BULGA COAL

GLENCORE

Bulga Coal Water Management Plan

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1. Introduction

The Bulga Coal Complex (BCC) is located approximately 12 kilometres (km) southwest of Singleton, and approximately 2 km from the townships of Broke and Bulga, in the Upper Hunter Valley of New South Wales (NSW).

BCC comprises two coal mining operations, being the Bulga Open Cut (BOC) operations and the Bulga Underground Operations (BUO). The Bulga Open Cut incorporates the Bulga Coal Handling and Preparation Plant (CHPP) and the Bulga Underground incorporates the Blakefield South Mine and the approved but yet to commence Blakefield North Underground Mine. Underground mining ceased in May 2018 with all workings sealed in July 2018. The CHPP and the rail loading facility are located in the north-east corner of the BCC and service both operations.

BCC is managed by Bulga Coal Management Pty Ltd (Bulga Coal) on behalf of the Bulga Joint Venture. Bulga Coal Management Pty Ltd is owned by Oakbridge Pty Ltd, which also is the majority shareholder (87.5%) of the Bulga Joint Venture. Glencore, which acquired Xstrata in early 2013, is the majority shareholder of Oakbridge Pty Ltd.

BCC currently operates pursuant to the modified DA SSD-4960 (the BOC consent) and modified DA 376-8-2003 (the BUO consent). The Bulga Optimisation Project (DA SSD-4960) approved in December 2014 included the development of the East Pit, re-alignment of Broke Road and the development of the Noise & Visual Bund.

1.1 Description of Latest Modifications for DA SSD-4960 and DA 376-8-2003

In 2019, Bulga Coal applied to modify the Bulga Open Cut SSD-4960 (Mod 3) and Bulga Underground DA 376-8-2003 (Mod 7). Mod 3 and Mod 7 were approved on 16 July 2020. Key aspects of the modifications include:

SSD-4960 (Mod 3)

- Continuation of mining behind the noise and visual bund and within the existing approved project area;
- Relocation of tailings within the Deep Pit to an in-pit tailings facility in the north of the mine to enable mining of the underlying coal. Relocation of the tailings will be via a system of pumps and pipelines;
- Mining of an approximately 63 million additional tonnes of coal over the life of the mine;
- Disturbance of an additional 20.2 hectares (ha) of vegetation, which will be offset;
- Extension of the mine life of the open cut operation by four years to 2039; and
- Re-disturbance and rehabilitation of approximately 200 ha of existing immature rehabilitation.

DA 376-8-2003 (Mod 7)

- Demolition and relocation of the Bulga Underground Operations Mining Infrastructure Area (MIA);
- Allowance for the relocation of underground mine ventilation, as required;
- Relocation of the 9 megawatt (MW) power station and associated flares;

- Relocation of the Bulga Underground Operations electrical substation;
- Upgrading, relocation, construction and decommissioning of mine owned power transmission lines and associated access tracks.

The BCC Water Management Plan (WMP) brings together the processes and responsibilities of all aspects of the site's Integrated Water Management System (IWMS). This WMP has been compiled to satisfy the relevant requirements of the aforementioned consents as well as Condition 4 of the Australian Government Department of the Environment approval under section 130(1) and 133 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC approval 2012/6637).

In accordance with Schedule 3, Condition 28(a) of DA SSD-4960 the WMP has been prepared by suitably qualified and experienced person whose appointment has been approved by the Planning Secretary. Furthermore the WMP has been prepared in consultation with the Environment Protection Authority, the Department of Planning, industry & Environment (DPIE) Water Group and the DPIE Biodiversity & Conservation Division of the Environment, Energy and Science (EES) Group (formerly the Office of Environment and Heritage [OEH]).

1.2 Purpose

The purpose of BCC WMP is to document the structured approach to managing water capture, supply, consumption, storage and disposal for both BOC and BUO.

In addition to this, the purpose of the WMP is to:

- Guide the management of surface and groundwater resources throughout the construction and operational life of the mine;
- Address the relevant conditions of the Development Application consents such as:
  - documenting the water balance for the development;
  - documenting baseline surface water and groundwater flow and quality information for watercourses potentially affected by the development;
  - describing the water management system including design objectives and performance criteria;
  - detailing the assessment criteria and trigger levels / performance indicators;
  - documenting management actions and mitigation measures to minimise the impact of the development;
  - outlining surface water and groundwater monitoring and reporting requirements;
  - documenting the process of groundwater model validation and independent review;
  - outlining a contingency plan to respond to unpredicted impacts and exceedances of assessment criteria;
  - outlining the reporting and reviewing requirements; and
  - detailing the accountabilities and responsibilities associated with implementation of the WMP; and
- Address legislative requirements and guidelines relevant to the WMP.

1.3 Scope

The scope of the WMP includes all activities associated with the management of water at BCC (inclusive of the open cut and underground operations) with the exception of the potable water supply. The extent of this area is presented on **Figure 1**. The potable water supply is sourced from the Singleton Council Broke Village system and is not included in the scope of this WMP.

The scope of the BCC WMP includes describing the existing IWMS for the BOC and BUO operations, as well as the water management aspects of the recently approved BOC SSD 4960 Modification 3.

1.4 Objectives

The objectives of the WMP are to:

- control the contamination of clean water runoff from catchment areas upstream of the operations by directing clean water around the disturbance footprint where possible;
- control the potential effects of erosion and its associated impacts as a result of mining operations changing flows or conditions downstream;
- prevent the discharge of pollutants from the disturbed area except where discharges are licenced, or where the discharge will not cause environmental harm such as runoff suitable for release from rehabilitated areas;
- reinsure the use mine water to meet on site water consumption requirements wherever possible to reduce the need for sourcing of water from the Hunter River;
- secure access to water via water allocation licences for the operations during periods when there is insufficient water from the IWMS; and
- manage the controlled discharge of excess water in line with relevant Environment Protection Licence (EPL) and Hunter River Salinity Trading Scheme (HRSTS) conditions when excess water volumes are stored on site beyond projected future requirements and the capacity of the site to manage.

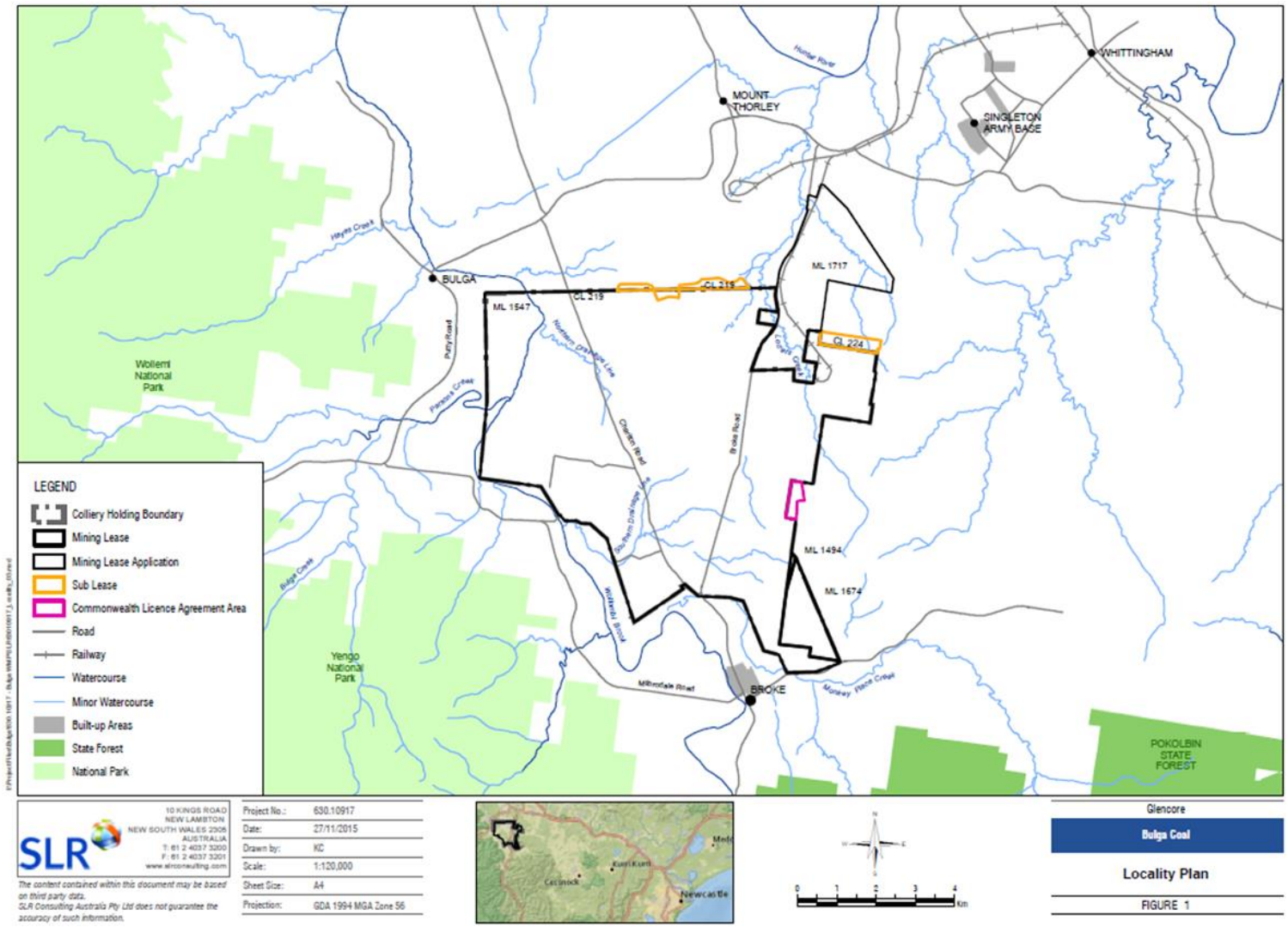

Figure 1 – Locality Plan

2. Planning Requirements

2.1 Overview

The BCC operations are regulated by a range of leases, licences and approvals.

BCC currently operates under two NSW Development Consents (BUO DA 376-8-2003 and BOC DA SSD-4960) as well as Development Consent conditions provided by the Federal Australian Government Department of the Environment under section 130(1) and 133 of the Environment Protection and Biodiversity Conservation Act 1999. The requirements of these consents that are relevant to the WMP are outlined in *Table 1 to Table 3*, respectively.

In addition to these Development Consents, BCC operates within the following leases: ML 1547, ML 1494, ML 1674, ML 1717, ML1788 and Coal Lease (CL) 224. The requirements of these leases that are relevant to the WMP are outlined in *Table 4 to Table 7*.

BCC are also able to undertake exploration activities in accordance with Exploration Licences and Authorisations. The requirements of these Exploration Licences and Authorisations relevant to the WMP are outlined in *Table 8*.

2.2 Development Consent Conditions

Table 1 – Relevant Water Management Conditions (DA 376-8-2003)

Relevant Water Management Conditions (DA 376-8-2003)		
Condition	**Requirement**	**Section Addressed**
Schedule 6 – Environmental Management, Reporting and Auditing		
2 – Adaptive Management	The applicant must assess and manage development-related risks to ensure that there are no exceedances of the criteria and/or performance measures in Schedule 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and	**Section 12.1 & Section 12.2**

<table>
<tr><th colspan="3">Relevant Water Management Conditions (DA 376-8-2003)</th></tr>
<tr><td></td><td>(c) implement remediation measures as directed by the Planning Secretary,

to the satisfaction of the Planning Secretary.</td><td></td></tr>
<tr><td colspan="3">Schedule 4 - Specific Environmental Conditions</td></tr>
<tr><td>8 - Pollution of Waters</td><td>Except as may be expressly provided by an Environment Protection Licence, the Applicant must comply with section 120 of the Protection of the Environment Operations Act 1997 during the carrying out of the development.</td><td>Section 2.5.1 & Section 5</td></tr>
<tr><td rowspan="4">9 - Discharge Limits</td><td>Except as may be expressly provided by an Environment Protection Licence or the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002, the Applicant must:</td><td rowspan="4">Section 2.41 & Section 5.3

Note that the discharge limit is set by the BCC Environment Protection Licence at 500 ML/day – refer Section 2.5.1</td></tr>
<tr><td>a) not discharge more than 55 ML/day from the licensed discharge point/s at the development; and</td></tr>
<tr><td>b) ensure that the discharges from any licensed discharge points comply with the limits in Table 2:

Discharge Limits
<table><tr><th>Pollutant</th><th>Units of measure</th><th>100 percentile concentration limit</th></tr><tr><td>pH</td><td>pH</td><td>6.5≤ pH ≤ 9.5</td></tr><tr><td>Non-filterable residue</td><td>mg/litre</td><td>NFR ≤ 120</td></tr></table>Table 2

Note: This condition does not authorise the pollution of waters by any other pollutants</td></tr>
<tr><td rowspan="5">10 - Site Water Balance</td><td>Each year, the Applicant must:</td><td rowspan="5">Section 6</td></tr>
<tr><td>a) review the site water balance for the development against the predictions in the EIS;</td></tr>
<tr><td>b) re-calculate the site water balance for the development; and</td></tr>
<tr><td>c) report the results of this review in the Annual Review.</td></tr>
<tr><td>These calculations must exclude the clean water system, including any sediment control structures, and any dams in the mine lease area which fall under the Maximum Harvestable Right Dam Capacity; include any dams that are licensable under Section 205 of the Water Act 1912, and water harvested from any non-harvestable rights dam on</td></tr>
</table>

Relevant Water Management Conditions (DA 376-8-2003)		
	the mine lease area; address balances of inflows, licensed water extractions, and transfers of water from the site to other sites; include an accounting system for water budgets; and include a salt budget.	
10A & 10B – Water Supply	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of the development to match its available water supply. *Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain necessary water licences for the development, including during rehabilitation and post mine closure.*	**Section 2.5.3 & Section 6.2.1**
	The Applicant must report on water extracted from the site each year (direct and indirect) in the Annual Review, including water taken under each water licence for the development. The Applicant must also report on any water transferred to/from the site each year (direct and indirect) in the Annual Review, including water taken under water licences that apply to other mining operations	**Section 6.4 & Section 12**
11 - Flood Exclusion Levee	The Applicant must design, construct, maintain, and rehabilitate the Flood Exclusion Levee to the satisfaction of the Planning Secretary. This levee must:	Wollombi Brook Flood Exclusion Levee Plan (*BULUG-1844516901-3119*)
	a) remain stable under a 1 in a 100 year ARI flood event; &	
	b) not cause an increase in backwater stream heights in Wollombi Brook of greater than 20mm upstream of the confluence of the unnamed watercourse and Wollombi Brook under conditions up to and including a 1 in a 100 year ARI flood event.	
12 - Flood Exclusion Levee	Within one month of completing the construction of the Flood Exclusion Levee, the Applicant must submit an as-executed report, certified by a practising registered engineer, to the Planning Secretary.	Wollombi Brook Flood Exclusion Levee Plan (*BULUG-1844516901-3119*)
13 - Monitoring	The Applicant must:	
	a) measure: i the volume of water discharged from the site via the licensed discharge points; ii water use on the site; iii dam and water structure storage level for dams associated with the mine discharge system;	**Section 5.3 & Section 6.4**

Relevant Water Management Conditions (DA 376-8-2003)		
	iv water transfers across the site; and v water transfers between the site and surrounding mines;	
	b) monitor the quality of the surface water: i discharged from the licensed discharge point/s at the development; and ii upstream and downstream of the development;	**Section 8.31 & Section 8.3.2**
	c) monitor flows in the Wollombi Brook;	**Section 8.1.3 & Section 9.5.6**
	d) monitor the volume and quality of water inflows to and from the underground workings; and	**Section 6.4 & Section 9.5**
	e) monitor regional ground water levels and quality in the alluvial, coal seam, and inter-burden aquifers during the development and at least 10 years after mining, and	**Section 9**
	f) periodically assess groundwater pressure response in the coal measures; in consultation with EPA and DPIE Water and to the satisfaction of the Planning Secretary.	**Section 9.6**
14 - Site Water Management Plan	Within 12 months of the date of this consent, the Applicant must prepare or update the existing Site Water Management Plan for the development in consultation with EPA, and to the satisfaction of the Planning Secretary. This plan must include:	**This Document**
	a) the predicted site water balance;	**Section 6**
	b) a Surface Water Monitoring Program;	**Section 8**
	c) a Ground Water Monitoring Program;	**Section 9**
	d) a Surface and Ground Water Response Plan; and	**Section 10**
	e) a strategy for decommissioning water management structures on the site.	**Section 11**
15 - Site Water Management Plan	The Surface Water Monitoring Program must include:	
	a) detailed baseline data on surface water flows and quality in the Wollombi Brook and Loders Creek;	**Section 8.1**
	b) surface water impact assessment criteria;	**Section 8.2**

Relevant Water Management Conditions (DA 376-8-2003)		
	c) a program to monitor surface water flows and quality in the Wollombi Brook and Loders Creek; and	**Section 8.3**
	d) a program to monitor the effectiveness of the Erosion and Sediment Control Plan.	**Section 7 & Section 8.3**
16 - Site Water Management Plan	The Ground Water Monitoring Program must include:	
	a) detailed baseline data on ground water levels and quality, based on statistical analysis, to benchmark the pre-mining natural variation in groundwater levels and quality;	**Section 9.1 & 9.2**
	b) ground water impact assessment criteria;	**Section 9.4**
	c) a program to monitor the volume and quality of ground water seeping into the underground mine workings; and	**Section 9.5**
	d) a program to monitor regional ground water levels and quality in the alluvial and coal seam aquifers.	**Section 9.1 & Section 9.5**
17 - Site Water Management Plan	The Surface and Ground Water Response Plan must include:	**Section 9.5.4 & Section 10** and the Wollombi Brook and Monkey Place Creek Surface Water and Groundwater Response Plan *(BULUG-1844516901-973)*
	a) measures to mitigate any adverse impacts on existing water supply bores or wells in either the alluvial or coal measure aquifer systems;	
	b) measures to remediate any connective cracking between the underground mine workings and any surface water stream channels, floodplain areas, or the alluvial aquifer;	
	c) measures to address a decrease in throughflow rates caused by the development within the Wollombi Brook/Monkey Place Creek alluvium adjacent to or downstream of the development within the mine lease boundary; and	
	d) the procedures that would be followed if any unforeseen impacts are detected during the development.	
18 - Flood Levee Plan	Three months prior to the commencement of construction of the flood levee on the northern drainage line, the Applicant must submit a Flood Exclusion Levee Plan for the Planning Secretary's approval. The Plan must include:	Wollombi Brook Flood Exclusion Levee Plan (*BULUG-1844516901-3119*)

Relevant Water Management Conditions (DA 376-8-2003)		
	a) the detailed design and specifications of the levee, including any measures to allow waters to flow through the levee when required;	
	b) the measures that would be implemented to minimise soil erosion and the potential for the migration of sediments to downstream waters;	
	c) a construction program for the levee, describing how the work would be staged, and integrated with the proposed works in the Northern Drainage Line; and	
	d) a program to inspect and maintain the levee and associated revegetation works during the development.	
19 - Erosion and Sediment Control Plan	Three months prior to the commencement of construction works outside the Bulga Complex Water Management System or subsidence remediation, the Applicant must submit an Erosion and Sediment Control Plan for the Planning Secretary's approval. The Plan must:	**Section 7**
	a) be consistent with the requirements of the Department of Housing's Managing Urban Stormwater: Soils and Construction Manual;	
	b) identify activities that could cause soil erosion and generate sediment;	
	c) describe the location, function, and capacity of erosion and sediment control structures; and	
	d) describe the measures to minimise soil erosion and the potential for the migration of sediments to downstream waters. *Note: The Erosion & Sediment Control Plan should only relate to development that is scheduled to occur outside the mine's "dirty water" system. Given that this development is likely to be staged, the Department accepts that the Erosion & Sediment Control Plan is likely to be prepared in stages to coincide with the relevant stages of the development.*	
20 - Surface & Sub-surface Investigation & Monitoring Program	Within 12 months of the date of this consent, or prior to the commencement of longwall extraction in the approved panels, whichever occurs first, the Applicant must develop and implement a surface and subsurface investigation and monitoring program to assess the likely fracturing of geological strata and hydraulic property changes above each longwall panel, to the satisfaction of the Planning Secretary. This program must:	**Section 9** and the Wollombi Brook and Monkey Place Creek Surface and Groundwater Response Plan

Relevant Water Management Conditions (DA 376-8-2003)		
	a) assess the impact on groundwater resources and surface expression resulting from underground mining at varying depths;	*(BULUG-1844516901-973)*
	b) compare the results from all longwall panels against pre-mining baseline geological conditions, in order to assess the level of variability of fracture and changes in hydraulic properties between panels; and	
	c) be repeated for each coal seam as it is mined.	
21 - Final Void Management	At least 5 years prior to the completion of the development, the Applicant must evaluate the potential long-term impacts of any final pit voids on groundwater resources, and develop an appropriate management plan to the satisfaction of the Planning Secretary.	**Section 11**

Table 2 - Relevant Water Management Conditions (DA SSD-4960)

Relevant Water Management Conditions (DA SSD-4960)		
Condition	Requirement	**Section Addressed**
Schedule 3 - Environmental Performance Conditions		
24 – Water Supply	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of mining operations to match its available water supply. *Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain necessary water licences for the development, including during rehabilitation and post mine closure.*	**Section 6.2.1**
24A – Water Supply	The Applicant must report on water extracted from the site each year (direct and indirect) in the Annual Review, including water taken under each water licence for the development. The Applicant must also report on any water transferred to/from the site each year (direct and indirect) in the Annual Review, including water taken under water licences that apply to other mining operations.	**Section 12**
25 – Water Transfers	The Applicant may receive water from, and transfer water to, the Mt Thorley mine.	**Section 5.4**
26 – Water Pollution	Unless an EPL or the EPA authorises otherwise, the Applicant must ensure all surface water discharges from the site comply with the: a) discharge limits (both volume and quality) set for the development in any EPL; and b) relevant provisions of the POEO Act of Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002. *Note: for the avoidance of doubt, it is noted that the EPA will determine the cumulative allowable salinity discharges to the Hunter River Catchment, according to rules of the Hunter River Salinity Trading Scheme and the respective quantities of tradeable salinity credits held by participants in the scheme (including the Mount Thorley Mine and other nearby mining operations).*	**Section 1.3 Section 5.3 and Section 8**
27 – Water Management Performance Measures	The Applicant must comply with the performance measures in Table 8 to the satisfaction of the Planning Secretary.	**Section 4, Section 5, Section 7, Section 8, Section 9 and Section 10**

Relevant Water Management Conditions (DA SSD-4960)		
	Water Management Performance Measures	**Section 4, Section 5, Section 7, Section 8, Section 9 & Section 10**

Feature	Performance Measure
Water Management – General	Minimise the use of clean water on site Minimise the need for make-up water from external supplies. Minimise cumulative water impacts with the other mines in the region.
Construction & operation of infrastructure	Design, install and maintain erosion and sediment controls generally in accordance with the series *Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads* Design, install and maintain the infrastructure within 40 m of watercourses generally in accordance with the *DPI Water Controlled Activities Guideline (2012)*, or its latest version Design, install and maintain any creek crossings generally in accordance with the *Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries, 2003) and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries 2003), or their latest versions
Clean water diversion & storage infrastructure	Design, install and maintain the clean water system to capture and convey the 100 year ARI flood. Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site.
Sediment dams	Design, install and maintain the dams generally in accordance with the series *Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries*

Relevant Water Management Conditions (DA SSD-4960)		
	Mine water storages	Design, install and maintain mine water storage infrastructure to ensure no unlicensed or uncontrolled discharge of mine water off-site. Design, install and maintain on-site storage (including tailings dams, mine infrastructure dams, groundwater storage and treatment dams) to minimise permeability. Ensure adequate freeboard within the pit void at all times to minimise the risk of discharge to surface waters.
	Tailings storage	Design and maintain tailings storage areas to maximise recovery of tailings decant water. Design and maintain tailings storage areas to encapsulate and prevent the movement of tailings seepage/leachate offsite, where reasonable and feasible.
	Overburden emplacements	Design, install and maintain emplacements to encapsulate and prevent migration of tailings, acid forming and potentially acid forming materials, and saline and sodic material. Design, install & maintain emplacements to prevent and/or manage long term saline groundwater seepage.
	Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.
	Aquatic and riparian ecosystem	Maintain or improve baseline channel stability. Develop site-specific in-stream water quality objectives in accordance with ANZECC 2000 and *Using the ANZECC Guidelines and Water Quality Objectives in NSW* procedures (DECC 2006), or its latest version.
28 – Water Management Plan	The Applicant must prepare and implement a Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	

Relevant Water Management Conditions (DA SSD-4960)		
	a) be prepared in consultation with the EPA, DPIE Water and BCD, by suitably qualified and experienced person/s whose appointment has been approved by the Planning Secretary;	**Section 1**
	b) be submitted to the Planning Secretary for approval within 3 months of the approval of Modification 3; and	-
	c) in addition to the standard requirements for management plans (see condition 3 of schedule 5), include a: i Site Water Balance that includes details of: • sources and security of water supply, including contingency planning for future reporting periods; • water use and management on site, including details of water sharing between neighbouring mining operations; • water access licences held for the development • any off-site water transfers and discharges; • reporting procedures, including the preparation of a site water balance for each calendar year; and	**Section 6,** **Section 2.5.3,** **Section 5.4**
	• investigates and implements all reasonable and feasible measures to minimise water use on site;	**Section 6.3**
	ii Surface Water Management Plan, that includes: • detailed baseline data on surface water flows and quality in the watercourses that could potentially be affected by the development;	**Section 8.1**
	• a detailed description of the water management system on site, including the: - clean water diversion systems; - erosion and sediment controls and works (mine water system); • dredging, extraction, reprocessing and redistribution of coal reject materials; and	**Section 5**

Relevant Water Management Conditions (DA SSD-4960)		
	- mine water management systems including irrigation areas	
	• detailed plans, including design objectives and performance criteria, for: - design and management of final voids; - design and management for the handling, transfer, emplacement and capping of coal reject materials; - 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;	**Section 4, Section 5.2.3, Section 8.3.2, & Section 11**
	• performance criteria for the following, including trigger levels for investigating any potentially adverse impacts (or trends) associated with the development: - mine water management system; - surface water quality of Loders Creek and Wollombi Brook; - channel stability, stream and riparian vegetation health of Loders Creek and Wollombi Brook; and - post-mining water pollution from rehabilitated areas of the site;	**Section 8**
	• a program to monitor and report on: - the effectiveness of the mine water management system; and - surface water flows and quality, stream and riparian vegetation health in Loders Creek and Wollombi Brook potentially affected by the development;	**Section 8.3**
	• a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the development; and	**Section 10**
	iii Groundwater Management Plan, which includes: • detailed baseline data on groundwater levels, yield and quality in the region, and	**Section 9.1 and Section 9.2**

Relevant Water Management Conditions (DA SSD-4960)		
	privately-owned groundwater bores, that could be affected by the development;	
	• groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;	**Section 9.4**
	• a program to monitor and report on: - groundwater inflows to the open cut pits; - the seepage/leachate from water storages, tailings storage areas, emplacements, backfilled voids, and final voids; - the impacts of the development on: - regional and local (including alluvial) aquifers; - groundwater supply of potentially affected landowners; and - groundwater dependent ecosystems and riparian vegetation; and - base flows to Wollombi Brook;	**Section 9.4 and Section 9.6**
	• a program to validate the groundwater model for the development, including an independent review of the model with every independent environmental audit, and compare the monitoring results with modelled predictions; and	**Section 9.5, Section 9.6 & Section 14**
	• a plan to respond to any exceedances of the groundwater assessment criteria; and	**Section 10**
	(d) builds on the commitments described in the documents listed in condition 2 of Schedule 2, any improvements identified in periodic reviews and the results of water monitoring data, to inform and update future modelling, management and reporting. *The Applicant must implement the Water Management Plan as approved by the Planning Secretary.*	**Section 6.2.1, Section 6.5, Section 8.3, Section 9.5 & Section 9.6**
Schedule 5 - Environmental Management, Reporting and Auditing		

Relevant Water Management Conditions (DA SSD-4960)		
3 – Management Plan Requirements	The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
	a) detailed baseline data;	**Section 8.1 & Section 9.2**
	b) a description of: i the relevant statutory requirements (including any relevant approval, licence or lease conditions); ii any relevant limits or performance measures/criteria; iii the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	**Section 2, Section 8.2 and Section 9.4**
	c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	**Section 10**
	d) a program to monitor and report on the: i impacts and environmental performance of the development; ii effectiveness of any management measures (see c above);	**Section 8.3, Section 9.5 & Section 14**
	e) a contingency plan to manage any unpredicted impacts and their consequences;	**Section 10**
	f) a program to investigate and implement ways to improve the environmental performance of the development over time;	**Section 13**
	g) a protocol for managing and reporting any: i incidents; ii complaints; iii non-compliances with statutory requirements; and iv exceedances of the impact assessment criteria and/or performance criteria; and	**Section 10, Section 12, Section 14 & Section 16**
	h) a protocol for periodic review of the plan.	**Section 13**

Table 3 – Relevant Water Management Conditions from Section 130(1) and 133 of the Environment Protection and Biodiversity Conservation Act 1999 approval 2012/6637)

Relevant Water Management Conditions from Section 130(1) and 133 of the Environment Protection and Biodiversity Conservation Act 1999 approval 2012/6637		
Condition	**Requirement**	**Section Addressed**
Condition 4	The approval holder must submit for the Minister's approval a Water Management Plan (WMP) which provides for the avoidance, mitigation and offsetting of residual impacts to water resources. The WMP must include:	
	a) management actions, mitigation measures and practices designed to limit impacts of the proposal on surface and ground water resources;	**This Document**
	b) surface and groundwater monitoring programs to monitor the success of the management actions in the WMP and define measurable targets of management actions, performance indicators, and an adaptive management framework for the duration of the action's impact on water resources. Management actions, mitigation measures and practices prescribed by the plan must be clear, measurable, auditable and time bound;	**Section 8 and Section 9**
	c) clear objectives and performance indicators, as well as corrective actions for circumstances where a management action, mitigation measure or practice fails to meet its prescribed objective or performance indicator.	**Section 10**
	d) The WMP must be submitted within 3 months of commencement of the action. The approved WMP must be implemented. The approved WMP must be published on the approval holder's website within one month of approval of the WMP and remain published on this website for the duration of the action.	-

2.3 Mining Leases

2.3.1 Mining Lease (ML 1547)

Table 4 – Relevant Water Management Conditions (ML 1547)

Relevant Water Management Conditions (ML 1547)		
Condition	**Requirement**	**Section Addressed**
25	The lease holder shall provide and maintain to the satisfaction of the minister efficient means to prevent contamination, pollution, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment and shall observe any instruction given by the minister with a view of preventing or minimising the contamination, pollution, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment.	**Section 4, Section 5, & Section 7**
30	The lease holder shall conduct operations in such a manner as not to cause or aggravate soil erosion and the lease holder shall observe and perform any instructions given or which may be given by the Minister with a view of preventing soil erosion.	**Section 4, Section 5, & Section 7**
33	a) Operations shall be carried out in such a way as not to cause any pollution to the Hunter River Catchment Area.	**Section 4, Section 5, & Section 7**
	b) If the lease holder is using or about to use any process which in the opinion of the minister is likely to cause the contamination of the waters of the said catchment area the lease holder shall refrain from using or cease using as the case may require such process within twenty four (24) hours of the receipt by the lease holder to do so.	
	c) The lease holder shall comply with any regulations now or hereafter to be in force for the protection of the said catchment area.	

2.3.2 Mining Lease (ML 1494)

Table 5 – Relevant Water Management Conditions (ML 1494)

Relevant Water Management Conditions (ML 1494)		
Condition	**Requirement**	**Section Addressed**
18 - Prevention of soil erosion and pollution	Operations must be planned and carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination. For the purpose of this condition, water shall be taken to include any watercourse, water body or ground waters. The licence holder must observe and perform any instructions given by the Department in this regard.	**Section 7, Section 8, & Section 9**

2.3.3 Mining Lease (ML 1674)

Table 6 – Relevant Water Management Conditions (ML 1674)

Relevant Water Management Conditions (ML 1674)		
Condition	**Requirement**	**Section Addressed**
12 – Prevention of soil erosion and pollution	Prospecting operations must be carried out in a manner that does not cause or aggravate, air pollution, water(including groundwater) pollution, soil contamination or erosion unless otherwise authorised by a relevant approval, and in accordance with an accepted mining operations Plan.	**Section 7, Section 8, & Section 9**

2.3.4 Mining Lease (CL224)

Table 7 – Relevant Water Management Conditions (CL 224)

Relevant Water Management Conditions (CL 224)		
Condition	**Requirement**	**Section Addressed**
4 g)	The Mining operations plan must present a schedule of proposed mine development for a period of up to 7 years and contain diagrams and documentation which identify: a) water management systems (including erosion and sediment controls).	**Bulga MOP**
25	The lease holder shall provide and maintain to the satisfaction of the Minister efficient means to prevent contamination, pollution, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment and shall observe any instruction given or which may be given by the Minister with a view to preventing or minimising the contamination, pollution, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment.	**Section 4, Section 5, & Section 7**
33 a)	Operations shall be carried out in such a way as to not cause any pollution of the Hunter Catchment Area.	**Section 4, Section 5, & Section 7**

2.4 Exploration Licences

2.4.1 Exploration Licences A450, A447, EL5461 and EL5277

Table 8 – Relevant Water Management Conditions (A450, A447, EL5461 and EL5277)

Relevant Water Management Conditions (A450, A447, EL5461 and EL5277)		
Condition	**Requirement**	**Section Addressed**
17 - Streams & Watercourses	The licence holder must not interfere with the flow of water in any stream or watercourse without the prior written approval of the Department, and subject to any conditions that may be stipulated.	**This Document** and the Bulga Coal ESCP *(BULCX-2103827161-7624)*
18 - Erosion and Sediment Controls	a) All operations must be planned and carried out in a manner that minimises erosion and controls sediment movement. The licence holder must observe and perform any instructions given by the Department in this regard.	**This Document** and the Bulga Coal ESCP *(BULCX-2103827161-7624)*
	b) For operations requiring approval under Condition 2 the licence holder must document in any Reviews of Environmental Factors required a plan setting out the proposed methods for minimising erosion and controlling sediment movement.	
	c) The procedures undertaken to minimise erosion and control sediment movement must be included in reports prepared in accordance with Condition 28(a).	

2.5 Licences

2.5.1 Environmental Protection Licence

BCC operates under a single EPL (EPL 563) which is renewed annually on 29 July. EPL 563 includes a single Licenced Discharge Point (LDP): LDP11 (Northern Dam), and stipulates a maximum discharge volume of 500 ML per day – Refer to *Figure 2* for the location of the Northern Dam in the existing IWMS and *Figure 3* for the physical location of LDP11.

Water quality parameters for LDP11 are outlined below in *Table 9*. EPL 563 also authorises discharge into the Hunter River catchment in accordance with the HRSTS.

Table 9 – Concentration Limits for EPL 563

Concentration Limits for EPL 563		
Pollution	**Units of Measure**	**100 Percentile Concentration Limit**
pH	pH	6.5 – 9.5
Total suspended Solids (TSS)	Milligrams per litre	120

2.5.2 Groundwater Licences

Bulga Coal currently holds groundwater licences as outlined below in *Table 10*.

Bulga Coal holds 2365 ML of hard rock Water Access Licence allocation from the Sydney Basin-North Coast Groundwater Source. This allocation covers groundwater flow from the Permian coal measures into the Open Cut and Underground workings.

Bulga Coal also holds 300 ML of Water Access Licence from the Lower Wollombi Brook water source aquifer. This allocation covers the potential leakage from the alluvial aquifer into the Permian hard rock aquifer in response to depressurisation associated with Underground and Open Cut mining.

Bulga Coal also holds a number of groundwater licences for a number of water monitoring bores (refer to Section 9).

2.5.3 Surface Water Licences

Bulga Coal has access to 865 ML of Hunter River high security allocation via the Singleton Council operated Mt Thorley Water Supply Scheme which supplies water to Bulga Coal and other joint venture parties via Water Access Licence 10543. Bulga Coal also sources additional allocation via water allocation assignments if required. Bulga Coal also has a surface water works approval (20WA211078) for the clean water diversion around the Surge Dam.

Table 10 – Water Licences

Water Licences - Groundwater	
Licence	Details
WAL41687	Mining: Volume licence limit 500ML. Sydney Basin-North Coast Groundwater Source
WAL41546	Mining: Volume licence limit 365ML. Sydney Basin-North Coast Groundwater Source
WAL41543	Mining: Beltana MG4. Volume licence limit 500ML. Sydney Basin-North Coast Groundwater Source
WAL41544	Mining: South Bulga MGE1. Volume licence limit 500ML. Sydney Basin-North Coast Groundwater Source
WAL41545	Mining: South Bulga MGE4. Volume licence limit 500ML. Sydney Basin-North Coast Groundwater Source
WAL36221	Mining: Wollombi Brook Aquifer leakage to Permian coal measures 300 ML
20BL166867	Monitoring (mining bore): GW1 – GW10. Total of 16 bores for monitoring purposes.
20BL167776	Monitoring: P1 – P3, P4A, P4B, P5 – P8 and V3. Licence for total of 9 bores for monitoring purposes.
20BL169204	Monitoring: Bore – ACARP Project.
20BL169246	Monitoring: Bore – ACARP Project.
20BL167777	Monitoring: V1, V2, F1 and F2.

Water Licences - Groundwater	
20BL172659	Monitoring: WBR180 and WBR181.
20BL172660	Monitoring: WBR182 and WBR183.
20BL173014	Monitoring: SBD194, SBD196.
20BL173617	Monitoring Bore - 61//755264
20BL173618	Monitoring Bore - 34//755264
20BL173619	Monitoring Bore - 33//755264
20BL173620	Monitoring Bore - 23//755264
20BL173621	Monitoring Bore - 24//755264
20BL173640	Monitoring Bore - 25//755264
20BL173657	Monitoring Bore - 22//755264
20BL173708	Monitoring Bore - 11//730762
Water Licences – Surface water	
Licence	**Details**
20WA211078	Surge Dam clean water diversion drain

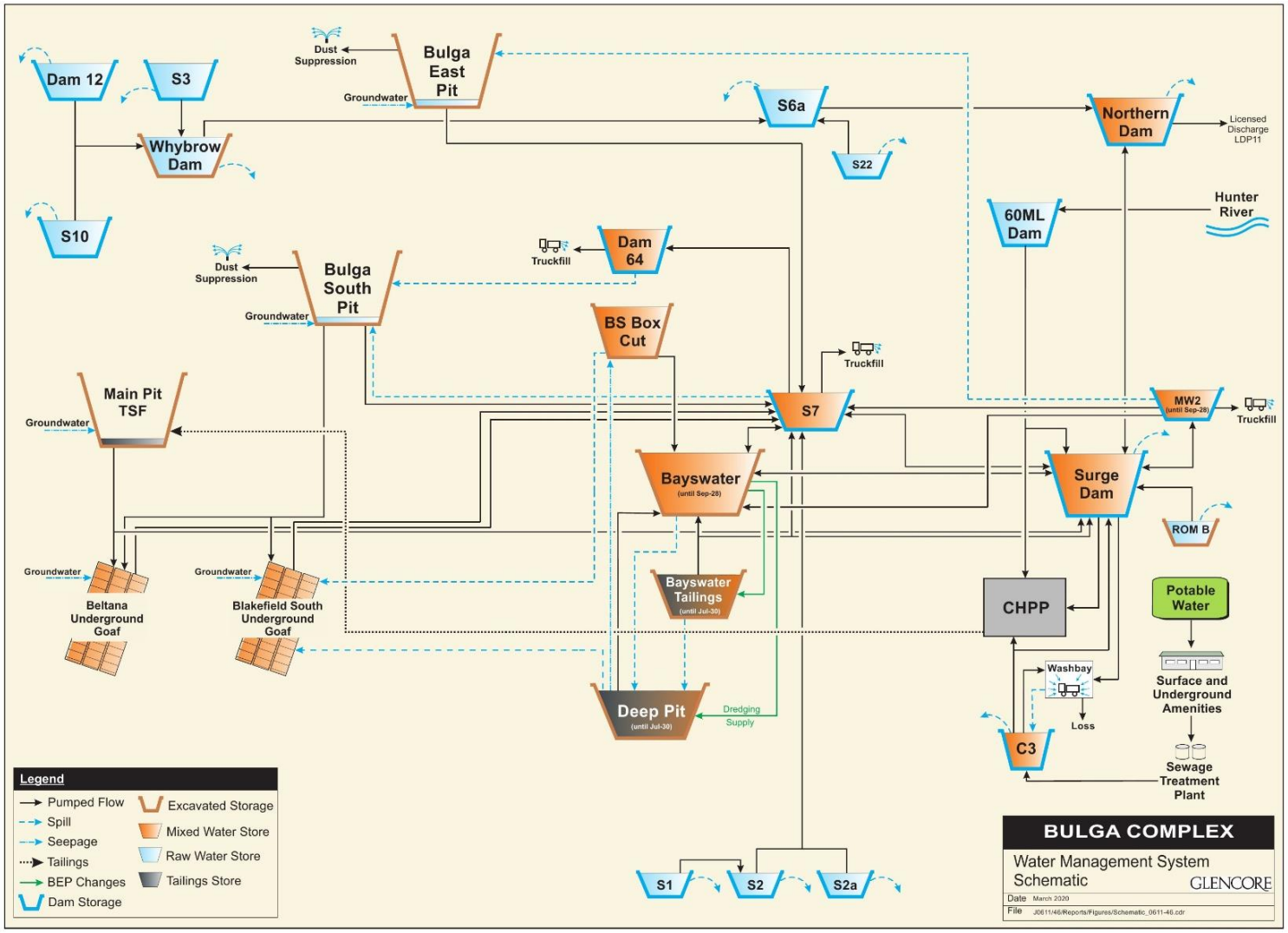

Figure 2 –Integrated Water Management System Schematic

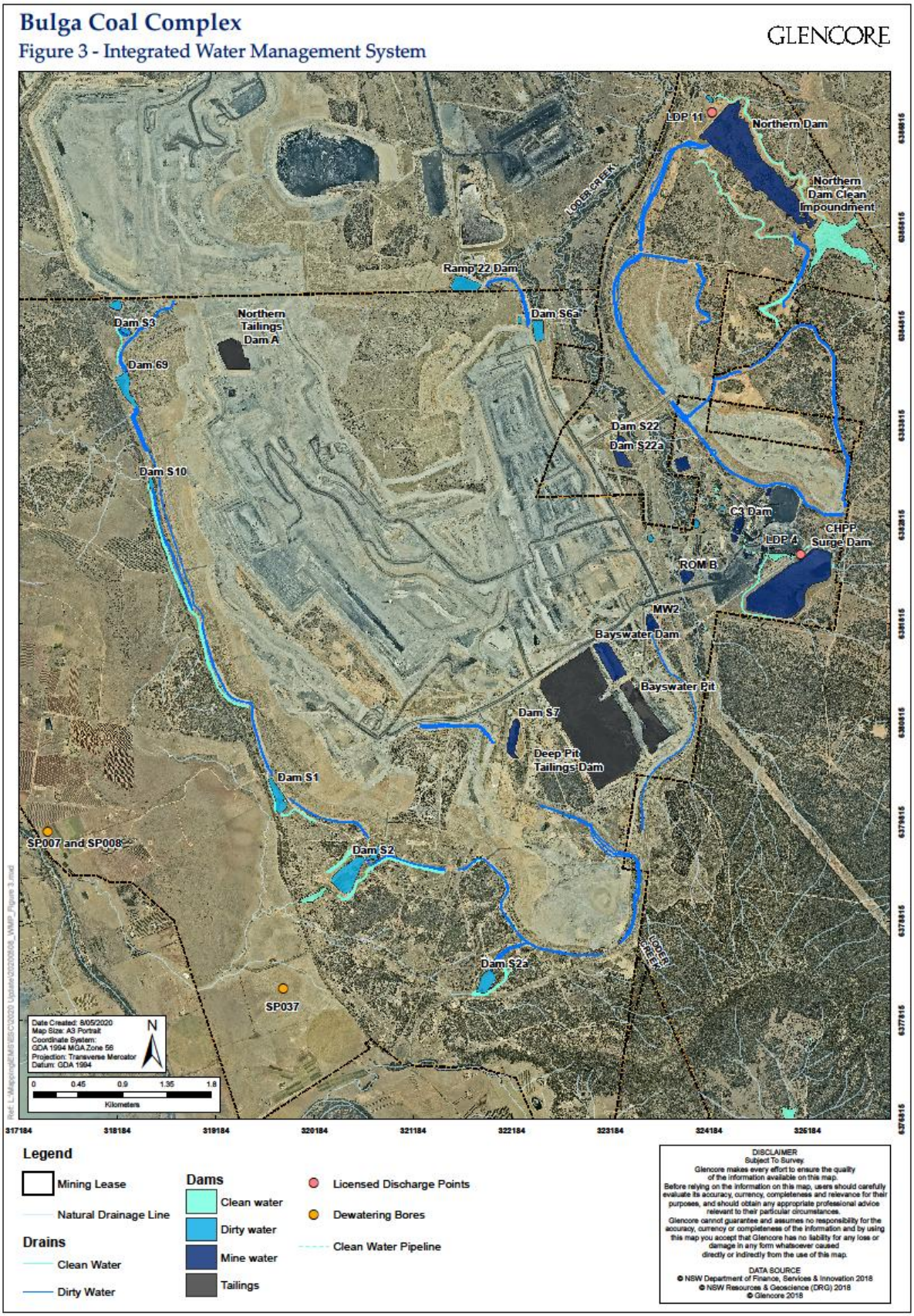

Figure 3 –Integrated Water Management System Layout

3. Site Overview

3.1 Introduction

Water management at the BCC has evolved to manage groundwater, surface runoff and mine water from the open cut and underground mining areas and water reclaim (decant) from the CHPP tailings The majority of the water used onsite is extracted from underground or collected from surface runoff generated from mine disturbed areas (totalling 3200 ha). This water is preferentially recycled on site for use in the CHPP, for mine dust suppression and to maintain the statutory volumes of water required for operational purposes. Water at the BCC is managed through the IWMS.

The IWMS enables water to be collected and reticulated around site for use or discharge to one of the three main surface storages: the Bayswater Pit, CHPP Surge dam and Northern Dam. Together these three surface storages have a maximum operating storage capacity in excess of 6,000 ML. In addition, the former Beltana underground workings provide an additional storage capacity estimated in excess of 7,000 ML, while the Blakefield South and South Bulga former underground workings provide a further estimated 6,000 ML. The substantial storage capacity enables effective site water management during high rainfall periods and drought, by facilitating the regulation of water supplied to site sourced from the Hunter River and discharges via the LDP and HRSTS. A schematic of the existing IWMS is shown in ***Figure 2*** and ***Figure 3*** shows the layout of the BCC IWMS.

Typically water is consumed at the BCC through mine dust suppression (Open Cut) and coal washing in the CHPP. Water is also lost through evaporation and discharged via the LDP at times of high water inventory. The CHPP consumes an average net volume of approximately 1,600 ML/yr, Open Cut dust suppression consumes approximately 1,700 ML/yr and approximately 1,400 ML/yr is lost to evaporation. Supply of potable water to offices, workshops, bathhouses and underground workings is drawn from Singleton Council's Broke Village water supply.

Generally water intercepted (surface and groundwater) by the mining operations meets the site raw water supply requirement, however in times of deficit or when required, supplementary water is sourced from the Hunter River. Supplementary water, when sourced from the Hunter River, is transferred and stored in the 60 ML Dam through the Mount Thorley Water Supply Scheme, of which Bulga Coal is a member. The 60 ML Dam can be used to supply, as required, the CHPP, the CHPP Surge Dam, truck fill points or the underground operations. Alternatively, in times of water surplus, water can be released to the Hunter River through the LDP, in accordance with the EPL and HRSTS.

BCC has approval to receive water from, and transfer water to, the neighbouring Mt Thorley mine. Water transfers generally occurs via the Ramp 22 Dam which is located on the eastern side of the boundary of the two mines (Figure 3).

Wastewater from administration offices, workshops and bathhouses is collected and treated on site in one of two aerated sewage treatment plants (STPs). Treated wastewater is then returned to the IWMS for reuse.

An overview of the existing IWMS is provided in Section 5.

3.2 Hydrology

The BCC surrounding surface water catchment flows either to (refer *Figure 3*):

- Loders Creek which drains northwards joining the Hunter River approximately seven kilometres upstream of Singleton. Loders Creek originally flowed through the mine, but is now diverted to the east of the open cut.
- The Northern and Southern drainage lines which drain to the west and southwest to Wollombi Brook.

Nine Mile Creek flows west of the CHPP, workshop, administration and run-of-mine (ROM) stockpile areas and drains northwards to Loders Creek.

Figure 3 shows the mine layout in relation to regional roads and aforementioned watercourses.

3.3 Geology and Hydrogeology

The BCC is geologically located within the Hunter Coalfield, northern part of the Sydney Basin. The area is underlain by Late Permian age strata - the Whittingham Coal Measures, which are directly overlain by the Wollombi Coal Measures Group. The late Permian sequence is characterised by a series of sandstone, siltstone, conglomerate and coal formations. The Late Permian strata outcrops across the site, but is overlain by more recent Quaternary alluvial deposits along watercourses - Wollombi Brook, Monkey Place Creek and Loders Creek. Detailed geology is provided in Umwelt (2019) – Appendix 11).

Three hydrostratigraphic units are identified within the BCC area:

- The alluvial aquifer associated with Wollombi Brook, Monkey Creek Place and Loders Creek;
- Weathered and fractured shallow sandstone and coal strata, regolith and colluvium; and
- Fractured rock aquifers associated with Whittingham and Wollombi Coal measures.

The alluvium typically has higher permeability and therefore yield. Private bores installed in this aquifer are used for stock and domestic and irrigation purpose. Weathered units exhibit relatively low permeability and provide the transition zone between the alluvial and fractured rock aquifers. Fractured rock aquifers have generally poor quality water and low permeability, hence it is not used as water supply.

4. Water Management Principles

4.1 General

The following general water management principles are applied at BCC where possible:

- Minimise the use of water on site;
- Minimise the need for make-up water from external supplies; and
- Minimise cumulative water impacts with the other mines in the region.

4.2 Water Management Classes, Design Objectives and Performance Criteria

Under Section 120 of the Protection of the Environment Operations Act 1997 (POEO Act) it is an offence to pollute waters or cause harm unless licenced to do so. Inherent in the concept of not causing harm is the need to manage the risk of spilling from water management dams or related infrastructure, and an understanding of the background qualities in the various creeks.

For management purposes, three classes of water have been identified at Bulga Coal, typically dependent upon the source of the runoff. *Table 11* lists the classes of water on site, describes their source, the target design objectives / performance criteria and the way they are managed. A detailed description of the management classes is provided in the Erosion and Sediment Control Plan (ESCP) *(BULCX-2103827161-7624)*.

Table 11 – Water Management Classes, Design Objectives & Performance Criteria

Water Management Classes, Design Objectives & Performance Criteria			
Surface Water Classification	**Description and Source(s) of runoff**	**Target Design Objective / Performance Criteria**	**Treatment**
Mine Water	Water exposed to coal or used in coal processing. Sources of runoff may include: • Haul roads • Open cut mine pits • Coal handling and stockpile areas • Mine infrastructure areas (e.g. workshops, etc.) • active overburden emplacement areas, This water quality is typically at a higher level of salinity in the range of 5000 µS/cm to 8500 µS/cm. Generally water at the BCC is typically neutral to slightly alkaline with low metals concentrations. Water from Mine Infrastructure Areas (MIAs) (particularly workshops) has the potential to be contaminated with oils & hydrocarbons.	New mine water infrastructure will be designed, installed and maintained to contain runoff from events up to and including the 1 in 100annual exceedance probability (AEP), 24 hour rainfall event to mitigate the risk of uncontrolled discharge of mine affected water off-site. Any new on-site mine water storages will be designed and constructed with a low permeability embankment and storage area.	Contained within the mine water management system. Potential for controlled release from the Northern Dam under the HRSTS and EPL conditions. Water from MIAs (sometimes contaminated with hydrocarbons) receives additional treatment by routing through oil/water separators.
Dirty Water	Runoff from disturbed areas (during both construction and operation). Sources of runoff include:	Diversion / storage infrastructure designed, installed and maintained in	Directed to appropriately sized (Blue Book) dirty water sediment

Water Management Classes, Design Objectives & Performance Criteria			
	• rehabilitated overburden emplacement areas that have not been fully established, • general disturbed areas (e.g. construction areas, pre-stripped areas, etc.) These areas have the potential for moderate levels of salinity and elevated TSS.	line with the 'Blue Book' (Managing Urban Stormwater: Soils and Construction Volumes 1 and 2 – Landcom [2004] and DECC [2008]) and BCC ESCP *(BULCX-2103827161-7624)*. #1 #2	dams which are actively maintained (regular inspections and de-silting) and kept in a drawn down state. Refer to ESCP for further details regarding management of dams.
Clean Water	Runoff from areas that are undisturbed as well as rehabilitated areas where vegetation is established.	Diversion and drainage infrastructure designed, installed and maintained to convey runoff from a 1%AEP rainfall event.	Maximised as far as reasonably practical, diverted around disturbance areas and directed into existing drainage lines off site.

#1 *Any works within 40m of watercourses will generally be undertaken in accordance with the relevant Regulators Guidelines, Policies, etc.*

#2 *Overburden emplacements are generally designed, installed and maintained to encapsulate and prevent migration of tailings, acid forming and potentially acid forming materials, and saline and sodic material as well as long term saline groundwater seepage.*

Dirty water is generated around site in general disturbance areas, construction areas, pre-stripped areas, gas drainage works and also on shaped soil overburden dumps. The management of dirty water is described in more detail within the ESCP.

The design and management objectives for final voids are discussed in Section 11.

4.3 Operational Philosophy

The operating philosophy of the IWMS is to:

- Retain a volume equal to approximately 1 year of water demand on site (2500 ML) in the CHPP Surge Dam;
- Maintain the Bayswater pit with freeboard to provide capacity for short term mine (open cut) dewatering;
- Maintain the Truck-fill dams full;
- Maintain the CHPP Surge Dam with a minimum storage reserve to ensure supply to the CHPP;
- Transfer surplus water to Beltana goaf until the goaf water level reaches 15 mAHD (approximately 500 ML below capacity);
- Discharge to the HRSTS when site surface water storage exceeds 4,990 ML and Beltana Goaf water level reaches 15 mAHD;

- Following high rainfall periods, preferentially store lower total suspended solids water in the Northern Dam to increase the volumes able to be discharged (when discharge opportunities arise) in accordance with the provisions of the HRSTS;
- Maintain the tailings emplacement facility effectively dewatered;
- Maintain adequate volumes of water in the former Deep Pit and Bayswater tailings emplacement voids to facilitate tailings relocation (when this operations occur in the future); and
- Source water from the Hunter River via the Mount Thorley Water Supply Scheme as required in line with forecast water balance predictions.

5. Water Management System

The existing IWMS incorporates water management from both the underground mine water management system and the open cut pit water management system. Both systems transfer water to the Surge Dam (amongst others) and can supply both the CHPP and active mining operations.

The location of key dams, diversions and drains of the existing IWMS are shown in *Figure 4*.

5.1 Clean Water Management

There are four key clean water catchment areas upstream of the BCC that are currently managed as follows:

- The Nine Mile Catchment drains an area of approximately 488 hectares (ha). Nine Mile Ck (shown on *Figure 3*) flows in a northerly direction between the mining operations and the CHPP and flows into Loder Ck.
- A catchment of approximately 145 ha is located upstream of the CHPP Surge Dam, with an additional approximately 7 ha upstream of the coal stockpile areas on the northern side of the CHPP area. The clean runoff upslope at the northern end of the CHPP Surge Dam is collected and pumped to an unnamed tributary of Nine Mile Creek downstream of the CHPP Surge Dam. The clean runoff upslope of the southern end of the CHPP Surge Dam gravitates via a pipeline and constructed drain back to the same un-named tributary of Nine Mile Creek. In order to reduce the potential for pollution of the tributary, a clean water detention basin is to be constructed to receive the clean water from the catchment to the north and east of the CHPP Surge Dam. The water collected in the detention basin will be reticulated via a pipeline north of the CHPP into the same tributary as shown on *Figure 3* and in the figure included in Appendix A. Also included in these proposed changes is the construction of Dam C3A which will capture the runoff from the catchment (2.9ha) below the detention basin.
- Drainage over underground mining areas – both the Northern Drainage Line and the Southern Drainage Line are undermined by longwall mining on the western side of the open cut pit area. Bulga Coal regularly inspects these drainage lines and undertakes repairs if necessary to minimise the loss of clean water runoff due to subsidence induced cracking and ponding (managed in accordance with the underground consent DA 376-8-2003).
- A catchment of approximately 670 ha is located upstream of the Northern Dam. A Diversion Dam has been constructed across the upstream watercourse as indicated in *Figure 3*, with an open channel diverting accumulated clean water around the Northern Dam, discharging to the watercourse downstream of the dam.

There is currently no plan to recommence underground mining.

5.2 Mine and Dirty Water Management

The IWMS includes the collection, management, and transfer of water pumped from the underground workings and open cut, runoff and seepage from overburden emplacement areas, and management of water affected by coal handling and processing activities.

The IWMS comprises various dams, including water storage dams, pollution control and sediment dams, and associated pumps and pipelines.

Table 12 lists the dams and storage areas currently part of the mine water management system together with their approximate design capacity and function. *Figure 3* shows the location the dams and drains and *Figure 4* shows the location of the dams and major pipelines.

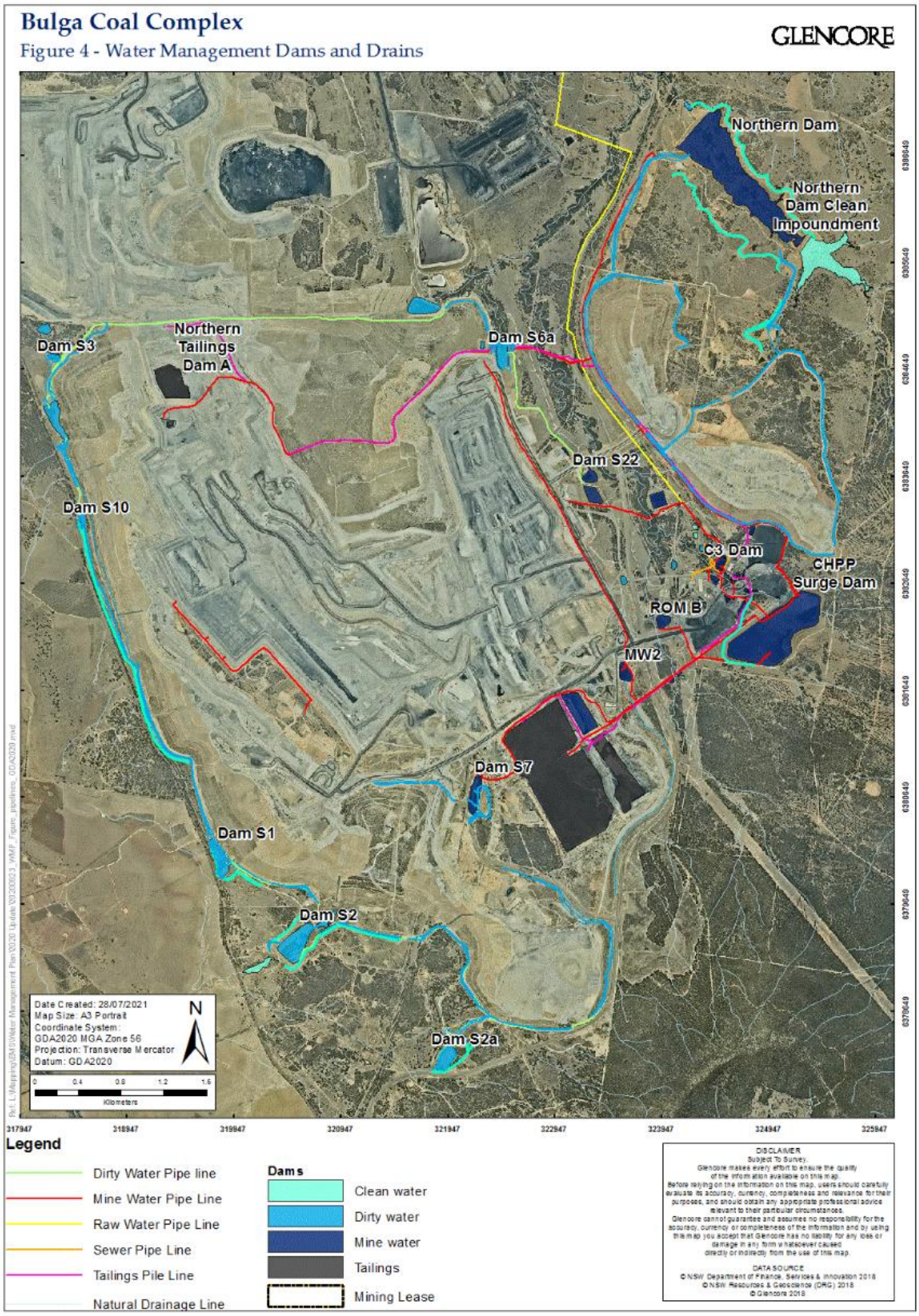

Figure 4 – Water Management Systems Dams and Pipelines

Table 12 – Key Dams in the IWMS

Key Dams in the IWMS		
Dirty Water Dams		
Dam Name	**Capacity (ML)**	**Function**
Dam S3	7	Disturbed area, overburden and rehabilitation run off sediment dam reticulated back into the IWMS.
Dam 69	423	Disturbed area, overburden and rehabilitation run off sediment dam reticulated back into the IWMS.
Dam S1	59	Disturbed area, overburden and rehabilitation run off sediment dam reticulated back into the IWMS.
Dam S2	156	Disturbed area, overburden and rehabilitation run off sediment dam reticulated back into the IWMS.
Dam S2a	40	Disturbed area, overburden and rehabilitation run off sediment dam reticulated back into the IWMS.
Dam S6a	85	Disturbed area, overburden and rehabilitation run off sediment dam reticulated back into the IWMS.
Dam S10	10	Disturbed area, overburden and rehabilitation run off sediment dam reticulated back into the IWMS.
Dam S22	18	Disturbed area, overburden and rehabilitation run off sediment dam reticulated back into the IWMS.
Ramp 22 Dam	87	Rehabilitation run off sediment dam operated by and reticulated back to Mount Thorley Operations.
Mine Water Dams		
Dam Name	**Capacity (ML)**	**Function**
Dam S7	77	Receives water from dirty water dams and mining areas and supplies mine dust suppression or is transferred to CHPP Surge Dam.
Bayswater Dam (void)	1090	Mine water storage void, can transfer to S7 or CHPP Surge Dam.
MW2	53	Mine dust suppression Truckfill dam receives water from CHPP Surge Dam and can transfer to CHPP Surge Dam, S7 or Bayswater Dam.
S22A	22	Mine dust suppression Truckfill dam receives water from MW2 (22 ML of operational capacity and additional 22 ML retained for sediment and spill prevention)

Key Dams in the IWMS		
ROM B	28	Captures runoff from run-of-mine (ROM) stockpile area and transfers to CHPP Surge Dam.
Surface Dams at the CHPP Area		
Dam Name	**Capacity (ML)**	**Function**
Dams C1, C2, C11, C12	26	Mine water dams at CHPP area, east of Nine Mile Creek. Transfer to Dam C3.
Dams C4, C7, C9, C10, X and Y and Billabong	23	Dirty water dams at CHPP area, east of Nine Mile Creek. Transfer to Dam C3.
Dam C3	37	Main mine water dam at CHPP area, east of Nine Mile Creek. Transfers to CHPP or CHPP Surge Dam.
Dam C3A	TBC	To be constructed to capture the runoff that reports to the drainage adjacent to C3 and transfers to C3 (see Appendix A)
Main Water Storage Dams		
Dam Name	**Capacity (ML)**	**Function**
CHPP Surge Dam	3140	Main site water storage and supply dam. Operating capacity = 3140 ML minus 147ML flood buffer storage.
60 ML Dam	64	Hunter River water supply dam. Transfers to CHPP or CHPP Surge Dam.
Northern Dam	2033	Main site excess water storage dam, for discharging water via LDP 11 under the HRSTS.
Tailings Storage		
Dam Name	**Capacity (ML)**	**Function**
Deep Pit	0*	Used for tailings disposal.
Bayswater Tailings Void	0*	Used for tailings disposal.
Main Pit TSF (Northern Tailings Dam)	0*	Used for tailings disposal.
*** Zero capacity for storage of water**		

Key Dams in the IWMS		
Underground Storages		
Dam Name	**Capacity (ML)**	**Function**
Beltana Goaf	6400	Receives pumped transfer from Main Pit Tailings Storage and Open Cut. Water can be withdrawn from 2 dewatering bores (SP007 & SP008) and is reticulated back to S7
Blakefield South/South Bulga Goaf	6000	Receives pumped transfer from Main Pit Tailings Storage and Open Cut. Water can be withdrawn from 1 dewatering bore (SP037)and is reticulated back to S7 (there is some storage not available to SP037)

Note

Generally, the capacities given in Table 12 have been sourced from as built survey information.

5.2.1 Underground Mine Water Management

The BUO were sealed in July 2018 and as such there is no operational demand for water other than that used for dust suppression on the gas drainage wellfield roads. Groundwater continues to flow into the BUO as it progresses towards full recovery. Additionally during periods where there is excess mine water on the surface, this is pumped into the underground workings as opposed to discharging through the HRSTS. The stored water can then be withdrawn by dewatering bores thus reducing the potential demand on the Hunter River.

There are currently two dewatering bores that draw on the Beltana (Whybrow) workings (SP007 and SP008) and one that draws from the Blakfield South workings (SP037). Water from these bores is reticulated back to mine water Dam S7.

The majority of the Blakefield South Pit Top facilities have been removed/rehabilitated and there is now no waste water generated from the Pit Top facility. Surface water generated from the former BUO Pit Top area is captured with the BOC mine water system. Water quality monitoring around the BCC includes analysis for hydrocarbons with records showing that all sites average below detection limits.

5.2.2 Open Cut Pit Water Management

The BOC is dewatered from various locations through the pit. Water is pumped primarily to mine water dam S7 where water can be pumped to the CHPP area via the CHPP Surge Dam or used for dust suppression. BOC Water Trucks draw from mine water dams S7, MW2 and S22A.

The BOC overburden emplacement is contained within the dirty water management system or open cut area shown on *Figures 3* and *Figure 4*.

5.2.3 CHPP and Tailings Water Management

The CHPP is located on either side of an un-named tributary of Nine Mile Creek. Dam C3 is the most downstream dam in a series of dams which captures runoff from the CHPP, ROM Pad and workshop

areas. The surface water management system in this area is designed to ensure runoff from these areas does not flow to Nine Mile Creek which runs between the CHPP and workshop areas. Oil/water separators have been installed to capture and treat runoff from workshop and maintenance areas before reaching the water management dams.

Dam C3 is equipped with pumps which enable pumping of water to the clarified water tank in the CHPP or to the CHPP Surge Dam.

The CHPP is supplied with process water from the CHPP Surge Dam. The CHPP produces a fine rejects or tailings stream. Conventional gravity thickeners with flocculant addition are used at the CHPP to thicken the tailings. A portion of the conventionally thickened tailings is further thickened to produce a paste tailings which is co-disposed with coarse rejects in the BOC overburden emplacement areas. The remaining conventionally thickened tailings are pumped to the Main Pit tailings storage. The Deep Pit and Bayswater tailings storages also receive tailings on occasion, however their operational capacity has effectively been reached. Decant from the Main Pit tailings storage is reticulated back to the CHPP Surge Dam or the underground storages. Decant from the Deep Pit and Bayswater tailings storages is reticulated to the Bayswater Dam (void).

Tailings from Deep Pit and Bayswater Tailings Storages will be relocated to the Northern Tailings Dam emplacement facility between approximately 2022 and 2027 to allow continued mining within the BOC. These tailings will be mobilised by dredging and then pumping the resulting tailings slurry to the Main Pit Tailings Storage. Water supply for the dredging operation will be drawn from other storages in the IWMS (refer *Table 12*). Relocated tailings will be discharged along with CHPP tailings to the Main Pit Tailings Storages via multiple discharge points to enhance the beaching angle to promote dewatering and consolidation of the tailings, with decant continuing to be reticulated back to the CHPP Surge Dam or the underground storages. Bulga Coal will aim to increase stored water inventory at the BCC ahead of tailings relocation in order to ensure a reliable supply at all times.

5.3 Controlled Discharges via Licenced Discharge Point

Bulga Coal's licenced discharge point (LDP) is located at the Northern Dam and discharges into a tributary of Loder Creek as shown on *Figures 3* and *4*. TLDP11 has a discharge limit of 500 ML/day.

The HRSTS allows controlled discharges via the LDP based on volume and salinity (electrical conductivity - EC) during declared 'high' or 'flood' flow conditions in the Hunter River. The scheme has a target salinity (EC) level of 900µS/cm for the lower sector of the Hunter River (the reach between Glennies Creek and Singleton).

EPL 563 prescribes the conditions (in terms of water quality) for releases as part of the HRSTS – refer to Section 2.51. The EC of the water is not specified in the EPL, but the EC is used, together with the number of salinity credits held by Bulga Coal, to compute the mass of salt that can be discharged in a given discharge event. EC remains a key component in the HRSTS discharge protocol.

The Northern Dam LDP is fitted with calibrated flow, water level, EC, pH, turbidity sensors and telemetry, information which is available online (https://realtimedata.waternsw.com.au/).

All controlled discharges via the LDP are undertaken in accordance with the HRSTS discharge protocol.

5.4 Water sharing between neighbouring mining operations

BCC has approval to receive water from, and transfer water to, the neighbouring Mt Thorley mine. Water transfers generally occurs via the Ramp 22 Dam which is located on the eastern side of the boundary of the two mines (*Figure 3*).

6. Site Water Balance

The BCC water balance includes both the BOC and BUO and is modelled as an integrated system.

Inflows which contribute to the BCC water balance include site rainfall runoff, tailings water reclaim (decant), underground flows and water abstracted under licence from the Hunter River. The primary source of water for the BCC is site rainfall runoff.

Bulga Coal stores water on site to maintain supply security during dry conditions, and maximise the reuse of mine water and dirty water in the CHPP and for dust suppression. The BCC discharges surplus water in accordance with EPL 563 and via the HRSTS.

Hydro Engineering & Consulting Pty Ltd (HEC) have developed a life-of-mine water balance model for the BCC IWMS which is used to predict surface runoff, evaporation, supply requirements, reliability, storage and discharge requirements.

6.1 Model Overview

The structure of the water balance model has been based on the storages and linkages shown in the Water Management System schematic in *Figure 2*. The model undertakes a mass balance on all simulated water storages on a sub-daily time step. The model simulates the 20-year period (from mid-2020 to the end of 2039) – i.e. to the end of the planned mine life using the climatic data for the region from 1892 to 2012[1]. One hundred and twenty one possible 20-year climatic "scenarios" are simulated using the available climatic record. The results from all scenarios are used to generate water storage volume estimates and other relevant water balance statistics.

The model uses output from the Hunter River Integrated Quantity Quality Model (IQQM) in order to simulate variations in Hunter River water flows, from which available water determinations and opportunities for water release in accordance with the HRSTS are computed.

The model has been updated to take into account the continuation of the BOC. Modelled dam and other storage catchment areas were derived from conceptual future mine stage plans.

Figure 5 summarises the total catchment area reporting to the mine water management system over the simulated mine life. *Figure 5* illustrates that the contributing catchment area is forecast to reach a peak in early 2024 at just over 37.5 km^2. Any storage which contains fully rehabilitated catchment only was assumed excised (removed) from the water management system from the time that it is fully rehabilitated – this is reflected in the reduced catchment area in the later years in *Figure 5*.

The catchment areas were split into different sub-catchment types for rainfall-runoff modelling. Sub-catchments were defined on the basis of vegetation coverage and surface type. Sub-catchment types included in the model were: hardstand (roads, roofed, paved areas), natural surface, open cut, tailings, active overburden, regraded overburden, rehabilitated overburden and coal stockpiles.

The Australian Water Balance Model (AWBM - Boughton, 2004) was used to simulate runoff from rainfall on the various catchments and landforms across the mine area.

[1] Data was sourced from the 'SILO Data Drill' for the mine location. The Data Drill is a system which provides synthetic data sets for a specified point by interpolation between surrounding point records held by the Bureau of Meteorology (refer http://www.longpaddock.qld.gov.au/silo/). Both rainfall and pan evaporation data were obtained from this source.

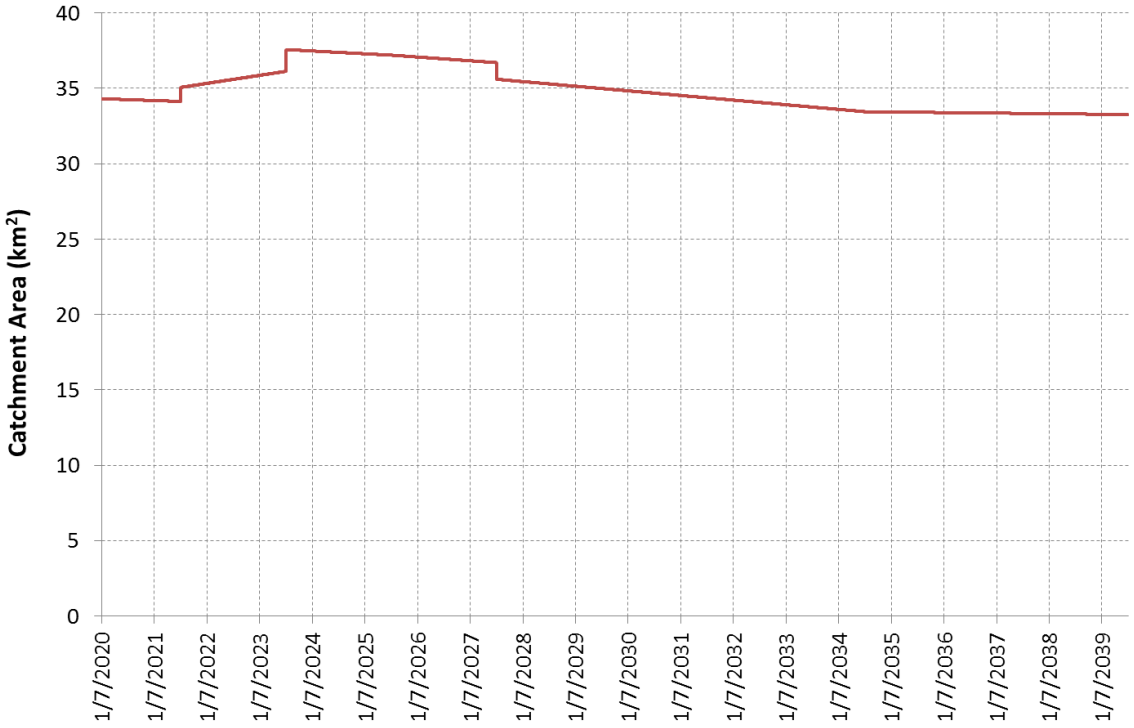

Figure 5 – Total Catchment Area over Time

A maximum HRSTS discharge rate of 500 ML/d from the Northern Dam was modelled. It was assumed that discharge would not occur if the total volume of water stored on site fell below 4,990 ML.

Initial storage volumes, based on recorded water levels as at July 2020 are summarised in *Table 13*.

Table 13- Modelled Initial Storage Volumes

Modelled Initial Storage Volume	
Storage	**Initial Stored Water Volume (ML)**
Bayswater Dam (Void) Water Storage	690
Beltana Underground Storage	4068
Bulga East Open Cut Pit	0
Bulga South Open Cut Pit	28
C3 Dam	7
CHPP Surge Dam	2713
60ML Dam	17
Northern Dam	939
Blakefield South Underground Storage	500

Modelled Initial Storage Volume	
Dam 69	24
S22	6
Sediment Dams S1 to S10, ROM B, MWD2	250

6.2 Overall Site Water Balance Model Results

Table 14 below summarises the water balance for the BCC for the median (50th percentile) rainfall scenario (averaged over the 20 year simulation period).

Table 14 – Summary Water Balance for Median Rainfall Scenario

Summary Water Balance for Median Rainfall Scenario	
	Inflows (ML/year)
Rainfall Runoff	4,740
Tailings Water (water liberated as tailings settle)	2,287
Underground Groundwater Inflow	535
Open Cut Pit Groundwater Inflow	1,298
Hunter River Licenced Extraction	403
TOTAL	9,263
	Outflows (ML/year)
Evaporation	1,443
HRSTS Release	1,480
External Spill from Sediment Dams*	2
CHPP Supply	1,549
Haul Road Dust Suppression Supply	1,162
Overburden Dust Suppression	518
Supply for Tailings Relocation†	2,570
TOTAL	8,724

* Note that sediment dams are designed to spill in events exceeding the 5-day design rainfall event in accordance with the Blue Book

† Tailings from Deep Pit and Bayswater Tailings Storages will be relocated to the Main Pit Tailings Storage between approximately 2022 and 2027 to allow continued mining within the BOC.

The total forecast volume of water stored at the BCC is tracked over time and shown in *Figure 6* as probability plots, derived from all 121 scenarios, over the simulated 20 year period.

Figure 6 shows that median simulated water stored on site is forecast to fall during the period of tailings relocation up to 2027 before gradually rising thereafter, with the rise related to reduced demand.

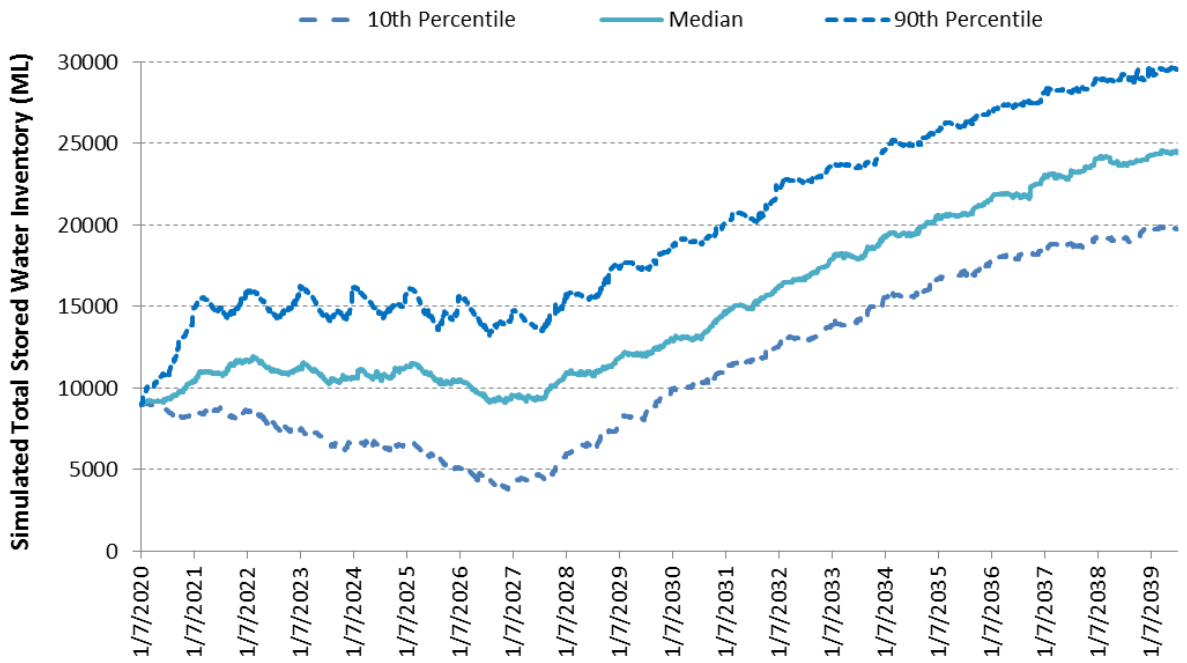

Figure 6 – Simulated Total Water Stored on Site

6.2.1 Water Supply Reliability

Predicted average supply reliability is expressed as total water supplied divided by total demand (i.e. a volumetric reliability). Average supply reliability for the simulation period over all climatic scenarios, as well as the lowest reliability in any one scenario, for the CHPP, haul road and overburden dust suppression are summarised in *Table 15*.

Table 15 - Summary of Modelled Water Supply Reliability

Summary of Modelled Water Supply Reliability		
	CHPP Supply	**Haul Road Dust Suppression**
Average	>99.9%[#1]	99.3%
Minimum	>99.9%[#1]	95.7%

[#1] Although no shortfalls were simulated, the inherent uncertainty in the representativeness of low rainfall periods in the historical climate data set used in the model precludes the use of the term "100%".

In *Table 15* the "average" reliability is averaged over all scenarios, while the "minimum" represents the minimum reliability in any scenario. These numbers provide a "single measure" of water supply reliability for the remaining mine life. It should be noted that reliability predictions are averaged over the mine life and include periods of low and high rainfall and of varying demand through the mine life.

Monitoring and review of the mine water balance during the course of the operation's life would occur and water balance model predictions would be used to forecast the risk and magnitude of any future water supply shortfalls. Contingency measures, such as the purchase of additional water allocation licences on the open market, would be assessed and put in place if warranted. Should a significant forecast shortfall be identified then consultation with DPIE - Water will take place regarding a water licencing strategy for the BCC.

6.2.2 Controlled Releases

Figure 7 shows model predicted annual (water year – July to June) releases from the BCC as probability plots, derived from all 121 scenarios. The volume and likelihood of releases would increase from 2028 onwards following the period of tailings relocation. Any controlled releases would be made in accordance with the requirements of the HRSTS.

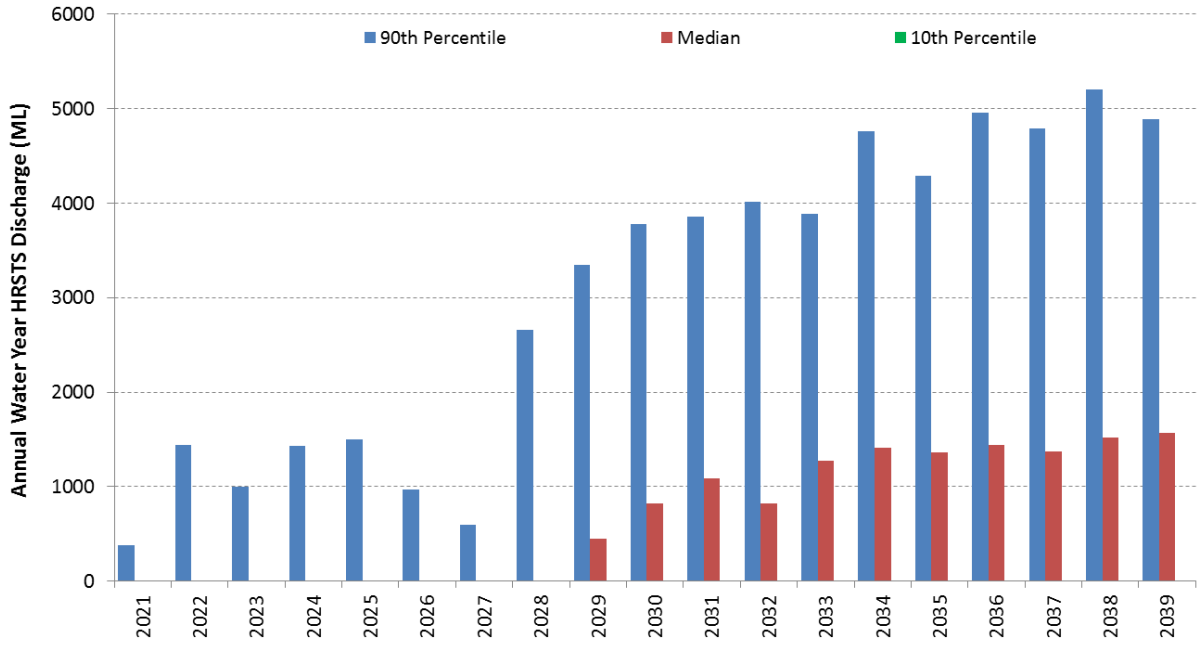

Figure 7 – Predicted Annual (Water Year) Controlled Release to Hunter River

6.2.3 Hunter River Extraction

Supply from Hunter River licenced extraction would vary through the mine life. Prior to the end of tailings relocation, modelling has assumed that Hunter River licenced extraction would only occur when the total volume of water stored in the CHPP Surge Dam, Northern Dam and Bayswater Dam (Void) fell below 4880 ML and the stored volume in the Beltana Goaf fell below 5900 ML. Following the end of tailings relocation, it has been assumed that Hunter River licenced extraction would only occur when the total volume of water stored in the CHPP Surge Dam and Northern Dam fell below 2220 ML and the stored volume in the Beltana Goaf fell below 5900 ML. This change in 'trigger' volume for sourcing water from the Hunter River reflects the reduced demand for water following tailings relocation.

Figure 9 shows predicted median, 10th percentile and 90th percentile annual water year (July to June) extraction volumes. The model forecast indicates that supply from Hunter River licenced extraction is only likely to be required up until just after the end of planned tailings relocation in 2028.

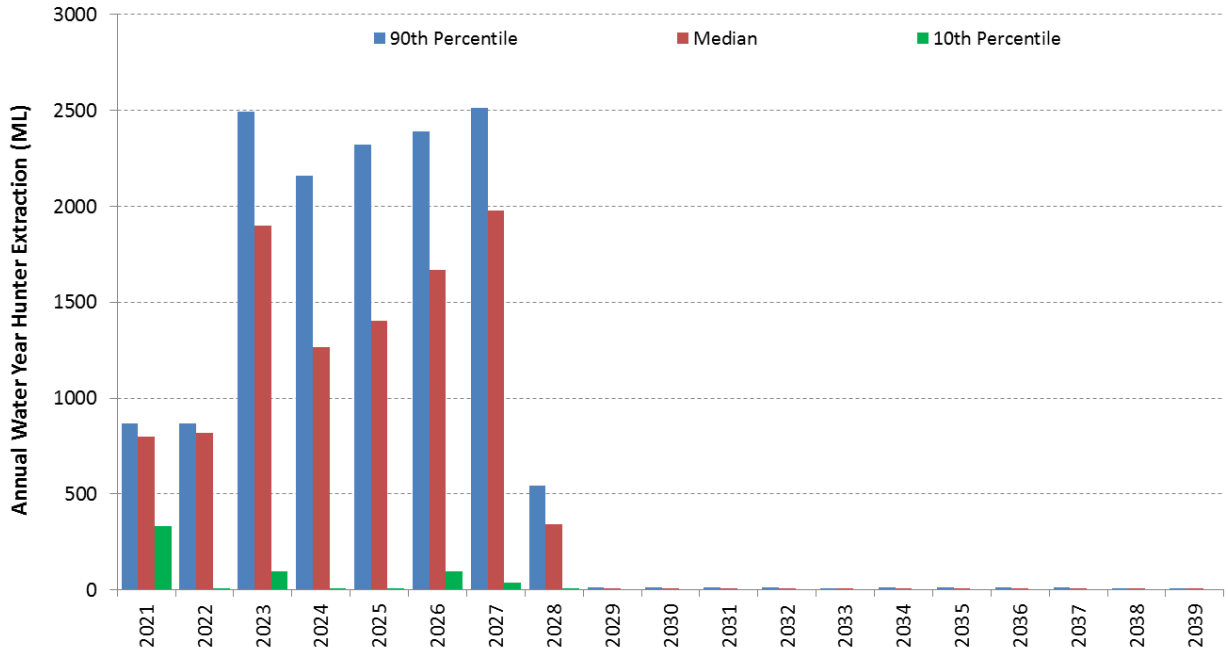

Figure 9 – Predicted Annual (Water Year) Hunter River Extraction

6.3 Water Efficiency

The majority of water (50% on average) consumed at the BCC is sourced from rainfall runoff within the mine disturbance footprint, from groundwater inflow to the open cut and former underground workings (20% on average) and from water recycled from settling tailings (25% on average) (refer *Table 14*). Runoff is typically mixed with the more saline groundwater and tailings water within the IWMS and reticulated around site for reuse. The collected water is reused for dust suppression, in the CHPP (coal washing) or lost through evaporation. Alternatively discharge may occur, via the LDP, under the provisions of the HRSTS and in accordance with EPL 563.

Through preferentially sourcing water from the IWMS and the buffering capacity of the CHPP Surge Dam and Northern Dam, there is a reduced need to discharge water off site (via the HRSTS) or to draw water from the Hunter River (refer *Table 14*).

A number of measures to reduce water use on site at the BCC have been implemented as follows:

- Tailings thickening and flocculation and the use of water reclaimed from the tailings storages as a priority over using Hunter River water allocations;
- Storage and use of runoff from disturbed areas as a priority over using Hunter River water allocations; and
- Regular inspections and maintenance of water management infrastructure.

6.4 Water Balance Monitoring

As part of the water management system, monitoring of water imported to site, water used on site, water discharged from site in accordance with the HRSTS and volumes of water stored on site will continue to occur.

Routine monitoring occurs at the BCC of water usage, water imported to and discharged from the mine and volumes of water stored on site. The data is used to:

- track the predicted against actual water balance;
- record stored water inventory;
- comply with the requirements of the HRSTS;
- plan for future mine water supply (sourcing of water from Hunter River water allocations) and management (including discharge of water via the HRSTS); and
- monitor trends in water use and efficiency.

Table 16 provides a summary of the current existing monitoring undertaken at the BCC. Naturally, as mining progresses and existing dams are decommissioned and mined though these monitoring locations will alter accordingly.

Table 16 - Water Balance Monitoring Summary

Water Balance Monitoring Summary			
Monitoring of	**Description**	**Location**	**Frequency**
Discharge	Volume discharged via licenced discharge point	Discharge from Northern Dam (LDP11)	In accordance with EPL
Imported Water Supply	Volume supplied to site by licenced extraction from Hunter River.	Inflow to 60 ML Dam	Continuous
CHPP Water Usage	Volume supplied to CHPP	Flow from 60 ML Dam, C3 Dam and CHPP Surge Dam	Continuous
Pumped to Former Underground Mine Storage and Extraction	Volume pumped to and the underground goaf and from dewatering bores.	Various flow meters	Continuous
Mine Dust Suppression Consumption	Water drawn from Truckfill points and used by BOC Water Trucks.	BOC	Continuous

Water Balance Monitoring Summary			
Rainfall	Automatic rainfall gauge	BCC weather stations	Continuous
Storage volumes	Stored volumes in all main water storages (level measured; volume calculated)	All main storages shown in *Figure 2* and mine sumps	At least monthly

6.5 Water Balance Model Review

A review the site water balance is undertaken annually or with the completion of significant developments to enable effective water management decisions to be made.

7. Erosion and Sediment Control

An operational Erosion and Sediment Control Plan (ESCP) *(BULCX-2103827161-7624)* has been prepared to apply to all operational land within the BCC (i.e. BOC, BUO and CHPP) as defined by the Mining Lease boundaries.

The ESCP provides guidance to Bulga Coal staff and contractors in limiting the potential for erosion and its associated impacts as a result of mining operations including land disturbance and subsidence. The ESCP includes prevention and management of erosion impacts as well as implementation of a monitoring program to provide early detection of potential issues and to ensure the controls are working efficiently and effectively.

The ESCP fulfils the requirements of the relevant development consent conditions and relevant statutory requirements for the current BCC operations.

The objective of the ESCP is to ensure that appropriate procedures and programs of work are in place to:

- Meet the requirements of the development consents relevant to the operations at the BCC;
- Meet the requirements of Managing Urban Stormwater: Soils and Construction (the Blue Book);
- Meet the requirements of the EPL 568 with regards to total suspended solids;
- Identify activities that could cause soil erosion and generate sediment;
- Limit soil erosion, the potential discharge of sediment to downstream waters during mining and recommend erosion and sediment controls in accordance with best management practices;
- Describe the location, function and capacity of erosion and sediment control structures; and
- Ensure erosion and sediment control structures are appropriately maintained.

The ESCP is implemented in conjunction with the WMP to ensure that the objectives of the ESCP are met.

Surface water quality monitoring is included in the WMP (refer to Section 8) with erosion and sediment control monitoring included in the ESCP. The erosion and sediment control inspections are conducted on a quarterly basis at the same time as site-wide rehabilitation inspections are undertaken. Actions from these inspections are recorded in in the BCC compliance managements system (CMO) and maintenance, remediation or improvement works undertaken as required.

Prior to any disturbance activities being undertaken by the site, a Ground Disturbance Permit (GDP) *GCAA-625378177-10043* is required to be completed. The purpose of the GDP is to identify and address any potential environmental, community, infrastructure or safety hazards associated with the proposed works. As part of completing the GDP, an ESCP is required to be developed.

All erosion and sediment control activities are to be undertaken in accordance with the guidelines from:

- the Blue Book; and
- Glencore's internal standard *GCAA-625378177-10323* Erosion and Sediment Control Management (Glencore, 2013).

8. Surface Water Monitoring Program

The objective of the surface water monitoring program is to provide details of the monitoring undertaken on site to monitor the effects of the Project on existing surface water bodies. The purpose of this monitoring is to assist in detecting if any significant off-site impacts occur as a result of mining and to trigger response plans to address any adverse impacts or trends.

8.1 Baseline Data

Two primary characteristics of a watercourse that principally determine the environmental value of the watercourse are the quality of the available water and the volume of the water (yield).

It should be noted that mining has been ongoing at the BCC and other mines in the area for many years, while historic sampling indicates that some of the creeks in the area are naturally saline. Characterisation of the water resource in terms of quality must consider both of these facts.

Historical data relating to water quality and flows in Wollombi Brook and Loders Creek catchment areas is summarised below. This data is used as a baseline for on-going monitoring of the impacts of mining activities on surface water in the Wollombi Brook and Loders Creek catchment areas.

8.1.1 Surface Water Quality

The earliest water quality data from the site is recorded in the 1980 Environmental Impact Statement (EIS) (BHP Ltd 1980). Sampling was undertaken at nine points on Loders Creek/Nine Mile Creek and at various dams in the area. The EC measured in 1980 varies from 2,000 µS/cm to 14,200 µS/cm, with an average of 7,100 µS/cm. The salinity was attributed in the 1980 EIS to seepage from the Saltwater Creek coal measures which subcrop in areas of Loders Creek.

Water quality in the receiving watercourses has been monitored monthly as part of the operations at the BCC since 1994. Water samples have been monitored for pH, TSS and EC although data for the current monitoring points on the creek system is only available within the site electronic database from January 2004. The surface water monitoring points and locations are outlined in *Table 17*.

Table 17 – Selected Surface Water Quality Monitoring Points

Selected Surface Water Quality Monitoring Points		
Monitoring Point	Watercourse / Location	Data Available Since

Selected Surface Water Quality Monitoring Points		
LR1	Wollombi Brook upstream of the village of Broke.	January 2004
LR5	Wollombi Brook downstream of the confluence with the Southern Drainage Line.	January 2004
LR2	Monkey Place Creek at Broke Road.	January 2004
W2	Wollombi Brook downstream of LR5, and upstream of W4.	January 2004
W4	Wollombi Brook downstream of the confluence with Northern Drainage Line.	January 2004
SDL1	Northern Drainage line west of BOC – tributary of Wollombi Brook	July 2018
NDL1	Southern Drainage Line west of BOC – tributary of Wollombi Brook	July 2018
W9	Loder Creek upstream of the New England highway	January 2018
W10	Loder Creek upstream of confluence with Nine Mile Creek and just upstream of Mining Lease Boundary	July 2018
NMC1	Nine Mile Creek adjacent to Broke Rd	July 2018

The location of the current surface water quality monitoring points are shown in *Figure 10*. These include numerous sampling locations within the mine water management system, as well as sampling points upstream and downstream of the BCC.

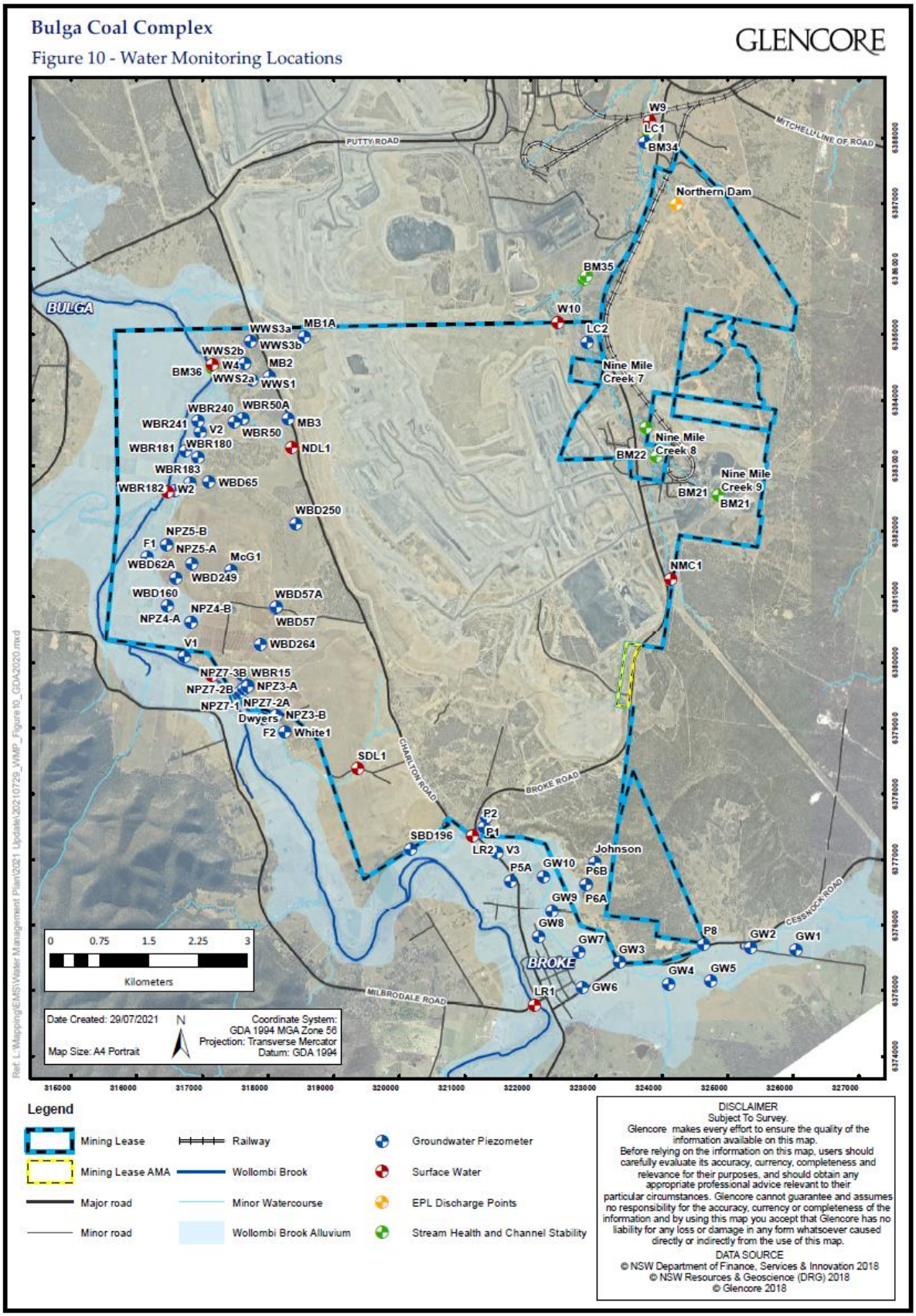

Figure 10 – Water Monitoring Locations

The surface water quality data for the above monitoring points is summarised in *Table 18*.

Table 18 - Surface Water Quality Monitoring Data (2004 – 2020)

Surface Water Quality Monitoring Data (2004 – 2020)									
Site	pH			EC (µS/cm)			TSS (mg/L)		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
LR1	7.5	6.36	8.78	773	4	9,470	12	<5	170
LR5	7.7	6.36	8.42	925	141	3,470	11	2	144
W2	7.4	6.37	8.15	659	139	1,470	10	1	114
LR2	7.8	6.30	8.80	2,967	130	6,710	36	3	440
W4	7.6	6.40	8.37	821	182	2,370	9	2	137
W8	8.3	7.25	9.54	9,789	615	22,500	69	4	1,610
W9	7.7	7.02	8.13	2,625	816	8,470	113	10	514
W10	7.4	6.88	8.37	679	370	1,280	82	24	159
NDL1	7.3	7.13	7.63	330	250	409	45	9	75
SDL1	7.0	6.29	7.57	359	102	1,250	44	6	192
NMC1	7.3	7.19	7.44	846	482	1,210	17	<5	28

8.1.2 Mine Water Quality

Mine water quality is monitored both for internal water management purposes and to maintain compliance with EPL 563 which prescribes conditions in terms of water quality for releases as part of the HRSTS – refer to Section 2.5.1 and 5.3.

The sediment dams and drains that capture the water that runs off the rehabilitation and overburden areas pump water to either Dam S7, the CHPP Surge Dam or the Northern Dam. The location of the current existing mine water quality monitoring points are shown in *Figure 3*.

Mine water quality data is summarised in *Table 19*.

Table 19 - Mine Water Quality Monitoring Data (2008 – 2020)

Mine Water Quality Monitoring Data (2008 – 2020)									
Site	pH			EC (µS/cm)			TSS (mg/L)		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
CHPP Surge Dam	9.0	8.68	9.40	4,589	3,250	5,550	35	1	476
Northern Dam (ND1)	8.6	8.28	8.81	2,064	1,270	3,260	31	4	134
Dam S7	8.9	8.05	9.28	4,715	1,280	7,540	95	11	403

8.1.3 Streamflow

All of the creeks, that are located within or around the BCC are ephemeral and have periods of no flow in between runoff producing rainfall events. Wollombi Brook, although also ephemeral, displays sustained flow (baseflow) in periods between rainfall events.

Streamflow gauging stations are maintained on Wollombi Brook by WaterNSW. The nearest gauging stations to the BCC are GS210028 at Bulga township (3.5km downstream of the BCC) and GS210135 at Brickmans Bridge (34km upstream of the site). Data is available online at:*https://realtimedata.waternsw.com.au/*. The streamflow data recorded at these two stations is summarised in *Table 20*.

Table 20 - Summary of Wollombi Brook Recorded Streamflow Data

Summary of Wollombi Brook Recorded Streamflow Data		
Station:	**GS210028 (Bulga)**	**GS210135 (Brickmans Bridge)**
Period of Record:	Feb 1949 – Feb 2020	Nov 1995 – Feb 2020
% Missing Days:	28%	1.6%
% Zero Flow Days:	13%	20%
Max. Daily Flow (ML/d):	93,016	69,258
Mean Daily Flow (ML/d):	367	144
Median Daily Flow (ML/d)	26	9.1
Catchment Area (km2)	1,672	1,088

The BCC has the potential to impact on annual flow volumes within downstream catchment areas due to the need to manage runoff from disturbed areas, including mining areas and overburden emplacement areas, during the operational and rehabilitation phases.

The approved mine layout results in a relatively deep final void with an associated significant final void extent and as such final void catchment area. Hence BOC will generally reduce catchment areas

compared to pre-mining catchments, particularly during the operational phase prior to rehabilitation of the overburden emplacement areas, as follows:

- Wollombi Brook, estimated at approximately 0.02%;
- Northern Drainage Line, estimated at approximately 0.1%;
- Southern Drainage Line, estimated at approximately 2%; and
- Loders Creek (excluding the Doctors Creek catchment), estimated at approximately 7%.

The open cut operations include a number of measures to limit the loss of catchment associated with mining, including diversion of clean water around mine infrastructure areas, and drainage of rehabilitated areas back to the clean catchment where the water quality is suitable for release. Additional measures that will be implemented to reduce the loss of catchment area include the following:

- The overburden emplacement areas will be rehabilitated as soon as practicable. The strategy of concurrent rehabilitation will reduce the duration for which catchment is lost during the operational phase. Once rehabilitation is established and runoff water quality has been determined to be suitable for release, areas will be allowed to return water to the surrounding environment; and
- The final landform will include channels to drain as much of the rehabilitated areas back to the Loders Creek and Wollombi Brook catchments as is practicable, reducing the loss of catchment due to the presence of the final landform.

It is important to note that the changes in annual flow volumes with the proposed final landform are considered to be small within the context of ephemeral streams, with the change in flows being less than the seasonal and annual variations in flow volumes comparing dry years to wet years. Hence the BCC is considered likely to have limited impact on ecosystems and downstream users as the predicted impact is within the natural flow variation of the existing creek systems.

8.2 Surface Water Impact Assessment Criteria

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000) apply to the quality of both surface water and groundwater as they have been developed to protect environmental values relating to uses such as irrigation and stock use. Trigger values (which are not assessment criteria) are used to initiate investigations into surface water quality as reported by the monitoring program.

ANZECC (2000) recommends that wherever possible, site-specific data should be used to define trigger values for physical and chemical factors which can adversely impact the environment. Trigger levels developed in accordance with the guidelines are statistically-based, accommodate site-specific anomalies and use a statistical measure to represent the variability of natural conditions.

A minimum of two years of monthly data at reference sites is required before a valid trigger value can be established. Monitoring data exists for the BCC since 2007 however due to the ephemeral nature of the surrounding watercourses there is insufficient data to develop triggers in accordance with the ANZECC (2000) guidelines, with the exception of monitoring point LR2. Whilst there is insufficient data for other sites, temporary trigger levels have been and will be continually refined as further data becomes available.

Trigger values for pH have been determined as the 80th and 20th percentile, while the trigger levels for EC and TSS are calculated as the 80th percentile i.e. upper trigger level in accordance with the

ANZECC (2000) guidelines. The trigger values will be revised every five years or subsequent to a consent modification that has reassessed the surface water impacts.

Table 21 presents the trigger levels.

Table 21 - Impact Assessment Trigger Values Surface Water (2007 – 2020)

Impact Assessment Trigger Values Surface Water (2007 – 2020)					
Watercourse	**Monitoring Location**	**pH**		**EC (µS/cm)**	**TSS (mg/L)**
		Lower 20th%ile	**Upper 80th%ile**	**80th%ile**	**80th%ile**
Monkey Place Creek	LR2	7.39	7.91	4,924	40
Wollombi Brook#1	LR1#2	7.12	7.81	944	12
	LR5	7.41	7.98	1,350	12
	W2	7.13	7.67	836	12
	W4	7.33	7.87	947	10
Northern Drainage Line	NDL1	7.14	7.26	399	70
Southern Drainage Line	SDL1	6.70	7.24	285	39
Loder Creek#1	W9	7.36	7.92	1,970	157
	W10	7.00	7.64	691	102
Nine Mile Creek	NMC1	Insufficient data			

#1 Due to the ephemeral nature of the watercourses there is insufficient data to develop triggers in accordance with the guidelines for sites other than LR2. Hence only temporary trigger values have been adopted.

#2 LR1 is upstream of the operations and is used as a reference site.

Where the surface water monitoring reveals a result outside the above trigger levels, the Response Plan will be activated as detailed in Section 10.

8.3 Surface Water Monitoring

Ongoing surface water quality monitoring will aim to:

- Continue to record and document the existing water qualities upstream and downstream of the BCC so as to highlight any areas of concern or impact;
- Review and monitor the performance of erosion and sediment controls at construction areas; and
- Continue the reporting of monitoring results in the EPL Annual Review and Bulga Coal Annual Review which includes an assessment of results in terms of off-site impacts as a result of operations and continuing improvement as a result of monitoring.

The surface water quality monitoring points are shown in *Figure 10*.

8.3.1 Surface Water Quality

Surface water quality monitoring is currently undertaken at various upstream and downstream locations on the creeks in the vicinity of the BCC.

Additional surface water quality monitoring locations will be established as part of continued BOC operations and samples will be collected and tested in line with the existing monitoring program with respect to parameters and frequency.

Table 22 summarises the surface water quality monitoring undertaken at sites within and surrounding the BCC.

Table 22 - Surface Water Quality Monitoring Program

Surface Water Quality Monitoring Program			
Site	**Location**	**Parameters**	**Frequency[#1]**
Existing Sites			
LR1	Wollombi Brook	pH, TSS, EC, flow condition	Monthly
LR2	Monkey Place Creek	pH, TSS, EC, flow condition	Monthly
LR5	Wollombi Brook	pH, TSS, EC, flow condition	Monthly
W2	Wollombi Brook	pH, TSS, EC, flow condition	Monthly
W4	Wollombi Brook	pH, TSS, EC, flow condition	Monthly
NDL1	Northern Drainage Line	pH, TSS, EC, flow condition	Monthly
SDL1	Southern Drainage Line	pH, TSS, EC, flow condition	Monthly
NMC1	Nine Mile Creek	pH, TSS, EC, flow condition	Monthly
W9	Loder Creek	pH, TSS, EC, flow condition	Monthly
W10	Loder Creek	pH, TSS, EC, flow condition	Monthly

[#1] Flow permitting.

Post mining water quality monitoring will continue at the sites given in *Table 22* for a period of at least two years following completion of rehabilitation activities in order to ensure that runoff water quality from rehabilitated areas is within the range of water quality data recorded from nearby (analogue) sites and does not pose a significant risk to downstream water quality.

8.3.2 Onsite Mine Water Quality Monitoring

On-site mine water quality monitoring is currently undertaken at various locations within the BCC for internal water management purposes, and to maintain compliance with EPL 563 which prescribes the conditions in terms of water quality for releases as part of the HRSTS.

Table 23 summarises the onsite mine water quality monitoring undertaken at sites within the BCC.

Table 23 - Onsite Mine Water Quality Monitoring Program

Onsite Mine Water Quality Monitoring Program			
Site	**Location**	**Parameters**	**Frequency**
Dam S7	Dam S7	pH, TSS, EC, Dam Level, Oil and grease	Monthly
Northern Dam	Northern Dam (LDP11)	pH, TSS, EC, Dam Level, Discharge Volume, Oil and grease	Monthly
		pH, EC, Discharge Rate, turbidity, temperature	Continuously under discharge. TSS daily when discharge occurring

On site water quality monitoring will be undertaken downstream of rehabilitated areas to monitor runoff water quality from these areas and compare to baseline water quality from nearby locations (refer to Section 8.1.1). Monitoring would continue until the relevant surface water impact assessment criteria (refer to *Table 21*) were not exceeded for a period of six months. Runoff from the rehabilitated area would then be directed off site.

8.3.3 Stream Health and Channel Stability

A program to monitor creek channel stability, the health of riparian vegetation and aquatic fauna has commenced and will continue throughout the mine life. The monitoring program includes Nine Mile Creek, Loder Creek and Wollombi Brook. The monitoring is undertaken on downstream watercourses to ensure their stability is not impacted by the existing or proposed operations. The location of the various monitoring locations are shown on *Figure 10*.

Annual monitoring of the drainage lines includes a channel stability assessment encompassing:

- Documenting locations and dimensions of significant erosive or depositional features;
- Photographs upstream, downstream and at both banks;

- Rating the site with the Ephemeral Stream Assessment protocol developed by the CSIRO to assess the erosional state of the creek at the monitoring location (a measure of channel stability);
- Rating the site with the Rapid Appraisal of Riparian Condition (RARC) protocol developed by Land & Water Australia. This assesses the ecological condition of riparian habitats using indicators that reflect functional aspects of the physical, community and landscape features of the riparian zone (a measure of stream health); and
- Taking measurements of the channel cross-sections (transects) for comparison purposes for any future monitoring.

Results of monitoring data will be reviewed and compared to previous rounds of monitoring to assess whether there is any degradation of the riparian vegetation, ecology or stream channel stability (refer *Table 24*). Where degradation or adverse erosion is occurring, additional investigations will be undertaken to assess whether the impacts may be associated with the BCC operations and ameliorative actions undertaken as required.

Table 24 - Stream Health Impact Assessment Trigger Values

Stream Health Impact Assessment Trigger Values	
Performance Indicators	**Trigger Level**
Negligible change in the channel stability of the creek	A 20% reduction in the Activity Rating of the CSIRO Ephemeral Stream Assessment
Negligible change in ecological condition in riverine ecosystems	A 10% reduction in the RARC

Note

Note: the trigger levels nominated are subject to change with ongoing monitoring and are preliminary values only.

8.3.4 Private Dams

The water levels in privately owned dams will be monitored in accordance with the relevant Private Property Subsidence Management Plans (PPSMP), Subsidence Monitoring Plan and the Surface Safety Subsidence Management Plans for the approved longwalls BSLW7 – BSLW9 Blakefield South Mining Area.

9. Groundwater Monitoring Program

The aim of the groundwater monitoring program is to provide an early warning of the potential changes in groundwater levels and quality which exceed trigger levels determined for the site and are outside of the predicted (modelled) values.

The groundwater monitoring program started at the BCC in 1998 and has been expanded since, with some monitoring bores decommissioned and new bores installed as the mining operations expanded. The groundwater monitoring program currently comprises:

- Bi-monthly water level monitoring in all standpipe piezometers including the measurement of EC and pH;
- Continuous monitoring of pressure heads in 15 vibrating wire piezometers;
- Continuous monitoring of water levels in 26 standpipe piezometers which are equipped with dataloggers; and
- Extensive sampling and chemical analysis undertaken on a half yearly basis in 51 standpipe piezometers (including pH, total dissolved solids, total suspended solids, alkalinity, dissolved major ions (Ca, Mg, Na, K, Cl, HCO_3, CO_3 & SO_4), total metals (Al, As, Be, Ba, Cd, Cr, Co, Cu, Pb, Mn, Ni, Zn, B, Fe, Hg), Fluoride, Nitrate and Phosphorous.

The temperature, turbidity and Colour (visual observation) of all groundwater samples taken are recorded on site.. Testing of EC, pH and chemical analysis are conducted by NATA accredited laboratories.

Water samples are collected using a polyvinyl chloride (PVC) bailer. The piezometers are bailed until the field measured pH and EC stabilise. This is validated by recording the pH and EC of two successive samples on the field sheet, with the second sample then transferred into bottles for analysis.

BCC ceased underground mining in July 2018 and as such relevant elements of the Wollombi Brook Groundwater Contingency Plan *BULUG-1844516901-973* have been incorporated into the WMP Surface and Groundwater Response Plan (Section 10).

9.1 Groundwater Monitoring Network

The BCC has a comprehensive groundwater monitoring network within and outside of the mine footprint area with 49 groundwater monitoring points (see *Figure 10*). The monitoring network comprises both standpipe piezometers and multilevel vibrating wire piezometers installed in all hydrostratigraphic units.

9.2 Baseline Data

Baseline groundwater level and quality data collected at the piezometers shown on *Figure 10* are summarised in *Table 25*.

Table 25 - Baseline Groundwater (1998 to May 2020) Level and Quality Monitoring

Baseline Groundwater (1998 to May 2020) Level and Quality Monitoring						
Piezometer No.	Water Level (mAHD)		pH		EC (µS/cm)	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Broke Area Alluvials						
GW1	84.37	90.42	6.45	7.67	762	3,650
GW2[#1]	82.56	85.80	6.59	7.55	615	6,420
GW3	74.48	77.28	6.48	8.00	210	6,480
GW4[#1]	77.84	79.92	6.40	7.97	644	1,850
GW5[#1]	78.86	81.62	6.50	8.07	1,660	6,230
GW6	72.21	75.72	6.92	8.19	4,440	8,370
GW7	63.21	75.01	6.37	9.05	141	6,790
GW8	66.86	72.88	5.60	7.70	4,200	6,850
GW9	70.83	73.36	6.14	9.73	100	4,790
GW10	69.76	73.32	6.50	8.20	820	11,400
V3	65.49	70.24	6.70	8.20	344	2,780
Broke Area Wollombi Seam						
P2	67.10	70.60	6.90	8.62	2,480	14,700
P5A	67.84	73.56	6.50	9.07	265	7,540
P6A	63.40	85.00	6.20	8.61	13	7,410
Northern Area Shallow Alluvials						
F1	61.26	85.00	7.10	8.30	265	2,090
F2	63.30	65.80	6.68	8.75	180	2,044
WBR50A[#2]	56.98	62.90	6.20	8.27	130	15,110
V1[#2]	63.14	65.48	6.70	8.13	880	1,720
V2[#2]	58.56	63.71	5.81	8.15	101	2,570

Baseline Groundwater (1998 to May 2020) Level and Quality Monitoring						
SBC/Broke Area Lower Whybrow Seam						
P6B	-24.84	80.20	6.23	8.90	1	8,440
P7B	66.17	73.72	6.63	9.87	120	4,500
P8	63.30	84.60	6.60	10.20	7	12,000
Northern Area Lower Whybrow Seam						
WBR50[#2]	24.30	63.80	6.00	8.80	4	9,710
Northern Alcheringa Seam						
WBD62A[#2]	62.70	66.83	6.00	8.34	1	1,681
Beltana Area Miscellaneous Bores and Wells						
Dwyers[#3]	60.90	64.10	6.20	8.10	1	2,035
Fernance[#2]	59.74	66.01	6.68	8.60	402	1,810
McG1[#2]	89.86	95.64	6.80	8.62	125	1,280
White1[#2]	63.36	65.65	6.29	8.20	1	3,080
WBR15[#2]	59.32	67.17	6.01	8.60	293	1,736
Beltana Area NPZ						
NPZ3-A[#4]	56.01	73.11	6.49	8.11	100	2,190
NPZ3-B[#4]	59.63	67.60	6.79	8.20	196	1,240
NPZ4-A[#4]	58.54	64.29	6.07	7.98	573	1,193
NPZ4-B[#4]	45.32	55.13	6.49	8.41	1	1,575
NPZ5-A[#4]	60.90	64.90	6.30	8.00	240	1,116
NPZ5-B[#4]	41.16	61.30	6.30	8.21	3	3,290
NPZ7-1[#4]	53.47	60.30	6.74	7.85	267	1,494
NPZ7-2A[#4]	62.04	64.71	6.44	8.00	2	2,654
NPZ7-2B[#4]	45.36	67.02	5.80	8.33	120	1,591
NPZ7-3A[#4]	62.0	69.00	6.10	9.10	2	3,070

Baseline Groundwater (1998 to May 2020) Level and Quality Monitoring						
NPZ7-3B[#4]	53.7	69.20	6.10	8.40	1	14,332
Wollombi Alluvials and Shallow Coal Measures						
WBD160[#6]	63.83	65.81	6.52	7.89	442	1,540
WBR180[#5]	34.30	55.93	6.32	8.04	20	24,800
WBR181[#5]	59.41	62.11	6.52	8.18	3	7,150
WBR182[#5]	61.70	64.10	6.80	9.50	2	1,710
WBR183[#7]	58.96	64.35	6.43	8.26	3	4,560
SBD196[#8]	67.10	69.40	6.40	7.90	4	5,660
WBR240[#9]	58.36	60.50	6.16	8.10	20	31,000
WBR241[#9]	59.63	62.16	5.95	7.98	180	524
Warkworth Sands monitoring bores						
WWS1 (2.15m deep)	Dry when constructed in June 2021					
WWS2 (1.5m deep)	Dry when constructed in June 2021					
WWS2a (2.6m deep)	Dry when constructed in June 2021					
WWS3 (1.4m deep)	Dry when constructed in June 2021					
WWS2a (2.0m deep)	Dry when constructed in June 2021					
Loders Creek Alluvials						
LC1	No data					
LC2	No data					
Northern Tailings emplacement facility piezometers						

Baseline Groundwater (1998 to May 2020) Level and Quality Monitoring						
MB1a shallow Permian (25.5 mbgl)	No data					
MB1a deep Permian (136 mbgl)	No data					
MB2 Whybrow seam (43 mbgl)	No data					
MB3 shallow Permian (23.5 mbgl)	No data					
MB3 deep Permian (192 mbgl)	No data					

#1 During Q1 2014 these sites were added to the sampling schedule. These sites have been recommissioned after monitoring ceased in 2002.

#2 These sites were added to the sampling schedule in 2002.

#3 This site was added to the sampling schedule in 2003.

#4 These sites were added to the sampling schedule in 2005.

#5 These sites were added to the sampling schedule in 2007.

#6 This site was added to the sampling schedule in 2008.

#7 This site was added to the sampling schedule in 2009.

#8 This site was added to the sampling schedule in 2012.

#9 These sites were added to the sampling schedule in March 2014.

Results of comprehensive groundwater quality analysis is provided in the Annual Reviews.

9.3 Future Groundwater Inflow

9.3.1 Groundwater Inflows into the Open Cut

Groundwater inflows for the mining operations were simulated as part of the groundwater studies undertaken for the Statement of Environmental Effects (SEE) for the Bulga Optimisation Project Modification 3 and Underground Modification 7 (Umwelt, 2019 – Appendix 11). The results of the groundwater prediction modelling for the optimised open cut are summarised in *Table 26* (Umwelt, 2019 – Appendix 11). Modelling indicates that open cut groundwater inflow rates are predicted to peak in approximately 2032 at an average 1,840 ML/year

Table 26 - Predicted Groundwater Inflows into Open Cut

Predicted Groundwater Inflows into Open Cut	
Year	**Predicted Groundwater Inflow into Open Cut (ML)**
2021	590
2022	610
2023	570
2024	750
2025	940
2026	1020
2027	1240
2028	1320
2029	1380
2030	1,10
2031	1710
2032	1840
2033	1670
2034	1570
2035	1,650
2036	1690
2037	1710
2038	1740
2039	1,690

9.3.2 Groundwater Inflows into the Former Underground Workings

Groundwater inflow rates to the Beltana and Blakefield South underground have been estimated to be approximately 380 ML/year and 155 ML/year respectively, based on recorded underground dewatering, volumes transferred to the underground and recorded water levels.

9.4 Groundwater Impact Assessment Criteria

The ANZECC (2000) guidelines apply to the quality of both surface water and groundwater as they have been developed to protect environmental values relating to uses such as irrigation and stock use. Trigger values (which are not assessment criteria) are used to initiate investigations into groundwater quality as reported by the monitoring program.

ANZECC (2000) recommends that wherever possible, site-specific data should be used to define trigger values for physical and chemical factors which can adversely impact the environment, hence impact assessment criteria have been nominated for existing and proposed piezometers, including piezometric pressure (measured as depth to water level), and water quality parameters: pH and EC. Vertical pressure gradients are also monitored in a number of additional piezometers constructed in the buffer zone between the alluvial deposits and the longwall panel area.

According to ANZECC (2000) and Australian guidelines for water quality monitoring and reporting, the recommended trigger-based approach for physio-chemical stressors is defined as follows:

A trigger for further investigation will be deemed to have occurred when the median concentration of an independent samples taken at a test site exceeds the eightieth percentile of the same indicator at a suitably chosen reference site.

Trigger levels defined in such a way are statistically-based, accommodate site-specific anomalies and use a statistical measure to represent the variability of natural conditions. ANZECC (2000) recommends that wherever possible site-specific data are used to define trigger values for physical and chemical factors which can adversely impact the environment. A minimum of two years of monthly data at reference sites is required before a valid trigger value can be established.

Monitoring data exists for the BCC since 1998 providing a sufficiently long and good quality dataset to define site specific trigger levels. A full review of trigger levels was undertaken for all monitored piezometers to update the trigger levels set in 2011 (RPS Aquaterrra, 2012), 2014 (David, 2014) and May 2020. Trigger values for pH have been determined as the 80th and 20th percentile, while the trigger levels for EC are calculated as the 80th percentile i.e. upper trigger level in accordance with the ANZECC (2000) guidelines.

The baseline water level data was also analysed to derive trigger levels for the bores installed in the strata other than Permian coal measures such that they represent a 5% reduction of saturated thickness, based on the minimum of the historical baseline monitoring. The confined Permian strata will be depressurised as a result of mining and therefore the trigger levels for those bores are not considered relevant.

Table 27 presents the trigger levels derived from the piezometer monitoring data for the period up until May 2020.

The trigger values will be revised every five years or subsequent to a consent modification that has reassessed the groundwater impacts.

Table 27 - Impact Assessment Trigger Values for Piezometers

Impact Assessment Trigger Values for Piezometers				
Piezometer No.	Water Level (mAHD)	pH		EC (µS/cm)
	Lowest depth Trigger Value	20th %ile Trigger Value	80th %ile Trigger Value	80th %ile Trigger Value
Broke Area Alluvials[#1]				
GW1	NA[2]	6.7	7.3	3,634
GW3	73.99	6.7	7.2	6,010
GW6	72.19	7.3	7.8	7,900
GW7	63.29	6.7	7.4	3,946
GW8	70.00	6.6	7.0	5,936
GW9	70.34	6.7	7.2	4,458
GW10	69.14	7.1	7.6	10,252
V3	64.99	7.1	7.6	1,744
Broke Area Wollombi Seam				
P2	NA[1]	7.4	8.0	12,834
P5A	NA[1]	7.5	8.2	6,242
P6A	NA[1]	7.0	8.1	2,740
Northern Area Shallow Alluvials				
F1	60.83	7.2	7.6	1,025
F2	62.93	7.1	7.4	1,720
WBR50A	NA[1]	7.1	7.7	14,000
V1	62.53	7.3	7.7	1,570
V2	58.7	6.4	7.1	922
SBC/Broke Area Lower Whybrow Seam				
P1	NA[1]	7.4	7.9	14,274
P6B	NA[1]	6.7	7.3	1,353

Impact Assessment Trigger Values for Piezometers				
P8	NA[1]	7.3	9.3	5,076
Northern Area Lower Whybrow Seam				
WBR50	NA[1]	6.7	8.0	8,382
Beltana Area Miscellaneous Bores & Wells				
Dwyers	60.54	7.3	7.6	1,476
Fernance	59.27	7.3	8.0	1,473
McG1	NA[2]	7.5	8.0	918
White 1	62.22	7.0	7.4	2,444
WBR15	62.16	6.8	7.3	924
Beltana Area NPZ				
NPZ3-A	NA[1]	7.3	7.7	1,362
NPZ3-B	NA[1]	7.3	7.5	921
NPZ4-A	NA[1]	6.9	7.3	729
NPZ4-B	NA[1]	7.3	7.8	1,342
NPZ5-A	NA[1]	6.9	7.3	886
NPZ5-B	NA[1]	7.1	7.6	2,760
NPZ7-1	NA[1]	6.7	7.7	1,240
NPZ7-2A	NA[1]	7.1	7.6	2,250
NPZ7-2B	NA[1]	6.8	7.8	1,307
NPZ7-3A	NA[1]	7.0	7.5	2,540
NPZ7-3B	NA[1]	7.4	7.8	1,316
Wollombi Alluvials and Shallow Coal Measures[#2]				
WBD160	NA[2]	6.9	7.3	1,310
WBR180	NA[1]	7.1	7.5	20,850
WBR181	59.65	7.2	7.5	2,670
WBR182	62.16	7.3	8.3	1,512

Impact Assessment Trigger Values for Piezometers				
WBR183	NA[1]	7.0	7.4	3,484
WBR240	NA[1]	7.0	7.5	26,800
WBR241	60.20	6.4	6.9	435

[#1] During Q1 2014 sites GW2, GW4 and GW5 were added to the sampling schedule and hence no trigger values have been established as yet.

[#2] No trigger values have been established for SBD196 as yet.

NA[1] Trigger levels are not set for Permian Coal measures due to depressurisation resulting from seam extraction.

NA[2] Trigger levels are not defined as depth of bore is unknown.

ND Not determined - insufficient data available to trigger levels assessment.

Where the groundwater monitoring reveals a result outside the impact assessment criteria the Response Plan will be activated as detailed in Section 10.

9.5 Groundwater Monitoring

The objectives of the comprehensive groundwater monitoring program are to identify any decline in groundwater levels and deterioration in groundwater quality or depressurisation as a result of mining operations that exceeds the set trigger values and may impact on local or regional groundwater systems and groundwater dependent ecosystems.

Monitoring is undertaken at the bores/piezometers every second month for physicals (depth, pH, EC) and twice a year for comprehensive chemical parameters. Bore locations are shown in *Figure 10*.

With the suspension of underground mining and sealing of all underground workings the underground water balance now only includes three key elements, groundwater inflow (including rainfall recharge), water drawn from dewatering bores and water discharged into the underground workings via recharge bores. The volumes of water drawn from and discharged to the underground workings are monitored, meaning that the balance of the change in goaf storage is the result of groundwater inflow. The quality of water extracted from the underground workings, via dewatering bores, is tested biannually along with the piezometers when the full chemical analysis is performed. When and if water is discharged into the underground workings full chemical analyses will be undertaken. The results of water quality monitoring are reported quarterly on the BCC website and annually in the BCC Annual Report, which is also available online. The Annual Review includes an assessment of results in terms or regional site impacts as a result of mining as well as trends against predictions.

With the suspension of the underground mining a groundwater monitoring report is completed at the end of each year. These reports are included in the Annual Review which is available on the BCC website.

Monitoring of the regional groundwater levels and quality in the alluvial, coal seam, and inter-burden aquifers will be maintained for the entire mining period and at least 10 years after mining.

9.5.1 Groundwater Inflows into the Open Cut Pit

Current groundwater contribution to open pit (simulated 460 ML/year) is low compared to in pit rainfall runoff and is not directly measurable. The inflow occurs as seepage into sumps with a portion lost during blasting and is incorporated with the considerable rainfall runoff (3,000 to 4,000 ML/annum) that reports to the open cut pit. The predicted groundwater inflow into the pit is however predicted to increase in future years (refer *Table 26*).

Volumes of pit dewatering are monitored and recorded on a monthly basis. The site water balance model is used with recorded site rainfall to simulate rainfall runoff reporting to the open cut pit as well as evaporative losses. This therefore allows estimation of actual groundwater inflow rates reporting to the open cut pit. This will allow ongoing validation of the groundwater inflow estimates (*Table 26*) and adjustment/refinement if required. Estimated groundwater inflow rates will be reported in the Annual Review.

9.5.2 Seepage from Water Storages, Emplacements and Voids

Water storages and emplacement areas are being monitored for potential seepage using the existing groundwater monitoring network with the addition of some shallow standpipe piezometers for the proposed Northern Dam. The monitoring schedule will be the same as for other piezometers in the monitoring network.

A review of the results will be undertaken quarterly and if seepage/leachate loss is suspected, based on the monitoring program, a hydrogeological expert will be engaged to review the suspected loss and if required make recommendations to reduce the loss.

The Deep Pit, Bayswater Pit and Northern Tailings Emplacement facility are located within mine voids. Seepage modelling and an assessment of emergent seepage pathways away from the Northern Tailings emplacement facility is included in the SSD 4960 modification 3 SEE groundwater impact assessment (Umwelt, 2019 – Appendix 11). The results indicate that the flow vectors for the Permian strata for the end of mining conditions indicate a preference for flow under regional gradients towards the south and the final pit void. Seepage modelling of the Northern tailing Emplacement facility (Umwelt, 2019 – Appendix 11) indicates that a component of the potential groundwater flow from the Northern Tailings emplacement facility will flow towards the Mt Thorley mine to the North. It is predicted that this flow would peak at about 1.6L/s with the longer term flow being < 1L/s.

Five new piezometers have been constructed to the west and north of the Northern Tailings emplacement facility (MB1a shallow and deep, MB2 and MB3 shallow and deep). There locations are shown on *Figure 10* and they have been included in the groundwater monitoring network (*Table 25*).

9.5.3 Regional and Local Aquifers

The groundwater model (Umwelt, 2019 – Appendix 11) predicts the water table within the shallow alluvium to remain unaffected by leakage to the depressurised coal seams. Therefore, current monitoring of the groundwater pressure response within the coal measures and the water table within shallow alluvial strata is considered sufficient and will continue as per the current schedule.

A quarterly review of water level and quality monitoring data will be undertaken and will include consideration of relevant meteorological and rainfall data. Measured values will be compared to background trends and, if water quality parameters and groundwater levels exceed the impact assessment trigger values, an investigation of potential cause will be undertaken in accordance with the response plan (refer Section 10).

If monitoring of these parameters is proposed to be altered or discontinued, Bulga Coal will consult with the NRAR and the DPIE during the revision of the monitoring program. Monitoring results will be reported in the Annual Review. Reporting will include a comparison of water quality trends with those of previous years and will highlight any results that are inconsistent with trends in baseline data. All monitoring data will be retained in an appropriate format on site and will be used to review the effectiveness of the BCC water management system on an ongoing basis.

9.5.4 Groundwater Supply in Privately Owned Bores

As the impact to alluvium is predicted to be negligible, little impact on the groundwater supply bores on neighbouring properties is expected with mining induced drawdown predicted to be less than 2m (Umwelt, 2019 – Appendix 11). Despite this, Bulga Coal will continue the extensive monitoring program on site to ensure that any changes to groundwater pressures, levels and quality are recorded and managed prior to any potential impact reaching private bores. These monitoring results will be reviewed every quarter and reported in the Annual Review. Bulga Coal receiving a complaint or expression of concern from any approval or licence holder suspecting their supply has been impacted by the Bulga mining operations will trigger a full investigation into the matter by Bulga Coal in consultation with the NRAR. If the operations do adversely impact on an approval of licence holder water supply Bulga Coal will make good the supply.

9.5.5 Groundwater Dependent Ecosystems

Mining operations are not predicted to impact on the Groundwater Dependent Ecosystem (GDE) located at some reaches of Wollombi Brook and Loders Creek and hence there is no monitoring program proposed for the GDE's during mining operations.

Shallow monitoring bores (LC1 and LC2) have been installed in the Loders Creek alluvium and will provide baseline data, allowing for early detection of altered baseflow contribution to the creek and provide information on any potential impact from seepage from water storages or emplacement areas on the alluvium.

Five shallow monitoring bores were installed in the Warkworth Sands which are located to the north-west of the Open Cut as shown on Figure 10. None of these monitoring bore had any free water in them when constructed or when an attempt to sample them two weeks after construction. They have also been included in the groundwater monitoring network *Table 25*.

9.5.6 Wollombi Brook Baseflow

Groundwater modelling indicates no impact to the Wollombi Brook alluvium as a result of continued BOC operations.

Nevertheless, to provide early warning of any potential losses from the Wollombi Brook alluvium, Bulga Coal will use the two WaterNSW streamflow gauging stations located upstream and downstream of the operation and will assess the changes in baseflow contribution based on the long term historical data available for those two stations. This information will be reported in the Annual Review. In addition, groundwater monitoring bores installed in the alluvium will provide early warning of any potential changes in groundwater levels and therefore changes to flow. The review of groundwater monitoring data will occur quarterly.

9.6 Groundwater Model Review

Bulga Coal will undertake validation of the groundwater model using the groundwater data collected since the last review. Should the observed results differ appreciably from the calibrated model; the model may need to be re-calibrated.

The groundwater model will be validated and re-calibrated (if needed) on a three yearly basis (to coincide with the independent environmental audit) and in consultation with the NRAR. If required and when completed, the groundwater model calibration with be supplied to the NRAR. In preparation for this audit, the validation and potential re-calibration of the groundwater model will be reviewed by an independent suitably qualified hydrogeologist in accordance with the groundwater modelling guidelines (Barnett et al, 2012).

10. Surface and Groundwater Response Plan

Potential impacts resulting from the mining process largely relate to the shallow alluvial aquifer systems that support aquatic ecosystems and are used for irrigation water supply. The response plans for such impacts are detailed in subsequent sections below with the impact mitigation measures being drawn from the Bulga Coal Underground Operations EIS 2003, Bulga Optimisation Project 2013 EIS and SSD-4960 Modification 3 SEE. BCC ceased underground mining in July 2018 and as such relevant elements of the Wollombi Brook Groundwater Contingency Plan *BULUG-1844516901-973* have been incorporated into the WMP.

10.1 Exceedance of Trigger Values and Criteria Exceedance Protocol

If, as a consequence of the surface water and groundwater monitoring programs for offsite locations, any samples or test results exceed the trigger values then the Environment and Community Manager will be responsible for initiating an investigation into the causes.

If any surface water and/or groundwater triggers are reached and are potentially attributable Bulga Coal induced impacts then DPIE and NRAR will be notified in writing via email to *compliance@plannning.nsw.gov.au* and *water.referrals@dpi.nsw.gov.au*

If regular exceedances occur, the Environment and Community Manager is to notify and formulate corrective actions in consultation, as required, with any relevant stakeholders.

10.2 Response Plan

A Trigger Action Response Plan (TARP) has been developed to outline Bulga Coal's response and identify required management actions to potential exceedances of surface water and groundwater trigger values.

The TARP is provided as *Table 28* below, and will be reviewed and may be revised as conditions at the BCC change or new risks are identified.

Table 28 - Trigger Action Response Plan

Trigger Action Response Plan		
Key Element	**Trigger**	**Response**
Exceedance of EPL Discharge Criteria	pH outside range 6.5-9.5 TSS >120 mg/L	Investigate results, considering any mitigating factors where applicable. Report results to senior management and where relevant initiate criteria exceedance protocols (report to the EPA, DPIE or potentially as per the Pollution Incident Response Management Plan). Report within 3 months of exceedance.
Impacts on Channel Stability	See **Section 8.3.3**	Investigate results and trends, considering any mitigating factors where applicable. Determine if an incident related to the BCC operations has occurred. Initiate detailed investigation if trends indicate potential for harm. Report results to senior management and where relevant initiate works to reinstate channel stability. Report within 3 months of impact detection/indication for potential harm.
Stream & riparian vegetation health & aquatic ecology	**Section 8.3.3** and **Table 24**	Investigate results and trends, considering any mitigating factors where applicable. Report results to senior management and where relevant, initiate criteria exceedance protocols (Section 10.1). Report within 3 months of detection of a 10% reduction in the RARC.
Loss of Baseflow in Wollombi Brook or Monkey Place Creek	See **Section 9.5.6**	Investigate the cause of any losses in baseflow contribution and where relevant initiate the criteria exceedance protocols. Investigation report to be completed with 3 months of detection of loss. If loss of base flow beyond predictions is established, BCC will relinquish Wollombi Book Water Access Licence allocation to compensate for loss to the underground operations.

Trigger Action Response Plan		
Surface water monitoring results are outside the relevant quality impact assessment criteria	See **Section 8.2** and **Table 21**	Investigate results and trends, considering any mitigating factors where applicable. Determine if an incident related to the BCC operations has occurred and initiate detailed investigation if results indicate potential for harm. Report results to senior management and where relevant, initiate criteria exceedance protocols (Section 10.1). Report with 3 months of exceedance of impact assessment criterion.
Loss of groundwater availability and privately owned bores	See **Sections 9.4, 9.5.4** and **Table 27**	Investigate loss of groundwater availability considering any mitigating factors where applicable. Provide feedback to complainant within 3 months of complaint. Report complaint to senior management and where relevant initiate criteria exceedance protocols and negotiate a make good agreement.
Increased Groundwater Inflows into Open Cut Pit or Underground Workings	See **Section 9.3**	Investigate the cause of increased inflows. Purchase additional groundwater or surface water licences to volumetrically offset the impact on the groundwater system.
Water monitoring results are outside the maximum reported groundwater level or quality criteria	See **Section 9.4**	Investigate results and trends, considering any mitigating factors where applicable. Report results to senior management and where relevant initiate criteria exceedance protocols (Section 10.1). Report with 3 months of exceedance of impact assessment criterion.
Seepage from emplacement and spoil areas	See **Section 9.52**	Investigate the amount of seepage and assess the water quality. Engage a hydrogeological expert to review the suspected loss and if required make recommendations to reduce the loss. Where relevant initiate criteria exceedance protocols (Section 10.1). Report with 3 months of detection of seepage.

10.3 Unforeseen Impacts

In the event of unforeseen impacts associated with surface water or groundwater, the following protocol will be implemented:

- conduct a preliminary review of the nature of the impact, including:
  - any relevant monitoring data; and
  - current mine activities and land use practices;
- commission an investigation by an appropriate qualified expert into the unforeseen impact to confirm likely cause and effect and consider relevant options for amelioration of impact(s) as appropriate;
- prepare an action plan in consultation with the appropriate regulatory agency;
- mitigate causal factors where possible; and
- implement additional monitoring as necessary to measure the effectiveness of the controls implemented.

The outcomes of this protocol will be reported in the Annual Review. The implementation of any mitigation measures will be undertaken in consultation with DPIE and will be reported in the Annual Review.

11. Decommissioning Strategies

Decommissioning of water management structures was conceptually discussed in the BOP EIS and will be detailed in the closure and decommissioning MOP that will be submitted prior to mine closure. Prior to closure, each mine water management structure will be assessed in regards to its post mining land use and its potential value. If the assessment concludes that the water management structure is of no further value it will be rehabilitated.

After mining is complete the open cut final void will trap and accumulate some surface water. However, final contouring of the surrounding rehabilitation areas will aim to:

- reduce the catchment area of the final voids and redirect as much rehabilitated catchment as practicable to natural drainages;
- control runoff flow rates, velocity and potential for erosion;
- facilitate revegetation; and
- create a visually aesthetic final landform.

While the final void will remain as a water body in the final landform, the water level is expected to establish approximately 120 m below spill level and this would be reached very slowly over a period of several hundred years (Umwelt, 2019). Groundwater outflow would occur in the longer term at a very low rate of up to 0.3 ML/d.

A final void management plan will be developed for inclusion in future revisions of this management plan, prior to closure.

The Main Pit TSF will be capped and shaped into a free draining landform with overland flow generally directed to the north west. Where possible, capping and final landform shaping material for the in-pit

tailings facility will be obtained through the rehandling of emplaced overburden adjacent to the facility. Long term consolidation of the Main Pit TSF may require progressive shaping to achieve a free draining landform. The design of Main Pit TSF capping and the selection of appropriate capping material, including the importation of selected ameliorants, will have regard to the hydrological, physical and geochemical characterisation of the fine rejects and the proposed cover materials to achieve an effective cover system design. A final mine closure plan will be developed prior to closure and will include detailed consideration of the Main Pit TSF including anticipated consolidation timing.

12. Reporting

Monitoring and water balance results will be reported according to the requirements in the relevant monitoring sections of this management plan. Typically these results are presented in either the Quarterly Environmental Monitoring reports and in the Annual Review. Both reports are available on the Bulga Coal external website. The Annual Review will include volumes of water:

- extracted from the site (monitored and modelled);
- taken under each water licence; and
- transferred to and from the site, including water taken under water licences that apply to other mining operations.

Additionally each discharge event is recorded. An annual report of activity under the HRSTS is forwarded to DPIE - EES.

A hydrogeological monitoring report will be completed each year by an independent expert. The hydrogeological monitoring report will review the:

- groundwater hydrographic responses including the comparison of the alluvial aquifer responses to the rainfall excess/deficit;
- groundwater inflows to the underground and open cut and comparing them to the groundwater model predicted inflows;
- groundwater quality including the use of Piper trilinear plots; and
- adequacy of the groundwater monitoring network recommending aditonal monitoring where necessary.

The annual hydrogeological monitoring report is included as an appendices of the Annual Review which is made available on the Bulga Coal website.

12.1 Incidents and Corrective Action

In accordance with Bulga Coal Environmental Management Strategy *BULCX-1254107625-5*, an incident or non-compliance is defined as:

a) Any inspection/test result that does not meet the acceptance criteria specified in any environmental approvals or relevant standard or legislation;

b) any notice of non-compliance issued by a government agency with environmental jurisdiction;

c) any non-compliance with identified objectives and targets;

d) any action that causes unapproved environmental harm; or

e) a community complaint.

Bulga Coal record incident data in the CMO database (within two working days) to allow retrieval of records for analysis and reporting. All Category 2 or greater environmental incident triggers an Incident Cause Analysis Method (ICAM) investigation form which the appropriate corrective or preventative actions are raised.

12.2 Adaptive Management

Where an exceedance of the performance measures in either of the Bulga Coal development consents has occurred, at the earliest opportunity the site will:

f) Take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; and

g) Consider all reasonable and feasible options for remediation (where relevant) and submit a report to the DPIE describing those options and any preferred remediation measures or other course of action.

13. Review

This document shall be reviewed, and if necessary revised, within 3 months of the following:

- The submission of an Annual Review;
- The submission of an incident report under Section 10;
- The submission of an independent environmental audit; and
- Following any modification to the Bulga Coal approvals.

DPIE and the NRAR will be consulted whenever this document is revised or updated.

14. Audits and Inspections

Internal and external audits of this document will be carried out as described below. Audits shall be carried out by personnel who have the necessary qualifications and experience to make an objective assessment of the issues. The extent of the audit, although pre-determined may be extended if a potentially serious deviation from this document is detected.

Any non-conformances and/or improvement opportunities will have corrective and preventative actions implemented to avoid recurrence. Actions will be recorded in either the Bulga Coal work order system or CMO so actions can be tracked.

14.1 Internal Audits

Internal audits of this document will be undertaken every three years or when triggered by a modification to either of the development consents. Improvements from the audit are to be incorporated in the site action database so the actions are assigned to the relevant people and completed.

14.2 External Audits

External audits of this management plan will be undertaken by specialists periodically as determined by the Bulga Coal Environment and Community Manager, or in response to significant environmental incidents for which a systems failure has been determined as a contributor to the incident.

An Independent Environmental Audit will be undertaken every three years (or as otherwise required by the DPIE) by an audit team whose appointment has been endorsed by the Secretary of the DPIE.

Any actions arising from external audits will be loaded into CMO and assigned to the relevant people for completion.

15. Accountabilities

Role	Accountabilities for this document
Bulga Coal Environment and Community Manager	Implement the WMP. Review this plan at least every three years or as otherwise advised by the Secretary of Planning, Industry & Environment. The reviews will reflect changes in environmental requirements, technology or operational procedures. Requirements for corrective actions identified during monthly inspections are to be reported and managed to ensure that the corrective actions are implemented in a timely manner. A summary of monitoring, works undertaken and results of surface and sub-surface investigations are to be reported in the Annual Review in accordance with EPL 563.
BOC Operations Manager	Provide adequate resources for the implementation of this Plan.

16. Complaints Procedures

If complaints relating to surface water or groundwater are received by Bulga Coal, the complaint details are to be circulated and actioned by the responsible party. The procedures and protocols are as follows:

- Depending upon the nature of the complaint, a revision to the procedures maybe required to avoid similar complaints;
- Actions required in response to complaints are to be effected in a timely manner. The response to complaints shall be communicated to the complainant by the responsible party via a formal letter; and
- The Environment and Community Manager is to maintain a register of all of the complaints, actions and responses.

17. Training and Awareness

Personnel and contractor new starter training and awareness programs, which include subsidence and environmental components, are undertaken within induction programs outlined within the site Environmental Management System. Records are to be maintained for personnel that have undertaken additional training in pipeline and water management on site.

18. Document Information

Relevant legislation, standards and other reference information must be regularly reviewed and monitored for updates and should be included in the site management system. Related documents and reference information in this section provides the linkage and source to develop and maintain site compliance information.

18.1 Related Documents

Related documents, listed in *Table 29* below, are documents directly related to or referenced from within this document.

Table 29 – Related documents

Number	Title
BULUG-1844516901-3119	*Wollombi Brook Flood Exclusion Levee Plan*
BULCX-2103827161-7624	*Bulga Coal Complex Erosion and Sediment Control Plan*
GCAA-625378177-10043	*Ground Disturbance Permit*

18.2 Reference Information

Reference information, listed in *Table 30* below, is *information* that is directly referred to for the development of this document.

Table 30 – Related documents

Reference
ANZECC (2000), "Australian and New Zealand guidelines for fresh and marine water quality Vol. 1, The guidelines" Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.
BHP (1980). "Saxonvale Mine Development Environmental Impact Statement". The Broken Hill Proprietary Company.
Barnett, B, Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peeters, L., Richardson, S., Werner, A.D., Knapton, A. and Boronkay, A., 2012. "Australian Groundwater Modelling Guidelines". Waterlines report 82, National Water Commission, Canberra.
Boughton, W.C. (2004). "The Australian Water Balance Model", Environmental Modelling and Software, vol.19, pp. 943-956.
David, K (2014), "Groundwater Management Plan for Bulga Optimisation Project (DRAFT) (Report KD2014/3)".
DECC (2008). "Managing Urban Stormwater – Soils & Construction Volume 2E Mines and Quarries". Department of Environment and Climate Change NSW, June.

Reference
Glencore (2013). Internal Standard "XCN SD ANN 0077 Erosion and Sediment Control Management".
Landcom (2004). "Managing Urban Stormwater: Soils & Construction Volume 1", 4th Edition, March.
RPS Aquaterra (2012). "Review of groundwater trigger levels (Ref: S26K/120a)".
Umwelt (Australia) Pty Limited (2019). "Bulga Optimisation Project, Modification 3 and Bulga Underground Modification 7 Statement of Environmental Effects, Appendix 11, Groundwater Impact Assessment".
Xstrata Coal, Bulga Coal (2012). "Erosion and Sediment Control Plan (BULCX-2103827161-7624)".

18.3 Change Information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in *Table 31* below.

Table 31 – Related documents

Version	Date	Change Details
1.0	22/10/2013	Document updated. Joel Jelbart and Paul Amity
2.0	28/06/2016	Document revision. Approval from NSW Department of Planning and Environment - letter included on the last page of document. R Northey
3.0	28/02/2017	SharePoint Migration.
Draft 1 4.0	June 2020	Construction infrastructure included and water balance revised. R Northey
Draft 2 4.0	September 2020	Updated to include July 2020 Modification
Draft 3 4.0	July 2021	Updated to address comments received from the DPIE on 13 May 2021, and comments received from NRAR on 26 April 2021.

Appendix A - DPIE Approval of Management Plan

Contact: Chris Knight
Phone: 02 6575 3405
Email: christopher.knight@planning.nsw.gov.au
Our ref: SSD - 4960

Ralph Northey
Bulga Coal Complex
PMB 8
SINGLETON NSW 2330

Dear Ralph,

Bulga Coal Complex –Approval of Water Management Plan.

Thank you for forwarding the Bulga Coal Complex - Water Management Plan to this Department for review as required under Condition 28, Schedule 3 of the Bulga Approval SSD-4960.

The Department has reviewed the Water Management Plan and found that it generally satisfies the requirements of the Approval. I would like to advise you that the Secretary has approved the Plan.

The Department requests that you provide a final pdf version which includes a copy of this letter of approval, to the Department by Friday 15th July 2016. Please note that this plan must be implemented by Friday 15th July 2016.

Please place a copy of the approved plan on your website in accordance with Condition 11, Schedule 5 of SSD -4960 by Friday 15th July 2016.

If you require further information or clarification on this matter please contact Chris Knight on 6575 3404 or by email to christopher.knight@planning.nsw.gov.au.

Yours sincerely
W Jones 21/6/16

Wayne Jones
A/Investigations (lead) Compliance Northern Region
as the Secretary's Nominee

Singleton Office: P.O. Box 3145, Suite 14, Level 1, 1 Civic Avenue Singleton NSW 2330
Website: www.planning.nsw.gov.au

Appendix B - Appointment of Experts Letter from DPIE

Planning, Industry & Environment

Mr Ralph Northey
Environment and Community Manager

Private Mail Bag 8
SINGLETON, NSW, 2330

13/02/2020

Dear Mr Northey

Bulga Optimisation Project (SSD 4960)
Approval of Water Expert

I refer to your request for the Secretary's approval of suitably qualified persons to prepare a revised Site Water Management Plan for the Bulga Optimisation Project (SSD 4960).

The Department has reviewed the nomination and information you have provided and is satisfied that this expert is suitably qualified and experienced. Consequently, I can advise that the Secretary approves the appointment of Mr Anthony Marzsaleck of HEC Consulting to prepare the revised Site Water Management Plan.

If you wish to discuss the matter further, please contact Melanie Hollis on 8712 2043.

Yours sincerely

Matthew Sprott
A/Director
Resource Assessments (Coal & Quarries)

As nominee of the Planning Secretary

Appendix C - CHPP Clean Water Detention Basin Design