Whitehaven

WERRIS CREEK COAL

WATER MANAGEMENT PLAN

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ACRONYMS USED THROUGHOUT THIS DOCUMENT

AR	-	Annual Review
ANZECC	-	Australian and New Zealand Environment and Conservation Council, Guidelines for Fresh and Marine Water Quality, 2000.
AS	-	Australian Standard
CCC	-	Community Consultative Committee
DPHI	-	Department of Planning, Housing and Infrastructure
DA	-	Development Approval
DGM -		Means the three-day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples.
EA	-	Environmental Assessment
EC	-	Electrical Conductivity
EL	-	Exploration License
EPA	-	Environment Protection Authority
EPL	-	Environment Protection License
GW	-	Groundwater Works
IMP	-	Irrigation Management Plan
Km	-	Kilometre
I&I NSW	-	Industry & Investment NSW
LOM	-	Life of Mine
m	-	metre
mg/L	-	milligrams per litre
ML	-	Mining Lease
ML	-	Million Litres
MOP	-	Mining Operations Plan for the Werris Creek Coal Mine, December 2015
NRAR	-	Natural Resources Access Regulator
OEH	-	Office of Environment and Heritage
PA	-	Project Approval
ROM	-	Run-Of-Mine
RLF	-	Rail Load-out Facility
RWC	-	RW Corkery and Associates Pty Limited
VWD	-	Void Water Dam
WAL	-	Water Access License
WCC	-	Werris Creek Coal Pty Ltd
WCC	-	Werris Creek Coal Mine
WMP	-	Water Management Plan (formerly SWMP – Site Water Management Plan)
μS/cm	-	microsiemens per centimetre

1 INTRODUCTION

The Werris Creek Coal Mine (WCC) is operated by Werris Creek Coal Pty Limited (WCC) and is located within the North West Slopes and Plains of New South Wales, approximately 45km southwest of Tamworth (Figure 1). WCC is located approximately 4km South of Werris Creek and 11km North-Northwest of Quirindi.

WCC was granted Project Approval (PA) 10_0059 on the 25th October 2011 by the Minister of Planning and Infrastructure for the Life of Mine (LOM) project. The Project involves a northerly extension of the current mine footprint, increasing the projected mine life by approximately 10 to 15 years. PA 10_0059 has subsequently been modified five times under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as follows:

- Modification 1 (10_0059 MOD1) dated 30th August 2012 allowing for the relocation of some surface infrastructure.
- Modification 2 (10_0059 MOD2) dated 3rd November 2015 allowing for minor overburden emplacement changes, agricultural water supply, coal deshaling plant and SB18, and is hereafter referred to as the Modified PA.
- Modification 3 (10_0059 MOD3) dated 6th March 2020 allowing for administrative changes to the Project Site Layout map.
- Modification 4 (10_0059 MOD4) dated 12th May 2021 allowing for changes to burial of waste.
- Modification 5 (10_0059 MOD5) dated 17th December 2024 allowing for changes to final landform

To satisfy Condition 23, Schedule 3 of PA 10_0059, WCC is required to prepare and implement a Water Management Plan (WMP) for the project. The plan has also been prepared to meet the management plan requirements specified in Condition 2, Schedule 5 of the Project Approval, the commitments made in LOM Project and Modification Environmental Assessments (EA), Environment Protection Licence (EPL) 12290 and other water licensing requirements.

This Water Management Plan has been developed using a risk management process that follows hazard identification, impact assessment, development of management and mitigation measures and contingency planning. The WMP summarises the results of the surface water and groundwater impact assessments and outlines the control measures to be implemented as a part of the continued operations at WCC to minimise the potential for water impacts on the local community and the environment. The WMP also contains a monitoring program, developed to quantify any water quality impacts of the operation and to assess compliance against the relevant water criteria and also includes the reporting and record keeping requirements to be maintained throughout the mining operations

This WMP has been prepared in consultation with the DPHI, Natural Resources Access Regulator (NRAR), and EPA.

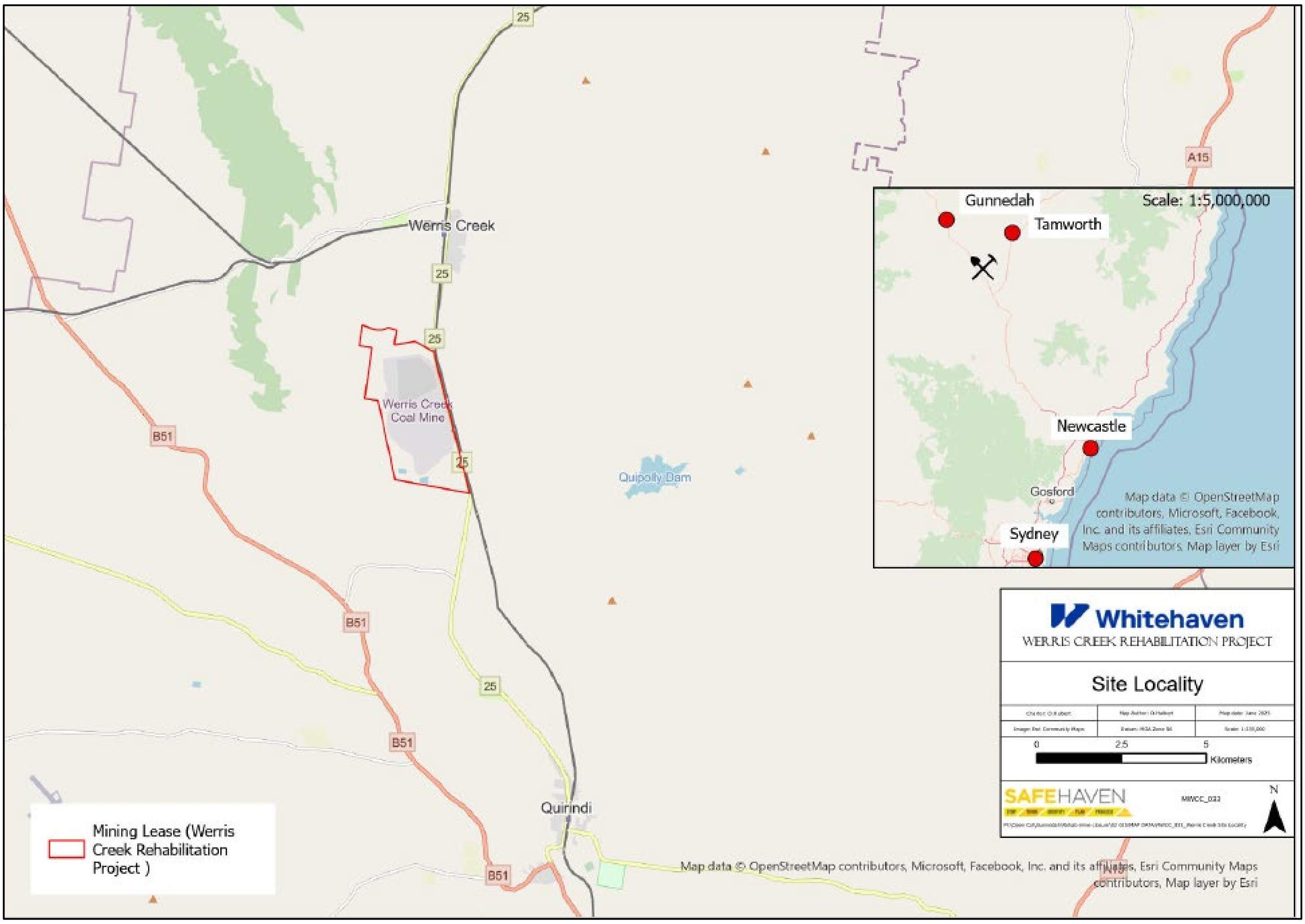


Figure 1 - Locality Plan and Local Setting

1.1 Project Description

WCC has approval to mine in full, the Werris Creek coal measures which occur as a synclinal (bowl shaped) formation to the immediate South of Werris Creek. Figure 2provides the layout of WCC, as approved by the Modified PA.

Overburden and interburden generated by the progressive exposure of the coal seams is placed within an overburden emplacement which in-fills the mined-out void of the open cut and extends around the South Western, Southern and Western perimeter of the open cut. The overburden emplacement is limited in lateral and vertical extent by the Modified PA (see Figure 2). The overburden emplacement of WCC is progressively rehabilitated as the RL445 dump is extended Northward, in-filling the advancing active void.

Coal mined was placed on a ROM Pad to the West of the open cut where it was crushed, screened and further beneficiated as required before being transferred to a Product Coal stockpile adjacent to the Werris Creek Rail Siding. The majority of product coal was loaded into trains from a Rail Load-out Facility (RLF). The Modified PA permits revisions to the overburden emplacement extent and height, construction of a dry separation plant, revisions to the surface water management system to supply surplus void water to irrigation and development of a permanent pit lake in the final void, amongst other changes.

1.2 Purpose

The purpose of the WMP is to:

- Address and comply with the relevant conditions of the Modified PA, Environment Protection Licence (EPL) 12290 and Water Access Licences (WAL) 32224 and WAL29506;
- Consolidate information relating to baseline conditions and potential impacts from operations associated with the WCC;
- Outline measures to minimise the water related impacts from the WCC on the surrounding community and environment;
- Establish water monitoring programs to assess and report on the level of impact on water as required by statutory approvals; and
- To keep the local community and relevant agencies informed and to provide a mechanism to respond to water issues and complaints effectively.

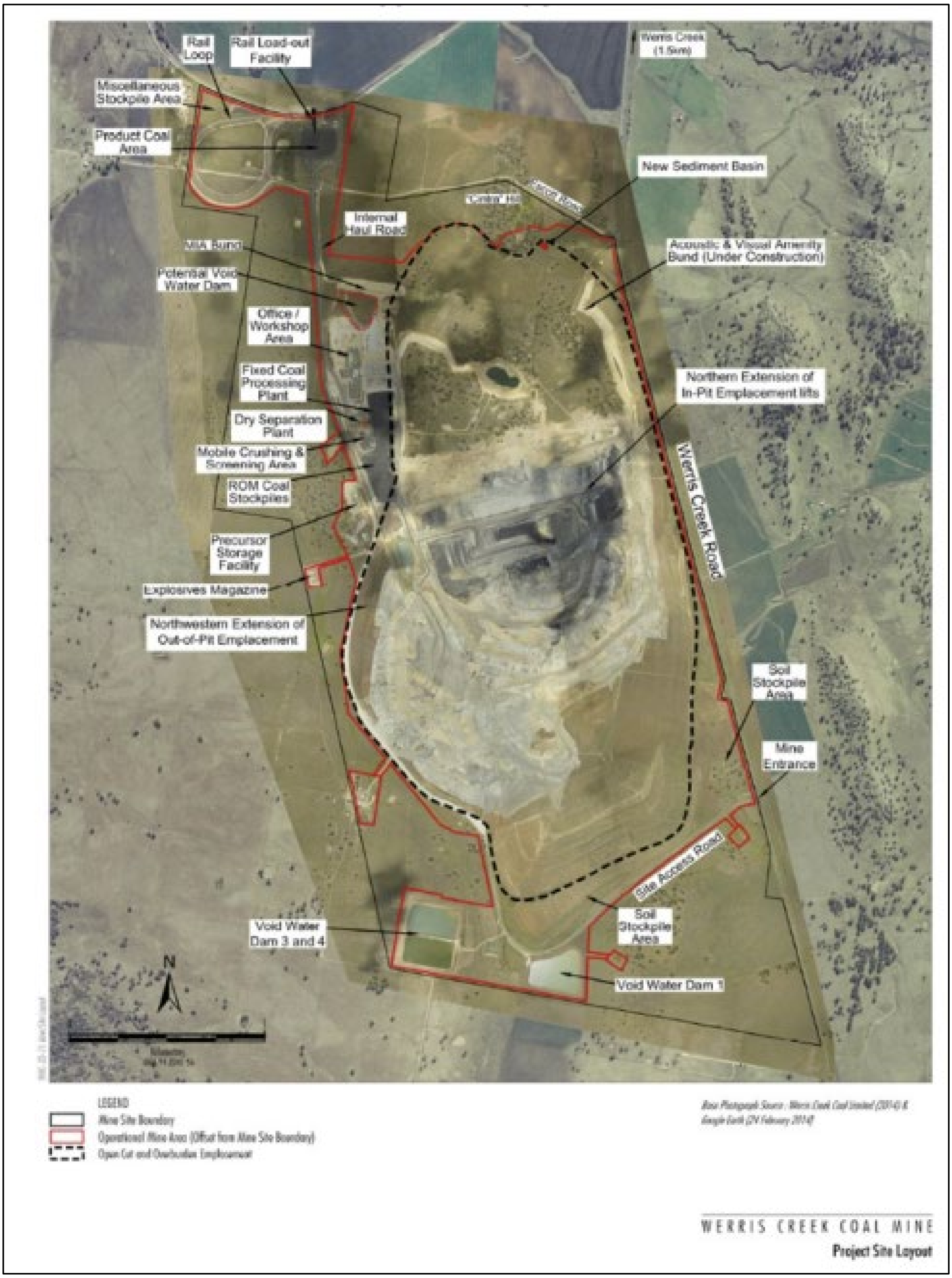


Figure 2 - WCC Site Layout

2 STATUTORY REQUIREMENTS

The WMP has been prepared in accordance with the requirements established under various legislative instruments, which are outlined in the following sections.

2.1 Mining Leases ML1563, ML1671, and ML 1672

The WMP has been prepared in accordance with the conditions listed in each of the mining leases ML1563, ML1671, and ML1672, including the Rehabilitation Management Plan for Werris Creek Coal Mine, January 2025.

2.2 Project Approval 10_0059 (MOD5)

The WMP has been prepared in accordance with the requirements of the Modified PA. **Table 1** summarises the requirements relating to water management from Schedule 3, Conditions 21 to 23a of the Modified PA, and identifies where these requirements are addressed within this WMP.

Table 1 Relevant Conditions from PA 10_0059 (MOD5)

Condition	Condition Requirement	Section in this WMP is addressed
Schedule 3 – Environmental Performance Conditions		
SOIL AND WATER		
	Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Proponent is required to obtain the necessary water licenses for the project.	Section 2.5
21	**Water Supply** The Proponent shall ensure that it has sufficient water for all stages of the project, and if necessary, adjust the scale of mining operations to match its available water supply, to the satisfaction of the Secretary.	Sections 6.3.9
21A	**Water Supply** The Proponent must provide a compensatory water supply to any landowner of privately-owned land whose rightful water supply is predicted to be adversely impacted (other than an impact that is minor or negligible) as a result of the development, to the satisfaction of the Secretary. The burden of proof that any loss of surface water or groundwater access is not due to mining impacts rests with the Proponent.	Section 7.2
21B	**Water Supply** If the Proponent is unable to provide an alternative long-term supply of water, then the Proponent must provide compensation, to the satisfaction of the Secretary.	Section 7.2
22	**Surface Water Discharges** The Proponent shall ensure that all surface water discharges from the site comply with the discharge limits (both volume and quality) set for the project in any EPL.	Section 6.4.2, 7.1.1, 5.1
22A	**Void Water Irrigation** The Proponent shall not provide any water for the purpose of irrigation or stock watering, unless the activity has been approved by the Secretary as part of the Water Management Plan.	Section 4.2, 6.3.3
23	**Water Management Plan** The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Secretary. This plan must be prepared in consultation with Water Group and EPA by suitably qualified and experienced persons whose appointment has been approved by the Secretary, and submitted to the Secretary by the end of April 2012.	This document

Condition	Condition Requirement	Section in this WMP is addressed
	In addition to the standard requirements for management plans (see condition 2 of schedule 5), this plan must include:	
23 (a)	A Site Water Balance that includes details of: sources of water supply; water use on-site; water management on-site; reporting procedures, which provide for the update of the site water balance in each annual review; and describes what measures would be implemented to minimise potable water use on-site.	Section 4
23 (b)	A Surface Water Management Plan, that includes: detailed baseline data of the surface water flows and quality in the water bodies that could be affected by the project. A detailed description of the water management system on-site, including the: clean water diversion systems; erosion and sediment controls; and water storages. A plan for identifying, extracting, handling, and the long-term storage of potentially acid forming material on-site; Detailed plans, including design objectives and performance criteria, for: design and management of the final void; reinstatement of drainage lines on the rehabilitated areas of the site; and control of any potential water pollution from the rehabilitated areas of the site. a program to monitor the effectiveness of the water management system; A plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the project.	Section 2.5 Section 6.2.1 Section 6.7 Section 6.4.1, 6.3.6 Section 3.1, 6.3.11 Section 4, 6.3.11 Section 6.7.3, 6.7.2 Section 6.7.3, 6.7.2 Section 6 Section 8
23 (c)	A Groundwater Management Plan, which includes: • detailed baseline data of groundwater levels and quality surrounding the site;	Section 3.2.2

Condition	Condition Requirement	Section in this WMP is addressed
	• groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts.	Section 5
	A program to monitor: • groundwater inflows to the open cut mining operations;	Section 6.1
	• the impacts of the project on any groundwater bores on privately-owned land;	Section 7.4
	• the seepage/leachate from water storages or backfilled voids on-site.	Section 7.3
	A program to validate the groundwater model for the project, and calibrate it to site specific conditions; and A plan to respond to any exceedances of the performance criteria and mitigate and/or offset any adverse groundwater impacts of the project.	Section 6
23 (d)	An Irrigation Management Plan, which includes: • a detailed methodology for the transfer (including for pipeline and/or road transportation) and application of void water for each irrigation site; • detailed assessment of the irrigation activities guided by the Environmental Guideline "Use of Effluent by Irrigation, DEC 20014", including site specific soil analysis and assessment of the short and long term impacts of salinity and sodicity on soils; • parameters for the sustainable application of void water to maximise water uptake and minimise deep percolation to groundwater and/or run-off for the application site; • identification of the appropriate approvals held under the Water Management Act 2000; • a program to monitor void water quality and soil characteristics; and • a description of the procedures to be implemented to measure and report on the quality of water supplied to each individual user and the quantity of void water used against the parameters identified.	Appendix A
23A	**Void Water Dam 1** Within 2 months of the completion of construction works of the expanded Void Water Dam 1, the Proponent shall submit a "works as executed" report to the Secretary and EPA, certified by a practicing engineer, confirming that the expanded dam has been constructed to its design	Works as executed report was submitted in February 2013

Condition	Condition Requirement	Section in this WMP is addressed
	specifications.	

2.3 Statement of Commitments

The WMP has been prepared to address the commitments made under Appendix 6 of the Modified PA. **Table 2** summarises the Statement of Commitments related to groundwater and surface water, along with where these requirements are addressed within the WMP.

Table 2 Statement of Commitments

Objective	Task	Timeframe	Section Reference
Groundwater			
Effective management of the potential contamination and/or reduction in availability of groundwater resources.	Implement impact mitigation measures in accordance with an approved WMP.	As defined by the WMP.	Section 10
	Undertake groundwater monitoring in accordance with an approved WMP.	As defined by the WMP.	Section 3.2
	Implement additional assessment, landowner notification and contingency or compensatory measures in accordance with an approved WMP.	As defined by the WMP.	Section 7.2
Prevent accumulation of void water within the final landform which may impact on final landform and land use.	Backfill overburden into the final void above the equilibrium water level.	Following cessation of mining.	Section 6.3.11
Surface Water			
Effective management of the potential contamination and/or reduction in availability of surface water resources.	Construct and maintain surface water management infrastructure in accordance with an approved WMP.	Ongoing	Section 6.3.6
	Implement impact mitigation measures in accordance with an approved WMP.	As defined by the WMP.	Section 10
	Undertake surface water monitoring in accordance with an approved WMP.	As defined by the WMP.	Section 7
Prevention of void water discharge off site.	Operate void water dams with sufficient freeboard to prevent discharge during high rainfall events.	Ongoing	Section 6.3.6
	Complete an irrigation assessment for specific irrigation campaigns in accordance with EPA requirements.	Prior to commencement of offsite irrigation.	Section 6.3.3
	Provide each irrigation assessment to the EPA for review and approval.	Prior to commencement of offsite irrigation.	Section 6.3.3

2.4 Environment Protection Licence

WCC operates under EPL 12290, issued under Section 55 of the *Protection of the Environment Operations Act 1997*. **Table 3** summarises the water management, monitoring and reporting requirements established in EPL12990 for scheduled activities undertaken at the WCC.

Table 3 Relevant Requirements from EPL12290

Condition	Condition Requirement	Section in this WMP where it is addressed
P1.3	Monitoring of discharge water quality, groundwater quality, and water supplied for agricultural use.	Section 7
L1.1	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 Plan
L2	Concentration limits	Section 5
M1	Monitoring Records	Section 8
M2.3	Requirements to monitor concentration of pollutants discharged	Section 6.4.2, 7.1.1
M3.1	Testing method – concentration limits	Section 5
M7	Requirement to monitor volume of water supplied for agricultural use	Section 7.5
R1	Reporting requirements	Section 8
O4.1	Water Management Approval prior to providing water for agricultural use	Section 6.3.3

2.5 Water Sharing Plans and Water Management Act 2000

The Southern portion of WCC is in the catchment of the Quirindi Creek, which flows into the Mooki and Namoi Rivers. Since July 2016 these catchments are now incorporated into the *Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources 2012, which is now the single water sharing plan applying to* WCC. The sharing plan contains water sharing rules which are specific to the Phillips Creek, Mooki Creek, Warrah Creek, Quirindi Creek and Quirindi Alluvial.

The NSW Aquifer Interference Policy (AIP) provides a framework for the identification and assessment of impacts to groundwater resources from mining activities. While it was introduced after the approval of the Life of Mine project and as such does not form the basis of the assessment of WCC impacts on groundwater, it nevertheless provides an information resource to ensure compliance with the Water Management Act 2000. This includes provisions for quantifying groundwater take through mining operations, as well as ensuring minimal harm to any water source because of the activity.

Two Water Access Licenses are in operation to allow the take of water for mining purposes. WAL32224 has been allocated 211ML per annum for incidental groundwater in-flow into the void. WCC also holds WAL29506 for 50ML per annum via bore extraction.

2.6 Guidelines

Key guidelines which are relevant to the preparation and implementation of this WMP include:

- ANZG," Australian and New Zealand Guidelines for Fresh and Marine Water Quality" , 2018;
- Department of Environment and Climate Change, "Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries", June 2008;
- NSW Department of Housing, "Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition" (the "Blue Book"), 2004;
- Department of Environment and Conservation, "Approved Methods for the Sampling and Analysis of Water Pollutants in NSW", March 2004; and
- Draft, "Water Reporting Requirements for Mines", Major Projects Assessment Unit, Department of Water and Energy.

3 BASELINE CONDITION

This section summarises the baseline condition of water management at WCC including the hydrogeological context of the site. WCC have been undertaking water monitoring since 2004 and this section presents a summary of previous monitoring results and analysis of that data as it related to background conditions. Monitoring locations are presented in **Section 7**.

3.1 Surface Water

Surface water resources in the local area are defined by two semi-permanent creeks that flow from east to west, fed from the ranges to the east of WCC on the Western side of the Great Dividing Range. Werris Creek is located north of WCC and Quipolly Creek to the south. A catchment divide slicing East-West through the middle of the present day WCC divides the Werris Creek catchment to the North from the Quipolly Creek catchment to the South, with minor drainage lines in the vicinity of WCC feeding these creeks. Water quality in these creeks is highly variable, with flows largely dependent on rainfall in the catchment areas. Two medium-sized dams are located on Quipolly Creek, providing one of a number of drinking water supplies to the local townships. The main Quipolly Dam was enlarged in late 2012, allowing the capture and storage of a significantly larger volume of water. The *Water Sharing Plan for the Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources 2003* requires releases of water from the dam to be no less than 10L/s or the equivalent to dam inflows, whichever is less.

A summary of water quality within the receiving environment is shown below, with average water quality and maximum recorded result or a range of parameters listed from 2008 to 2024

Table 4 Average Receiving Water Quality (2008-2024)

Sample Location	EP ID	EC (µS/cm)	pH	TSS	NO_3 as N	Total N	Reactive P as P	Total P	Oil & Grease
QCU	25	761	7.86	123	0.62	2.57	0.16	0.48	20
QCD	26	911	7.96	60	0.19	1.04	0.15	0.26	7

WCU	23	1061	8.21	305	3.77	5.33	0.25	0.47	5
WCD	24	775	7.94	81.11	1.21	2.01	0.25	0.36	1.40
QCU refers to an upstream location within Quipolly Creek and QCD refers to a downstream location within Quipolly Creek. WCU refers to an upstream location within Werris Creek and WCD refers to a downstream location within Werris Creek.									
Source - WCC Surface Water Monitoring Results									

Table 5 Maximum Receiving Water Quality (2008-2024

Sample Location	EPL ID	EC (µS/cm)	pH (min)	pH (max)	TSS	NO_3 as N	Total N	Reactive P as P	Total P	Oil & Grease
QCU	25	1790	7.26	8.36	319	1.48	5	0.51	0.9	140
QCD	26	1420	7.40	8.55	182	0.86	2.80	0.44	0.60	23
WCU	23	1500	7.34	8.42	504	4.44	6	0.81	1.69	7
WCD	24	1440	7.80	8.52	1830	25.20	30.70	0.66	1.66	27
QCU refers to an upstream location within Quipolly Creek and QCD refers to a downstream location within Quipolly Creek. WCU refers to an upstream location within Werris Creek and WCD refers to a downstream location within Werris Creek.										
Source - WCC Surface Water Monitoring Results										

3.1 Spoil Characterisation and Acid Forming Potential

Investigations into the acid generating potential of overburden/interburden and coal materials have been undertaken to assess the likelihood of hostile material impacting on background surface and groundwater quality (URS 2004). Analysis of overburden/interburden and coal material has identified:

- Spoil materials are generally slightly alkaline, with pH ranging from 6.6 to 8.4 (mean 7.9).
- EC is very low, ranging from 184 to 248 µS/cm (mean 203 µS/cm).
- Sulphur content of spoil is very low in both spoil and coal material, ranging from <0.01 to 0.03 %S in spoil, and 0.25 to 0.35% in coal seams.
- Acid Neutralising Capacity (ANC) is low to moderate (2.6 to 36kg H_2SO_4/t) for the upper strata (to C seam) and very high (227 to 229kg H_2SO_4/t) for the lower strata.
- Net Acid Producing Potential (NAPP) was negative in all samples. All samples are considered Non-Acid Forming (NAF) and also barren due to the negligible sulphur content.

Based on this characterisation of spoil and coal material, the investigation identified a low potential for both acid formation and soluble salt formation, due to the low concentrations of sulphur in the material, as well as the high ANC, derived from the presence of carbonaceous claystones and carbonaceous mudstones within the coal seams.

3.2 Groundwater

3.2.1 Hydrogeology

The main hydrogeological units identified within and surrounding WCC are shown on **Figure 3:**

- Quipolly Alluvium – the Quaternary sediments (clay overlaying sands and gravels) located along Quipolly Creek approximately 2.5km South of the WCC;
- Permian Coal Measures – consisting of seven coal seams and interburden strata of sandstones/siltstone and shales;
- Leard Formation (Peller Claystone unit) – underlying the coal measure, as a claystone aquitard providing confinement/semi-confinement of the underlying basalt aquifer, and
- Werrie Basalt – consisting of basaltic lava flows with a significant weathered profile of clay.

The Permian-aged Coal Measures have a low permeability and porosity due to their compacted nature. The main water-bearing zones occur in the more permeable coal seams with minor water-bearing zones in the interburden rocks. The Coal Measures strata at WCC forms a closed basin within the core of the Werrie Syncline, which is underlain and surrounded by the low permeability Leard claystone aquitard that limits the interaction of flows between the Coal Measures and the adjacent Werrie Basalt aquifer. Hydraulic testing of the claystone has demonstrated permeability of between 2.5×10^{-9} and 9.9×10^{10} m/s, which provides an effective seal to the Coal Measures. Further evidence to support this aquitard is the discrepancy in water level between the open cut pit and the Werrie Basalt aquifer, with a typical difference in hydraulic head of 110 metres. Similarly, the groundwater levels measured within the Coal Measures aquifer prior to mining varied from that of the Werrie Basalt aquifer at the time, indicating a hydraulic separation between these two groundwater systems. Finally, the water chemistry of the groundwater contained in the Werrie Basalt varies from that of water contained within the open cut pit, signifying different sources and flow paths.

The surface of the Werrie Basalt has weathered to a clay layer that acts as a confining or semi-confining layer to the basalt aquifer. Due to the presence of this overlying weathered layer, recharge to the basalt aquifer is considered to occur where this layer is thin or absence, and to the west and east of WCC where the topographical high sandstone ridges of the Temi and Currabubula formations crop out. Therefore, groundwater flow in the Werrie Basalt is characterised by flow from these recharge areas west and east towards Werris Creek Mine before turning northward and southward towards Werris Creek and Quipolly Creek.

The alluvial aquifer associated with Quipolly Creek contains extensive sand and gravel material of high permeability, with groundwater flows from the east to the west generally mimicking the topography and following the course of the current creek. The ephemeral Werris Creek does not appear to be supported by a significant alluvial aquifer, with its flow largely derived from rainfall within the catchment.

The permeability of the Quipolly Alluvium is high relative to the underlying basalt/weathered basalt, which promotes horizontal flow through the alluvium. R.W. Corkery & Co. (2010) state that some connectivity between basalt and alluvium may occur in zones where vertical fracturing intersects the alluvium or where alluvium is sufficiently deep to intersect water bearing basalt layers. Groundwater within the Quipolly Alluvium would provide the base flow for Quipolly Creek when alluvial groundwater levels are sufficiently high This connectivity can be observed in the lower sections of Quipolly Creek, where the predominantly dry watercourse is recharged by seepage from the aquifer at the point where Quipolly Creek intersects the Quirindi Dome range, as well as in upper sections of Quipolly Creek where releases from Quipolly Dam into Quipolly Creek quickly infiltrate into the alluvial aquifer.

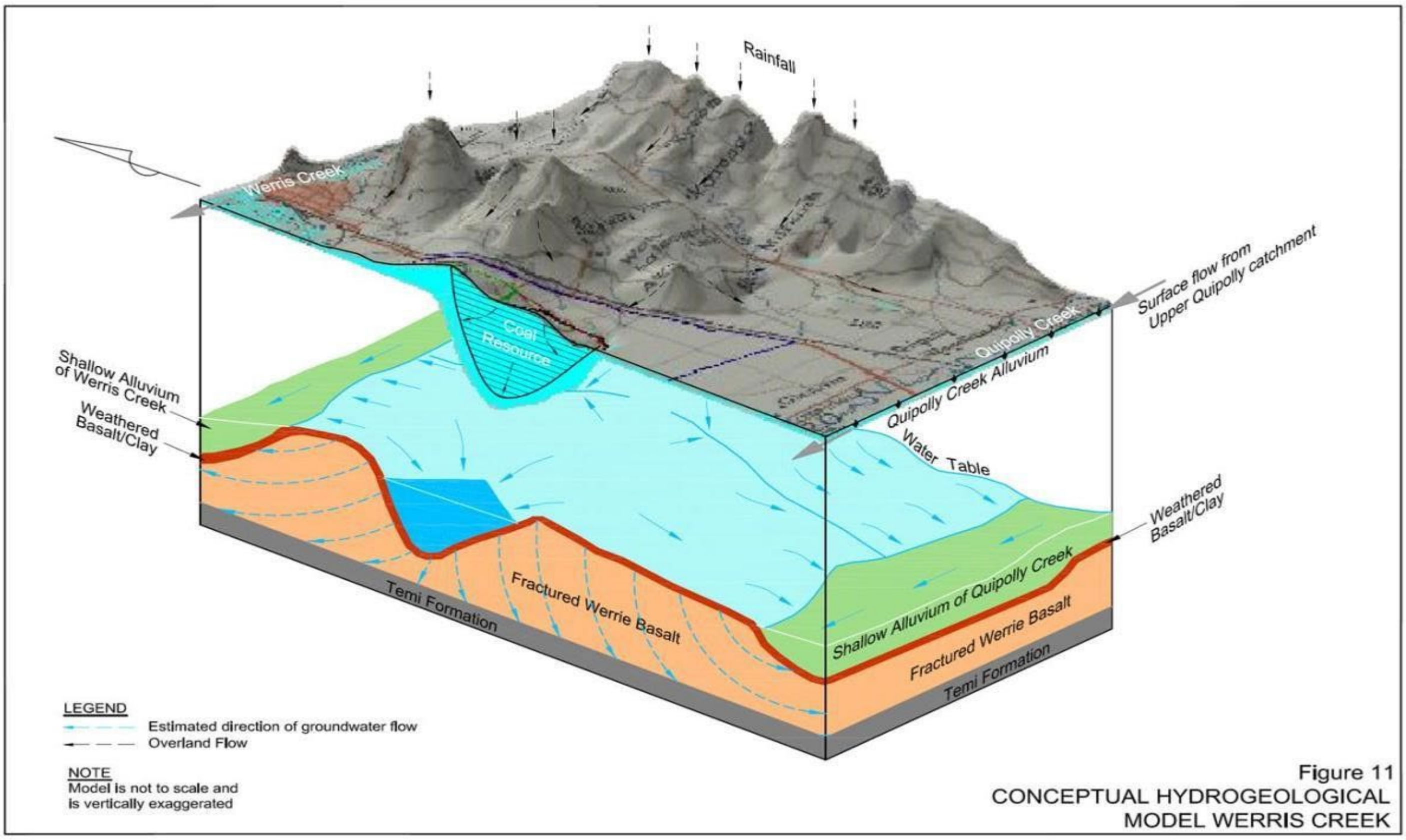


Figure 3 - Conceptual WCC Groundwater System (modified from Figure 11 RCA, 2010)

3.2.2 Groundwater Quality

Groundwater was sampled at the project site in 2004 prior to the commencement of open cut mining activities (RCA 2004). This sampling program found:

- Groundwater within the existing underground mine workings was slightly acidic with low salinity. The low salinity (brackish water) was considered unusual for coal measures and attributed to the proximity of the recharge point (i.e. the subcrop).
- Groundwater of the basalt aquifer was found to have a slightly acidic to neutral pH and was brackish. The concentrations of other analytes indicated that the water within the basalt aquifer was generally suitable for irrigation and livestock use.
- Groundwater of the alluvial aquifer was found to be of neutral pH and fresh to slightly brackish. The concentration levels of other analytes indicated that the water within the alluvium was suitable for irrigation and livestock use.

Table 6 and **Table 7** present a summary of the water quality in the basalt and alluvial aquifers. The analysis includes all data collected between 2004 and 2024.

Table 6 Summary of Water Quality in the Werrie Basalt

Region Werrie Basalt	No of Bores	No of Samples	Guidelines Agricultural Irrigation and Livestock		Concentration Ranges		
			Irrigation	*Livestock*	*Min*	*Max*	*Mean*
Phosphorous Reactive (mg/L)	19	458	-	-	0.01	2.21	0.18
Total Phosphorous (mg/L)	19	458	0.8 – 1.2^{stv} 0.05ltv	-	0.01	6.58	0.34
Total Nitrogen (mg/L)	19	460	25 - 125^{stv} 5ltv		0.1	72.2	8.31
Nitrates (mg/L)	19	452	6.77	6.77	0.01	38.8	6.46
Electrical Conductivity (µS/cm)	19	482	1900 - 4500stv 2000 - 5000^{ltv}	5000$^{\#}$	25	4500	1427
pH-field	19	482	6.5 – 8.5	6.5 – 8.5	6.5	8.5	7.28
ltv – long term value, stv – short-term value, # Poultry – sheep value/long-term trigger value, - No published values							
Source - WCC Groundwater database							

Table 7 Summary of Water Quality in the Alluvium

Region Alluvium	No of Bores	No of Samples	Guidelines Agricultural Irrigation and Livestock		Concentration Ranges		
			Irrigation	*Livestock*	*Min*	*Max*	*Mean*
Phosphorous-Reactive (mg/L)	20	239	-	-	0.01	1.86	0.07
Total Phosphorous (mg/L)	20	239	0.8 – 1.2stv 0.05ltv	-	0.01	3.24	0.18
Total Nitrogen (mg/L)	20	239	25 - 125stv 5ltv		0.10	23.3	2.21
Nitrates (mg/L)	20	239	6.77	6.77	0.01	20.2	1.64
Electrical Conductivity (uS/cm)	20	239	1900 - 4500stv 2000 - 5000ltv	5000#	60	4320	804.46
pH-field	20	239	6.5 – 8.5	6.5 – 8.5	6.60	8.6	7.26
ltv – long-term value, stv – short-term value, # Poultry – sheep value/long-term trigger value.							
Source - WCC Groundwater database .							

3.2.3 Groundwater Level

Groundwater levels have been monitored on a bimonthly basis since 2004 as part of the WCC groundwater monitoring programme.

Groundwater levels within the Werrie Basalt and Quipolly Alluvium aquifers exhibit a close correlation with residual rainfall in the area, with relatively steep rises in groundwater level following wetter periods interspersed with longer periods of gradually declining water tables during drier years. This pattern is more pronounced in the shallower Quipolly Alluvium system, and less pronounced in those areas of the Alluvium fed by springs from the Werrie Basalt, immediately upstream from the Kamilaroi Highway crossing.

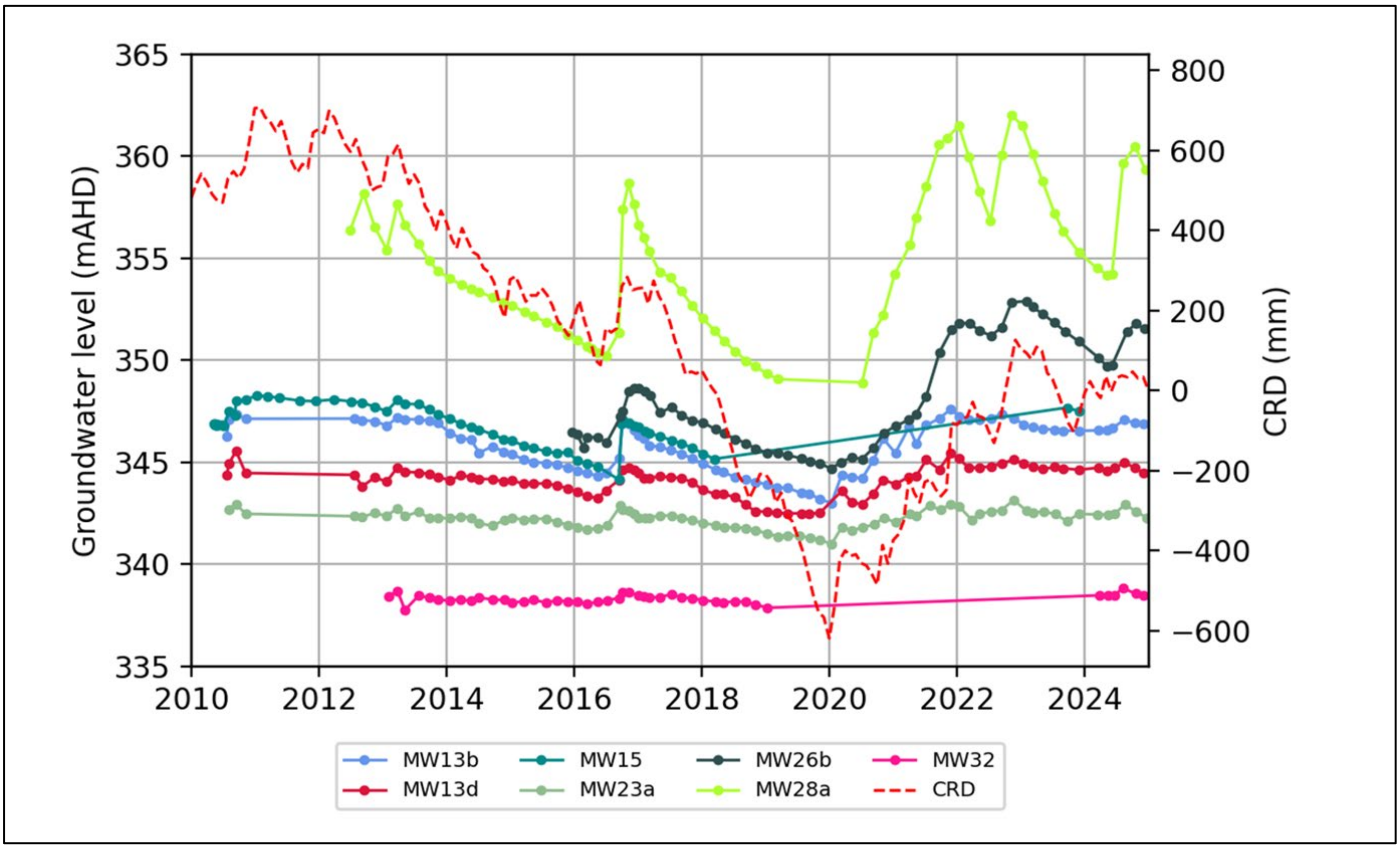


Figure 4 - Groundwater Levels in the Quipolly Alluvium compared to cumulative rainfall

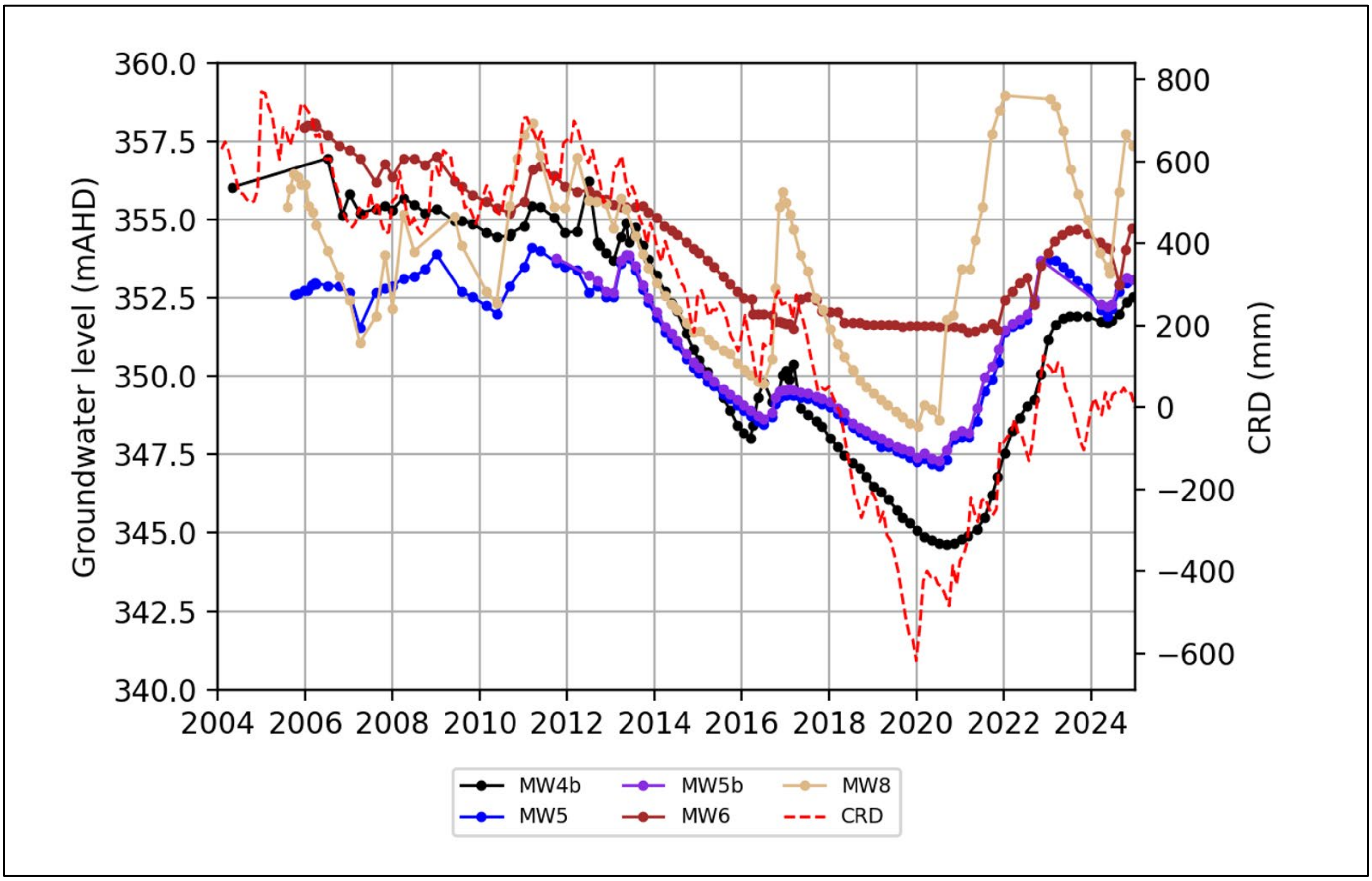


Figure 5 - Groundwater Levels in the Werrie Basalt compared to cumulative rainfall

4 SITE WATER BALANCE

4.1 Post-mining Water Management

Following the completion of mining operations in 2024, active dewatering of the final void has ceased. Water stored in existing Void Water Dams is currently being returned to the final void, along with water collected in sediment dams. Site water demands have also very substantially reduced. As a result, catchment runoff will generate a net positive water balance (gaining water) for the site in most years because the most significant water demand will only be net evaporation from storages.

4.2 Long-term Assessment of Final Void Water Levels

An assessment of long-term (hundreds of years) water levels was completed as part of the surface water assessment for the Final Landform Modification (Whitehaven Coal, 2022b). The assessment found that the post-mining final void will continually accumulate water due to catchment runoff and groundwater inflow. Water levels will rise to about 330 mAHD after 90 years, reaching a long—term equilibrium level of about 343 mAHD after more than 500 years.

4.3 2024 Annual Site Water Balance

The site OPSIM water balance model was updated based on recorded site data for 2024. Active mining operations ceased in mid-2024.

Figure 6 shows the modelled 2024 mine pit water inventory compared to recorded data. Results are shown for free water only, which is the water stored above the ground surface within the mine pit. It does not include the significant volume of water contained in the pore space of the in-pit spoil. The model results show a good match between the modelled and recorded free water volume in the pit. The rising in-pit water volume from mid-2024 corresponds to the end of pit dewatering and commencement of water transfer from out-of-pit storages to the pit.

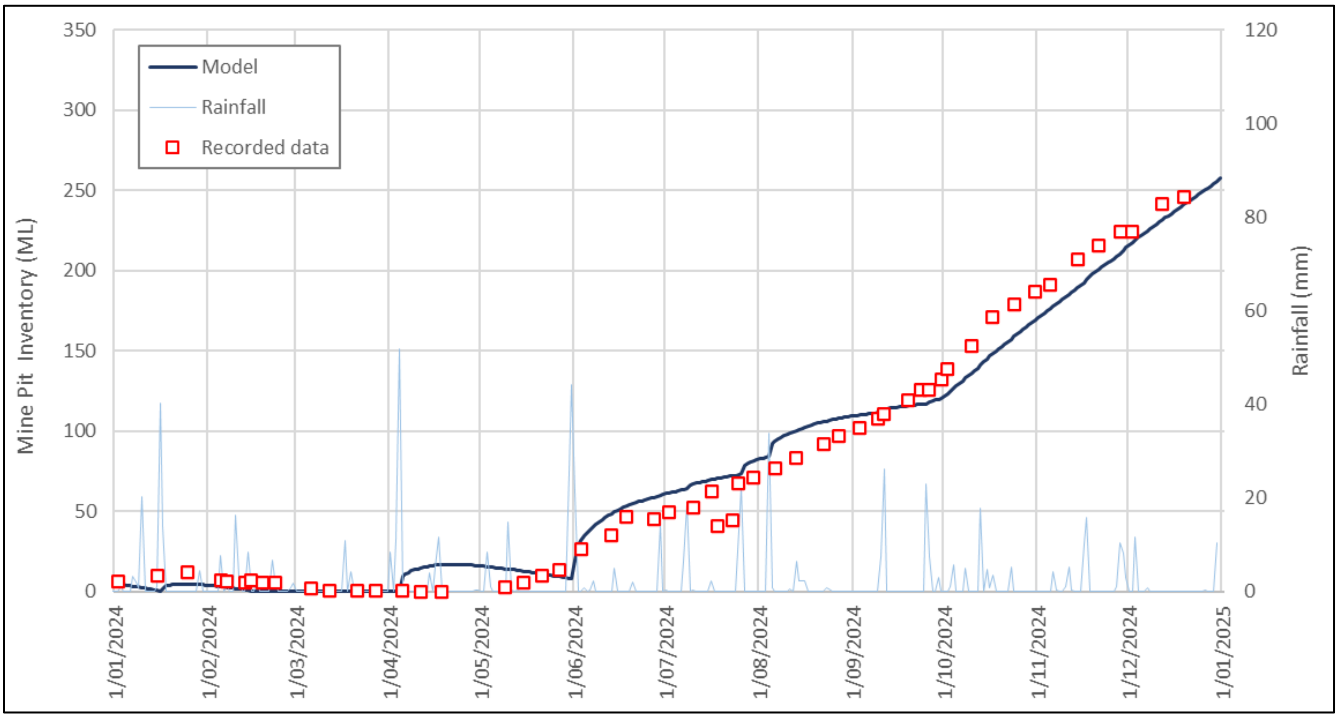


Figure 6 - Modelled and recorded mine pit free water inventory, 2024

4.4 6-year Site Water Balance Forecast

A 6-year forecast (from the start of 2025) of the post-mining site water balance was undertaken using the existing OPSIM site water balance model with minor changes to reflect post-mining operations.

The forecast model was run for many climate sequences extracted from historical data to assess the performance of the water management system over the full range of historical climate conditions.

Rainfall and evaporation climatic inputs to the water balance model were based on data obtained from SILO (www.longpaddock.qld.gov.au/silo/) for Werris Creek Mine (-31.4039 latitude, 150.6428 longitude). The long-term average rainfall for this location is 673 mm.

The following assumptions were adopted for the forecast water balance:

- 6-year simulation commencing 1 January 2025.
- Adopted site catchments and land use shown in **Figure 7.**
- All storages dewatered to mine pit at pumping rates as per 2024 annual water balance assessment. Schematic of site storages is shown in **Figure 8.** No water pumped out of mine pit.
- Adopted final void stage-area-volume relationship shown in **Figure 9**, based on site data provided
- Adopted rainfall runoff parameters the same as adopted for the 2024 annual site water balance.
- No active mining or coal processing on the site.
- Groundwater inflows to the mine pit at a rate of 134 kL/d, as per assumptions adopted in the 2024 annual water balance assessment.
- VWD8 decommissioned.
- Water cart demand of 4 ML/month to the end of 2025 to support rehabilitation works, then zero. Adopted water cart demand is based on the average post-mining use in the second half of 2024.
- No irrigation or other site demands.

The forecast mine pit water volume and level are shown in **Figure 10** and **Figure 11**. The results show percentiles, based on the range of historical climatic conditions. The 50th percentile is the median of all modelled climate sequences. The 1st percentile represents the highest modelled water levels for the modelled climate sequences and would correspond to climatic conditions that are very much wetter than average.

The annual average site water balance results for the 6 year simulation period (2025-2030) are shown in **Table 8.**

Table 9 shows the annual average Mine Pit water balance for the 6-year forecast period. Most of the mine pit inflows are from catchment runoff.

The forecast water balance results show a net water surplus for the site averaging about 272 ML per year. Actual inflows and the rate of rise in the final void water level will depend on climatic conditions.

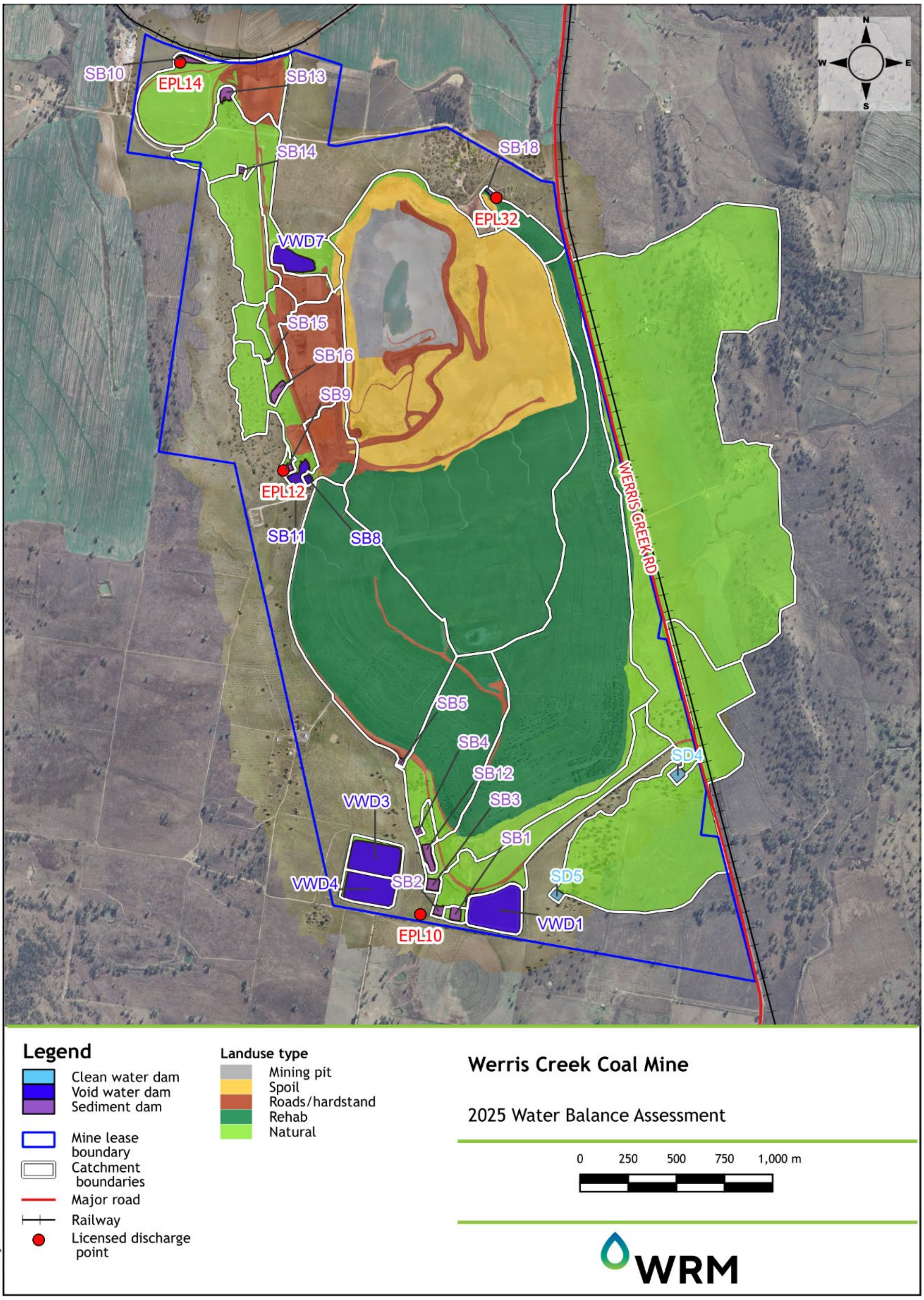


Figure 7 - Adopted post-mining catchments and land use

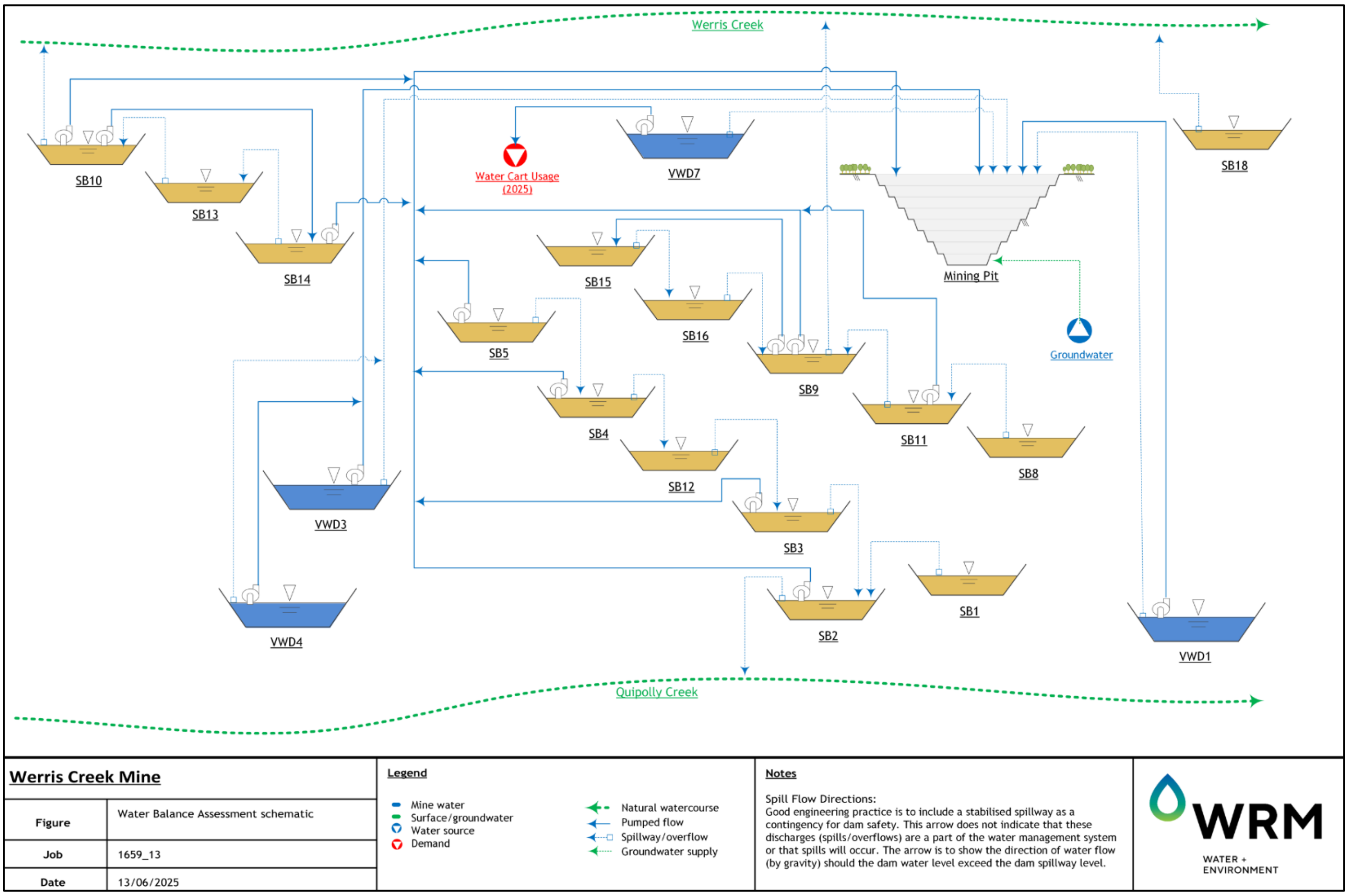


Figure 8 – Water management system schematic

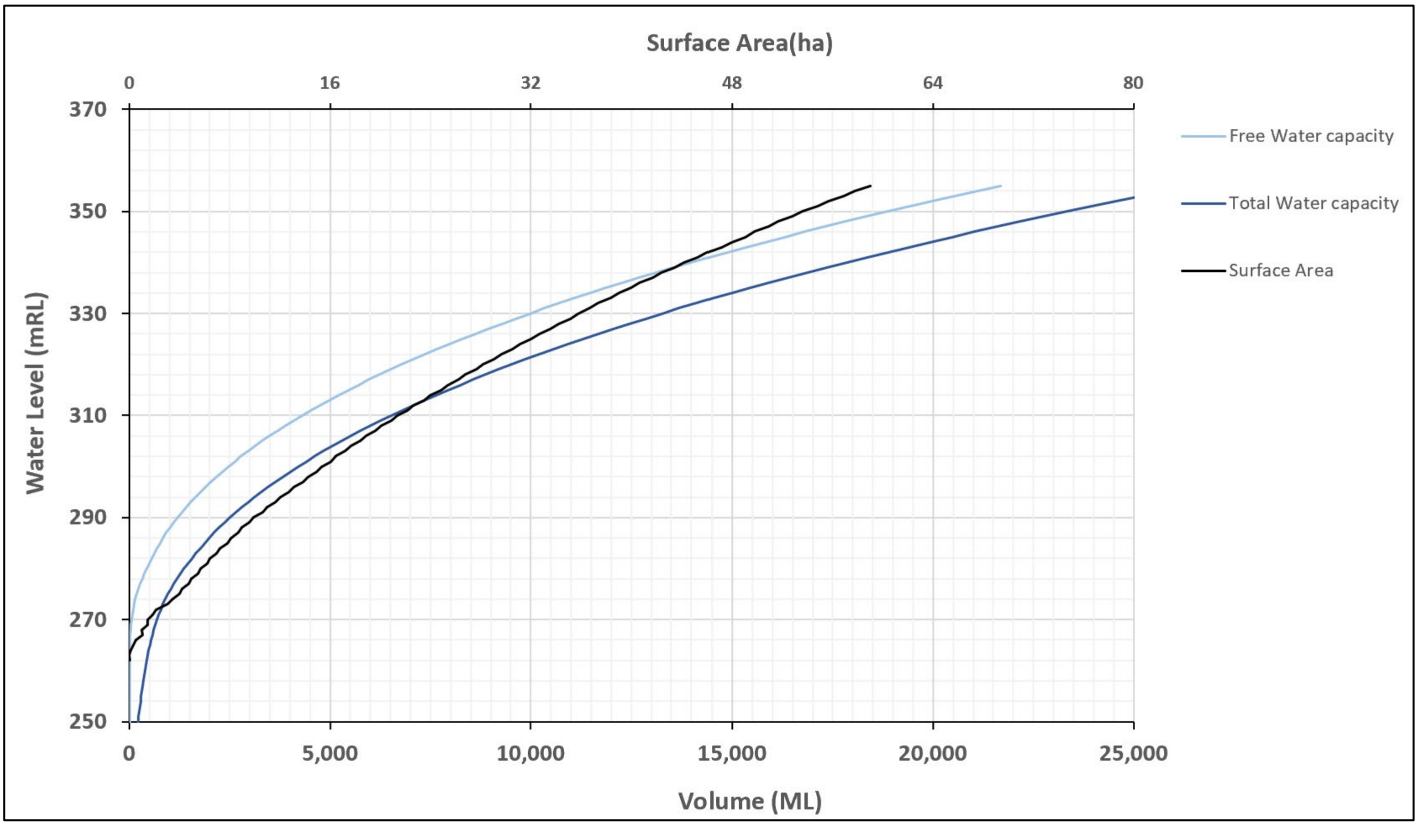


Figure 9 – Adopted stage-area-volume relationship for final void

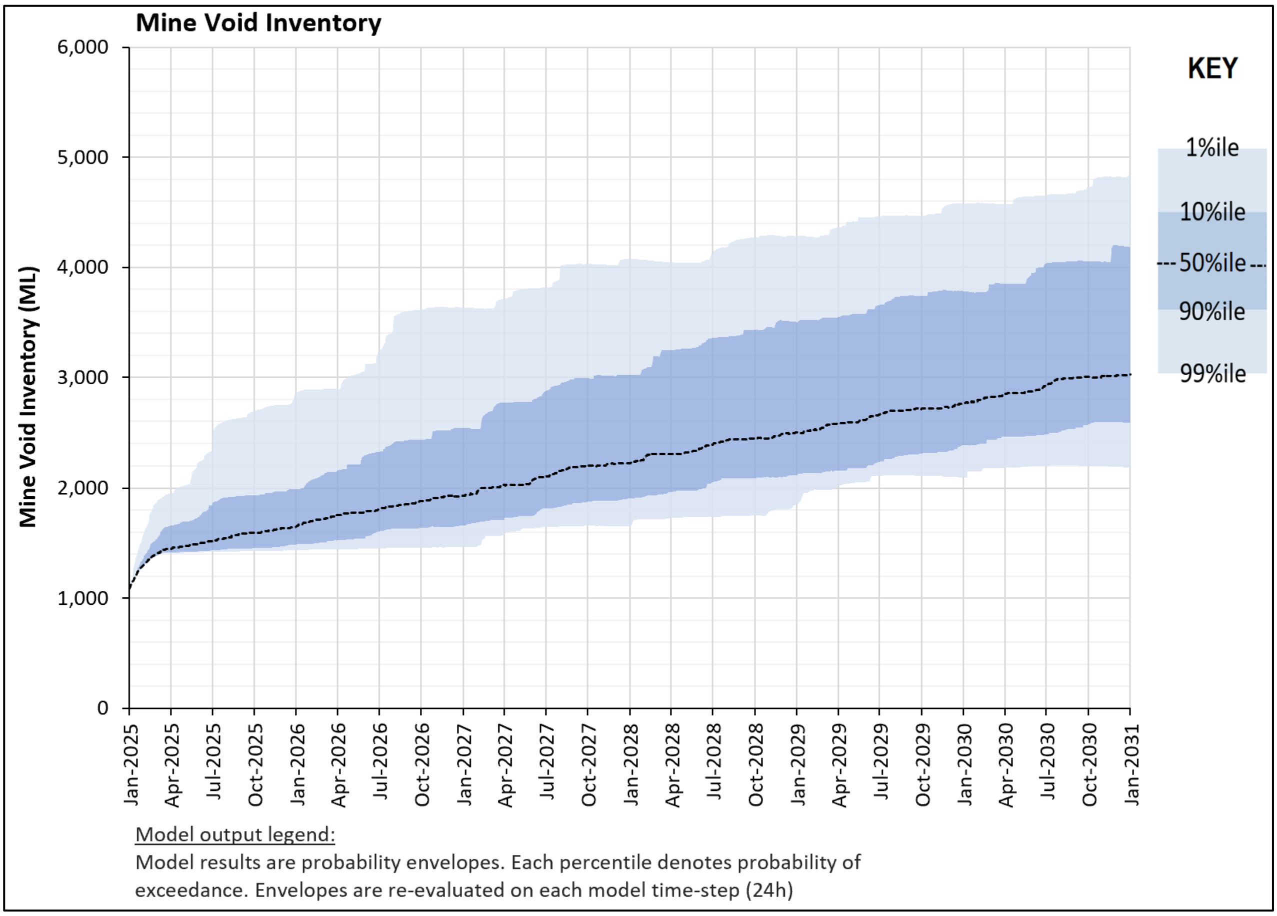
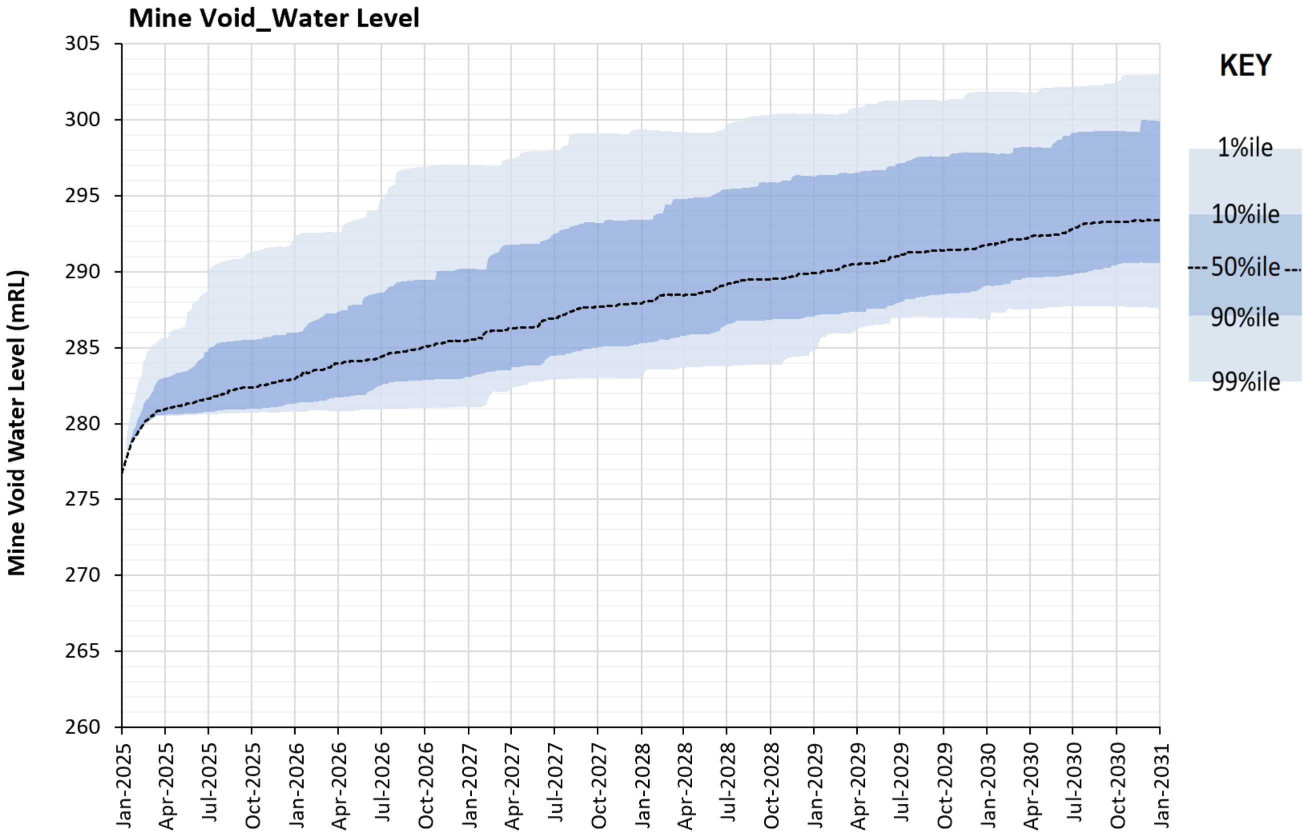


Figure 10 – Mine pit total water volume – 6 year forecast



Model output legend:
Model results are probability envelopes. Each percentile denotes probability of exceedance. Envelopes are re-evaluated on each model time-step (24h)

Figure 11 – Mine pit water level – 6 year forecast

Table 8 Estimated average annual site water balance for forecast period

	Description	Annual average (ML/year)
Water Source (Inputs)	Total runoff and direct rainfall	437
	Groundwater (aquifer) inflow	49
	Total Input	**497**
Water Losses and Usage (Outputs)	Evaporation (from water storages)	169
	Water cart use (post-2025)	0
	Controlled discharges (EPL10, EPL12 and EPL14)	0
	Sediment dam uncontrolled discharges	15
	Total Output	225
Water Surplus/Deficit	**Total Input - Total Output**	**272**

Table 9 Annual average Mine Pit water balance results for forecast period

	Description	Annual average (ML/year)
Water Source (Inputs)	Rainfall and Runoff	212
	Net Groundwater	49
	Sediment dams dewatering to Mine Pit	137
	Total input	398
Water Losses and Usage (Outputs)	Evaporation	95
	Mine Void dewatering	0
	Total Output	95
Water Surplus/Deficit	Total Input-Total Output	303

4.5 Agricultural Use of Void Water Offsite

Historically, some excess water collected on site has been made available to the owners or users (under lease) of land adjoining or surrounding WCCM for irrigation and/or other agricultural use (i.e. stock watering).

In order to demonstrate that the void water could be utilised for agricultural purposes without adversely impacting on the local environment, SEEC (2015) undertook an assessment to investigate the use of excess void water from WCCM, via irrigation on agricultural land surrounding WCC. SEEC utilised the EPA endorsed *Effluent Reuse Irrigation Model* (ERIM) to demonstrate the feasibility of irrigating the void water to surrounding agricultural lands.

ERIM uses water and nutrient balances to calculate the amount of water and nutrients that should be applied, and at what times, to meet crop requirements whilst ensuring runoff and percolation are minimised.

The SEEC assessment determined that the irrigation of void water to land on and adjacent to WCC could provide a viable means of reducing the volume of water stored within the Void Water Dams and that the void water is a valuable resource to encourage agricultural activities (SEEC 2015). The methods for the use of the void water by agricultural users are discussed in an Irrigation Management Plan (IMP), which has been developed in consultation with the landowner / lease holder, and is attached as **APPENDIX A**.

4.6 Short-term Water Strategy

WCC maintains a short-term water strategy tool for monitoring current water usage and storage levels and projecting future water usage to determine:

- Expected void water dam storage;
- How much surplus void water there could be;
- Quantify additional options for water use.

4.7 Potable Water Use

Potable water for use at WCC is delivered by truck on an as required basis and is stored in dedicated tanks in the Mine Industrial Area (MIA). To minimise the use of potable water on site, plumbing works have been designed to ensure that potable water is only delivered to those facilities that require water of this quality, including washroom and crib facilities. Following completion of mining operations in 2024, potable water use at Werris Creek Mine has reduced.

5 CRITERIA, OBJECTIVES AND TARGETS

5.1 Water Criteria

Table 10 outlines the approach to water quality monitoring for each of the monitored elements.

Table 10 Water Monitoring Triggers

Parameter	Triggers
Surface Water (Dirty Water Discharge)	
Total Suspended Solids	Licence conditions outlined in **Table 11**
Oil & Grease	
pH	
EC	Concentrations are below the maximum background concentrations presented in **Table 5.**
Nitrate, total nitrogen, total phosphorus and reactive phosphorus	
Surface Water Monitoring Quipolly Creek and Werris Creek (downstream monitoring sites)	
pH and EC Oil & Grease Nitrate, total nitrogen, total phosphorus and reactive phosphorus	Concentrations are consistent with upstream values.
Groundwater	
Water level	Detection of an increasing trend (depth to water) using Cusum one-sided analysis.
Groundwater interception	Determination of groundwater interception as part of AR process identifies annual pit interception exceeds 261ML (WAL32224 & WAL29506).
pH, EC, nitrate, total nitrogen, total phosphorus and reactive phosphorus	Concentrations are within the minimum and maximum background values presented in **Table 6** and **Table 7.**
Water supplied for agricultural use	
pH, EC, and Oil & Grease	Licence conditions as outlined in **Table 12.**

Should the values identified in **Table 10** be triggered, **Section 10** of this WMP outlines the Trigger Action Response Protocol (TARP) references associated with managing the incident.

Recorded values for pH, Total Suspended Solids (TSS) and Oil & Grease will be compared against the criteria presented in **Table 11** adopted from EPL 12290.

Table 11 Surface Water Assessment Criteria, EPL 12290

Pollutant	Unit of Measure	50% concentration limit	90% concentration limit	100% concentration limit
Total Suspended Solids	mg/L	20	35	50
Oil & Grease	mg/L	-	-	10
pH	-	-	-	6.5 – 8.5

Recorded water quality values of water supplied for agricultural purposes will be compared against the criteria presented in **Table 12**, adopted from EPL 12290.

Table 12 Agricultural Water Supply Assessment Criteria, EPL 12290

Pollutant	Unit of Measure	50% concentration limit	90% concentration limit	100% concentration limit
Electrical Conductivity	µS/cm	-	-	2000
Oil & Grease	mg/L	-	-	10
pH	pH units	6.5 – 8.5	-	9.0

The methods for evaluating compliance with revised water criteria are presented in **Section 7**.

5.2 Water Objectives and Targets

WCC has established specific objectives and targets for the higher risk water hazards identified in the EA. The objectives and targets (**Table 13**) will be reviewed monthly and revised annually based on the overall year's performance. The objectives and targets proposed for the future years are only indicative and will be subject to the results of the AR.

Table 13 Water Objectives and Targets

Objective		Performance Indicator	2019-2020 Performance	Target				
Activity	Environmental Hazard			2020-2021	2021-2022	2022-2023	2024-2026	Reason
Discharge	Non-compliance with discharge surface water criteria	Number of Non-compliance's with EPL or PA	1	0	0	0	**0**	Expectation that there will be no non-compliances
Mining operations dewater aquifer reducing saturated thickness in offsite bores	Landholder's water availability is reduced due to WCC operations	Groundwater investigations identify drawdown in a landholder bore of greater than 10cm due to WCC Operations.	0	0	0	0	**0**	Nil project related impacts on landholder bores

6 MANAGEMENT STRATEGIES AND MEASURES

For the three distinct environmental aspects of site water management – surface water, erosion and sediment control, and groundwater, the specific management strategies and measures are outlined in **Table 14.**

Table 14 Site Water Management Controls

Section	Measure	Responsibility	Timing
6.1	Water Modelling	C	Annual
6.2 Surface Water Management			
6.2.1	Segregated Water Streams	Pumper/EO/OCE	As required
6.3 Void Water Management			
6.3.1	Void Water Management System	Pumper/EO	As required
6.3.2	Void Water Pumping	Pumper	As required
6.3.3	Agricultural Use of Void Water	Pumper/EO	As required
6.3.5	Dust Suppression Water Usage (until completion of rehabilitation activities)	OCE	As required
6.3.6	Void Water Dam Storage Management	Pumper/Mining Superintendent	As required
6.3.7	Pipelines and Valves	Pumper/OCE	As required
6.3.8	High Water Level Alarms	Pumper/EO/OCE	As required
6.3.9	Site Water Usage	EO	As required
6.3.11	Final Void Water Level and Quality	Engineer/C	Annual
6.4 Dirty Water Management			
6.4.1	Dirty Water Dams	EO/Pumper	As required
6.4.2	Dirty Water Discharge	EO	As required
6.4.3	Rehabilitation Program	EO	As required
6.5 Clean Water Dams			
6.5.1	Clean Water Dams and Maximum Harvestable Rights	EO	As required
6.5.2	Clean Water Diversion	EO	As required
6.5.3	Water Management at Mine Closure	EO/Engineer	At closure
6.6 Contaminated Water Management			

6.6.1	Oil/Water Treatment	EO/Workshop	As required
6.6.2	Septic Water Treatment	EO	As required
6.7 Erosion and Sediment Controls		Operations/EO	As required
6.8 Groundwater Management			
6.8.1	Groundwater Level and Inflow Management	EO	As required
6.8.2	Groundwater Licensing	EO	Annual
6.8.3	Groundwater Quality Management	EO	As required
6.8.4	Hydrocarbon Management	Workshop	As required
6.8.5	Saline Water Body Within Mine Void on Cessation of Mining	EO	Year 12
Pumper, OCE – Open Cut Examiner, EO – Environment Officer, C – Consultant			

In order to mitigate any potential water impacts from the WCC LOM Project, a number of surface water and groundwater management controls will be implemented throughout the life of the operation. The management of surface water aims to prevent surface water pollution both within onsite dams and offsite water courses, whilst groundwater management aims to prevent groundwater contamination and minimise groundwater level impacts as a result of mining operations. All water management controls are detailed in **Table 14.**

6.1 Water Modelling

Modelling of site water volumes is undertaken for the following purposes:

- To assist with the management of water for site operations;
- To report to (NRAR) on groundwater use under the licensing requirements; and
- To calibrate against actual conditions and allow improved predictions of future mining sequences.

To facilitate the above, the numerical groundwater model was used to predict future groundwater conditions (including pit inflows) and revisions of the surface water balance will be routinely undertaken. Outcomes of the site water balance, included predicted versus actual pit inflows, are reported as part of the AR. The site water balance updates will be undertaken by appropriately qualified persons and will be in line with the water balance updates prepared to date.

6.2 Surface Water Management

6.2.1 Segregated Water Streams

Surface water management is based on the separation and segregation of void, dirty and clean water to ensure each stream is appropriately managed based on the potential pollutants in each stream. The definitions of each water stream category are as follows:

> Void Water – the void water catchment area is comprised of the active mining area and overburden emplacement which collects both rainfall runoff and groundwater in the base of the open cut void. Post-mining, dewatering operations have ceased, and void water will accumulate within the pit.

- Dirty Water – the dirty water catchment area comprises those areas previously disturbed by mining such as rehabilitation, infrastructure and soil stockpile areas with the focus on treatment of water quality and subsequent discharge. Runoff of "coal contact" water from the ROM Coal Stockpile/Coal Processing area and TLO/Product Coal Stockpile area has been approved for capture in dirty water dams since the original Werris Creek open cut mine commenced operations in 2005, and with subsequent approvals for the Life of Mine project in 2011. Whitehaven Coal has worked with the NSW EPA to address the key environmental risks associated with coal contact water. Whitehaven Coal has committed to considering and investigating the identified risks and if deemed appropriate explore actions to mitigate any risks identified in consultation with the EPA. All coal from the ROM and TLO stockpile has been removed.
- Clean Water – the clean water catchment area is undisturbed by mining activities and allowed to flow offsite without active management required. Clean water upslope of the mining area and to the east of Werris Creek Road is diverted around the outside of mining operations; and
- Contaminated Water – includes potentially hydrocarbon contaminated water runoff from the workshop and fuel farm areas which is treated through an oil-water separator and water from ablutions is treated through septic systems onsite.

Figure 12 & 13 displays the current void, dirty and clean water catchments of WCC. However, void and dirty water areas are in the process of rehabilitation post-mining. The segregation of each water stream is undertaken by diverting clean water away from the active mining (void water) and other disturbed areas (dirty water). Clean and dirty water streams are separated and diverted using a series of contour banks, diversion drains and dams and appropriate erosion and sediment controls. Void water is contained within enclosed pipelines when pumped to the surface and stored within turkeys' nest dams segregated from the dirty water catchment. Management strategies for each of the three main surface water streams and the contaminated water stream are outlined in **Sections 6.3 to 6.6.**

All attempts are made to capture and divert clean water runoff around the site to avoid contamination. The volume of 'Dirty' and 'Void' water to be controlled is minimised by both preventing mixing with 'Clean' water, and through maximising the re-use of 'Dirty' and 'Void' water onsite for irrigation, dust suppression and other process water requirements. The water is used on site based on the following preferential order:

'Void' water (1st) ⟹ 'Dirty' water (2nd) ⟹ 'Clean' water (3rd).

6.3 Void Water Management

Post-mining, accumulation of void water within the pit is no longer a risk to operations and transfer from out-of-pit storage to the pit is the preferred management strategy.

6.3.1 Void Water Management System

A dedicated system of pumps, pipelines and dams has been established to manage void water on site and forms the basis of the Void Water Management System (VWMS). The Open Cut Examiners (OCE) or delegate (i.e. an operator acting as the "Pumper") are responsible for the daily void water management with the two most common activities including void water pumping and water cart dust suppression.

Figure 12 - WCC Water Management Streams

Figure 13 - WCC Void Water Management System

6.3.2 Void Water Pumping

Void Water Pumping is a key water management activity at WCC. Pit water storage, pumping and piping are recognised as environmentally high-risk activities. To manage those activities, procedures are in place to minimise the potential for the discharge of void water offsite while safely dewatering the pit and pumping to void water dams at the surface for dust suppression and other purposes. WCC maintains a water licence for the interception of groundwater encountered in pit as part of void dewatering (WAL32224 and WAL29506) with a 261ML annual allocation.

6.3.3 Void Surface Drainage

Drainage of the design surface of the final void have will be achieved using natural landforms geomorphic design, designed by a landform engineer. The alignment of design drainage channels within the final void is shown in Figure 14. Final landform contours are shown in Figure 15.

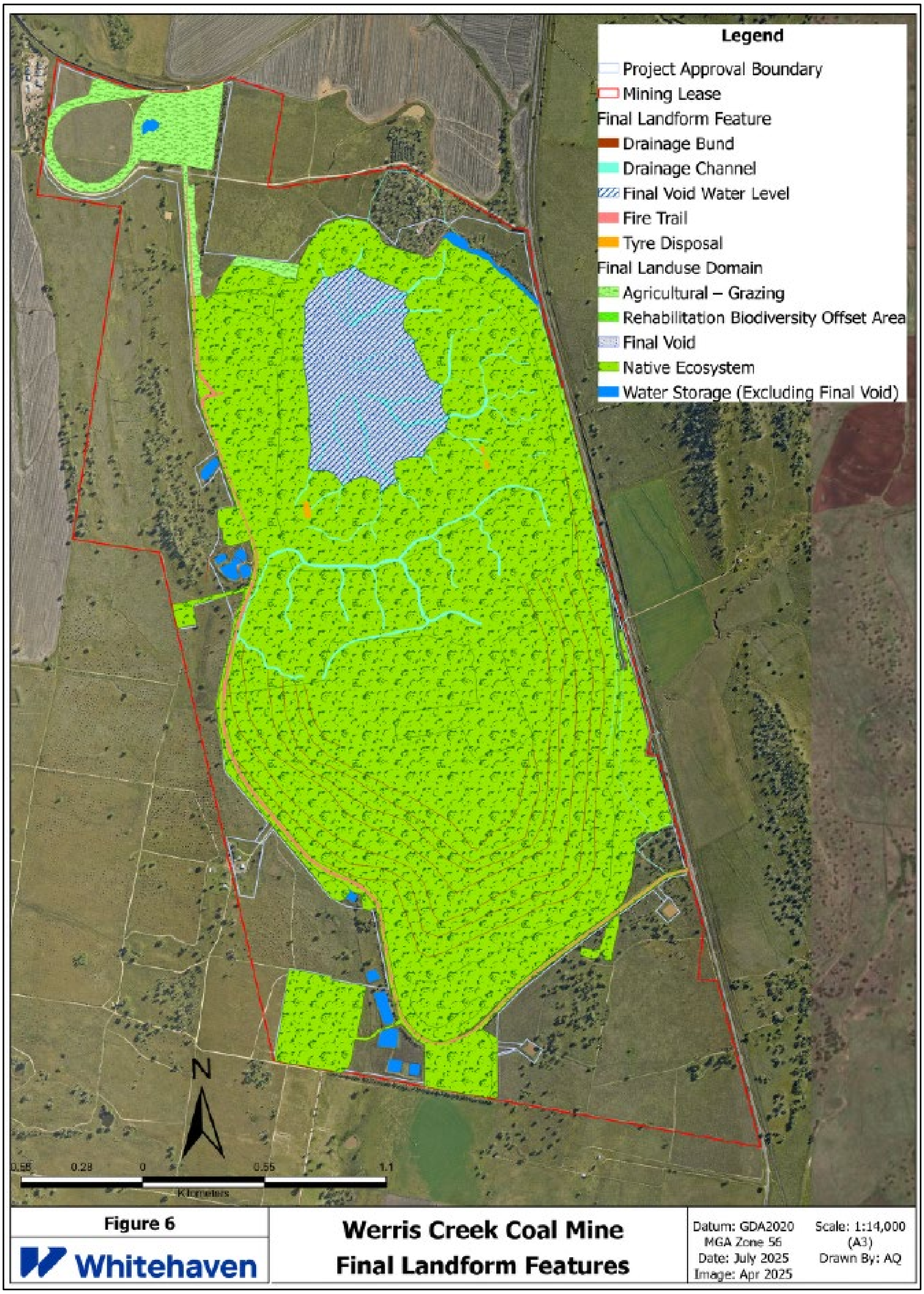


Figure 14 – Final landform features (source: Rehabilitation Management Plan)

Figure 15 – Final landform contours (source: Rehabilitation Management Plan)

6.3.4 Management of Void Water for Agricultural Uses

To manage excess void water at WCC, WCC may periodically enter arrangements for the supply of void water to nearby end users. The provision of void water for agricultural purposes, such as irrigation or stock watering, will be reviewed and managed on a case-by-case basis as prospective projects are identified by WCC or applications for access to the void water are received from land owners or lease holders (“the User”). Following review of the predicted site water balance, and current storage levels, WCM may enter into agreement to supply water. Pre-requisite for commencing the supply of water are as follows:

- Preparation of an Irrigation Management Plan (IMP) (within this document)
- Provide each irrigation assessment to the EPA for review and approval
- Execution of an agreement between the parties – the supplier and the irrigator
- Landowners consent
- Approval of the WMP
- Construction of the necessary water transfer infrastructure

To address the requirements of the Modified PA, WCC have adopted the IMP as a site-specific assessment,

Each irrigation project will require the preparation of a site-specific IMP, which will be appended to and form part of this WMP. An IMP for the ‘Plainview Irrigation Project’ is included at Appendix A. A template for future IMP’s is included at Appendix B.

Unless modified by individual contract, WCC will be responsible for the accumulation and storage of void water on the mine site (within void water dams or the open cut) and initial pumping transfer (to the mine site boundary) of this water. The User will be responsible for the delivery of this water to off-site water storage and use of the water in accordance with the IMP and the POEO Act. Once the void water has been provided to the User under the provisions of this subsection, the water will be considered for all purposes as irrigation water rather than void water. WCC will not and cannot be held liable for the use or misuse of this irrigation water once it has been provided to the User, provided WCC meets the requirements, as far as practicable, of the IMP. Responsibility for the safe use and management of the irrigation water then resides with the User.

Prior to the supply of water to any agricultural Water User, WCC will sample the proposed supply dam for the parameters listed in **Table 24** to ascertain the likely suitability for irrigation purposes. During supply monitoring results will be compared to the concentration limits listed in the EPL to ensure any supply of agricultural water will comply with the applicable licence limits.

6.3.3.1 Water Management Act 2000 Approval Requirements

WCC have held discussions with licensing officers of the NRAR regarding the appropriate approvals required under the *Water Management Act 2000* to ensure the compliant supply and use of void water for irrigation. Under the Act, WCC is required to hold a current Water Access License for the extraction of the water (as part of a Water Supply Works Approval) used for any irrigation program. In addition, an irrigator may be required to hold a Water Use Approval for the specific land under which irrigation is to occur where this land has not previously been identified within an applicable statutory document for WCC.

6.3.3.2 Management of Void Water for Irrigation

Any irrigation program will be managed on a case-by-case basis, through the application of an IMP (see **APPENDIX A**) which assesses the specific characteristics unique to each site and irrigation program including:

- An assessment of baseline conditions utilising the EPA guideline "*Use of Effluent by Irrigation*", including site specific soil analysis, consideration of the short- and long-term impacts of salinity and sodicity on soils, and local groundwater and surface water resources.
- An assessment of the quality of the void water to be used, and desirable parameters for the sustainable application of void water to maximise water uptake and minimise deep percolation to groundwater and/or run-off from the irrigation site.
- Modelling to determine the optimum amount of water and nutrients to be applied.
- A detailed review of the processes and operating methodologies of the proposed irrigation program.
- Monitoring and reporting requirements of the irrigation program.

6.3.3.3 Management of Void Water for Stock Watering

The supply of void water for stock watering will be managed on a case-by-case basis, through the application of a risk assessment and individual agreement with the Water User which assesses the particulars of the program, including:

- A summary of the baseline conditions, including a comparison of void water quality to the water quality of key sources of stock drinking water in the area.
- An assessment of the suitability of the void water for stock watering against the ANZECC 2000 Guidelines regarding Livestock Drinking Water Quality.
- An overview of the mechanisms for the provision of void water for stock watering, including a summary of responsibilities.
- Monitoring and reporting requirements associated with the provision of void water for stock watering.

Once the void water has been provided to the User under the provisions of this subsection, the water will be considered for all purposes as stock water rather than void water. WCC will not and cannot be held liable for the use or misuse of this stock water once it has been provided to the User, provided WCC meets the requirements, as far as practicable, as detailed in this WMP. Responsibility for the safe use and management of the stock water then resides with the User.

6.3.5 Former Underground Workings Water Management

Active dewatering of the former underground workings ceased in July 2013 as mining advanced through the former dewatering bore. Underground working where mined through and no longer require water management control. WCC maintains a water licence for dewatering the former underground workings (WAL29506 and 90AL822531) with a 50ML annual extraction allocation. While the bore is no longer in use, WCC maintains a Water Works Approval (90WA822532) for a bore.

6.3.6 Dust Suppression Water Usage

The primary use of void water at WCC is for dust suppression. Water used for dust suppression is via water carts used to water mainly trafficable areas such as haul roads, excavator loading faces and dumps. The workshop utilises a small volume of water for equipment and plant wash down prior to maintenance. Water use for dust suppression has reduced substantially since the end of mining in mid-2024 and will reduce further once rehabilitation operations are substantially complete.

6.3.7 Void Water Dam Storage Management

Void dewatering requires surface storage dams to manage void water until it can be used for dust suppression or for agricultural use offsite. WCC currently uses four dedicated void water dams for surface storage of void water as outlined in **Table 15.** An additional temporary storage (VWD7) has been development to replace VWD2 and was commissioned in 2021. Post-mining, void water is being transferred from the void water dams to the mine pit.

Table 15 Void Water Dams

Identification	VWD1	VWD3	VWD4
Local Name	250ML Dam	214ML Dam	140ML Dam
Capacity (ML)	265	226	157
Operating (ML)	238	210	137
Freeboard (m)	0.3	0.3	0.3
Spillway RL	363.821	364.30	364.30
Dam Full RL	363.521	364.00	364.00
Wall Crest RL	364.450	365.30	365.40
Natural RL	358.5	362.10	361.00
Dam Floor RL	357.0	357.74	357.74

Piezometers have been installed in the vicinity of the large Void Water Dams 1, 3 & 4 specifically to measure perched water tables that could indicate seepage through embankments and potential instability.

Void Water Dams 1,3 and 4 declaration status was revoked by the Dam Safety Committee (DSC) in June 2025.

6.3.8 Pipelines and Valves

Operational pipelines are located within void or dirty water catchments and this practice will continue as far as practical so that any potential leaks are contained onsite. Pipelines and valves are located in areas outside of heavy vehicle interactions, with major pipe infrastructure protected by bunds/roadway verges. If a potential leak were to occur, water would report to either the void water or dirty water systems. Regular site inspections completed by the pumper identify the integrity of the system.

6.3.9 High Water Level Alarms

In addition to regular inspections of void water dam storage levels, WCC has installed high water level alarms in void water dams 1, 3, and 4. Each high water level alarm system will have two float switches, one at the dam full level (“High Water Level”) designated as 0.3m below the spillway level and a high water level just below the spillway level (“Spillway Level”). The float switches when triggered will send a prearranged SMS message to the OCE/Pumper and Environmental Officer for the condition “High Water Level” or to the OCE/Pumper, Operations Manager, Planning Engineer/Manager of Mining Engineering and Environmental Officer when the “Spillway Level” has been reached and overflow is imminent.

6.3.10 Site Water Usage

Water on site is used regularly for:

- Dust suppression

Surplus water may be reduced by the following uses:

- Pumped back into the void
- Agricultural Water Use

The Environmental Advisor will monitor void water usage based on flow meters, void water dam storage levels and water cart load counts. In addition, WCC will engage a hydrogeologist (or similar expertise) to analyse void dewatering records and rainfall levels to update the water model for WCC on an annual basis, and determine the twelve-month total incidental groundwater make for the open cut pit**.** This will include an assessment of the availability of surplus water for offsite agricultural use over the upcoming year, with particular reference to the security of water supply over the LOM. Further information on these methods is provided in **Section 4.1**.

6.3.11 Evaporators

Evaporators are no longer in use at WCC

6.3.12 Final Void Water Level and Quality, and Management of Acid-Forming Materials

An assessment of long-term (hundreds of years) water levels and water quality was completed as part of the surface water assessment for the Final Landform Modification (Whitehaven Coal, 2022b). The assessment found that the post-mining final void will continually accumulate water due to catchment runoff and groundwater inflow. Water levels will rise to about 330 mAHD after 90 years, reaching a long—term equilibrium level of about 343 mAHD after more than 500 years. Salt concentration will slowly accumulate in the final void, rising by about 700 µS/cm every 100 years.

After the completion of mining, handling of potentially acid-forming materials is no longer required.

Final design specifications for the void will be consistent with final landform as detailed in PA 10_0059 (MOD 5) which includes a pit lake that offers short term beneficial re-use of accumulated water in the final void for agricultural or other purposes.

6.4 Dirty Water Management

Dirty water management at WCC utilises sediment dams and drains to capture water runoff from disturbed areas (**Figure 16 and Figure 17)** and, after treatment of suspended solids (predominant potential pollutant), can be allowed to discharge offsite in accordance with EPL 12290.

6.4.1 Dirty Water Dams

Dams in dirty water catchments are designed to capture the 90th percentile 5-day rainfall depth for the catchment area, which for WCC is 39.2mm. Dirty water containment structures are constructed generally in accordance with the Soils and Construction, Managing Urban Stormwater, Volume 1, 4th Edition (Landcom, March 2004) and Soil and Construction, Managing Urban Stormwater, Volume 2E Mines and Quarries (DECC, June 2008) guidelines as best practice references. Dirty water dams at WCC and their storage volumes are outlined in **Table 16**. WCC has completed a survey program of these dams to confirm actual storage capacities. The available storage volume in all of the sediment dams has been determined by survey.

Sediment load is monitored visually by photographic record of sediment plumes at the entry to dirty water dams during monthly environmental inspections. If it is apparent that the sediment deposition rate is higher than desirable the catchment will be inspected to identify any areas requiring either improvement to drainage or erosion control. Sediment will be excavated from these identified dams as required.

Table 16 Dirty Water (Sediment Basins) Dams

No.	Description	ML	Comment
SB18	North East – Dirty water capture, treatment and discharge point (EPL 32)	2.0	Estimated
SB13	Northern Area – Dirty water capture, treatment and use	6.9	Surveyed
SB14	Northern Area – Dirty water capture, treatment and use	2.0	Surveyed
SB10	Northern Area – Dirty water capture, treatment and discharge point (EPL 14)	4.7	Surveyed
SB11	Middle Area – Dirty water capture, treatment and use	8.9	Estimated
SB17	Middle Area – Dirty water capture, treatment and use (BWD)	4.1	Estimated
SB16	Middle Area – Dirty water capture, treatment and use	6.0	Surveyed
SB8	Middle Area – Dirty water capture, treatment and use	3.0	Estimated
SB9	Middle Area – Dirty water capture, treatment and discharge point (EPL 12)	4.0	Surveyed
SB1	Southern Area – Dirty water capture, treatment and use	7.0	Surveyed
SB3	Southern Area – Dirty water capture, treatment and use	4.4	Surveyed
SB4	Southern Area – Dirty water capture, treatment and use	1.4	Estimated
SB5	Southern Area – Dirty water capture, treatment and use	1.1	Estimated
SB12	Southern Area – Dirty water capture, treatment and use	7.4	Surveyed
SB2	Southern area – Dirty water capture, treatment and discharge point (EPL 10)	4.7	Surveyed
	Total Capacity of All Dirty Water Dams	**67.6**	

Figure 16 - Middle and Northern Dirty Water Management Systems

Figure 17 - Southern Dirty Water Management Systems

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6.4.2 Dirty Water Discharge

EPL 12290 permits WCC to undertake discharges from the licensed discharge points (LDPs) of SB2 (EPL10), SB9 (EPL12), SB10 (EPL14) and SB18 (EPL32). WCC categorises two types of discharges, a discharge due to rainfall runoff and overflowing via the spillway is called a wet weather discharge, while a controlled discharge occurs when the dam water is pumped out. All discharge water quality must meet the limits specified in **Section 7.1.1**. WCC can exceed the Total Suspended Solid limit if over 39.2mm of rainfall is received over a 5-day period, resulting in a wet weather discharge. WCC treats dirty water when required by using polymer based flocculants to lower Total Suspended Solids reducing the turbidity maintain within discharge limits. A controlled discharge of settled and (if necessary) treated dirty water would be undertaken in accordance with the EPL 12290 when storage levels within respective LDPs (SB2, SB9 and SB10) are greater than 50%. This would provide the capacity to contain more rainfall events and reduce wet weather . Discharge of dirty water in a controlled manner allows adequate settlement of sediment to be achieved prior to discharge and reduce the potential for sediment-laden water to discharge during wet weather events.

Water sampling laboratory certification requirements are outlined in **Section 7.1.3**. All laboratory results undertaken prior to a controlled discharge are reviewed against exceedance criteria for compliance.

6.4.3 Rehabilitation Program

Progressive rehabilitation is being undertaken at WCC providing a major control to reduce sediment loads in the dirty water system. A summary of rehabilitation plans and designs as required by the Modified PA is discussed below, however for further details regarding the rehabilitation program and success criteria for WCC, refer to the RMP

WCC have adopted a combination of geomorphic and conventional contour landform design. The emplacement includes contours that are spaced at 60 metre slope length intervals, which avoids the need for drop-structures. Hydraulic modelling of this contour bank arrangement has demonstrated that maximum velocities will remain below 2m/s during a 1:50 ARI rainfall event along the length of the 1.2% longitudinal slope, dropping significantly following vegetation cover establishment. Runoff from the central plateau of the final rehabilitation will report to one of five sub-catchments, which form the source of the contour banks. Contour banks are inspected to identify areas of potential failure, such that repairs can be made in a timely manner.

The northern section of the overburden dump and the final void have been rehabilitated using natural landforms geomorphic design, designed by a landform engineer.

6.5 Clean Water Management

6.5.1 Clean Water Dams and Maximum Harvestable Rights

The clean water management system is comprised of dams and drains to divert water runoff from undisturbed areas around WCC operations and allow it to continue to drain offsite unimpeded. Clean water dams at WCC are outlined in Figure 16 and **Table 17**.

The *Water Act 1912* and *Water Management Act 2000* (WM Act) contain provisions for the licensing of water capture and use, which only apply to clean water dams at WCC. The NSW Farm Dams Policy (1999) outlines the maximum harvestable right dam capacity (MHRDC) for the LOM Project by the following calculation - MHRDC = Project Site Area (ha) x Multiplier Value (0.07).

The MHRDC has been calculated to be approximately 63 ML based on the LOM Project area of 908ha. From **Table 17,** the capacity of the existing clean water storage dams that could be used for water supply are within the MHRDC. Hence no licenses are required for these existing dams. No new clean water dams are proposed for the LOM Project.

Table 17 Clean Water Dams

No.	Description	ML	Method
SD4	Clean water capture and use Diversion of Clean water around mine	5.1	Estimated
SD5	Clean water capture and use Diversion of Clean water around mine	4.0	Estimated
Total Capacity of Existing Clean Water Dams		9.1	Estimated

6.5.2 Clean Water Diversion

As discussed in **Section 6.5**, WCC will divert clean water away from disturbed areas using contour banks and diversion drains. Existing clean water diversion drains are effective for managing runoff from the adjacent “Railway View” property to the east.

6.5.3 Water Management at Mine Closure

At mine closure, WCC will ensure final design specifications for the void will be consistent with final landform as detailed in PA 10_0059 (MOD 5) which includes a pit lake that offers short term beneficial re-use of accumulated water in the final void for agricultural or other purposes. Dirty water dams will be retained for a period after mine closure to manage runoff from disturbed areas until fully rehabilitated at which time a decision will be made whether to retain dirty water dams within the final landform.

Figure 18 - WCC Clean Water Management System

6.6 Contaminated Water Management

The contaminated water stream includes potentially hydrocarbon contaminated water runoff from the workshop and fuel farm and the septic system for treating water from ablutions. Furthermore, runoff from the explosives mixing facility may increase nutrient and hydrocarbon loading to the dirty water management system if not effectively managed. Each of these sub-streams of contaminated water are discussed below, with the locations shown in **Figure 17.**

6.6.1 Oil/Water Treatment

Potentially hydrocarbon contaminated runoff from the workshop concrete hardstand (draining via the workshop sump) and from the separate diesel fuel farm area overflows to a continuous media oil/ water treatment system.

6.6.2 Septic Water Treatment

Ablutions raw water is treated by a septic treatment system approved by the Liverpool Plains Shire Council (Onsite Sewerage Management System 16/13 dated 15th May 2013). Solid effluent is contained within 2x3000L septic tanks and periodically collected by a licensed waste collection and disposal contractor as required while the liquid effluent drains into adsorption trenches. An additional 3000L septic system is located at the Train Load Out (TLO) Facility, with minimal flow through this system.
Solid effluent from this septic system is collected by a licensed waste contractor as required.

6.6.3 Explosives Mixing Facility

The Explosive Mixing Facility has been decommissioned, and products including ammonium nitrate and mineral oil are no longer used on site. To minimise the risk of contamination at the mixing facility, a sump is used to catch runoff from the mixing facility. Furthermore, SB11, which catches any overflow from the sump, is maintained at a low level to minimise the risk of contamination to the discharge site SB9, with water from SB11 pumped back to VWD2 following rainfall runoff events.

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Figure 19 - Contaminated Water Management Infrastructure

6.7 Erosion and Sediment Control

In addition to the controls already discussed in **Section 6.2** to **6.5**, general erosion and sediment controls implemented by WCC are described in the following sections. Erosion and Sediment Control management will follow the guidelines referred to in *Managing Urban Stormwater: Soils and Construction, 4th Edition* (known as the "Blue Book" – Landcom, 2004) and *Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries* (DECC, 2008), and with the objective of meeting EPL requirements for total suspended solids.

Regular inspections are carried out to ensure that the controls are working as intended, provide early detection of any potential issues requiring rectification, and monitor to ensure sediment controls are adequately maintained. Monitoring will identify areas of potential failure, such that repairs can be made in a timely manner.

6.7.1 Contour banks

A combination of geomorphic and contour landform design has been used within the rehabilitation of the overburden emplacement to direct runoff from the upper heights of the rehabilitation to the natural ground level, in a low-moderate energy environment, as described in **Section 6.4.3**. In addition, contour banks will be utilised alongside select boundaries of the dirty water management catchments, where required to separate the clean water catchment from the dirty water catchment.

6.7.2 Diversion drains

Diversion drains will be utilised within the dirty water catchment to conduct runoff away from clean catchments to the dirty water dams (sediment basins) in a low-slope, low-moderate intensity fashion. Diversion drains will also be used to connect successive sediment basins that are operated in series.

6.7.3 Rock lined drains

Rock lined drains will be incorporated into the geomorphic landform design to stabilise water drainage lines during initial vegetation establishment period.

6.7.4 Sediment basins

Sediment basins are used across WCC as a settling basin for managing sediment loads within the dirty water management system. Their use and distribution across site have previously been described in **Section 6.4.1**.

6.7.5 Sediment fences

Sediment fences may be utilised on an ad hoc basis to manage sediment loads in freshly disturbed areas, as well as in areas that cannot report to the dirty water management system such as runoff from remote facilities. Sediment fences are not the preferred form of sediment control, and as such will generally only be utilised where the other controls identified above are not practical or effective.

6.7.6 Erosion Control

Generally, erosion rates are reduced by progressive site rehabilitation as discussed in Section 6.4.3 along with contour banks to limit exposed surfaces.

Site specific erosion controls where excessive erosion is evident will be selected as appropriate to the site but may include combinations of measures such as armouring with granular material, placement of jute mesh, hydro seeding, mulching or stabilisation with a binding agent.

6.8 Groundwater Management

6.8.1 Groundwater Level and Inflow Management

Impact to the regional groundwater table from dewatering the former underground workings and from mining below the water table is mitigated by the presence of an existing natural clay aquitard, reducing to minimal the flow of groundwater from the outside Werrie Basalt aquifer into the Coal Measures aquifer and subsequently the WCC open cut pit as described in **Section 3.2.1**. Monitoring of the groundwater regime will be undertaken to provide a routine evaluation of groundwater conditions and to identify groundwater trends. The monitoring program is described in **Section 7**. Monitoring data will be used to revise the existing groundwater model and refine the impact to groundwater evaluations presented in the LOM EA.

Changes in groundwater flow regimes resulting from the operations will be managed through actions to mitigate any impacts determined to be related to the rehabilitation activities. Mitigation measures are described in **Section 10.**

6.8.2 Groundwater Licensing

Groundwater interception licences held by WCC under the Water Management Act 2000 are listed in **Table 18**.

Table 18 WCC Groundwater Licences

Water Access Licence	NRAR Reference	Water Works Approval	Former Water Act 1912	Allocation
WAL29506	90AL822531	90WA822532	90BL252588	50ML
WAL32224	90AL828344	90WA828345	90BL255087	211ML

6.8.3 Groundwater Quality Management

Impacts to groundwater quality can only be caused by activities on the surface in particular the management of hydrocarbons (**Section 6.8.4**). Annual groundwater quality monitoring will be undertaken to assess the trend in a range of analytes as outlined in **Section 7.4**.

6.8.4 Hydrocarbon Management

Hydrocarbon use and storage on the site can result in contamination of groundwater and surface water. The following principles will be implemented to reduce the risk of a pollution incident:

- An oil/water treatment system (Section 6.6.1) manages potentially contaminated water from the workshop and fuel farm areas;
- Waste oil will be disposed offsite by a licensed waste transporter to be recycled; and
- Soils impacted with hydrocarbons around the workshop including silt from the oil/water treatment system and workshop sump will be taken to the onsite bioremediation area for treatment and eventually disposed of onsite when tested to comply with Waste Regulations.

6.8.5 Saline Water Body within Mine Void on Cessation of Mining

The final mine landform is to achieve a pit lake with a minimum elevation of 270 mAHD, final void catchment area of 142ha and equilibrium pit lake of 343 mAHD (46 mbgl) in accordance with PA 10_0059 (MOD5).

The final void water balance model was configured to use salinity as an indicator of water quality. This was achieved by assigning representative electrical conductivity (EC) values to runoff from catchments, spoil seepage and groundwater inflows (Whitehaven Coal, 2022b). The final void salt concentration is predicted to build steadily over the very long term, from an initial value of 1,000 µS/cm to approximately 8,000 µS/cm after 1,000 years. For the entirety of the simulation, the pit lake level sits below the groundwater equilibrium level and therefore only receives rainfall runoff and groundwater inflows (i.e. no groundwater outflows).

7 MONITORING

Monitoring is undertaken in accordance with the conditions of EPL12290 and the Modified PA, which specify required methods of sampling, analysis and frequency of monitoring.

7.1 Surface Water Monitoring Program

Surface water monitoring at WCC is structured for discharge monitoring (dirty water controlled or wet weather), and routine (quarterly) monitoring of clean, dirty and void water dams and offsite streams. Non-routine monitoring also occurs on an ad hoc basis to determine immediate water quality of dams onsite. The WCC surface water monitoring locations are presented in **Figure 18** and **Figure 19.**

7.1.1 Discharge Water Monitoring

WCC is permitted to undertake discharges from the licenced discharge points when the water quality complies within EPL 12290 criteria in Condition L2.4 (or if a rainfall event greater than 39.2mm over five days then the total suspended solids are allowed to be exceed criteria the 50mg/L criteria). The monitoring locations, frequency and analytes tested for discharges are the same regardless of whether it is a wet weather or controlled discharge event into either Quipolly Creek and/or Werris Creek catchments (**Table 19**).

Table 19 Discharge Monitoring Locations, Frequency and Parameters

<table>
<tr><th>Location</th><th>Frequency</th><th>Parameters</th></tr>
<tr><td colspan="2">Discharge commences from Licenced Discharge Points SB2 and/or SB9 into the Quipolly Creek catchment:</td><td rowspan="6">Electrical Conductivity (µS/cm)
Nitrate (mg/L as Nitrogen)
Total Nitrogen (mg/L) Oil & Grease (mg/L) pH (no units)
Total Phosphorus (mg/L)
Reactive Phosphorus (mg/L)
Total Suspended Solids (mg/L)</td></tr>
<tr><td>SB2 (EPA10) and/or SB9 (EPA12)</td><td>As soon as practicable and not more than 12 hours after discharge</td></tr>
<tr><td>QC-U (EPA25)
QC-D (EPA26)</td><td>Within 12 hours of discharge.</td></tr>
<tr><td colspan="2">Discharge commences from Licenced Discharge Point SB10 and/or SB18 into the Werris Creek catchment:</td></tr>
<tr><td>SB18 (EPA 32) and/or SB10 (EPA 14)</td><td>As soon as practicable and not more than 12 hours after discharge</td></tr>
<tr><td>WC-U (EPA23)
WC-D (EPA24)</td><td>Within 12 hours of discharge.</td></tr>
<tr><td colspan="3">Note: Sampling method is by a representative grab sample
Note: Sampling will be undertaken in accordance with DEC, 2004</td></tr>
</table>

Figure 20 - Clean, Dirty and Void Water Dams Onsite at WCC

Figure 21 - EPL12290 Licensed Discharge Points and Offsite Creek Monitoring Locations

7.1.2 Routine Water Monitoring

Routine surface water quality monitoring is undertaken quarterly in accordance with EPL 12290 M2.3 for the void water dams (VWD) 1 & 2 (EPA 16 & 27). Routine water monitoring locations are differentiated by their proximity to WCC, either onsite or offsite. Other onsite monitoring locations from the clean (SD5 and SD6), dirty (SB2, SB9, SB10 and SB18) and void (VWD1, VWD2, VWD3, VWD4) water streams are also sampled on a quarterly basis (**Table 20**).

Table 20 Quarterly Routine Onsite Surface Water Monitoring

Location	Water Stream	Comment	Parameters
VWD1	Void	EPA16 - 20ML Dam	Biochemical Oxygen Demand (BOD) Electrical Conductivity (µS/cm) Nitrate (mg/L as Nitrogen) Total Nitrogen (mg/L) Oil & Grease (mg/L) pH (no units) Total Phosphorus (mg/L) Reactive Phosphorus (mg/L) Sodium Absorption Ratio (SAR) Total Suspended Solids (mg/L)
VWD3	Void	200ML Dam North	
VWD4	Void	200ML Dam South	
SB2	Dirty	EPA10 - Southern catchment	Electrical Conductivity (µS/cm) Nitrate (mg/L as Nitrogen) Total Nitrogen (mg/L) Oil & Grease (mg/L) pH (no units) Total Phosphorus (mg/L) Reactive Phosphorus (mg/L) Total Suspended Solids (mg/L)
SB5	Dirty	Southern catchment	
SB8	Dirty	Middle catchment	
SB9	Dirty	EPA12 – Middle catchment	
SB11	Dirty	Middle catchment	
SB13	Dirty	Northern catchment	
SB10	Dirty	EPA14 – Northern catchment	
SB18	Dirty	EPA TBC – North Eastern catchment	
SD4	Clean	Eastern Clean Diversion	
SD5	Clean	Eastern Clean Diversion	
Note: Sampling method is by a representative grab sample Note: Sampling will be undertaken in accordance with DEC, 2004			

Offsite routine surface water quality monitoring focuses on two catchments, Quipolly Creek and Werris Creek, as the WCC site is situated on the divide between the two catchments. The Northern catchment is part of the Werris Creek watershed, and the middle and Southern catchment are a part of the Quipolly Creek watershed. To quantify any potential impacts from WCC releases into either catchment, an upstream monitoring location has been selected as representative of in-stream water quality before any inflow from WCC and a downstream monitoring point has been selected that represents both upstream and mine water quality. Locations have been selected with easy access from the public road network. During dry periods, the upstream monitoring locations (in particular Quipolly Creek upstream) can run dry and therefore the upstream monitoring point will be taken at the next available location with water in stream, preferably flowing. Any discharge water from WCC into the Quipolly Creek catchment will flow via an unnamed gully into Black Gully before reaching Quipolly Creek. A monitoring location has also been adopted for Black Gully downstream of the confluence with the unnamed gully. **Table 21** outlines the quarterly routine offsite surface water quality monitoring program.

Table 21 Quarterly Routine Offsite Surface Water Monitoring

Location	Water Stream	Comment	Parameters
QC-U	Quipolly	EPA25 – Quipolly Creek Upstream of mine inflow	Electrical Conductivity (µS/cm) Nitrate (mg/L as Nitrogen) Total Nitrogen (mg/L) Oil & Grease (mg/L) pH (no units) Total Phosphorus (mg/L) Reactive Phosphorus (mg/L) Total Suspended Solids (mg/L)
QC-D	Quipolly	EPA26 – Quipolly Creek Downstream of mine inflow	
BG-D	Quipolly	Black Gully Downstream of mine inflow	
WC-U	Werris	EPA23 - Werris Creek Upstream of mine inflow	
WC-D	Werris	EPA24 - Werris Creek Downstream of mine inflow	
Note: Sampling method is by a representative grab sample Note: Sampling will be undertaken in accordance with DEC, 2004			

7.1.3 Water Sampling Methods

Trained or experienced personnel undertake environmental monitoring using industry accepted monitoring techniques with equipment calibrated to relevant Australian Standards. Analysis of all samples is completed by NATA approved laboratories.

7.2 Water Usage Monitoring

WCC maintains a network of inline flow meters, void water dam storage level boards and water cart fill points to record the void water transfer within the water management system onsite. Each month the Environmental Officer records the flow meters and storage levels of void water dams to determine water usage onsite. These locations are subject to change in response to mining operations and are provided as a guide only. The pit dewatering pipelines are key water inputs and dust suppression are the key output from the water management system.

In the event a privately-owned landholder whose rightful water supply is predicted to be adversely impacted (other than an impact that is minor or negligible) because of the development, WCC will provide compensatory water supply or establish compensation agreements to the satisfaction of the secretary.

7.3 Void Water Dam Piezometers

Piezometers have been installed in the vicinity of the large void water dams 1, 3 & 4 specifically to measure perched water tables that could indicate seepage through embankments and potential instability as mentioned in **Section 6.3.6**. Three piezometers at each facility have been installed so that a water table surface can be triangulated and monitored over time, while also providing an indication of any loss of containment from the dam that may contribute to groundwater contamination.

7.4 Groundwater Monitoring Program

To monitor groundwater impacts because of mining operations, WCC has established the groundwater monitoring network as shown in **Figure 20** and **Table 22**. Furthermore, groundwater inflows to the mining void are calculated on an annual basis as part of the update of the WBM and validation.

Groundwater monitoring locations will be reviewed, and if necessary, modified in consultation with relevant Departments over the life of the project, in response to monitoring results and changes in the mining operations.

The groundwater monitoring network focuses on the Werrie Basalt and Quipolly Alluvium aquifers adjacent to WCC. The Werrie Basalt groundwater bores can be broken up into mining (adjacent to mining operations and therefore first to show signs of any mining influence), Northern (representative of Werrie Basalt aquifer to the north towards Werris Creek) and Southern (representative of Werrie Basalt aquifer to the south towards Quipolly Creek and the Alluvium aquifer) bores.

In 2014, a deep nested piezometer (to 99m and 168m) was installed into the Werrie Basalt aquifer adjacent to the coal measures specifically to monitor differences between the shallow and deep (equivalent to the base of the open cut) areas of the Werrie Basalt aquifer. Piezometers have also been installed around the major void water dams at WCC to identify any seepage or other loss of containment, which may contribute to groundwater contamination, as described in **Section 7.3**.

Groundwater levels in all bores are monitored bi-monthly with the levels assessed to the nearest 0.01m. All monitoring bore locations have been surveyed (coordinates and Australian Height Datum elevation) and the stick up (difference between top of bore case and bore collar) known so that the relative levels of the aquifer can be determined for reporting. The bore depth will be used to calculate the saturated thickness.

Groundwater sampling is conducted in accordance with the sampling methods specified in EPL12290 and the Approved Methods (DEC, 2004). Furthermore, analysis of groundwater quality is undertaken by a NATA accredited laboratory, with the exception of pH and electrical conductivity, which are measured in the field using calibrated equipment.

Data collected as part of this Groundwater Monitoring Program is routinely examined as part of the Annual Review (AR) process, to assess changes to groundwater quality or quantity within the monitoring network. The AR also includes an assessment of groundwater contribution to the open cut pit as part of the annual update of the WBM (**Section 4**) which also feeds into assessments of mining-related impacts on privately-owned bores. Assessing potential mining related impacts on privately-owned bores focusses on identifying any changes in groundwater quality or level, taking into consideration the groundwater flow paths and observations from background monitoring bores such as MW8 and MW28A.

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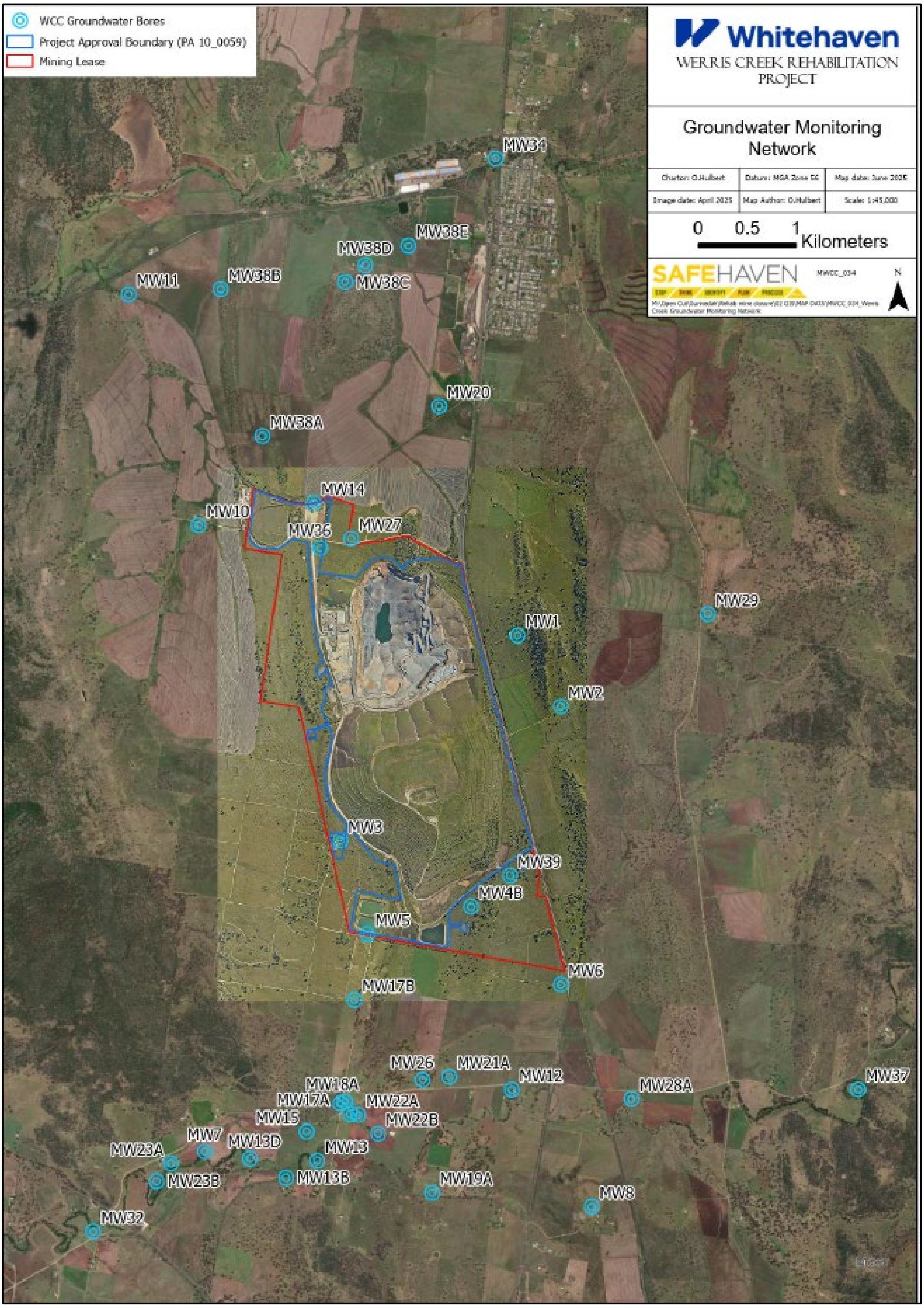

Figure 22 - Groundwater Monitoring Locations

Following discussions with the NRAR regarding opportunities to improve the understanding of groundwater dynamics in the area, WCC committed to installing additional targeted monitoring bores to drive the continuous improvement of the Groundwater Monitoring Program. WCC installed additional groundwater monitoring bores as follows:

- a cluster of monitoring bores through the Quipolly Alluvium aquifer and into the Werrie Basalt in FY2017. This cluster of monitoring bores enhanced the historic understanding of interactions between the Quipolly Alluvium and Werrie Basalt aquifers.

- a monitoring bore into the syncline of the Coal Measures aquifer enhancing the historical understanding around groundwater interactions between the Coal Measures aquifer and the Werrie Basalt aquifer. This monitoring bore will also support the determination of a final groundwater level in the post-mining environment, as described in **Section 6.8.5**.

Table 22 Groundwater Monitoring Locations, Frequency and Bore Information, as occurred in 2024

Parameters	Frequency	2024 Monitored Bore/Piezometers
Standing Water Level	Bimonthly	MW1, MW2, MW3, MW4b, MW5, MW5b, MW5c, MW5d, MW5e, MW5f, MW5g, MW6, MW9, MW10, MW14, MW14b, MW27, MW36a, MW36b, MW39, MW20, MW34, MW38a, MW38b, MW38c, MW38e, MW8, MW17b, MW19a, MW24a, MW29, MW41, MW43, MW7,MW7b, MW12, MW13, MW13b, MW13d, MW15, MW16, MW17a (Black Gully), MW18a (Black Gully), MW21a Black Gully), MW21b, MW22a, MW22b, MW22c, MW23a, MW23b, MW26b, MW28a, MW28b, MW32, MW40, MW42, Glenara, MW11, MW37, Medholm #2
Total Nitrogen Nitrate Nitrogen Total Phosphorus Reactive Phosphorus Electrical Conductivity pH	Six-monthly – WCCM owned bores Annually – Private bores	MW1, MW3, MW4b, MW5, MW5b, MW5c, MW5d, MW5e, MW5f, MW5g, MW6, MW7, MW7b, MW8, MW10, MW11, MW13, MW13b, MW13d, MW14, MW14b, MW16, MW17a, MW17b, MW18a, MW20, MW21a, MW21b, MW22a, MW22b, MW22c, MW23a, MW23b, MW26b, MW27, MW28a, MW28b, MW32, MW34, MW36b, MW37, MW38c, MW38e, MW39, MW40, MW41, MW42,
Chloride, Sulfate, Alkalinity, Calcium, Magnesium, Sodium, Potassium, Arsenic, Barium, Beryllium, Cadmium, Cobalt, Chromium, Copper, Manganese, Nickel, Lead, Vanadium, Zinc, Mercury Ammonium, Nitrite, Nitrite+Nitrate, TKN, Anions, Cations, Ion Balance, TPH	Six-monthly – WCCM owned bores Annually – Private bores	MW1, MW3, MW4b, MW5, MW5b, MW5c, MW5d, MW5e, MW5f, MW5g, MW6, MW7, MW7b, MW8, MW10, MW11, MW13, MW13b, MW13d, MW14, MW14b, MW16, MW17a, MW17b, MW18a, MW20, MW21a, MW21b, MW22a, MW22b, MW22c, MW23a, MW23b, MW26b, MW27, MW28a, MW28b, MW32, MW34, MW36b, MW37, MW38c, MW38e, MW39, MW40, MW41, MW42
# Regional monitoring bores		

7.5 Monitoring Related to the Agricultural Use of Void Water

As stated in **Section 6.3.3**, WCC will extend the quarterly water monitoring program to include the analytes critical to the assessment of impacts on soil salinity and nutrient levels. The Irrigation Management Plan will determine the appropriate monitoring regime specific to each irrigation program, however generic monitoring requirements will apply to any program. These include monitoring the volume of water delivered each day for agricultural use (**Table 23**), and the quality of water supplied (**Table 24**), however this monitoring will only occur if and when water is provided to a third party for agricultural use as outlined in **Table 24**. Where multiple agricultural users receive water from the same pump, the volume attributable to each user will be individually determined.

Table 23 Water Volume Monitoring Requirements for Agricultural Use Supply

Frequency	Unit of Measure	Sampling Method
Daily during any discharge	Kilolitres per day	By calculation (volume flow rate or pump capacity multiplied by operating time) or meter

Table 24 Water Quality Monitoring Requirements for Agricultural Use Supply

Pollutant	Units of Measure	Frequency	Sampling Method
pH	pH	Special Frequency 4	Grab sample
Conductivity	Micro-Siemens per centimetre	Special Frequency 4	Grab sample
BOD	Milligrams per litre	Special Frequency 3	Grab sample
Cations (Mg, K, Na)	Milligrams per litre	Special Frequency 3	Grab sample
Dissolved metals (Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Ni, Se, Va, Zn)	Milligrams per litre	Special Frequency 3	Grab sample
Oil & Grease	Milligrams per litre	Special Frequency 3	Grab sample
Total Dissolved Solids	Milligrams per litre	Special Frequency 3	Grab sample
Special Frequency 3 means every three months. If no water is planned to be provided for agricultural purposes within the three months following scheduled sampling, then sampling is not required. Special Frequency 4 means prior to but not more than 24 hours prior to providing water for agricultural purposes and then weekly thereafter until the provision of water ceases.			

7.6 Monitoring Related to the Agricultural Use of Void Water

Monitoring of drainage and erosion control measures will be undertaken as part of the rehabilitation monitoring program as documented in the Rehabilitation Management Plan.

8 REPORTING

8.1 Incident Reporting

In the event of an incident which has caused or threatens to cause material harm to the environment, the WCC PIRMP will be implemented and relevant PIRMP reporting requirements adhered to. WCC will notify the Secretary, and any other relevant agencies, of the incident at the earliest opportunity. Within 7 days of the date of the incident, WCC will provide the DPHI and other relevant agencies with a detailed incident report which will:

- Describe the date, time, duration and nature of the exceedance/incident;
- Identify the type and concentration of every pollutant discharged;
- Identify the cause (or likely cause) of the exceedance/incident;
- Name and contact details of witnesses to the event;

- Describe what action has been taken to date; and
- Describe the proposed measures to address the exceedance/incident.

Any further reports requested by the DPHI will be provided in a timely manner as agreed with the Department.

For any other incidents related to water management, WCC will notify the Secretary and any other relevant agencies as soon as practicable after WCC becomes aware of the incident.

8.2 Regular Reporting

WCC will provide regular reporting on the environmental performance of WCC on the Whitehaven Coal website, via Complaints Register, EPL reports, CCC reports and ARs in accordance with the reporting arrangements in any plans or programs approved under the conditions of the Project Approval. WCC is committed to keeping any information on the website up to data and valid to the satisfaction of the Secretary.

By the end of March each year, WCC will review the environmental performance of the project to:

(a) describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;

(b) include a comprehensive review of the monitoring results and complaints records of the project over the past year, which includes a comparison of these results against the:

- relevant statutory requirements, limits or performance measures/criteria;
- monitoring results of previous years; and
- relevant predictions in the EA;

(c) identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;

(d) identify any trends in the monitoring data over the life of the project;

(e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and

(f) describe what measures will be implemented over the next year to improve the environmental performance of the project.

8.2.1 Annual Review

Schedule 5 Condition 3 requires that, by the end of March each year, the Proponent review the environmental performance of the project to the satisfaction of the Secretary. This review must:

(a) describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;
(b) include a comprehensive review of the monitoring results and complaints records of the project over the past year, which includes a comparison of these results against the:
    (i) relevant statutory requirements, limits or performance measures/criteria;
    (ii) monitoring results of previous years; and
    (iii) relevant predictions in the EA;

(c) identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;
(d) identify any trends in the monitoring data over the life of the project;
(e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
(f) describe what measures will be implemented over the next year to improve the environmental performance of the project.

As part of the Annual Review, WCC will update the Site Water Balance for the calendar-year reporting period (1 January to 31 December) and report the updated Site Water Balance outcomes in the Annual Review as required by Schedule 3 Condition 23(a).

WCC compiles groundwater level and groundwater quality monitoring results and interpretation for the calendar-year reporting period in a Groundwater Annual Review (GWAR), which is used as a technical input to support the groundwater-related content of the Annual Review.

8.3 Reporting for Exceedance of Licence Conditions

If a licence condition is breached or exceeded WCC will advise relevant regulatory agencies that a breach or exceedance has occurred at the earliest opportunity.

8.4 Independent Environmental Audit

By the end of June 2014, and every 3 years thereafter, unless the Secretary directs otherwise, WCC will commission and pay the full cost of an Independent Environmental Audit of the project. This audit will:

(a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary;

(b) include consultation with the relevant agencies;

(c) assess the environmental performance of the project and whether it is complying with the requirements of the Project Approval, any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals); and

(d) recommend appropriate measures or actions to improve the environmental performance and rehabilitation of the project.

Within 6 weeks of the completion of the audit, or as otherwise agreed by the Secretary, WCC will submit a copy of the audit report to the Secretary, together with WCC's response to any recommendations contained in the audit report.

9 REVIEW

This document will be reviewed in accordance with the requirements of Condition 4 Schedule 5 of the Modified PA. WCC will investigate and implement ways to improve the environmental performance of the project over time. This will be achieved by keeping abreast of best practice in the industry for water management controls and reporting on outcomes of water quality monitoring and assessment annually in the AR.

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Within 3 months of the submission of an annual review, incident report, audit report or any modification to the approval conditions (unless the conditions require otherwise) WCC will review, and if necessary revise, the strategies, plans, and programs required under the approval to the satisfaction of the Secretary. Where this review leads to revisions of any plan then, within four weeks of the review, the revised document will be submitted to the Secretary and any other relevant agencies for approval.

10 CONTINGENCY PLAN

WCC is required to implement a contingency plan for the management of any unpredicted impacts and their consequences. Regarding contingency plans for water management, WCC have a number of management strategies that would identify unpredicted water impacts and management measures to mitigate or ameliorate those impacts. The contingency plan and associated Trigger Action Response Protocols will be implemented when water monitoring triggers have been reached as identified in **Table 10**.

Records and monitoring data are to be maintained and available for review by the appropriate Departments. Details on reporting procedures are contained within **Section 8** of the WMP and the Pollution Incident Response Management Plan may apply.

10.1 Considerations of Potential Surface Water Impacts

10.1.1 Operational Water Use

Surface water contingencies for site operations are no longer required as the site has entered rehabilitation and closure phase.

10.1.2 Impacts to Geomorphology

If impacts to geomorphology are identified to have resulted from surface water runoff the following steps will be undertaken:-

- Determine if the identified impacts are resulting from mine operations, and the nature of operations that have resulted in the impacts;
- Identify opportunities to remove or reduce the impact and concurrently identify if restoration or rehabilitation works are required in the impacted area;
- If impacts are resulting from water quality, undertake a review of the water treatment procedures for controlled water releases.

10.1.3 Surface Water Quality Contingency

If routine monitoring indicates that a trigger as described in **Section 5.1** has been reached, WCC will review the data, with the outcomes of that review, including any recommendations, being subject to discussion and agreement with the NRAR hydrologists. Response measures may be implemented to include changes to surface water management practices or changes to the use of site chemicals.

10.2 Consideration of Potential Groundwater Impacts

10.2.1.1 Groundwater Quality Contingency

In the event of a major liquid hydrocarbon/contaminant spill, WCC will enact the PIRMP, which outlines communication and notification protocols, as well as immediate actions to be taken to respond to the pollution incident.

Notwithstanding the measures taken in response to a major incident, WCC recognises that the potential remains for changes in groundwater quality to occur which may or may not be a consequence of potential contaminants from WCC. A trigger of pH, EC, nitrate or phosphate would initially lead to an increase in the analytes monitored and/or frequency of sampling to confirm the magnitude and extent of the change in water chemistry and verify the change is a consequence of mining. Should such a situation be demonstrated by monitoring, appropriate measures to mitigate impacts on groundwater quality will be developed in consultation with NRAR hydrogeologists, with the nature of the “appropriate solution(s)”, e.g. pumping and treatment, isolation or remediation, being dependent on the nature of the issue.

10.2.1.2 Groundwater Quantity Contingency

If routine monitoring indicates that a trigger has been reached as described in **Table 10** Water Monitoring Triggers**,** with regard to water level being reached the following approach will be taken:

1. WCC will commission a hydrogeologist to undertake a cusum analysis of monitoring bores. The cusum analysis will determine whether the variation is within historical variability or is outside of the range of expected values;

2. Where the cusum analysis demonstrates the water level within the bore is outside of the range of expected values, the hydrogeologist will investigate the cause of the change. The hydrogeologist should review a range of data sources in their determination including:
    - Water level changes in nearby bores;
    - Water level observations from background monitoring bores;
    - Changes in water use of the bore or neighbouring bores;
    - Changes in hydraulic head or flow direction;
    - Climatic influences such as residual rainfall trends;
    - Proximity to other monitoring bores; and
    - Modelled groundwater inflow to the open cut pit.

3. If the hydrogeologist is of the opinion that the reduction is a consequence of mining, WCC will notify the affected landowner(s) and NRAR, and WCC will enter into negotiations with the affected landowners with the intent of formulating an agreement which provides for one or a combination of:
    - Re-establishment of saturated thickness in the affected bore(s) through bore deepening;
    - Establishment of additional bores to provide a yield at least equivalent to the affected bore prior to mining;
    - Provision of access to alternative sources of water; and/or
    - Monetary compensation to reflect increased water extraction costs (if any), for example as a consequence of lowering pumps or installation of additional or alternative pumping equipment.

An independent authority may also be used where a dispute arises as to the cause of the change, given that groundwater supply and quality can be affected by non-mining related factors such as bore siltation, aquifer depletion by large scale agricultural users, bacterial infection and fertilizer contamination.

10.2.1.3 CuSum Methodology

A one-sided CuSum (cumulative sum) analysis is a trend-detection method used to identify sustained departures in time-series data from a defined target condition (US EPA, 2009). In this application it is applied to each monitoring bore’s historical groundwater record, with the target condition defined by the bore’s long-term mean. The analysis is performed annually and documented in the Groundwater Annual Review. The parameters are calculated using the dataset current at the time of the Annual Review and are applied within that reporting period.

In **Table 10** (Water Monitoring Triggers) of the Water Management Plan (WMP), the groundwater trigger is defined as detection of an increasing trend in depth to water using a one-sided CuSum analysis. When a trigger is indicated, the response process is managed under WMP **Section 10.2.1.2** (Groundwater Quantity Contingency).

For each bore, long-term statistical parameters are calculated from the historical groundwater dataset and then applied in the tabular CuSum calculation to compute a CuSum value for each observation in the time series. A one-sided (upper) CuSum applies a zero floor, so the statistic cannot become negative and accumulates only under sustained increases in depth to water (drawdown).

Under minor short-term variability, departures do not persist in a single direction and the one-sided CuSum typically remains low or decreases toward zero. Where successive observations consistently indicate increasing depth to water, the CuSum accumulates across multiple readings and may breach the Upper Control Limit (UCL). This indicates a sustained trend of increasing depth to groundwater beyond expected historical variability and initiates the follow-up actions described in WMP **Section 10.2.1.2**.
The tabular upper CUSUM is calculated following ISO 7870-4:2021 (International Organization for Standardization, 2021):

$$C_t^+ = max(0, C_{t-1}^+ + (x_t - \mu - k)), \; with\, C_0^+ = 0$$

Where:
C_t^+ is the upper CuSum value at time t.
C_{t-1}^+ is the upper CuSum value at the previous time step.
x_t is the groundwater level observation at time t.
μ is the long-term mean for the bore.
σ is the long-term standard deviation for the bore.
k is the reference value controlling sensitivity (commonly set to 0.5σ).
$max(0, \dots)$ applies the one-sided (upper) floor (ie. CuSum is not permitted to go below zero).

The decision rule to activate a trigger is:

$$C_t^+ > UCL$$

Where:
C_t^+ is the upper CuSum value at time t.
UCL is the Upper Control Limit (equivalent to 4σ).

CuSum Worked Example

The following worked example demonstrates how the one-sided CuSum method is applied under the Water Management Plan using simplified dummy data. Error! Reference source not found. shows the groundwater level and CuSum time series charts for a hypothetical bore, with a starred marker indicating the specific observations used in the worked example. This example illustrates CuSum values above the Upper Control Limit (UCL) indicating an increasing depth to water (drawdown) trend, which is a Water Monitoring Trigger as defined in **Table 10** in **Section 5.1** of the Water Management Plan.

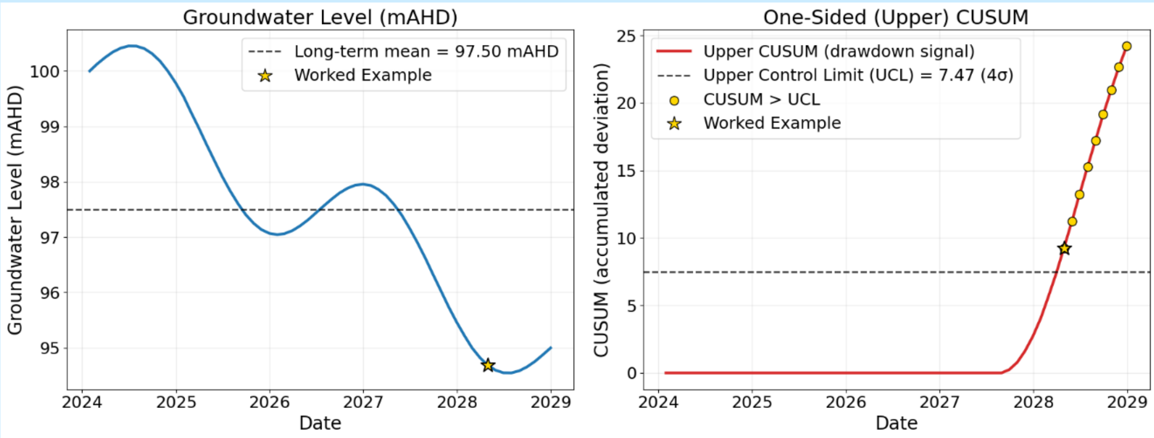

Figure 23. Side-by-side plot of groundwater level (mAHD) and one-sided (upper) CuSum for drawdown screening

WORKED EXAMPLE

This example represents sustained drawdown conditions where successive observations continue to depart from long-term conditions in the same direction. The CuSum has accumulated over time and, with another positive increment, exceeds the decision limit- indicating a trigger.

Step 1 – Derive CuSum Parameters from Historical Data

For each bore, statistical parameters are calculated from the historical groundwater level dataset as follows:

- μ = Long-term mean
- σ = Long-term standard deviation
- k = 0.5σ = Sensitivity control
- UCL = 4σ = Upper Control Limit which is set as four standard deviations from the long term mean.

These parameters are used to calculated the CuSum value at each timestep in a tabular fashion from the groundwater level timeseries dataset of each bore.

Example parameter values:

- $\mu = -97.5$
- $\sigma = 1.87$
- $k = 0.5\sigma = 0.93$
- $UCL = 4\sigma = 7.47$

Step 2 – Increment

The CuSum is a tabular calculation and therefore relies on data from both the current and previous timesteps.

For this example calculation:

- Previous timestep CuSum: $C_{t-1}^{+} = 7.38$
- Current timestep Groundwater Level: $x_t = -94.69$

Note: For the example, $x_t = -GWL\ (mAHD)$ so that a decline in groundwater elevation (drawdown) corresponds to an increase in x_t.

Calculate the deviation from the long-term mean (μ), adjusted by k.

$$(x_t - \mu - k) = -94.69 - (-97.50) - 0.93 = 1.88$$

Step 3 – Update

Add the increment to the previous CuSum as follows:

$$C_t^{+} = max(0, 7.38 + 1.88) = 9.26$$

The result remains positive and is not reset by the one-sided (upper) rule.

*Note: Steps 1 to 3 are repeated in a tabular fashion for the entire dataset to produce a CuSum plot as shown in **Figure 23**.*

Step 4 – Decision

Compare the updated CuSum values to the decision limit (UCL) to determine if a trigger has been exceeded as follows:

$$C_t^{+} = 9.26 > UCL = 7.47 \Rightarrow Trigger$$

In this case, the CuSum value is greater than the UCL meaning that an increasing depth to water trend has been identified and therefore activates a Water Monitoring Trigger as per **Table 10** in **Section 5.1** of the WMP.

10.2.1.4 Groundwater Elevation above the Final Landform

The final mine landform is to achieve a pit lake with a minimum elevation of 270 mAHD, final void catchment area of 142ha and equilibrium pit lake of 342 mAHD (46 mbgl) in accordance with PA 10_0059 (MOD5).

11 REFERENCES

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APPENDIX A – Plainview Irrigation Management Plan

IRRIGATION MANAGEMENT PLAN

PLAINVIEW IRRIGATION PROJECT

1. INTRODUCTION

Water balance model predictions for Werris Creek Coal Mine (WCC) demonstrate that the volume of void water generated, primarily through rainfall runoff, is predicted to exceed the capacity of the void water dams under median and high rainfall scenarios. Werris Creek Coal Pty Ltd (WCC) has been approached by multiple landholders in the Quipolly area regarding access to surplus void water for their productive agricultural use. WCC has progressed changes to the Project Approval, Water Management Plan, and Environmental Protection License for WCC, to allow for the offsite supply of excess void water for productive agricultural use. As required under the Environmental Assessment and Project Approval of the Modification (MOD2 Approval), WCC has developed this Irrigation Management Plan (IMP) to assess at an application site level the suitability of the area for irrigation and other controls that will need to be implemented to minimise any impacts on the receiving environment. This IMP, along with the broader Water Management Plan for WCC, addresses the requirements of Schedule 3 Condition 23 (d) of the Modified Project Approval (PA 10_0059 MOD2). This detailed assessment of the proposed irrigation activities has been conducted using the Environmental Guideline “Use of Effluent by Irrigation, DEC 2004”, to assess the specific site characteristics of the Plainview Irrigation Area and the suitability of the use of void water for irrigation in the manner as described by the IMP.

Water Supplier: Werris Creek Coal Pty Ltd (wholly owned by Whitehaven Coal)

Water Irrigator: Peter Hird

Irrigation Area: “Plain View” property (56.4 hectares) is owned by Betalpha Pty Ltd (wholly owned by Whitehaven Coal), leased to Peter Hird (**Figure 1**) and is to the south of the Werris Creek Coal mining lease.

Figure 24 - Werris Creek Mine and Plainview Irrigation Area

2. IRRIGATION METHODOLOGY

The proposed Plain View Irrigation Area is 56.4 hectares

WCC will supply water for irrigation via pump from Void Water Dam 1 (Figure 2) to a pivot irrigation system and additional traveling irrigators as required to effectively apply water to the identified areas.

The Water Irrigator proposes to plant lucerne and irrigate year round (as per requirements for irrigated lucerne production).

2.1 Responsibilities

Water Supplier is responsible for:

- The infrastructure and management of pumping irrigation water from the Werris Creek Coal void water system to the irrigation equipment within the Plain View Irrigation Area;
- Monitoring the quality of the irrigation water to ensure water quality is suitable for irrigation as outlined in this Irrigation Management Plan; and
- Metering the water supplied to the Water Irrigator.

The Water Irrigator is responsible for the management of irrigation water once it has been transferred from the Void Water Dam to the Plain View Irrigation Area, as well as complying with any specific legislative requirements of the irrigation application, including the Protection of the Environment Operations Act (1997) and the Water Management Act (2000).

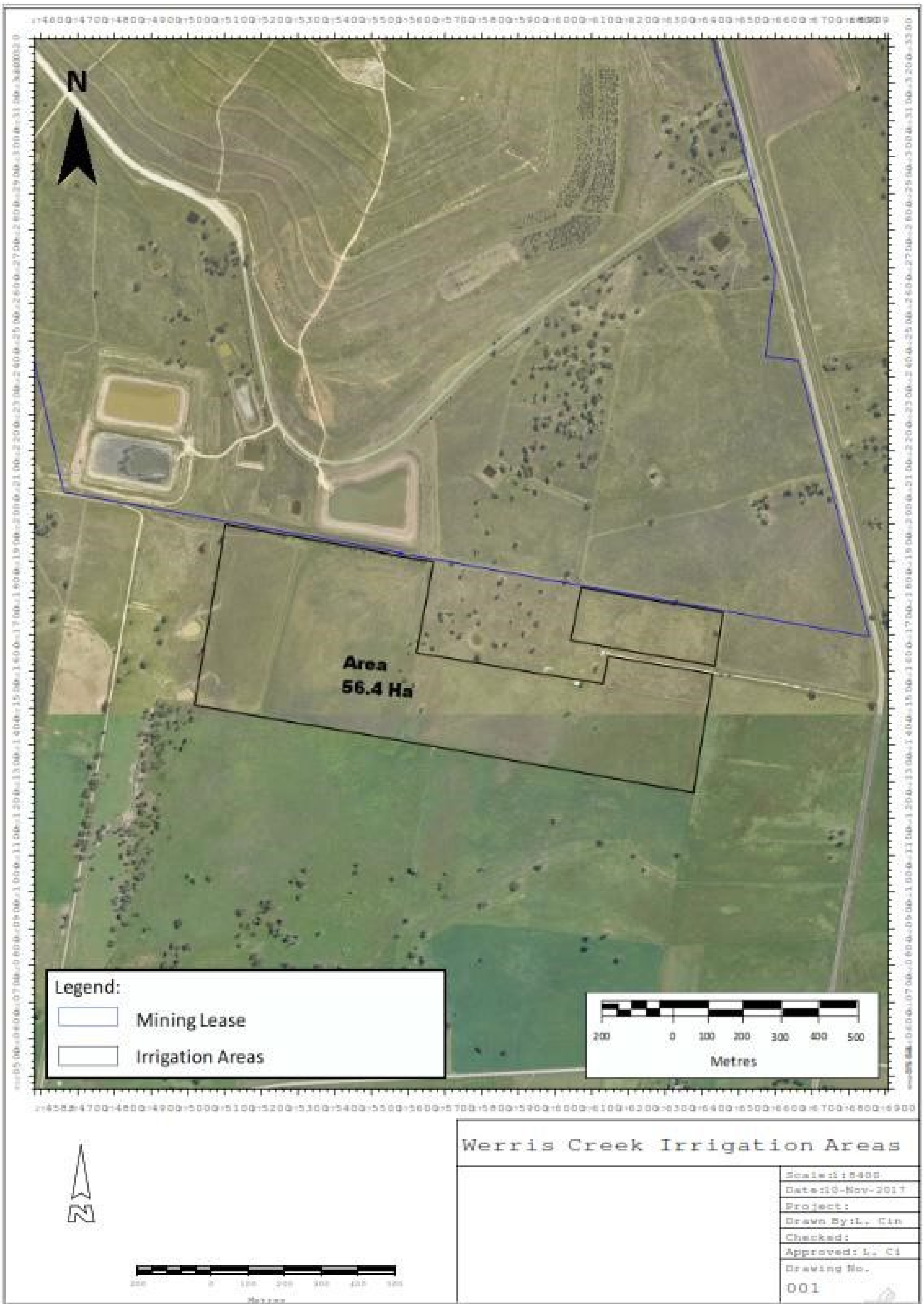

Figure 25 - Plainview Irrigation Area

3. ASSESSMENT OF IRRIGATION ACTIVITIES

3.1 IRRIGATION AREA SOILS

Initial desktop review of available information indicated topography, drainage and soil type present would be suitable for an irrigation enterprise.

3.2 Land Use Conflicts

The Plain View Irrigation Area is bounded by land owned by Betalpha Pty Ltd (wholly owned by Whitehaven Coal). Land uses consist of cropping and grazing land to the east, south and west, and the mining lease to the north. Previous land uses for the Plain View Irrigation Area were cropping and grazing. There are no land use conflicts associated with proposed irrigation.

3.3 Soil Landscape

Soil Landscapes Units are described as “areas of land that have recognisable and specific topographies and soils that can be presented on maps and described by concise statements”. The Duff’s Gully Soil Landscape Unit has been mapped as occurring across the Study Area by the former NSW Department of Land and Water Conservation, incorporating the NSW Soil Conservation Service (now part of NSW Department of Primary Industries (DPI)), on the Soil Landscapes of the Tamworth Sheet 1:100,000 Sheet (Banks, 2001).

Duff’s Gully is derived from geology associated with the Permian-Carboniferous Werrie Basalts and Permian Warrigundi Intrusives, which include basalt, tuffs, tuffaceous sandstones and quartz dolerite. Duff’s Gully is characterised by very long footslopes with broad drainage plains of productive agricultural land. Slopes are generally less than 2% with local relief less than 30 metres and elevation ranging between 340 – 420 metres above sea level.

3.4 Soil Type

The Duff’s Gully Soil Landscape Unit is described by Banks (2001) as being dominated by Vertosols on the lower slopes and drainage plains. Vertosols are clay soils with shrink-swell properties that exhibit strong cracking when dry and have a clay content of 35% or greater.

Soil test results indicate the soil type present within the Study Area is a Black Vertosol. Black Vertosols are characterised as having high inherent soil fertility with widespread gully erosion hazard. They are well suited to intensive cropping (including irrigation) and grazing activities.

Soil test results are shown in Table 1 and Table 2. Both sites A and B were sampled at depths of 15 cm, 60 cm and 120 cm. A summary of the soil test results are as follows:

- Soil texture ranges between a clay loam to silty clay loam.
- pH is strongly alkaline to very strongly alkaline, indicating zinc deficiency could become a production inhibitor when conducting intensive cropping enterprises.
- Exchangeable Sodium Percentage (ESP) indicates soils are non-sodic to marginally sodic throughout the profile.

- Electrical Conductivity according to clay content (EC) indicates soils are non-saline to marginally saline throughout the profile.
- Cation Exchange Capacity (CEC) for all samples is very high
- Phosphorous Sorption Capacity and Phosphorus Sorption Index for all samples are high.
- Organic carbon levels in the topsoil are moderate for both samples.
- Calcium to magnesium (Ca:Mg) ratio is low for all samples which could be corrected with a gypsum application of up to 4 tonnes per hectare prior to planting of lucerne and irrigation. This will greatly increase water use efficiency of any crop and also provide a source of sulfur, reducing fertiliser costs. Gypsum will also aid in reducing sub-soil sodicity.
- Based on their texture, soils have a high water holding capacity of between 240 – 280 millimetres per metre (Williams et al, 1983), making them very suitable for long term irrigation.
- Based on their texture soils have a root zone leaching fraction (LF) of 0.33 (ANZECC, 2000), which when combined with the low soil EC levels is suitable for producing irrigated Lucerne.

Table 1 (APP 1) Soil Chemical Parameters

Plain View	pH		ESP		EC (1:5)		CEC	
	Unit	Rating	%	Rating	dS/m	Rating	cmol/kg	Rating
A1	8.7	Strongly Alkaline	3.9	Non Sodic	0.4	Non-Saline	45.9	Very High
A2	9.4	Very Strongly Alkaline	8.9	Marginally Sodic	1.6	Non-Saline	49.2	Very High
A3	9.6	Very Strongly Alkaline	8.7	Marginally Sodic	2.4	Slightly Saline	54.0	Very High
B1	8.9	Strongly Alkaline	1.0	Non Sodic	1.2	Non-Saline	61.9	Very High
B2	9.3	Very Strongly Alkaline	4.9	Non Sodic	2.4	Slightly Saline	61.5	Very High
B3	9.3	Very Strongly Alkaline	5.5	Non Sodic	2.5	Slightly Saline	62.2	Very High

Table 2 (APP 1) Soil Physical Parameters

Plain View	Soil Texture	Colour	Phosphorus Sorption	Phosphorus Sorption	Ca:Mg	Organic Carbon
	ASC	Munsell	Capacity mg/kg	Index mg/kg	Ratio	%
A1	Silty Clay Loam	Black	1,670	38	1.68	2.5
A2	Silty Clay Loam	Black	1,500	32	1.15	1.7
A3	Silty Clay Loam	Very Dark Grey	1,480	30	1.32	1.4
B1	Clay Loam	Black	2,210	37	2.90	2.8

B2	Clay Loam	Very Dark Grey	2,240	38	0.96	1.5
B3	Clay Loam	Very Dark Grey	2,180	35	0.97	0.9

3.5 Selecting the Site

The Plain View Irrigation Area is located directly to the south and south east of Void Water Dam 1 (VWD1) with landform across the area flat (less than 3% slope), flooding events being rare and nil surface rock outcrop.

Werris Creek is located in a temperate climate zone, with plant water use requirements often deficient during spring, summer and autumn, making the area suited to irrigation.

Soils were mapped as the Duff's Gully Soil Landscape Unit (Banks, 2001) which is described as being dominated by Vertosols on the lower slopes and drainage lines.

Detailed soil testing confirms the soil type as a Black Vertosol which is strongly alkaline, non-sodic, non-saline with a very high cation exchange capacity. This soil type is well suited to irrigation, and detailed in Table 3.

Table 3 (APP 1) Soil Suitability for Irrigation

Soil Property	Limitation			Correction Required
	Nil/Slight	Moderate	Severe	
Exchangeable Sodium (0-40 cm)	0-5	5-10	>10	No
Exchangeable Sodium (40-100 cm)	<10	>10	N/A	No
Salinity as EC (0-70 cm)	<2	2-4	>4	No
Salinity as EC (70-100 cm)	<4	4-8	>8	No
Depth to top of seasonal high water table (m)	>3	0.5-3	<0.5	No
Depth to bedrock or hardpan (m)	>1	0.5-1	<0.5	No
Saturated hydraulic conductivity (mm/h)	20-80	5-20 or >80	<5	No
Available water capacity (mm/m)	>100	<100	N/A	No
Soil pH (surface layer)	>6-7.5	3.5-6.0 or >7.5	<3.5	Yes (2*)
Effective cation exchange capacity (0-40 cm)	>15	3-15	<3	No
Emerson aggregate test	4,5,6,7,8	2,3	1	Yes (1*)
Phosphorus sorption capacity	High	Moderate	Low	No

(1*) Dispersion can be ameliorated using gypsum, which will result in a higher Emerson aggregate score.

(2*) As pH is >7.5 particular attention must be paid to plant available zinc and calcium. Zinc can be applied as granular fertiliser or foliar spray. Gypsum contains calcium, so if dispersion is corrected in (1*) then adequate calcium will also be supplied for optimum plant growth.

3.5.1 Soil Organic Matter

It is recommended that topsoil has >2% organic matter. Soil samples tested have 2.5% and 2.8% organic matter in the top 15 centimetres.

3.5.2 Acid Sulfate Soils

The Plain View Irrigation Area is not located in an acid sulfate soil risk area, therefore there is no risk of acid sulfate soils.

3.6 WATER RESOURCES

3.6.1 Local Groundwater

All monitoring wells/bores (MW) surrounding the Plain View Irrigation Area have a standing water level of greater than 10 metres below ground level. The Evaluation of Groundwater Inflows Werris Creek Coal Mine (Environ, 2014) gives the following standing water levels (below ground level):

- MW1 at 69 metres
- MW2 at 66 metres
- MW5 at 28 metres
- MW6 at 16 metres

3.6.2 Local Surface Water

Surface drainage is to the south towards Quipolly Creek, approximately 2 kilometres away. The Plain View Irrigation Area is not prone to flooding.

Given the location of the Plain View Irrigation Areas distance to surface water sources, along with the soil type and its high moisture holding capacity minimise any risk of irrigation water entering any surface water source. Lucerne is a year round user of water, further reducing any risk from run-off into surface water catchments.

3.6.3 Void Water Quality

Representative samples of void water within the open cut pit and Void Water Dams 1, 2, 3 and 4 are compared to various triggers for short-term agricultural application (irrigation), livestock watering and aquatic ecosystem protection (95%) of ANZECC (2000) summarised in Table 4. These results illustrated each of the analytes tested generally comply with the Short Term Exposure (STE) trigger level for irrigation of ANZECC (2000). In particular, the concentration of metals was generally undetectable or present at very low concentrations (several orders of magnitude below the trigger levels). Some minor exceedances of short-term exposure limits for irrigation of pH, electrical conductivity and sodium were identified as follows:

- Soils within the Plain View Irrigation Area have a naturally high pH with a high pH buffering index (high clay content). Use of void water is highly unlikely to further increase soil pH
- Whilst void water electrical conductivity (EC) has slight exceedances for STE, it is well within NSW Department of Primary Industries tolerances for lucerne and other broadacre crops such as wheat, barley and sorghum (Table 5).
- Whilst zinc and nitrate are above the criteria for Ecosystem Protection for 95% of species, the Plain View Irrigation Area is already a highly modified “farming ecosystem”. Additionally,

both zinc and nitrate are beneficial nutrients for the proposed lucerne crop, and as described earlier, soil sampling has indicated available zinc within the soil may be deficient.

- ESP throughout the soil profile is low and along with the soil's high clay content, it is unlikely the elevated sodium levels in the void water will decrease agricultural production.

Table 4 (APP 1) Void Water Quality

Analyte	Unit	Void Water		Void Water Dams				ANZECC (2000) Criteria		
		(after rain)	(no rain)	1	2	3	4	Irrig (STE)	Stock	Ecos (95%)
pH		8.02	7.92	8.5	8.41	8.74	8.97	6-8.5	-	6.5-7.5
EC	µS/cm	921	929	1,100	1,070	994	1,030	950	-	30-350
SAR		3.03	3.23	4.59	NT	4.82	4.74	-	-	-
TDS	mg/L	512	501	583	NT	546	561	-	4000	-
Hardness as CaCO3	mg/L	244	229	215	NT	173	175	-	-	-
Alkalinity as CaCO3	mg/L	159	160	150	NT	129	121	-	-	-
Sulfate	mg/L	98	118	154	NT	144	145	-	1000	-
Chloride	mg/L	113	117	150	NT	140	147	175	-	-
Calcium	mg/L	78	77	50	NT	43	42	-	1000	-
Magnesium	mg/L	12	9	22	NT	16	17	-	2000	-
Sodium	mg/L	109	113	155	NT	146	144	115	-	-
Potassium	mg/L	9	12	10	NT	10	10	-	-	-
Aluminium	mg/L	<0.01	<0.01	0.02	NT	0.03	0.06	20	5	0.055
Arsenic	mg/L	0.006	0.004	<0.001	NT	0.002	0.001	2	0.5	0.024
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	NT	<0.0001	<0.0001	0.05	0.01	0.0002
Chromium	mg/L	<0.001	<0.001	<0.001	NT	0.012	0.001	1	1	0.001
Copper	mg/L	0.001	0.001	0.001	NT	0.002	0.003	5	1	0.0014
Lead	mg/L	<0.001	<0.001	<0.001	NT	<0.001	<0.001	5	.01	0.0034
Nickel	mg/L	0.006	0.005	<0.001	NT	0.008	<0.001	2	1	0.011
Selenium	mg/L	<0.01	<0.01	<0.01	NT	<0.01	<0.01	0.05	0.02	0.011
Zinc	mg/L	0.024	0.011	0.051	NT	0.006	0.146	5	20	0.008
Iron	mg/L	<0.05	<0.05	<0.05	NT	0.07	<0.05	10	-	-
Mercury	mg/L	<0.0001	<0.0001	<0.0001	NT	<0.0001	<0.0001	0.002	0.002	0.0006
Fluoride	mg/L	0.1	0.2	0.2	NT	0.2	0.1	-	-	-
Ammonia	mg/L	0.15	0.23	<0.01	NT	0.01	<0.01	-	-	0.9
Nitrite	mg/L	0.07	0.08	0.03	0.05	0.05	0.07	-	9.1	-
Nitrate	mg/L	6.23	6.13	2.29	4.86	2.48	4.78	-	90.3	0.7

Kjeldahl N	mg/L	6.3	1.3	0.5	0.7	1.1	1	-	-	0.5
Phosphorus	mg/L	0.01	<0.01	<0.01	<0.01	0.06	<0.01	0.8	-	-
BOD$_5$	mg/L	<2	<2	<2	<2	<2	<2	-	-	85-110
	Exceedance of Irrigation (STE) Criteria									
	Exceedance of Ecosystem Protection (95%) Criteria									

Table 5 (APP 1) Crop Tolerance to Electrical Conductivity

Water Use	Production Threshold		Water Use	Production Threshold
Enterprise	**EC (µS/cm)**		**Enterprise**	**EC (µS/cm)**
Lucerne	2,000		Canola	4,300
Wheat	4,000		Sheep	5,000
Barley	5,300		Beef Cattle	4,000

3.7 Void Water Quality for Irrigation

According to the Environmental Guideline, the void water proposed to be utilised for irrigation is classed as "Low" strength as shown in Error! Reference source not found.**6**.

Table 6 (APP 1) Void Water Characterisation

Void Water Constituent	Classification mg/ L			Correction Required
	Low	**Medium**	**High**	
Total Nitrogen	<50	50-100	>100	No
Total Phosphorus	<10	10-20	>20	No
Biological Oxygen Demand$_5$	<40	40-1,500	>1,500	No
Total Dissolved Solids	<600	600-1,000	>1,000	No
Other Pollutants ANZECC 2000	<5 times	-	>5 times	No
Grease and Oil	<1,500	-	>1,500	No

Error! Reference source not found.**7** summarises the mean and median analytes of the void water quality sampled from the open cut void and void water dams to be used for irrigation modelling. The Sodium Absorption Ratio (SAR) is a measure of the proportion of sodium ions to calcium and magnesium ions, essentially the higher the SAR the more likely soil structural problems will occur.

Table 7 (APP 1) Void Water Quality for Input to Irrigation Model

Sample	EC	pH	SAR	Nitrate	Nitrite	Total N	Total Phosphorus
Type	**µS/cm**	**unit**	**-**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Mean (Median*)	1,023	8.41*	4.3	4.1	0.05	5.0	0.01

Considering the void water quality, SEEC (2015) calculated the root zone salinity and plotted this against sodium absorption ratio (SAR). The root zone salinity (ECse in dS/m) is calculated as ECi (salinity of the water) divided by (2.2 x the root zone leaching fraction [LF]). Based on the texture of the soil, SEEC (2015) applies a LF of 0.3, therefore:

Root Zone Salinity = 1.02 / (2.2 x 0.3) = 1.55

The red circle on Figure 15 represents the plotted root zone salinity against the SAR of 4.3 over a base graph from ANZECC (2000), which shows the relationship between salinity, sodicity and impact on soil structure. This plot indicates that the void water would be suitable for irrigating lucerne without impacting soil structural stability, especially when consideration is given to the low ESP and high clay content of the Plain View Irrigation Area soil.

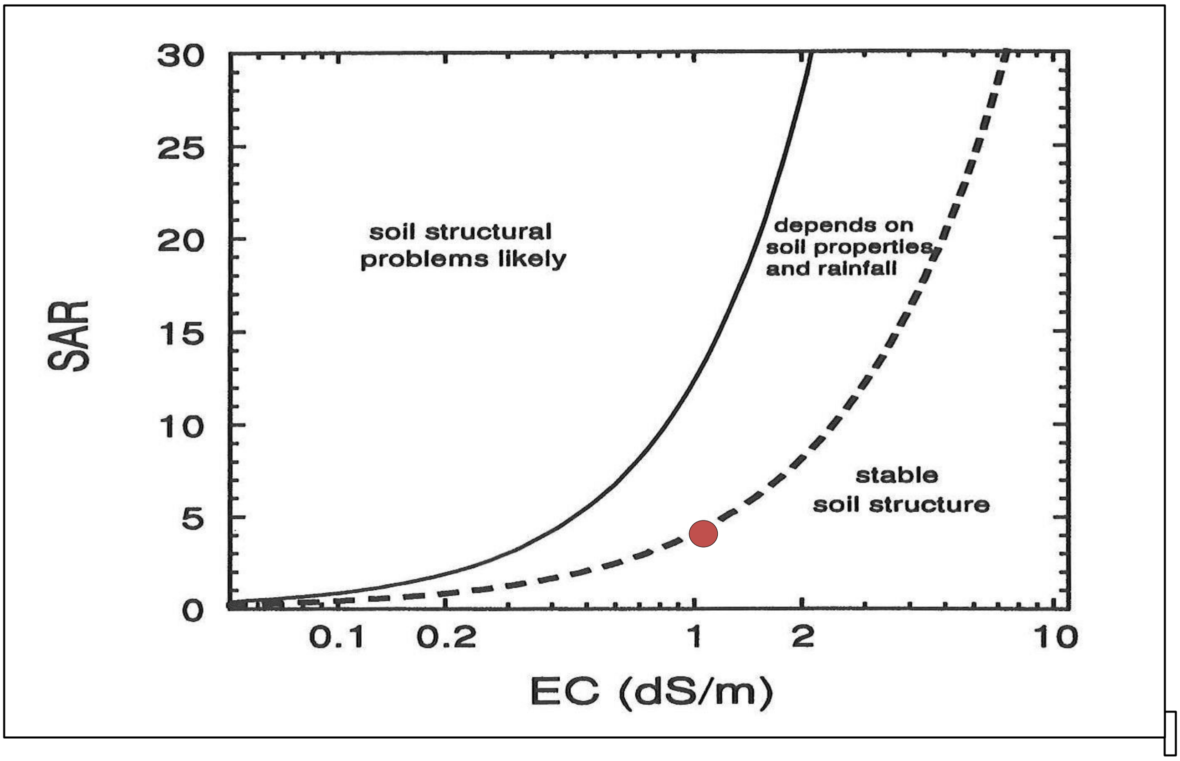

Figure 26 - Relationship between SAR and ECi of irrigation water

3.8 Irrigation Modelling

Water and nutrient balances were modelled using software known as ERIM (Effluent Reuse Irrigation Model) to calculate the amount of water and nutrients that should be applied, and at what times, to meet crop requirements whilst ensuring increases in runoff and percolation are minimised. The ERIM model does not assume water is irrigated every day. Using historical daily rainfall and evaporation data it predicts the deficit of rainfall over evapotranspiration each day and this is used to calculate the irrigation demand. If there is no demand, the water is stored. The model was run for the maximum amount of void water which could be applied in the 90th percentile high rainfall years, as this is likely to cause the greatest impact to soil chemistry.

Inputs to ERIM are as follows:

- Daily Rainfall Data from the Werris Creek Post Office is used and is in-built into ERIM.

- Daily potential evapotranspiration from the Tamworth Airport is used and is in-built into ERIM.
- Vegetation type (in this case it is pasture or moderately sensitive crop).
- Soil water holding capacity estimated from soil texture to be as 164 millimetres (McMullen, 2000). Some percolation is required to ensure salt does not build up in the topsoil. The maximum rate suggested by ERIM is 15 millimetres per month but, in this case, as the site is a re-charge area, and there is a possibility of triggering salinity, 10 millimetres per month has been adopted.
- Nutrient concentrations in void water from Table 4.
- Phosphorous sorption of the soil = 2,065 milligrams per kilogram from Table 2.
- Soil density 1,300 kilograms per cubic metre

- Soil depth available for phosphorous sorption is 1.0 metre.
- Irrigation Water Quantity applied to land is 500 megalitres per annum

Water quantity is assumed as 500 megalitres per annum as this is the amount which would need to be disposed of during a 90th percentile year. The ERIM model (SEEC, 2015) determined the minimum land area required for irrigation in 90th percentile high rainfall years (500 megalitres) would be 80 hectares (assumed for worst case assessment given Plain View Irrigation Area is only 56.4 hectares). SEEC (2015) found that as the nutrient concentrations in void water are very low, they do not match crop demand and so the model predicts they would not increase in the soil over time (Figure 4 and Figure 5). Metals were generally undetectable or present in concentrations much lower than the trigger levels given in ANZECC (2000) and as such these too would not accumulate in the soil to unacceptable levels.

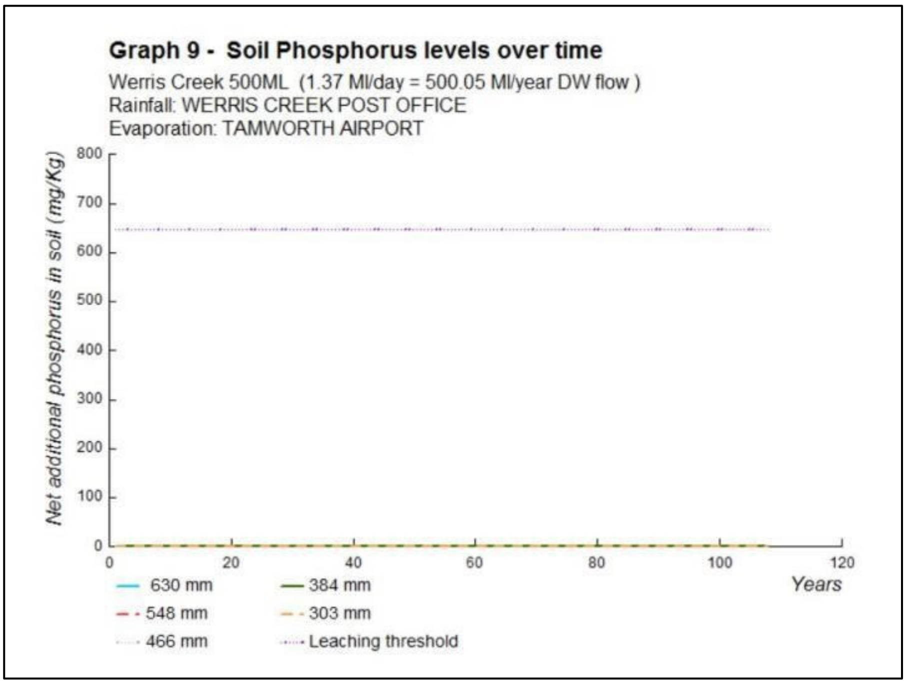

Figure 27 - Projected Soil Phosphorus Levels with Time

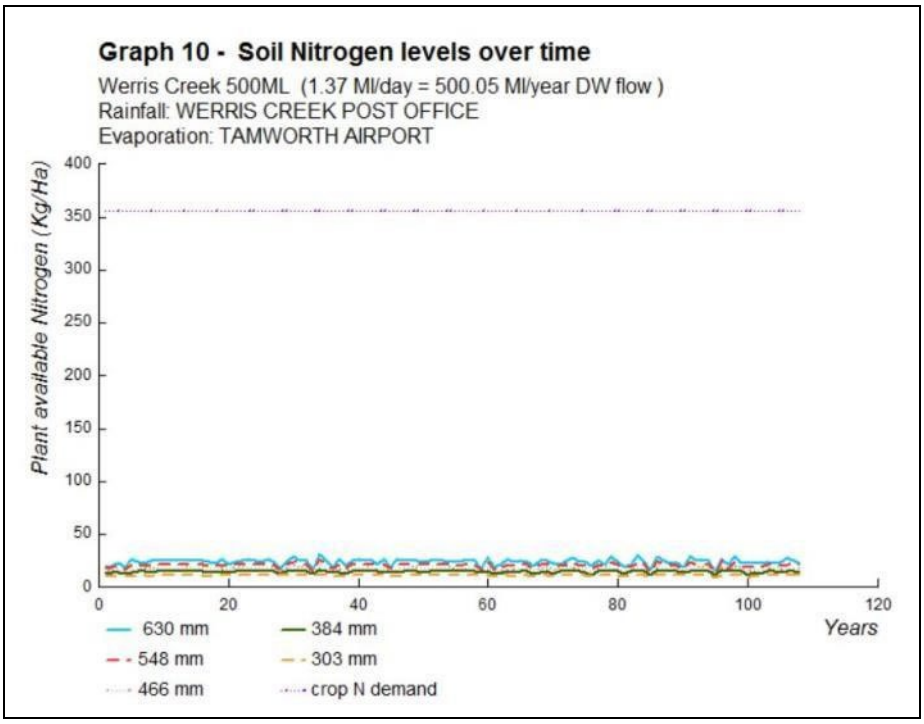

Figure 28 - Projected Soil Nitrogen Levels with Time

4. APPLICATION OF IRRIGATION WATER

4.1 Irrigation Scheduling

The interval between irrigation and the amount of water to apply when irrigating is dependent on the amount of water held within the crop's root zone and the water requirements of the crop at that particular point in the growing season. Factors influencing this include:

- Soil texture;
- Soil structure and water permeability
- Depth of effective root zone of the soil;
- Evaporation;
- Crop grown; and
- Stage of crop development.

Commercially available programs can be accompanied by agronomic advice to estimate irrigation scheduling for lucerne according to available soil water. The soil textures present, being clay loam and silty clay loam, have some of the highest water holding capacities of all soil types, with an average water storing capacity of 164 millimetres per metre of soil (McMullen, 2000).

WCC suggests that the following guidelines are adhered to in the operation of the irrigation schedule:
 The irrigation schedule is initiated once the soil profile is either saturated following a rainfall event which produces runoff, or after irrigation to bring the soil close to the point of saturation, but prior to any surface runoff. On this date the soil water storage is set to the maximum permissible (164 millimetres per metre for a silty clay loam).

- Evaporation and rainfall are recorded on a daily basis in millimetres.

- To ensure maximum crop production, irrigation should be commenced prior to soil water storage reaching zero.
- The amount of irrigation applied (millimetres per square metre) is recorded.
- The Crop Factor of 0.9 is the average for an established lucerne crop, varying from 0.5 after cutting to 1.2 during peak water demand.
- Crop Water Use is Evaporation multiplied by the Crop Factor.
- Effective Rainfall discounts the first 5 millimetres during any rainfall event in spring, summer and autumn.

Average daily evaporation by month for the Tamworth Agricultural Institute is shown in Table 8. Evaporation generally exceeds plant water demand during spring, summer and part of autumn.

Table 8 (APP 1) Average Daily Evaporation by Month

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Ave**
8.6	8.1	6.9	4.6	2.9	2.0	2.1	3.0	4.4	6.0	7.6	8.7	**5.4**

Table 9 shows an example of an indicative irrigation schedule spreadsheet during January 2015 (using Tamworth BOM data) a typically peak water use period for irrigated lucerne.

Table 9 (APP 1) Irrigation Schedule (January Example)

Day	Evaporation	Crop Factor	Crop Water Use	Effective Rainfall	Soil Water Store
0	N/A	N/A	N/A	**Full Irrigation**	164
1	10.6	0.7	7.4	0	157
2	10.0	0.7	7.0	0	150
3	4.0	0.7	2.8	0	147
4	8.0	0.7	5.6	0	141
5	7.4	0.7	5.2	0	136
6	6.0	0.7	4.2	0	132
7	10.6	0.9	9.5	0	122
8	9.4	0.9	8.5	0	114
9	6.8	0.9	6.1	0	108
10	1.8	0.9	1.6	0	106
11	4.4	0.9	4.0	0	102
12	5.4	0.9	4.9	15	112
13	6.2	0.9	5.6	0	106
14	7.6	1.2	9.1	0	97
Day	**Evaporation**	**Crop Factor**	**Crop Water Use**	**Effective Rainfall**	**Soil Water Store**
15	9.0	1.2	10.8	0	87

16	9.6	1.2	11.5	0	75
17	9.2	1.2	11.0	0	64
18	10.1	1.2	12.1	0	52
19	7.8	1.2	9.4	0	42
20	7.0	1.2	8.4	0	34
21	10.0	1.2	12.0	0	22
22	3.0	1.2	3.6	**Full Irrigation**	
23	N/A	N/A	N/A	0	164

Soil moisture monitoring may allow the Water Irrigator to calibrate the spreadsheet by adjusting the crop factor and effective rainfall parameters and quantify movement of irrigation water within the soil profile. An important consideration would be for the soil moisture monitoring to concentrate on the wetter areas to minimise waterlogging and accessions to the groundwater.

The Water Irrigator may monitor the irrigation practices and make adjustments to the crop factor and allowable soil water storage as required. If necessary, the Water Irrigator may seek the advice of a professional agronomist.

Given lucerne is a perennial crop with growth 12 months of the year, an effective rooting zone of established lucerne plants of greater than 2 metres, it is unlikely that this enterprise will result in the percolation of irrigation water into the groundwater.

5. APPROVALS REQUIRED UNDER THE WATER MANAGEMENT ACT 2000

Werris Creek Coal currently holds a Water Supply Works approval and Water Access License (WAL32224) under the Water Management Act 2000 (WM Act), for the interception of up to 211ML of water per year through mining activities, and Water Access Licence (WAL29506) for bore extraction of up to 50ML per year. Following discussions with the NRAR regarding approval and licensing requirements, NRAR have advised that where the irrigation program is included within a statutory approval document, a Water Use Approval will not be required. The Water Management Plan and this Irrigation Management Plan is a statutory document requiring approval under the Environmental Planning and Assessment Act (1979), and as the Plainview Irrigation Project is included within this statutory plan, no further approvals are required under the Water Management Act (2000). Where the irrigation program is not covered by a statutory plan, the Water Irrigator may require a Water Use Approval prior to irrigation activities.

6. MONITORING AND REPORTING

6.1 Irrigation Water Monitoring

Monitoring of water quality in Void Water Dam 1 by the Water Supplier would occur within the timeframes and parameters shown in Table 10 when applicable within the quarterly surface water monitoring program, and through weekly in situ sampling of pH and electrical conductivity. As the void water has been classified as "Low" strength, the corresponding timeframes for sampling have been adopted.

Table 10 (APP 1) Void Water Quality Monitoring Frequency

Constituent	Low Strength Effluent
pH	Weekly
Electrical Conductivity	
Total Suspended Solids	Quarterly
Biological Oxygen Demand	
Total Dissolved Solids	
Cations (Ca, Mg, K, Na)	
Sodium Absorption Ratio	
Oil and Grease	
Dissolved Metals (Al, As, Ba, Be, Cd, Cr, Co, Cu. Pb, Mn, Ni, Se, Va, Zn, Fe)	
Total Nitrogen	
Total Phosphorus	

6.2 Soil Monitoring

Baseline soil investigations and irrigation modelling have demonstrated that irrigation water can be successfully applied with no long-term degradation in soil quality. Monitoring of the irrigation program will focus on the quality of the void water supplied for irrigation, to ensure that the irrigation water is of an equivalent quality to that of the modelled irrigation water. As such, further monitoring of soil quality will not be undertaken as part of this Irrigation Management Plan.

7. CONCLUSION

The use of Werris Creek Coal void water to irrigate lucerne on the Black Vertosol soils which comprise the Plain View Irrigation Area will result in negligible negative impacts to the current soil status. The supply of excess void water for irrigation will result in significantly improved agricultural productivity on the Plain View Irrigation Area, while reducing the current void water surplus of Werris Creek Mine.

This Irrigation Management Plan has demonstrated that the void water to be supplied for irrigation is of a suitable quality for the long term irrigation of Lucerne and other similar crops on the soils of the proposed Plainview Irrigation Area. As such, irrigation of Lucerne can be achieved using traditional techniques as described above, without any additional controls required. Furthermore, the Water Irrigator is a third party with no prior commercial relationship with WCC, other than as a tenant on a property owned by WCC, and as such, the Water Supplier cannot be held responsible for the actions of the Water Irrigator in the event the Water Irrigator does not follow the requirements within this Irrigation Management Plan, or other legislative requirements.

8. REFERENCES

Australian and New Zealand Environment and Conservation (ANZECC) Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality

Banks (2001) Soil Landscapes of the Tamworth Sheet 1:100,000 Sheet

Environ (2014) Evaluation of Groundwater Inflows Werris Creek Coal Mine

McMullen (2000) Soilpak for Vegetable Growers NSW Agriculture

NSW Department of Energy and Conservation (2004) Environmental Guidelines Use of Effluent by Irrigation

SEEC (2015) Void Water Irrigation Assessment for Werris Creek Coal Mine (Ref: 14000171-R-02 dated 2 April 2015)

SLR (2022) Groundwater Closure Assessment Hydrogeological Conceptual Model and Numerical Modelling Final

APPENDIX B – Template Irrigation Management Plan

Irrigation Management Plan (IMP)

TEMPLATE IRRIGATION MANAGEMENT PLAN

IRRIGATION PROJECT

1. IRRIGATION AREA DETAILS

Water Supplier: Werris Creek Coal Pty Ltd (wholly owned by Whitehaven Coal)

Water Irrigator: <NAME>

Property Name: <NAME OF PROPERTY>

Property Description: <LOT AND DP>

Location: <INSERT DESCRIPTION OF PROPERTY LOCATION >

Ownership/Leasing: <NAME OF OWNER/NAME OF LESSEE (IF APPLICABLE)>

Proposed area of irrigation: <AREA IN HECTARES>

Proposed crop/landuse: <DECRIBE TYPOE(S) OF CROP/LAND-USE>

Site Plan: <INSERT>

2. PLAN PREPARATION

This Irrigation Management Plan is to be prepared by a suitably qualified professional with qualifications in agronomy or soil science.

Name of person who prepared plan: <NAME>

Organisation: <NAME OF COMPANY>

Qualifications of person: <QUALIFICATIONS>

3. REGULATORY CONTEXT

Werris Creek Coal currently holds a Water Supply Works approval and Water Access License (WAL32224) under the Water Management Act 2000 (WM Act), for the interception of up to 211ML of water per year through mining activities, and Water Access Licence (WAL29506) for bore extraction of up to 50ML per year.

Werris Creek Coal Mine (WCC) has progressed changes to the Project Approval, Water Management Plan, and Environmental Protection License for WCC, to allow for the offsite supply of excess void water for productive agricultural use.

An Irrigation Management Plan (IMP) is required to assess at an application site level the suitability of the area for irrigation and other controls that will need to be implemented to minimize any impacts on the receiving environment. This IMP, along with the broader Water Management Plan for WCC, addresses the requirements of Schedule 3 Condition 23 (d) of the Modified Project Approval (PA 10_0059 MOD2).

NRAR has advised that where the irrigation program is included within a statutory approval document, a Water Use Approval will not be required. This Irrigation Management Plan will form part of the Water Management Plan, which is a statutory document requiring approval under the Environmental Planning and Assessment Act (1979, and no further approvals are required under the Water Management Act (2000). Where an irrigation program is not covered by a statutory plan, the Water Irrigator may require a Water Use Approval prior to irrigation activities.

4. IRRIGATION METHODOLOGY

<Describe irrigation method, accuracy and controls to prevent waterlogging>

<Describe required flow rate and method of regulating flow>

<Describe frequency of irrigation and anticipated annual water usage per annum>

5. SUPPLY CONNECTION POINT

WCC will supply water for irrigation via pump from Void Water Dam 1 (Figure 2). Irrigation water will be pumped through either PN10 100mm or PN10 150mm polypipe from the pump pad to the Water Irrigator's pipework adjacent to Void Water Dam 1.

The point of connection will be at the property boundary of WCC.

6. RESPONSIBILITIES

Prior to the commencement of supply the Water Supplier (WCM) is responsible for providing information on the typical water quality in accordance with Table 7.5 of the WMP, and the Irrigator is responsible for engaging a suitably qualified professional to complete an Irrigation Management Plan.

During the term of supply the Water Supplier (WCM) is responsible for:

- The infrastructure and management of pumping irrigation water from the Werris Creek Coal void water system to the connection point;
- Monitoring the quality of the irrigation water to ensure compliance with EPL license requirements; and
- Metering or calculating the volume of water supplied to the Water Irrigator.

During the term of supply the Water Irrigator (Applicant) is responsible for:

- the infrastructure and management of irrigation water downstream of the connection point
- complying with any specific legislative requirements of the irrigation application, including the Protection of the Environment Operations Act (1997) and the Water Management Act (2000).

7. TECHNICAL ASSESSMENT

This detailed assessment of the proposed irrigation activities has been conducted using the Environmental Guideline “Use of Effluent by Irrigation, DEC 2004”, to assess the specific site characteristics of the proposed irrigation area and the suitability of the use of void water for irrigation in the manner as described by the IMP.

<DESCRIBE ANY DEPARTURES OR QUALIFICATIONS ON THE USE OF THESE METHODS>

<The Applicant is to provide a comprehensive technical assessment of the suitability of the site for the proposed allocation of water. The assessment should include but not necessarily be limited to the following matters:

- *soil landscape and type*
- *soil chemical and physical parameters,*
- *general suitability of the soil for irrigation,*
- *risk of acid sulfate soils,*
- *general crop tolerance to the water quality and specifically crop tolerance to electrical conductivity,*
- *any corrections required to water quality,*
- *the risk of impact on surface waters and groundwater,*
- *proposed methods of irrigation scheduling, and*
- *environmental monitoring requirements>*

8. CONCLUSION

<Provide a concise conclusion as to the suitability of irrigating mine void water, and summary key environmental risks and how they will be mitigated and monitored.>

9. AGREEMENT

The supply of mine void water for irrigation will be subject to application by the Irrigator, consent of the landowner, agreement of Werris Creek Coal, and regulatory approval of the Irrigation Management Plan. These processes will be captured by separate documentation.

Revisions	Revision Description	Who Consulted	Date
1.	First Draft for WCC Approval	Environ, WCC	26 March 2012
2.	Annual Review Revision	A Wright, P Easy	31 October 2013
3.	Annual Review Revision	A Wright	27 May 2014
4.	Final – Removal of Coal Contact Water	A Wright, R Hicks	17 July 2015
5.	Draft – MOD2 Revision	M Hammond, R Hicks	14 January 2016
6.	Final – following comments from DP&E	M Hammond, N Archer (SLR), R Hicks	10 May 2016
7.	Draft - following further comments from DP&E and NRAR	L Cini, P Delaney (SLR)	25 January 2017
8.	Final – incorporating comments from DP&E and NRAR	L. Cini, R Hicks	10 March 2017
9.	Updated Irrigation Management Plan	L. Cini, R Hicks	November 2017
10.	Update for closure & transfer into new WHC template. RFI - Response March 2026	O.Hulbert, D.Robinson, S.Hulbert (SLR), D.Newton (WRM), M Hollis	March 2026

Department of Planning, Housing and Infrastructure

Our ref: MP10_0059-PA-57

Tony Dwyer
Group Manager – Approvals and Environment
Werris Creek Coal Pty Ltd
PO Box 600
Gunnedah, NSW, 2380

08/05/2026

Subject: Werris Creek Coal – Water Management Plan

Dear Mr. Dwyer

I refer to your submission requesting review and approval of the Water Management Plan in accordance with Schedule 3 Condition 2 of the Project Approval for Werris Creek Coal (MP10_0005). I also acknowledge your response to the Department's review comments and request for additional information.

I note the Water Management Plan:

- has been prepared in consultation with DCCEEW and EPA; and
- contains the information required by the conditions of approval.

Accordingly, as nominee of the Planning Secretary, I approve the Water Management Plan (Rev 10, dated March 2026).

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 Wayne Jones on (02) [redacted].

Yours sincerely

[redacted]

Stephen O'Donoghue
Director
Resource Assessments

As nominee of the Planning Secretary