HUNTER VALLEY
OPERATIONS

WATER MANAGEMENT

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1 | PREFACE

1.1 | INTRODUCTION

Hunter Valley Operations (HVO) is an open cut mining complex located approximately 24 kilometres north-west of Singleton, New South Wales (NSW) and geographically divided by the Hunter River into HVO North and HVO South. While HVO is managed as one operation, HVO North and HVO South each have separate planning approvals.

This Water Management Plan (WMP) applies to the whole HVO complex (the Project).

The Project is generally bounded by Lemington Road and Jerrys Plains Road alongside its western boundary. The New England Highway is located to the north and east of the Project area with the Golden Highway to the south.

The HVO North Approval (DA 450-10-2003) was granted on 12 June 2004. The most recent modification (Mod 8) was granted on 24 April 2025.

HVO South operates in accordance with the Project Approval (PA 06_0261) granted on 24 March 2009 (the HVO South Approval). The most recent modification (Mod 8) was granted on 6 February 2023.

The HVO North Approval and the HVO South Approval are jointly referred to herein as 'the Approvals'.

The March 2013 modification to the HVO North Approval involved an extension to the south-west of the existing Carrington Pit and it is that modification which brought about the requirement for a WMP for HVO North. The existing requirement under the HVO South Approval is the basis under which this plan is required to cover HVO South.

The Project is described in detail in:

- the EIS titled '*Hunter Valley Operations – West Pit Extension and Minor Modifications*', dated October 2003, and prepared by Environmental Resources Management Australia;
- the section 96(1A) modification application for the '*Hunter Valley Loading Point*', dated 30 June 2005, and prepared by Matrix Consulting;
- the '*Carrington Pit Extended Statement of Environmental Effects*', dated October 2005, and prepared by Environmental Resources Management Australia;
- the Environmental assessment titled '*Hunter Valley Operations South Coal Project Environmental Assessment Report*', Volumes 1, 2 and 3, dated January 2008, including the response to submissions;
- the Environmental Assessment titled '*Raising of Lake James Dam*', dated October 2009, and the response to submissions (including its Statement of Commitments) dated November 2009;
- the Environmental Assessment titled '*Proposed Modification to HVO South Project'*, dated May 2010, and the response to submissions dated August 2010;
- the '*Carrington West Wing Environmental Assessment*', dated 1 October 2010, and prepared by EMGA Mitchell McLennan (CWW EA);

- the Environmental Assessment titled '*Hunter Valley Operations South Project Approval – Modification 4 – Administrative Omissions and Clarifications*' [sic], dated 26 September 2012; and

- the Environmental Assessment titled '*Hunter Valley Operations South Project Approval – Modification 5 – Dedication of Lands for Offsets'* [sic], dated 26 September 2012.

- The Environmental Assessment titled '*North – Fine Reject Emplacement Modification*', dated June 2013.

- The Environmental Assessment titled '*Barry's Pit Modification Groundwater Assessment',* dated September 2013.

- The Environmental Assessment titled '*HVLP Sediment Basin and HVO North Communication Towers',* dated November 2016.

- The Environmental Assessment titled '*Carrington In-Pit Fine Reject Emplacement',* dated November 2016.

- The Environmental Assessment titled '*Hunter Valley Operations South – Modification 5*' dated 1 February 2017.

- The Statement of Environmental Effects titled 'Hunter Valley Operations Proposed Modular Ammonium Nitrate Emulsion Plant' dated July 2021.

- Modification Report Titled *'MTW/HVO Lemington Underground Mine Water Storage Project'* Modification Report (MP06_0261 MOD 7) dated, September 2021, and Submissions report dated December 2021, and Response to Additional Information Requested dated 15 March 2022.

Surface and Groundwater studies were prepared as part of the Environmental Assessments, the most recent being for the Carrington In-Pit Fine Reject Emplacement and Hunter Valley Operations South – Modification 5.

The Project occurs in an area where mining is already a feature of the landscape. HVO is located in the Hunter Valley coalfields with surrounding mines and infrastructure including Mount Thorley Warkworth (MTW), United/Wambo, Ravensworth and Bayswater and Liddell Power Stations.

This WMP is the primary tool that will be utilised to reduce potential water impacts related to the Project.

1.2 | SCOPE

This WMP was prepared in accordance with Schedule 3, Condition 27 of the HVO North and HVO South Approvals. The Department of Planning and Environment approved Andrew Speechly as being suitably qualified and experienced to undertake the preparation of this plan on 27 February 2019.

This WMP applies to the area within HVO North and HVO South boundaries, including:

- Operating Pits;

- Rehabilitated land;
- Biodiversity areas within the mine footprint;
- Coal Preparation Plants (CPPs);
- Loading Points; and
- Water abstraction and discharge points.

This WMP is to be applied from the time of approval of this plan, during construction and operation of the Project and incorporates mitigation measures and strategies that HVO will employ to comply with the relevant water management conditions of the Approvals and Environment Protection Licence (EPL). Table 1-1 below highlights the conditions required to be covered by this WMP and the sections within this document in which they are addressed.

Table 1-2 highlights where items in the Statement of Commitments (SOC) related to water impacts are addressed in this WMP.

Table 1-1: Consent Conditions Assessed

HVO NORTH CONSENT (DA 450-10-2003)

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
SCH. 3, COND.27	**Water Management Plan** The Applicant must prepare a Water Management Plan for the HVO North mine to the satisfaction of the Secretary. This plan must be prepared in consultation with Water Group and the EPA by suitably qualified and experienced persons whose appointment has been approved by the Secretary and submitted to the Secretary by the end of September 2013 unless otherwise agreed. This plan must include:	Section 3 Appendix A Appendix B Appendix C
SCH. 3, COND. 27(A)	a Site Water Balance that: • includes details of: ○ sources and security of water supply, including contingency planning for future reporting periods; ○ water use on site; ○ water management on site, including details of water sharing between neighbouring mining operations; ○ any off-site water transfers and discharges; ○ reporting procedures, including comparisons of the site water balance for each calendar year; and • describes the measures that would be implemented to minimise clean water use on site;	Section 7

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
SCH. 3, COND. 27(B)	a Surface Water Management Plan, that includes: • detailed baseline data on surface water flows and quality in the waterbodies that could be affected by the development;	Section 8.1, 8.2
SCH. 3, COND. 27(B)	a detailed description of the water management system on site, including the: • clean water diversion systems and their final positioning; • erosion and sediment controls; and • water storages;	Section 8.6,
SCH. 3, COND. 27(B)	detailed plans, including design objectives and performance criteria, for: • design and management of the final voids; • design and management of the evaporative sink; • design and management of any tailing's dams; • ensuring the stability of high walls adjacent to low permeability barriers; • establishment of drainage lines on the rehabilitated areas of the site; and • control of any potential water pollution from the rehabilitated areas of the site;	Section 8.7, Section 6.11, Section 8.6.2
SCH. 3, COND. 27(B)	performance criteria for the following, including trigger levels for investigating any potentially adverse impacts associated with the development: • the water management system; • the stability of high walls adjacent to low permeability barriers; • surface water quality of the Hunter River; and • stream and riparian vegetation health of the Hunter River;	Section 6, Section 8.2, Section 8.7, Section 10
SCH. 3, COND. 27(B)	a program to monitor: • the effectiveness of the water management system; and • surface water flows and quality, stream and riparian vegetation health in the Hunter River (in so far as it could potentially be affected by the development); and	Section 8, Section 10
SCH. 3, COND. 27(B)	• a plan to respond to any exceedances of the performance criteria and mitigate and/or offset any adverse surface water impacts of the development.	Section 11
SCH. 3, COND. 27(C)	a Groundwater Management Plan, which includes: • detailed baseline data on groundwater levels, yield and quality in the region, and privately owned groundwater bores, that could be affected by the development;	Section 9
SCH. 3, COND. 27(C)	• groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;	Section 9.6

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
SCH. 3, COND. 27(C)	• a program to monitor: ○ groundwater inflows to the open cut mining operations; ○ the impacts of the development on: – the alluvial aquifers, including additional groundwater monitoring bores as required by Water Group; – the effectiveness of the low permeability barrier; – base flows to the Hunter River; – any groundwater bores on privately-owned land that could be affected by the development; and – groundwater dependent ecosystems, including the River Red Gum Floodplain Woodland EEC located in the Hunter River alluvium; • the seepage/leachate from water storages, backfilled voids and the final void;	Section 9.5, 9.6, 8.7
SCH. 3, COND. 27(C)	• a program to validate and recalibrate (if necessary) the groundwater model for the development, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions; and	Section 9.7
SCH. 3, COND. 27(C)	• a plan to respond to any exceedances of the groundwater assessment criteria. The Applicant must implement the approved management plan as approved from time to time by the Secretary.	Section 11
SCH. 5, COND. 2(A)	**Management Plan Requirements** The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: • detailed baseline data;	Section 7 Section 8 Section 9.4
SCH. 5, COND. 2(B)	• a description of: ○ the relevant statutory requirements (including any relevant approval, licence or lease conditions); ○ any relevant limits or performance measures/criteria; and ○ the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 2
SCH. 5, COND. 2(C)	• a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria	Section 2 Section 10

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
SCH. 5, COND. 2(D)	• a program to monitor and report on the: ○ impacts and environmental performance of the development; ○ effectiveness of any management measures (see (c) above);	Section 8 Section 9 Section 10 Section 11
SCH. 5, COND. 2(E)	• a contingency plan to manage any unpredicted impacts and their consequences to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 9
SCH. 5, COND. 2(F)	• a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 11
SCH. 5, COND. 2(G)	• a protocol for managing and reporting any: ○ incidents; ○ complaints; ○ non-compliances with statutory requirements; and ○ exceedances of the impact assessment criteria and/or performance criteria;	Section 11
SCH. 5, COND. 2(H)	• a protocol for periodic review of the plan; and	Section 12
SCH. 5, COND. 2(I)	• a document control table that includes version numbers, dates when the management plan was prepared and reviewed, names and positions of people who prepared and reviewed the management plan, a description of any revisions made and the date of the Secretary's approval. *Note: The secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*	Section 13
SCH. 5, COND.4	**Revision of Strategies, Plans & Programs** Within 3 months of: (a) the submission of an incident report under condition 7 below; (b) the submission of an Annual Review under condition 9 below; (c) the submission of an audit report under Condition 10 below; and (d) approval of a modification to this consent; the Applicant must review, and if necessary, revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary. Within 6 weeks of conducting any such review, the Applicant must advise the Secretary of the outcomes of the review and provide any documents that have been revised to the Secretary for review and approval. *Note: This is to ensure the strategies, plans and programs are updated on a regular basis and incorporate any recommended measures to improve the environmental performance of the development.*	Section 12

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
SCH. 5, COND.7	**Incident Reporting** The Applicant must immediately notify the Secretary and any other relevant agencies of any incident. Within 7 days of the date of the incident, the Applicant must provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.	Section 11.3
SCH. 5, COND. 8	**Regular Reporting** The Applicant must provide regular reporting on the environmental performance of the development on its website in accordance with the reporting arrangements in any plans or programs approved under the conditions of this consent.	Section 11

HVO SOUTH CONSENT (PA 06_0261)

SCH. 3, COND. 26(A)	**Protection of Watercourses** The Applicant must: • Ensure mining operations do not interfere with the stability of the Hunter River, Wollombi Brook and creek lines located outside the area of mining operations;	Section 5.3, Section 8.2, Section 9.5, Section 10
SCH. 3, COND. 26(B)	• to the south of the Hunter River, retain a buffer zone of 150 metres, or less if agreed by the Planning Secretary following consultation with DPE Water, from the edge of open cut pits and the high bank of the Hunter River and its connected alluvium, excepting the area of the site adjacent to the Hobden Gully levee;	These commitments have been met and are therefore not covered in this WMP
SCH. 3, COND. 26(C)	• ensure negligible environmental consequences to the Hunter River alluvial aquifer and the Wollombi Brook alluvial aquifer beyond those predicted for the development; and	Section 5.3, Section 8.2, Section 9.5, Section 10
SCH. 3, COND. 26(D)	• during water transfer into the Lemington underground mine workings, retain a maximum fill level of 30m AHD in the Lemington underground mine workings or retain a buffer zone of 10m between the base of the Hunter River alluvium and the Lemington underground mine workings fill level, whichever gives the greater vertical separation.	Section 6.1
SCH. 3, COND. 27(A)	**Water Management Plan** The Applicant must prepare a Water Management Plan to the satisfaction of the Planning Secretary. This Plan must: be prepared in consultation with DPE Water by a suitably qualified expert whose appointment has been approved by the Planning Secretary;	Section 3 Appendix A and B Section 8

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
SCH. 3, COND. 27(B)	• be submitted to the Planning Secretary for approval within 6 months of this consent or otherwise agreed by the Planning Secretary; and	HVO rely upon the "Water Management Plan: Hunter Valley Operations, September 2009" which is superseded by this WMP
SCH. 3, COND. 27(C)	include: • a site water balance, which includes details of sources and security of water supply, on site water use and management and off site water transfers and investigates and describes measures to minimise water use by the development; and a methodology to quantify the annual groundwater inflow into the Lemington underground mine workings during the period water is to be stored and extracted, and the ongoing maximum annual groundwater inflow after these activities have ceased;	Section 6 Section 7
SCH. 3, COND. 27(C)	• an erosion and sediment control plan for surface works on the site that is consistent with the requirements of the Managing Urban Stormwater: Soils and Construction Manual (Landcom 2004, or its latest version);	Section 8.6
SCH. 3, COND. 27(C)	• a program for review of groundwater modelling that includes assessment of the effect of short and long-term changes to groundwater quality and mobilisation of salts;	Section 9, Section 9.7
SCH. 3, COND. 27(C)	• a surface water monitoring program that includes: ○ detailed baseline data of surface water flows and quality in the watercourses that could be affected by the development, including the Hunter River and Wollombi Brook; ○ a detailed description of the surface water management system; ○ details of water licensing requirements for all water storages; ○ details of licensed discharged points and limits; ○ detailed design objectives and performance measures for erosion and sediment control works, water storages, water diversions, sediment dams, emplacement areas, backfilled voids, and the final void; ○ surface water impact assessment criteria, including trigger levels for investigating potentially adverse impacts of the development; ○ a program to monitor potentially adverse impacts of the development on the surface water flows and quality, flooding, stream and riparian health, including monitoring controlled and uncontrolled discharges and seepage/leachate from the site; and ○ A plan to respond to any exceedance of the performance criteria or surface water impact assessment criteria, and repair, mitigate and/or offset any adverse surface water impacts of the development;	Section 7.3 Section 7 Section 11.1 Section 7.5 Section 8.6 Section 8.7 Section 10.1

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
SCH. 3, COND. 27(C)	• a groundwater monitoring program that includes: ○ additional baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores, which could be affected by the development; ○ groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts of the development; and ○ a program to monitor: – groundwater inflows to the open cut mining operations; – impacts of the development on the region's aquifers, any groundwater bores, and surrounding watercourses, and in particular, the Hunter River and Wollombi Brook and adjacent alluvium; and – impacts of the development on groundwater dependent ecosystems, riparian vegetation and River Red Gum populations; and • a plan to respond to any exceedances of the performance criteria or surface water impact assessment criteria, and repair, mitigate and/or offset any adverse groundwater impacts of the development; and	Section 9.4 Section 9.5 Section 9.6 Section 11.1
SCH. 3, COND. 27(C)	• a program to periodically update and validate the water balance and groundwater model for the development and compare monitoring results with modelled predictions, unless otherwise agreed by the Planning Secretary. The Applicant must implement the Water Management Plan as approved by the Planning Secretary	Section 9.7 This WMP
SCH. 5, COND. 1A(A)	**Management Plan Requirements** The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: • a summary of relevant background or baseline data;	Section 2, Section 5,
SCH. 5, COND. 1A(B)	a description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; and • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 2
SCH. 5, COND. 1A(C)	• a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 2 Section 11

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
SCH. 5, COND. 1A(D)	a program to monitor and report on the: • impacts and environmental performance of the development; • effectiveness of any management measures (see (c) above);	Section 7, Section 8, Section 9, Section 11
SCH. 5, COND. 1A(E)	• a contingency plan to manage any unpredicted impacts and their consequences to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 11.4
SCH. 5, COND. 1A(F)	• a program to investigate and implement ways to improve the environmental performance of the development over time	Section 11
SCH. 5, COND. 1A(G)	a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria;	Section 11
SCH. 5, COND. 1A(H)	• a protocol for periodic review of the plan; and	Section 12
SCH. 5, COND. 1A(I)	• a document control table that includes version numbers, dates when the management plan was prepared and reviewed, names and positions of people who prepared and reviewed the management plan, a description of any revisions made and the date of the Secretary's approval. *Note: The planning Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*	Section 13.2
SCH. 5, COND. 4A	**Revision of Strategies, Plans and Programs** Within 3 months of the submission of an: (a) the submission of an incident report under condition 2 above; (b) Annual Review under condition 4 above; (c) audit under Condition 5 below; or (d) any modification to conditions of this consent; the Applicant must review, and if necessary, revise the strategies, plans, and programs required under this consent to the satisfaction of the Planning Secretary. Within 6 weeks of conducting any such review, the Applicant must advise the Planning Secretary of the outcomes of the review and provide any documents that have been revised to the Planning Secretary for review and approval. *Note: This is to ensure the strategies, plans and programs are updated on a regular basis and incorporate any recommended measures to improve the environmental performance of the development*.	Section 12

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
ENVIRONMENT PROTECTION LICENCE – EPL640		
P1.3	The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.	Section 6.8

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
3	Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS) Discharge quality monitoring Volume monitoring	Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS) Discharge quality monitoring Volume monitoring	HRSTS discharge pipe from Dam 11, marked and shown as "3" on Figure 1.
4	Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS) Discharge Quality Volume Monitoring	Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS) Discharge Quality Volume Monitoring	Discharge from outlet pipe on Parnell's Dam, marked and shown as "4" on Figure 1.
5	Alluvial lands discharge Discharge quality monitoring Volume monitoring	Alluvial lands discharge Discharge quality monitoring Volume monitoring	Outlet of the alluvial lands discharge pipeline, marked and shown as "5" on Figure 1.
8	Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS) Discharge quality monitoring Volume monitoring	Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS) Discharge quality monitoring Volume monitoring	Outlet of discharge pipe from the Lake James storage dam, marked and shown as "8" on Figure 1.
23	Discharge to utilisation area Effluent quality monitoring	Discharge to utilisation area Effluent quality monitoring	Howick STP, marked and shown as "23" on Figure 2.
24		Discharge to utilisation area	Howick Primary Lagoon, marked and shown as "24" on Figure 2.
25	Discharge to utilisation area Effluent quality monitoring	Discharge to utilisation area Effluent quality monitoring	Howick Secondary Lagoon, marked and shown as "25" on Figure 2.
26	Discharge to utilisation area Effluent quality monitoring	Discharge to utilisation area Effluent quality monitoring	HVO North STP, marked and shown as "26" on Figure 2.
27		Discharge to utilisation area	HVO South STP, marked and shown as "27" on Figure 2.
28		Discharge to utilisation area	HVO South Primary Lagoon, marked and shown as "28" on Figure 2.

Section 6.8

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
		Section 6.8

29	Discharge to utilisation area Effluent quality monitoring	Discharge to utilisation area Effluent quality monitoring	HVO South Secondary Lagoon, marked and shown as "29" on Figure 2.
45	Ambient water monitoring		Hunter River, marked and shown as "H1 Hunter R (upstream K Dam)" on Figure 4.
46	Ambient water monitoring		Hunter River, marked and shown as "H2 Hunter R." on Figure 4.
47	Ambient water monitoring		Hunter River, marked and shown as "H3 Hunter River downstream Wollombi" on Figure 4.
48	Ambient water monitoring		Hunter River, marked and shown as "W1 Hunter River (Carrington)" on Figure 4.
49	Ambient water monitoring		Hunter River, marked and shown as "W109 Hunter R. Moses Crossing" on Figure 4.
50	Ambient water monitoring		Wollombi Brook, marked and shown as "W2 Wollombi Bk" on Figure 4.
51	Ambient water monitoring		Hunter River, marked and shown as "W3 Hunter River" on Figure 4.
52	Ambient water monitoring		Hunter River, marked and shown as "W4 Hunter River (Oaklands)" on Figure 4.
53	Ambient water monitoring		Wollombi Brook, marked and shown as "Warkworth Bridge Wollombi Brook" on Figure 4.
54	Ambient water monitoring		Wollombi Brook, marked and shown as "WL1 Wollombi Bk" on Figure 4.
55	Ambient water monitoring		Dam 19s, marked and shown as "55" on Figure 1.

L1.1	Pollution of waters Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.	This WMP
L2.1	For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.	Section 8.4
L2.2	Where pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.	Section 8.4
L2.3	To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.	This WMP

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
L2.4	Water and/or Land Concentration Limits	Section 8.4

POINT 3,4

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
pH	pH				6.5 - 9.5
Total suspended solids	milligrams per litre				120

POINT 5

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Conductivity	microsiemens per centimetre				400

POINT 8

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
pH	pH				6.5 - 9.5
Total suspended solids	milligrams per litre				120

L2.5	In addition to the concentration limit specified against Point 5 in the table above, wastewater must not be discharged from Point 5 if the conductivity of the wastewater is greater than the conductivity of the receiving waters in the Hunter River at the time of discharge.	Section 8.4
L3.1	For each discharge point or utilisation area specified below (by a point number), the volume/mass of: a) liquids discharged to water; or; b) solids or liquids applied to the area; must not exceed the volume/mass limit specified for that discharge point or area.	Section 8.4

Point	Unit of Measure	Volume/Mass Limit
3	megalitres per day	100
4	megalitres per day	130
5	megalitres per day	7
8	megalitres per day	200

M2.1	**Requirement to monitor concentration of pollutants discharged** For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:	Section 8.4

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
M2.3	**Water and/or Land Monitoring Requirements**	Section 8.4

POINT 3,4

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Continuous during discharge	A probe designed to measure the range 0 to 10,000 uS/cm
pH	pH	Daily during any discharge	Grab sample
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample

POINT 3,4,8

Pollutant	Units of measure	Frequency	Sampling Method
Turbidity	nephelometric turbidity units	Continuous during discharge	Probe

POINT 5

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Special Frequency 1	Probe

POINT 8

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Continuous during discharge	A probe designed to measure the range 0 to 10,000 uS/cm
pH	pH	Daily during any discharge	Grab sample
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample

POINT 23,25,26,29

Pollutant	Units of measure	Frequency	Sampling Method
Faecal Coliforms	colony forming units per 100 millilitres	Quarterly	Grab sample
pH	pH	Quarterly	Grab sample

POINT 45,46,47,48,49,50,51,52,53,54

Pollutant	Units of measure	Frequency	Sampling Method
Electrical conductivity	microsiemens per centimetre	Quarterly	Grab sample
pH	pH	Quarterly	Grab sample
Total suspended solids	milligrams per litre	Quarterly	Grab sample

POINT 55

Pollutant	Units of measure	Frequency	Sampling Method
Ammonia	milligrams per litre	Every 6 months	Grab sample
Nitrogen (total)	milligrams per litre	Every 6 months	Grab sample
Total petroleum hydrocarbons	milligrams per litre	Every 6 months	Grab sample

M2.4	For the purposes of the table(s) above Special Frequency 1 means the collection of samples at least every 10 minutes during discharge. Note: The requirement for turbidity monitoring at Points 3, 4 and 8 will be reviewed by the EPA after review of data obtained during HRSTS discharge events.	Section 8.4

<table>
<tr><th>CONSENT CONDITION</th><th>ENVIRONMENTAL PERFORMANCE CONDITIONS</th><th>SECTION CONDITION IS ADDRESSED</th></tr>
<tr><td>M7.1 & M7.2</td><td>Requirement to monitor volume or mass
For each discharge point or utilisation area specified below, the licensee must monitor;
a) the volume of liquids discharged to water or applied to the area;
b) the mass of solids applied to the area;
c) the mass of pollutants emitted to the air;
at the frequency and using the method and units of measure, specified below.
<table>
<tr><td colspan="3">POINT 3</td></tr>
<tr><td>Frequency</td><td>Unit of Measure</td><td>Sampling Method</td></tr>
<tr><td>Continuous during discharge</td><td>megalitres per day</td><td>Flow meter and continuous logger</td></tr>
<tr><td colspan="3">POINT 4</td></tr>
<tr><td>Frequency</td><td>Unit of Measure</td><td>Sampling Method</td></tr>
<tr><td>Continuous during discharge</td><td>megalitres per day</td><td>Weir structure and level sensor</td></tr>
<tr><td colspan="3">POINT 5</td></tr>
<tr><td>Frequency</td><td>Unit of Measure</td><td>Sampling Method</td></tr>
<tr><td>Special Frequency 1</td><td>megalitres per day</td><td>Special Method 1</td></tr>
<tr><td colspan="3">POINT 8</td></tr>
<tr><td>Frequency</td><td>Unit of Measure</td><td>Sampling Method</td></tr>
<tr><td>Continuous during discharge</td><td>megalitres per day</td><td>Flow meter and continuous logger</td></tr>
</table>
M7.2 Special Frequency 1 means at least once every 10 mintues during discharge.
Special Method 1 means a method approved in writing by the EPA.</td><td>Section 8.4</td></tr>
<tr><td>M9.1</td><td>Other monitoring and recording conditions
HRSTS Monitoring
The licensee must continuously operate and maintain communication equipment which makes the conductivity and flow measurements, taken at Point 3, 4 and 8 available on the “Service Coordinator” within one hour of those measurements being taken and makes them available in the format specified in the “Hunter River Salinity Trading Scheme Discharge Point Telemetry Specification – Rev V1.0” released 4 October 2018 by Water NSW.</td><td>Section 8.4</td></tr>
<tr><td>M9.2</td><td>The licensee must ensure that all monitoring data is within a margin of error of 5% for conductivity measurements and 10% for discharge flow measurement.</td><td>Implemented as per condition, therefore not detailed in this Plan.</td></tr>
<tr><td>M9.3</td><td>The licensee must mark monitoring point(s) 3,4 and 8 with a sign which clearly indicates the name of the licensee, whether the monitoring point is up or down stream of the discharge point(s) and that it is a monitoring point for the Hunter River Salinity Trading Scheme.</td><td>Implemented as per condition, therefore not detailed in this Plan.</td></tr>
</table>

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
R4.1	**Other notifications** **Notification of Pollution of Waters** The Licensee must notify the EPA by telephoning the Environment Line service on 131 555 immediately after the Licensee becomes aware of any contravention or potential contravention of Condition L1.1	Table 11-2
R4.2	The Licensee must provide written details of the notification to the EPA within seven days of the date of the notification.	Table 11-2
R5.1	**Other reporting conditions** **HRSTS Reporting** The licensee must compile a written report of the activities under the Scheme for each Scheme year. The scheme year shall run from 1 July to 30 June each year. The written report must be submitted to the EPA by email to info@epa.nsw.gov.au within 60 days after the end of each scheme year and be in a form and manner approved by the EPA. The information will be used by the EPA to compile an annual HRSTS report.	Section 11.3
R5.2	**Turbidity Report** The Licensee must provide a report to the EPA with the Annual Return that shows graphical analysis of continuous turbidity against continuous discharge volume measured at EPA Point 3 and 4 for the length of any discharges from EPA Point 3 and 4.	Table 11-2
R5.5	**Sewage Treatment Systems** The sewage treatment system maintenance program required by Condition O2.6 must be submitted annually to the EPA with the Annual Return.	Annual Return
R5.8	**Water Quality Monitoring Report** The licensee must provide an annual water quality monitoring report to the EPA with each Annual Return. The report must be prepared by an appropriately qualified and experienced person and include the following: a) for the monitoring required by the licence during the reporting period to which the Annual Return relates: i) a summary of results for all ambient water quality monitoring results required by the licence in table form and graphical form; ii) total daily rainfall records from the premises meteorological monitoring required by the licence eon the day that the sampling was undertaken in table form; iii) total daily continuous rainfall records in graphical form; and iv) a plan with the monitoring locations. b) A graphical representation of the trends of monitoring results required by the licence for the reporting period to which the Annual Return relates and the preceding data for the period of record the licensee has monitoring results for the licensed location. c) A graphical representation of total daily continuous rainfall records required by the licence for the record that matches the ambient water quality results, if available.	Table 11-2

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
U1.1	**PRP 13 - North Void Tailings Storage Facility Barrier Wall** The licensee must engage an appropriately qualified and experienced person to design a barrier wall in respect of the North Void Tailings Storage Facility (TSF) to prevent or mitigate saline and sulfate seepage from the TSF to groundwater during the continued life of the mine, remediation and after capping. The design and assessment must be completed by 31 March 2026 and must: i) be consistent with the recommendations of the "North Void Tailings Storage Facility, Barrier Wall Construction Feasibility Assessment PS122997-CIV-LTR-002 Rev A dated 25 June 2021" by WSP; ii) be keyed into bedrock; and iii) be of sufficient height and depth to prevent or mitigate saline and sulfate seepage from the TSF to groundwater during continued life of mine, remediation and after capping. Note: The intention of this barrier wall is to prevent the pollution of waters.	Addressed via requirements of PRP.
U1.2	By 2 July 2027, the licensee must construct the North Void TSF and provide a report to the EPA detailing the works installed and complete and includes an assessment of the permeability of the wall (North Void TSF Completion Report). The North Void TSF Completion Report must be provided by email to info@epa.nsw.gov.au. Note: This timeline is dependent upon engineering assessments and approvals, with approvals the responsibility of the licensee.	Addressed via requirements of PRP.
U2.1	**PRS 14 - Lake James Dam Saline Mixing Investigation** As part of the increase to the licensed discharge volume limit from 120 ML/day to 200 ML/day at Point 8 (being the Lake James Dam HRSTS discharge point), the licensee must undertake conductivity sampling during the next discharge event which exceeds 120 ML/day at the nearest downstream sampling location - coordinates 316696 6398312 (easting and northing). Note: The intent is to demonstrate adequate mixing of salts to achieve a downstream water quality less than 900 uS/cm. The licensee must provide a report with monitoring results to the EPA by email to info@epa.nsw.gov.au.	Section 8.4
U3.1	**PRP 16 - Hunter River Bridge Upgrade Works** a) By 30 June 2026, the licensee must design, install and commission upgrades to the existing Hunter River Bridge pollution control infrastructure. The works are to be guided by the report titled "HV Operations Pty Ltd Water Management Infrastructure Upgrade Assessment Hunter Valley Operations", prepared by Engeny, dated September 2019. b) Within one week of completing the works required above, the licensee must notify the EPA in writing of the completed works. Notification must be provided by email to info@epa.nsw.gov.au.	Addressed via requirements of PRP.
E1.1	**Hunter River Salinity Trading Scheme** The licence authorises the discharge of saline water into the Hunter River Catchment from an authorised discharge point (or points), in accordance with the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.	Section 6.8 Section 7.5 Section 8.4

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
E1.2	For the purposes of Clauses 23 and 29 the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002 the licensee must apply the conversion factor of 0.6.	Addressed by requirements of HRSTS Scheme.
E1.3	The licensee must not exceed the hourly volume discharge limit calculated using the following formula, at all discharge point(s) on this license titled “Discharge of saline water under the Hunter River Salinity Trading Scheme (HRSTS)”: H = V / RRT Where: H is the hourly volume discharge limit (in megalitres per hour) V is the licence holder’s volume discharge limit for the block (in Megalitres) calculated in accordance with clause 23 of the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation (2002); and RRT is the difference between the discharge stop and start times shown on the river register for that block (hours) Note 1: The intent of this condition is to prevent spikes of saline water in the Hunter River as a result of discharges of less than the duration permitted by the river register. Note 2: A river register is issued by the Service Co-ordinator and allows participants of the Hunter River Salinity Trading Scheme (HRSTS) to discharge saline to the Hunter River during a discharge period.	Addressed by requirements of HRSTS Scheme.

CONSENT CONDITION	ENVIRONMENTAL PERFORMANCE CONDITIONS	SECTION CONDITION IS ADDRESSED
E2.1	**North Void Tailings Facility Seepage Monitoring** The Licensee must implement a North Void Tailings Facility monitoring program. This monitoring program must be implemented and undertaken by a suitably qualified and experiences person. The program must include: I. installation of a groundwater and surface water monitoring network to monitor the extent of the plume of polluted water to estimate the volume of seepage from the North Void Tailings Facility and the flux of salt and sulphate difference from baseline alluvial groundwater and to monitor seepage changes; II. a groundwater surface water model to demonstrate attenuation time and mixing if the polluted groundwater is not remediated; III. development of milestones or thresholds that would trigger consideration for the introduction of works or other options to mitigate seepage from the North Void Tailings Facility; IV. an ecological risk assessment; V. as assessment of tailings consolidation, permeability and strength testing; VI. likely time frames involved for filling, capping and rehabilitating of the North Void Tailings Facility; VII. daily rainfall; VIII. estimates of rainfall ingress into the North Void Tailings Facility; and IX. volumetric monitoring of the decant of surface waters from the North Void Tailings Facility. The Licensee must provide an analysis report of this monitoring data and any modelling prepared by an appropriately qualified and experienced person. The licensee must submit this report to the EPA by 30 March 2020 and annually thereafter. The report must demonstrate progress in mitigating seepage from the North Void Tailings Facility. The report must report against the following objectives: a. prevent pollution of waters at all times; b. mitigate degradation of groundwater beneficial use; c. prevent impact to endangered ecological communities; and d. capping and rehabilitation to produce a free draining landform.	Addressed via requirements of PRP.
E2.2	The Licensee must submit an interim report to the EPA at each quarter, within one month of the completion of quarterly monitoring required by Condition U1.1. The interim report must be prepared by an appropriately qualified and experienced person and include: a. an assessment of rainfall data for the quarterly period; b. an estimate of rainfall ingress to the North Void Tailings Facility for the quarterly period; and c. the volume of decant water removed from the North Void Tailings Facility in the quarterly period.	Addressed via requirements of PRP.

Table 1-2: Statement of Commitments Addressed

SOC REFERENCE	COMMITMENTS	SECTION CONDITION IS ADDRESSED
HVO NORTH – CARRINGTON WEST WING STATEMENT OF COMMITMENTS – 4 MARCH 2013		
GROUNDWATER	Prior to mining within 100m of the western arm of the Hunter River Palaeochannel a groundwater barrier wall will be constructed across the western arm of the palaeochannel. The wall will be sufficiently deep to prevent flows of groundwater within the alluvium in either direction.	To be included in future version when date of mining within 100m of the western arm of the Hunter River Palaeochannel is known.
GROUNDWATER	Continued monitoring will include: • two-monthly monitoring of water levels in any new standpipe piezometer in proximity to the proposed extension area and quarterly monitoring elsewhere, unless water level changes dictate otherwise; • daily or more frequent monitoring of pore pressures by installed auto recorders at some existing piezometers in order to discriminate between oscillatory groundwater movements attributed to rainfall recharge, and longer term pressure losses related to open cut and underground mining; and • construction of additional piezometers where deemed necessary, as information is generated from within the existing network, during the course of mining. Permeability testing will be completed on new piezometers in order to facilitate estimation of leakage and subsurface flows.	Section 9.6
GROUNDWATER	Continued groundwater quality monitoring will include: • two-monthly or quarterly (depending upon location) monitoring of basic water quality parameters, pH and EC, in existing and any new piezometers; and • six monthly measurement of TDS and speciation of water samples in piezometers.	Section 9.6
GROUNDWATER	Future impact analyses will include the following. • Where monitoring data shows significant departures from predictions in three consecutive readings, an investigation into the cause will be triggered. This could include a need to conduct more intensive monitoring, e.g. increased frequency, parameters or additional piezometers, or to review the management and mitigation measures. • Formal review of depressurisation of coal measures and comparison of responses with aquifer model predictions, conducted biennially by a suitably qualified hydrogeologist. Annual reporting (including all water level and water quality data) in the AEMR.	Section 11

SOC REFERENCE	COMMITMENTS	SECTION CONDITION IS ADDRESSED
SURFACE WATER	Water quality monitoring will be continued.	Section 8.3
SURFACE WATER	The HVO water balance model will be updated regularly to ensure currency with the operational configuration of the mine water management system.	Section 7
SURFACE WATER	Runoff from undisturbed catchments will be diverted away from disturbed areas using surface drains.	Section 8.6
SURFACE WATER	Surface runoff from disturbed areas will be treated through sedimentation basins prior to discharge from the site. All new sediment dams and water management systems will be designed in accordance with relevant standards.	Section 8
SURFACE WATER	Sedimentation basins will be used to treat surface runoff from rehabilitated areas until the quality of runoff is suitable for release. These will be maintained or constructed as required and will be designed in accordance with relevant design standards.	Section 8
SURFACE WATER	Saline water from mining related activities will be collected within the mine water management system. Discharges will be managed in compliance with the HRSTS.	Section 8
SURFACE WATER	A Management Plan for the positioning of the diversion of the Unnamed Tributary will be developed in consultation with NOW and I&I NSW, and will include details of: • existing and proposed channel alignment, longitudinal section and cross-sections; • proposed locations of cut and fill; • sediment and erosion control measures to be implemented during construction; • proposed revegetation of the channel bed, banks and riparian zone; • a proposed monitoring regime to ensure ongoing stability and ecological health of the stream, which would include periodic inspection for erosion or deposition and a photographic record of key cross-section locations, supplemented by ground survey if instability is detected; and contingency measures to be implemented to address any observed issues with establishment of the modified channel.	To be included in future version when date of mining in Carrington West Wing Extension area is known.
HVO SOUTH, CHAPTER 16 OF ENVIRONMENTAL ASSESSMENT FOR HUNTER VALLEY OPERATIONS SOUTH MODIFICATION 5		

SOC REFERENCE	COMMITMENTS	SECTION CONDITION IS ADDRESSED
GROUNDWATER	In addition to the mitigation measures undertaken at HVO for groundwater management, the following controls specific to the proposal will be implemented: • Groundwater Flow To and From Rivers: ○ development of protocols for monitoring and reporting of DPI Water stream gauge results to clearly record any reductions in flows that are attributed to mining. This will include monitoring Hunter River flows immediately up gradient and down gradient of the site. In addition, consideration will be given to tying in specific CNA water level recordings with current DPI Water gauging locations; ○ monitoring of groundwater elevations within alluvium between the Hunter River and the Cheshunt Pit; and ○ measured groundwater elevations and river flow will be assessed against predictions to determine whether application of additional management measures is required; and offset seepage to pits in accordance with regulatory requirements.	Section 9
GROUNDWATER	• Regional Groundwater Drawdown: ○ the HVO River Red Gum Rehabilitation and Restoration Strategy and CNA EMS procedure for Flora and Fauna will be updated to reflect changes resulting from the proposal. This will include monitoring the health of the River Red Gums located on the Hunter River and Wollombi Brook alluvium as identified in Chapter 11 (Figure 11.2) of the ERM (2008) EA. The monitoring programme will include details on frequency of monitoring, reporting and corrective actions; and up to three monitoring wells will be installed in the proximity of the cluster of registered NOW bores located to the east of the LCPP (Figure 25 Annex J of the ERM (2008) EA). Data will be used to compare actual versus predicted impacts. Deviations away from predicted impacts will be assessed, and if predictions are exceeded, management measures will be implemented.	These commitments have been met and are therefore not covered in this WMP
GROUNDWATER	• Alluvial Buffer Zone: ○ a buffer zone of 100 m will be retained from the Cheshunt Pit highwall to the edge of alluvium of the Hunter River; ○ a buffer zone of 150 m will be retained from the South Lemington Pit 2 highwall to the edge of alluvium of the Wollombi Brook; ○ bores will be installed to further delineate the saturated zone between the Hunter River and the Cheshunt Pit before mining commences within this area; and the groundwater component of the HVO Water Management Manual will include procedures for monitoring potential impacts, including accurately measuring seepage to pits throughout mining and assessment of proximity to alluvials as mining approaches.	These commitments have been met and are therefore not covered in this WMP

SOC REFERENCE	COMMITMENTS	SECTION CONDITION IS ADDRESSED
GROUNDWATER	• Final Void: ○ the final void will be designed to intercept leachate from overburden emplacements and minimise discharge of saline groundwater. Final void design will be reviewed at least three years prior to anticipated mine closure; ○ a post closure monitoring programme will be developed as part of the Final Void Management Plan for water quality monitoring of the final void; and the mine plan will be further reviewed with a view to minimise the area of the final void as much as practicable.	To be included in future version when date of final void is known.
SURFACE WATER	In addition to the mitigation measures undertaken at HVO for surface water management, the following controls specific to the proposal will be implemented. • Water Supply: ○ modify Water Access Licences, review conditions and report on water use in the AEMR; ○ monitor and record abstraction quantities; and increase pump capacity from Dam 20S (or alternative storage) to the LCPP and undertake minor improvements to the existing HVO South water system in conjunction with the design of the LCPP to minimise need to pump from Hunter River Water Discharge	To be implemented prior to the LCPP being developed
SURFACE WATER	• review current discharge conditions in respect of the proposal and incorporate where applicable into the Water Management Manual.	This WMP
SURFACE WATER	• Flood Mitigation: ○ construct South Lemington Pit 2 Levee SLL2 as a permanent levee and ensure the outer face of the levee will withstand 100-year ARI flood flow velocities; and assess Hobden Gully levee (CL1) prior to mine closure to determine if protection of the Deep Cheshunt Pit final void is required.	Section 8.6.3 Hobden Gully commitment not applicable. Final Void is proposed for Riverview
SURFACE WATER	• Erosion and Sediment Control: erosion and sediment control structures will remain in place to divert water away from the Deep Cheshunt Pit final void unless required for use as flood flow storage.	Not applicable. Final Void is proposed for Riverview

SOC REFERENCE	COMMITMENTS	SECTION CONDITION IS ADDRESSED
SURFACE WATER	• Monitoring and Inspections: ○ prior to LCPP and infrastructure construction works review the Surface Water Monitoring Programme, establish additional representative monitoring sites where required and undertake monitoring; and annual monitoring of water level and water quality in the final void after mining operations have ceased as part of the post closure monitoring programme. Monitoring will continue in accordance with regulatory requirements.	To be implemented prior to the LCPP being developed
HVO NORTH – FINE REJECT EMPLACEMENT STATEMENT OF COMMITMENTS – 7 JUNE 2013		
GROUNDWATER	The monitoring bores and vibrating wire piezometers that were installed as part of the groundwater assessment (GW_103 to GW_115 series) will be retained and integrated into the groundwater monitoring plan for the life of the Carrington Pit.	Carrington Pit is no longer being mined and the Fine Reject emplacement is not constructed.
HUNTER VALLEY OPERATIONS – PROPOSED AMMONIUM NITRATE EMULSION PLANT – SUBMISSIONS REPORT – SEPTEMBER 2021		
SURFACE WATER	Nitrogen compounds and hydrocarbons are two analytes monitored as part of the HVO Surface Water Monitoring Programme. These analytes will continue to be monitored in Lake James and also in Dam 19s (for proposed Location B) to detect potential contamination from the facility and (in the case of Lake James) ensure water is of an adequate quality for discharge.	Section 8.3
HUNTER VALLEY OPERATIONS – LEMINGTON UNDERGROUND MODIFICATION 7 - DECEMBER 2021		
SITE WATER BALANCE	The HVO Water Management Plan including site water balance will be updated to include the Lemington Underground Mine void temporary water storage following approval of the Modification.	Section 5.10
MAXIMUM FILL LEVEL	DPE Water recommends HV Operations Pty Ltd set a maximum fill level at 30mAHD, and/or a minimum 10 m buffer separation between the base of the alluvium and fill level, whichever gives the greater vertical separation. Final reference level can be revised after the additional drilling is completed.	Section 7

SOC REFERENCE	COMMITMENTS	SECTION CONDITION IS ADDRESSED
GROUNDWATER QUALITY ANALYSIS	Additional sampling for water quality analysis will be conducted from the existing LUG Bore and LUG_S001 as well as from the new transfer sites upon completion of the bores (where they are not dry). The sampling would be undertaken in accordance with the Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales (EPA, 2004) and would include an analysis of the analytes in Table 2. The additional sampling would be described in the revised Water Management Plan.	Section 9.6 Appendix F
REVISED WATER MANAGEMENT PLAN	• DPE Water recommends HV Operations Pty Ltd revise the Water Management Plan to include a reporting process that: ○ accounts for the inflows and outflows via the LUG bore; and ○ informs on both water level recovery efficiency (inputs) and water level decay (extraction) so that 1:1 presumption of inflow/outflow can be reconciled.	Section 6.10
REVISED WATER MANAGEMENT PLAN	• Prior to the use of the Lemington Underground Void as a storage, DPE Water recommends HV Operations Pty Ltd to provide a methodology to quantify the maximum annual groundwater inflow during the period water is to be stored and removed, and the ongoing maximum annual groundwater inflow after this is completed. The methodology may use tools such as modelling, and verification programs including water balance assessments and needs to be based on a comprehensive understanding of the interaction between water in the void and the adjacent groundwater source. The methodology needs to be endorsed prior to the voids use and needs to provide confidence in predicting maximum water take to ensure water entitlement is held prior to the water take occurring. The methodology must provide an accuracy to within +/- 5% for modelled, measured and metered values. The ability to acquire sufficient entitlement to account for the maximum predicted water take from groundwater inflows will also need to be demonstrated.	Section 6.10
REVISED WATER MANAGEMENT PLAN	• DPE Water recommends HV Operations Pty Ltd install additional monitoring points as proposed in the Modification Report.	Section 9.6 Appendix F

1.3 | OBJECTIVES

The purpose of this WMP is to provide reasonable and feasible measures to address potential water impacts of the Project as identified in the Approvals and satisfy the relevant conditions of the Approvals.

This WMP describes procedures required to ensure compliance with conditions of the Approvals relating to potential water impacts. This WMP also provides a mechanism for assessing water quality and quantity monitoring results.

The key elements of the WMP are:

- Site water balance;
- Surface water management; and
- Groundwater management.

HVO manages 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;
- An 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.

2 | REGULATORY REQUIREMENTS

2.1 | BACKGROUND

This WMP has been prepared to fulfil the requirements of relevant legislation, the Approvals, EA commitments, EPL conditions and relevant standards and guidelines.

2.2 | PROJECT APPROVAL

The Approvals and subsequent amendments were assessed under the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act.). The current HVO North Approval was granted on 12 June 2004 and subsequently modified by the Planning Assessment Commission as delegate of the Minister for Planning and Infrastructure in March 2013, January 2014, December 2016, January 2017 and July 2017. The most recent modification (Mod 8) was granted on 24 April 2025.

The current HVO South Approval was granted on 24 March 2009. Subsequent modifications were granted in December 2009, February 2012, October 2012, February 2018, November 2021 and 27May 2022. The most recent modification (Mod 8) was granted on 6 February 2023.

The requirement for this WMP arises from Condition 27 of Schedule 3 of the HVO North Approval and Condition 27 of Schedule 3 of the HVO South Approval. A list of the relevant conditions of the Approvals and where they are addressed in this WMP is found in Section 1.2 (Table 1-1 & Table 1-2).

2.3 | ENVIRONMENT PROTECTION LICENCE

The *Protection of the Environment Operations Act 1997* (NSW) (PoEO Act) is the principal legislation regulating pollution (including water pollution) emissions in NSW. EPL 640 for HVO was issued on 29 September 2000 by the Environmental Protection Authority (EPA) under the PoEO Act.

EPL 640 prescribes the licensed discharges to water including locations of discharge points and concentration limits as well as volume limits and the monitoring and recording limits associated with those.

2.4 | RELEVANT STANDARDS AND GUIDELINES

- HVO Water Balance Model – updated 2022;
- HVO Hunter River Salinity Trading Scheme (HRSTS) Discharge Point Procedure;
- HVO Dam Ownership Register
- River Red Gum Rehabilitation and Restoration Strategy.

3 | CONSULTATION

Schedule 3, Condition 27 of the HVO North Approval requires the WMP to be prepared in consultation with Water Group and the EPA.

Schedule 3, Condition 27 of the HVO South Approval requires the WMP to be prepared in consultation with DPE Water.

3.1 | GOVERNMENT AGENCIES

Correspondence undertaken in relation to the revision of the Water Management Plan is presented in Table 3-1. A copy of the most recent consultation records are shown in Appendix B.

Table 3-1: External Stakeholder Consultation

Date	Stakeholder	Summary of Consultation
30/04/2014	Ben Harrison (DPIE)	Coal & Allied submit letter to DPIE regarding WMP submission
20/05/2014	Ben Harrison (DPIE)	Letter received from DPIE approving V1.0 WMP
06/12/2017	Irene Zinger (DPIE CL&W)	Letter received from DPIE CL&W division recommending updates to V3.0 of WMP
26/07/2018	Melissa Anderson (DPIE)	Revised WMP addressing comments submitted to DPIE

16/10/2018	Melissa Anderson (DPIE)	Conditional Approval of WMP received from DPIE.
28/02/2019	Melissa Anderson (DPIE)	Revised WMP submitted to DPIE to include monitoring stream and riparian vegetation health
18/04/2019	Melissa Anderson (DPIE)	Email sent to HVO from DPIE with comments on revised WMP
3/07/2020	DPE	HVO submitted WMP via Projects portal following feedback from DPIE
6/10/2022	DPE	DPE Water & EPA were provided with a copy of this WMP through the Major Projects Portal and were asked to provide any comments for HVO to consider, and where appropriate, incorporate into the WMP
14/10/2022	Jenny Lange (EPA)	In a letter dated 14 October 2022, the EPA advised they had not reviewed and had no comments on the management plan
22/11/2022	Joe Fittell (DPE)	Letter sent to DPE, regarding evidence of consultation of HVO WMP
3/05/2023	Tegan Cole (DPHI)	DPHI provided response to submitted WMP with a list of comments to enhance understanding of WMP.
29/08/2023	Keren Halliday (DPHI)	HVO submitted draft WMP for review following Annual Review submission and HVO South Mod 8 approval.
26/07/2024	Keren Halliday (DPHI)	DPHI provided response to submitted WMP with a request for information.
11/08/2025	EPA/DCCEEWW	HVO Submitted draft WMP for consultation with the EPA and DCCEEW following 2024 Annual Review submission and HVO North Mod 8 approval.
08/09/2025	DCCEEW	Consultation advice received from DCCEEW on draft WMP. Evidence of this consultation is provided in Appendix C.
17/11/2025	EPA	Letter received from the EPA advised they had not reviewed and had no comments on the WMP. Evidence of this consultation is provided in Appendix C.
17/11/2025	DPHI	Draft WMP updated to reflect comments from DCCEEW and submitted draft WMP to DPHI for approval (MP06_0261-PA-174).
23/12/2025	DPI/DCCEEW	DPHI advised DCCEEW requested further information on revised draft WMP (REF OUT25/15362). This correspondence can be seen in Appendix C.
13/03/2026	DPHI	Email sent to DPHI stating that HVO has been unable to contact DCCEEW to discuss several aspects of the RFI to ensure HVO was able to adequately address these.
27/03/2026	DPHI	Letter received from DPIE approving V3 of the WMP. Evidence of this approval is provided in Appendix A..

4 | EXISTING SITE LAYOUT

4.1 | EXISTING SITE LAYOUT

The HVO North complex comprises the:

- Carrington Pit;
- West Pit;

- North Pits;
- Mitchell Pit;
- Hunter Valley Coal Preparation Plant (HVCPP);
- Howick Coal Preparation Plant (HCPP);
- Hunter Valley Load Point (HVLP); and
- Newdell Loading Point (NLP).

HVO South comprises the:

- Cheshunt Pit;
- Riverview Pit; and
- Lemington South Pit.

4.2 | EXISTING APPROVED ACTIVITIES

HVO's mining activities north of the Hunter River are comprised of:

- three coal mining areas, including the West, and Mitchell Pit and Carrington Pit;
- use of the HCPP and HVCPP;
- use of the NLP and the HVLP train loading facilities;
- use of two administration areas including bathhouses, one adjacent to the HVCPP and one adjacent to the HCPP;
- two workshops, one adjacent to the HVCPP and one adjacent to the HCPP; and
- use of numerous internal haul roads and conveyors.

HVOs mining activities south of the Hunter River are comprised of:

- open-cut and highwall mining of coal reserves in Cheshunt Pit, Riverview Pit;
- mining by a combination of draglines, shovels, excavators and associated haul trucks;
- use of numerous internal haul roads;
- use of one administration area, including a bathhouse; and
- use of infrastructure to facilitate transfer of product coal (a rail spur and loop, overland conveyor or trucks, or any combination).

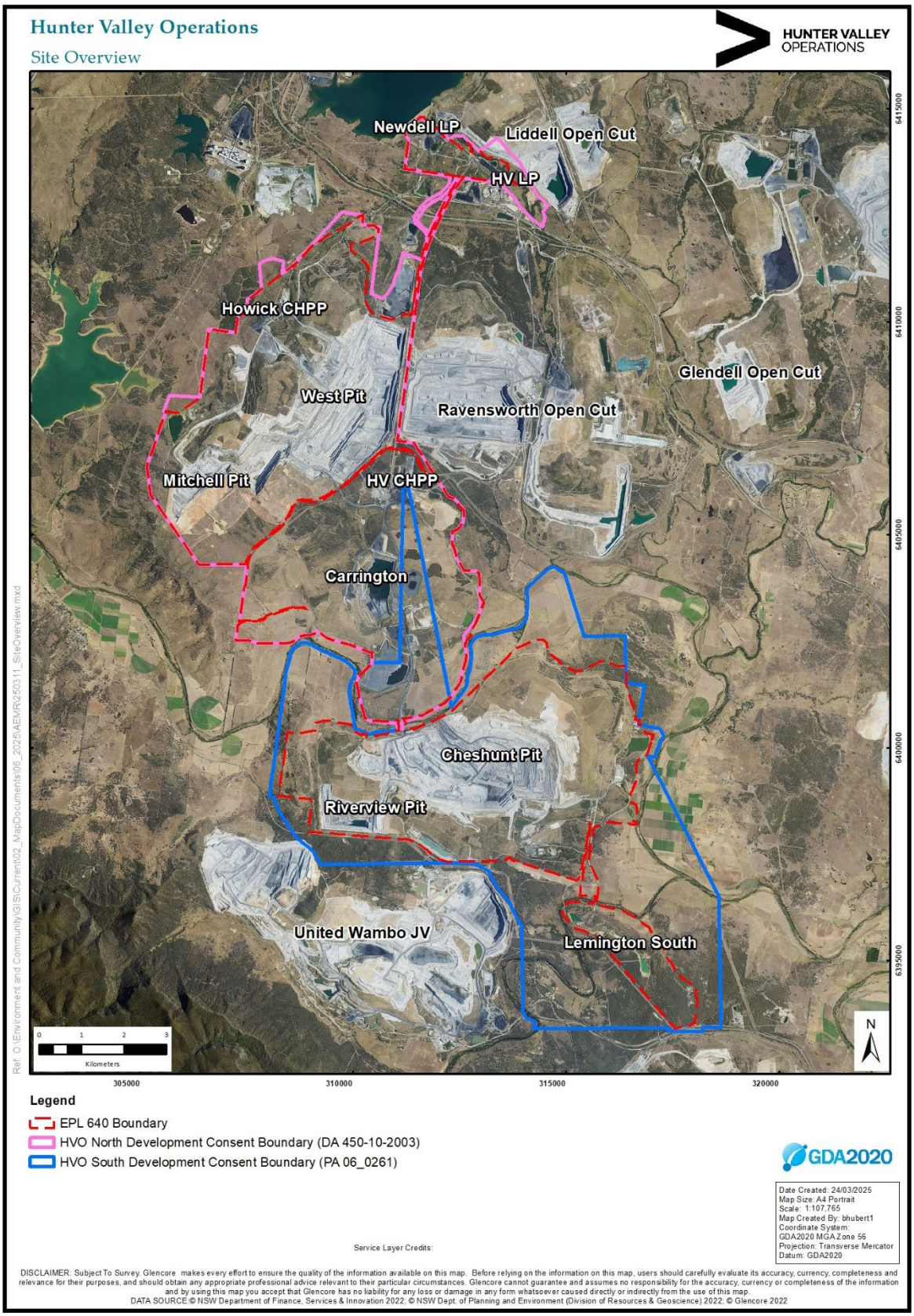

Figure 4-1: HVO Layout

5 | BACKGROUND

This section presents a summary of the existing environmental setting that informed the management measures.

5.1 | CLIMATE

The climate within the HVO area is sub-tropical, with temperatures, rainfall and evaporation highest over the summer months of December to February. Daily rainfall data is collected at HVO at the site meteorological gauge HVO Corp. Table 5-1 provides the historical average monthly rainfall data (2012 to 2023). Climate data was also obtained from the Scientific Information for Land Owners (SILO) database of historical climate records for Australia hosted by the Department of Environment and Science (DES). This service interpolates raw rainfall and evaporation records obtained from the Bureau of Meteorology (BOM), with data gaps addressed through data processing in order to provide a spatially and temporally complete climate dataset. Climate data was obtained for a SILO grid point (Latitude -32.45, Longitude 151.00) at HVO between 1983 to 2023. A summary of rainfall data for SILO is presented in Table 5-1

The rainfall data indicates slightly higher rainfall over the summer months, from November to March. The rainfall averages for the site data and SILO data are similar, with around 680 mm rainfall per year. Table 5-1 shows that the SILO average monthly actual evapotranspiration exceeds rainfall in all months.

Table 5-1: Climate Data Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Site Historical Average Rainfall (mm)	81	71	118	42	22	38	42	35	35	48	78	65	676
SILO Historical Average Rainfall (mm)	73	80	76	48	36	45	39	38	42	53	77	73	680
SILO Historical Average Pan Evaporation (mm)	201	159	138	98	68	53	61	87	119	156	173	199	1512

Long-term climate trends in the HVO site (HVO Corp) rainfall data from 2012 and SILO rainfall data from 1983 to 2023 are displayed using a cumulative rainfall departure (CRD) rainfall plot in Figure 5-1. The CRD graphically shows trends in recorded rainfall compared to long-term averages and provides a historical record of relatively wet and dry periods. A rising trend in slope in the CRD graph indicates periods of above average rainfall, whilst a declining slope indicates periods when rainfall is below average. A level slope indicates average rainfall conditions. The site data largely corresponds to the SILO dataset. The long-term trends show approximate 10 year (± 3 years) climatic cycles of above average rainfall followed by below average rainfall, influenced by La Niña and El Niño events. The region experienced periods of generally above average rainfall from 1986, 1998, 2007 and 2020, followed by periods of below average rainfall. The SILO data shows the highest quarterly rainfall that exceeded evaporation occurred in 1989 (April to June) with 397 mm rain and 178 mm evaporation.

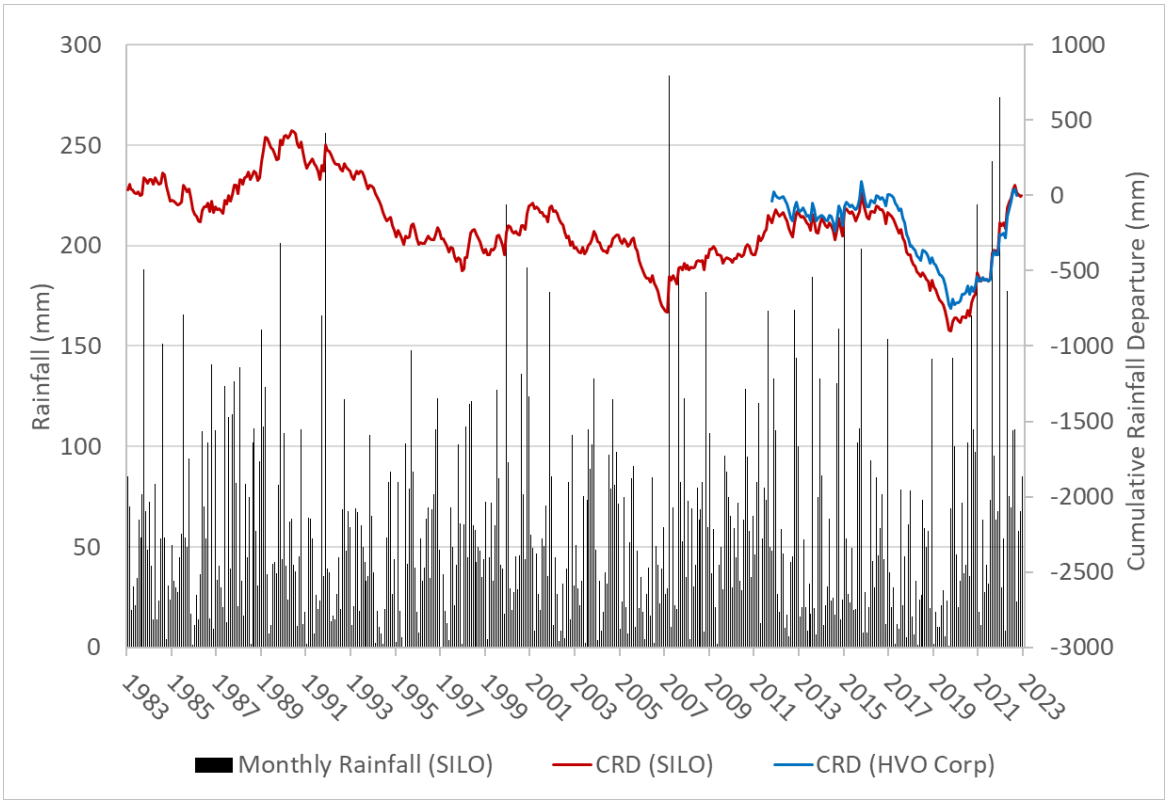

Figure 5-1: Cumulative Rainfall Departure

5.2 | TOPOGRAPHY

Regionally, topography is characterised by a steep and incised range to the southwest grading down towards the low-lying floodplains of the Hunter River and Wollombi Brook. The surface levels surrounding the Hunter River and Wollombi Brook range between 50 m Australian Height Datum (mAHD) and 70 mAHD (AGE, 2022). To the west of the HVO Complex, elevations range between 300 mAHD and 650 mAHD (AGE, 2017).

5.3 | DRAINAGE

The terrain and drainage at HVO are dominated by the easterly flowing Hunter River, which dissects the complex in a general east-west direction. Ground elevations range between 60 mAHD along the Hunter River alluvial plains to 180 mAHD in the northern parts of HVO North. Minor ephemeral drainage features are also present around HVO including Parnell's Creek, Farrells Creek, Bayswater Creek, Bowmans Creek and Wollombi Brook, which drain into the Hunter River. The Hunter River and Wollombi Brook are the main water courses flowing through the HVO Complex.

The Hunter River is regulated with controlled releases from the Glenbawn Dam located 35 km north of HVO. River levels and flow volumes vary due to climate, water releases and annual water demand from water licence holders (AGE, 2022).

Real time stream flow data is monitored along the Hunter River at WaterNSW gauging stations via the Hunter Integrated Telemetry System (HITS). Time series river water elevations (mean level above zero-gauge elevation) are shown in Figure 5-2 for two HITS stations (Hunter River @ Liddell and Hunter River

@ U/S Foy Brook). In addition, HVO monitors the Hunter River monthly at surface water sites WL03 and WL05, WL10 and WL14.

Figure 5-2 shows the long-term river levels for the Hunter River. The upstream river levels (210083) have, on average, been recorded around 66.3 mAHD (5 m stage height), with levels regulated by releases from Glenbawn Dam. Discharge along the Hunter River is around 6,743 ML/day on average (210083) but can range between 687 ML/day and 76,337 ML/day. The peak discharge relates to flood events that record peak river levels of up to 74.7 mAHD (14 m stage height).

Wollombi Brook is an ephemeral water course which flows in a north easterly direction across HVO South before joining the Hunter River. Stream flow data in Wollombi Brook is monitored by WaterNSW gauging station Wollombi Brook at Warkworth (210004) near HVO. The long term average flow measured at 210004 was 258 ML/d, based on average flow data between 2010 and 2021 (AGE, 2021),

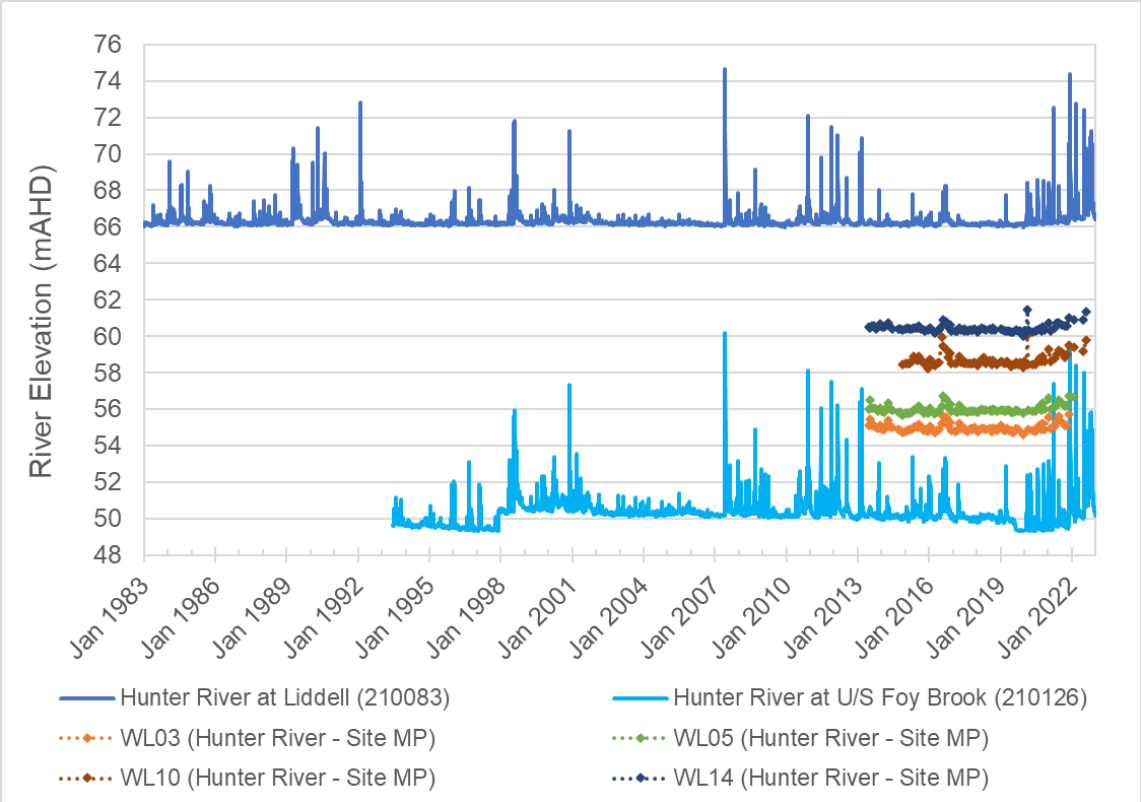

Figure 5-2: Hunter River Levels

5.4 | GEOLOGY

The HVO Complex is situated within the Hunter Coalfields on the north-eastern margins of the Permian and Triassic Sydney Basin. The Hunter-Mooki Thrust Fault bounds the basin approximately 6 kms to the northeast (AGE, 2022). Permian sediments form the Whittingham Coal Measures of the Hunter Coalfields. The Whittingham Coal Measures occur at outcrop to the north and east of HVO and generally dip to the south to southwest. The coal seams occur as various splits and plies, with an average combined thickness of around 0.5 m to 6 m. The seams are interbedded with siltstone, sandstone and shale that is around 4 m to 32 m thick. Where the Permian coal measures outcrop, weathering has occurred resulting in a thin veneer of unconsolidated weathered material (regolith) extending to a depth of approximately 50 m (AGE,

2021). The Whittingham Coal Measures overlie the Maitland Group, which comprises the Mulbring Siltstone, Muree Sandstone and Branxton Formation.

The Permian coal measures are unconformably overlain by Quaternary alluvium and a palaeochannel has also been identified and mapped by MER (2010) within the Carrington Pit area. Along the Hunter River and Wollombi Brook thin Quaternary alluvial deposits are comprised of surficial fine grained sediments (clay, silty sand and sand) and coarser basal sediments (sands and gravels). The coarser basal sediments are generally 7 m to 20 m thick along the Hunter River and Wollombi Brook and are considered highly productive alluvium. Along minor drainage lines the surficial alluvium is generally within 400 m of creeks and between 7 m and 19 m thick. The surficial alluvium is present at the north-eastern end of the Riverview Pit and at the south-eastern end of South Lemington Pit 2 (AGE, 2017).

Aeolian Sands of the Warkworth Sands are mapped within the southern area of HVO South and are comprised of feldspathic quartz aeolian sands, approximately 3 m thick. The sands overlie low permeability clay, associated with weathered Permian coal measures, which reduces vertical flow of groundwater resulting in a thin, perched water table at the base of the sands. The Warkworth Sands support a unique woodland due to the storage and slow release of water (AGE, 2021).

The current West Pit operations of HVO North targets the shallow Broonie Seam of the Jerrys Plains Subgroup, as well as coal seams down to the Barrett Seam of the Foybrook Formation (Vane Subgroup).

The Carrington Pit operations of HVO North targeted coal seams from Piercefield to Bayswater Seam series. The primary constituents of the overburden and interburden at HVO are sandstone, siltstone, mudstone, conglomerate and tuff (EGi, 2021).

5.4.1 | STRUCTURES

The major fold structure running through the HVO Complex is the Bayswater Syncline with the Muswellbrook Anticline located to the west. The Camberwell Anticline is also approximately 5 km northeast of the HVO Complex. More localised structures include:

- Within HVO South, Cheshunt Pit and Riverview Pit lie on the western limb of the Bayswater Syncline with the southern end of the Muswellbrook Anticline 3 kms to the west (AGE, 2022).
- The Hunter Valley Cross Fault, mapped in the 1:100,000 Hunter Coalfields geological map, occurs along the southern edge of Riverview Pit and north of the South Lemington Pit, with an approximate displacement of 10 m (AGE, 2021).
- Within Carrington Pit the horst and graben structure of the Hunter Valley Fault Zone can be seen. Small scale northeast to southwest thrust faults associated with the zone can also be observed in the Carrington Pit (AGE, 2022).
- At West Pit, Parnell’s Fault and the GRS Fault can be observed.
- The north-south striking Lemington Fault bounds the eastern edge of the Lemington Underground with a vertical displacement of 20 m.
- The sub vertical Lemington Dyke, which is a major dolerite dyke, passes through the Cheshunt Pit area. Minor dykes are also present in the Riverview Pit area.
- Within HVO North the northeast-southwest trending Carrington Dyke cuts through Carrington Pit (AGE, 2022). The dyke likely has low permeability but has associated localised fracturing, enhancing groundwater storage (MER, 2009).

The surface geology at site is summarised in Table 5-2 and presented in Figure 5-3 based on the NSW Seamless Geology Mapping (Colquhoun et. al, 2023) and palaeochannel mapping by MER (2010).

Table 5-2: Generalised Stratigraphy

Age	Stratigraphic Unit		Description
Cainozoic	Quaternary alluvial sediments (Qa)	Surficial alluvium (Qhb)	Shallow sequences of clay, silty sand and sand.
		Productive basal sand/gravel (Qha)	Basal sands and gravels along major watercourses (i.e., Hunter River and Wollombi Brook).
	Silicified weathering profile (Czas)		Silcrete.
	Alluvial terraces (Cza)		Silt, sand and gravel.
Jurassic	Volcanics (Jv)		Flows, sills and dykes.
Permian	Whittingham Coal Measures	Jerrys Plains Sub-group (Pswj)	Coal bearing sequences interbedded with sandstone and siltstone. Coal seams (youngest to oldest) include Whybrow, Redbank Creek, Wambo, Whynot, Blakefield, Glen Munro, Woodlands Hill, Arrowfield, Bowfield, Warkworth, Mt Arthur, Piercefield, Vaux, Broonie and Bayswater.
		Archerfield Sandstone (Pswv)	Lithic sandstone marker bed.
		Vane Sub-group (Pswv)	Coal bearing sequences interbedded with sandstone and siltstone. Coal seams (youngest to oldest) include Lemington, Pikes Gully, Arties Liddell, Barrett and Hebden.
		Saltwater Creek Formation (Psws)	Sandstone and siltstone, minor coaly bands, siltstone at base.

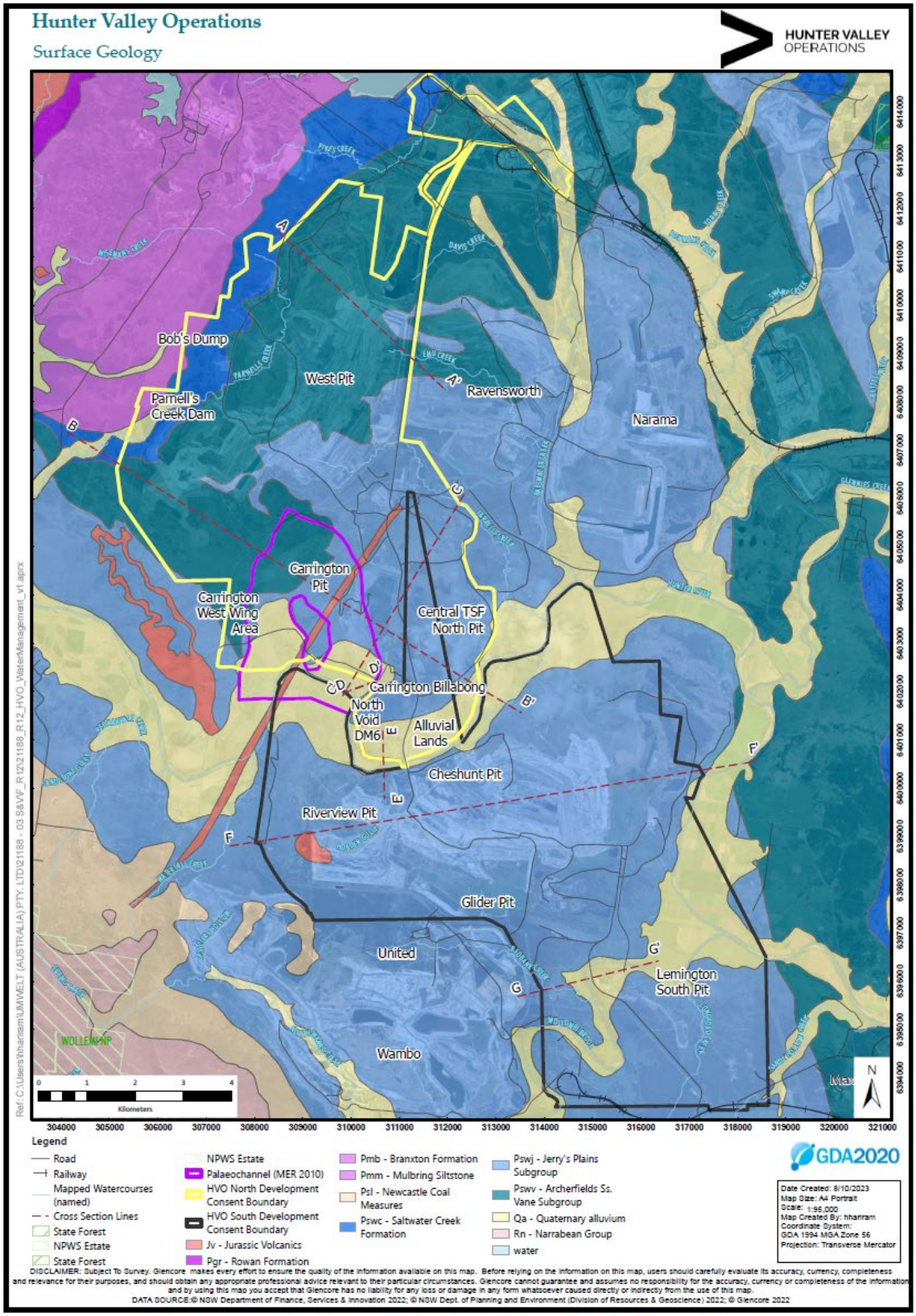

Figure 5-3: Surface Geology

5.5 | HYDROGEOLOGY

The main groundwater units at HVO and the surrounding area are the productive alluvium associated with the Hunter River, less productive alluvium localised along Parnell's Creek and Wollombi Brook, and the Permian coal seams of the Whittingham Coal Measures. These units are summarised below.

5.5.1 | QUATERNARY ALLUVIUM

The Quaternary alluvium is localised along creeks and drainage lines. Along the Hunter River the alluvium comprises basal sands and gravels between 7 m and 20 m thick. The base of the Hunter River alluvium occurs to around 47 mAHD to 60 mAHD at the southern end of HVO South. The Hunter River alluvium is more laterally extensive with a thickness ranging between 10 m to 25 m. Most water supply bores target the basal portion of the alluvium due to the sand and gravel composition making the aquifer highly productive. The Wollombi Brook alluvial aquifer is estimated be 10 m thick in the South Lemington area.

The Quaternary alluvium is an unconfined groundwater system that is recharged by rainfall infiltration, streamflow and upward leakage from the underlying stratigraphy, particularly in undisturbed areas (i.e., away from active mining). The flow direction within the alluvium generally follows topography. Groundwater within the Hunter River alluvium flows in an easterly direction.

Regionally, the Hunter River predominantly gains water from the surrounding alluvium, as well as from rainfall and regulated flow. However, there are also areas with losing conditions where rivers recharge the underlying alluvium. These losing conditions can occur around areas of active mining, where the hydraulic gradient is increased due to depressurisation of the underlying coal measures.

The less productive groundwater within the surficial alluvium does not meet the ANZECC (2000) water quality guidelines for stock water supply. However, the water quality of the highly productive alluvium, which includes basal sands and gravels is considered suitable for stock water supply. However, most agricultural producers (crop and cattle) utilise surface water resources (Hunter River and Wollombi Brook) in preference to alluvial groundwater (Umwelt, 2022).

The alluvial aquifer of the Hunter River supports the Carrington Billabong, an ephemeral freshwater wetland located south of Carrington Pit that is considered a Groundwater Dependant Ecosystem (GDE). Alluvial groundwater levels around the Carrington Billabong have remained relatively stable during active mining at Carrington Pit. This is due to installation of a barrier wall through the unconsolidated alluvial sediments, which separates the billabong from Carrington Pit. The stable alluvial groundwater levels in this area are also taken to indicate limited hydraulic connection between the nearby palaeochannel alluvium and the underlying depressurised coal measures (Umwelt, 2020).

5.5.2 | WARKWORTH SANDS

The Warkworth Sands are mapped at the northern, north-western and western extents of HVO (ELA, 2022). The sands are generally 3m thick comprised of fine grained aeolian dune sands, overlying low permeability weathered residual clays. The feldspathic quartz aeolian sands are approximately 1 m to 6 m thick, overlying low permeability basal clay and Permian coal measures (EMM, 2022). The presence of the clays limits vertical flow and forms a thin ephemeral perched water table, which is not in hydraulic connection with the underlying regional Permian fractured rock aquifer (AGE, 2021).

The Warkworth Sands is understood to form a perched aquifer that receives recharge from rainfall (ELA, 2022; EMM, 2022)). Two groundwater bores were installed in the Warkworth Sands near South Lemington Pit in 2020 and recorded the presence of water following large rainfall events (EMM, 2022).

5.5.3 | PALAEOCHANNEL

The palaeochannel was mapped by MER (2010) with site specific drill data indicating the unconsolidated sediments (silts, clays, sand and gravels) are between 12 m to 20 m thick. Where present, the base of the palaeochannel alluvium extends from around 54 mAHD to 60 mAHD. The palaeochannel sediments are heterogeneously distributed based on the depositional environment; however, the unit comprises three main sequences, as reported by MER (2010):

- upper layer, comprised of thin bands of sand, silt and clay;
- middle layer, which is approximately 3 m to 8 m thick and is comprised of stiff clays; and
- basal layer, which is approximately 3 m to 8 m thick and is comprised of fine to coarse-grained silty clay gravels and cobbles or in some areas, sandy gravels.

Prior to mining, groundwater flow within the Hunter River alluvium recharged the western limb of the palaeochannel, with southerly flow from the eastern limb. Groundwater within the palaeochannel was collated and reported by MER (1999) as being of poor quality, with a TDS of around 4,672 mg/L, pH of 7.4 and sulphate concentration of 469 mg/L. This is similar to available site water quality data for palaeochannel bore CGW39, which records an EC of around 5,355 µS/cm and 8,131 µS/cm (5th and 95th percentile).

The palaeochannel was partially mined at Carrington Pit and Carrington Extended, with a barrier wall put in place across the eastern limb of the palaeochannel. Construction of a barrier wall across the western limb was approved as part of Carrington West Wing (CWW) approvals but has not been constructed and no mining has been undertaken at CWW.

5.5.4 | PERMIAN COAL MEASURES

The Whittingham Coal Measures outcrop across the north and east of the HVO complex. The coal measures form unconfined groundwater systems at outcrop, becoming semi-confined to confined as they dip towards the southwest.

Recharge occurs from direct rainfall infiltrating into the formations through the thin soil cover and weathered profile. The coal measures also occur at subcrop in localised zones beneath the alluvium associated with the Hunter River, where the unit is recharged by downward seepage where gradients induce flow. The coal seams are typically moderately to slightly permeable, with hydraulic conductivity of the interburden generally less than coal seams but more variable, depending on the predominance of fractures in the rock mass. The hydraulic conductivity of the coal seams generally decreases with depth due to the closure of the cleats with increasing stratigraphic pressure (Umwelt, 2022).

The groundwater flow direction within the Whittingham Coal Measures is influenced by the local geomorphology and structural geology. The long history of mining within the region has also significantly altered groundwater flow paths within the Permian units. On a regional scale, groundwater flow in the Permian aquifers follows topography, flowing in a north-easterly direction. On a local scale, groundwater levels show drawdown impacts associated with the extensive active mining areas. Groundwater discharge from the Whittingham Coal Measures occurs as discharge to active mining and abstraction bores, as well as upward seepage to the Quaternary alluvium where hydraulic gradients induce flow. Post closure, groundwater will also be discharged via evapotranspiration/evaporation from the final voids.

Groundwater use from the Permian coal measures is limited due to being brackish to saline with low and variable yields. Yields are generally less than 5 L/s and are classified as ‘less productive aquifers’ based on the NSW AIP criteria (AGE, 2021). Due to the poor water quality of the Permian coal measures, that generally exceeds ANZECC (2000) water quality guidelines for stock supply, there is no significant usage of groundwater from the Permian coal measures. Stock supply is primarily derived from perennial surface water flows (Hunter River and Wollombi Brook) and the more productive alluvial aquifer.

Within HVO South the historical Lemington Underground Workings (LUG) mined the Mt Arthur coal seam, which has affected the permeability and storage of the coal seam, particularly in areas of longwall mining (AGE, 2021).

5.6 | GROUNDWATER USERS

This section presents a summary of groundwater users around HVO, both anthropogenic and environmental.

5.6.1 | REGISTERED BORES

The National Groundwater Information System (NGIS) database indicates groundwater use in the region, largely associated with the Hunter River alluvium. A search of the NGIS database for registered private bores was conducted in 2023 within 5 km of HVO North and HVO South, excluding bores within the mine areas and monitoring bores. NGIS indicates there are 20 registered private bores along the Hunter River alluvium. At HVO North there are 15 bores located to the west of site, between Parnell's Creek and the palaeochannel at Carrington Pit. At HVO South there are five bores located to the east of site, north of Wollombi Brook, used for commercial/industrial or irrigation purposes. There is also one bore within the Wollombi Brook alluvium, used for water supply. The location of the registered bores is presented in Figure 5-4

Two additional unregistered bores were also previously identified as part of a landholder bore census reported by AGE (2017) that are used for stock water supply. Based on the available information, the bores largely target groundwater from the Hunter River alluvium and are used for stock water supply and irrigation purposes.

5.6.2 | GROUNDWATER DEPENDENT ECOSYSTEMS

A Groundwater Dependant Ecosystem (GDE) is one in which the plant and/or animal community is dependent on the availability of groundwater to maintain its structure and function, which can be classified into three broad types:

- Ecosystems dependent on the subsurface presence of groundwater (terrestrial GDEs, including some riparian vegetation communities).
- Ecosystems dependent on the surface expression of groundwater (aquatic GDEs, including river baseflow systems, springs and swamps).
- Aquifer and cave ecosystems (subterranean GDEs).

The GDE Atlas (BoM 2022) classifies ecosystems based on the potential for dependence on groundwater, based on multiple lines of scientific evidence. Ecosystems are mapped as either:

- High potential for groundwater interaction (indicating a strong possibility the ecosystem is interacting with groundwater).
- Moderate potential for groundwater interaction.
- Low potential for groundwater interaction (indicating it is relatively unlikely the ecosystem will be interacting with groundwater and will include ecosystems that are not interacting with groundwater).

DPHI (2022) Probable Vegetation Groundwater Dependent Ecosystems - Hunter / Central Rivers is derived from the NSW Sharing and Enabling Environmental Data (SEED) portal (www.seed.nsw.gov.au). The mapping shows terrestrial vegetation communities that have a probability of being GDEs. The mapping indicates vegetation with a high probability of being GDEs localised along the Hunter River and around

Carrington Billabong. Mapping also indicates areas of vegetation with a high probability of being a GDE along sections of Farrells Creek and Parnell's Creek.

High probability GDEs have also been mapped in an area that corresponds with the remnant palaeochannel, to the north of Carrington Pit. These are mapped as Central Hunter Swamp Oak Riparian Forest. Within HVO South, Bull Oak Grassy Woodland occurs along Redbank Creek, which is an ephemeral tributary of Wollombi Brook near Warkworth. The location of the GDEs is presented in Figure 5-4

Potential GDE field assessments have been undertaken for the HVO complex as part of the HVO Continuation Project (EcoLogical, 2022). Identified GDEs include:

- Terrestrial GDEs:
  - River baseflow systems of the Hunter River.
  - Aquifer ecosystems (i.e., stygofauna) of the Hunter River and aquifers of associated tributaries and the palaeochannel;
  - River Red Gums along the Hunter River and Wollombi Brook;
  - River Red Gums within the Carrington Billabong, near the Hunter River;
  - River Oak Grassy Riparian Woodland in the Hunter River riparian zone; and
  - Warkworth Sands Woodland community within the South Lemington area and east of Barrys Pit and the historical North Lemington Pit, which is intermittently reliant on a perched water table.
- Aquatic GDEs:
  - Wollombi Brook is dependent on the Wollombi Brook alluvial aquifer; and
  - The Hunter River is considered a high potential aquatic GDE dependent on the Hunter River alluvial aquifer.

Field surveys of potentially groundwater dependent vegetation sites were recently conducted in 2020 and 2022. The surveys identified that the ecological condition in the Hunter River sites was poor to moderate, with macroinvertebrate communities dominated by pollution-tolerant taxa (EcoLogical, 2022).

Stygofauna sampling was also conducted from 2020 to 2022 with stygofauna taxa identified in the Hunter River alluvium (EcoLogical, 2022). The same taxa were also identified in the palaeochannel aquifer at HVO North. The common taxa in these two systems are unsurprising given the gradient of flow from the Hunter River to the western limb of the palaeochannel.

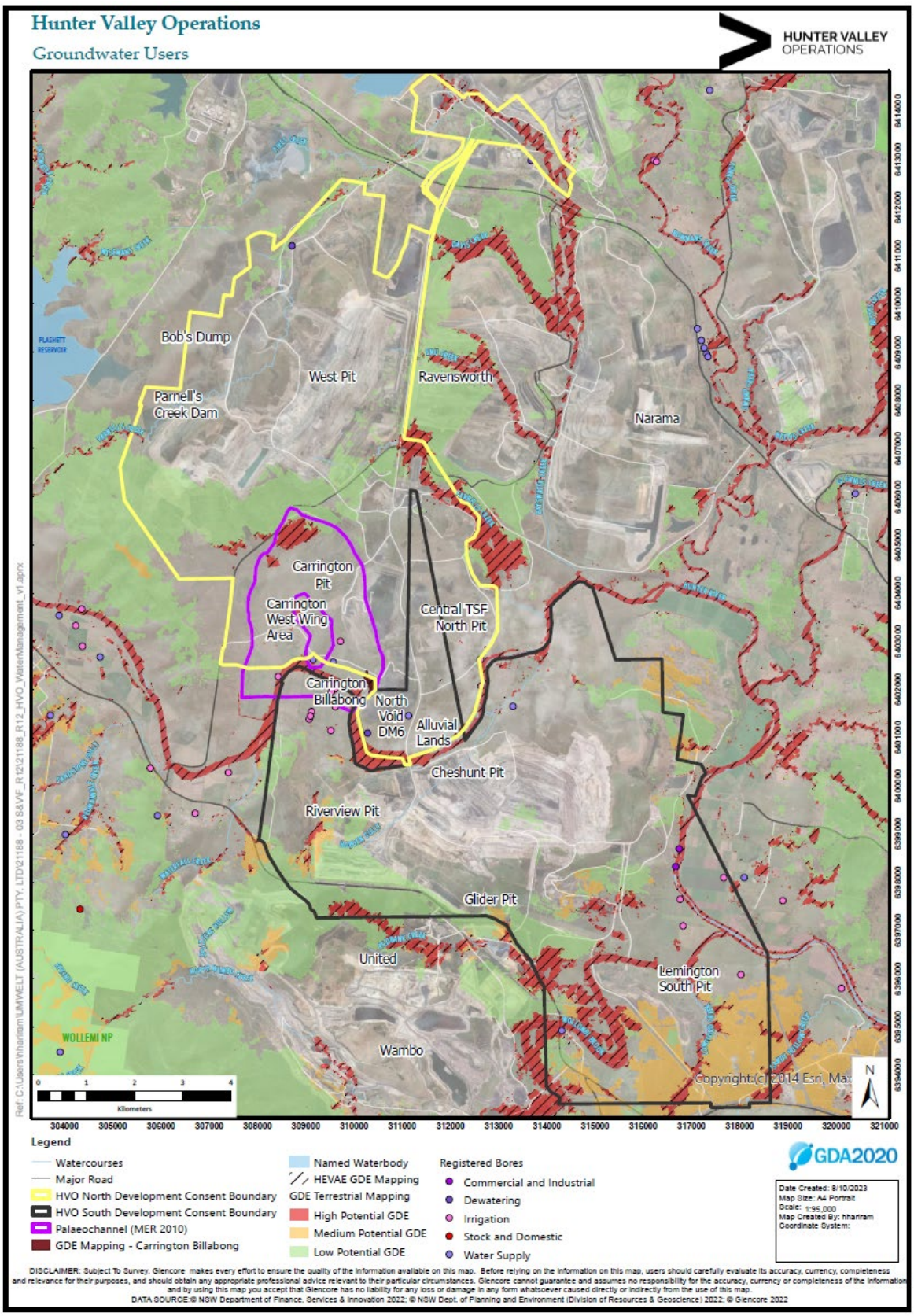

Figure 5-4: Groundwater Users

5.7 | CONCEPTUAL GROUNDWATER MODELS

The conceptual groundwater model is summarised below:

- Quaternary alluvium along the Hunter River and Wollombi Brook forms a thin aquifer system within the HVO complex, with a general thickness of less than 20 m, with the highly productive alluvium within the sands and gravels at the base of the aquifer. The alluvium is primarily recharged via river leakage, as well as rainfall recharge and can receive upward seepage from the underlying coal measures when gradients enable flow.
- Permian coal measures are less productive aquifers due to low yields and poor water quality, limiting any beneficial use. The coal seams are more permeable compared to the interburden material and recharge is from downwards leakage from the overlying alluvium or rainfall recharge via subcrops and outcrops of the coal measures (AGE, 2022).
- Mining within the region has depressurised the Permian groundwater system reducing groundwater levels below the base of the Quaternary alluvium. Historic depressurisation of the Permian coal measures has resulted in disconnection from the alluvium, leading to drawdown within the Hunter River and Wollombi Brook alluvium (AGE, 2022).
- In areas where mining has ceased groundwater levels within the Permian coal measures will recover and likely reconnect to the overlying alluvium. This will reduce drawdown but may reduce water quality in the alluvium.
- Within the mined area, final voids are proposed to generally act as groundwater sinks and minimise potential seepage of spoil water to alluvium. An exception to this is South Lemington Void that intersects Wollombi Brook alluvium and was previously predicted to act as a throughflow system (AGE, 2017).
- A conceptual cross section of the HVO Complex is shown in Figure 5-5. Conceptual ecohydrological models are also presented in Figure 5-6 to Figure 5-12, covering the final void and recovery predictions for HVO North, as well as predicted groundwater interactions and impacts with active mining in Riverview Pit and Cheshunt Pit, and water storage and recovery in South Lemington Pit and Lemington Underground. The location of the cross sections are shown in Figure 5-3.

A summary of the site activities and previously predicted impacts to groundwater and groundwater users is presented in Section 9.5 |.

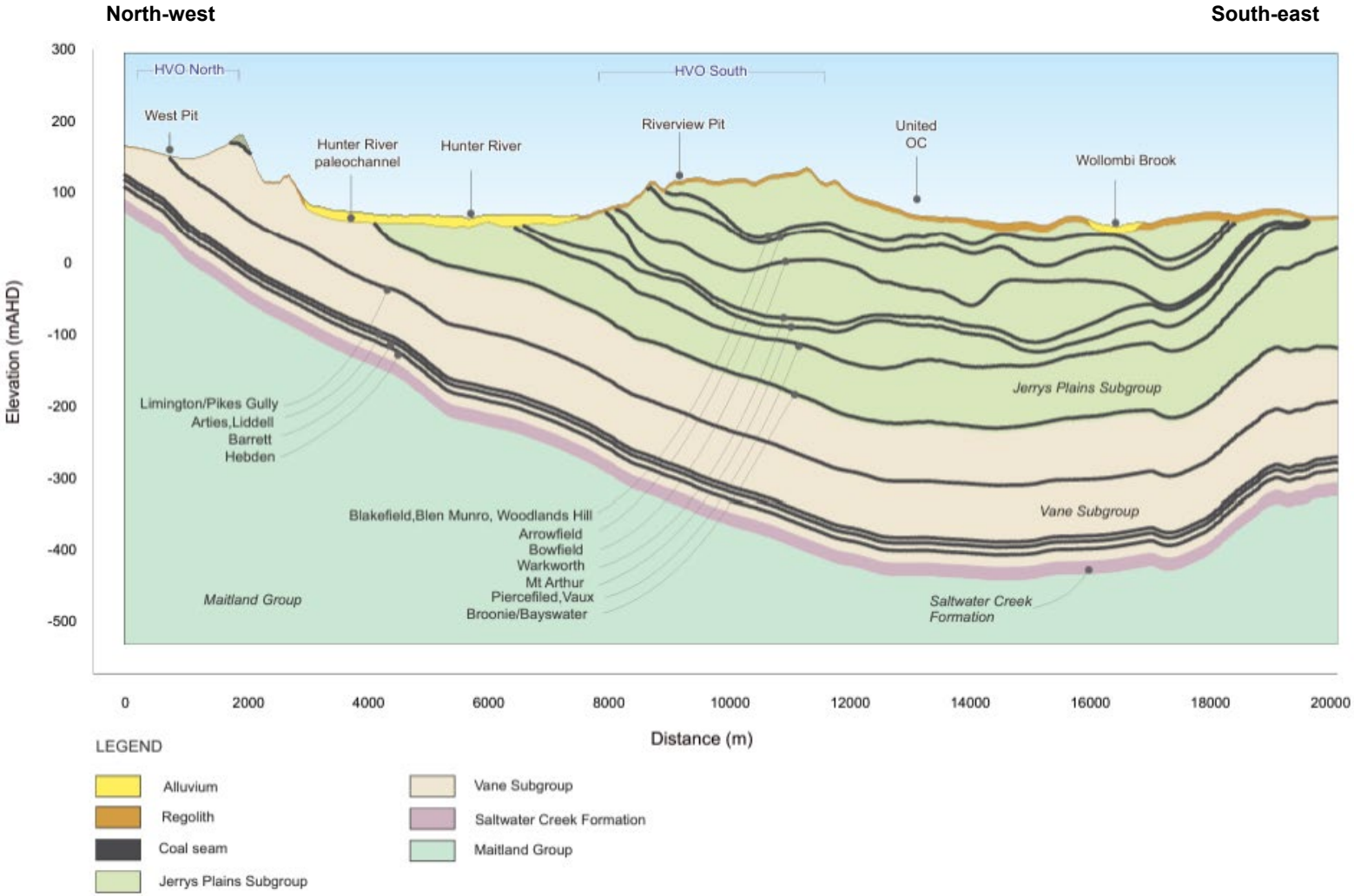

Figure 5-5: Conceptual Groundwater Model (AGE, 2022)

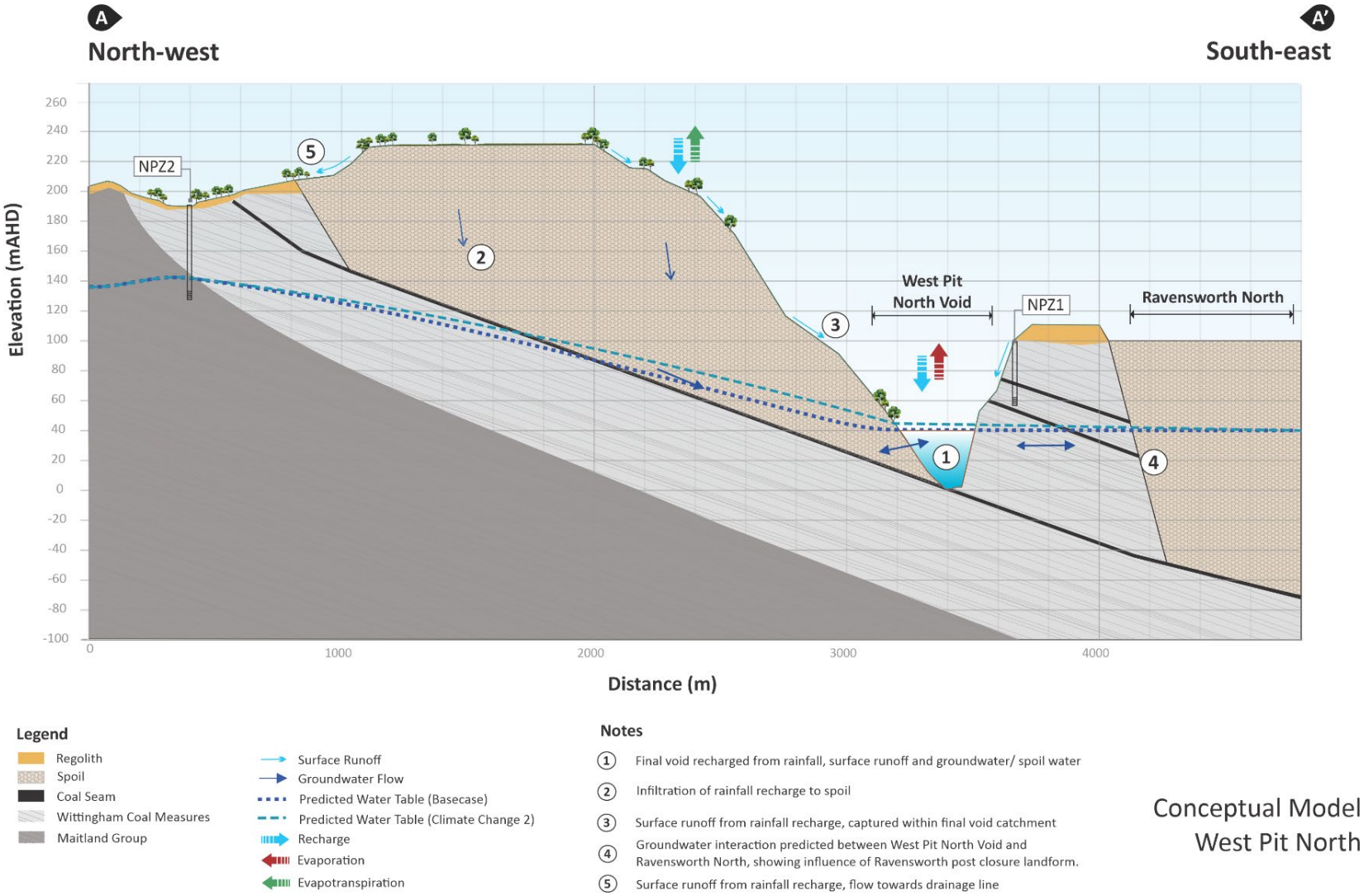

Figure 5-6: Conceptual Ecohydrological Model – Section A

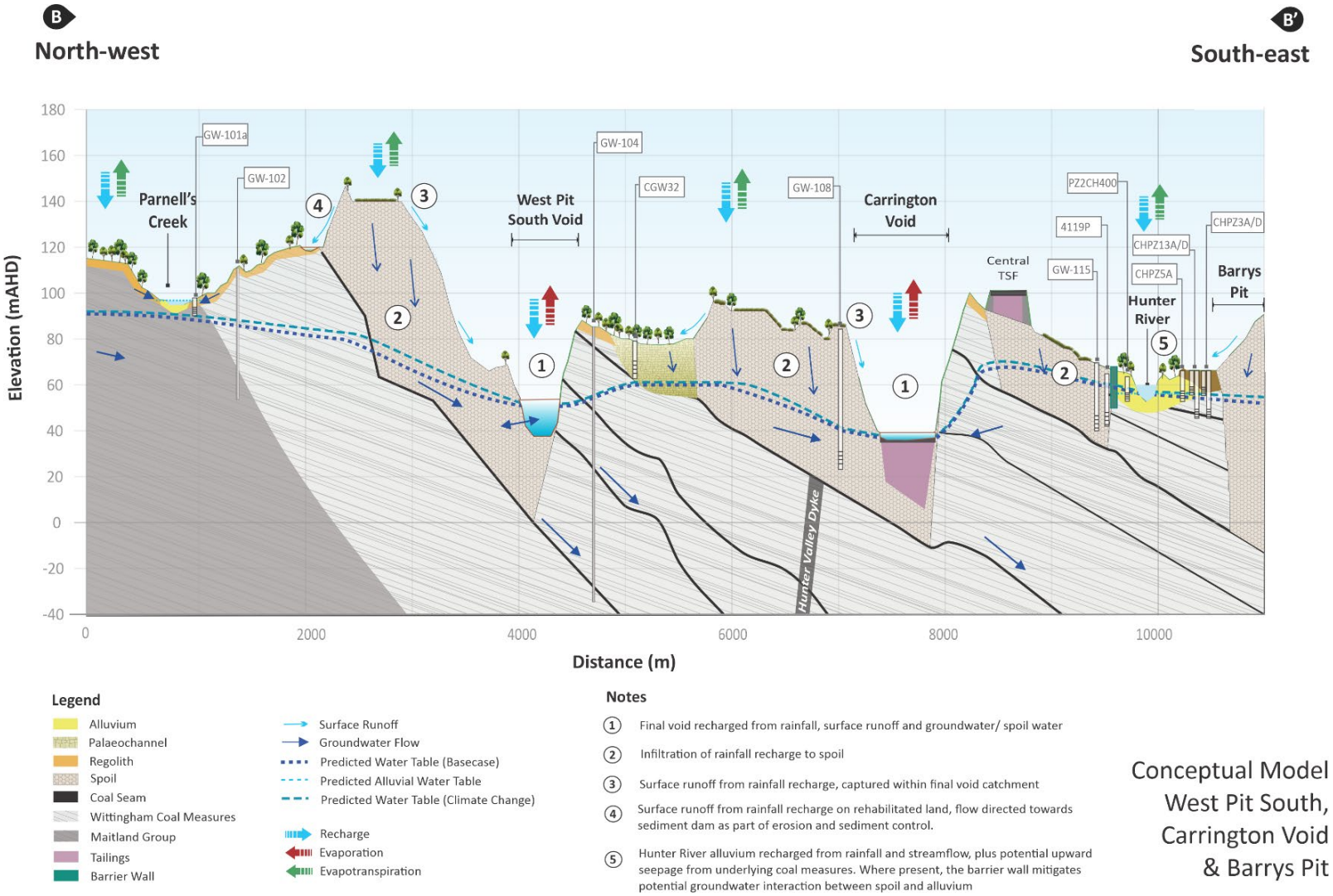

Figure 5-7: Conceptual Ecohydrological Model – Section B

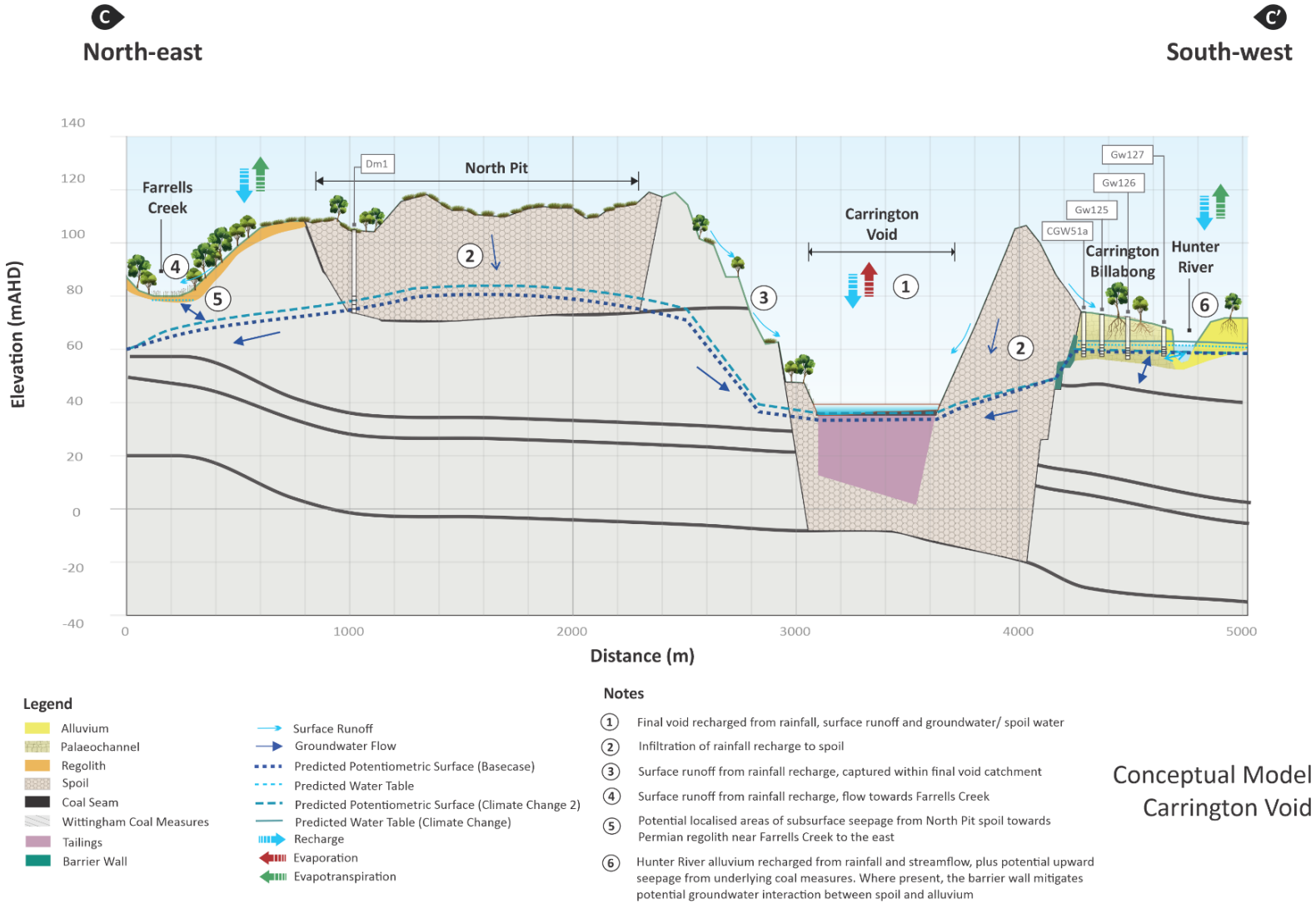

Figure 5-8: Conceptual Ecohydrological Model – Section C

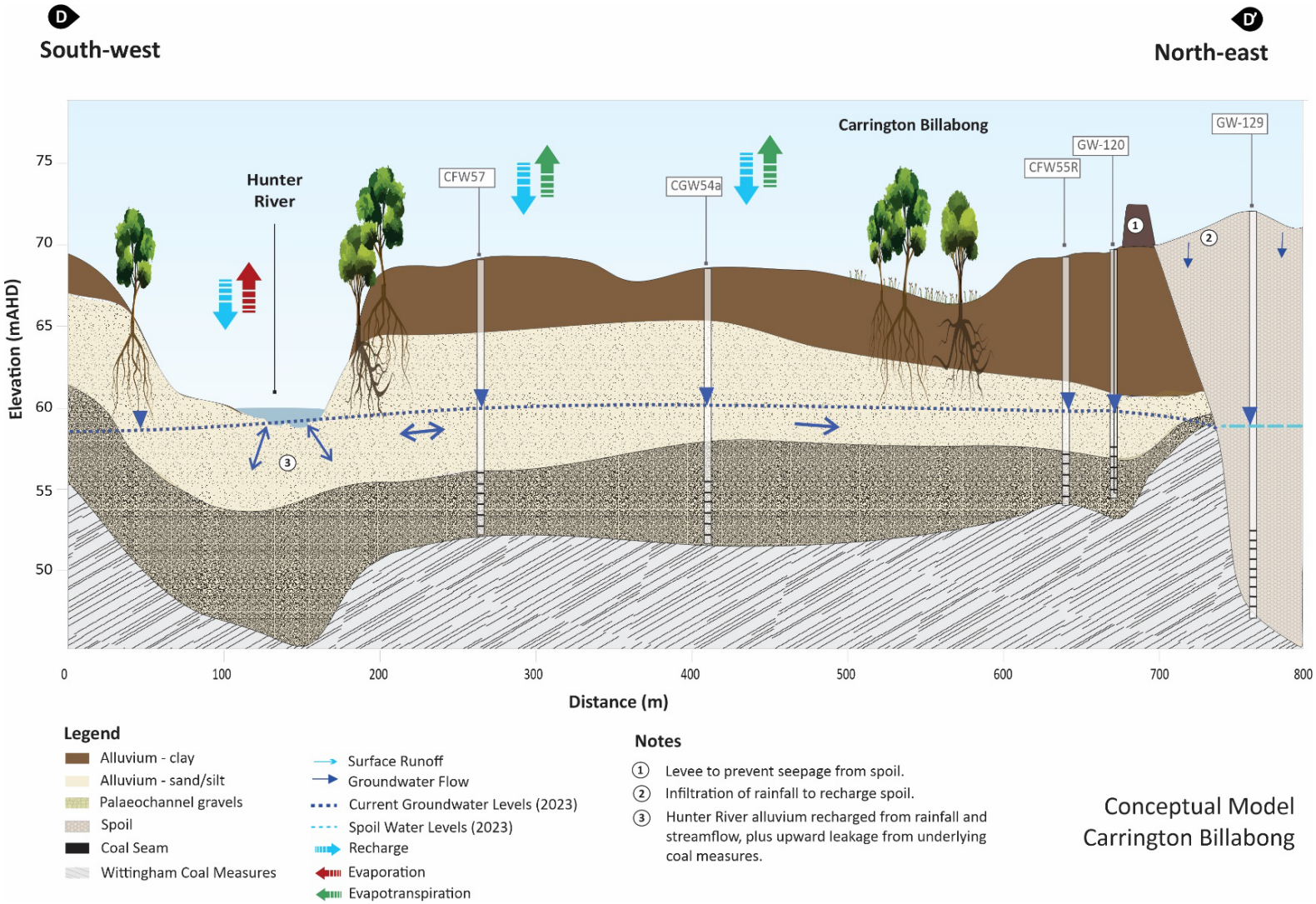

Figure 5-9: Conceptual Ecohydrological Model – Section D

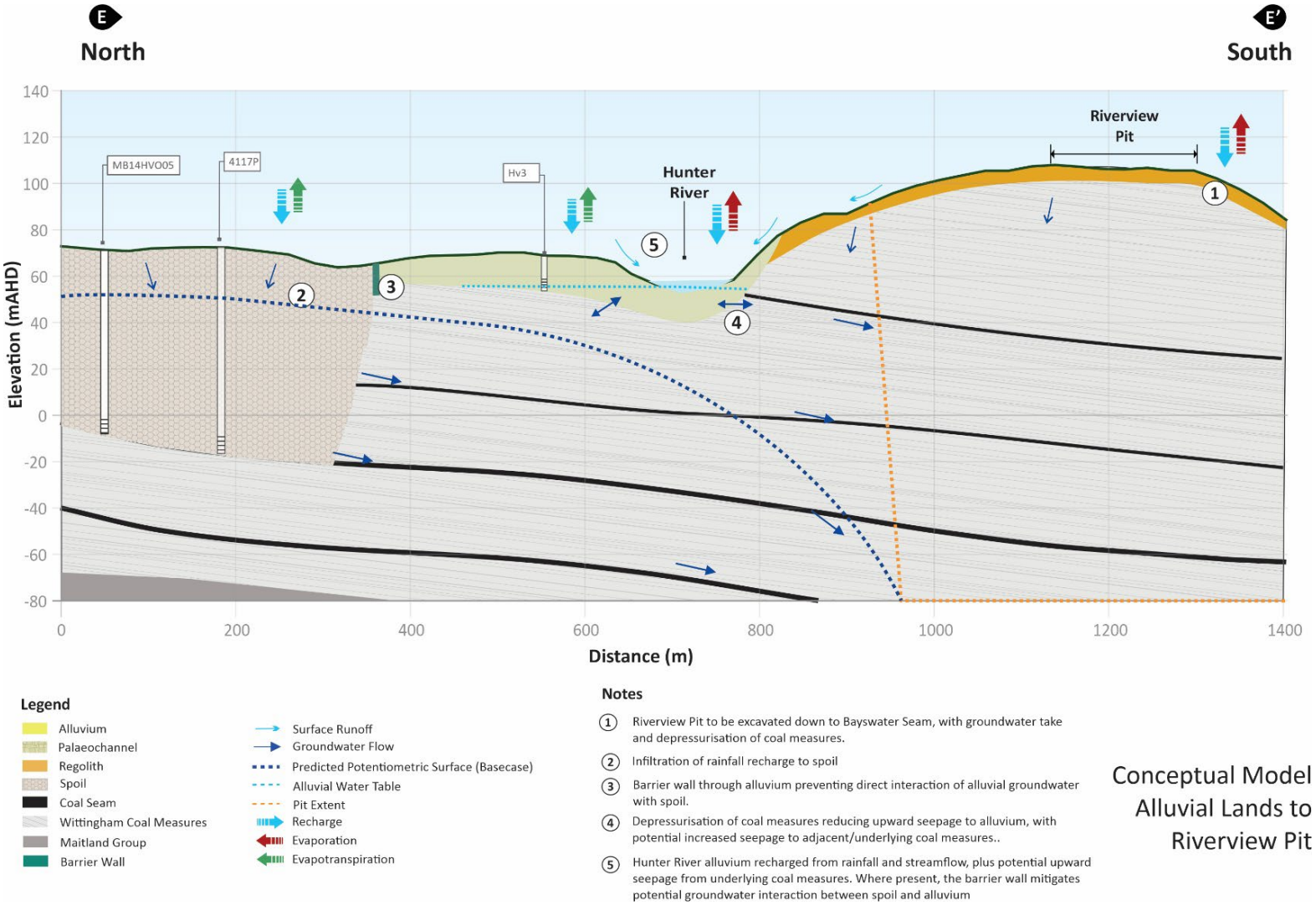

Figure 5-10: Conceptual Ecohydrological Model – Section E

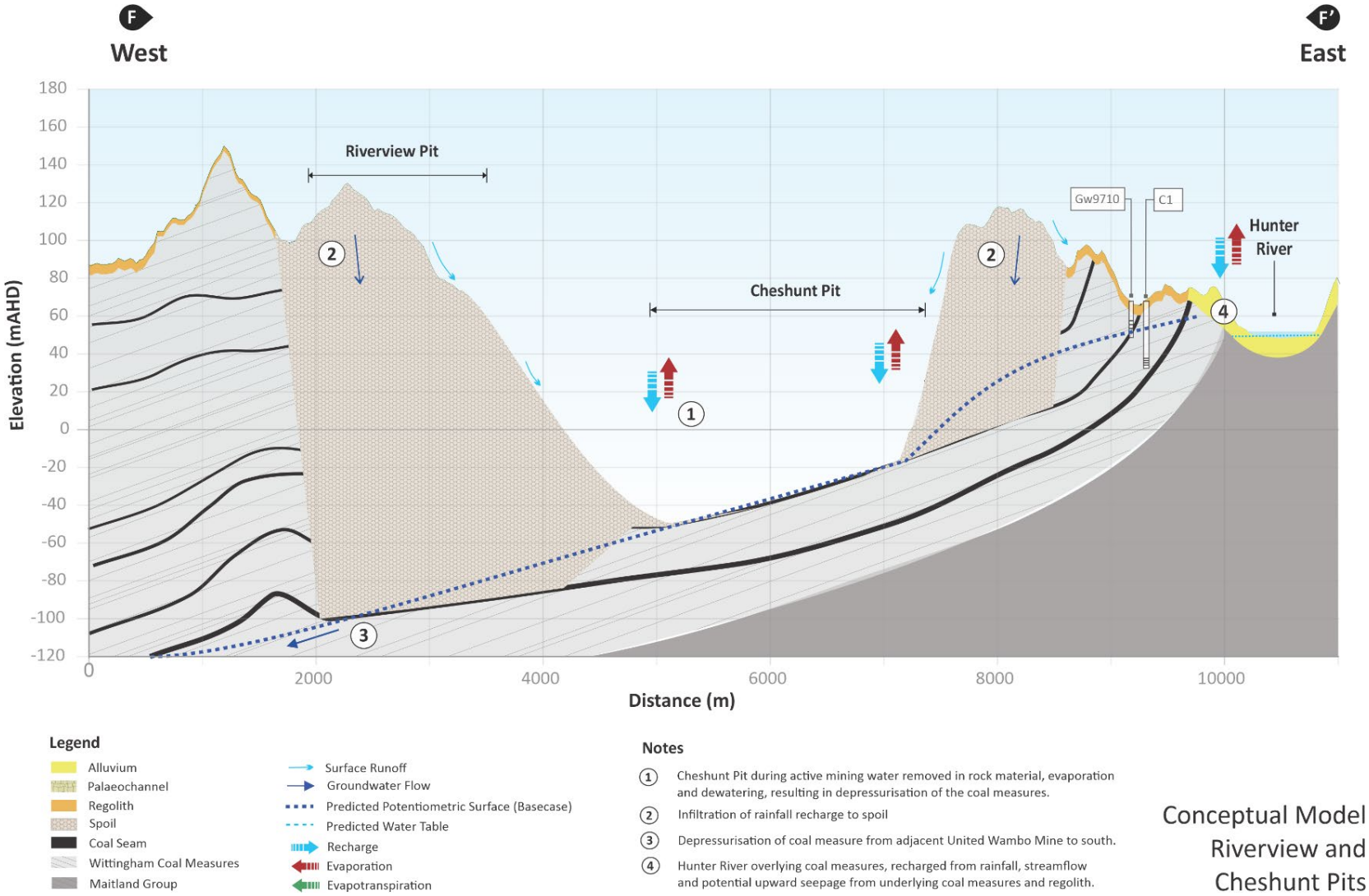

Figure 5-11: Conceptual Ecohydrological Model – Section F

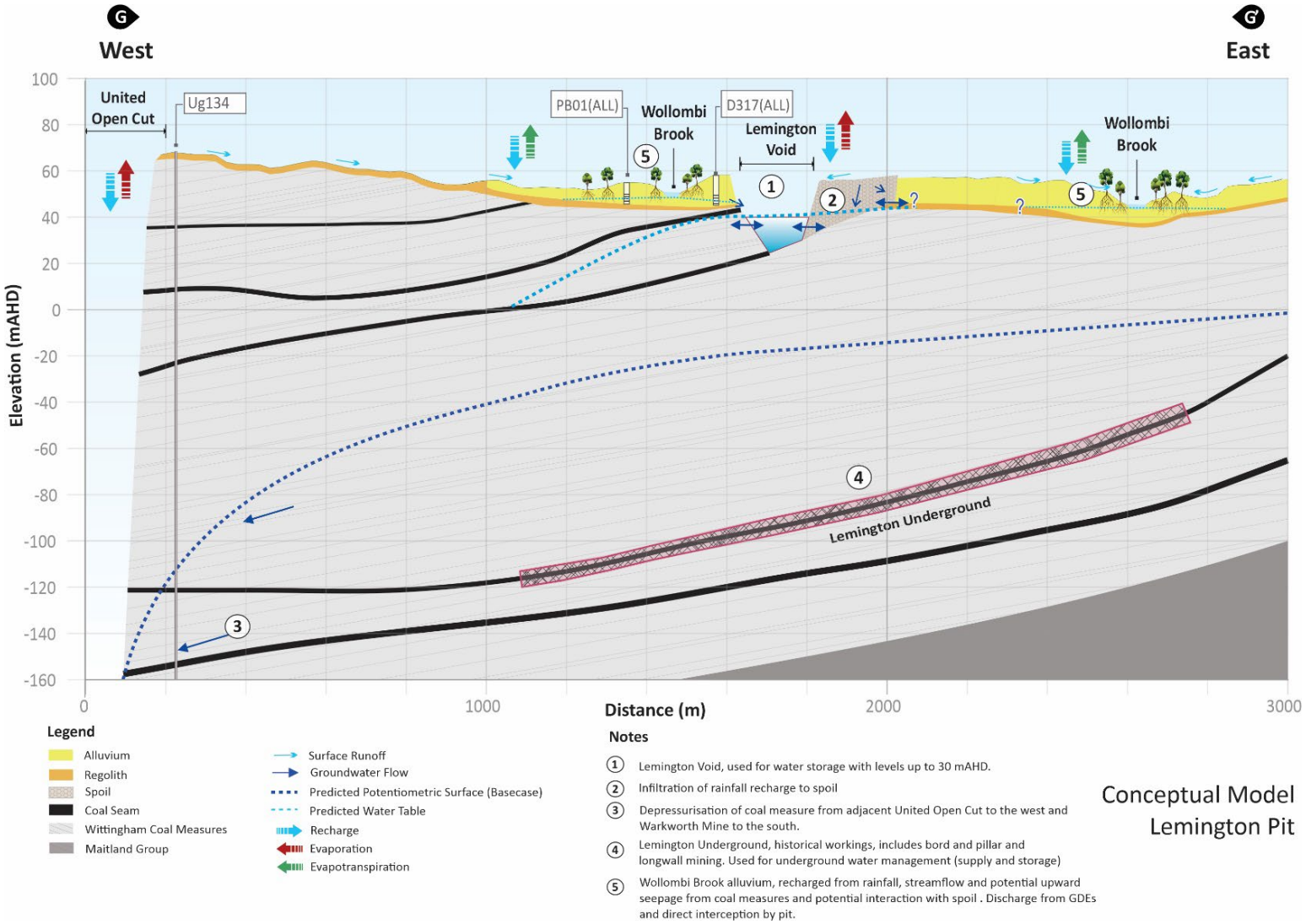

Figure 5-12: Conceptual Ecohydrological Model – Section G

6 | HVO WATER MANAGEMENT SYSTEM

6.1 | OBJECTIVES

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;
- An 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.

6.2 | WATER MANAGEMENT CLASSIFICATION

Water is managed according to type. Water type is determined by catchment source, quality and use. The main types of water managed at HVO include:

- Mine Water;
- Sediment Water; and
- Clean Water

6.2.1 | MINE WATER

Mine Water is coal contact water or used in the production of coal, consisting of:

- Runoff from pits, haul roads, active waste dumps and CHPP or workshop areas;
- Groundwater seepage and seepage from spoils/tailings dams; and
- Water output from coal processing, including water recovered from tailings.

These three streams of saline water become so thoroughly intermixed as to be indistinguishable, and they are generically referred to as ‘mine water’.

Water used in coal production at HVO is predominantly saline due to interaction with saline groundwater within coal seams and contact with saline mine spoils. Saline water cannot be released from site except for opportunistic discharges as regulated by the HRSTS.

6.2.2 | SEDIMENT WATER

Sediment water consists of runoff from:

- Rehabilitated mine spoil (waste dumps) without established ground cover;
- Disturbed areas, such as roads, car parks, ancillary infrastructure areas; and

- Pre-stripped areas ahead of mining.

Sediment water is typically lower salinity but may contain elevated Total Suspended Solids (TSS).

6.2.3 | CLEAN WATER

Clean (fresh) water consists of runoff from:

- Non-mined (undisturbed) areas; and
- Rehabilitated areas with established ground cover.

Clean water is typically low salinity and low TSS.

6.3 | WATER MANAGEMENT INFRASTRUCTURE

The HVO water management system consists of a network of infrastructure (i.e. dams, sumps, tanks, pipelines, drains, contour banks) to control the movement of water around the site. The elements of the water management system are depicted geographically in

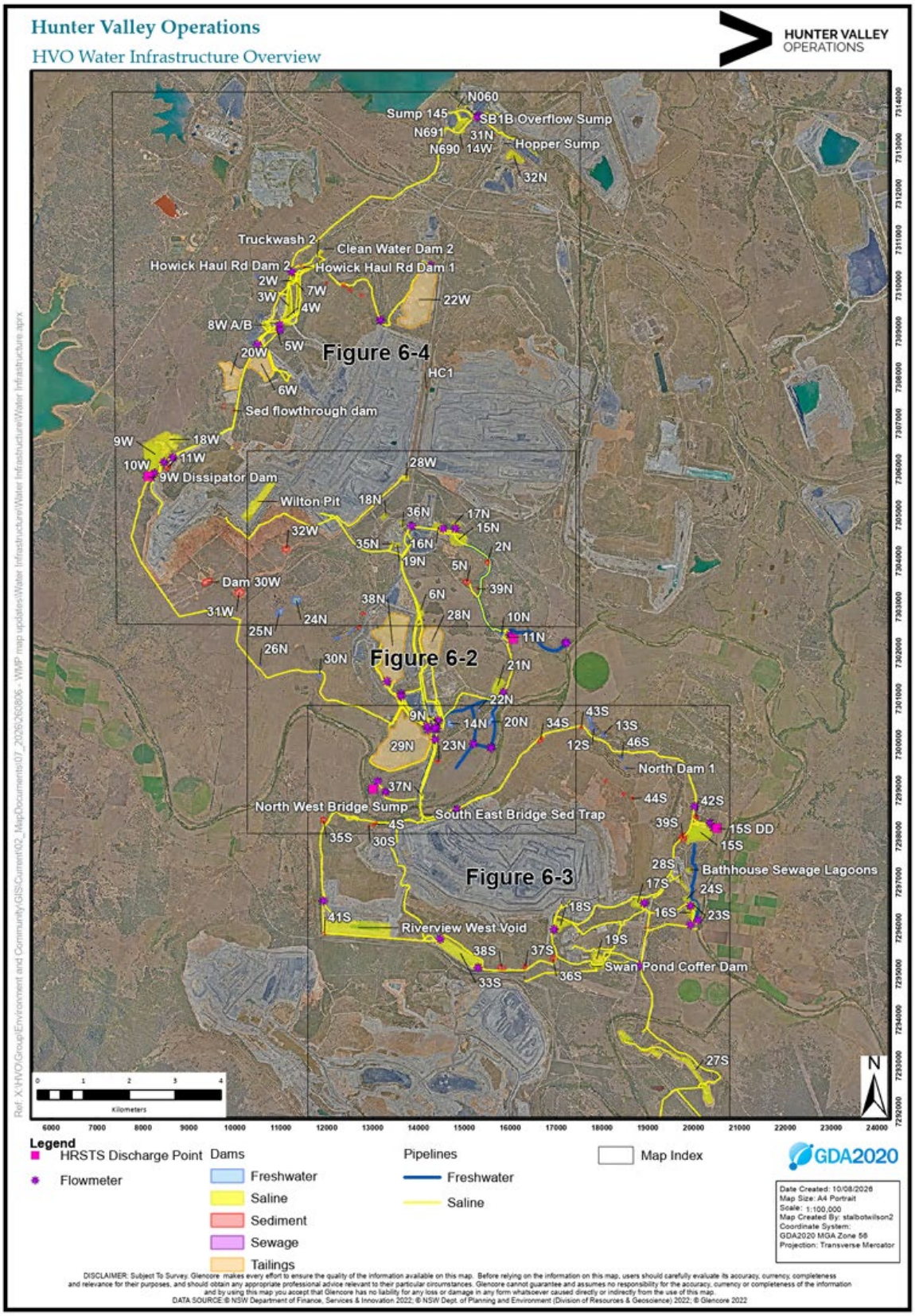

Figure 6-1 to Figure 6-4, Appendix E and schematically in Figure 6-5 to Figure 6-8.

Pit water is pumped to out of pit storage dams or to available in-pit storages using mobile diesel or electric pumps and relocatable high-density polyethylene (HDPE) pipelines. Priority is given to water that

accumulates in active mining areas, followed by areas to be mined in the short term, and last of all, inactive mining areas. The majority of dewatering is directed to:

- Parnells Dam (Dam 9W)
- Dam 21N at Carrington/North Pit, with a maximum operating level of 51 mAHD;
- Carrington Void TSF, Dam 9N and 11N;
- Riverview Void (Dam 33S), Riverview West Void; and
- Lake James (15S) at South Pit.

Water is pumped between HVO South and HVO North via pipelines across the Hunter River haul road bridge. Water is pumped between HVO North and HVO West via pipelines between Dam 9W and Dam 9N. Water from the open cuts can be moved in both directions using these pipelines, although the majority of flows are from HVO South to HVO North.

Surplus mine water from Carrington and South Pits is directed primarily to Dam 9N, which ultimately feed water to the HVO North CHPP.

In-pit dust suppression consumes large quantities of mine water via fast fill water cart tanks located at West, North and South Pits. In accordance with clause 10(3)(i) of the Mining SEPP, HVO utilises water tanks up to 100,000 litres to aid in dust suppression around the operation.

Once CHPP and dust suppression usage is met, excess mine water is retained in the storages set out in Table 6-1

Table 6-1: Large Storages at HVO

STORAGES IN EXCESS OF 200ML	MAXIMUM CAPACITY (ML)
DAM 9W – PARNELLS	*634*
WILTON PIT	*1621*
CARRINGTON VOID TSF	*7070*
DAM 21N – SOUTH EAST SUMP	*320*
DAM 15S – LAKE JAMES	*738*
DAM 16S – OLD EAST CUT	*262*
DAM 27S – SOUTH LEMINGTON VOID	*858*

STORAGES IN EXCESS OF 200ML	MAXIMUM CAPACITY (ML)
DAM 33S RIVERVIEW PIT VOID	*859*
RIVERVIEW WEST VOID	*2,400 (plus spoil storage)*
DAM 15N	*210*

6.4 | TAILINGS WATER

There are two active tailings dams: Carrington Void and Cumnock Void TSF; and three inactive facilities known as Dam 29N (North Void TSF), Dam 28N (Centre TSF) and Dam 6W. Cumnock Void is utilised for tailings storage, via agreement with Glencore (Glencore owned and operated facility, which HVO has access rights for a defined volumetric capacity for tailings storage). Active and inactive tailings facilities are managed in accordance with environmental procedures for coarse rejects and tailings disposal, and Operational and Maintenance manuals in accordance with requirements for management of prescribed dams.

6.5 | CLEAN CATCHMENT

Clean catchment consists of non-mined and ancillary catchment. Catchment and diversion structures for clean water are installed with consideration to “Harvestable Rights” quantities (*Water Management Act 2000* (NSW) [WMA Act]) and storm induced flood flows into operating pits.

Clean water diversion structures are employed to divert clean water away from the active pits. Diversion structures are currently employed for West Pit, North Pit and South Pit. Clean catchment which has been disturbed by ancillary mining activities (e.g. road construction or car-parks) has the potential to produce degraded water. Prior to release from site this water is managed to minimise sediment load. Sediment control structures are implemented generally in accordance with “Managing Urban Stormwater Volume: 2E mines and Quarries”.

6.6 | RIVER WATER

Hunter Valley Operations holds both High and General Security Entitlement (HSE and GSE) Water Access Licences (WALs) to withdraw water from the Hunter River. Should HVO require more water, entitlements can be traded to this licence in accordance with the WMA to increase output through the scheme.

Water access licences (WALs) are detailed in Table 6-2. The combined HSE entitlement is 4,665 Units (ML/annum or a share of the available resources). The currently licensed water extraction volume of 4,665 ML/A is adequate for both HVO North and HVO South requirements provided internal water use continues to be actively managed, and provided high security water licence allocations are maintained at the current levels.

River water is accessed from various pump stations located in Zone 1b and Zone 2a of the Hunter Regulated River source. Prior to water take occurring, HVO will ensure relevant nomination of work dealing applications for Water Access Licences proposed to account for water take by the project have been completed with Water NSW.

6.7 | GROUNDWATER INTERCEPTION

Under the Water Act 1912, the Water Management Act 2000 and the Aquifer Interference Policy 2015, Groundwater intercepted either directly or indirectly is required to be licensed under the relevant water sharing plan. A summary of the WAL's for each water sharing plan held by HVO to account for groundwater interception is also shown in Table 6-2. An estimate of the volume of groundwater intercepted by HVO mine operation is undertaken annually and reported in the Annual Environment Report. This includes direct take from Permian sources and indirect take from streams and alluvium. Further details on groundwater management can be found in Section 8.

Table 6-2: HVO WALs

WAL	WORKS APPROVAL	WATER SHARING PLAN	WATER SOURCE MANAGEMENT ZONE	SHARE COMPONENT (UNITS)	DETAIL
867	*20CA201015*	*Hunter Regulated River*	*Hunter River Zone 2a*	*486*	*Comleroi, farming & irrigation*
962	*20WA201238*	*Hunter Regulated River*	*Hunter River Zone 1b*	*3,165*	*HVCPP River Pump*
969	*20CA201255*	*Hunter Regulated River*	*Hunter River Zone 1b*	*39*	*HVO South – Former Riverview pump*
970	*20WA201257*	*Hunter Regulated River*	*Hunter River Zone 2a*	*500*	*LCPP River Allocation*
1006	*20WA201338*	*Hunter Regulated River*	*Hunter River Zone 2a*	*500*	*LCPP River Allocation*

WAL	WORKS APPROVAL	WATER SHARING PLAN	WATER SOURCE MANAGEMENT ZONE	SHARE COMPONENT (UNITS)	DETAIL
1070	*20WA201501*	*Hunter Regulated River*	*Hunter River Zone 2a*	*500*	*LCPP River Allocation*
13387	*20WA201685*	*Hunter Regulated River*	*Hunter River Zone 1b*	*20*	*Macquarie Generation Hunter River Pump Station*
13391	*20CA201896*	*Hunter Regulated River*	*Zone 1b (Hunter River From Goulburn River Junction To Glennies Creek Junction*	*420*	*HVO North – Alluvial Rehabilitation Irrigation.*
18127	*20MW065020*	*Hunter Unregulated and Alluvial Water Sources*	*Hunter Regulated River Alluvial Water Source – Upstream Glennies Creek management zone*	*383*	*Carrington BB1*

WAL	WORKS APPROVAL	WATER SHARING PLAN	WATER SOURCE MANAGEMENT ZONE	SHARE COMPONENT (UNITS)	DETAIL
18158	*20MW065020*	*Hunter Unregulated and Alluvial Water Sources*	*Hunter Regulated River Alluvial Water Source – Upstream Glennies Creek management zone*	*65*	*Ollenberry*
18307	*20WA210991*	*Hunter Unregulated and Alluvial Water Sources*	*Jerrys Management Zone*	*500*	*HVO West – Parnells Creek Dam (Diversion Works Bywash)*
18327	*20WA210985*	*Hunter Unregulated and Alluvial Water Sources*	*Jerrys Management Zone*	*150*	*HV Loading Point Pump Bayswater Creek (diversion works)*
23889	*20MW065020*	*Hunter Unregulated and Alluvial Water Sources*	*Lower Wollombi Brook*	*144*	*Greenleek*
36190	*20CA212713*	*Hunter Unregulated and Alluvial Water Sources*	*Jerrys Management Zone*	*120*	*HVO North, old farm bore*

WAL	WORKS APPROVAL	WATER SHARING PLAN	WATER SOURCE MANAGEMEN T ZONE	SHARE COMPONENT (UNITS)	DETAIL
41527	*20MW065020*	*North Coast Fractured and Porous Rock*	*Permian Coal Seams*	*700*	*HVO North Carrington Pit*
41533	*20MW065020*	*North Coast Fractured and Porous Rock*	*Permian Coal Seams*	*20*	*HVO North Pit Excavations*
40466	*20MW065020*	*North Coast Fractured and Porous Rock*	*Permian Coal Seams*	*460*	*HVO Pit Excavation – Alluvial Lands Bores*
40463	*20MW065020*	*North Coast Fractured and Porous Rock*	*Permian Coal Seams*	*180*	*HVO Pit Excavation – Alluvial Lands Bores*
40462	*20MW065020*	*North Coast Fractured and Porous Rock*	*Permian Coal Seams*	*2400*	*HVO Pit Excavation – Alluvial Lands Bores*

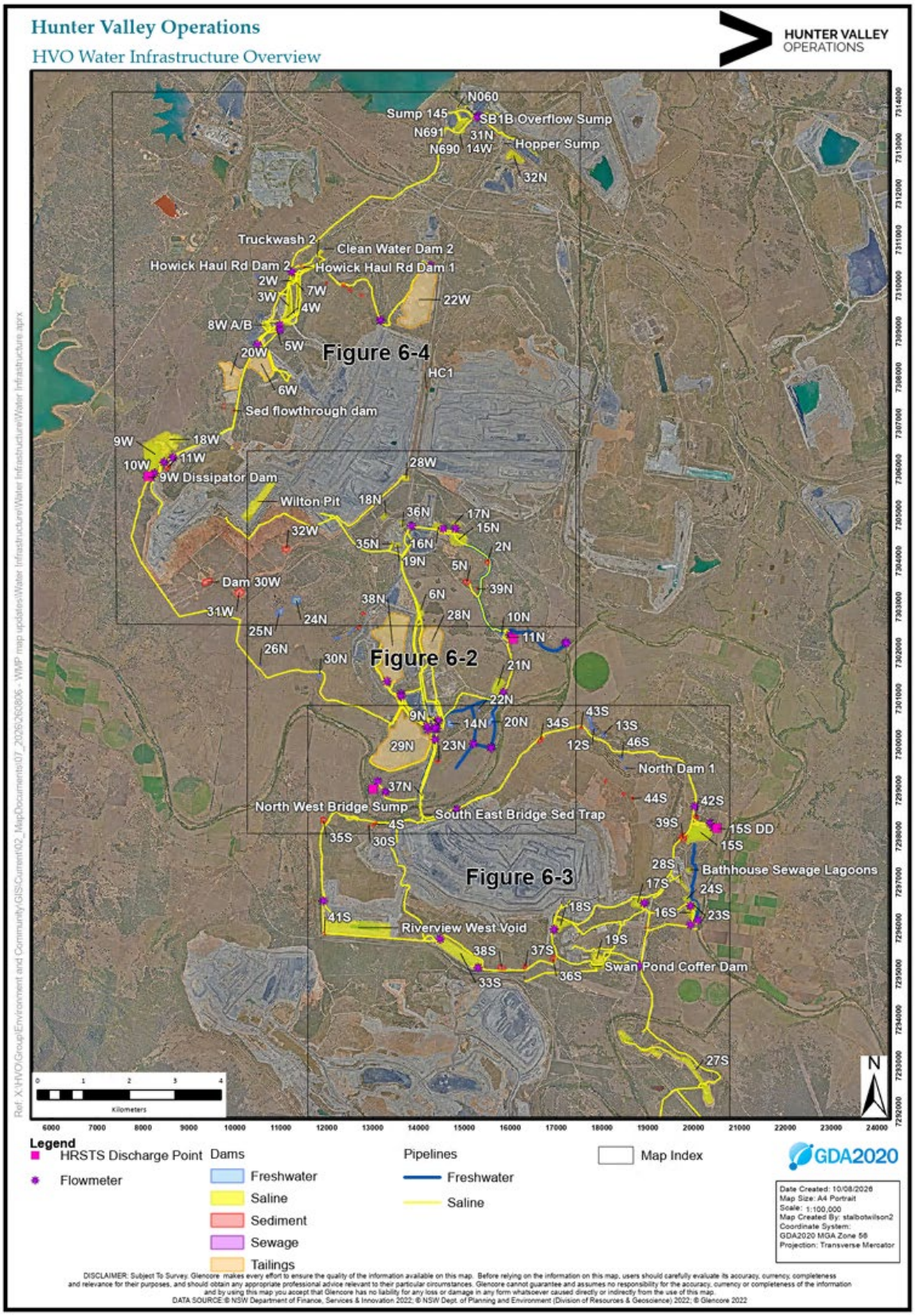

Figure 6-1: HVO Water Infrastructure Overview

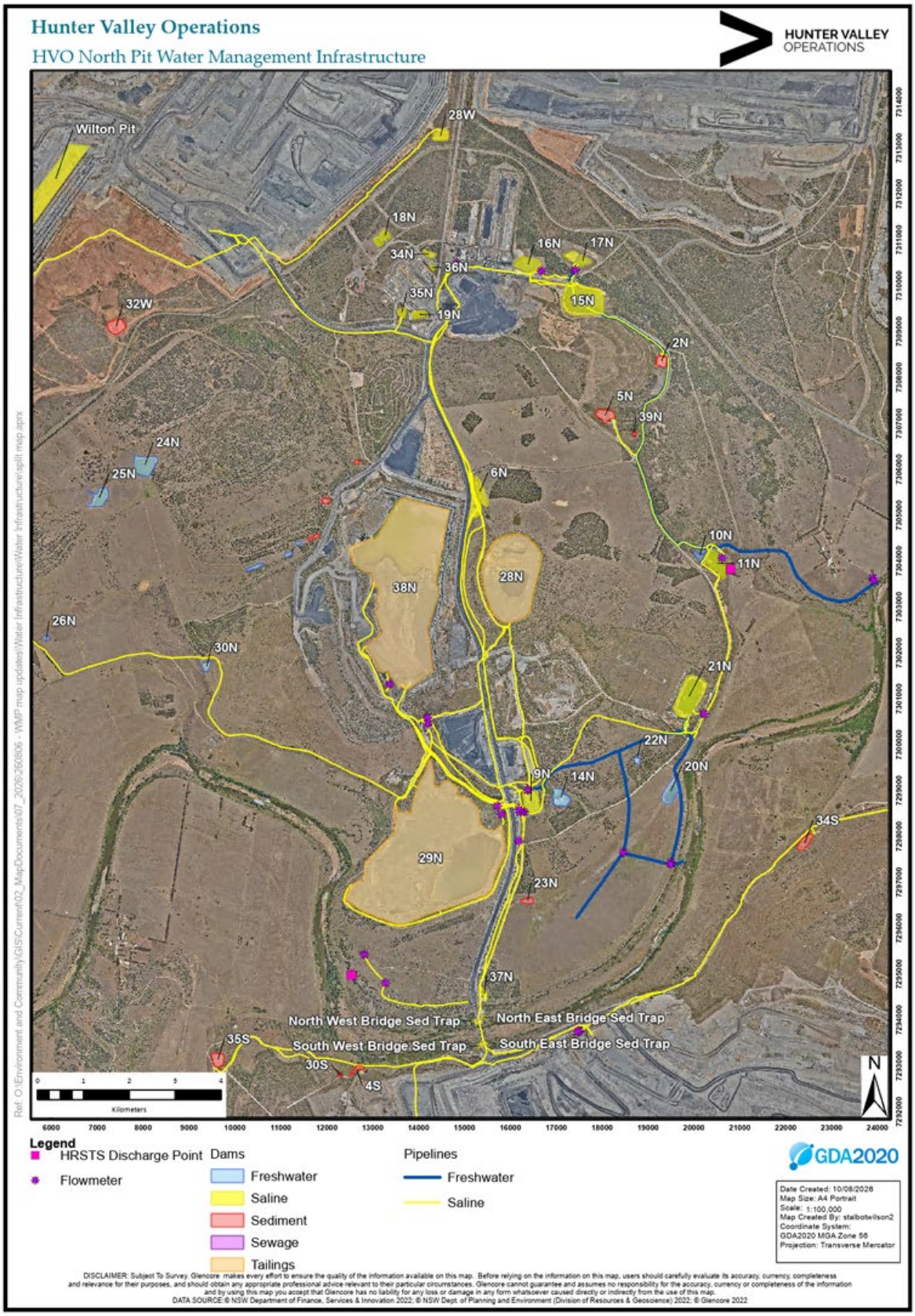

Figure 6-2: HVO North Pit Water Management Infrastructure

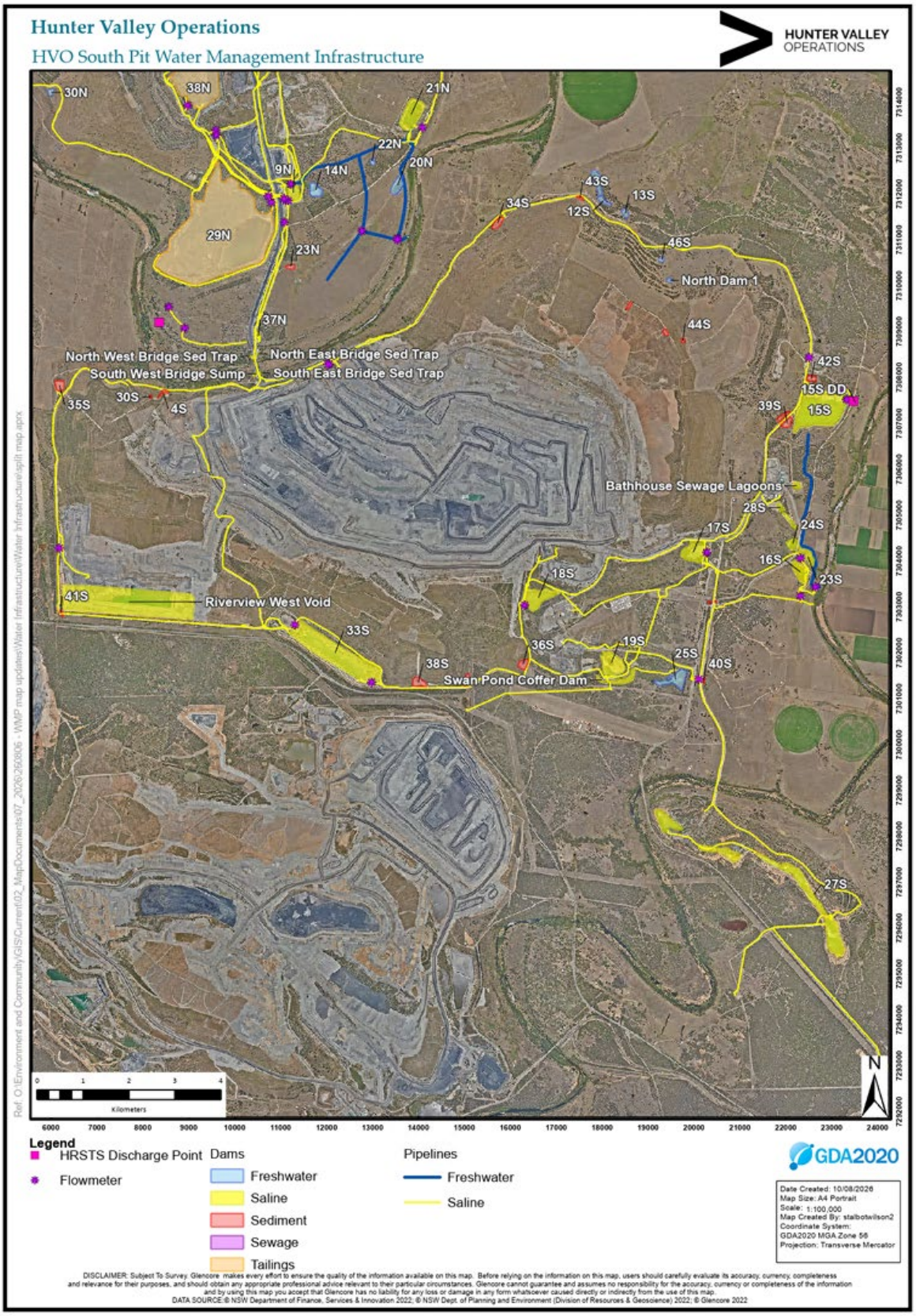

Figure 6-3: HVO South Pit Water Management Infrastructure

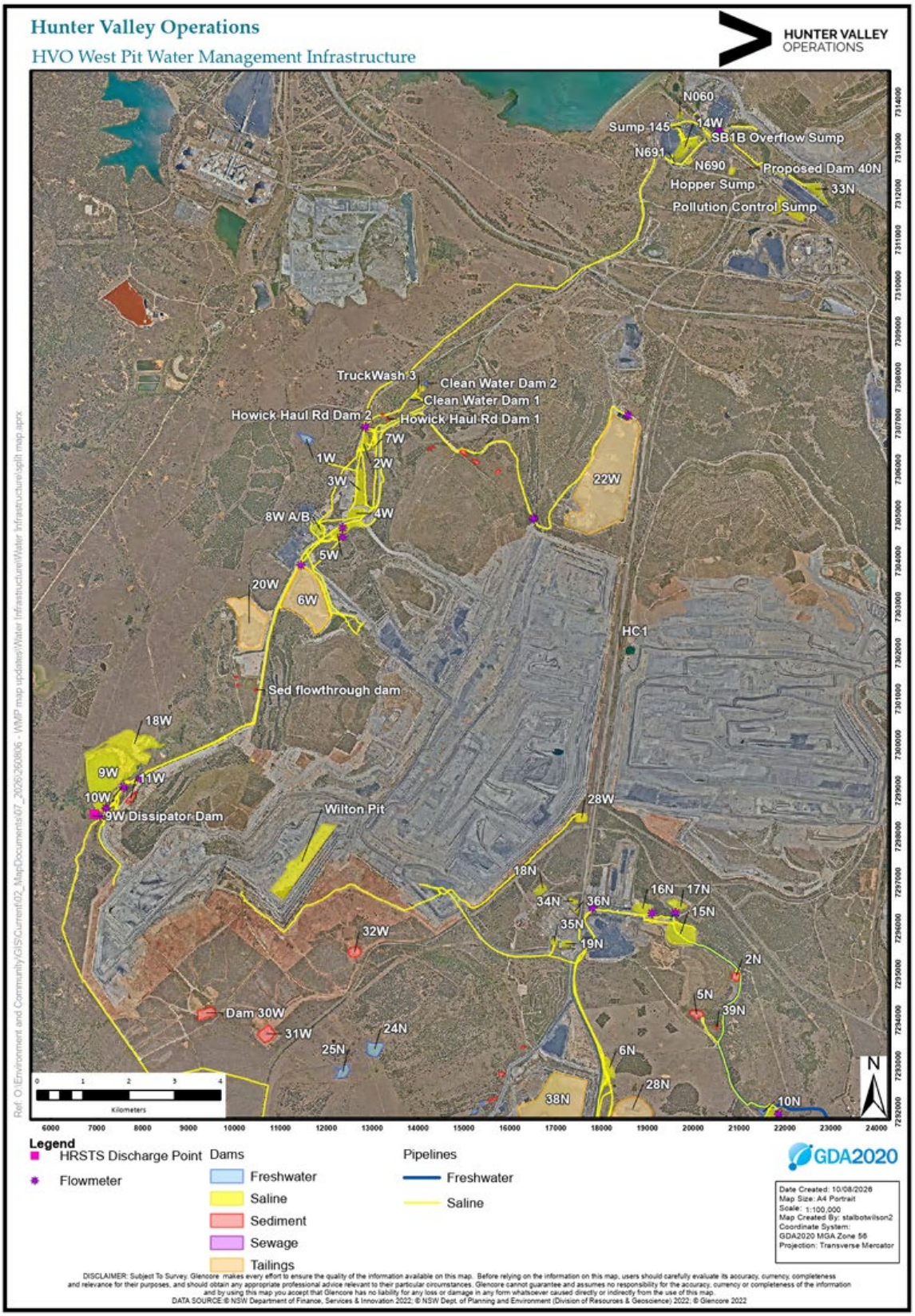

Figure 6-4: HVO West Pit Water Management Infrastructure

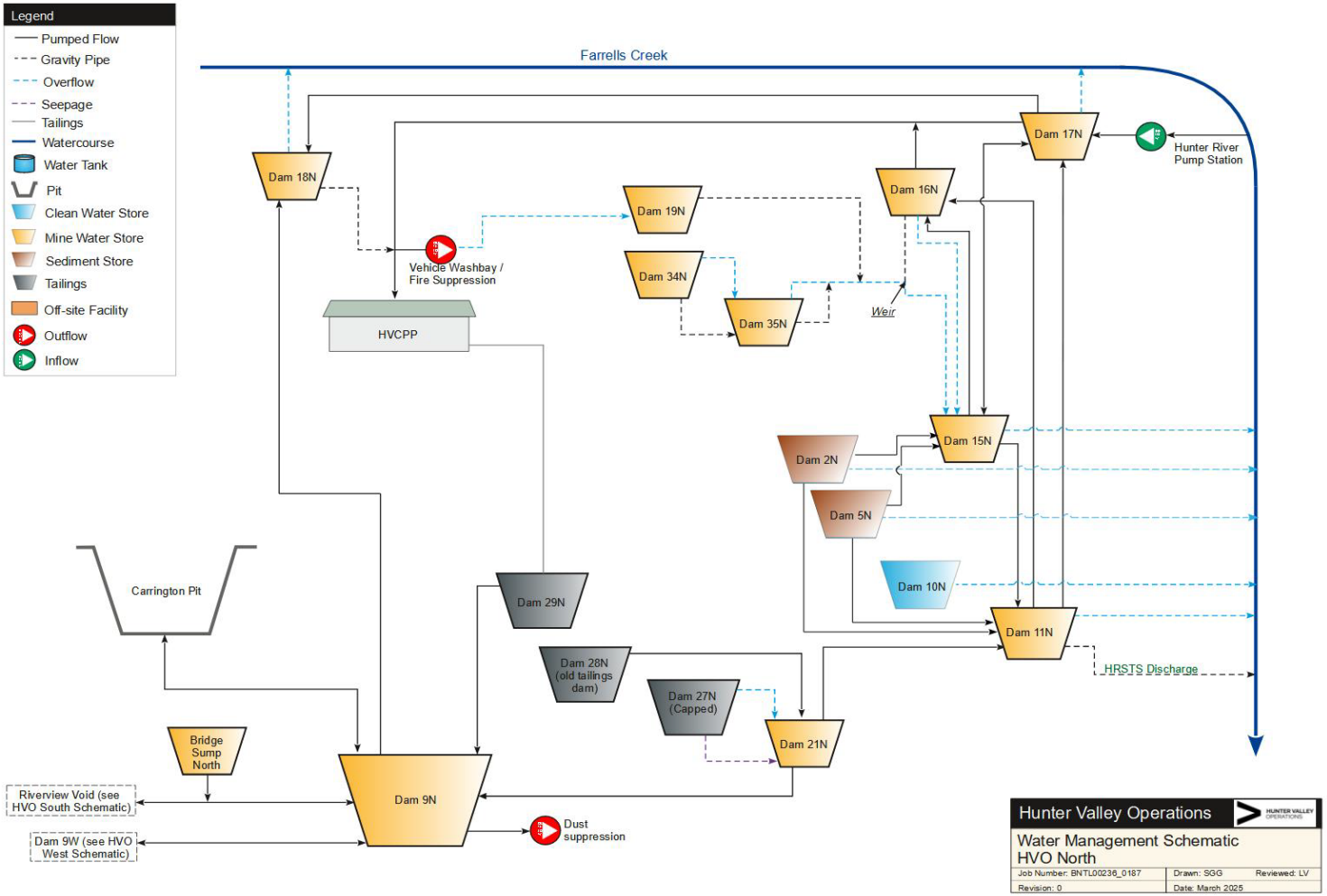

Figure 6-5: HVO North Pit Water Management Schematic

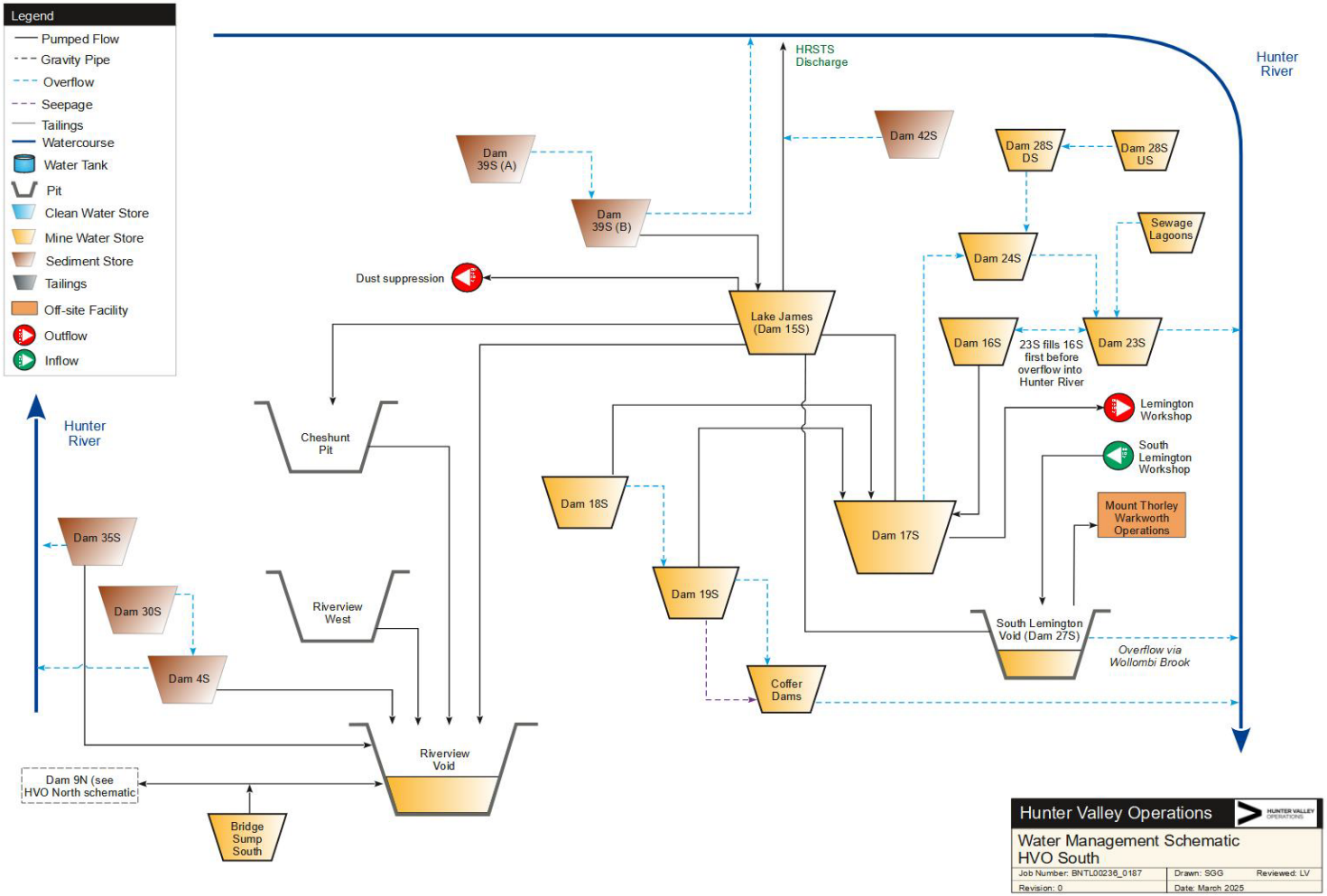

Figure 6-6: HVO South Pit Water Management Schematic

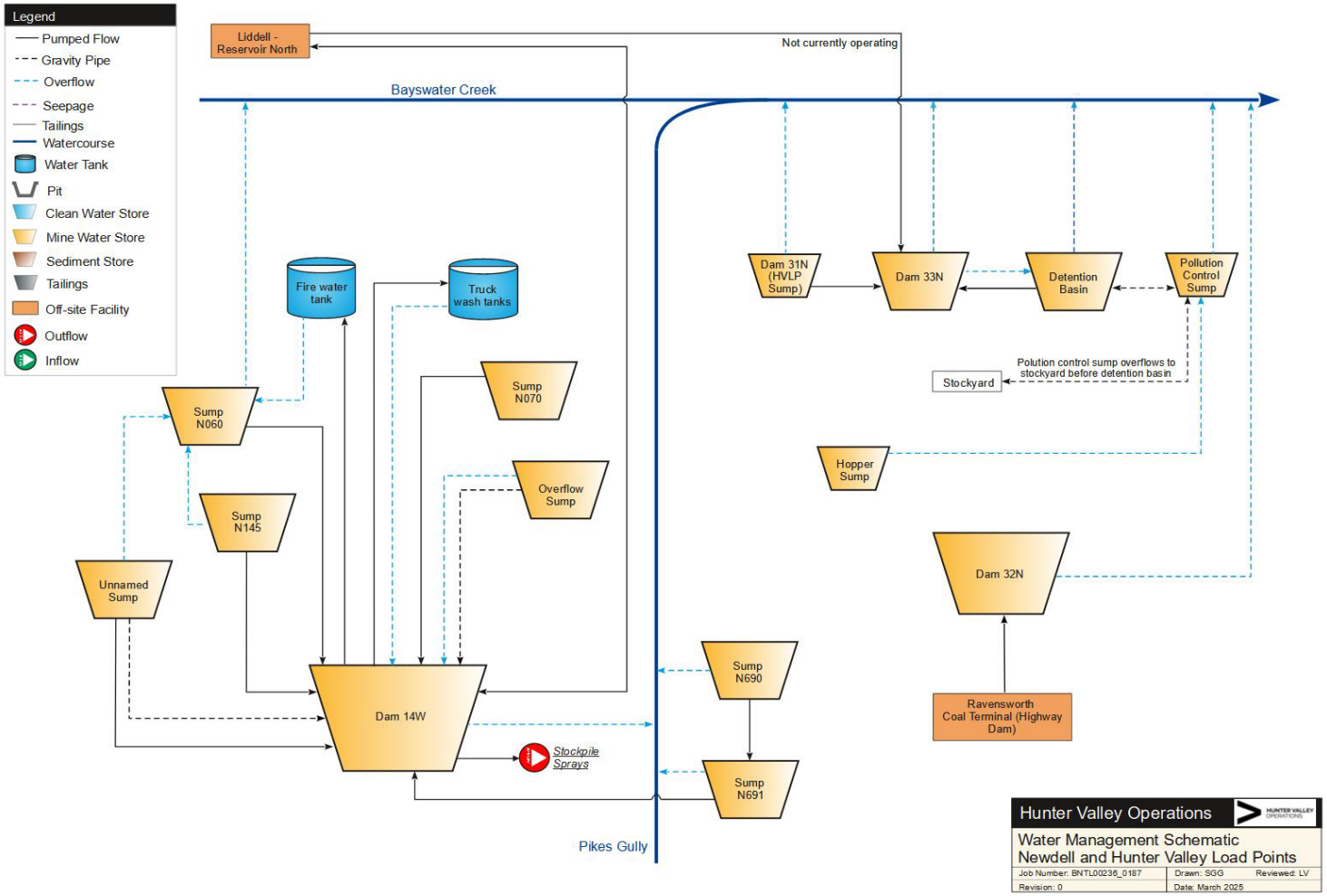

Figure 6-7: Load Point Water Management Schematic

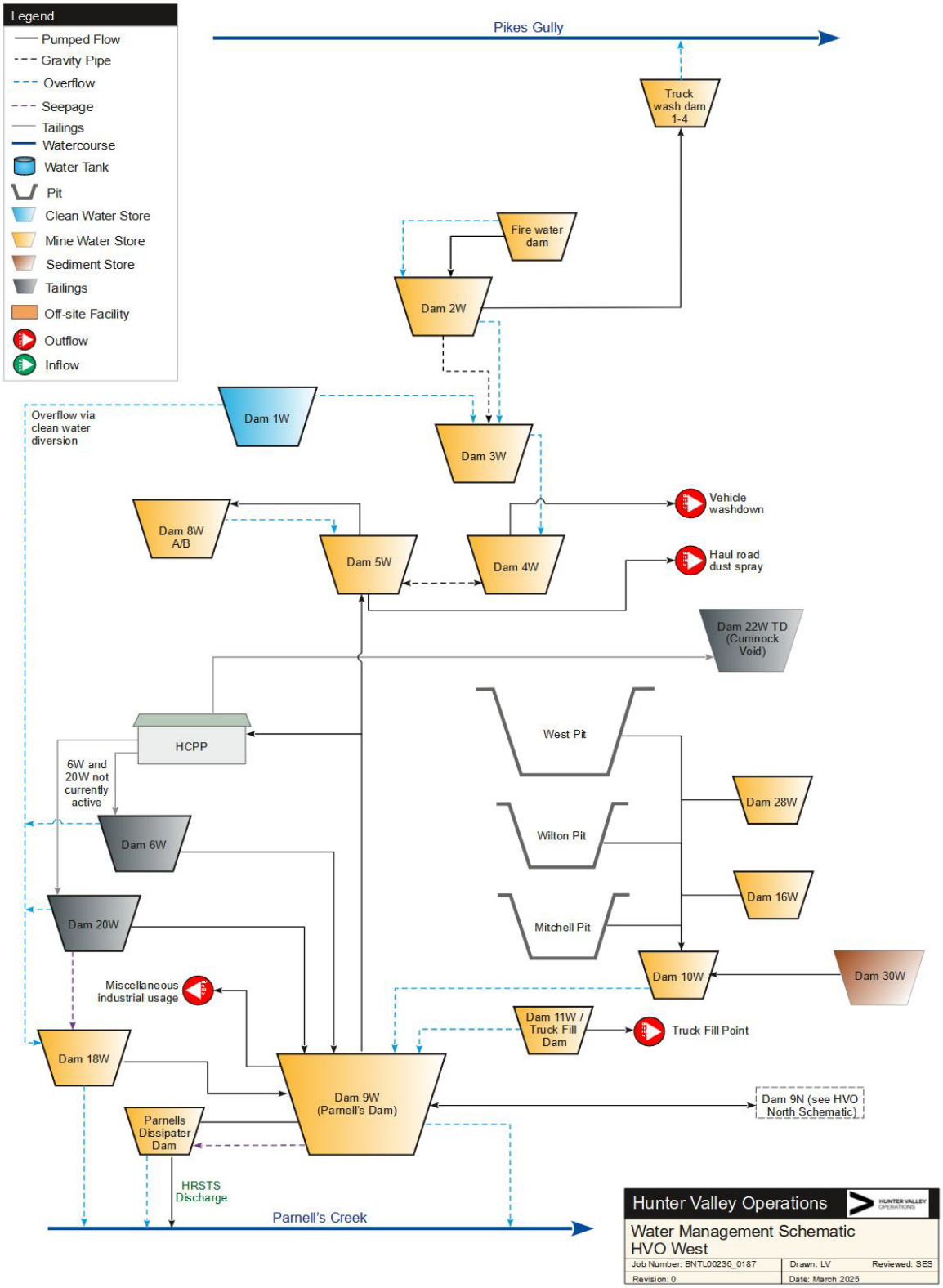

Figure 6-8: HVO West Pit Water Management Schematic

6.8 | LICENCED DISCHARGES

Excess mine water can be released via licensed discharge points into the Hunter River. Licensed discharge points are located on Parnells Dam (9W), Dam 11N and Lake James (Dam 15S). Discharges are only allowed during high and flood flow periods in the Hunter River as determined by Water NSW and Water Group. Discharges are regulated by conditions in the site EPL 640 and by the Hunter River Salinity Trading Scheme Regulation 2000. A summary of the current discharge limits under the HRSTS for EPL 640 are outlined in Section 7.4 |.

HVO is also licensed in its EPL 640 to discharge water from its Alluvial Lands. This discharge point has specific discharge parameters and is not regulated under the Hunter River Salinity Trading Scheme. Discharge parameters are in accordance with EPL 640 and only allow for discharge of fresh quality water.

6.9 | WATER STORAGES

Providing sufficient water storage capacity provides a buffer against drought and flood interruptions to the business and prevents unlicensed discharge of polluted water offsite. HVO utilises disused mining voids and large out of pit dams to provide storage. The capacity and status of large storages located at HVO are listed in Table 6-1.

In addition to the main water stores a series of smaller dams provide buffer storage for production and ancillary demands.

A water licence was secured to access water from the decommissioned Lemington Underground Mine workings. The production bore can supply water to both HVO and the neighbouring Mount Thorley Warkworth (MTW) mining operation.

6.10 | LEMINGTON UNDERGROUND

On 27 May 2022 HVO was granted approval by DPHI for the construction of bores and associated infrastructure allowing transfer of water from HVO and MTW into and out of the former Lemington Underground (LUG) Mine void. In accordance with Condition 27 (c) of the consolidated consent (refer to Table 1-1) prior to the use of Lemington Underground Void as a storage, HVO will provide a methodology to Water Group to quantify the maximum annual groundwater inflow during the period water is stored and extracted and the ongoing maximum annual groundwater inflow after this is completed. Additional monitoring points will be installed prior to commencement of water storage in the void at locations described in the Mod 7 report.

During water transfer into the Lemington underground mine workings, HVO will retain a maximum fill level of 30m AHD in the Lemington underground mine workings or retain a buffer zone of 10m between the base of the Hunter River alluvium and the Lemington underground mine workings fill level, whichever gives the greater vertical separation.

6.11 | DRAINAGE LINES ON REHABILITATION SITES

Drainage lines are designed in accordance with the Rehabilitation Management Plan.

7 | SITE WATER BALANCE

7.1 | OVERVIEW

HVO has developed a representative water balance model utilising the GoldSIM Operational Simulation Program. The GoldSIM operational simulation model was initially set up for HVO in 2019 and has since been regularly updated and calibrated when new data has been made available (most recently in 2022).

HVO uses the water balance to record and assess water flux, but also to forecast and plan water management needs. These annual site water balances are then compared to previous results. The model has been configured to simulate the operations of all major components of the water management system including:

- Climatic variability – rainfall and evaporation;
- Catchment runoff and collection;
- Pit dewatering;
- Pump and gravity transfers;
- Water storage filling, spilling and leaking;
- Industrial water extraction, usage and return; and
- Discharge to the Hunter River under the HRSTS.

Table 7-1 shows a summary water balance for 2025 at HVO.

Table 7-1: 2025 HVO Water Balance

WATER STREAM	VOLUME (ML)
INPUTS	
FRESH WATER (POTABLE)	45 (0.4%)
FRESH WATER (HUNTER RIVER EXTRACTION)	32 (0.3%)
GROUNDWATER	1,879 (18.6%)
RAINFALL RUNOFF	6,804 (67.4%)
RECYCLED TO CHPP FROM TAILS & STORAGE (NOT INCLUDED IN TOTAL)	4,222
IMPORTED (LIDDELL/RAVENSWORTH (VIA CUMNOCK))	22 (0.2%)

WATER STREAM	VOLUME (ML)
WATER FROM ROM COAL	1,307 (13%)
TOTAL INPUTS	**10,090**
OUTPUTS	
DUST SUPPRESSION	1,666 (17.7%)
EVAPORATION - MINE WATER & TAILINGS DAMS	1,833 (19.4%)
ENTRAINED IN PROCESS WASTE	2,273 (24.1%)
DISCHARGED (HRSTS)	1,165 (12.3%)
VEHICLE WASH DOWN	310 (3.3%)
SENT TO THIRD PARTY	3 (0.0%)
MISCELLANEOUS INDUSTRIAL USE	350 (3.7%)
WATER IN COARSE REJECT	671 (7.1%)
WATER IN PRODUCT COAL	1,168 (12.4%)
TOTAL OUTPUTS	**9,439**
CHANGE IN PIT STORAGE	651 (increase)

7.2 | CLIMATE INFLUENCE

Long term climate trends in the HVO site (HVO Corp) rainfall data from 2012 to 2023 are displayed using a cumulative rainfall departure (CRD) rainfall plot in Figure 7-1. The CRD graphically shows trends in recorded rainfall compared to long-term averages and provides a historical record of relatively wet and dry periods. The area has generally experienced below average rainfall from 2016 until the end of 2019, with above average rainfall recorded from January 2020 onwards.

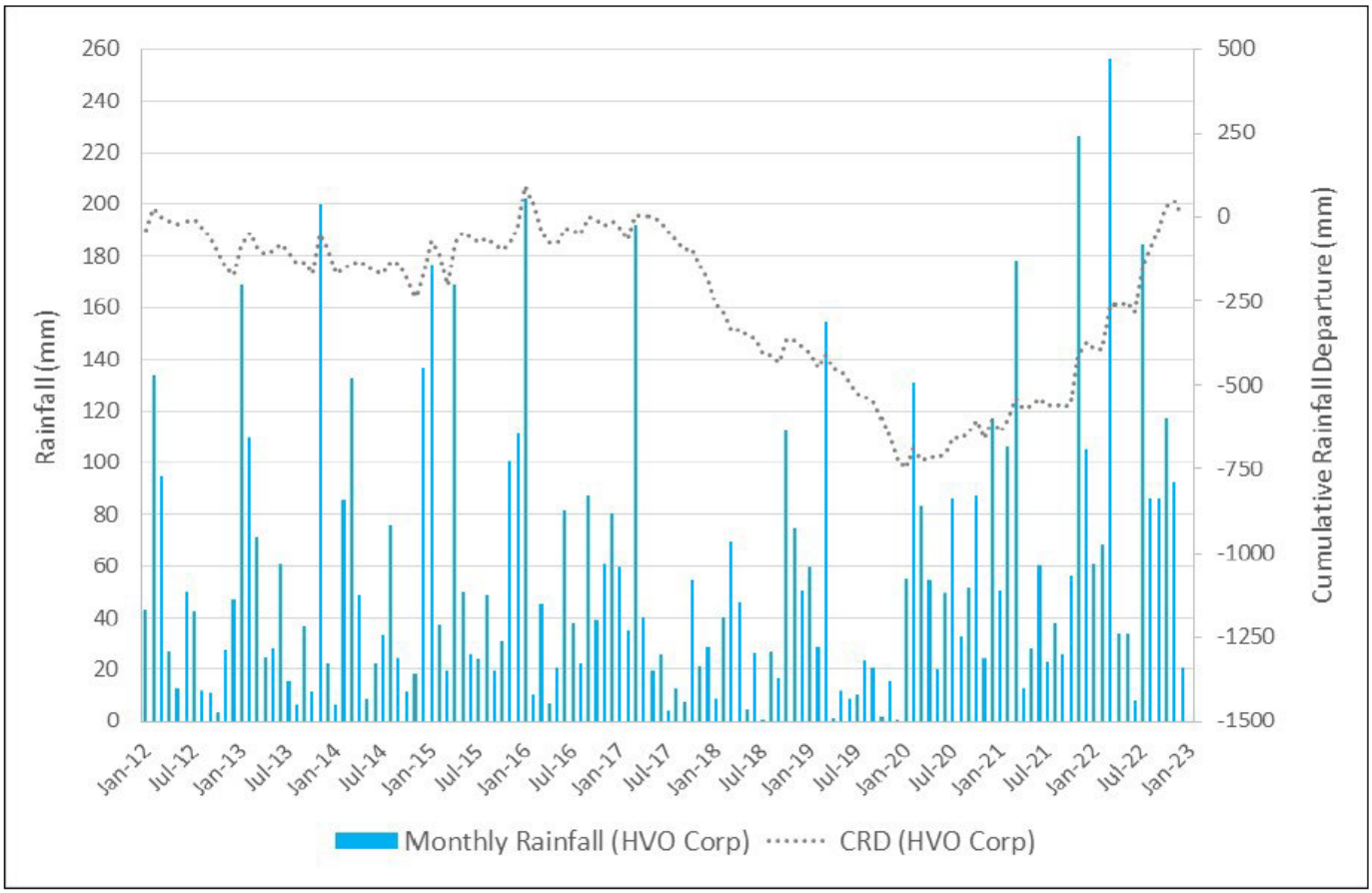

Figure 7-1: Cumulative Rainfall Departure and Monthly Site Rainfall

7.3 | SOURCES & SECURITY OF WATER SUPPLY

Water is supplied to HVO through a number of sources, including:

- Rainfall runoff;
- Pit groundwater inflows; and
- Moisture entrained in ROM coal.

Additional sources of poor quality water are also available from the Lemington Underground Bore and inter-site transfer. Abstraction of water from the Hunter River water is also available should alternative sources be unavailable (see Section 6.6 |).

HVO is typically a net generator of water; that is, the water captured via rainfall runoff and pit groundwater inflows is generally greater than the water demand. Coupled with significant mine void and out of pit storage capacity external sources of water are not typically required unless prolonged drought conditions occur. Significant High Security Water holdings for the Hunter River are available as contingency should poor quality water sources be exhausted. Regular updates to the HVO water balance model will ensure currency with the current operational configuration of the mine water management system.

7.4 | WATER SHARING WITH NEIGHBOURING MINES

HVO seeks to use non-potable sources of water preferentially prior to accessing water from the Hunter River. Typically, excess water is stored on site, however piping infrastructure is in place to transfer water to MTW via Dam 27S (Lemington void). A water transfer agreement is in place with the Glencore Liddell mine. When required, water is transferred from the Liddell mine to HVO's train load points for use.

HVO (where possible) would seek to transfer surplus mine water from neighbouring mines to supplement its water demands. Infrastructure is currently in place that allows the transfer of water to and from the Peabody Wambo mine, the Mount Thorley Warkworth mine and a connection to the Ravensworth mine water supply is also available when required.

7.5 | DISCHARGES

Saline water cannot be released from site except for opportunistic discharges as regulated by the Hunter River Salinity Trading Scheme (HRSTS). Controlled discharges are undertaken in accordance with the HRSTS as specified in the EPL. Any discharges of water that are required are managed under the guidelines of the HRSTS.

8 | SURFACE WATER MANAGEMENT PLAN

8.1 | OVERVIEW

HVO has built up a large knowledge base from more than 30 years of surface water monitoring providing detailed baseline data of surface water flows and quality in watercourses that could be affected by the project.

The HVO surface water management plan is detailed in the following sections. The plan includes:

- Baseline water quality and flow assessment;
- Detailed plans of mine water infrastructure;
- Erosion and sediment controls;
- Performance criteria for the water management system, surface water quality and stream and riparian vegetation health; and
- Water quality and flow trigger response plans.

8.2 | WATER QUALITY AND WATER FLOW

Water quality data is collected for water courses, ephemeral streams and water bodies that could be affected by the Project. These sites are detailed in the Surface Water Monitoring Program (8.3 |) The main water courses potentially affected by mining at HVO are the Hunter River and Wollombi Brook.

The Hunter River is sampled from seven monitoring locations adjacent to HVO to monitor the impact of mining on the Hunter River. The Hunter River monitoring sites extend from Moses Crossing upstream (Site W109) to just downstream of the Wollombi Brook confluence (H3). The Wollombi Brook is sampled from three monitoring locations upstream and downstream of operations.

Water quality is also monitored in several ephemeral watercourses: Bayswater Creek, Parnells Creek, Farrells Creek, Davis Creek, Emu Creek, Comleroi Creek, Pikes Creek and Carrington Billabong

Baseline data for HVO and receiving waters are detailed in the Carrington West Wing EA for HVO North (2007-2008). Recent electrical conductivity (EC), pH and total suspended solids (TSS) data for 2013 to 2017 are given in Table 8-1, Table 8-2 and Table 8-3.

Water flow data up and downstream of the operation is accessed from Water NSW who maintain and operate stream gauging stations. Impacts to streamflow by pumping or discharge are managed in accordance with the Water Management Act or the POEO (HRSTS) Regulation respectively. Streamflow losses to the mine are assessed as part of the annual groundwater impact assessment.

Table 8-1: Historical Surface Water pH Results 2014-2017

LOCATION	2014		2015		2016		2017	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
H1	*8.0*	*8.4*	*7.9*	*8.4*	*8.1*	*8.2*	*8.1*	*8.3*
H2	*8.1*	*8.4*	*8.0*	*8.4*	*8.1*	*8.3*	*8.1*	*8.6*
H3	*7.8*	*8.3*	*8.2*	*8.3*	*8.0*	*8.3*	*8.1*	*8.5*
W1	*7.8*	*8.4*	*8.1*	*8.4*	*8.1*	*8.3*	*8.0*	*8.5*
W109	*7.8*	*8.4*	*8.0*	*8.4*	*8.2*	*8.3*	*8.1*	*8.5*
W3 (HUNTER RIVER)	*7.9*	*8.5*	*8.3*	*8.4*	*8.1*	*8.3*	*8.1*	*8.6*
W4	*7.9*	*8.4*	*8.2*	*8.4*	*8.2*	*8.3*	*8.0*	*8.6*
W2	*7.5*	*8.3*	*7.8*	*8.1*	*7.3*	*7.9*	*7.5*	*8.2*
WL1	*7.6*	*7.9*	*7.9*	*8.2*	*7.7*	*7.9*	*7.5*	*8.1*
WARKWORTH BRIDGE	*7.5*	*7.7*	*7.7*	*8.2*	*7.4*	*7.8*	*7.3*	*8.1*
BAYSWATER CREEK UPSTREAM	*7.9*	*8.4*	*7.2*	*8.0*	*7.9*	*8.1*	*7.7*	*7.7*
BAYSWATER CREEK MIDSTREAM	*8.0*	*8.4*	*7.8*	*8.2*	*7.9*	*8.1*	*7.8*	*7.8*
BAYSWATER CREEK DOWNSTREAM	*n/m*	*7.5*	*n/m*	*7.8*	*7.2*	*7.7*	*8.0*	*8.0*
COMLEROI CREEK	*7.3*	*7.7*	*6.9*	*8.0*	*6.3*	*7.6*	*6.5*	*6.5*
NSW 2 EMU CREEK	*7.5*	*9.1*	*7.0*	*9.3*	*7.0*	*7.5*	*7.0*	*7.0*

LOCATION	2014		2015		2016		2017	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
PIKES CREEK UPSTREAM	*7.8*	*7.8*	*7.4*	*8.3*	*7.5*	*7.7*	*7.6*	*7.6*
PIKES CREEK DOWNSTREAM	*7.2*	*7.7*	*7.3*	*7.7*	*7.5*	*8.1*	*7.7*	*7.7*
W11 FARRELLS CREEK	*7.5*	*8.5*	*7.5*	*8.2*	*7.3*	*8.4*	*7.0*	*7.0*
CARRINGTON BILLABONG	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*
NSW1 PARNELLS CREEK	*7.9*	*8.5*	*8.0*	*8.4*	*8.2*	*8.3*	*n/m*	*n/m*
NSW3 DAVIS CREEK	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*

n/m – not monitored

Table 8-2: Historical Surface Water EC Results - 2014 -2017

LOCATION	2014		2015		2016		2017	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
H1	*513*	*913*	*525*	*1241*	*526*	*1132*	*106*	*752*
H2	*512*	*920*	*538*	*1239*	*541*	*1180*	*420*	*745*
H3	*408*	*554*	*562*	*1196*	*587*	*904*	*423*	*733*
W1	*n/m*	*511*	*544*	*1353*	*560*	*1222*	*521*	*1267*
W109	*519*	*1187*	*513*	*1277*	*576*	*1231*	*515*	*1128*
W3 (HUNTER RIVER)	*512*	*1148*	*599*	*1286*	*556*	*1167*	*524*	*1226*
W4	*511*	*1138*	*619*	*1316*	*546*	*1185*	*525*	*1213*
W2	*307*	*989*	*615*	*1022*	*696*	*964*	*734*	*1309*
WL1	*308*	*801*	*607*	*1000*	*698*	*954*	*587*	*720*

LOCATION	2014		2015		2016		2017	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
WARKWORTH BRIDGE	*307*	*990*	*627*	*1022*	*710*	*987*	*732*	*1074*
BAYSWATER CREEK UPSTREAM	*4150*	*5020*	*2730*	*4890*	*3790*	*3860*	*1830*	*1830*
BAYSWATER CREEK MIDSTREAM	*3630*	*4940*	*2820*	*5160*	*2040*	*3900*	*2250*	*2250*
BAYSWATER CREEK DOWNSTREAM	*n/m*	*2210*	*n/m*	*1931*	*95*	*3700*	*1480*	*1480*
COMLEROI CREEK	*180*	*211*	*121*	*338*	*50*	*356*	*106*	*106*
NSW 2 EMU CREEK	*1666*	*4960*	*161*	*3420*	*86*	*206*	*271*	*271*
PIKES CREEK UPSTREAM	*3120*	*8550*	*5280*	*10280*	*1130*	*2540*	*2500*	*2500*
PIKES CREEK DOWNSTREAM	*3190*	*5530*	*4230*	*5890*	*854*	*1822*	*2330*	*2330*
W11 FARRELLS CREEK	*648*	*2160*	*959*	*3140*	*196*	*3060*	*386*	*386*
CARRINGTON BILLABONG	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*
NSW1 PARNELLS CREEK	*3270*	*8530*	*3240*	*8350*	*6580*	*8090*	*n/m*	*n/m*
NSW3 DAVIS CREEK	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*

n/m – not monitored

Table 8-3: Historical Surface Water TSS Results 2014 -2017

LOCATION	2014		2015		2016		2017	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
H1	*8*	*108*	*12*	*22*	*12*	*33*	*15*	*17*
H2	*13*	*93*	*12*	*29*	*10*	*30*	*13*	*24*
H3	*12*	*59*	*12*	*33*	*12*	*64*	*16*	*19*

LOCATION	2014		2015		2016		2017	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
W1	*14*	*112*	*9*	*18*	*14*	*37*	*16*	*17*
W109	*12*	*96*	*16*	*26*	*13*	*31*	*16*	*29*
W3 (HUNTER RIVER)	*8*	*114*	*16*	*30*	*17*	*37*	*16*	*28*
W4	*11*	*114*	*16*	*32*	*9*	*30*	*18*	*33*
W2	*5*	*6*	*<1*	*4*	*1*	*13*	*2*	*4*
WL1	*5*	*18*	*4*	*15*	*4*	*42*	*10*	*22*
WARKWORTH BRIDGE	*3*	*6*	*<1*	*5*	*2*	*6*	*2*	*3*
BAYSWATER CREEK UPSTREAM	*1*	*5*	*<1*	*6*	*2*	*19*	*71*	*71*
BAYSWATER CREEK MIDSTREAM	*2*	*9*	*<1*	*7*	*6*	*337*	*22*	*22*
BAYSWATER CREEK DOWNSTREAM	*n/m*	*5*	*n/m*	*5*	*14*	*58*	*30*	*30*
COMLEROI CREEK	*5*	*36*	*11*	*68*	*14*	*33*	*16*	*16*
NSW 2 EMU CREEK	*5*	*38*	*3*	*63*	*29*	*143*	*46*	*46*
PIKES CREEK UPSTREAM	*n/m*	*5*	*1*	*4*	*14*	*148*	*11*	*11*
PIKES CREEK DOWNSTREAM	*8*	*12*	*<1*	*4*	*56*	*92*	*13*	*13*
W11 FARRELLS CREEK	*5*	*12*	*1*	*69*	*6*	*14*	*22*	*22*
CARRINGTON BILLABONG	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*
NSW1 PARNELLS CREEK	*n/m*	*n/m*	*1*	*39*	*4*	*79*	*n/m*	*n/m*
NSW3 DAVIS CREEK	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*	*n/m*

n/m – not monitored

8.3 | SURFACE WATER MONITORING PROGRAM

Surface water monitoring is undertaken at the locations and frequency as described in Table 8-4, and shown on Figure *8-1*

Table 8-4: Surface Water Monitoring Program

MONITORING LOCATION	FREQUENCY & PARAMETER			
	EC	pH	Comprehensive Analysis[1]	TSS
BARELLAN	*RE*	*RE*	*A*	*RE*
BAYSWATER CREEK DOWNSTREAM	*RE*	*RE*	*A*	*RE*
BAYSWATER CREEK MID	*RE*	*RE*	*A*	*RE*
BAYSWATER CREEK UPSTREAM HVLP	*RE*	*RE*	*A*	*RE*
BAYSWATER CREEK UPSTREAM NLP	*RE*	*RE*	*A*	*RE*
CARRINGTON BILLABONG	*RE*	*RE*	*A*	*RE*
CARRINGTON DOWNSTREAM	*RE*	*RE*	*A*	*RE*
CARRINGTON UPSTREAM	*RE*	*RE*	*A*	*RE*
DAM 33N (COAL LOADER DAM)	*Q*	*Q*	-	*Q*
COMLEROI CREEK	*RE*	*RE*	*A*	*RE*
DAM 11N	*Q*	*Q*	*A*	*Q*
DAM 18W PARNELL'S CK	*Q*	*Q*	*A*	*Q*
DAM 19S	*Q*[3]	*Q*	*6M*	*Q*
DM6 NORTH VOID TAILINGS	*Q*	*Q*	*A*	*Q*
EOC (DAM 16S)	*Q*	*Q*	-	*Q*

MONITORING LOCATION	FREQUENCY & PARAMETER			
	EC	pH	Comprehensive Analysis[1]	TSS
H1 HUNTER RIVER (UPSTREAM K DAM)	*Q*	*Q*	*A*	*Q*
H2 HUNTER RIVER	*Q*	*Q*	*A*	*Q*
H3 HUNTER RIVER DOWNSTREAM WOLLOMBI	*Q*	*Q*	*A*	*Q*
K DAM/ LAKE JAMES	*Q*[3]	*Q*	*6M*	*Q*
NSW1 (PARNELLS CK)	*RE*	*RE*	*A*	*RE*
NSW2 (EMU CK)	*RE*	*RE*	*A*	*RE*
NSW3 (DAVIS CK)	*RE*	*RE*	*A*	*RE*
PIKES CREEK DOWNSTREAM	*RE*	*RE*	*A*	*RE*
PIKES CREEK UPSTREAM	*RE*	*RE*	*A*	*RE*
REDBANK CREEK CATCHMENT	*RE*	*RE*	*A*	*RE*
W1 HUNTER RIVER (CARRINGTON)	*Q*	*Q*	*A*	*Q*
W109 H UNTER R. MOSES CROSSING	*Q*	*Q*	-	*Q*
W11 FARRELLS CK LEMINGTON RD	*RE*	*RE*	*A*	*RE*
W2 WOLLOMBI BK	*Q*	*Q*	*A*	*Q*
W3 HUNTER RIVER	*Q*	*Q*	-	*Q*
W3 PARNELLS CK DAM	*Q*	*Q*	*A*	*Q*

MONITORING LOCATION	FREQUENCY & PARAMETER			
	EC	pH	Comprehensive Analysis[1]	TSS
W4 HUNTER RIVER (OAKLANDS)	*Q*	*Q*	*A*	*Q*
W5 FARRELLS CK DOWNSTREAM	*RE*	*RE*	*A*	*RE*
W5 FARRELLS CK UPSTREAM	*RE*	*RE*	*A*	*RE*
W9 (DAM 14W)	*Q*	*Q*	*A*	*Q*
WARKWORTH BRIDGE WOLLOMBI BK	*Q*	*Q*	*A*	*Q*
WL1 WOLLOMBI BK	*Q*	*Q*	*A*	*Q*
WLP3	*6M*	*6M*	*6M*	*-*
WLP10[2]	*M*	*M*	*M (including elevation)*	*M*
WLP14[2]	*M*	*M*	*M (including elevation)*	*M*

[1]Comprehensive analysis includes major ions TDS, Al, As, B, Ca, Cd, Cl, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Se, SO4 (or S), Zn, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity.

RE – Rain Event sampling (≥30mm rainfall in 24hrs, maximum 2 sampling events per quarter), Q – Quarterly, 6M – Six Monthly, A – Annual, A* - Annual comprehensive analysis to be undertaken on the first rain event sampling occasion for the year).

[2]Monitoring frequency at WLP10 and WLP14 is determined by frequency of monitoring required for groundwater monitoring bores CFW55R, CFW57, CGW54a, GW_123, GW_124, GW_125, GW_126 & GW_127.

[3]Includes Nitrate + Nitrite as N, ammonia, and total hydrocarbons.

Table 8-5: STP Monitoring Program

SITE	PARAMETER	FREQUENCY
EPA 23 – HOWICK STP	*Faecal Coliforms, pH*	*Quarterly*
EPA 25 – HOWICK SECONDARY LAGOON		
EPA 26 – HVO NORTH STP		

SITE	PARAMETER	FREQUENCY
EPA 29 – HVO SOUTH SECONDARY LAGOON		

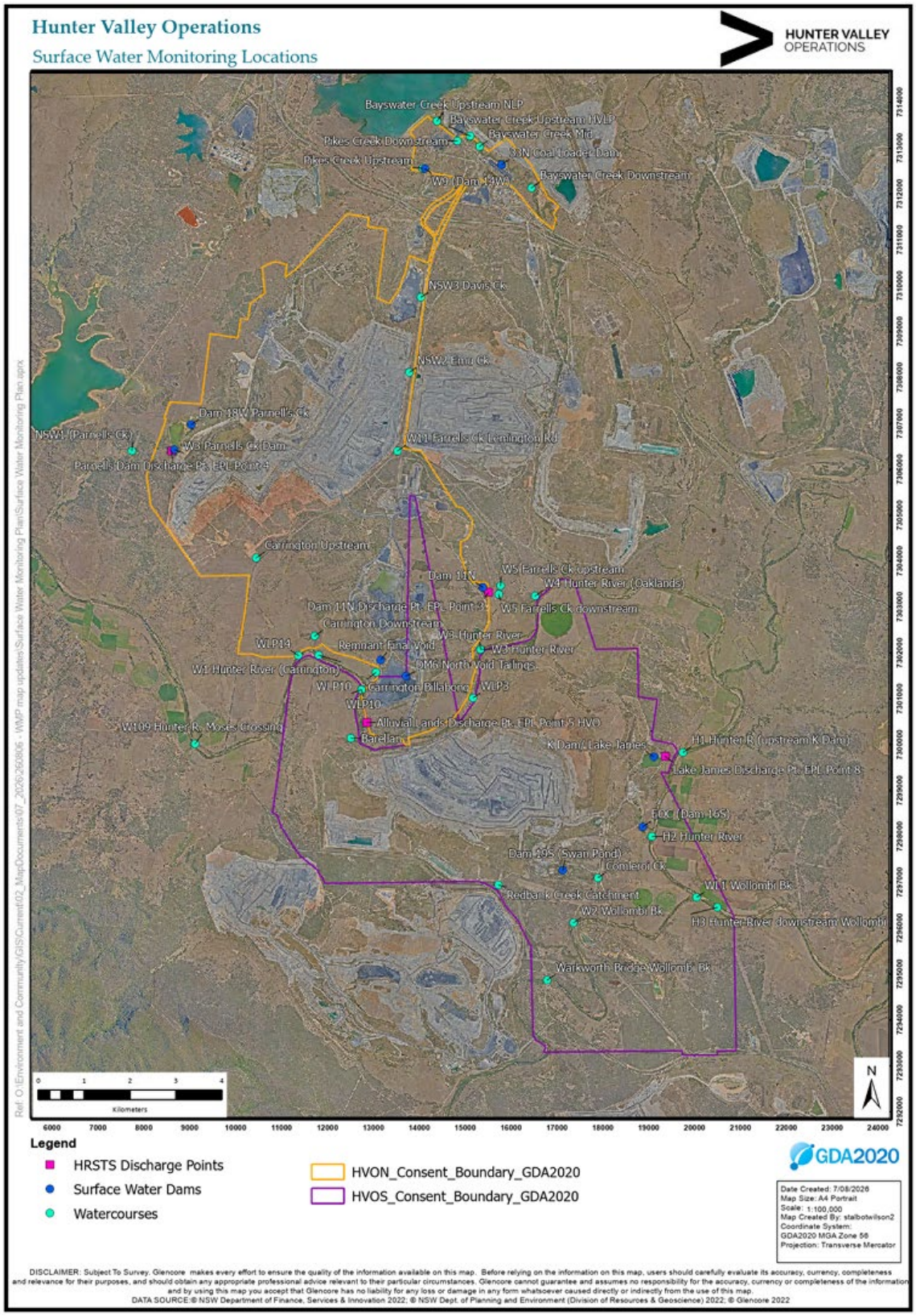

Figure 8-1: HVO Surface Water Monitoring Plan

8.3.1 | SURFACE WATER MONITORING METHODS

HVO engages suitably qualified and experienced contractors to carry out sampling and analysis. Sampling is undertaken in accordance with relevant Australian Standards and other regulatory guidelines. Samples are analysed by laboratories that are National Association of Testing Authorities (NATA) accredited or equivalent for the parameters being analysed.

8.3.2 | SURFACE WATER IMPACT ASSESSMENT CRITERIA

Trigger levels for investigating potentially adverse surface water impacts are specified in Table 8-6. Trigger limits are calculated as the 95th percentile maximum value (pH and EC), and the 5th percentile minimum value (pH) from historical data 2011 – current collected from the monitoring location. The 50mg/L ANZECC criteria has been adopted for TSS. Trigger limits have only been calculated for Watercourses.

The response to trigger levels is detailed in Section 10.1 |

Table 8-6: Surface Water Trigger Limits

MONITORING LOCATION	ELECTRICAL CONDUCTIVITY µS/CM	PH		TOTAL SUSPENDED SOLIDS (MG/L)	SULPHATE (MG/L)
	95th	5th	95th		
BARELLAN	*544*	*6.9*	*8.4*	*50*	-
BAYSWATER CREEK DOWNSTREAM	*3273*	*7.0*	*8.0*	*50*	-
BAYSWATER CREEK UPSTREAM NLP	*3148*	*7.4*	*7.8*	*50*	-
BAYSWATER CREEK UPSTREAM HVLP	*4916*	*7.7*	*8.4*	*50*	-
BAYSWATER CREEK MIDSTREAM	*5068*	*7.8*	*8.3*	*50*	-
CARRINGTON BILLABONG	*836*	*6.8*	*8.2*	*50*	-
CARRINGTON BILLABONG DOWNSTREAM	*375*	*6.8*	*8.3*	*50*	-

MONITORING LOCATION	ELECTRICAL CONDUCTIVITY µS/CM	PH		TOTAL SUSPENDED SOLIDS (MG/L)	SULPHATE (MG/L)
	95th	5th	95th		
CARRINGTON BILLABONG UPSTREAM	*223*	*6.6*	*7.1*	*50*	*-*
COMLEROI CREEK	*372*	*6.3*	*7.9*	*50*	*-*
H1	*1137*	*7.9*	*8.4*	*50*	*-*
H2	*1089*	*8.0*	*8.6*	*50*	*-*
H3	*890*	*7.7*	*8.5*	*50*	*-*
NSW 1 PARNELLS CREEK	*8413*	*8.0*	*8.7*	*50*	*-*
NSW 2 EMU CREEK	*9835*	*7.0*	*8.9*	*50*	*-*
NSW3 DAVIS CREEK	*265*	*7.0*	*7.3*	*50*	*-*
PIKES CREEK DOWNSTREAM	*5962*	*7.3*	*8.0*	*50*	*-*
PIKES CREEK UPSTREAM	*10377*	*7.3*	*8.2*	*50*	*-*
W1 (HUNTER RIVER)	*1251*	*8.0*	*8.5*	*50*	*-*
W109	*1216*	*8.0*	*8.5*	*50*	*-*
W11 FARRELLS CK LEMINGTON RD	*2997*	*7.3*	*8.6*	*50*	*-*
W2	*1010*	*7.1*	*8.3*	*50*	*-*
W3 HUNTER RIVER	*1200*	*8.0*	*8.5*	*50*	*-*
W4 HUNTER RIVER	*1205*	*8.0*	*8.6*	*50*	*-*

MONITORING LOCATION	ELECTRICAL CONDUCTIVITY µS/CM	PH		TOTAL SUSPENDED SOLIDS (MG/L)	SULPHATE (MG/L)
	95th	5th	95th		
W5 FARRELLS CK DOWNSTREAM	*5553*	*7.2*	*8.8*	*50*	*-*
W5 FARRELLS CK UPSTREAM	*9382*	*7.0*	*8.6*	*50*	*-*
WL1 WOLLOMBI BROOK	*843*	*7.3*	*8.2*	*50*	*-*
WLP10	*1200*	*7.2*	*8.8*	*50*	*40*
WLP14	*1200*	*7.2*	*8.8*	*50*	*40*
WARKWORTH BRIDGE	*1056*	*7.1*	*8.2*	*50*	*-*

8.4 | MONITORING CONTROLLED DISCHARGES

Controlled discharges at HVO are authorised under the HRSTS. All controlled discharges will be monitored in accordance with the criteria prescribed in EPL 640. A summary of the monitoring requirements for controlled discharges are shown below in Table 8-7. HRSTS discharge limits are shown in Table 8-8.

Table 8-7: Controlled Discharges Sampling Method Requirements

EPA ID NO.	ANALYTE MONITORED	SAMPLING METHOD	SAMPLING FREQUENCY
POINT 3, 4, 5 AND 8	*Conductivity*	*Probe designed to measure the range of 0 to 10,000 uS/cm*	*Continuous during discharge*
	pH	*Grab Sample*	*Daily During Discharge*
	Total Suspended Solids	*Grab Sample*	*Daily During Discharge*
POINT 3, 4, 8 ONLY	*Turbidity*	*Nephelometer*	*Continuous during discharge*

Table 8-8: HRSTS discharge limits under EPL640

EPA IDENTIFICATION NO.	NAME	VOLUME LIMIT (ML/D)	TSS (MG/L)	PH RANGE	CONDUCTIVITY
3	Dam 11N	100	120	6.5 - 9.5	-
4	Parnells Dam	130	120	6.5 - 9.5	-
5	Alluvial Lands	7	-	-	400
8	Lake James	200*	120	6.5 - 9.5	-

*Note: the sampling event detailed in Condition U2.1 of EPL 640 (Licence Version Date 30 May 2023) requires a saline mixing investigation sampling event the first time HVO discharges from Lake James at a rate above the previous limit of 120ML/day.

8.5 | MONITORING UNCONTROLLED DISCHARGES

Uncontrolled discharges from saline mine water storages at the HVO complex will be regarded as an environmental incident and will be investigated and reported as detailed in Table 11-1 if the incident causes or threatens to cause material environmental harm.

Uncontrolled overflow from sediment control structures as a result of rain events which exceed the design capacity of the sediment control structure will be monitored as part of the rain event sampling program. Where an uncontrolled overflow from a sediment control structure has been experienced during a rainfall event which has not exceeded the design rainfall event (or in the absence of a rainfall event), the uncontrolled discharge will be investigated and reported as required.

The HVO rain event sampling procedure was developed to assess water quality at sites located in watercourses (or representative of) downslope of the operations. Where an exceedance of the trigger limit is obtained during the rain event sampling program, results will be investigated and if necessary, further upstream sampling will be undertaken including dams.

The trigger to initiate a rain event sampling event is 30mm in 24 hours. Locations which are monitored during rain event sampling are shown in Table 8-4**.**

8.6 | WATER MANAGEMENT SYSTEM

8.6.1 | CLEAN WATER DIVERSIONS

Clean water diversion structures are employed to divert clean water away from the active pits. Prior to release from site, if required, this water is managed to minimise sediment load. Sediment control structures are implemented generally in accordance with '*Managing Urban Stormwater Volume: 2E mines and Quarries*'.

8.6.2 | EROSION AND SEDIMENT CONTROL

8.6.2.1 | OVERVIEW

A Ground Disturbance Permit (GDP) is required for all disturbance activities. Prior to disturbance, appropriate erosion and sediment controls will be established. This includes establishing erosion and sediment controls due to advance of mining and establishment or disturbance of rehabilitation. Where ground conditions allow, erosion and sediment controls are designed generally in accordance with the 'Blue Book': Managing Urban Stormwater: soils and construction (Volume 1 and 2E – Mines and Quarries). Not all sediment dams identified in the Water Infrastructure Plans have been constructed to this standard. HVO has a number of dams that it is bringing up to this standard via a Pollution Reduction Programme forming part of the site Environmental Protection Licence. Table 8-9 outlines the dams/ sumps being brought up to standard via the staged rollout of the PRP.

Sediment mobilisation and erosion will be minimised by;

- Where practical, diverting runoff from undisturbed catchments around disturbed areas via diversion drains and banks to discharge into natural watercourses;
- Retaining runoff from disturbed areas in sediment dams to settle out suspended sediment with possible treatment prior to discharge back to the natural system;
- Return water back to the mine water system if water quality is not suitable for release;
- Installing appropriate erosion and sediment controls prior to disturbance of any land;
- Limiting the extent of disturbance to the practical minimum and maintaining groundcover;
- Reducing the flow rate of water across the ground on disturbed surfaces;
- Progressively stripping and stockpiling topsoil for later use in rehabilitation and stabilisation;
- Stabilising topsoil stockpiles to minimise erosion;
- Progressively rehabilitating disturbed land to increase ground cover, increase infiltration and reduce erosion potential;
- Constructing drainage controls such as scour protection to improve stability in concentrated flow areas; and
- Restricting access to rehabilitation and non-disturbed areas.

Table 8-9: Dam/Sump Upgrades Subject to rollout of PRP

STRUCTURE NAME	LOCATION	SUMMARY OF WORKS BEING CONDUCTED	SCHEDULED COMPLETION DATE
DAM 4S	HVO South	Dam expansion	2027
DAM 34S	HVO South	Dam expansion	2027

STRUCTURE NAME	LOCATION	SUMMARY OF WORKS BEING CONDUCTED	SCHEDULED COMPLETION DATE
DAM 35S	HVO South	Dam Expansion	2027
DAM 36S	HVO South	Dam expansion	2029
DAM 39S	HVO South	Dam expansion	2027
DAM 43S	HVO South	Pumping or conversion to freshwater (rehab catchment)	2027
DAM 9W	HVO North	Increase storm buffer capacity to 1:100 ARI (24hr). Segregate catchment inputs (Dam 11W).	2029
DAM 18W	HVO North	Segregate mine water inputs from clean water diversion.	2029

Note: projects listed above are subject to change and completion dates will be determined as new PRP programmes are rolled out and included in the EPL, replacing completed projects. The dates in this table are indicative only and not sequential as the PRP also includes non-dam related projects.

8.6.2.2 | POTENTIAL IMPACTS FROM MINING

Activities that have the potential to cause erosion at HVO include:

- Vegetation clearing and topsoil stripping;
- Stockpiling of topsoil;
- Rehabilitation
- Vehicle movements;
- Construction of roads and infrastructure; and
- Construction of overburden dumps.

Potential impacts from these activities include:

- Increased surface erosion from disturbed and rehabilitated areas through the removal of vegetation and stripping of topsoil;
- Increased sediment and pollutant load entering the natural water system; and Siltation or erosion of watercourses and waterbodies.

In addition to potential impacts from mining other sources of sediment may include:

- Clearing associated with powerline easements;
- Erosion from disturbed areas created by natural processes; and
- Erosion from areas disturbed by previous agricultural land uses.

8.6.2.3 | PERFORMANCE INDICATORS FOR EROSION AND SEDIMENT CONTROLS

The performance of erosion and sediment controls across the HVO is assessed as part of the HVO Surface Water Monitoring Program. A set of monitoring sites located in (or representative of) downstream receival drainage lines are sampled under the "rain event" sampling routine to assess the effectiveness of erosion and sediment controls. Samples which record elevated levels of the key analytes (or lower in the case of pH analysis) are investigated and reported accordingly. Further detail on the surface water monitoring program can be found in Section 7.3 |

8.6.2.4 | EROSION AND SEDIMENT CONTROL STRUCTURES

Contour banks are positioned at HVO to direct runoff from rehabilitated areas and disturbed areas to sedimentation dams. Erosion and sediment control structures will remain in place to divert water away from the final void unless required for use as flood flow storage.

8.6.3 | FLOOD MITIGATION

Existing flood mitigation controls in place at HVO include:

- HVO North:
  - Levee No. 3 (20FW213278);
  - Carrington Levee No. 5 (20FW213280);
  - North Pit Levee – Alluvial Lands (20FW213274); and
  - North Pit Levee – West (20FW213278).

- HVO South:
  - Barry's Levee and Barry's Levee South (20FW213281); and
  - Hobden Gully Levee (20FW213277).

HVO will construct South Lemington Pit 2 Levee as a permanent levee and ensure the outer face of the levee will withstand 100-year ARI flood flow velocities; this will not be triggered until mining recommences at South Lemington (currently not planned).

8.7 | DETAILED PLANS

FINAL VOIDS

The rehabilitation objective of the mine site, including the final void is to be safe, stable and non-polluting. Design and management of the voids will be in accordance with the Rehabilitation Management Plan or (for HVO North) the Final Void Management Plan. The EA's depict three final voids; one in West Pit, one in Carrington and one in Riverview Pit.

8.7.1 | EVAPORATIVE SINK

The final void evaporative sinks located in Carrington Pit and Riverview Pit have been designed to facilitate evaporative losses at a rate which is greater than the accumulation of groundwater within the pit shell, rainfall runoff and infiltration through the rehabilitated final landform. Further details on the proposed evaporative sinks can be found in the respective Environmental Assessments for each of the Project Approvals

8.7.2 | EMPLACEMENT AREAS AND BACKFILLED VOIDS

All overburden, interburden and coarse reject material is disposed of in out-of-pit emplacement areas or within backfilled voids within the HVO complex. Operations will be managed to ensure that the method of placing material in these areas will be safe, stable and non-polluting Design and management of these areas is dependent on material competency. These areas may be reshaped as required to ensure that the final landform is capable of maintaining a stable watershed and drainage conduits.

8.7.3 | TAILINGS DAMS

Table 8-10 details the current tailings impoundments at HVO and the status of each facility. The locations of each facility are shown in Figure 6-2, Figure 6-3 and Figure 6-4.Tailings dams are engineered in accordance with the Dams Safety Act 1978 (NSW).

Table 8-10: Current tailings impoundments at HVO and their status

STORAGE	LOCATION	STATUS
CARRINGTON VOID	*North*	*Active*
NORTH PIT VOID (29N)	*North*	*Inactive*
DAM 6W	*West*	*Inactive*
CENTRE (28N)	*North*	*Inactive*
SOUTH EAST (27N)	*North*	*Capping complete*
BOBS DUMP (20W)	*West*	*Capping commenced*

8.7.4 | HIGHWALLS ADJACENT TO LOW PERMEABILITY BARRIERS

Detailed plans, including design objectives and performance criteria for ensuring the stability of high wall adjacent to low permeability barriers as part of the Carrington West Wing Extension will be developed in consultation with the Department of Planning, Housing and Infrastructure (DPHI) prior to construction

8.7.5 | ENFORCEABLE UNDERTAKING

HVO entered into an enforceable undertaking with the EPA 23 March 2020. The following future actions were completed as part of the enforceable undertaking:

- Documentation of a remediation plan for the East Tailings Storage Facility (East TSF) within 2 years of the date the EPA accepted the enforceable undertaking (completed)
- Annual walkover inspection of all rehabilitation areas to be conducted annually, with the first inspection to be by 31 December 2020 (completed).
- Pay $100,000 to Hunter local Land Services (LLS) to undertake a project to improve Travelling Stock Reserves (TSRs) within the Singleton Local Government Area. This payment has been made.

9 | GROUNDWATER MANAGEMENT PLAN

9.1 | OVERVIEW

Detailed assessments of the potential groundwater impacts of mining at HVO were undertaken using a numerical groundwater model during the EA for HVO North (2003), HVO South (2017) and Carrington West Wing Extension (2010). The model calculated groundwater seepage and drawdown responses for the development, as detailed in this plan.

An integrated management approach is employed at HVO to mitigate the potential impacts of mining on the groundwater environment and other groundwater users, including groundwater dependent ecosystems.

The key groundwater management measures are:

1. Physical water management;
2. Groundwater monitoring, data management and reporting;
3. Groundwater model revisions and verification of predictions;
4. Salinity trading and water sharing; and
5. Direct compensation measures.

9.1.1 | OBJECTIVES

The key objectives of the groundwater monitoring program is to provide accurate information to effectively:

- Monitor groundwater inflows to the open cut mining operations;
- Identify any impacts to the base flow to the Hunter River from operations;
- Measure water take from water sources;
- Monitor the effectiveness of the low permeability barrier walls;
- Monitor the effectiveness of the Alluvial Lands dewatering management programme;
- Identify any impacts to private groundwater bores;
- Identify any impacts to GDEs;
- Identify any seepage/leachate from water storages, backfilled voids and the final void;

- Assess performance of management measures against impact assessment criteria (trigger levels);
- Manage depressurisation and water quality impacts on aquifers due to operations;
- Define groundwater impact assessment criteria (trigger levels);
- Outline the plan to respond to any exceedance of the groundwater assessment criteria (TARP);
- Provide evidence that effective water monitoring has taken place; and
- Validate and recalibrate the groundwater model, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions.

The groundwater management measures are intended to compliment the groundwater monitoring program given in Section 9.6 |. HVO will continue to meet all commitments under the relevant water sharing and Hunter River Salinity Trading Scheme. Continued groundwater monitoring combined with a 3-yearly review of the site numerical groundwater model will inform future decision making with respect to quantifying impacts on the groundwater environment.

Overall, the studies to date have highlighted that the Carrington West Wing Extension and HVO South operations will pose limited risk to the groundwater regime. By the implementation of these groundwater management measures, any residual risks can be effectively mitigated or managed.

9.2 | WATER SHARING PLANS

NSW Water Sharing Plans (WSPs) establish rules for sharing water between environmental needs of the river or aquifer and water users, and difference types of water use such as town supply, rural domestic supply, stock watering, industry and irrigation.

Three WSP's apply to the area of the aquifers and surface waters which are within the HVO complex development consent boundary, namely:

- Hunter Regulated River Water Source 2016 (Hunter Regulated)
- Hunter Unregulated and Alluvial Water Sources 2009 (Hunter Unregulated)
- North Coast Fractured and Porous Rock Groundwater Sources 2016 (North Coast Fractured and Porous Rock)

The Hunter Unregulated and Alluvial Water Source WSP includes unregulated rivers and creeks within the hunter river catchment, the highly connected alluvial groundwater (above the tidal limit), and the tidal pool areas. In total there are 39 water sources covered by the Hunter Unregulated and Alluvial Water Source WSP and nine of these are further sub-divided into management zones. The following water sources / management zones are located within or immediately adjacent to the HVO complex development consent boundary.

- Hunter Regulated River Water Source- Upstream Glennies Creek Management Zone (Zone 1B)
- Hunter Regulated River Water Source- Downstream steam Glennies Creek Management Zone (Zone 2A)
- Hunter Unregulated and Alluvial Water Sources
- Wollombi Brook Management zone within the Hunter Extraction Management Unit
- Jerrys Management Zone.

9.3 | NSW AQUIFER INTERFERENCE POLICY

The NSW Aquifer Interference Policy (AIP) clarifies the water licensing and approval requirements for aquifer interference activities in NSW, including the interception of water from an aquifer as a course of mining activities. The water licenses held by the HVO complex are displayed in Table 6-2.

The AIP requires that potential impact on groundwater sources, including Ground Water Dependant Ecosystems and fellow groundwater users, be assessed against minimal impact considerations for water pressure, water table and water quality.

Based on the AIP, the groundwater system impacted by HVO Mining activities can be separated into two systems, as follows:

- porous and/or fractured consolidated sedimentary rock of the Permian coal measures (less productive aquifer); and
- groundwater within alluvium associated with the Hunter River and Wollombi Brook (both highly productive and less productive zones).

The minimal impact considerations described in the AIP have been referenced for developing groundwater assessment criteria where applicable.

9.4 | BASELINE DATA

Baseline data for HVO, including water levels, quality and yield estimates are detailed in the EA for HVO North (2003), HVO South (2017) and Carrington West Wing Extension (2010) and the HVO North Fine Reject Emplacement (2014). Groundwater level and quality data collected between 2000 and 2023, used for the derivation of triggers, is summarised in Appendix D.

An extensive network of groundwater monitoring bores and piezometers, screening the alluvium, coal seams and interburden is routinely monitored. Environmental monitoring data is presented on the company website. The current groundwater monitoring network is shown in Appendix F.

9.5 | IMPACTS ON GROUNDWATER AND MONITORING

HVO has developed a knowledge base from 30 years of groundwater monitoring to provide detailed baseline data of groundwater yield and quality in the immediate region.

Groundwater monitoring will be undertaken in accordance with the Groundwater Monitoring Program in Section 9.6 |.

In accordance with Schedule 3, Condition 27(c) of the HVO North Consent and Schedule 3, condition 27(c) of the HVO South Consent, the Groundwater Monitoring Program should address the predicted impacts. The potential impacts from mining are described in the below sections and summarised in Table 9-1. For each of these risks some groundwater monitoring works will be considered in addition to the Groundwater Monitoring Programme in Section 9.6 |.

Commitments related to installing monitoring bores and subsequent monitoring requirements for the development of Carrington West Wing are detailed in Table 9-2.

Table 9-1: Summary of Previously Predicted Impacts to Groundwater

AREA/MODIFICATION	PREDICTED IMPACTS
HVO North: *Carrington West Wing Extension* *Groundwater impacts assessed in Modification 3 (MER, 2010)*	• *Impacts predicted include:* • *Depressurisation and removal of the alluvium and coal measures and potential indirect impacts on the Hunter River and the alluvial systems.* • *Changes to groundwater hydrochemistry induced by regional depressurisation.* • *During active mining at Carrington West Wing the zone it was predicted the level drawdown within the Permian coal measures could extend up to 2 km form the active mine area.* • *Water levels within the spoil and Permian coal measures are drawn down around Carrington Pit void and active mining at HVO South. The drawn down groundwater levels indicate Carrington Pit void* acts as a hydraulic sink.
HVO North: *Carrington In-Pit Fine Reject Emplacement* *Groundwater impacts assessed in Modification 6 (AGE, 2017)*	• *No impacts to private groundwater water users predicted.* • *No adverse changes in groundwater level or quality near ecosystems predicted.* • *Final void will continue to act as a sink and previously predicted groundwater conditions would be maintained and no impacts to beneficial use of water within the void which is not suitable for stock or irrigation use.* • *No changes to final landform already approved in Mod 3, therefore no new impacts predicted.*
HVO North: *HVO North Final Void Hydrological Modelling (Umwelt, 2023)*	• *Groundwater level recovery within HVO North mine workings predicted.* • *Final voids in West Pit predicted to act as groundwater sinks, but with some throughflow to the south and east via the coal measures due to cumulative impacts from surrounding mines/voids.* • *Carrington Void predicted to act as a groundwater sink, drawing in groundwater within around 1.5 km of the void extent.* • *Areas over 1.5 km from the void include the eastern edge of North Pit/Alluvial Lands where potential subsurface flow through regolith/Permian coal measures to the east (towards Ravensworth Mine) is predicted. The potential for seepage of spoil water to alluvium is mitigated by the presence of Dam 21N.* • *Potential for seepage of saturated spoil to palaeochannel alluvium was also predicted at the western edge of Carrington Pit. Low seepage volumes predicted and considered unlikely to adversely impact water quality in alluvium.*

AREA/MODIFICATION	PREDICTED IMPACTS
HVO South: *HVO South EA for Cheshunt, Riverview and South Lemington Pits* *Groundwater impacts assessed in Environmental Assessment (ERM, 2008)*	• *Flows within the Hunter River not predicted to be significantly impacted by mining.* • *The number of days Wollombi Brook is dry was predicted to increase by up to 6%, under worst case conditions.* • *GDEs were not predicted to be significantly impacted.* • *Seepage into Cheshunt Pit was predicated to range from 0.7 ML/day to 7.3 ML/day. However, accounting for evaporation, this was predicted to reduce to 6.5 ML/day in winter and 5.0 ML/day in summer.*
HVO South: *Barry's Pit* *Groundwater impacts assessed in Modification 4 (AGE, 2013)*	• *Additional pit seepage ranging between 2.2 ML/yr to 4.4 ML/yr derived from the Permian coal measures.* • *Indirect seepage from the Alluvial Lands spoil accounting for up to 0.1 ML/yr of total pit seepage.* • *Seepage from alluvium to underlying coal measures and baseflow loss predicted to increase by 1.9 ML/yr to 4.4 ML/yr.* • *Reduction in flow of the Hunter River predicted to be up to 4.4 ML/yr equating to 0.008 % to 0.02 % of daily river flows and is considered negligible.* • *The reduction of flow volumes reduces the discharge of more saline groundwater into streams, therefore, an increase in stream salinity due to the Mod is unlikely.* • *No impacts to groundwater users predicted.* • *A slight increase in seepage from all aquifers predicted relating to an increase in the hydraulic gradient. The groundwater flow regime and degree of hydraulic connectivity will not be noticeably impacted beyond current conditions.* • *A less than 0.6 m change in groundwater levels within the Hunter River alluvium predicted and will not impact on localised GDEs.*

AREA/MODIFICATION	PREDICTED IMPACTS
HVO South: *Groundwater impacts assessed in Modification 5 (AGE, 2017)*	• *Peak take from the Permian strata of 1,591 ML/yr at Year 11 under North Coast Fractured and Porous Rock WSP.* • *Peak indirect take of 423 ML/yr under the Hunter Unregulated WSP.* • *Peak indirect take of 584 ML/yr under the Hunter Regulated WSP.* • *Volumes are within previously predicted maximum water takes and accommodated by licensed water entitlements.* • *Drawdown predicted at registered bore 10011459 of up to 2.7 m. Bore is located on Glencore owned land (Ravensworth Mine). No other private bores outside of mine owned land predicted to be impacted.* • *Potential GDEs were identified at six locations comprising River Red Gums, Hunter Flood Plain Red Gum Woodland, Hunter Valley River Oak and the Carrington Billabong. Drawdown for the remodelled approved plus proposed modification was predicted within localised areas along the Hunter River alluvium.* • *Drawdown in Wollombi Brook alluvium was predicted around Lemington Pit, which directly intersects the alluvium.* • *Void in HVO South (Cheshunt and Riverview Pit) designed to act as a groundwater sink reducing release of saline water in the surrounding environment, including the Hunter River and Wollombi Brook.* • *Final void in South Lemington Pit 1 was predicted to form a flow through system with groundwater passing through the spoils and into the surrounding stratigraphy, including the Wollombi Brook alluvium. The void was not proposed to be used for mine water storage in this assessment.*
HVO South: *Lemington Underground Water Storage* *Groundwater impacts assessed in Modification 7 (AGE, 2021)*	• *Proposed maximum water storage level in the underground workings to 30 mAHD, to minimise potential for seepage and impacts on water quality in the Hunter River alluvium.* • *No groundwater level drawdown impacts greater than the 2 m threshold for the AIP are predicted.* • *No impacts to GDEs predicted.* • *No impacts on water quality in the surrounding strata, nearby water users or GDEs are predicted.* • *Any potential minor increase in metals concentrations due to the transfer of water from surface water storages is not predicted to effect groundwater use.* • *No impacts to the hydraulic connection between aquifers predicted.* • *No additional indirect take is expected from local groundwater sources including Wollombi Brook, the Hunter River or underlying Permian units.*

Table 9-2: Monitoring Commitments associated with developing the Carrington West Wing Groundwater barrier

WORKS/ACTIONS	ESTIMATED TIMING
TWO-MONTHLY MONITORING OF WATER LEVELS IN ANY NEW STANDPIPE PIEZOMETER IN PROXIMITY TO THE CARRINGTON WEST WING EXTENSION AREA AND QUARTERLY MONITORING ELSEWHERE UNLESS WATER LEVEL CHANGES DICTATE OTHERWISE.	*When mining begins in the Carrington West Wing extension area*
DAILY OR MORE FREQUENT MONITORING OF PORE PRESSURES BY INSTALLED AUTO RECORDERS AT SOME EXISTING PIEZOMETERS IN ORDER TO DISCRIMINATE BETWEEN OSCILLATORY GROUNDWATER MOVEMENTS ATTRIBUTED TO RAINFALL RECHARGE, AND LONGER TERM PRESSURE LOSSES RELATED TO OPEN CUT AND UNDERGROUND MINING.	*When mining begins in the Carrington West Wing extension area*
CONSTRUCTION OF ADDITIONAL PIEZOMETERS. PERMEABILITY TESTING WILL BE COMPLETED ON NEW PIEZOMETERS IN ORDER TO FACILITATE ESTIMATION OF LEAKAGE AND SUBSURFACE FLOWS.	*Where deemed necessary, as information is generated from within the existing network, during the course of mining*
TWO-MONTHLY OR QUARTERLY (DEPENDING UPON LOCATION) MONITORING OF BASIC WATER QUALITY PARAMETERS, PH AND EC, IN EXISTING AND ANY NEW PIEZOMETERS	*When mining begins in the Carrington West Wing extension area*
six monthly measurement of TDS and speciation of water samples in piezometers	*When mining begins in the Carrington West Wing extension area*

Table 9-3: Monitoring Commitments associated with Lemington Underground Modification 7 – December 2021

WORKS ACTIONS	ESTIMATED TIMING
ADDITIONAL SAMPLING FOR WATER QUALITY ANALYSIS WILL BE CONDUCTED FROM THE EXISTING LUG BORE AND LUG_S001 AS WELL AS FROM THE NEW TRANSFER SITES UPON COMPLETION OF THE BORES (WHERE THEY ARE NOT DRY). THE SAMPLING WOULD BE UNDERTAKEN IN ACCORDANCE WITH THE APPROVED METHODS FOR THE SAMPLING AND ANALYSIS OF WATER POLLUTANTS IN NEW SOUTH WALES (EPA, 2004) AND WOULD INCLUDE AN ANALYSIS OF THE ANALYTES IN TABLE 2. THE ADDITIONAL SAMPLING WOULD BE DESCRIBED IN THE REVISED WATER MANAGEMENT PLAN.	*When transfer of water commences into Lemington Underground*

WORKS ACTIONS	ESTIMATED TIMING
DPE WATER RECOMMENDS HV OPERATIONS PTY LTD INSTALL ADDITIONAL MONITORING POINTS AS PROPOSED IN THE MODIFICATION REPORT.	*Prior to transfer of water commencing into Lemington Underground*

9.5.1 | GROUNDWATER INFLOWS TO THE OPEN CUT MINING OPERATIONS

Groundwater and surface water at HVO is considered to be regulated as follows:

- Hunter Unregulated and Alluvial Water Sources WSP – alluvial groundwater;
- Hunter River Regulated Water Source WSP – Hunter River surface water; and
- North Coast Fractured and Porous Rock WSP – groundwater from the coal measures.

HVO South lies within the Glennies Creek Management Zone, Jerrys Management Zone and Lower Wollombi Brook Water Source of the Hunter Unregulated and Alluvial Water Sources WSP. The AIP requires the accounting for all groundwater take, either directly or indirectly. Groundwater intercepted from the mining area is considered a direct take from the Permian groundwater system, while fluxes within the alluvium and rivers results from depressurisation of the underlying Permian is considered an indirect take (AGE, 2017).

The Hunter Regulated WSP values are derived from the indirect take from the Hunter River. The Hunter Unregulated WSP values are derived from the indirect take from the Hunter River alluvium, Wollombi Brook alluvium and Wollombi Brook. The indirect take from the Hunter River alluvium is partially comprised of water from the Hunter River, which is managed under the Hunter Regulated WSP. Therefore, the total indirect take for the Hunter Unregulated WSP is considered to be the indirect take from the Hunter River alluvium minus the induced Hunter River take. The same process is used to ensure there is no double accounting of groundwater and surface water take from Wollombi Brook AGE (2017).

A numerical groundwater model was developed for the HVO South Modification 5. The numerical groundwater model was updated in 2025 for the HVO Final Void Management Plan. The model was calibrated up to December 2020 and replicates mine progression on a quarterly basis to the year 2035. Year 5 model results (predictive model) represent predicted groundwater conditions and take for the 2025 reporting period. The latest figures are given in the Groundwater Impacts Reports for HVO North and South, found in the Annual Review.

The calculated groundwater inflows show good agreement with previously modelled leakage estimates in the EA's. A summary of annual predicted groundwater take for each WSP is presented in Table 9-4 and the corresponding years Annual Reviews.

Table 9-4: Predicted Groundwater Take for 2025 -2030

	HUNTER REGULATED	HUNTER UNREGULATED WSP			NORTH COAST FRACTURED AND POROUS ROCK
MANAGEMENT ZONE	Downstream Glennies	Jerrys Management Zone	Lower Wollombi Brook Water Source	Upstream Glennies Creek	Permian Coal Seams
2025	*68.1 ML*	*0.2 ML*	*45.5 ML*	*312.5 ML*	*1879 ML*
2026	*67.2 ML*	*0.2 ML*	*42.9 ML*	*291.3 ML*	*1307 ML*
2027	*66.9 ML*	*0.2 ML*	*41.3 ML*	*281.2 ML*	*1779 ML*
2028	*66.5 ML*	*0.2 ML*	*39.6 ML*	*271.1 ML*	*1805 ML*
2029	*66.4 ML*	*0.1 ML*	*39.1 ML*	*270.4 ML*	*1267 ML*
2030	*64.9 ML*	*12.0 ML*	*36.9 ML*	*257.8 ML*	*1770 ML*

9.5.1.1 | BORE ABSTRACTION

Lemington Underground (LUG) bore is an abstraction bore constructed into the abandoned LUG mine void underlying HVO. Mt Thorley Warkworth hold the licence to the bore which permits water take of up to 1,800 ML of water from the North Coast Fractured and Porous Rock aquifer (20BL173392) per water year.

9.5.2 | EFFECTIVENESS OF THE LOW PERMEABILITY BARRIER

A monitoring program to measure the effectiveness of the low permeability barriers as part of the Carrington West Wing Extension will be developed in consultation with the Department and NRAR prior to construction. Groundwater monitoring to the south of existing Carrington barrier wall is undertaken in accordance with the groundwater monitoring program.

Performance of the Alluvial Lands Barrier is assessed regularly through a series of piezometers along the length of the barrier. A summary of monitoring results for the monitoring bores associated with verifying the effectiveness of the Low Permeability Barrier is shown below in Table 9-5, including a basic analysis of the data set at each location.

Table 9-5: Low Permeability Barrier Monitoring Results Summary (dataset from 2001 to present)

MONITORING POINT	MONITORING FREQUENCY	MAX. WATER LEVEL (MAHD)	MIN. WATER LEVEL (MAHD)	AVERAGE WATER LEVEL (MAHD)
PZ5CH1800	*Quarterly*	*56.54*	*51.34*	*55.58*
PZ4CH1380		*56.51*	*54.44*	*55.46*
PZ3CH800		*56.71*	*54.10*	*55.11*
PZ2CH400		*62.58*	*53.54*	*58.00*
PZ1CH200		*60.90*	*53.65*	*55.88*

9.5.3 | BASE FLOW

Loss of baseflow is currently assessed on an annual basis in the Groundwater Impacts Reports for HVO North and South, found in the Annual Review. The annual estimate is derived from the groundwater model as indirect water take from streams and alluvium.

Loss of baseflow includes reduction in contributions to the river from connected alluvium and additional leakage of streamflow into the connected alluvium. Baseflow is not measurable and therefore can only be quantified and reported on from the groundwater model with results provided as indirect take. This process is illustrated in Figure 9-1 below.

Baseflow loss from the Hunter River is accounted for in the indirect take under the Hunter Regulated River Water Source WSP (Hunter River management zone). Baseflow loss in Wollombi Brook is accounted for in the indirect take under the Hunter Unregulated River and Alluvial Water Source WSP (Lower Wollombi Brook Water Source management zone).

As shown in Figure 9-1, the system is connected, and indirect take also includes reduced upward seepage from Permian to alluvium and additional seepage from alluvium to underlying Permian. Therefore, water loss in the alluvium in turn induces water loss from the surface water system. Consistent with the approach undertaken for previous approvals, and as reported by AGE (2017), to exclude double accounting in this connected system the maximum indirect take from any one source (alluvium or surface water) is applied.

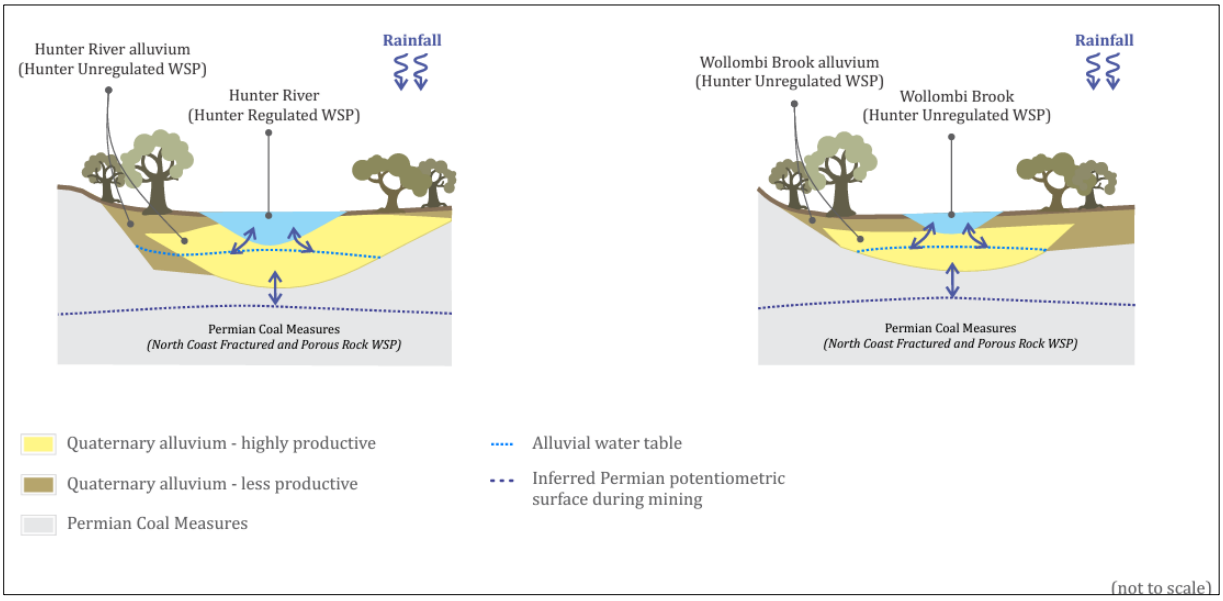

Figure 9-1: Schematic Showing Baseflow Licensing (Source: AGE, 2017)

9.5.4 | IMPACT ON PRIVATE GROUNDWATER BORES

Groundwater level drawdown due to operations at HVO is largely restricted to the extent of the HVO complex. It is not anticipated that HVO mining operations will result in any unreasonable loss of groundwater yield at existing privately owned water bores in the local area.

There are no privately owned bores (excluding those associated with mining operations) where the yield is likely to be affected within the predicted envelope of groundwater depressurisation that will surround the mine pit. Nearest bores are located about 2.5 km to the south and are situated in Hunter River alluvium. The existing network of groundwater monitoring bores, covering both the coal seams and the alluvium, should be sufficient to ascertain whether a change in private water bore production could be attributed to the HVO operation.

9.5.5 | IMPACT ON GROUNDWATER DEPENDANT ECOSYSTEMS

Site-specific assessments of potential Groundwater Dependent Ecosystems (GDEs) nearby HVO operations and the surrounding area have been conducted as part of environmental assessments for the complex. The following potential GDEs have been identified:

- Subterranean fauna within aquifer ecosystems (e.g. stygofauna) of the Hunter River, Wollombi Brook and associated tributary aquifers, which are known to occur throughout the Hunter River;
- River Red Gum populations at Carrington Billabong, and along the Hunter River, which rely on flooding for germination;
- River Oak Grassy Riparian Woodland of the Hunter River riparian zone; and
- Warkworth Sands Woodland community, present in South Lemington Pits area, considered to intermittently rely on a perched watertable.

It is not anticipated that groundwater drawdown (as a result of this project) will result in stress to the associated vegetation communities. Whilst the species utilises groundwater, it relies on flooding regimes for recruitment. Current flooding regimes are not predicted to be significantly affected as a result of the project.

The HVO River Red Gum Rehabilitation and Restoration Strategy outlines the management and monitoring regime to ensure these communities are maintained.

9.5.6 | SEEPAGE/LEACHATE FROM WATER STORAGES

Overburden removed and dumped as a function of mining is prone to preferential weathering and will tend to leach dissolved salts, which can enter the groundwater and surface water environment. Modelling undertaken concluded that the final void water levels will equilibrate below the regional water table and will therefore act as a sink to groundwater flow in the area. Seepage from voids is therefore not expected to occur.

The existing groundwater monitoring program is currently sufficient to verify voids will operate as designed. To verify that the groundwater is retained in the mine voids at closure HVO should install and maintain permanent floating buoys that measure the water level and electrical conductivity of the void water, combined with water level / electrical conductivity loggers fitted into a representative selection of monitoring bores.

9.5.7 | ALLUVIAL LANDS DEWATERING MANAGEMENT

The alluvial lands area of North Pit was mined and subsequently backfilled between the late-1990's and mid-2000's, following initial approval in 1995. The original groundwater modelling predicted the backfilled void would recharge via rainfall runoff and equilibrate to a water quality which would ultimately allow mixing with the Hunter River.

To ensure management commitments relating to the water quality objectives for Hunter River mixing could be achieved at some time in the future investigations determined dewatering of the void should be undertaken to reduce the salt load.

One deep dewatering bore (DM6) and three shallow dewatering bores (DM7, 8 and 9) were constructed as the void was backfilled in the mid-2000's. The bores were intermittently operated following construction however pumping ceased in June 2007, as site water inventories were full due to heavy rainfall.

Shallow bores DM8 and DM9 were re-commissioned in 2013 and provide a low dewatering rate. In 2015, the drilling of test holes to confirm the target site for a deep dewatering bore was undertaken. Four holes were drilled, none of which yielded sufficient water to support the construction of a dewatering bore. Subsequent groundwater modelling and geochemical investigations have identified that groundwater level in the North Void spoil has not been increasing, and groundwater flows in a southerly direction towards south pit indicating it is hydraulically connected to Cheshunt via coal seams. Production bores in the alluvial lands are unable to sustain yield and are not required to lower water based on the knowledge of hydraulic connection with South Pit.

The existing Groundwater Monitoring Program and Groundwater Impacts Report are used to monitor and manage alluvial lands dewatering.

9.6 | GROUNDWATER MONITORING PROGRAM

The groundwater monitoring network includes bores located within HVO North and HVO South. The monitoring network and the purpose for the inclusion of each bore is detailed in Appendix F: Specific bores have been included in the network to monitor:

- HVO North:
  - HVO North Void:
    - Consolidation of HVO North Void and free draining surface to minimise seepage and impacts to water quality in alluvium.
    - Recovery in voids, potential seepage and impacts on water quality to alluvium, GDEs and downstream water users/landholder bores.
  - Parnells Creek Dam:
    - Monitor water storage and potential impacts on water quality along Parnells Creek, alluvium and downstream water users.
  - Dam 21N:
    - Monitor groundwater levels and quality in spoil and alluvium for early detection of potential seepage.
  - Carrington Spoil:
    - Monitor groundwater level recovery and water quality in spoil and adjacent palaeochannel alluvium, for early detection of potential seepage.

- HVO South:
  - South Lemington Pit:
    - Monitor potential water level and water quality changes in the Wollombi Brook alluvium and underlying strata due to seepage from South Lemington Pit which is used for water storage. Bores will be used to provide information to manage water levels within the pit to minimise potential seepage/impacts to water quality in alluvium, Wollombi Brook and the Warkworth Sands.
  - LUG Bore Abstraction:
    - Alluvium monitoring bores in South Lemington are used to monitor potential water level and water quality impacts in the alluvium due to abstraction from LUG Bore.
  - Lemington Underground Water Storage:
    - Monitor potential impacts to water quality with seepage from key areas (coal seam subcrop) to alluvium/surface water upon commencement of water storage within Lemington Underground. Bores will monitor water levels and water quality in key areas of Lemington Underground and likely seepage points.
  - Rehabilitated Areas:
    - Monitor potential impacts to alluvium water quality with the rise in groundwater levels in rehabilitated areas, including Barry's Pit and Lemington North.
  - Cheshunt Pit and Riverview Pit Active Mining:

– Monitor drawdown and seepage from the Hunter River alluvium and identify potential impacts to GDEs and water users downstream of active mine areas. Results of water level monitoring are used to compare water level trends to model predictions.

9.6.1 | GROUNDWATER MONITORING METHODOLOGY

HVO engages suitably qualified and experienced contractors to carry out sampling and analysis. Sampling is undertaken in accordance with relevant Australian Standards and other regulatory guidelines. Specifically, Groundwater sampling is undertaken in accordance with AS5667.1-1998, *Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples and AS5667.11-1998*, *Guidance on the Sampling of Groundwater's*. Samples are analysed by laboratories that are National Association of Testing Authorities (NATA) accredited or equivalent for the parameters being analysed.

Representative monitoring bores in the alluvial aquifers and Permian strata have been fitted with data loggers for continuous depth to water measurement via either a pressure transducer (with barometric pressure correction) or vibrating wire piezometer (VWP) sensors. The monitoring schedule allows groundwater levels to be assessed in terms of impacts on regional aquifers, alluvial aquifers (Hunter River and Wollombi Brook), GDEs and private groundwater users. The impacts of the operation on water users and surrounding aquifers will be monitored, assessed and responded to as specified in section 11 |.

MONITORING LOCATIONS

Bore monitoring locations are shown in Figure 9-2 with a description of location, geographic coordinates, bore details, and bore purpose, provided in Appendix F:

MONITORING FREQUENCY

Monitoring of groundwater levels and groundwater quality is undertaken at the frequency specified in Appendix F:, and as further defined below:

- Groundwater Level:
  - Manual groundwater elevation/depth to groundwater every three months;
  - Pressure transducers continuous every six hours; and
  - VWP data logger download, and verification and validation of instrument drift and correction.
- Groundwater Quality:
  - Field readings of pH, EC, water temperature, dissolved oxygen (DO), and redox;
  - Groundwater Quality Analysis (Major Ions) – Water temperature, pH, EC, Total Dissolved Solids, Total Suspended Solids, iron, sulphate, chloride, calcium, magnesium, potassium, sodium, total alkalinity, bicarbonate alkalinity, carbonate alkalinity and hydroxide alkalinity; and
  - Groundwater Quality Analysis (Comprehensive) – In addition to the major ion analysis above, aluminium, antimony, arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silicon, strontium and zinc. All metals and metalloids required as total and dissolved analytes.

9.6.2 | GROUNDWATER IMPACT ASSESSMENT CRITERIA

Specific groundwater impact assessment criteria have been derived from predicted changes in the HVO North and HVO South EA's and also give consideration to minimal impact considerations in the AIP (Table

9-6). Performance against these assessment criteria will be reported in the Annual Review. Sufficient baseline groundwater data is available to guide the development and use of the various impact assessment criteria.

SLR were engaged in 2019 to complete a review of the HVO groundwater monitoring network, including review of trigger levels. This review was conducted to consider the opportunities to optimise the network. Bores were recommended to be removed from the network where they were damaged/destroyed and not providing representative groundwater data, where duplicate monitoring locations existed and where site activities have ceased since the bores were initially installed.

The monitoring network has been designed to focus on potential groundwater related impacts associated with active mining at West Pit, Cheshunt and Riverview Pits, as well as tailings storage at Carrington and North Void. Regional bores are also included to monitor recovery within historical mine areas around Lemington Pit, Barry's Pit, North Pit, Alluvial Lands and Carrington Pit. The baseline monitoring data for the proposed network bores was used to determine the water quality trigger levels.

Impact assessment criteria related to the performance of the Carrington West Wing Low Permeability Barrier will be developed in consultation with DPHI and Water Group prior to construction commencing.

The response to trigger levels is detailed in Section 10.1 |

Table 9-6: Groundwater Impact Assessment Criteria

CRITERIA	DESCRIPTION
1	*The groundwater level does not decline more than 2m at any privately owned bores and wells identified in the HVO complex EA's (with the exception of a single bore on land owned by the Ravensworth mine (10011459) which is predicted to decline by a maximum of 2.7m.)*
2	*Water quality does not lower the beneficial use category of the groundwater source beyond 40m from the mining pit. This will be identified using groundwater triggers (EC) for individual monitoring bores specified in the Groundwater Monitoring Programme.*
3	*The alluvial groundwater source within 40m of the recognised GDE communities does not experience more than a 10% reduction in piezometric levels predicted in the EA's for HVO North and HVO South (allowing for typical climatic variation).*

9.6.2.1 | GROUNDWATER QUALITY

Electrical Conductivity (EC) and pH are monitored in accordance with the frequency and methodology outlined in Appendix F:

Bores have been grouped where spatially and geologically relevant and field data aligns. A statistical analysis of groundwater quality data from individual bores was undertaken of all groundwater monitoring data between 2000 and 2023. The analysis of the baseline data is shown in Appendix D: The statistical analysis of pH and EC data from bores grouped based location and the groundwater source was used to derive the water quality triggers. During the statistical analysis for each group, outliers were removed using the four times standard deviation method.

The 5th and 95th percentiles of data for pH, and 95th percentile for EC is shown in Table 9-7. The trigger exceedance criteria for groundwater quality for each groundwater source includes:

- pH
  - Three consecutive readings recorded outside the 5th and 95th percentile trigger level range indicates a trigger exceedance.
- EC
  - Three consecutive readings recorded above the 95th percentile trigger level indicates a trigger exceedance.

9.6.2.2 | GROUNDWATER LEVEL

To ensure the AIP criteria for GDE's has been met, bores located in the alluvium near to the recognized GDE communities of the Carrington Billabong at HVO (CGW52a, CGW53a, CGW55a) will adopt the 5th and 95th percentile of the available validated data record for the standing water level for each site as the basis of groundwater management trigger guideline.

In addition, as part of the North Void Tailings Storage Facility (NV TSF) management groundwater level within bores CFW55R, CFW57, CGW54a, GW-123, GW 124, GW-125, GW-126, and GW 127 are also monitored. The trigger criteria for these bores are based on an increase of more than 0.5 m over a 12 month period (rising trend). An observed rise in groundwater levels by more than 0.5 m over a 12 month period, in conjunction with water quality changes not related to above average rainfall/Hunter River flow, will initiate an investigation into the cause of the trend by a suitably qualified person.

Manual groundwater level monitoring at Carrington Billabong is conducted on a monthly basis, with daily readings collected at bores equipped with timeseries loggers (refer to Appendix F:).

A trigger level exceedance occurs where three consecutive readings are below the individual bore trigger level specified in Table 9-7.

Table 9-7: Groundwater Monitoring Trigger Levels

Location		Lithology	Monitoring Location	Field EC (µS/cm)	Field pH		Standing Water Level (mAHD)		Sulphate (mg/L)	Sulphate/ Chloride Ratio (meq)
				95th Percentile	5th Percentile	95th Percentile	5th Percentile	95th Percentile		
HVO North	*Carrington Pit*	*Carrington Alluvium*	*CFW55R*	*N/A*	*6.8*	*8.0*	*Increase >0.5m in 12 months*		*2,000*	*0.80*
			CFW57						*680*	*0.50*
			CGW54a						*680*	*0.50*
			GW_123						*1,400*	*0.80*
			GW_124						*680*	*0.50*
			GW_125						*230*	*0.24*
			GW_126						*230*	*0.24*
			GW_127						*230*	*0.24*
			CGW52a	*9600*	*6.9*	*7.8*	*60.30*	*58.60*	*N/A*	
			CGW53a				*59.87*	*58.64*		
			CGW55a				*59.19*	*57.59*		

	North Pit	Hunter River Alluvium	PZ1CH200	2000	6.6	7.4	N/A	N/A
			PZ5CH1800					
			GA3					
	Carrington West Wing	Palaeochannel	CGW32	9600	6.9	7.8	N/A	N/A
			GW-106					
			CGW39					
			CGW49					
			CGW47					
		Palaeochannel Western Limb - Lower	4032P	2100	7.0	7.4	N/A	N/A
			4037P					
			4040P					
	Parnells Creek	Alluvium	GW_100	11000	7.3	7.6	N/A	N/A
HVO South	Cheshunt Pit	Regolith	BUNC45A	2529	6.6	6.8	N/A	N/A
		Hunter River Alluvium	CHPZ10A	1170	6.7	7.7	N/A	N/A
			CHPZ12A					
			CHPZ2A					
			CHPZ3A					
			CHPZ4A					
			Hobden's Well					
		Interburden	BZ1-1	9143	6.7	7.5	N/A	N/A
			HG2					
		Mt Arthur Seam	BC1a	2733	6.4	7.6	N/A	N/A
			BUNC45D					
			BZ1-3					
			CHPZ12D					
			CHPZ3D					
			HG2a					
	South Lemington Pit	Wollombi Brook Alluvium	Appleyard Farm	4510	6.6	8.0	N/A	N/A
			C919(ALL)					
			D317(ALL)					
			PB01(ALL)					
		Arrowfield Seam	C130(AFS1)	14306	6.9	7.7	N/A	N/A
			D406(AFS)					
		Bowfield Seam	B334(BFS)	9710	6.8	8.0	N/A	N/A
			B925(BFS)					
			C130(BFS)					
			C317(BFS)					
			C630(BFS)					
			D317(BFS)					
			D406(BFS)					

		Overburden	*C130(ALL)*	*26500*	*6.7*	*7.2*	*N/A*	*N/A*
		Mt Arthur Seam	*LUG Bore*	*8717*	*7.0*	*8.8*	*N/A*	*N/A*
		Woodlands Hill Seam	*C130(WDH)*	*21265*	*6.5*	*7.1*	*N/A*	*N/A*
			C317(WDH)	*11062*	*7.2*	*7.9*	*N/A*	*N/A*

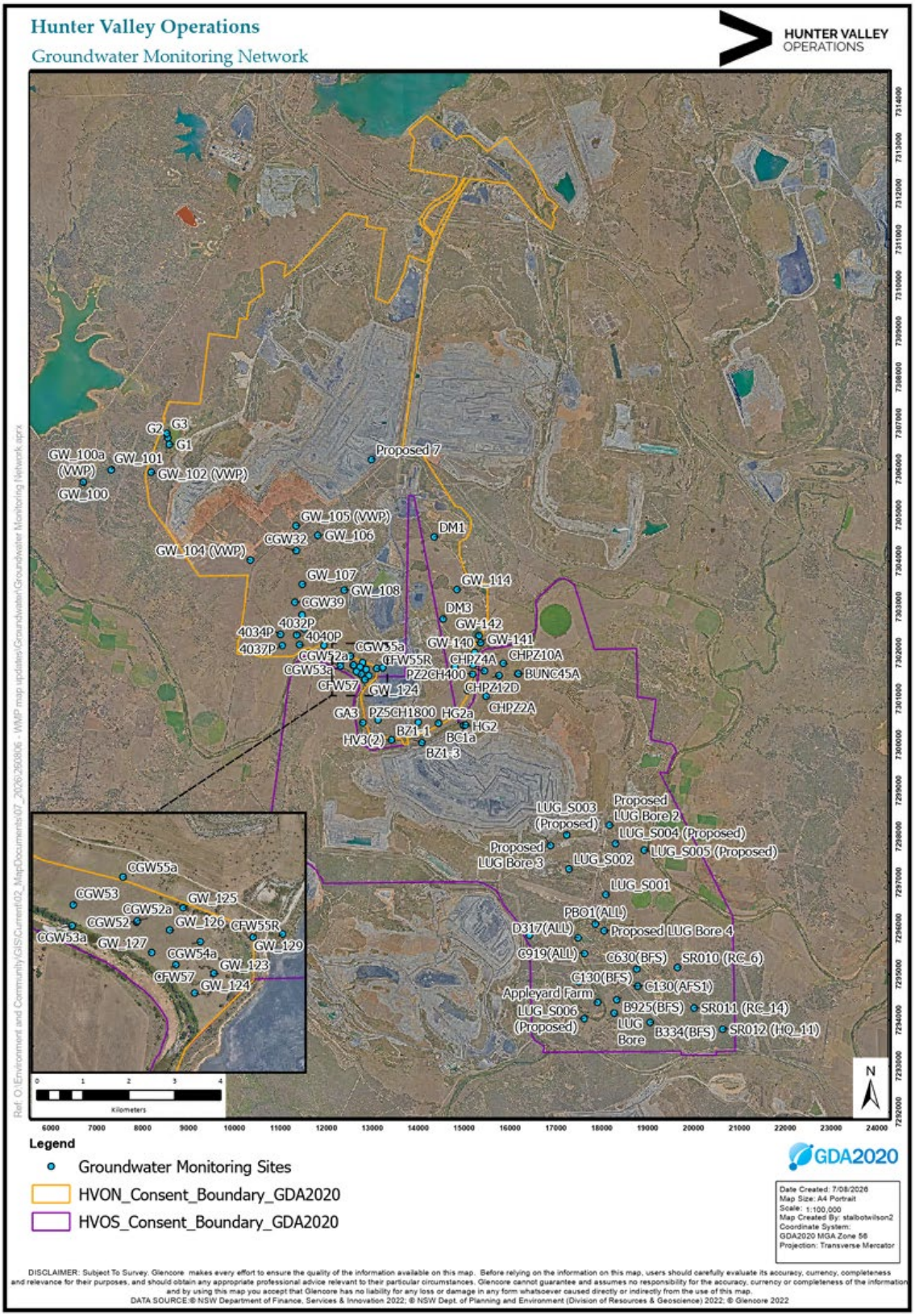

Figure 9-2: HVO Groundwater Monitoring Network

9.7 | VALIDATION OF GROUNDWATER MODEL

Every three years HVO will instigate an independent review (validation and recalibration, if necessary) of the groundwater model. The years for these reviews are based on the dates of the latest Environmental Assessments where the groundwater models were reviewed. HVO North was 2016 and HVO South was 2018.

10 | MONITORING STREAM AND RIPARIAN VEGETATION HEALTH

As required by Schedule 3 Condition 27, of the HVO South and HVO North Approvals, monitoring of impacts from surface water flows on stream and riparian vegetation health potentially affected by HVO along the Hunter River and Wollombi Brook will be conducted in accordance with the Surface Water Monitoring Program detailed in Section 7.3 |

Assessment of Riparian Vegetation health will be undertaken in accordance with the Rapid Appraisal of Riparian Condition (RARC) method developed by Land and Water Australia (2005) to assess the ecological condition of the riparian corridor of the Hunter River and Wollombi Brook at defined monitoring locations.

Assessment of stream stability will be undertaken in accordance with the CSIRO Ephemeral Stream[1] Assessment protocol to assess the erosional state of the Hunter River and Wollombi Brook at defined monitoring locations.

10.1 | PROGRAM FOR MONITORING STREAM AND RIPARIAN VEGETATION HEALTH

Monitoring of impacts from surface water flows on stream and riparian vegetation health potentially affected by HVO along the Hunter River and Wollombi Brook will be conducted in accordance with the Stream and riparian vegetation monitoring program detailed in Table 10-1 and shown on Figure 10-1. The frequency is based on the perennial or intermittent nature of high flow in the Hunter River and Wollombi Brook. In areas of low flow / rainfall there would be minor amounts of water flow in the area to impact on stream health, limiting the effectiveness of monitoring at a higher frequency than annually. Any impacts are likely to be following discharge events from the site, both due to the discharge from site itself, and the higher flow / rainfall that is typically associated with discharge events being available.

Table 10-1: Stream and Riparian Vegetation Health Monitoring Program

MONITORING LOCATION	Parameter	Frequency
HR1 – Hunter River Upstream	*Channel Stability*	
HR2 – Hunter River Mid-Stream		
HR3 – Hunter River Down Stream		

MONITORING LOCATION	Parameter	Frequency
WB1 – Wollombi Brook Up Stream	*Riparian Vegetation Health*	*Annually or once annually after a discharge event.*
WB2 – Wollombi Brook Down Stream		

[1] Although the Hunter River and Wollombi Brook experience perennial or intermittent flows, published methods for assessment of stream stability are not available. However, the CSIRO publication provides adequate assessment methods for these stream types.

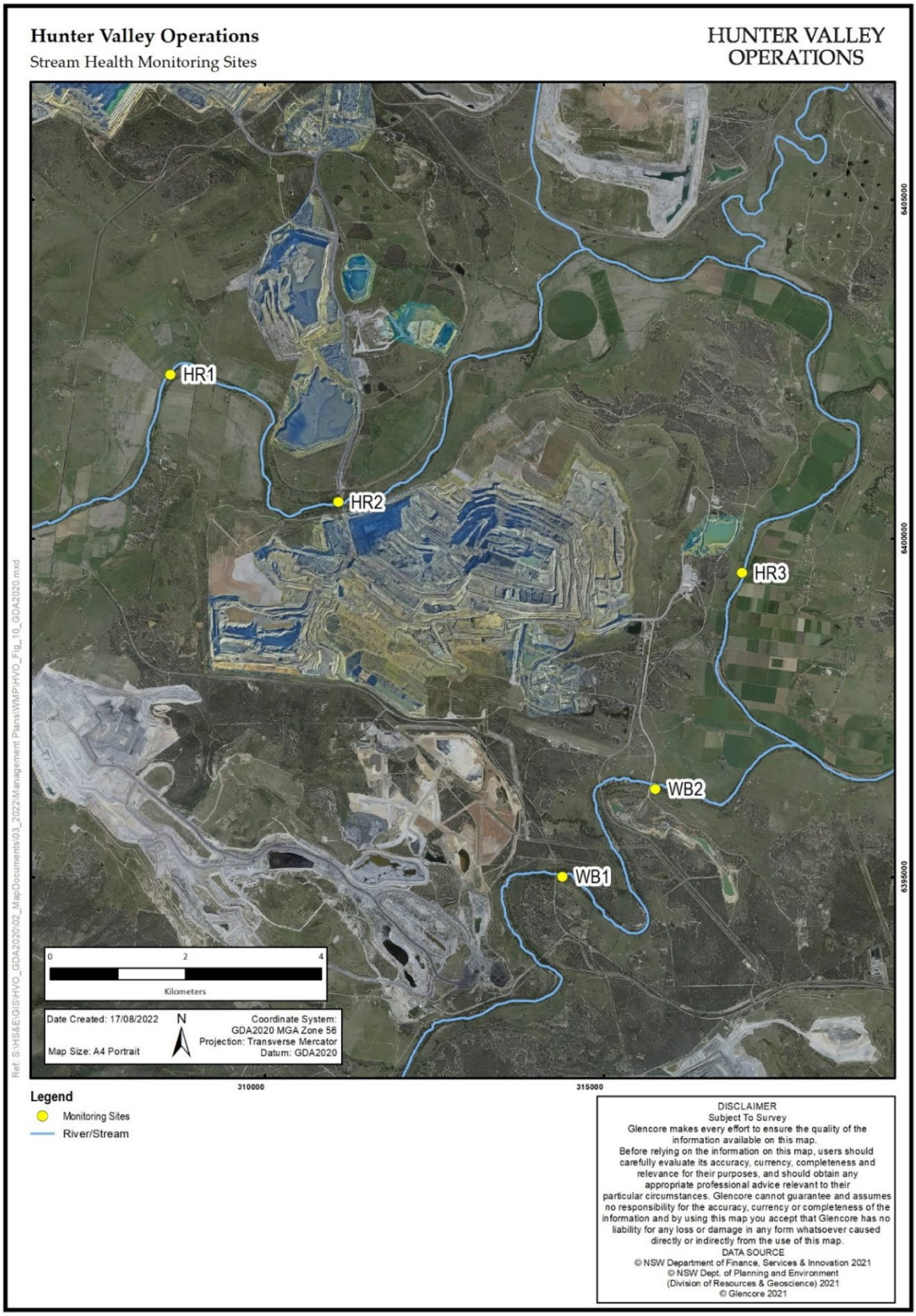

Figure 10-1: Stream Health Monitoring Sites

10.1.1 | STREAM STABILITY MONITORING

Assessment of stream stability will be undertaken by a suitably experienced person in accordance with the CSIRO Ephemeral Stream Assessment protocol to assess the erosional state of the Hunter River and Wollombi Brook at defined monitoring locations.

Although the Hunter River and Wollombi Brook experience perennial or intermittent flows, published methods for assessment of stream stability are not available. However, the CSIRO publication provides adequate assessment methods for these stream types.

The assessment incorporates routine visual observations to evaluate of four key indicators to rate the erosional state of the stream:

1. The type and condition of the vegetation present, if any;
2. The shape and profile of the drainage line and type of materials on the drainage line floor;
3. The nature of the drainage line wall materials; and
4. The nature of the stream bank bordering flats and/or slopes and regulation of lateral flow into

the drainage line.

The indicators produce a rating based on a scoring system, and the combined total of the indicators rank each monitoring location from very actively eroding through to very stable as shown in Table 10-2**.**

Scores can be statistically analysed and compared with those calculated for the same monitoring locations in the future to monitor any changes in the erosional state at the monitoring location. Baseline data will be established during the initial monitoring event which will be undertaken within 3 months of approval of Version 3.2 of this Management Plan. Outcomes of the monitoring and assessments will be reported in the Annual Review.

10.1.1.1 | STREAM STABILITY ASSESSMENT CRITERIA

Should a monitoring event indicate a decrease in the stream stability classification a review will be undertaken to determine the potential causes. Should the causes of degradation of stream stability be identified to be a result of activities associated with HVO, an investigation will commence within a month to identify remedial actions as soon as practicable.

Table 10-2: Stream Stability Assessment Criteria

ACTIVITY RATING (%)	CLASSIFICATION	DISCUSSION OF CLASSIFICATION
80 +	*Very Stable*	*Drainage line is very stable and likely to be in original form. It is able to withstand all flow velocities that have previously occurred in this area and only minimal monitoring is required, predominantly after high flow events, to ensure condition does not deteriorate.*

ACTIVITY RATING (%)	CLASSIFICATION	DISCUSSION OF CLASSIFICATION
70-80	*Stable*	*Drainage line is stable. It is important to assess this zone in relation to the other classifications and define whether this zone is moving from potentially stabilising to a more stable form, or if it is deteriorating from a very stable form. The nature of this relationship will identify the type of monitoring required.*
60-69	*Potentially Stabilising*	*Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.*
50-59	*Active*	*Drainage line is actively eroding and remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.*
<50	*Very Active*	*Drainage line is very actively eroding and immediate remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.*

Source: CSIRO Ephemeral Stream Assessment Protocol

10.1.2 | RIPARIAN VEGETATION HEALTH

Assessment of Riparian Vegetation health will be undertaken by a suitably experienced person in accordance with the Rapid Appraisal of Riparian Condition (RARC) method developed by Land and Water Australia (2005) to assess the ecological condition of the riparian corridor of the Hunter River and Wollombi Brook at defined monitoring locations.

RARC is an assessment incorporating numerous components, which together can estimate the overall health and condition of an area of riparian vegetation. The assessment will result in an overall score with a corresponding classification, (very poor to excellent as shown in Table 10-3, calculated for riparian vegetation at each monitoring location. Scores are developed based on five key indicators including:

1. Habitat (continuity of vegetation and proximity to nearby vegetation);
2. Vegetation cover (canopy, understory, ground cover and number of layers);
3. Native Species (percentage native species in each layer);
4. Debris (leaf litter, standing dead trees, potential habitat bearing trees both standing and fallen); and
5. Features (Native species regeneration, grasses and reeds).

Scores can be statistically analysed and compared with those calculated for the same monitoring locations in the future to monitor any changes in riparian vegetation condition over time. Baseline data

will be established during the initial assessment which will be undertaken within 3 months of approval of Version 3.2 of this Management Plan. Outcomes of the assessments will be reported in the Annual Review.

10.1.2.1 | RIPARIAN VEGETATION ASSESSMENT CRITERIA

Should a monitoring event indicate a decrease in the riparian vegetation health classification a review will be undertaken to determine the potential causes. Should the causes of degradation of riparian vegetation health be identified to be a result of activities associated with HVO, an investigation will commence within a month to identify remedial actions as soon as practicable.

Table 10-3: RARC Assessment Criteria

RARC TOTAL SCORE	CLASSIFICATION
40-50	*Excellent*
35-39	*Good*
30-34	*Average*
25-29	*Poor*
<25	*Very Poor*

11 | IMPLEMENTATION OF THE WMP

11.1 | RESPONSE TO EXCEEDANCE & PERFORMANCE INDICATORS

The following management responses will be routinely implemented as per below.

- Formal review of measured depressurisation of coal measures and alluvial aquifers will be undertaken annually by a suitably qualified hydrogeologist.
- The predicted loss of water from the alluvial aquifer and from baseflow in the Hunter River and Wollombi Brook will be offset by ensuring sufficient entitlements are held from the Hunter Regulated River and Unregulated Water Sharing Plan.

11.2 | TRIGGER ACTION RESPONSE PLAN

The objective of the Trigger Action Response Plan (TARP) is to support the WMP by providing appropriate response protocols for events that may result in adverse impacts to the surrounding surface water and/or groundwater environment. Table 11-1 outlines the response protocol for anticipated water management events. In addition to the protocols defined in Table 11-1 HVO has developed a Pollution Incident Response Management Plan (PIRMP), in accordance with the requirements of the Protection of the Environment Operations Act 1997. The PIRMP details the incident reporting process to be utilised in the event of an environmental incident.

Table 11-1: HVO Water Management TARP

Event Trigger	Summary of Response Protocol
Breach Licensed Discharge Non-compliance with EPL and HRSTS discharge limits for: • pH; • total suspended solids (TSS);	• Investigate results, considering any mitigating factors where applicable; • Determine if an incident has occurred; If an incident has occurred: • Report results to senior management; and • Notify relevant regulators (e.g DPHI, EPA etc) immediately after becoming aware of incident • Provide report on incident to relevant regulators within seven days.
Water Quality • three consecutive measurements of EC, pH or Standing water level (for specific groundwater sites only) exceed trigger values. • One measurement of TSS exceeds the trigger value.	• Investigate results and trends, considering any mitigating factors where applicable; • Determine if an incident has occurred related to HVO; • Initiate detailed investigation if trends indicate potential for environmental harm; If an incident has occurred: • Report results to senior management; and • Notify relevant regulators (e.g DPHI, EPA etc) immediately after becoming aware incident

	• Undertake mitigation actions as required. • Provide report on incident to relevant regulators within seven days
Failure of an Erosion and Sediment Control Structure/Overflow from Mine WMS Dirty/Mine water discharged to natural environment.	• Investigate results, considering any mitigating factors where applicable; • Determine if an incident has occurred related to HVO; • Initiate detailed investigation if trends indicate potential for environmental harm; If an incident has occurred: • Report results to senior management; and • Notify relevant regulators (e.g DPHI, EPA etc) immediately after becoming aware incident • Review adequacy of Erosion and Sediment Control Structure and the maintenance and inspection regime; and • Undertake mitigation actions as required • Provide report on incident to relevant regulators within seven days

11.3 | REPORTING

The process for compliance reporting is described in Table 11-2**.** The WMP will be available on the HVO website.

Table 11-2: Water Quality Management Reporting

REPORTING ASPECT	RELEVANT LEGISLATION	WHAT IS REPORTED	WHEN	WHO TO REPORT TO
Results of water monitoring undertaken in accordance with the requirements of this approval	Condition 8 & 12 of Schedule 5 of the HVO North Consent (DA 450-10-2003) Condition 3 & 9 of Schedule 5 of HVO South Consent (PA 06_0261)	Monitoring results	Monthly	Public via the company website HVO website The HVO Community Consultative Committee (CCC)
Results of monitoring collected in accordance with EPL	PoEO Act, Schedule 2, Section 66	Monitoring results	Within 14 days of receipt - reported on the HVO website (monthly summary)	Public via the company website

REPORTING ASPECT	RELEVANT LEGISLATION	WHAT IS REPORTED	WHEN	WHO TO REPORT TO
Annual review	Condition 9 of Schedule 5 of the HVO North Consent (DA 450-10-2003) Condition 4 of Schedule 5 of HVO South Consent (PA 06_0261)	All water monitoring results for the corresponding year. The Annual Review will also detail any complaints relating to water quality received at HVO	By the end of March each year	Relevant stakeholders including but not limited to EPA, DPHI, Singleton Council and Community Consultative Committee (CCC)
HRSTS Annual Report	EPL 640 R5.1	Report on activities carried out under the HRSTS for last financial year.	29 August each year	NSW EPA
Turbidity Report	EPL 640 R5.2	Graphical analysis of continuous turbidity against continuous discharge volume measured at EPA Point 3 and 4 for the length of any discharges from EPA Point 3 and 4.	Within 60 days of anniversary date of EPL 640	NSW EPA
Water Quality Monitoring Report	EPL 640 R5.8	Annual water quality monitoring report, as detailed in Condition R5.8 of EPL 640.	Within 60 days of anniversary date of EPL 640	NSW EPA
Sewage Treatment Systems	EPL 640 R5.5	Annual sewage treatment system maintenance program records.	Within 60 days of anniversary date of EPL 640	NSW EPA
Potential Or Confirmed Exceedance / Noncompliance of Water Triggers (Internal Reporting)	HVO Environmental Management Strategy	Details of potential or confirmed exceedance / noncompliance of water triggers incidents	By exception	The Environmental Superintendent reports to the Environment and Community Manager
Trigger Exceedance Investigation Determines Contingency Measures Required	HVO Environmental Management Strategy	Details of the trigger exceedance investigation and contingency measures to be enacted	Following exceedance investigation	Relevant stakeholders including but not limited to DPHI, Water Group

REPORTING ASPECT	RELEVANT LEGISLATION	WHAT IS REPORTED	WHEN	WHO TO REPORT TO
Incident Causing or Threatening to Cause Environmental Harm	PoEO Act, Section 148	Details of incident	Notification Immediately following receipt of information indicating actual or potential harm Incident report to be provided within 7 days of the incident	Relevant stakeholders including but not limited to EPA, DPHI, Water Group EPA notification by telephoning the Environment Line service on 131555.
Water Use	Water Access Licence under the WMA	Water supply and use NB: Where conditions of Water Licences issued by NoW dictate, a compliance report, which reports on the results of the Groundwater Monitoring and Contingency Plan required by a Water Licence, will be lodged Water Group	Annually	Reported on in the AR and in accordance with Water Licence requirements.
Annual Environmental Audit Report	Water Act 1912 20BL173587 (WAL40462) 20BL173588 (WAL40462) 20BL173589 (WAL40462)	report on: • Compliance with the terms and conditions of the relevant Water Licence, including any Groundwater Monitoring and Contingency Plan; • Actual impacts of the extractions on any aquifers, groundwater dependant eco-systems and any streams in the area; • The difference between actual and predicted impacts (modelled results); and • Recommendations as to works that ought to be performed or additional obligations that ought to be imposed in order to rectify any impacts on groundwater.	Annually	Reported on in the AR

11.4 | MANAGEMENT OF UNPREDICTED IMPACTS

Contingency measures will be implemented commensurate with the degree of impacts determined by the investigation. Depending on the outcomes of an investigation, one or a number of remedial actions may be taken.

Remedial actions for surface water may include:

1. intercepting and pumping the water back into the mine water management system;
2. establishment of containment or diversion systems upstream to prevent the water discharging offsite;
3. establishing controls to improve the water quality; and/or
4. cease or modify any activity that may be degrading the water quality; and/or
5. additional water licences or water allocations will be sourced if required to ensure that HVO's water allocation is not exceeded.

Remedial actions for groundwater may include:

1. more intensive monitoring and/or seeking professional advice in regard to model predictions; and/or
2. geotechnical investigations; and/or
3. structural assessments; and/or
4. contingency measures to ensure the long term viability of recognised GDE's, as guided by suitable professionals, (to the satisfaction of the Minister, as required in the AIP) and/or.
5. consideration of changes to the mine plan if required. Monitoring and reporting would be continued to demonstrate the effectiveness of the actions in remediating the water excursion.

11.5 | COMPLAINTS MANAGEMENT

Community Complaints are lodged via the Complaints and Blasting Hotline (1800 888 733). The hotline number will be prominently displayed on the HVO website and regularly advertised in the local newspaper. The Community Complaints and Blasting Hotline will be in operation 24 hours per day, seven days a week.

Complaints will be recorded and investigated by HVO staff. All other complaints lodged via letter, in person or by fax, will also be recorded and investigated by Environment & Community Personnel.

All complaints will be investigated, and, where the investigation identifies potential non-compliance with a consent or licence condition, mitigating action will be taken.

The details of all water related complaints, and any mitigating actions taken, will be circulated to senior management. Where requested, follow-up correspondence with the complainant will be provided.

HVO will maintain a register of complaints in accordance with the conditions of EPL 640 relating to handling of pollution complaints. This register will be updated on the HVO website monthly.

11.6 | CONTINUOUS IMPROVEMENT/QUALITY ASSURANCE

HVO will continuously seek to further water management by way of improving existing controls or implementing new controls where required and thoroughly investigating any exceedance and non-compliance events.

HVO has developed an Assurance Plan HVOOC-1797567310-3745 to measure HSEC performance and ensure that Health, Safety Environment and Community practices are adequate across the operation.

11.7 | ROLES AND RESPONSIBILITIES

Table 11-3: Roles and Responsibilities

ROLE	RESPONSIBILITIES
MINE SERVICES SUPERINTENDENT	*Manage water in compliance with the WMP and HVO Water Management procedures.* *Water infrastructure in the mining area is regularly inspected and maintained. Specifically:* o *Maintain dewatering capability.* o *Systems to protect against sudden inrushes of water are operational.* *Budget for the maintenance of all permanent clean, sediment, erosion control and mine water drains and dams.* *Mitigate spills, leaks and unlicensed discharges.* *Water supply from the mine meets supply demands of the CHPP's.* *Water management infrastructure is designed and constructed in accordance with this WMP and HVO Water Management procedures.* *Water is ordered and administered in accordance with the WMA.*

ROLE	RESPONSIBILITIES
ENVIRONMENT & COMMUNITY MANAGER	*A site Water Management Plan is prepared, implemented & maintained.* *Surface and groundwater monitoring programmes are implemented and current.* *Review and reporting of water data is consistent with regulatory requirements.* *Administer and manage compliance with water licenses.* *Design and budget for the construction of small to medium cleanwater diversions and, sediment/erosion control structures and discharge facilities.* *Budget for water management infrastructure inspections and storage facility inspections as required.* *Manage releases of water for the mine site so that releases comply with statutory requirements.* *Advise Managers for Short, Medium and Long Term Mine Planning on water management control & planning requirements.* *Prepare site water balances that define water use, storage and discharge requirements.* *Regularly monitor the availability, use, quality and discharge of water with licence requirements and relevant site management plans.*
CHPP MANAGER	*Manage water in compliance with the WMP and HVO Water Management procedures.* *Water infrastructure in the CHPP area of accountability is regularly inspected and maintained.* *Mitigate spills, leaks and unlicensed discharges.* *Water is ordered and administered in accordance with the WMA.* *Water management infrastructure is designed and constructed in accordance with this WMP and HVO Water Management procedures.* *Communicate the WMP to relevant members of team.* *Maintain operational procedures and work instructions for the management of water in the CHPP area.*

ROLE	RESPONSIBILITIES
MAINTENANCE MANAGER	*Water is managed in compliance with the WMP and the HVO Water Management procedures.* *Water infrastructure in the Maintenance area of accountability is regularly inspected and maintained.* *Mitigate spills, leaks and unlicensed discharges.* *Planned maintenance schedules are implemented to maintain water infrastructure in the mining area.* *Provide EPCM for water management projects.* *Water management infrastructure is designed and constructed in accordance with this WMP and HVO Water Management procedures.* *Communicate the WMP to relevant members of team.* *Maintain operational procedures and work instructions for the management of water in the Maintenance area.*
TECHNICAL SERVICES MANAGER	*Incorporate surface and ground water management into mine planning and landform design.*

12 | REVIEW

The WMP will be reviewed within three months of the submission of the Annual Review and updated to the satisfaction of the DPHI where necessary.

The WMP will also be reviewed within three months of submission of an incident report relating to water, the submission of an independent environmental audit report or approval of a modification to the consent. Within 6 weeks of conducting any such review, HVO will advise the Secretary of the outcomes and provide revised documents (where required) to the Secretary for review and approval.

Any major amendments to the WMP that affect its application will be undertaken in consultation with the appropriate regulatory authorities and stakeholders. Minor changes such as formatting edits may be made with version control.

13 | DOCUMENT INFORMATION

13.1 | REFERENCE INFORMATION

REFERENCE	TITLE
DA 450-10-2003	*HVO West Pit – Development Consent*

REFERENCE	TITLE
PA 06_0261	*HVO South Pit – Project Approval*
HVOOC-1797567310-3745	*Assurance Plan*
-	*The Environmental Impact Assessment titled 'Hunter Valley Operations – West Pit Extension and Minor Modifications', dated October 2003, and prepared by Environmental Resources Management Australia.*
-	*The 'Carrington West Wing Environmental Assessment', dated 1 October 2010, and prepared by EMGA Mitchell McLennan (CWW EA).*
-	*The Environmental assessment titled 'Hunter Valley Operations South Coal Project Environmental Assessment Report', Volumes 1, 2 and 3, dated January 2008, including the response to submissions.*
-	*The Environmental assessment titled 'Hunter Valley Operations South Coal Project- Modification 5 Environmental Assessment Report', dated February 2017, including the response to submissions.*
-	*FAO 2013, Food and Agricultural Organisation of the United Nations http://www.fao.org/docrep/t0667e/t0667e05.htm.*

13.2 | DOCUMENT CONTROL

VERSION	DATE	CHANGE DETAILS	REVIEW TEAM	REGULATOR APPROVAL DATE
1	*20/12/2013*	*Original*	*Chris New (E&C Specialist)*	-
1.0	*30/04/2014*	*Barry's extension approval- additional conditions & P&E feedback from v1*	*Chris New (E&C Specialist)*	-
1.1	*27/05/2015*	*Approval from P&E on 28/5/14*	*Chris New (E&C Specialist)*	*28/5/2014*
1.2	*17/07/2015*	*Updated water monitoring programmes, approved by P&E on 10/7/15*	*Chris New (E&C Specialist)*	*10/7/2015*
1.3	*04/05/2016*	*Annual update to water monitoring programmes*	*Chris New (E&C Specialist)*	-
2	*22/11/2017*	*Revision to align with new ownership management practices (Yancoal).* *Review following HVO North Mod. 7*	*Andrew Hodge (E&C Specialist)*	-
	27/7/2018	*Review following HVO South Mod.5.* *Incorporation of comments from CLWD review of the plan.* *Rebranding due to HVO joint venture commencement.*	*Andrew Hodge (E&C Specialist)*	*16/10/2018*
3	*28/02/2019*	*Revision to included Stream Health & Riparian Monitoring Program.* *Update Document Format & minor changes*	*Andrew Speechly (E&C Manager)*	-

VERSION	DATE	CHANGE DETAILS	REVIEW TEAM	REGULATOR APPROVAL DATE
	03/07/2020	*Revision following Feedback from DP&E* *Review following submission of 2018 Annual Review.* *Review following Groundwater Monitoring Network Review.* *Review following submission of 2019 Independent Environmental Audit.*	*Andrew Speechly (E&C Manager)*	-
	15/07/2021	*Revision following feedback from DPIE*	*Keith Simkin (E&C Coordinator)* *Brenton Hubert (E&C Coordinator)*	-
	04/04/2022	*Revision following approval of PA 06_0261 Mod 6*	*Keith Simkin (E&C Coordinator)*	-
	5/10/2022	*Revision following approval of PA 06_0261 Mod 7*	*Brenton Hubert (E&C Superintendent)* *Andrew Speechly (E&C Manager)* *Chris Bonomini (Water Consultant Specialist)*	-
	14/06/2023	*Revision following approval of PA 06_0261 Mod 8,* *Review following submission of 2022 Annual Review* *Review following submission of 2022 Independent Environmental Audit.*	*Brenton Hubert (E&C Superintendent), Andrew Speechly (E&C Manager)*	-
	25/06/2024	*Revision following submission of 2023 Annual Review*	*Brenton Hubert (E&C Superintendent),*	
	30/06/2025	*Revision following submission of 2024 AR and DA 450-10-2003 Mod 8 Approval*	*Brenton Hubert (E&C Superintendent), Ben de Somer (E&C Manager)*	

VERSION	DATE	CHANGE DETAILS	REVIEW TEAM	REGULATOR APPROVAL DATE
	11/08/2025 *17/11/2025*	*Revision following submission of 2024 AR and DA 450-10-2003 Mod 8 Approval* *Update to address comments received from DCCEEW.*	*Brenton Hubert (E&C Superintendent),* *Ben de Somer (E&C Manager)*	*27/03/2026*
4.0	*10/08/2026*	*Revision following submission of 2025 AR and 2025 IEA*	*Sam Talbot Wilson (E&C Officer), Brenton Hubert (E&C Superintendent)*	*11/09/2026*

APPENDIX A: APPROVAL OF WATER MANAGEMENT PLAN

Department of Planning, Housing and Infrastructure

NSW GOVERNMENT

Our ref: DA450-10-2003-PA-120

Ben de Somer
Manager Environment and Community
1011 LEMINGTON ROAD
Lemington, New South Wales, 2230

11/09/2026

Subject: Water Management Plan

Dear Mr de Somer

I refer to the Water Management Plan (the Plan) which is required under Condition 27 of Schedule 3 of the consent for HVO North – West Pit Consent 2003 (DA450-10) and Condition 4A of Schedule 5 for the consent HVO – South (MP06-0261).

I note that administrative updates have been made to the Plan including the revision of figures to reflect the site water balance and water licences and that the Plan contains the information required by the conditions of consent.

In accordance with Condition 3A of Schedule 5 of the consent for HVO North – West Pit Consent 2003 (DA450-10) and Condition 1C of Schedule 5 HVO South (MP06-0261), The Department agrees that consultation is not required for the revision of the Plan given the administrative nature of the updates

Accordingly, as nominee of the Planning Secretary, I approve the Water Management Plan (Submitted 11 August 2026).

You are reminded that if there are any inconsistencies between the Plan and the conditions of approval, the conditions prevail.

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Patrick Worthington at Patrick.worthington@dphi.nsw.gov.au

Yours sincerely

Jack Turner
Team Leader
Resource Assessments
As nominee of the Planning Secretary

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150 www.dphi.nsw.gov.au 1
Locked Bag 5022, Parramatta NSW 2124

Department of Planning, Housing and Infrastructure

NSW GOVERNMENT

Our ref: MP06_0261-PA-174

Ben de Somer
Manager Environment and Community
Hunter Valley Operations
Via Major Projects Portal

27/03/2026

Subject: Water Management Plan

Dear Mr de Somer

I refer to the Water Management Plan which has been submitted following revision after the submission of Annual Reviews and a modification to DA 450-10-2003, as required under Condition 4 of Schedule 5 of the consent for the HVO North mine (DA 450-10-2003) and Condition 4A of Schedule 5 of the consent for the HVO South mine (PA 06_0261). I also acknowledge your response to the Department's review comments and request for additional information.

I note the Water Management Plan

- is prepared to meet the respective requirements for a water management plan under the consents for HVO North and HVO South;
- has been prepared in consultation with the NSW Environment Protection Authority and NSW Department of Climate Change, Energy, the Environment and Water – Water Group; and
- contains the information required by the conditions of consent.

The Department has carefully reviewed the document and is satisfied that it meets the requirements of the relevant conditions in respective consents for HVO North (DA 450-10-2003) and HVO South (PA 06_0261).

The Department notes the residual advice Water Group has identified it provided on the development applications for the HVO North Continuation Project (SSD-11826681) and HVO South Continuation Project (SSD-11826621), which are subject to ongoing assessment by the Department.

Accordingly, as nominee of the Planning Secretary, I approve the Water Management Plan (submitted 13 March 2026), subject to the following condition:

1. Within 12 months from the date of this letter, update the Water Management Plan based on the Water Group advice OUT25/16431 dated 18 December 2025, unless otherwise agreed by the Planning Secretary.

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150 www.dphi.nsw.gov.au 1
Locked Bag 5022, Parramatta NSW 2124

With the agreement of the Planning Secretary, the plan may not need to be updated depending on status of the development applications for the HVO North Continuation Project (SSD-11826681) and HVO South Continuation Project (SSD-11826621).

You are reminded that if there are any inconsistencies between the Plan and the conditions of approval, the conditions prevail.

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Jack Turner on 9995 587.

Yours sincerely

Stephen O'Donoghue
Director
Resource Assessments

As nominee of the Planning Secretary

APPENDIX B: SECRETARY ENDORSEMENT OF SUITABLY QUALIFIED AND EXPERIENCED AUTHOR

NSW GOVERNMENT | Planning & Environment

Resource Assessments
Planning Services
Contact: Melissa Anderson
Phone: 8275 1392
Email: Melissa.anderson@planning.nsw.gov.au

Mr Andrew Speechly
Manager Environment and Community
Hunter Valley Operations
PO Box 315
Singleton NSW 2330

Dear ~~Mr Speechly~~ Andrew

Hunter Valley Operations (DA 450-10-2003 and MP 06_0261)
Approval of Suitably Qualified and Experienced Persons

I refer to your letter dated 27 February 2019, seeking approval of a suitably qualified and experienced person to revise the Hunter Valley Operations Project's Water Management Plan, as required under condition 27 of Schedule 3 of HVO North (DA 450-10-2003) and condition 27 of Schedule 3 of HVO South (MP 06_0261).

The Secretary has approved Mr Andrew Speechly as a suitably qualified and experienced person to revise the Project's Water Management Plan.

Should you have any questions in relation to this matter, please contact Melissa Anderson on the above details.

Yours sincerely

Howard Reed 27.2.19
Howard Reed
Director Resource Assessments
as the Secretary's nominee

Department of Planning and Environment
320 Pitt Street Sydney 2000 | GPO Box 39 Sydney 2001 | planning.nsw.gov.au

APPENDIX C: CORRESPONDENCE WITH DPE WATER AND THE EPA

NSW Department of Climate Change, Energy, the Environment and Water

NSW GOVERNMENT

Our ref: OUT25/15362

Jack Turner
Planning Group
NSW Department of Planning, Housing and Infrastructure

Email: Jack.Turner@planning.nsw.gov.au

19 December 2025

Subject: HVO North and South Complex - MP06_0261-PA-174 - Water Management Plan

Dear Jack Turner,

I refer to your request for advice sent on 21 November 2025 to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Water Group about the above matter.

NSW DCCEEW Water Group has reviewed the Water Management Plan and has recommendations regarding water supply take and licensing, and groundwater monitoring.

Should you have any further queries in relation to this submission please do not hesitate to contact the Water Assessments team at water.assessments@dcceew.nsw.gov.au.

Yours sincerely,

Rob Brownbill,
Manager, Water Assessments, Knowledge Division
NSW Department of Climate Change, Energy, the Environment and Water

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150
Locked Bag 5022, Parramatta NSW 2124
https://www.nsw.gov.au/departments-and-agencies/dcceew

Attachment A

Detailed advice regarding the HVO North and South Complex - MP06_0261-PA-174 - Water Management Plan

1.0 Water supply, take and licensing

1.1 Recommendation – pre-approval

The Department of Planning, Housing and Infrastructure (DPHI) should request the proponent to quantify the maximum annual predicted volumes of water take due to the project from each water source by summarising within a table.

Explanation

The proponent has partially addressed this in Table 9-4; however, this requires further information. This table must outline take per source/management zone and should be for predicted volumes rather than previous take.

2.0 Groundwater monitoring

2.1 Recommendation – pre-approval

DPHI should request the proponent to update the Water Management Plan to address the recommendations made in previous DCCEEW Water Group advice on 8 September 2025 (OUT25/10329) and 18 December 2025 (OUT25/16431) and resubmit the WMP for further review by the DCCEEW Water Group.

Explanation

Recommendation 2.1 in our correspondence OUT25/10329 requested that Table 11-1 of the WMP include a timeframe for addressing any performance target exceedances; and recommendation 2.2 sought the inclusion of groundwater level triggers in the alluvial aquifer for the North Pit, Cheshunt Pit and South Lemington Pit areas. The WMP has not been updated with these improvements.

Additionally, our very recent advice contained in a Response to Submissions for HVO North and South expansion (OUT25/16431) identified improvements for groundwater level reporting and predictions. Please refer to that advice for details.

End Attachment A

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150
Locked Bag 5022, Parramatta NSW 2124
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NSW Department of Climate Change, Energy, the Environment and Water

NSW GOVERNMENT

Our ref: OUT25/10329

HV Operations
Hunter Valley Operations

Email: environmentand community@hvo.com.au

8 September 2025

Subject: **Hunter Valley Operations (MP06_0261) – Water Management Plan – Version 4**

Dear HV Operations,

I refer to your request sent on 11 August 2025 to the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) Water Group about the above matter.

NSW DCCEEW Water Group has reviewed the HVO Water Management Plan and makes recommendations in regard to:

- Reviewing water licensing details.
- Updates to the Trigger Action Response Plan.

Please see **Attachment A** for more detail.

Should you have any further queries in relation to this submission please do not hesitate to contact the Water Assessments team at water.assessments@dcceew.nsw.gov.au.

Yours sincerely

Rob Brownbill,
Manager Water Assessments, Water Knowledge
NSW Department of Climate Change, Energy, the Environment and Water

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150
Locked Bag 5022, Parramatta NSW 2124
https://www.nsw.gov.au/departments-and-agencies/dcceew

Attachment A

Detailed advice to Hunter Valley Operations regarding the HVO Water Management Plan, Version 4

1.0 Water licensing and document referencing

1.1 Recommendation – pre-approval

The proponent should:

- Review and update Table 1-1 to ensure correct references to section of the Water Management Plan (WMP) where performance conditions are addressed and include additional information where necessary.
- Ensure that relevant nomination of work dealing applications for Water Access Licences (WALs) to account for water take by the project have been completed prior to the water take occurring.

Explanation

Table 1-1 includes a number of references to WMP sections, eg. 5.9, 5.10, 10.2, 10.3, 10.5 that were not provided in this version for review. It is unclear whether this information is addressed elsewhere or is missing from the document. These references need to be updated and additional information included where relevant to enable DCCEEW Water to complete the review.

It is noted that WAL39798 listed in Table 6-2 has no active links to works in the Department's system and therefore is not authorised to account for take of water. WALs must not be used to account for take of water until they are linked to an extraction point or they may be in breach of the *Water Management Act 2000*.

1.2 Recommendation – pre-approval

The proponent should quantify the maximum annual predicted volume of water take due to aquifer interference activities required for the project within each water source by summarising within a table.

Explanation

Information has been provided on water access licence entitlements for groundwater sources but the predicted water take for each groundwater source has not been broken down into a format to enable licensing requirements to be easily and accurately determined for each water source.

2.0 Trigger Action Response Plan

2.1 Recommendation – pre-approval

The proponent should update Table 11-1 to include a timeframe that addresses performance target exceedances.

Explanation

Table 11-1 of the Trigger Action Response Plan does not include a timeframe that addresses performance target exceedances, this must be addressed.

2.2 Recommendation – pre-approval

The proponent should:

- Update Table 9-7 to include groundwater level triggers for additional alluvial aquifer areas including North Pit, Cheshunt Pit and South Lemington Pit.
- Clarify the baseline data and trigger value setting as several bores have the same EC trigger values.

Explanation

Groundwater level triggers are missing for most areas including North Pit, Cheshunt Pit and South Lemington Pit, in particular the proximal alluvial aquifers where mined coal seams sub-crop. Table 9-7: Groundwater Monitoring Trigger Levels therefore requires an update.

Clarity around the baseline data and setting the trigger values is also required as several of the bores appear to have the same EC trigger values. For example, three Carrington Pit bores and five Carrington West Wing bores all have an EC trigger value of 9600 µS/cm.

End Attachment A

Your ref: MP06_0261-PA-174
Our ref: DOC25/980728, EF16/2461

Department of Planning, Housing and Infrastructure

Email: information@planning.nsw.gov.au

17 November 2025

Dear Sir/Madam

Hutner Valley Operations – Water Management Plan

The Environment Protection Authority (EPA) has received a request from Hunter Valley Operations seeking a response to its updated Water Management Plan (Plan), required under MP06_0261-PA-174, reportedly lodged via the Major Projects Portal. The EPA have not received a Public Authority Consultation request in respect of this Plan and have not been provided the Plan.

The EPA encourages the development of such plans and procedures to ensure that proponents and licensees have determined how they will meet their statutory obligations and designated environmental objectives.

Being a regulatory authority, the EPA's role is to administer and regulate statutes for environmental management and protection. As such the EPA does not directly get involved in the development of strategies to achieve those objectives and does not review or comment on such procedures and/or plans. Accordingly, the EPA offers no comment.

If you have any further questions about this issue, please contact me on 02 4968 6824 or email info@epa.nsw.gov.au.

Yours sincerely

HAMISH RUTHERFORD
A/Unit Head – Operations
Environment Protection Authority

cc. Mr Brenton Hubert, Hunter Valley Operations, brenton.hubert@hvo.com.au.

NSW Environment Protection Authority
As the environmental steward and regulator of our State we are committed to a sustainable future.
Join us on our mission to protect tomorrow together.

Phone: 131 555
Website: epa.nsw.gov.au

Email: info@epa.nsw.gov.au
Mail: Locked Bag 5022
Parramatta NSW 2124

NSW GOVERNMENT

APPENDIX D: BASELINE GROUNDWATER DATA (2000 – 2023)

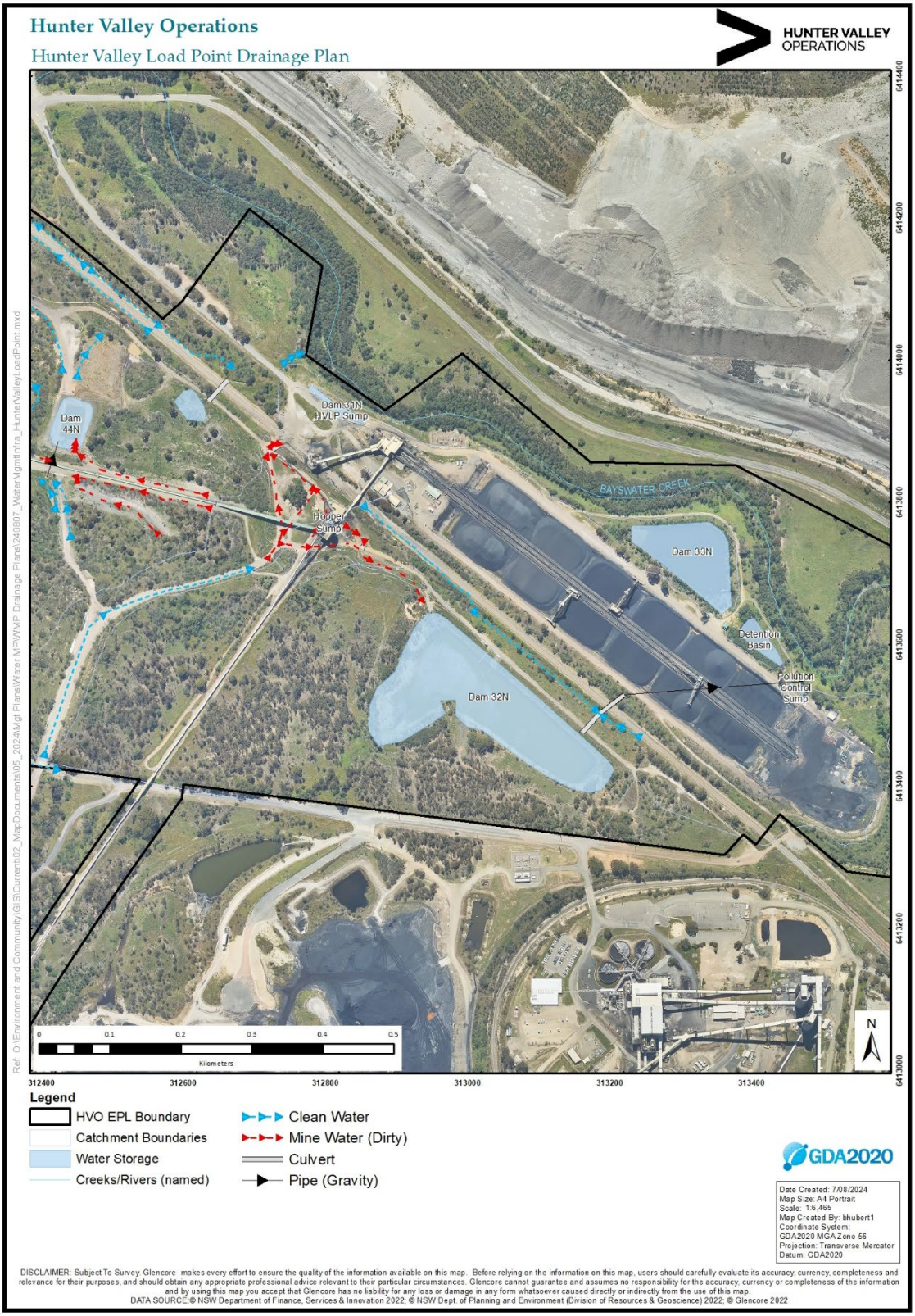
Location / Unit	Statistic	SWL (mAHD)	pH	EC (µS/cm)
Hunter River Alluvium	Count (n)	209	230	223
	Minimum	53.65	6.4	123
	5th Percentile	54.67	6.6	486
	10th Percentile	54.75	6.7	621
	20th Percentile	54.84	6.8	725
	50th Percentile	55.56	7.0	843
	80th Percentile	56.93	7.2	984
	90th Percentile	57.62	7.2	1390
	95th Percentile	58.15	7.4	2000
	Maximum	60.90	7.9	3300
Carrington West Wing Palaeochannel	Count (n)	253	253	253
	Minimum	54.73	6.6	600
	5th Percentile	57.63	6.9	5348
	10th Percentile	58.65	6.9	6414
	20th Percentile	58.92	7.0	7160
	50th Percentile	59.56	7.3	8420
	80th Percentile	59.82	7.4	8956
	90th Percentile	59.92	7.6	9170
	95th Percentile	59.96	7.8	9600
	Maximum	60.73	8.5	9540
Carrington West Wing Palaeochannel - Western Limb	Count (n)	221	228	229
	Minimum	59.23	6.7	799
	5th Percentile	59.56	7.0	935
	10th Percentile	59.59	7.1	1006
	20th Percentile	59.69	7.2	1167
	50th Percentile	59.94	7.3	1465
	80th Percentile	60.23	7.3	1896
	90th Percentile	60.43	7.4	1962
	95th Percentile	61.24	7.4	2100
	Maximum	62.11	7.9	3320
Parnell's Creek Alluvium	Count (n)	42	42	42
	Minimum	83.39	7.1	9570
	5th Percentile	83.57	7.3	9781
	10th Percentile	83.76	7.3	9934
	20th Percentile	84.06	7.4	10232
	50th Percentile	85.10	7.5	10590
	80th Percentile	85.35	7.5	10908

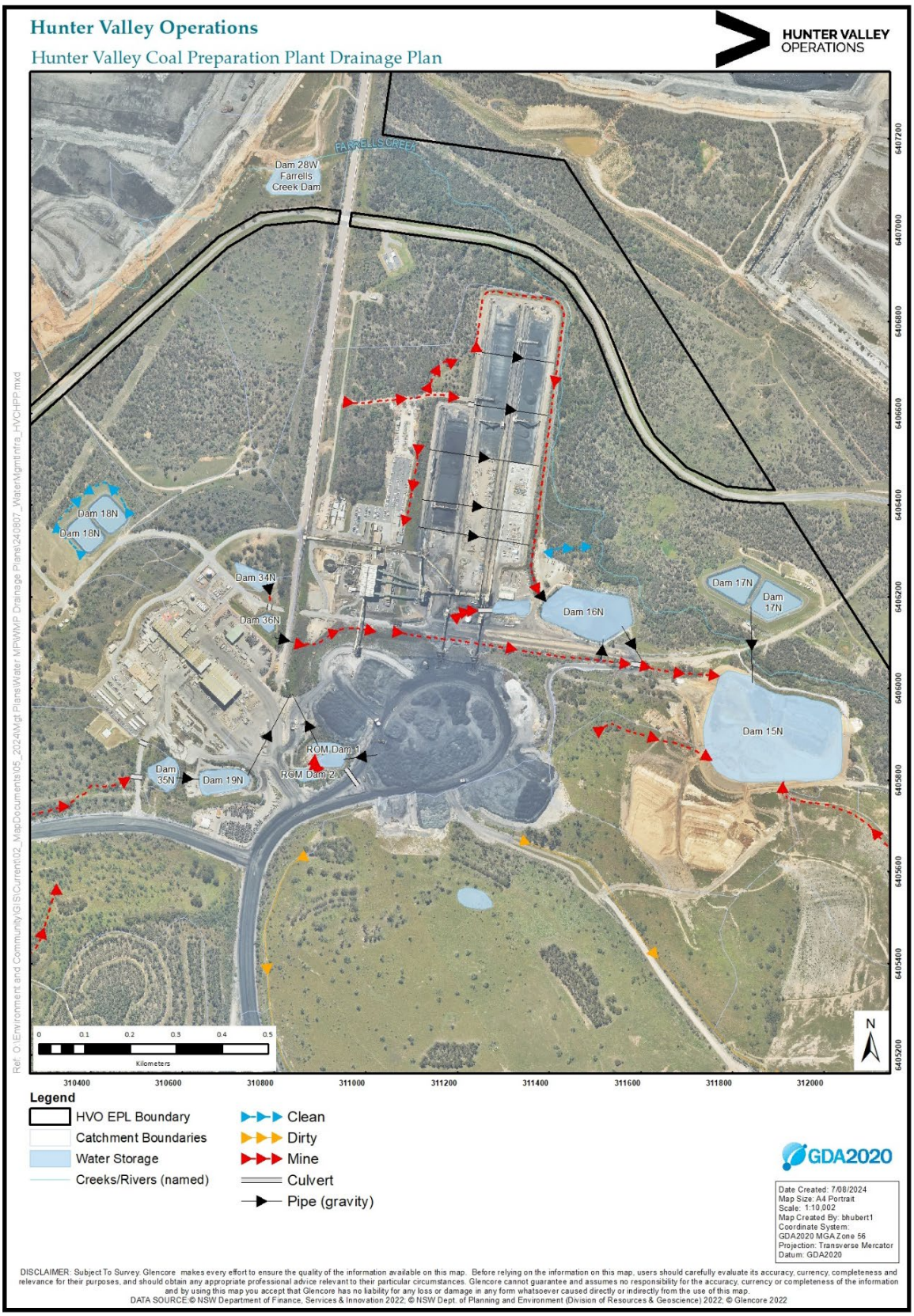
	90th Percentile	85.72	7.6	11052
	95th Percentile	85.99	7.6	11000
	Maximum	86.15	7.7	11510
Cheshunt Alluvium	Count (n)	293	332	322
	Minimum	53.50	6.6	359
	5th Percentile	54.01	6.8	590
	10th Percentile	54.07	6.8	659
	20th Percentile	54.17	6.9	726
	50th Percentile	54.53	7.1	837
	80th Percentile	56.55	7.5	973
	90th Percentile	59.38	7.7	1125
	95th Percentile	59.94	7.7	1228
	Maximum	62.70	8.2	2340
Cheshunt Regolith	Count (n)	62	62	62
	Minimum	51.23	6.5	1530
	5th Percentile	51.87	6.6	1654
	10th Percentile	51.89	6.6	1756
	20th Percentile	51.94	6.6	1814
	50th Percentile	52.92	6.7	1990
	80th Percentile	53.74	6.8	2130
	90th Percentile	53.91	6.8	2208
	95th Percentile	53.96	6.8	2529
	Maximum	54.35	7.1	3070
Cheshunt Interburden	Count (n)	193	217	216
	Minimum	46.74	6.1	820
	5th Percentile	47.59	6.7	1155
	10th Percentile	47.75	6.7	1219
	20th Percentile	48.88	6.9	1383
	50th Percentile	54.63	7.0	3685
	80th Percentile	55.87	7.2	5130
	90th Percentile	56.94	7.4	8540
	95th Percentile	57.28	7.5	9143
	Maximum	59.16	7.8	14120
Cheshunt Mt Arthur Seam	Count (n)	466	457	459
	Minimum	24.24	6.2	369
	5th Percentile	25.17	6.4	842
	10th Percentile	32.46	6.5	888
	20th Percentile	34.09	6.6	999
	50th Percentile	48.61	6.9	1312
	80th Percentile	53.10	7.2	2092
	90th Percentile	54.01	7.4	2450

	95th Percentile	54.42	7.6	2733
	Maximum	57.00	8.5	6910
South Lemington Alluvium	Count (n)	134	192	131
	Minimum	37.35	6.0	205
	5th Percentile	45.15	6.6	312
	10th Percentile	45.63	6.7	351
	20th Percentile	46.46	6.9	445
	50th Percentile	47.10	7.2	790
	80th Percentile	47.82	7.6	2690
	90th Percentile	48.20	7.7	3890
	95th Percentile	48.69	8.0	4510
	Maximum	49.93	8.3	7450
South Lemington Overburden	Count (n)	51	79	49
	Minimum	47.26	6.4	18670
	5th Percentile	47.33	6.7	19350
	10th Percentile	47.38	6.8	19998
	20th Percentile	47.44	6.8	20600
	50th Percentile	47.69	7.0	21500
	80th Percentile	47.88	7.1	23100
	90th Percentile	48.24	7.1	24380
	95th Percentile	48.43	7.2	26500
	Maximum	49.31	7.3	27400
South Lemington Arrowfield Seam	Count (n)	59	118	59
	Minimum	39.02	6.7	6860
	5th Percentile	39.59	6.9	10392
	10th Percentile	40.81	6.9	10870
	20th Percentile	42.72	7.0	11370
	50th Percentile	44.73	7.3	12270
	80th Percentile	45.47	7.5	13110
	90th Percentile	45.68	7.6	13452
	95th Percentile	45.90	7.7	14306
	Maximum	46.41	8.1	15590
South Lemington Bowfield Seam	Count (n)	224	415	221
	Minimum	-1.11	6.6	1920
	5th Percentile	7.35	6.8	2700
	10th Percentile	12.64	6.9	2830
	20th Percentile	21.37	7.0	3330
	50th Percentile	28.14	7.3	4600
	80th Percentile	32.59	7.6	7100
	90th Percentile	33.47	7.9	8390
	95th Percentile	36.82	8.0	9710

	Maximum	39.57	8.8	11210
South Lemington Mt Arthur Seam	Count (n)	-	34	34
	Minimum	-	7.0	7400
	5th Percentile	-	7.0	7706
	10th Percentile	-	7.0	7985
	20th Percentile	-	7.1	8166
	50th Percentile	-	7.2	8425
	80th Percentile	-	7.6	8654
	90th Percentile	-	8.6	8697
	95th Percentile	-	8.8	8717
	Maximum	-	9.3	8730
South Lemington Woodlands Hill Seam (C130(WDH))	Count (n)	29	58	28
	Minimum	45.18	6.4	18210
	5th Percentile	47.22	6.5	18975
	10th Percentile	47.26	6.6	19292
	20th Percentile	47.38	6.6	19740
	50th Percentile	47.66	6.8	20300
	80th Percentile	47.96	7.0	20960
	90th Percentile	48.13	7.0	21130
	95th Percentile	48.27	7.1	21265
	Maximum	50.64	7.5	21300
South Lemington Woodlands Hill Seam (C317(WDH))	Count (n)	33	64	33
	Minimum	44.91	6.7	5190
	5th Percentile	45.64	7.2	6968
	10th Percentile	45.97	7.2	7596
	20th Percentile	46.21	7.3	7628
	50th Percentile	47.00	7.4	7900
	80th Percentile	47.60	7.6	9630
	90th Percentile	47.78	7.7	10812
	95th Percentile	47.85	7.9	11062
	Maximum	48.07	8.2	11230

APPENDIX E: WATER MANAGEMENT DRAINAGE PLANS




Hunter Valley Operations
Hunter Valley Coal Preparation Plant Drainage Plan
HUNTER VALLEY OPERATIONS
FARRELLS CREEK
Dam 28W Farrells Creek Dam
Dam 18N
Dam 18N
Dam 34N
Dam 36N
Dam 16N
Dam 17N
Dam 17N
Dam 15N
ROM Dam 1
ROM Dam 2
Dam 35N
Dam 19N
N
Kilometers
Legend
HVO EPL Boundary
Catchment Boundaries
Water Storage
Creeks/Rivers (named)
Clean
Dirty
Mine
Culvert
Pipe (gravity)
GDA2020
Date Created: 7/08/2024
Map Size: A4 Portrait
Scale: 1:10,002
Map Created By: bhubert1
Coordinate System: GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020
DISCLAIMER: Subject To Survey. Glencore makes every effort to ensure the quality of the information available on this map. Before relying on the information on this map, users should carefully evaluate its accuracy, currency, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances. Glencore cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Glencore has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map.
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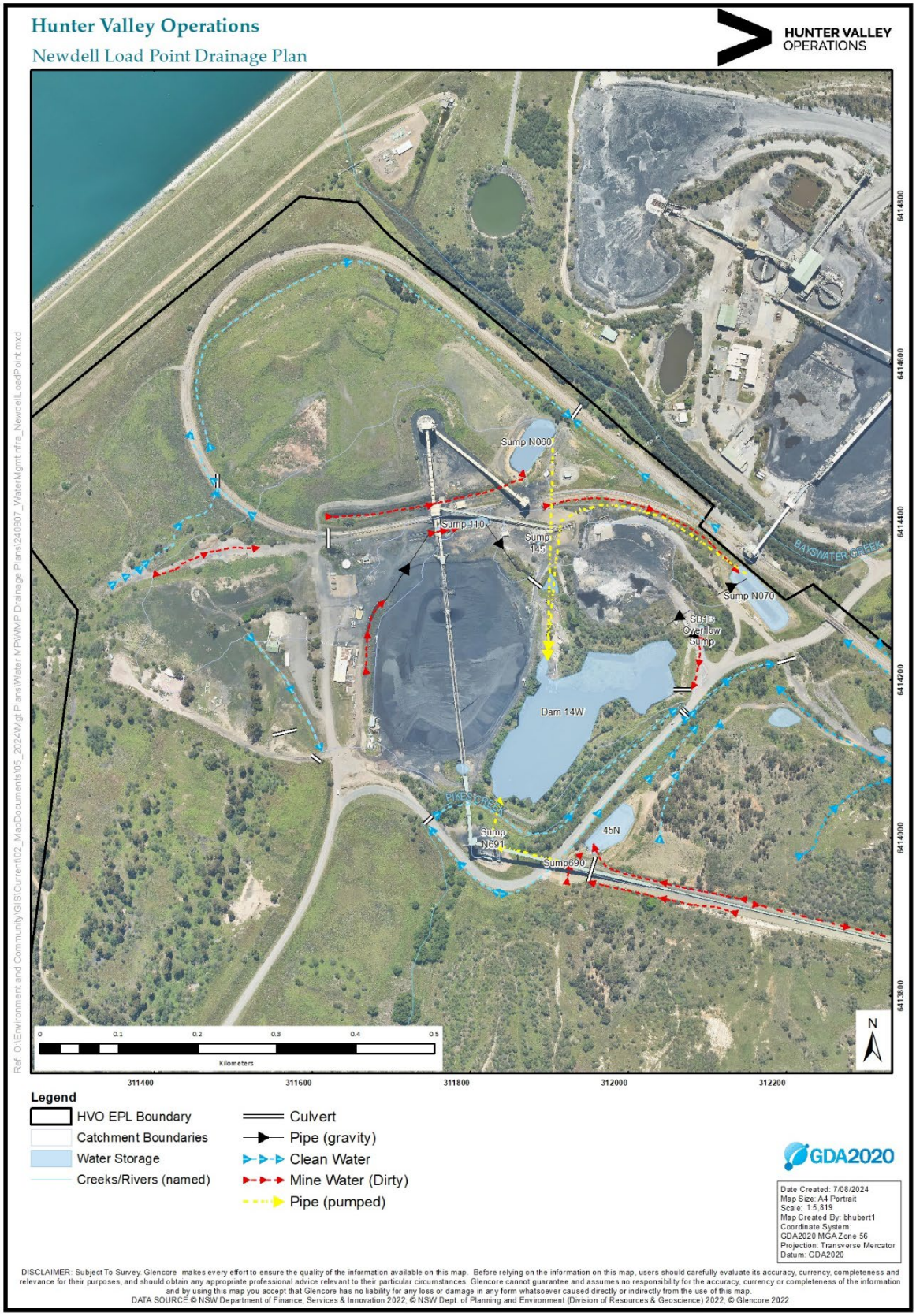
Hunter Valley Operations
Newdell Load Point Drainage Plan
HUNTER VALLEY OPERATIONS
Sump N060
Sump 110
Sump 145
Sump N070
SB1B Overflow Sump
Dam 14W
45N
Sump 1691
Sump 90
BAYSWATER CREEK
PIKES CREEK
6414800
6414600
6414400
6414200
6414000
6413800
311400
311600
311800
312000
312200
0 0.1 0.2 0.3 0.4 0.5
Kilometers
N
Legend
HVO EPL Boundary
Catchment Boundaries
Water Storage
Creeks/Rivers (named)
Culvert
Pipe (gravity)
Clean Water
Mine Water (Dirty)
Pipe (pumped)
GDA2020
Date Created: 7/08/2024
Map Size: A4 Portrait
Scale: 1:5,819
Map Created By: bhubert1
Coordinate System: GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020
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Ref: O:\Environment and Community\GIS\Current\02_MapDocuments\05_2024\Wgt Plans\Water MP\WMP Drainage Plans\240807_WaterMgmtInfra_NewdellLoadPoint.mxd

APPENDIX F: GROUNDWATER MONITORING PROGRAMME

Monitoring Location	Type	Easting (m)	Northing (m)	Location	Unit	Ground Level (mAHD)	Top of Casing (mAHD)	Screened Interval / Sensor Depth (mbgl)	Water Level[7]	Field EC	Field pH	Major Ions[1]	Comprehen-sive Analysis[2]
GW-115	MB	312227	6402216	Alluvial Lands	Spoil	68.30	68.30	22.20 - 28.20	Q (logger)	Q	Q	6M	A
MB14HVO02	MB	310469	6401001			70.90	70.90	? - 90.00	Q (logger)	Q	Q	6M	A
MB14HVO03	MB	311387	6400950			67.10	67.10	? - 80.00	Q (logger)	Q	Q	6M	A
Proposed 2[5]	MB	~312465	~6402601			TBC	TBC	TBC	Q (logger)	Q	Q	6M	A
CFW55R[3]	MB	310439	6402180	Carrington Pit	Carrington Alluvium	69.78	70.28	8.90 - 15.90	M (logger)	M	M	-	6M
CFW57[3]	MB	310084	6402053			70.05	70.75	7.70 - 14.70	M (logger)	M	M	-	6M
CGW52a[3]	MB	309902	6402249			70.61	71.36	14.25 - 17.25	M (logger)	M	M	-	6M
CGW53a[3]	MB	309606	6402333			69.83	70.53	11.00 - 14.00	M (logger)	M	M	-	6M
CGW54a[3]	MB	310196	6402159			69.21	70.00	11.80 - 14.80	M (logger)	M	M	-	6M
CGW55a[3]	MB	309840	6402457			70.56	71.04	12.32 - 15.32	M (logger)	M	M	-	6M
GW-123[3]	MB	310259	6402014			68.99	70.01	9.90 - 12.90	M (logger)	M	M	-	6M
GW-124[3]	MB	310170	6401923			68.90	69.61	11.70 - 14.70	M (logger)	M	M	-	6M
GW-125[3]	MB	310117	6402315			68.46	69.12	10.40 - 13.40	M (logger)	M	M	-	6M
GW-126[3]	MB	310055	6402213			70.29	71.24	11.80 - 14.80	M (logger)	M	M	-	6M
GW-127[3]	MB	309972	6402109			68.92	69.65	11.10 - 14.10	M (logger)	M	M	-	6M
CGW52	MB	309906	6402255		Broonie	70.70	71.40	38.90 - 41.90	Q	Q	Q	6M	A
CGW53	MB	309606	6402333			69.87	70.48	37.89 - 40.89	Q	Q	Q	6M	A
GW-107	MB	308738	6404103		Spoil	73.50	73.50	24.20 - 27.20	Q (logger)	Q	Q	6M	A
GW-108	MB	309695	6403971			84.40	84.40	52.50 - 58.50	Q (logger)	Q	Q	6M	A
GW-129	MB	310553	6402211		Spoil/ Tailings	72.30	73.03	12.30 - 21.30	Q (logger)	Q	Q	6M	A
4032P	MB	308609	6402945	Carrington Western Palaeochannel	Alluvium	69.35	70.29	6.46 - 12.46	Q	Q	Q	6M	A
4034P	MB	308239	6402959		Alluvium	71.15	71.46	5.29 - 14.29	Q	Q	Q	6M	A
4037P	MB	308277	6402702		Alluvium	70.74	71.77	7.27 - 13.27	Q	Q	Q	6M	A
4040P	MB	308675	6402724		Alluvium	69.16	70.13	4.93 - 10.93	Q (logger)	Q	Q	6M	A

Monitoring Location	Type	Easting (m)	Northing (m)	Location	Unit	Ground Level (mAHD)	Top of Casing (mAHD)	Screened Interval / Sensor Depth (mbgl)	Water Level[7]	Field EC	Field pH	Major Ions[1]	Comprehen -sive Analysis[2]
CGW32	MB	308598	6404872		Remnant Palaeochannel alluvium	78.48	79.06	13.42 - 22.42	Q	Q	Q	6M	0
GW-106	MB	309092	6405224		Alluvium	82.30	83.10	23.20 - 26.20	Q	Q	Q	6M	A
CGW46	MB	308413	6403276		Bayswater	71.95	71.95	13.60 -?	Q	Q	Q	6M	A
CGW47	MB	308729	6403406		Bayswater	70.39	70.83	? - 15.20	Q	Q	Q	6M	A
CGW49	MB	308778	6403098		Bayswater	69.05	69.57	12.78 -?	Q	Q	Q	6M	A
CGW47a	MB	308731	6403405		Broonie	70.39	70.83	16.03 -?	Q	Q	Q	6M	A
CGW39	MB	308566	6403694		Palaeochannel alluvium	70.31	70.84	4.47 - 13.47	Q	Q	Q	6M	A
Proposed 1[5]	MB	~312679	~6402560	Hunter River	Hunter River Alluvium	TBC	TBC	TBC	Q (logger)	Q	Q	6M	A
GW-140	MB	312818	6402771	Dam 21N	Hunter River Alluvium	64.50	65.00	5.50 – 8.50	Q (logger)	Q	Q	6M	A
GW-141	MB	312813	6402764		Vaux	64.60	65.28	28.20 – 28.20	Q (logger)	Q	Q	6M	A
GW-142	MB	312778	6402930		Spoil	66.30	66.98	14.80 – 24.50	Q (logger)	Q	Q	6M	A
PZ1CH200	MB	312646	6402256	North Pit/ Alluvial Lands	Hunter River Alluvium	62.06	62.16	>8.90 - 11.00	Q (logger)	Q	Q	6M	A
PZ2CH400	MB	312635	6402051		Hunter River Alluvium	62.53	62.63	>9.90 - 11.10	Q (logger)	Q	Q	6M	A
PZ3CH800	MB	312522	6401674		Hunter River Alluvium	64.16	64.16	10.47 -?	Q (logger)	Q	Q	6M	A
PZ4CH1380	MB	312196	6401176		Hunter River Alluvium	64.93	65.03	14.48 -?	Q	Q	Q	6M	A
PZ5CH1800	MB	311852	6400928		Hunter River Alluvium	66.10	66.20	14.90 -?	Q	Q	Q	6M	A
GA3	MB	310159	6400876		Hunter River Alluvium/ Shallow Coal	67.02	67.02	12.00 -?	Q	Q	Q	6M	A
HV3(2)	MB	310776	6400546		Hunter River Alluvium	68.06	68.64	? - 16.12	Q	Q	Q	6M	A
Proposed 3[5]	MB	~312504	~6404200		Regolith	TBC	TBC	TBC	Q (logger)	Q	Q	6M	A
DM1	MB	311778	6405164		Spoil	102.73	103.05	28.83 -?	Q (logger)	Q	Q	6M	A
DM3	MB	311971	6403310		Spoil	94.14	94.97	40.67-?	Q (logger)	Q	Q	6M	A
GW-114	MB	312272	6403981		Spoil	98.20	98.20	27.00 - 30.00	Q (logger)	Q	Q	6M	A

Monitoring Location	Type	Easting (m)	Northing (m)	Location	Unit	Ground Level (mAHD)	Top of Casing (mAHD)	Screened Interval / Sensor Depth (mbgl)	Water Level[7]	Field EC	Field pH	Major Ions[1]	Comprehen-sive Analysis[2]
G1	MB	305694	6407301	Parnells Creek Dam	Parnells Creek Alluvium	110.00	110.00	<10.00 -?	Q	Q	Q	6M	A
G2	MB	305660	6407451		Parnells Creek Alluvium	110.60	110.60	3.04 -?	Q	Q	Q	6M	A
G3	MB	305636	6407556		Parnells Creek Alluvium	108.60	108.60	<10.00 -?	Q	Q	Q	6M	A
GW_100	MB	303729	6406436		Parnells Creek Alluvium	89.60	TBC	4.40 - 5.00	Q	Q	Q	6M	A
GW_101	MB	304374	6406728		Parnells Creek Alluvium/Regolith	100.50	TBC	9.00 - 12.00	Q (logger)	Q	Q	6M	A
GW_100a	VWP	303729	6406436	West Pit	Barrett and Interburden	89.40	-	60.00	Q (logger)	-	-	-	-
GW_104	VWP	307549	6404657		Highwall	86.70	-	136.00	Q (logger)	-	-	-	-
GW_105	VWP	308597	6405442		Coal	93.10	-	33.00 103.50 154.00	Q (logger)	-	-	-	-
GW_109	VWP	309232	6402706		Coal and Bayswater	85.20	-	96.00	Q (logger)	-	-	-	-
GW_101a	VWP	304362	6406721		Interburden	100.50	-	52.00	Q (logger)	-	-	-	-
GW_102	VWP	305280	6406668		Interburden	114.60	-	60.50	Q (logger)	-	-	-	-
Proposed 5[5]	MB	~307024	~6407896		Basement	TBC	TBC	TBC	Q (logger)	Q	Q	6M	A
Proposed 6[5]	MB	~311123	~6409194		Highwall	TBC	TBC	TBC	Q (logger)	Q	Q	6M	A
Proposed 7[5]	MB	~310326	~6406955		Highwall	TBC	TBC	TBC	Q (logger)	Q	Q	6M	A
CHPZ10A	MB	313334	6402297	Barry's Pit	Hunter River Alluvium	62.57	63.37	8.70 - 11.80	Q (logger)	Q	Q	6M	A
CHPZ12A	MB	313238	6402013		Hunter River Alluvium	63.13	63.43	9.20 - 11.20	Q (logger)	Q	Q	6M	A
CHPZ2A	MB	312941	6401539		Hunter River Alluvium	65.14	65.78	13.06 - 16.26	Q (logger)	Q	Q	6M	A
CHPZ3A	MB	313086	6401756		Hunter River Alluvium	63.18	63.86	13.82 - 10.82	Q (logger)	Q	Q	6M	A
CHPZ4A	MB	312904	6402123		Hunter River Alluvium	65.45	66.19	10.16 - 13.46	Q (logger)	Q	Q	6M	A
BUNC45D	MB	313677	6402060		Mt Arthur	73.36	73.72	25.54 - 28.54	Q (logger)	Q	Q	6M	A
CHPZ12D	MB	313236	6402019		Mt Arthur	63.26	63.51	? - 11.75	Q (logger)	Q	Q	6M	A

Monitoring Location	Type	Easting (m)	Northing (m)	Location	Unit	Ground Level (mAHD)	Top of Casing (mAHD)	Screened Interval / Sensor Depth (mbgl)	Water Level[7]	Field EC	Field pH	Major Ions[1]	Comprehen-sive Analysis[2]
CHPZ3D	MB	313094	6401756	Cheshunt Pit	Mt Arthur	62.96	63.60	19.86 - 22.96	Q	Q	Q	6M	A
BUNC45A	MB	313667	6402055		Regolith	72.90	73.20	17.00 - 20.00	Q (logger)	Q	Q	6M	A
Hobden's Well	MB	312540	6401093		Hunter River Alluvium	71.00	71.70	TBC	Q (logger)	Q	Q	6M	A
BC1a	MB	312421	6400872		Mt Arthur	66.08	66.36	21.70 -?	Q	Q	Q	6M	A
BZ1-1	MB	311472	6400483		Interburden	71.39	71.79	20.60 - 23.60	Q (logger)	Q	Q	6M	A
BZ1-3	MB	311472	6400483		Mt Arthur	71.39	71.79	52.60 - 55.60	Q (logger)	Q	Q	6M	A
HG2	MB	312469	6400886		Interburden	67.40	68.03	10.37 - 16.37	Q	Q	Q	6M	A
HG2a	MB	312469	6400886		Mt Arthur	66.82	66.87	25.75 - 27.75	Q (logger)	Q	Q	6M	A
Appleyard Farm	MB	315491	6394639		Wollombi Brook Alluvium	43.40	54.20	6.20 - 9.20	M (logger)	Q	Q	6M	A
C919(ALL)	MB	315192	6395655		Wollombi Brook Alluvium	57.94	58.24	7.20 - 13.20	Q (logger)	Q	Q	6M	A
PB01(ALL)	MB	314754	6396026		Wollombi Brook Alluvium	54.37	54.61	9.26 - 12.26	Q (logger)	Q	Q	6M	A
D317(ALL)	MB	315044	6396018		Wollombi Brook Alluvium	59.05	59.34	9.20 - 12.20	M (logger)	Q	Q	6M	A
D317(BFS)	MB	315043	6396019		Bowfield	59.64	59.97	38.67 - 43.87	Q	Q	Q	6M	A
D406(AFS)	MB	313931	6396074	South Lemington Pit	Arrowfield	57.41	57.73	23.68 - 27.18	Q	Q	Q	6M	A
D406(BFS)	MB	313931	6396074		Bowfield	57.36	57.68	50.68 - 56.68	Q	Q	Q	6M	A
B334(BFS)	MB	316684	6394088		Bowfield	73.37	73.67	58.20 - 64.20	Q	Q	Q	6M	A
B925(BFS)	MB	315921	6394604		Bowfield	62.45	62.82	80.63 - 86.63	Q (logger)	6M	6M	6M	A
C130(ALL)	MB	316400	6394916		Overburden	63.17	63.49	14.62 - 16.62	Q	Q	Q	6M	A
C130(AFS1)	MB	316400	6394916		Arrowfield	63.17	63.50	41.61 - 43.61	Q	Q	Q	6M	A
C130(BFS)	MB	316400	6394916		Bowfield	62.98	63.32	55.16 - 64.16	Q	Q	Q	6M	A
C130(WDH)	MB	316400	6394916		Woodlands Hill	63.14	63.52	18.62 - 21.12	Q	Q	Q	6M	A
C317(BFS)	MB	315054	6395007		Bowfield	60.38	60.74	69.64 - 76.14	Q	Q	Q	6M	A

Monitoring Location	Type	Easting (m)	Northing (m)	Location	Unit	Ground Level (mAHD)	Top of Casing (mAHD)	Screened Interval / Sensor Depth (mbgl)	Water Level[7]	Field EC	Field pH	Major Ions[1]	Comprehen-sive Analysis[2]
C317(WDH)	MB	315054	6395007		Woodlands Hill	60.12	60.33	30.79 - 33.29	Q	Q	Q	6M	A
C630(BFS)	MB	316378	6395306		Bowfield	68.81	69.15	39.96 - 47.96	Q	Q	Q	6M	A
LUG Bore	MB	315874	6394295		Mt Arthur	TBC	TBC	TBC	-	Q	Q	6M	A
GW_143[4]	MB	TBC	TBC		TBC	TBC	TBC	TBC	Q	Q	Q	6M	A
Proposed 4[6]	MB	TBC	TBC		Wollombi Brook Alluvium	TBC	TBC	~ 15	Q	Q	Q	6M	A
LUG_S001[4]	MB	TBC	TBC	Lemington Underground	Mt Arthur workings	TBC	TBC	TBC	M[4]	M[4]	M[4]	6M[4]	A[4]
LUG_S002[4]	MB	TBC	TBC		Mt Arthur workings	TBC	TBC	TBC	Q[4]	Q[4]	Q[4]	6M[4]	A[4]
LUG_S003[4]	MB	TBC	TBC		TBC	TBC	TBC	TBC	Q[4]	Q[4]	Q[4]	6M[4]	A[4]
LUG_S004[4]	MB	TBC	TBC		TBC	TBC	TBC	TBC	Q[4]	Q[4]	Q[4]	6M[4]	A[4]
LUG_S005[4]	MB	TBC	TBC		TBC	TBC	TBC	TBC	Q[4]	Q[4]	Q[4]	6M[4]	A[4]
LUG_S006[4]	MB	TBC	TBC		TBC	TBC	TBC	TBC	Q[4]	Q[4]	Q[4]	6M[4]	A[4]
SR010	MB	317319	6395338	South Lemington Pit and Southern	Interburden and Warkworth	57.50	TBC	24.60 - 30.60	Q	Q	Q	6M	A
SR011	MB	317699	6394412		Mt Arthur and underburden	88.20	TBC	41.40 - 47.40	Q	Q	Q	6M	A
SR012	MB	318354	6393926		Overburden	76.20	TBC	23.40 - 29.40	Q	Q	Q	6M	A

Notes:

Coordinates: GDA2020 zone 56

TBC - To Be Confirmed

1 Major ions analysis includes:

- TDS

- Major ions (Ca, Mn, Na, K, SO4, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity) as total and dissolved analytes

2 Comprehensive analysis includes (in addition to major ions analysis):

- TDS

- SiO_2;

- Metals (Al, As, B, Be, Cd, Co, Cr, Cu, Fe, Hg, Mg, Ni, Pb, Sb, Se, Sr, Zn) as total and dissolved analytes

3 Monitoring frequency reduced to quarterly when:

- pH is within the range of 6.8 - 8.0 for two consecutive samples;

-Sulphate has dropped below respective trigger levels for two consecutive samples;

- Sulphate/Chloride Ratio has dropped to <0.5 meq for three consecutive samples;

- Water level records stable to decline levels for three consecutive samples.

4 Proposed Monitoring Bore as per PA 06_0261 Mod 7. Exact location to be determined. To be installed and monitored if activities under Mod 7 proceed. Water level to be maintained below 30 mAHD as specified in Mod 7.

5 Proposed Monitoring Bore as per Final Void Management Plan. Exact location to be determined. Monitoring to commence once installed.

6 Proposed Monitoring Bore. Exact location to be determined. Monitoring to commence once installed.

7 (logger) indicates that the hole is fitted with a grouted vibrating wire piezo or downhole level logger. Data is logged daily and downloaded quarterly or monthly.