WATER MANAGEMENT PLAN

Edition	Rev.	Comments	Author	Authorised	Date
1	0	Initial document	J Johnson	C Sullivan	October 2017
	1	Administrative update to address Department comments	M Whitten	C Sullivan	December 2017
	2	Update to address Department comments	M Whitten	C Sullivan	June 2018
	3	Update to address NARA comments, (baseline surface monitoring, pit water balance and summary of groundwater drawdown)	A Raal	C Sullivan	October 2018
	4	Added groundwater trigger levels	A Raal	C Sullivan	January 2020
	4.1	Updated water storages for closure, groundwater licenses	O.Hulbert	A Raal	Feb 2023

Contents

Tables

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ACRONYMS USED THROUGHOUT THIS DOCUMENT

ANZECC	-	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
DP&E	-	Department of Planning and Environment
DPI-Water	-	Department of Primary Industries - Water
EA	-	Environmental Assessment
EC	-	Electrical Conductivity
EMS	-	Environmental Management System
EPA	-	Environment Protection Authority
EPL	-	Environment Protection Licence
ESCP	-	Erosion and Sediment Control Plan
GWMP	-	Groundwater Monitoring Program
LDP	-	Licenced Discharge Point
ML	-	Mining Lease
NMPL	-	Namoi Mining Pty Ltd
NATA	-	National Association of Testing Authorities
PA	-	Project Approval
SWL	-	Standing Water Level
SWMP	-	Surface Water Monitoring Program
WAL	-	Water Access Licence
WMP	-	Water Management Plan
SB	-	Sediment Basin
SD	-	Sediment Dam
CCUS	-	Coocooboonah Upstream sampling point
CCDS	-	Coocooboonah Downstream sampling point

1 INTRODUCTION

This Water Management Plan (WMP) has been prepared in accordance Schedule 3 Conditions (22) to (27) of Project Approval (PA) 06_0308 (MOD4) for the Sunnyside Coal Project (Sunnyside). Sunnyside is operated by Namoi Mining Pty Ltd (NMPL), a subsidiary company of Whitehaven Coal Limited. Mining operations at Sunnyside were suspended in late November 2012 and recommenced in late 2017.

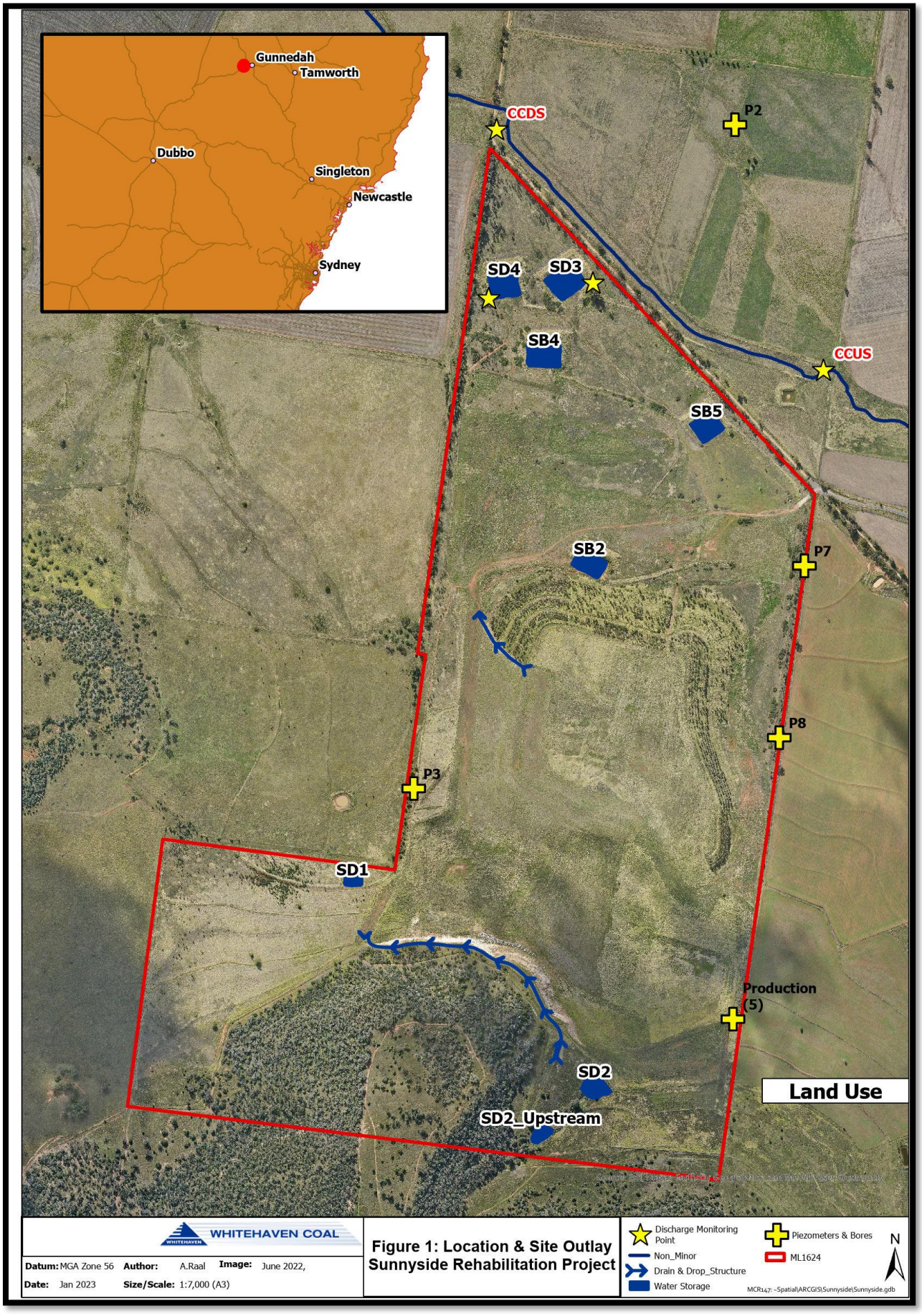
Mining operations for coal ceased in August 2019, with coal crushing and transporting activities ceasing on the 27th of October 2019. Activities at Sunnyside Coal Mine are limited to rehabilitation maintenance and monitoring.

All infrastructure has been removed from site except for two 5,000L water tanks and meteorological station.

This document considers the area of land corresponding to the project site boundary for Sunnyside, referred to as the “mine site”.

As illustrated in Figure 1 (Locality and Project Layout), Sunnyside is located approximately 15km west of Gunnedah.

The WMP was originally prepared by NMPL with assistance from Colin Davies (Carbon Based Environmental) and Andrew Dawkins (GeoTerra) as the suitably qualified experts in relation to surface and groundwater assessment.


Gunnedah
Tamworth
Dubbo
Singleton
Newcastle
Sydney
CCDS
P2
SD4
SD3
SB4
CCUS
SB5
SB2
P7
P8
P3
SD1
Production (5)
SD2
SD2_Upstream
Land Use
WHITEHAVEN COAL
Figure 1: Location & Site Outlay
Sunnyside Rehabilitation Project
Datum: MGA Zone 56
Author: A.Raal
Image: June 2022,
Date: Jan 2023
Size/Scale: 1:7,000 (A3)
Discharge Monitoring Point
Non_Minor
Drain & Drop_Structure
Water Storage
Piezometers & Bores
ML1624
N
MCR147: ~Spatial\ARCGIS\Sunnyside\Sunnyside.gdb

2 SITE WATER BALANCE

2.1 Sources and Security of Water Supply

Since rehabilitation was completed in 2019, the mine site has been in monitoring and maintenance.

Only water used on site is potable water, which is delivered to site, and placed in 5,000L polyurethane water tank.

2.2 Water Use Onsite

Water use on site is limited to weed spraying, which is taken from tanks. Future water use will include stock watering.

2.3 Water Management Onsite

For management purposes, the water within the mine site has been divided into three classes: clean water, dirty water, mine water.

As the site has been fully rehabilitated and all sources of potential contamination has been removed, there is no longer any potentially contaminated or coal contact water.

Definitions:

- **'Clean Water'** – runoff from undisturbed catchments.
- **'Dirty Water'** – runoff from the disturbance of topsoil or spoil where sediment is the main pollutant.
- **'Mine Water'** (also referred to as Mine Affected Water) - runoff from areas in contact with coal (such as coal stockpiles or industrial areas) that typically has elevated concentrations of salts and other pollutants.

2.3.1 Clean Water

The diversion of clean water away from disturbed areas reduces the potential for erosion and contamination. Diversion, collection and storage of "clean" water has been achieved using a series of diversion banks, waterways and storage dams which were constructed prior to surface disturbance activities within the adjacent upslope catchments.

The clean water catchment area south of the open cut area is diverted around the most easterly edge of the open cut area. A highwall drain to divert all clean run-on water from the Sunnyside hill to around the western void extent will be erected such that no clean water enters the backfilled open cut.

The design for all structures has been consistent with the requirements of *Managing Urban Stormwater, Soils and Construction Manual* (Landcom 2004), or its latest version.

All structures will be inspected following significant storm events of >38.4 mm in 24 hours to ensure the structures have been able to sustain those flow velocities.

2.3.2 Dirty Water

Dirty water structures collect water that may have suspended solids concentrations that would be outside the range of those prescribed by EPA guidelines, presented in Table1.

Table 1 – Discharge Parameter Limits

Parameter	100th Percentile Limit
pH	6.5 to 8.5
Suspended Solids (mg/l)	≤ 50
Total Oil and Grease(mg/l)	≤ 10

Catch banks/drains have been constructed to divert potentially sediment-laden waters into sediment basins below sites that can potentially generate sediment laden water. As rehabilitating has been completed, there is no longer any open or exposed areas that have risk of sedimentation generation. Key sedimentation basins will be maintained for at least 5 years post rehabilitation as contingency for high rainfall or erosion events while vegetation is progressing to ecosystem establishment.

The sediment basin locations are presented in Figure 2. They store and settle out potentially sediment laden waters. Basins that have been earmarked for closure after vegetation is fully established are noted in Figure 3. These include SD3, SB4 and SB5.

Sediment basins and storage dams SD3 and SD4 are managed to ensure retention of sufficient capacity to reduce the potential for discharge off site. The management practices to be employed to ensure this is achieved are as follows:

- Regular water quality analysis to assess effectiveness of sediment system. Where sediment levels are determined to be at greater levels than discharge limits, consideration will be given to ameliorative measures including use of flocculants, and increase in sizing or additional sediment basin construction.

As recommended in the Blue Book Landcom guidelines, sediment basin capacity has been calculated on a 90%ile 5-day storm event. Application of this measure results in an overall required sediment basin capacity of 35.3ML.

Calculation of settling zone volume, storage zone volume and total basin volume for the dirty water catchment is presented in Table 2.

Table 2 - Sediment Basin Design Capacity (90%ile 5-day storm event)

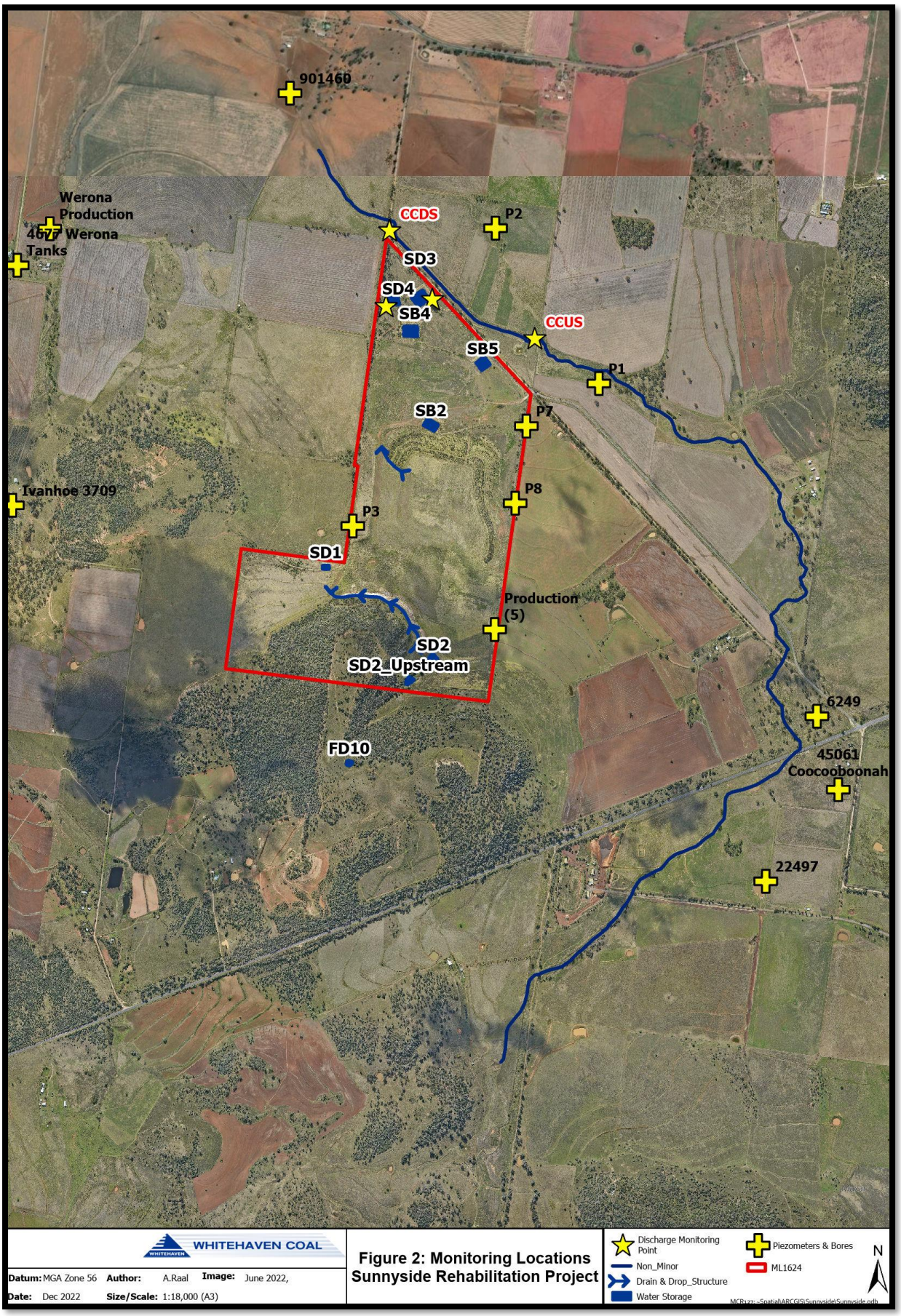
Site	Volumetric Runoff coefficient	Rainfall Depth (mm)	Total Catchment Area (ha)	Settling Zone Volume (ML)	Sediment Storage Volume (12 month) (ML)	Total Basin Volume (ML)
Establishing rehabilitation	0.64	39	109	26.8	8.5	35.3

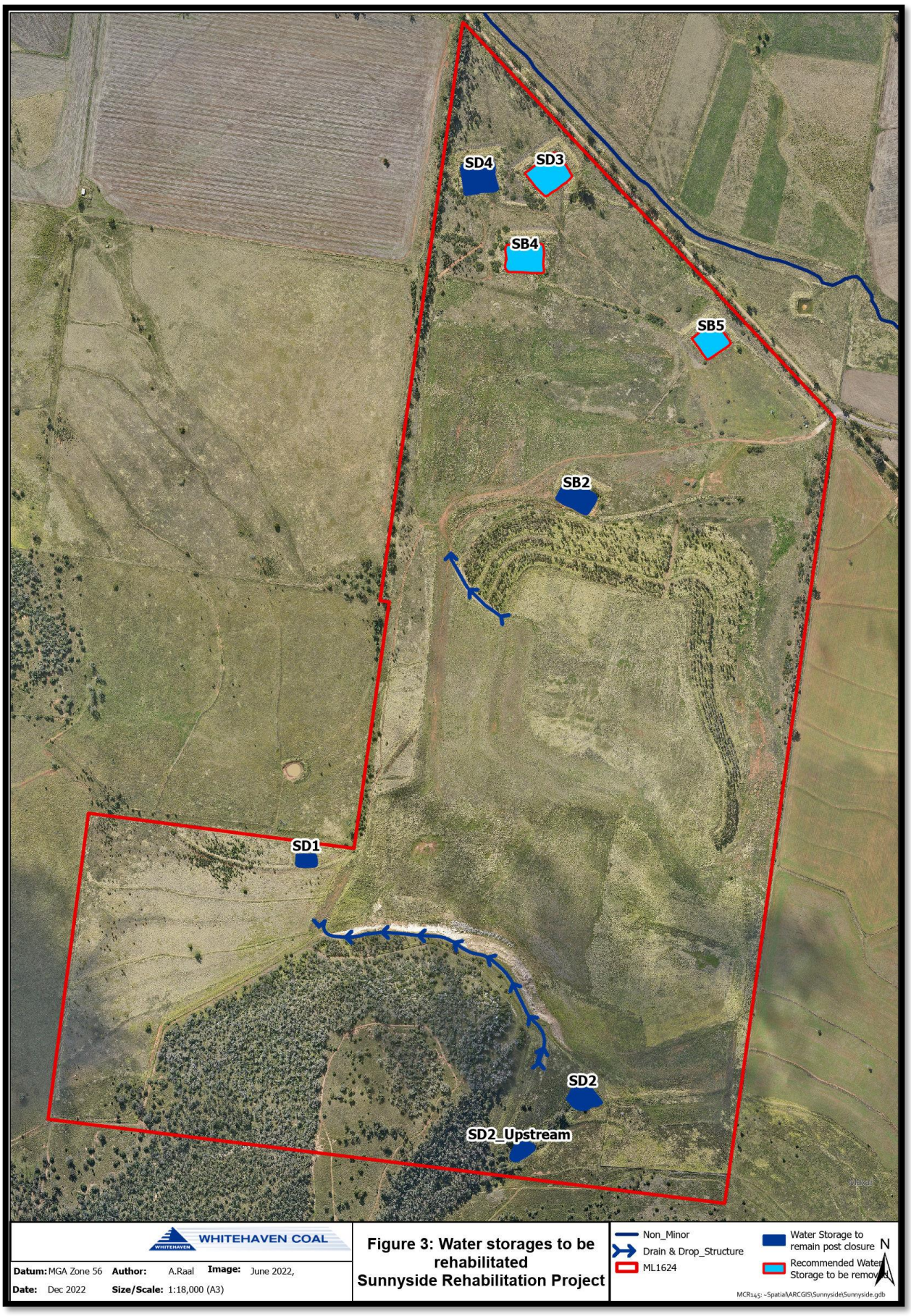
This quantity of water can be captured in any number of basins of suitable dimensions that totals 35.3ML capacity. The indicative catchment areas and available volumes of sediment basins are shown in Table 3.

Table 3 - Sediment Basin Catchment Areas and Available Volumes

Structure ID	Catchment Area Total contributing (ha)	Available Volume (m3)
SB2	40	7,200
SB3	20	6,700
SB4	70	10,300
SB5	90	7,000
Total Volume	-	31,200

The final sediment basin in the chain, SB4, spills into SD3 and SD4 which have a combined available volume of 19.3ML. This capacity ensures there is always storage basins with capacity greater than 35.3ML to achieve the 90th %tile 5-day event criteria, and ensure that uncontrolled discharges only occur when the designed sediment basin capacity has been exceeded.


901460
Werona Production 4677
Werona Tanks
CCDS
P2
SD3
SD4
SB4
CCUS
SB5
P1
SB2
P7
Ivanhoe 3709
P8
P3
SD1
Production (5)
SD2
SD2_Upstream
6249
FD10
45061
Coocooboonah
22497
WHITEHAVEN COAL
Datum: MGA Zone 56
Author: A.Raal
Image: June 2022,
Date: Dec 2022
Size/Scale: 1:18,000 (A3)
Figure 2: Monitoring Locations Sunnyside Rehabilitation Project
Discharge Monitoring Point
Non_Minor
Drain & Drop_Structure
Water Storage
Piezometers & Bores
ML1624
N


SD4
SD3
SB4
SB5
SB2
SD1
SD2
SD2_Upstream
WHITEHAVEN COAL
Datum: MGA Zone 56
Author: A.Raal
Image: June 2022,
Date: Dec 2022
Size/Scale: 1:18,000 (A3)
Figure 3: Water storages to be rehabilitated
Sunnyside Rehabilitation Project
Non_Minor
Drain & Drop_Structure
ML1624
Water Storage to remain post closure
Recommended Water Storage to be removed
N
MCR145: ~Spatial\ARCGIS\Sunnyside\Sunnyside.gdb

2.3.3 Site Water Balance

Site water use is limited to potable water for weed spraying which is delivered to site by a contractor.

Rainfall runoff has been dramatically reduced as there are no-longer any hardstands, roofs and cleared areas that would have a high rainfall runoff coefficient.

2.4 Measures to Minimise Water Use

No measures are required to reduce water usage.

2.4.1 Water Balance Review

A review of the site water balance will be undertaken as part of annual review report and after any changes to current water management system are made.

3 EROSION AND SEDIMENT CONTROL PLAN

3.1 Introduction

In accordance with Schedule 3, Condition 24 of PA 06_0308, this Erosion and Sediment Control Plan (ESCP) is consistent with the requirements of the Department of Housing's *Managing Urban Stormwater: Soils and Construction Manual* (Landcom, 2004), or its latest versions. All erosion and sediment control structures have been constructed or erected in accordance with the recommendations identified in the relevant standard drawing and construction notes of Landcom (2004).

3.2 Sources of Erosion and Sedimentation

Water runoff from rehabilitated overburden dump through water structures and upstream runoff from Sunnyside hill into the mine void are main erosion risks.

3.3 Erosion and Sediment Control Measures

Although all structures have been designed in accordance with the requirements of *Managing Urban Stormwater, Soils and Construction Manual* (Landcom 2004) or its latest version, the following additional procedures and management practices will be implemented to further reduce the risk of erosion and sedimentation.

- As part of a surface water monitoring program, water flowing from the nominated discharge points will be sampled for suspended sediments; and
- All surface water flows from drainage structures will flow to sediment basins.

3.4 Erosion and Sediment Control Structures

The contour banks on the sloped surfaces of the final landform direct surface water flows to a number of drop structures which control the flow of water off the constructed final landform and therefore assist in reducing erosion and maintaining the long-term stability of the landform.

Highwall drain that was recently approved in updated MOD will be constructed in 2023 to divert all rainfall runoff from the upstream Sunnyside Hill around the void preventing erosion on the remaining highwall.

All design works for erosion and sediment control are in accordance with the requirements of *Managing Urban Stormwater, Soils and Construction Manual* (Landcom 2004) or its latest version.

3.5 Monitoring and Maintenance of Erosion and Sediment Control Structures

The erosion and sediment control structures as well as areas previously identified as erosion risk will be inspected monthly, or after a rainfall event of >38.4mm/24hr, to assess their success in preventing erosion, identify signs of potential erosion and determine the retained capacity, especially within the sediment basins.

The erosion and sediment control structures will be cleaned of accumulated sediment material (or extended or replaced) as soon as practicable when 25% capacity is lost due to the accumulation of material such that the specified capacities are maintained.

If, following heavy rain, erosion is identified on the final rehabilitated landform, it will be remediated using one or a combination of the following:

- Filling the erosion channels
- Cross-ripping (along the contour) to assist infiltration
- Installation of additional controls, e.g., banks sown with a non-persistent cover crop.

4 SURFACE WATER MONITORING PROGRAM

4.1 Introduction

This Surface Water Monitoring Program (SWMP) has been prepared in accordance with Schedule 3, Condition 25 of PA 06_0308 and includes:

- Provision of baseline data on surface water flows and quality in adjoining creeks and that could be affected by the project;
- Surface water impact assessment criteria;
- A program to monitor the impact of the project on surface water flows and quality; and
- Procedures for reporting the results of this monitoring.

4.2 Baseline Surface Water Quality

Baseline studies of field pH and Electrical Conductivity measurements were recorded in 2008 for the Environmental Assessment. Essentially, the surface water has low electrical conductivity and above neutral pH (Table 4).

Table 4 – Pre Mining surface water quality

Site	Date	EC (µS/cm)	pH
Coocooboonah Creek "Plain View"	22/Oct/06	960	6.13
Coocooboonah Creek (after rain)	3/Nov/06	272	7.64
"Sunnyside" Dam 1	24/Jan/08	324	8.71
"Sunnyside" Dam 2	25/Jan/08	330	9.07
"Sunnyside" Dam 3	26/Jan/08	234	9.06
"Sunnyside" Dam 4	27/Jan/08	236	9.17
Arithmetic mean		392.7	8.3
Source GeoTerra (2008)			

4.2.1 Surface Water flow

Sunnyside Mine falls within the Namoi drainage catchment. Water leaving site would flow into the Coocooboonah Creek, making its way into the Namoi River via the Native Cat Creek, Collygra Creek and Deadmans Creeks.
Coocooboonah Creek and the Native Cat Creek are both defined as falling within the NSW River Style, Swampy Meadow Group. These creeks have no defined drainage channels and are ephemeral with only noted flows are during high rainfall events.
Since the site has been rehabilitated and has high groundcover, there is little runoff and only occasional spillage from the final settling dams after substantial rainfall.
With the planned removal of the following sedimentation basins and dams SD3, SB4, SB5 (Figure 3), the Sunnyside property will be within harvestable rights for total surface storage. There will be no adverse impact on downstream flows.

4.3 Surface Water Impact Assessment Criteria

4.3.1 Environment Protection Licence

Impact assessment criteria for surface water are only relevant to water actually discharged from the site. EPL 12957 contains two Licence Discharge Points (LDPs) for wet weather discharge. The concentration limits set in EPL 12957 for both discharge locations are presented in Table 5.

Table 5 - Concentration Limits for Licenced Discharge Points

Pollutant	Unit of Measure	100th percentile Concentration Limit
Oil and Grease	mg/L	10
pH	pH	6.5 – 8.5

Total Suspended Solids	mg/L	50*

** The total suspended solids concentration limits may be exceeded for water discharge provided that:*

- *The discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4 mm over any consecutive 5 day period immediately prior to the discharge occurring; and*
- *All practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store rainfall runoff from a 38.4 mm, 5 day rainfall event.*

Whilst there are no concentration limits for Conductivity and Total Organic Carbon, these parameters also have to be monitored at the LDPs. There are no volumetric limits on the LDPs.

4.3.2 ANZECC Guidelines

Downstream and upstream water quality monitoring results are assessed, for each monitoring event, against key default trigger values presented in Table 6 and sourced from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000).

Table 6 - Key Default Trigger Values for Slightly Disturbed Upland NSW Rivers (ANZECC 2000)

Indicator	Trigger Value
pH	6.5 – 8.0
Conductivity (µS/cm)	30 - 350
Turbidity (NTU)	2 - 25
Total Phosphorus (µg/L)	20
Total Nitrogen (µg/L)	250
Dissolved Oxygen (% saturation)	90 -100%
Total Aluminium (mg/L)	0.055
Total Cadmium (mg/L)	0.0005[1]
Total Copper (mg/L)	0.004[1]
Total Lead (mg/L)	0.014[1]
Total Nickel (mg/L)	0.028[1]
Total Zinc (mg/L)	0.020[1]

1. Range based on lower 85% saturation limit and typical water temperature range 13- 20ºC
2. Trigger values for the slightly disturbed lowland river aquatic ecosystems
3. Modified trigger levels, factored based on typical moderate water hardness (60-119 mg/L as $CaCO_3$)

In the event of trigger values for any of the indicators included in Table 6 being reached, a review of upstream water quality results will be undertaken, along with a general review of the water management practices undertaken on site, to determine whether exceedances relate to background water quality or site impact.

4.4 Surface Water Monitoring

4.4.1 Surface water quality monitoring

NMPL has implemented a surface water monitoring program to enable appropriate auditing and management of surface water quality. The frequency of monitoring reflects the parameters to be monitored, the locations to be monitored and the potential for environmental impact. Table 7 presents the monitoring schedule to be implemented.

Table 7 - Surface Water Monitoring Schedule

Location	Parameter	Frequency
Storage Dams SD3 and SD4	Electrical Conductivity, pH, Total Suspended Solids, Oil and Grease, Total Organic Carbon, Total Metals, Nutrients	Once when discharging water
Upstream and downstream of the Project Site's runoff into Coocooboonah Creek.	Electrical Conductivity, pH, Total Suspended Solids, Oil and Grease, Total Metals, Nutrients, Total Organic Carbon.	Once discharging from the site

Whitehaven adopts the concentration limits for discharge waters stated in EPL 12957 as the assessment criteria for pH and Total Suspended Solids (TSS) as opposed to the ANZECC Guidelines.

Total Metals will include Iron (Fe), Copper (Cu), Zinc (Zn), Lead (Pb), Arsenic (As), Cadmium (Cd), Aluminium (Al), Mercury (Hg), Molybdenum (Mo), Manganese (Mn) and Nickel (Ni). Nutrients will include Total Phosphorus and Total Nitrogen.

The monitoring results are reviewed on an annual basis and review will occur over time to determine relevancy of monitoring locations and parameters.

4.4.2 Surface Water Flow Monitoring

Water flow monitoring will include a calculation of discharge volume from the final discharge dams during any overflow event, and any visual monitoring for upstream (CCUS) and downstream (CCDS) flow after a greater than 38.4mm rainfall event in a 24h period.

4.5 Reporting of Monitoring Results

The results of water quality analysis will be reported in the Annual Review, and on Whitehaven Coal web page for EPL monitoring sites

5 GROUNDWATER MONITORING PROGRAM

5.1 Introduction

This Groundwater Monitoring Program (GWMP) has been developed in accordance with Schedule 3, Condition 26 of PA 06_0308, and includes a Groundwater Contingency Plan (refer section 7), as required by Schedule 3, Condition 27 of PA 06_0308.

5.2 Groundwater Model

Golder Associates Pty Limited (Golders) undertook groundwater modelling to assess the likely impact of Sunnyside on the local groundwater.

The report of their assessment is included as Appendix 5 in GeoTerra (2008). GeoTerra (2015) concluded that *"Groundwater monitoring conducted since 2008 during the operational life of the Sunnyside Coal Mine supports the predictions of the 2008 Groundwater Assessment (e.g. limited change in groundwater levels and no impacts at private bores*)." An updated groundwater assessment was carried out in 2018 by GeoTerra which conclude that local depressurisation of private bores was due to private usage and climatic conditions*. "The private bore water levels remained relatively static to slightly depressurised over the January 2008 to June 2018 ten year monitoring period, except for GW44884, which had an approximate, short lived, 16m depressurisation during September 2011. The 16m depressurisation was short lived and does not present a long term issue. The other bores generally depressurised by around 1m".*

Summary of local and surrounding groundwater levels and changes since commencement of mining is presented in Table 8, and Figures 4 & 5.

Table 8 – Distance from pit and summary of groundwater level changes

Sunnyside Bore ID	Distance to open Pit (m)	Monitoring Date start	Monitoring Latest	Depth (mbgl) Start	Depth (mbgl) last monitored	Depth (mbgl) Min	Depth (mbgl) Max	Change in level (most recent)
Piezometers & Bores available for dipping								
P3	334	Jun/07	Oct/22	12.5	23.64	12.5	16.59	-4.09
P8	789	Jun/07	Oct/22	15.63	23.94	15.63	23.64	-7.97
P7	1,156	Jun/07	Oct/22	12.77	13.50	8.12	13.7	-0.35
P1	1,598	Jun/07	Oct/22	11	12.58	11	12.68	-1.68
P2	2,135	Jun/07	June/22	16.77	15.13	14.41	16.89	1.91
22497	2,280	Dec/09	Oct/22	15.01	14.38	14.52	16.59	-1.88
6249	2,335	Sep/09	Oct/22	10.1	9.26	9.11	10.46	-0.36
45061 Coocooboonah	2,599	May/10	June/22	9.1	8.23	8.33	9.1	0
901460	2,964	Dec/08	Oct/22	15.38	13.91	14.01	19.73	0.99
Piezometers & Bores not currently available for dipping, due to access or in pit destruction								
P4	136	Jun/07	Sep/11	60.48	67.76	60.48	68.16	-7.28
P5	190	Jun/07	May/10	40.25	52.5	39.69	52.5	-12.25
45098	543	Jun/07	May/10	10.42	11.93	10.42	12.62	-1.51
P6	918	Jun/07	Jun/09	16.7	17.79	16.7	17.83	-1.09
27356	1506	Jan/08	Jun/12	14.3	13.41	13.41	17.61	0.89
44884	1525	Mar/11	May/14	13.1	15.65	13.1	30.78	-2.55

Figure 4 - Sunnyside Piezometer water levels over time and monthly rainfall totals

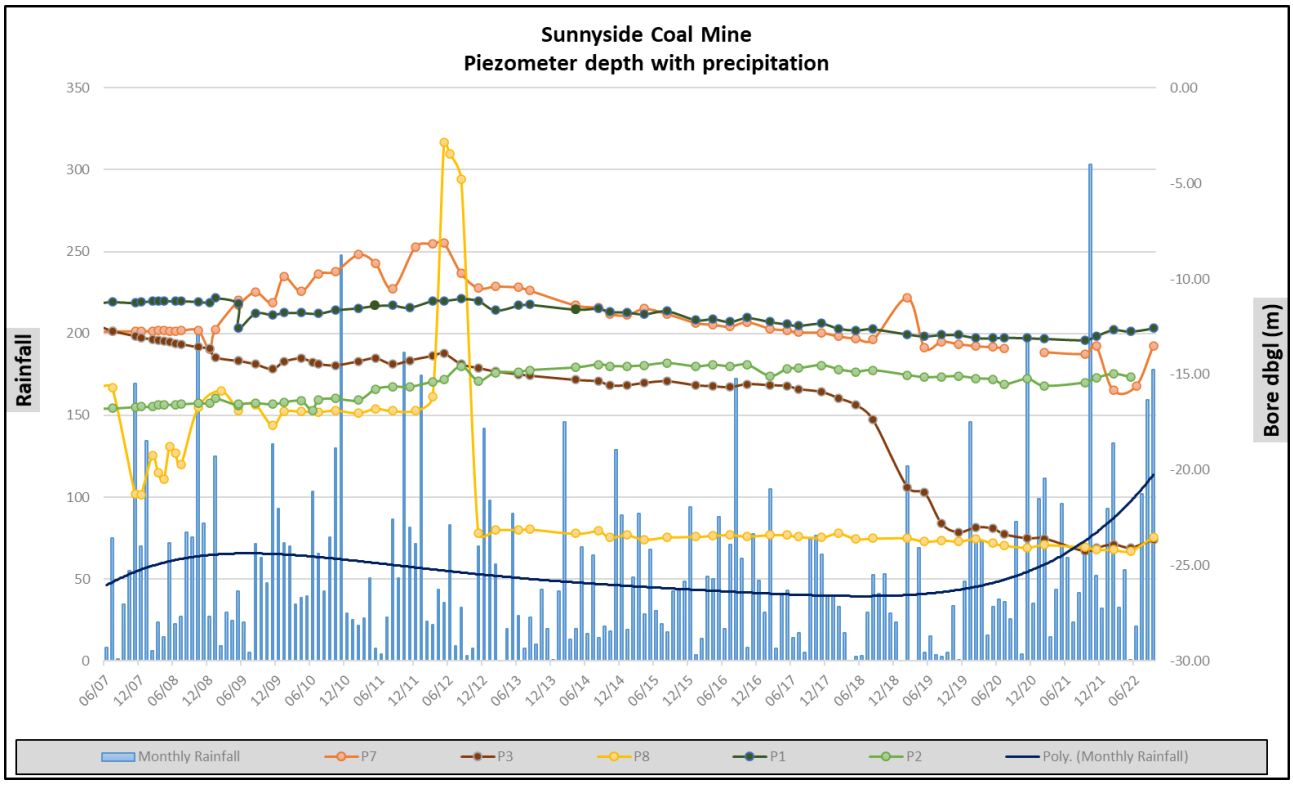
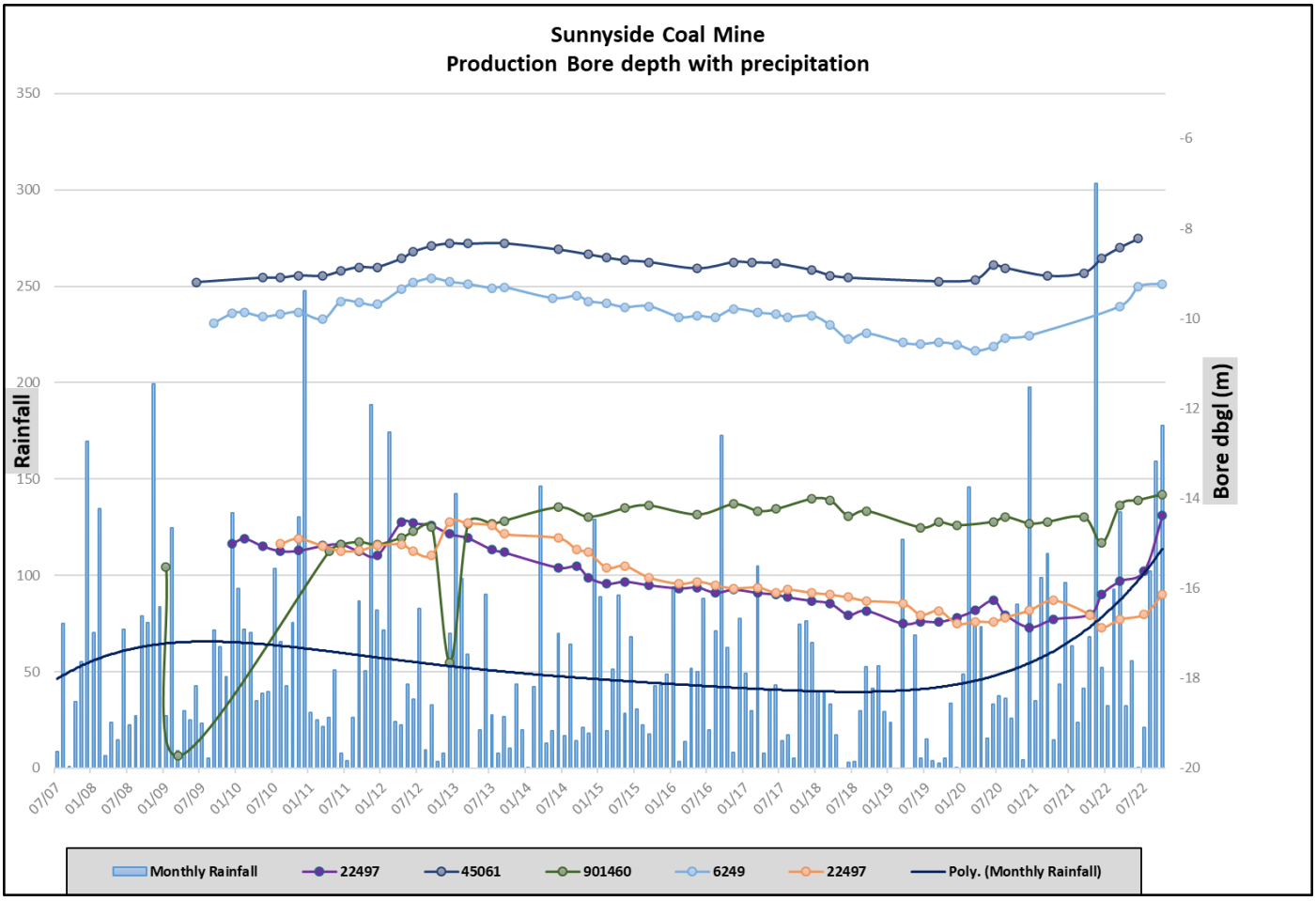


Figure 5 – Sunnyside Production Bores water level over time and monthly rainfall totals



Post Mining Pit Void Water Levels

Void has been backfilled above groundwater level and is free draining. There is no pit void lake post mining.

Potential Impact on Local Streams

It is not anticipated that stream flow in Coocooboonah Creek or Rock Well Creek would be affected by mining as the cone of groundwater depression from the void does not extend as far as the creek channels. The Void has been backfilled above natural groundwater levels and local influence will diminish as groundwater levels return to premining.

Potential Impact on the Namoi River and its Associated Alluvial Groundwater Resources

Groundwater drawdown from mining the proposed Sunnyside Pit would not extend significantly into or within the alluvium of Coocooboonah Creek, and would not extend into the alluvium of Native Cat Creek, Rock Well Creek or tributaries of the Namoi River.

Mining the Sunnyside open cut to date has not affected river flow or groundwater supplies associated with the Namoi River alluvium.

Potential Impact on Groundwater

No adverse effect is anticipated on the surface water quality in Coocooboonah Creek and other streams due to groundwater movement as the Sunnyside cone of depression does not extend as far as the creek channel. Depressurisation in the basement strata under or near the creek is not anticipated due to the isolated dewatering of the Hoskissons Seam.

No adverse effect is anticipated on water quality within Rock Well Creek as depressurisation of the Hoskissons Seam is not anticipated to sufficiently propagate up through strata above the Hoskissons Seam to the creek bed.

Groundwater levels are in sync with rainfall, but locally impacted by water use. Post mining groundwater levels have increased which is likely a result of increased rainfall.

Potential Salt and Contaminant Migration Pathways

It is not anticipated that an increase in salinity levels in Coocooboonah Creek would occur due to leakage of groundwater out of the backfilled void or abandoned underground working. This is a result of the pit forming an inward cone of depression and the underground workings to the south being mostly dry.

It is also anticipated that no contaminants would be transported off site via the groundwater system due to the inward flowing cone of depression.

Potential Impacts on Groundwater-Dependent Ecosystems

No groundwater-dependent ecosystems (GDEs) have been identified within the site, and therefore there are no anticipated adverse effects on GDEs in the study area.

Private Bore and Well Groundwater Levels, Yield and Quality

A total of 24 stock and domestic bores, one irrigation bore and eight piezometers are registered within a 3km radius of the Sunnyside open cut as shown in Table 10.

These bores have yields ranging up to 0.9L/sec. The depth of the stock and domestic bores ranges from 12.2m to 85.3m. Three bores (GW27356, 45097 and 45098) are on the “Sunnyside” property.

The registered bores directly west and southwest of the proposed open cut pit have their water supply intakes located stratigraphically above the Hoskissons Seam, those to the west of and down dip of the subcropping Hoskissons Seam generally obtain supplies from either or both the Hoskissons and Melville Seams, whilst those to the east of the Hoskissons Seam Subcrop generally obtain water from the Upper and or Lower Melville Seams.

Table 10 - Registered Bore Data

Bore	Registered Use	Drilled	Depth	Water Intersection	Drilled Standing Water Level	Yield	Aquifer Intake
INTAKE ABOVE HOSKISSONS COAL SEAM							
3706	Stock	1940	15.2	9.1 / 13.4-15.2	6.4	0.4	Sandstone
3709	Stock	1940	37.5	36.6	19.2	0.46	Shale
3715	Stock	1940	45.1	30.5 / 42.1	? / 28.7	0.04 / 0.2	Shale / sandstone
8810	Stock?	N.A.	53.3	N.A.	N.A.	N.A.	N.A.
15665	Stock	1957	24.4	15.8-16.1	12.2	0.03	Basalt
16789	Stock	1961	23.2	16.8-17.1 / 18.9-21.3	12.2/12.2	0.06 / 0.51	Conglomerate
901803	Stock Domestic Irrigation	N.A.	58	N.A.	N.A.	N.A.	N.A.
966680	Piezometer	1990	5.4	N.A.	N.A.	N.A.	N.A.
966681	Piezometer	1990	2.1	N.A.	N.A.	N.A.	N.A.
967523	Stock domestic	1997	42.36	N.A.	N.A.	N.A.	N.A.
INTAKE WITHIN HOSKISSONS COAL SEAM							
22497	Stock	1965	45.7	28.7-32.1	24.4	0.25	? / coal
44677	Stock Domestic	1926	75.9	N.A.	15.2	N.A.	? / coal
45098	Stock Domestic	1965	44.2	26.5 / 39.6-40.8	N.A.	N.A.	? / coal
INTAKE BENEATH HOSKISSONS COAL SEAM AND / OR WITHIN MELVILLE COAL SEAM							
6249	Stock	N.A.	70.7	68.9	20.7	0.25	Sandstone / coal
17082	Stock	1947	24.4	N.A.	N.A.	N.A.	? / coal
27356	Stock	1966	35.4	27.1 / 31.4-33.5	27.1 / 24.7	0.01 / 0.63	Shale / coal
44580	Stock Domestic	1977	34.0	N.A.	18.0	N.A.	? / coal
44581	Stock Domestic	1977	35	N.A.	18.0	N.A.	? / coal
44884	Stock domestic	?	73.2	N.A.	N.A.	N.A.	? / coal
44885	Domestic	1976	36.6	N.A.	15.3	N.A.	? / coal
45013	Stock	?	76.2	N.A.	N.A.	N.A.	? / coal
45061	Stock	N.A.	84.1	N.A.	N.A.	N.A.	? / coal
45044	Stock domestic	1942	34.1	14.6 / 34.1	N.A.	N.A.	? / coal
45045	Stock	1965	62.5	61	N.A.	N.A.	? / coal
45097	Stock Domestic	1934	85.3	54.9 / 85.3	N.A.	N.A.	? / coal
48701	Stock Domestic	1978	61.0	N.A.	45.7	0.51	? / coal
901460	Stock Domestic	1920	34	N.A.	16.0	N.A.	? / coal
Note: N.A. DPI-Water data not supplied Shading indicates bore in use as at 2008							
Source: GeoTerra (2008) – Table 1							

The 27 bores and piezometers were all installed between 1920 and 1997 with groundwater generally extracted by low flow windmills, and to a lesser degree, submersible pumps.

Five of the 27 bores and the two piezometers are no longer used. Of the remainder, 14 are low, variable yield windmills, and 6 obtain water by submersible pumps.

Water quality ranges from 6.61 to 9.37pH and 1,704µS/cm to 8,440µS/cm electrical conductivity.

All water is extracted from the fractured basement aquifers, with no inspected bores obtaining groundwater from the alluvium of Coocooboonah Creek or Rock Well Creek.

The majority of groundwater in the Rock Well Creek catchment is obtained from basement fractured rocks rather than valley fill alluvium. Standing water levels ranged from 4.9m to 28.7m below surface.

5.3 Groundwater Chemistry

DPI-Water data presented in GeoTerra (2008) shows that groundwater in the Sunnyside area has low to moderate salinity within the basement fractured rock aquifers, with electrical conductivity values of between 510µS/cm and 10,080µS/cm and pH between 3.81 and 8.7. The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) (ANZECC) guidelines for stock watering (cattle) are used when reviewing groundwater quality results.

5.4 Groundwater Flow

Due to its confined nature and 2^{o} to 3^{o} dip to the south and west of the pit, groundwater flow within the Hoskissons Seam is down dip along the seam to the southwest, into the hills, with a modification due to topographical effects to the east giving an overall south-easterly flow direction within the pit area.

Groundwater flow in the combined, underlying Shallow Marine Formation, Melville Seams and Lower Delta Plain Facies is to the northwest, which is in the opposite direction to the Hoskissons Seam and conforms to the influence of topography.

The flow pattern represents a combination of:

- Recharge within the hills to the southwest of the open cut, with gravity driven flow from the hills to the valleys;
- Flow down dip in confined lithologies to the southwest, with modification for topographical effects; and
- Unconfined flow to the northeast then north-northwest along the Coocooboonah Creek and Rock Well Creek valleys.
- Flow within the area would also be modified by the effect of strata dislocation from faulting;
- Possible flow along higher permeability faults; and
- The reduction in Hoskissons Seam and overburden permeability due to the presence of weathered doleritic sills and dykes.

5.5 Groundwater Monitoring Program

5.5.1 A groundwater monitoring program has been conducted since October 2006. The proposed monitoring program is outlined in Table 11.Groundwater Levels and Groundwater Quality

The monitoring program has emphasis on capturing data from piezometers and bores located in the vicinity of surface water systems, open cut pit, abandoned underground workings, and the predicted drawdown area.

Bores are measured for Standing Water Level (SWL), field pH and electrical conductivity (EC) on a quarterly basis. Groundwater samples are collected on a six-monthly basis and analysed for major ions (TDS, Na, K, Ca, Mg, Cl, HCO3, NO3, SO4 and hardness) and selected filtered (0.45μm) metals including Iron (Fe), Copper (Cu), Zinc (Zn), Lead (Pb), Arsenic (As), Cadmium (Cd), Aluminium (Al), Mercury (Hg), Manganese (Mn), Boron (B), Barium (Ba), Beryllium (Be), Cobalt (Co), Chromium (Cr), Nickel (Ni), Selenium (Se), Vanadium (V), at a NATA registered laboratory.

Table 11 - Groundwater Monitoring Program

Location	Parameters
Coocooboonah Ck Alluvium Bores P1 and P2	Manual SWL, field pH, EC Detailed Analysis
Hoskisson Coal Seam Bore P3	Manual SWL, field pH, EC
	Detailed Analysis
Shallow Marine Facies and Melville Seam Bores P7 and P8	Manual SWL, field pH, EC
	Detailed Analysis
Potential Drawdown Bore intake above Hoskisson Seam Bore 3709 Ivanhoe	Manual SWL, field pH, EC
	Detailed Analysis
Potential drawdown intake within Hoskisson seam Bores 22497 Coocooboonah and 44677 (and production bore) “Werona”	Manual SWL, field pH, EC
	Detailed Analysis
Potential drawdown intake beneath Hoskisson seam or within Melville seam Bores 44884 and 6249 “Lilydale”	Manual SWL, field pH, EC
	Detailed Analysis
Bores 27356, 45061, and 901460	Manual SWL, field pH, EC
	Detailed Analysis

The monitoring results are reviewed on an annual basis and review will occur over time to determine relevancy of monitoring locations and parameters.

5.5.2 Groundwater Yield

Sunnyside mine does not extract any groundwater and the pit has been backfilled above groundwater level and made free draining. Groundwater licence have been transferred to other operations.

Groundwater occurs within basement fractured rock aquifer that are very poorly interconnected. There have been no groundwater complaints relating to yield, additionally groundwater levels have risen across the local region around the mine site due to increased rainfall.

On receival of any complaints relating to bore yield a suitable qualified person will be engaged to review groundwater data, usage and undertake yield testing compared to regional baseline data.

5.6 Reporting of Monitoring Results

The results of water quality analysis will be reported in the Annual Review.

6 GROUNDWATER CONTINGENCY PLAN

6.1 Introduction

This Groundwater Response Plan describes the response procedures for managing groundwater if or when trigger levels are exceeded, in accordance with relevant statutory requirements. This Groundwater Response Plan provides procedures for exceedance of trigger levels, complaints from nearby users, and measures for excessive leakage from alluvial aquifers.

The objective of this Groundwater Response Plan is to present a set of procedures to be followed and actions for implementation should the groundwater trigger levels be exceeded.

Impact assessment criteria investigation trigger levels will be set at an overall 3m sustained reduction in monitored groundwater levels in a private bore over a 3-month period. In accordance with Statement of Commitment 7.11, remedial action will be undertaken if the available groundwater for existing groundwater users is reduced by over 15% due to mine activities.

6.2 Groundwater Trigger Levels

Groundwater impact assessment criteria can be described as trigger levels, which if triggered would lead to a response in terms of more frequent monitoring, further investigation and, if required, remedial action.

Groundwater impact assessment criteria are contained in Table 12 below, and gives trigger levels for groundwater levels and quality (pH, EC, TDS).

Table 12 - Trigger Levels for Groundwater Quality and Quantity

Potential Impact	Parameter	Trigger Value
Groundwater Level	Drawdown	The larger of: a) 10% greater than observed from baseline monitoring, or b) 20% greater than model prediction*; or b) 2 m greater than model prediction. If three or more alluvial bores exceed the above in one round of monitoring OR Any bore exceeds the above for three consecutive readings
Groundwater Quality	pH	If recorded value is 10% greater than the maximum of baseline data for two consecutive readings or, for pH, more than 1 pH unit less than or greater than the minimum and maximum baseline data, respectively, for two consecutive readings
	EC	
	TDS	

Trigger levels have been designed to identify if measured readings vary significantly from baseline data or modelled predictions detailed in the hydrogeological assessment and groundwater model will be reviewed.

6.3 Identification, Notification and Mitigation of Identified Groundwater Exceedances or Non-Compliances

Where exceedances to the trigger values occur, the following procedure will be adopted. It should be noted that due to the high variability in data, the trigger levels are reviewed annually to revise and improve the environmental performance of the project over time.

Groundwater exceedance procedure:

1. Check and validate the data which indicates an exceedance of the assessment criteria / trigger level (as soon as possible and within 7 days).
2. Notify NSW Department of Planning and Environment (DP&E) and any other relevant department as soon as practicable (within 7 days after becoming aware of the exceedance).
3. A preliminary investigation will be undertaken to identify the cause and determine whether changes to the groundwater management system are required. This will comprise analysis of the exceedance result, baseline groundwater monitoring, current monitoring results in the vicinity of the exceedance, meteorological conditions of the period, current site activities and adjacent land use activities, including pumping from nearby irrigation bores.
4. A preliminary investigation report of the exceedance is to be prepared and submitted to the DP&E and any other relevant department (within 28 days of the incident).
5. Any further investigations recommended by the preliminary investigation report will be conducted in consultation with DP&E and any other relevant departments (timeframe to be determined in consultation with DP&E).
6. Remedial measures will be developed in consultation with DP&E and any other relevant department and implemented in response to the outcomes of the investigations (timeframe to be determined in consultation with DP&E).
7. In emergency situations water will be supplied to the impacted landholder within 7 days of the exceedance, at least on an interim basis, until investigations are completed.
8. Additional monitoring would be implemented to measure the effectiveness of contingency measures where necessary (timeframe to be determined in consultation with DP&E).

6.4 Procedure to Address Complaints from Nearby Groundwater Users

In the event that a complaint is received from nearby groundwater users, the following procedure will be followed:

1. Check and validate the nature of the complaint (as soon as possible and within 7 days).
2. If Whitehaven groundwater data shows constant or increased groundwater levels, and it is determined therefore to be unlikely to be attributed to Sunnyside, this advice will be provided to the complainant with no further action. However, if levels are consistently dropping across multiple bores, a groundwater specialist will be engaged to review groundwater and climatic data. Where the complaint is potentially attributable to Sunnyside's mining operations, as determined by the groundwater specialist, DP&E and any other relevant department will be notified within 7 days of receipt of the complaint (where practical).
3. An investigation will be undertaken to establish the cause and mitigation measures to improve the groundwater supply to the affected property (within 28 days of complaint).
4. In the event that the investigation identifies an adverse impact to the existing groundwater supply due to Sunnyside operations, Sunnyside will investigate appropriate remedial and contingency measures (timeframe to be determined in consultation with landholder, DP&E and any other relevant department). The details of the contingency measures (including water source) will be determined in consultation and agreement with the affected landholder.
5. In emergency situations water will be supplied to the impacted landholder within 7 days of the exceedance, at least on an interim basis, until investigations are completed.

6.5 Unforeseen Impacts

The potential for unforeseen impacts associated with the continued operation of Sunnyside are generally considered to be quite low, however, in order to protect against any unforeseen environmental impacts associated with groundwater, the following procedure will be followed:

1. Review the unforeseen impact inclusive of any available monitoring data and existing operational activities or catchment activities which may potentially have contributed to the unforeseen impact;
2. An investigation will be commissioned by suitably qualified persons to determine the nature and extent of the impact;
3. Relevant and appropriate ameliorative action measures will be developed based on the results of investigations into the impact;
4. Prepare an action plan in consultation with the appropriate regulatory agency; and

5. Additional monitoring will be implemented where relevant to measure the effectiveness of any improvement measures implemented.

The implementation of any mitigation measures will be undertaken in consultation with the appropriate regulatory agency and will be reported in the Annual Review.

7 INCIDENTS

Incident reporting will be undertaken in accordance with Conditions 5(3) and 5(4) of PA 06_0308.

8 DOCUMENT REVIEW AND CONTINUOUS IMPROVEMENT

This document will be reviewed in accordance with the requirements of Condition 5(5A) of PA 06_0308.