HUNTER VALLEY
OPERATIONS

2022 ANNUAL ENVIRONMENTAL REVIEW

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TITLE BLOCK

Name of Operations	Hunter Valley Operations
Name of Operator	HV Operations Pty Ltd
Development Consent / Project Approval	DA 450-10-2003 / PA 06_0261
Name of holder of development consent/project approval	HV Operations Pty Ltd
Mining Lease Number	Contained within Table 3-2 of this report
Name of Mining Lease Holder	Contained within Table 3-2 of this report
Water Licence Number	Contained within Table 3-4 of this report
Name of Water Licence Holder	Contained within Table 3-4 of this report
RMP Start Date	01/07/2022
RMP End Date	30/06/2023

I, David Foster, certify that this audit report is a true and accurate record of the compliance status of Hunter Valley Operations for the period 01/01/2022 to 31/12/2022 and that I am authorised to make this statement on behalf of Hunter Valley Operations.

Note.

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

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

Name of Authorised Reporting Officer	David Foster
Title of Authorised Reporting Officer	General Manager
Signature of Authorised Reporting Officer	DocuSigned by: David Foster F5D6268380614F5...
Date	31-3-2023

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Executive Summary

This Annual Environmental Review (Annual Review) reports on the environmental performance of Hunter Valley Operations (HVO) during the 2022 calendar year and satisfies the requirements of HVO's Development Consents. The structure of the 2022 Annual Review intends to align with the *NSW Government Post - approval requirements for State significant mining developments – Annual Review Guideline* (October 2015).

Operations Summary

HVO extracted 11.94 million tonnes of run-of-mine (ROM) coal during 2022 against an approved ROM extraction rate of 42 million tonnes per annum (mtpa). The Coal Handling Preparation Plants (CHPPs) produced 9.63 million tonnes of saleable coal.

Noise

A total of 120 noise measurements were recorded in the attended noise compliance monitoring programme in 2022. No noise exceedances were recorded against HVO's criteria.

HVO continued to operate a real-time noise monitoring network which alerts operations to potential noise exceedances. A total of 1050[1] internal noise alarms were received and responded to and as a result 58 hours of equipment downtime was recorded for the management of noise during 2022.

Blasting

A total of 250 blast events were initiated, 140 from HVO South and 110 from HVO North. HVO complied with all blasting related overpressure and vibration development consent and licence criteria during 2022.

HVO employs a blast fume management protocol to mitigate generation of post blast fume emissions. During 2022, there were no incidents relating to blast fume. Manufacturing of Ammonium Nitrate Emulsion commenced on site following modification to the HVO South approval in 2021. A modification to the HVO South Approval was submitted in 2022 to allow for increased storage of Ammonium Nitrate Emulsion and associated precursor chemicals on site. This increased storage has been approved and will be implemented on site in 2023.

Air Quality

No non-compliances were recorded against HVO's air quality criteria in 2022.

HVO continued to implement operational controls to manage dust emissions in accordance with its Air Quality Management Plan during 2022 including response to internal air quality alerts. During the reporting period, HVO responded to 551 air quality alerts and recorded 1175 hours of operational downtime to manage dust in response to real time monitoring alerts and visual inspections. Aerial seeding was conducted over an approximate area of 319 ha to reduce dust from wind erosion of mine stockpiles.

[1] Noise alarm triggers are based on internally set noise criteria. Alarms received include noise exceedances from other mines and non-mine sources.

Heritage

Two compliance inspections were conducted under the provision of the HVO South ACHMP and one inspection was conducted under the HVO North Heritage Management Plan (HMP). The inspections found that all sites have been managed in conformance with the ACHMP/HMP requirements. Sites requiring maintenance and upgrades to site barricading, fencing and vegetative sediment controls were identified. Barricade upgrade and maintenance will be included as part of the works planning for 2023.

Under the provisions of both the HVO South and HVO North Aboriginal Cultural Heritage Management Plans (ACHMP), field based due diligence assessments were undertaken at four locations across HVO in 2022. No additional artefacts were identified through these assessments.

There were no incidents, nor any unauthorised disturbance caused to heritage sites at HVO during 2022.

Water

A total of 1047.2mm of rainfall was recorded at HVO Corporate Meteorological (MET) Station in 2022 producing an estimated 17,848ML of runoff. No water was pumped from the Hunter River during 2022. HVO discharged 6,622.8ML of water under the Hunter River Salinity Trading Scheme (HRSTS).

Surface and ground water monitoring activities continued in 2022 in accordance with the HVO Water Management Plan (WMP), the HVO Surface Water Monitoring Program (SWMP) and the HVO Ground Water Monitoring Program (GWMP).

HVO progressed its Water Containment Pollution Reduction Programme, completing installation of a burst pipe detection system, automated dam level monitoring and augmentation of sediment dam 28W. Preliminary engineering was completed for all projects. Works commenced for the Load Point area upgrade and detailed design commenced for mine water dam 15N augmentation.

Controls identified through the Pollution Reduction Programme (PRP) to mitigate seepage from the North Void Tailings Facility Analysis continued with management of water levels on the surface and continued monitoring of groundwater. Groundwater monitoring results indicate that current management practices are effective in minimising seepage from the facility. A geotechnical investigation was undertaken to inform construction method for the barrier wall.

There were four reportable incidents related to water. These incidents relate to dams overtopping due to rainfall exceeding dam design criteria. For each of the events it was deemed that no environmental harm would have occurred. Application to modify the HVO South approval to permit storage of excess surface water in the Lemington Underground workings submitted in 2021 was granted approval in 2022.

Rehabilitation and Land Management

Rehabilitation at HVO was previously undertaken in accordance with commitments made in the Mining Operations Plan (MOP). During 2022, HVO replaced this with a Rehabilitation Management Plan (RMP) as required by new standard conditions for Mining Leases.

A total of 146 ha of rehabilitation was completed to “Ecosystem Establishment” phase during 2022 including 65 ha of new rehabilitation and 81 ha of “Growth Medium Development” phase rehabilitation. The total rehabilitation footprint is consistent with commitments for progressive rehabilitation establishment.

Rehabilitation areas monitored were assessed to be generally trending well. Initial TARP triggers relating to erosion and species composition have been activated and will inform response actions during the forward period.

Rehabilitation maintenance works aligned with previous NSW Resources Regulator Section 240 Notice commitments and continued to be implemented. Key activities included progression of 81.2 ha of historic

Growth Medium Development phase rehabilitation to native vegetation, weed control within areas of concern, and preparation works for ongoing progression of areas to final vegetation covers.

A number of baiting programmes were carried out on a seasonal basis and at a frequency designed to disrupt pest species such as wild pigs, wild dogs, feral cats, foxes, hares and rabbit's breeding/colonisation cycles. A variety of methodologies are employed including baiting, trapping and ground-based shooting.

A total of 135 baits were taken by dogs, 22 by foxes and 37 by feral pigs using the new 'Hoggonne' baiting method. 102 feral pigs were trapped, 10 feral pigs were shot.

Biodiversity areas were managed in accordance with approved management plans and restoration strategies. Management activities included ecological monitoring, seed collection, removal of redundant fence posts, fencing and pest and weed controls. Monitoring of the Carrington Billabong indicated relatively stable health of the River Red Gum population despite increasing exotic species with increased rainfall.

Community

A total of 7 community complaints were received related to blasting, dust, and one complaint related to unsafe driving on a public road. Four CCC meetings were held during the reporting period to discuss operations, projects and mine activities.

HVO provided $83,000 to 16 local projects and initiatives and continues its partnership with Jerrys Plains Public School providing funding for their pre-school program.

A range of methods were used to keep the community informed of operational and project activities. This included a community information session at Maison Dieu and Jerrys Plains, Community Newsletters and development and update of a new web page.

1 | STATEMENT OF COMPLIANCE

Table 1-1 is a Statement of compliance against the relevant approvals. **Table 1-2** provides a brief summary of the non-compliances against development consents and a reference to where these are addressed within this Annual Review. **Table 1-3** shows the compliance status descriptions relating to **Table 1-2.**

Table 1-1: Statement of Compliance

Were all conditions of the relevant approvals complied with?	
PA 06_0261 (HVO South)	Yes
DA 450-10-2003 (HVO North)	No

Table 1-2: Non-Compliances

Relevant Approval	Condition Number	Condition Description	Compliance Status	Where Addressed in Annual Review
DA 450-10-2003	Schedule 3 Condition 20	Overflow from Dam 15N – March 2022	Non-compliant (low)	**11**
DA 450-10-2003	Schedule 3 Condition 20	Overflow from Dam 32N – March 2022	Non-compliant (low)	**11**
DA 450-10-2003	Schedule 3 Condition 20	Overflow from Dam 15N – July 2022	Non-compliant (low)	**11**

Table 1-3: Compliance Status Key for Table 1-2

Risk Level	Colour Code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence.
Medium	Non-compliant	Non-compliance with: Potential for serious environmental consequences, but is unlikely to occur; or Potential for moderate environmental consequences, but is unlikely to occur
Low	Non-compliant	Non-compliance with: Potential for moderate environmental consequences, but is unlikely to occur; or Potential for low environmental consequences, but is unlikely 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)

2 | INTRODUCTION

2.1 | DOCUMENT PURPOSE

This Annual Review is written to satisfy the requirements of the Development Consents and conditions of mining leases held by Hunter Valley Operations (HVO) for events which occurred during the 2022 calendar year (the reporting period). The Annual Review has been written in accordance with the *Post-approval requirements for State significant mining developments – Annual Review Guideline* (NSW Government, October 2015).

This report is distributed to:

- NSW Department of Planning and Environment (DPE);
- NSW Resource Regulator (RR);
- NSW Environment Protection Authority (EPA);
- Natural Resource Access Regulator (NRAR);
- Singleton Council;
- Muswellbrook Shire Council; and
- HVO Community Consultative Committee (CCC).

2.2 | BACKGROUND

HVO is situated in the Upper Hunter Valley between Singleton and Muswellbrook, approximately 24 km northwest of Singleton, and approximately 100 km northwest of Newcastle. The Hunter River geographically divides HVO into HVO North (DA 450-10-2003) and HVO South (PA 06_0261), however they are integrated operationally with personnel, equipment and materials utilised as required. This improves operational efficiency, rationalisation of infrastructure and resource utilisation.

HVO is a jointly controlled operation through a Joint Venture (JV) between Glencore (49%) and Yancoal (51%).

The regional context and layout of the HVO pits and facilities are shown in **Figure 2-1** and **Figure 2-2** respectively.

Figure 2-1: Regional Context

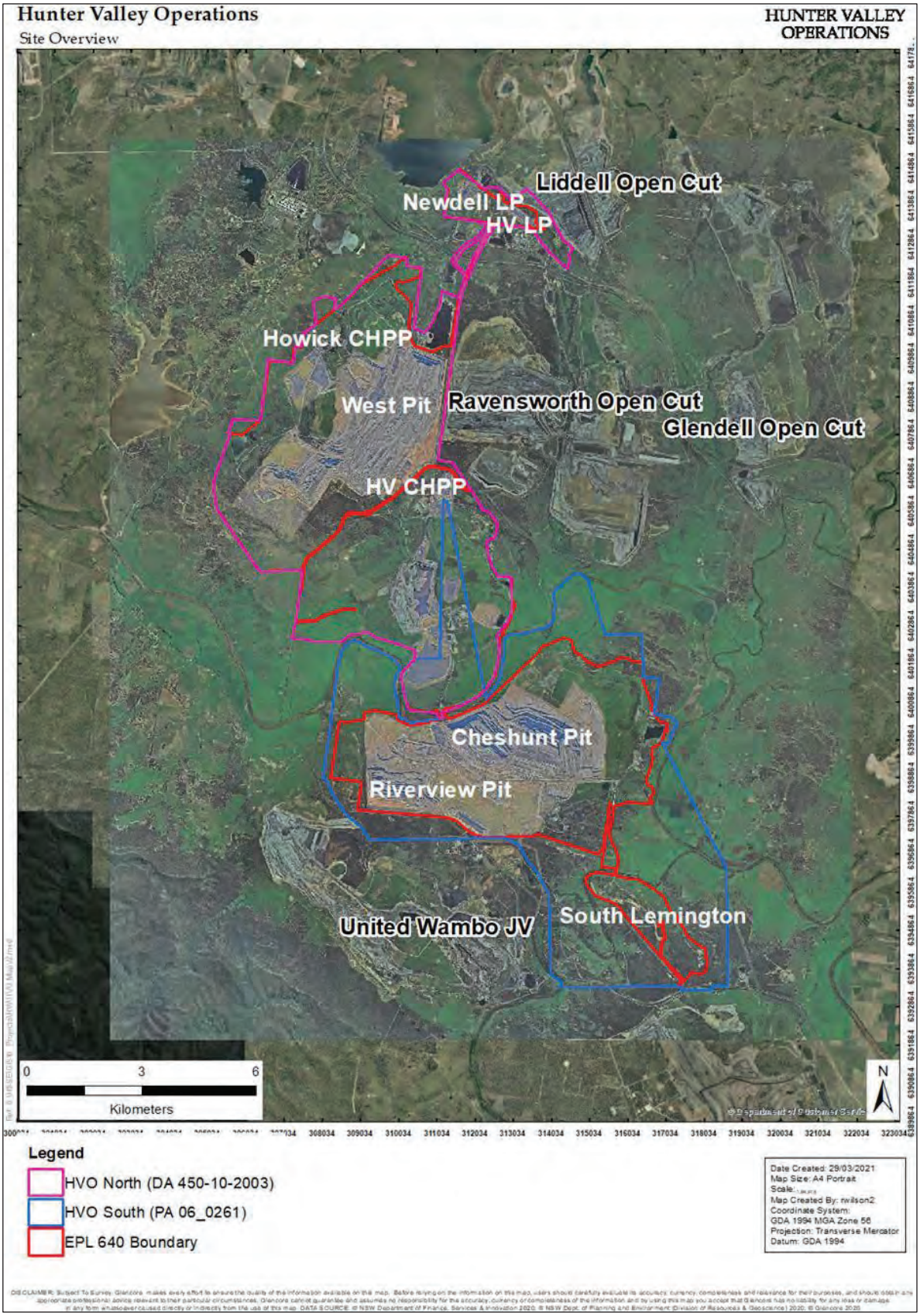

Figure 2-2: Hunter Valley Operations Site Overview

2.3 | MINE CONTACTS

Key mine contacts are listed in **Table 2-1**.

Table 2-1: Mine Contacts

Contact	Role	Phone	Email
David Foster	General Manager	1800 888 733	david.foster@hvo.com.au
Phillip Enderby	Operations Manager		phil.enderby@hvo.com.au
Andrew Speechly	Environment & Community Manager		andrew.speechly@hvo.com.au

3 | APPROVALS

3.1 | APPROVALS, LEASES AND LICENCES

3.1.1 | CURRENT APPROVALS

The status of HVO development consents, licenses and relevant approvals are listed in:

Table 3-1: HVO Major Approvals

Table 3-2: Summary of Mining Tenements

Table 3-3: HVO Licences and Permits

Table 3-4: Water Related Approvals

Table 3-5: Surface Water Licences

Table 3-6: Groundwater Access Licences

Table 3-1: HVO Major Approvals

Approval Number	Description	Issue Date	Expiry Date
HVO North DA 450-10-2003 MOD 7	HVO West Pit Extension & Minor Modifications (2003); and associated modifications. MOD 7 approved July 2017. Covers West Pit (approved production limit of 12mtpa), Carrington Pit (approved production limit of 10mtpa), HVCHPP (approved processing limit of 20mtpa) and WCHPP (approved processing limit of 6mtpa).	28/07/2017	12/06/2025
HVO South PA 06_0261 MOD 8	Hunter Valley Operations – South Coal Project & associated modifications: MOD8 Approved 6 February 2023 Permits construction of an Ammonium Nitrate Storage Compound. MOD7 Approved 27 May 2022 Permits storage of water in Lemington Underground Workings. MOD 6 Approved 26 November 2021 Permits onsite Manufacturing of Ammonium Nitrate Emulsion. MOD 5 approved February 2018 The modification covered: - the progression of mining to the base of the Bayswater seam from Cheshunt Pit into Riverview Pit, and to the base of the Vaux seam in South Lemington Pit 2. - increased overburden emplacement height in some areas to 240m AHD and incorporation of micro-relief extraction rate increase from 16Mpta to 20Mtpa of ROM coal at peak production and increased processing rate from 16Mpta to 20Mtpa of ROM coal across HVO coal preparation plants.	06/02/2023	24/03/2030

Approval Number	Description	Issue Date	Expiry Date
EPBC 2016/7640	Hunter Valley Operations – State approved mining Hunter Valley NSW	10/10/2016	31/12/2030

Table 3-2: Summary of Mining Tenements

Title	Mining Tenement	Titleholder	Purpose	Grant Date	Expiry Date	Status
AL 32	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted
AL 33	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted
AL 34	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted
AUTH 72	Authorisation	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	08/03/1977	08/03/27	Granted
EL 5291	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	28/04/1997	28/04/2023	Granted
EL 5292	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	28/04/1997	27/04/2028	Granted
EL 5417	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	23/12/1997	23/12/2024	Granted
EL 5418	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	23/12/1997	23/12/2028	Granted
EL 5606	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	11/08/1999	10/08/2019	Renewal Pending
EL 8175	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	23/09/2013	23/09/2018	Renewal Pending
EL 8821	Exploration Licence	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	13/02/2019	13/02/2025	Granted
(Part) CCL 708	Sub lease	Liddell Tenements Pty Ltd	Prospecting and Mining Coal	17/05/1990	29/12/2023	Renewal pending
CCL 714	Consolidated Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	23/05/1990	30/08/2030	Granted

Title	Mining Tenement	Titleholder	Purpose	Grant Date	Expiry Date	Status
CCL 755	Consolidated Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	24/01/1990	05/03/2030	Granted
AL 32	Assessment Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting	04/11/2020	03/11/2026	Granted
CL 327	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	06/03/1989	06/03/2031	Granted
CL 359	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	21/05/1990	21/05/2032	Granted
CL 360	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	29/05/1990	29/05/2032	Granted
CL 398	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	04/06/1992	04/06/2034	Granted
CL 584	Coal Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	01/01/1982	31/12/2044	Granted
CML 4	Consolidated Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	02/03/1993	03/06/2033	Granted
ML 1324	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	19/08/1993	19/08/2035	Granted
ML 1337	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	01/02/1994	01/02/2034	Granted
ML 1359	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	01/11/1994	31/10/2015	Renewal Pending
ML 1406	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	27/02/1997	10/02/2027	Granted
ML 1428	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	15/04/1998	14/04/2040	Granted
ML 1465	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	21/02/2000	21/02/2042	Granted
ML 1474	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	24/11/2000	23/11/2042	Granted
ML 1482	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	19/03/2001	19/03/2040	Granted

Title	Mining Tenement	Titleholder	Purpose	Grant Date	Expiry Date	Status
ML 1500	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	21/12/2001	20/12/2043	Granted
ML 1526	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	03/12/2002	02/12/2023	Granted
ML 1560	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	28/01/2005	27/01/2026	Granted
ML 1589	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	02/11/2006	01/11/2027	Granted
ML 1622	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	22/10/2010	10/03/2027	Granted
ML 1634	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	31/07/2009	31/07/2030	Granted
ML 1682	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	16/12/2012	15/12/2033	Granted
ML 1704	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	05/12/2014	05/12/2035	Granted
ML 1705	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	17/12/2014	17/12/2035	Granted
ML 1706	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	09/12/2014	0912/2035	Granted
ML 1707	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	09/12/2014	09/12/2035	Granted
ML 1710	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Prospecting and Mining Coal	22/12/2016	10/03/2027	Granted
ML 1732	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	06/04/2016	06/04/2037	Granted
ML 1734	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	06/04/2016	06/04/2037	Granted
ML 1748	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	05/12/2016	04/12/2037	Granted
ML 1753	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	19/04/2017	19/04/2038	Granted

Title	Mining Tenement	Titleholder	Purpose	Grant Date	Expiry Date	Status
ML 1810	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	04/11/2020	04/11/2041	Granted
ML 1811	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	04/11/2020	04/11/2041	Granted
ML 1840	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	03/11/2022	03/11/2043	Granted
ML 1841	Mining Lease	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	03/11/2022	03/11/2043	Granted
MLA 495	Mining Lease Application	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	Mining Lease Application lodged 12th May 2015		Application Pending
MLA 496	Mining Lease Application	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	Mining Lease Application lodged 12th May 2015		Application Pending
MLA 520	Mining Lease Application	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	Mining Lease Application lodged 23rd December 2015		Application Pending
MLA 535	Mining Lease Application	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities	Mining Lease Application lodged 28th October 2016		Application Pending
MLA 562	Mining Lease Application	Coal & Allied Pty Ltd and Anotero Pty Ltd	Ancillary Mining Activities (Mining Purposes)	Mining Lease Application lodged 21st December 2018		Application Pending

Table 3-3: HVO Licences and Permits

Type	Licence Number	Description	Authority	Expiry Date
Environment Protection Licence	EPL640	Environment Protection Licence	EPA	N/A
Licence to Store Explosives	XSTR200117	Licence to Store	SafeWork	02/05/2026
Radiation Licence	RML5085293	Radiation Management Licence	EPA	14/11/2023
Aboriginal Heritage Permit	C0001890	Care Agreement	OEH	03/06/2036
	C0002193	Aboriginal Heritage Impact Permit	OEH	06/12/2026
Road Closure Permit	1543350	Road Occupancy Licenses– Golden Highway	RMS	30/06/2023
	N/A	Road Closure Approval - Lemington Road	Singleton Council	30/06/2023

Table 3-4: Water Related Approvals

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20BL030566	Bore	Well	Part 5 Water Act 1912	East Open Cut	Perpetuity
20BL141584	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Carrington Work Licence	Perpetuity
20BL166637	Bore	Monitoring Bore	Part 5 Water Act 1912	No Current Bores	Perpetuity
20BL168820	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO North – Bores: CGW39, CGW45a, CGW46, CGW47, CGW47a, CGW48, CGW49, P50/38.5, CGW56, 4036C, 4035P, 4032P, 4034P, 4033P, 4053P, 4052P, 4051C, 4040P, 4038C, 4037P** Destroyed: CGW7, CGW50, CGW57, CGW58, CGW59, CGW60, CGW61, CGW62, CGW63	Perpetuity
20BL169241	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO North – Bores: DM1, HF3, HF7** Destroyed: DM2	Perpetuity
20BL169641	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO North – Bores: CGW5, CGW51A, CGW52, CGW53, CGW54, CGW55A, CGW53A, CGW52A, CGW54A, CGW6, CFW55, CFW57, CFW57A, CFW59, and CFW55R.** Destroyed: CGW1, CGW2, CGW3, CGW5, CGW8, CGW9, CGW10, CGW12, CGW13, CGW14, CGW30, CGW33, CGW34, CGW35, CGW36, CGW37, CGW38, CGW40, CGW41, CGW42, CGW43, CGW44, CFW56, CFW56A, CFW58	Perpetuity
20BL170496	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO South – Bores: BZ10 (CHPZ 2A), BZ11 (CHPZ 3A), BZ18 (CHPZ 10A), BZ20 (CHPZ 12A), BZ21 (CHPZ 13D), BZ21A (CHPZ 13A), BZ20A (CHPZ 12D), BZ11A (CHPZ 3D)** Destroyed: AP50/47.5, AQ52, AV50/56.5, AS50/62.5, AR55, Bunc 3, BZ25 (Bunc 12), BZ23 (Bunc 14), BZ24 (Bunc 13),	Perpetuity
20BL170497	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO South – Bores: BZ15 (CHPZ 7A), BZ16 (CHPZ 8D), BZ17 (CHPZ 9A), BZ19 (CHPZ 11A), BZ16A (CHPZ 8A), Bunc 46D** Destroyed: Bunc 39 (Shallow & Deep), Bunc 44D	Perpetuity
20BL170498	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO South – Bores: BZ12 (CHPZ 4A), BZ13 (CHPZ 5A), BZ14, BZ9 (CHPZ 1A), BC1, BC1a, BZ8-1, BZ8-2, BZ8-3, HG1, HG2, HG2a, HG3, S4, S6, BZ22 (CHPZ14D), BZ22A (CHPZ 14A), BZ5-1, BZ5-2** Destroyed: S2, S3, S9, S11	Perpetuity
20BL171423	Bore	Monitoring Bore	Part 5 Water Act 1912	E1.5	Perpetuity
20BL171424	Bore	Monitoring Bore	Part 5 Water Act 1912	Destroyed: GW9711	Perpetuity

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20BL171425	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: GW9701, GW9710	Perpetuity
20BL171426	Bore	Monitoring Bore	Part 5 Water Act 1912	**Bores: GW9702** Destroyed: D2(WH236)	Perpetuity
20BL171427	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: C335, C630 (BFS)	Perpetuity
20BL171428	Bore	Monitoring Bore	Part 5 Water Act 1912	D807	Perpetuity
20BL171429	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: B925 (BFS), C122 (BFS), C122 (WDH)	Perpetuity
20BL171430	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: C613 (BFS), C809 (GM/WDH)	Perpetuity
20BL171431	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: B631 (BFS), B631 (WDH)	Perpetuity
20BL171432	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: C130 (AFSH1), C130 (ALL), C130(BFS), C130 (WDH)	Perpetuity
20BL171433	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bore B334 (BFS)	Perpetuity
20BL171434	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: C317 (BFS), C317 (WDH)	Perpetuity
20BL171435	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ3-1, BZ3-2, BZ3-3	Perpetuity
20BL171436	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ4A(1), BZ4A(2), BZ4B	Perpetuity
20BL171437	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: WG1, WG2, WG3	Perpetuity
20BL171439	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: BRN, E012	Perpetuity
20BL171492	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: C1(WJ039), GW9704, North, GWAR981	Perpetuity
20BL171681	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: Bunc 45A, Bunc 45D	Perpetuity
20BL171725	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO South – Bores: B425 (WDH), BRS, C621 (BFS), C919 (ALL), D317 (BFS), D317(ALL), D317(WDH)** Destroyed: D420, D425, D621, PB02	Perpetuity
20BL171726	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: SR002, SR003, SR004, SR005, SR006, SR007	Perpetuity
20BL171727	Bore	Monitoring Bore	Part 5 Water Act 1912	SR001	Perpetuity
20BL171728	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: BZ2B, BZ1-1, BZ1-2, BZ1-3, BZ2-1, BZ2-2	Perpetuity
20BL171762	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO South – Bores: C817, D010 (BFS), D214 (BFS), D406 (BFS) (AFS), D510 (BFS), PB01 (ALL), D510 (AFS), D010 (GM), D010 (WDH), D406 (BFS) (AFS), D612 (AFS), D612 (BFS)	Perpetuity

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20BL171851	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North/South – Bores: HV2, PZ1CH200, PZ2CH400, PZ3CH800, 4118P, 4119P	Perpetuity
20BL171852	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – PZ4CH1380	Perpetuity
20BL171853	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – DM3	Perpetuity
20BL171854	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Bores: DM5, PZ6CH2450	Perpetuity
20BL171855	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – PZ5CH1800	Perpetuity
20BL171856	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – Bores: HV6, HV3, DM6, HV2 (2), 4113P, 4114P. 4116P, 4117P	Perpetuity
20BL171857	Bore	Monitoring Bore	Part 5 Water Act 1912	Bores: HV4, HV4 (2) (GA3), GA3,	Perpetuity
20BL171858	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO North – DM4	Perpetuity
20BL171895	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO West –** Destroyed: NPZ4	Perpetuity
20BL171896	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO West – NPZ2	Perpetuity
20BL171897	Bore	Monitoring Bore	Part 5 Water Act 1912	**HVO West – Bores: NPZ1** Destroyed: NPZ5	Perpetuity
20BL171898	Bore	Monitoring Bore	Part 5 Water Act 1912	HVO West – NPZ3	Perpetuity
20BL173062	Bore	Monitoring Bore	Part 5 Water Act 1912	RC14	Perpetuity
20BL173065	Bore	Monitoring Bore	Part 5 Water Act 1912	HQ11	Perpetuity
20BL173063	Bore	Monitoring Bore	Part 5 Water Act 1912	RC07, RC08	Perpetuity
20BL173064	Bore	Monitoring Bore	Part 5 Water Act 1912	RC06	Perpetuity
20BL173069	Bore	Monitoring Bore	Part 5 Water Act 1912	RC11	Perpetuity
20CA201247	Works Approval	Pumping Plant	Water Management Act 2000	Associated with WAL965	Perpetuity
20CA212713	Works Approval	Pumping Plant	Water Management Act 2000	Associated with WAL36190	30/05/2025
20FW213280	Flood Work Approval	Levee	Water Management Act 2000	HVO North Carrington Levee 5	21/09/2027
20FW213281 Formerly 20CW802613	Flood Work Approval	Levee	Water Management Act 2000	HVO South – Barry Levee	21/09/2027

Licence Number	Type of Licence	Purpose	Legislation	Description	Expiry Date
20FW213277 Formerly 20CW802603	Flood Work Approval	Block Dam	Water Management Act 2000	HVO South – Hobden Gully Levee	21/09/2027
20FW213278 Formerly 20CW802604	Flood Work Approval	Levee	Water Management Act 2000	HVO North – North Pit Levee 3	21/09/2027
20WA210991 **(see WAL 18307)** Formerly 20SL050903	Stream Diversion	Stream Diversion	Water Management Act 2000	HVO West – Parnells Creek Dam	09/01/2033
20WA211427 **Formerly** 20SL061290	Stream Diversion	Cutting (Diversion Drain)	Section 10 Water Act 1912	Pikes Gully Creek Stream Diversion	07/09/2023
20WA210985 **(see WAL 18327)** 20SL042746	Diversion Works	Industrial	Water Management Act 2000	HV Loading Point Pump Bayswater Creek	08/09/2032
20WA211428 20SL061594	Stream Diversion	Cutting (Diversion Drain)	Water Management Act 2000	HVO North – Carrington Stream Diversion	31/07/2032
20WA201238 (see WAL 962)	Diversion Works	Pumping Plant	Water Management Act 2000	HVCPP River Pump	16/03/2028
20WA201257 (see WAL 970)	Diversion Works	Pumping Plant	Water Management Act 2000	HVO South – LCPP River Pump	Perpetuity
20WA201338 (see WAL 1006)	Diversion Works	Pumping Plant	Water Management Act 2000	HVO South – LCPP River Pump	Perpetuity
20WA201501 (see WAL 1070)	Diversion Works	Pumping Plant	Water Management Act 2000	HVO South – LCPP River Pump	Perpetuity
20WA201685 (see WAL 13387)	Diversion Works	Pumping Plant	Water Management Act 2000	HVO West – "Lake Liddell" Licence	Perpetuity
20FW213274	Flood Work Approval	Levee	Water Management Act 2000	Riverview	26/10/2028

Table 3-5: Surface Water Access Licences 2021/22 Water Year

Licence Number	Description	Water Source	Water Sharing Plan	Water Source Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total Take (ML)
WAL867	Comleroi, farming & irrigation	Hunter River	Hunter Regulated River WSP	Zone 2a (Hunter River From Glennies Creek Junction To Wollombi Brook Junction)	486	0	0	0
WAL962	HVO North – HVCPP River Pump – Water Access Licence	Hunter River	Hunter Regulated River WSP	Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction)	3,165	0	0	0
WAL969	HVO South – Former Riverview pump	Hunter River	Hunter Regulated River WSP	Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction)	39	0	0	0
WAL970	HVO South – LCPP River Pump – Water Access Licence	Hunter River	Hunter Regulated River WSP	Zone 2a (Hunter River From Glennies Creek Junction To Wollombi Brook Junction)	500	0	0	0
WAL1006	HVO South – LCPP River Pump – Water Access Licence	Hunter River	Hunter Regulated River WSP	Zone 2a (Hunter River From Glennies Creek Junction To Wollombi Brook Junction)	500	21	0	21
WAL1070	HVO South - LCPP River Pump – Water Access Licence	Hunter River	Hunter Regulated River WSP	Zone 2a (Hunter River From Glennies Creek Junction To Wollombi Brook Junction)	500	0	0	0
WAL13387	Macquarie Generation Hunter River Pump Station	Hunter River	Hunter Regulated River WSP	Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction)	20	0	0	0
WAL 13391	HVO North – Alluvial Rehabilitation Irrigation.	Hunter River	Hunter Regulated River WSP	Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction	420	0	0	0
WAL18127	Carrington BB1	Hunter River Alluvium	Hunter Unregulated and Alluvial Water Sources WSP	Hunter Regulated River Alluvial Water Source – Upstream Glennies Creek management zone	383	346	0	346

Licence Number	Description	Water Source	Water Sharing Plan	Water Source Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total Take (ML)
WAL18158	Ollenberry	Hunter River Alluvium	Hunter Unregulated and Alluvial Water Sources WSP	Hunter Regulated River Alluvial Water Source – Upstream Glennies Creek management zone	65	0	0	0
WAL18307	HVO West – Parnells Creek Dam (Diversion Works Bywash)	Unregulated River	Hunter Unregulated and Alluvial Water Sources WSP	Jerrys Water Source; Jerrys Management Zone	500	352	0	352
WAL18327	HV Loading Point Pump Bayswater Creek (Diversion Works)	Unregulated River	Hunter Unregulated and Alluvial Water Sources WSP	Jerrys Water Source; Jerrys Management Zone	150	0	0	0
WAL 23889	Greenleek	Wollombi Brook	Hunter Unregulated and Alluvial Water Sources WSP	Lower Wollombi Brook Water Source	144	0	0	0
WAL 36190	HVO North, old farm bore	Hunter River Alluvium	Hunter Unregulated and Alluvial Water Sources WSP	Hunter Regulated River Alluvial Water Source – Jerrys Management Zone	120	0	0	0
WAL 41527	HVO North (Carrington Pit)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	700	0	0	0
WAL 41533	HVO North – Pit Excavation	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	20	0	0	0

Table 3-6: Groundwater Access Licences 2021/22 Water Year

Licence Number	Description	Water Source	Water Sharping Plan (WSP)	Water Source – Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total (ML)
WAL39798	Lemington Underground (LUG) Bore	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	1,800	0	41.5	41.5
WAL40462	HVO Pit Excavations / Alluvial Lands Bores (x4)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	2,400	477	0	477
WAL40463	HVO Pit Excavations / Alluvial Lands Bores (x4)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	180	180	0	180
WAL40466	HVO Pit Excavations / Alluvial Lands Bores (x4)	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16)	Permian Coal Seams	460	460	0	460
WAL41527	HVO North – Carrington Pit	Permian Coal Seams	North Coast Fractured and Porous Rock Groundwater Sources WSP (commenced 1/7/16) Previously Water Act 1912	Permian Coal Seams	700	700	0	700

3.1.2 | MANAGEMENT PLANS, PROGRAMS, STRATEGIES

HVO is required by the site approvals to develop and submit a range of environmental management plans for approval prior to implementation. Approved management plans are made publicly available on the HVO website (https://hvo.com.au/).

Many updated plans were submitted to DPE in 2022. Some plans remain under review and will be submitted to DPE in 2023. The status of management plans is shown in **Table 3-7** and **Table 3-8.**

Table 3-7: Management Plans Required for HVO North

Management Plan	Date Approved	Date Submitted to DPE
Agricultural Lands Reinstatement Management Plan*	20/06/2022	23/05/2022
Fine Reject Management Strategy	19/01/2023	4/11/2022
HVO Air Quality and Greenhouse Gas Management Plan	12/09/2019	24/08/2022
HVO Blast Management Plan	03/04/2019	07/04/2022
HVO Bushfire Management Plan	04/04/2020	N/A
HVO Environmental Management Strategy	08/01/2019	7/04/2022
HVO Greenhouse and Energy Efficiency Plan (Addressed in HVO Air Quality and Greenhouse Gas Management Plan)	12/09/2019	24/08/2022
HVO Noise Management Plan	16/12/2021	7/04/2022
HVO North Heritage Management Plan	09/02/2020	N/A
HVO River Red Gum Rehabilitation & Restoration Strategy	19/05/2022	N/A
HVO Water Management Plan	16/10/2018	23/11/2022
Final Void Management Plan	16/05/2022	Under revision
Rehabilitation Management Plan and Forward Program**	N/A	6/10/2022

*The Agricultural Lands Reinstatement Management Plan states that the agricultural reinstatement activities and monitoring results will be reported in the HVO Annual Environment Review (Annual Review). However, work has not yet commenced hence no monitoring or reporting against the management plan specific to the Carrington West Wing project is provided in this report.

**The Rehabilitation Management Plan and Forward Program is prepared in accordance with the provisions under the Mining Act 1992 and is not approved by DPE.

Table 3-8: Management Plans Required for HVO South

Management Plan	Date Approved	Date Submitted to DPE
HVGC Amenity Management Plan	22/01/2013 (revision submitted 28/12/2021)	9/09/2022
HVO Air Quality and Greenhouse Gas Management Plan	12/09/2019	24/08/2022
HVO Biodiversity Offset Strategy	23/10/2017	9/06/2022
HVO Blast Management Plan	03/04/2019	07/04/2022
HVO Bushfire Management Plan	01/04/2020	N/A
HVO Environmental Management Strategy	08/01/2019	7/04/2022
HVO Integrated Biodiversity Management Plan	02/08/2018	5/10/2022
HVO Noise Management Plan	16/12/2021	7/04/2022
HVO River Red Gum Rehabilitation & Restoration Strategy	19/05/2022	N/A
HVO South Aboriginal Cultural Heritage Management Plan	09/02/2020	-
HVO Water Management Plan	16/10/2018	23/11/2022
Rehabilitation Management Plan and Forward Program*	N/A	6/10/2022
Biodiversity Management Plan (offsets component)	26/06/2017- Goulburn River Biodiversity Area Management Plan	-
HVGC Amenity Management Plan	22/01/2013 (revision submitted 28/12/2021)	9/09/2022

** The Rehabilitation Management Plan and Forward Program is prepared in accordance with the provisions under the Mining Act 1992 and is not approved by DPE.

4 | OPERATIONS SUMMARY

4.1 | MINING

Areas to be mined are geologically modelled, a mine plan is formed, and the relevant mining locations are surveyed prior to mining. The mining process is illustrated in **Figure 4-1**. There are no active underground workings at HVO.

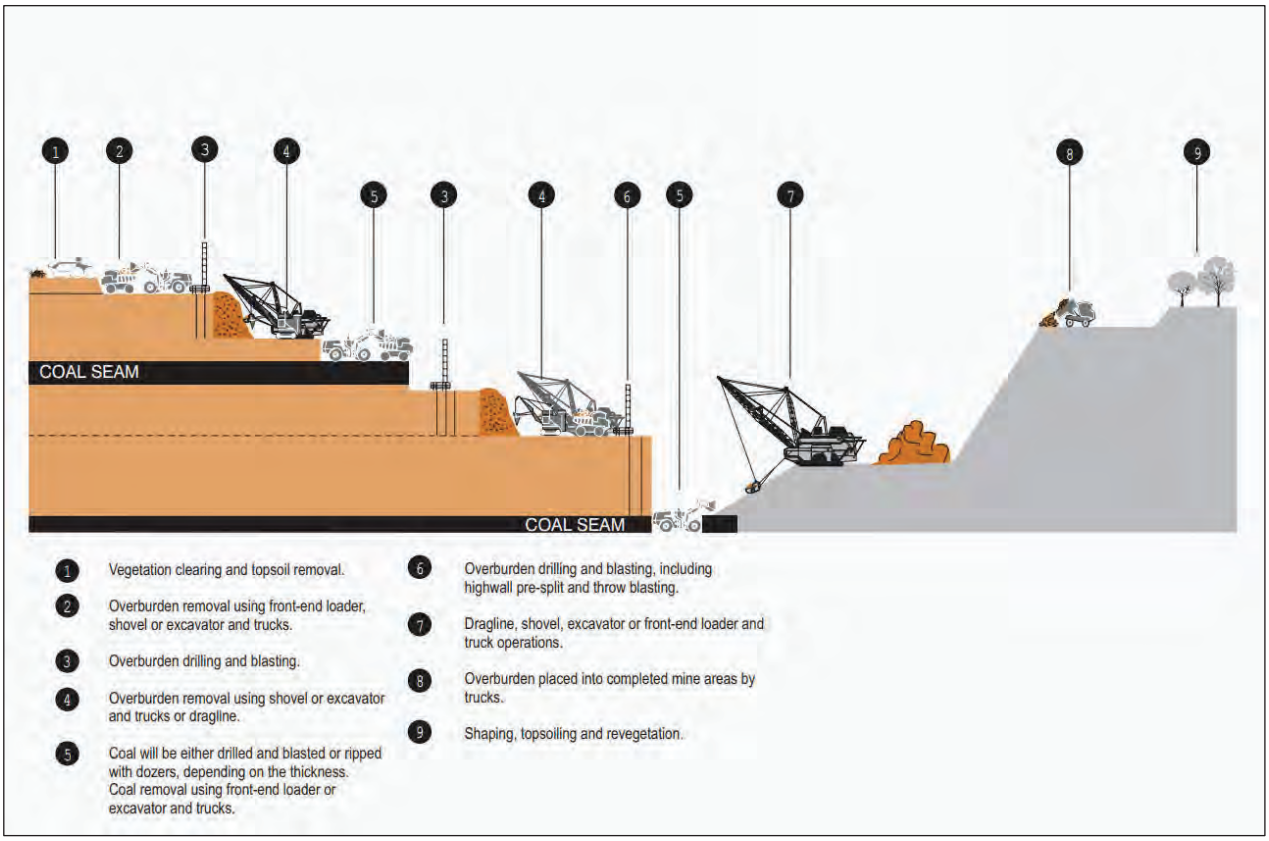

Figure 4-1: Open Cut Mining Schematic

No material changes were made to the mining method during the reporting period. Mining progress deviated slightly from the schedule of the RMP as a result of normal variations in productivity and utilisation.

The mining equipment fleet employed to carry out mining operations at HVO in 2021 and 2022 is detailed in **Table 4-1** along with the fleet forecast for 2023.

Table 4-1: HVO Equipment Used 2021-2022

Equipment Type	Number Used in 2021	Number Used in 2022	Forecast Numbers in 2023
Scrapers	2	2	2
Drills	7	8	9
Draglines	2	2	1
Shovels	3	3	2
Excavators	7	11	13
Trucks	73	86	95
Loaders	6	6	6
Service Trucks	5	4	4
Track Dozers	27	31	28
Rubber Tyre Dozers	4	4	4
Graders	11	11	12
Water Trucks	10	10	10
Floats	1	1	1
Cable Reeler	1	1	1
Cable Tractors	5	5	5
Total	**164**	**185**	**193**

4.1.1 | MINERAL PROCESSING

Coal is transported to one of two CHPPs where it is crushed to size and processed to remove impurities. Processing produces saleable coal, along with coarse and fine reject materials. Coarse rejects are disposed of in-pit and fine rejects are placed in a tailings dam in accordance with the RMP. Each CHPP site has storage facilities for processed (saleable) and raw (unprocessed) coal. The capacity of each site is listed in **Table 4-2**.

No material changes or additions were made to process or facilities during the reporting period.

Table 4-2: Stockpile Capacities

Location	Raw Stockpile (t)	Saleable Stockpile (t)
Hunter Valley CHPP	176,000	330,000
Howick CHPP	15,000	30,000
Newdell Load Point	0	400,000

Processed, or product coal is transported to one of the two loading points via conveyor belt or road, detailed in **Table 4-3.** The coal from Hunter Valley CHPP (HVCHPP) is transported to the Hunter Valley Load Point (HVLP) by means of overland conveyor whereas coal from Howick CHPP is typically trucked to Newdell Load Point (NLP). After the coal has reached either HVLP or the NLP it is transported to the Port of Newcastle by rail.

Table 4-3: Methods of Coal Transportation

Transport Category	Quantity (Mt)
Coal transported from the site via trains	9.5
Amount of coal received from Hunter Valley Operations South of the Hunter River	7.5
Amount of coal hauled by road to the Hunter Valley Loading Point	Nil
Coal hauled by road to the Newdell Load Point	0.80
Amount of coal hauled by road from the Newdell Loading Point to the Ravensworth Coal Terminal	Nil
Amount of coal hauled by road from the Hunter Valley Loading Point to the Ravensworth Coal Terminal	Nil
Number of coal haulage truck movements generated by the development. (Includes -coal hauled to stockpile, coal hauled to bins, coal hauled from stockpile to bins)	133,350 (truck movements)

4.1.2 | PRODUCTION STATISTICS

Project approvals allow for the extraction of up to 22 million ROM tonnes from operations north of the Hunter River and 20 million ROM tonnes from operations south of the Hunter River. A summary of production and waste at HVO during 2022 in comparison to previous years and approval limits is provided in **Table 4-4**.

Product coal includes low-ash, semi-soft and steaming coals.

Table 4-4: Production Statistics and Correlating Project Approval Limits

	Approved Limit (PA 06_0261 and DA 450-10-2003)	Reporting Period 2021	Reporting Period 2022	Forecast for 2023
Prime Waste (Mbcm)	-	81.19	71.44	91.90
ROM Coal (Mtpa) (mined)	42	14.41	11.94	15.27
- *HVO South*	20	9.87	7.55	9.53
- *West Pit*	12	4.54	4.38	5.74
- *Carrington Pit*	10	0	0	0
Coarse Reject (Mt)	-	3.02	2.31	3.06
Fine Reject-Tailings (Mt)	-	1.43	1.38	1.09
Product (Mtpa)	-	10.57	9.63	10.39
ROM Coal Processed	26	14.86	13.68	14.53
- *Hunter Valley CHPP*	20	14.59	12.42	14.53
- *Howick CHPP*	6	0.25	1.26	0

4.1.3 | SUMMARY OF CHANGES

Production numbers throughout 2022 were reduced due to increased rain and flooding compared to previous years.

Mining in the Carrington West Wing location has not yet commenced. As of the time of reporting, mining in this area is not planned to commence during 2023.

Tailings emplacement continued in the Carrington mining void in 2022.

4.2 | FORECAST OPERATIONS FOR NEXT REPORTING PERIOD

Table 4-5 outlines the forecast operations for the next reporting period.

Table 4-5: Production Operations Forecast

Material	Unit	2022 (Forecast)	2022 (Actual)	2023 Forecast	2024 Forecast
Stripped Topsoil	kbcm	217.16	113.3	176.0	370.8
Rock / Overburden	Mbcm	108.39	80.46	95.19	99.50
ROM Coal	Mt	18.90	11.94	15.27	18.35
Reject Material	Mt	5.11	3.69	3.06	3.41
Product	Mt	13.79	9.63	10.39	12.77

5 | ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

DPE responded to HVO on 14 June 2022 accepting the 2021 Annual Review. DPE did not require any changes to the 2021 Annual Review, however actions from the 2021 Annual Review for future reviews and HVO's response are detailed in **Table 5-1**. The NSW Resources Regulator did not provide any feedback in response to the 2021 Annual Review.

Table 5-1: Actions Recommended in 2021 Annual Review

Action Recommended in 2021 Annual Review	Action Taken By HVO
Investigations into elevated PM2.5 levels at the Maison Dieu monitor, and more broadly, the elevated PM2.5/PM10 ratios from the Maison Dieu and Kilburnie South monitors as detailed in the Annual Data Review 2021 produced by Todoroski Air Sciences (Appendix A of the 2021 Annual Review).	HVO have provided an update on these investigations in Appendix B and **Section 6.4.3**.
The implementation (or lack thereof) of the recommendations noted in Section 6.2 of the 2021 Annual Groundwater Monitoring Review produced by EMM (Appendix B of the 2021 Annual Review).	HVO have provided an update on progress against these recommendations in **Section 7.7**

6 | ENVIRONMENTAL PERFORMANCE

6.1 | METEOROLOGICAL DATA

The collection of meteorological (weather) data is carried out to assist in day-to-day operational decisions, planning, environmental management and to maintain a historic record. The meteorological stations record:

- wind speed
- wind direction
- temperature
- humidity
- solar radiation
- rainfall

HVO operates two real-time meteorological stations; the HVO Corporate Meteorological Station and the Cheshunt Meteorological Station. The locations of these monitors are shown in **Figure 6-2**. Daily average data is publicly available via the Monthly Environmental Monitoring Reports published on the HVO website.

Total annual rainfall for 2022 was 1047.2mm (recorded at the HVO Corporate Meteorological Station) compared to 910.2mm in 2021 and 793mm in 2020. (**Figure 6-1**).

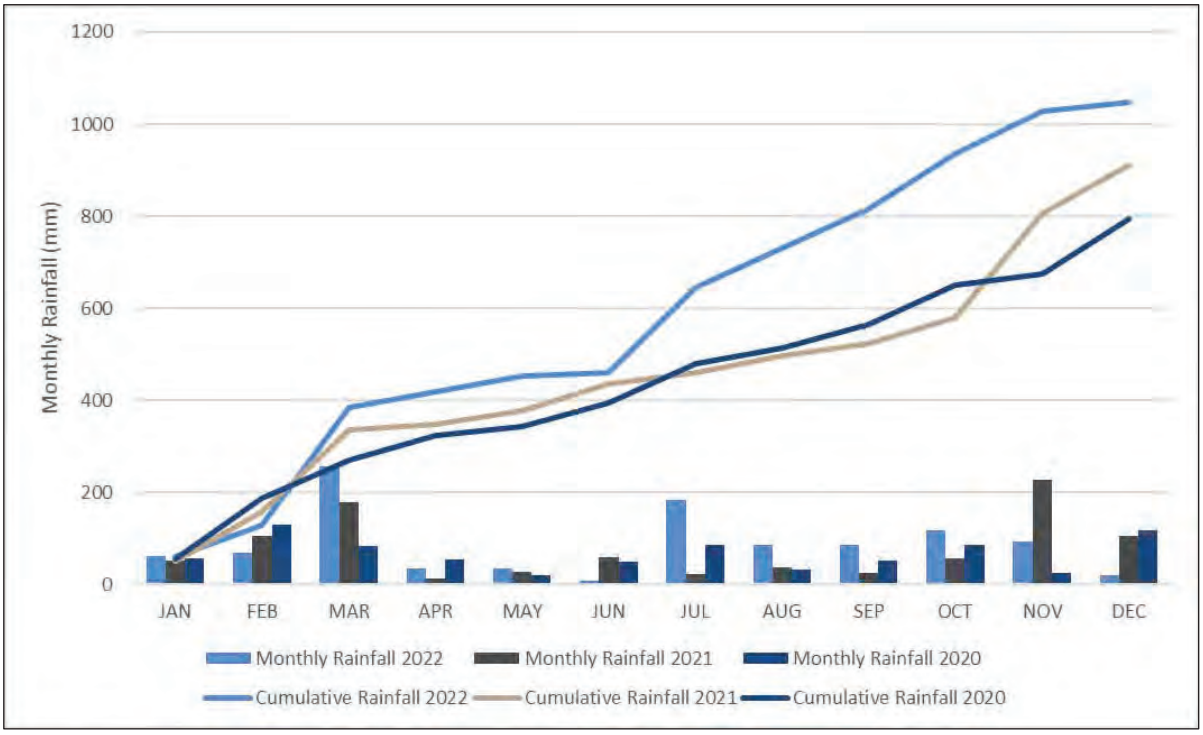

Figure 6-1: HVO Corporate Meteorological Station 2020 - 2022 Rainfall Data

6.2 | NOISE

6.2.1 | NOISE MANAGEMENT

Mining activities at HVO are managed to minimise adverse noise impacts and to maintain compliance with permissible noise limits at nearby private residences. A combination of proactive and reactive noise controls are employed to ensure effective management of noise. Noise controls are as detailed in the HVO Noise Management Plan (NMP).

6.2.2 | SOUND ATTENUATION OF HEAVY EQUIPMENT

All existing haul trucks at HVO have been fitted with sound attenuation kits. New equipment brought to site arrives sound attenuated or is scheduled for retro-fitting.

Routine sound power level testing was completed according to the schedule and will continue throughout 2023. Sound power level testing was completed on 33 heavy vehicles on site in 2022. 10 of these vehicles required additional maintenance to meet relevant sound attenuation requirements which will be completed in 2023.

6.2.3 | REAL TIME NOISE MANAGEMENT

HVO operates a network of directional real-time noise monitors to measure and manage noise emissions and to minimise community impact.

The real-time system generates alarms when elevated noise is measured, triggering the implementation of reactive controls to reduce noise levels. HVO received and responded to 1050 noise alarms during 2022. Noise alarm triggers are based on internally set noise criteria. Alarms received include noise exceedances from other mines and non-mine sources. HVO recorded over 58 hours of equipment downtime for the management of noise during 2022. The location of real-time noise monitoring locations as per the approved NMP are shown in **Figure 6-2.**

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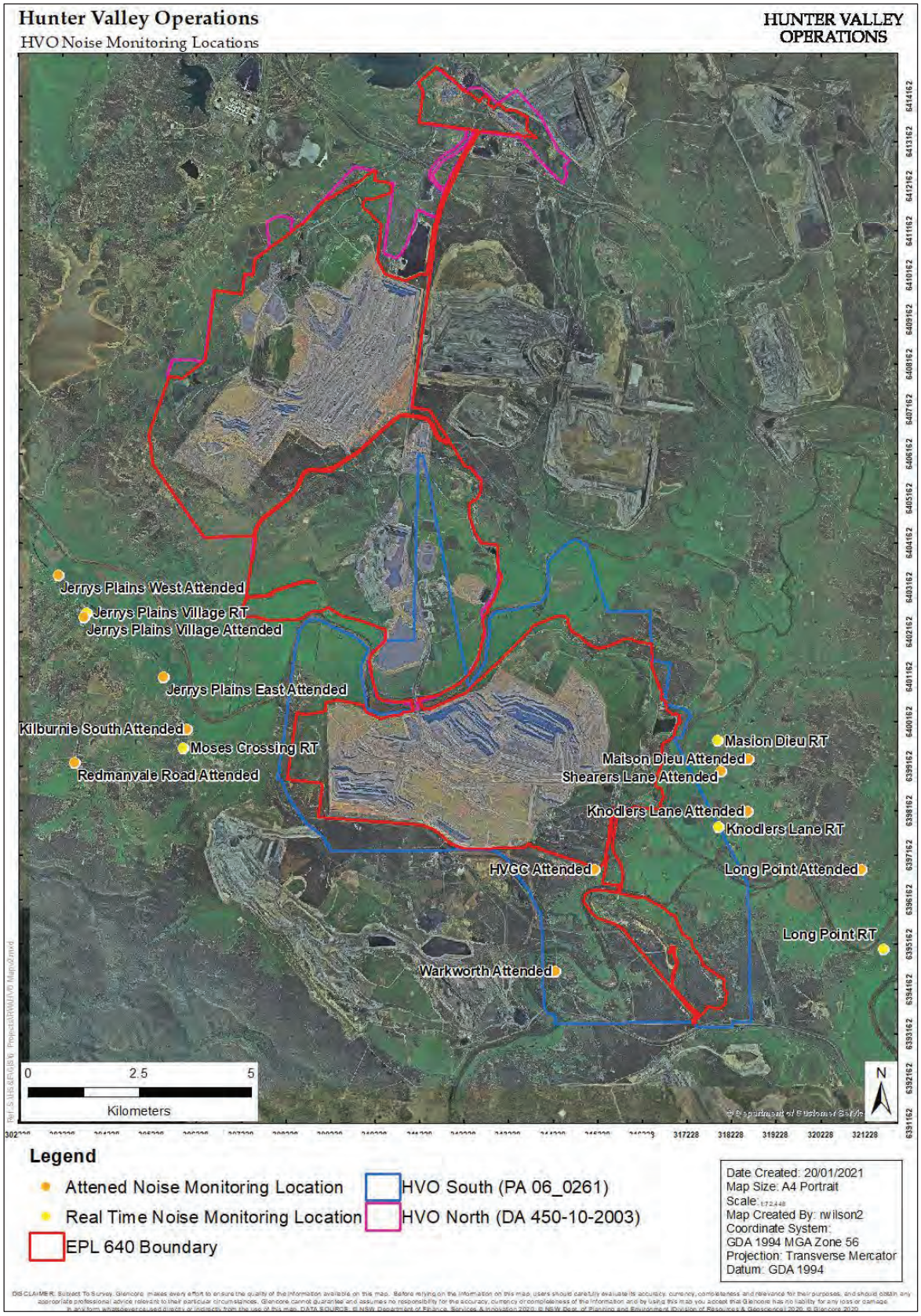

Figure 6-2: HVO Attended and Real Time Noise Monitoring Locations

Attended monitoring during 2022 was compared to real time noise monitoring results where a comparison could be made (e.g., where HVO was audible) in order to validate real time noise monitoring systems. Where comparisons were able to be made, results indicated that the real time monitoring system generally aligned with values recorded during attended noise measurements. Where they didn't align, there was even distribution between measurements being higher or lower than attended noise measurements. Comparisons were not able to be made for a majority of measurements due to low/inaudible noise from HVO than attended noise measurements.

Details of this assessment is provided in **Table 6-1**.

Table 6-1: Comparison of Attended and Real Time Noise Monitoring 2022

Monitoring Location	Number of attended noise measurements where comparison could be made[1]		Real time measurements that aligned[2] with attended measurements		Real time measurements with positive variance > 3dB(A) of attended measurements		Real time measurements with a negative variance >3dB(A) of attended measurements	
	South	North	South	North	South	North	South	North
MaisonDieu	3	-	2	-	1	-	-	-
Knodlers Lane[3]	4	0	1	-	-	-	3	-
Long Point	-	-	-	-	-	-	-	-
Kilburnie South	3	3	1	-	2	2	-	1
Jerrys Plains Village[3]	-	3	-	2	-	-	-	1

Notes:

[1] Includes measurements under all meteorological conditions

[2] Aligned indicates measurements were within 3dB (A) of each other or measurement results <25dB indicated that source contribution was in audible or not measurable.

[3] One or more data points not available for attended and / or real time monitoring events.

6.2.4 | OPERATIONAL NOISE PERFORMANCE

HVO engages a suitably qualified and experienced acoustic consultant to undertake routine attended noise compliance monitoring at nearby private residences to assess compliance with the relevant Project Approval and EPL noise criteria, in accordance with the HVO NMP. Monitoring is undertaken at a frequency of one night per month and an additional one night per quarter as required by the HVO North Approval. This monitoring is undertaken to evaluate and assess noise impacts under a range of meteorological conditions throughout the year.

A total of 120 measurements were recorded during 2022. Each measurement involves an assessment of HVO mine noise against the various $L_{Aeq,\ 15minute}$ and $L_{A1,1min}$ noise criteria in place under the HVO North and South Approvals. Full details for all noise assessments completed can be found in HVO Monthly Environmental Monitoring Reports published on the HVO website.

HVO was compliant with relevant noise criteria for all measurements recorded in 2022.

Comparison between the 2022 L_{Aeq} attended noise monitoring results (maximum HVO contribution levels measured under applicable meteorological conditions) and previous years are shown in **Table 6-2**.

Table 6-2: Comparison of 2022 Noise Monitoring Results Against Previous Years

Year	Number of Measurements	Number of measurements which exceeded allowable noise (under applicable	Number of non-compliances
2022	120	0	0
2021	121	1	0
2020	110	0	0
2019	101	1	0
2018	105	3	0
2017	100	1*	0
2016	109	2*	0

* The now superseded NSW Industrial Noise Policy (INP) allowed for the measured result to be less than or equal to 2 dB above the applicable noise limit without constituting a non-compliance. Note: Where the measured result is greater than 2dB above the applicable noise limit, the site has 75 minutes to reduce noise levels below applicable noise limits before constituting a non- compliance. As of late October 2017, the NSW INP was superseded by the Noise Policy for Industry (NpfI), with the requirements of this policy implemented in late 2017.

6.2.5 | COMPARISON WITH PREDICTIONS

Comparisons against the predicted noise levels in the Noise Impact Assessment (NIA) for HVO North prepared in October 2010 to support Modification 3 of the HVO North DA (450-10-2003). Noise predictions contained within the NIA do not correspond with specific meteorological conditions. Attended noise monitoring results have been compared directly to Year 5, mitigated, total noise predictions in the NIA for Carrington & West Pit under all meteorological conditions where noise criteria were applicable. This comparison is shown in **Table 6-3**.

Table 6-3: Comparison of 2022 Attended Noise Monitoring Against EIS Predictions

Location	Units	EIS Prediction	2022 max measured LAeq 15 min (under applicable met conditions)
Shearers Lane	dB(A)	27	Inaudible
Kilburnie South	dB(A)	37	34
Jerrys Plains	dB(A)	41	39
Jerrys Plains East	dB(A)	39	38
Jerrys Plains West	dB(A)	41	34

Comparison of measured results against the modelled predictions demonstrates noise levels lower than predicted at all monitoring locations.

Comparisons against the predicted noise levels in the HVO South Modification 5 Environmental Assessment have been made against Stage 2 modelling scenario (indicative of activities carried out during 2021), (Table 6.10 of Appendix E– Hunter Valley Operations South Modification 5 Approval Environmental Assessment Report Volume 2). The comparison (**Table 6-4**) indicates that noise during 2022 was equal to or lower than predicted levels for all receptors.

Table 6-4: Comparison of 2022 Monitoring Against HVO South (Stage 2 HVO South Modification 5 EA – 2017)

Location	Units	EIS Prediction (INP)	2022 max measured LAeq 15 min (under applicable met conditions)
Knodlers Lane	dB(A)	40	34
Maison Dieu	dB(A)	40	35
Shearers Lane	dB(A)	41	36
Kilburnie South	dB(A)	39	36
Jerrys Plains	dB(A)	34	<25
Jerrys Plains East	dB(A)	36	<35
Jerrys Plains West	dB(A)	32	Inaudible
Long Point	dB(A)	37	<30

6.3 | BLASTING

6.3.1 | BLASTING MANAGEMENT

HVO operates a blast monitoring network to assess and evaluate blast vibration and overpressure impacts against the HVO North and HVO South Consent Criteria. There was 100% blast data capture for all blast monitors in 2022.

Monitors are located at or in close proximity to nearby privately owned residences as shown in Figure 2 in Appendix D of the HVO Blast Management Plan (HVO, 2019). The monitors function as regulatory compliance monitors. These monitors are located at:

- Jerrys Plains Village
- Warkworth
- Maison Dieu
- Moses Crossing
- Knodlers Lane

See **Figure 6-3** for the blast monitoring locations.

6.3.2 | BLASTING PERFORMANCE

250 blast events were initiated at HVO during the reporting period. 140 blasts were fired at HVO South, and 110 at HVO North. HVO complied with all blasting related consent and licence conditions. Air blast overpressure and ground vibration results for all blasts fired during the reporting period are presented in **Figure 6-4** to **Figure 6-8**.

There were 2 blasts that recorded overpressure greater than 115 dB(L) during the reporting period, and no exceedances of the 5 mm/s ground vibration criteria at any residence on privately-owned land.

Blasting occurred only between the hours of 7am and 6pm Monday to Saturday an no blasting was carried out on Sundays or Public Holidays. No more than 3 blasts were fired per day and the maximum number of blasts fired during any week was nine (9), which is less than the maximum weekly blasting frequencies as specified in both project approvals.

During the reporting period, HVO closed Lemington Road on 13 occasions for an average of 10 minutes, and the Golden Highway on 16 occasions for an average of 10 minutes. In addition, on three occasions the closure of Lemington Road was initiated however was cancelled due to changes in operational requirements.

In accordance with PA 06_0261, long term blast monitoring data has been reviewed to identify any trends in the monitoring data over the life of the project. Both ground vibration and overpressure monitoring results have remained generally consistent since monitoring commenced, with no increasing trends developing in the data. Notably in 2022 there were no exceedances of 115 dB(L) air blast overpressure criteria.

See **Table 6-5** and **Table 6-6** for a review of long-term blasting data for both ground vibration and overpressure.

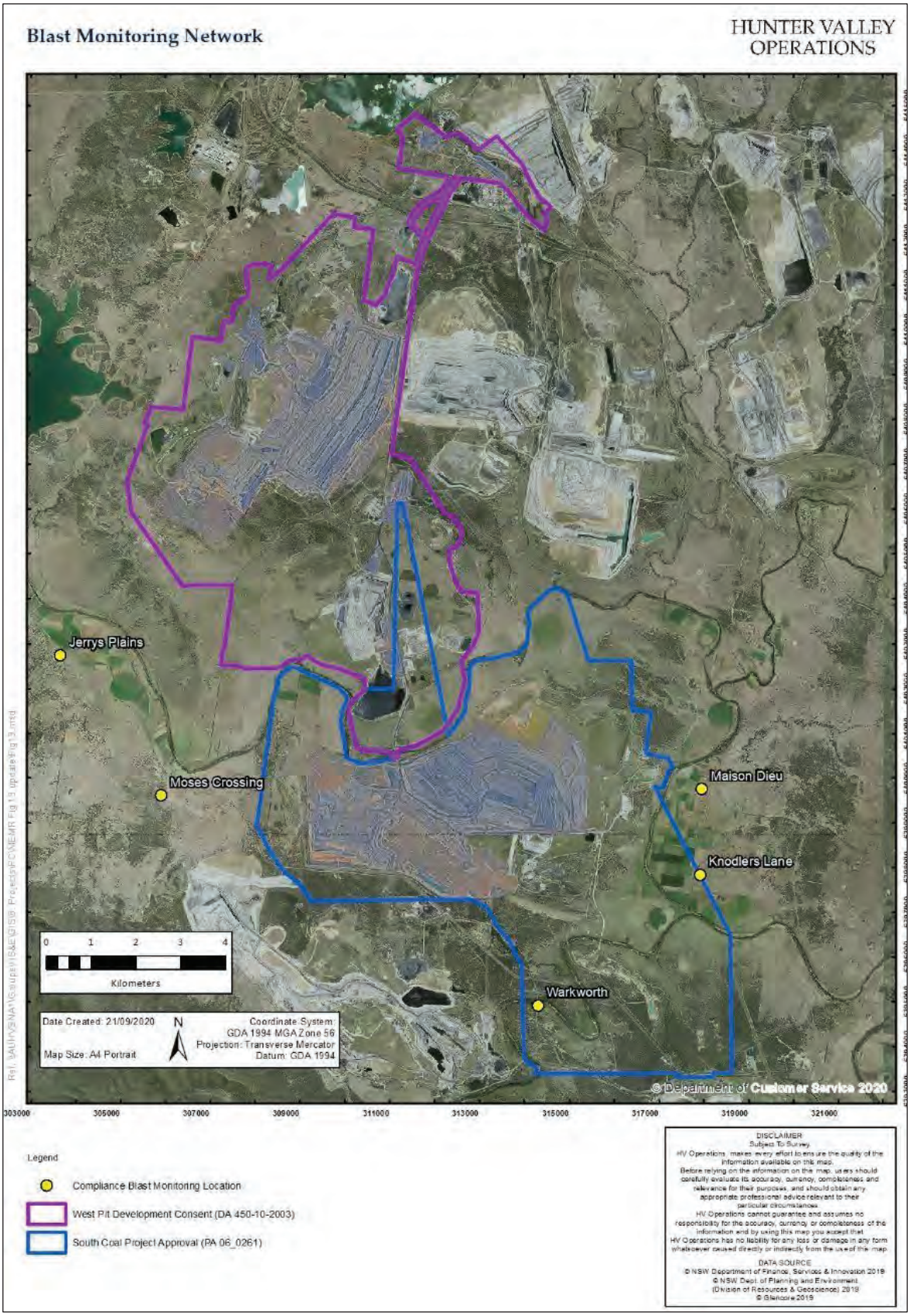

Figure 6-3: HVO Blast Monitoring Network

Table 6-5: Recent Blasting Data Trends for HVO North

Monitoring Location	2020		2021		2022	
	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)
Moses Crossing	0	0	0	0	0	0
Jerrys Plains	0	0	0	0	0	0
Warkworth	0	0	0	0	0	0
Maison Dieu	1.5	0	0	0	0	0
Knodlers Lane	0	0	0	0	0	0

Table 6-6: Recent Blasting Data Trends for HVO South

Monitoring Location	2020		2021		2022	
	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)	Percentage of blasts over 115dB(L) (%)	Percentage of blasts >5mm/s (%)
Moses Crossing	0	0	0	0	0	0
Jerrys Plains	0	0	0	0	0	0
Warkworth	0.8	0	0	0	0	0
Maison Dieu	2.5	0	0	0	0	0
Knodlers Lane	0.8	0	0	0	1.4	0

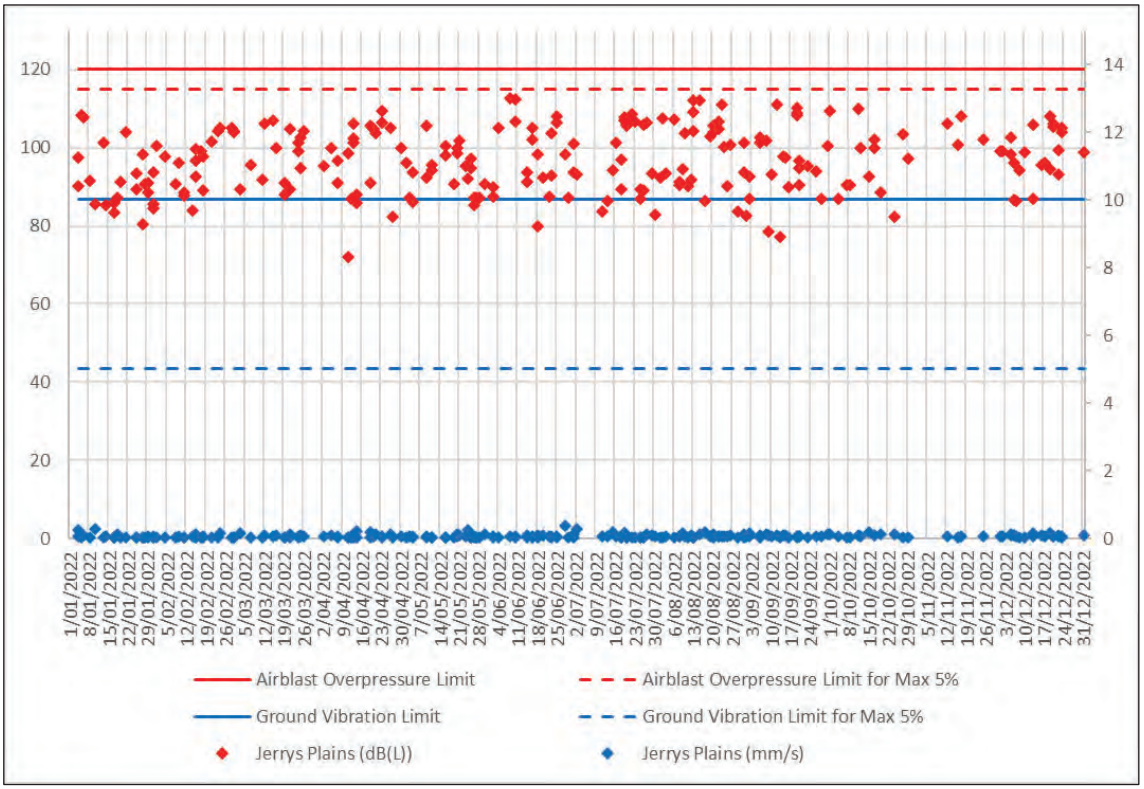

Figure 6-4: Jerrys Plains Blast *Monitoring Results 2022*

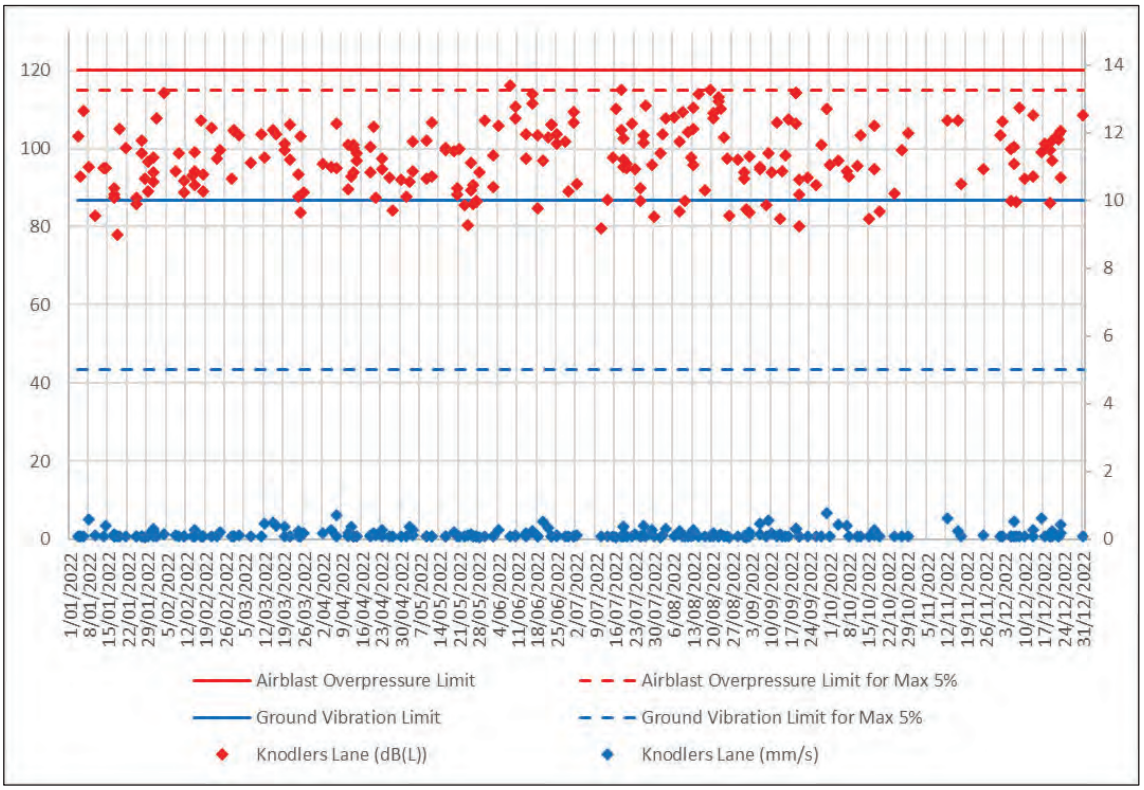

Figure 6-5: Knodlers Lane Blast Monitoring Results 2022

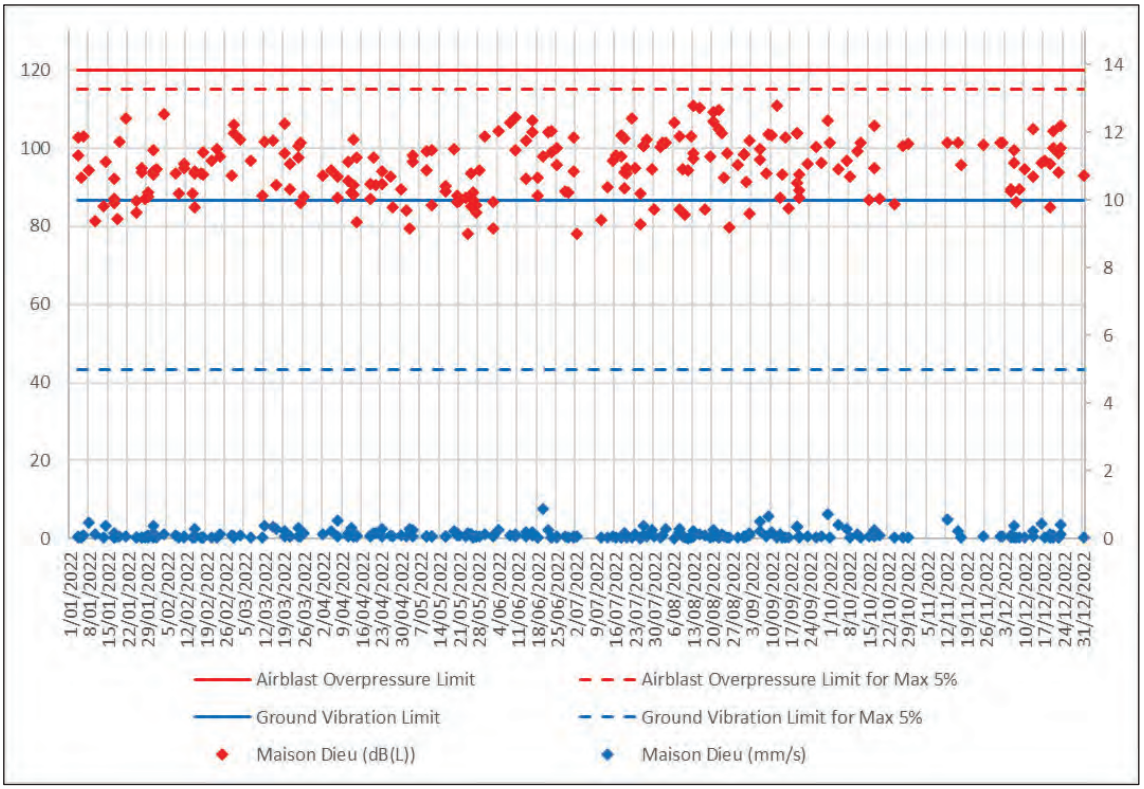

Figure 6-6: Maison Dieu Blast Monitoring Results 2022

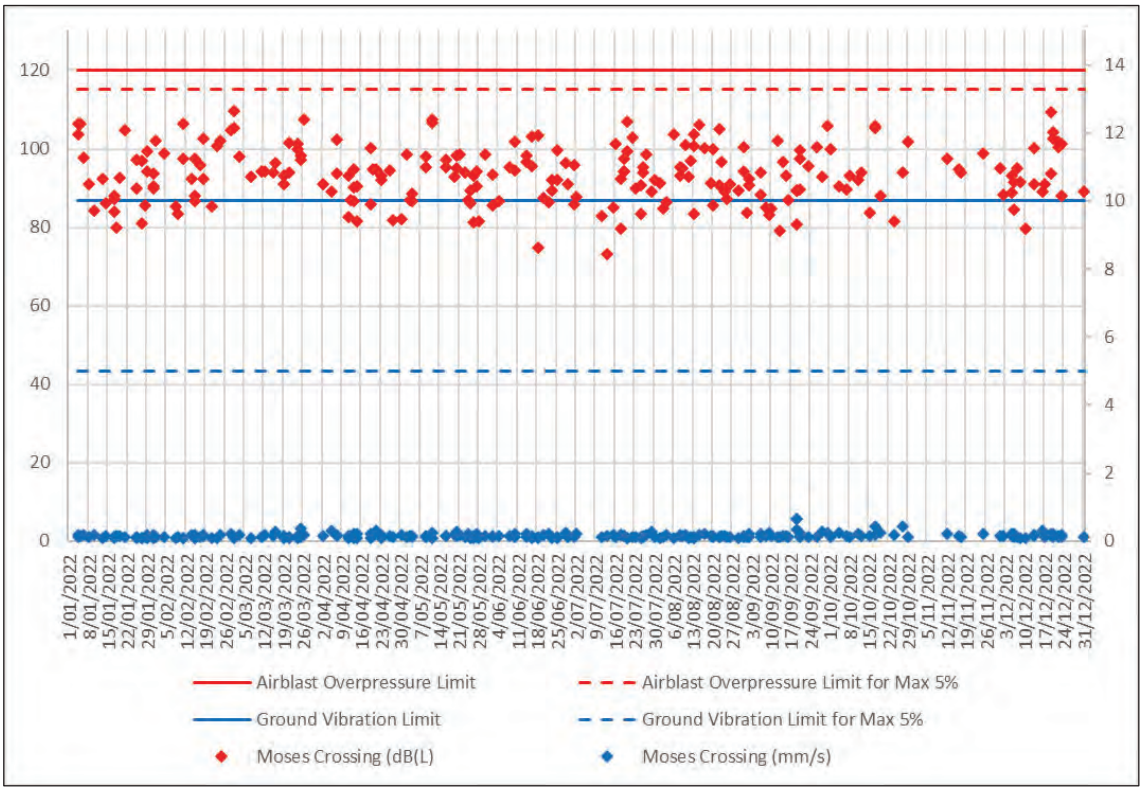

Figure 6-7: Moses Crossing Blast Monitoring Results 2022

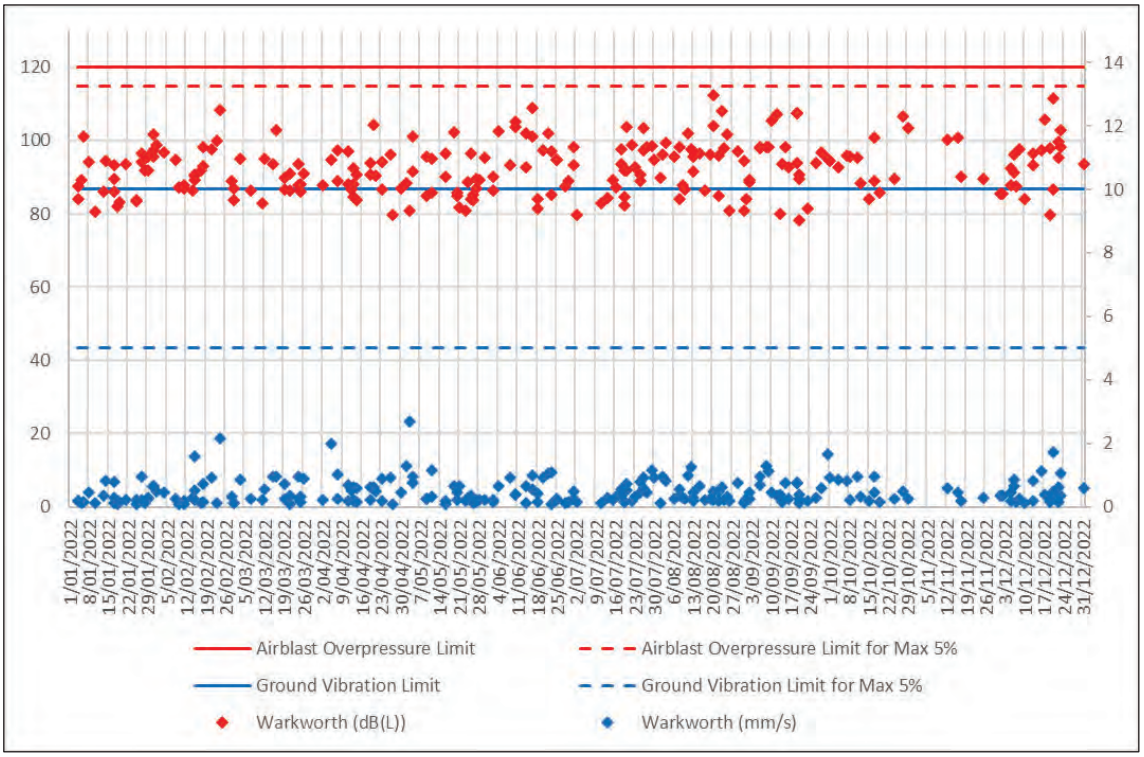

Figure 6-8: Warkworth Blast Monitoring Results 2022

6.3.3 | BLAST FUME MANAGEMENT

Blasting operations at HVO are undertaken in accordance with the HVO Post Blast Fume Generation Mitigation and Management Plan. The plan outlines the practices to be utilised to reduce the risk of generation of post blast fume and reduce potential offsite impact from any fume which may be produced. This includes specialised blasting design, appropriate product selection, on-bench water management, implementation of fume management zones and use of existing blasting permissions to identify likely path of any fume which may be produced and restrictions on firing.

All blasts are observed for fume and any fume produced is ranked according to the Australian Explosive Industry & Safety Group (AEISG) Scale.

Fume rankings for shots fired during 2022 and comparison to previous years is provided in **Table 6-7**. No blast fume ranked as Category 4 or Category 5 was observed at HVO during the reporting period. Four blasts were ranked as Category 3 and no fume was observed to leave the site. There was an overall increase in category 1, 2 and 3 fume rankings compared to 2021 due to increase in the number of blasts, proportionally the number of fume events is consistent with 2021.

Table 6-7: Visible Blast Fume Rankings According to the AEISG Colour Scale

AEISG Ranking	2017	2018	2019	2020	2021	2022
0	272	214	202	160	170	212
1	39	19	39	22	45	52
2	11	16	15	27	27	30
3	2	4	4	0	3	4
4	0	0	0	0	1	0
5	0	0	0	0	0	0
Total*	324	253	260	209	246	298

* Where a number of individual blasts were fired as a blast event, fume was assessed for each individual blast pattern rather than for the event as a whole.

6.4 | AIR QUALITY

6.4.1 | AIR QUALITY MANAGEMENT

Air quality management initiatives are implemented at HVO to ensure that:

- Air quality impacts on surrounding residents are minimised;
- All statutory requirements are adhered to; and
- Local community and regulators are kept informed through prompt and effective response to issues and complaints.

Air quality control mechanisms employed at HVO are described in detail in the *Hunter Valley Operations Air Quality and Greenhouse Gas Management Plan (AQGHMP)*, publicly available via the HVO website.

HVO continued to implement operational controls to manage dust emissions in accordance with the AQGHMP. HVO also continued implementation of additional dust management measures including the further training of Dispatch officers in response to alarms.

6.4.2 | AIR QUALITY MONITORING

Air quality monitoring at HVO is undertaken in accordance with the HVO Air Quality Monitoring Program (AQMP). An extensive network of monitoring equipment is utilised to assess performance against the relevant conditions of HVO's approvals. Air quality monitoring locations are shown in **Figure 6-9**. Air quality monitoring data is made publicly available through the HVO Monthly Environmental Monitoring Report, available on the HVO website.

6.4.3 | AIR QUALITY PERFORMANCE

Real Time Air Quality Management

HVO's real time air quality monitoring stations continuously log information and transmit data to a central database, generating alarms when particulate matter levels exceed internal trigger limits to guide the operational management of air quality on site.

A total of 551 real time alarms for air quality and meteorological conditions were received and acknowledged during 2022, which is a decrease from 797 alarms recorded during 2021. This decrease is likely due to the increase in wet weather days recorded across site and the optimisation of air quality alarm trigger criteria.

In response, 1175 hours of equipment downtime was recorded due to air quality management. A detailed breakdown of air quality related equipment stoppages (per month, per equipment type) presented in **Figure 6-10.** Note that these delays are instances where operations were completely stopped and does not include occasions where operations were changed/modified but not stopped (e.g., changed from exposed dump to in-pit dump).

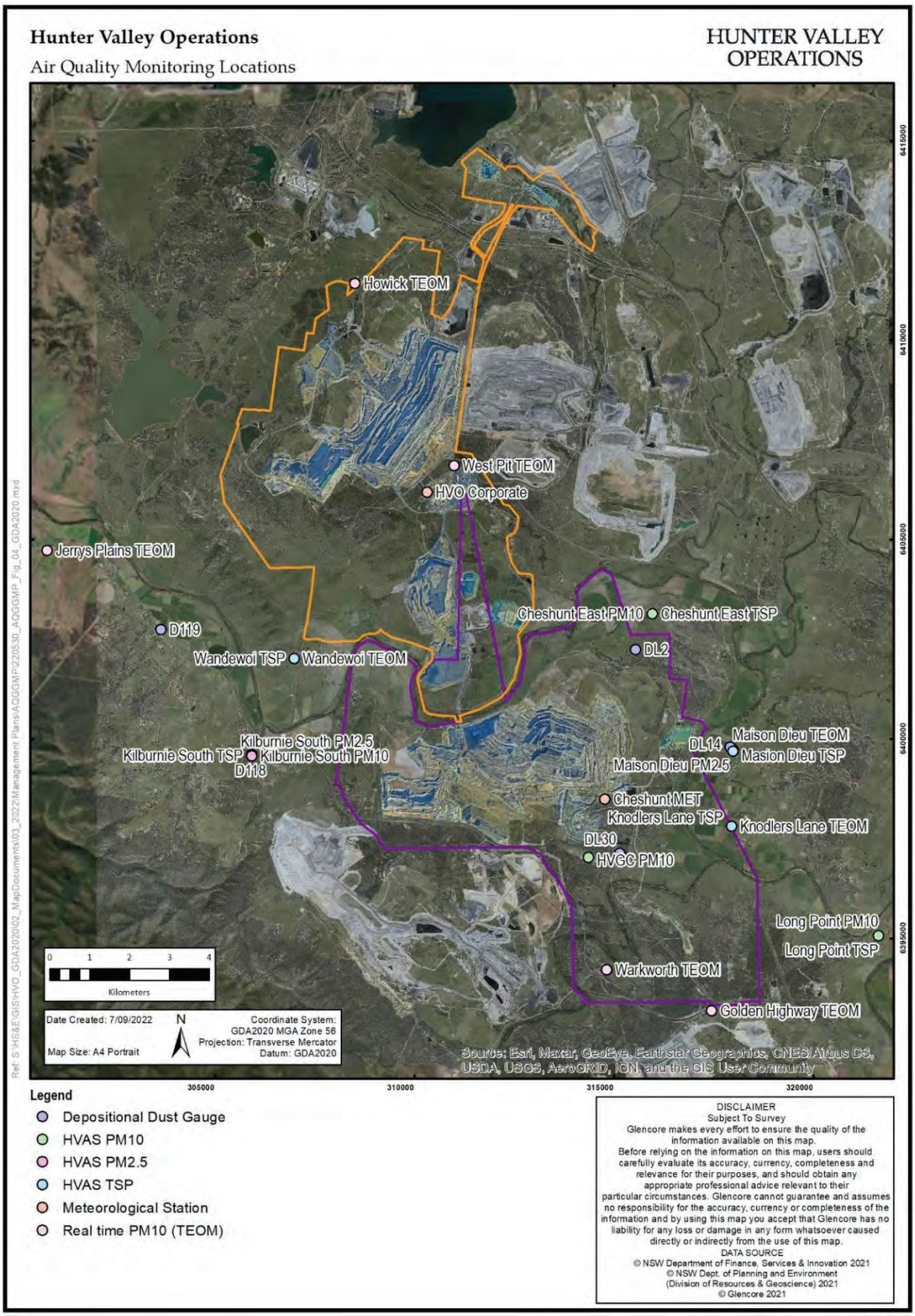

Figure 6-9: Air Quality Monitoring Locations

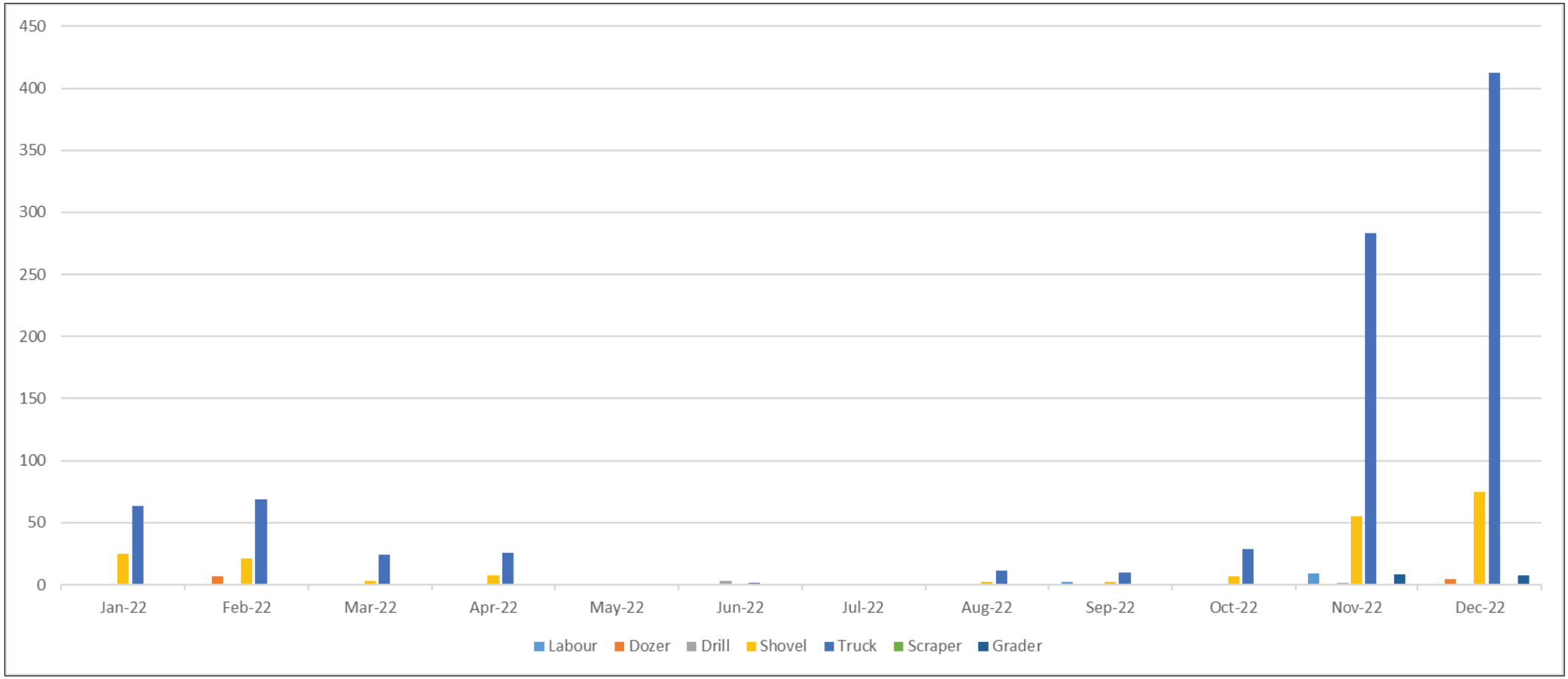

Figure 6-10: Equipment Downtime Hours for Air Quality Management 2022

Data availability from HVO's real time air quality monitoring stations is presented in **Table 6-8.** There was high data availability across the network with common reasons for data mis-captures being data-logger lockups, power failures and storms.

Table 6-8: Real Time PM_{10} Air Quality Monitoring Data Availability 2022

Monitoring Location	2022 Data Availability
Warkworth	95.6%
Knodlers Lane	98.4%
Maison Dieu	95.9%
Howick	97.0%
CHPP North	95.1%
Wandewoi	98.1%
Golden Highway	98.4%
Jerrys Plains	97.8%

Note: Data availability calculated across 2022 is based on availability of a 24-hour average result. Greater than 75% data capture is required to record a 24hr average result.

Temporary Stabilisation

Aerial Seeding was undertaken in May 2022 by fixed wing aircraft to provide temporary cover to areas exposed to wind generated dust and erosion at HVO. Waste dumps and exposed areas were selected for seeding if they were not planned to be disturbed within six months. A total area of 319 ha was seeded which included waste dumps ahead of mining re-disturbance (**Figure 6-11**). All areas were seeded using an exotic pasture and legume mix suitable for autumn sowing. A starter fertiliser was mixed with the seed prior to loading to provide sufficient nutrients for plant growth.

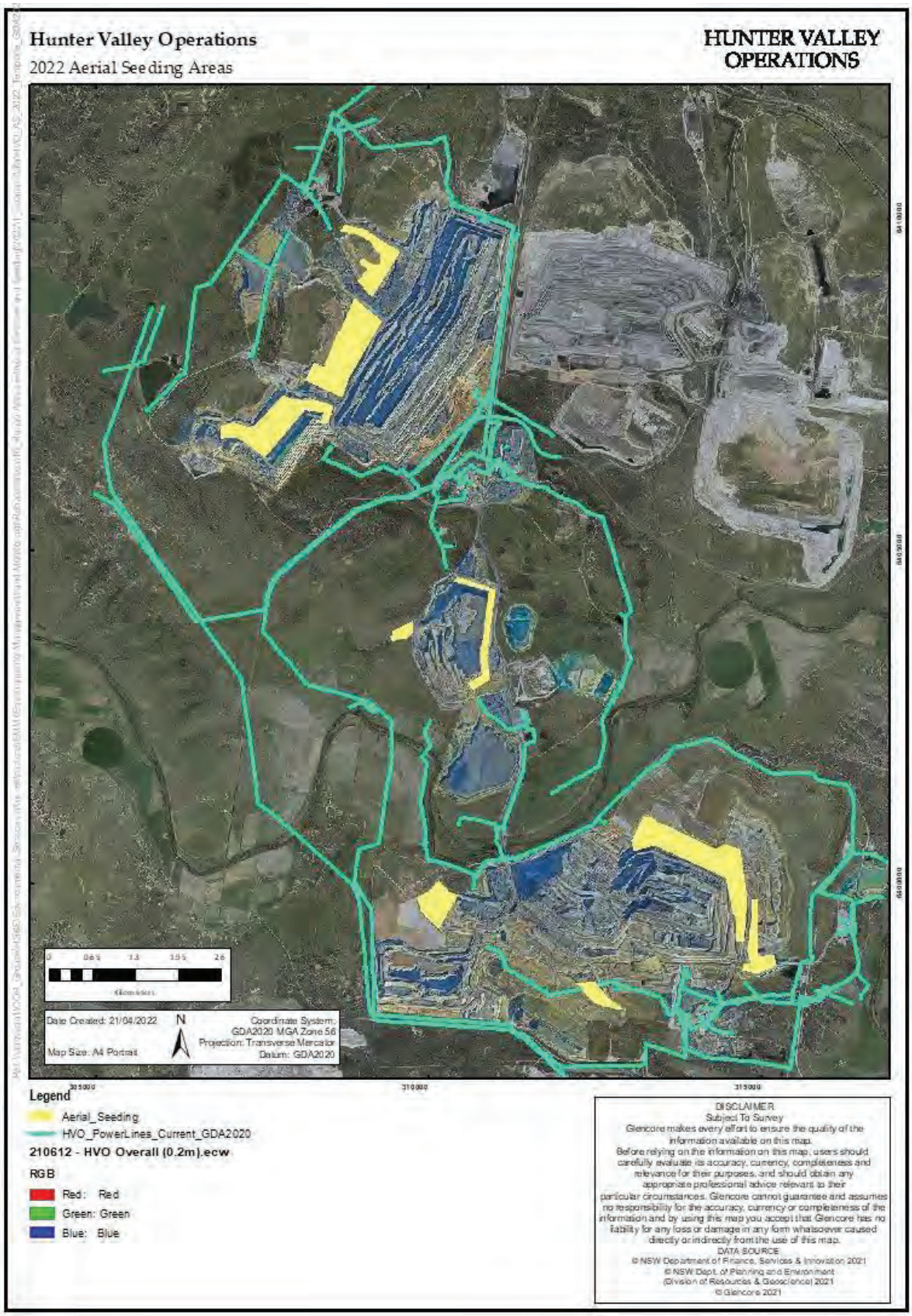

Figure 6-11: Areas Aerial Seeded in 2022 – NVO North (West Pit, Carrington Pit) and HVO South

Depositional Dust

Depositional dust is monitored at nine locations in accordance with the AQGHMP. The annual average insoluble matter deposition rates in 2022 compared with the depositional dust impact assessment criterion and previous years' data are shown in **Figure 6-12**.

Depositional dust samples are collected monthly. Where field observations denote a sample as contaminated (typically with insects, bird droppings or vegetation), the results are excluded from annual average compliance assessment.

The Warkworth monitoring location exceeded the annual average insoluble matter deposition rate criteria of 4 g/m^2/month (HVO North only) during 2022. However, all results were below the maximum insoluble solids incremental increase criterion of 2 g/m^2/month (**Figure 6-13**).

Meteorological conditions and the results of nearby monitors for the sampling period are also considered when determining level of HVO contribution to any elevated result. An external specialist investigation (See **Appendix A**) determined the exceedance to be due to local sources of dust in close proximity to the monitor. Most of the deposited dust monitors are located in close proximity to HVO South, on the opposite side of HVO South from HVO North. Given the significant separation distances between HVO North and these monitors, HVO North's contribution to these monitoring sites would always be low and likely indiscernible from background concentrations and the influences of other mines. Therefore, HVO North could only reasonably have a tangible impact at its nearest monitors which include D118 and D119. These monitors recorded annual average deposited dust levels below both the incremental and cumulative criteria. It is considered that HVO North could not have had significant contribution to the Warkworth deposited dust level.

The elevated Warkworth level was assessed to estimate the maximum contribution from HVO North to the annual result. The HVO North maximum contribution to the incremental increase was 0.1 g/m^2/month and was not deemed to have caused the exceedance (**Table 6-9**).

Table 6-9: Dust Deposition Annual Average Assessment

Date	Site	Measured Annual Average Dust Deposition (g/m^2/month)	Annual Average Dust Deposition Criteria (g/m2/month)	HVO's Contribution to Dust Deposition (g/m2/month)	Discussion
2022	Warkworth	6.9	4	0.1	An external consultant was engaged to investigate the exceedance, which determined that HVO North could have only provided a minor contribution to the exceedance which is attributable to local sources of dust near the monitor.

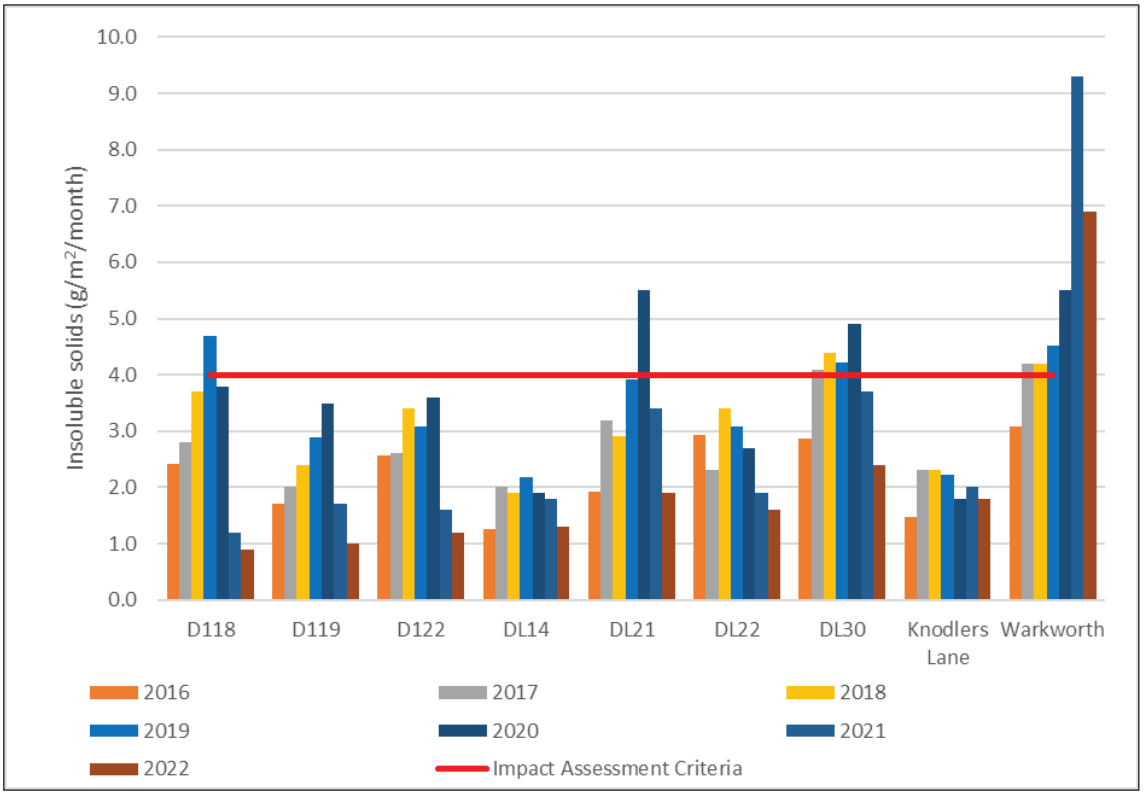

Figure 6-12: Annual Average Insoluble Matter Deposition Rates 2016-2022

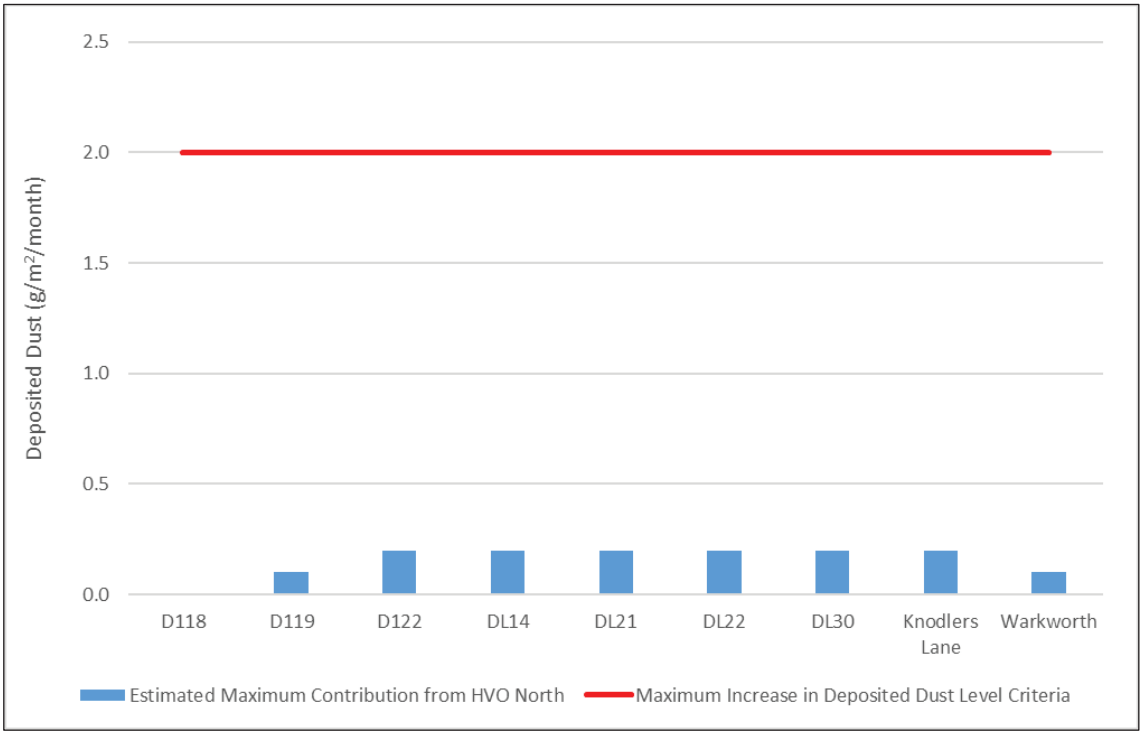

Figure 6-13: Maximum Allowable Increase in Deposited Dust Level 2022

Total Suspended Particulates (TSP)

TSP is monitored using High Volume Air Samplers (HVAS) at six locations in accordance with the AQGHMP.

Annual average TSP concentrations recorded in 2022 compared with the long-term impact assessment criterion and data from previous years are shown in **Figure 6-14**. TSP results in 2022 are considered to be generally lower than with those recorded in previous years, with the exception of Warkworth which showed similar levels to 2018 – 2020.

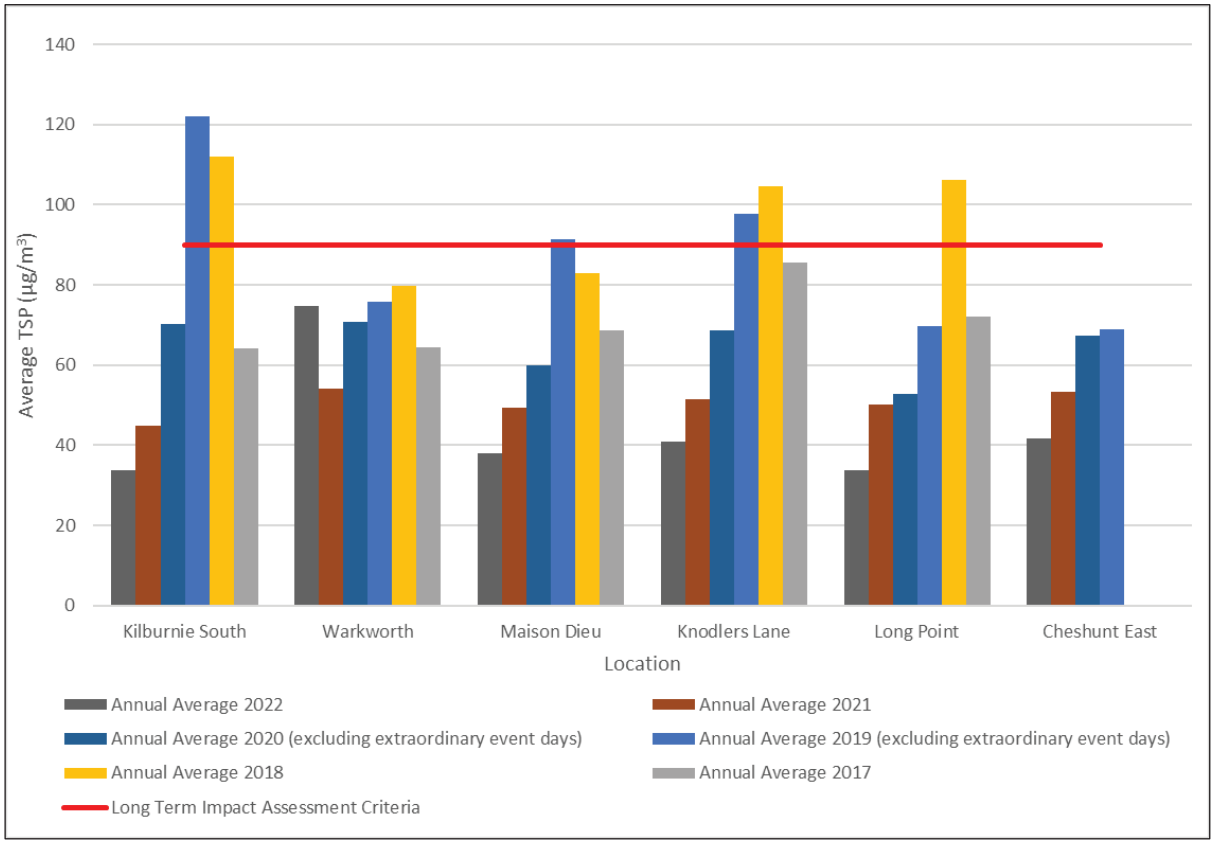

Figure 6-14: Annual Average TSP Concentrations 2017 to 2022 (Excludes Extraordinary Events)

Particulate Matter <10µm (PM_{10})

Particulate Matter <10 μm^3 (PM10) is monitored using High Volume Air Samplers (HVAS) and Real Time Tapered Element Oscillating Microbalance (TEOM) monitors.

Assessment of annual averages is presented against the full year results recorded against the current approved monitoring program and compliance protocol detailed in the AQGHMP.

Particulate Matter <10µm (PM10) – Short Term (24-hour average) Impact Assessment Criteria

Short Term (24-hour average) PM10 concentrations were calculated for both HVAS and TEOM monitors and assessed against the relevant criteria as per the AQGHMP. For TEOM monitors, this is calculated daily using measured hourly average data. The HVAS samples are taken over a 24-hour period every sixth day.

Short term (24-hour average) results recorded by HVO's compliance monitoring network during 2022 is presented in **Figure 6-15**.

Two PM10 measurements at the Gliding Club HVAS and two PM10 measurements at the Kilburnie South HVAS were not able to be collected on the scheduled sampling date (based on a sampling frequency of every six days). Details of these miscaptures are provided in **Table 6-10**.

Table 6-10: PM_{10} HVAS 24hr Miscaptures

HVAS Location	Date	Reason for Miscapture
Long Point	03/06/2022	Cause identified as a localised power outage
Gliding Club PM10	13/09/2022	Filter was damaged when being changed out by monitoring contractor following sampling

The data presented includes total measured results including contribution from all particulate sources. There was one exceedance of PM10 criteria recorded during the reporting period. This exceedance was investigated to determine the level of contribution from either HVO North, HVO South or where relevant both. Outcomes of this assessment is provided in **Table 6-11.** The exceedance was assessed to have received incremental dust contributions below HVO criteria.

Table 6-11: 2022 PM_{10} HVAS 24hr Exceedance Investigation

Date	Site	Measured 24-Hour Average PM_{10} Level (µg/m^3)	HVO 24-Hour Average PM_{10} Criteria (µg/m^3)	Estimated HVO Maximum Incremental Contribution to PM_{10} Level (µg/m^3)	Discussion
31/10/2022	Gliding Club	53.2	50[2]	33.5[3]	Investigated based on wind direction, site increment below criteria.

[2] HVO South (PA 06_0261) – Incremental Air Quality Criterion (HVO increment only)

[3] Estimated maximum incremental PM_{10} concentration from HVO South alone.

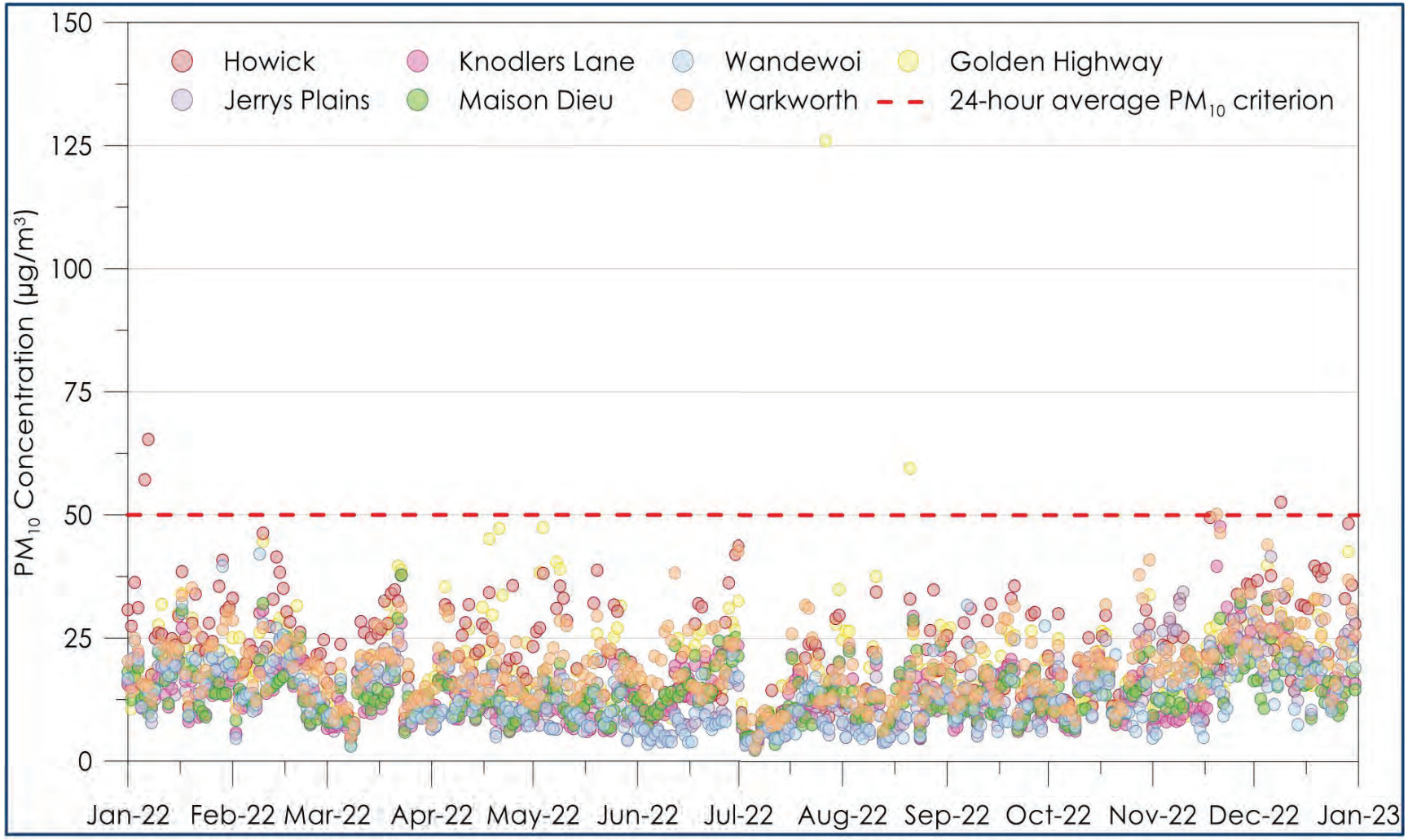

Figure 6-15: 24-hour Average Total PM_{10} results- 2022

Long Term PM_{10} Impact Assessment Criteria

Annual average PM10 concentrations were calculated for both HVAS and TEOM monitors and assessed against the relevant criteria as per the AQGHMP. This was undertaken for TEOM monitors using hourly average data and was calculated for HVAS units using 24-hour average concentrations on each of the run days.

Annual average PM10 levels were below the impact assessment criteria at all compliance monitoring locations during the reporting period.

A comparison of the long term PM10 impact assessment criterion and previous years' data are shown in **Figure 6-16**.

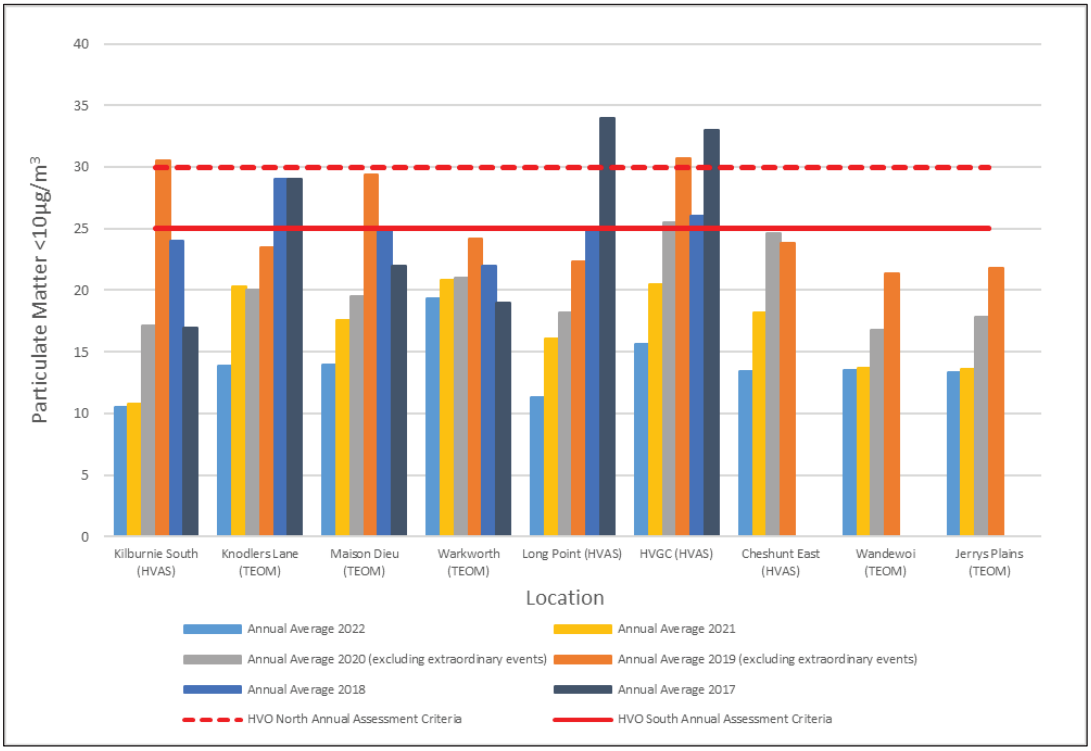

Figure 6-16: Annual Average HVAS PM_{10} results 2017 to 2022

$PM_{2.5}$ Impact Assessment Criteria

$PM_{2.5}$ samples were collected at Maison Dieu and Kilburnie South using HVAS, and these results are provided in **Table 6-12** and **Figure 6-17**.

There were 5 $PM_{2.5}$ measurements at the Maison Dieu HVAS that were not able to be collected on the scheduled sampling date (based on a sampling frequency of every six days). These miscaptures are detailed in **Table 6-13**. Following the run failures on 10 April and 10 May 2022 a new HVAS unit was installed at Maison Dieu.

2 results above criteria were recorded over 2 monitoring days during 2022. The results were assessed through investigation to have not been significantly contributed to by HVO and are therefore compliant against 24-hour impact assessment criteria. As discussed in the Long-Term Impact section the $PM_{2.5}$ levels recorded appear to be anomalous when compared to co-located PM10 monitor results.

Table 6-12: Short Term Impact Assessment Criteria – $PM_{2.5}$ Results 2022

Date	Site	Measured 24-Hour Average $PM_{2.5}$ Level ($\mu g/m^3$)	HVO South 24-Hour Average $PM_{2.5}$ Incremental Criteria ($\mu g/m^3$)	Estimated HVO South Incremental Contribution to $PM_{2.5}$ Level ($\mu g/m^3$)	Discussion
06/12/2022	Kilburnie South	28.1	25	9.4	Investigated based on wind direction and background, site increment below criteria
12/12/2022	Maison Dieu	57.7	25	4.4	Investigated based on wind direction and background, site increment below criteria

Table 6-13: $PM_{2.5}$ HVAS Miscaptures - 2022

HVAS Location	Date	Reason for Miscapture
Maison Dieu	10/04/2022	Mains power trip. RCD was replaced as advised by technician.
Maison Dieu	10/05/2022	Caused by trip of RCD. Cause of trip unknown. Power cable was replaced as a precaution to isolate the source of the failure.
Maison Dieu	15/06/2022	No cause for failure could be fully determined. The unit was replaced with a new HVAS.
Maison Dieu	07/10/2022	Caused by a power supply failure.
Maison Dieu	19/10/2022	Caused by a suspected power supply failure.

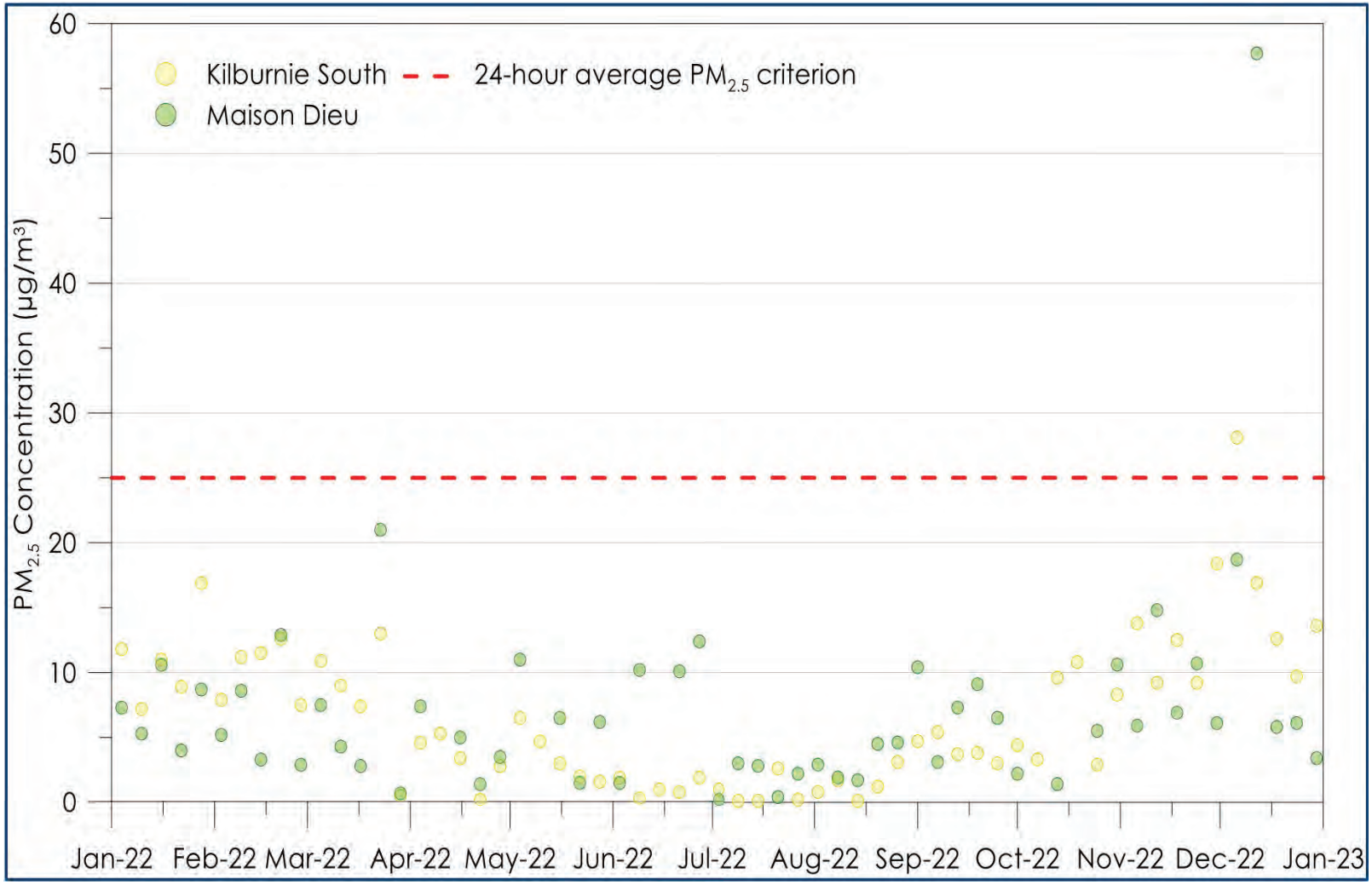

Figure 6-17: 24-hour Average $PM_{2.5}$ Results 2022

Particulate Matter <2.5µm (PM2.5) – Long Term (Annual Average) Impact Assessment Criteria

Annual average $PM_{2.5}$ was below the annual average criteria of 8 µg/m^3 at all locations for the reporting period, as presented in **Table 6-14**. While HVO's contribution is not calculated to be significant, the elevated total levels are considered to be anomalous. $PM_{2.5}$ levels recorded have been investigated throughout the year. Investigations have included the following:

- Monitoring locations have been inspected multiple times to identify any local $PM_{2.5}$ sources, with none identified.
- Calculation of PM10:PM2.5 ratios for monitoring equipment for co-located units (as shown in **Table 6-15**). The ratio in the Hunter Valley is typically 0.3 to 0.4. Ratios measured at HVO range from 0.7 to above 1. A ratio above 1 suggests that $PM_{2.5}$ fractions are above PM_{10} fractions, which is not possible and suggests error.

These investigations have not been conclusive to identify source of errors. It is believed that the source of the errors is due to the high-volume air sampler monitoring method. HVO engaged an air quality consultant to review the air quality monitoring network. This review recommended the implementation of real-time $PM_{2.5}$ monitoring at Maison Dieu and Kilburnie South. HVO installed two E-BAMs in these locations in Q1 2023.

Table 6-14: $PM_{2.5}$ Annual Average Monitoring Data 2022

Monitoring Location	HVO South Annual Average $PM_{2.5}$ Criteria (µg/m^3)	Measured Annual Average $PM_{2.5}$ Level (µg/m^3)	Estimated Contribution to Annual Average $PM_{2.5}$ Level (µg/m^3)
Maison Dieu	8	7.1	1.8
Kilburnie South	8	6.6	2.3

Table 6-15: Annual $PM_{2.5}$ / PM_{10} Ratios in Upper Hunter

Year	PM2.5 / PM10 Ratios					
	Muswellbrook	Singleton	Camberwell	Merriwa	Maison Dieu	Kilburnie South
2015	0.46	0.39	0.33	*	*	*
2016	0.44	0.41	0.31	*	*	*
2017	0.43	0.39	0.27	*	*	*
2018	0.35	0.34	0.27	*	*	*
2019	0.35	0.36	0.26	*	*	*
2020	0.41	0.41	0.31	*	0.63	0.78
2021	0.41	0.37	0.30	0.38	0.48	0.54
2022	0.39	0.36	0.32	0.31	0.40	0.57

* Monitoring locations were not in place during this year

$PM_{2.5}$ levels measured at the Maison Dieu and Kilburnie South HVAS units were higher than UHAQMN annual average $PM_{2.5}$ results in comparable locations, as shown in **Table 6-16**.

Table 6-16: UHAQMN Annual Average $PM_{2.5}$ Results for 2022

UHAQMN Monitor	Measured Annual Average 2022 PM2.5 Level (µg/m³)
Muswellbrook	6.2
Singleton	5.1
Camberwell	4.8
Merriwa	3.4

6.4.4 | COMPARISON AGAINST EA PREDICTIONS

Table 6-17 and **Table 6-18** show a comparison between 2022 air quality data and the Stage 2 predictions made in the HVO South Modification 5 EIS. Comparisons have been made against the predictions listed in the EA for the nearest private residence to each monitoring location.

Annual average PM_{10} measurements in 2022 were similar to or below predicted levels for all monitoring locations for both short term (24-hour average) and long term (annual average) criteria as shown in **Table 35**. Annual average TSP measurements in 2022 were below predicted levels for all monitoring locations.

*Table 6-17: HVO South PM10 Annual Average Results Compared Against Cumulative Predictions^*

Site (EA Receptor)	Short Term (24hr) Criteria		Long Term (Annual Average) Criteria	
	Predicted Maximum 24hr PM_{10} Due to HVO South Alone (µg/m³)	2022 Maximum 24hr PM_{10} HVO Contribution (µg/m³)	Predicted PM_{10} Annual Averages (µg/m³)	2022 PM_{10} Annual Average (µg/m³)
	Stage 2		Stage 2	
Maison Dieu (256)	36	8.2	21	14.0
Warkworth (90)	95	8.6	46	19.3
Kilburnie South(307)	31	5.7	27	10.5
Knodlers Lane(117)	59	23.8	28	13.9
Long Point (137)	36	5.9	20	11.3
Hunter ValleyGliding Club***	>50	33.5	>30	15.6

^ Cumulative predictions for Stage 2 of the HVO South Mod 5 Environmental Assessment.

*** The HVGC has entered into an Amenity Management Plan with Hunter Valley Operations.

*Table 6-18: HVO South TSP Annual Average Results Compared Against Cumulative Predictions^*

Site (EA Receptor)	Long Term (Annual Average) TSP Criteria	
	Stage 2 Prediction (µg/m^3)	2022 PM10 Annual Average (µg/m^3)
Maison Dieu (256)	60	37.9
Warkworth (90)	106	74.7
Kilburnie South (307)	76	33.8
Knodlers Lane (117)	75	40.9
Long Point (137)	61	33.9

^ Cumulative predictions for Stage 2 of the HVO South Mod 5 Environmental Assessment.

Table 6-19 and **Table 6-20** detail comparisons between 2022 air quality monitoring results and the modelled predictions from the 2010 HVO North Carrington West Wing Air Quality Impact Assessment. Predictions have been sourced from modelled scenarios of Year One of the Carrington West Wing development. It should be noted that while Approval has been granted for the commencement of that project, works have not yet commenced.

*Table 6-19: HVO 2022 PM_{10} Annual Average Results Compared Against Cumulative Predictions^*

Site (EA Receptor	Long Term (Annual Average) Criteria			
	Predicted PM_{10} Annual Average (µg/m^3)	2022 PM10 Annual Average (µg/m^3)	HVO Estimated Contribution to 2022 PM_{10} Annual Average (µg/m^3) (North)	HVO Estimated Contribution to 2022 PM_{10} Annual Average (µg/m^3) (South)
Maison Dieu(6)	19.1	13.8	**	0.5
Warkworth(39)	20.8	18.6	**	1.2
KilburnieSouth (4)	19.7	10.1	0.2	0.7
Jerrys Plains (13)	16.6	13.0	0.3	1.2
CheshuntEast (7)	20.8	13.4	2.9	**

^ Cumulative predictions for Year One (CWW) of the HVO North Environmental Assessment.

*No modelled predictions for the Long Point area

+. Measured result includes both HVO North and South

** no relevant criteria under this consent

*Table 6-20: 2022 TSP Annual Average Results Compared Against Cumulative Predictions^*

Site (EA Receptor)	Long Term (Annual Average) Criteria	
	Predicted TSP Annual Average (µg/m^3)	2022 TSP Annual Average (µg/m^3)
Maison Dieu (6)	44.7	37.9
Warkworth (39)	46.6	72.2
Kilburnie South (4)	45.2	37.7
Cheshunt East (7)	46.5	41.6

^ Cumulative predictions for Year One (CWW) of the HVO North Environmental Assessment.

*No modelled predictions for the Long Point area

Annual average TSP and PM_{10} measurements in 2022 were generally lower than or similar to modelled predictions, with the exception of Warkworth TSP. Given that the Warkworth TSP HVAS recorded significantly higher levels than the other monitors in the network and that the PM_{10} level at the Warkworth TEOM, which is located approximately 850m to the southeast of the HVAS, corresponds reasonably well with the modelled predictions, it is considered that the Warkworth HVAS monitoring location is likely impacted by highly localised sources of dust.

6.5 | GREENHOUSE GAS AND ENERGY MANAGEMENT

6.5.1 | REPORTED GREENHOUSE GAS EMISSIONS

HVO reports greenhouse gas emissions (GHG) in accordance with National Energy and Greenhouse Gases (NGER) legislation. Each financial year HVO is required to submit to the Federal government the emissions from their NGERs registered facility into the Emissions and Energy Reporting System (EERS). Also, because HVO emits over 100kt of CO_2e- each year, HVO 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. **Table 6-21** 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) compared to annual average emissions forecast for HVO South (PA 06_0261) in the *Air Quality and Greenhouse Gas Study HVO South Modification 5 (Todoroski Air Sciences, 2017*) (the EIS forecast). Greenhouse emission forecasts for HVO North are only suitable for comparison in the EIS for the Carrington West Wing modification, which has not commenced.

Table 6-21: Greenhouse Gas Emissions 2022

FY 2021/2022	Scope 1 (tCO_2e-)	Scope 2 (tCO_2e-)	Total Scope 1 & Scope 2 (tCO_2e-)
EERS Reported Value (HVO North and South)	577,874	93,865	671,739
EIS Forecast (HVO South only)	570,807	137,231	708,038

6.5.2 | COMPARISON AGAINST PREDICTIONS

The EIS forecast estimated that the annual average greenhouse gas emissions (Scope 1 and Scope 2) from HVO South would be 708,038 CO_2e-. As outlined in **Table 6-21**, total emissions during FY2022 were 671,739 CO_2e-. Total emissions reported are for the HVO Complex, which includes activities in both HVO South and HVO North.

Total emissions during FY2022 were below the HVO South EIS forecast of 708,038 CO_2e-. Scope 1 emissions were above the projected greenhouse gas emissions in the EIS Forecast.

While Scope 1 emissions were slightly (1.2%) above prediction, this prediction is for HVO South only. Considering that total emissions are below forecast and that the forecast does not include HVO North, HVO is operating below predictions.

6.5.3 | STEPS TAKEN TO IMPROVE ENERGY EFFICIENCY AND REDUCE GHG EMISSIONS

HVO is actively engaged in minimising greenhouse gas emissions associated with their coal operations and supporting the NSW Government objectives of net-zero emissions by 2050. In addition, HVO is governed by a range of climate change commitments made by Yancoal and Glencore, as the JV partners of HVO, including:

- Yancoal
    - Supporting innovation and investment in carbon capture, utilisation and storage through various industry and policy initiatives, to work towards the commitments outlined in the Paris Agreement;
    - Taking a constructive role in public policy development and participation in relevant industry associations, guided by recognition of the aims of the Paris Agreement; and
    - Supporting research into technologies that will reduce GHG emissions from the downstream consumption of products (Scope 3).
- Glencore
    - Announcing a 1.5ºC pathway aligned target of 50% reduction of total emissions (Scope 1, 2 and 3) by 2035 on 2019 levels, consistent with the midpoint of the Intergovernmental Panel on Climate Change's 1.5ºC scenarios and the 1.5ºC pathways set out by the International Energy Agency; and
    - Setting an ambition to achieve, with a supportive policy environment, net zero total emissions by 2050. This will be done by managing the carbon footprint of Glencore's operations and contributing to global decarbonisation.

6.6 | WASTE AND HAZARDOUS MATERIALS

6.6.1 | RECYCLING

HVO has continued reinforcing the principles of effective waste management across the site, including recycling.

During the reporting period, 11% of non-mineral waste material generated at HVO was disposed of in licensed offsite landfill facilities and 89% of waste was recycled. These results show an increase in recycling rates compared to 2021.

HVO will continue to maintain high recycling rates in 2023.

Details of waste and recyclables removed from demolition activities undertaken during the reporting period are included in **Section 7.6.7** and **Section 9.11**.

6.6.2 | SEWAGE TREATMENT/DISPOSAL

The sewage treatment and disposal facilities at HVO consist of sewage treatment plants which treat, disinfect and re-use the treated effluent on-site where practicable. The remaining effluent from some septic systems that is unable to be treated on site is sent to approved facilities for disposal.

HVO currently operates 3 main grouped on-site sewage management facilities that are interconnected from multiple systems. These facilities are located at Howick, HVO North and HVO South. Design works continued towards upgrade of these systems.

6.6.3 | HYDROCARBONS

A total of 917kL of waste oil was taken offsite to be refined into a base oil for reuse in new oil products during the reporting period. Other hydrocarbons recycled via a licenced waste hydrocarbon disposal contractor include approximately 16 tonnes of waste grease.

6.6.4 | CONTAMINATED SOIL

HVO operates and maintains two bioremediation areas to manage hydrocarbon contaminated soil.

Contaminated soil is taken to one of the bioremediation areas and placed in cells based on the time of contamination. Contaminated soil is spread out in beds approximately 300 mm in height and turned to provide aeration for beneficial microbial activity.

Soil in the treatment area is sampled and tested as required until total hydrocarbon levels are below relevant guidelines. Soil meeting these criteria is then removed and disposed of in the spoil dump.

6.6.5 | ACID ROCK DRAINAGE

There were no observed issues relating to Acid Rock Drainage during 2022. The Geochemical Monitoring Programme was reviewed during the reporting period, and this will be implemented from 2023.

6.6.6 | WASTE/HAZARDOUS MATERIALS NON-COMPLIANCES

There were no externally reportable incidents related to waste or hazardous material management during the reporting period.

6.6.7 | BUILDING DEMOLITION

HVO completed demolition of the Orica Reload Facility at HVO South (Cheshunt). A total of 84 tonnes of scrap metal, 536 tonnes of concrete, 47 tonnes of industrial waste and 203 tonnes of liquid waste material was removed to approved waste facilities. Works were performed safely and in accordance with AS 2601 The Demolition of Structures. Soil sampling was undertaken to determine potential for contaminants, none were identified. The site was left in a neat and safe condition, with the voids backfilled and levelled out.

6.7 | HERITAGE

6.7.1 | ABORIGINAL CULTURAL HERITAGE MANAGEMENT AND COMMUNITY CONSULTATION

Aboriginal cultural heritage is managed under the provisions of separate Aboriginal Cultural Heritage Management Plans (ACHMP) approved for the project approvals. At HVO North, where mining or associated development activities may impact Aboriginal cultural heritage sites, an Aboriginal Heritage Impact Permit (AHIP) must also be sought from Heritage New South Wales (formerly Office of Environment and Heritage) under Part 6 of the National Parks and Wildlife Act 1974 (NPW Act), on the basis of the management requirements established through the ACHMP process.

The HVO South ACHMP area was approved as a State Significant Development which excludes the requirement for obtaining AHIPs prior to implementing cultural heritage management measures authorised under the provisions of the ACHMP.

HVO consults jointly with the Upper Hunter Valley Aboriginal Cultural Heritage Working Group (CHWG) The CHWG is comprised of representatives from HVO and Registered Aboriginal Parties (RAPs) from Upper Hunter Valley aboriginal community groups, corporations and individuals. The CHWG met and discussed cultural heritage management matters associated with HVO at the meeting held on 7 December 2022.

Aboriginal cultural heritage at HVO is managed in consultation with the RAPs associated with the CHWG, in accordance with the ACHMPs, and development consent conditions, to protect, manage and mitigate cultural heritage at HVO. Management measures include:

- Ongoing consultation and involvement of the local Aboriginal community in all matters pertaining to Aboriginal cultural heritage management;
- Compliance with existing ACHMP's and Development Consent conditions;
- A cultural heritage Geographic Information System (GIS) and Cultural Heritage Zone Plan (CHZP) incorporating cultural heritage spatial and spatial data (site location, description, assessments, date recorded, associated reports, management provisions and various other details to assist with the management of sites);
- A Ground Disturbance Permit (GDP) system for the assessment and approval of ground disturbing activities to ensure these activities do not disturb cultural heritage places;

- Limit of Disturbance Boundary (LODB) procedures to demarcate approved disturbance areas and delineate areas not to be disturbed;
- Ongoing cultural heritage site inspections, monitoring and auditing along with regular compliance inspections of development works;
- Protective management measures such as fencing/barricading sites to avoid disturbance, protective buffer zones, cultural heritage off-set areas; and
- Communicating cultural heritage issues and site awareness to personnel via internal electronic and face to face processes.

In consultation with the CHWG and Office of Environment and Heritage (OEH), a Cultural Heritage Storage Facility (CHSF) was established at Hunter Valley Services. The CHSF is a storage shed, with an adjacent shipping container, fitted out to allow safe and secure storage of cultural materials, such as stone artefacts. It is a central repository for all materials collected during community collection and salvage activities on all lands related to HVO (including offset properties).

6.7.2 | ABORIGINAL ARCHAEOLOGICAL AND CULTURAL HERITAGE INVESTIGATIONS

Arrow Heritage Solutions conducted due diligence assessments and surveys at four separate areas in 2022 which were the subject of internal Ground Disturbance Permits (GDPs). These assessments included an area adjacent to the Hunter River east of Archerfield Road on 9 April 2022, an area at the Newdell facility and Dam 32N on 11 June and 22 July 2022 and an area south of Riverview Pit on 9 November 2022. Proposed works in these areas include, respectively, vegetation slashing, drilling and water infrastructure maintenance. No artefacts were identified within the GDP areas covered by the assessments.

A separate due diligence assessment and survey was conducted by OzArk Environment and Heritage on 1 June 2022 for a GDP covering the decommissioning of six boreholes south west of HVO north near Lemington Road. No artefacts were identified within the GDP area.

At the December 2022 HVO Cultural Heritage Working Group (CHWG) meeting, the CHWG reached a consensus to recommend salvage of a remnant artefact scatter at HVO South that was located in an area that had been the subject of historical Aboriginal Heritage Impact Permits. The remnant artefacts were identified in 2020, inspected by the CHWG in 2021 and the subject of consultation with the CHWG at several meetings in 2021 and 2022.

During 2022 HVO has conducted consultation for the Aboriginal Cultural Heritage Assessment (ACHA) required by the Secretary's Environmental Assessment Requirements (SEARs) for the HVO Continuation Project (HVO South (SSD1186621) and HVO North (SSD 11826681)). Aboriginal consultation activities have been undertaken in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010). Consultation with Registered Aboriginal Parties and preparation of the ACHA for the HVO Continuation Project progressed during the 2022 Annual Review period, with the project EIS and ACHA forming part of the development application submitted to the DPE in December 2022.

6.7.3 | HERITAGE AUDITS AND INCIDENTS

Under the provisions of the HVO South ACHMP, two compliance inspections were conducted in 2022 and under the provisions of the HVO North HMP, a single compliance inspection was conducted during 2022. The purpose of the compliance inspections is to provide RAPs with:

The opportunity to visit mine operations and mine areas to inspect operational compliance with ACHMP/HMP provisions and GDP procedures;

- To inspect and monitor the condition and management of sites; and
- To review the effectiveness and performance of the ACHMP/HMP provisions in the management of cultural heritage at the mine.
- These compliance inspections were conducted by RAP representatives of the CHWG PCWP with the assistance of a qualified archaeologist and HVO personnel.

The biannual 2022 HVO South compliance inspection was conducted on 11 April 2022 by 2 RAP representatives of the CHWG. A total of 43 aboriginal heritage sites were inspected focusing on buffer property areas south of Cheshunt Pit primarily used for livestock grazing. The findings and recommendations of these inspections are documented in the HVO South Aboriginal Heritage Management Plan April 2022 Compliance Audit Inspections report dated May 2022 and included as Appendix D.

The annual 2022 HVO South and HVO North compliance inspection was conducted over several days between 8 and 10 of November 2022 by three RAP representatives of the CHWG and a suitably qualified and experienced archaeologist. During the HVO South portion of the compliance inspection, a total of 67 Aboriginal heritage sites were inspected in the HVO South Area at Cheshunt, Nichols, Glider Strip North and the HVO Southern areas. These areas are not active mining areas with some utilised for grazing by third party rural licensees. During the HVO North portion of the compliance inspection, a total of 20 heritage sites were assessed including the key sites in proximity to the Newdell Loading Facility Area, Mitchell Pit South and the Carrington area. The findings and recommendations of these inspections are documented in the Hunter Valley Operations Aboriginal Heritage Management Plans November 2022 Compliance Audit Inspections report dated November 2022 and included as Appendix D.

The inspections found that all sites have been managed in conformance with the ACHMP/HMP requirements. Sites requiring maintenance and upgrades to site barricading, fencing and vegetative sediment controls were identified. Barricade upgrade and maintenance will be included as part of the works planning for 2023. Inspections were hampered by high vegetation and ground cover resulting from recent rainfall. The CM CD1 site report included reference to the program of fencing upgrades proposed and endorsed by the CHWG to assist with demarcation of control zones for various activities including exclusion areas and areas where specific land management activities can be conducted.

During the reporting period there were 68 GDPs assessed for cultural heritage management considerations at HVO.

There were no incidents, nor any unauthorised disturbance caused to cultural heritage sites at HVO during 2022.

6.7.4 | HISTORIC HERITAGE – MANAGEMENT AND COMMUNITY CONSULTATION

Consultation was conducted at the Hunter Valley Operations Community Consultative Committee (CCC) Meetings held on 16 February, 18 May, 17 August, and 2 November 2022 as outlined in **Section 10.2.3**. Topics discussed included:

- Yard maintenance works and Termite Interception System inspections at LEP listed European heritage properties
- Arboreal works on trees around listed outbuildings and the Archerfield Stables. Structural works to the Archerfield Stables were also completed in July 2022. Works included removal of rotted posts and beams on the east and west stable verandahs and their replacement with species matched posts and beams.
- The Cockatoo Fence Asset Protection Zone maintenance works which were completed in August 2022 with the manual brushcutting of existing firebreaks on either side of the fence structure.
- HVO ‘s plan for an Historic Homestead Project, which will include the completion of detailed condition reports for the Archerfield, Wandewoi and Carrington Stud homesteads. In addition the project will prepare a long term maintenance and management plan for each homestead complex. An inspection of selected homesteads by the CCC is planned to take place in Q2 2023.

Figure 6-18: Cockatoo Fence Firebreak

Figure 6-19: Archerfield Homestead

6.8 | BUSHFIRE MANAGEMENT

The following bushfire management control and mitigation activities, outlined in the HVO Bushfire Management Plan were completed at the HVO site in 2022.

Operational Areas

Table 6-22: Bushfire Mitigation Measures Undertaken in Operational Areas

Task	Completion Note
Inspect and maintain operational area fire trails and breaks	Completed as per SAP maintenance strategy
Inspect, install and maintain signage for main intersections, and gates of firebreak trails	Completed as per SAP maintenance strategy
Inspect and maintain areas surrounding administration buildings, workshops, crib huts and external roads	Completed as per SAP maintenance strategy
Inspect and maintain areas around power poles, switch yards, transformers, air break switches, and substations	Completed as per SAP maintenance strategy
Inspect and maintain areas around powerlines	Completed as per SAP maintenance strategy
Inspect and maintain areas around CHPP and load points	Completed as per SAP maintenance strategy

Task	Completion Note
Inspect and maintain HC1 conveyor	Completed as per SAP maintenance strategy
Inspect and maintain workshops	Completed as per SAP maintenance strategy
Inspect and maintain water hydrant and pump function	Completed as per SAP maintenance strategy
Report any instances of bushfire outbreak to supervisor / manager, or raise emergency alarm	No instances of bushfire onsite during the reporting period
Review Bushfire Management Plan including currency of information including maps, access routes)	Plan reviewed, see section below for further details.
Bushfire reporting in the Annual Review	Completed – this report

Non-Operational Areas

Table 6-23: Bushfire Mitigation Measures Undertaken in Non-Operational Areas

Task	Completion Note
Report any instances of bushfire outbreak to supervisor / manager, or raise emergency alarm	No reportable bushfire events in non operational areas in 2022
Inspect and maintain non-operational fire trails and breaks	Inspection and maintenance of fire trails completed August 2022, with follow up slashing of fire trials completed in November.
Inspect, install and maintain signage for gates or firebreak trails	Fire trail signage installed October 2022
Review fuel loads and complete necessary reduction including areas adjacent to neighbouring properties	Fuel Load inspection and review completed August 2022

HVO did not conduct any fuel reduction burning activities during 2022.

HVO Bushfire Management Plan Review and Improvement

HVO conducted a review and update of the Bushfire Management Plan in 2022. The updated management plan has been approved by the Hunter Valley District RFS on the 31 October 2022. The RFS review of the plan was endorsed by Singleton Council on 9 March 2023.

7 | WATER MANAGEMENT

HVO manages surface and ground water according to three main objectives:

- Fresh water usage is minimised.
- Impacts on the environment and HVO neighbours are minimised; and
- Interference to mining production is minimal.

This is achieved by:

- Minimising freshwater use from the Hunter River.
- Preferentially using mine water for coal preparation and dust suppression.
- Emphasis on control of water quality and quantity at the source.
- Segregating waters of different quality where practical.
- Recycling on-site water.
- Ongoing maintenance and review of the system; and
- Disposing of water to the environment in accordance with statutes and regulations.

Plans showing the layout of all water management structures and key pipelines are shown in **Figure 7-1** to **Figure 7-3**. The HVO Water Management Plan contains further detail on management practices and is available on HVO website. Note that **Figure 7-1** to **Figure 7-3** are updated versions of plans presented in the currently approved *HVO Water Management Plan*, and have been included in the revised version of the plan provided to DPE for approval.

Figure 7-1: West Pit Water Management Infrastructure

Figure 7-2: North Pit Water Management Infrastructure

Figure 7-3: South Pit Water Management Infrastructure

7.1 | WATER BALANCE

The 2022 static water balance for HVO is presented in **Table 7-1.**

Table 7-1: 2022 HVO Water Balance

Water Stream	Volume (ML)
Inputs	
Fresh Water (potable)	38 (0.2%)
Fresh Water (Hunter River extraction)	0 (0%)
Groundwater	1,616 (8.3%)
Rainfall Runoff	17,848 (87.2%)
Recycled to CHPP from Tails & Storage (not included in total)	3,989 (19.5%)
Imported (Liddell/Ravensworth (via Cumnock))	0 (0%)
Water from ROM Coal	958 (4.7%)
Total Inputs	20,460
Outputs	
Dust Suppression	2,168 (13.8%)
Evaporation – Mine Water & Tailings Dams	2,733 (17.3%)
Entrained in Process Waste	2,148 (13.6%)
Discharged (HRSTS)	6,623 (42.0%)
Vehicle Wash-down	311 (2.0%)
Sent to Third Party	91 (0.6%)
Miscellaneous Industrial Use	351 (2.2%)
Water in Coarse Reject	477 (3.0%)
Water in Product Coal	866 (5.5%)
Total Outputs	**15,768**
Change in Pit Storage	**5,663 (increase)**

7.1.1 | WATER INPUTS

A total of 1,047.2 mm of rainfall was recorded at HVO in 2022 producing an estimated 17,848 ML of runoff. Water falling on undisturbed clean water catchments is diverted off site into natural systems where practicable.

Groundwater inflows to the pits are calculated via numerical groundwater modelling methods. These are given in **Table 7-1**.

Groundwater inflows were estimated to have contributed 1,616 ML to the site during 2022. No fresh water was extracted from the Hunter River during the reporting period.

7.1.2 | WATER OUTPUTS

The main outputs were water use for dust suppression (2,168 ML), evaporation from dams (2,733 ML), water entrained in process waste (2,148 ML) and water in product coal (1,338 ML).

HVO participates in the Hunter River Salinity Trading Scheme (HRSTS) allowing it to discharge from licensed discharge points during declared discharge events, associated with increased flow in the Hunter River. HVO maintains three licensed discharge monitoring locations:

- Dam 11N, located at HVO North, which discharges to Farrell's Creek.
- Lake James, located at HVO South, which discharges to the Hunter River; and
- Parnell's Dam, located at HVO West, which discharges to Parnell's Creek.

During 2022 HVO discharged 6,623 ML under the Hunter River Salinity Trading Scheme and Environment Protection Licence 640.

7.2 | SURFACE WATER

Surface water monitoring activities continued in 2022 in accordance with the HVO WMP and HVO Surface Water Monitoring Program (SWMP). HVO maintains a network of surface water monitoring sites located on mine site dams, discharge points and surrounding natural watercourses (**Figure 7-4**). Water quality monitoring is undertaken to verify the effectiveness of the water management system onsite, and to identify the emergence of potentially adverse effects on surrounding watercourses. A number of mine water dams are monitored routinely to verify the quality of mine water. This water is used in coal processing, dust suppression, and other day to day activities around the mine.

Surface water monitoring data is reviewed on a quarterly basis. The review involves a comparison of measured pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS) results against internal trigger values which have been derived from the historical data set. The response to measured monitoring levels outside the trigger limits is detailed in the HVO Monthly Environmental Monitoring Reports that can be found on the HVO website.

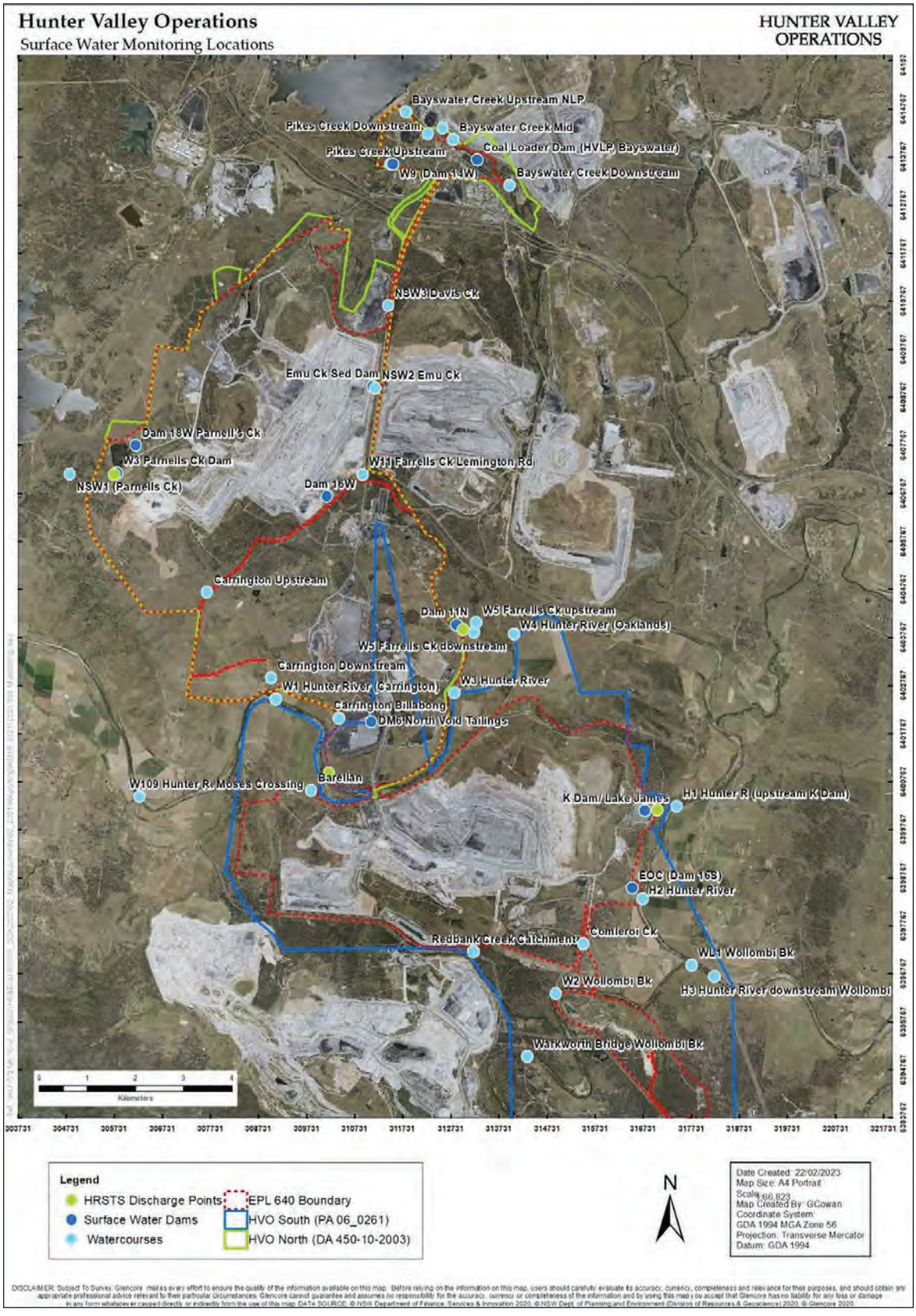

Figure 7-4: Surface Monitoring Locations

7.2.1 | SURFACE WATER MONITORING

Routine surface water monitoring was undertaken in 2022 in accordance with the HVO SWMP. All laboratory analysis of surface water was carried out in accordance with approved methods by a NATA accredited laboratory.

Water quality is evaluated through the parameters of pH, EC and TSS. Pertinent surface water sites are also sampled for comprehensive analysis annually. Long term water quality trends for the Hunter River, Wollombi Brook, other surrounding tributaries, and site dams are also presented in this section. The sampling frequency for ephemeral water sites was modified in 2016, from quarterly to a rain-event trigger system, in an effort to ensure samples taken were more representative of typical water quality for those streams – up to eight sampling events per annum can now be taken under the revised sampling protocol.

All required sampling and analysis was undertaken, except as detailed in **Table 7-2.** Australia and New Zealand Environment and Conservation Council (ANZECC) criteria are shown in the figures for comparative purposes.

Table 7-2: HVO Water Monitoring Data Recovery for 2022 (By Exception)

Location	Data Recovery (%)	Comments
Barellan	66%	No access for two events due to localised flooding
Carrington Billabong	33%	No access for four events due to localised flooding
DM6 North Void Tailings	92%	Unable to access for one event due to low water level in the dam.
EOC	75%	This monitoring location was unable to be sampled on one occasion due to localised flooding.
H3 – Hunter River	75%	This monitoring location was unable to be sampled on one sampling occasion due to localised flooding.
NSW1 (Parnell's Ck)	75%	This monitoring location was unable to be sampled on one sampling event due to localised flooding.
W3 – Hunter River	75%	This monitoring location was unable to be sampled on one sampling occasion due to localised flooding.
W5 (Farrell's Creek Downstream)	75%	This monitoring location was unable to be sampled on one sampling occasion due to localised flooding.
WL1	75%	This monitoring location was unable to be sampled on one sampling occasion due to localised flooding.

Hunter River

The Hunter River was sampled on 50 occasions from eight monitoring locations during 2022. Long term trends for pH, EC and TSS are shown in **Figure 7-5** to **Figure 7-7**.

The elevated TSS levels recorded at multiple locations throughout 2022 are likely due to higher than average rainfall received for the year and the variable flow volumes through the catchment.

Trigger exceedance results are detailed in **Table 7-3**.

Table 7-3: Hunter River Internal Trigger Tracking Results

Location	Date	Trigger Limit	Action Taken in Response
H2 – Hunter River	3/02/2022	TSS – 58	First exceedance of TSS trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. TSS at W1 Hunter River (upstream of H2) also exceeded TSS trigger indicating elevated TSS in broader catchment rather than a localised impact near H2. Approximately 7 mm of rainfall in the two days prior to sampling. The result is consistent with TSS in Hunter River following rainfall. pH and EC results consistent with historical range of results at H2 and upstream in the Hunter River (i.e. W109) presented in WMP. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact.
W1 – Hunter River	3/02/2022	TSS – 54	First exceedance of TSS trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. Approximately 7 mm of rainfall in the two days prior to sampling. The result is consistent with TSS in Hunter River following rainfall. pH and EC results consistent with historical range of results at W1 and upstream in the Hunter River (i.e. W109) presented in HVO WMP. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact.
W109 – Hunter River	30/03/2022	TSS – 117	First exceedance of TSS trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. Approximately 75 mm of rainfall in the six days prior to sampling. The result is consistent with TSS in Hunter River following rainfall. pH and EC results are generally consistent with historical range of results at W109 presented in WMP, however, EC results are lower than the historical range which may be attributed to the high rainfall in the catchment. W109 because is an upstream reference monitoring location that cannot be impacted by HVO mining activities and the trigger exceedance is considered to be a consequence of high rainfall prior to sampling.
W1 – Hunter River	30/03/2022	TSS – 122	Second consecutive exceedance of TSS trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. TSS at W109 Hunter River (upstream of W1) also exceeded TSS trigger indicating elevated TSS in broader catchment rather than a localised impact near W1. Approximately 75 mm of rainfall in the six days prior to sampling. The result is consistent with TSS in Hunter River following rainfall. pH and EC results are generally consistent with historical range of results at W1 and upstream in the Hunter River (i.e. W109) presented in WMP. HRSTS discharges that occurred on or two days prior to sampling had TSS concentrations of <25 mg/L. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact.
W4 – Hunter River	30/03/2022	TSS – 135	First exceedance of TSS trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. TSS at W109 Hunter River and W1 (upstream of W4) also exceeded TSS trigger indicating elevated TSS in broader catchment rather than a localised impact near W4. Approximately 75 mm of rainfall in the six days prior to sampling. The result is consistent with TSS in Hunter River following rainfall pH and EC results are generally consistent with historical range of results at W4 and upstream in the Hunter River (e.g. W1 and W109) presented in WMP, however, EC results are lower than the historical range which may be attributed to the high rainfall in the catchment. HRSTS discharges that occurred on or two days prior to sampling has TSS concentrations of <25 mg/L There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact.

Location	Date	Trigger Limit	Action Taken in Response
H1 – Hunter River	30/03/2022	TSS – 114	First exceedance of TSS trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. TSS at W109 Hunter River, W1 and W4 (upstream of H1) also exceeded TSS trigger indicating elevated TSS in broader catchment rather than a localised impact near H1. Approximately 75 mm of rainfall in the six days prior to sampling. The result is consistent with TSS in Hunter River following rainfall. pH and EC results are generally consistent with historical range of results at H1 and upstream in the Hunter River (i.e. W1, W4 and W109) presented in WMP. HRSTS discharges that occurred on or two days prior to sampling had TSS concentrations of <25 mg/L. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact.
W1 – Hunter River	5/04/2022	TSS – 62	Third consecutive exceedance of TSS trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. TSS at W109 Hunter River (upstream of W1) also exceeded TSS trigger on 30/03/22 indicating elevated TSS in broader catchment rather than a localised impact near W1. Approximately 24.6 mm of rainfall in the seven days prior to sampling. The result is consistent with TSS in Hunter River following rainfall. pH and EC results are generally consistent with historical range of results at W1 and upstream in the Hunter River (i.e. W109) presented in WMP. Hunter River upstream Liddell Gauging station was in High Flow (1600ML/day) from rainfall received in weeks prior to sampling. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact.
W1 – Hunter River	11/07/2022 13:50	TSS – 102	First exceedance of TSS. Field Observations indicated that the sample was brown in colour and turbid. Approximately 70 mm of rainfall in the seven days prior to sampling. HRSTS discharges that occurred on or 6 days prior to sampling have TSS concentrations of <40 mg/L There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS value appears to be a result of high TSS within the broader catchment and high rainfall prior to sampling.
H2 – Hunter River	11/07/2022 9:35	TSS – 64	First exceedance of TSS. Field Observations indicated that the sample was brown in colour and turbid. Approximately 70 mm of rainfall in the seven days prior to sampling. HRSTS discharges that occurred on or 6 days prior to sampling have TSS concentrations of <40 mg/L There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS value appears to be a result of high TSS within the broader catchment and high rainfall prior to sampling.
W1 – Hunter River	20/09/2022 10:20	TSS – 59	First exceedance of TSS. Field Observations indicate that the sample was brown in colour and turbid. Approximately 25mm of rainfall in the seven days prior to sampling. TSS at W109-Hunter River (upstream of W1) on 20/09/22 was 43mg/L indicating elevated TSS in broader catchment. No HRSTS discharges upstream of W1 on or prior to the 20/09/22. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS value appears to be a result of high TSS within the broader catchment.

Location	Date	Trigger Limit	Action Taken in Response
W4 – Hunter River	20/09/2022 9:20	TSS – 68	First exceedance of TSS. Field Observations indicate that the sample is brown in colour and turbid. Approximately 25mm of rainfall in the seven days prior to sampling. TSS at W109 Hunter River (upstream of W4) on 20/09/22 was 43mg/L, indicating elevated TSS in broader catchment. HRSTS discharges that occurred 1 day prior to sampling had a TSS concentration of <15 mg/L. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS value appears to be a result of high TSS within the broader catchment.
W3 – Hunter River	20/09/2022 12:00	TSS – 68	First exceedance of TSS. Field Observations indicate that the sample is brown in colour and turbid. Approximately 25mm of rainfall in the seven days prior to sampling. TSS at W109 Hunter River (upstream of W3) on 20/09/22 was 43mg/L, indicating elevated TSS in broader catchment. No HRSTS discharges upstream of W3 on or prior to the 20/09/22. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS value appears to be a result of high TSS within the broader catchment.
W1 – Hunter River	11/10/2022 9:30	TSS – 234	Second consecutive exceedance of TSS. Field Observations indicate that the sample was brown in colour and turbid. Approximately 60mm of rainfall in the seven days prior to sampling. No HRSTS discharges upstream of W1 on or prior to the 11/10/22. No sediment basins overtopped during rain event. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS exceedance appears to be a result of high rainfall prior to sampling leading to elevated suspended solids concentrations in broader catchment runoff.
H2 – Hunter River	11/10/2022 10:40	TSS – 231	First exceedance of TSS. Field Observations indicate that the sample was brown in colour and turbid. Approximately 60mm of rainfall in the seven days prior to sampling. HRSTS discharges at Lake James Discharge point, upstream of H2 on the 10/10/22 and the 11/10/22 (96.13ML). Discharge water quality records for both dates indicated TSS concentrations of 7mg/L and 6 mg/L. No sediment basins overtopped during rain event. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS exceedance appears to be a result of high rainfall prior to sampling leading to elevated suspended solids concentrations in broader catchment runoff.
W1 – Hunter River	3/11/2022 9:50	TSS – 345	Third consecutive exceedance of TSS. Field Observations indicate that the sample was brown in colour and turbid. Approximately 23mm of rainfall in the seven days prior to sampling. No HRSTS discharges upstream of W1 on or prior to the 3/11/22. No sediment basins overtopped during rain event. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS exceedance appears to be a result of rainfall prior to sampling leading to elevated suspended solids concentrations in broader catchment runoff.

Location	Date	Trigger Limit	Action Taken in Response
H2 – Hunter River	3/11/2022 10:40	TSS – 419	Second consecutive exceedance of TSS. Field Observations indicate that the sample was brown in colour and turbid. Approximately 23mm of rainfall in the seven days prior to sampling. No HRSTS discharges upstream of H2 on or prior to the 3/11/22. No sediment basins overtopped during rain event. There is no evidence to indicate that the TSS exceedance is associated with a HVO mining impact. The exceeded TSS exceedance appears to be a result of rainfall prior to sampling leading to elevated suspended solids concentrations in broader catchment runoff.

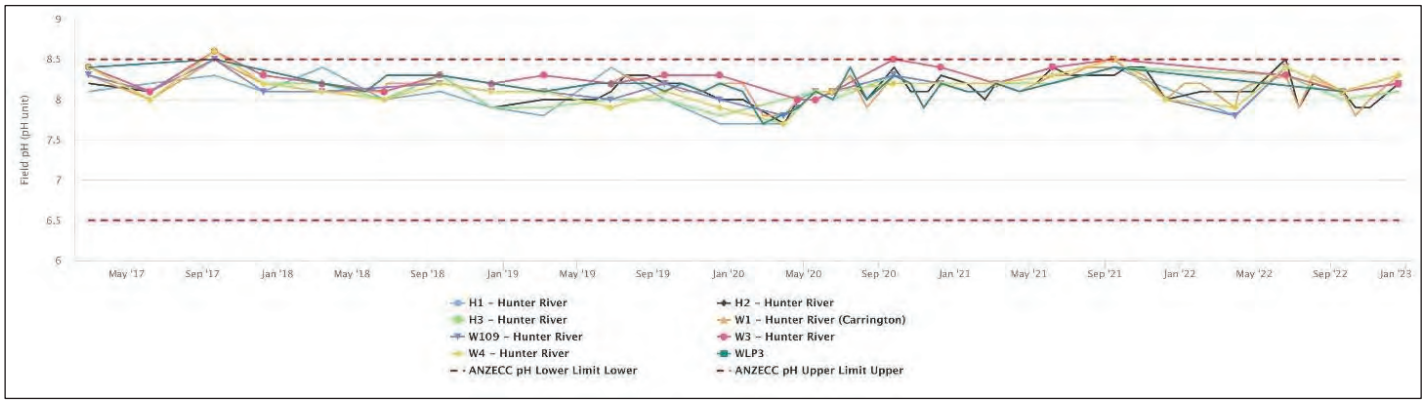

Figure 7-5: Hunter River pH Trends 2017 – 2022

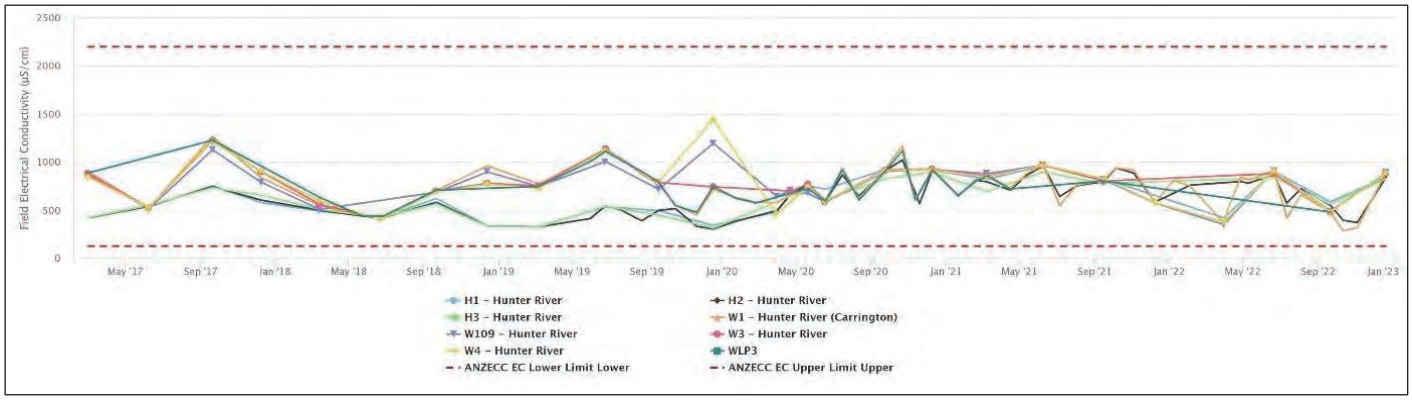

Figure 7-6: Hunter River EC Trends 2017- 2022

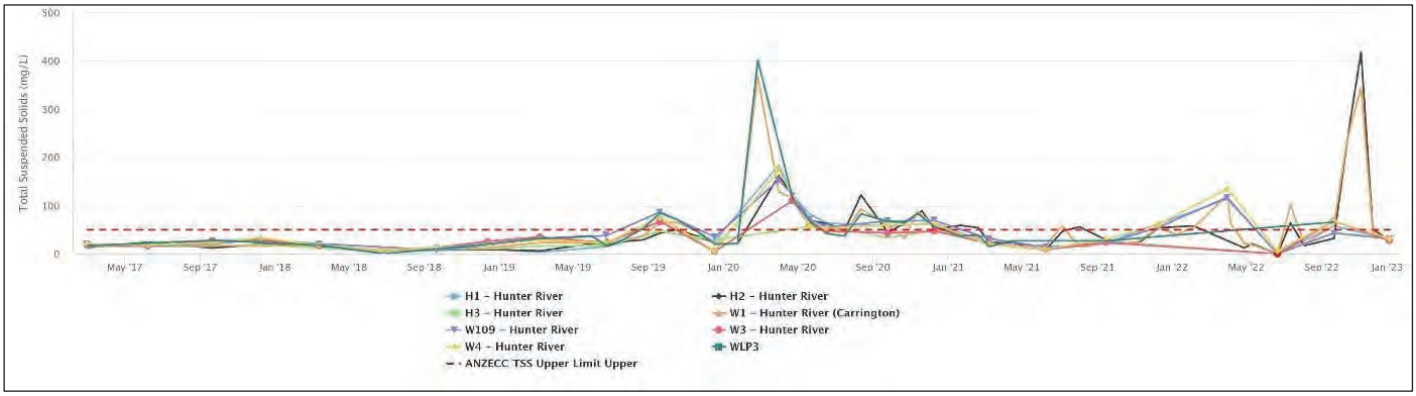

Figure 7-7: Hunter River TSS Trends 2017 – 2022

Wollombi Brook

Wollombi Brook was sampled on 15 occasions from three monitoring locations during 2022. Long term trends for pH, EC and TSS from Wollombi Brook are shown in **Figure 7-8** to **Figure 7-10**.

Results were generally consistent with historical trends and acceptable ranges.

There were no trigger exceedances in 2022.

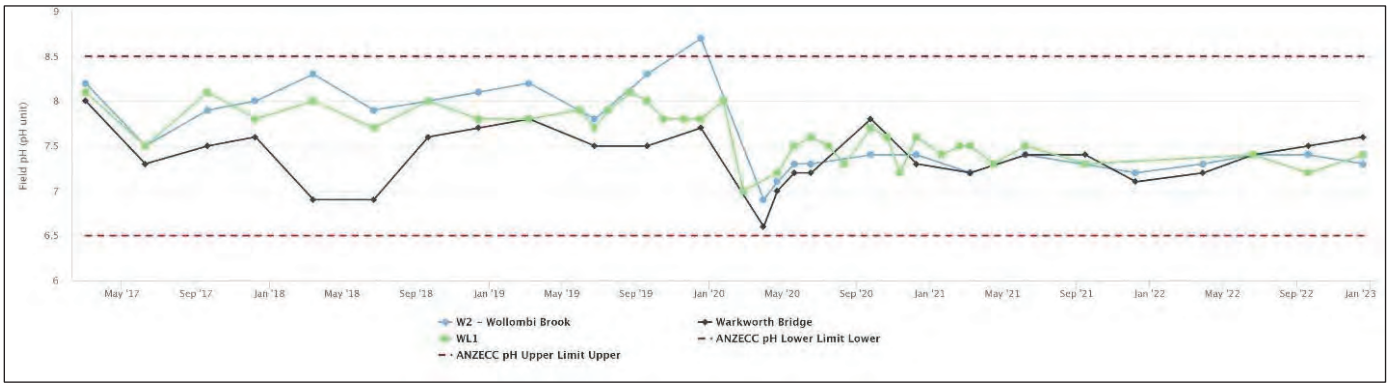

Figure 7-8: Wollombi Brook pH Trends 2017 – 2022

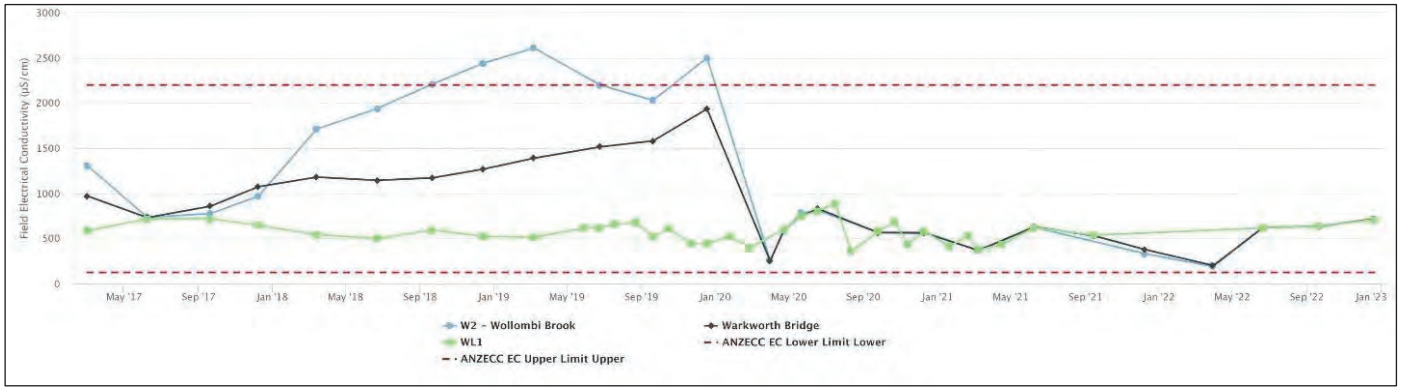

Figure 7-9: Wollombi Brook EC Trends 2017 – 2022

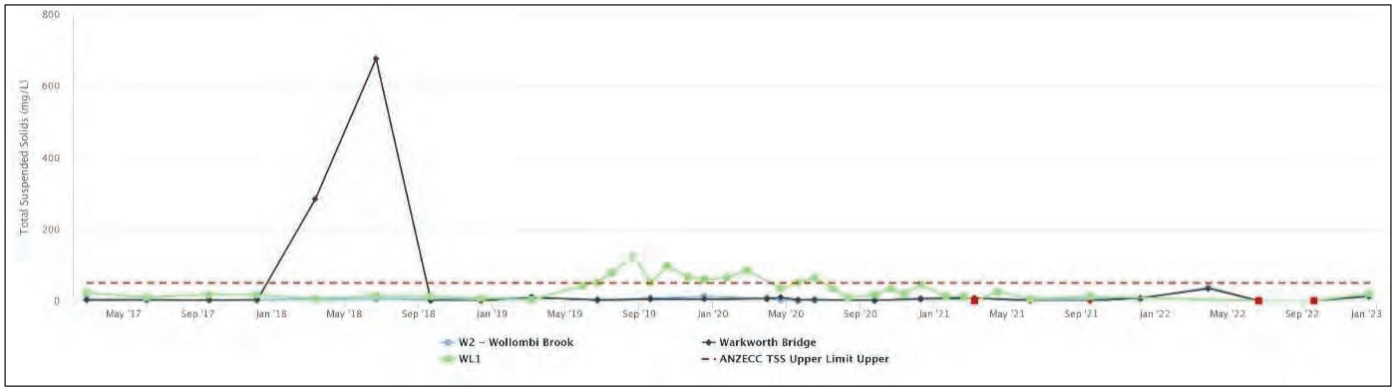

Figure 7-10: Wollombi Brook TSS Trends 2017 – 2022

Other Surrounding Tributaries

Rain event-based monitoring of natural tributaries surrounding HVO continued during 2022.

In accordance with the HVO WMP, four rain event sampling rounds were triggered during 2022. These occurred following rainfall greater ≥30mm in a 24-hour period on the days of 05/01/2021, 02/02/2021, 11/11/2021 and 12/12/2021. Monitoring during these rain events occurred on the following water courses:

- Comleroi Creek.
- Emu Creek.
- Farrells Creek.
- Pikes Creek.
- Redbank Creek.
- Davis Creek.
- Bayswater Creek; and
- Parnells Creek.

Long term trends for pH, EC and TSS are shown **Figure 7-11** to **Figure 7-14**. On occasion, some sampling sites recorded results outside of the internal trigger levels however, results for water quality remained generally consistent with historical trends The ephemeral nature of these monitoring locations is the primary reason for the considerable variation in physical water quality.

Trigger tracking results are detailed in **Table 7-4**.

Table 7-4: Other Tributaries Internal Trigger Exceedance Results

Location	Date	Trigger Limit	Action Taken in Response
Bayswater Creek Downstream	7/03/2022	TSS- 132	First exceedance of TSS trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. Approximately 65 mm of rainfall in the seven days preceding the exceedance as well as over 30 mm on the day of the exceedance. Upstream result for TSS at Bayswater Creek Mid was 37 mg/L indicating an impact on TSS concentration between the two monitoring locations. pH and EC at Bayswater Creek Downstream was consistent with Bayswater Creek Mid results. pH and EC generally consistent with historical Bayswater Creek Downstream results presented in HVO WMP.
Bayswater Creek Mid	5/07/2022	pH – 8.4	Third consecutive exceedance of pH trigger. Field observations indicated that the sample was light brown in colour and slightly turbid. Approximately 137 mm of rainfall in the seven days prior to sampling. Approx 240ML/Day discharging from Bayswater power station who discharges upstream from sampling point. The result is consistent with pH in Bayswater Creek following rainfall. No evidence of scouring or mine influence from HVO.
Bayswater Creek Downstream	14/11/2022 11:45	pH – 8.3	Third consecutive exceedance of pH trigger. Field Observations indicate that the sample was brown in colour and turbid. Approximately 42mm of rainfall in the seven days prior to sampling. No sediment basins overtopped during rain event. HRSTS discharge from Bayswater Power station at time of sample. The Bayswater Power station November discharge monitoring results indicate a pH value of 8.1, therefore it is not likely to be the cause of the exceedance.
Pikes Creek Downstream	14/11/2022 11:10	TSS – 62	First exceedance of TSS. Field Observations indicate that the sample was brown in colour and turbid. Approximately 42mm of rainfall in the seven days prior to sampling. No dams overtopped during rain event.

Location	Date	Trigger Limit	Action Taken in Response
Bayswater Creek Mid	14/11/2022 11:20	TSS – 89	First exceedance of TSS. Field Observations indicate that the sample was brown in colour and turbid. Approximately 42.0mm of rainfall in the seven days prior to sampling. No dams overtopped during rain event.
Bayswater Creek Downstream	14/11/2022 11:45	TSS – 106	First exceedance of TSS. Field Observations indicate that the sample was brown in colour and turbid. Approximately 42.0mm of rainfall in the seven days prior to sampling. No dams overtopped during rain event.

* = Watching brief established pending outcomes of subsequent monitoring events. No specific actions required.

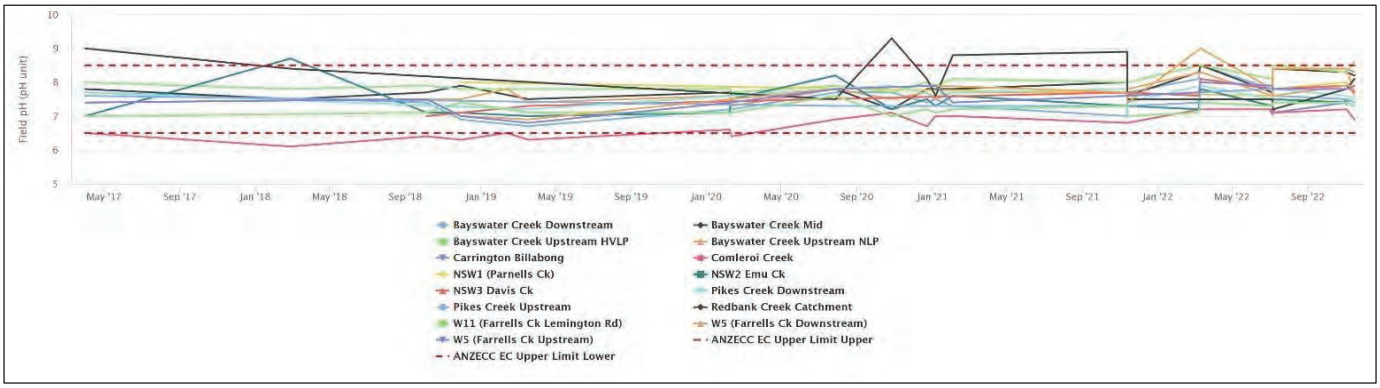

Figure 7-11: Other Tributaries pH Trends 2017 – 2022

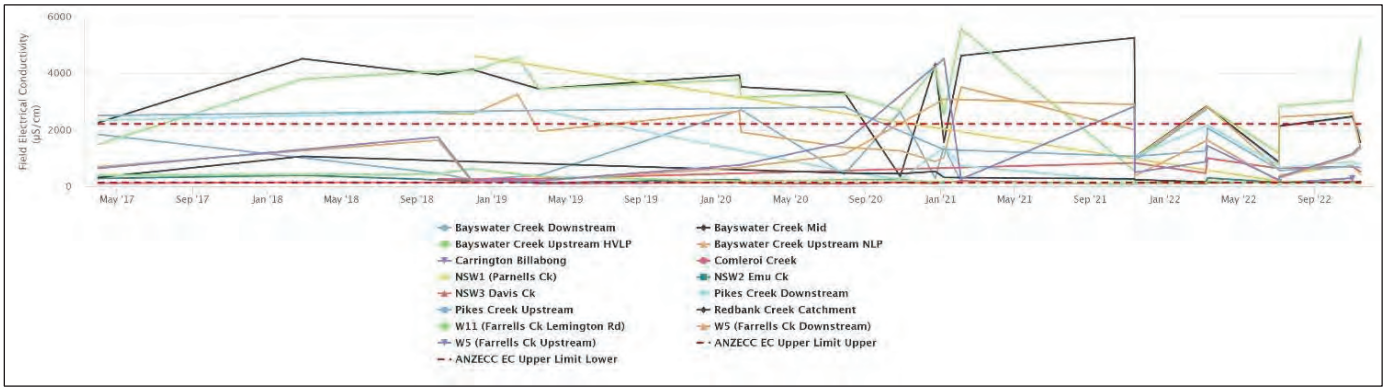

Figure 7-12: Other Tributaries EC Trends 2017 – 2022

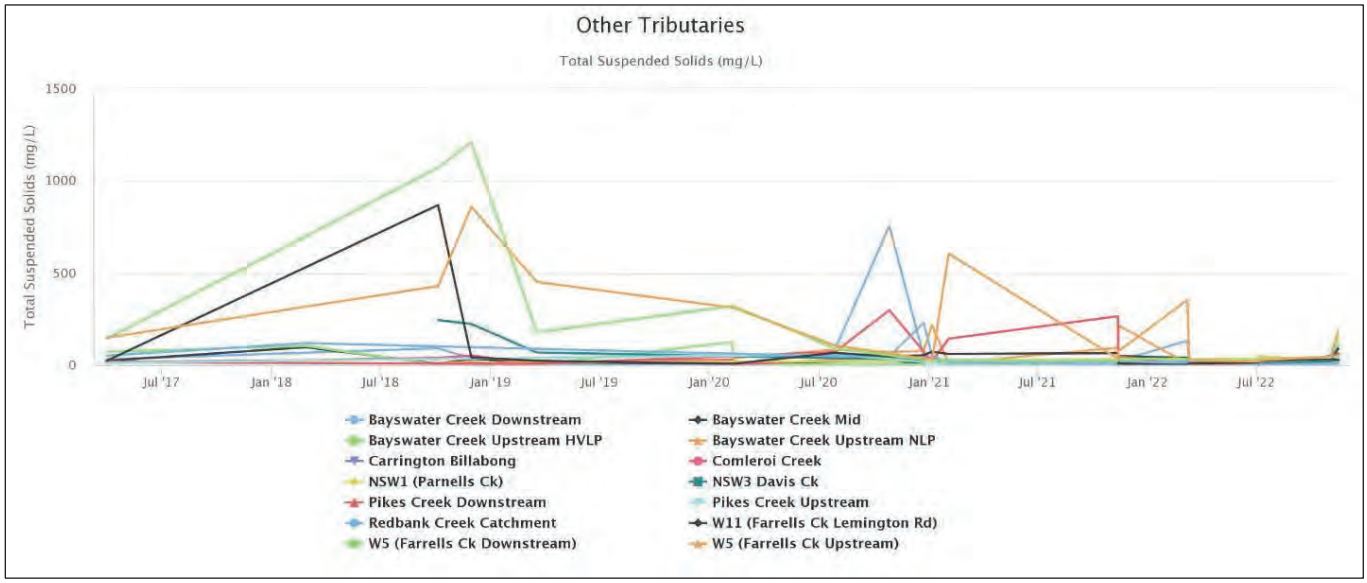

Figure 7-13: Other Tributaries TSS Trends 2017 – 2022

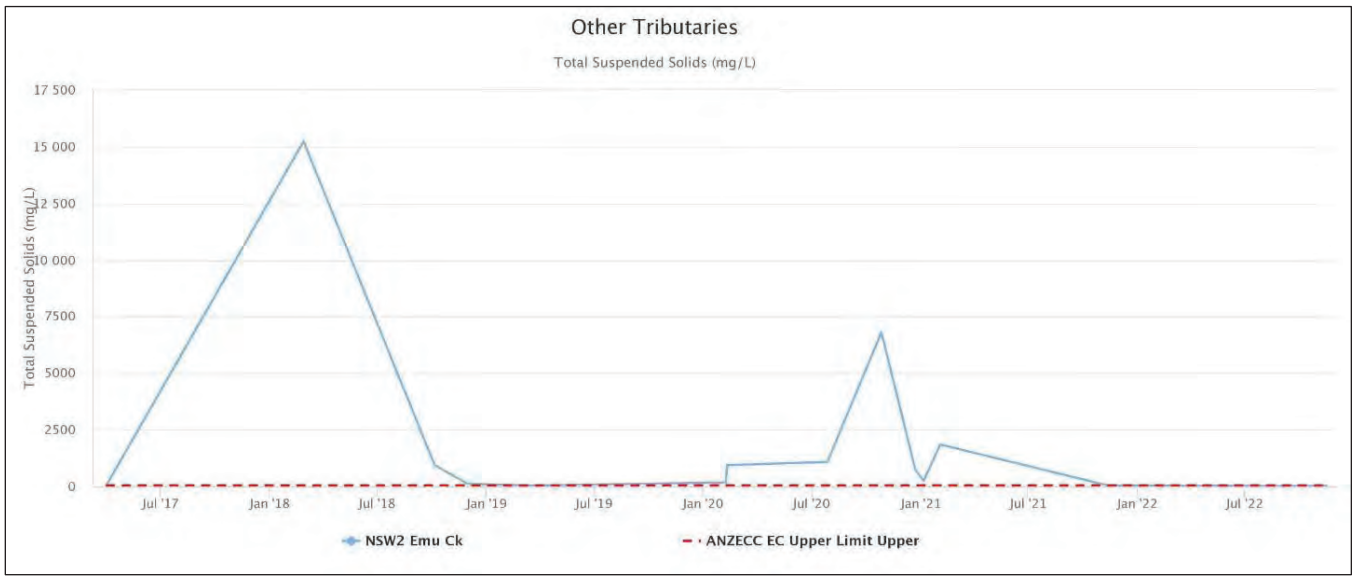

Figure 7-14: NSW2 Emu Creek TSS Trends 2017 – 2022

HVO Site Dams

During 2022, 62 samples were collected across 9 onsite dams. Long term trends for pH, EC and TSS are shown in **Figure 7-15** to **Figure 7-17**. HVO's onsite dams do not have impact assessment criteria. Results for water quality remained generally consistent with historical water quality trends.

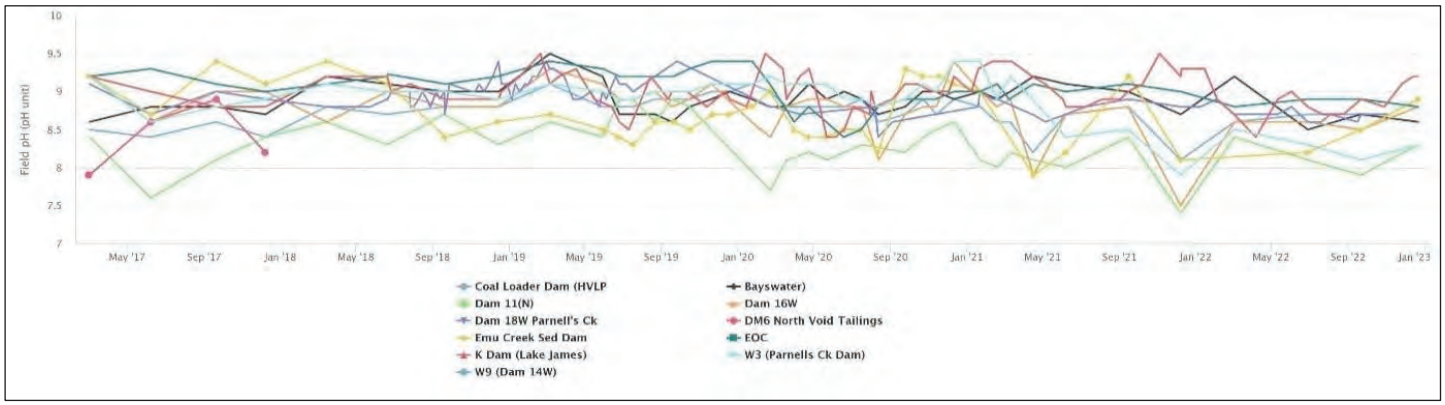

Figure 7-15: HVO Site Dams pH Trends 2017 – 2022

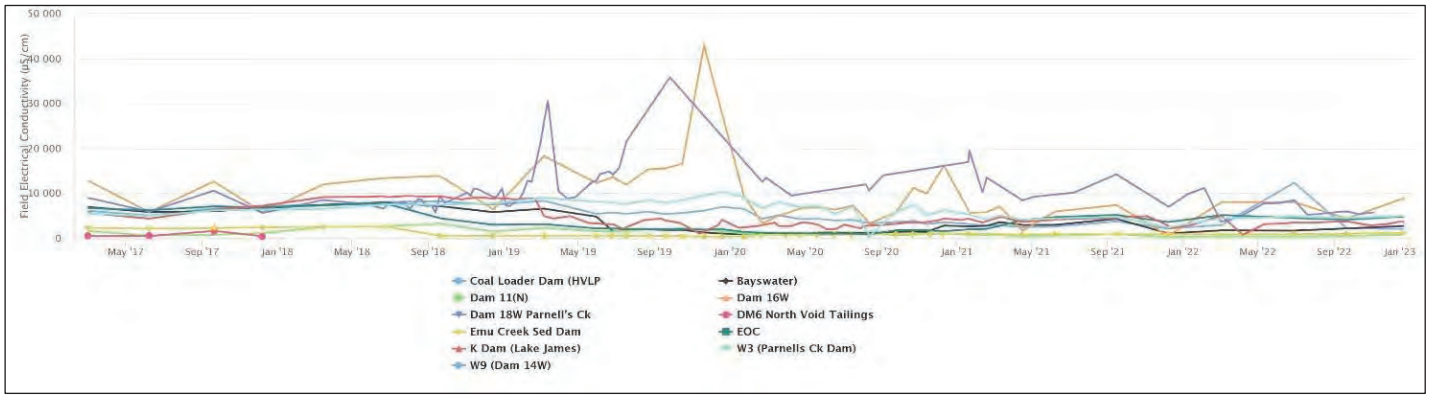

Figure 7-16: HVO Site Dams EC Trends 2017 – 2022

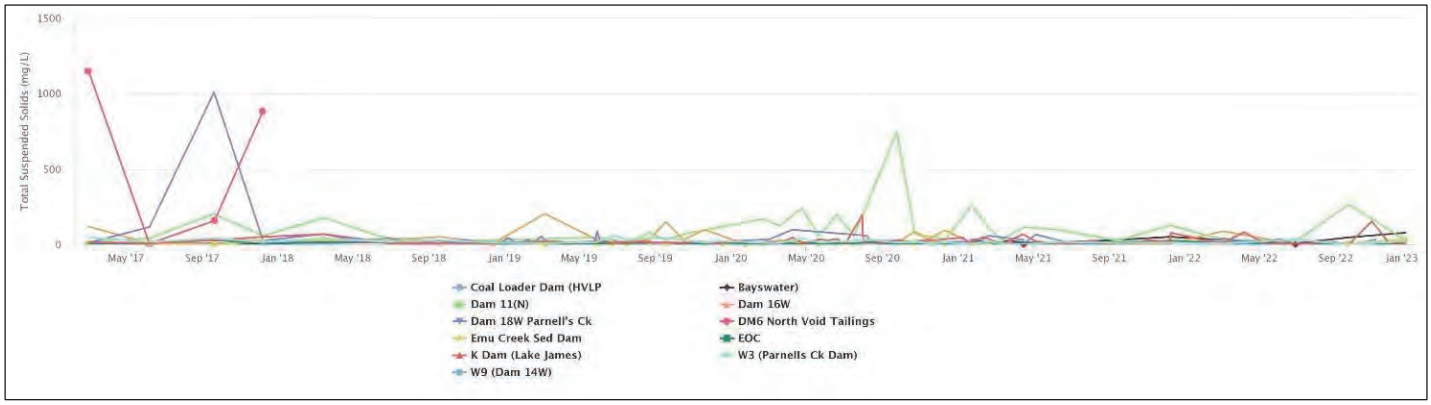

Figure 7-17: HVO Site Dams TSS Trends 2017 – 2022

7.3 | COMPARISON WITH EIS PREDICTIONS

7.3.1 | SOUTH PIT EIS PREDICTIONS

The South Pit EIS estimated an 'instantaneous' water quality for Electrical Conductivity of 5,700 µS/cm as an upper limit. Instantaneous water quality is a simple estimate obtained by dividing the total salt available by the maximum amount of possible void water. Electrical Conductivity measurements at Lake James averaged 3,869 µS/cm during 2022, in line with predicted EC levels.

The South Pit EIS estimated average runoff water quality from undisturbed catchments to be 400 mg/L for TSS and 615 µS/cm for EC. Comleroi Creek, south of Cheshunt Pit, was sampled five times during rain events in 2022 resulting in an average TSS of 15 mg/L and EC of 125 µS/cm, demonstrating that runoff water from undisturbed catchments in the HVO South area is of better quality than that which was predicted in the EIS.

7.3.2 | WEST PIT EIS PREDICTIONS

The West Pit EIS included the data in **Table 7-5** as representative of water quality in the local catchment area. During the review period Emu Creek (NSW2) recorded an average pH of 7.4 and an average EC of 149 µS/cm, both lower than the predicted results of **Table 7-5**. The pH and EC at Farrells Creek (combined upstream and downstream monitoring sites) averaged 7.9 and 903.1 µS/cm respectively during the review period, were also slightly lower than EIS predictions. The average pH and EC for Davis Creek (NSW3) were 7.8 and 653 µS/cm respectively during the review period, in the lower range and slightly lower than EIS predictions. Parnell's Dam (W3) measured an average EC of 3,374 µS/cm in 2022, within the prediction.

Table 7-5: Representative Water Quality for West Pit

Watercourse	pH (pH Units)	EC (µS/cm)
Davis Creek	7.7 to 8.4	767 to +8,000
Emu Creek	7.5 to 8.8	365 to +1,000
Farrells Creek	7.0 to 9.2	195 to +12,000
Mine Water (Parnell's Dam)	-	2,400 to 6,300

7.4 | PERFORMANCE RELATING TO HRSTS DISCHARGES

HVO participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing it to discharge to the Hunter River via three licensed discharge points, including Dam 11N, Dam 15S (Lake James) and Dam 9W (Parnells Dam). Discharges can only take place subject to the scheme's regulations.

As required by the EPL, HVO submitted a discharge report for the 2021/22 financial year. A total of 6623 ML of water was discharged during 2022 in accordance with the HRSTS.

7.5 | GROUNDWATER

7.5.1 | GROUNDWATER MANAGEMENT

Groundwater monitoring activities were undertaken in 2022 in accordance with the HVO WMP and Groundwater Monitoring Programme. The monitoring results are used to establish and monitor trends in physical and geochemical parameters of surrounding groundwater potentially influenced by mining.

The groundwater monitoring programme at HVO measures the quality of groundwater against background data, EIS predictions and historical trends. Ground water quality is evaluated through the parameters of pH, EC, and Standing Water Level (SWL) (measured as elevation in metres with respect to the Australian Height Datum, mAHD). On a periodic basis (nominally once per annum) a comprehensive suite of analytes are measured, including major anions, cations and metals. Prior to sampling for comprehensive analysis, bore purging is undertaken to ensure a representative sample is collected.

Groundwater monitoring data is reviewed regularly for trigger exceedances and analysed in detail on a quarterly basis. The review involves a comparison of measured results against internal trigger values which have been derived from the historical data set. Trigger limits are calculated as the 95th percentile maximum value (EC and pH) and the 5th percentile minimum value (pH only) from data collected since 2011. Trigger levels have been set on the basis of geographical proximity and target stratigraphy. Bores that record as dry and bores of unknown seam have not been included in calculation of the trigger limits. The response to measured data outside the trigger limits is detailed in the 2018 HVO Water Management Plan. Where investigations and subsequent actions have been undertaken following review of monitoring data, these are detailed in this section. Monitoring locations are shown in **Figure 7-18**.

Groundwater monitoring is conducted at HVO in accordance with the WMP (HVO, 2018), which includes details on the Groundwater Management Plan and Groundwater Monitoring Program. The monitoring results are used to monitor trends in physical and geochemical parameters of groundwaters that are potentially influenced by mining.

In 2019 SLR undertook a network review which identified some changes in target geology compared to the WMP. The network review also assessed the condition and purpose of each bore and made

recommendations to remove bores from the monitoring network that were damaged or destroyed, not providing representative groundwater data, where duplicate monitoring locations existed and where site activities have ceased. It was recommended that these bores be removed from the next update of the WMP leaving 77 bores within the groundwater compliance monitoring network with triggers assigned. Groundwater quality triggers were reviewed, and the trigger levels were updated based on all historical data available and set based on geographical and target stratigraphy. The baseline data was used to update the 95th percentile for EC and 5th and 95th percentiles for pH. An updated groundwater monitoring program has been included in the draft WMP (version 3.4) which is currently with DPE awaiting approval. For the purposes of annual reporting, the results are presented in comparison to the details in the current WMP (HVO, 2018) and, if exceedances recorded, discussed with reference to the revised monitoring programme recommendations.

The Annual Groundwater Impacts Review conducted during 2022 is provided in **Appendix B.**

7.5.2 | GROUNDWATER PERFORMANCE

Sampling of groundwater was carried out in accordance with the HVO Groundwater Monitoring Programme. Where laboratory analysis was undertaken, this was performed by a NATA accredited laboratory. Sites with a data capture rate of less than 100 per cent are outlined in **Table 7-6**. Data recovery presented in **Table 7-6** has been calculated based on the number of times the sampling location was able to be accessed and at least one sampling parameter was able to be collected. Detailed data capture by sampling parameters is provided in **Appendix B**.

Table 7-6: HVO Groundwater Monitoring Data Recovery for 2022 (By Exception)

Location	Data Recovery	Comments
4034P	75%	No access due to flooding in Q1
4036C	50%	No access due to flooding in Q1 and bore blocked in Q4
4051C	0%	Bore blocked
4116P	50%	No access due to flooding in Q1 and Q2
4119P	25%	No access due to flooding in Q1, Q2 and Q3
B425(WDH)	50%	Bore dry in Q2 and no access Q4 due to flooding
BZ3-1	25%	Bore blocked in Q2, Q3 and Q4
BZ4A(2)	50%	Insufficient water to sample in Q3 and Q4
BZ8-2	0%	No access due to flooding in Q1, Q2, Q3 and Q4
C122(BFS)	75%	Insufficient water to sample in Q4
C919(ALL)	25%	No access due to flooding in Q2
CGW32	75%	Not measured in Q2, reason unknown
CGW39	75%	Bore dry in Q1
CGW45	0%	Bore blocked
CGW46	75%	No access due to flooding in Q1
CGW47a	75%	No access due to flooding in Q1
CGW51a	75%	No access due to flooding in Q1
CGW52	75%	No access due to flooding in Q1
CGW52a	75%	No access due to flooding in Q1
CGW53	75%	No access due to flooding in Q1
CGW53a	75%	No access due to flooding in Q1
CGW55a	75%	No access due to flooding in Q1
D510(AFS)	50%	Bore blocked in Q2 and Q4
DM1	75%	No access due to flooding in Q1
DM3	50%	No access due to flooding in Q1 and blocked in Q4

Location	Data Recovery	Comments
DM4	75%	No access due to flooding in Q1
DM7	75%	No access due to flooding in Q1
GA3	50%	No access due to flooding in Q1 and Q3
GW-100	75%	No access due to flooding in Q1
GW-100a (VWP)	0%	Awaiting installation of new units
GW-101	50%	No access due to flooding in Q1, bore dry in Q2, Q3 and Q4
GW-101a (VWP)	0%	Awaiting installation of new units
GW-102 (VWP)	0%	Awaiting installation of new units
GW-103 (VWP)	0%	All sensors failed in 2020
GW-104 (VWP)	50%	Not downloaded in Q3 or Q4
GW-107	50%	No access due to flooding in Q1, insufficient water to sample in Q2 and Q3, bore dry in Q4
GW-108	50%	No access due to flooding in Q1 and Q3, insufficient water to sample in Q2, bore blocked in Q4
GW-114	75%	No access due to flooding in Q1
GW-115	75%	No access due to flooding in Q1
HV3(2)	50%	No access due to flooding in Q1 and Q3
MB14HVO01	50%	No access due to flooding in Q1 and Q2
MB14HVO02	50%	No access due to flooding in Q1 and Q2
MB14HVO03	75%	No access due to flooding in Q1
MB14HVO04	50%	No access due to flooding in Q1 and Q3
MB14HVO05	50%	No access due to flooding in Q1 and Q2
NPz2	75%	No access due to flooding in Q1
NPz3	75%	Bore blocked in Q4
NPz5	0%	No longer exists, mined through

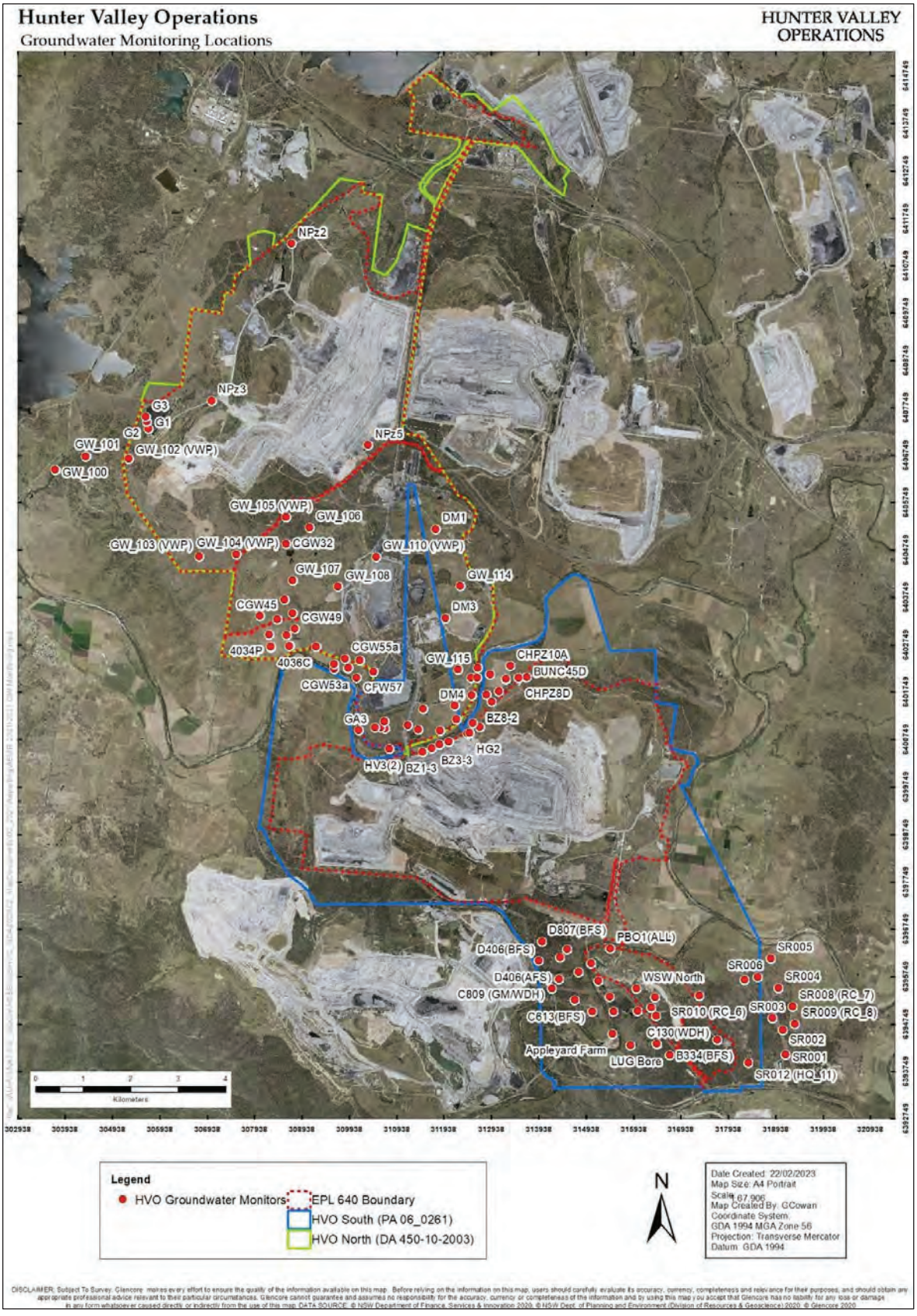

Figure 7-18: Groundwater Monitoring Network at HVO – 2022

7.5.3 | GROUNDWATER MONITORING SUMMARY

The following section presents groundwater monitoring data in relation to the geographic locations and target stratigraphy for groundwater monitoring bores.

Each location is discussed, and a summary of monitoring data presented. Where monitoring results required further investigation following the recording of three consecutive measurements outside the internal statistical limits, these results are summarised in tables for each location. A detailed Annual Groundwater Review is provided in **Appendix B**.

Carrington Broonie

The EC, pH and SWL trends for 2017 to 2022 for Carrington Broonie Seam groundwater bores are shown in **Figure 7-19** to **Figure 7-21** respectively. Water quality results were generally consistent with historical ranges with some minor variation noted with pH and SWL results.

Trigger exceedance results are shown in **Table 7-7**.

Table 7-7: Carrington Broonie Internal Trigger Tracking 2022

Location	Date	Trigger Limit	Action Taken in Response
CGW53	27/09/2022	pH – 5th Percentile	First consecutive trigger exceedance – monitor
CGW53	14/12/2022	pH – 5th Percentile	Second consecutive trigger exceedance – watching brief established

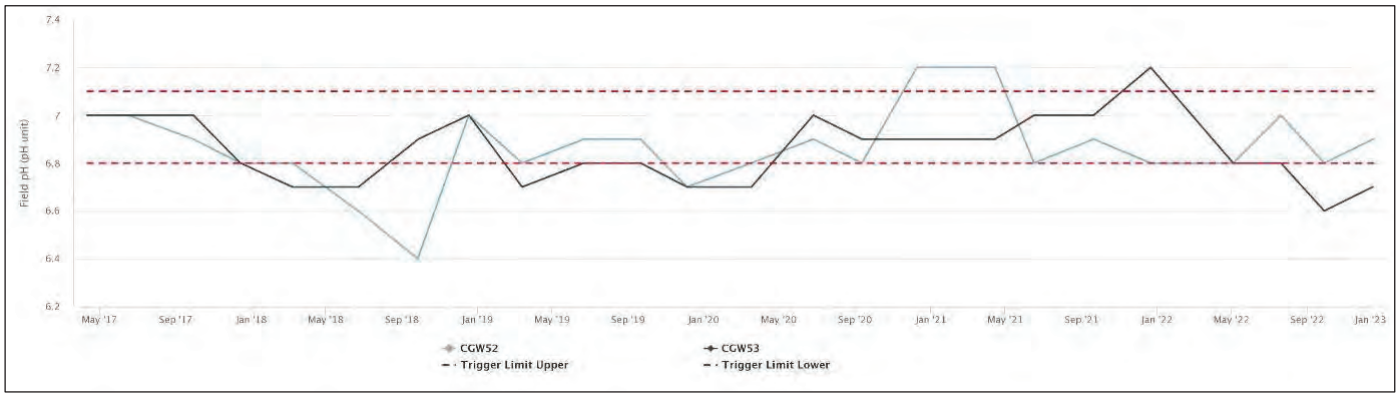

Figure 7-19: Carrington Broonie Groundwater pH Trends 2017 – 2022

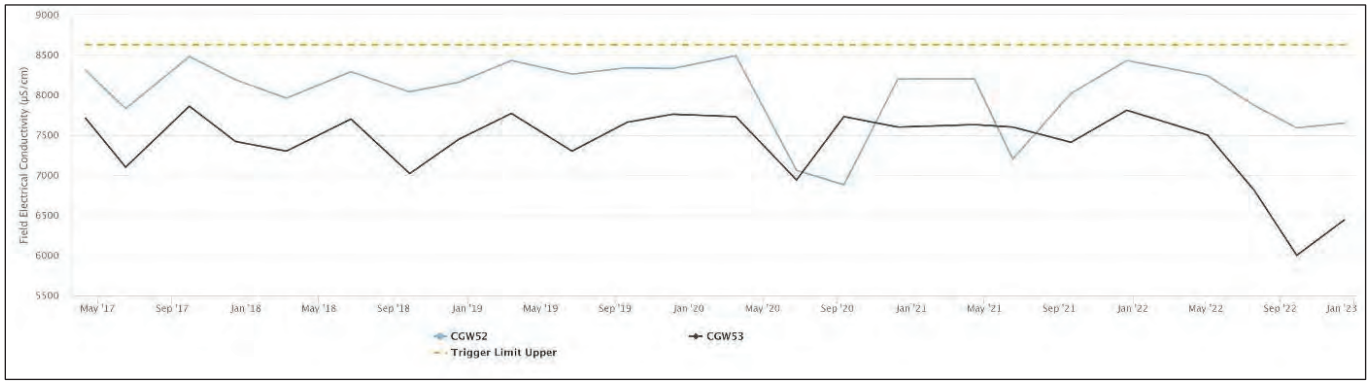

Figure 7-20: Carrington Broonie Groundwater EC Trends 2017 – 2022

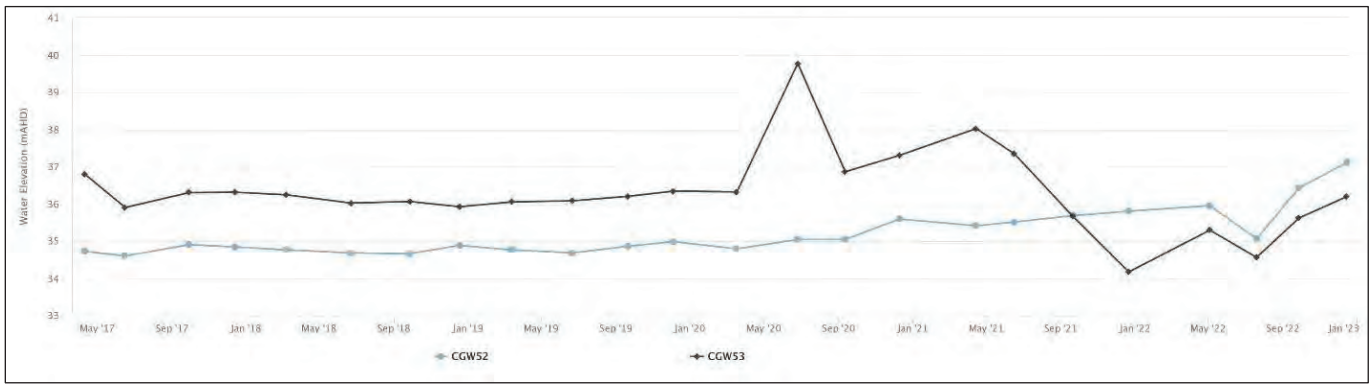

Figure 7-21: Carrington Broonie Groundwater SWL Trends 2017 – 2022

Carrington Alluvium

The EC, pH and SWL trends for 2017 to 2022 for Carrington Alluvium groundwater bores are shown in **Figure 7-22** to **Figure 7-24**. Water quality results were generally consistent with historical trends.

New triggers have been developed following an independent review of the groundwater network and better represent current conditions and monitoring in the area. These have been included in the revised Water Management Plan pending approval. Monitoring results are assessed against these new triggers as part of the North Void Tailings Storage Facility (NV TSF) Pollution Reduction Programme monitoring and reporting requirements via the Environmental Protection Licence. The current EC trigger is considered not to be representative of historical (pre-mining) conditions or adequate to assess improving water quality following seepage from the NV TSF.

HVO continued to mitigate potential impacts of seepage from the NV TSF. This included no deposition of tailings to the TSF and decanting of surface water to allow the tailings to dry and consolidate. Monitoring of the area continues at an increased frequency including data collection from continuous groundwater loggers measuring water level and quality. EC and pH have stabilised and standing water level has declined, this is an indication that current controls are being effective.

As part of a Pollution Reduction Programme, works in 2022 include a detailed engineering design for a permeability barrier wall to be constructed between the TSF and the alluvium.

Trigger exceedance results are listed in **Table 7-8**.

Table 7-8: HVO Carrington Alluvium Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
CFW55R	12/04/2022	EC	Fourth exceedance. Investigation Bore CFW55R recorded consecutive EC readings above the trigger level from January to April 2022 (Q1), declining from 8,960 µS/cm (Jan) to 6,880 µS/cm (Apr). The declining trend is corresponding to increased water levels which are a response to above average rainfall over the same period. EC levels have remained below the trigger level since May 2022.

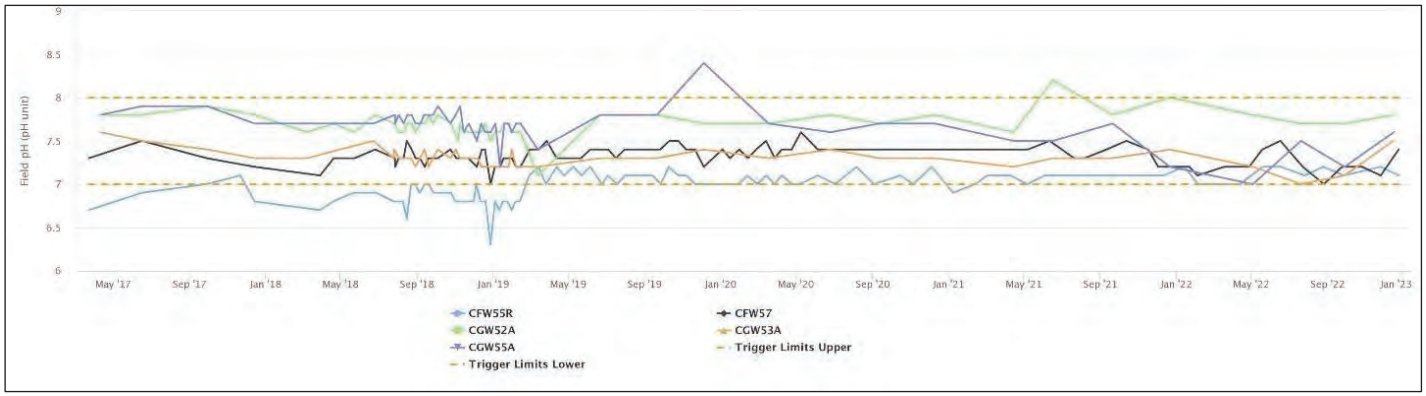

Figure 7-22: Carrington Alluvium Groundwater pH Trends 2017 – 2022

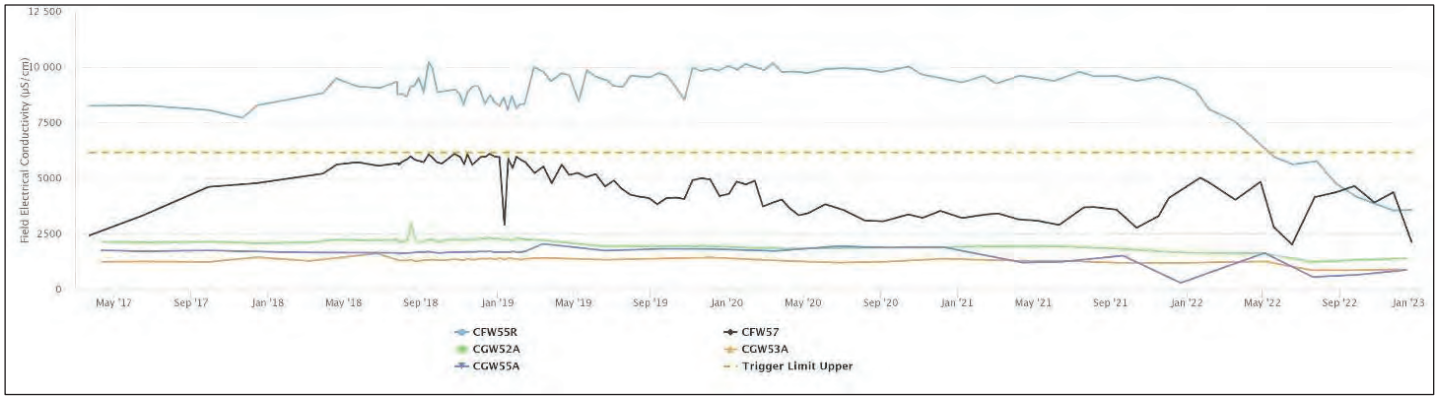

Figure 7-23: Carrington Alluvium Groundwater EC Trends 2017 – 2022

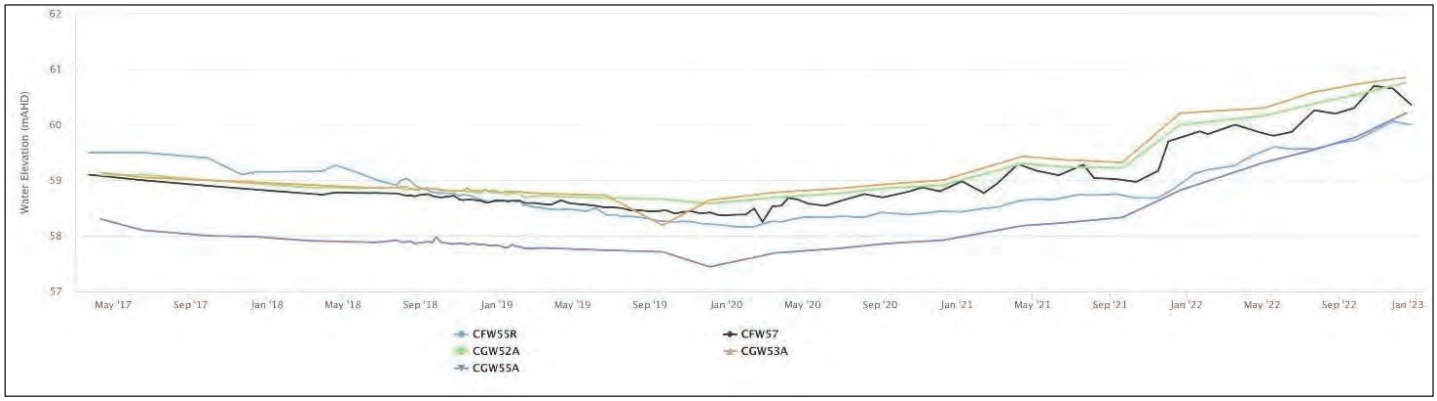

Figure 7-24: Carrington Alluvium Groundwater SWL Trends 2017 – 2022

Carrington Interburden

The EC, pH and SWL trends for 2017 to 2022 for groundwater bores in the Carrington Interburden are shown in **Figure 7-25** to **Figure 7-27** respectively. Water quality results were generally consistent with historical trends. Bore 4036C was dry and therefore samples were unable to be collected during 2022.

Trigger exceedance results are listed below in **Table 7-9.**

Table 7-9: HVO Carrington Interburden Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
CGW51A	27/09/2022	pH – 95th Percentile	First consecutive trigger exceedance – watching brief established
GCW51A	15/12/2022	pH – 95th Percentile	Second consecutive trigger exceedance – watching brief maintained

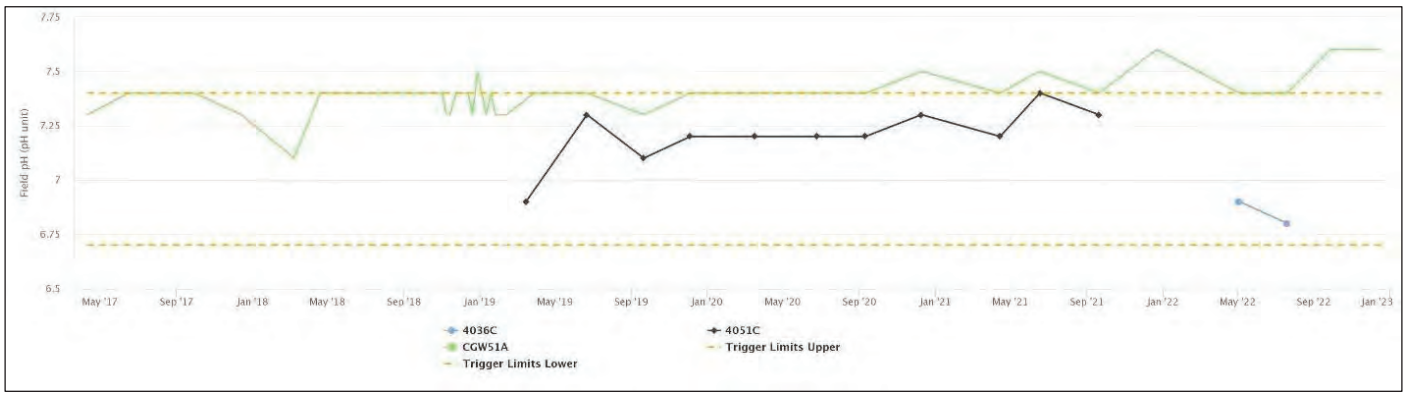

Figure 7-25: Carrington Interburden Groundwater pH Trends 2017 – 2022

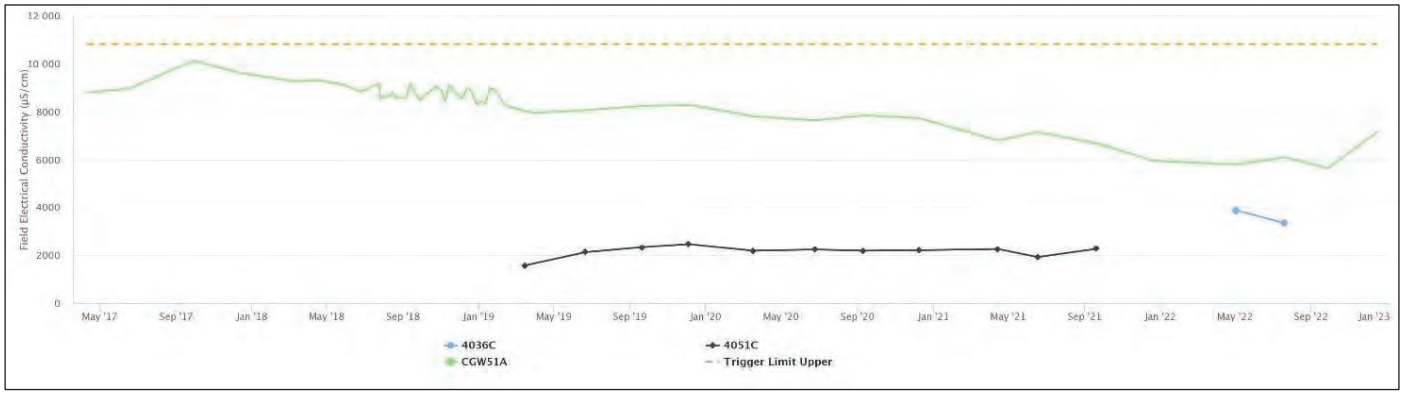

Figure 7-26: Carrington Interburden Groundwater EC Trends 2017 – 2022

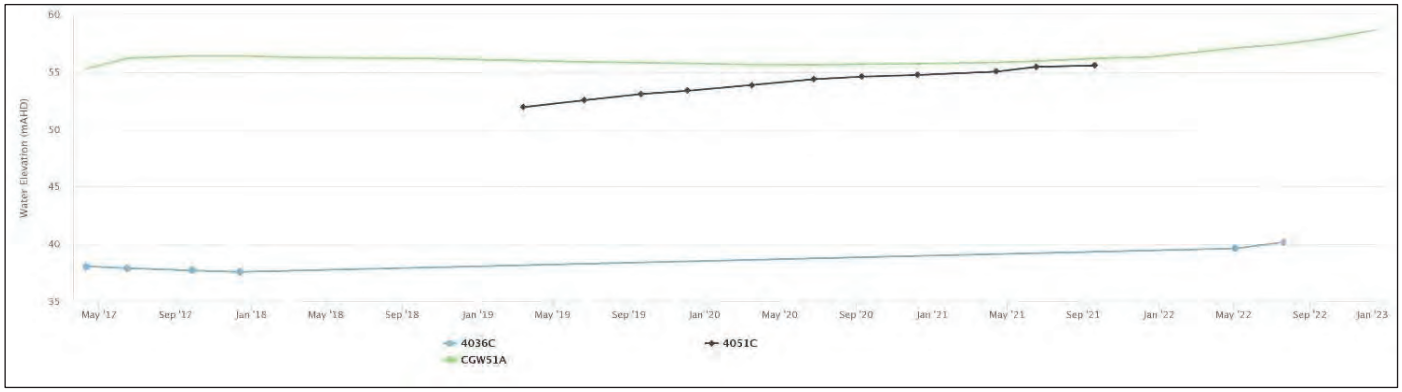

Figure 7-27: Carrington Interburden Groundwater SWL Trends 2017 – 2022

Carrington West Wing Alluvium

Results are shown in **Figure 7-28** to **Figure 7-30**. Water quality results were generally consistent with historical trends. Bore CGW49 intersects alluvium within the western limb of the paleochannel. Historical readings show that bore CGW49 has recorded pH ranging between 6.6 and 8.1. Review of pH readings remained fairly stable and within historical levels over 2022. The results show no adverse impacts due to mining.

Trigger exceedances in 2022 are shown in **Table 7-10**.

Table 7-10: HVO Carrington West Wing Alluvium Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
CGW49	14/12/2022	pH – 95th Percentile	First exceedance - monitor

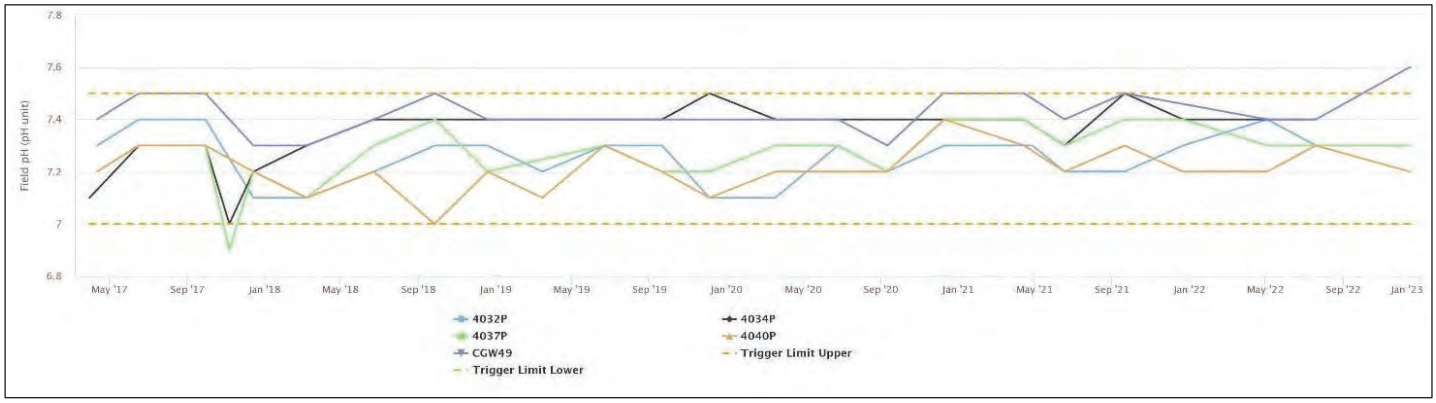

Figure 7-28: Carrington West Wing Alluvium Groundwater pH Trends 2017 – 2022

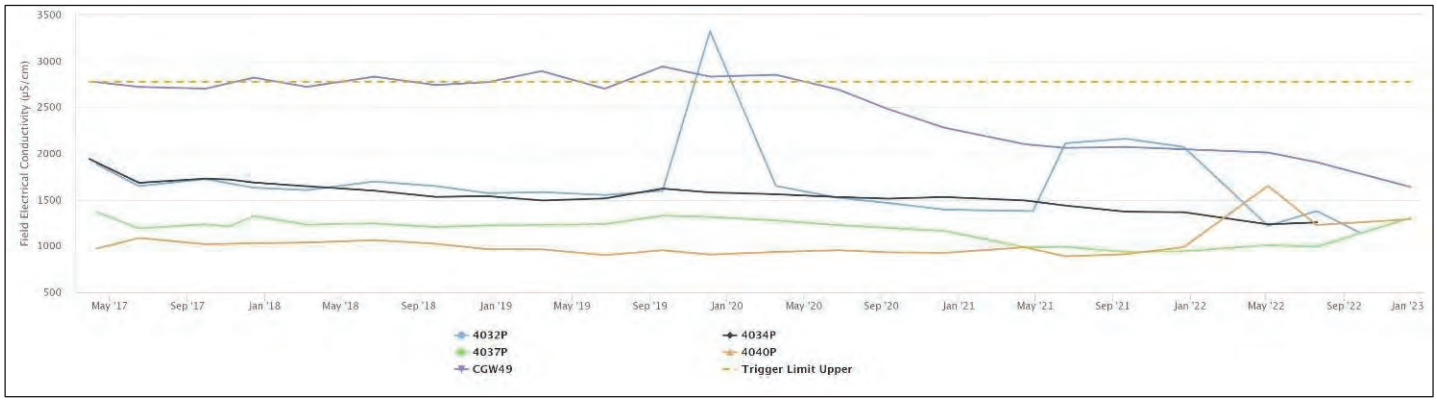

Figure 7-29: Carrington West Wing Alluvium Groundwater EC Trends 2017 – 2022

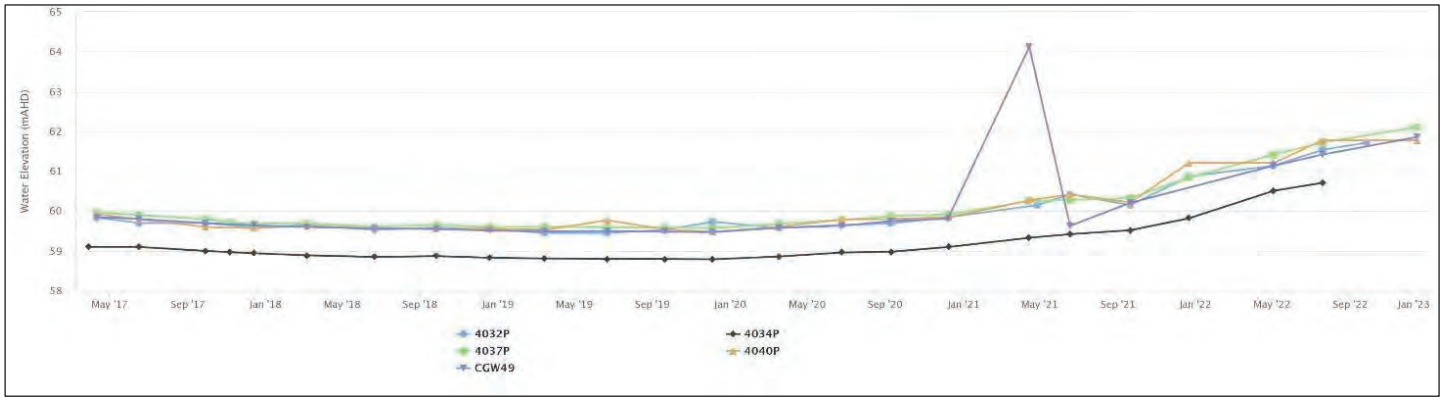

Figure 7-30: Carrington West Wing Alluvium Groundwater SWL Trends 2017 – 2022

Carrington West Wing Flood Plain

Results are shown in **Figure 7-31** to **Figure 7-33**. Water quality results were generally consistent with historical trends. pH levels for GW-106 were slightly below the lower pH trigger for Q1 to Q3 2022. This bore has been removed in the revised Version 3.4 of the Water Management Plan that has been submitted to DPE for approval.

Trigger tracking results are listed in **Table 7-11**

Table 7-11: HVO Carrington West Wing Flood Plain Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
GW-106	18/07/2022	pH – 5th Percentile	First exceedance - monitor

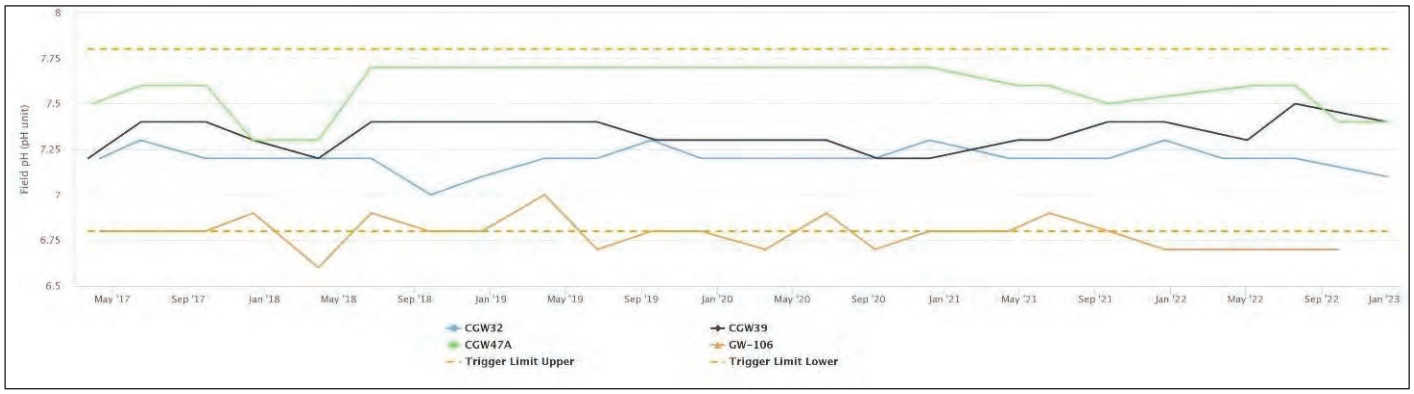

Figure 7-31: Carrington West Wing Flood Plain Groundwater pH Trends 2017 – 2022

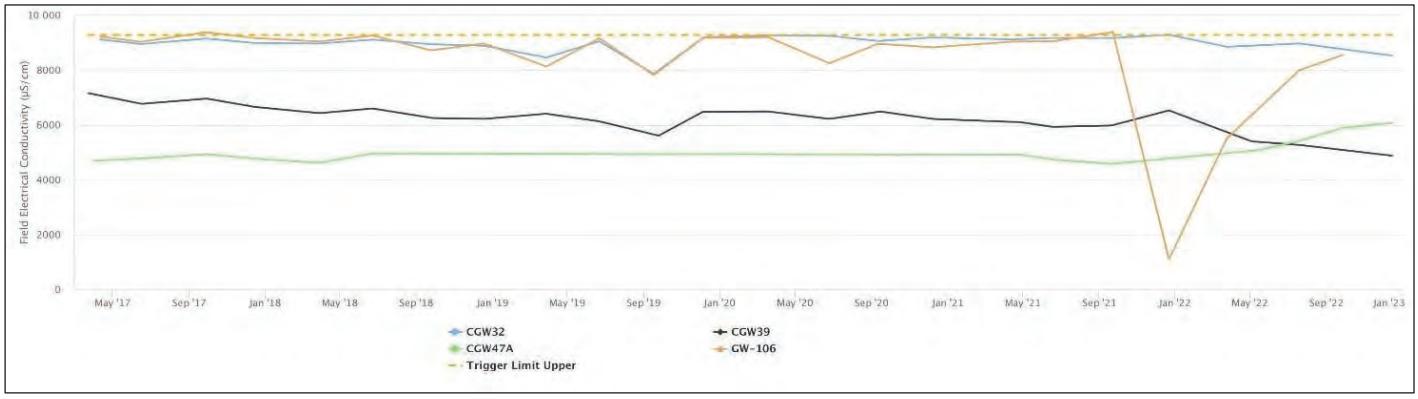

Figure 7-32: Carrington West Wing Flood Plain Groundwater EC Trends 2017 – 2022

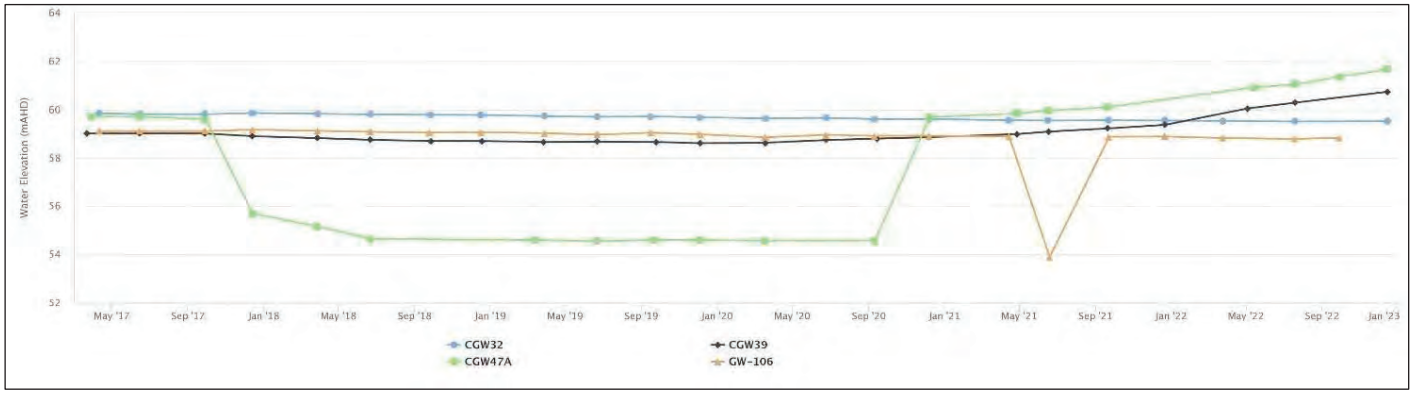

Figure 7-33: Carrington West Wing Flood Plain Groundwater SWL Trends 2017 – 2022

Cheshunt/North Pit Alluvium

Electrical Conductivity, pH and SWL trends for 2017 to 2022 are shown in **Figure 7-34** to **Figure 7-36**. Water quality results were generally consistent with historical trends. Hobdens Well is screened within alluvium, located between the Hunter River and Cheshunt Pit. Historical readings show that Hobdens Well has recorded pH ranging between 7.1 and 8.2. Review of pH readings indicated levels fluctuated slightly, but within historical levels over 2022. The results show no adverse impacts due to mining.

Trigger tracking results are listed in **Table 7-12**

Table 7-12: HVO Cheshunt/North Pit Alluvium Groundwater 2022 Monitoring Internal Trigger Exceedances

Location	Date	Trigger Limit	Action Taken in Response
Hobdens Well	23/08/2022	pH – 95th Percentile	First exceedance - monitor

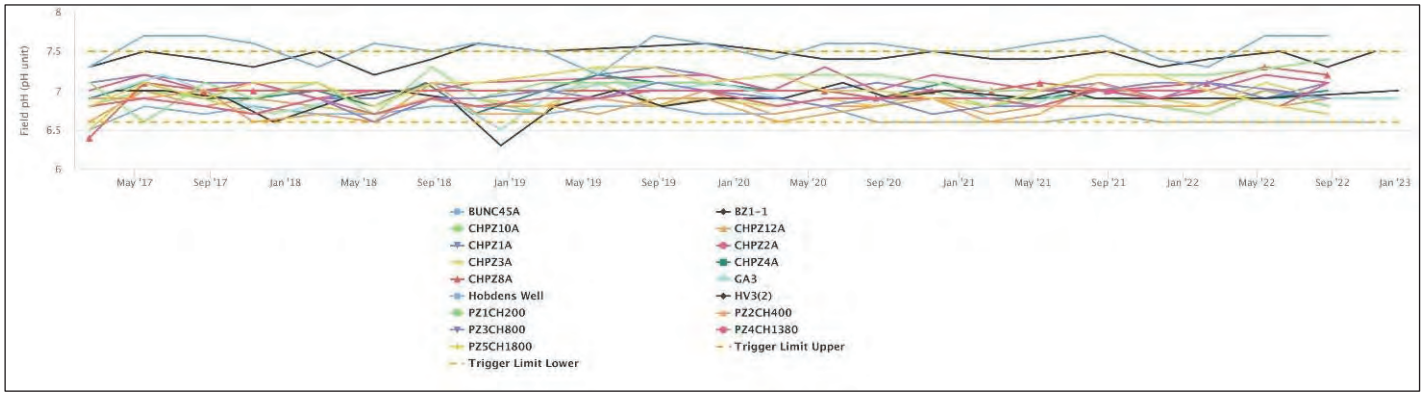

Figure 7-34: Cheshunt/North Pit Alluvium Groundwater pH Trends 2017 – 2022

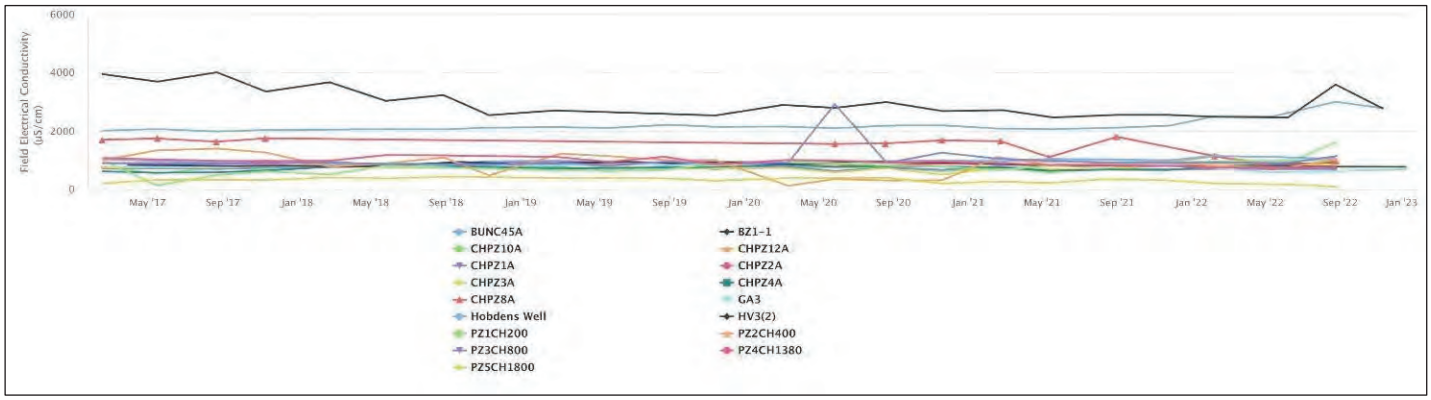

Figure 7-35: Cheshunt/North Pit Alluvium Groundwater EC Trends 2017 – 2022

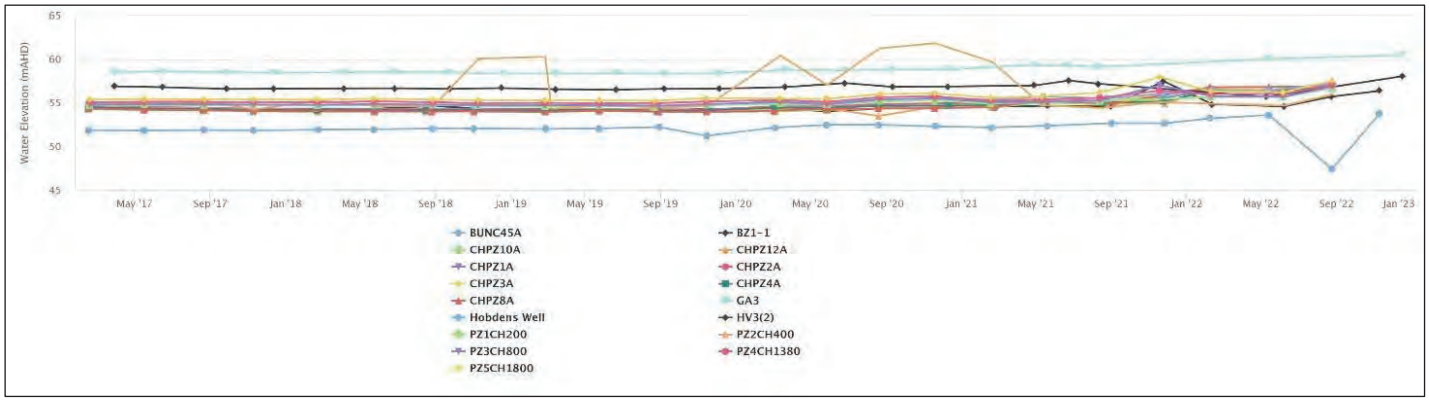

Figure 7-36: Cheshunt/North Pit Alluvium Groundwater SWL Trends 2017 – 2022

Cheshunt Interburden

The EC, pH and SWL trends for 2017 to 2022 are shown in **Figure 7-37** to **Figure 7-39**. Water quality results were generally consistent with historical trends.

There were no results outside of triggers in 2022.

Figure 7-37: Cheshunt Interburden Groundwater pH Trends 2017 – 2022

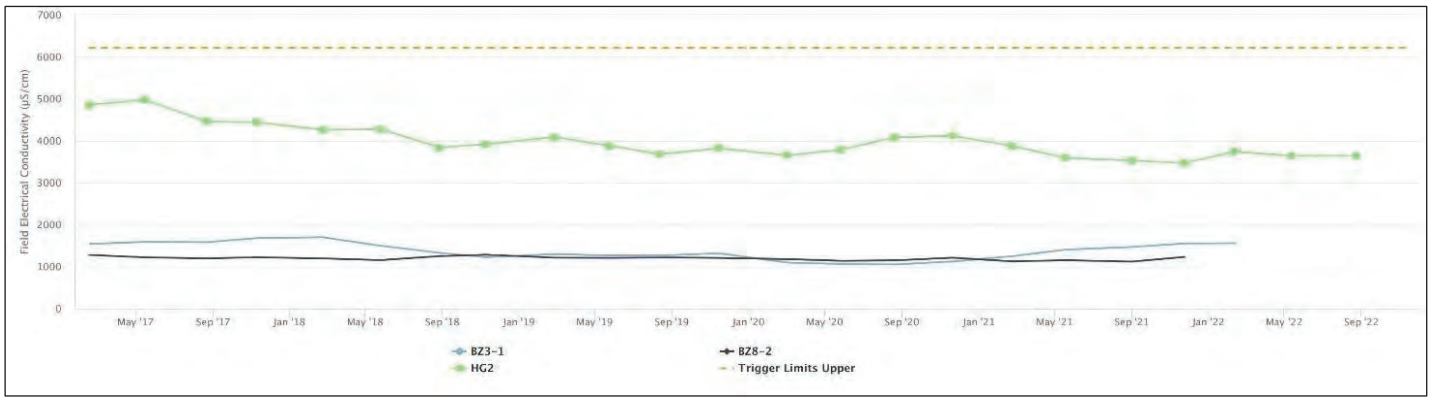

Figure 7-38: Cheshunt Interburden Groundwater EC Trends 2017 – 2022

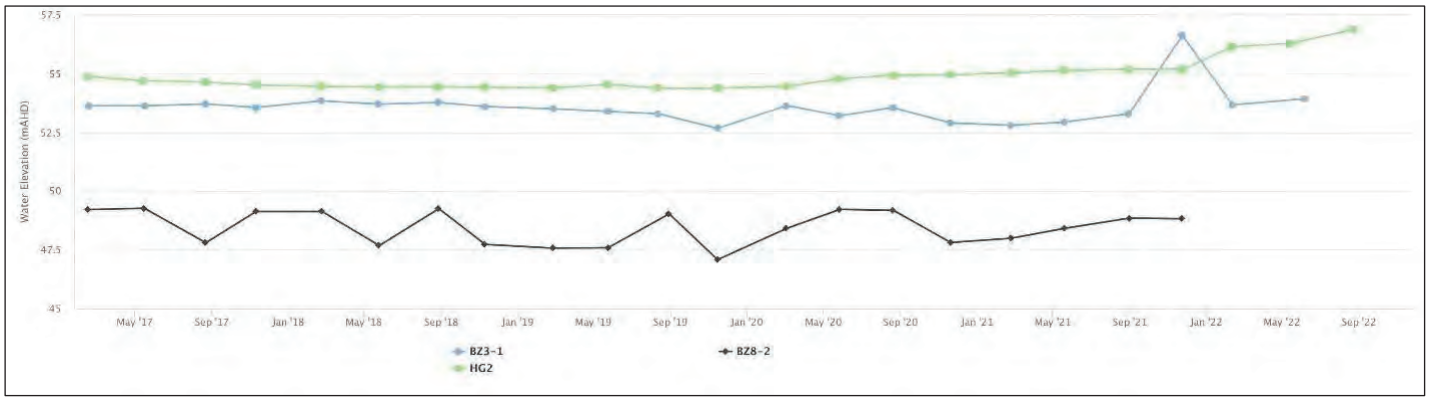

Figure 7-39 Cheshunt Interburden Groundwater SWL Trends 2017 – 2022

Cheshunt Mt Arthur

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-40** to **Figure 7-42**. Water quality results were generally consistent with historical trends except for pH. Based on historical data, pH results from all three bores have been gradually trending downward since July 2011. The groundwater level measured at the bores has typically been within or below the screened section of bores BZ4A(2) and BZ3-3 (pH – 5th Percentile). Purging/sample collection within bore BZ2A(1) and BZ3-3 may induce localised groundwater drawdown to within the screened section. This may be the cause of the reducing pH measured at these bores. The updated draft WMP includes amendments to the Cheshunt - Mt Arthur seam groundwater monitoring, including:

• BZ2A(1) and BZ3-3 being removed from trigger level assessment, with trigger values remaining for BZ4(A)2; and

• the pH trigger level value reducing to 6.4 (from the current value of 6.5) for all bores monitoring the Cheshunt- Mt Arthur Seam.

Trigger tracking results are listed in **Table 7-13**.

Table 7-13: Cheshunt Mt Arthur Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
BZ2A(1)	10/02/2022	pH – 5th Percentile	First consecutive trigger exceedance - watching brief established
BZ3-3	11/02/2022	pH – 5th Percentile	First consecutive trigger exceedance - watching brief established
BZ4A(2)	10/02/2022	pH – 5th Percentile	First consecutive trigger exceedance - watching brief established
BZ2A(1)	06/06/2022	pH – 5th Percentile	Second consecutive trigger exceedance - watching brief maintained
BZ3-3	06/06/2022	pH – 5th Percentile	Second consecutive trigger exceedance - watching brief maintained
BZ4A(2)	06/06/2022	pH – 5th Percentile	Second consecutive trigger exceedance - watching brief maintained
BZ2A(1)	23/08/2022	pH – 5th Percentile	First consecutive trigger exceedance - watching brief established
BZ3-3	23/08/2022	pH – 5th Percentile	First consecutive trigger exceedance - watching brief established

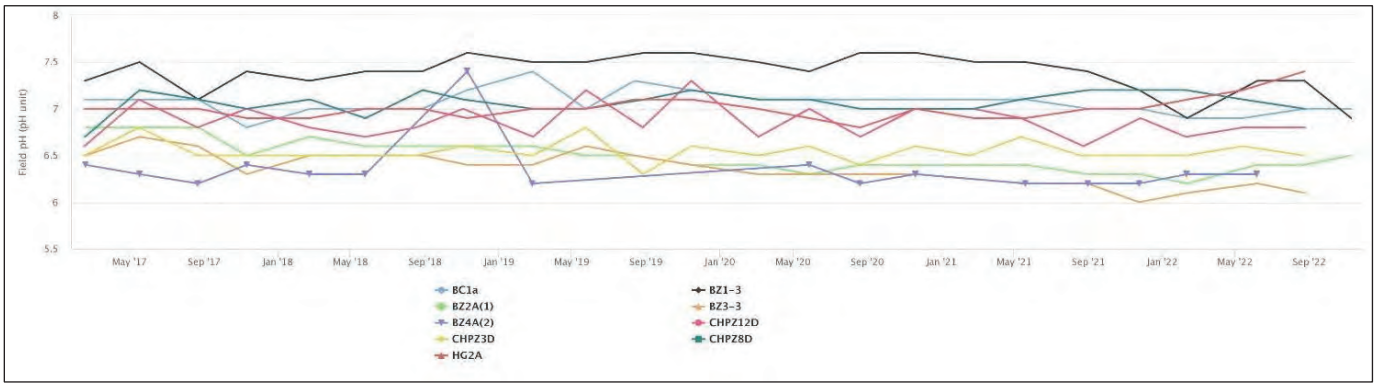

Figure 7-40: Cheshunt Mt Arthur Groundwater pH Trends 2017 – 2022

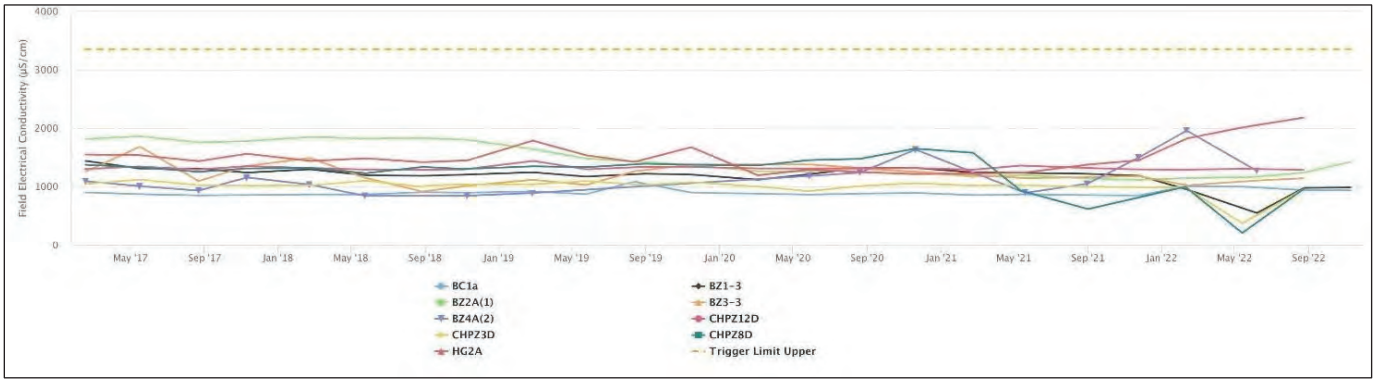

Figure 7-41: Cheshunt Mt Arthur Groundwater EC Trends 2017 – 2022

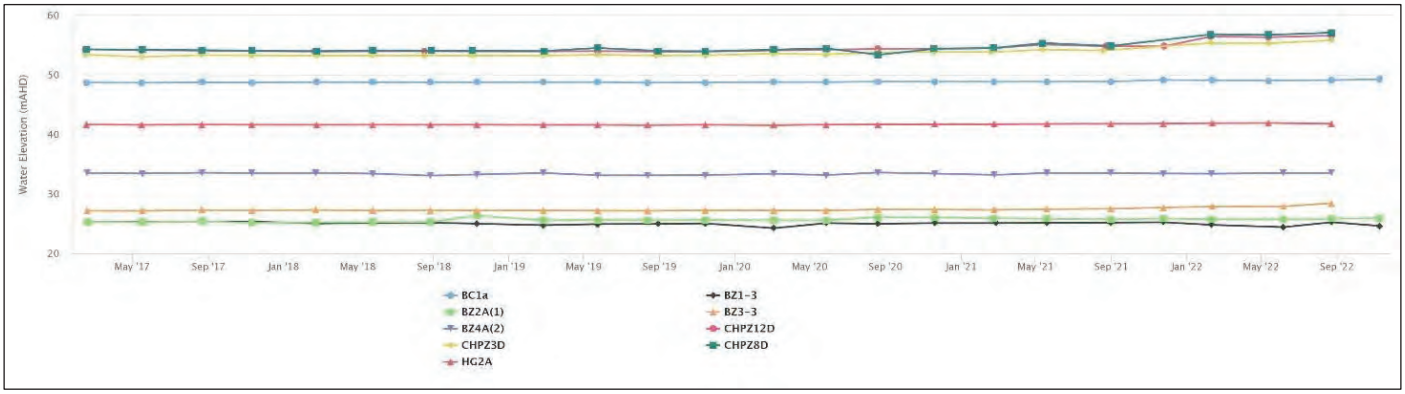

Figure 7-42: Cheshunt Mt Arthur Groundwater SWL Trends 2017 – 2022

Cheshunt Piercefield

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-43** to **Figure 7-45**. Water quality results were generally consistent with historical trends.

There were no trigger exceedances recorded in 2022.

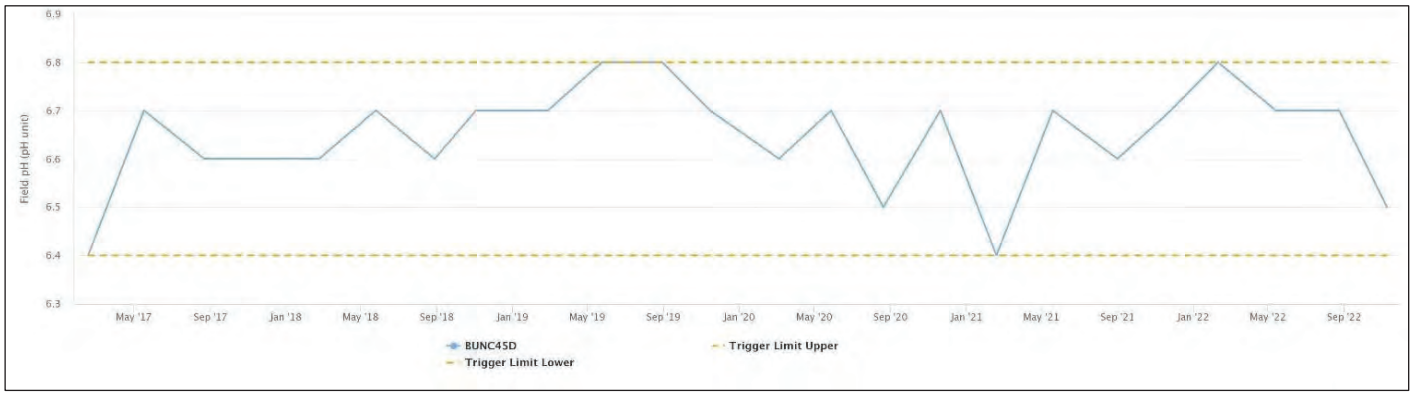

Figure 7-43: Cheshunt Piercefield Groundwater pH Trends 2017 – 2022

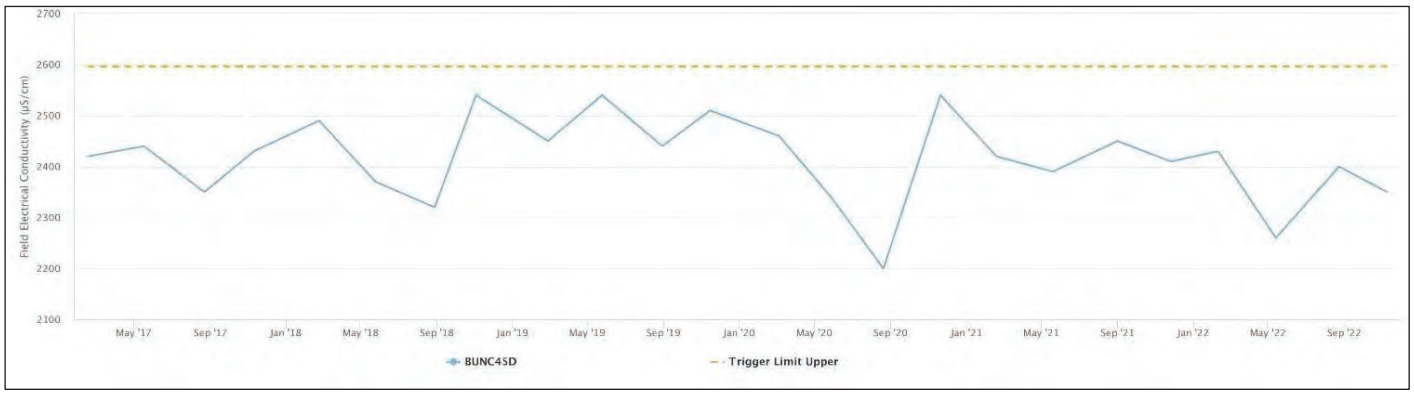

Figure 7-44: Cheshunt Piercefield Groundwater EC Trends 2017 – 2022

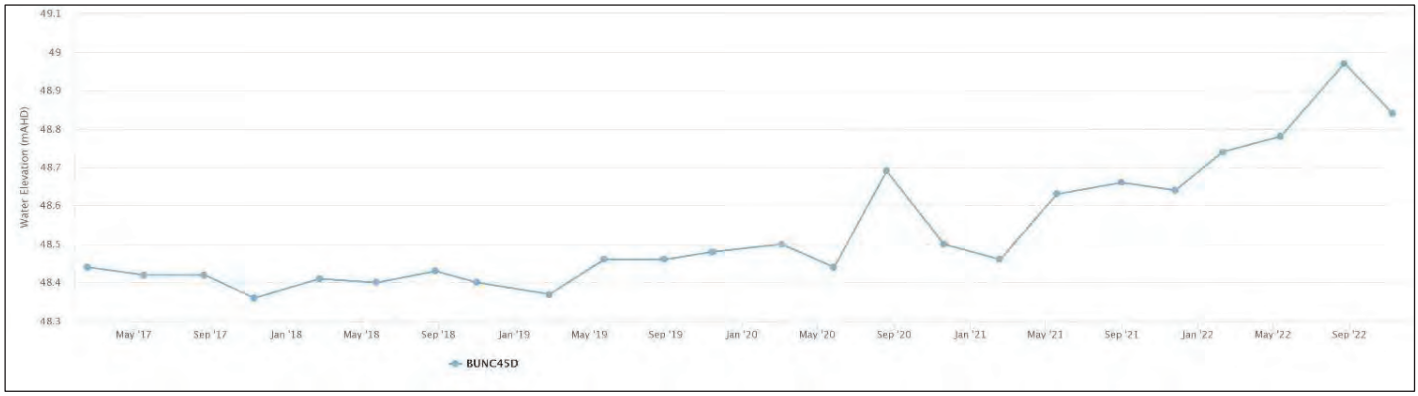

Figure 7-45: Cheshunt Piercefield Groundwater SWL Trends 2017 – 2022

Lemington South Alluvium

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-46** to **Figure 7-48**. Water quality results were generally consistent with historical trends.

Trigger limits are listed in **Table 7-14.**

Table 7-14: Lemington South Alluvium Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
PB01(ALL)	02/08/2022	pH – lower	First consecutive trigger exceedance - watching brief established
PB01(ALL)	22/11/2022	pH – lower	Second consecutive trigger exceedance - watching brief maintained

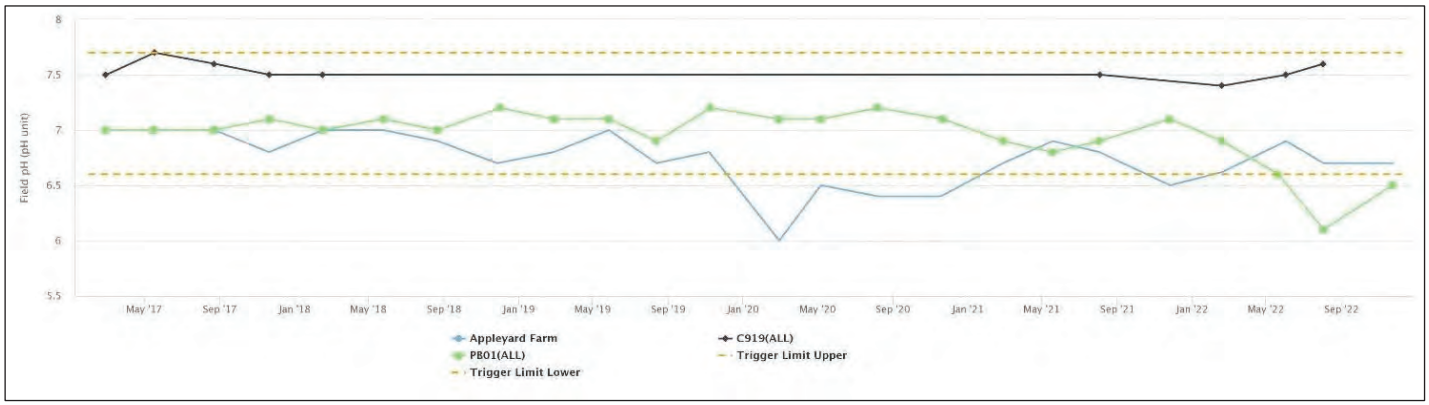

Figure 7-46: Lemington South Alluvium Groundwater pH Trends 2017 – 2022

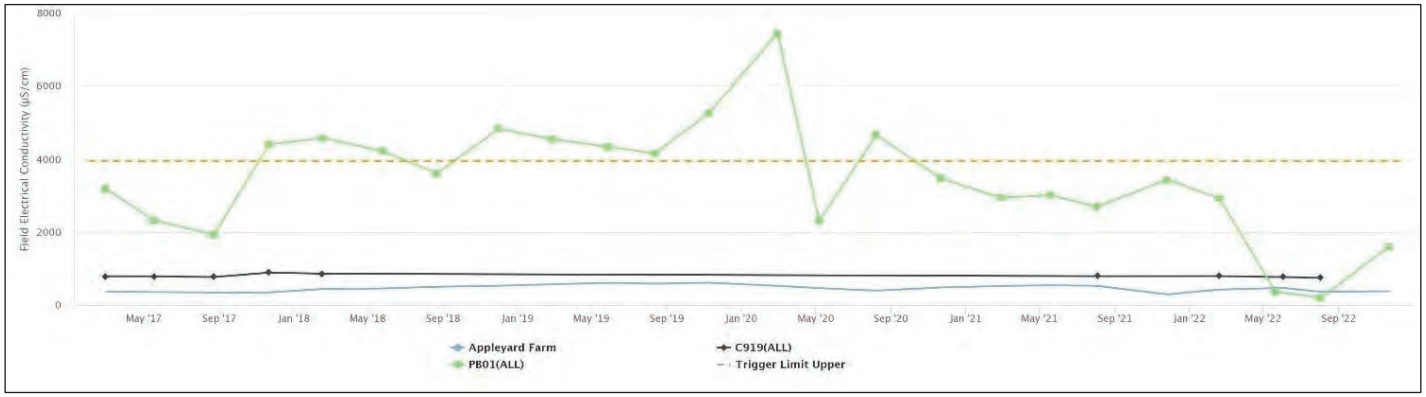

Figure 7-47: Lemington South Alluvium Groundwater EC Trends 2017 – 2022

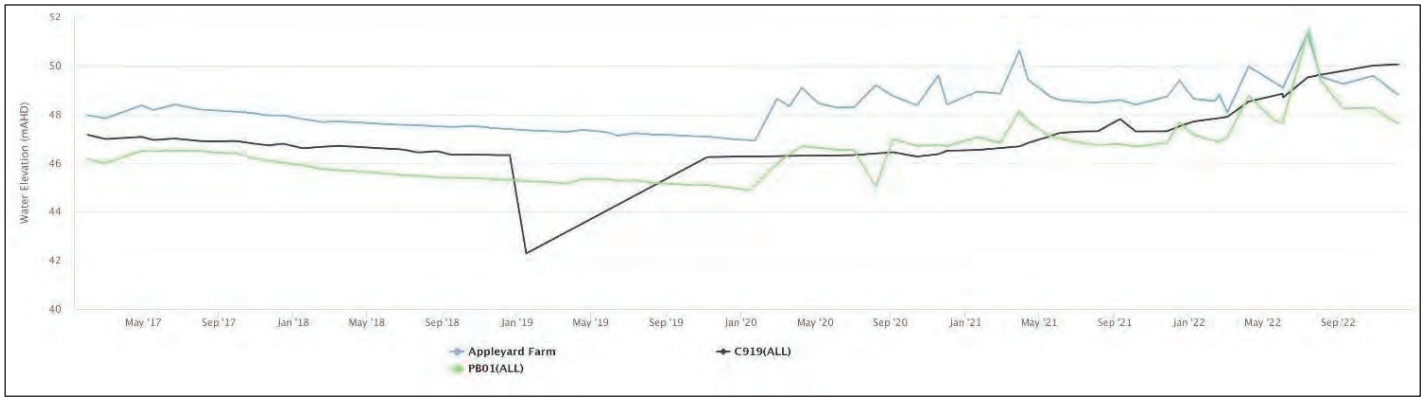

Figure 7-48: Lemington South Alluvium Groundwater SWL Trends 2017 – 2022

Lemington South Arrowfield

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-49** to **Figure 7-51**. Water quality results were generally consistent with historical trends.

There were no trigger exceedances recorded in 2022.

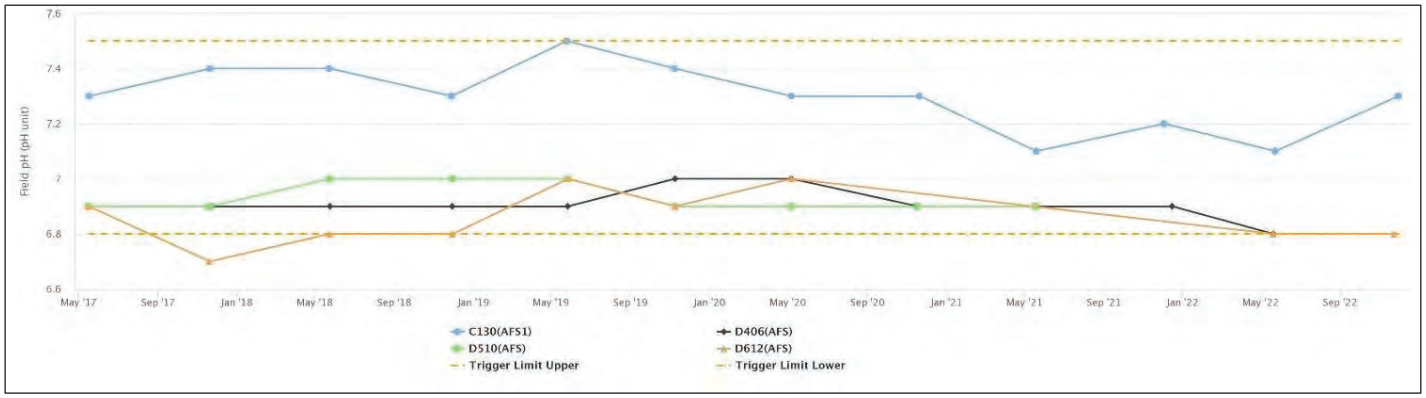

Figure 7-49: Lemington South Arrowfield Groundwater pH Trends 2017 – 2022

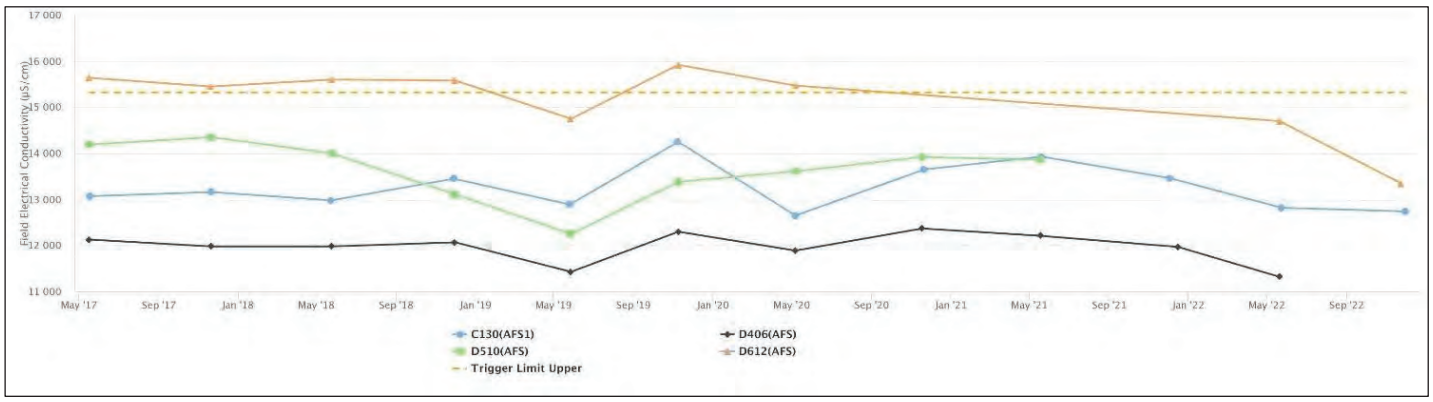

Figure 7-50: Lemington South Arrowfield Groundwater EC Trends 2017 – 2022

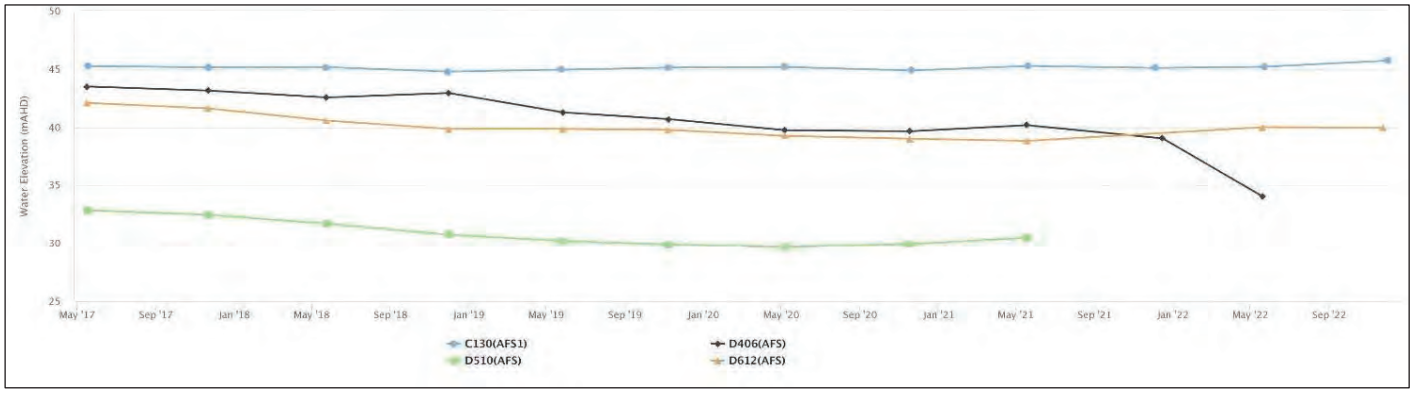

Figure 7-51: Lemington South Arrowfield Groundwater SWL Trends 2017 – 2022

Lemington South Bowfield

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-52** to **Figure 7-54**. Water quality results were generally considered to be consistent with historical trends with the exception of triggers exceeded as listed in **Table 7-15**. The 2022 trigger value exceedances are not considered to reflect a mining related impact. Historical monitoring data from July 2011–December 2022 shows that EC values have exceeded the trigger value at bores B631(BFS), D010(GM) and C130(WDH) for approximately 10 years. Therefore, the EC trigger value for the Lemington South - Bowfield Seam, Glen Munro Seam and Woodlands Hill Seam is not considered appropriate to assess mining activity induced groundwater impacts. The WMP (HVO 2021) has been updated to reflect this observation and the assignment of trigger values has been removed for bores B631(BFS) and D010(GM). The draft WMP includes a revised upper EC trigger value for all Woodlands Hill seam bores, including C130(WDH), to 20,900 µS/cm. However, future monitoring results may still exceed this trigger value and therefore may not be suitable for C130(WDH). pH trigger values are no longer assigned to B631(BFS) in the updated draft WMP. In addition, the upper pH trigger value has been increased to 8.0 (from 7.9) for all other Bowfield Seam bores (in the Lemington South area).

Note that C122 (BFS) has been excluded from the graphs as there was insufficient water for sampling during the reporting period.

Trigger limits tracking is listed in **Table 7-15**

Table 7-15: Lemington South Bowfield Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
C122(BFS)	02/06/2022	pH – 95th Percentile	Sample was likely below the base of the screen and not representative of the Bowfield seam.
D214(BFS)	23/11/2022	pH – 5th Percentile	First consecutive trigger exceedance - watching brief established
D510(BFS)	23/11/2022	pH – 5th Percentile	First consecutive trigger exceedance - watching brief established
B631(BFS)	30/11/2022	pH – 95th Percentile	First consecutive trigger exceedance - watching brief established

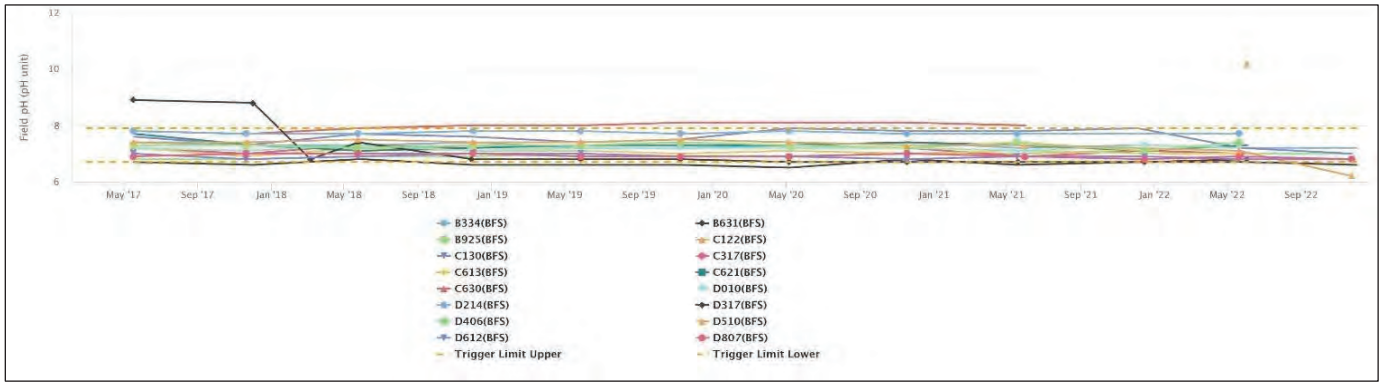

Figure 7-52: Lemington South Bowfield Groundwater pH Trends 2017 – 2022

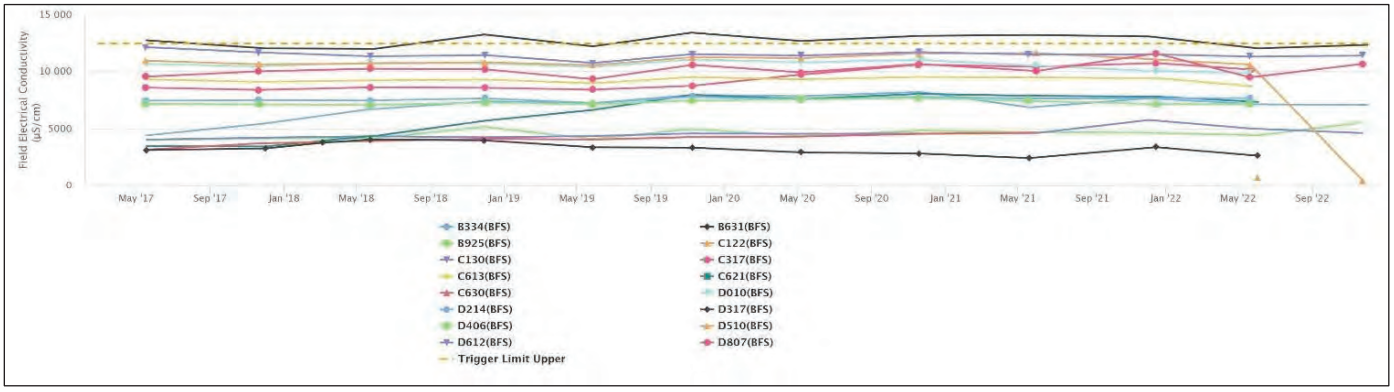

Figure 7-53: Lemington South Bowfield Groundwater EC Trends 2017 – 2022

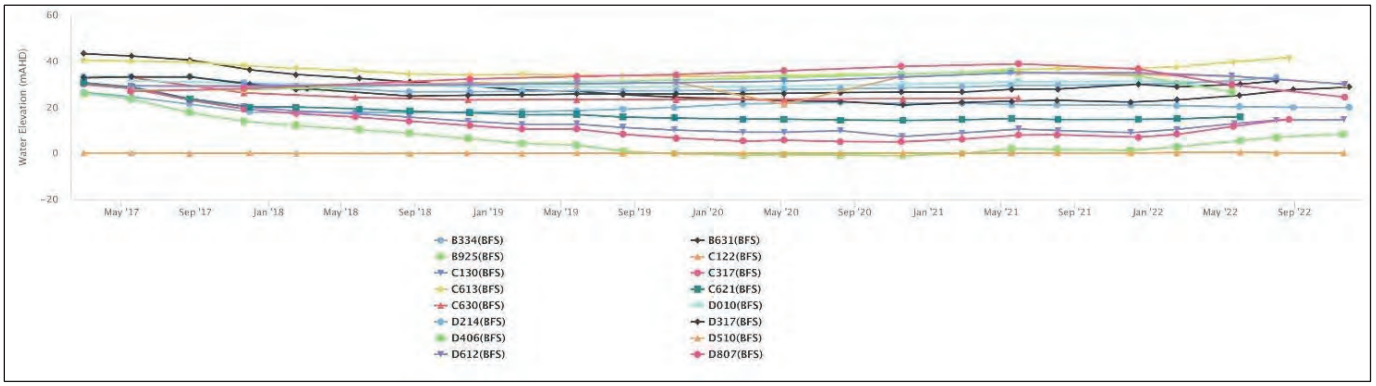

Figure 7-54: Lemington South Bowfield Groundwater SWL Trends 2017 – 2022

Lemington South Interburden

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-55** to **Figure 7-57**. Historical readings of C130(ALL) show regular fluctuations of pH between 6.4 and 7.9 The 2022 readings for pH are considered consistent with historical concentrations. All of the EC measurements in the period 2011-2022 have exceeded the trigger value of 11,408 µS/cm. Therefore, the EC trigger value for the Lemington South – Interburden is not considered appropriate to assess the potential impact of approved mining activity on groundwater at this bore location. EC values were consistently reported between 20,000 and 22,000 µS/cm from 2011 to 2017 and followed an increasing trend from 2018 to early 2020 reaching a maximum of 32,400 µS/cm in February 2020 as reported in previous annual groundwater reviews.

A downward trend has been observed since early 2020, which coincides with a period of increased rainfall following the recent drought. In the updated draft WMP (HVO 2021), C130(ALL) has been reassigned to Lemington South – Overburden, and the EC trigger value is proposed to increase to 23,500 µS/cm.

Trigger limits tracking is listed in **Table 7-16**.

Table 7-16: Lemington South Interburden Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
C130 (All)	30/11/2022	EC – 95th Percentile	New trigger value recommended

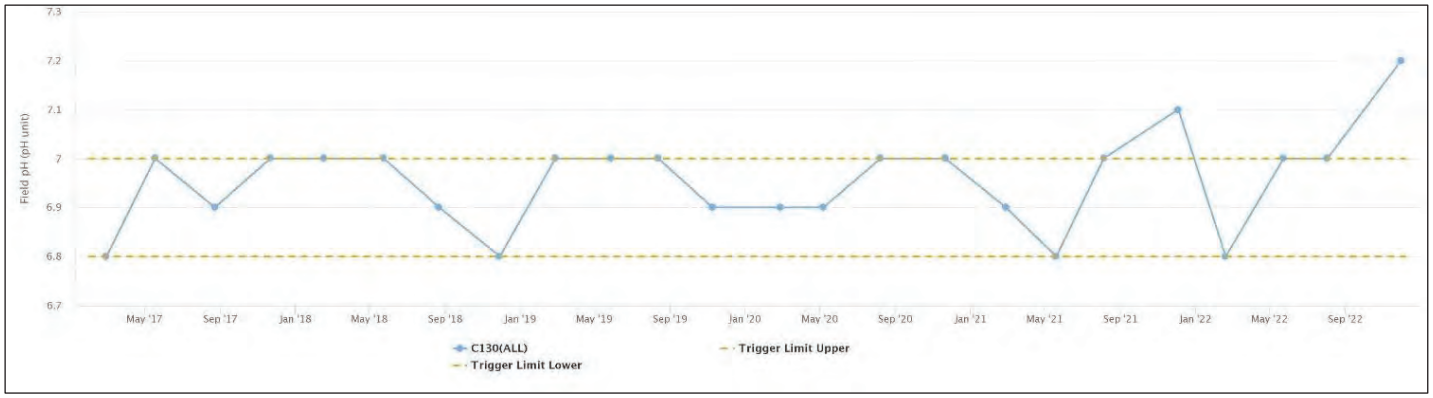

Figure 7-55: Lemington South Interburden Groundwater pH Trends 2017 – 2022

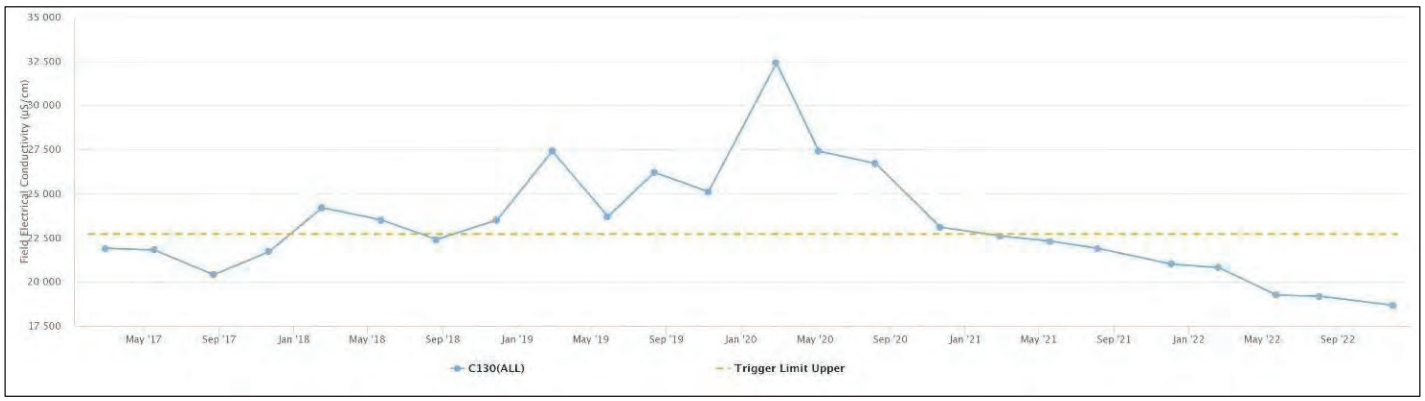

Figure 7-56: Lemington South Interburden Groundwater EC Trends 2017 – 2022

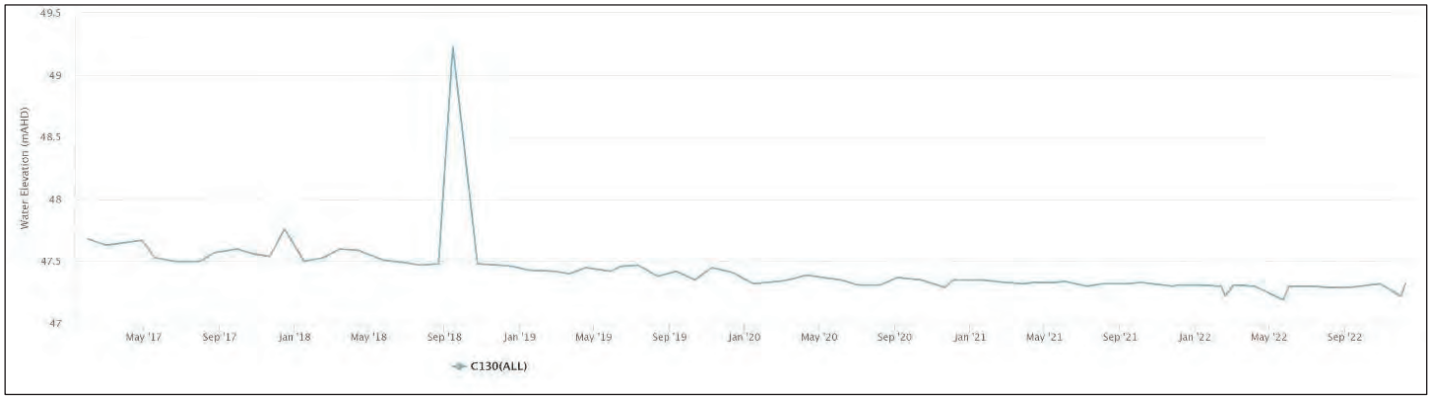

Figure 7-57: Lemington South Interburden Groundwater SWL Trends 2017 – 2022

Lemington South Woodlands Hill

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-58** to **Figure 7-60**. Water quality results were generally consistent with historical trends.

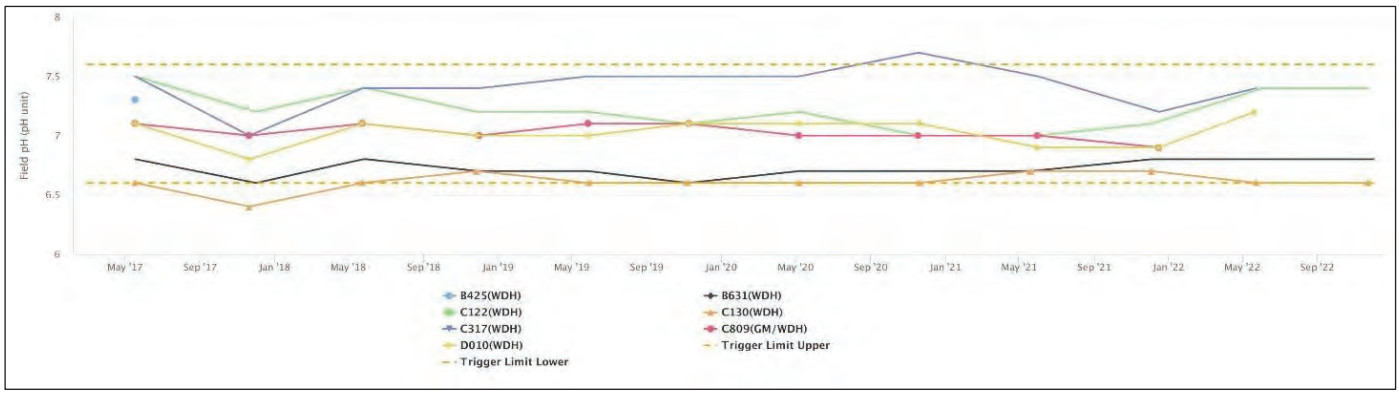

Figure 7-58: Lemington South Woodlands Hill Groundwater pH Trends 2017 – 2022

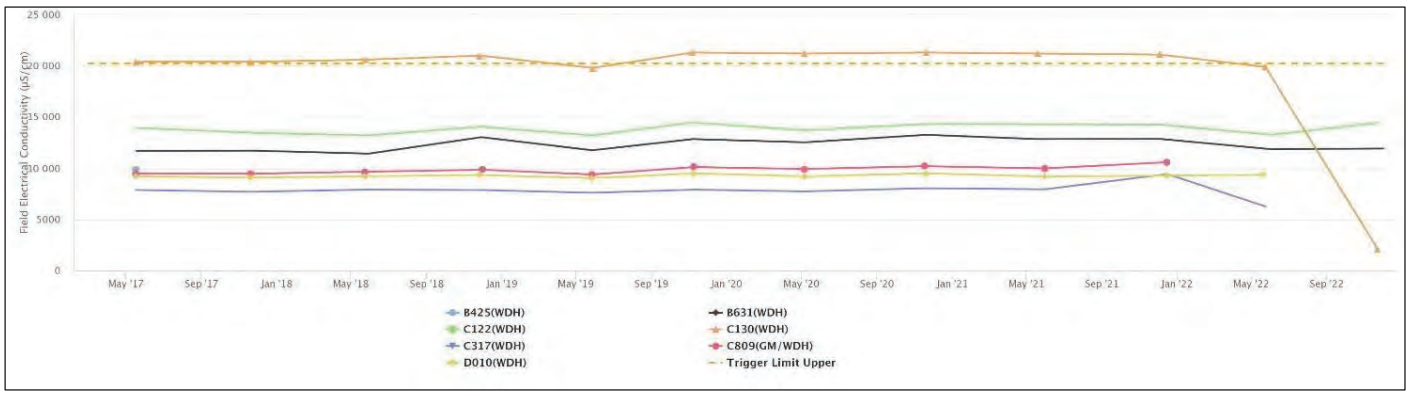

Figure 7-59: Lemington South Woodlands Hill Groundwater EC Trends 2017 – 2022

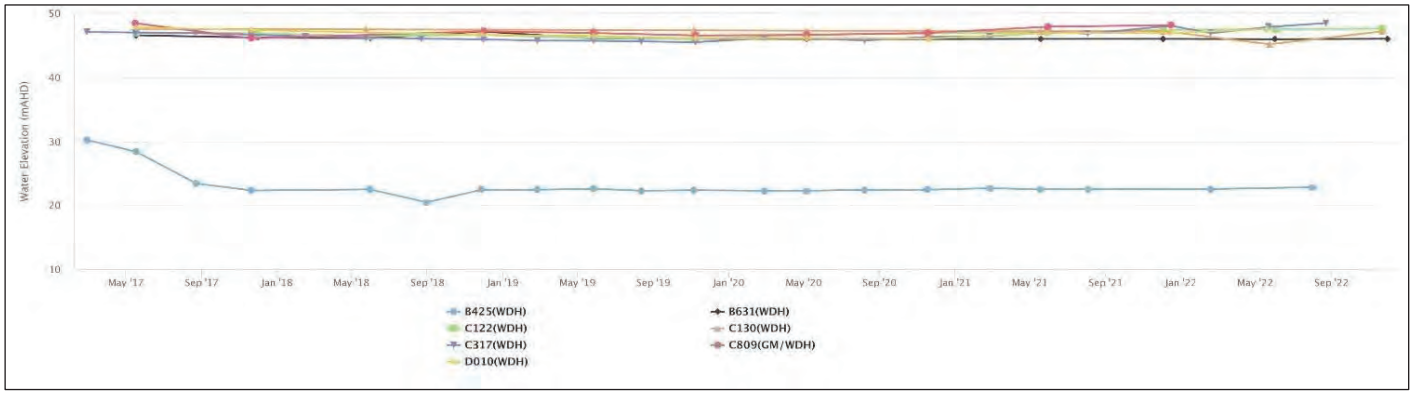

Figure 7-60: Lemington South Woodlands Hill Groundwater SWL Trends 2017 – 2022

Lemington South Glen Munro

Groundwater monitoring in the Lemington South Glen Munro seam was conducted twice in 2022 from one monitoring location. The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-61** to **Figure 7-63**. Water quality results were generally consistent with historical trends.

Internal triggers are listed in **Table 7-17**. As noted above the assignment of trigger values has been removed for bore D010(GM) in the draft WMP.

Table 7-17: Lemington South Glen Munro Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
D010 (GM)	Q4	EC – 95th Percentile	Recommendation to cease monitoring against trigger level.

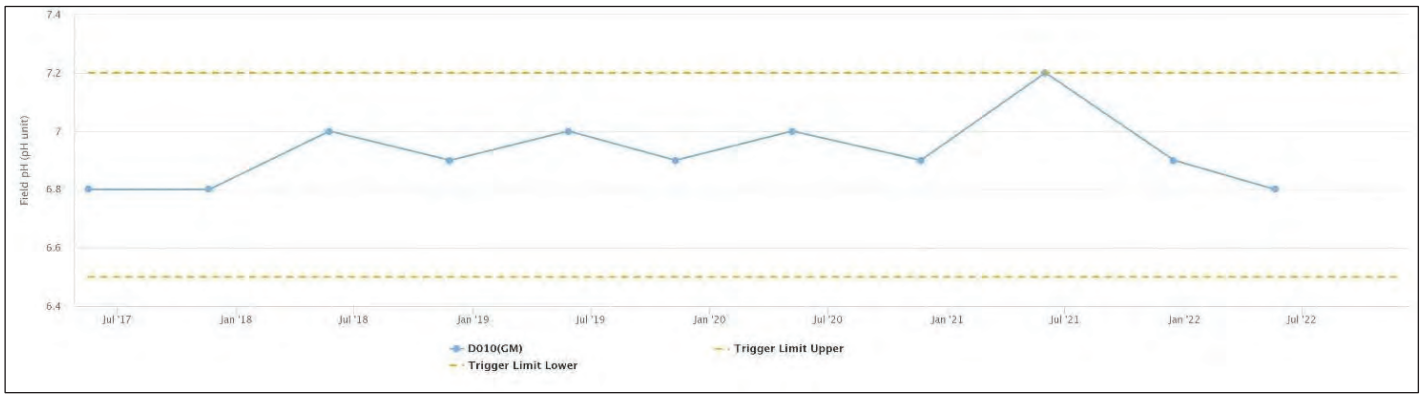

Figure 7-61: Lemington South Glen Munro Groundwater pH Trends 2017 – 2022

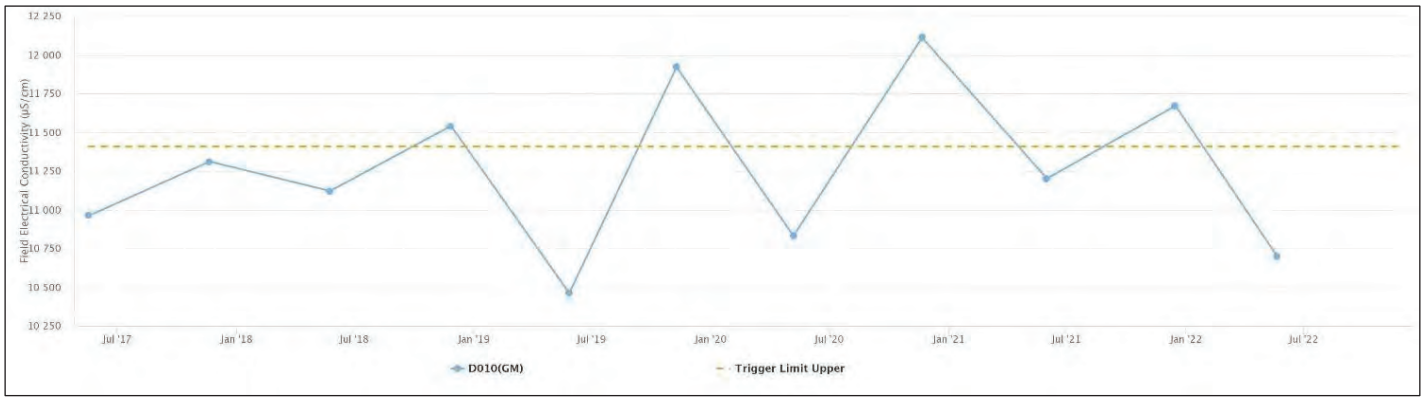

Figure 7-62: Lemington South Glen Munro Groundwater EC Trends 2017 – 2022

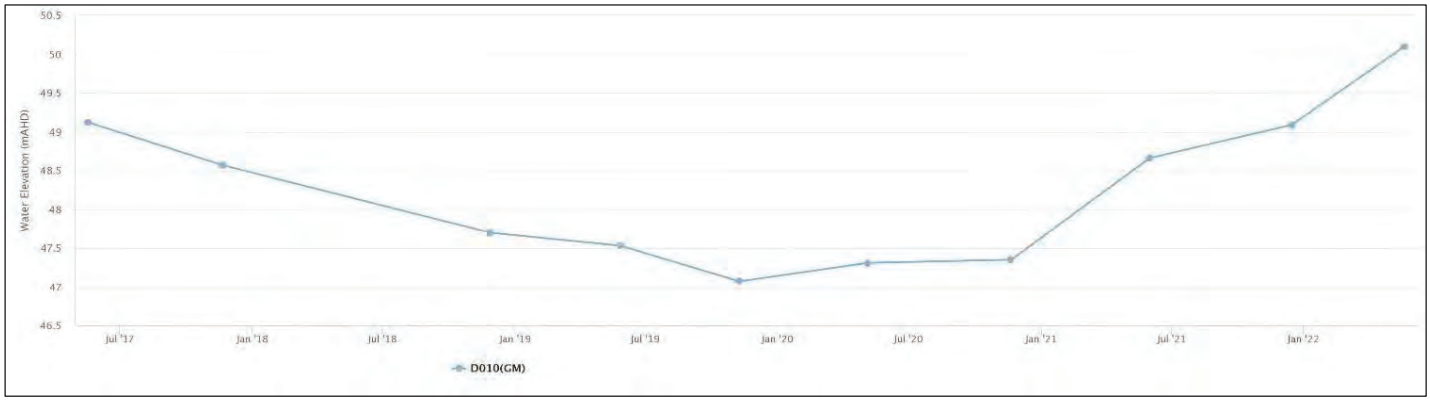

Figure 7-63: Lemington South Glen Munro Groundwater SWL Trends 2017 – 2022

North Pit Spoil

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-64** to **Figure 7-66**. Groundwater levels increased by up to 2.5m (DM7) consistent with rainfall trends. Groundwater within the spoil flows from northern-most bore DM1 in a southerly direction towards the southern-most bore MB14HVO03. EC and pH was found to generally be within historical levels.

Internal triggers are listed in **Table 7-18**.

Table 7-18: North Pit Spoil Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
4116P	27/07/2022	EC – 95th Percentile	First consecutive trigger exceedance – watching brief established
DM3	27/09/2022	pH - 5th Percentile	First consecutive trigger exceedance – watching brief established

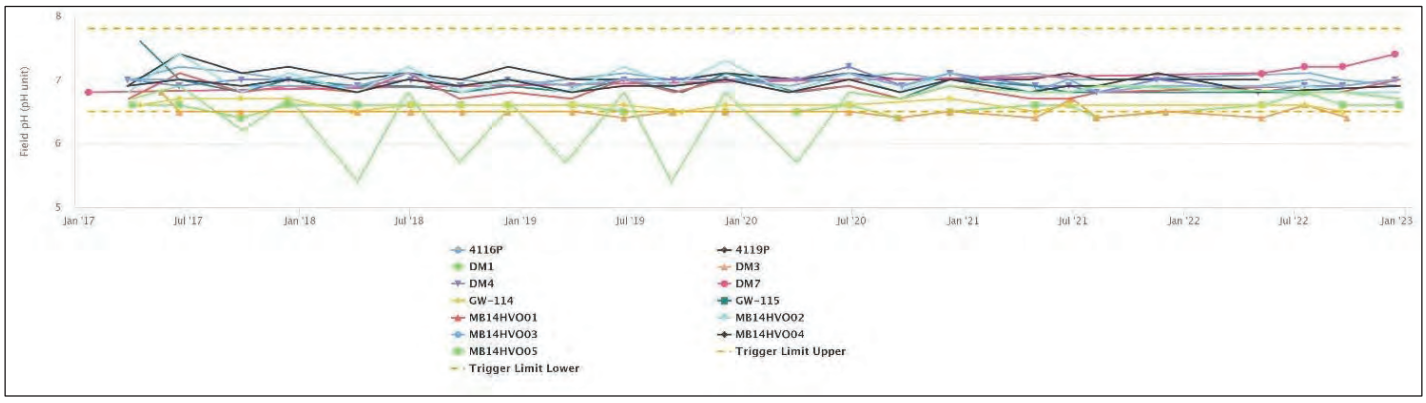

Figure 7-64: North Pit Spoil Groundwater pH Trends 2017 – 2022

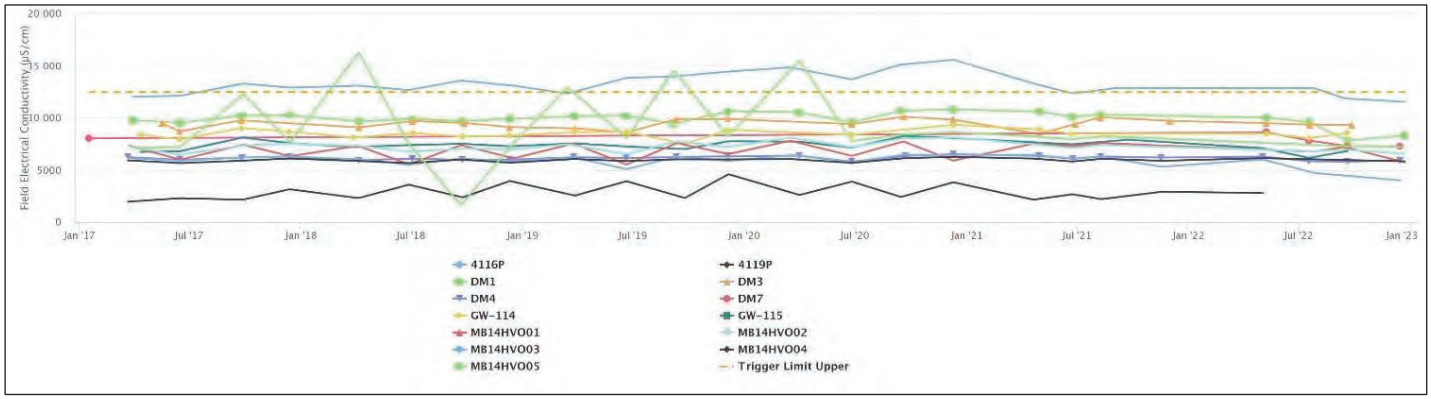

Figure 7-65: North Pit Spoil Groundwater EC Trends 2017 – 2022

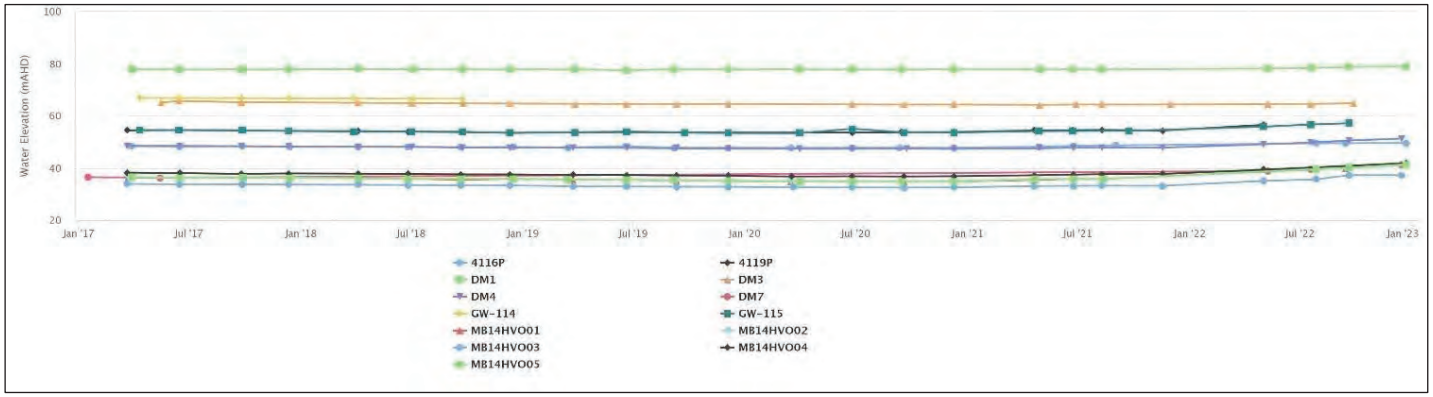

Figure 7-66: North Pit Spoil Groundwater SWL Trends 2017 – 2022

West Pit Alluvium

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-67** to **Figure 7-69**. Bore GW-101 was unable to be sampled due to insufficient water and lack of access throughout 2022. Water quality results were generally consistent with historical trends.

Bores G1, G2 and G3 continued to be monitored on a monthly basis during the reporting period. Monitoring frequency of these bores will be reviewed in the next reporting period. Monitoring in bores GW-100 and GW-101 was undertaken quarterly in accordance with the HVO Groundwater Monitoring Programme.

There were no trigger exceedances recorded in 2022.

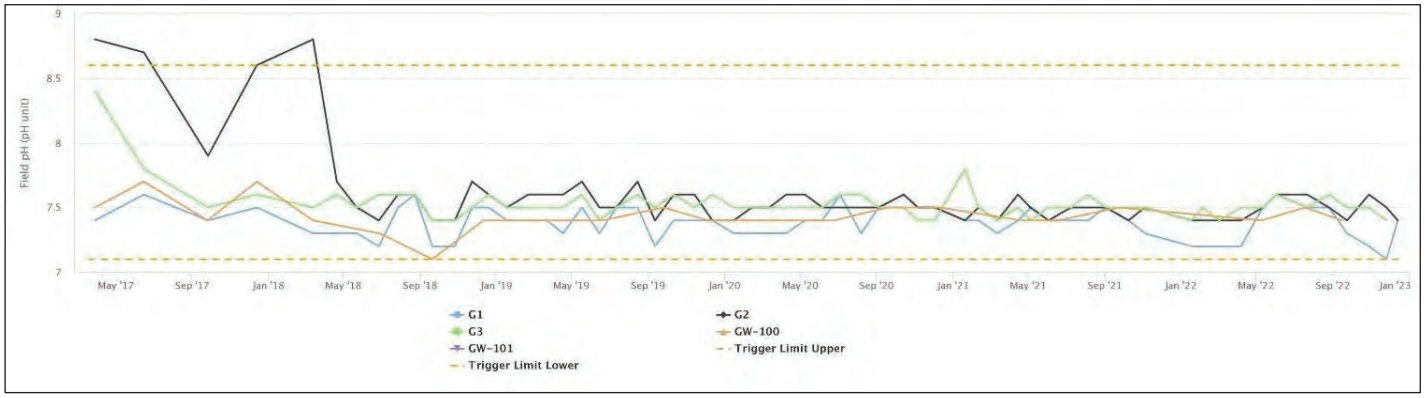

Figure 7-67: West Pit Alluvium Groundwater pH Trends 2017 – 2022

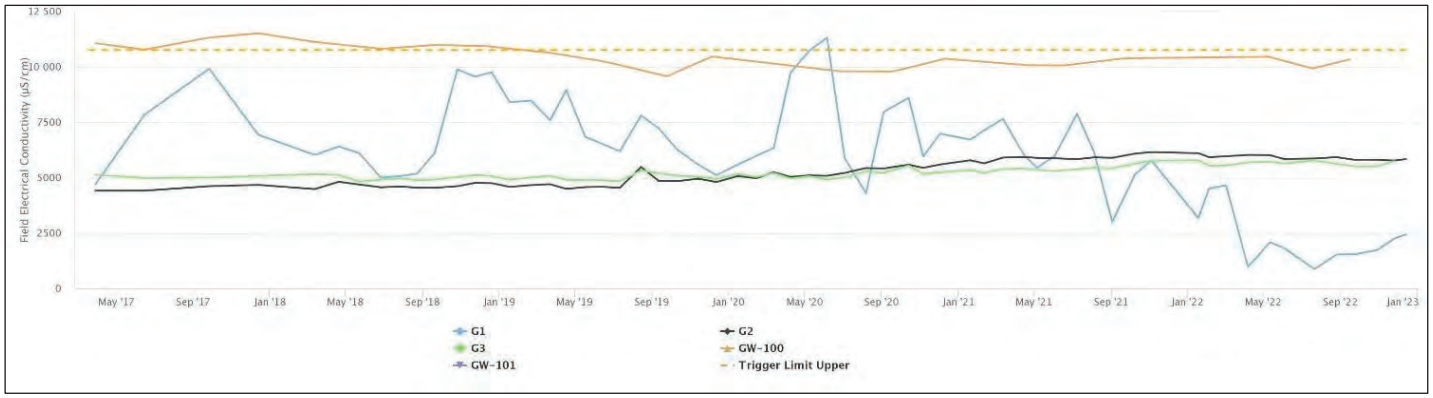

Figure 7-68: West Pit Alluvium Groundwater EC Trends 2017 – 2022

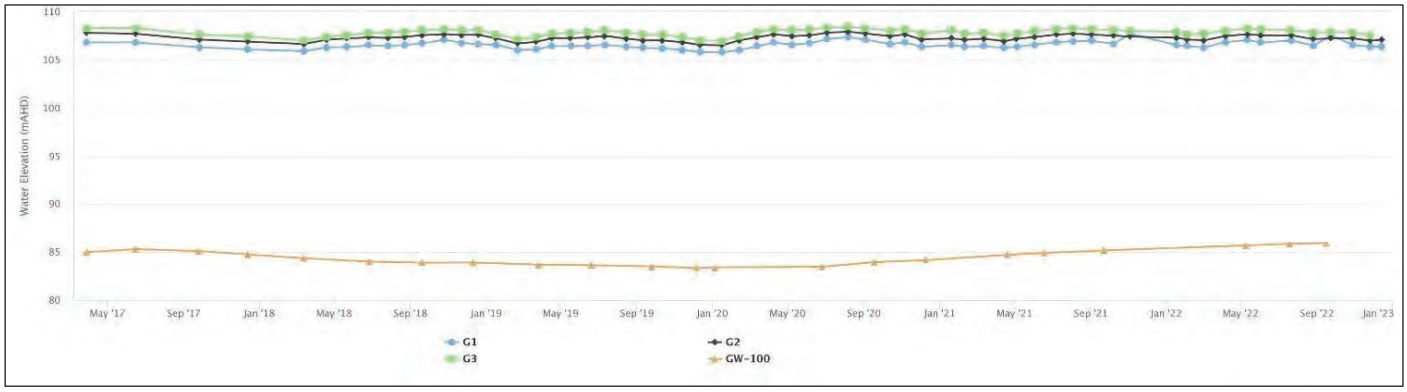

Figure 7-69: West Pit Alluvium Groundwater SWL Trends 2017 – 2022

West Pit Sandstone/Siltstone

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-70** to **Figure 7-72**. Water quality results were generally consistent with historical trends. Bore NPZ2 is located northwest of West Pit beyond the outcrop of coal seams mined at West Pit and intersects Interburden sequences beneath the coal seams. EC readings range from 12,590 µS/cm (December 2014) and 19,400 µS/cm (December 2009). The 2022 readings are consistent with historical concentrations. The 2019 Groundwater Network Review (SLR, 2019a) noted that the bore is unlikely to detect relevant site impacts and recommended removal from the compliance monitoring network but kept in operational monitoring network for future work. The bore has already been removed from the compliance monitoring network in version 3.4 of the WMP which is currently with DPE for approval.

Internal triggers are listed in **Table 7-19**.

Table 7-19: West Pit Sandstone/Siltstone Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
NPZ2	09/05/2022	EC – 95th Percentile	Recommendation to remove from compliance monitoring
NPZ2	18/07/2022	EC – 95th Percentile	
NPZ2	15/09/2022	EC – 95th Percentile	
NPZ2	15/12/2022	EC – 95th Percentile	

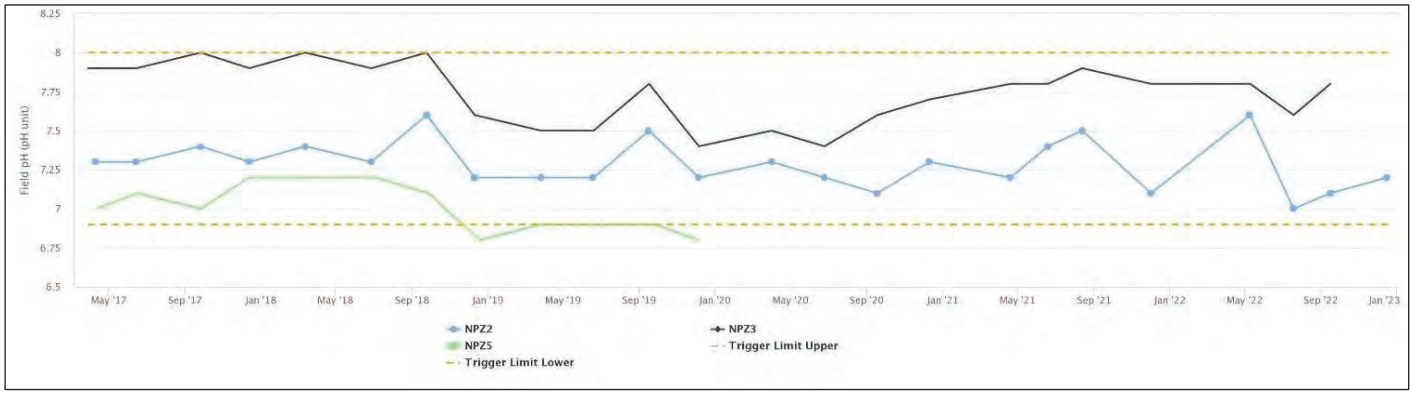

Figure 7-70: West Pit Sandstone/Siltstone Groundwater pH Trends 2017 – 2022

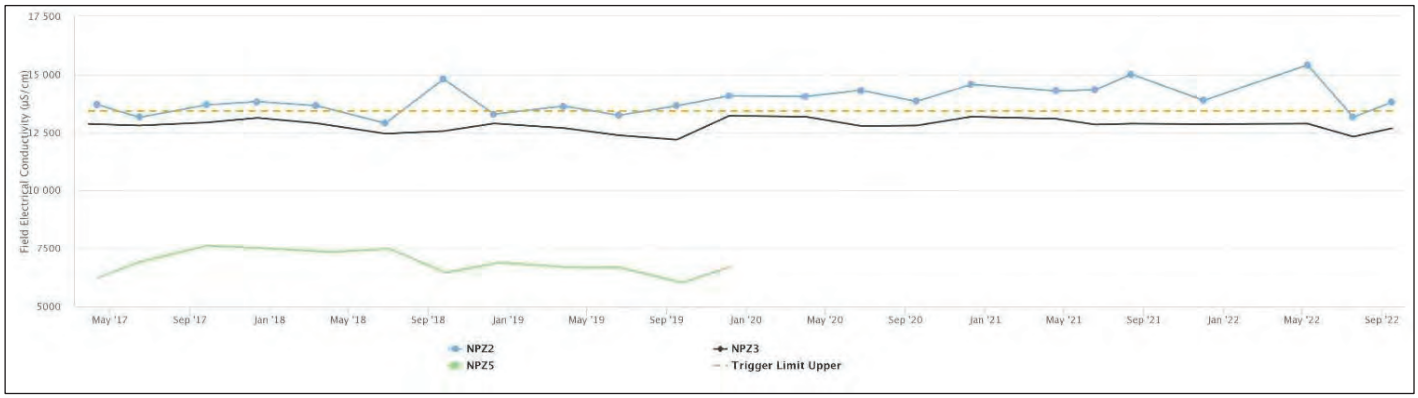

Figure 7-71: West Pit Sandstone/Siltstone Groundwater EC Trends 2017 – 2022

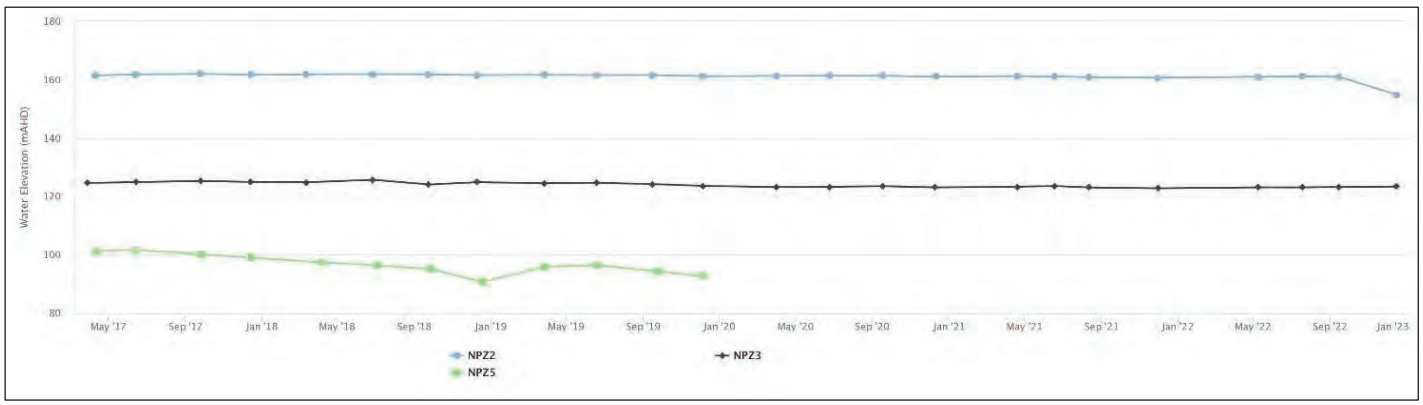

Figure 7-72: West Pit Sandstone/Siltstone Groundwater SWL Trends 2017 – 2022

Carrington West Wing Bayswater

The pH, EC and SWL trends for 2017 to 2022 are shown in **Figure 7-73** to **Figure 7-75**. Water quality results were generally consistent with historical trends although there was a drop in EC and SWL.

Internal triggers are listed in **Table 7-20**

Table 7-20: Carrington West Wing Bayswater Groundwater 2022 Monitoring Internal Trigger Tracking

Location	Date	Trigger Limit	Action Taken in Response
CGW46	27/07/2022	pH – 5th Percentile	First consecutive trigger exceedance – watching brief established

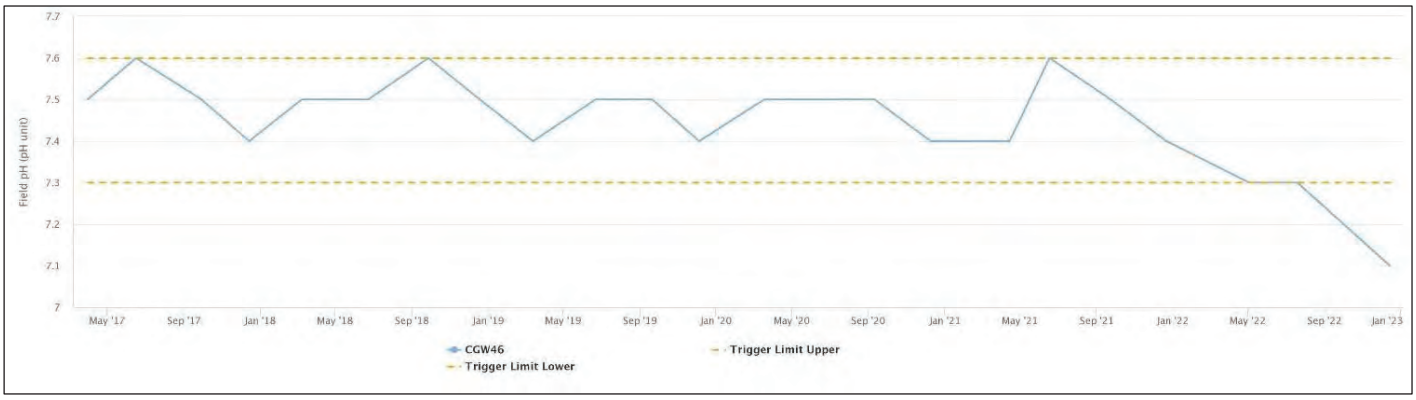

Figure 7-73: Carrington West Wing Bayswater Groundwater pH Trends 2017 to 2022

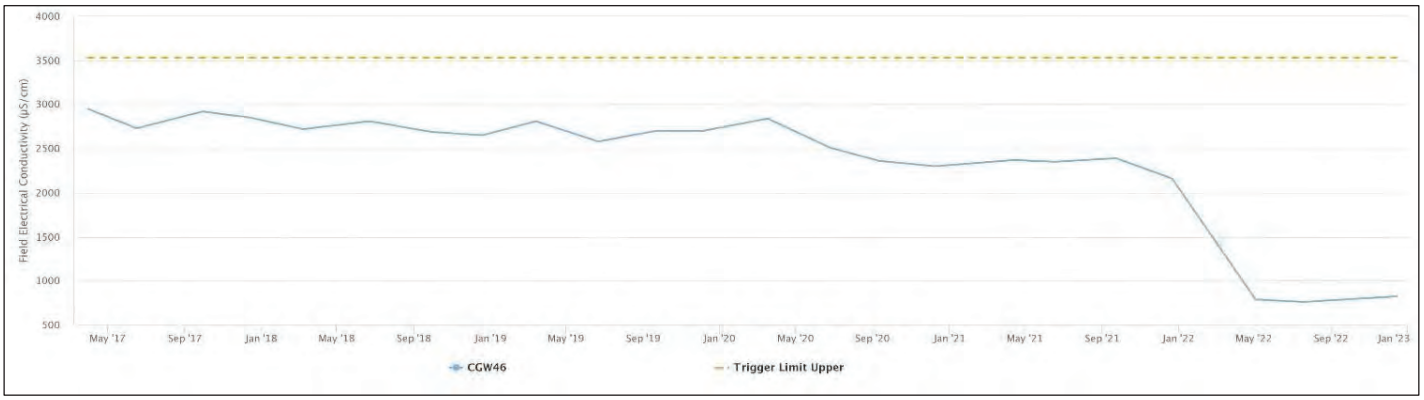

Figure 7-74: Carrington West Wing Bayswater Groundwater EC Trends 2017 to 2022

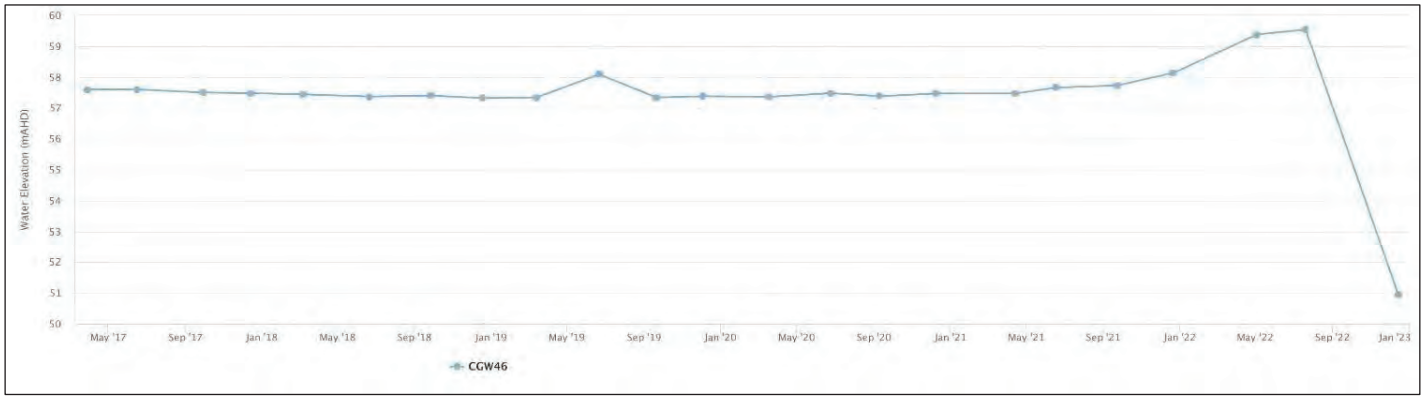

Figure 7-75: Carrington West Wing Bayswater Groundwater SWL Trends 2017 to 2022

7.6 | COMPENSATORY WATER SUPPLY

During 2022 HVO did not provide compensatory water supply or alternate compensation in lieu of compensatory water supply under any new or existing agreements, and circumstances which may trigger a requirement to provide a compensatory water supply were not identified.

7.7 | PROGRESS AGAINST RECOMMENDATIONS IN 2021 ANNUAL GROUNDWATER REVIEW

A number of recommendations were made in the Annual Groundwater Monitoring Review produced by EMM (Appendix B of the 2021 Annual Review) in Section 6.2. Progress against these actions is shown in **Table 7-21.**

Table 7-21: Progress Against Recommendations in 2021 Annual Groundwater Review

Recommendation	Progress in 2022
The relevance of the lower pH trigger value assigned to the - Mt Arthur Cheshunt Seam bores should be validated, specifically: - It is recommended that pH trigger levels be removed for bores BZ2A(1) and BZ3-3 (consistent with the updated draft WMP).	Bores BZ2A and BZ3-3 have been removed from updated WMP as per additional advice from Umwelt. WMP awaiting DPE approval.
- As the groundwater levels measured in BZ4A(2) are at the base of the screen in this bore, with continuous pH/EC trigger value exceedance, BZ4A(2) is not considered representative of groundwater in the Mt Arthur seam. Further to this, the dry sampling events at BZ4A(2) are likely to continue. Hence it is recommended that bore BZ4A(2) be removed as a monitoring bore in the revised WMP.	Bore has been removed in revised WMP advice. WMP awaiting DPE approval.

Recommendation	Progress in 2022
- It is recommended that the pH trigger level value be lowered to 6.4 (from the current value of 6.5) for all of the remaining bores monitoring the Cheshunt - Mt Arthur Seam (consistent with the updated draft WMP).	Updated in revised WMP. WMP awaiting DPE approval
It is recommended the proposed EC and pH trigger values at bores C130(WDH) and C630(BFS) in the updated draft WMP be revised, as historical monitoring data suggest that trigger value exceedances may continue despite being revised in the draft WMP.	Umwelt engaged to undertake review. Still in progress.
It is recommended that the ground elevation and bore construction be reviewed for some monitoring bores (including D406(AFS), D612(AFS) and D612(BFS))	Monitoring bore ground elevations and construction data reviewed. Follow on action in CMO to confirm survey level of some bores.
The 95th percentile groundwater level trigger value for CGW53A should be reviewed as the bore has been showing an increasing trend since the drought ended in late 2019 / early 2020.	Groundwater level trigger no longer required to be reviewed as per additional advice from Umwelt - water level rise corresponds with level rises across other bores within area which can be attributed to higher than average rainfall.
Trigger values that were exceeded at the end of 2021, yet do not require action (Section 5.2) should be reviewed in the subsequent groundwater data review.	Groundwater trigger values addressed in referenced actions and also Qrtly GW impacts reports for 2022.
An assessment should be undertaken (potentially using a submersible inspection camera or similar) of bore CGW45 to determine the depth of blockage and assess options for re-instating the bore as an effective monitoring location. In addition, the monitoring records noted that this bore could not be located.	Bore was assessed and discovered to have animal faeces in it. Extension post put on bore, monitoring contractor working on clearing blockage and reinstating bore.
If monitoring continues at GW-114, survey data should be obtained and provided via the EMD	GW-114 site info updated in EMD - results uploaded to EMD.

8 | REHABILITATION AND LAND MANAGEMENT

8.1 | SUMMARY OF REHABILITATION

Rehabilitation at HVO is undertaken in accordance with commitments made in the 2020 to 2022 Mining Operations Plan (MOP) and 2022-2025 Forward Works Program (FWP) and Rehabilitation Management Plan (RMP). Although site had an approved MOP to 31 December 2022, a newly developed FWP was provided to the Resources Regulator to satisfy the requirements of the Mining Act 1992. The distinct difference being the MOP having calendar year targets whilst the FWP covers a financial year period for July 2022-July 2025. During December 2022, HVO gained approval from the Resources Regulator to re-align to a calendar year period from 2023 onward. The updated RMP was provided to the Department during August 2022 to satisfy the requirements of both development consents and remains pending approval.

A summary of the key rehabilitation performance indicators is shown in **Table 8-1**.

Table 8-1: Key Rehabilitation Performance Indicators

Mine Area Type	Previous Reporting Period (Actual) Year 2021 (ha)	This Reporting Period (Actual) Year 2022 (ha)	Next Reporting Period (Forecast) Year 2023 (ha)
A. Total mine footprint[2]	6666.7	6817.2	7028.2
B. Total Active Disturbance[3]	3695.7	3781.2	3957.2
C. Land being prepared for rehabilitation[4]	338.0	256.8	159.8
D. Land under active rehabilitation[5]	2631.2	2779.2	2911.2
E. Completed rehabilitation[6]	0	0	0

*Large land being prepared for rehabilitation figures is due to reclassification of areas previously reported as under active rehabilitation. These require remedial actions prior to being re-sown to final vegetation (i.e. reclassified to Growth Medium Development phase).

[2] **Total mine footprint** includes all areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to mining and associated activities. As such it is the sum of total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem establishment, ecosystem development and relinquished lands (as defined in DRE MOP/RMP Guidelines). Please note that subsidence remediation areas are excluded

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

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

[5] **Land under active rehabilitation** – includes areas under rehabilitation and being managed to achieve relinquishment – includes the following rehabilitation phases as described in the DRE MOP/RMP Guidelines – “ecosystem and land use sustainability” (revegetation assessed as showing signs of trending towards relinquishment OR infrastructure development).

[6] **Completed rehabilitation** – requires formal sign off by DRE that the area has successfully met the rehabilitation land use objectives and completion criteria.

8.2 | REHABILITATION OVERVIEW

A summary of rehabilitation completed in 2022 is shown in **Table 8-2**.

Table 8-2: Summary of New Rehabilitation Completed in 2022

Rehabilitation Site Name	Rehabilitation Type	Seed Mix	Area (ha)	Summary
West North 210 & 230	New Rehabilitation	Pasture / Woodland	15.5	Final landform sown with final cover
Cheshunt Pit 160-165	New Rehabilitation	Woodland	12.3	Final landform sown with final cover
Riverview RL138	New Rehabilitation	Pasture / Woodland	13.5	Final landform sown with final cover
Carrington RL80	New Rehabilitation	Pasture	6.4	Final landform sown with final cover
Carrington park-up	New Rehabilitation	Pasture	6.5	Final landform sown with final cover
South East TSF	New Rehabilitation	Pasture	10.8	Final landform sown with final cover
Riverview - Glider	GMD Progression	Woodland	7.1	Final landform sown with final cover
Cheshunt Pit 155	GMD Progression	Woodland	8.9	Final landform sown with final cover
Wilton Pit slopes	GMD Progression	Pasture	18.3	Final landform sown with final cover
West North slopes	GMD Progression	Pasture	34.1	Final landform sown with final cover
South East TSF	GMD Progression	Pasture	12.8	Final landform sown with final cover
TOTAL REHABILITATION			**146.2**	

8.3 | REHABILITATION PERFORMANCE

A total of 146.2 ha rehabilitation was undertaken during 2022, including 65 ha of new rehabilitation, and 81.2 ha of Growth Media Development (GMD) progression. Details of the rehabilitation areas completed during 2022, including vegetation types are provided in **Figure 8-1**.

Table 8-3 details the amount of rehabilitation and disturbance completed during the reporting period compared with proposed area in the respective MOP/FWP.

Table 8-3: Summary of Rehabilitation and Disturbance Completed in 2022

FWP	2022 Totals (ha)	
	Actual	Proposed FWP (22/23 FY)
Rehabilitation		
HVO North	39.2	-
HVO South	25.8	-
GMD North	65.2	-
GMD South	16.0	-
HVO Total	146.2	152.0
Rehabilitation Disturbance		
HVO North	6.9	-
HVO South	25.4	-
HVO Total	32.3	63.0
New Disturbance		
HVO North	81.0	-
HVO South	0.0	-
HVO Total	81.0	113.0
Net Rehabilitation (Rehabilitation minus Rehabilitation Disturbance)		
HVO Total (Rehab)	HVO Total (Rehab Disturbance)	HVO Total
146.2	32.3	+113.9

HVO previously had a single consolidated MOP for HVO North and HVO South which expired 31 December 2022. In July 2022, HVO submitted a single FWP for the complex for the 2022/23 – 2024/25 period in line with the Rehabilitation Reforms to meet the requirements of the Mining Act 1992.

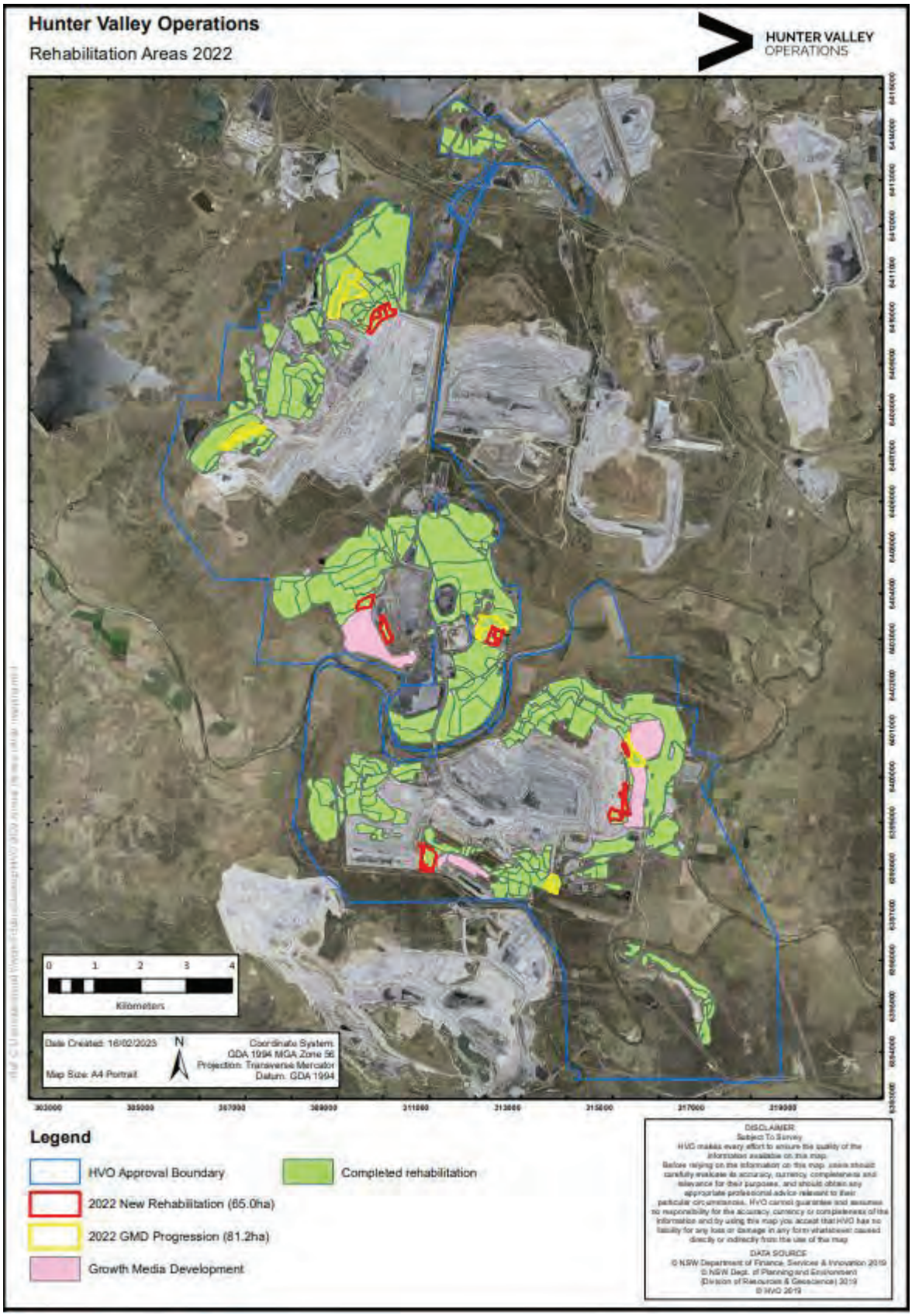

Figure 8-1: HVO Rehabilitation Areas

A comparison of rehabilitation progression against predictions in the *HVO West Pit Extension and Minor Modifications Environmental Impact Statement (EIS) (October 2003*) and subsequent modifications to the HVO North approval (DA 450-10-2003) indicates that rehabilitation progression is generally consistent with EIS predictions. Planning approval modifications that changed the rate of rehabilitation progression at HVO North include: Carrington East Extension (Modification 2 - 2006); Carrington Out-of-Pit TSF (Modification 4 - 2014); and Carrington In-Pit TSF (Modification 6 - 2014). When the modifications listed above are taken into account the EIS projection for cumulative rehabilitation area at the end of 2018 was 1766.9 hectares. The EIS projection for average annual rehabilitation between 2018 (Year 14) and 2024 (Year 20) is 26.2 hectares hence projected rehabilitation at the end of 2022 was 1871.7 hectares. Land under active rehabilitation at HVO North at the end of 2022 totalled 1798.2 hectares. A further 84.0 hectares are classified as within growth medium development phase representing a total rehabilitation management footprint at end of 2022 of 1882.2 hectares which is consistent with EIS projections.

As at the end of 2022, rehabilitation progress for HVO South is consistent with the predictions in the HVO South Coal Project Environmental Assessment Report (January 2008), although with similar considerations to HVO North with respect to current rehabilitation phase classifications. EIS rehabilitation progression at the end of 2022 shows 1141 ha of rehabilitation completed. Land under active rehabilitation at the end of 2022 was 979.1 hectares in association with 141.2 hectares in growth medium development phase. Total rehabilitation management footprint at end 2022 is therefore 1120.3 hectares and consistent with progression to the end of Stage 1.

8.4 | REHABILITATION PROGRAMME VARIATIONS

The 2022 variations to the rehabilitation programme are summarised in **Table 8-4**.

Table 8-4: Variations to the Rehabilitation Program in 2022

FWP	Has rehabilitation work proceeded generally in accordance with the conditions of an accepted Mining Operations Plan?	Comment
HVO South	Yes	HVO South net rehabilitation (net rehabilitation = rehabilitation minus – rehabilitation disturbance) completed during period 2022 was 16.4 ha. HVO North net rehabilitation (net rehabilitation = rehabilitation minus – rehabilitation disturbance) completed during period 2022 was 97.5 ha. Both areas have progressed ahead of FWP/RMP forecasts due to works being completed ahead of financial year reporting, as well as some rehabilitation disturbance being delayed (32.3 ha against forecast of 63 ha). **Historic rehabilitation** Following receipt of a Section 240 notice issued 18/7/19 from the Resources Regulator, rehabilitation in the GMD phase that was only sown with a cover crop was re-classified from completed to temporary rehab. HVO has since commenced a program of re-sowing these areas with its final cover. During 2022, 65.2 ha of GMD was progressed to final cover in HVO North, and 16.0 ha was progressed in HVO South.
HVO North	Yes	

8.5 | REHABILITATION TRIALS

No rehabilitation trials were conducted during 2022.

8.6 | KEY ISSUES THAT MAY AFFECT REHABILITATION

HVO has conducted several risk assessments relating to rehabilitation, including during the preparation of the MOP and RMP to identify the main risks to rehabilitation establishment. The key risks to rehabilitation at HVO include:

- Exotic weeds;
- Having insufficient biological resources (topsoil, vegetation, seeds etc);
- Weather and climatic influences (high rainfall or extended dry conditions); and
- Erosion and sedimentation.

These key risks have been addressed in a rehabilitation Trigger Action Response Plan (TARP) within the HVO RMP. The TARP identifies the required management actions in the event of impacts to rehabilitation, or where rehabilitation outcomes are not achieved in an acceptable timeframe. An assessment of the 2022 rehabilitation monitoring results against the TARP is included in **Section 8.8**.

8.7 | REHABILITATION MONITORING

HVO adopted the revised GCAA rehabilitation monitoring program to monitor rehabilitation areas and trajectory towards meeting the rehabilitation objectives and performance and closure criteria. The monitoring framework comprises Initial Establishment Monitoring (IEM) and Long Term Monitoring (LTM) depending upon the age of the rehabilitation area. Additionally, a walkover assessment is completed whereby the full extent of each monitoring block included in the annual program is assessed for maintenance requirements.

IEM is a rapid style assessment of young (≤3 years old) rehabilitated areas, principally to determine germination success and landform stability, and describes differing methods for HVO's key final land uses of grazing and non-specific woodland.

LTM utilises the Biodiversity Assessment Methodology (BAM) to compare rehabilitation areas with analogue site results. The objective of the LTM program (areas ≥4 years old) is to evaluate progress of rehabilitation towards fulfilling completion criteria and, ultimately, the targeted post-mining land use. Like methods apply for LTM of both rehabilitation and reference monitoring sites.

Monitoring during 2022 represented a continuation of this ecological monitoring program adopted during 2020. During the 2022 monitoring, ninety five sites were monitored and these comprised:

a. 31 sites of Initial Establishment Monitoring for Grazing Pastures.
b. 7 sites of Long Term Monitoring for Grazing Pastures;
c. 37 sites of Initial Establishment Monitoring for Non-specific native vegetation.
d. 20 sites of Long-Term Monitoring Non-specific Native Vegetation.

The results of the annual rehabilitation monitoring, combined with the annual walkover, are utilised to assess rehabilitation performance against the sites closure criteria, the RMP TARP and GCAA's Rehabilitation Report Card. An overview of TARP triggers and closure criteria performance are presented in **Section 8.8**.

8.7.1 | IEM PASTURE RESULTS

The newly established pasture rehabilitation sites generally recorded a high ground cover percentage (average of 80.7%) with only minor rilling or sheet erosion being observed. Preferred pastures species averaged 36.6%, whilst priority weed cover ranged from 0.5 – 44% (averaged 12.5%). It was also noted that grazing by kangaroos and rabbits appeared to be impacting vegetation at some sites. The improved IEM sites results compared to previous years are a combination of favourable meteorological conditions (high rainfall) as well as early intervention (maintenance) of juvenile pasture rehabilitation areas.

An assessment of IEM pasture rehabilitation blocks against the RMP TARP triggers is presented in **Table 8-5**.

Table 8-5: Assessment of IEM Pasture Monitoring Blocks against RMP TARP

Block Code	Erosion Control	Surface Cover	Species Composition	Weeds
HVOWES20190101	Green	Green	Green	Green
HVOWES20190201	Green	Green	Green	Green
HVOWES20200301	Green	Green	Green	Green
HVOWES20200401	Green	Amber	Amber	Green
HVOWES20200501	Green	Green	Green	Green
HVOWES20210101	Green	Green	Green	Green
HVOWES20210102	Green	Green	Green	Green
HVOWES20210201	Green	Amber	Green	Green
HVOWES20210202	Green	Amber	Green	Green
HVOWES20210203	Green	Green	Green	Green
HVOWES20210301	Green	Green	Green	Green
HVOWES20210302	Green	Green	Green	Green
HVOWES20210303	Green	Green	Green	Green
HVOWIL20210101	Green	Green	Green	Amber
HVOWIL20210102	Green	Green	Green	Green
HVOWIL20210103	Green	Green	Green	Green
HVOCHE20210501	Green	Amber	Green	Green
HVOCHE20210502	Green	Green	Green	Green
HVOCHE20210503	Green	Amber	Green	Green
HVOCHE20210504	Green	Green	Green	Green
HVOCHE20210601	Green	Green	Green	Green
HVOCHE20210602	Green	Green	Green	Green
HVOCHE20210603	Green	Green	Green	Amber
HVOCHE20210604	Green	Green	Green	Amber

Block Code	Erosion Control	Surface Cover	Species Composition	Weeds
HVORIV20190701	Green	Green	Green	Amber
HVORIV20190801	Green	Green	Green	Amber
HVORIV20190802	Green	Green	Green	Green
HVORIV20190803	Green	Green	Green	Green
HVORIV20191101	Green	Green	Green	Green
HVORIV20191102	Green	Green	Green	Green
HVORIV20191103	Green	Green	Green	Green

8.7.2 | LTM PASTURE RESULTS

The LTM pasture rehabilitation blocks exhibited a higher ground cover percentage (81.6%), along with improved pastured composition (averaged 49.0%) and whilst priority weed species ranged from 4.0-35.1% (average 17.1%). These slightly improved scores are a natural result of the rehabilitation maturing over time and are expected to continue to improve with ongoing management and monitoring. Additionally, pasture biomass results scored well, ranging from 34.5 – 3000 kgDM/ha. Only minor rilling or sheet erosion was observed in these blocks, similar to the IEM sites.

An assessment of LTM pasture rehabilitation blocks against the RMP TARP triggers is presented in **Table 8-6**.

Table 8-6: Assessment of LTM Pasture Monitoring Blocks against RMP TARP

Block Code	Erosion Control	Surface Cover	Species Composition	Weeds
HVOWES20160302	Green	Green	Green	Green
HVOWES201603	Green	Green	Green	Green
HVOWES201601	Green	Green	Green	Green
HVOWES20160301	Green	Green	Green	Amber
HVOWES20160303	Green	Green	Green	Green
HVOWES20170501	Green	Green	Amber	Amber
HVOWES20170502	Green	Green	Green	Amber

8.7.3 | IEM WOODLAND RESULTS

Observations from the LTM non-specific native vegetation rehabilitation blocks include:

- Erosion was relatively low across all sites, with most sites recording only minor rills or sheeting (<10 cm). Four sites recorded active erosion with a maximum depth of 10 to 30cm;
- Percentage of bare ground ranged from 0 to 45.5%;
- The total priority weed cover ranged from 6 to 93%;
- Native species richness ranged from 57.1 to 93.2%; and
- Tree stem density ranged from 0 to 1600.

An assessment of IEM non-specific native vegetation rehabilitation blocks against the RMP TARP triggers is presented in **Table 8-7** below.

Table 8-7: Assessment of IEM Non-specific native vegetation Monitoring Blocks against RMP TARP

Block Code	Erosion Control	Surface Cover	Species Composition	Weeds
HVOCAR20210101	Green	Green	Green	Green
HVOCAR20210102	Green	Green	Green	Green
HVOCAR20210103	Green	Green	Green	Green
HVOCHE20210101	Green	Green	Green	Green
HVOCHE20210102	Green	Green	Green	Green
HVOCHE20210103	Green	Green	Green	Green
HVOCHE20210201	Green	Green	Amber	Green
HVOCHE20210202	Amber	Green	Green	Green
HVOCHE20210301	Green	Green	Green	Green
HVOCHE20210302	Green	Green	Green	Green
HVOCHE20210303	Green	Green	Green	Green
HVOCHE20210401	Green	Green	Green	Green
HVOCHE20210402	Green	Green	Green	Amber
HVOCHES20200101	Green	Green	Green	Green
HVOCHES20200102	Green	Green	Green	Green
HVOCHES20200103	Green	Green	Amber	Green
HVOCHES20200201	Green	Green	Green	Green
HVOCHES20200202	Green	Green	Green	Green
HVOCHES20200203	Green	Green	Green	Green
HVORIV20200301	Green	Green	Green	Red
HVORIV20200302	Green	Green	Green	Green
HVORIV20200303	Green	Green	Green	Amber
HVORIV20200304	Green	Green	Green	Green
HVORIV20210101	Green	Green	Green	Red
HVORIV20210102	Green	Green	Green	Red
HVORIV20210103	Green	Green	Green	Red
HVORIV20210301	Green	Green	Green	Green
HVORIV20210302	Green	Green	Amber	Amber
HVORIV20210303	Green	Green	Green	Green
HVOWES20200101	Green	Green	Green	Green
HVOWES20200102	Green	Green	Green	Green
HVOWES20200103	Green	Green	Green	Green

Block Code	Erosion Control	Surface Cover	Species Composition	Weeds
HVOWES20200201	Green	Green	Green	Green
HVOWES20200202	Green	Green	Green	Green
HVOWES20200203	Green	Green	Green	Green
HVOWES20210401	Green	Green	Amber	Green
HVOWES20210402	Green	Green	Amber	Green
HVOWES20210403	Green	Green	Green	Amber

8.7.4 | LTM WOODLAND RESULTS

Observations from the LTM non-specific native vegetation rehabilitation blocks include:

- Erosion was relatively low across all sites, with most sites recording only minor rills or sheeting (<10 cm);
- Percent bare ground was low, ranging from 0 to 40%;
- The total priority weed cover ranged from 0.3 to 90.2%;
- Native species richness ranged from 58.3 to 95.5%;
- Tree stem density ranged from 50 to 3325; and
- Canopy cover ranged from 5 to 70%.

An assessment of LTM non-specific native vegetation rehabilitation blocks against the RMP TARP triggers is presented in **Table 8-8** below.

Table 8-8: Assessment of LTM Non-specific native vegetation Monitoring Blocks against RMP TARP

Block Code	Erosion Control	Surface Cover	Species Composition	Weeds	Habitat Corridors
HVOCHE20170401	Green	Green	Green	Green	Red
HVOCHE20170402	Green	Green	Amber	Green	Red
HVOCHE20170403	Green	Green	Green	Green	Red
HVOCHE20180101	Green	Green	Green	Green	Red
HVOCHE20180102	Green	Green	Green	Green	Red
HVOWES19990401	Green	Amber	Green	Amber	Green
HVOWES19990402	Green	Green	Green	Green	Green
HVOWES19990403	Green	Green	Amber	Green	Green
HVOWES19990404	Green	Green	Green	Green	Green
HVOWES19990405	Green	Green	Amber	Red	Amber
HVOWES20020101	Green	Green	Green	Amber	Green
HVOWES20020102	Green	Green	Green	Green	Green
HVOWES20020103	Green	Green	Amber	Red	Green
HVOWES20150201	Green	Green	Green	Green	Amber
HVOWES201602	Green	Green	Green	Green	Amber
HVOWOOP20000101	Green	Green	Green	Red	Amber
HVOWOOP20000102	Green	Green	Amber	Red	Amber
HVOWOOP20000103	Green	Green	Amber	Red	Amber
HVOWOOP20000104	Green	Green	Green	Red	Amber
HVOWOOP20000105	Green	Green	Green	Red	Amber

Figure 8-2: Overview of 2022 Rehabilitation Monitoring Locations

8.8 | OVERVIEW OF REHABILITATION TRAJECTORY

The objective of rehabilitation monitoring is to assess the progression of rehabilitation areas towards relevant criteria and commitments and to facilitate continuous improvements in rehabilitation practices.

In line with the GCAA's Rehabilitation Report Card, performance against key rehabilitation metrics was assessed for each rehabilitation polygon. Each polygon is assigned one of four performance rankings as per the criteria in **Table 8-9**.

Table 8-9: GCAA Rehabilitation Report Card Criteria

Category	Criteria
Rework	• Does not meet completion criteria. • Extensive rework required that would not typically form part of a rehabilitation maintenance program; e.g. slopes do not comply with approval requirements, large bare areas >0.1ha, very severe and widespread erosion, etc. • TARP condition red.
Maintenance	• Does not meet completion criteria. • Routine rehabilitation maintenance works required (e.g. weed control, infill seeding/plantings, repair of minor erosion, fertiliser application). • TARP Condition Amber.
Monitor	• Trending towards completion criteria but does not meet all criteria. • No intervention required other than ongoing routine land management, but continued monitoring required (e.g. ecologically young areas, variable results). • TARP condition Green.
Acceptable	• Rehabilitation objectives and completion criteria are generally met and the area is ready for sign off by regulators. • Routine management and monitoring should be continued to maintain status until relinquishment process is sought. • TARP Condition Green.

A summary of rehabilitation performance as determined through rehabilitation monitoring during 2022 is shown in **Figure 8-3**.

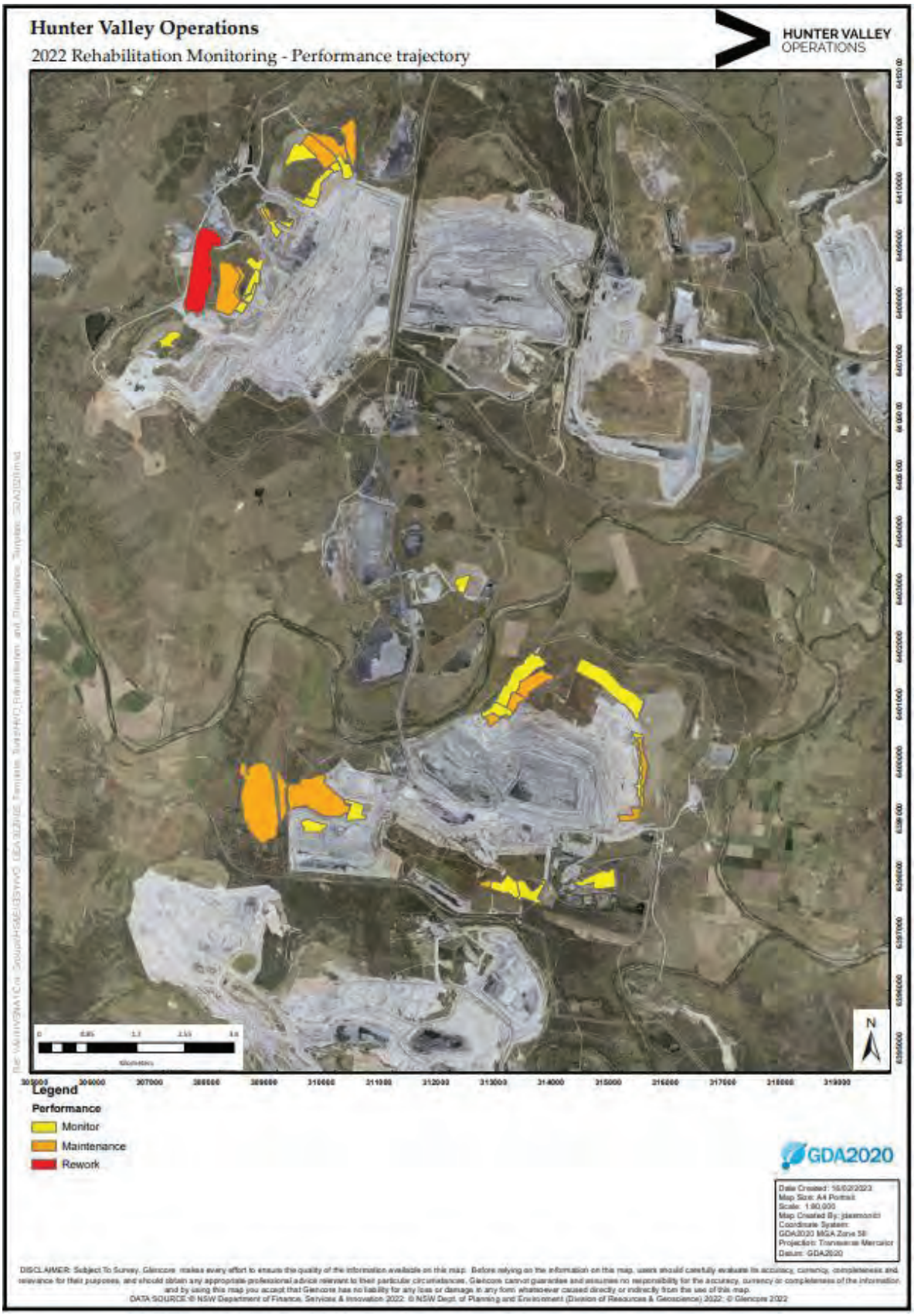

Figure 8-3: Overview of Rehabilitation Monitoring Performance Trajectory

8.9 | REHABILITATION MAINTENANCE

Management of rehabilitated areas is undertaken proactively to assist in initial establishment and when issues are identified through monitoring, auditing or inspections.

An overview of key rehabilitation maintenance activities is shown in **Figure 8-4** and detailed below.

Section 240 Maintenance Program

In July 2019 the DP&E – Resources Regulator issued HVO with Notice 3259 under Section 240(1)(c) of the Mining Act (1992) (Section 240 Improvement Notice) requiring HVO to outline measures or actions to improve progressive rehabilitation performance across the site. This follows an earlier similar notice received during 2018 which was limited to 12 initial sites of concern. In response to these notices HVO has developed and committed to a rehabilitation maintenance and improvement program across the site as detailed in Appendix C (the s240 Maintenance Plan). This plan integrates and prioritises rehabilitation maintenance activities across the site to progress areas of rehabilitation initially sown to cover crop, manage weed competition, and encourage vegetation establishment. An overview of work from the plan undertaken during 2022 is presented in **Figure 8-4**, in addition to being detailed further below.

Weed Control

Broadacre weed treatment within rehabilitation areas is undertaken using agricultural methods comprising boom sprays, wick wipers and slasher/mulchers. In existing rehabilitation areas boom spraying is primarily used to manage cover crop and fallow areas prior to sowing to final native seed mixes. Pre-emergent application of herbicide is used when appropriate and necessary to control emerging weeds in the period between sowing and germination of the desired species. Wick wiping targets rapidly growing exotic grasses and other erect growing weeds in the period following native germination while desirable species remain below the wiper target zone. Slashing and mulching is also used to remove rank pasture grasses and stimulate fresh growth.

Hand spraying and manual removal of weeds is undertaken in rehabilitation areas with early stage and establishing native vegetation that would be likely to be damaged or destroyed should broadacre methods be used.

During 2022 rehabilitation blocks totalling 476 ha were boom sprayed, wick wiped, slashed/mulched or spot sprayed. The key weed species targeted in 2022 maintenance works were galenia (*Galenia pubescens*), Saligna (*Acacia saligna*), green panic (*Panicum maximum*), Rhodes grass (*Chloris gayana*) and mustard weed (*Brassica juncea*).

Erosion Repairs

Drainage structures such as contour banks, drop structures and sediment dams are largely functioning as designed and require little to no maintenance, particularly in more recently established rehabilitation areas. The 2022 Annual Walkover and Ecological monitoring reports identified some contour failures in historical areas which had mainly stabilised, along with some minor rilling and gullying in newer rehabilitation areas. These have been prioritised and incorporated into HVO's detailed rehabilitation maintenance plan.

In response to S240 notices NTCE 0009902 and NTCE 0009942 covering contour bank failure, tunnelling and gullying on HVO's Western Out of Pit (WOOP) emplacement HVO have conducted the following works. In 2021 HVO engaged ERR to prepare an initial erosion assessment which was submitted to the to the regulator in January 2022. Following this HVO engaged SLR Consulting Australia Pty Ltd to prepare a detailed strategy /design for the remediation of existing erosion on the WOOP Dump. HVO conducted initial repairs to contours 1 and 2 in June 2022. These contours were reformed and reseeded and several gullies backfilled along with the installation of a dissipation dam. The repair works were inspected by the Hunter

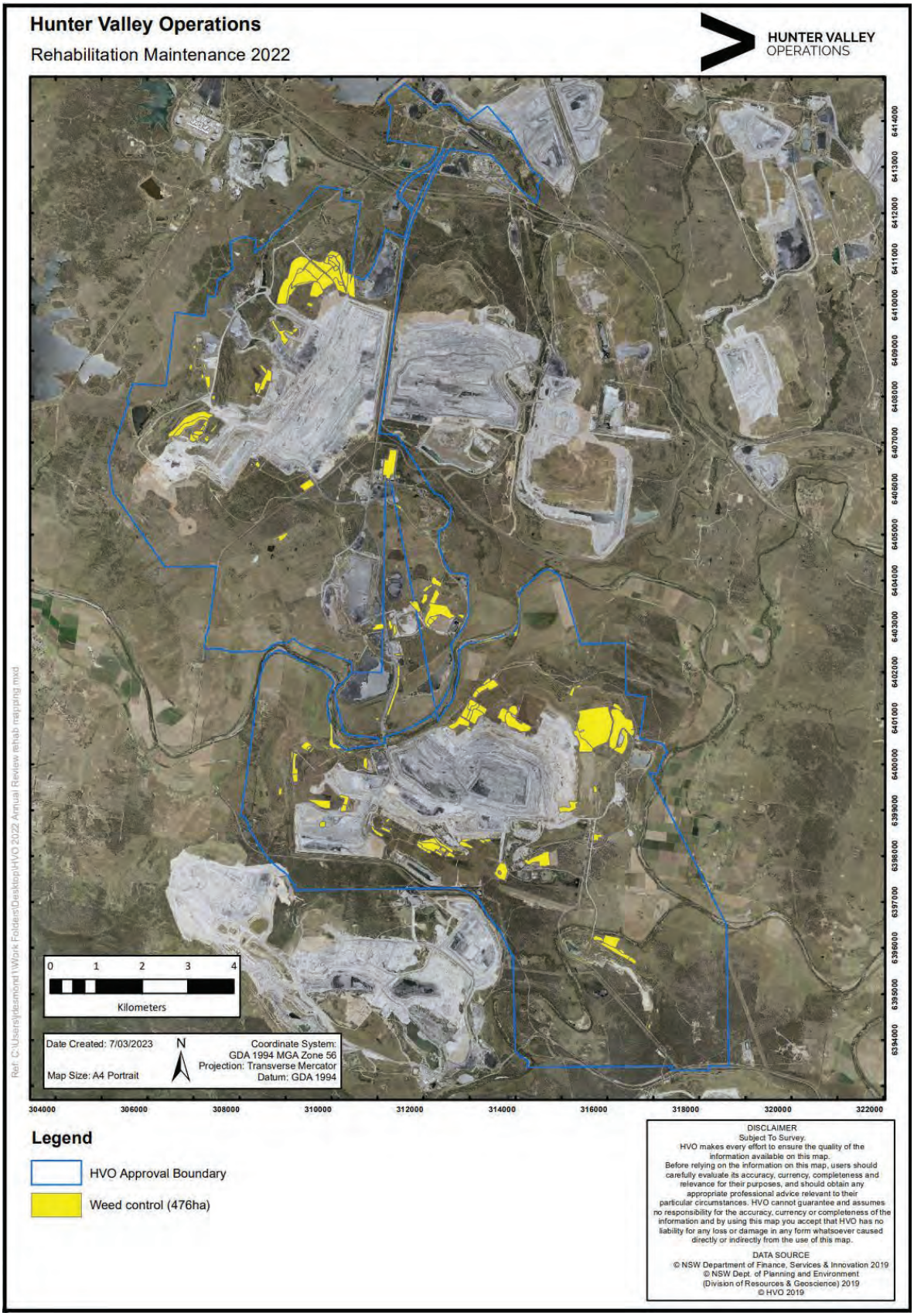

Figure 8-4: *Rehabilitation Maintenance – Post-Rehabilitation Weed Control*

local land Services in July and their feedback resulted in further revisions to the SLR HVO WOOP Dump Remediation Design with further works planned for implementation in 2023. Update reports were submitted to the Regulator in July 2022 and January 2023 as required in the s240 Notices.

Grazing of Rehabilitation Areas

Grazing of rehabilitation areas is utilised to encourage and maintain pasture diversity, encourage nutrient cycling, and assist in fuel load management. A licence agreement is in place for grazing 666 ha of HVO North rehabilitation area, with temporary fuel load licences across a further 394 ha of rehabilitated land around HVO North and 210 ha around HVO South. Opportunities to integrate grazing to assist rehabilitation progression continues to be assessed.

Vegetation Enhancement

In addition to the progression of GMD areas throughout the year, HVO undertakes regular re-seeding and planting of tube-stock in rehabilitation areas that have been identified as failing or requiring additional species diversity. The need for these interventions, and the most appropriate method, are identified during the Annual Walkover and the Ecological monitoring. During 2022, erosion repairs were re-seeded and no tube-stock planting occurred.

Topsoil Stockpiles

Regular inspections of topsoil stockpiles are completed to identify required maintenance activities. Maintenance works include weed control and re-seeding (if weed species have dominated). During 2022, 94 topsoil stockpiles were inspected with follow up works including herbicide spraying and/or re-seeding to improve their long term viability and reduce the spread of weeds onto new rehabilitation areas.

8.10 | VERTEBRATE PEST MANAGEMENT

A number of baiting programs are carried out on a seasonal basis as part of the HVO Vertebrate Pest Action Plan. These programs are conducted at a level of frequency designed to disrupt pest species breeding/colonisation cycles and employ a variety of methodologies including baiting, trapping and ground based shooting.

Wild Dog and Fox Baiting Programs

Three 1080 ground baiting programmes targeting wild dogs and foxes were implemented across operational and biodiversity areas. These were undertaken during summer, winter, and spring. Each programme consisted of approximately 60 bait sites utilising meat and ejector baits. Baits were checked over a three week period and replaced each week when taken. The winter and spring baiting programmes were synchronised to coincide with neighbouring mine operations programs, with the timing of these events coordinated with and by Hunter Local Land Services.

Rural Licensee Wild Dog Trapping Program

Between the 1080 ground baiting programs, one of HVO's rural licensees implemented a wild dog control program on Hunter Valley Operations buffer farm properties utilising a professional dog trapper from February to May 2022. During the course of this program 9 wild dogs were controlled.

Pig Trapping and Baiting

Two pig baiting programmes using Sodium Nitrite 'Hoggone' baiting systems were implemented at HVO during winter and spring. The programmes resulted in 32 pigs being controlled across 5 bait stations. An additional 107 pigs were controlled by rural licensees using a combination of pig traps and 'Hoggone' baiting systems on buffer properties over the course of the year. An additional 10 pigs were controlled as part of opportunistic ground based shooting activities. The programs undertaken throughout the year resulted in 149 pigs being controlled.

Ground Based Shooting

HVO has three shooters attending the site on a regular basis opportunistically controlling feral pest species. Feral species controlled include pigs, wild dogs, foxes, hares/ rabbits, deer, and cats.

Table 8-10 summarises the results from the programmes carried out at HVO during 2022 with wild dog and fox baiting locations and results for the programs illustrated in **Figure 8-7** to **Figure 8-9.**

Table 8-10: Summary of Vertebrate Pest Management 2022

	1080 Baiting			Hoggone Baiting	Trapping			Shooting		
	Total Lethal Baits Laid	Takes by Wild Dog	Takes by Fox	Takes by Feral Pig	Wild Dog	Feral Pig	Feral Pig	Wild Dog/ Fox	Feral Cat	Hares & Rabbits
Summer	118	48	7	0	0	0	0	0	0	0
Autumn-Winter	119	48	9	37	9	102	10	0	0	0
Spring	117	39	6	0	0	0	0	0	0	0
Total	**354**	**135**	**22**	**37**	**9**	**102**	**10**	**0**	**0**	**0**

Table 8-11 provides a comparison of results from the last 22 baiting programmes undertaken at HVO. In 2022, as for previous programs undertaken at HVO, the vast majority of baits showed evidence of being consumed by wild dogs at 68% with foxes taking 11%, and 21% of baits being consumed by non-target species.

Results reported indicate the majority of takes by dogs or foxes, and photographic evidence taken in previous programs indicate a high population of wild dogs in the area. The number of takes by dogs in spring has increased slightly (49 takes currently compared to 47 in the last program); and by foxes has decreased (6 in the current program compared to 15 in the last). The results may reflect an increase in pressure on the dog population by increasing the frequency of trapping events between baiting programs. Trapping programs may be intercepting new dogs entering territory vacated by dogs removed after baiting programs. The resulting decrease in the fox population/bait take may be from reduced competition for territory and / or prey.

Motion sensor camera photographic data has confirmed the trend of previous years with bait stations continuing to attract attention from non-target species including Australian ravens and lace monitor lizards that are digging up and extracting meat baits and activating ejector baits.

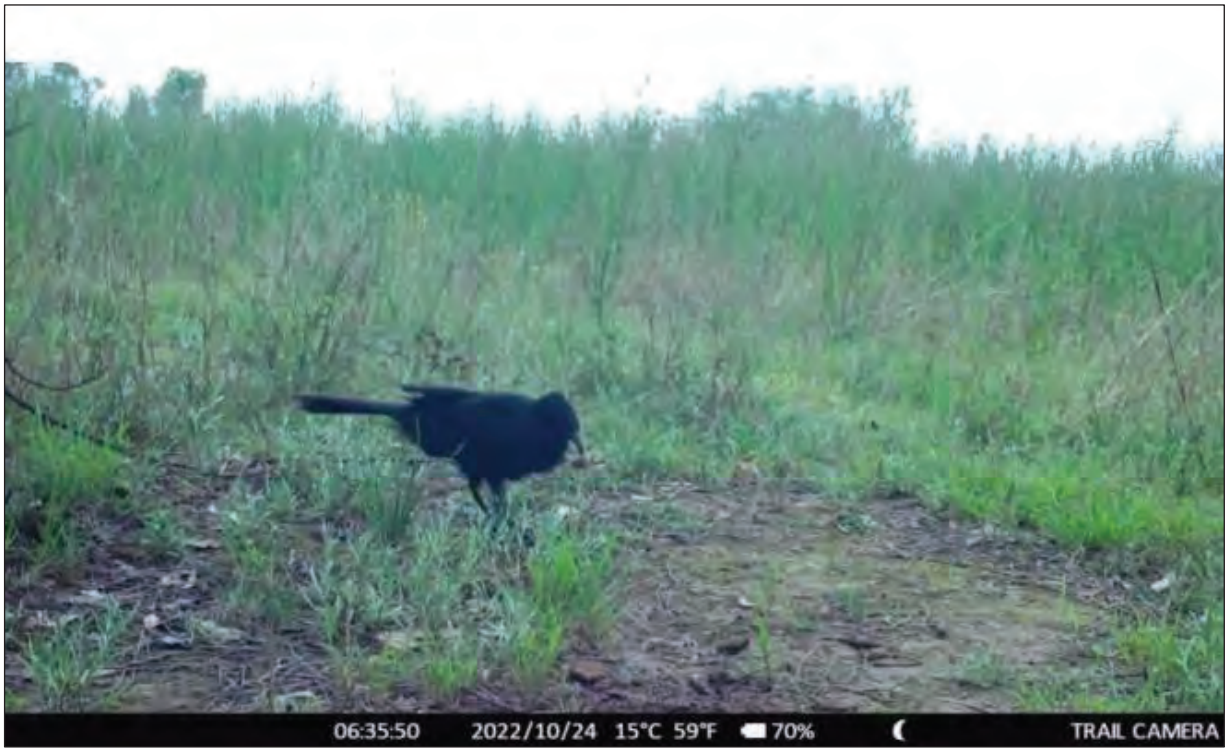

Figure 8-5: White-Winged Chough, Cocorax Melanorhamphos, captured on motion sensor camera pecking at kangaroo meat bait lure at Ejector Bait Site 3 24/10/2022

When assessing bait sites in the field, it is often difficult to determine if wild dogs, ravens or goannas have taken the meat baits as dogs, goannas and birds have been photographed investigating bait sites (**Figure 8-5** and **Figure 8-6**). A White-Winged Chough and Lace Monitor were captured on motion sensor camera at Ejector Site 3 within days of each other.

Figure 8-6: A Lace Monitor Captured on Motion Sensor Camera at Ejector Bait Site 3 27/10/2022

Table 8-11: Comparison of Results Between Baiting Programmes at HVO

Baiting Program	No of Baiting Sites	Baiting Opportunities	Baits taken by Dogs	Dog (%)	Baits Taken by Foxes	Fox (%)	Baits Taken by Non Target Species	Other (%)	Total No. of Baits Taken	No Sites Where Baits Taken At Least Once	Represented as Percentage (%)	No. Sites with Baits Taken on All Occasions	No. Sites With No Baits Taken	No. Baits Disturbed Not Taken	No. Baits Taken Alternatively by Dog or Fox	Baiting Efficiency %	Baiting Efficiency Excluding Other
1506 HVO	40	120	55	98%	0	0%	1	2%	56	31	76%	5	9	1	0	47%	46%
1510 HVO	60	180	71	89%	8	10%	1	1%	80	43	72%	10	17	4	5	44%	44%
1602 HVO	60	120	49	92%	3	6%	1	2%	53	42	70%	13	18	0	2	44%	43%
1606 HVO	60	180	94	96%	4	4%	0	0	98	54	90%	10	6	6	4	54%	54%
1609 HVO	60	180	83	94%	5	6%	0	0%	88	49	82%	11	11	12	3	49%	49%
1702 HVO	59	117	58	84%	10	14.5%	1	1.5%	69	49	87%	20	11	7	5	59%	58%
1705 HVO	60	120	70	95%	4	5%	0	0%	74	51	85%	23	9	3	0	62%	62%
1709 HVO	60	120	67	96%	3	4%	0	0	70	48	80%	22	12	5	2	58%	58%
1803 HVO	60	120	69	90%	6	8%	2	2%	77	49	82%	31	11	7	0	64%	63%
1806 HVO	60	120	77	94%	5	6%	0	0%	82	50	83%	32	10	8	4	68%	68%
1809 HVO	61	122	73	87%	10	12%	1	1%	84	50	82%	34	11	2	6	69%	68%
1905 HVO	64	124	61	85%	10	14%	1	1%	72	50	78%	22	17	8	8	64%	63%

Baiting Program	No of Baiting Sites	Baiting Opportunities	Baits taken by Dogs	Dog (%)	Baits Taken by Foxes	Fox (%)	Baits Taken by Non Target Species	Other (%)	Total No. of Baits Taken	No Sites Where Baits Taken At Least Once	Represented as Percentage (%)	No. Sites with Baits Taken on All Occasions	No. Sites With No Baits Taken	No. Baits Disturbed Not Taken	No. Baits Taken Alternatively by Dog or Fox	Baiting Efficiency %	Baiting Efficiency Excluding Other
1910 HVO	60	120	66	93%	4	6%	1	1%	71	48	80%	23	12	9	2	59%	58%
2002 HVO	60	140	72	94%	4	5%	1	1%	77	48	80%	2	12	9	2	55%	54%
2005 HVO	60	118	44	71%	15	24%	3	5%	62	41	68%	21	19	12	6	53%	50%
2010 HVO	60	120	56	89%	4	6%	3	5%	63	43	72%	20	17	7	2	53%	50%
2102 HVO	60	113	51	65%	16	21%	11	14%	78	53	80%	26	7	12	5	69%	59
2105 HVO	60	119	65	72%	16	18%	11	12%	90	55	92%	37	5	8	7	76%	66%
2110 HVO	63	119	47	61%	15	19%	15	19%	77	51	81%	26	12	4	5	65%	52%
2202 HVO	60	118	48	71%	7	10%	14	21%	68	46	77%	22	14	2	4	58%	46%
2205 HVO	60	119	48	74%	9	14%	8	12%	65	45	75%	20	15	2	6	55%	48%
2210 HVO	60	117	49	59%	6	9%	21	32%	66	45	75%	21	15	1	4	56%	38%
												Average Baiting Efficiency				**58%**	**54%**

Figure 8-7: HVO Vertebrate Pest Management Bait Locations – Summer 2022

Figure 8-8: HVO Vertebrate Pest Management Bait Location – Autumn – Winter 2022

Figure 8-9: HVO Vertebrate Pest Management Bait Locations – Spring 2022

8.11 | RENOVATIONS

No renovations were completed in 2022.

8.11.1 | DERELICT RURAL BUILDINGS

HVO scaled back demolition of derelict rural buildings located within its rural property portfolio in 2022 due to unseasonal wet weather hampering the implementation of non-essential civil works.

8.12 | TAILINGS MANAGEMENT

Key tailings management activities in 2022 included:

- Capping of the Southeast TSF was completed;
- Continued secondary flocculant dosage into Carrington n-Pit TSF to improve beaching;
- Temporary cessation of deposition into Dam 6W TSF has been extended, allowing time for consolidation prior to final top up deposition;
- Ongoing implementation of the North Void TSF Management Plan to manage and mitigate any potential impacts from an identified seepage pathway. This included provision of quarterly and annual analysis reports to the EPA; and
- Design of the first capping stages of Bob's Dump completed.

Table 8-12 below outlines the current state of Tailings Storage Facilities across HVO that are still active or pending decommissioning.

Table 8-12: HVO Tailings Storage Facilities

Facility	Status	Decant System
North Void	Inactive	Decant pumps in place, regular pumping.
Dam 6W	Inactive	Decant pumps in place, regular pumping.
Cumnock Void	Active	Decant pump in place, regular pumping when deposition occurring.
Bob's Dump	Inactive; preparation for decommissioning	Pump in place, pumping as required.
Southeast TSF	Inactive - capping complete	Removed, Decant pumps in place, regular pumping.
Central TSF	Inactive	No pumps required due to drying after rainfall (small catchment reporting to TSF).
Carrington In-pit TSF	Active	Decant pumps in place, regular pumping.

8.13 | RIVER RED GUM RESTORATION AND REHABILITATION

8.13.1 | RIVER RED GUM OVERVIEW

Eucalyptus camaldulensis (River Red Gum) populations have become increasingly rare in the Hunter Valley, and the entire population occurring within the Hunter catchment is now listed as an Endangered Population under the NSW *Biodiversity Conservation Act 2016*. There are a number of River Red Gum sites across HVO North and South. HVO manages the River Red Gum stands on lands that it owns in accordance with the HVO River Red Gum Restoration and Rehabilitation Strategy (Strategy) (HVO 2020) which is a compliance requirement under Sch 3, Condition 31 of DA 450-10-2003.

The sites at HVO have been categorised into a high level of management at the Carrington Billabong, intermediate level at the priority sites and low level at the low priority sites. Each level has been allocated varying amount of monitoring and maintenance as outlined in the Strategy.

As the site with the highest priority, the objectives of the monitoring program at Carrington Billabong are to:

determine if there is any improvement or deterioration in RRG within Carrington Billabong

determine if there is any improvement or deterioration of the natural habitat at Carrington Billabong

provide management recommendations to achieve further improvements in the ecological management of the site to assist in the recovery of RRG and their habitat.

remove any potential influence that mining activities at HVO may have on the population. The monitoring results are compared to a reference site to the north of HVO that is not within a mining area.

The locations of the River Red Gum stands at HVO are shown in **Figure 8-10**.

The Strategy has an established monitoring programme of the river red gum subpopulations and vegetation communities in Carrington Billabong and priority sites on the Hunter River and Wollombi Brook in HVO North and South. The Reference Site is located between Scone and Aberdeen (NSW).

Ecological monitoring occurred in 2022. The locations of the sampling points are shown in **Figure 8-11** to **Figure 8-13**. Flooding within the Reference Site prevented monitoring from occurring and thus the monitoring results discussed below relate only to the HVO sites.

Across 2022, the management activities undertaken within the River Red Gum areas at HVO were restricted due to access issues related to flooding and boggy conditions. Despite this, activities undertaken during the year included tubestock planting of 200 river red gums within the Carrington Billabong, slashing weeds and grasses in the broader Billabong fenced area, weed removal (primarily balloon vine and castor oil plant) from along the Hunter River priority areas, replacement fencing along a priority area on the Wollombi Brook and slashing the floodplain riparian area inside this new fence.

The intent of the tubestock planting programme is to reduce the linear influence of the billabong on the existing mature *E. camaldulensis* (**Figure 8-14**). Over time, the new plantings should offer some protection to the mature individuals from storm events and assist to reduce the competitive advantages of the annual weeds on recruiting native species. In addition, dense or prickly mid-storey species that characterise the community are being planted in discrete areas along the Billabong and adjacent plain areas to provide nesting habitat for insectivorous birds. The intention is to increase the resident population of small insectivorous birds, to control lerps and other such insects, to assist with the health of the trees in the community. Future plantings are intended to form a vegetative link between the Billabong and the adjacent high priority site along the Hunter River, encouraging native fauna movement between these areas.

Unfortunately, the tubestock planted in 2022 largely failed to establish due to factors such as grazing by herbivores soon after planting, and competition from weeds that arose from the inability to slash the site due to the restricted access. While some individuals still occur, replanting of these areas is occurring early in 2023 with stronger tubestock.

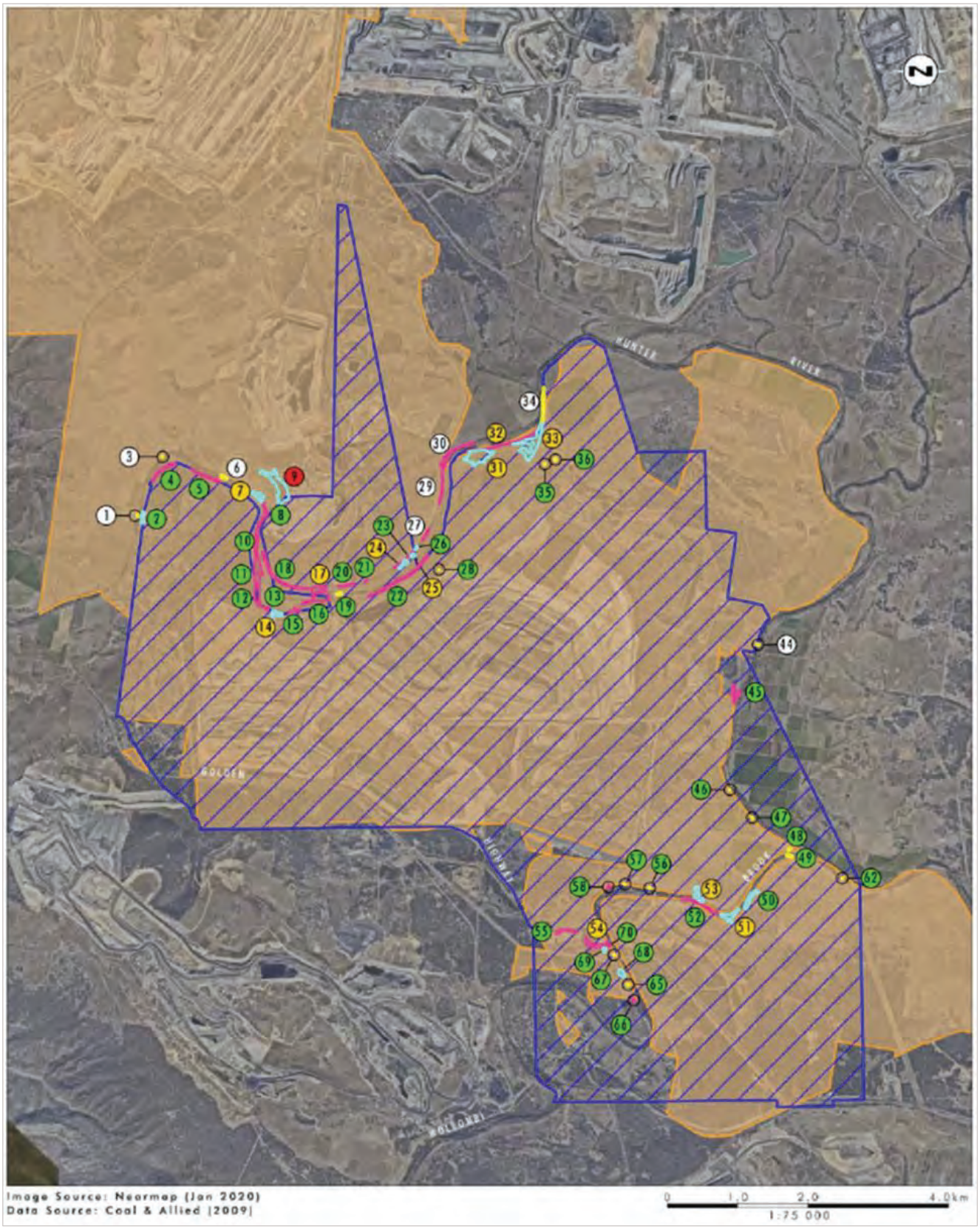

Figure 8-10: Eucalyptus camaldulensis stands being managed at HVO

Figure 8-11: Eucalyptus camaldulensis monitoring sites at Carrington billabong.

Figure 8-12: Eucalyptus camaldulensis priority site monitoring locations

Figure 8-13: Eucalyptus camaldulensis monitoring locations at the Reference Sites

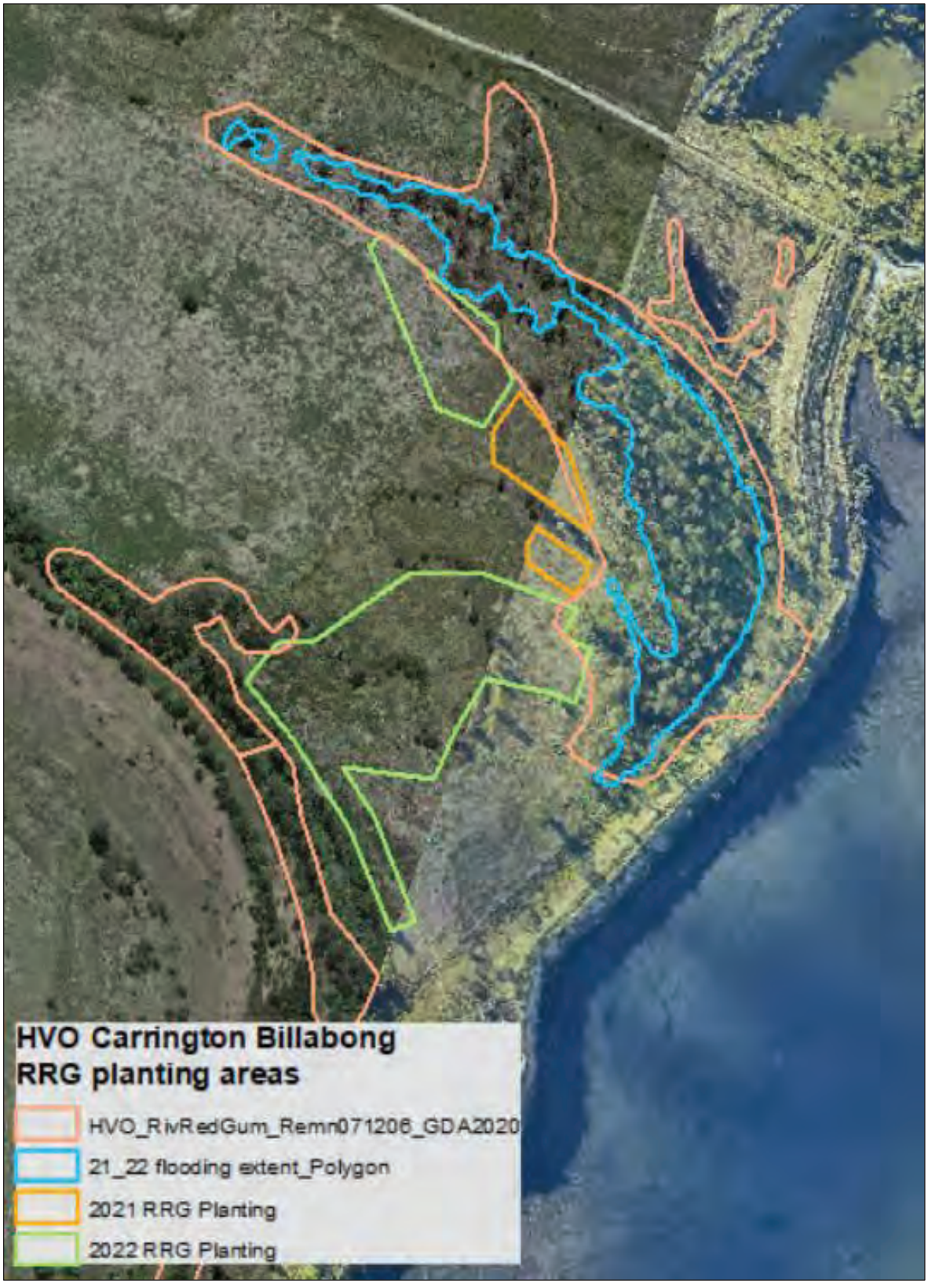

Figure 8-14: Tubestock planting locations of E.camaldulensis and extent of flooding within the Carrington Billabong during 2022

8.13.2 | RRG MONITORING ACTIVITIES

Rainfall and Recruitment

Above average rainfall occurred during 2022, which repeated the La Nina rainfall pattern from 2020 and 2021. The total rainfall for the year at HVO was 1047.2 mm which was 412.2 mm above the historical average.

A result of the additional rainfall over the summer period has been a noticeable increase in vegetation growth in the understorey, particularly of grasses and annual weeds within the Poaceae and Asteraceae families. Flooding of the Carrington Billabong occurred during November 2021 and remained persistent through the majority of 2022 (**Figure 8-15**).

The recruitment that has occurred within the Billabong since 2007 can be readily seen in **Figure 8-16**. The image illustrates the canopy growth on a remnant RRG tree between 2007 and 2022. During that period the Billabong has been subject to flooding in 2007 followed by an extended drought, then the La Nina flood during 2021 and the majority of 2022. The flooding events provided the opportunity for recruitment to occur as can be seen within the Billabong in the background.

Figure 8-15: Flood Waters Within the Carrington Billabong 2022

Figure 8-16: Changes in Vegetation Density Over Time at Carrington Billabong Between 2007 (Left) and 2022 (Right)

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Figure 8-17: Flood Waters Within the Carrington Billabong 2022

Figure 8-18: Changes in Vegetation Density Over Time at Carrington Billabong Between 2007 (Left) and 2022 (Right)

Floristic Survey

A full floristic survey was conducted within set quadrats in the Carrington Billabong. Due to extensive flooding of the quadrat locations, the Reference Site was unable to be accessed for monitoring to occur. The 2022 monitoring identified 70 species across all sites comprising 41% native species and 59% exotic species. Within the floristic plots at Carrington Billabong, there was an increase in native species diversity with a slight decrease in weed species diversity in comparison to previous monitoring events (**Table 8-18**).

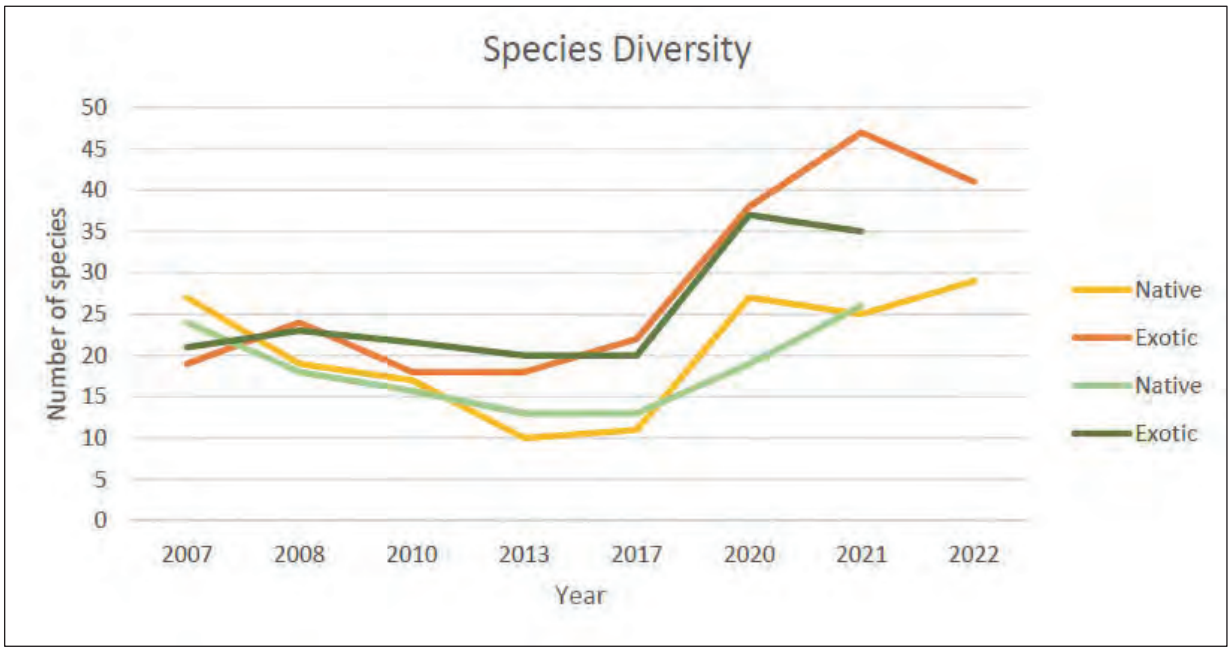

Figure 8-19: Change in Species Diversity Over Time at Carrington Billabong (Orange) and the Reference Site (Green) – Note that the Reference Site (CA) Was Not Sampled in 2022

It is difficult to identify a single management activity that resulted in the increase in diversity when the total rainfall has been above average. High rainfall has resulted in very high biomass in the ground layer. The main management activity for weeds and ground cover vegetation has been slashing prior to seed set within the Billabong and within adjacent open areas. Reducing the ground cover biomass is important to increase the establishment of seedlings. Recently inundated areas will leave exposed earth as water recedes, which will be a productive media for seedling recruitment.

It is expected that as water recedes in Carrington Billabong a new cohort of seedlings will establish. However, high soil moisture and warm weather may also be accompanied by a flush of weeds and colonising flora that may out compete the River Red Gum seedlings.

Weed management has been an ongoing activity within the Carrington Billabong during 2022. A focus for early 2023 will be managing the extent of exotic grasses on the periphery of the flood zones to enable any recruiting seedlings to establish and be identified before further management actions are imposed.

The Eucalyptus camaldulensis tubestock that were planted within the open areas adjacent to the Carrington Billabong in 2021 are growing with great vigour. Continued growth of these trees will provide harbour for small passerines and leaf gleaners that will prey on the insects and their larvae that are devouring the canopies of older remnant eucalypts on site. Most of the planted trees have reached a height above the ground layer providing some certainty that they have overcome potential competition from plants within this stratum.

Remnant Ecological Health Monitoring

The health of adult trees was assessed using a representative sampling method using thirteen attributes to score and monitor the overall condition of each tree. At Carrington Billabong, the health of 63 adult river red gum trees were assessed across the site from the original 140 trees that were tagged in 2007. These trees had retained tags from previous monitoring enabling comparison with prior datasets.

The results of the ecological health assessment are presented in Table 8-13. Sites with higher scores are in better condition (the maximum potential score is 39). Factors such as weed invasion, low native diversity in the mid and ground layers, and limited connectivity often scored values of 1, reducing overall scores for each site.

Tree health at Carrington Billabong is generally in good condition with 49.2% of trees given a ‘healthy’ score. A general increase in condition at Carrington Billabong (particularly healthy trees) from 2021 to 2022 was observed.

Trees given the “near dead” condition score went up by 7.8%. Many of the trees assessed as “near dead” or with a canopy with low cover had a high level of insect attack. While there were no signs or insects or their larvae during the survey, new growth and increased water availability is likely to have resulted in an ideal food supply for invertebrates. The warmer months may provide suitable conditions for the eucalypts to reshoot, and it is possible that there will be a flush of epicormic growth in these trees over this period.

While there was an increase in overall condition, canopy density generally increased or remained stable. Of the trees monitored, 22% of trees recorded a reduced overall condition, and 14% of trees scored a reduced canopy density.

The increased canopy density, new growth, and improvement in overall condition in trees and seedlings seems to be clearly linked to the increased rainfall and flooding of Carrington Billabong, Hunter River and its tributaries.

Table 8-13: A Comparison of the Remnant Ecological Health Assessment Scores Between Monitoring Events

Site	Remnant Ecological Health Assessment Score*							
	2007	2008	2010	2012	2017	2020	2021	2022
CB1	21	25	27	24	28	28 (26)	27	30
CB2						28 (26)	28	27
CB3						31 (29)	28	NA
CB4						30 (28)	26	NA
CB5						27 (26)	25	28
HR1	25	21	25	26	26	27	25	26
HR2	32	32	28	25	25	25 (23)	25	29
HR8	23	23	2	25	24	28 (26)	24	25
HR11	26	28	25	25	26	26 (24)	27	25
HR13	24	26	26	24	24	26 (24)	22	27
WB1	28	28	27	29	26	29 (27)	25	31
CA1	29	27		31	31	31	32	NA
CA2	26	25		26	28	30	32	NA
CA3						30	31	NA
CA4						30	29	NA
CA5						30	33	NA

* Out of a maximum of 39.

Note for 2020 scores, an adjusted score based on flood information provided in 2021 is in brackets.

Note: CB = Carrington billabong, HR = Hunter River sites, WB = Wollombi Brook sites, CA = Reference Site (Camyr Allen)

The change in remnant ecological health assessment scores from 2021 data is shaded to indicate a decrease in condition (red), stable condition (blue) and improved condition (green).

The monitoring observations from the Carrington Billabong that relate to the goals and objectives of the Strategy are presented in **Table 8-14** below.

Table 8-14: Observations That Relate to the Monitoring Objectives Outlined in the Strategy

Goals	Objectives	2022 Observations
To reduce the impacts of threatening processes on the stands	To supress or eradicate the in situ environmental factors that are acting to reduce the viability of the remnant population	Weeds continue to dominate the species assemblage at Carrington Billabong and priority sites. The previous 10 years of data suggests that active management and restoration should continue in order to “suppress and eradicate” this threat. The growth of planted RRG in cleared areas adjacent Carrington Billabong was noted in 2022. It is hoped that, while these trees may protect the remnant trees from climatic factors, that they may also provide habitat for birds and other species that may prey in the invertebrates that consume the eucalypt leaves.
	To improve the conditions within this population such that it can withstand reasonable periods of stress, predation and shortage of water supply	Flooding is required for germination of RRG. At the time of the monitoring a major flooding event occurred in March 2022, and excessive rainfall is likely to be the cause of isolated/patchy areas of inundation. Average tree health and canopy condition data showed an increase in health for 2022 within Carrington Billabong. Planted eucalypts (discussed above) also play a role in protecting the remnant from climatic and biotic threats.
To aid the establishment of the appropriate conditions to promote the health of the River Red Gum populations	To identify the likely *ex situ* factors that are contributing to the reduction in viability of this population and the health of the billabong and act, where possible, to control those factors or to take account of those factors in management approaches if they are not able to be directly controlled	The ERA outlines the groundwater exceedance issues around Carrington Billabong and ecological monitoring and triggers. Refer to **Table 8-17**.

Goals	Objectives	2022 Observations
	To ensure that the results of ongoing monitoring are appropriately used to modify the management regime in response to new or unexpected information	This report is provided to HVO to inform ongoing management decisions. Tubestock plantings occurred in 2022 to buffer the Billabong from wind events, and encourage bird diversity, over time. These plantings largely failed and will be repeated in early 2023.
Increase the understanding of the water requirements of the River Red Gums	Develop an understanding of water requirements through the timely monitoring of responses of River Red Gums to flood and storm events	The Strategy requires additional monitoring to be undertaken when triggered by flooding. As the flooding occurred following the 2021 monitoring event, and was still inundated during early 2022, the additional monitoring was not required in 2021 The volume of rain and persistence of flood waters, and the apparent response of remnant trees to these factors, provides some insight into the triggers required to see an improvement in overall tree health. Groundwater monitoring is undertaken at Carrington Billabong.
To enhance the River Red Gum population to enable it to persist as a viable functioning population	To assist this population to continue to self-propagate to ensure ample replacement of senescing trees with juvenile recruits.	Weeds continue to dominate the RRG community and can limit natural regeneration of RRG. Active weed management will continue in order to assist the community to become a self-sustaining population. However, it is also likely that, given the predominance of weeds in the area, flooding, wind and other vectors will affect ongoing weed management efforts.
	To support the establishment of a self-sustaining, functional and viable ecosystem that resembles what is likely to have been present in Carrington Billabong prior to European settlement	Species diversity has increased slightly at Carrington Billabong from 2021 to 2022. Recruitment is evident at Carrington Billabong but no (likely) recent

Goals	Objectives	2022 Observations
	To support the establishment of a self-sustaining, functional and viable ecosystem	recruitment of the canopy was noted. Remnant Ecological Health Assessments generally improved at Carrington Billabong and the Priority Sites.
To increase biodiversity including residence habitat, foraging habitat and native flora and fauna species	To increase habitat for the identified and potential native flora and fauna species	Tubestock plantings that occurred in 2021 and 2022 will increase the habitat area and local linkages once the tubestock become established and develop with time. The trees are too small to provide effective habitat for small fauna. Further tubestock plantings are planned for 2023.
To determine if there is any improvement or deterioration in RRG within Carrington Billabong	Data shows a slight improvement in RRG condition. Average canopy health increased from 2.4 in 2017 to 3.8 in 2020, declined slightly to 3.5 in 2021, and have increased to 3.8 in 2022.	
To determine if there is any improvement or deterioration of the natural habitat at Carrington Billabong	Data shows a slight improvement in the overall condition of remnant vegetation at Carrington Billabong and Priority Sites.	
To provide management recommendations to achieve further improvements in the ecological management of the site to assist in the recovery of RRG and their habitat	• Continued weed management and reduce ground cover biomass. • Record the extent and duration of flood events within Carrington Billabong to identify potential areas for recruitment events/actions. • Plant additional canopy and midstorey species in open areas.	

8.13.3 | ECOLOGICAL RISK ASSESSMENT

As noted in **Section 7.5**, HVO has a monitoring programme in place to monitor changes in groundwater quality due to seepage from the North Void TSF. Carrington Billabong is located adjacent to the North Void TSF.

As part of Condition 8, U1 of EPL 640, HVO has implemented a monitoring program that includes an Ecological Risk Assessment (ERA) (Umwelt 2020) that assesses the impact to the RRG community from the North Void TSF seepage. The annual monitoring is required to detect any notable decline in ecological condition of RRG at the Carrington Billabong. Should ecological monitoring identify any of the following factors, additional investigations will be implemented to determine the cause:

- An increase in tree dieback of 10% or greater compared to the previous year;
- Adult tree death of 10% compared to the previous year;
- Remnant ecological health scores decline of 10% compared to the previous year; and

• Unforeseen event that indicates a relatively rapid decline in ecological health or function that can't be linked to catchment wide causes (such as drought).

The results of the 2022 monitoring relative to these ERA trigger values is presented in **Table 8-15**.

Table 8-15: Factors to be Considered to Detect a Notable Decline in Ecological Condition of the RRG Community in Accordance With the ERA (Umwelt 2020)

Trigger	Monitoring Outcome - 2022
Groundwater quality indicates an increase in seepage from NV TSF	Five bores (CFW55R, CGW54a, GW-125, GW- 126, GW-129) showed water levels trending above the trigger values during the Q3 reporting period. Examination of these levels indicated a clear gradient from the Hunter River to the northeast. Water quality results show a decline in sulphate and EC with the rise in water levels, indicating the source is from rainfall/streamflow and not related to mine activities. Seepage from NV TSF was not identified as the source of these exceedances and, therefore, additional ecological monitoring is not triggered.
An increase in tree dieback of 10% or greater compared to the previous year	Data for 63 tagged RRG trees was collected. Canopy cover scores were compared to 2021 data for the same 63 RRG trees. Most trees had a stable canopy cover or improved canopy cover. 22% of trees recorded a reduced overall condition, and 14% scored a reduced canopy density. The leaf die off assessment recorded most trees with no evidence of leaf loss. Herbivory was noted on some trees which resulted in a poor canopy health score and severe insect attack score. This is not dieback.
Adult tree death of 10% compared to the previous year	One tree has died since monitoring in 2021.
Remnant ecological health scores decline of 10% compared to the previous year	Remnant ecological health scores were slightly higher or similar in 2022 compared to 2021 scores for Carrington Billabong and the Priority Sites.
Unforeseen event that indicates a relatively rapid decline in ecological health or function that can't be linked to catchment wide causes (such as drought)	A rapid decline has not been observed in the ecological health or function of the RRG population.

8.13.4 | MANAGEMENT ACTIONS

Weed Management

A targeted campaign to reduce the weed population along the Hunter River occurred in 2022, specifically within and adjacent to the Carrington Billabong, HR11 and HR13, and other priority areas along the Hunter River (**Figure 8-10**).

The weeds commonly found within these riparian areas include castor oil (Ricinus communis), balloon vine (Cardiospermum grandiflorum), boxthorn (*Lycium ferocissimum*) and green cestrum (*Cestrum parqui*) (**Figure 8-20**). The extensive floods that occurred reduced the extent of the standing exotic vegetation in many areas and the intention was to spray the germinating weeds that took advantage of the reduced competition. Managing the riparian vegetation along the Hunter River will reduce the weedy recruitment that is likely to occur within the stands of *E.camaldulensis* that occur within HVO lands along the river. While this is likely to be a never ending task while the river continues to flood, the benefits will be realised with the return to typical climatic conditions when native species can become established in sufficient densities that, hopefully, outcompete the germinating weeds.

Within the Billabong, HVO has been concentrating efforts on regular slashing the open areas and the adjacent grazing paddock to reduce the possibility for weeds to establish and reseed. Previously, the density of exotic weeds smothered the shorter native species in the area. While it was not possible to slash the Billabong area as frequently as we would have liked due to the risk of getting bogged, slashing did occur and the weeds did not obtain the height observed in previous years.

In addition, the creek line leading to the Billabong was brushcut around the existing RRGs to reduce the weed seed load originating from this feature. This concentrated effort has worked well with the exotic diversity within the Billabong recorded during the monitoring showing a decline in 2022 (**Table 8-13**).

The priority sites shown in **Figure 8-12** were also sprayed and/or slashed during 2022 along with extended areas of the Hunter River immediately adjacent to the priority RRG stands.

Previous reporting proposed that the dense stands of African olive that occurs in areas along the Hunter River would be mulched during 2022. Access to these areas was largely prevented by the height of the river for much of the year and the boggy conditions that prevailed once the levels had decreased. A focussed attention will be given to these areas when suitable access is possible.

Figure 8-20: Post Spraying of Weeds Within a Priority RRG Location at HVO

Active Regeneration

As discussed previously, to assist to protect the existing stand at Carrington Billabong from future storm and wind damage, HVO planted an additional 200 *E.camaldulensis* tubestock within the Hunter River floodplain adjoining the billabong to broaden the population (Figure 8-14). These tubestock were supplemented with 30 *Bursaria spinosa* planted in groups of five across the area as bird habitat 'islands'.

To facilitate access and monitoring of the River Red Gum Reference Site, HVO agreed to plant additional plants at a designated site specified by the landholder. During 2022, 100 *E.camaldulensis* tubestock and 100 tubes of a mix of *Bursaria spinosa*, *Melaeuca decora* and *Callistemon citrinus* were established within the landholders designated location.

To ensure genetic integrity of each population, seeds from each location was collected during 2020 for propagation and planting back within the location from which it came. Unfortunately, despite supplementary watering and hand weeding as needed during 2022 to assist survival and establishment, a clear majority of these tubestock failed at both HVO and the Reference site and will need to be repeated.

Additional plantings are planned to occur in 2024 in both the Billabong and the Reference Site and site preparation for this activity will occur in 2023.

Condition Assessments

To comply with the management actions outlined in the Strategy, environmental monitoring and a condition assessment was undertaken across the RRG sites at HVO. While the environmental monitoring has been discussed above, the condition assessment documented any identifying features indicating the presence of feral animals, erosion, presence of insect or fungus dieback, the condition of fences and summarised weeds present at each site. The results outlined the priority weeds at each site, summarised any bank erosion resulting from the flood events in 2022, stated what feral animal control was required if any, and did not identify any insect or fungus issues as occurring at each of the RRG sites. The findings and recommendations for each RRG location will be actioned across 2023.

Importantly, the assessment provided valuable information regarding the required management actions relating to weed and grass management at the lower priority sites. Weed and grass management at these sites will also be implemented during 2023 to facilitate improved habitat for the passive regeneration of the RRG populations.

Vertebrate Pest Control

As part of HVO's Vertebrate Pest Action Plan, programs are carried out on a seasonal basis and include sites where the River Red Gum populations are found. These programmes are conducted at a level of frequency designed to disrupt pest species breeding/colonisation cycles and employ a variety of methodologies including baiting, trapping and ground based shooting. Feral pig control was undertaken in the Billabong and other RRG sites as a result of pig activity being observed. Further detail on vertebrate pest control undertaken in 2022 is included in **Section 8.10**.

Figure 8-21: Location of 2022 Tubestock Plantings at the Carrington Billabong

8.13.5 | RIVER RED GUM CONDITION SUMMARY

Overall, the comparison of the monitoring data between 2022 and previous events have indicated that, weed management at each site needs to continue. With La Nina providing increased rainfall and flooding in areas, weed germination and seed dispersion will require management to ensure that recruitment at each of the RRG sites is not impended.

The condition assessments determined that the Billabong and the Priority Sites at HVO responded favourably to the improved environmental conditions. Despite the average canopy health in the Billabong increasing since 2017, additional works to encourage further improvement is required, particularly with some of the mature trees having being impacted by insects. During 2023, management activities will focus on the removal of kikuyu from the base of the RRG trees in the Billabong and focus on increasing the native component of the understorey within these communities.

The control of feral pests and weeds within areas managed for the RRGs at HVO will continue and efforts to enlarge and protect the stands of RRGs both at HVO and within the reference site will be planned during 2023.

8.14 | BIODIVERSITY OFFSETS

8.14.1 | GOULBURN RIVER BIODIVERSITY AREA OVERVIEW

In accordance with condition 29 of HVO's Project Approval, PA 06_0261, Hunter Valley Operations are accountable for managing a 140ha offset at the Goulburn River Biodiversity Area (BA).

HVO manage a number of other offsets including the Wandewoi, Condon View, Crescent Head and Mitchelhill biodiversity areas, however, these are managed under EPBC approval 2016/7640, are subject to compliance reporting under that approval and are not subject to further discussion in this document.

The Goulburn River BA is located near the town of Merriwa and, when considered in combination with the adjoining offset for the Warkworth Mine, forms an area of protected vegetation extending from the Goulburn River National Park (**Figure 8-23**). The Goulburn River BA is managed according to the Goulburn River Management Plan that is available on the HVO website.

Given that the Goulburn River offsets for the Warkworth Mine and HVO are adjacent to each other and both parties have a common managing partner in Yancoal, HVO and the Warkworth Mine have a commercial agreement for the HVO BA to be managed by the Warkworth Mine on its behalf. The benefit of this agreement is a reduction in duplication related to the management and monitoring activities that are undertaken by consultants and contractors. As such, while the figures presented below may include information relating to the Warkworth Mine, the text will focus on the data and activities originating from the HVO BA.

8.14.2 | WEATHER RECORDS

Overall, the rainfall recorded at the closest weather station to the Goulburn River BA exceeded the average total rainfall in 2022 (**Figure 8-22**). In this period, the Merriwa (Roscommon gauge) received 862.8 mm, which is well above the mean average rainfall for the area (600 mm). Exceedances of the mean rainfall were typical of records occurring across the Hunter Valley during 2022.

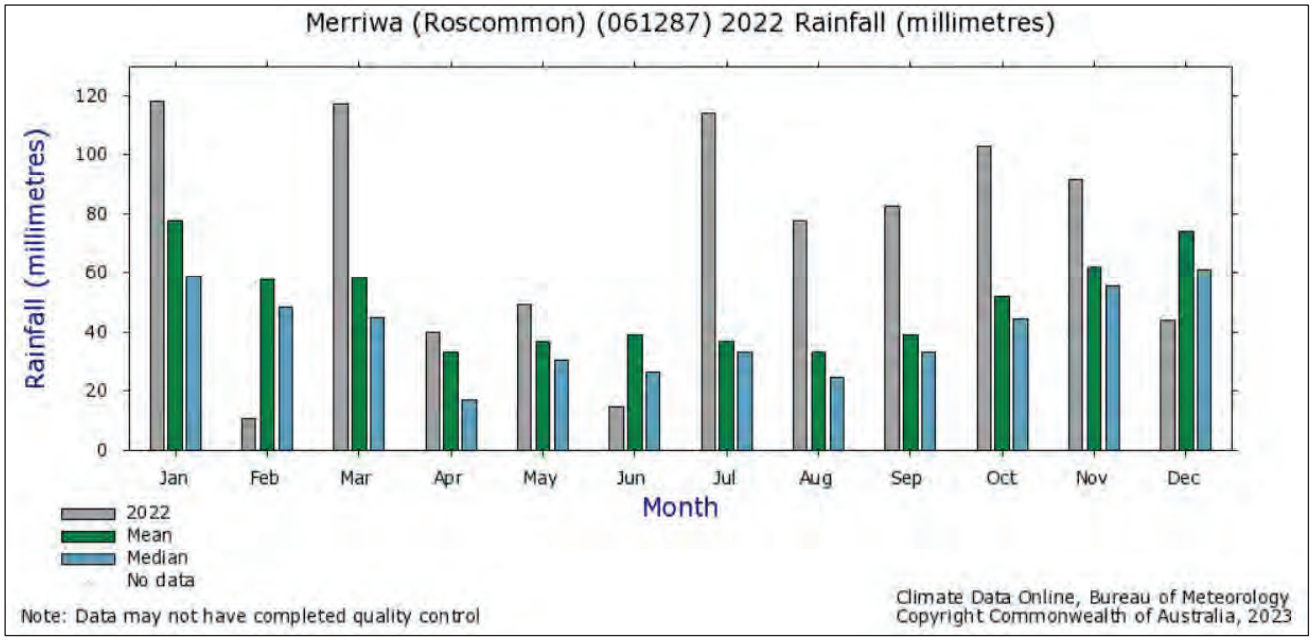

Figure 8-22: Rainfall records recorded at the Merriwa (Roscommon Gauge) - 2022

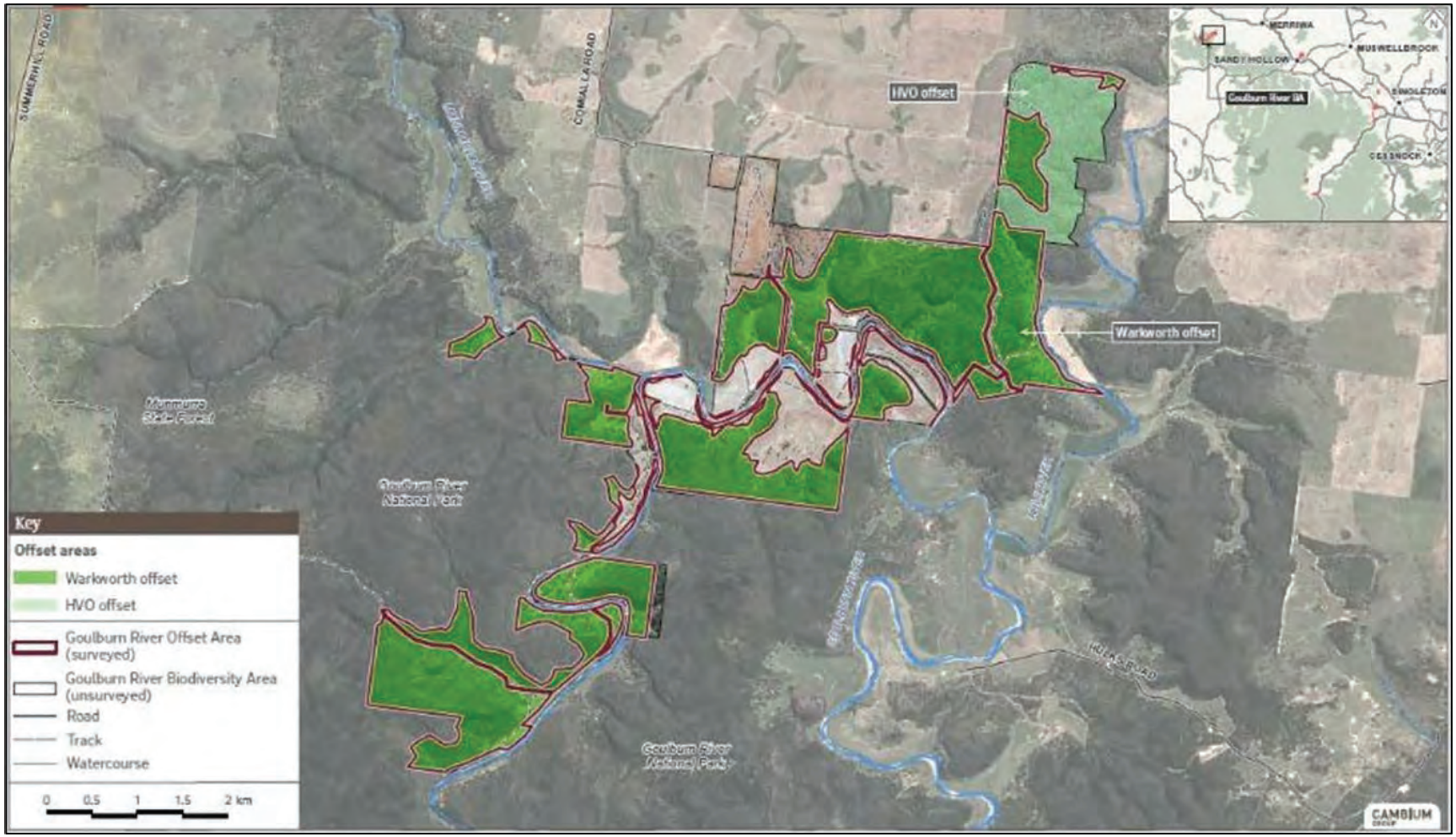

Figure 8-23: HVO's Goulbourn River Offset and adjoining Warkworth Mine Offset

8.14.3 | BIODIVERSITY AREA MANAGEMENT ACTIVITIES

Access to the HVO portion of the Goulburn River offset is via the Warkworth Mine offset and requires two crossings across the Goulburn River. Due to the extensive rainfall experienced during 2021 and 2022, flood waters in the Goulburn River was at a depth such that safe access was prevented and, once the water had receded, one of the crossings had been damaged by the floodwaters.

The cost to repair the crossing was prohibitive and an alternative access via an upgrade to a walk trail was installed. **Figure 8-24** indicates the two alternate locations to access the HVO offset. The previous access across the Goulburn River (yellow track) and the upgraded track (red track) that was constructed in February/March 2022.

A summary of the key actions in the offset management plan is outlined in **Table 8-16** below.

Table 8-16: Biodiversity Area Management Activities 2022

Activity	Description
Weed Control	No access obtained to undertake this activity.
Habitat Monitoring	Undertaken in accordance with the management plan.
Bird Assemblage Monitoring	Bird assemblage monitoring was completed.
Infrastructure Management and Improvement	Track upgraded to enable access to the HVO offset to avoid the river crossing.
Vertebrate Pest Management	Autumn/Winter and the Spring vertebrate pest management programmes undertaken. Night shooting/cat trapping occurred in October. Pig baiting occurred late November/early December.

Figure 8-24: Access locations from the MTW offset to HVO's Goulbourn River Offset

Habitat Monitoring

In September 2022, habitat monitoring assessed the condition of the native vegetation and determined whether the conservation objectives of the management plan were being met.

- The key conservation outcomes include:
- enhanced landscape connectivity within the surrounding landscape,
- improved fauna movement and flora dispersal opportunities within the surrounding landscape,
- increase in the total area of suitable habitats for threatened fauna species within protected reserves, specifically Regent Honeyeater and Swift Parrot, and

- contribute to and enhance the existing network of protected vegetation within the Hunter Valley.

To assess these outcomes, the key performance indicators and completion criteria are outlined in **Table 8-17** below.

Table 8-17: Habitat KPI and Completion Criteria for Goulburn River Biodiversity Area

Key Performance Indicators	Completion Criteria
Habitat improved condition over 10 years	Observed trajectory towards and/or attainment of benchmark values over 10 years measured biennially
Bird usage over 10 years	Observed richness or maintained species richness and usage by woodland birds over 10 years measured biennially

There are two management zones within the BA: called Management Zone MZ4 and MZ5.

Data recorded within both management zones showed the vegetation to be in good condition with many values achieving or exceeding the Benchmark range. Species richness was well above the Benchmark minimum for all plots and diversity was spread across all strata.

Within the two MZ5 plots, of note were the lack of native vegetation cover across the mid-storey and the lower scores for fallen logs and tree hollows. The data for MZ4 plots found the native overstorey cover and the number of hollows were both below Benchmark. These will be examined further prior to intervention.

Weed levels were generally very low throughout the Goulburn River BA. Most exotic species recorded were annual species that generally do not pose a threat to biodiversity. Common Prickly pear, *Opuntia stricta*, was recorded in one plot and is likely to occur at low density through the offset. Fireweed, *Senecio madagascariensis*, was also recorded. Although considered a priority weed, it does not threaten native biodiversity in native woodland areas with good diversity.

It was concluded that, on the whole, the remnant woodland vegetation was stable and should continue to recover from past disturbance with limited management intervention. Weed control targeting priority weds should continue and feral animal control, specifically feral pigs, should be undertaken. Canopy regeneration in management zone MZ4 should be monitored closely and management actions implemented if necessary.

Bird Assemblage Monitoring

A bird monitoring event was undertaken in October 2022 to determine the usage of the HVO biodiversity area by two priority species: the critically endangered regent honeyeater *Athochaera phrygia* and swift parrot *Lathamus discolour*. The monitoring also aimed to assess bird usage of the biodiversity area in general, with a particular focus on other threatened woodland birds, and to determine if management of the area is leading to an increase in woodland bird abundance and species richness over time.

No regent honeyeaters or swift parrots were detected occupying the biodiversity area during the survey. The summary of bird species richness and abundance during the monitoring event are presented in **Table 8-18.** Relative to 2020 data, bird species richness increased at all three monitoring sites surveyed in that year. Wet conditions in 2021-2022 may have impacted woodland bird abundance and species richness as blossom abundance within the biodiversity area was limited.

Five other threatened species were detected during surveys: wedge-tailed eagle (*Aquila audax*), speckled warbler (*Pyrrholaemus sagittatus*), varied sittella (*Daphoenositta chrysoptera*), dusky woodswallow (*Artamus cyanopterus*) and brown treecreeper (*Climacteris picumnus*).

Mean species richness and bird abundance increased in 2022 at all three sites that were surveyed in 2020, apart from woodland bird species richness at HVOGR2. Overall species richness also increased in 2022 relative to 2020.

Within monitoring sites, the increases in species richness (both total and only for woodland birds) were statistically significant at HVOGR1 relative to 2020 levels. Total and woodland bird abundance increased significantly at all sites surveyed in 2020. Increases were particularly large at HVOGR3 due to white box blossom attracting good numbers of nectarivores, as well as extraordinarily large numbers of migrating striated pardalotes (*Pardalotus striatus*).

The consultant reported that blossom abundance across the biodiversity area was generally low in winter/spring 2022. The wet weather may mean regent honeyeaters and swift parrots are occupying different habitats to where they typically occupy. Preliminary data from the National Regent Honeyeater Monitoring Program suggests regent honeyeaters are also not occupying other traditional breeding sites such as the Capertee Valley this spring.

The report stated that management of the biodiversity area is generally excellent. Continuation of feral pig management is recommended as there were widespread signs of pig presence within the property, although severe wet weather has made pig management a challenge in recent years. Understorey and midstorey vegetation are extensive and in good condition, which is reflected in the numbers of small woodland birds detected on site. A noisy miner cull could be considered on the eastern boundary of the property.

Table 8-18: Mean Bird Abundance and Species Richness Metrics at Goulburn River Biodiversity Area Monitoring Sites in 2020 and 2022

Site	Total Bird Species Richness		Woodland Bird Species Richness		Total Bird Abundance		Woodland Bird Abundance	
	2020	2022	2020	2022	2020	2022	2020	2022
HVOGR1	9.7	20	8.7	18	16.3	39.3	14.7	36.7
HVOGR2	14.7	15.3	14.3	13.3	21.7	29.7	20.7	26.7
HVOGR3	17.3	19.7	13.7	19	32.3	84.7	32	84
HVOGR4	n/a	9.7	n/a	9.3	n/a	17.7	n/a	17.3

Property Inspections and Rapid Condition Assessment

Due to the restricted access associated with elevated rainfall, not all the property inspections could be undertaken during 2022 as planned. For those that were undertaken, native regeneration was reported to be abundant across all areas. Native fauna species were active and observed. Feral pig activity was noted, no waste or illegal activity was observed to have occurred. Fences were recorded as being in fair condition with no repairs required at this time.

Due to the extensive vegetation growth, fuel loads were high and, as a result, routine track and fire break slashing occurred. The quadrat assessments averaged 100% groundcover which exceeded the >70% groundcover requirements in the management plan. In addition, the sward height averaged 40.9cm which also exceeded the management plan requirements of 10cm.

Feral Animal Control

Wild Dogs and Foxes

HVO undertakes vertebrate pest management activities within the offset properties that it manages. The aim of the vertebrate pest management programme is to target wild dogs and foxes that have been reported in and around the BA. The programme involves 1080 ground baiting and ejector baiting in conjunction with the Hunter Local Land Services (HLLS), National Parks and Wildlife Services (NPWS) and local landholders. The Autumn/Winter and the Spring programmes were the 14th and 15th respective programmes to have occurred at the Goulburn River BA.

During each programme, nine bait stations were established along with monitoring cameras to record the effectiveness of the stations.

During the Autumn/Winter programme, 13 takes were recorded within the HVO BA from the nine bait stations. Four were wild dogs, two from foxes and seven by feral pigs.

Comparing the Autumn/Winter results with previous years saw a decrease in baiting efficiency for both target and non-target species. The decrease in target species can be attributed to the exceptionally wet weather experienced over the previous six months and the cooler temperatures affecting foraging patterns of both predators and prey alike.

Within the spring programme, 93% of baits were taken at least once (across both HVO and MTW). Evidence indicated that 37% of baits were consumed by wild dogs, 15% by foxes and 41% were consumed by other species, including feral pigs and lace monitors. Research shows that the concentration in the meat baits is not of sufficient strength to adversely impact native fauna given their natural resistance to 1080.

The baiting efficiency for the Spring programme (81%) was consistent with previous programmes at the same time of year (70% and 82%) with a slight decline in non-target species takes.

Noisy Miners

Overabundant populations of the Noisy Miner (Manorina melanocephala) have been identified as having an impact on threatened and endangered birds, such as the Regent Honeyeater. In 2022, Yancoal obtained a permit under the Biodiversity Conservation Act 2016 to engage a contract shooter to reduce the population of Noisy Miners within the Goulburn River BA.

The shooting occurred over seven days in August 2022 across both the HVO and MTW portions of the Goulburn River BA. No Regent Honeyeaters were sighted during the programme. Within the HVO portion, the control events focused on the boundary with the adjacent farmland.

Within the areas containing noisy miners, significant numbers were present with no gaps in territories, and high numbers of bird groups holding, patrolling and calling within well-defined areas. The programme resulted in 230 noisy miners being removed from the programme boundaries within the HVO and MTW biodiversity areas.

Pigs

In November to December 2022, a 1080 pig bating programme was undertaken following a free-feed period. Eleven free-feed stations were monitored across both HVO and MTW biodiversity areas to determine the best places to install the 1080 bait station. A total of 72 feral pigs were observed interacting at the free-feed locations. Two 1080 bait stations were established within the HVO BA (**Figure 8-25**). During baiting, 66 feral pigs were observed during the effective period of baiting across both BAs. Post-baiting, six of the identified pigs returned with an additional previously unidentified seven feral pigs.

Other feral animals observed by the camera monitors included two foxes and four rabbits. No wild dogs were recorded which may explain why the large numbers of pigs were noted within the biodiversity area.

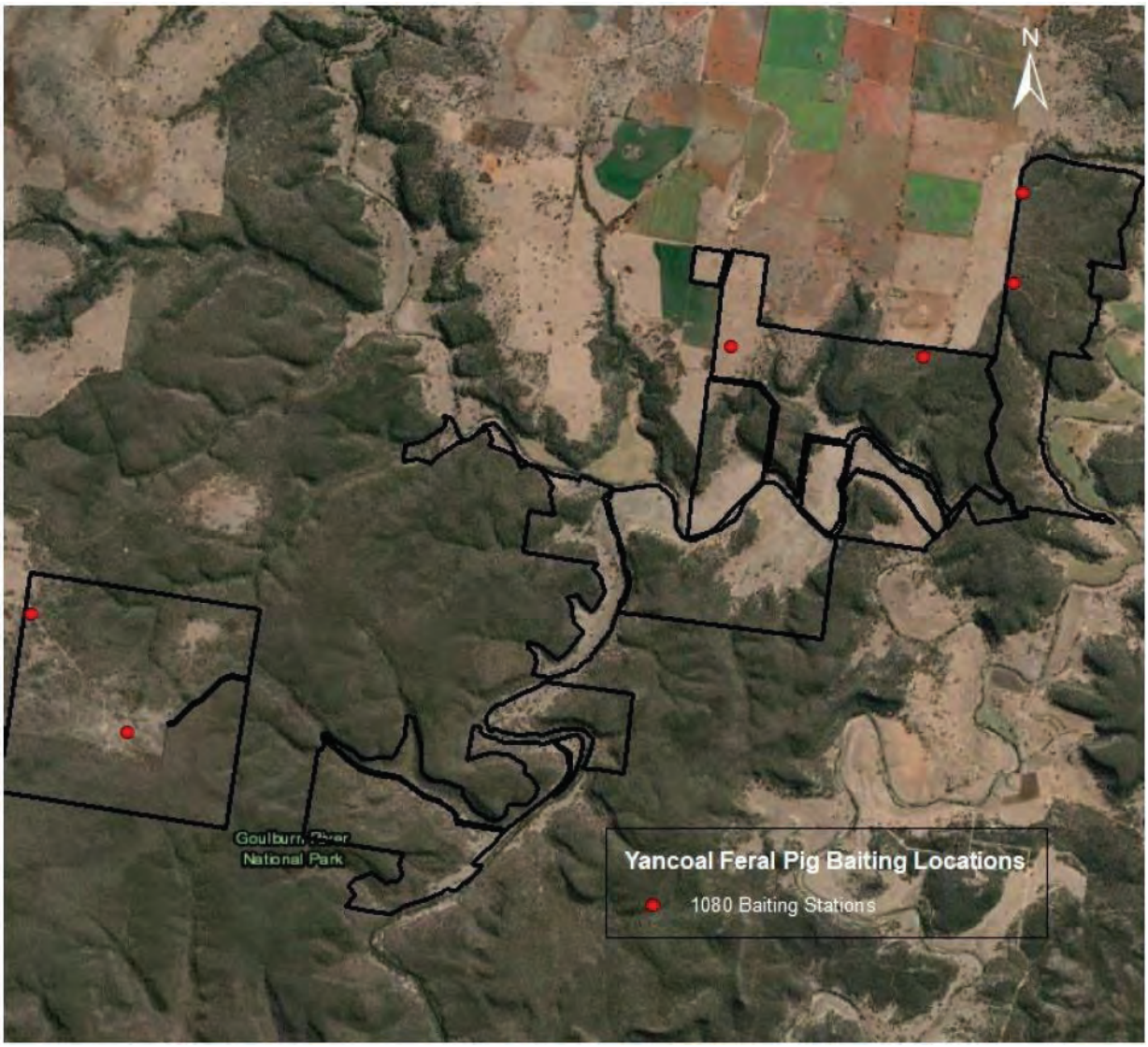

Figure 8-25: 2022 Feral Pig Baiting Locations at HVO's Goulburn River Offset. The HVO BA are the two stations to the North-East

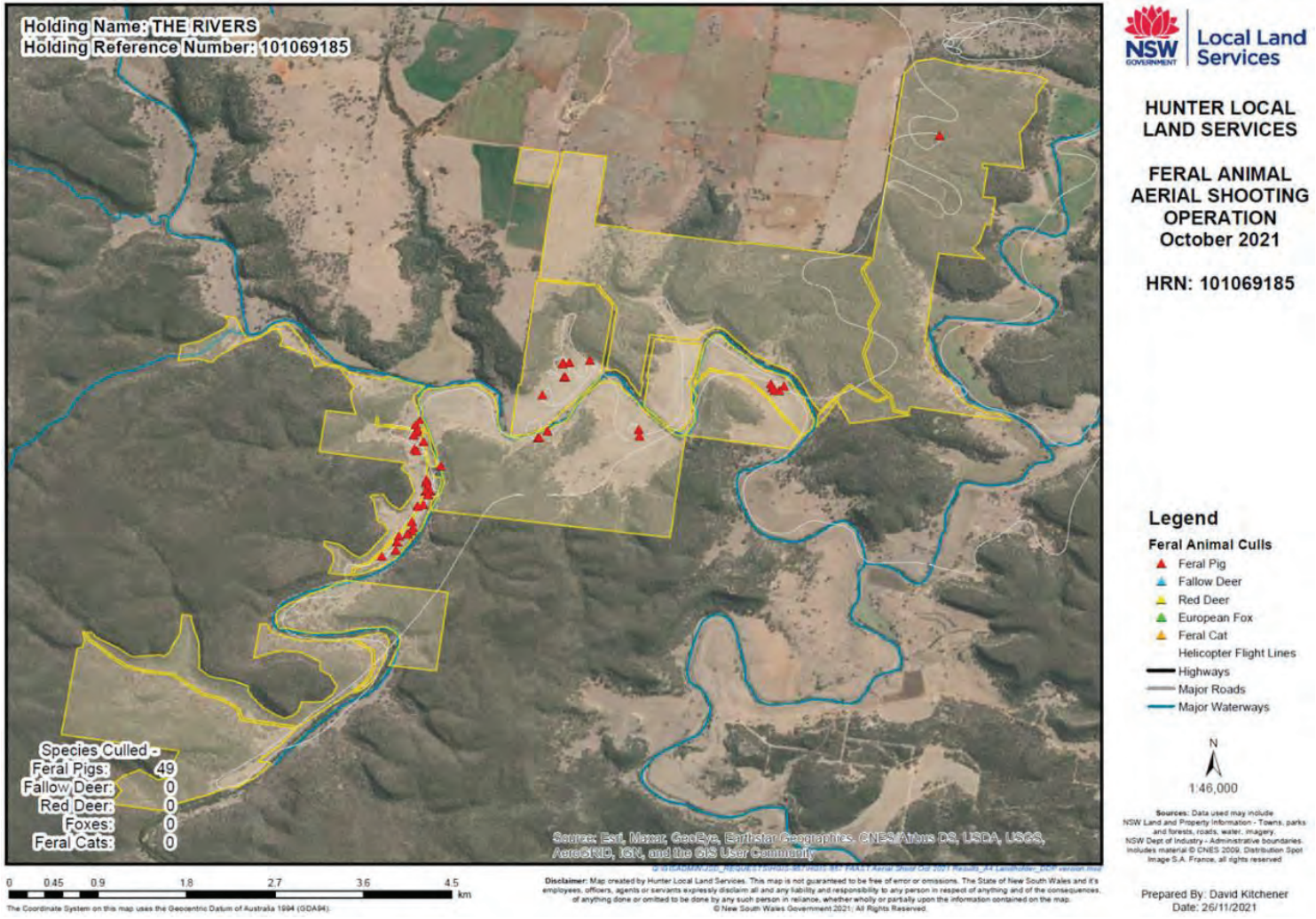

Figure 8-26: Aerial shooting of feral vertebrate pests at the Goulbourn River BA

9 | COMMUNITY

9.1 | COMPLAINTS

HVO provides a 24-hour Community Complaints Hotline (via freecall number 1800 888 733) for community members to comment on concerns relating to its operations. All complaint details are recorded in a database in accordance with Condition M4.2 of Environmental Protection Licence 640 and made available on HVO's website (www.hvo.com.au).

A total of 7 complaints were received by HVO during 2022 (**Figure 9-1**) This represents a decrease of 18 community complaints from the previous year, and is lower than typically received at HVO (**Figure 9-3**). Complaints were predominantly received relating to blasting and dust. **Figure 9-2** provides further detail regarding the number of complaints per complaint type. Details of complaints received in 2022 are included in **Table 9-1**. Additional blast rules were put in place in response to blast dust complaints from a resident and the Hunter Valley Gliding Club.

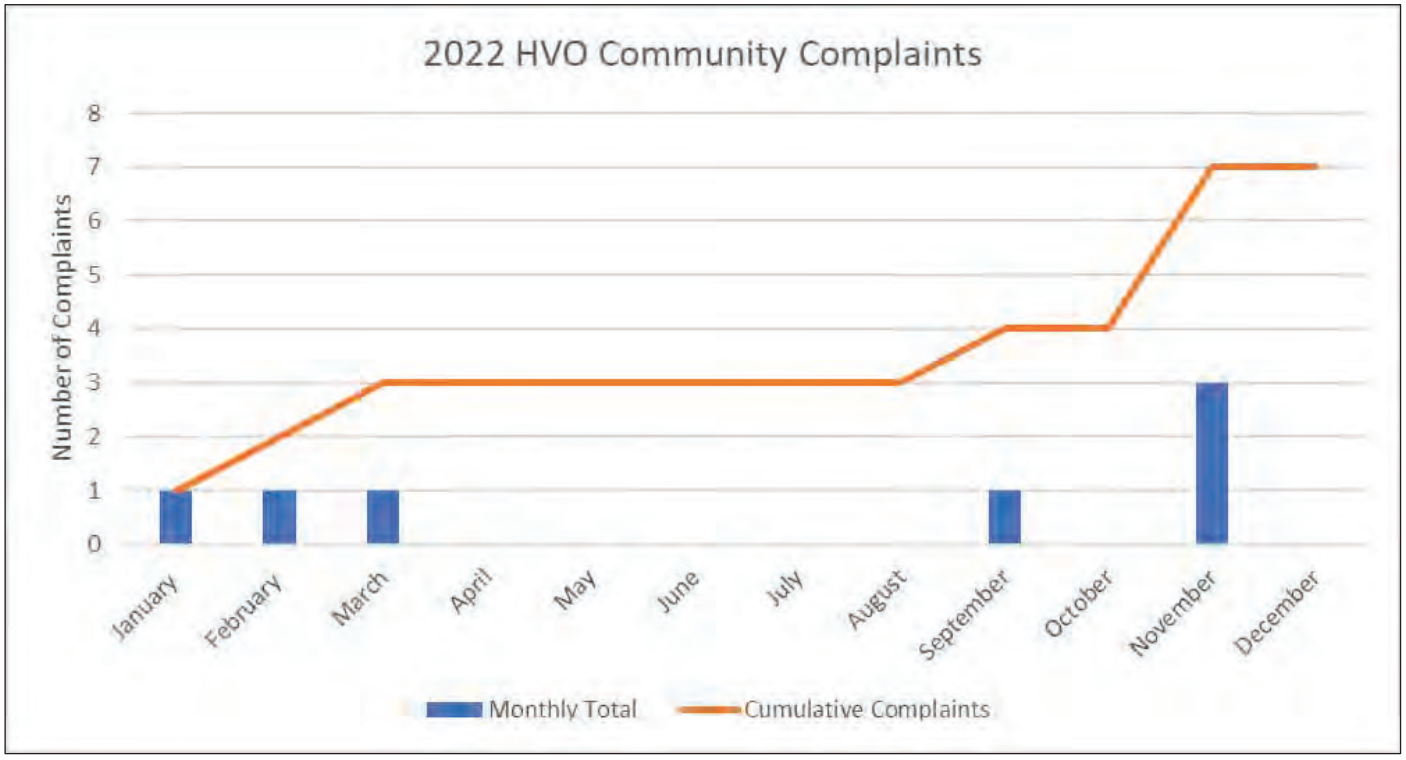

Figure 9-1: Summary of Community Complaints in 2022

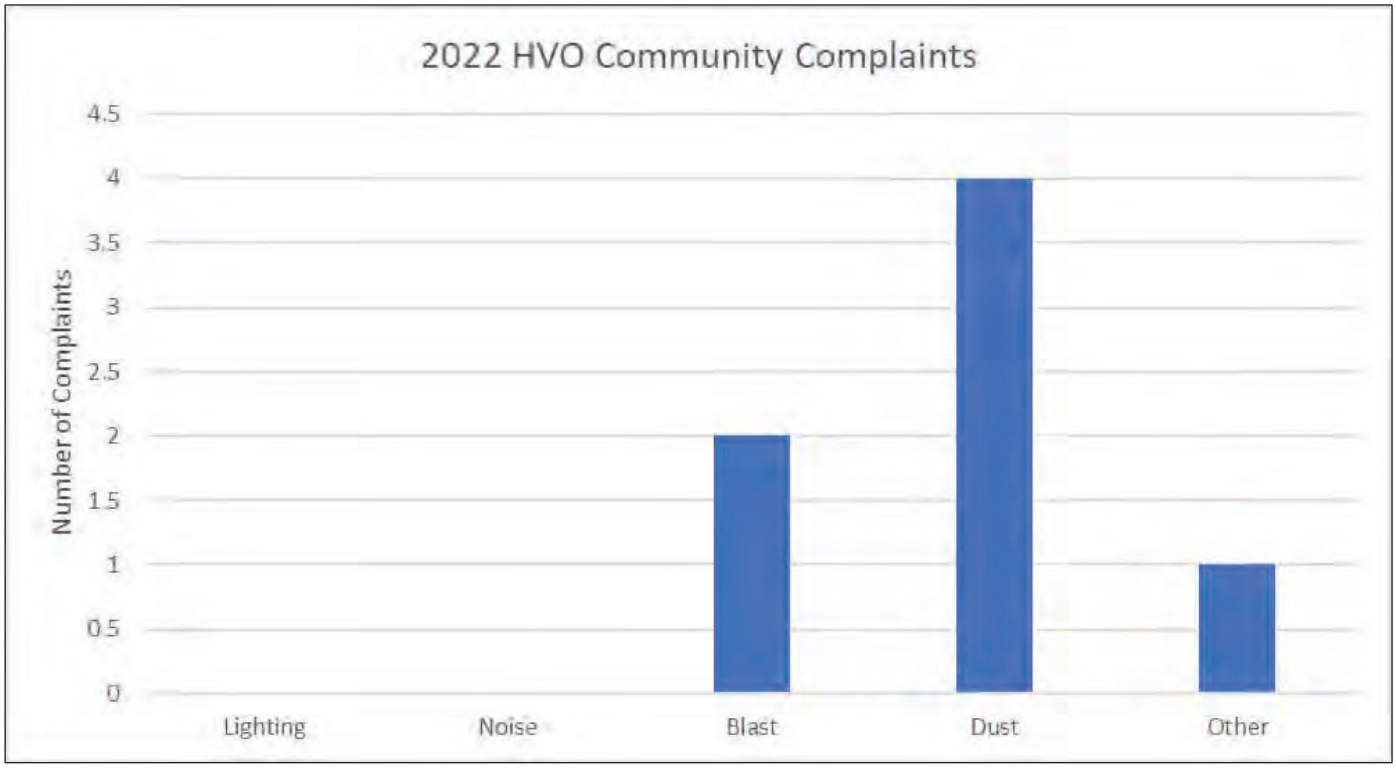

Figure 9-2: Number of Complaints per Type

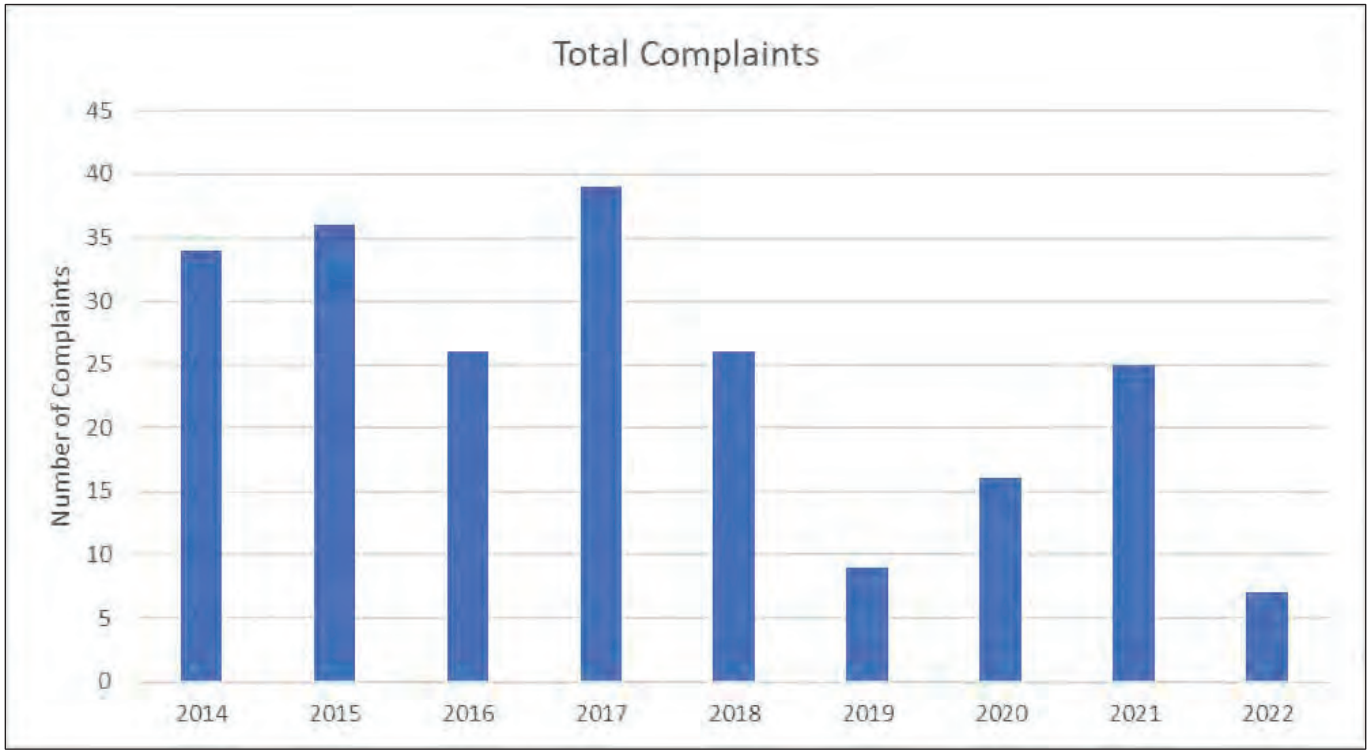

Figure 9-3: Community Complaints 2014 – 2022

Table 9-1: Details of Complaints Received in 2022

Date	Time	Nature of Complaint	Description	Follow Up Action
5 January 2022	1:24pm	Blast	A resident from Jerrys Plains called the Community Hotline at 1.24pm to mention that a blast fired at approximately 1:06pm was noisy and sounded like lighting had struck their house and that the windows rattled.	The Environment and Community Officer contacted the resident and confirmed that HVO fired a shot at 1.06pm from Cheshunt Pit 2. The recorded overpressure and ground vibration levels for the Jerrys Plains blast monitor were 108.39 dB and 0.04mm/s which are under compliance levels of 120dB and 10mm/s.
11 February 2022	1:05pm	Blast	A resident from Maison Dieu sent an SMS to the Environment and Community Officer at 1.05pm asking to record a complaint due to noise and movement from a blast at ~1pm. The complaint followed two successive blasts in Cheshunt Pit 2. The Environment and Community Officer confirmed HVO blast firing times aligned with the complaint and called the resident. The resident noted that "vibration and sound was the main issue, the blast shook the whole house, it was a long blast and its blasts like this one that create movement in the house and damage".	Maison Dieu is the closest monitor to the property and recorded low overpressure and vibration (94.75 dBL and 0.08 mm/s) – this is the highest vibration reading of the two shots fired. No anomalies were observed with the blast, however elevated noise was possible due to it being a shallow parting shot (holes less than 2m). Wind was ~3 m/s from the south east, blowing away from the residence.
19 March 2022	7.35pm	Other	A member of the public (who wished to remain anonymous) stated that they were driving along the Golden Highway near the secondary entrance to HVO South, when a car pulled out behind the complainant and tail gated the driver. The complainant reported that the rear driver sped past them (near the roadworks at Warkworth) and cracked the car windscreen of the car which was brand new. The care details were provided to HVO. They identified the driver to be wearing orange high visibility clothing.	A search was conducted of HVO carparks in days following the complaint however the vehicle was not able to be identified. A presentation slide about safe driving practices when traveling to and from HVO was communicated to employees and contractors.

Date	Time	Nature of Complaint	Description	Follow Up Action
19 September 2022	1.02pm	Blast Dust	A resident of Long Point called the Community Complaints Hotline at 1.02pm regarding a dust complaint. The complaint followed blasting in Cheshunt Pit 2. The resident was called back by the Environment and Community Officer at 1.03pm to ascertain the details relating to the complaint. The resident was annoyed and felt that it was unacceptable for HVO to be blasting given the windy conditions at the time and that the dust was bad for the environment.	A review of camera footage of the blasts fired at 12.52 and 12.53 pm confirmed that a dust plume was produced and started dispersing once leaving the pit crest. The wind speed was ~8 m/s at 12:50pm and wind direction was 292°. The resident's property is approximately 8 kilometres from the blast location at a bearing of ~295°. As there are no near neighbours between the bearings of 280 and 311° the maximum permitted wind speed for firing the blast was 9 m/s. The nearest real-time PM10 monitors are located downstream of the blast but on either side of the wind bearing and levels did not spike following the blast. A high volume air sampler is located within 150m of their residence and was monitoring particulates during the blast. Results from the filter paper from the monitor were received in early October which indicated no exceedance on the run day of the monitor which was also the date of the complaint. The blasting permissions for wind directions between 280 and 311° were modified with a maximum of 7 m/s wind speed restriction applied for blasts in Cheshunt.

Date	Time	Nature of Complaint	Description	Follow Up Action
12 November 2022	10:14am	Blast Dust	A resident of Long Point called the Community Complaints Hotline at 10.14am regarding a dust complaint. The complaint followed blasting in Cheshunt Pit 2 at 10.01 am.	The wind direction and wind speed at 10:00am prior to the blast was 321 degrees and 1.29m/s. The blast was visible but did not travel in the direction of the resident. No fume was recorded and the blast was fired in accordance with internal blasting permissions. TEOM data was reviewed which showed the monitor in closest proximity to Long Point (Knodlers Lane) was below the daily criteria limit of 50 µg/m^3 from 10am to 11:10am. A meeting was subsequently arranged with a number of matters discussed including HVO review of blasting permissions.
12 November 2022	10:35	Blast Dust	A representative of the Hunter Valley Glider Club phoned the complaints hotline to complain about blast plume residue entering the Glider Club property and covering the runway.	The wind direction and wind speed at 10:00am prior to the blast was 321 degrees and 1.29m/s. The TEOM data was checked and shows the monitor in closest proximity to the Glider Club (Warkworth) experienced a peak in dust levels (~100µg/m^3) above the daily criteria from approximately 11:20am, aligning with wind speed and direction. Photos were reviewed from HVO cameras and the Hunter Valley Gliding Club cameras. These indicated the dust plume travelled in the direction of the air strip. No fume was visible. Blasting permissions were subsequently modified to introduce a low wind speed restriction of 2 m/s for blasts in Cheshunt when wind is from the northwest.

Date	Time	Nature of Complaint	Description	Follow Up Action
24 November 2022	16:23	Blast Dust	A resident in Long Point rang the Community Complaints Hotline at 4:23pm to complain about dust from the blast at 3pm.	Discussion was held regarding previous review of blasting restrictions which applied a restriction to blasting in the direction of the residents house and that the blast was fired in accordance with these permissions. The resident was not satisfied with the dust from the blast or the additional controls to blasting. Camera footage was reviewed which showed that dust from the blast rose to height under light winds and dispersed reasonably quickly and predominantly above HVO within 10-15 minutes after firing.

9.2 | REVIEW OF COMMUNITY ENGAGEMENT

9.2.1 | COMMUNICATION

One near neighbour newsletter was sent to HVO's near neighbours during 2022 providing an overview of:

- Operational updates;
- Environmental activities such as aerial seeding activities, feral pest management programme.
- Archerfield Stables heritage site;
- Community initiatives such as near neighbour amenity resource programme and community grants.
- Communication tools –website, environmental monitoring public reporting website and the blast notification SMS alert system; and
- Continuation Project updates.

A new HVO webpage was launched consolidating HVO environmental information, the Continuation Project and general information about HVO.

9.2.2 | CONSULTATION AND ENGAGEMENT ACTIVITIES

Consultation and engagement activities included Community Grants, the support of the Jerrys Plains Primary School pre-school programme, Apprentice community working bee at the Singleton Community Gardens and the Community Consultative Committee.

HVO continued to encourage the community to contact the company in a way that suits the individual community members.

Community information sessions were held at Jerrys Pains on 23 March and Maison Dieu on 30 April to provide information to near neighbours on current operations and the HVO Continuation Project.

9.2.3 | COMMUNITY CONSULTATIVE COMMITTEE

The HVO CCC meetings were held in February, May, August, and November 2022. The HVO CCC meet to discuss operations, projects and mine activities. The Committee is comprised of HVO representatives, community members and other key external stakeholders, including Council. The HVO CCC minutes are available on the HVO website (www.hvo.com.au). The community is invited to visit the website(s) to learn more about the HVO CCC.

In 2022 CCC members were:

- Dr Colin Gellatly (Independent chairperson)
- Cr Hollee Jenkins (replaced by Cr Sue George from November onwards)
- Dr Neville Hodkinson
- Mrs Janelle Wenham
- Mr Brian Atfield
- Mrs Di Gee
- Mr Todd Mills

- Mr Michael Wellard
- Mrs Jeanie Hayes
- Mrs Sarah Purser (minute taker)
- HVO General Manager – Tony Morris
- HVO Environment & Community Manager – Andrew Speechly
- HVO Environment & Community Officer – Merri Bartlett

9.2.4 | COMMUNITY GRANTS

HVO supports applications for local donations and sponsorships that have a clear community benefit.

Round one of the community grants programme closed in April with a number of local organisations successful in obtaining funds totalling almost $32,000 including:

- Australian Stock Horse Society Eastern Branch – Eastern Branch ASHS Championships and Performance Weekend;
- Business Singleton – Gold Sponsors of the Singleton Business Awards
- Early Links Inclusion Support Services Inc – Fun Factory
- Friends of St James Church Jerrys Plains Incorporated – Jerrys Plains Bicentennial Celebrations
- Jerrys Plains Public School P and C – Jerrys Plains Bicentennial Celebrations
- Jerrys Plains School of Arts Hall – Mental Health First Aid Course
- Mercy Services – TrioBike Taxi for Residents
- Glen Gallic Shooting Club Inc – Replacement Archery Targets.

Round Two of our Community Grants Programme closed in September with a number of local organisations successful in obtaining funds totalling over $21,000 including:

- Equipment for Star Club Milbrodale & Broke
- Muswellbrook South Public School P&C's Colour Your Threads for Pos Ed
- Singleton PCYC Book Fair
- Singleton ADRA Food Pantry
- Cessnock Community Leo Club's Native Wildflower Initiative
- Rotary Club of Muswellbrook
- Upper Hunter Where There's a Will's Burn Bright Program

HVO also continued to support the Jerrys Plains Public School 2023 Jerrys Juniors and Ready4School program.

Five new partnership mining trucks have started work for the mine and for local charities. The trays of the trucks have been painted in the colours of Westpac Rescue Helicopter Service, Hunter Prostate Cancer Alliance, Type 1 Foundation, Singleton Family Support and Hunter Breast Cancer Foundation. The charities will get an agreed donation for every load the trucks haul plus other fundraising support throughout the year.

In December, members of the HVO team drove to flood effected Central West NSW to distribute gifts, billy carts and toy kitchenettes with local Salvation Army officers. HVO staff made the toys as well as wildlife nesting boxes as a team building exercise at recent training days. Local (Hunter) kids in need also received the toys and the nesting boxes were donated to organisations in the Upper Hunter and Lake Macquarie.

HVO delivered $5,000 in gift vouchers to Singleton Family Support and the Salvos in time for Christmas. Many employees donated back the gift voucher HVO gave them for Christmas and HVO matched their generosity. We also provided St Vincent de Paul food items that our staff put under HVO Christmas trees.

Two of our trucks wore moustaches during Movember to raise awareness about men's health and $5,430 for the cause. Coffee carts and a hard hat sticker campaign raised $10,000 for the Mark Hughes Foundation.

9.2.5 | HVO CONTINUATION PROJECT

Community members and stakeholders have been consulted through each step of the HVO Continuation Project. Community feedback has helped to design and refine the proposal and our plans to minimise and manage social and environmental impacts.

HVO used a variety of tools to provide information and gather feedback consistent with the State Significant Development Engagement Guidelines 2021, Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 and the Secretary's Environmental Assessment Requirements (SEARs) issued by DPE.

Engagement has also included the following:

- Project newsletters for the local community;
- Community information sessions in Jerrys Plains, Maison Dieu and Long Point;
- Other community and stakeholder meetings;
- Consultation with HVO's Community Consultative Committee;
- Information on the HVO website;
- Consultation with 33 RAPs; and
- Responding to email and phone enquiries.

The HVO Continuation Project Environmental Impact Assessment was placed on public exhibition by DPE in Q1 2023 for public comment, with a Response to Submissions to be provided by HVO.

10 | INDEPENDENT AUDIT

The last Independent Environmental Audit (IEA) was undertaken in November 2022. This audit was undertaken against the conditions of both Project Approval 06_0261 (as modified) and DA 450-10-2003 (as modified). The audit also assessed compliance with other licences and approvals including mining leases and EPL 640.

RPS AAP Consulting Pty Ltd (RPS) were engaged and endorsed by DPE as suitably qualified, independent experts to undertake the audit. The timeframe for the audit was from 2 December 2019 to 30 November 2022. The site inspection component of the audit was undertaken over three days between 28 and 30 November 2022.

The audit report and HVO's response to the auditor's recommendations were submitted to the DPE on 23 February 2023.

Out of 225 conditions the audit identified 14 non-compliances with PA 06_0261 and DA 450-10-2003:

- 6 non-compliances associated with PA 06_0261
- 8 non-compliances associated with DA 450-10-2003

The non-compliances primarily relate to incidents reported during the audit period. These findings, along with the auditor's recommendation and HVO's response to these recommendations, are summarized in **Table 10-1**. The next IEA is due in 2025. The 2022 IEA can be downloaded from the HVO Website.

Table 10-1: 2022 Hunter Valley Operations Response to Audit Recommendations

Ref	Recommendation	HVO Response	Due Date
HVO South – PA 06_0261 Non-Compliance Recommendations			
S2 C2	No Further Action Required	No Further Action Required	N/A
S2 C2A	Refer S2 C2	No Further Action Required	N/A
S3 C2	Reference in Table 9 of the Monthly Environmental Monitoring Reports should be updated to reference LA1, 1-minute criteria Where a tonality penalty has been applied, the monthly report should include discussion and clarification on whether this constitutes an exceedance or is attributable to other sources.	HVO will amend future Monthly Environmental Monitoring Reports to included updated reference HVO will amend future Noise Reports to include discussion and clarification regarding observed tonality penalties	30/03/2023
S2 C7	No Further Action Required	No Further Action Required	N/A
S3 C15	Ensure that the blasting schedule on the HVO website is maintained.	Issue with the Blasting Schedule link from the “Contacts” page has been rectified	Complete
S3 C15	It is recommended that management plans, and other necessary documents include a table itemising the matters raised during consultation with identified parties, and description of the resolution of these matters.	HVO will amend and include in future revised management plans and other necessary documents a table itemising the matters raised during consultation with identified parties, and description of the resolution of these matters.	4/07/2023*
S3 C18	Recommend updating Section 1, Table 1 to Table 3 of the BMP to ensure correct references in column 3 (“Section of BMP which addresses this requirement”, “Where Commitment is addressed”, “Where Condition is addressed”).	HVO will amend in the next revision of the Blast Management Plan.	4/07/2023*
S3 C19	9 It is recommended that operators are provided with refresher training to ensure awareness of these TARPs and to ensure more proactive management of wheel generated and plant-generated dust.	HVO will roll out refresher training to operators to ensure awareness of Dust TARPS	30/06/2023

Ref	Recommendation	HVO Response	Due Date
S3 C25	Repair the eroded batter to Dam 37S or redirect flow to the existing stabilised entries. Sediment should then be removed from the basin to restore capacity	HVO will include repair works in future works programs to ensure completion. HVO will undertake a review of current sediment storage capacity compared to dam design criteria to determine whether further desilting is required.	20/06/2024
S3 C27	Version 3.4 of the WMP has been issued to the secretary and is waiting approval. Review the contents of the WMP to reflect the audit findings when next updated.	HVO will amend in the next revision of the Water Management Plan.	4/07/2023*
S3 C58	Ensure that waste containers have lids fitted and/or are stored undercover to limit additional generation of contaminated liquid.	HVO will undertake a site inspection to ensure lids are fitted to waste containers on bunded pallets that are not undercover and reinforce this expectation with a site communication.	30/04/2023
HVO North – DA 450-10-2003 Non-Compliance Recommendations			
S2 C2	No Further Action Required	No Further Action Required	N/A
S2 C2A	Refer S2 C2	No Further Action Required	N/A
S3 C2	Where a tonality penalty has been applied, the monthly report should include discussion and clarification on whether this constitutes an exceedance or is attributable to other sources.	HVO will amend future Noise Reports to include discussion and clarification regarding observed tonality penalties	30/03/2023
S3 C4A	It is recommended that operators are provided with refresher training to ensure awareness of these TARPs and to ensure more proactive management of wheel generated and plant-generated dust	HVO will roll out refresher training to operators to ensure awareness of TARPS	4/07/2023
S3 C7	Reference in Table 9 of the Monthly Environmental Monitoring Reports should be updated to reference LA1, 1-minute criteria	HVO will amend future Monthly Environmental Monitoring Reports to included updated reference	30/03/2023

Ref	Recommendation	HVO Response	Due Date
S3 C10	Recommend updating Section 8.1.1, Table 8-1 to reference AS1055- 2018 (supersedes AS1055-1997), and include reference to NSW EPA Approved methods for the measurement and analysis of environmental noise in NSW, 2022.	HVO will amend in the next revision of the Noise Management Plan.	4/07/2023*
S3 C19	Recommend updating Section 1, Table 1 to Table 3 of the BMP to ensure correct references in column 3 (“Section of BMP which addresses this requirement”, “Where Commitment is addressed”, “Where Condition is addressed”).	HVO will amend in the next revision of the Blast Management Plan.	4/07/2023*
S3 C20	No Further Action Required	No Further Action Required	N/A
S3 C21	No Further Action Required	No Further Action Required	N/A
S3 C27	Version 3.4 of the WMP has been issued to the secretary and is waiting approval. Review the contents of the WMP to reflect the audit findings when next updated. Repair the inlet to Dam 5N to stop ongoing sedimentation, remove sediment from the dam, and confirm the capacity of Dam 5N and Dam 2N meets industry guidelines.	HVO will amend in the next revision of the Water Management Plan. HVO will include repair works in future works programs to ensure completion. HVO will undertake a review of current storage capacity in relation to Bluebook Standard to confirm whether current storage capacities are sufficient or additional capacity is required.	4/07/2023* 30/12/2023 30/7/2023
S3 C28A	No Further Action Required	No Further Action Required	N/A

* Date indicates when Management Plans are submitted for Department approval. Timing of approval and finalisation of the plan with the changes is outside of HVO’s control.

11 | INCIDENTS AND NON-COMPLIANCES

During 2022 there were four incidents that required reporting to DPE. These were related to water and are summarised below.

Dam 2N, 35S, 39S and 15N Overflow Event – March 2022

During consecutive rain days between 6 and 9 March 2022, HVO recorded 141.2mm and 141.6mm of rainfall at its North and South weather stations respectively. The rainfall recorded significantly exceeded the design rainfall depth for sediment dams 2N, 35S and 39S. It also exceeded the capacity of mine stormwater containment Dam 15N. It was deemed that the incident would not have caused environmental harm

Dam 32N (Coffeys) Overflow Event – March 2022

During March, HVO recorded 256.2mm and 265.6mm of rainfall at its North and South weather stations respectively. The rainfall recorded exceeded the capacity of the mine stormwater containment Dam 32N (Coffeys Dam) resulting in it spilling to Bayswater Creek at the Hunter Valley Load Point. The dam is classified as a mine water dam. Samples were collected that indicated spilling water was of fresh quality, receiving runoff predominantly from clean catchment. A pump was installed to dewater the dam to Ravensworth CHPP. Spilling of the dam ceased 3 April 2022.

Dam 2N Overflow Event – July 2022

Sediment Dam 2N overtopped to Farrells Creek following continued rainfall in the preceding days. Rainfall volume exceeded the dam design capacity. The dam was being pumped out at the time and continued to operate until the level reduced below the spillway and water quality samples were collected. Due to the fresh quality of the water and excessive rainfall in the local catchment there was no potential for environmental harm.

Dam 35S, 39S and 15N Overflow Event – July 2022

During consecutive rain days between 2 and 6 July 2022, HVO recorded 161.6mm and 157.2mm of rainfall at its North and South weather stations respectively. The rainfall recorded significantly exceeded the design rainfall depth for sediment dams 35S and 39S and exceeded the capacity of mine stormwater containment dam 15N. The dams were pumped out to reduce water levels and water quality samples were collected.

12 | ACTIVITIES TO BE COMPLETED IN 2023

12.1 | APPROVALS

HVO will continue to progress its application for the HVO Continuation Project. Following public exhibition a response to submissions report will be provided to DPE.

12.2 | NOISE

Noise management improvements identified for implementation in 2023 include:

- Sound Power Level testing of various heavy mining equipment.
- Investigate replacement options for ageing Barnowl monitors
- Fitting of sound attenuation to new heavy mining equipment brought to site

12.3 | AIR QUALITY

Air quality management improvements identified for implementation in 2023 include:

- Aerial seeding of overburden that is temporarily unavailable for rehabilitation where available.
- Implementing recommendations from a review of the air quality monitoring program; and
- Refreshing employee training on response to visible dust triggers
- Commissioning E-Bam PM2.5 air quality monitors at Maison Dieu and Kilburnie South in place of HVAS monitors
- Continue the replacement programme for ageing HVAS monitors

12.4 | BLASTING

HVO will continue to manage blasting activities in 2023 in accordance with the *Blast Management Plan*.

12.5 | HISTORIC HERITAGE

Improvements to historic heritage identified for implementation in 2023 includes commencing the Historic Homestead Project, which will include the completion of detailed condition reports for the Archerfield, Wandewoi and Carrington Stud homesteads. In addition the project will prepare a long term maintenance and management plan for each homestead complex.

12.6 | WATER

Improvements to mine water management in 2023 include:

- Commence construction of water containment upgrades at the train load out facilities;

- Install water management structures ahead of mining in Mitchell Pit;
- Commence construction of Dam 15N enlargement project;
- Commence detailed engineering and scoping of water containment projects beyond 2023;
- Continue geotechnical investigations and engineering for barrier wall installation between the North Void TSF and Carrington Alluvium;
- Ongoing upgrade of internal water transfer pipelines, pumping infrastructure, and system controls and monitoring; and
- Updates to sites Operational Water Management Plan

12.7 | REHABILITATION

During the next reporting period key focus areas for HVO will be:

- Completion of annual rehabilitation target of 44 ha of new rehabilitation.
- Continuation of Section 240 rehabilitation maintenance plan including progression of historic cover crop management areas to final target land use.
- Finalise detailed design and commence works for remediation and rehabilitation of the former Eastern TSF at HVO North.
- Undertake contour repair works on the WOOP dump in line with the detailed design for the remainder of the contours.

12.8 | TAILINGS STORAGE FACILITIES

The following tailing storage facility activities are planned for 2023:

- Initial rehabilitation monitoring on Southeast TSF following completion of capping and rehabilitation of the remaining surface in 2022.
- Continuation of management activities for the North Void TSF, focusing on monitoring, dewatering and surface strength development.
- Review & Update of all tailings dam Operational and Maintenance Manuals; and
- Prepare for capping activities on Bob's Dump TSF.

12.9 | STAKEHOLDER ENGAGEMENT

The following stakeholder engagement activities are planned for 2023:

- Hosting four CCC meetings.
- Implementing two rounds of the HVO Community Grants Fund.
- Undertaking an improvement project in the community with HVO Apprentices.
- Developing and distributing two community newsletters.
- Conducting two Community Information sessions (at Jerrys Plains and Maison Dieu); and
- Hosting a School Site Tour.
- Stakeholder engagement activities related to the HVO Continuation Project.