12 PM	9,134.14
153	1/03/2023	12:54:00 AM	9,206.16
154	2/03/2023	5:45:04 AM	9,273.40
155	2/03/2023	4:41:47 PM	8,975.50
156	3/03/2023	10:15:13 AM	9,181.34

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
157	3/03/2023	2:33:01 AM	9,328.56
158	4/03/2023	12:41:31 PM	9,156.85
159	5/03/2023	1:35:45 AM	9,186.79
160	5/03/2023	1:44:43 PM	9,324.22
161	5/03/2023	11:15:23 PM	9,367.16
162	6/03/2023	4:48:53 AM	9,377.47
163	7/03/2023	9:08:32 PM	9,451.39
164	7/03/2023	12:50:00 AM	9,248.96
165	8/03/2023	12:12:11 PM	8,961.56
166	9/03/2023	7:23:57 AM	9,084.30
167	9/03/2023	7:06:53 PM	9,080.97
168	10/03/2023	11:21:01 AM	9,375.35
169	10/03/2023	7:24:45 PM	9,029.16
170	12/03/2023	3:28:50 AM	9,058.74
171	13/03/2023	1:27:43 AM	9,352.19
172	15/03/2023	4:39:20 AM	9,134.14
173	15/03/2023	12:16:11 PM	9,065.62
174	15/03/2023	3:13:02 PM	8,955.50
175	16/03/2023	8:46:18 AM	9,232.39
176	16/03/2023	12:30:00 PM	9,002.70
177	16/03/2023	11:10:00 PM	9,034.50
178	16/03/2023	3:11:35 AM	9,052.02
179	17/03/2023	9:44:16 AM	9,282.59
180	17/03/2023	12:59:17 PM	9,256.30
181	18/03/2023	8:52:28 AM	9,307.16
182	18/03/2023	11:47:17 AM	9,350.70
183	19/03/2023	2:09:52 AM	9,198.22
184	19/03/2023	7:00:04 AM	9,262.09
185	20/03/2023	2:54:03 PM	9,215.10
186	21/03/2023	2:18:56 AM	9,283.76
187	21/03/2023	5:18:53 AM	9,092.61
188	22/03/2023	10:27:50 PM	9,310.88
189	23/03/2023	12:53:42 AM	8,987.68
190	24/03/2023	5:05:37 AM	9,009.36
191	24/03/2023	9:32:36 AM	9,145.28
192	24/03/2023	5:43:50 PM	9,202.80
193	24/03/2023	9:22:35 PM	9,152.94
194	24/03/2023	12:40:00 AM	9,215.70
195	25/03/2023	6:20:39 AM	8,835.84
196	25/03/2023	5:16:27 PM	9,091.64
197	25/03/2023	8:48:12 PM	9,060.81

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
198	25/03/2023	12:01:58 AM	9,162.90
199	26/03/2023	3:41:22 AM	9,186.82
200	26/03/2023	7:03:01 AM	9,305.21
201	26/03/2023	11:00:11 AM	9,321.90
202	26/03/2023	5:29:54 PM	9,241.02
203	26/03/2023	9:04:00 PM	9,054.24
204	27/03/2023	8:19:21 AM	9,158.96
205	28/03/2023	5:09:38 AM	9,253.22
206	28/03/2023	3:24:01 PM	9,251.41
207	28/03/2023	6:39:27 PM	9,317.22
208	28/03/2023	2:19:32 AM	9,176.28
209	29/03/2023	2:14:57 PM	9,252.56
210	30/03/2023	5:20:15 AM	9,150.28
211	30/03/2023	6:29:20 PM	9,206.56
212	30/03/2023	1:00:55 AM	9,170.17
213	31/03/2023	8:10:02 AM	9,165.68
214	31/03/2023	12:22:21 PM	9,059.44
215	1/04/2023	1:12:41 PM	8,490.40
216	1/04/2023	4:40:45 PM	9,159.36
217	1/04/2023	1:43:19 AM	9,190.16
218	2/04/2023	5:23:00 AM	9,232.81
219	2/04/2023	9:11:13 AM	9,217.92
220	2/04/2023	2:31:00 PM	9,170.24
221	2/04/2023	5:47:51 PM	9,220.82
222	2/04/2023	2:24:17 AM	8,833.84
223	3/04/2023	5:42:46 AM	9,290.59
224	3/04/2023	1:01:25 PM	8,651.80
225	3/04/2023	8:20:42 PM	9,240.08
226	3/04/2023	11:55:00 PM	9,182.59
227	7/04/2023	11:39:40 AM	9,015.88
228	7/04/2023	3:20:37 PM	9,390.19
229	8/04/2023	5:46:28 AM	9,142.97
230	12/04/2023	2:45:21 AM	9,366.54
231	12/04/2023	2:30:08 PM	9,351.14
232	12/04/2023	1:54:29 AM	9,206.90
233	13/04/2023	12:36:24 AM	9,299.36
234	15/04/2023	3:06:40 AM	8,960.10
235	15/04/2023	6:35:53 AM	9,302.42
236	15/04/2023	3:32:42 PM	9,278.34
237	15/04/2023	9:25:13 PM	9,201.22
238	16/04/2023	3:31:39 AM	9,386.17

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
239	17/04/2023	3:37:29 AM	9,109.48
240	17/04/2023	6:27:23 AM	9,106.16
241	17/04/2023	10:07:03 AM	9,292.62
242	18/04/2023	1:41:13 PM	9,224.65
243	18/04/2023	5:25:35 PM	9,175.28
244	19/04/2023	4:23:14 AM	9,322.22
245	19/04/2023	8:20:00 AM	4,129.30
246	19/04/2023	1:52:00 PM	9,349.48
247	19/04/2023	7:00:30 PM	9,177.20
248	19/04/2023	10:42:00 PM	4,117.00
249	20/04/2023	8:06:18 AM	9,413.62
250	20/04/2023	4:32:55 PM	9,170.56
251	20/04/2023	1:08:31 AM	9,337.60
252	21/04/2023	9:19:57 PM	8,936.84
253	21/04/2023	10:04:12 AM	4,189.56
254	21/04/2023	10:02:25 PM	4,145.50
255	22/04/2023	4:27:40 AM	9,103.72
256	22/04/2023	8:46:03 AM	8,917.84
257	22/04/2023	12:10:06 PM	9,317.82
258	22/04/2023	6:41:26 PM	9,136.72
259	23/04/2023	4:13:08 AM	9,038.68
260	23/04/2023	10:17:24 AM	4,141.96
261	23/04/2023	2:24:29 PM	9,145.97
262	23/04/2023	10:05:00 PM	4,132.00
263	23/04/2023	1:42:25 AM	9,197.57
264	24/04/2023	12:47:46 PM	9,179.60
265	24/04/2023	8:48:38 AM	9,172.92
266	24/04/2023	4:23:40 PM	8,193.00
267	25/04/2023	8:27:31 AM	9,246.42
268	25/04/2023	11:48:44 AM	4,144.63
269	27/04/2023	2:47:12 PM	9,171.68
270	27/04/2023	10:59:06 PM	9,126.32
271	28/04/2023	3:11:10 AM	9,042.28
272	28/04/2023	10:00:56 AM	9,152.06
273	28/04/2023	1:51:00 PM	9,197.60
274	28/04/2023	5:43:00 PM	9,211.00
275	28/04/2023	10:26:35 PM	9,219.40
276	29/04/2023	9:48:31 AM	9,395.80
277	29/04/2023	10:28:19 PM	8,970.26
278	29/04/2023	2:11:42 AM	9,472.57
279	30/04/2023	6:11:00 AM	9,250.20

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
280	1/05/2023	9:08:49 PM	9,299.70
281	1/05/2023	1:53:46 AM	9,124.26
282	2/05/2023	11:19:31 PM	9,083.60
283	3/05/2023	3:43:32 AM	9,052.60
284	3/05/2023	12:13:02 AM	9,223.40
285	4/05/2023	3:39:26 AM	9,138.88
286	4/05/2023	9:49:15 PM	4,151.40
287	4/05/2023	1:26:00 AM	9,216.00
288	5/05/2023	9:43:02 AM	9,492.40
289	5/05/2023	5:29:50 PM	8,958.80
290	5/05/2023	7:56:08 PM	4,206.56
291	6/05/2023	1:59:01 AM	9,293.25
292	6/05/2023	5:10:18 AM	9,193.51
293	6/05/2023	5:14:26 PM	9,019.60
294	6/05/2023	9:00:17 PM	9,118.28
295	6/05/2023	11:02:43 PM	4,187.76
296	7/05/2023	2:51:58 AM	9,276.11
297	7/05/2023	7:57:00 AM	4,215.83
298	7/05/2023	12:30:26 PM	9,220.30
299	7/05/2023	7:49:57 PM	8,989.08
300	7/05/2023	12:11:13 AM	9,219.26
301	7/05/2023	3:02:42 AM	8,866.60
302	8/05/2023	6:26:35 AM	9,313.40
303	8/05/2023	12:13:00 PM	4,228.96
304	8/05/2023	6:50:46 PM	9,256.70
305	8/05/2023	1:55:34 AM	9,332.00
306	9/05/2023	5:46:00 AM	8,975.52
307	9/05/2023	9:03:05 AM	9,089.02
308	9/05/2023	2:14:37 PM	9,159.50
309	9/05/2023	6:44:00 PM	9,210.51
310	9/05/2023	3:04:31 AM	9,215.66
311	10/05/2023	3:54:48 PM	9,267.70
312	10/05/2023	6:56:20 PM	9,311.40
313	10/05/2023	12:13:00 AM	9,388.73
314	11/05/2023	5:19:47 PM	9,303.40
315	11/05/2023	9:18:29 PM	9,176.88
316	12/05/2023	3:25:26 AM	9,337.80
317	12/05/2023	8:58:13 AM	9,078.92
318	12/05/2023	5:22:45 PM	9,031.00
319	13/05/2023	2:36:37 AM	9,085.26
320	13/05/2023	10:24:46 AM	9,198.70

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
321	13/05/2023	6:40:10 PM	9,399.00
322	13/05/2023	9:51:07 PM	9,395.46
323	13/05/2023	1:47:03 AM	9,204.40
324	14/05/2023	9:28:17 AM	9,257.66
325	14/05/2023	12:17:02 PM	9,307.52
326	14/05/2023	5:45:53 PM	9,048.90
327	14/05/2023	9:09:21 PM	9,493.93
328	15/05/2023	2:26:31 AM	9,398.80
329	15/05/2023	8:49:51 AM	9,315.33
330	15/05/2023	3:55:52 PM	8,960.30
331	15/05/2023	9:42:10 PM	9,340.13
332	15/05/2023	2:33:22 AM	9,032.28
333	16/05/2023	11:43:10 AM	9,282.68
334	16/05/2023	3:51:47 PM	9,199.80
335	16/05/2023	7:18:01 PM	9,206.30
336	16/05/2023	10:40:58 PM	9,316.46
337	17/05/2023	2:20:44 AM	9,422.05
338	17/05/2023	4:50:09 PM	9,095.86
339	17/05/2023	10:14:22 PM	9,319.60
340	18/05/2023	5:01:24 AM	9,242.30
341	18/05/2023	11:56:18 AM	9,158.86
342	18/05/2023	3:50:07 PM	9,576.20
343	18/05/2023	10:51:52 PM	9,313.76
344	18/05/2023	2:15:33 AM	9,235.80
345	19/05/2023	5:56:37 AM	9,463.73
346	19/05/2023	9:38:51 PM	9,188.70
347	20/05/2023	4:45:55 AM	9,368.88
348	20/05/2023	8:28:02 AM	9,391.73
349	20/05/2023	1:14:00 AM	9,304.66
350	21/05/2023	4:23:28 AM	9,335.50
351	21/05/2023	2:31:36 PM	9,363.20
352	21/05/2023	7:40:48 PM	9,492.54
353	21/05/2023	11:43:00 PM	9,426.93
354	22/05/2023	3:42:00 AM	9,349.26
355	22/05/2023	8:13:51 AM	9,477.06
356	22/05/2023	11:19:02 AM	9,277.92
357	22/05/2023	4:43:52 PM	9,444.18
358	22/05/2023	4:38:44 PM	9,442.46
359	23/05/2023	8:32:44 PM	9,345.96
360	25/05/2023	3:34:08 AM	9,261.26
361	26/05/2023	1:43:36 AM	8,995.70

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
362	27/05/2023	4:37:17 AM	9,225.96
363	27/05/2023	10:59:23 AM	9,067.86
364	27/05/2023	2:32:05 PM	8,927.00
365	27/05/2023	12:50:06 AM	9,255.51
366	28/05/2023	7:29:00 AM	9,371.18
367	28/05/2023	11:11:15 AM	9,390.33
368	28/05/2023	6:51:56 PM	9,133.35
369	28/05/2023	10:41:00 PM	9,235.70
370	28/05/2023	2:45:16 AM	9,287.66
371	29/05/2023	6:20:40 AM	9,277.32
372	29/05/2023	10:54:43 AM	9,174.26
373	29/05/2023	2:40:54 PM	9,277.56
374	29/05/2023	5:53:51 PM	9,412.38
375	29/05/2023	10:06:14 PM	9,109.70
376	30/05/2023	2:27:00 AM	9,320.94
377	30/05/2023	4:01:31 PM	8,977.36
378	31/05/2023	3:09:25 AM	9,358.06
379	31/05/2023	9:24:24 PM	9,353.77
380	31/05/2023	12:39:50 AM	9,473.26
381	1/06/2023	3:51:33 AM	9,037.13
382	1/06/2023	7:14:09 AM	9,342.58
383	1/06/2023	1:34:00 AM	9,004.60
384	2/06/2023	3:05:24 PM	9,166.16
385	2/06/2023	1:34:17 AM	9,197.93
386	3/06/2023	5:02:20 AM	9,183.88
387	3/06/2023	9:38:06 AM	9,289.77
388	3/06/2023	5:16:16 PM	9,565.86
389	3/06/2023	8:34:14 PM	9,115.78
390	4/06/2023	3:33:18 AM	9,275.68
391	4/06/2023	3:48:41 PM	9,435.66
392	7/06/2023	9:04:42 PM	9,384.50
393	8/06/2023	4:52:00 PM	9,046.16
394	8/06/2023	12:12:50 AM	9,088.02
395	8/06/2023	4:11:57 AM	9,085.56
396	9/06/2023	1:11:39 PM	9,222.56
397	10/06/2023	6:17:22 AM	9,215.73
398	10/06/2023	12:50:00 PM	9,184.00
399	10/06/2023	8:19:10 PM	9,179.20
400	11/06/2023	11:11:00 AM	9,127.20
401	12/06/2023	2:26:00 AM	9,177.60
402	12/06/2023	7:27:10 AM	9,103.22

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
403	12/06/2023	5:43:06 PM	9,113.79
404	12/06/2023	9:11:11 PM	9,143.22
405	13/06/2023	9:55:20 AM	8,891.76
406	13/06/2023	4:16:48 PM	9,024.40
407	14/06/2023	6:13:04 AM	9,193.17
408	14/06/2023	4:55:05 PM	9,241.56
409	14/06/2023	10:17:07 PM	9,132.56
410	15/06/2023	5:17:24 AM	9,293.00
411	15/06/2023	5:14:08 PM	9,180.60
412	17/06/2023	10:11:15 AM	9,054.14
413	17/06/2023	4:30:27 PM	8,881.60
414	17/06/2023	8:29:00 PM	9,124.76
415	17/06/2023	1:12:00 AM	9,128.02
416	18/06/2023	12:33:16 PM	9,321.93
417	18/06/2023	5:11:41 PM	9,021.22
418	18/06/2023	9:55:56 PM	9,035.00
419	18/06/2023	1:28:10 AM	9,258.00
420	19/06/2023	4:05:04 PM	9,103.30
421	19/06/2023	8:47:25 PM	9,085.01
422	19/06/2023	12:11:05 AM	8,807.80
423	20/06/2023	1:00:10 PM	9,014.54
424	20/06/2023	1:12:04 AM	9,043.70
425	20/06/2023	4:22:01 AM	9,173.95
426	22/06/2023	6:58:40 AM	8,970.93
427	23/06/2023	5:13:22 AM	9,027.20
428	23/06/2023	6:17:41 AM	9,238.20
429	24/06/2023	10:04:42 AM	9,124.60
430	24/06/2023	7:36:34 PM	9,251.10
431	24/06/2023	10:44:14 PM	9,159.33
432	24/06/2023	3:14:19 AM	9,137.76
433	25/06/2023	7:15:00 AM	8,908.87
434	25/06/2023	6:55:07 PM	9,291.60
435	25/06/2023	3:24:53 AM	9,210.34
436	26/06/2023	6:38:43 AM	9,266.17
437	27/06/2023	3:59:27 AM	9,280.16
438	27/06/2023	4:21:42 PM	8,874.00
439	28/06/2023	5:24:00 AM	9,140.47
440	28/06/2023	10:03:05 PM	9,004.57
441	28/06/2023	3:00:50 AM	9,316.74
442	29/06/2023	4:30:28 PM	9,224.22
443	30/06/2023	5:54:13 AM	9,015.02

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
444	30/06/2023	10:55:04 AM	9,091.40
445	30/06/2023	9:58:24 PM	9,103.40
446	1/07/2023	3:02:54 AM	9,018.63
447	1/07/2023	11:03:46 AM	9,242.10
448	1/07/2023	2:28:46 PM	9,001.22
449	1/07/2023	5:03:15 PM	8,894.23
450	1/07/2023	12:24:10 AM	9,268.60
451	2/07/2023	4:44:33 AM	8,998.03
452	2/07/2023	11:51:44 AM	8,994.40
453	2/07/2023	4:49:38 PM	9,256.40
454	2/07/2023	11:56:30 PM	9,002.02
455	3/07/2023	12:20:00 PM	9,226.80
456	4/07/2023	3:41:06 PM	9,017.20
457	4/07/2023	10:30:45 PM	8,928.03
458	5/07/2023	6:07:15 AM	8,896.20
459	6/07/2023	12:34:00 AM	8,961.02
460	7/07/2023	7:32:14 AM	9,110.56
461	8/07/2023	8:25:00 AM	8,967.62
462	8/07/2023	11:55:57 AM	8,853.28
463	8/07/2023	2:45:12 PM	8,952.23
464	8/07/2023	9:40:37 PM	8,870.48
465	8/07/2023	3:07:47 AM	8,954.63
466	9/07/2023	3:54:41 PM	9,260.97
467	9/07/2023	8:19:19 PM	8,995.60
468	10/07/2023	4:22:39 AM	9,026.72
469	10/07/2023	8:21:20 AM	9,086.80
470	10/07/2023	1:28:45 PM	9,098.10
471	10/07/2023	4:46:47 PM	9,105.77
472	10/07/2023	8:57:29 PM	9,159.40
473	10/07/2023	12:52:07 AM	9,160.96
474	11/07/2023	4:19:19 AM	9,059.48
475	11/07/2023	10:41:44 PM	9,199.83
476	12/07/2023	4:21:27 AM	9,170.72
477	12/07/2023	11:41:58 PM	9,295.20
478	12/07/2023	3:06:06 AM	9,075.56
479	12/07/2023	6:53:45 AM	9,065.88
480	13/07/2023	6:35:50 PM	9,087.30
481	13/07/2023	9:51:19 PM	9,138.37
482	13/07/2023	1:10:00 AM	9,164.14
483	14/07/2023	12:52:00 PM	9,011.92
484	14/07/2023	6:15:00 PM	9,112.76

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
485	14/07/2023	11:19:00 PM	9,164.82
486	14/07/2023	3:16:55 AM	9,048.90
487	15/07/2023	10:32:42 AM	9,171.22
488	15/07/2023	1:51:00 PM	9,144.97
489	15/07/2023	9:53:52 PM	9,036.60
490	15/07/2023	1:22:00 AM	9,151.37
491	15/07/2023	4:15:04 AM	9,115.83
492	16/07/2023	8:05:49 AM	8,910.42
493	16/07/2023	10:49:00 AM	8,869.68
494	16/07/2023	1:46:40 PM	9,217.12
495	16/07/2023	12:04:08 AM	9,309.10
496	17/07/2023	11:05:26 AM	9,102.22
497	18/07/2023	6:55:00 AM	9,209.54
498	18/07/2023	4:56:18 PM	9,001.54
499	19/07/2023	8:14:46 AM	9,090.62
500	19/07/2023	3:46:58 AM	9,021.30
501	19/07/2023	9:23:52 PM	9,112.76
502	19/07/2023	12:41:30 AM	9,092.10
503	20/07/2023	5:57:40 AM	8,994.42
504	20/07/2023	11:56:50 AM	9,001.22
505	20/07/2023	3:23:10 PM	9,170.50
506	20/07/2023	11:25:10 PM	9,122.65
507	21/07/2023	3:47:20 AM	8,938.63
508	21/07/2023	8:59:00 AM	9,216.05
509	21/07/2023	1:00:00 PM	9,069.63
510	21/07/2023	10:48:49 PM	9,094.83
511	22/07/2023	12:15:00 PM	9,285.43
512	22/07/2023	5:59:09 PM	9,170.00
513	22/07/2023	5:23:30 AM	9,029.08
514	23/07/2023	9:01:00 AM	9,185.34
515	23/07/2023	12:37:00 PM	9,030.00
516	23/07/2023	4:07:00 PM	9,045.88
517	23/07/2023	10:00:36 PM	9,158.97
518	24/07/2023	2:46:40 PM	9,180.02
519	24/07/2023	3:57:00 AM	9,008.03
520	25/07/2023	4:10:13 AM	9,148.12
521	25/07/2023	7:43:00 AM	9,066.40
522	26/07/2023	10:45:17 AM	9,196.62
523	26/07/2023	5:59:09 PM	9,170.00
524	26/07/2023	9:20:54 PM	9,034.72
525	27/07/2023	4:12:23 PM	8,894.30

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
526	27/07/2023	7:04:00 PM	9,122.42
527	28/07/2023	10:11:00 AM	9,112.74
528	28/07/2023	7:24:00 PM	8,790.90
529	28/07/2023	1:12:00 AM	9,016.80
530	29/07/2023	7:04:40 AM	8,872.92
531	29/07/2023	1:06:20 PM	8,931.00
532	29/07/2023	6:34:00 PM	9,069.83
533	30/07/2023	3:50:00 AM	9,069.43
534	30/07/2023	12:51:50 PM	8,997.77
535	30/07/2023	8:25:00 PM	8,853.05
536	30/07/2023	11:55:00 PM	8,895.62
537	31/07/2023	5:13:00 PM	8,884.32
538	1/08/2023	10:44:41 PM	8,938.16
539	2/08/2023	10:39:50 AM	8,743.44
540	2/08/2023	9:42:47 PM	9,142.84
541	3/08/2023	1:58:46 AM	8,824.72
542	3/08/2023	9:11:00 PM	9,170.04
543	3/08/2023	2:48:00 AM	9,110.22
544	4/08/2023	4:28:38 PM	9,188.83
545	4/08/2023	10:02:41 PM	9,053.65
546	4/08/2023	9:31:47 PM	9,217.42
547	5/08/2023	2:21:36 PM	9,088.31
548	8/08/2023	9:25:00 PM	8,931.43
549	8/08/2023	12:35:00 AM	8,984.77
550	9/08/2023	8:43:00 AM	9,011.82
551	9/08/2023	6:58:00 PM	9,251.94
552	11/08/2023	2:52:30 PM	8,781.63
553	13/08/2023	1:16:40 PM	9,254.02
554	14/08/2023	7:28:17 AM	9,027.22
555	14/08/2023	1:32:50 PM	9,179.03
556	14/08/2023	10:14:10 PM	9,227.82
557	15/08/2023	5:57:00 AM	9,172.26
558	15/08/2023	1:53:41 AM	9,035.84
559	16/08/2023	9:11:10 PM	9,153.17
560	16/08/2023	12:54:50 PM	9,083.84
561	16/08/2023	12:11:30 AM	9,113.92
562	17/08/2023	6:28:00 AM	9,083.57
563	17/08/2023	9:52:30 AM	8,900.90
564	17/08/2023	10:41:26 PM	9,126.32
565	17/08/2023	1:59:04 AM	9,030.62
566	18/08/2023	4:52:46 AM	8,979.84

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
567	18/08/2023	10:10:00 PM	8,921.30
568	18/08/2023	2:10:30 AM	9,133.52
569	19/08/2023	7:20:00 AM	9,090.64
570	19/08/2023	3:41:00 PM	9,039.05
571	19/08/2023	7:37:00 PM	9,129.62
572	20/08/2023	6:13:00 AM	9,173.42
573	20/08/2023	9:28:00 AM	9,059.44
574	20/08/2023	2:38:00 PM	8,844.85
575	20/08/2023	7:21:00 PM	9,096.84
576	20/08/2023	11:23:56 PM	8,810.65
577	21/08/2023	7:31:00 AM	9,152.37
578	21/08/2023	11:25:00 PM	9,085.72
579	21/08/2023	2:47:00 AM	9,118.48
580	22/08/2023	12:42:00 AM	9,004.66
581	23/08/2023	10:47:33 AM	8,858.92
582	23/08/2023	4:03:20 PM	8,966.02
583	23/08/2023	7:00:00 PM	8,919.51
584	23/08/2023	10:22:04 PM	9,228.32
585	24/08/2023	6:00:00 AM	9,075.05
586	25/08/2023	5:51:00 AM	8,922.85
587	25/08/2023	11:17:01 AM	8,864.04
588	25/08/2023	3:39:00 PM	9,033.66
589	26/08/2023	10:18:00 AM	8,999.17
590	26/08/2023	3:47:00 PM	9,056.45
591	26/08/2023	12:04:00 AM	9,091.12
592	27/08/2023	9:02:51 AM	9,060.04
593	27/08/2023	12:46:39 PM	9,082.64
594	27/08/2023	4:40:00 PM	9,131.42
595	27/08/2023	12:18:54 AM	8,912.04
596	29/08/2023	4:59:00 PM	9,263.70
597	30/08/2023	12:13:00 PM	9,021.85
598	30/08/2023	3:31:00 PM	9,204.77
599	30/08/2023	6:54:46 PM	9,251.70
600	31/08/2023	12:11:10 PM	8,997.46
601	31/08/2023	12:55:00 AM	8,963.22
602	1/09/2023	12:49:00 PM	8,979.62
603	1/09/2023	3:27:10 PM	8,799.66
604	1/09/2023	6:40:00 PM	9,035.64
605	1/09/2023	11:33:20 PM	8,915.57
606	2/09/2023	6:11:00 AM	8,984.80
607	3/09/2023	7:26:00 AM	9,094.99

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
608	4/09/2023	9:44:00 AM	9,029.61
609	4/09/2023	9:13:00 PM	9,013.25
610	4/09/2023	11:58:00 PM	8,995.42
611	5/09/2023	7:23:00 AM	9,115.26
612	6/09/2023	3:35:00 PM	8,979.38
613	6/09/2023	1:35:00 AM	8,974.18
614	7/09/2023	4:59:20 AM	8,843.82
615	7/09/2023	9:50:00 AM	8,854.85
616	7/09/2023	1:00:00 PM	8,913.18
617	7/09/2023	5:03:00 PM	9,211.77
618	8/09/2023	2:58:00 PM	9,128.86
619	8/09/2023	4:18:00 AM	8,834.41
620	9/09/2023	10:40:00 AM	8,996.38
621	10/09/2023	5:32:50 PM	9,190.38
622	11/09/2023	12:39:00 PM	9,164.12
623	11/09/2023	10:40:30 PM	9,093.52
624	12/09/2023	9:29:00 AM	8,792.92
625	12/09/2023	9:20:10 PM	8,750.32
626	12/09/2023	12:22:00 AM	9,007.59
627	13/09/2023	8:32:00 AM	9,090.07
628	13/09/2023	4:26:00 PM	9,085.78
629	14/09/2023	9:33:30 AM	9,104.78
630	14/09/2023	12:38:00 AM	9,243.06
631	15/09/2023	9:53:00 AM	9,020.85
632	15/09/2023	1:49:00 PM	9,166.57
633	15/09/2023	10:27:10 PM	9,115.46
634	16/09/2023	5:05:40 AM	9,038.14
635	16/09/2023	1:24:00 PM	8,935.80
636	17/09/2023	3:38:20 AM	9,143.00
637	17/09/2023	12:10:50 AM	9,148.66
638	18/09/2023	6:38:00 AM	9,007.25
639	18/09/2023	9:35:50 AM	8,869.57
640	18/09/2023	1:23:00 PM	8,965.94
641	18/09/2023	11:06:00 PM	8,799.84
642	18/09/2023	3:35:00 AM	9,160.88
643	19/09/2023	7:22:44 AM	9,086.81
644	19/09/2023	10:51:00 PM	9,020.37
645	19/09/2023	3:57:00 AM	8,959.08
646	21/09/2023	2:44:00 AM	9,193.78
647	21/09/2023	10:34:00 AM	8,883.34
648	21/09/2023	5:52:00 PM	8,993.39

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
649	21/09/2023	1:17:00 AM	8,999.77
650	22/09/2023	9:11:00 AM	9,092.77
651	22/09/2023	1:02:50 PM	9,150.80
652	22/09/2023	4:56:00 PM	9,112.98
653	22/09/2023	8:36:50 PM	8,959.37
654	22/09/2023	12:36:00 AM	9,024.77
655	23/09/2023	3:28:00 AM	9,213.28
656	23/09/2023	7:49:30 AM	9,135.17
657	23/09/2023	11:19:00 AM	9,024.18
658	23/09/2023	3:01:30 PM	9,020.02
659	24/09/2023	4:56:00 AM	9,146.88
660	24/09/2023	9:30:00 AM	9,104.53
661	24/09/2023	1:00:00 PM	9,031.37
662	24/09/2023	7:40:00 PM	9,021.39
663	24/09/2023	10:48:00 PM	9,161.58
664	25/09/2023	10:22:00 AM	9,096.58
665	25/09/2023	2:15:00 PM	9,253.50
666	25/09/2023	6:24:00 PM	9,006.32
667	25/09/2023	10:50:00 PM	9,087.38
668	25/09/2023	2:36:00 AM	9,128.94
669	26/09/2023	5:47:00 AM	9,049.39
670	26/09/2023	10:21:00 PM	9,093.48
671	27/09/2023	10:44:00 PM	9,097.12
672	27/09/2023	1:41:00 AM	9,023.02
673	28/09/2023	8:38:36 AM	9,007.38
674	28/09/2023	9:15:00 PM	9,172.20
675	28/09/2023	1:51:04 AM	8,986.33
676	29/09/2023	5:49:22 AM	9,194.60
677	29/09/2023	2:50:48 PM	9,084.68
678	29/09/2023	9:45:27 PM	9,025.25
679	30/09/2023	8:10:19 AM	8,884.84
680	30/09/2023	2:12:00 PM	9,248.13
681	30/09/2023	6:28:28 PM	9,125.37
682	1/10/2023	3:39:30 AM	9,324.00
683	1/10/2023	1:26:17 PM	9,275.00
684	1/10/2023	4:53:27 PM	9,327.40
685	1/10/2023	8:29:39 PM	9,328.20
686	1/10/2023	11:38:01 PM	9,400.90
687	2/10/2023	2:59:57 AM	9,173.10
688	2/10/2023	10:49:14 AM	9,204.80
689	2/10/2023	5:23:59 PM	9,243.10

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
690	3/10/2023	10:18:00 AM	9,290.50
691	3/10/2023	8:57:41 PM	9,149.90
692	3/10/2023	1:05:47 AM	9,023.17
693	4/10/2023	1:54:46 AM	9,368.00
694	7/10/2023	9:42:28 AM	9,237.40
695	7/10/2023	1:15:56 PM	9,078.35
696	7/10/2023	5:01:03 PM	8,862.93
697	8/10/2023	1:22:03 PM	9,020.50
698	8/10/2023	6:45:06 PM	8,904.38
699	9/10/2023	4:58:58 PM	9,051.60
700	10/10/2023	5:58:10 PM	8,815.16
701	10/10/2023	9:36:16 PM	9,087.84
702	11/10/2023	4:01:00 AM	8,903.90
703	11/10/2023	5:22:15 PM	9,168.36
704	11/10/2023	8:26:08 PM	9,019.75
705	12/10/2023	6:32:05 AM	9,051.97
706	12/10/2023	2:20:32 PM	9,009.95
707	12/10/2023	6:37:14 PM	9,011.78
708	12/10/2023	10:22:23 PM	9,271.60
709	12/10/2023	1:20:16 AM	9,152.57
710	13/10/2023	9:39:18 AM	8,889.78
711	13/10/2023	12:56:00 PM	8,848.64
712	13/10/2023	4:25:24 PM	9,142.35
713	14/10/2023	9:40:10 PM	9,052.93
714	14/10/2023	12:24:02 AM	8,970.24
715	15/10/2023	12:33:23 PM	9,036.84
716	15/10/2023	9:38:57 PM	9,032.18
717	16/10/2023	12:38:27 PM	8,887.77
718	16/10/2023	9:49:27 PM	9,324.35
719	17/10/2023	5:43:40 AM	9,218.10
720	17/10/2023	3:06:02 PM	9,063.37
721	17/10/2023	8:35:52 PM	9,169.37
722	18/10/2023	5:19:07 AM	9,123.80
723	18/10/2023	6:37:51 PM	9,112.80
724	18/10/2023	12:13:00 AM	9,196.10
725	18/10/2023	2:59:24 AM	8,976.41
726	19/10/2023	7:21:15 PM	9,131.30
727	19/10/2023	11:56:40 PM	9,224.70
728	19/10/2023	2:47:38 AM	9,082.96
729	20/10/2023	7:48:14 PM	9,079.77
730	21/10/2023	5:19:42 AM	9,057.73

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
731	21/10/2023	1:42:00 AM	9,256.31
732	22/10/2023	9:22:07 AM	9,049.00
733	22/10/2023	11:32:21 PM	9,053.14
734	23/10/2023	7:27:39 AM	8,984.77
735	23/10/2023	11:02:24 AM	8,949.11
736	23/10/2023	4:32:33 PM	8,977.16
737	23/10/2023	1:10:07 AM	9,122.50
738	24/10/2023	3:47:50 PM	8,871.55
739	24/10/2023	7:06:03 PM	8,918.96
740	25/10/2023	11:48:15 AM	9,215.49
741	25/10/2023	5:38:00 AM	8,870.27
742	26/10/2023	9:29:33 AM	9,208.80
743	26/10/2023	6:09:09 PM	8,993.41
744	27/10/2023	8:10:48 AM	9,120.94
745	27/10/2023	7:07:37 PM	8,991.08
746	27/10/2023	2:34:50 AM	9,070.15
747	27/10/2023	5:38:07 AM	9,018.61
748	28/10/2023	9:41:17 AM	9,211.91
749	28/10/2023	1:07:03 PM	8,931.68
750	28/10/2023	4:03:31 PM	8,858.57
751	28/10/2023	7:53:13 PM	8,961.51
752	28/10/2023	12:50:20 AM	9,076.17
753	29/10/2023	12:03:40 PM	8,943.98
754	29/10/2023	3:46:26 PM	9,084.21
755	29/10/2023	8:22:10 PM	8,809.41
756	30/10/2023	4:46:24 AM	8,986.76
757	30/10/2023	10:13:08 PM	9,031.37
758	30/10/2023	1:44:11 AM	9,017.00
759	31/10/2023	10:35:02 PM	9,282.90
760	31/10/2023	2:03:53 AM	8,892.23
761	1/11/2023	5:01:04 AM	8,779.61
762	1/11/2023	10:34:44 PM	9,110.51
763	1/11/2023	3:20:32 AM	9,119.64
764	2/11/2023	10:00:18 PM	9,045.13
765	2/11/2023	1:49:35 AM	9,090.43
766	3/11/2023	6:10:49 AM	8,794.17
767	3/11/2023	1:05:42 PM	9,032.57
768	3/11/2023	10:18:15 PM	9,080.61
769	3/11/2023	1:24:15 AM	8,984.97
770	4/11/2023	6:10:19 AM	9,010.41
771	4/11/2023	11:59:59 AM	8,864.77

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
772	4/11/2023	5:49:00 PM	9,147.63
773	4/11/2023	8:44:56 PM	8,958.21
774	4/11/2023	12:42:13 AM	8,794.37
775	5/11/2023	9:01:23 AM	8,923.88
776	5/11/2023	12:25:47 PM	9,037.20
777	5/11/2023	3:14:25 PM	8,796.64
778	5/11/2023	11:32:13 PM	9,208.60
779	5/11/2023	3:10:35 AM	8,933.75
780	6/11/2023	8:57:43 AM	9,067.76
781	6/11/2023	12:20:52 PM	9,097.48
782	6/11/2023	9:43:08 PM	9,027.81
783	7/11/2023	11:19:00 AM	9,059.43
784	7/11/2023	2:46:23 PM	8,958.57
785	7/11/2023	12:02:59 AM	9,245.75
786	8/11/2023	3:56:33 AM	8,662.01
787	9/11/2023	2:42:26 AM	8,930.40
788	9/11/2023	2:08:32 PM	9,095.77
789	10/11/2023	11:33:34 PM	9,118.63
790	10/11/2023	2:49:06 AM	9,259.68
791	11/11/2023	12:39:20 PM	9,275.50
792	11/11/2023	4:54:55 PM	9,103.44
793	11/11/2023	10:14:11 PM	8,882.11
794	12/11/2023	6:08:36 AM	9,141.04
795	12/11/2023	10:29:27 AM	9,139.71
796	12/11/2023	4:28:30 PM	9,113.44
797	12/11/2023	12:53:09 AM	8,980.80
798	13/11/2023	4:10:44 AM	9,012.68
799	13/11/2023	2:12:47 PM	9,032.71
800	13/11/2023	5:05:24 PM	9,034.48
801	13/11/2023	9:08:13 PM	9,149.65
802	13/11/2023	2:12:00 AM	8,997.24
803	14/11/2023	12:19:00 PM	9,134.75
804	14/11/2023	3:39:54 PM	9,214.44
805	14/11/2023	8:40:05 PM	9,086.83
806	14/11/2023	2:32:17 AM	9,097.48
807	14/11/2023	5:39:15 AM	9,070.44
808	15/11/2023	8:51:02 AM	9,105.55
809	15/11/2023	2:14:20 PM	9,088.94
810	15/11/2023	6:15:40 PM	9,010.55
811	15/11/2023	9:58:35 PM	9,022.21
812	16/11/2023	5:34:07 AM	9,047.75

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
813	16/11/2023	8:51:56 PM	8,996.69
814	16/11/2023	12:05:21 AM	9,107.25
815	16/11/2023	3:01:33 AM	9,027.36
816	17/11/2023	8:45:21 AM	8,762.68
817	17/11/2023	2:38:43 PM	9,142.35
818	17/11/2023	8:25:27 PM	9,108.14
819	17/11/2023	3:34:34 AM	9,146.55
820	18/11/2023	7:18:00 AM	9,038.27
821	18/11/2023	10:46:34 AM	8,981.24
822	18/11/2023	2:26:27 PM	8,935.41
823	18/11/2023	10:32:58 PM	9,029.04
824	18/11/2023	2:29:52 AM	8,987.88
825	19/11/2023	5:40:38 AM	8,953.46
826	19/11/2023	10:18:26 AM	8,969.84
827	19/11/2023	2:43:57 PM	8,961.94
828	19/11/2023	6:00:32 PM	8,971.28
829	19/11/2023	3:22:25 AM	8,983.17
830	20/11/2023	6:53:14 AM	9,124.68
831	20/11/2023	11:26:57 AM	9,042.06
832	20/11/2023	6:26:16 PM	8,897.23
833	20/11/2023	10:16:33 PM	9,262.81
834	20/11/2023	1:08:53 AM	9,226.26
835	24/11/2023	1:09:33 PM	8,866.85
836	24/11/2023	9:00:40 PM	8,848.04
837	24/11/2023	12:38:19 AM	8,918.83
838	25/11/2023	6:51:00 AM	9,252.35
839	25/11/2023	12:46:07 PM	9,119.83
840	25/11/2023	4:14:48 PM	9,144.35
841	26/11/2023	4:25:22 AM	8,943.26
842	26/11/2023	4:57:29 PM	8,906.26
843	26/11/2023	11:48:20 AM	9,040.90
844	26/11/2023	2:35:52 AM	8,886.01
845	27/11/2023	8:09:43 AM	8,745.64
846	27/11/2023	11:48:50 AM	8,865.55
847	27/11/2023	3:46:42 PM	8,962.25
848	27/11/2023	7:23:55 PM	8,996.62
849	27/11/2023	10:10:00 PM	9,175.75
850	28/11/2023	7:37:14 AM	9,075.06
851	28/11/2023	2:03:29 PM	9,086.84
852	28/11/2023	6:22:38 PM	9,108.26
853	28/11/2023	11:02:30 PM	9,042.03

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
854	28/11/2023	2:20:08 AM	8,996.04
855	28/11/2023	7:03:00 AM	9,129.60
856	29/11/2023	3:27:18 PM	8,876.84
857	29/11/2023	6:07:49 PM	9,052.95
858	29/11/2023	9:31:27 PM	9,093.26
859	29/11/2023	4:27:21 AM	9,004.04
860	30/11/2023	8:16:25 AM	8,779.77
861	30/11/2023	11:09:34 AM	8,933.55
862	30/11/2023	2:31:13 PM	8,971.61
863	30/11/2023	8:11:08 PM	9,150.01
864	30/11/2023	11:27:52 PM	9,208.57
865	1/12/2023	8:12:36 AM	8,966.04
866	1/12/2023	1:29:00 PM	9,044.81
867	1/12/2023	4:50:00 PM	9,044.85
868	1/12/2023	12:58:41 AM	9,033.55
869	1/12/2023	4:17:04 AM	8,886.05
870	2/12/2023	3:37:54 PM	8,917.85
871	2/12/2023	7:38:40 PM	9,046.21
872	3/12/2023	3:10:52 AM	8,835.02
873	3/12/2023	6:18:24 AM	8,753.41
874	3/12/2023	5:19:44 PM	8,942.35
875	3/12/2023	12:51:00 AM	9,064.77
876	4/12/2023	7:57:00 AM	8,920.95
877	4/12/2023	10:31:00 AM	8,856.15
878	4/12/2023	7:22:59 PM	9,094.51
879	5/12/2023	3:01:11 AM	9,090.20
880	5/12/2023	9:44:22 AM	9,027.42
881	6/12/2023	4:35:28 PM	9,147.61
882	6/12/2023	12:44:52 AM	9,124.29
883	7/12/2023	10:11:16 PM	9,085.22
884	7/12/2023	1:16:00 AM	9,081.00
885	8/12/2023	6:10:00 AM	8,750.00
886	8/12/2023	9:17:12 AM	9,012.24
887	8/12/2023	7:33:15 PM	9,174.50
888	8/12/2023	10:46:20 PM	9,025.69
889	8/12/2023	1:40:14 AM	9,306.30
890	8/12/2023	5:05:22 AM	9,236.90
891	9/12/2023	9:11:00 AM	8,900.00
892	9/12/2023	4:49:03 PM	8,926.84
893	9/12/2023	4:46:07 AM	8,992.62
894	9/12/2023	8:28:17 AM	9,047.50

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
895	10/12/2023	12:27:00 PM	9,209.89
896	10/12/2023	10:05:37 PM	9,007.16
897	11/12/2023	2:59:22 PM	9,074.61
898	11/12/2023	1:10:14 AM	9,045.70
899	12/12/2023	7:10:54 AM	9,140.69
900	12/12/2023	10:25:39 AM	9,162.15
901	12/12/2023	9:21:08 PM	9,043.29
902	13/12/2023	5:17:38 AM	9,047.21
903	13/12/2023	1:27:32 PM	9,089.15
904	13/12/2023	12:30:19 AM	8,471.42
905	14/12/2023	9:42:32 AM	8,952.89
906	14/12/2023	9:43:00 AM	9,008.81
907	14/12/2023	4:06:51 AM	8,969.69
908	15/12/2023	7:59:12 AM	8,944.61
909	15/12/2023	12:29:03 PM	8,991.84
910	15/12/2023	11:03:08 PM	8,974.44
911	16/12/2023	5:05:15 AM	8,970.95
912	16/12/2023	8:55:41 AM	8,959.10
913	16/12/2023	6:00:00 PM	9,186.63
914	17/12/2023	3:20:01 AM	9,099.75
915	17/12/2023	10:15:19 AM	9,168.23
916	17/12/2023	2:04:02 AM	9,035.23
917	18/12/2023	5:45:12 AM	8,869.56
918	18/12/2023	12:54:56 PM	9,149.03
919	18/12/2023	5:21:00 AM	9,111.11
920	19/12/2023	2:45:23 PM	8,839.18
921	19/12/2023	6:31:38 PM	9,114.50
922	19/12/2023	6:36:40 AM	9,179.30
923	20/12/2023	10:23:02 AM	9,092.43
924	20/12/2023	6:45:49 PM	9,044.11
925	20/12/2023	9:36:00 PM	9,149.83
926	20/12/2023	1:12:02 AM	9,382.70
927	20/12/2023	4:00:00 AM	9,046.16
928	20/12/2023	7:56:05 AM	8,814.31
929	21/12/2023	8:53:22 PM	9,116.56
930	21/12/2023	12:03:51 AM	8,931.24
931	21/12/2023	3:22:17 AM	9,026.51
932	22/12/2023	7:16:58 AM	9,059.16
933	22/12/2023	2:37:10 PM	9,143.91
934	22/12/2023	9:00:41 PM	9,032.21
935	22/12/2023	3:46:56 AM	9,051.55

Train Index	Load Finish Date	Load Finish Time	Net Weight (t)
936	23/12/2023	8:47:02 AM	9,187.63
937	23/12/2023	1:38:35 PM	8,985.24
938	23/12/2023	4:14:30 PM	9,129.50
939	23/12/2023	8:27:09 PM	9,040.63
940	23/12/2023	11:52:20 PM	9,080.30
941	24/12/2023	2:39:12 AM	9,102.11
942	24/12/2023	5:16:25 AM	9,103.60
943	25/12/2023	8:55:15 AM	8,806.84
944	27/12/2023	2:17:45 PM	8,806.84
945	27/12/2023	8:15:27 PM	8,819.75
946	27/12/2023	11:34:29 PM	9,010.04
947	28/12/2023	11:02:24 AM	9,066.36
948	28/12/2023	7:00:42 PM	8,934.10
949	28/12/2023	11:03:51 PM	9,177.30
950	29/12/2023	6:53:50 AM	9,030.67
951	29/12/2023	10:30:33 AM	9,072.59
952	29/12/2023	6:15:37 PM	8,846.70
953	29/12/2023	12:38:51 AM	8,988.76
954	29/12/2023	4:29:39 AM	9,005.24
955	30/12/2023	9:26:03 AM	8,713.18
956	30/12/2023	1:21:31 PM	9,019.96
957	30/12/2023	7:53:40 PM	9,041.51
958	30/12/2023	11:15:43 PM	9,056.45

Appendix B - Noise Monitoring Results (Spectrum Acoustics, 2023)

Table B.1 Noise Monitoring Results January 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:00pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	10:55pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:13pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:33pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.2 Noise Monitoring Results February 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	11:30pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	10:55pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:50pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	1209:pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R7 (Site 7) Spiteri	10:00pm	<20	N/A	N/A	35	Yes	<20	45	Yes	<20	N/A	N/A

Table B.3 Noise Monitoring Results March 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:13pm	<20	<30-33	Yes	35	Yes	25	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	11:05pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:27pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:47pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.4 Noise Monitoring Results April 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:00pm	33	<30-33	Yes	35	Yes	<20	45	Yes	33	40	Yes
R3 (Site 3) W. Bowman	10:51pm	32	<30-34	Yes	35	Yes	<20	45	Yes	32	40	Yes
R3 (Site 5) Camberwell South	11:13pm	<30	<30-34	Yes	35	Yes	<20	45	Yes	30	40	Yes
R4 (Site 6) Camberwell North	11:33pm	<29	<30-34	Yes	35	Yes	<20	45	Yes	29	40	Yes

Table B.5 Noise Monitoring Results May 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:37pm	29	<30-33	Yes	35	Yes	<20	45	Yes	29	40	Yes
R3 (Site 3) W. Bowman	11:32pm	29	<30-34	Yes	35	Yes	<20	45	Yes	29	40	Yes
R3 (Site 5) Camberwell South	11:44pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	12:03am	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R7 (Site 7) Spiteri	10:02pm	<20	N/A	N/A	35	Yes	<20	45	Yes	<20	N/A	N/A

Table B.6 Noise Monitoring Results June 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:16pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	29	40	Yes
R3 (Site 3) W. Bowman	11:06pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:26pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:45am	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.7 Noise Monitoring Results July 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:00pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	10:49pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:11pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:30pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.8 Noise Monitoring Results August 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:39pm	24	<30-33	Yes	35	Yes	<20	45	Yes	24	40	Yes
R3 (Site 3) W. Bowman	11:30pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:50pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	12:06am	<20	<30-34	Yes	35	Yes	<20	45	Yes	20	40	Yes
R7 (Site 7) Spiteri	10:01pm	<20	N/A	N/A	35	Yes-	<20	45	Yes	<20	N/A	N/A

Table B.9 Noise Monitoring Results September 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:16pm	<20	<30-33	Yes	35	Yes	33	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	11:06pm	<20	<30-34	Yes	35	Yes	34	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:26pm	<20	<30-34	Yes	35	Yes	30	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:46pm	<20	<30-34	Yes	35	Yes	32	45	Yes	<20	40	Yes

Table B.10 Noise Monitoring Results October 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:03pm	24	<30-33	Yes	35	Yes	<20	45	Yes	24	40	Yes
R3 (Site 3) W. Bowman	10:56pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:18pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:38pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Table B.11 Noise Monitoring Results November 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	11:05pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	11:54pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	12:16am	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	12:35am	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R7 (Site 7) Spiteri	10:27pm	<20	N/A	N/A	35	Yes	<20	45	Yes	<20	N/A	N/A

Table B.12 Noise Monitoring Results December 2023

Site	Time	Ravensworth Contribution LAEQ (dB)	EA Prediction	Within Predicted level	Compliance Limit	Compliant	LA1 Ravensworth Contribution	LA1 Criterion (dB)	Compliant	Cumulative Noise LAEQ(dB)	Criteria	Compliant
R2 (Site 2) A. Bowman	10:01pm	<20	<30-33	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 3) W. Bowman	10:50pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R3 (Site 5) Camberwell South	11:12pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes
R4 (Site 6) Camberwell North	11:33pm	<20	<30-34	Yes	35	Yes	<20	45	Yes	<20	40	Yes

Appendix C - Blast Monitoring Results

Table C.1 Annual Blast Overpressure Monitoring Results

	Bowmans	Camberwell Village	Camberwell Church	Chain of Ponds Hotel	Ravensworth Public School	Ravensworth Homestead
Limit	120	120	120	133	133	126
Limit 5% up to 120 dBL	115	115	115	N/A	N/A	N/A
EA Prediction	115	115	N/A	N/A	N/A	115
Min	77.3	76.5	75.8	66.4	82.3	74.1
Mean	94.9	92.5	93.5	97.1	97.9	97.6
Max	113.8	112.8	113.6	112.9	120.4	114.1
Blast Events Exceeding 120 dBL	0	0	0	N/A	N/A	N/A
Blast Events Exceeding 115dBL	0	0	0	N/A	N/A	N/A
% > 115 dBL up to 120 dBL	0	0	0	N/A	N/A	N/A

Table C.2 Annual Vibration Monitoring Results

	Bowmans	Camberwell Village	Camberwell Church	Chain of Ponds Hotel	REA 86 Grinding Grooves	Rav West (HVO conveyor)	Powerline	Ravensworth Public School	Ravensworth Homestead
Limit	10	10	10	10	175	100	50	10	10
Limit 5% up to 10mm/s	5	5	5	N/A	N/A	N/A	N/A	N/A	N/A
EA Prediction	5	5	5	N/A	N/A	N/A	N/A	N/A	N/A
Min	0.1	0.01	0.1	0.03	0.01	0.12	0.1	0.03	0.1
Mean	0.09	0.08	0.06	0.98	0.52	4.10	3.19	0.24	0.081
Max	0.77	0.47	0.34	0.89	4.06	74.87	18.16	2.12	0.51
Blast events exceeding 10mm/s	0	0	0	0	N/A	N/A	N/A	0	0
Blast events exceeding 5mm/s	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
%> 5mm/s up to 10mm/s	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A

Appendix D - Air Quality Monitoring Results

Table D.1 Daily PM10 Averages 2023

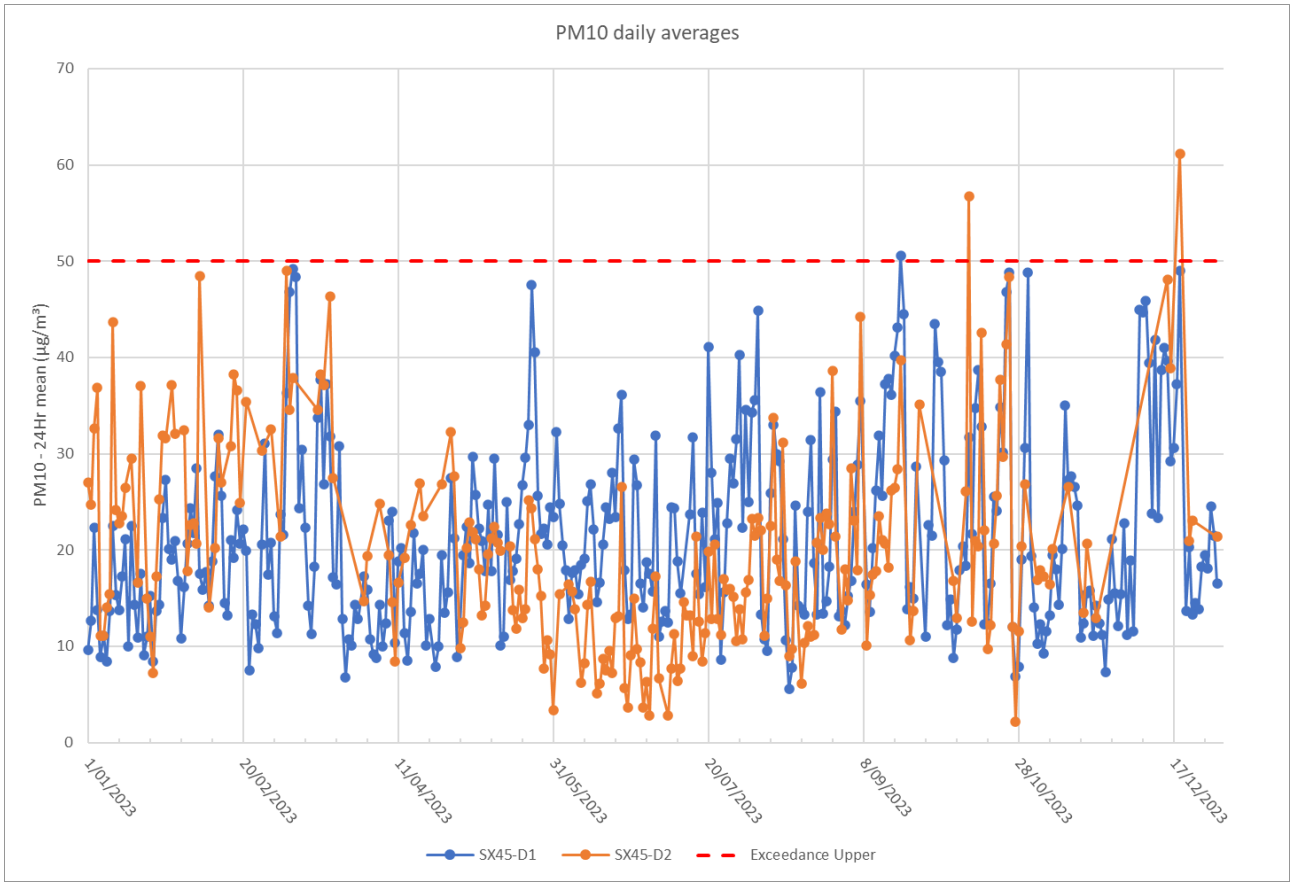


Table D.2 Total Suspended Particulates HVA (Church) 2023 Results

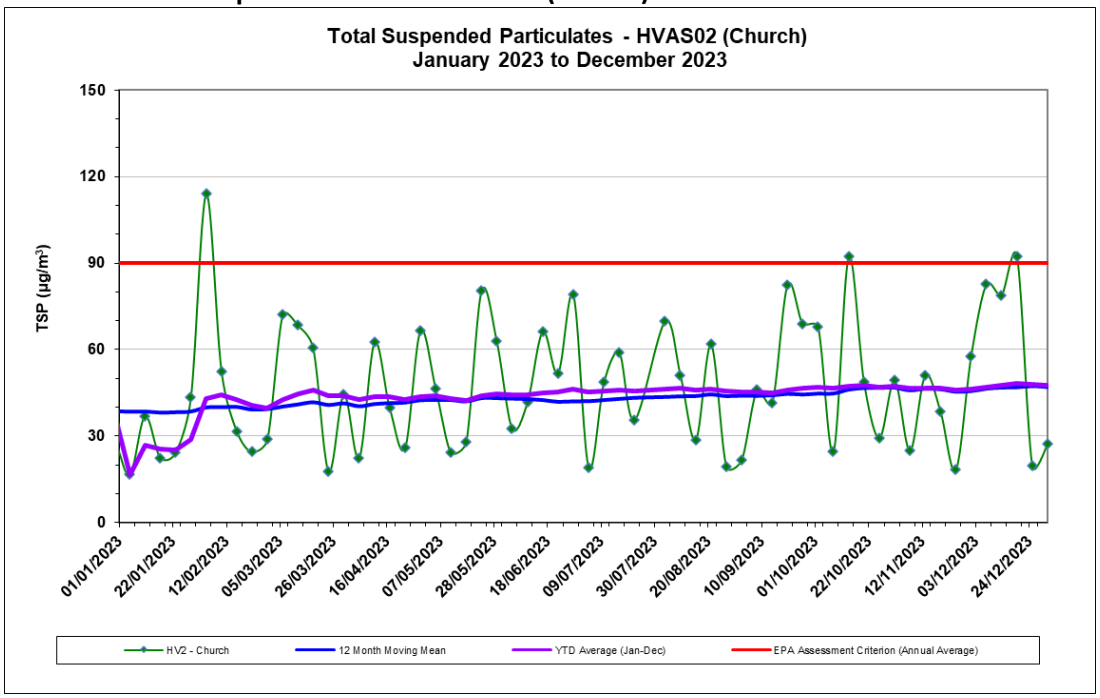


Table D.4 Total Suspended Particulates HVA S05 (Stapleton) 2023 Results

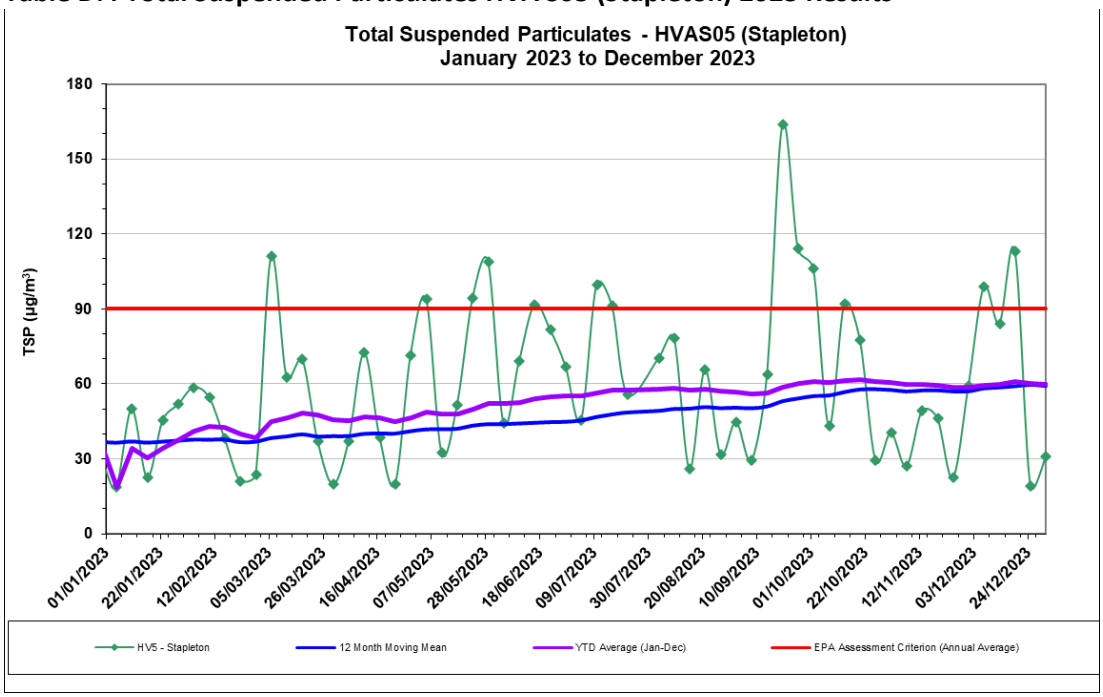


Table D.5 PM10 – HVAS19 (Church) 2022 Results

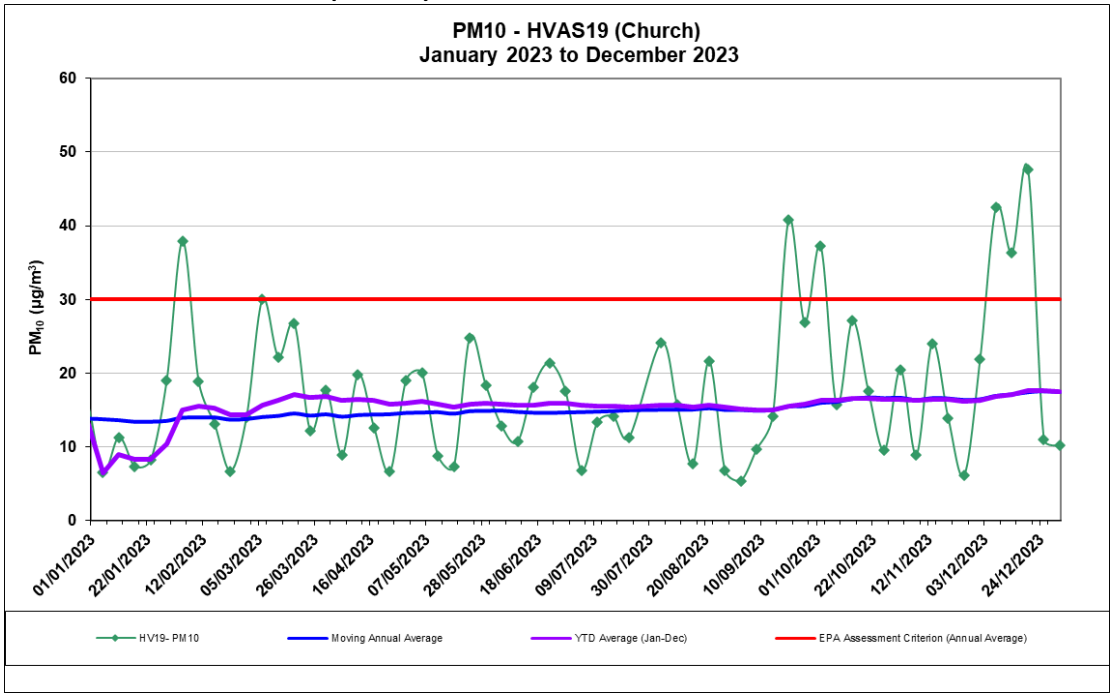


Table D.6 PM_{10} 24 hr Exceedances above 50 µg/m³ during 2023

Date	TEOM Unit	Result (µg/m³)
20/09/2023	TEOM G1	50.60
12/10/2023	TEOM G2	62.1
19/12/2023	TEOM G2	56.70

Appendix E - Meteorological Monitoring Results

Table F.1 Meteorological Results 2023

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
01-Jan-23	70.8	23.6	3.3	112	0	18.9
02-Jan-23	67.6	23.7	2.4	118	0	27.6
03-Jan-23	58.3	25.6	2.6	123	0	27.1
04-Jan-23	67.5	23.3	3	122	11.6	21.3
05-Jan-23	78.8	18.8	4	136	5.6	15.3
06-Jan-23	72.2	18.7	2.8	148	0.2	21.0
07-Jan-23	76.1	19.4	3.5	131	0.2	14.8
08-Jan-23	62.6	21.2	2.7	116	0	21.5
09-Jan-23	56.6	22.5	1.6	91	0	29.5
10-Jan-23	64.3	21.9	2.5	89	0	23.6
11-Jan-23	62.7	22.9	3.1	111	0	19.0
12-Jan-23	66.9	23.2	3.1	114	0	21.2
13-Jan-23	67.4	23.6	3.1	105	0	18.2
14-Jan-23	64.8	23.7	3.1	117	0	22.8
15-Jan-23	59.9	25.4	1.6	104	0	28.7
16-Jan-23	65.2	24.1	4.1	104	0	16.2
17-Jan-23	66.6	24	3	98	0	22.2
18-Jan-23	56.8	26.4	0.6	103	0	36.0
19-Jan-23	85.6	20.2	1.8	136	10	20.7
20-Jan-23	78.3	18.9	3.4	118	0.4	15.4
21-Jan-23	64.8	21.1	3.1	111	0	21.1

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
22-Jan-23	82.8	19.3	2.7	122	4.8	16.1
23-Jan-23	73.2	21.3	2.3	117	0	26.1
24-Jan-23	65.9	24.3	1.8	113	0	27.9
25-Jan-23	64	25.5	1.9	123	0	28.3
26-Jan-23	62	27.3	0.4	184	3.4	28.7
27-Jan-23	70.2	25.5	2.6	110	0	21.8
28-Jan-23	64.4	28.2	0.7	134	0	30.1
29-Jan-23	61.8	27.4	0.5	161	0.4	26.4
30-Jan-23	70.6	22.6	0.9	149	18	20.9
31-Jan-23	65.5	23.8	1.4	110	3	28.9
01-Feb-23	68.3	24.6	1.3	119	0	30.2
02-Feb-23	53.4	27.7	1.6	229	0	19.7
03-Feb-23	32.3	26.8	3.9	259	0	15.6
04-Feb-23	29.7	23	3.4	258	0	22.3
05-Feb-23	37.5	23.3	1.1	131	0	30.0
06-Feb-23	63.1	23.9	1.9	124	0	27.7
07-Feb-23	68	24.8	3.6	120	0	20.6
08-Feb-23	64.8	24	4	119	0	16.3
09-Feb-23	82.2	21.7	1.2	127	10.2	25.4
10-Feb-23	44.3	24.4	0.4	191	0	31.7
11-Feb-23	54	27.5	1.6	294	0	23.2
12-Feb-23	47.5	27.1	1.1	106	0	30.9
13-Feb-23	68.9	23.3	3.8	112	0	16.1

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
14-Feb-23	74.8	21.2	3.3	118	0	16.8
15-Feb-23	61.7	22.8	3.2	115	0	19.2
16-Feb-23	56	23.9	1.2	112	0	27.2
17-Feb-23	57.7	26	1.2	121	0	27.5
18-Feb-23	60.4	26.4	0.4	208	12	30.8
19-Feb-23	75.4	24.3	2.6	124	0	19.4
20-Feb-23	66.9	26	1.1	112	0	24.1
21-Feb-23	71.1	24.5	1.7	120	0	28.1
22-Feb-23	50	19.2	3.5	149	77.2	14.4
23-Feb-23	79.8	19.6	3.3	114	0.2	17.3
24-Feb-23	67.8	21	2.9	111	0	17.1
25-Feb-23	66.4	21	1.1	134	0	27.7
26-Feb-23	63	24.4	1	295	0	27.0
27-Feb-23	64.8	25.3	0.4	278	6.6	28.5
28-Feb-23	81.5	23.8	3	119	0	16.8
01-Mar-23	58.5	24.9	0.8	99	0	23.8
02-Mar-23	68.4	23.5	3.3	112	0	15.5
03-Mar-23	35.5	22.8	2.7	114	0	20.2
04-Mar-23	69.7	22.4	2.9	112	0	18.4
05-Mar-23	63.8	23.9	0.7	100	0	31.1
06-Mar-23	47.1	29.5	3.2	292	0	21.4
07-Mar-23	31.4	31.7	3.5	272	0	16.3
08-Mar-23	24.6	27.5	3.3	257	0	21.0

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
09-Mar-23	40	23.2	1.5	252	0	23.1
10-Mar-23	64.7	22.2	1.7	120	0	25.0
11-Mar-23	66.3	24.1	0.7	275	0	26.9
12-Mar-23	69.9	24.1	1.7	143	7.8	20.7
13-Mar-23	76.5	20.8	2.9	134	8.4	18.2
14-Mar-23	89.3	21.3	2.8	137	1.4	16.8
15-Mar-23	62.6	23.9	0.8	101	0	30.4
16-Mar-23	42.5	27.5	1.8	280	0	24.3
17-Mar-23	43.2	27	1.2	125	0	24.5
18-Mar-23	65.7	25.9	0.4	101	0	33.6
19-Mar-23	50.1	28.2	0.6	317	0	30.9
20-Mar-23	73	22.8	3	112	0	17.0
21-Mar-23	73.8	20.5	3.3	116	0	17.0
22-Mar-23	70.8	21.9	1.8	127	0	25.6
23-Mar-23	71	23.5	1.1	260	4	25.6
24-Mar-23	77.1	22.3	1.7	125	0.2	22.6
25-Mar-23	79.5	20.6	3.2	127	14.4	16.5
26-Mar-23	80.9	21.5	2.7	134	0	19.4
27-Mar-23	60.8	19.6	0.4	297	29.2	30.3
28-Mar-23	77.2	21.6	0.6	140	13.2	29.8
29-Mar-23	60.9	21.8	1.8	282	8.4	24.2
30-Mar-23	55.2	20.1	2.4	259	0	21.2
31-Mar-23	50.5	19.1	2	272	0	28.2

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
01-Apr-23	61.1	18.3	0.6	137	0	26.7
02-Apr-23	72.7	18.2	2.4	129	0	19.0
03-Apr-23	78.4	19.1	2.8	107	0	17.6
04-Apr-23	76.2	19.5	2.5	116	0.2	17.7
05-Apr-23	78.8	18.3	1.1	94	0	22.7
06-Apr-23	76.5	18.3	1.6	95	0	21.3
07-Apr-23	79	18.7	1.4	302	2	25.2
08-Apr-23	55.8	19.6	5.2	270	0	13.7
09-Apr-23	47	17.7	4.9	269	0	14.5
10-Apr-23	48	15.7	2.9	258	0	19.6
11-Apr-23	53.2	15.7	1.3	300	0	26.3
12-Apr-23	65.9	16.2	1.1	277	2	23.5
13-Apr-23	79.8	17.2	0.5	201	1.8	27.5
14-Apr-23	81.6	17.5	1.4	135	2.2	20.7
15-Apr-23	69.3	18.1	0.4	344	0.2	28.4
16-Apr-23	59.7	20.7	2.6	264	0	21.8
17-Apr-23	68.4	16.1	1.7	96	0	20.9
18-Apr-23	72	16.8	1.8	104	0	22.3
19-Apr-23	71.4	17.4	0.5	65	0	27.0
20-Apr-23	93.9	16	1.5	142	7.2	18.9
21-Apr-23	78.4	17	2	124	0	17.5
22-Apr-23	85.3	16.6	1.4	129	0.2	22.0
23-Apr-23	86.7	16.8	1.6	131	0	19.6

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
24-Apr-23	78.7	18.5	2.7	114	0.6	16.4
25-Apr-23	74.7	18.2	1.5	111	0	20.7
26-Apr-23	76.3	16.4	1.5	81	0	24.2
27-Apr-23	74	16.9	0.5	94	0	27.8
28-Apr-23	71.1	18	0.7	325	0	25.3
29-Apr-23	76.1	17.3	0.5	285	19.2	20.7
30-Apr-23	72.4	15.9	2.8	281	0.4	18.2
01-May-23	65.2	14.4	3.2	267	0	19.1
02-May-23	58.8	16.8	3.5	277	0	15.5
03-May-23	57	18.4	4.1	270	0	15.8
04-May-23	55	14.5	0.6	295	0	32.3
05-May-23	68.4	12.4	0.6	341	0	27.0
06-May-23	59.7	14	1.1	291	0	23.8
07-May-23	60.9	11.1	3.1	275	0	19.4
08-May-23	52.4	11.2	3.9	283	0	19.8
09-May-23	58.9	12.3	1.2	291	0	25.6
10-May-23	68.9	12.5	0.9	72	0	22.5
11-May-23	76.2	13.1	0.7	81	0	21.9
12-May-23	75.7	13.6	0.3	359	0	22.9
13-May-23	79.2	13.6	1.2	86	0	23.4
14-May-23	80.6	14.6	1.8	104	0	17.1
15-May-23	84.1	15.2	0.6	79	0	27.0
16-May-23	76.2	14.7	0.5	52	0	25.0

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
17-May-23	77.2	12.2	1.4	137	0.2	19.6
18-May-23	78.1	11.1	0.7	350	0.2	28.1
19-May-23	69.1	11.2	1.3	324	0.2	30.1
20-May-23	53.5	12.4	3	280	0	21.1
21-May-23	55.3	14.2	3.8	275	0	15.8
22-May-23	59.3	12.8	1	314	0	28.1
23-May-23	49.9	13.4	0.4	291	0	29.3
24-May-23	51.7	12.6	0.9	326	0	23.9
25-May-23	32	16.2	1.8	287	0	18.5
26-May-23	50	15.3	2	258	1	17.8
27-May-23	63.1	10.9	1.8	275	0	21.4
28-May-23	57.2	10.9	2.6	282	0	23.9
29-May-23	51.7	14.8	4	279	0	13.4
30-May-23	56.5	15.3	3.2	280	0	15.0
31-May-23	56.7	16.5	3.5	277	0	13.9
01-Jun-23	53.9	18.5	3.2	281	0	15.8
02-Jun-23	76.7	15.2	0.7	106	0	25.1
03-Jun-23	76	17.4	0.1	1	0	26.6
04-Jun-23	79.8	16.2	2.7	119	0.2	16.7
05-Jun-23	71.2	15.3	2.8	123	0	17.7
06-Jun-23	83.5	13.2	0.5	65	0	25.0
07-Jun-23	86.9	11.8	0.7	24	0	25.6
08-Jun-23	84.8	13	1.8	296	1.4	20.8

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
09-Jun-23	64.5	14.4	3.9	275	0.2	15.0
10-Jun-23	63.9	12.5	1.2	290	0	23.1
11-Jun-23	74	9.9	0.4	11	0	25.3
12-Jun-23	75.6	11.8	0.6	319	0	26.0
13-Jun-23	82.5	12.3	2	303	1.2	20.1
14-Jun-23	63.1	12.8	3.6	277	0.2	14.3
15-Jun-23	57	11.8	2.6	275	0	20.9
16-Jun-23	65.9	10.2	1.2	317	0	24.3
17-Jun-23	65.8	10.6	1.1	312	0	26.4
18-Jun-23	50.8	13.2	2.3	274	0	22.3
19-Jun-23	49.2	11.4	3.9	273	0	14.4
20-Jun-23	57	9.5	2.2	289	0	20.9
21-Jun-23	63.1	7.8	0.6	74	0	25.7
22-Jun-23	78	8.9	0.3	4	1.2	22.5
23-Jun-23	69	13.1	3.9	271	4.8	18.1
24-Jun-23	51	13.1	3.9	286	0	12.8
25-Jun-23	45.1	14.5	4	259	0	12.2
26-Jun-23	39.7	14.1	4.8	277	0	12.6
27-Jun-23	52.6	13.5	2.4	278	0	20.2
28-Jun-23	73.1	11.8	2.1	279	0.8	18.7
29-Jun-23	62.8	11.1	3.5	282	0	20.0
30-Jun-23	56.3	10.9	4.6	287	0	13.5
01-Jul-23	63	12	3.4	291	0	19.7

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
02-Jul-23	71.3	10.8	0.9	47	0	23.8
03-Jul-23	81.9	11.4	0.7	79	0	23.1
04-Jul-23	96.7	12	0.4	30	8.8	21.2
05-Jul-23	77.3	15.4	3.7	281	0	14.7
06-Jul-23	71.9	13.5	3.2	284	0	13.4
07-Jul-23	61.1	12.9	4.8	276	0	12.6
08-Jul-23	52	13.9	5.8	274	0	12.3
09-Jul-23	53.3	14	5.1	279	0	11.9
10-Jul-23	59.1	13.3	3.9	291	0	13.0
11-Jul-23	66.5	10.1	1.3	292	0	21.2
12-Jul-23	73.5	8.8	0.6	18	0.4	24.4
13-Jul-23	67.4	11.4	1.4	309	0	21.6
14-Jul-23	61.1	13.9	2.1	295	0	20.5
15-Jul-23	56	15.9	2.6	289	0	19.2
16-Jul-23	69.3	14.6	1.4	127	0	21.2
17-Jul-23	80.3	14.8	1.6	109	0	21.7
18-Jul-23	72.3	14.3	1.6	289	0	22.0
19-Jul-23	58.7	12	0.5	328	0	32.6
20-Jul-23	52.6	9.8	2	302	0	18.6
21-Jul-23	54.6	11.8	1.7	284	0	22.9
22-Jul-23	67.9	8.5	1	357	0	26.5
23-Jul-23	74	9.2	0.9	57	0	24.2
24-Jul-23	83.8	11.9	0.7	81	0.6	24.1

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
25-Jul-23	80.3	11	0.7	73	0	22.9
26-Jul-23	75.2	11	0.9	319	0	20.9
27-Jul-23	70.6	11.3	1	338	0	24.1
28-Jul-23	56.7	15.5	2.4	298	0	19.3
29-Jul-23	53.3	17.9	1.3	284	0	25.2
30-Jul-23	60.3	17.9	2.7	284	0	17.3
31-Jul-23	58	17.3	2.2	285	0	20.7
01-Aug-23	52.8	15.3	1	287	0	23.1
02-Aug-23	70.8	13.9	2.1	111	0	19.5
03-Aug-23	77.5	12.1	0.7	349	0	24.8
04-Aug-23	63	13.2	0.9	318	0	22.4
05-Aug-23	59.4	14.8	0.7	296	0	23.9
06-Aug-23	81.8	13.4	1.4	101	0.2	17.9
07-Aug-23	75.3	13.6	1.3	87	0	22.6
08-Aug-23	73.6	12.7	1.3	86	0	20.6
09-Aug-23	69.9	11.7	0.9	339	0	27.9
10-Aug-23	49.9	15.9	2.8	280	0	20.2
11-Aug-23	54.3	12.5	0.8	335	0	31.1
12-Aug-23	44.2	15.9	1.7	257	0	25.6
13-Aug-23	77.6	14.2	0.2	326	1.8	28.6
14-Aug-23	89.9	13	1.3	272	8.8	26.4
15-Aug-23	77.8	13.5	1	95	0.2	29.0
16-Aug-23	74.7	12.7	0.3	120	0.2	31.5

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
17-Aug-23	70.1	13.1	1.2	281	11.6	22.0
18-Aug-23	66	14.2	2.5	317	7.2	13.8
19-Aug-23	56.3	12.3	4.9	29	0	8.5
20-Aug-23	59.7	15.1	2.5	18	0	1.9
21-Aug-23	65.4	13.5	2	15	0	0.8
22-Aug-23	58.9	15.8	2	16	0	1.8
23-Aug-23	57	15.8	2.3	12	0	2.3
24-Aug-23	67.9	15	2.6	2	0	4.9
25-Aug-23	64.3	13.7	0.9	52	0	11.6
26-Aug-23	72.2	13.2	1.6	108	0	21.7
27-Aug-23	72.1	13.8	0.8	96	0	26.9
28-Aug-23	70.8	14.1	0.9	92	0	27.0
29-Aug-23	63.2	14.6	0.7	340	0	24.4
30-Aug-23	58.9	16.4	1.6	303	5.8	24.0
31-Aug-23	76.6	15.2	0.4	195	0.2	27.2
01-Sep-23	63.5	14.2	1	78	0	27.3
02-Sep-23	67.2	12.6	1.1	92	0	26.0
03-Sep-23	69.3	13.9	1.3	107	0	23.8
04-Sep-23	71.3	15.1	1	93	0	28.1
05-Sep-23	44.7	18.5	2.6	270	0	23.5
06-Sep-23	47.9	15.1	0.2	187	0	28.2
07-Sep-23	54.3	19	1.9	308	0	31.1
08-Sep-23	61.9	16.1	3.6	279	8.2	21.3

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
09-Sep-23	50.2	12.8	2.5	279	0	18.7
10-Sep-23	56.4	11.5	0.6	69	0	30.6
11-Sep-23	63	12.2	0.9	89	0	26.1
12-Sep-23	64.1	13.9	0.2	49	0	27.8
13-Sep-23	61.8	16	0.2	118	0	27.7
14-Sep-23	56.5	16.7	0.9	72	0	25.8
15-Sep-23	51.1	17.8	1.1	307	0	23.7
16-Sep-23	37.9	22.7	2.1	287	0	22.9
17-Sep-23	35.7	23.6	1	260	0	25.0
18-Sep-23	42.1	22.3	1.2	327	0	27.1
19-Sep-23	34	24.2	2.2	297	0	23.3
20-Sep-23	27.1	26.1	3.9	287	0	17.8
21-Sep-23	39.5	21.6	1.2	156	0	23.0
22-Sep-23	57.3	15.2	3.1	116	0	17.7
23-Sep-23	64	13.2	2	105	0	22.7
24-Sep-23	61.5	14.9	1.9	110	0	23.0
25-Sep-23	53.7	17.5	1	279	0	23.7
26-Sep-23	57.2	19.5	1.1	120	0.6	23.0
27-Sep-23	71.9	19.7	1	147	4.6	23.6
28-Sep-23	76.2	18.6	3	130	0.2	19.0
29-Sep-23	59.2	21.3	0.9	259	0	22.5
30-Sep-23	57.6	22.6	0.4	293	0	32.7
01-Oct-23	40.6	25.7	3.6	294	0	19.6

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
02-Oct-23	56	22.3	2.6	127	0	19.7
03-Oct-23	47.2	24.7	2.6	292	0	19.5
04-Oct-23	56.4	20.5	2.4	276	14.4	23.5
05-Oct-23	47.8	16	5.5	263	0	14.6
06-Oct-23	49.5	16.1	1.2	101	0	28.0
07-Oct-23	63.9	15.4	3	119	0.4	16.9
08-Oct-23	60.1	15.4	2	107	0	22.8
09-Oct-23	54.4	17.7	0.9	259	0	28.9
10-Oct-23	62.6	18	1.8	104	0	24.3
11-Oct-23	58.5	21.2	0.9	146	0	30.7
12-Oct-23	45.5	23.3	3.3	292	0	21.2
13-Oct-23	35.8	18.8	2.8	259	0	21.6
14-Oct-23	42.5	20.3	2.9	273	0	18.6
15-Oct-23	36.2	22.4	2.1	241	0	23.8
16-Oct-23	39	20.1	3.9	237	0	19.5
17-Oct-23	48.4	15.4	2.8	134	0	19.9
18-Oct-23	67	16	2.5	93	0.4	20.3
19-Oct-23	60.9	18.2	2.5	124	0	21.0
20-Oct-23	56.7	20.6	0.9	110	0	28.1
21-Oct-23	54.9	23.7	0.3	261	0	29.6
22-Oct-23	42.7	24.4	2.8	245	0	23.8
23-Oct-23	29.6	22	1.8	248	0	22.7
24-Oct-23	39.3	23.2	1.5	297	0	25.2

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
25-Oct-23	30.8	25.6	1.8	200	0	18.1
26-Oct-23	79.7	13.9	3.3	129	19.2	16.2
27-Oct-23	79.8	13.6	4.1	142	3.2	15.1
28-Oct-23	67.7	15.1	2	115	0	21.6
29-Oct-23	55.8	18.2	0.6	330	0	32.5
30-Oct-23	42.8	22.8	2.5	299	0	20.7
31-Oct-23	35	24.5	1.3	210	0	23.9
01-Nov-23	59.5	18.8	3.8	112	0	18.4
02-Nov-23	60.8	19.1	3.1	113	0	20.1
03-Nov-23	66.7	19.6	3	120	0	20.7
04-Nov-23	66.5	20.2	3.5	122	0	17.6
05-Nov-23	77.7	17.5	3.8	119	0.4	16.5
06-Nov-23	64	17.9	3.4	111	0	17.5
07-Nov-23	62.6	19.1	1.2	127	0	30.3
08-Nov-23	61.9	20.5	0.4	283	0	32.3
09-Nov-23	71.1	20.6	0.7	329	6	29.3
10-Nov-23	66.9	21.9	0.8	167	0.2	27.1
11-Nov-23	55.8	25.2	1	287	0	29.3
12-Nov-23	39.1	30.2	3	276	0	20.7
13-Nov-23	62.5	21.5	4.1	106	0	16.6
14-Nov-23	57.1	23	1.2	166	0	25.6
15-Nov-23	61.6	23.8	0.9	136	0	22.6
16-Nov-23	65.4	23.4	1.4	150	0	24.7

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
17-Nov-23	68.7	19.1	2.8	126	0.8	17.7
18-Nov-23	58.2	19.7	3.2	113	0	18.4
19-Nov-23	54	22.3	1.4	116	0	25.6
20-Nov-23	73.1	20.8	0.6	101	1.2	29.4
21-Nov-23	67.1	21.8	0.9	78	0.2	29.6
22-Nov-23	69.7	21.8	3.2	99	0	17.1
23-Nov-23	73.8	21.3	2.7	110	0	15.8
24-Nov-23	82	21.1	2.4	124	9.8	18.3
25-Nov-23	83.3	20.6	0.9	248	6.2	23.2
26-Nov-23	58.8	24.5	3	271	0	17.6
27-Nov-23	63.5	23.4	2	125	0	24.4
28-Nov-23	86	21.4	2.9	130	34.8	16.4
29-Nov-23	75.6	22.7	0.3	143	0.2	29.2
30-Nov-23	48.6	25	4.4	257	0	15.8
01-Dec-23	47.2	25.8	2.2	255	0	19.5
02-Dec-23	65.8	23.4	1.3	236	1.2	22.6
03-Dec-23	56.2	23.8	1.4	148	0	22.7
04-Dec-23	61.1	22.1	3.1	115	0	19.4
05-Dec-23	47.9	27	1.3	283	0	29.0
06-Dec-23	45.1	27.7	2.2	106	0	19.7
07-Dec-23	62	25.9	2.3	119	0	29.8
08-Dec-23	51.3	29.8	1	289	0.2	31.7
09-Dec-23	40.5	33.3	1.8	265	0	23.4

Date/Time Sampled	Mean Relative Humidity (%)	Mean Air Temperature @ 10m (°C)	Mean Wind Speed @ 10m (m/s)	Mean Wind Direction @ 10m (°)	Total Rainfall (mm)	Sigma Theta
10-Dec-23	63.6	26.4	4.6	133	0	15.9
11-Dec-23	61.8	26.9	2.6	110	0	26.2
12-Dec-23	63.4	25.2	4.1	118	0	17.6
13-Dec-23	56.8	28.3	1	132	0	35.7
14-Dec-23	33.5	32.8	3.3	248	0	18.6
15-Dec-23	57.1	26.2	3.4	116	0	20.4
16-Dec-23	47.8	27.5	2.2	230	0	20.5
17-Dec-23	62.3	24.8	4.2	117	0	17.1
18-Dec-23	62.2	28	2.8	124	0	24.1
19-Dec-23	63.7	27.1	1.6	328	9.6	23.1
20-Dec-23	90.9	19.9	1.4	144	31.8	18.1
21-Dec-23	74.8	19.7	2.9	136	0.2	17.5
22-Dec-23	57.2	21.1	2.8	118	0	21.2
23-Dec-23	67.5	21	1.1	91	12.4	31.3
24-Dec-23	80.2	20.7	1.3	132	12.8	26.3
25-Dec-23	74.3	22.7	2.5	124	0.6	23.1
26-Dec-23	63	25.5	1	274	0	31.9
27-Dec-23	50	24.4	1.6	254	0	22.3
28-Dec-23	52.5	26.1	1.8	243	0	23.0
29-Dec-23	59.8	25.1	1.7	265	0	23.2
30-Dec-23	53.1	25.6	1.8	132	0	26.1
31-Dec-23	74.5	20.1	4.2	116	0	16.8

Appendix F - Annual Review Water Summary Report

ENGENY

RAVENSWORTH OPERATIONS

2023 Annual Review

Water Summary Report

NC1000_023-REP-001-1

15 MARCH 2024

DISCLAIMER

This Report has been prepared on behalf of and for the exclusive use of Ravensworth Operations and is subject to and issued in accordance with Ravensworth Operations instruction to Engeny Australia Pty Ltd (Engeny). The content of this Report was based on previous information and studies supplied by Ravensworth Operations.

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Rev	Date	Description	Author	Reviewer	Project Mgr.	Approver
0	4/03/2024	Client Issue	Georgia Cowen	Laura Vincent	Laura Vincent	Chris Bonomini
1	15/03/2024	Client Issue	Georgia Cowen	Laura Vincent	Laura Vincent	Chris Bonomini
Signatures:						

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1. OVERVIEW

1.1 Scope

Ravensworth Operations comprises of the following operations:

- Ravensworth Open Cut (ROC),
- Ravensworth Underground Mine (RUM); and,
- Ravensworth Coal Handling and Preparation Plant.

This 2023 Annual Review Water Summary Report has been prepared for Ravensworth Operations in accordance with the requirements of Schedule 5, Condition 3 of PA 09_0176 and the monitoring program detailed in the Ravensworth Water Management Plan (WMP). The scope of this report includes:

- Identification of all water reporting requirements identified in PA 09_0176, DA 10/96 and the Ravensworth WMP and where each is addressed within the Annual Review Water Summary Report.
- A summary of all water monitoring results. This will involve:
  - Overview of surface water and groundwater monitoring and impact assessment criteria (IAC), in accordance with the monitoring program detailed in the Ravensworth Water Management Plan (WMP).
  - Preparation of updated surface water quality charts, groundwater quality charts and groundwater level contours for inclusion in the Annual Review appendices.
  - Preparation of summary tables of all recorded data, including identification of any exceedances of the IAC.
- Comprehensive review of the monitoring results and complaints records of the development over the past year, which includes a comparison of these results against the:
  - relevant statutory requirements, limits, or performance measures/criteria,
  - monitoring results of previous years; and,
  - relevant predictions in the EA.
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance.
- Comparison of surface water quality results against adopted trigger values/IAC documented in the latest version of the Ravensworth WMP, including a long-term trend analysis.
- Summary of the potential causes for any exceedances of the IAC and recommendations / corrective actions.
- Comparisons of surface water and groundwater extraction volumes with the relevant water access licence entitlement.
- Inclusion of the mine complex water balance results and comparison against the predictions in the EA.
  - Commentary regarding any volume error in the water balance results.
- Review of the effectiveness of erosion and sediment controls through:
  - Comparison of total suspended solids (TSS) and total dissolved solids (TDS) results with background levels.
- Recommendations on environmental management targets for the next year, including any changes to IAC, monitoring regimes or further investigations.

The 2023 Annual Review Water Summary Report covers the period from 1 January 2023 to 31 December 2023.

1.2 Water Management

Water management for Ravensworth Operations is detailed in the Ravensworth WMP (ROC, 2022). The WMP has been developed in order to satisfy the conditions of development consents and water access licenses (WALs) for the operations managed by Ravensworth Operations. The WMP:

- Details the water management strategies required by the development consent conditions in order to manage the quality and quantity of water on site and report on water quality in the area surrounding the mine; and,
- Outlines the management commitments and monitoring programs in place to address the specific requirements of the development consents relating to surface water and groundwater at Ravensworth Operations.

2. SURFACE WATER MONITORING

2.1 Surface Water Monitoring Program

The surface water monitoring program comprehensively oversees various facets of the Ravensworth Operations (RO) water management system (WMS) and the surrounding creeks. This includes the examination of:

- Surface water quality and flows in upstream and downstream watercourses.
- Channel stability on upstream and downstream watercourses (addressed separately).
- Stream health conditions in upstream and downstream watercourses (addressed separately).
- On-site water management.
- Discharge to the Hunter River via Bowmans Creek under the Hunter River Salinity Trading Scheme (HRSTS).

The specific surface water monitoring locations for watercourses can be found in Appendix A. Additionally, the monitoring program, as outlined in the WMP (ROC, 2022), incorporates the following elements:

- Daily Rainfall: Recorded from an on-site weather station.
- Water Level Monitoring: Regular monitoring of the main water storage dams.
- Water Level Monitoring of Other Dams: Conducted pre, during, and post rainfall events exceeding 20 mm in 24 hours.
- Monthly Volume of Imported Water: Compliance with relevant WAL requirements.
- Monthly Monitoring of Dams: Assessing water quality parameters such as pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), and Total Suspended Solids (TSS).
- Six-Monthly Speciation Monitoring: Focused assessment of the Narama In-pit Storage Dam for metals, nutrients, and hydrocarbons.
- Dams in key locations including the infrastructure area are tested monthly for other analytes including:
  - BOD.
  - Oil and grease.
  - Phosphorus.
- Regular Inspections: Scheduled inspections of all sediment and erosion control structures, particularly during and after storm events (i.e., rainfall events exceeding 20 mm in 24 hours), in accordance with Ravensworth Operations Erosion and Sediment Control Plan.
- Hydrocarbon Monitoring If hydrocarbon contamination is suspected (visible sheen), prompt monitoring will be initiated. In case of confirmed contamination, appropriate remediation actions will be promptly undertaken.

2.2 Impact Assessment Criteria

Impact assessment criteria (IAC), also referred to as 'trigger values,' for pH, EC, TSS and TDS have been determined for specific receiving water monitoring locations as part of the WMP (ROC, 2022). All surface water quality data collected as part of the monitoring program are assessed against the IAC to identify deviations from the baseline water quality conditions. Surface water quality IAC are presented in Appendix A.

2.3 Surface Water Quality Monitoring Results

Water quality sampling is undertaken monthly at upstream and downstream locations along Bowmans Creek, Bayswater Creek and Emu Creek and every two months in Davis Creek and Pikes Creek, shown in Table A.1. Samples that were not collected according to this schedule was due to the site being too dry or inaccessible.

Statistical analyses of the 2023 water quality monitoring data for pH, EC, TDS and TSS and time-series charts (including all historical data) are presented in Appendix B. The IAC triggers are shown on the graphs for each watercourse.

2.4 Bowmans Creek

Five samples were gathered from the upstream site of Bowmans Creek (EPL3) and ten at the downstream monitoring location (EPL4).

The water quality analysis at the Bowmans Creek monitoring locations identified:

- Two pH results at EPL3 and four at EPL4 were outside of the IAC range.
- Nine EC results at EPL4 exceeded the IAC value.
- Three TSS results at EPL3 were outside of the IAC range, however all results were well below the historically recorded maximum value of 176 mg/L.
- Nine TDS results at EPL4 exceeded the IAC range.

The exceeding readings for EPL3 (pH and TSS) are within the historical ranges for the site and have not varied significantly from values recorded in 2022. Throughout 2023 EPL4s EC and TDS readings observe a positive trend; however, values remain within the sites historical range. A similar positive trend in EC and TDS values was observed throughout 2022, however, the 2023 readings been higher than recorded in 2022. The exceeding pH values at EPL4 were all above the upper IAC trigger limit and the 2023 exceeding values have all been below the lower IAC trigger. Despite this difference, pH values remained within the historical range across both years.

No immediate actions are recommended for EPL3, as elevated results are likely due to low flow conditions. The exceedance investigation (Engeny, 2024) also found that the elevated EC and TDS readings at EPL4 are likely due to low flow and pooling conditions at the sample site. However, further investigation is recommended to rule out other possible sources.

2.4.1 Bayswater Creek

Eleven water quality samples were collected from the Bayswater Creek upstream of ROC (W114) and seven water quality samples were collected from the Bayswater Creek downstream of ROC (W115) in 2023.

Twelve water quality samples were collected from the Bayswater Creek upstream of RUM (W10) and four water quality samples were collected from the Bayswater Creek downstream of RUM (W11) in 2023.

The water quality analysis at the Bayswater Creek monitoring locations identified:

- Two pH samples at both W11 and W115 exceeded the IAC range.
- One pH sample at W114 was outside of the IAC range.
- Ten EC samples at W10, three samples at W11, eleven samples at W114 and two samples at W115 exceeded the IAC limit.
- Three TSS samples at W10, four samples at W11, eleven samples at W114 and five samples at W115 were above the IAC limit.
- Ten TDS samples at W10, three samples at W11, eleven samples at W114 and two samples at W115 were above the IAC limit.

None of the Bayswater Creek exceeding samples deviated considerably from historical site trends. When comparing the 2023 readings to the 2022 readings the following was observed for each of the sites:

- W114: the 2023 recorded parameter (TDS, TSS, EC, and pH) have all been higher than typically observed throughout 2022. Elevated values are not considered to vary significantly, as they still remain within historical ranges for the site.
- W115: the 2023 January and February pH readings were higher than observed throughout 2022, however, all other 2023 pH readings returned to what was typical for 2022. TDS and EC readings were lower than previously recorded throughout 2022, however do not deviate from the historical range. The TSS readings at W115 have been higher in 2023 than throughout 2022.
- W10: the February - September 2023 EC and TDS readings are higher than recorded in 2022, however, all other readings are consistent with 2022 values. The November and December 2023 TSS readings are higher than recorded throughout 2022, however, all other TSS readings throughout 2023 were consistent with 2022 readings.
- W11: the pH readings have observed a positive trend since 2020, and in line with this trend the 2023 readings are slightly higher than observed throughout 2022. The TDS, TSS, and TDS readings at W11 were slightly higher throughout 2023 than throughout 2022.

The exceedance investigation (Engeny, 2024) stated that no immediate actions are required for each of the Bayswater Creek monitoring locations, as exceedances are likely related to samples being taken from low flow and pooling water conditions, which is consistent with the drier climatic conditions observed.

2.4.2 Davis Creek

Four water quality samples were collected at the Davis Creek upstream monitoring location (W152).

The water quality analysis at the Davis Creek monitoring locations identified:

- Two samples exceeded the IAC limit for TSS.
- Three samples exceeded the IAC limits for EC and TDS.

All parameter results for W152 have remained consistent with readings recorded throughout 2022 and have not deviated from historical ranges for the site. Field sheets for W152 stated that samples were taken from pooled or no flow conditions throughout 2023, and this is the likely cause of IAC exceedances. As such, the exceedance investigation (Engeny, 2024) indicated that no immediate actions are required for the site.

2.4.3 Pikes Gully Creek

One water quality sample was collected at the upstream monitoring location (W135), with one exceedance of the IAC value for pH and TSS. The one pH value recorded for 2023 was lower than all values recorded in 2022, however, it was within the historical range. The one TSS value recorded was above all values recorded in 2022, and outside of the historical range.

One water quality sample was collected from the New England Highway (W136), downstream monitoring location, with one exceedance value for pH. This value was below the lower IAC trigger level but did not vary significantly from values recorded throughout 2022 and was within the historical range for the site.

One water quality sample was collected at the downstream monitoring location CHPP Culvert (W137), with one exceedance of the IAC value for pH and TSS. The pH exceedance was considered minor as it remained within the default ANZECC trigger value range for lowland river systems of 6.5 to 8.5 and within the historical range for the monitoring location. Field sheets indicate that the monitoring location was dry for all months expect February and that the February sample was collected from pooled water. The exceeding values are likely a result of the pooled water conditions of the site and therefore no immediate actions are required. However, the exceedance investigation (Engeny, 2024) did recommend that pH IAC triggers be updated to account for variability at the site.

3. GROUNDWATER MONITORING

3.1 Groundwater Monitoring Program

The groundwater monitoring program includes assessment of the following elements of the alluvial and hard rock/coal measure aquifers underlying RO:

- Groundwater inflows / seepage into open cut pits and former underground workings.
- Groundwater quality monitoring, including:
  - pH.
  - EC.
  - Various trace elements (i.e., speciation).
- Groundwater levels and aquifer depressurisation.
- Impacts on groundwater dependent ecosystems and riparian vegetation.

Further details on the groundwater monitoring program are included in the WMP (ROC, 2022).

Data from the monitoring program is also used to estimate the groundwater seepage into former underground workings and open cut voids.

Details of the groundwater monitoring locations are provided in Appendix C.

During the 2023 monitoring period, the groundwater monitoring program included monthly monitoring of water levels, quarterly (minimum) monitoring of pH and EC, and six-monthly monitoring of inorganic species (speciation data).

3.2 Impact Assessment Criteria

All monitoring data collected as part of this program is assessed against established IAC in order to:

- Determine whether groundwater extraction volumes are within WAL limits and are comparable with modelled predictions.
- Identify deviations from the baseline water quality conditions.
- Identify deviations from the baseline groundwater level trends.

3.2.1 pH and EC

Site-specific IAC values for pH and EC have been determined for each monitoring location as part of the WMP (ROC, 2022). These values are presented in Appendix C.

3.2.2 Speciation Data

Where site-specific values are not defined at any location, interim and site specific (sodium and chloride) water quality IAC are based on the ANZECC (2000) guidelines as per WMP (ROC, 2022), using values from “Table 5.2.3 - Summary of water quality guidelines for recreational purposes”.

The interim and site-specific IAC values for speciation data are presented in Appendix C.

3.3 Groundwater Quality Results

3.3.1 Overview

Groundwater quality data for pH, EC, and trace elements (speciation) are provided in Appendix D.

A summary of the pH and EC results for each monitoring location is presented in Appendix D (Table D.1), with individual results presented in Appendix D (Table D.2 to Table D.4).

Historical pH and EC results for all current and decommissioned monitoring bores are presented in Figure D.1 to Figure D.6.

3.3.2 Alluvium and Underlying Weather Coal Measures

Quarterly monitoring of groundwater from the alluvium has been undertaken since 2009 at the monitoring location NPZ5B P2 and near Bayswater Creek upstream of the confluence with Emu Creek.

It is noted that NPZ7 Small, located near the Hunter River, is listed as a monitoring bore for the Hunter River alluvium in the site WMP (ROC, 2022), however, an investigation of groundwater trigger exceedances undertaken by Umwelt in 2021 confirmed that the bore is monitoring weathered Permian coal measures underlying the Hunter River alluvium. This corresponds with the water quality results for the bore that are more saline than what would be expected for the Hunter River alluvium.

The ranges in water quality for NPZ7 Small and NPZ5B P2 is shown in Appendix D (Table D.1 to Table D.5).

NPZ5B P2

Eleven of the twelve pH results for NPZ5B P2 (Bayswater Creek alluvium) were outside of the IAC range. An investigation of the trigger exceedances (Engeny, 2024) indicates that the exceedances are minor, consistent with historical trends and recommends the trigger value for pH be reviewed.

Water quality results for NPZ5B P2 (Bayswater Creek alluvium) have exhibited higher salinity levels than the Hunter River alluvium (NPZ7 (Small)) over 2023, with all twelve of the EC reading being above the IAC trigger level.

Analysis of specification results at NPZ5B P2 monitoring bore showed that:

- Both sodium readings were above the interim IAC of 300 mg/L, with values of 544 and 711 mg/L.
- Both sulfate readings above the interim IAC of 400 mg/L, with values of 431 and 520 mg/L.
- Both chloride readings were above the interim IAC limit of 400 mg/L, with values of 690 and 1,370 mg/L.
- Both iron readings above the interim IAC of 0.3 mg/L, with readings of 0.88 and 0.95 mg/L.
- Both manganese trigger exceedances of the interim IAC of 0.1 mg/L, with readings of 1.32 and 1.64 mg/L.

All other speciation results for NP75B P2 were below interim IAC values. When comparing 2023 results to what was recorded in 2022, the following is observed:

- pH values are generally consistent across 2022 and 2023.
- EC, Chloride, Sodium, Sulfate, Iron, and Manganese values have observed a positive trend over 2023, and readings are higher than observed in 2022.

The investigation of trigger exceedances (Engeny, 2024) indicated that there is no evidence that the elevated groundwater results at NPZ5B P2 are mining related. No immediate actions were required for this site; however, it was recommended that IAC trigger values be reviewed for all analytes.

NPZ7 Small

The pH results for NPZ7 Small show that pH was generally consistent with historical data, with only one value below the IAC trigger. The pH values ranged from 7.1 to 7.3 throughout 2023, this is consistent with the 2022 pH range. All EC readings were below the IAC limit of 5,259 µS/cm in 2023. All values throughout 2022 were also below the EC IAC limit.

Analysis of speciation results at NPZ7 (Small) monitoring bore showed consistent or reduced concentrations of sodium and chloride relative to historical and 2022 results:

- Both sodium results were below the adopted sodium IAC range.
- Both chloride results were below the adopted chloride IAC range.

All other speciation results for NPZ7 (Small) were below interim IAC values. The exceedance investigation (Engeny, 2024) identified that no immediate actions are required for the site, however, a review of the lower IAC trigger levels for Chloride and Sodium is recommended.

3.3.3 Bayswater Seam

Monitoring of groundwater quality in the Bayswater Seam occurs at NPZ7 Tall. Water quality results for NPZ7 Tall monitoring bore are shown in Appendix D (Table D.1 to Table D.5).

Six pH samples were obtained at NPZ7 Tall, with two samples containing laboratory results. Four of the field samples were outside the IAC range for pH. The pH values recorded for the site are generally consistent with the readings recorded in 2022, with five of these values being below the lower IAC limit.

There were two rounds of sampling for the specification results. Both chloride and sodium samples exceeded the IAC trigger limits, which is consistent with historical results and the values recorded in 2022. There has been a negative trend observed in the historical results for chloride and sodium, with all values since 2015 being below the lower sodium IAC and all values since 2018 being below the lower IAC for Chloride. One of the selenium readings was about the interim IAC limit of 0.01 mg/L, this value is within the historical range for the site and the same value was recorded in 2022. All other specification values for NPZ7 Tall were within the interim IAC trigger limits.

The exceedance investigation (Engeny, 2024) recommended that the condition of NPZ7 Tall be assessed for the potential influence of local rainfall recharge on water quality results. It is also recommended that the IAC trigger values be updated to reflect typical site conditions once an appropriate sample count has been attained.

3.3.4 Broonies Seam

Monitoring of groundwater quality in the Broonies Seam is undertaken at NPZ6 (Tall) and NPZ5B P1. Water quality results for NPZ5B P1 and NPZ6 Tall are presented in Appendix D (Table D.1 to Table D.5).

NPZ5B P1

The groundwater readings for 2023 at NPZ5B P1 borehole exceeded the IAC limit for the following:

- Six of the 12 pH readings outside of the IAC range of 7.2 – 7.44 (one below and five above).
- Two sodium readings below the IAC trigger range of 820 – 939 mg/L, with values of 351 and 515 mg/L.
- Two chloride readings below the 20th percentile trigger level of 830 mg/L, with values of 412 and 436 mg/L.
- One exceedance of the interim IAC trigger for iron (0.3 mg/L), with a value of 1.57 mg/L.
- Two manganese values exceeded the interim IAC of 0.1 mg/L, with values of 0.25 and 0.22 mg/L.

All other specification results for NPZ5B P1 were within the IAC trigger limits. Each of the analyte/ parameter values recorded were within historical ranges for the site, and do not significantly vary from the values observed throughout 2022. The pH results are consistent across 2022 and 2023, and the specification results have been slightly higher in 2023 than in 2022. The exceedance investigation (Engeny, 2024) stated that no specific actions are required for the site as the analyte/ parameter results are consistent with climatic conditions. However, it is recommended that the groundwater triggers are reassessed to account for the site's variability.

NPZ6 Tall

Two of the twelve pH results and five of the twelve EC results for NPZ6 Tall were outside of the IAC range. An investigation of the trigger exceedances (Engeny, 2024) indicates that the pH and EC results do not deviate from historical trends, and as such it is recommended that the IAC triggers be updated to reflect the natural site conditions. The pH and EC results also so not deviate significantly than values recorded in 2022.

There were two rounds of specification samples taken during 2023, with sodium, chloride, and iron readings being above the interim IAC ranges. However, these results are considered typical of groundwater extracted from a coal seam and the IACs which are based on ANZECC 2000 guidelines for recreational water use are not considered applicable. These values were within the historical range for the site and did not deviate significantly from the 2022 results, only being slightly higher. All other speciation results for NPZ6 Tall were below interim IAC values.

3.3.5 Lemington Seam

Monitoring of groundwater quality in the Lemington Seam occurs at NPZ1 Tall and NPZ2 Tall. The ranges in water quality for each monitoring bore are shown in Appendix D (Table D.1 to Table D.5).

NPZ1 Tall

The groundwater readings for 2023 at NPZ1 Tall borehole exceeded the IAC limit for the following:

- Only one of the six pH readings above the IAC trigger range of 7 – 7.3, with a value of 7.4.
- Two sodium readings below site specific lower IAC of 1,820 mg/L, with both readings at 1,640 mg/L.
- Both chloride readings were below the lower IAC od 2,225 mg/L, with readings of 1,790 and 1,800 mg/L.
- One of the two iron readings exceeding the interim IAC trigger level of 0.3 mg/L, with a value of 1.2 mg/L in October 2023. The exceedance investigation found that this was an outlying value likely the result of an erroneous reading.
- Both manganese readings exceeding the interim IAC trigger level (0.11 and 0.12 mg/L).

All other specification results for NPZ1 Tall were within the IAC trigger limits. The exceedance investigation (Engeny, 2024) identified that the IAC triggers for the exceeding values do not deviate significantly from historical trends and have not accounted for site variability or the predicted depressurisation impacts. The values are also consistent with readings recorded throughout 2022. As such, it was recommended that now that 24 readings have been recorded for the site, IAC triggers be updated accordingly (as per ANZECC guideline recommendations).

NPZ2 Tall

The groundwater readings for 2023 at NPZ2 Tall borehole exceeded the IAC limit for the following:

- All six pH readings below the IAC trigger range of 8.3 – 8.4, with values ranging from 8 to 8.2.
- One sodium trigger above interim IAC trigger range of 2,100 – 2,178 mg/L, with a reading of 2,210mg/L.
- Both Chloride readings were outside of the chloride trigger IAC range, one below the 20th percentile trigger and one above the 80th percentile trigger (2,320 and 2,700 mg/L).
- Two barium trigger exceedances (1.29 and 1.31 mg/L).

All other specification values were with the IAC trigger limits. The trigger exceedance investigation (Engeny, 2024) found that the exceeding specification results do not deviate from the historical trends for the site. All 2023 readings are consistent with the values recorded throughout 2022. It was recommended that the trigger limits be revised, now that 24 samples have been recorded for the site (as per ANZECC guideline recommendations).

3.3.6 Pikes Gully Seam

Monitoring of groundwater quality in the Pikes Gully Seam is undertaken at CS4641C which lies within the Lower Pikes Gully Seam. The range in water quality for CS4641C is presented in Appendix D (Table D.1 to Table D.5).

Two samples were taken in 2023 with no speciation data available. Both pH readings were below the IAC trigger level (both readings at 7.9), and both EC readings exceeding the IAC trigger level, with values of 9,110 µS/cm and 8,980 µS/cm. The pH values have been consistently below the IAC trigger level and 2023 results have not deviated from typical trends or the values recorded throughout 2022. EC values have also stayed within typical historical ranges. As such, the exceedance investigation (Engeny, 2024) recommended that the groundwater trigger values be revised.

3.3.7 Liddell Seam

Monitoring of groundwater within the Liddell Seam is undertaken at the Coffey Dam Borehole. The range in water quality for Coffey's Dam Borehole is presented in Appendix D (Table D.1 to Table D.5). The groundwater readings for 2023 at this borehole exceeded the IAC limit for the following:

- All six pH readings below the IAC trigger level of 9.2 – 10, with readings ranging from 7 -7.4.
- All six EC readings exceeded the IAC trigger level of 3,160 µS/cm, with values ranging from 6110 - 6951 µS/cm.
- The two sodium readings exceeded the interim IAC trigger level of 300 mg/L, with readings of 1,250 and 1,180 mg/L.

- The two sulfate readings exceeded the interim IAC trigger level of 400 mg/L, with values of 896 and 956 mg/L.
- The two chloride readings exceeded the interim IAC trigger level of 400 mg/L, with values of 1,180 and 1,030 mg/L in April and August respectively).
- Both iron readings are above the Interim IAC of 0.3 mg/L, at 12 mg/L in February and 0.81 mg/L in October. The exceedance investigation revealed that the February reading is an outing vale likely the result of an erroneous recording.
- Both manganese readings above the IAC trigger of 0.1 mg/L, with readings of 0.34 mg/L and 0.11 mg/L.

All other specification values remained within the IAC trigger range. The 2023 results are consistent with the values recorded throughout 2022, and do not deviate significantly from historical trends. The exceedance investigation (Engeny, 2023) identified that exceedances are likely related to the declining water levels, which is in line with the EA impact predictions. Further, results are considered typical of groundwater extracted from a coal seam and the IACs which are based on ANZECC 2000 guidelines for recreational water use are not considered applicable. As such it has been recommended that groundwater trigger values be revised to account for typical site conditions.

3.3.8 Other Groundwater Monitoring Locations

Monitoring of groundwater quality in the vicinity of the former Cumnock Wash Plant Pit is undertaken at WPP1 and WPP2. The ranges in water quality within each monitoring bore are shown in Appendix D (Table D.1 to Table D.5).

WPP1

The groundwater readings for 2023 for WPP1 borehole exceeded the IAC limit for the following:

- Three above the adopted IAC range of 7 – 7.1, with all values at 7.2.
- Both sodium readings are above the Interim IAC trigger of 300 mg/L, with readings of 1,200 and 1,250 mg/L.
- Both sulfate readings are above the Interim IAC trigger of 400 mg/L, with readings at 3,240 and 3,270 mg/L.
  Two chloride readings exceeding the Interim IAC trigger of 400 mg/L, with values of 752 and 794 mg/L.
- One manganese reading exceeding the interim IAC trigger of 0.1 mg/L, with a reading of 0.18 mg/L.

All other specification values were within IAC trigger ranges. The 2023 results are consistent with the values recorded throughout 2022, and do not deviate significantly from historical trends. The specification values that have exceeded IACs are considered typical of groundwater extracted from a coal affected aquifer and are consistent with historical trends. Further, the interim IAC values are based on ANZECC 2000 guidelines for recreational water use are not considered applicable. The exceedance investigation (Engeny, 2024) recommends that IAC values be updated once the sufficient number of samples are taken.

WPP2

The groundwater readings for 2023 at WPP2 Tall borehole exceeded the IAC limit for the following:

- Three EC values above the IAC trigger of 9,352 µS/cm, with readings of 9640, 9740, and 9730 µS/cm).
- Two sodium readings exceeding the interim IAC trigger of 300 mg/L, with readings of 1,680 and 1,730 mg/L.
- Two Sulfate readings exceeding the interim IAC trigger of 400 mg/L, with readings of 4,270 and 4,970 mg/L.
- Two chloride readings exceeding the interim IAC trigger of 400 mg/L, with values of 892, and 852 mg/L.
- One manganese reading exceeding the Interim IAC trigger of 0.1 mg/L, with a reading of 0.12 mg/L.

All other specification values were within IAC trigger ranges. The 2023 results are consistent with the values recorded throughout 2022, and do not deviate significantly from historical trends. The specification values that have exceeded IACs are also considered typical of groundwater extracted from a coal affected aquifer and are consistent with historical trends. Further, the interim IAC values are based on ANZECC 2000 guidelines for recreational water use are not considered applicable. The exceedance investigation (Engeny, 2024) recommends that IAC values be updated once the sufficient number of samples are taken.

3.4 Groundwater Level Results

In 2023, groundwater levels were measured at 14 locations, with monitoring results shown in Appendix E (Table E.1 and Chart E.1) monitoring locations are shown on in Appendix B (Figure B.1). Most monitoring sites have observed a generally decreasing water level over 2023, which

is consistent with climatic conditions and predicted drawdown due to depressurisation. Site specific groundwater level summaries are provided in the sections below.

Alluvium and Underlying Weathered Coal Measures

Water level monitoring occurs in the Bayswater Creek Alluvium at NPZ5B P2 and the Hunter River Alluvium at NP27 Small.

Recorded levels at NPZ7 Small (Hunter River Alluvium) showed a decrease over the 2023 monitoring period, dropping from 42.6 mAHD to 41.9 mAHD.

The recorded level in NPZ5B P2 (Bayswater Creek Alluvium) slightly decreased throughout the 2023 monitoring period, dropping from 66.8 mAHD to 66.2 mAHD.

Bayswater Seam

Groundwater level monitoring in the Bayswater Seam is undertaken at NPZ1 Mid and NPZ7 Tall. NPZ1 Mid is currently blocked and therefore not monitored during 2023. NPZ27 Tall decreased during 2023, dropping from 42.8 mAHD to 42.1 mAHD, which is likely a result of lower rainfall.

Broonies Seam

Monitoring of groundwater level monitoring in the Broonies Seam is undertaken at NPZ6 Tall and NPZ5B P1. The recorded levels in NPZ6 Tall remained relatively constant throughout 2023. While NPZ5B P1 observed a decreasing water level over the 2023 period, dropping from 63.1 mAHD to 60.4 mAHD.

Lemington Seam

Monitoring of groundwater quality in the Lemington Seam occurs at NPZ1 Tall, NPZ2 Tall. The recorded levels in NPZ1 Tall continued to increase during 2023, rising from 38.3 in January to 40.3 in December.

NPZ2 Tall saw an increase over 2023, from 33.7 in January to 35.0 in December.

Pikes Gully Seams

Monitoring of groundwater quality in the Pikes Gully Seam is undertaken at CS4641C which lies within the Lower Pikes Gully Seam. Recorded water levels at CS4641C were relatively stable for the 2023 period. This is consistent with the recent trends, following a steady decline in level since 2015, which followed the sharp decline observed from 2013 to 2015 as a result of and dewatering of the former Cumnock underground workings to allow mining in the Ravensworth North Pit.

Liddell Seam

Monitoring of groundwater within the Liddell Seam is undertaken at the Coffey Dam Borehole. Recorded results at the Coffey Dam Borehole saw a rise in water level from January to February (57.3 mAHD to 58.7 mAHD). Since February, a negative trend was observed dropping to 57.6 mAHD in December.

Other Groundwater Monitoring Locations

Monitoring of groundwater quality in the vicinity of the former Cumnock Wash Plant Pit is undertaken at WPP1 and WPP2. Both WPP1 and WPP2 saw a decreasing trend over 2023. WPP1 dropped from 106.9 mAHD to 105.7 mAHD, and WPP2 dropped from 107.2 mAHD to 105.8 mAHD.

In addition to the above, groundwater level is recorded in 8 locations (RNW1, RNW2, RNW3, RNW4, RNW5, RNW6, RNW7 and RNW8 as shown on Figure C.1) at 6-hour or 12-hour intervals using vibrating wire piezometers. The purpose of these groundwater level monitoring locations is to identify the groundwater pressure response to mining operations. The water level and depressurisation results from the vibrating wire piezometers is discussed in Section 3.5.

3.5 Groundwater Pressure Response

The groundwater pressure response to mining operations for the 2023 reporting period was measured at 6-hour or 12-hourly intervals using vibrating wire piezometers. The vibrating wire piezometers were installed in 2007 at four locations (CS4655, CS4656, CS4657 and CS4658), in 2008 at four locations (RNVW1, RNVW2, RNVW3, RNVW4), in 2009 in two locations (RVVW5, RNVW6) and in 2010 at two locations (RVVW7, RNVW8). Monitoring results are presented graphically in Appendix E (Figure E.9).

Piezometers CS4655, CS2656, CS4545, CS4657 and CS4539A have been decommissioned as a result of the progression of the North Pit to the south. The locations of the vibrating wire piezometers are shown in Appendix B (Figure B.1).

RNVW1

Results for bore RNVW1 show depressurisation during 2023 at depths of 150 mbgl, 190 mbgl, 240 mbgl and 270 mbgl (refer to Appendix E, Figure E.2) but to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in *Ravensworth Operations – Review of Groundwater Model Predictions* (AGE, 2023). Historically depressurisation at a depth of 109 mbgl was also observed with the degree of depressurisation exceeding that predicted by the groundwater model. However, 2023 results indicate pressure recovery at this depth. Results at depths of 48 mbgl and 68 mbgl remain relatively constant.

RNVW2

Results for bore RNVW2 (refer to Appendix E, Figure E.3) show continued depressurisation at depths of 239 mbgl and 238 mbgl. Recovery has been observed at depths of 305 mbgl, 140 mbgl and 85 mbgl, and stabilisation is observed at depths of 180 mbgl, and 43 mbgl. Depressurisation at depths of 239 mbgl occurs to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2023). The groundwater model for the Ravensworth Project also predicted depressurisation at a depth of 140 mbgl for RNVW2, however, results over recent years indicate pressure recovery at this depth.

RNVW3

Results for RNVW3 (refer to Appendix E, Figure E.4) indicate ongoing depressurisation at depths of 254 mbgl, 210 mbgl, and 180 mbgl. Stabilisation is observed at 143 mbgl, and recovery is observed at depths of 103 mbgl and 61 mbgl.

RNVW4

Results for RNVW4 (refer to Appendix E, Figure E.5) show ongoing depressurisation at all depths. The depressurisation observed is typically to a lesser degree than predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2023).

RNVW5

Results for RNVW5 (refer to Appendix E, Figure E.6), indicate minimal or no depressurisation for the 2023 monitoring period. It is noted that the RNVW5 instrument is currently outputting zero readings on channels 1 (depth of 19 mbgl), 6 (depth of 279 mbgl) and 7 (depth of 350 mbgl) and therefore no observations of depressurisation at these depths can be made. It also only began outputting results at channel 3 (depth of 87 mbgl) in 2023 and therefore trend analysis cannot be made at this depth.

RNVW6

Results for RNVW6 (refer to Appendix E, Figure E.7) show slight depressurisation since 2021 at a depth of 265 mbgl. Results previously indicated depressurisation at depths of 19 mbgl and 66 mbgl in excess of those predicted in the Ravensworth Project groundwater model results as presented in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2023). However, pressures have now recovered at both of these depths.

RNVW7

Results for RNVW7 (refer to Appendix E, Figure E.8) show ongoing depressurisation at depths from 287 mbgl to 302 mbgl which is consistent with groundwater model predictions for the Ravensworth Project. It is noted that channel 1 (depth of 83 mbgl) appears to be outputting erroneous results and therefore no observations of depressurisation at this depth can be made.

RNVW8

Vibrating wire piezometer for RNVW8 was removed in June 2020, however, appears to be reinstated in November 2023 (refer to results shown in Appendix E, Figure E.9). The results indicate pressure recovery since the previous 2020 reading and overall depressurisation remains to a lesser degree than predicted in the Ravensworth Project groundwater model results as reported in Ravensworth Operations – Review of Groundwater Model Predictions (AGE, 2023).

3.6 Groundwater Model Review

Condition 6.8.4 of the PA 09_0176 requires biennial review of the groundwater model. A review of the model was completed in 2023 by AGE. The review concluded that the groundwater model continues to predict groundwater impacts with satisfactory accuracy, and that no further calibration of the model is required at this stage. A review of groundwater model predictions will be undertaken again in 2024.

4. WATER BALANCE

4.1 Water Sources and Demands

The water management system at RO consists of water storages, pumps, pipelines, and instrumentation for flow and level measurement. The existing RO water management system consists of three separate systems, including:

1. Clean (raw) water system.
2. Dirty water system (sediment).
3. Mine water system (saline).

These systems are further described in Ravensworth Operations WMP.

The WMS infrastructure is monitored and controlled via Ravensworth Operations Citect supervisory control and data acquisition (SCADA) systems (separate systems are used by Ravensworth Open Cut (ROC) and RCHPP). The Citect SCADA system incorporates a graphical user interface (GUI) that displays the status of WMS infrastructure (e.g. dam levels, pump on/off, flow rates, etc.) and operator access to operate equipment and adjust WMS infrastructure set points. Operational WMS data collected by the Citect SCADA system is utilised in site water accounting models to monitor RO water sources and demands.

Key water sources for the RO include:

- Rainfall/runoff within the ROC and RCHPP WMS.
- Groundwater seepage into operating open cut pits, voids, and underground mine pits (and spoils seepage to Narama Pit).
- Moisture in ROM coal.
- Groundwater extracted from the former Cumnock underground workings.
- Water imported from the Mount Owen Complex or Liddell Mine under the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS).
- Water imported from the Hunter River.
- Potable water trucked to site.

Key water demands for the RO include:

- Evaporative losses from water storages.
- Dust suppression (haul roads, stockpiles, and handling) and vehicle wash bay losses.
- RCHPP losses: moisture bound with product coal and rejects (coarse and fine).
- Discharges under the Hunter River Salinity Trading Scheme (HRSTS).
- Transfers to the Mount Owen Complex or Liddell Mine under the GRAWTS.

4.2 Surface Water Discharge

Surplus surface water at ROC is transferred to RCHPP or discharged from the Narama Dam to the Hunter River via Bowmans Creek under the conditions of Ravensworth Operations EPL 2652 and the HRSTS or transferred to other Glencore mine sites under the GRAWTS.

EPL 2652 permits a maximum discharge of 400 ML/day from the Narama In-pit Storage Dam under the HRSTS Regulations. In 2023, RO held a total of 134 salt credits. No discharge or salt credit transfers occurred during the 2023 period.

4.3 Surface Water Extraction

Ravensworth Operations holds water access licences WAL 9050, WAL 1046, WAL 1325, WAL 8964, WAL 13102, WAL 10771 and WAL816 that allow Ravensworth Operations to extract water from the Hunter River and Bayswater Creek. In the 2023 water year (1 July 2022 to 30 June 2023), Ravensworth Operations extracted a total of 119.2 ML from the Hunter River, not exceeding extraction entitlements. Table 4.1 presents the surface water extraction for each Ravensworth Complex WAL for the 2023 water year.

TABLE 4.1: 2023 WATER YEAR (JUL 22 – JUN 23) SURFACE WATER EXTRACTIONS

WAL / Reference Number	Water Source/ Management Zone	Category	Entitlement[1]	Extracted Volume (ML)
WAL 10771 (20WA200463)	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	High Security	25	11.9
WAL 1046 (20AL201444)	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	High Security	3	0
WAL 13102 (20AL203412)	Hunter River Regulated/Zone 1a (Hunter River from Glenbawn Dam to Goulburn River Junction)	High Security	15	0
WAL 9050 (20AL200744)	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	General Security	500	95.4
WAL 8964 (20AL203224)	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	General Security	1,590[2]	0
WAL 1325 (20AL203042)	Hunter River Regulated/Zone 1b (Hunter River from Goulburn River Junction to Glennies Creek Junction)	Supplementary	13	0
WAL816	Hunter River Regulated /Zone 3a (Glennies Creek)	General security	20	0

1. Excluding any potential carry over.
2. 1590 units temporarily transferred to another licence during the 2023 water year.

4.4 Groundwater Extraction

During the 2023 water year, Ravensworth Operations extracted a total of 2,790.9 ML of groundwater. The extraction was undertaken in compliance with the conditions of all relevant licences shown in Table 4.2.

TABLE 4.2: 2023 WATER YEARGROUNDWATER EXTRACTIONS

WAL / Reference Number	Extraction Limit (ML)[1]	Extracted Volume (ML)
WAL 41496	2520	2020.3
WAL 41505	300	0
WAL 41554	50	0
WAL 41507	576	624.6

WAL / Reference Number	Extraction Limit (ML)[1]	Extracted Volume (ML)
WAL 41530	100	0
WAL 41531	150	146

1. Excluding any potential carry over.

4.5 2023 Water Balance Summary

4.5.1 Site Recorded Data

The site recorded data in Ravensworth Operations 2023 Water Accounting Framework (WAF) was used to complete the 2023 water balance assessment. The site recorded rainfall for 2023 was 524 mm which does not exceed the long-term 90th percentile rainfall at the Jerry's Plains Bureau of Meteorology station (station number 61086) of 904 mm.

4.6 2023 Water Balance

The 2023 water balance summary for Ravensworth Complex is provided in Table 4.3.

TABLE 4.3: RAVENSWORTH COMPLEX 2023 SITE WATER BALANCE

Item	Volume (ML)
INFLOWS	
Rainfall Runoff	2,232
Groundwater Inflow	2,108
ROM Coal Moisture	1,039
From Mount Owen Complex (MOC)	78
From Liddell Coal Operations (LOC)	354
Potable Supply	5
From Hunter River	94
Total Inflows	5,909
OUTFLOWS	
Evaporation	603
Dust Suppression / Washbay	621
CHPP Supply	6,649
Product Coal Moisture	775

Item	Volume (ML)
Coarse Rejects Moisture	370
Tailings Water	185
To MOC	3
To LOC	0
Other third-party supply (to HVO, Oaklands Property)	775
HRSTS Discharges to the Hunter River	0
Uncontrolled Release	0
Total Outflows	9,981
Inflow – Outflow	-4,072
Recorded Stored on Site at Start of Annual Review Period	12,839
Recorded Stored on Site and End of Annual Review Period	8,456
Change in Storage	-4382.58
Error	-2%

Ravensworth Operations water balance assessment for 2023 produced a net inventory change over the year of 4,072 ML, which is lower compared to the recorded change in inventory of 4,383 ML. This resulted in a water balance error of approximately 2% deficit, which is well within the acceptable limit for Glencore WAF reporting. This suggests that all inflow and outflows of the mine water system have been accounted for. The minor balance error is likely attributed to estimated or calculated water streams where exact monitoring is impracticable (e.g. groundwater inflow calculations, runoff estimates, etc.).

4.6.1 Comparison to EA Predictions

The *Ravensworth Operations Project Environmental Assessment (EA)* (Umwelt, 2010) included the development of a predictive water balance model to ensure there would be sufficient water available to meet the requirements of the Ravensworth Operations Project. The predictive water balance indicated that Ravensworth Operations would have a net water deficit for most years of mining operation, including during 2023 (refer to Figure 4.1). It is noted that the actual operational water balance will be dependent on rainfall and the quantity of water held in the Barret seam workings of the former Cumnock underground mine workings, however, a net water balance ranging from a minor deficit to a minor surplus is expected.

Similarly, an update by GHD (2017) also indicates that the site is expected to site within a minor deficit between Year 5 (2021) and Year 10 (2026) of operations, as presented in Section 4.4 of the WMP (ROC, 2022). This is consistent with the 2023 results (2% deficit).

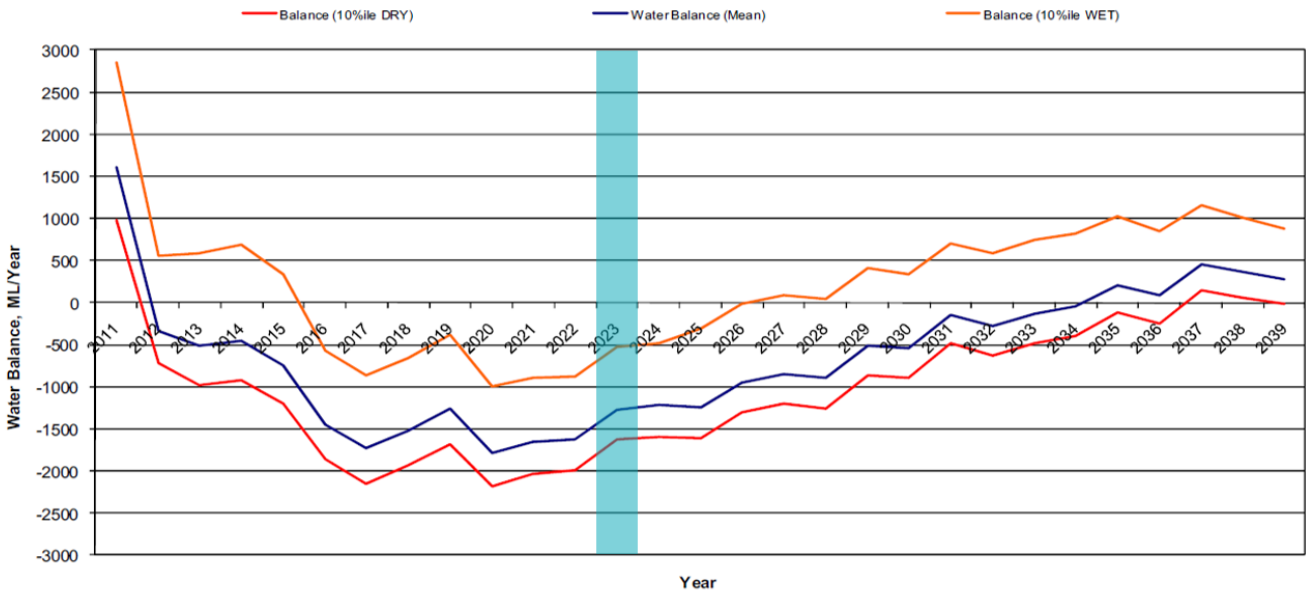

FIGURE 4.1: RAVENSWORTH OPERATIONS PROJECT WATER BALANCE (UMWELT, 2010)

5. QUALIFICATIONS

(a) In preparing this document, including all relevant calculation, and modelling, Engeny Australia Pty Ltd (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

(b) Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

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(g) This Report does not provide legal advice.

6. REFERENCES

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APPENDIX A: SURFACE WATER MONITORING LOCATIONS AND IMPACT ASSESSMENT CRITERIA

TABLE A.1: SURFACE WATER MONITORING LOCATION AND FREQUENCY

Watercourse	Monitoring Location	Location Code	Monitoring Frequency
Bowmans Creek	Bowmans Creek Upstream	EPL3	Monthly
	Bowmans Creek Downstream	EPL4	Monthly
Bayswater Creek (ROP)	Bayswater Creek Upstream	W114	Monthly
	Bayswater Creek Downstream	W115	Monthly
Bayswater Creek (RUM)	Bayswater Creek Upstream	W10	Monthly
	Bayswater Creek Downstream	W11	Monthly
Davis Creek	Davis Creek 2	W152	Bi-monthly
	Davis Creek Down	W164	Bi-monthly
Pikes Gully	Pikes Creek Upstream	W135	Bi-monthly
	Pikes Creek at New England Highway	W136	Bi-monthly
	Pikes Creek Road at CHPP Culvert	W137	Bi-monthly

TABLE A.2: ADOPTED SURFACE WATER IAC VALUES FOR KEY PARAMETERS

Watercourse	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)
Bowmans Creek	7.7 – 8.1	1,331	18	817
Bayswater Creek	7.7 – 8.5	4,882	23.2	3,216
Davis Creek	7.5 – 8.3	7,378	31	4,630
Pikes Gully	7.8 – 8.3	13,832	32	10,818

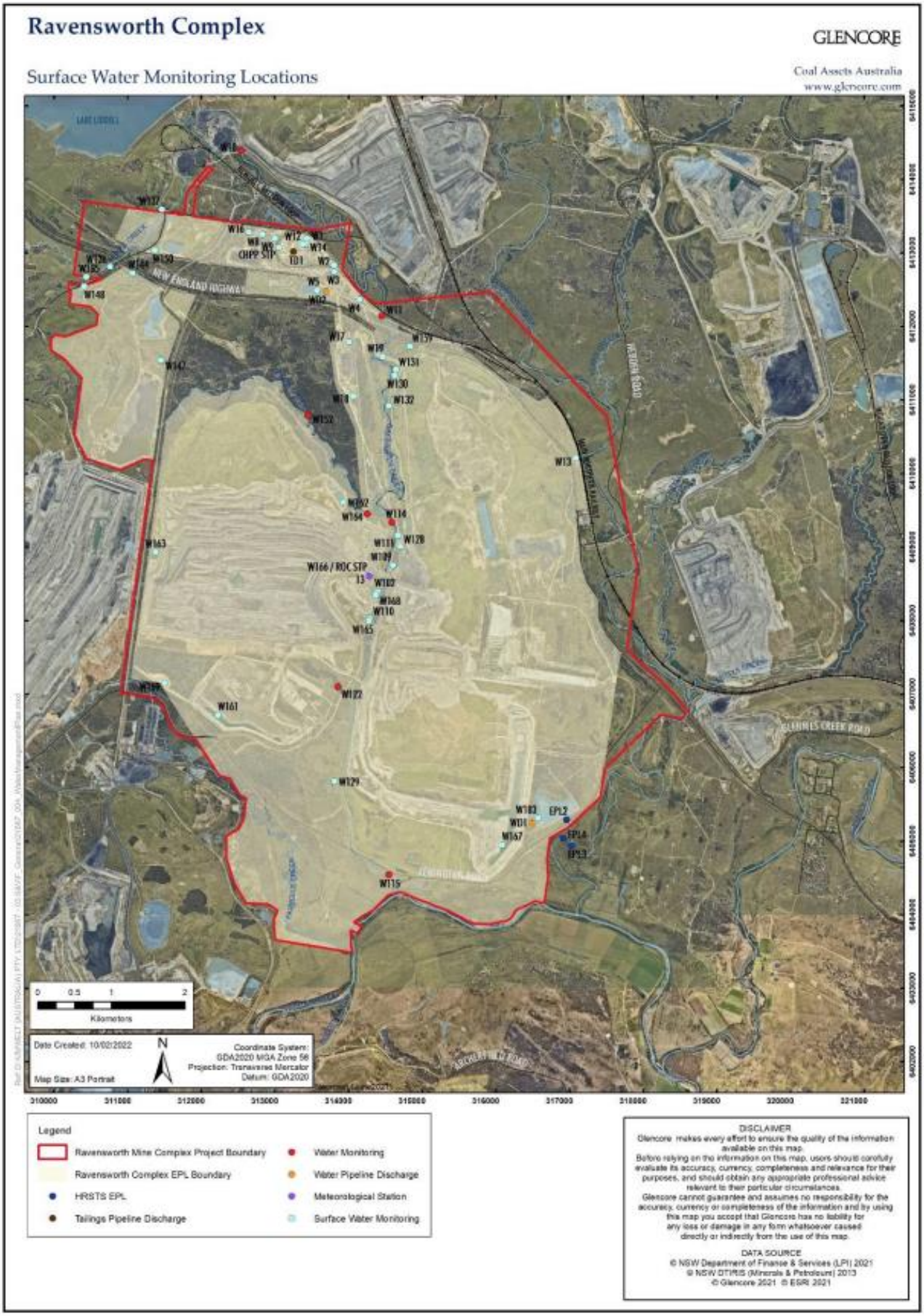


FIGURE A.1: SURFACE WATER MONITORING LOCATIONS

APPENDIX B: SURFACE WATER QUALITY MONITORING RESULTS

TABLE B.1: SUMMARY OF 2023 SURFACE WATER PH AND EC RESULTS

Water Course	Monitoring Location	pH			EC (µS/cm)			No. of samples
		Min	Max	Mean	Min	Max	Mean	
Bowmans Creek	EPL3	7.74	8.35	7.99	910	979	942.80	5
	EPL4	7.35	8.09	7.71	1,040	7,540	3850	10
Bayswater Creek (ROC)	W114	8.10	8.74	8.41	5,880	7,750	6,449.09	11
	W115	8.06	9.00	8.40	1,240	7,000	3,171.43	7
Bayswater Creek (RUM)	W10	8.00	8.40	8.18	3,110	8,160	6,693.33	12
	W11	8.40	8.60	8.53	4,220	7,030	5,662.50	4
Davis Creek	W152	7.78	8.09	7.94	6390	7730	7265	4
	W164	-	-	-	-	-	-	0
	W135	7.45	7.45	7.45	504	504	504	1
Pikes Gully Creek	W136	7.77	7.77	7.77	1,660	1,660	1,660	1
	W137	7.49	7.49	7.49	9,090	9,090	9,090	1

TABLE B.2: SUMMARY OF 2023 SURFACE WATER TSS ASND TDS RESULTS

Water Course	Monitoring Location	TSS (mg/L)			TDS (mg/L)			No. of samples
		Min	Max	Mean	Min	Max	Mean	
Bowmans Creek	EPL3	11	57	25.40	480	593	536.4	5
	EPL4	6	14	8.60	567	5020	2,405.2	10
Bayswater Creek (ROC)	W114	25	364	89.73	3,440	4,980	4,101.82	11
	W115	13	83	49.86	693	4,290	1,924.86	7
Bayswater Creek (RUM)	W10	6	78	21.82	1,820	6,170	4,620.83	12
	W11	37	1490	413.25	2,610	3,680	4,230	4
Davis Creek	W152	11	59	32	4,160	4,850	4,620	4
	W164	-	-	-	-	-	-	0

Pikes Gully Creek	W135	953	953	953	368	368	368	1
	W136	6	6	6	1,050	1,050	1,050	1
	W137	200	200	200	6,940	6,940	6,940	1

The 2023 monthly surface water quality monitoring results for pH, EC, TSS and TDS are presented in tables Table B.3 to Table B.6 respectively. The tables' identity when sampling was not achieved due to dry, inaccessible sites, or due to two monthly sampling regimes.

Table B.3 to C.6 contain the following formatting:

	Indicates monitoring location was dry or inaccessible.
	Indicates non-sampling month.
XXX	Indicates a value which exceeds the IAC range.
*	No site specific IAC for this site so Bayswater Creek triggers were applied.

TABLE B.3: 2023 WATERCOURSE PH MONITORING RESULTS

Site	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
EPL3 - Bowmans Creek Upstream	7.84	7.74	7.88	8.35		8.12						
EPL4 - Bowmans Creek Downstream	7.75	7.35	7.38	7.97	7.54	7.50	7.74	7.80	7.95	8.09		
W114 - Bayswater Creek Upstream	8.10	8.32	8.42	8.74	8.50	8.46	8.41	8.33	8.45	8.32	8.42	
W115 - Bayswater Creek Downstream	8.71	9.00	8.32	8.41	8.22	8.10	8.06					
W10 - Bayswater Creek Upstream*	8.10	8.20	8.20	8.20	8.20	8.20	8.30	8.00	8.10	8.30	8.40	8.0
W11 - Bayswater Creek Downstream*	8.60	8.50	8.60			8.40						
W152 - Davis Creek 2		7.78		7.82		8.09		8.07				
W164 - Davis Creek Down												
W135 - Pikes Gully Upstream		7.45										
W136 - Pikes Gully @ New England Highway				7.77								
W137 - Pikes Gully Road @ CHPP Culvert		7.49										

NOTE: *pH field results were used for sites W10 and W11 as no lab results were available.*

TABLE B.4: 2023 WATERCOURSE EC MONITORING RESULTS

Site	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
EPL3 - Bowmans Creek Upstream	947	949	929	910		979						
EPL4 - Bowmans Creek Downstream	1,040	1,610	1,840	2,260	2,960	3,880	5,020	5,760	6,590	7,540		
W114 - Bayswater Creek Upstream	6,320	6,730	6,300	5,880	6,000	6,170	6,390	6,490	6,170	6,740	7,750	
W115 - Bayswater Creek Downstream	6,540	7,000	1,940	1,240	1,650	1,840	1,990					
W10 - Bayswater Creek Upstream*	7,320	7,600	7,650	7,210	7,430	7,830	7,770	8,160	7,010	5,730	3,500	3,110
W11 - Bayswater Creek Downstream*	6,140	7,030	5,260			4,220						
W152 - Davis Creek 2		6,390		7,410		7,730		7,530				

W164 - Davis Creek Down												
W135 - Pikes Gully Upstream		504										
W136 - Pikes Gully @ New England Highway				1,660								
W137 - Pikes Gully Road @ CHPP Culvert		9,090										

TABLE B.5: 2023 WATERCOURSE TSS MONITORING RESULTS

Site	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
EPL3 - Bowmans Creek Upstream	11	19	24	57		16						
EPL4 - Bowmans Creek Downstream	7	< 5	6	< 5	< 5	< 5	< 5	14	7	9		
W114 - Bayswater Creek Upstream	58	74	97	51	26	25	36	69	99	88	364	
W115 - Bayswater Creek Downstream	22	33	77	13	60	61	83					
W10 - Bayswater Creek Upstream*	11	25	13	10	<5	6	6	14	10	15	52	78
W11 - Bayswater Creek Downstream*	40	37	86			1,490						
W152 - Davis Creek 2		45		11		13		59				
W164 - Davis Creek Down												
W135 - Pikes Gully Upstream		953										
W136 - Pikes Gully @ New England Highway				6								
W137 - Pikes Gully Road @ CHPP Culvert		200										

TABLE B.6: 2023 WATERCOURSE TDS MONITORING RESULTS

Site	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
EPL3 - Bowmans Creek Upstream	593	535	541	480		533						
EPL4 - Bowmans Creek Downstream	567	925	1,020	1,260	1,870	2,320	3,330	3,380	4,360	5,020		
W114 - Bayswater Creek Upstream	4,010	4,340	4,010	3,440	3,780	4,010	4,050	4,190	3,910	4,400	4,980	
W115 - Bayswater Creek Downstream	4,290	4,280	1,140	693	921	1,060	1,090					
W10 - Bayswater Creek Upstream*	5,040	4,910	6,170	4,950	5,130	5,140	5,380	5,530	4,780	3,910	2,690	1,820
W11 - Bayswater Creek Downstream*	4,030	4,230	3,850			2,610						
W152 - Davis Creek 2		4,160		4,720		4,850		4,750				
W164 - Davis Creek Down												
W135 - Pikes Gully Upstream		368										
W136 - Pikes Gully @ New England Highway				1,050								
W137 - Pikes Gully Road @ CHPP Culvert		6,940										

*No specific IAC

FIGURE B.1: BOWMAN'S CREEK PH – EPL3

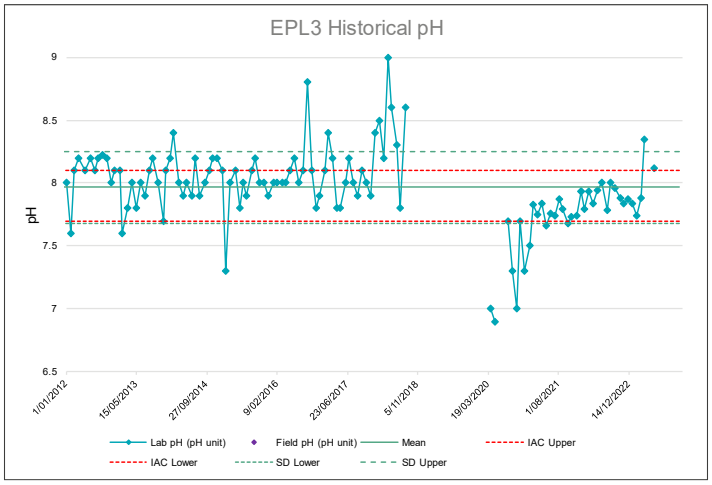


FIGURE B.2: BOWMAN'S CREEK EC – EPL3

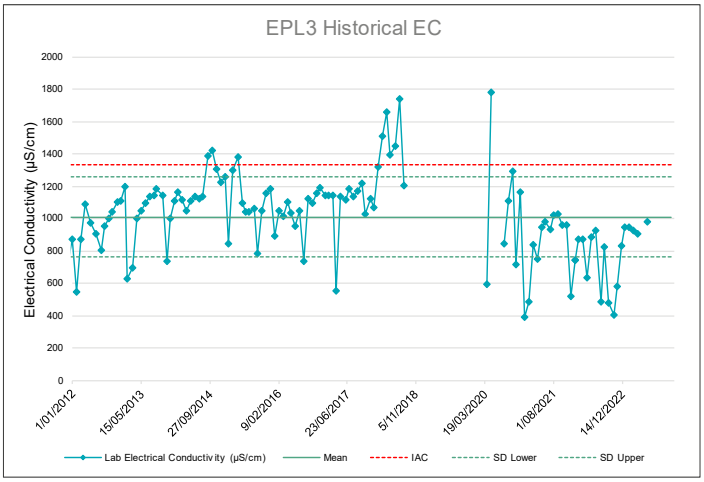


FIGURE B.3: BOWMAN'S CREEK TSS – EPL 3

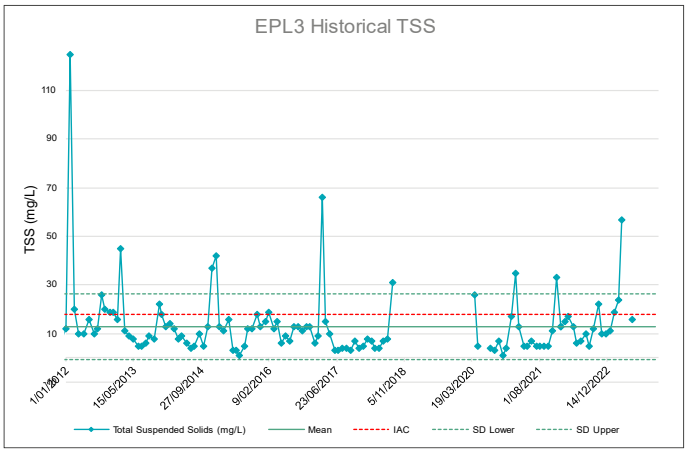


FIGURE B.4: BOWMAN'S CREEK TDS – EPL 3

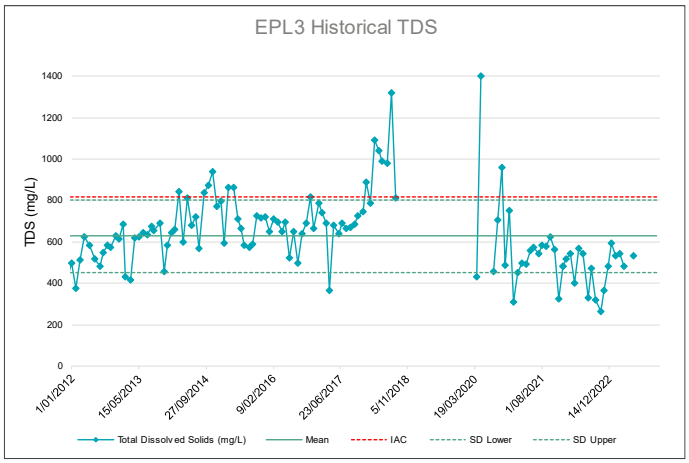


FIGURE B.5: BOWMAN'S CREEK PH – EPL4

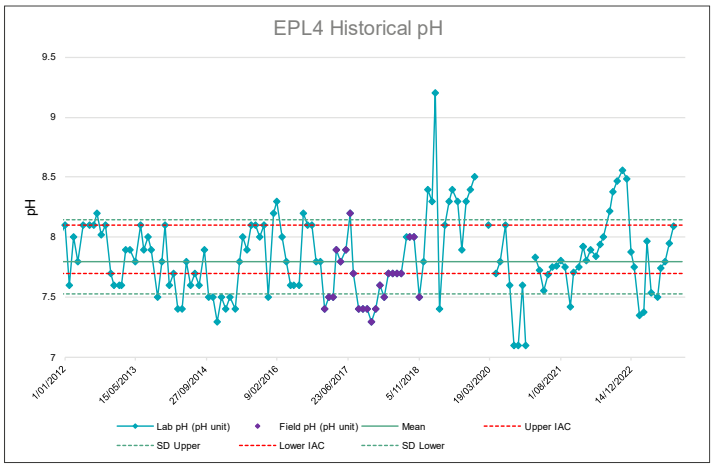


FIGURE B.6: BOWMAN'S CREEK EC – EPL4

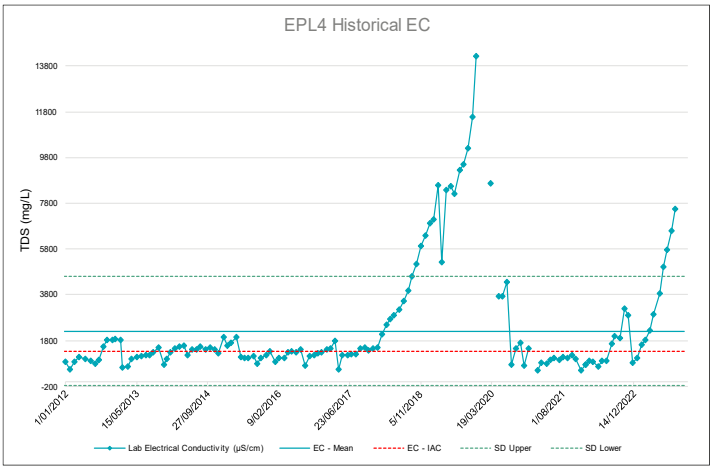


FIGURE B.7: BOWMAN'S CREEK TSS – EPL4

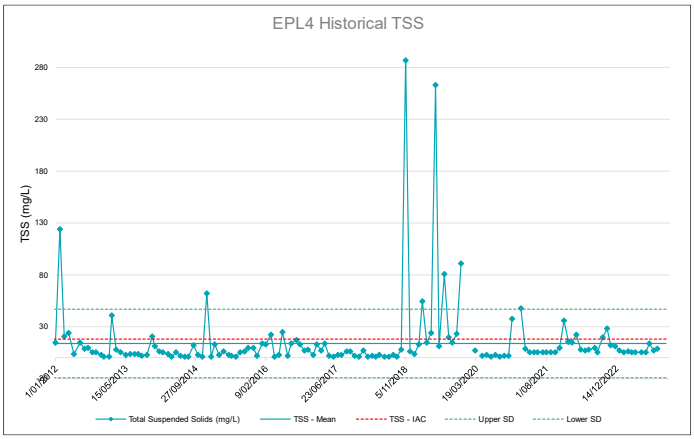


FIGURE B.8: BOWMAN'S CREEK TDS – EPL4

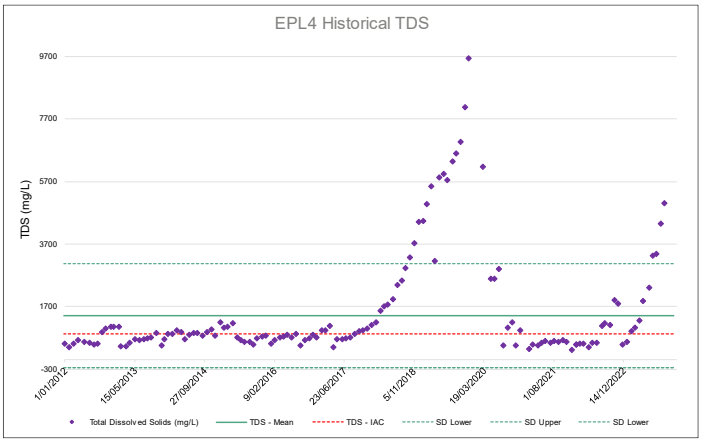


FIGURE B.9: BAYSWATER CREEK (ROP) PH -W114

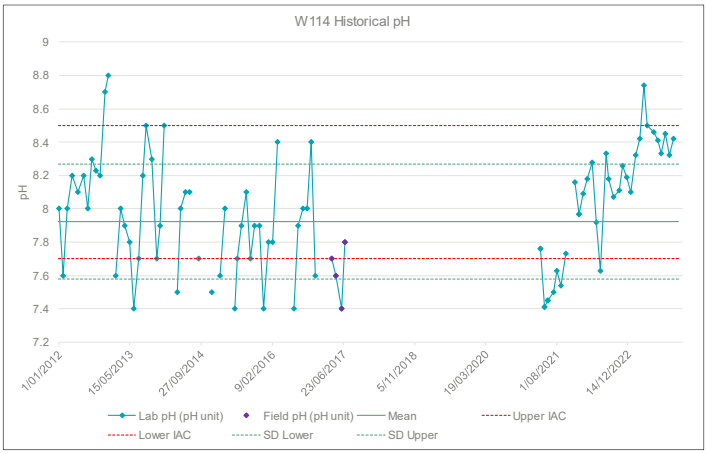


FIGURE B.10: BAYSWATER CREEK (ROP) EC – W114

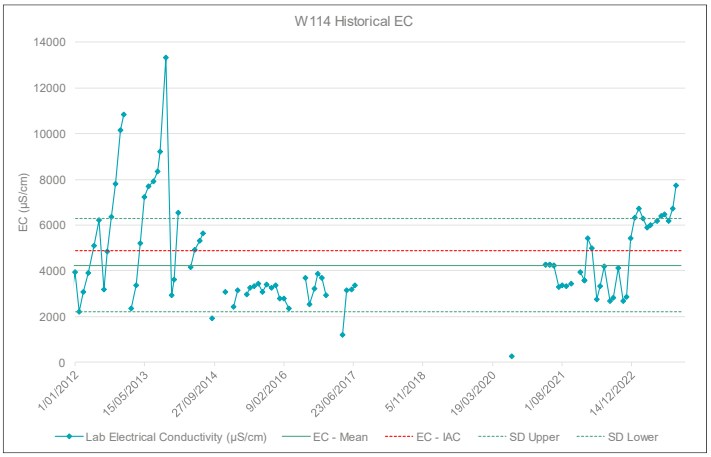


FIGURE B.11: BAYSWATER CREEK (ROP) TSS – W114

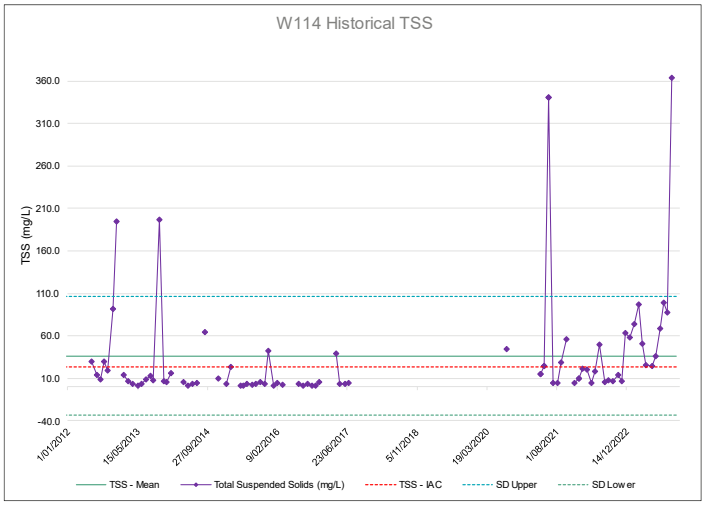


FIGURE B.12: BAYSWATER CREEK (ROP) TDS – W114

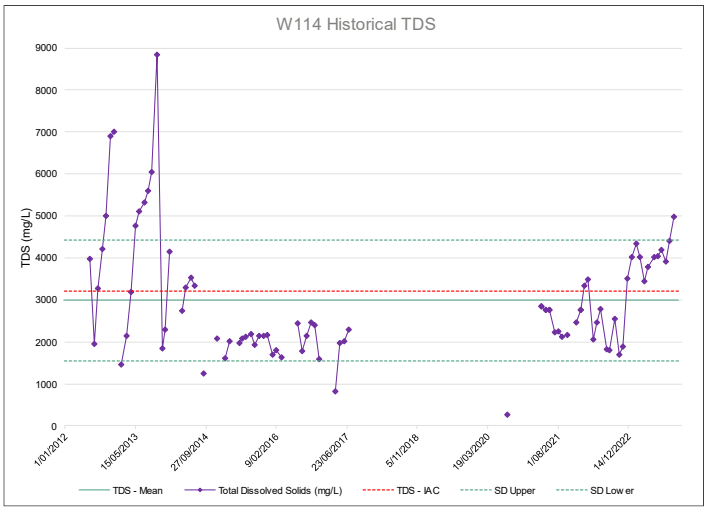


FIGURE B.13: BAYSWATER CREEK (ROP) PH -W115

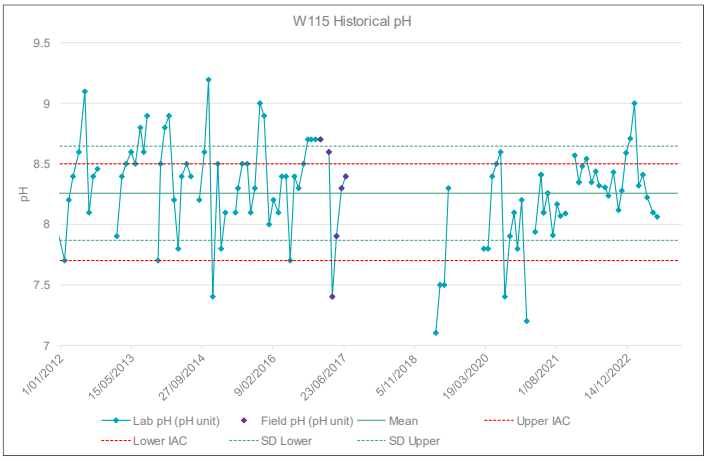


FIGURE B.14: BAYSWATER CREEK (ROP) EC – W115

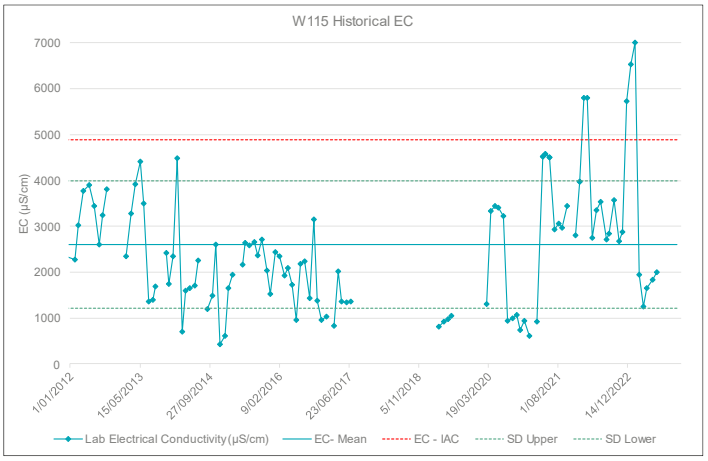


FIGURE B.15: BAYSWATER CREEK (ROP) TSS – W115

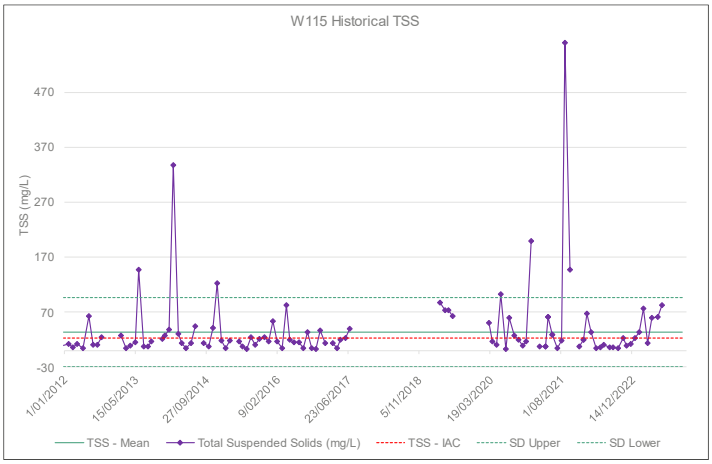


FIGURE B.16: BAYSWATER CREEK (ROP) TDS – W115

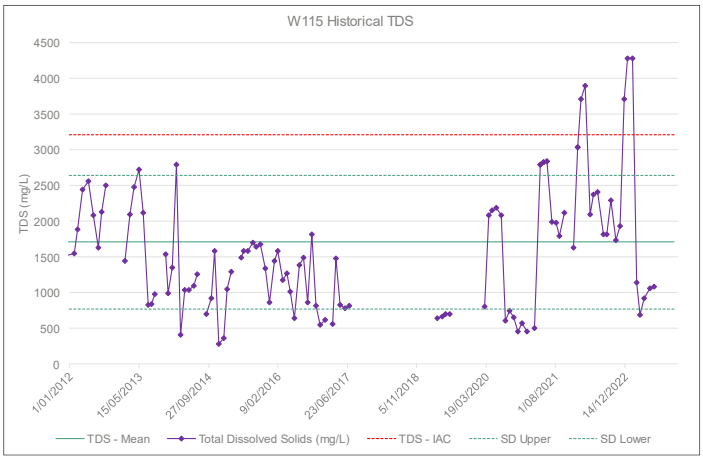


FIGURE B.17: BAYSWATER CREEK (RUM) PH – W10

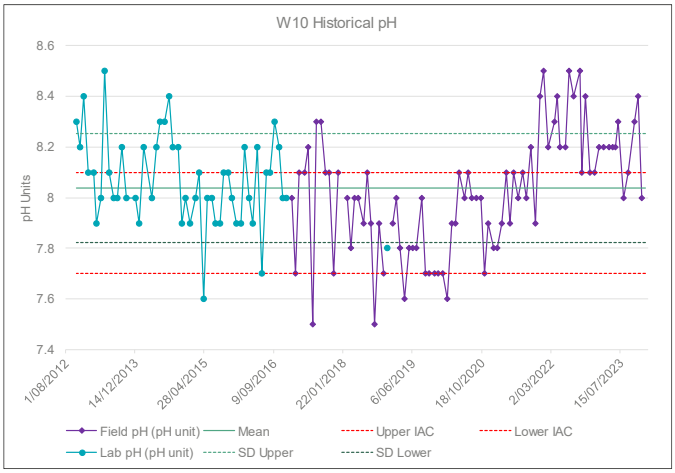


FIGURE B.18: BAYSWATER CREEK (RUM) EC – W10

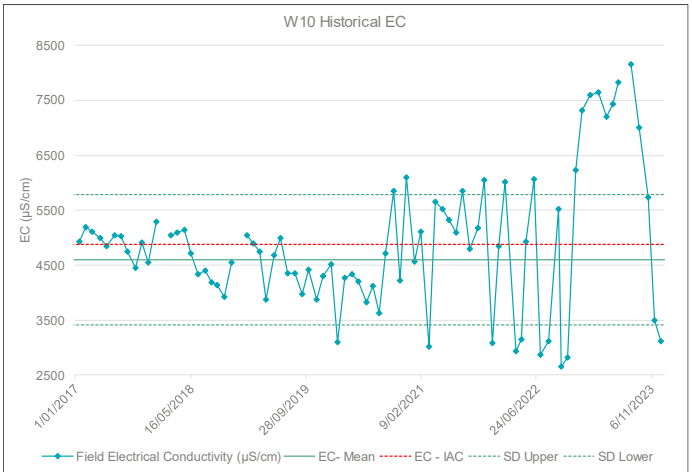


FIGURE B.19: BAYSWATER CREEK (RUM) TSS- W10

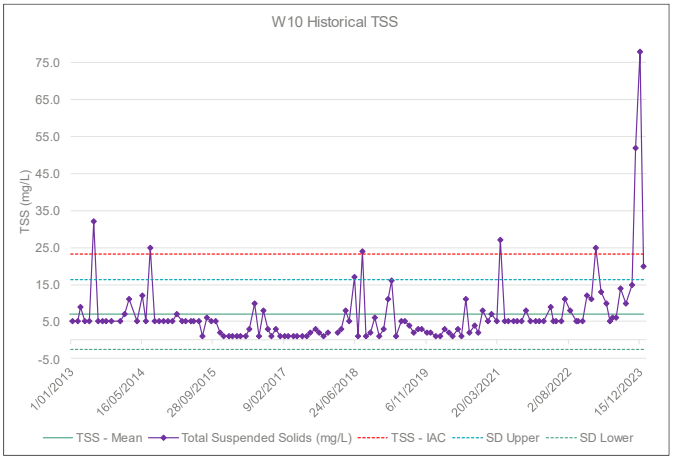


FIGURE B.20: BAYSWATER CREEK (RUM) TDS – W10

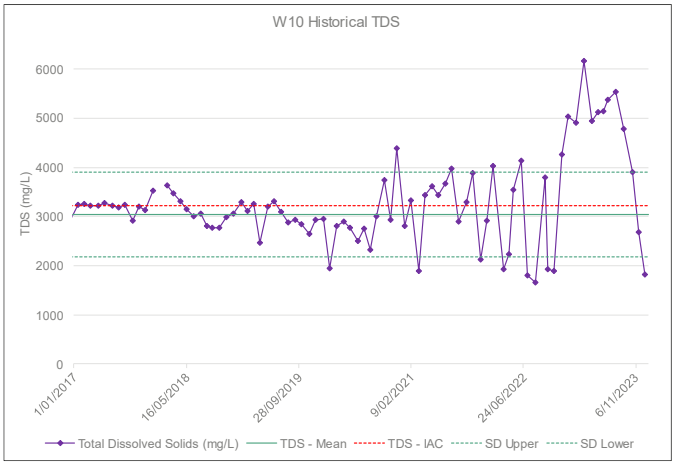


FIGURE B.21: BAYSWATER CREEK (RUM) PH – W11

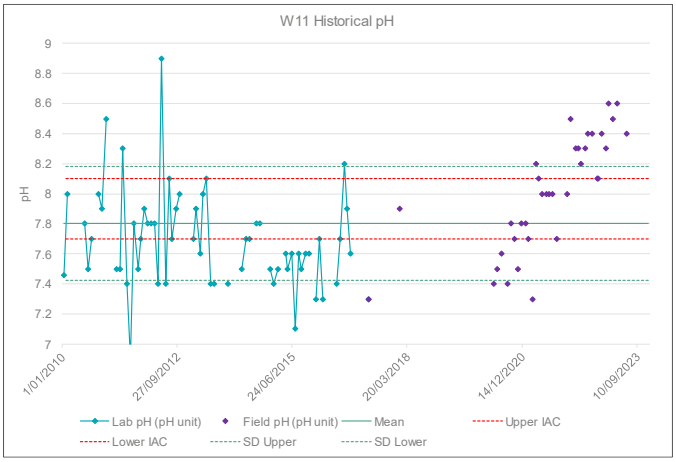


FIGURE B.22: BAYSWATER CREEK (RUM) EC – W11

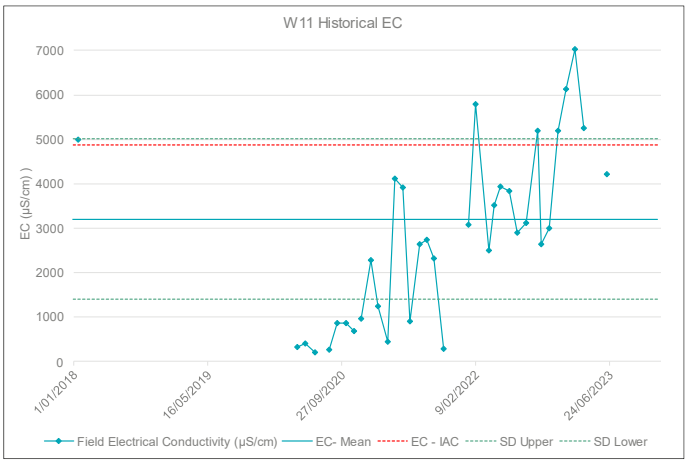


FIGURE B.23: BAYSWATER CREEK (RUM) TSS – W11

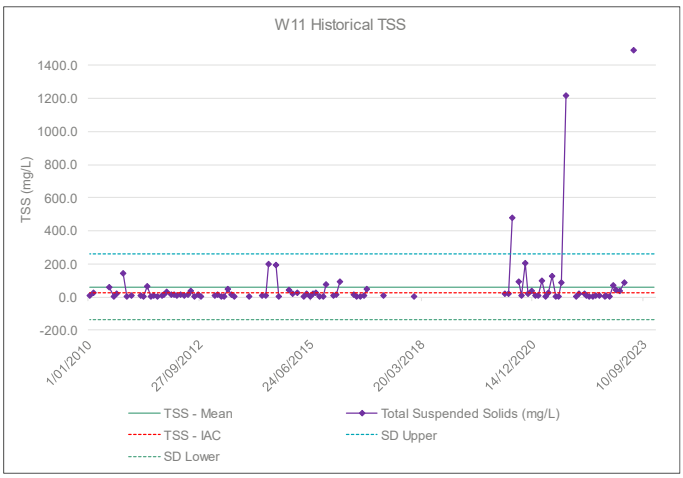


FIGURE B.24: BAYSWATER CREEK (RUM) TDS – W11

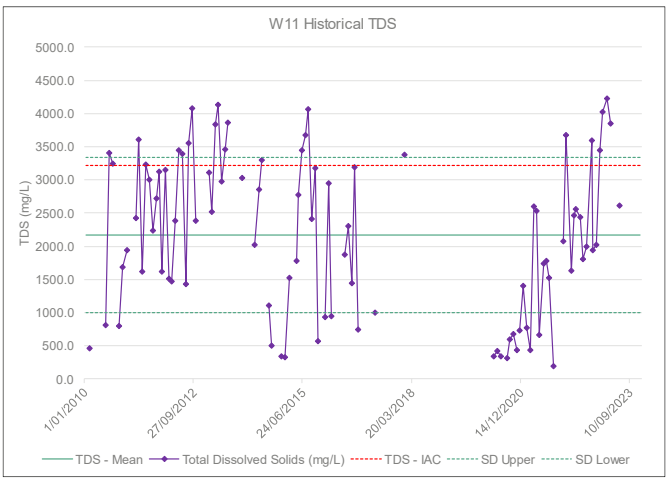


FIGURE B.25: DAVIS CREEK PH – W152

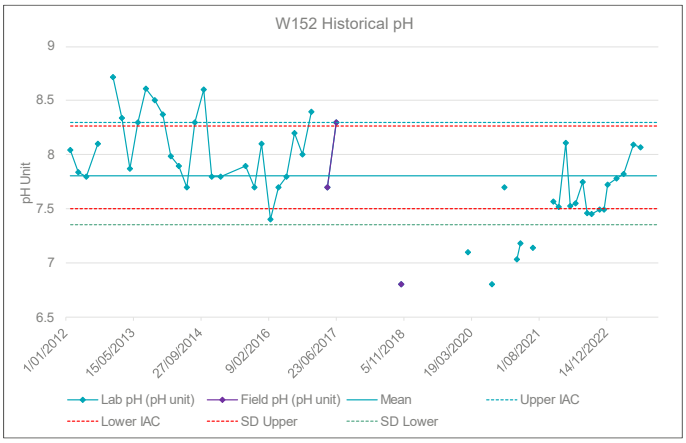


FIGURE B.26: DAVIS CREEK EC – W152

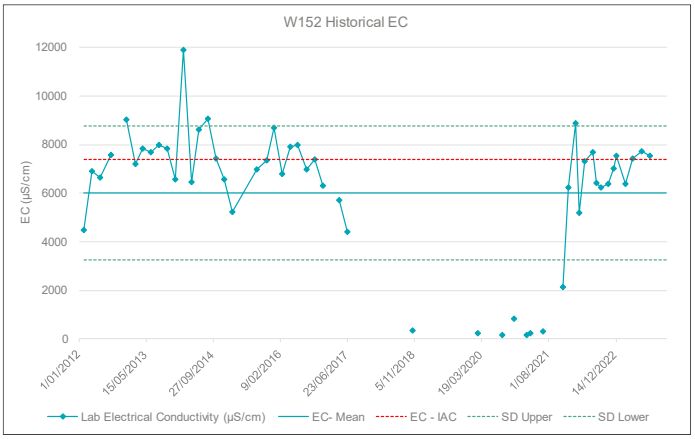


FIGURE B.27: DAVIS CREEK TSS – W152

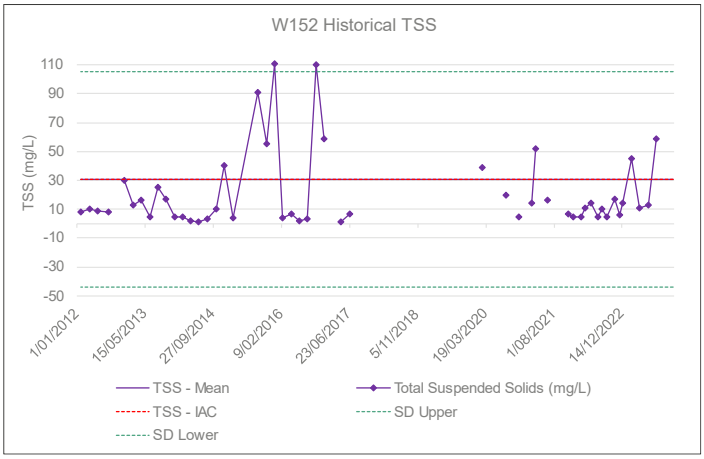


FIGURE B.28: DAVIS CREEK TDS – W152

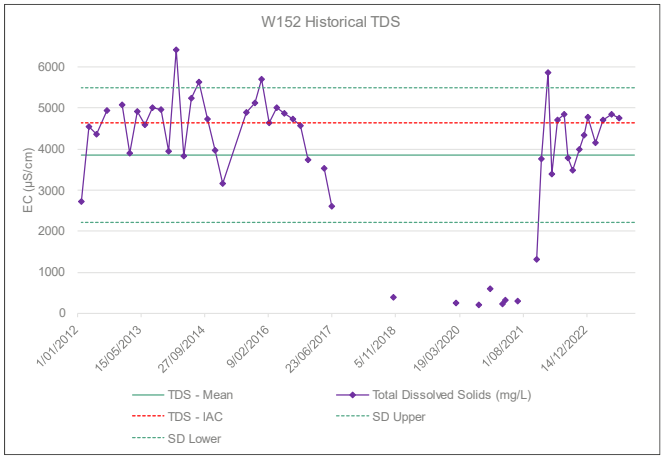


FIGURE B.29: PIKES GULLY PH – W135

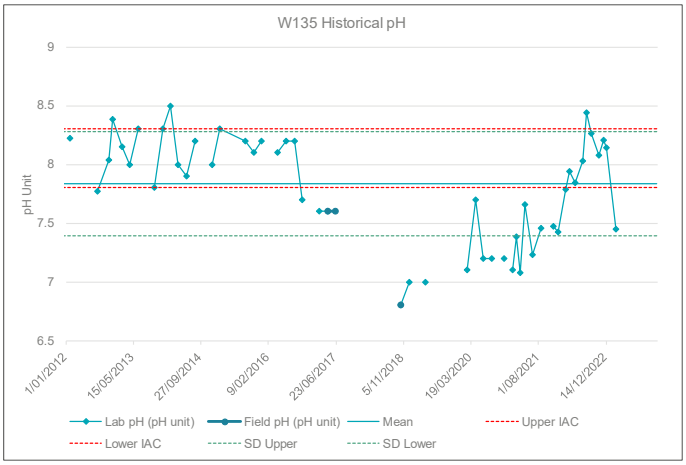


FIGURE B.30: PIKES GULLY EC – W135

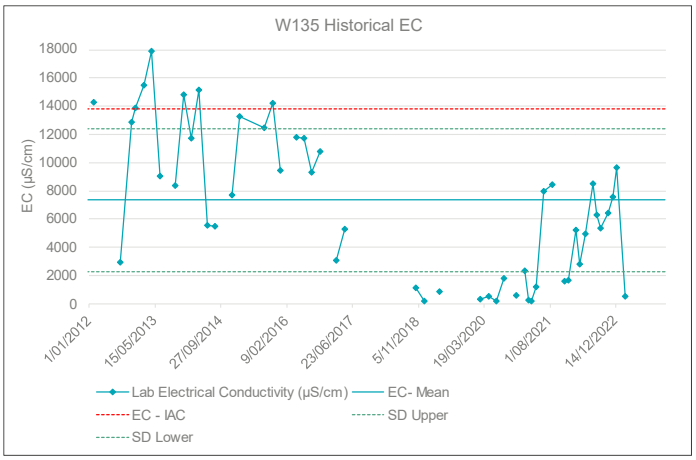


FIGURE B.31: PIKES GULLY TSS – W135

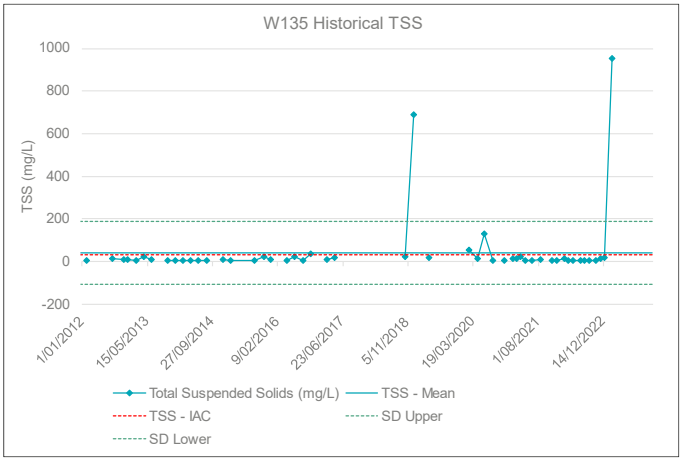


FIGURE B.32: PIKES GULLY TDS – W135

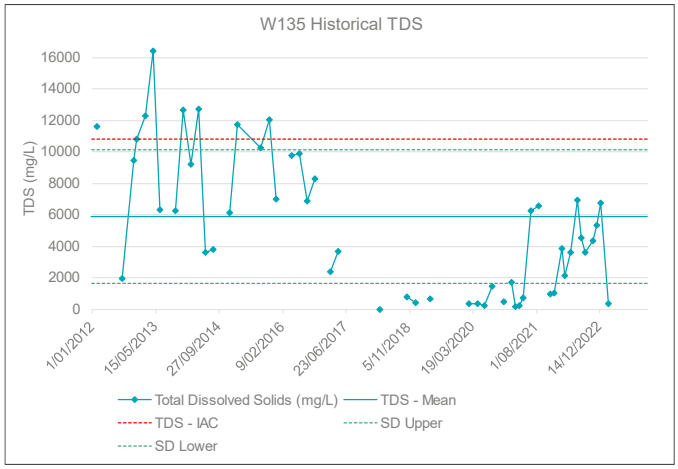


FIGURE B.33: PIKES GULLY PH – W136

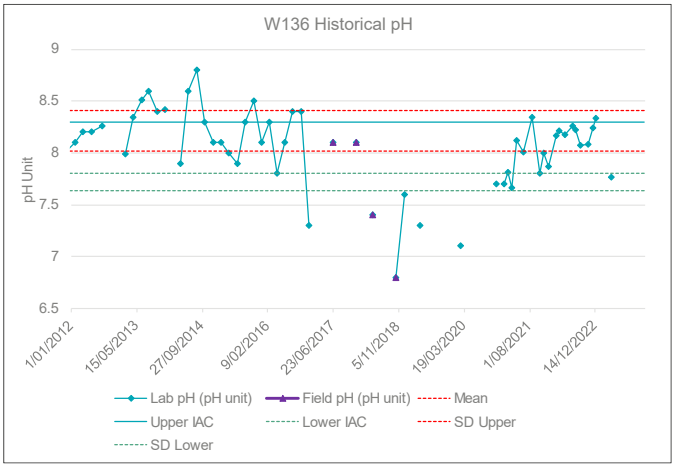


FIGURE B.34: PIKES GULLY EC – W136

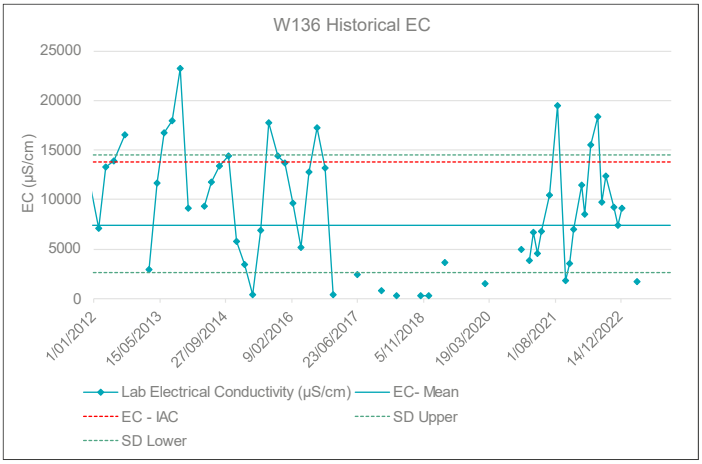


FIGURE B.35: PIKES GULLY TSS – W136

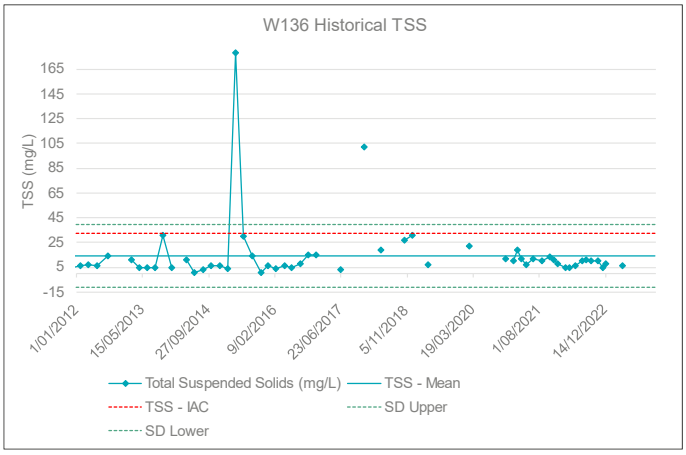


FIGURE B.36: PIKES GULLY TDS – W136

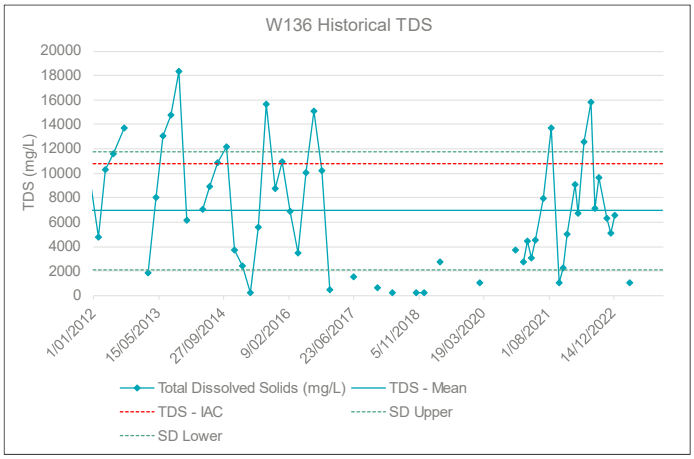


FIGURE B.37: PIKES GULLY PH – W137

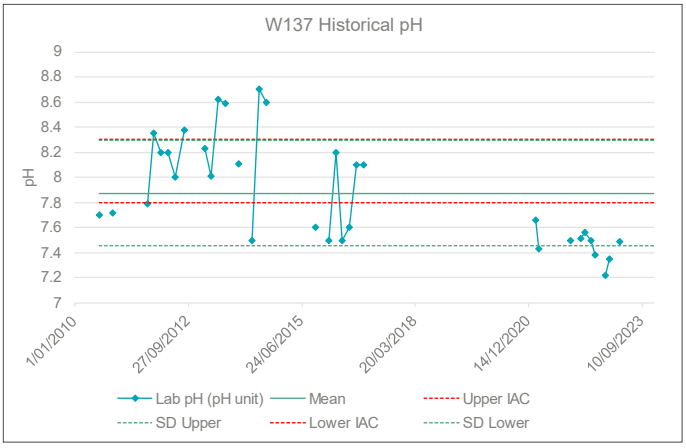


FIGURE B.38: PIKES GULLY EC – W137

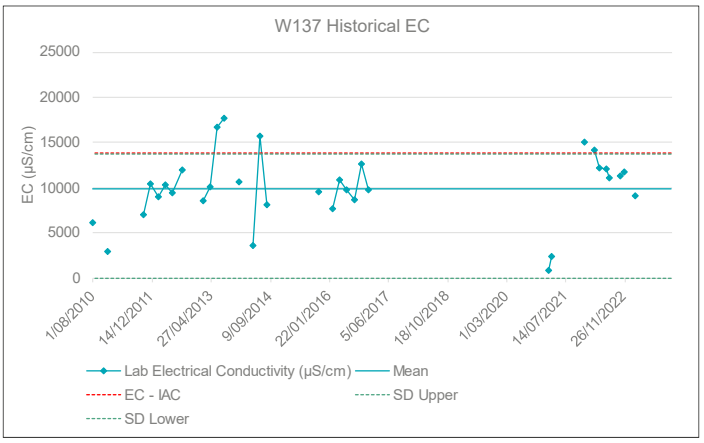


FIGURE B.39: PIKES GULLY TSS – W137

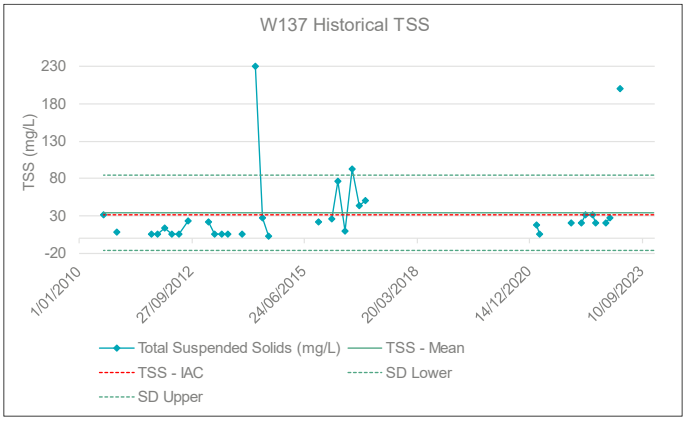
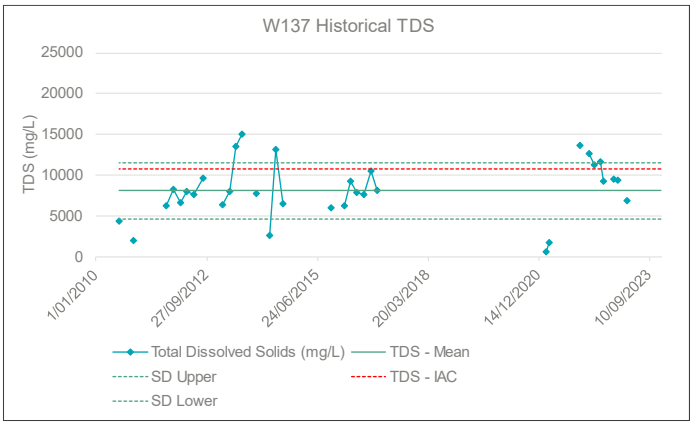


FIGURE B.40: PIKES GULLY TDS – W137



APPENDIX C: GROUNDWATER MONITORING LOCATIONS AND IMPACT ASSESSMENT CRITERIA

TABLE C.1: GROUNDWATER MONITORING LOCATION

Monitoring Location	Target	Monitoring Frequency			
		Water Level	pH	EC	Speciation
Coffey Dam Borehole	Liddell	Monthly	Quarterly	Quarterly	Annually
CS4641C	Pikes Gully	Monthly	Quarterly	Quarterly	Annually
NPZ1 Mid	Bayswater	Monthly	Quarterly	Quarterly	Annually
NPZ1 Tall	Lemington	Monthly	Quarterly	Quarterly	Annually
NPZ2 Tall	Lemington	Monthly	Quarterly	Quarterly	Annually
NPZ5B P1	Broonies	Monthly	Quarterly	Quarterly	Annually
NPZ5B P2	Bayswater Aluvium	Monthly	Quarterly	Quarterly	Annually
NPZ6 Tall	Broonies	Monthly	Quarterly	Quarterly	Annually
NPZ7 Small	Weathered Permian Coal Measures Underlying Hunter River Alluvium	Monthly	Quarterly	Quarterly	Annually
NPZ7 Tall	Bayswater	Monthly	Quarterly	Quarterly	Annually
NPZ7 Mid	Broonies	Monthly	Quarterly	Quarterly	Annually
Borehole P	Liddell	Monthly	Not Sampled	Not Sampled	Not Sampled
WPP1	-	Monthly	Quarterly	Quarterly	Annually
WPP2	-	Monthly	Quarterly	Quarterly	Annually

TABLE C.2: IMPACT ASSESSMENT CRITERIA VALUES FOR SPECIATION DATA FOR SELECT SITES

Site	Parameter	Unit of Measurement	IAC Value 80th Percentile	IAC Value 20th Percentile
CS4641C	Sodium	mg/L	1980	1820
	Chloride	mg/L	2482	2310
NPZ1 Tall	Sodium	mg/L	2048	1820
	Chloride	mg/L	2744	2225
NPZ2 Tall	Sodium	mg/L	2178	2100
	Chloride	mg/L	2685	2430
NPZ5B P1	Sodium	mg/L	939	820
	Chloride	mg/L	1020	830
NPZ7 Small	Sodium	mg/L	1496	1300

Site	Parameter	Unit of Measurement	IAC Value 80th Percentile	IAC Value 20th Percentile
	Chloride	mg/L	2492	1990
NPZ7 Tall	Sodium	mg/L	1602	1320
	Chloride	mg/L	2542	2099

TABLE C.3: INTERIM IMPACT ASSESSMENT CRITERIA VALUES FOR SPECIATION DATA

Parameter	Unit of Measurement	IAC Value
Sodium	mg/L	300
Sulphate	mg/L	400
Chloride	mg/L	400
Iron	mg/L	0.3
Silver	mg/L	0.05
Aluminium	mg/L	0.2
Barium	mg/L	1
Cadmium	mg/L	0.005
Copper	mg/L	1
Manganese	mg/L	0.1
Nickel	mg/L	0.1
Lead	mg/L	0.05
Selenium	mg/L	0.01
Zinc	mg/L	5
Mercury	mg/L	0.001
Nitrite N	mg/L	1
Nitrate as N	mg/L	10

TABLE C.4: ADOPTED IMPACT ASSESSMENT CRITERIA VALUES FOR WATER QUALITY PARAMETERS

Monitoring Location	Target	Location Coordinates	Water Quality Parameter	IAC (80th Percentile for Na & Chloride)
Coffey Dam Borehole	Liddell		pH	9.2 - 10.0
			EC (µS/cm)	3160
CS4641C	Pikes Gully		pH	8.8 - 11.9
			EC (µS/cm)	8900
			Sodium (mg/L)	1980
			Chloride (mg/L)	2482
NPZ1 Mid	Bayswater		pH	6.6 - 6.8
			EC (µS/cm)	15015
NPZ1 Tall	Lemington		pH	7.0 - 7.3
			EC (µS/cm)	9736
			Sodium (mg/L)	2048
			Chloride (mg/L)	2744
NPZ2 Tall	Lemington		pH	8.3 - 8.4
			EC (µS/cm)	9765
			Sodium (mg/L)	2178
			Chloride (mg/L)	2685
NPZ5B P1	Broonies		pH	7.2 - 7.4
			EC (µS/cm)	6340
			Sodium (mg/L)	939
			Chloride (mg/L)	1020
NPZ5B P2	Bayswater Creek Alluvium		pH	7.1 - 7.3
			EC (µS/cm)	2193
NPZ6 Tall	Broonies		pH	7.5 - 7.7
			EC (µS/cm)	7120
NPZ7 Small			pH	7.3 - 7.4

Monitoring Location	Target	Location Coordinates	Water Quality Parameter	IAC (80th Percentile for Na & Chloride)
	Hunter River Alluvium		EC (µS/cm)	5259
			Sodium (mg/L)	1496
			Chloride (mg/L)	2492
NPZ7 Tall	Bayswater		pH	7.4 - 7.5
			EC (µS/cm)	8678
			Sodium (mg/L)	1062
			Chloride (mg/L)	2542
NPZ7 Mid	Broonies		pH	7.3 -7.7
			EC (µS/cm)	8446
WPP1	-		pH	7.0-7.1
			EC (µS/cm)	8604
WPP2	-		pH	7.0 - 7.3
			EC (µS/cm)	9352

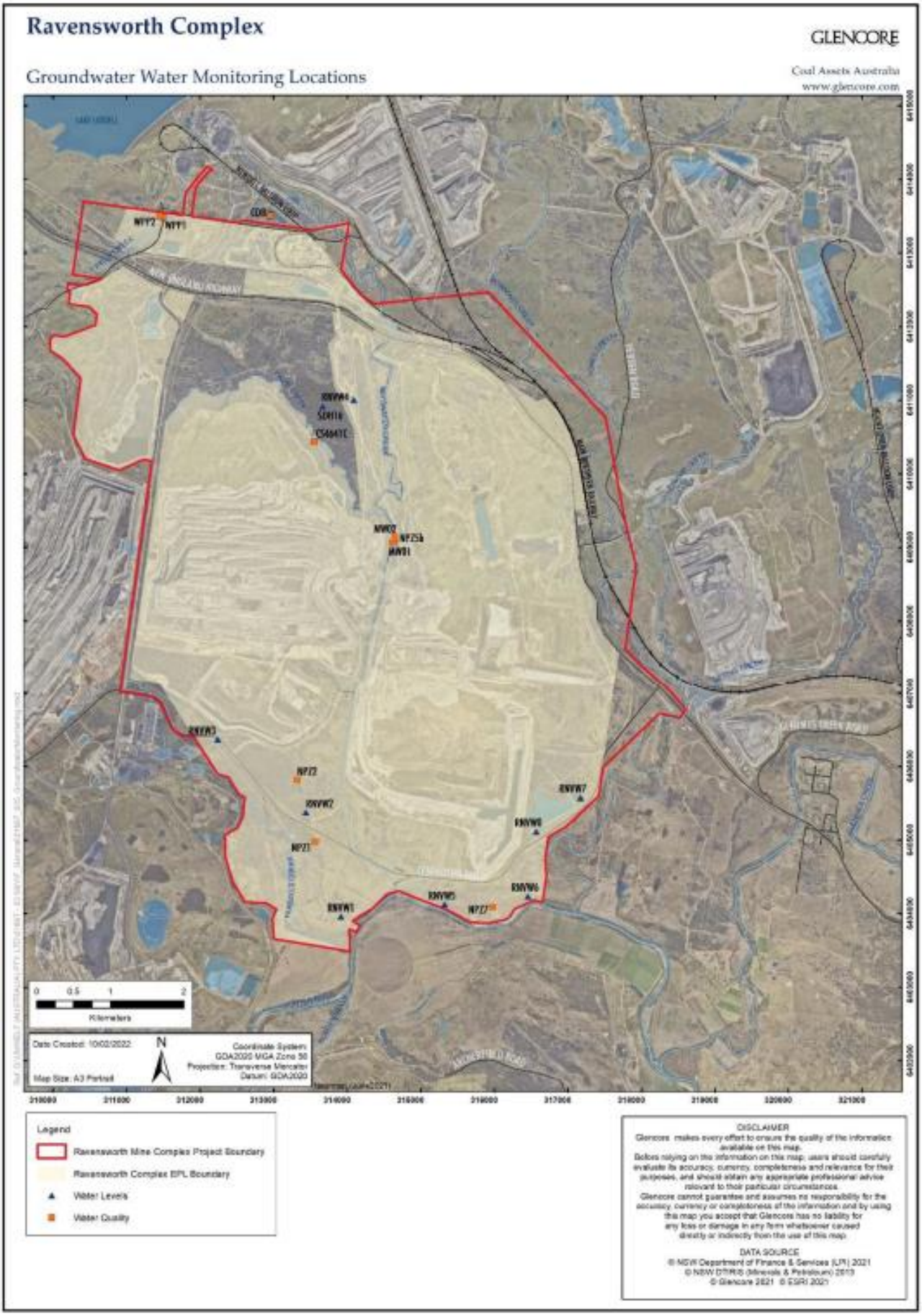


FIGURE C.1: GROUNDWATER MONITORING LOCATIONS FROM 2022 WATER MANAGMENT PLAN

APPENDIX D: GROUNDWATER QUALITY MONITORING RESULTS

TABLE D.1: SUMMARY OF GROUNDWATER PH ASND EC RESULTS

Monitoring Location	Target	pH			Electrical Conductivity			No. of samples
		Min	Max	Mean	Min	Max	Mean	
Coffey Dam Borehole	Liddell	7	7.4	7.15	6,110	6,951	6,597.67	6
CS4641C	Pikes Gully	7.9	7.9	7.9	8,980	9,110	9,045	2
NPZ1 Mid	Bayswater	-	-	-	-	-	-	-
NPZ1 Tall	Lemington	7.2	7.4	7.28	7,440	7,550	7,497.5	6
NPZ2 Tall	Lemington	8.0	8.2	8.05	9,470	9,760	9,678.3	6
NPZ5B P1	Broonies	7.1	7.6	7.43	1,009	3,480	2,129.4	12
NPZ5B P2	Bayswater Creek Alluvium	6.7	7.1	6.88	2,779	6,090	4,610.8	12
NPZ6 Tall	Broonies	7.1	7.8	7.64	6,880	7,310	7,121.7	12
NPZ7 Small	Hunter River Alluvium	7.1	7.3	7.27	487	4,900	3,447.8	6
NPZ7 Tall	Bayswater	7.2	7.6	7.35	5,200	5,410	5,344.2	6
NPZ7 Mid	Broonies	-	-	-	-	-	-	-
WPP1	Cumnock	7.1	7.2	7.15	5,150	7,650	6,790	6
WPP2	Cumnock	7	7.3	7.08	8,690	9,740	9,300.2	6

The 2023 groundwater monthly water quality monitoring results for pH and EC are presented in Tables D.2 to D.3, respectively. Table D.4 represents the 2023 groundwater speciation results.

Figures D.1 to D.6 present historical pH and EC results for all current and decommissioned monitoring bores. Historical pH and EC results for current monitoring bores are presented in Figures D.7 to D.32 with the mean and standard deviation for each bore shown on each figure. The mean and standard deviation values shown on these figures are based on historical monitoring data from January 2010 to January 2023, as made available through the Glencore Environmental Monitoring Database.

Tables D.2 – D.3 contain the following formatting:

	Indicates non-sampling month.
XXX	Indicates a value that has exceeded the IAC range

TABLE D.2: RAVENSWORTH MINING COMPLEX GROUNDWATER PH FOR 2023

Target	Borehole	IAC	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Liddell	Coffey Dam Borehole	9.2 - 10		7.4		7.1		7.1		7.1		7		7.2
Pikes Gully	CS4641C	8.78 - 11.9				7.9								7.9
Bayswater	NPZ1 Mid	6.6 - 6.8	Blocked											
Lemington	NPZ1 Tall	7 - 7.3		7.3		7.4		7.3		7.2		7.2		7.3
Lemington	NPZ2 Tall	8.3 - 8.4	11	8.0		8.1		8.0		8.2		8.0		8.0
Broonies	NPZ5B P1	7.2 - 7.44	7.6	7.6	7.5	7.4	7.4	7.4	7.5	7.5	7.3	7.4	7.4	7.1
Bayswater Creek Alluvium	NPZ5B P2	7.1 - 7.3	7.0	7.1	6.8	6.9	7.0	7.0	6.8	6.9	6.7	6.8	6.8	6.8
Broonies	NPZ6 Tall	7.5 - 7.7	7.7	7.1	7.8	7.7	7.7	7.7	7.7	7.7	7.6	7.7	7.6	7.7
Weathered Coal Measures	NPZ7 Small	7.3 - 7.4		7.1		7.3		7.3		7.3		7.3		7.3
Bayswater	NPZ7 Tall	7.4 - 7.5		7.6		7.4		7.4		7.2		7.2		7.3
Broonies	NPZ7 Mid	7.3 - 7.7	Blocked											
Cumnock	WPP1	7 - 7.1		7.2		7.1		7.1		7.2		7.1		7.2
Cumnock	WPP2	7 - 7.3		7.2		7		7		7		7		7.3

TABLE D.3: RAVENSWORTH MINING COMPLEX GROUNDWATER EC FOR 2023

Target	Borehole	IAC	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Liddell	Coffey Dam Borehole	3160		6951		6840		6560		6665		6460		6110
Pikes Gully	CS4641C	8900				8980								9110
Bayswater	NPZ1 Mid	15015	Blocked											
Lemington	NPZ1 Tall	9736	22	7550		7520		7460		7525		7440		7490
Lemington	NPZ2 Tall	9765	11	9470		9760		9760		9610		9710		9760
Broonies	NPZ5B P1	6340	1009	1014	1034	2490	2480	2480	1341	2075	2660	2190	3300	3480
Bayswater Creek Alluvium	NPZ5B P2	2193	2779	2890	4720	3560	3410	3410	4780	6030	5950	5640	6070	6090
Broonies	NPZ6 Tall	7120	7100	7090	7030	7120	7200	7200	7030	7180	7080	6880	7240	7310
Weathered Coal Measures	NPZ7 Small	5259		487		4550		4750		4900		3990		2010
Bayswater	NPZ7 Tall	8678		5400		5410		5350		5405		5300		5200
Broonies	NPZ7 Mid	8446	Blocked											
Cumnock	WPP1	8604		5150		6690		6930		7590		7650		6730
Cumnock	WPP2	9352		8711		9640		9740		9730		9290		8690

TABLE D.4: RAVENSWORTH MINING COMPLEX GROUNDWATER SPECIATION FOR 2023

Analysis	Interim IAC (ANZECC)	PIKES GULLY SEAM		BROONIES SEAM				ALLUVIUM & WEATHERED COAL MEASURES			
		CS4641C		NPZ6 Tall		NPZ5B P1		NPZ7 Small		NPZ5B P2	
		Apr-23	Oct-23	Apr-23	Oct-23	Apr-23	Oct-23	Apr-23	Oct-23	Apr-23	Oct-23
Field Ph	6.5 - 8.5	7.90	\	7.7	7.7	7.4	7.4	7.3	7.3	6.9	6.8
Field Conductivity (µS/cm)	X	6,980	\	3,600	3,950	1,490	1,580	2,260	2,330	2,000	4,170
Calcium (mg/L)	X	\	\	11	11	71	67	40	45	208	296
Magnesium (mg/L)	X	\	\	4	4	87	81	64	70	157	218
Sodium (mg/L)	300	\	\	1,570	1,500	515	351	722	725	544	711
Potassium (mg/L)	X	\	\	8	7	8	7	15	16	8	10
Hydroxide Alkalinity as CaCO3	X	\	\	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	X	\	\	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	X	\	\	1,010	1,020	535	577	603	571	404	647
Alkalinity as CaCO3 (mg/L)	X	\	\	1,010	1,020	535	577	603	571	404	647
Sulfate (mg/L)	400	\	\	<1	<1	281	283	31	40	431	520
Chloride (mg/L)	400	\	\	1780	1800	436	412	1070	967	690	1370
Hexavalent Chromium (mg/L)	X	\	\	\	\	\	\	\	\	\	\
Reactive Silica (mg/L)	X	\	\	\	\	\	\	\	\	\	\
Ammonia as N (mg/L)	X	\	\	2.06	2.01	0.63	0.87	4.04	3.9	0.5	0.31
Nitrite as N (mg/L)	1	\	\	<0.01	<0.01	0.07	0.02	0.03	<0.01	0.05	<0.01
Nitrate as N (mg/L)	10	\	\	<0.01	0.02	3.63	0.69	0.18	0.02	0.35	0.07
Nitrite + Nitrate as N (mg/L)	X	\	\	<0.01	0.02	3.7	0.71	0.21	0.02	0.4	0.07
TKN as N (mg/L)	X	\	\	3.2	3.2	1.4	3.8	6	4.7	1.2	1.3
Total Nitrogen as N (mg/L)	X	\	\	3.2	3.2	5.1	4.5	6.2	4.7	1.6	1.4
Total Cations (meq/L)	X	\	\	70.4	71.2	28.8	29	42.9	39.5	36.5	62.4
Total Anions (meq/L)	X	\	\	69.4	66.3	33.3	25.4	39	40	47.2	63.9
Zinc (µg/L)	5000	\	\	<0.005	0.009	0.008	0.062	<0.005	<0.005	0.006	0.044
Silver (µg/L)	50	\	\	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (µg/L)	10	\	\	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Nickel (µg/L)	100	\	\	<0.001	0.001	0.006	0.011	0.002	0.002	0.009	0.024
Mercury (µg/L)	1	\	\	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese (µg/L)	100	\	\	0.081	0.087	0.253	0.218	0.067	0.082	1.32	1.64
Lead (µg/L)	50	\	\	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (µg/L)	300	\	\	0.44	0.59	1.57	0.13	0.06	<0.05	0.88	0.95
Copper (µg/L)	1000	\	\	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	0.002
Cadmium (µg/L)	5	\	\	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Barium (µg/L)	1000	\	\	0.282	0.279	0.054	0.066	0.253	0.273	0.163	0.21

Antimony (µg/L)	X	\	\	<0.001	<0.001	0.002	0.011	<0.001	<0.001	<0.001	0.002
Aluminium (µg/L)	200	\	\	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Site Specific IAC for pH		8.78 - 11.9		7.5 - 7.7		7.2 - 7.44		7.3 - 7.4		7.1 - 7.3	
Site Specific IAC for EC (µS/cm)		8,900		7,120		6,340		5,259		2,193	
Site Specific IAC for Sodium (mg/L)		1,820 - 1,980		N/A		820 - 939		1,300 – 1,496		N/A	
Site Specific IAC for Chloride (mg/L)		2,310 - 2,482		N/A		830 – 1,020		1,990 - 2492		N/A	

TABLE D.5: RAVENSWORTH MINING COMPLEX GROUNDWATER SPECIATION FOR 2023- CONTINUED

Analysis	Interim IAC (ANZECC)	LIDDELL SEAM		BAYSWATER SEAM				LEMINGTON SEAM				CUMNOCK OPEN CUT	
		COFFEY		NPZ7 Tall		NPZ1 Tall		NPZ2 Tall		WPP1		WPP2	
		Apr-23	Oct-23	Apr-23	Oct-23	Apr-23	Oct-23	Apr-23	Oct-23	Apr-23	Oct-23	Apr-23	Oct-23
Field Ph	6.5-8.5	7.1	7	7.4	7.2	7.4	7.2	8.1	8	7.1	7.1	7	7
Field Conductivity (µS/cm)	X	4,410	4,170	3,070	3,140	4,300	4,300	5,650	6,010	5,250	6,540	8,040	8,540
Calcium (mg/L)	X	142	137	52	57	12	13	19	20	202	254	256	263
Magnesium (mg/L)	X	225	215	88	91	8	9	8	8	311	417	446	488
Sodium (mg/L)	300	1,250	1,180	979	994	1,640	1,640	2,210	2,160	1,200	1,250	1,680	1,730
Potassium (mg/L)	X	16	17	10	10	9	10	13	14	6	5	15	15
Hydroxide Alkalinity as CaCO3	X	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	X	<1	<1	<1	<1	<1	<1	23	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	X	1,200	1,160	773	702	1,240	1,240	1,460	1,460	754	833	877	897
Alkalinity as CaCO3 (mg/L)	X	1,200	1,160	773	702	1,240	1,240	1,480	1,460	754	833	877	897
Sulfate (mg/L)	400	896	956	57	143	<1	<10	<10	<10	3,240	3,270	4,270	4,970
Chloride (mg/L)	400	1,180	1,030	1,410	1,220	1,790	1,800	2,700	2,320	752	794	852	892
Hexavalent Chromium (mg/L)	X	\	\	\	\	\	\	\	\	\	\	\	\
Reactive Silica (mg/L)	X	\	\	\	\	\	\	\	\	\	\	\	\
Ammonia as N (mg/L)	X	1.53	1.69	1.97	2.61	7.28	6.26	5.74	4.55	0.17	0.03	0.07	0.03
Nitrite as N (mg/L)	1	<0.10	<0.01	<0.01	<0.01	0.08	0.04	0.01	<0.01	<0.01	<0.01	<0.01	0.01
Nitrate as N (mg/L)	10	<0.10	0.02	0.01	0.02	0.25	<0.01	0.15	0.03	<0.01	0.17	0.09	0.09
Nitrite + Nitrate as N (mg/L)	X	<0.10	0.02	0.01	0.02	0.33	0.04	0.16	0.03	<0.01	0.17	0.09	0.10
TKN as N (mg/L)	X	2.30	2.20	3.20	3.10	8.90	6.50	9.20	4.90	<1.0	0.50	1.20	0.80
Total Nitrogen as N (mg/L)	X	2.30	2.20	3.20	3.10	9.20	6.50	9.40	4.90	<1.0	0.70	1.30	0.90
Total Cations (meq/L)	X	75.90	72.10	56.40	51.40	75.30	75.60	106.00	94.60	104.00	107.00	130.00	146.00
Total Anions (meq/L)	X	80.40	76.30	52.70	53.80	72.80	73.00	98.10	96.00	88.00	101.00	123.00	129.00
Zinc (µg/L)	5000	<0.005	<0.005	<0.005	<0.005	0.03	<0.005	<0.005	<0.005	0.01	0.01	0.02	0.02
Silver (µg/L)	50	<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 (µg/L)	10	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel (µg/L)	100	0.00	0.00	<0.001	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Mercury (µg/L)	1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese (µg/L)	100	0.34	0.11	0.02	0.03	0.11	0.12	0.07	0.06	0.18	0.09	0.01	0.12
Lead (µg/L)	50	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (µg/L)	300	12.00	0.81	<0.05	<0.05	0.09	1.20	0.29	0.13	0.28	<0.05	0.08	0.16
Copper (µg/L)	1000	<0.001	<0.001	<0.001	<0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium (µg/L)	5	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Barium (µg/L)	1000	0.04	0.06	0.39	0.41	0.26	0.45	1.29	1.31	0.02	0.02	0.02	0.02
Antimony (µg/L)	X	<0.001	<0.001	<0.001	<0.001	0.00	<0.001	0.00	<0.001	<0.001	<0.001	<0.001	<0.001
Aluminium (µg/L)	200	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Site Specific IAC for pH		9.2 - 10		7.4 - 7.5		7 - 7.3		8.3 - 8.4		7 - 7.1		7 - 7.3	
Site Specific IAC for EC (µS/cm)		3,160		8,678		9,736		9,765		8,604		9,352	
Site Specific IAC for Sodium (mg/L)		N/A		1,320 – 1,602		1,820 – 2,048		2,100 – 2,178		N/A		N/A	
Site Specific IAC for Chloride (mg/L)		N/A		2,099 - 2,542		2,225 – 2,744		2,430 – 2,685		N/A		N/A	

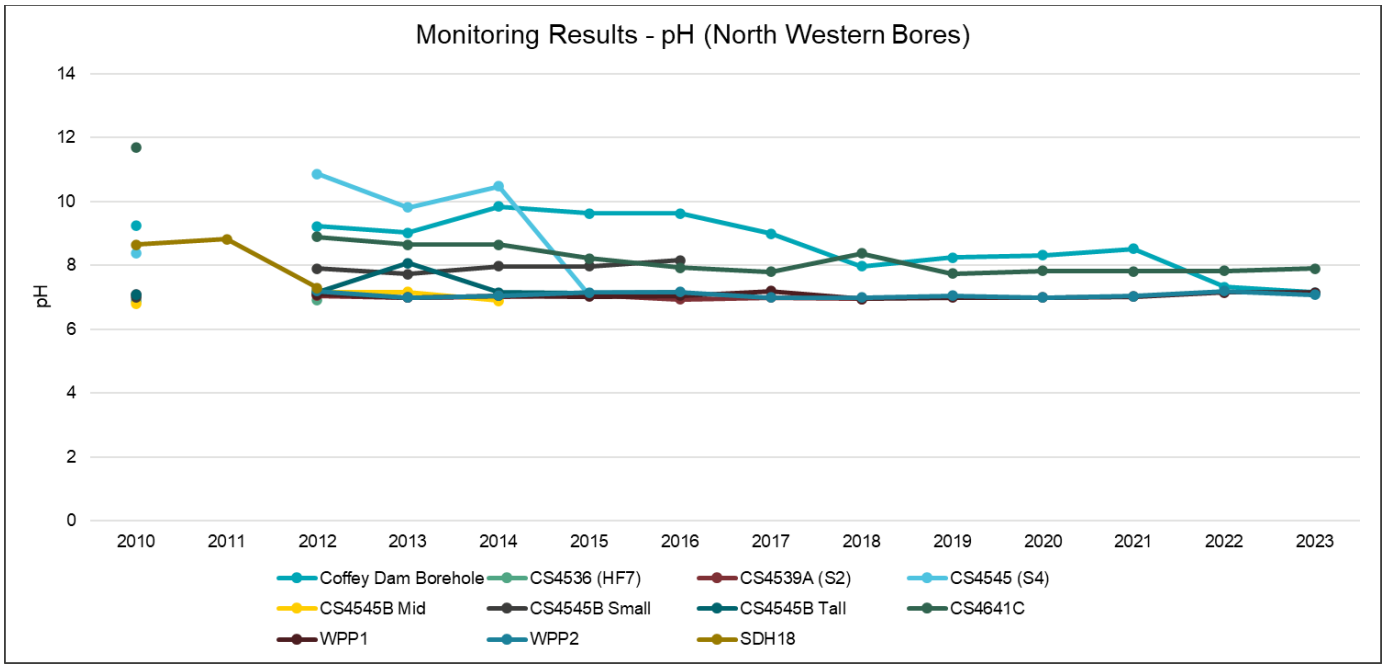


FIGURE D.1: RAVENSWORTH MINING COMPLEX GROUNDWATER HISTORICAL PH (NORTHWESTERN BORES)

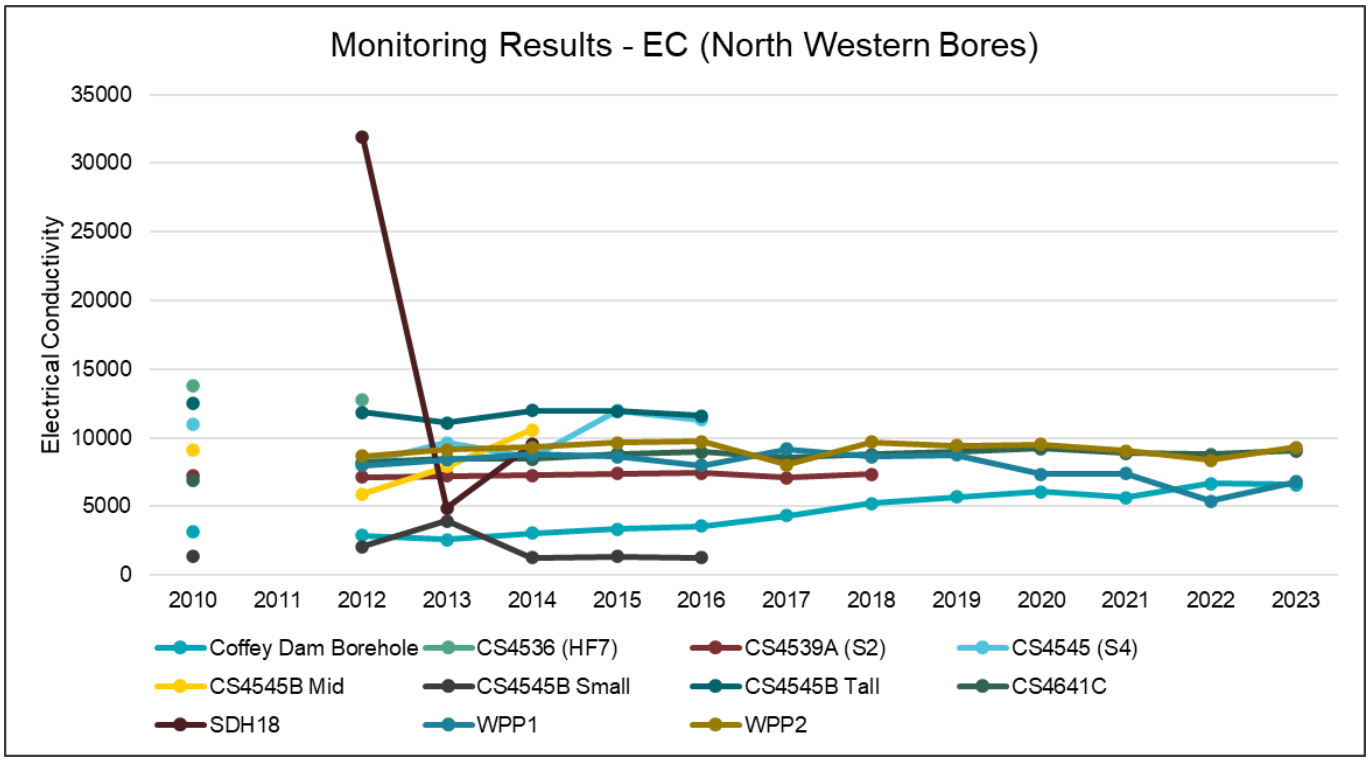


FIGURE D.2: RAVENSWORTH MINING COMPLEX GROUNDWATER HISTORICAL EC (NORTHWESTERN BORES)

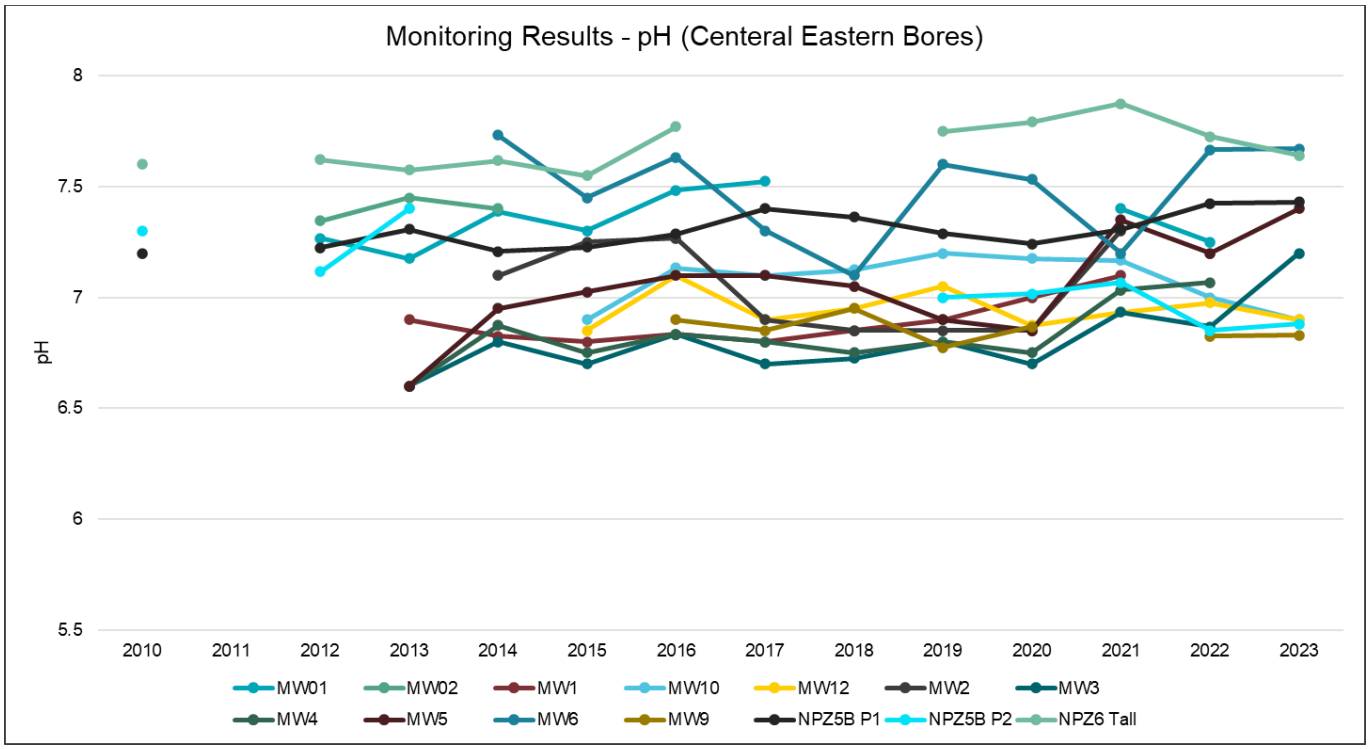


FIGURE D.3: RAVENSWORTH MINING COMPLEX GROUNDWATER HISTORICAL PH (CENTRAL EASTERN BORES)

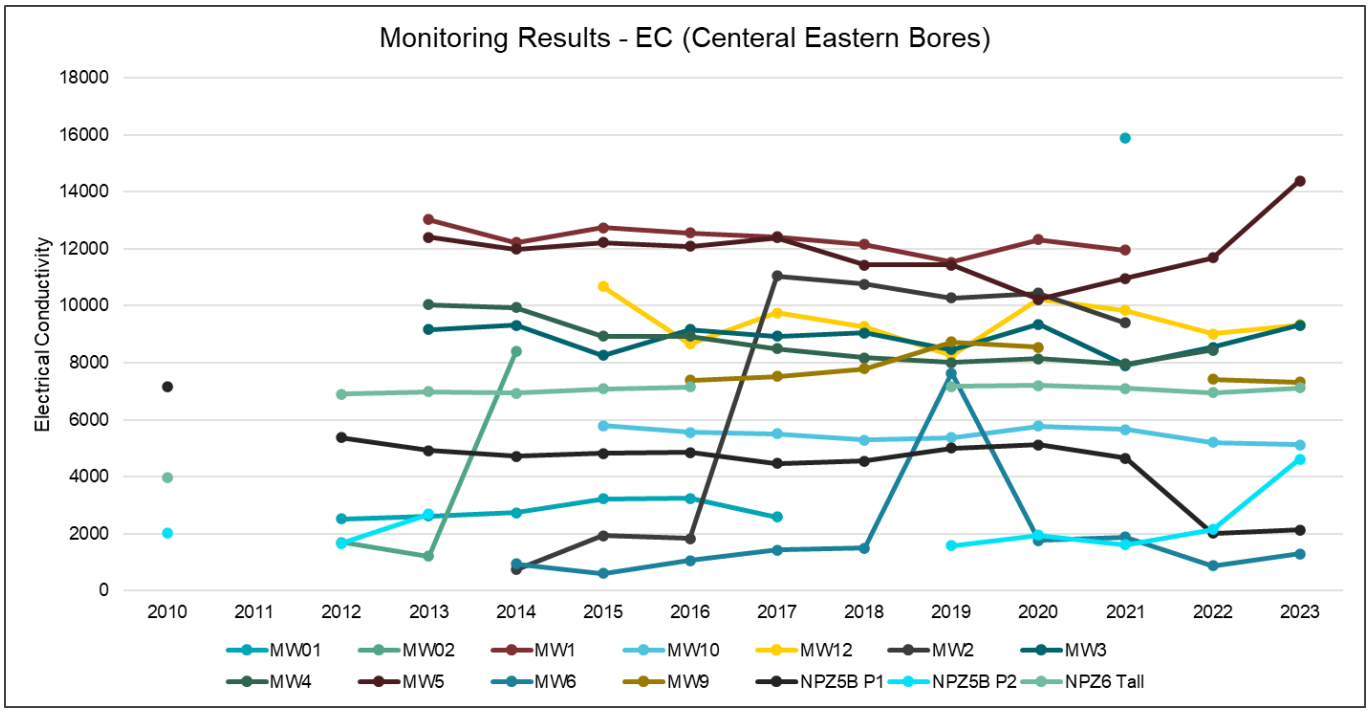


FIGURE D.4: RAVENSWORTH MINING COMPLEX GROUNDWATER HISTORICAL EC (CENTRAL EASTERN BORES)

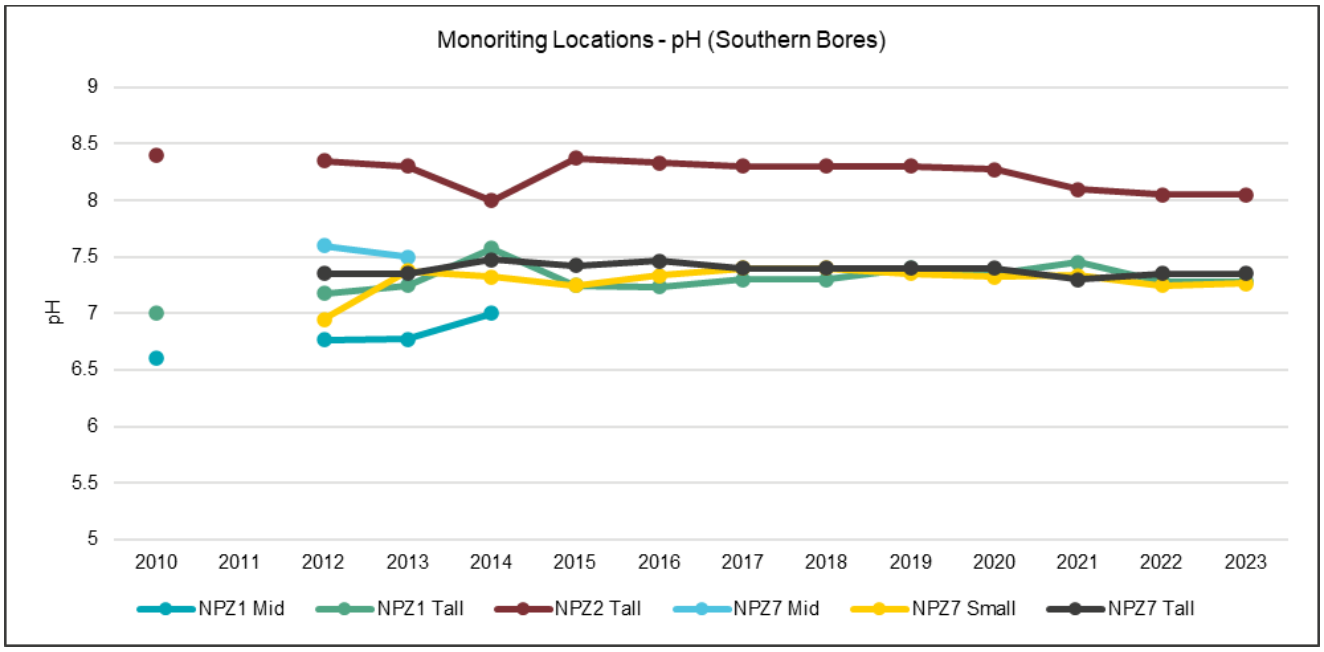


FIGURE D.5: RAVENSWORTH MINING COMPLEX GROUNDWATER HISTORICAL PH (SOUTHERN BORES)

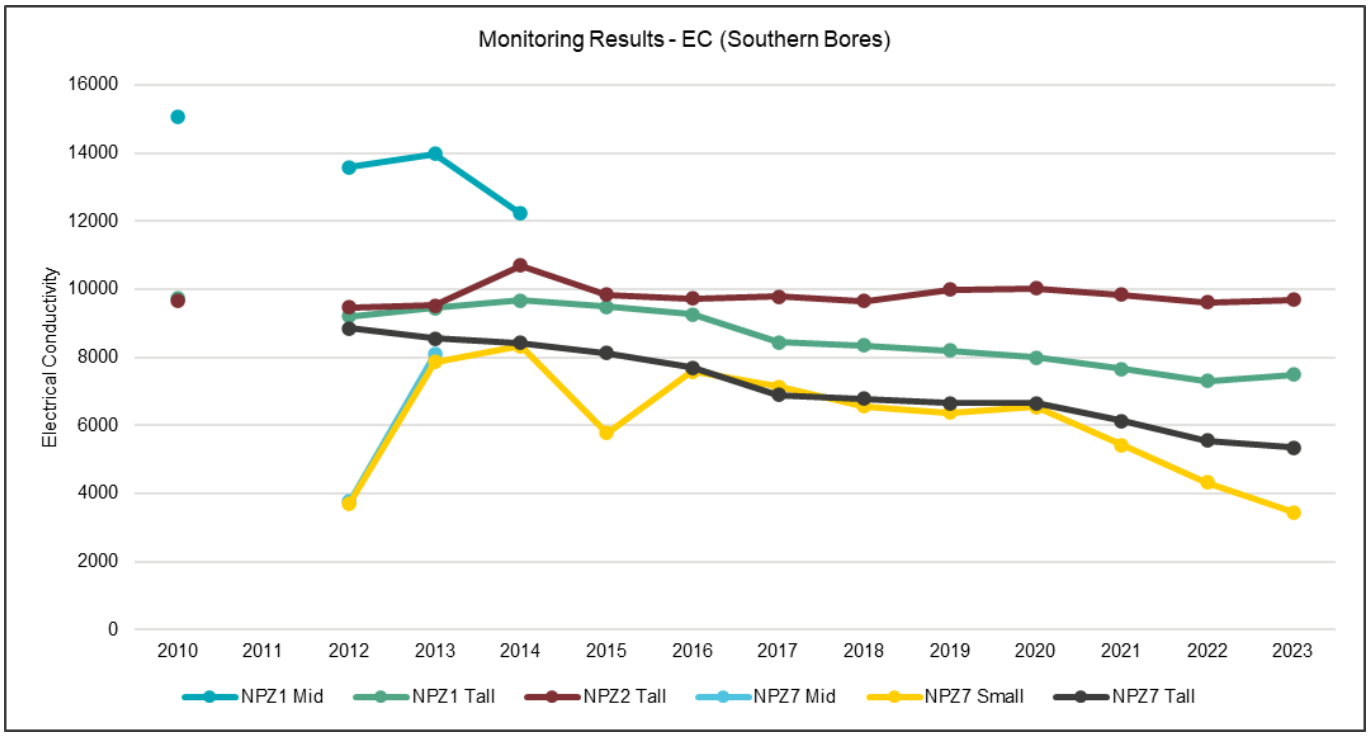


FIGURE D.6: RAVENSWORTH MINING COMPLEX GROUNDWATER HISTORICAL EC (SOUTHERN BORES)

Note: available data switched from “lab” results to “field” results in approximately 2017. This change is shown on the below graphs. Mean and standard deviation values were calculated from all historical field and lab values.

FIGURE D.7: COFFEY DAM HISTORICAL PH

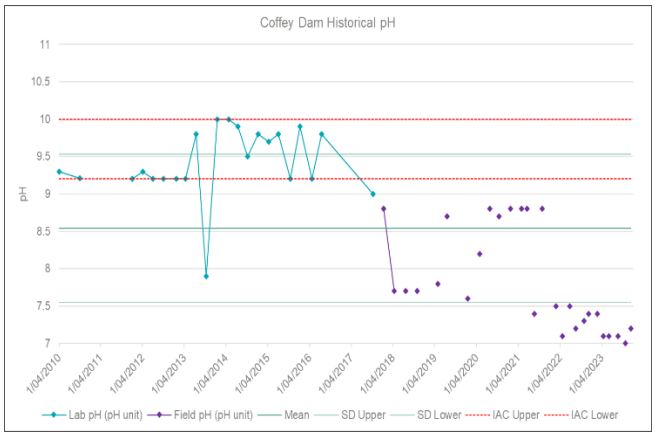


FIGURE D.8: COFFEY DAM HISTORICAL EC

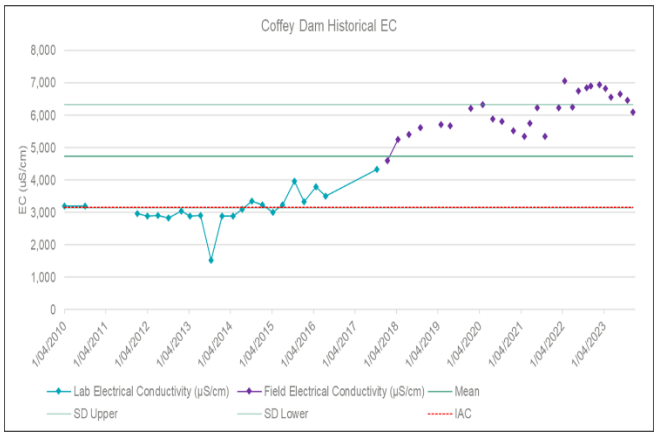


FIGURE D.9: CS4641C HISTORICAL PH

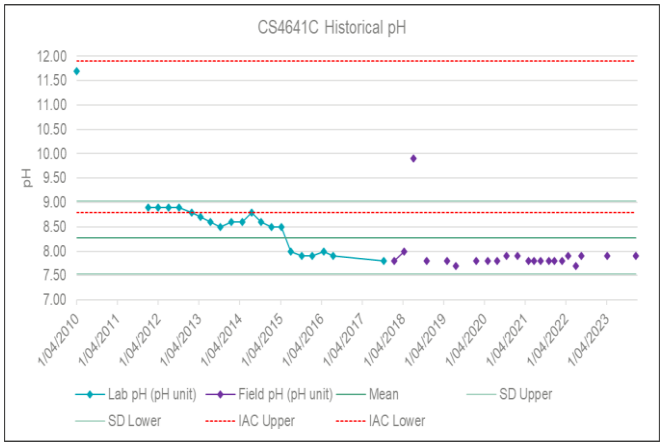


FIGURE D.10: CS4641C HISTORICAL EC

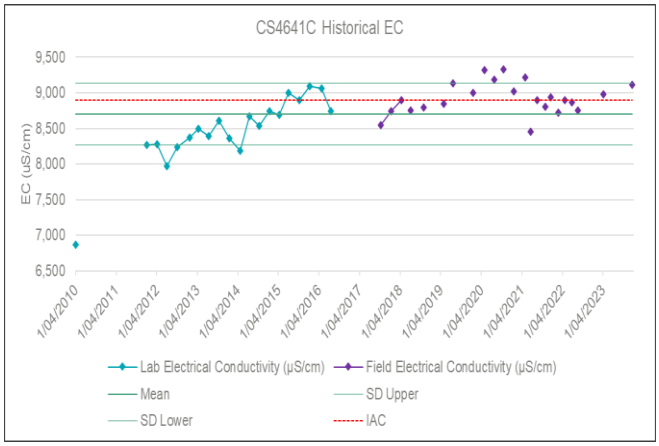


FIGURE D.11: NPZ1 MID HISTORICAL PH

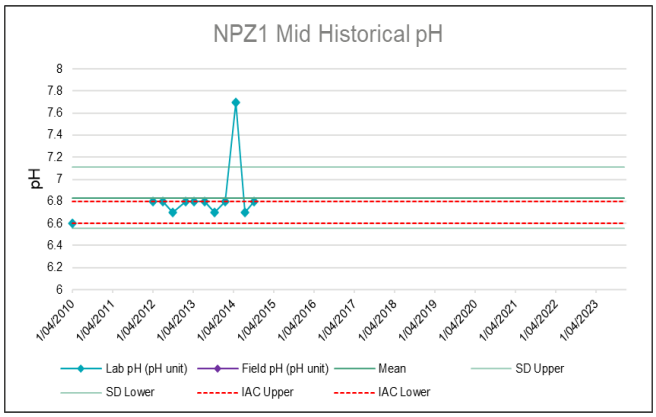


FIGURE D.12: NPZ1 MID HISTORICAL EC

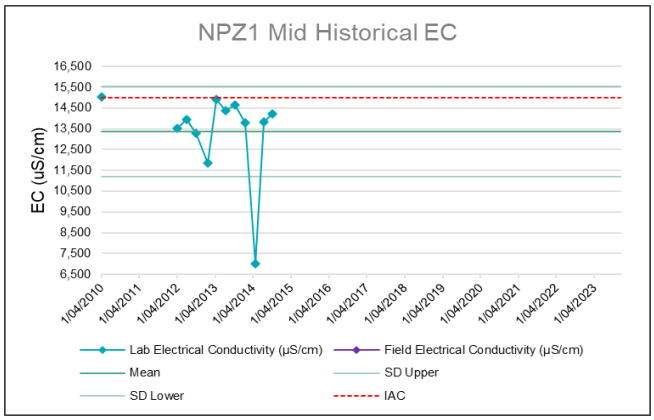


FIGURE D.13: NPZ1 TALL HISTORICAL PH

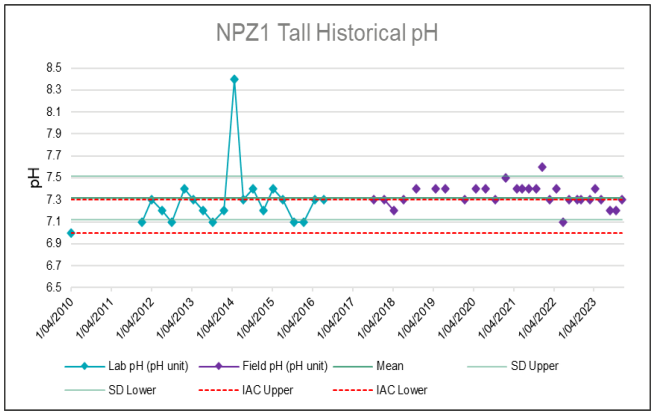


FIGURE D.14: NPZ1 TALL HISTORICAL EC

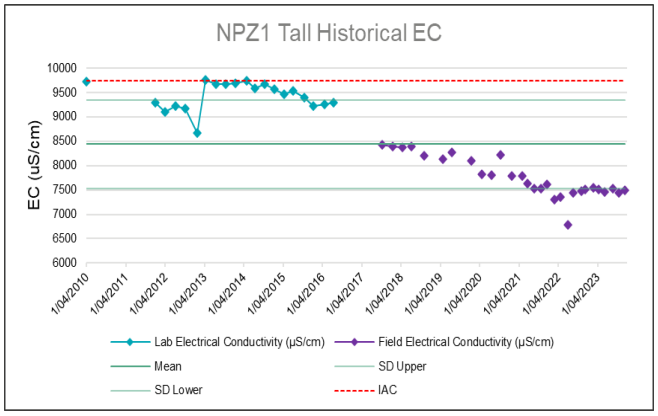


FIGURE D.15: NPZ2 TALL HISTORICAL PH

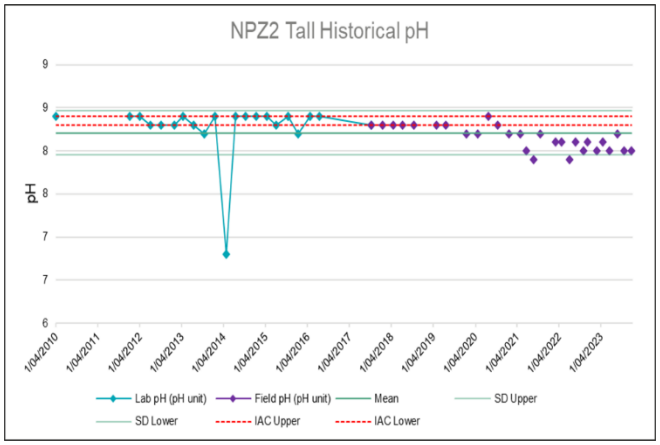


FIGURE D.16: NPZ2 TALL HISTORICAL EC

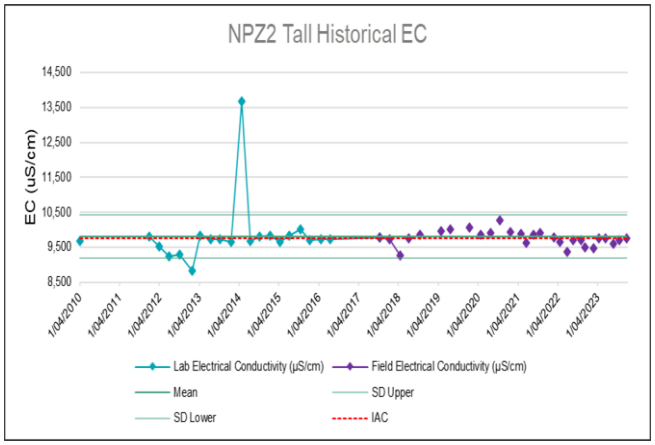


FIGURE D.17: NPZ5B P1 HISTORICAL PH

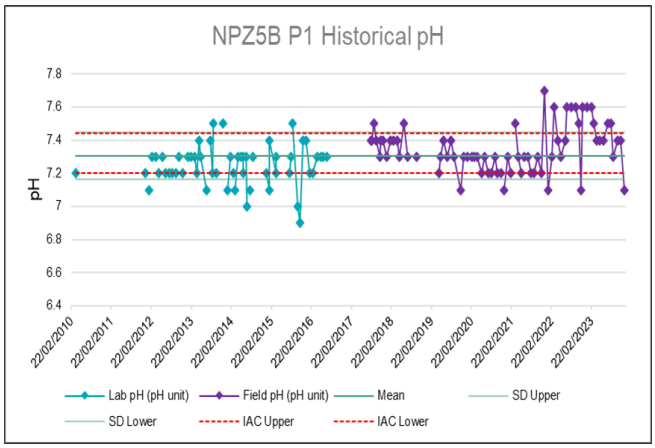


FIGURE D.18: NPZ5B P1 HISTORICAL EC

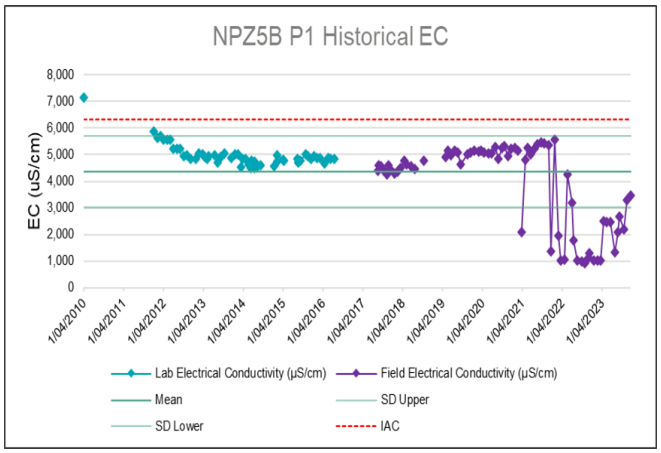


FIGURE D.19: NPZ5B P2 HISTORICAL PH

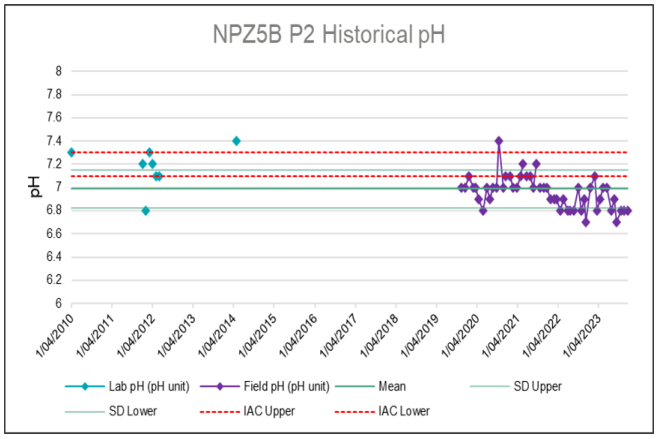


FIGURE D.20: NPZ5B P2 HISTORICAL EC

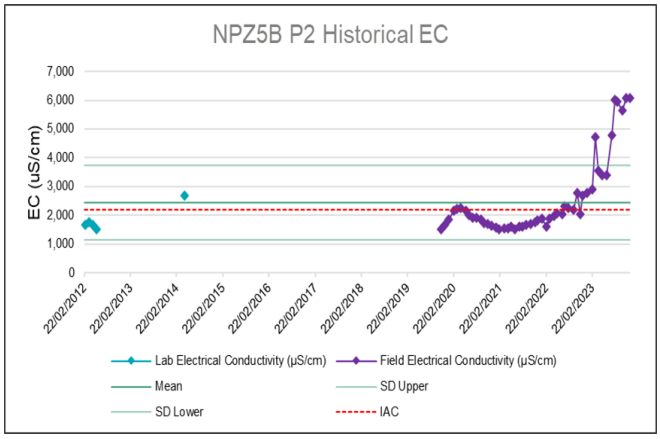


FIGURE D.21: NPZ6 TALL HISTORICAL PH

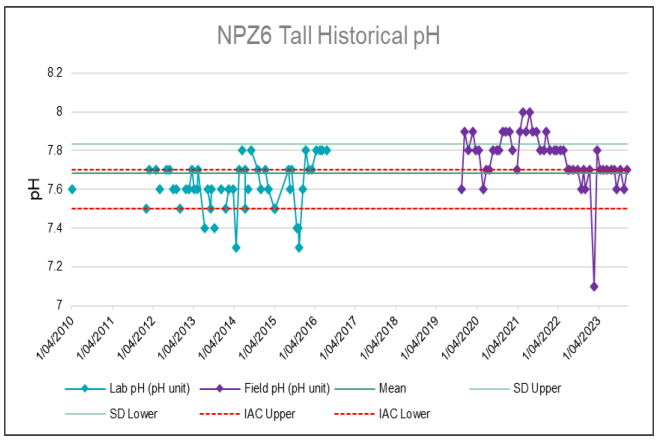


FIGURE D.22: NPZ6 TALL HISTORICAL EC

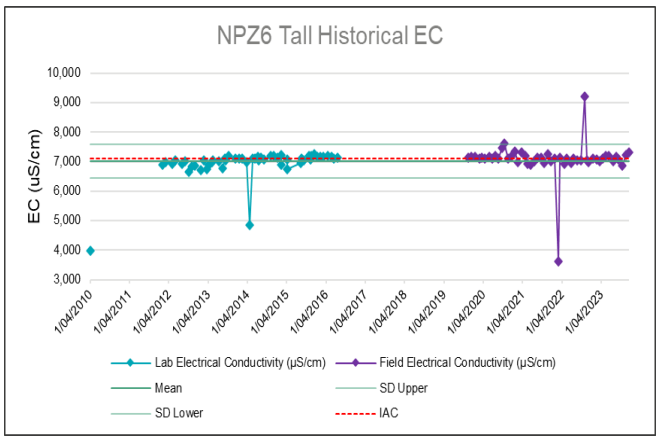


FIGURE D.23: NPZ7 SMALL HISTORICAL PH

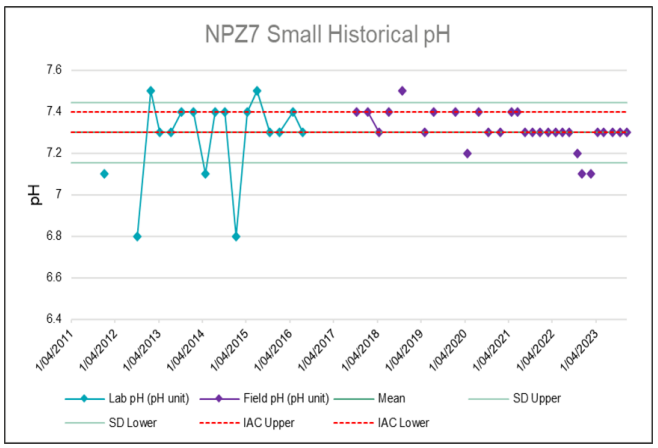


FIGURE D.24: NPZ7 SMALL HISTORICAL EC

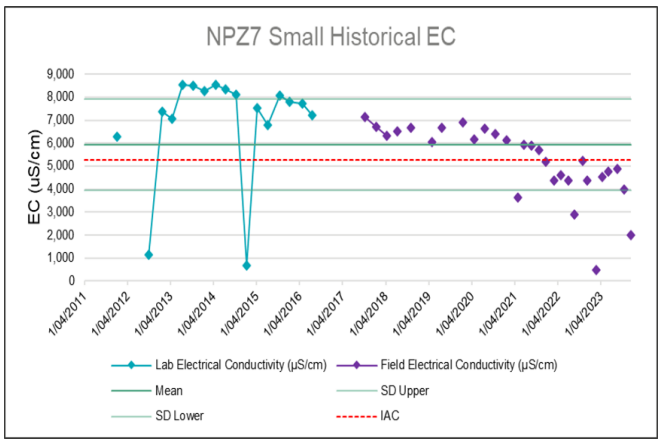


FIGURE D.25: NPZ7 TALL HISTORICAL PH

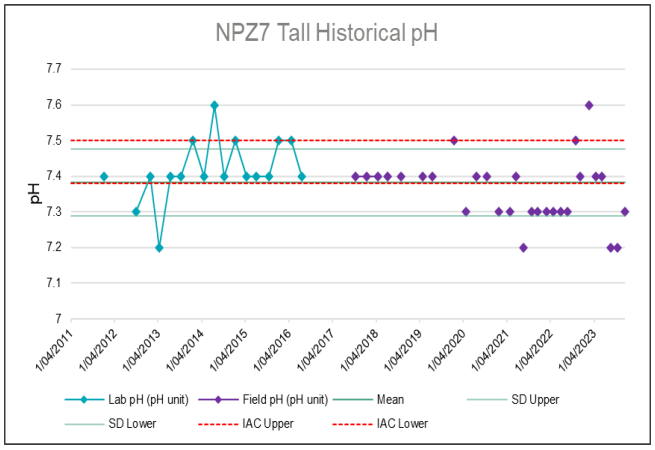


FIGURE D.26: NPZ7 TALL HISTORICAL EC

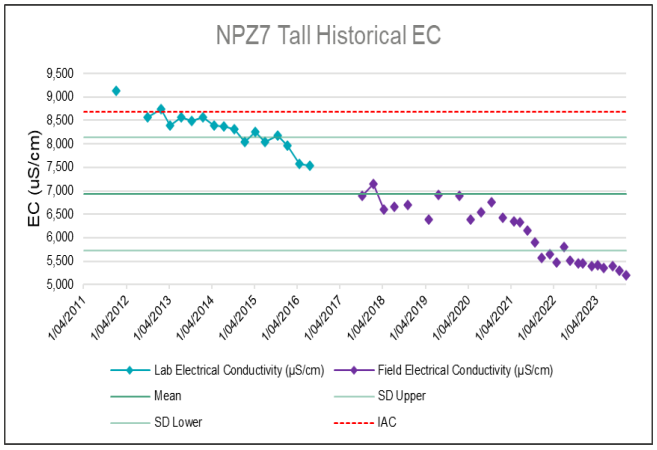


FIGURE D.27: NPZ7 MID HISTORICAL PH

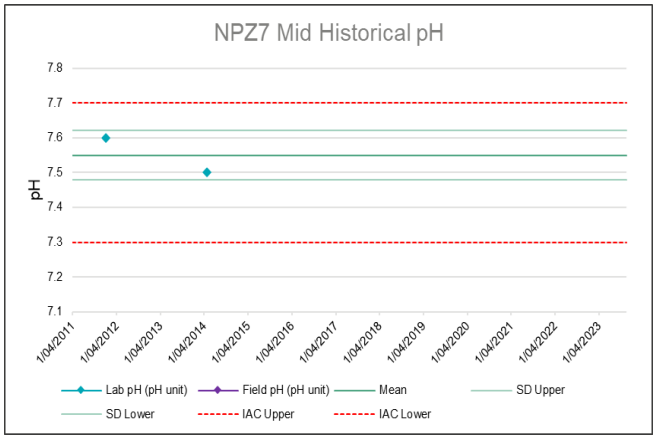


FIGURE D.28: NP27 MID HISTORICAL EC

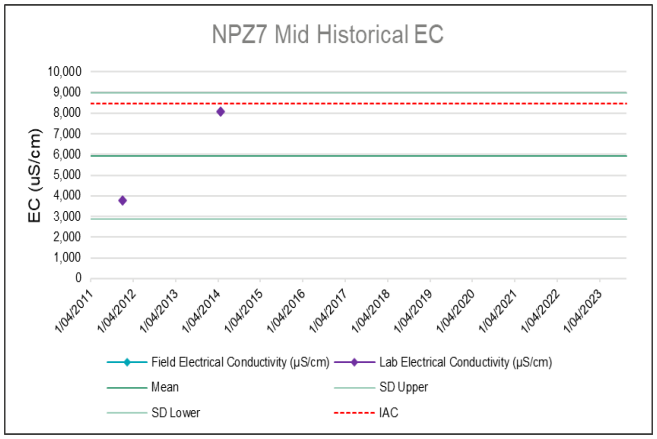


FIGURE D.29: WPP1 HISTORICAL PH

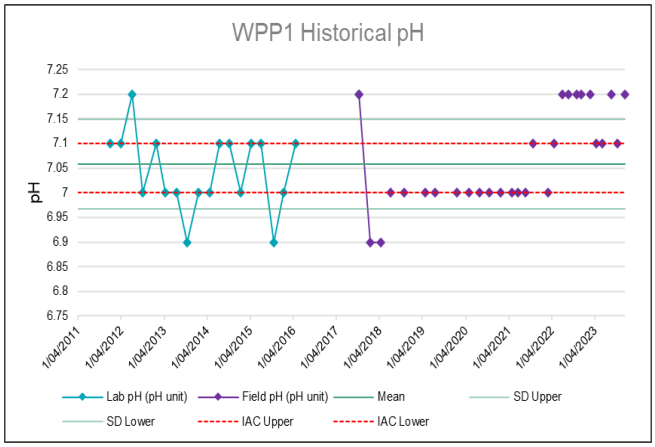


FIGURE D.30: WPP1 HISTORICAL EC

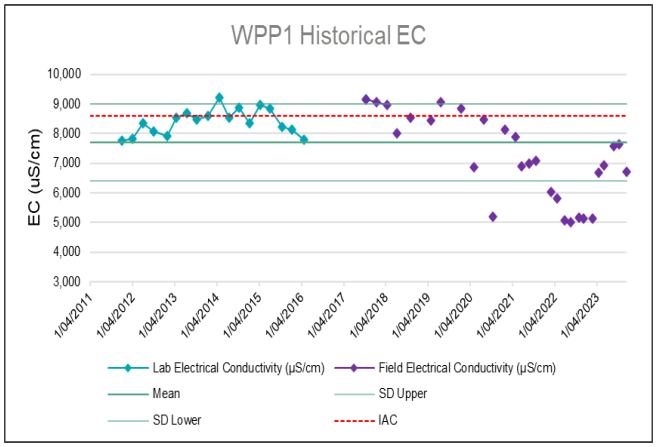


FIGURE D.31: WPP2 HISTORICAL PH

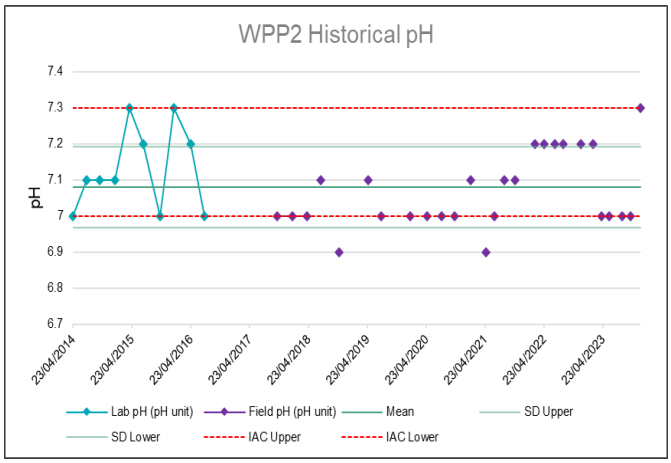
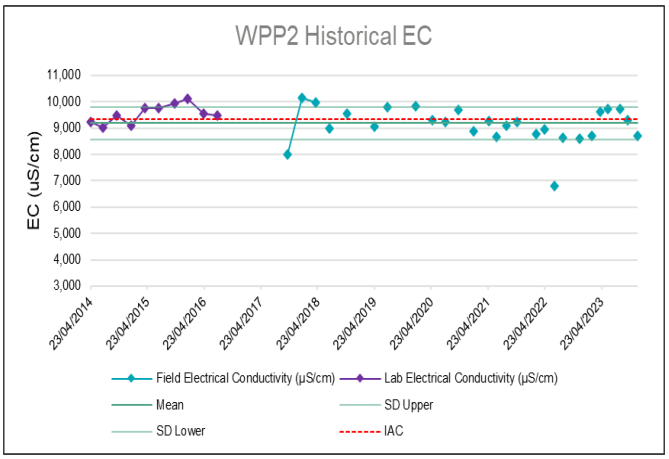


FIGURE D.32: WPP2 HISTORICAL EC



APPENDIX E: GROUNDWATER LEVEL MONITORING RESULTS

TABLE E.1: RAVENSWORTH MINING COMPLEX GROUNDWATER LEVELS 2023

Borehole	Coffey Dam Borehole		CS4641C		NPZ1 Mid		NPZ1 Tall		NPZ2 Tall		NPZ5B P1		NPZ5B P2	
Collar Level (RL)	100.4		81.6		91.4		91.4		100.9		76		76	
Date	Depth	RL	Depth	RL	Depth	RL	Depth	RL	Depth	RL	Depth	RL	Depth	RL
Dec-2023	42.71	57.64	101.29	-19.65	31.97	*	51.16	40.27	65.9	34.96	15.62	60.38	9.82	66.18
Nov-2023	42.62	57.73	101.12	-19.48	Blocked		52.65	38.78	66.71	34.15	15.39	60.61	9.78	66.22
Oct-2023	42.54	57.81	101.38	-19.74			53.84	37.59	66.22	34.64	15.08	60.92	9.71	66.29
Sep-2023	42.43	57.92	101.2	-19.56			*	*	65.97	34.89	14.54	61.46	9.58	66.42
Aug-2023	42.37	57.98	101.43	-19.79			54	37.43	66.44	34.42	14.51	61.49	9.58	66.42
Jul-2023	42.29	58.06	101.31	-19.67			53.59	37.84	66.8	34.06	14.37	61.63	9.54	66.46
Jun-2023	42.19	58.16	100.98	-19.34			53.44	37.99	66.7	34.16	13.7	62.3	9.35	66.65
May-2023	42.1	58.25	101.19	-19.55			52.79	38.64	66.74	34.12	13.72	62.28	9.35	66.65
Apr-2023	42.14	58.21	101.22	-19.58			52.85	38.58	66.74	34.12	13.7	62.3	9.35	66.65
Mar-2023	*	*	*	*			*	*	*	*	*	*	*	*
Feb-2023	41.63	58.72	102.5	-20.86			53.79	37.64	65.4	35.46	13.61	62.39	9.33	66.67
Jan-2023	43.04	57.31	102.1	-20.46			53.1	38.33	67.14	33.72	12.86	63.14	9.21	66.79

**No value entered in EMD*

TABLE E.2: RAVENSWORTH MINING COMPLEX GROUNDWATER LEVELS 2023- CONTINUED

Borehole	NPZ6 Tall		NPZ7 Tall		NPZ7 Small		NPZ7 Mid		Borehole P		WPP1		WPP2	
Collar Level (RL)	76.3		61.91		61.91		61.91		82.06		108		110	
Date	Depth	RL	Depth	RL	Depth	RL	Depth	RL	Depth	RL	Depth	RL	Depth	RL
Dec-2023	12.23	64.09	19.83	42.08	19.94	41.97	13.08	48.83	98.23	-16.17	2.29	105.71	4.24	105.76
Nov-2023	12.21	64.11	19.47	42.44	19.56	42.35	Blocked		98.85	-16.79	2.11	105.89	4.06	105.94
Oct-2023	12.18	64.14	19.59	42.32	19.68	42.23			97.63	-15.57	1.8	106.2	3.73	106.27
Sep-2023	12.12	64.2	18.97	42.94	19.03	42.88			97.44	-15.38	1.61	106.39	3.52	106.48
Aug-2023	12.18	64.14	19.11	42.8	19.28	42.63			97.43	-15.37	1.52	106.48	3.4	106.6
Jul-2023	12.19	64.13	18.91	43	18.95	42.96			95.67	-13.61	1.57	106.43	3.44	106.56
Jun-2023	11.91	64.41	19.06	42.85	19.29	42.62			91.21	-9.15	1.41	106.59	3.24	106.76
May-2023	11.96	64.36	19.06	42.85	19.19	42.72			91.81	-9.75	1.21	106.79	3	107
Apr-2023	11.93	64.39	19.08	42.83	19.17	42.74			91.85	-9.79	1.18	106.82	3.01	106.99
Mar-2023	*	*	*	*	*	*			*	*	*	*	*	*
Feb-2023	11.97	64.35	19.09	42.82	19.24	42.67			93.54	-11.48	0.81	107.19	2.79	107.21
Jan-2023	11.17	65.15	*	*	*	*			93.45	-11.39	1.1	106.9	2.82	107.18

**No value entered in EMD*

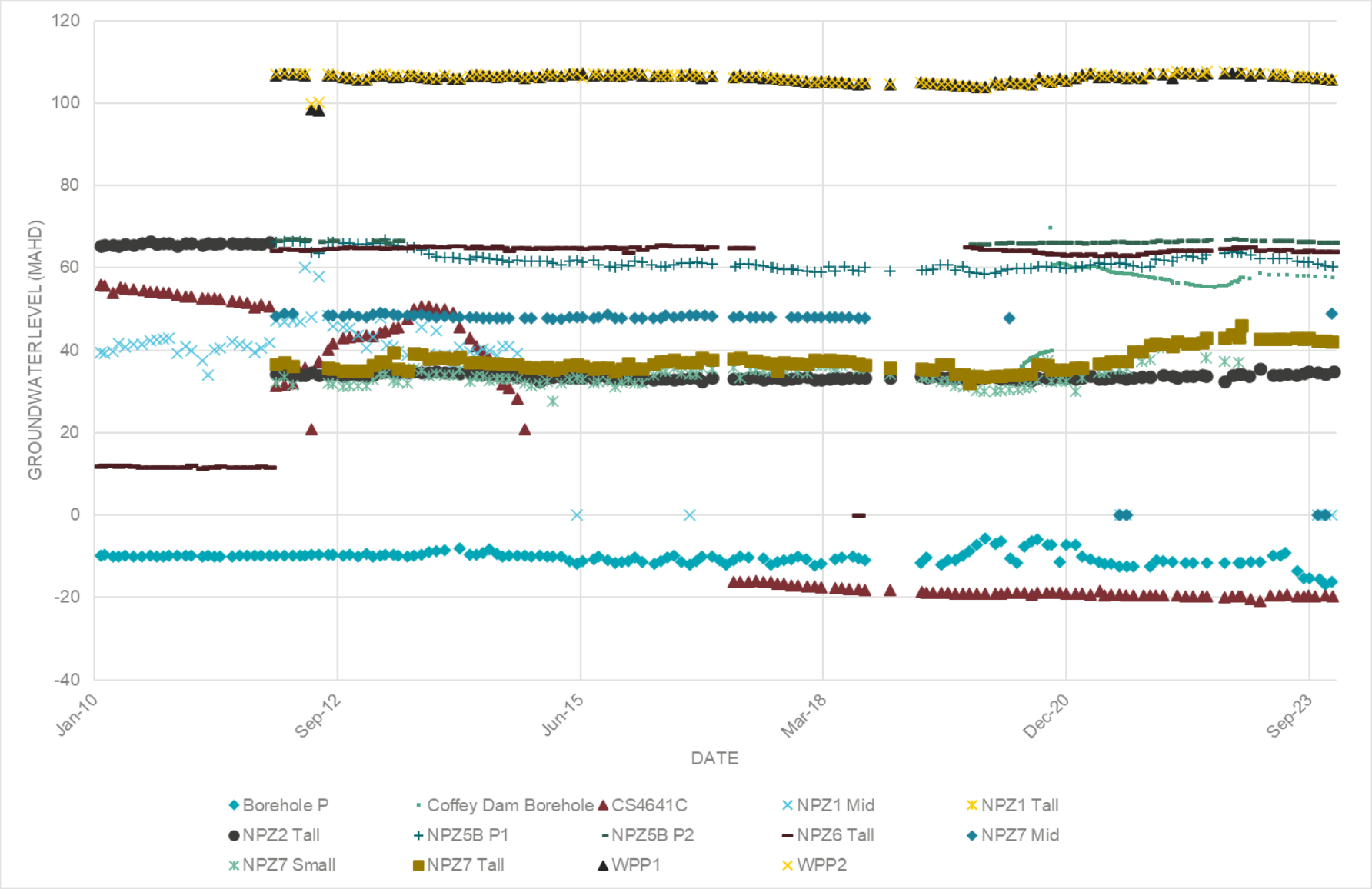


FIGURE E.1: RAVENSWORTH MINING COMPLEX HISTORICAL GROUNDWATER LEVELS

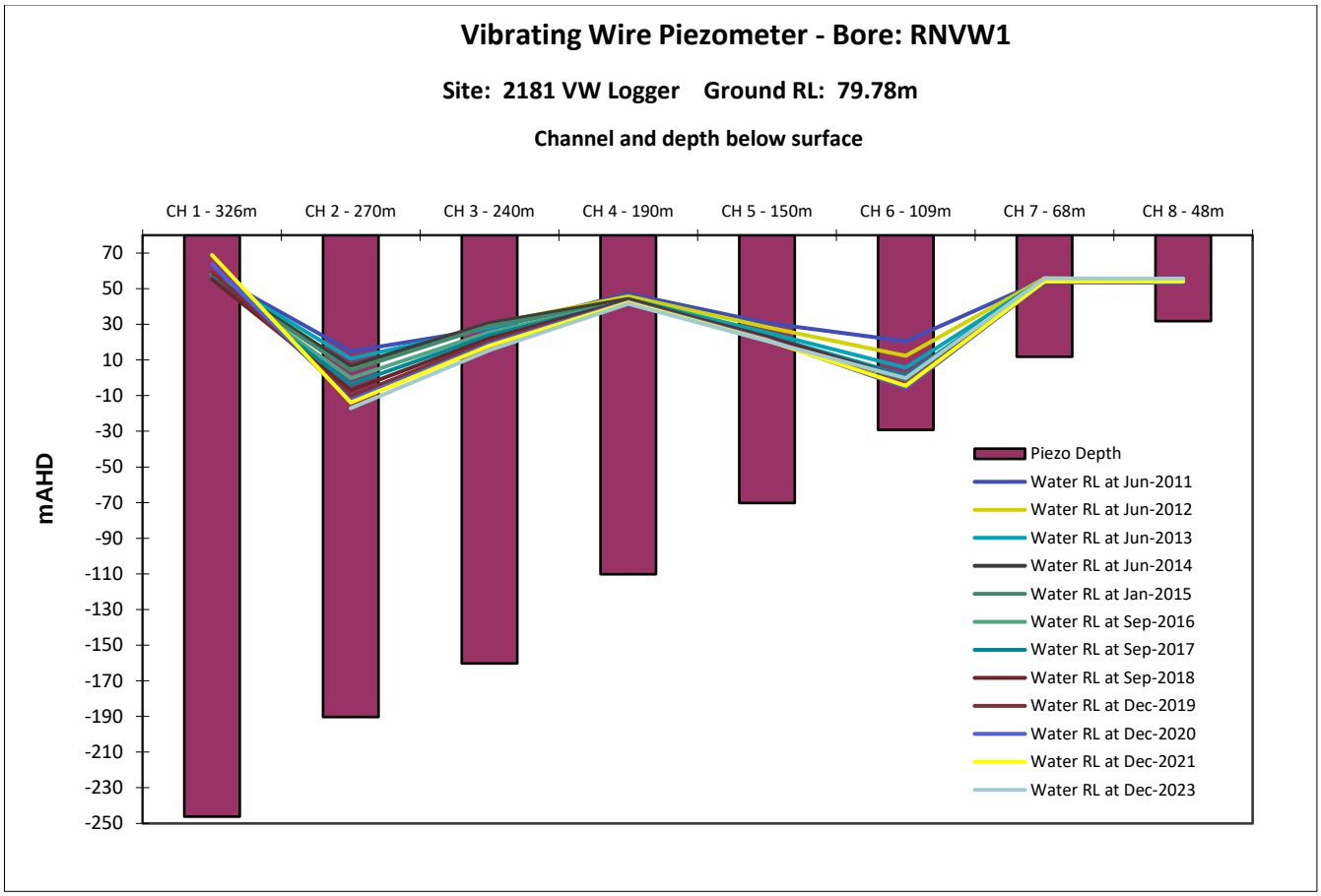


FIGURE E.2: VIBRATING WIRE PIEZOMETER - BORE: RNVW1 (SITE 2181)

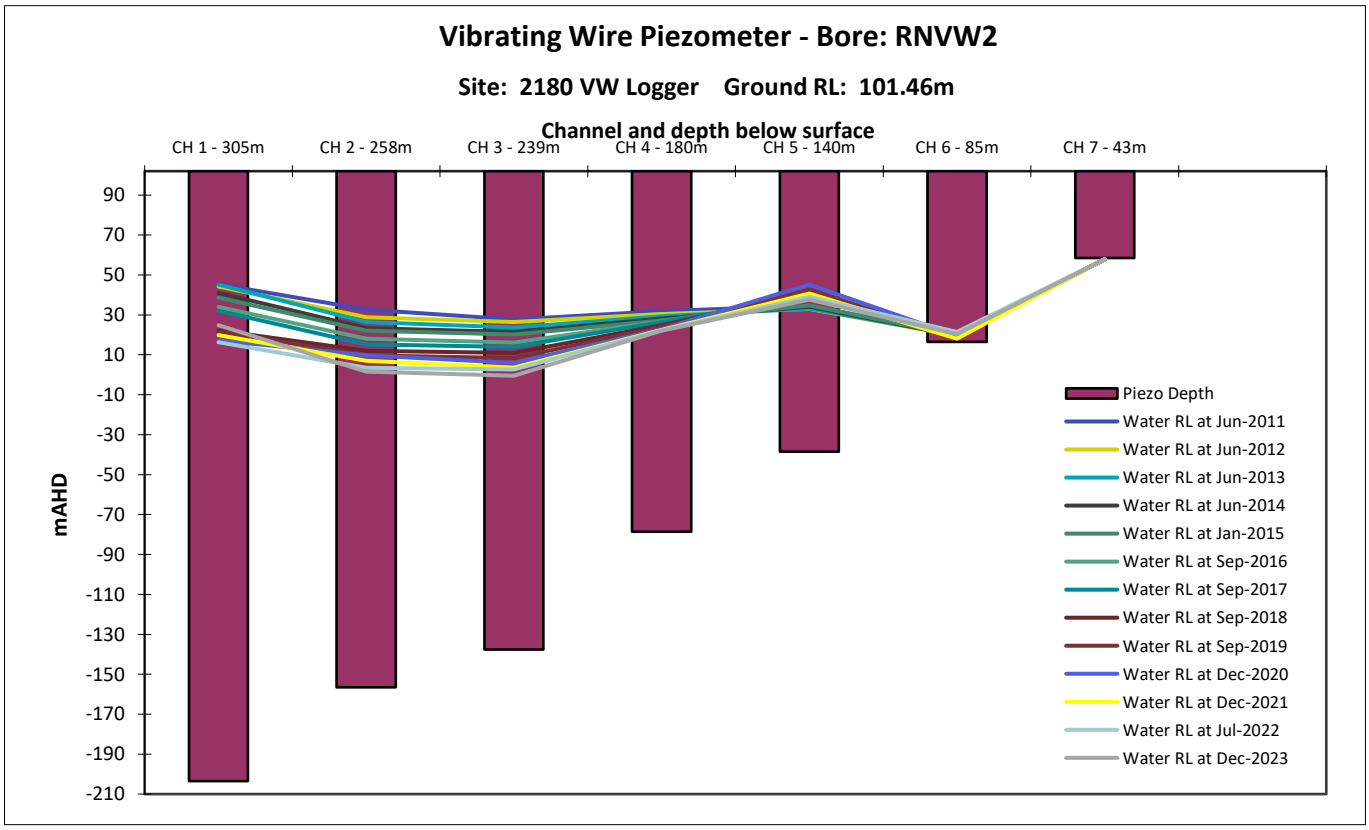


FIGURE E.3: VIBRATING WIRE PIEZOMETER - BORE: RNVW2 (SITE 2180)

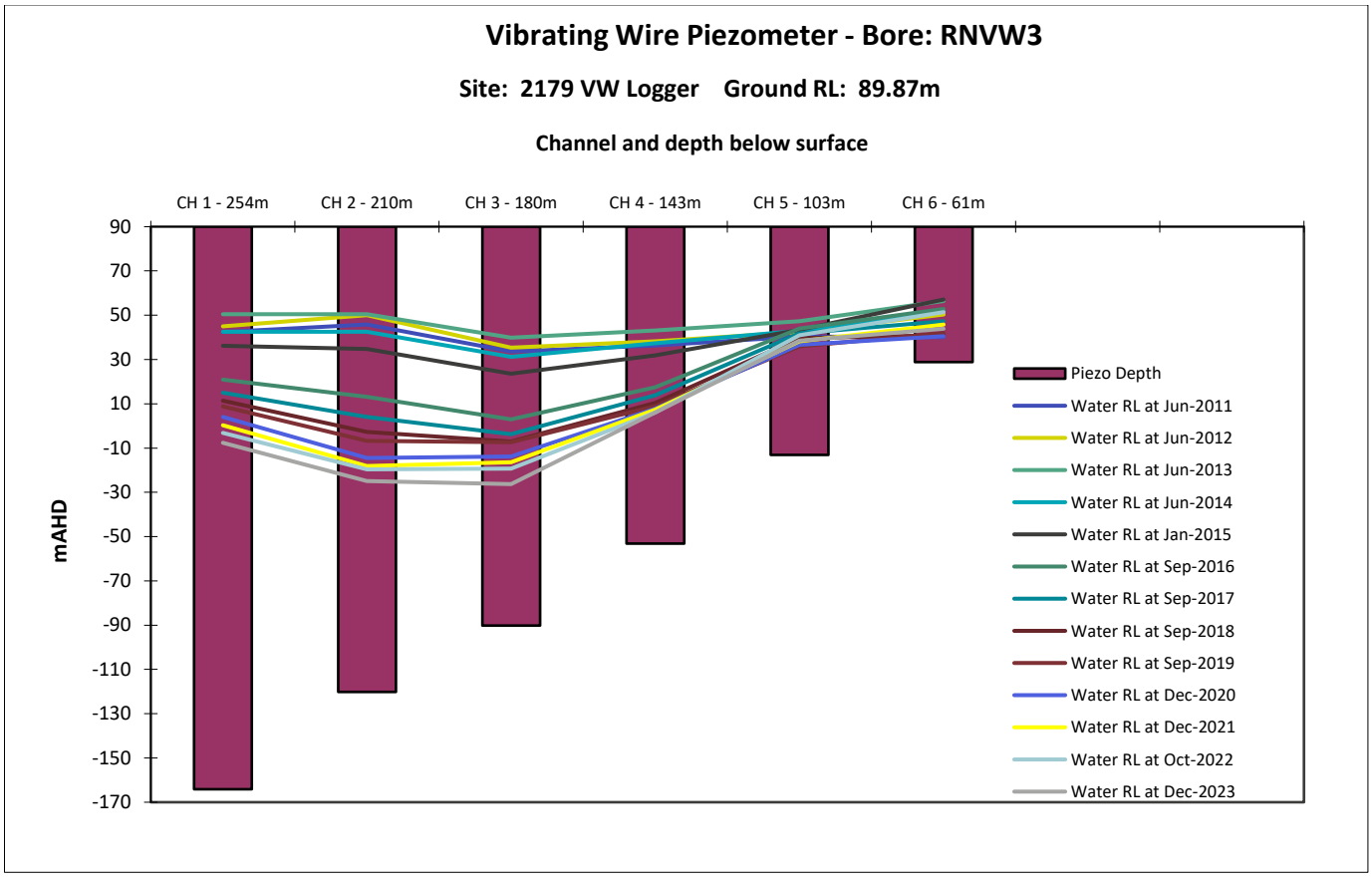


FIGURE E.4: VIBRATING WIRE PIEZOMETER - BORE: RNVW3 (SITE 2179)

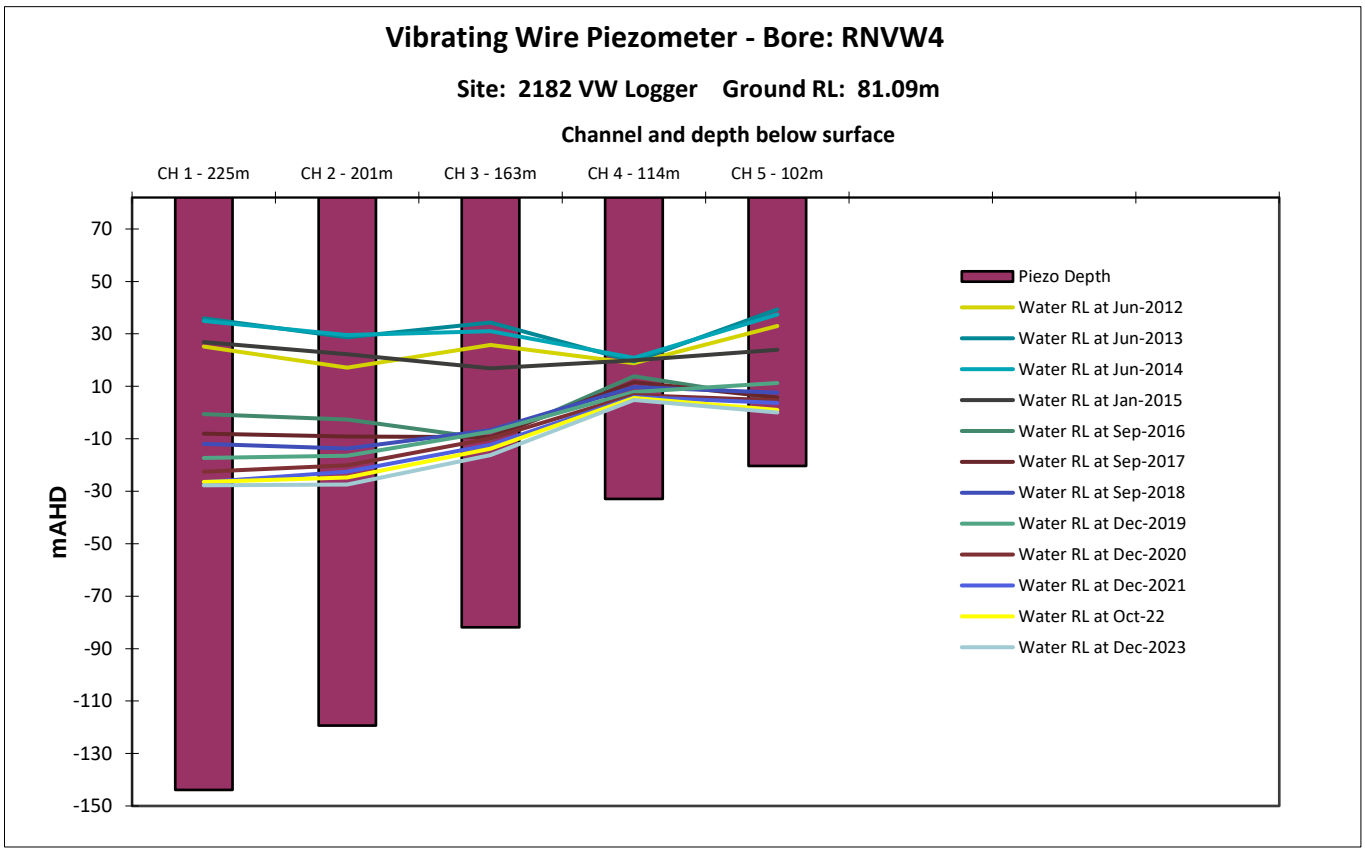


FIGURE E.5: VIBRATING WIRE PIEZOMETER - BORE: RNVW4 (SITE 2182)

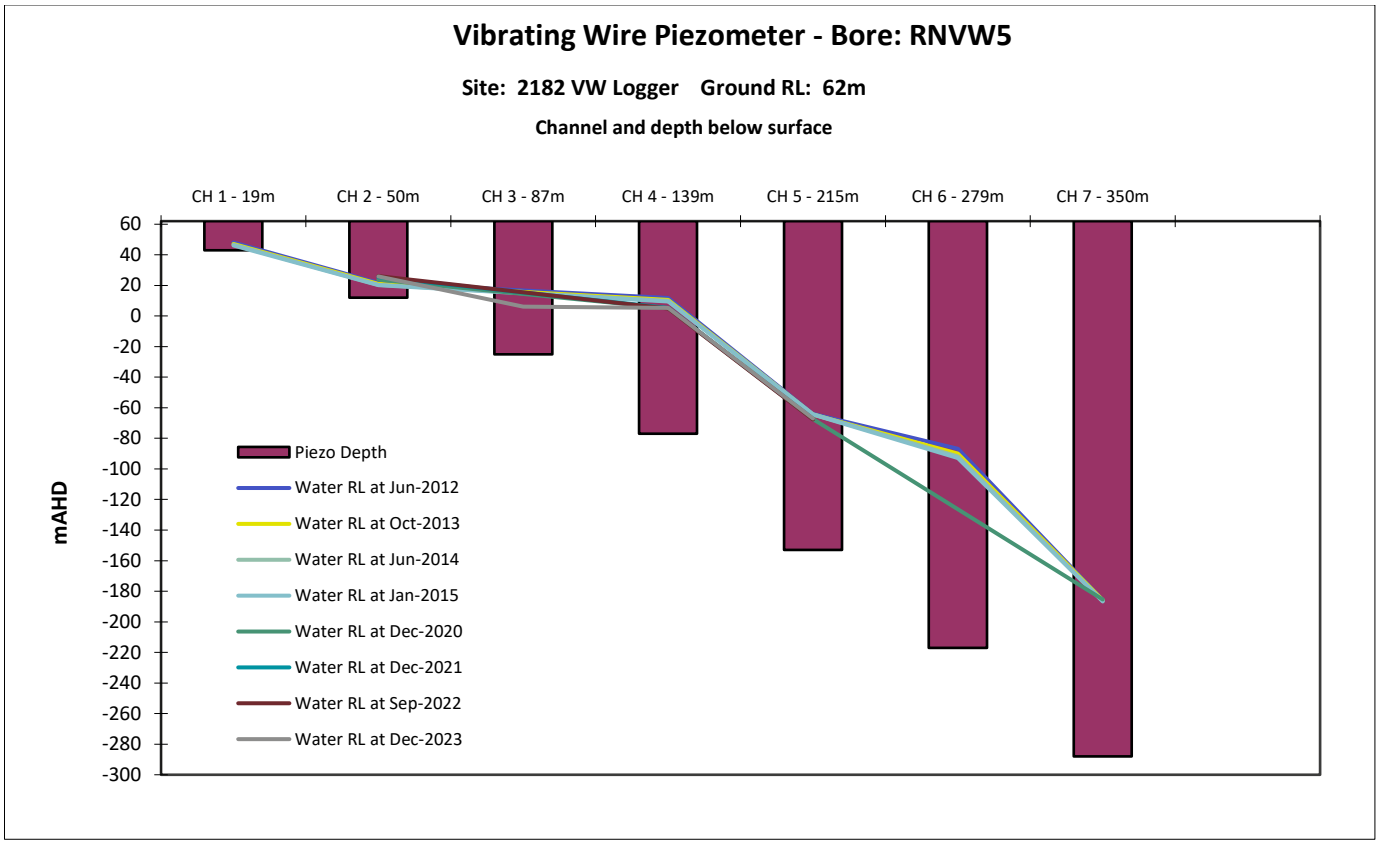


FIGURE E.6: VIBRATING WIRE PIEZOMETER - BORE: RNVW5 (SITE 2182)

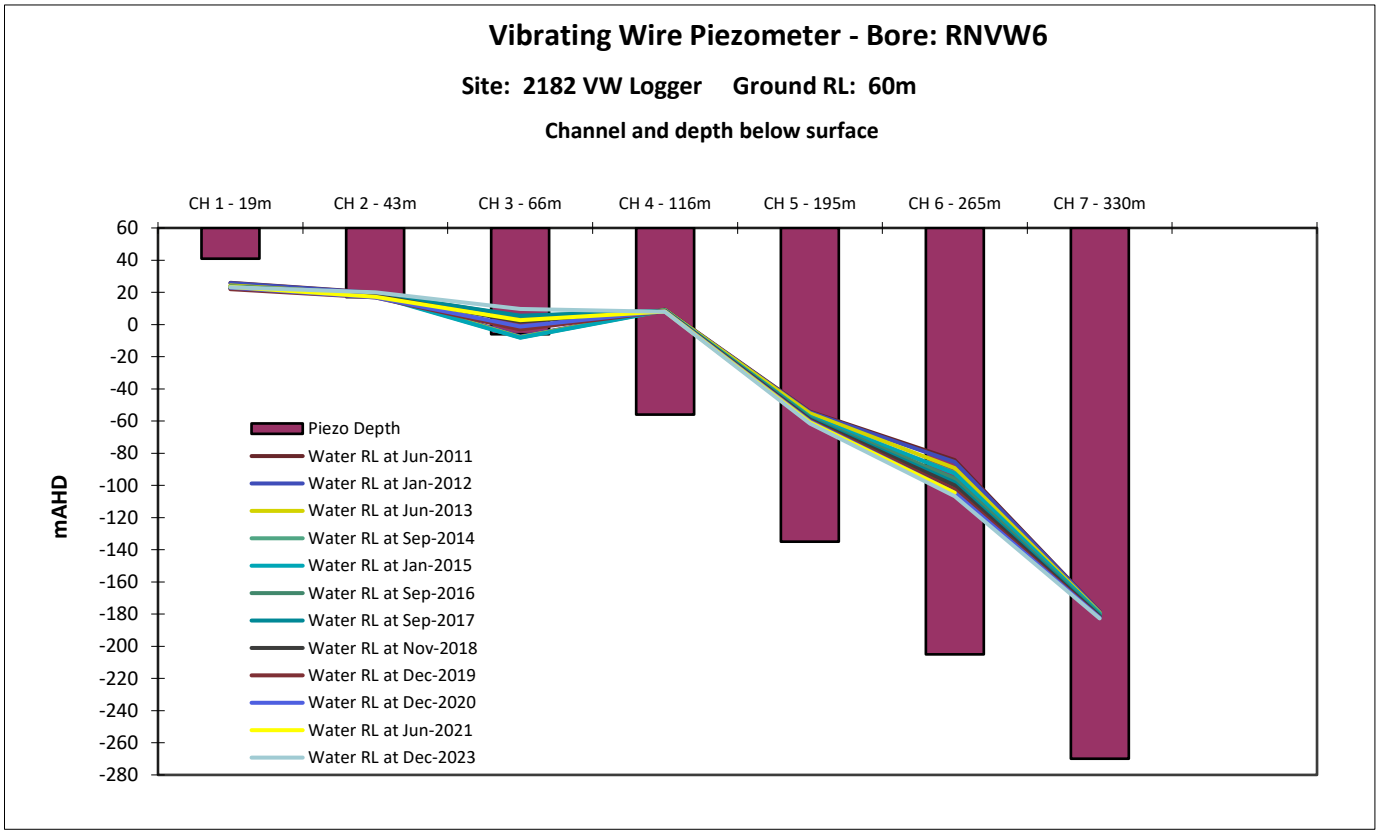


FIGURE E.7: VIBRATING WIRE PIEZOMETER - BORE: RNVW6 (SITE 2182)

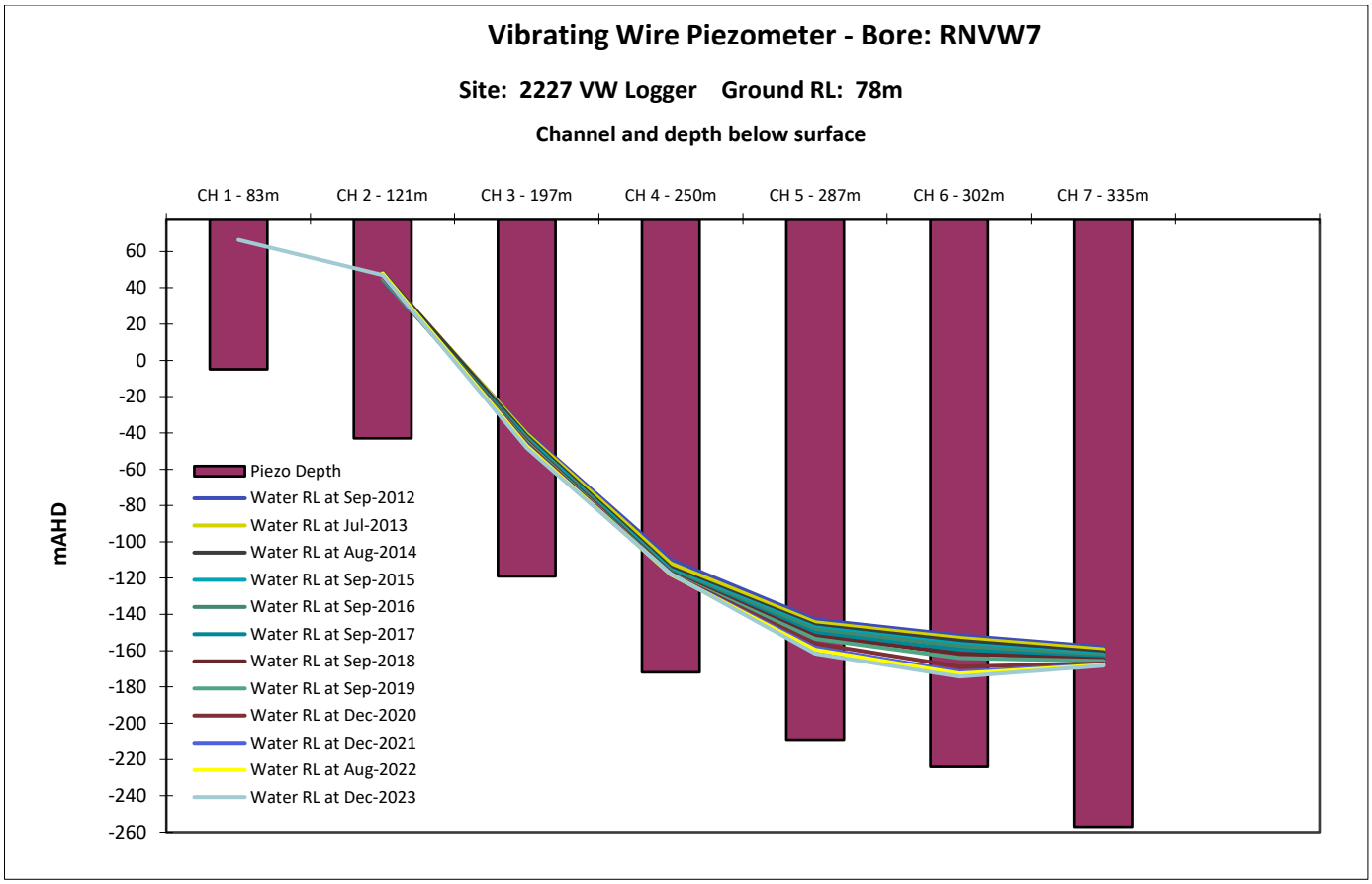


FIGURE E.8: VIBRATING WIRE PIEZOMETER - BORE: RNVW7 (SITE 2227)

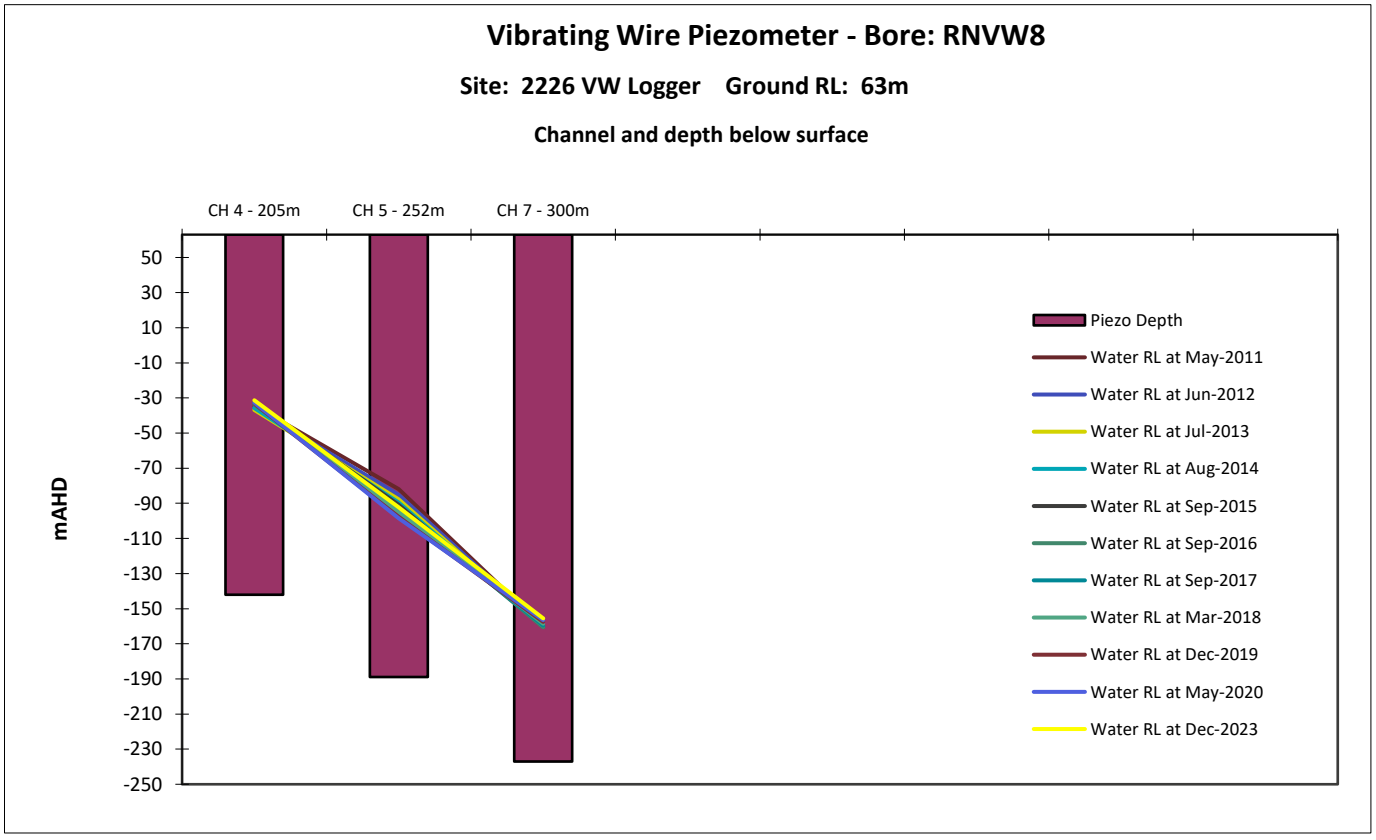


FIGURE E.9: VIBRATING WIRE PIEZOMETER - BORE: RNVW8 (SITE 2226)