ABEL UNDERGROUND COAL MINE

WATER MANAGEMENT PLAN

CARE AND MAINTENANCE

Version 4

Date: 3rd June 2019

version	*issue date*	*Section/s modified*	*Reason for modification (including whether review or minor amendment)*	*modified by*
1	07.12.2007	Original	Original Water Management	SP
2	14.3.2008	All	Incorporate comments received from original	SP
3	04.08.2014	All	Review and update plan to incorporate MOD3 impacts to water.	Donaldson Coal, Evans & Peck, Andrew Fulton
4	03.06.2019	All	Update water management at Abel Mine for Care and Maintenance phase.	Donaldson Coal Reviewed; P.Dundon
Document Owner (Role)		Environment and Community Relations Superintendent	***Document Approver (Role)***	Operations Manager
Document Owner (Name)		Phillip Brown	***Document Approver (Name)***	William Farnworth

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Appendix 1 Consultation Correspondence

1. Introduction

1.1 Purpose and Scope

The Abel Underground Mine is owned and operated by Donaldson Coal Pty Limited (Donaldson Coal), a wholly owned subsidiary of Yancoal Australia Limited. Project Approval 05_0136 for the Abel Underground Mine was granted in 2007 pursuant to section 79J of the New South Wales (NSW) Environmental Planning and Assessment Act, 1979.

In December 2013, the Minister approved Abel Upgrade Modification (Mod 3), as a modification of Project Approval 05_0136, for upgrades to underground mining operations at the Abel Underground Mine.

This 2019 Water Management Plan (WMP) for the Abel Underground Mine is a revision of the 2014 Water Management Plan and provides an overarching management system to ensure that Donaldson Coal maintains best practice controls to manage potential surface water and groundwater impacts during operations. The 2019 WMP includes general requirements for implementation, monitoring and auditing in accordance with the requirements of the approval for Mod 3 whilst the mine is in care and maintenance.

The 2019 WMP has been prepared/reviewed by a suitably qualified and experienced person, whose appointment has been approved by the Director- General, comprising of Donaldson Coal Pty Ltd (agency consultation)

1.2 Project Location and Description

Donaldson Coal owns and operates the Abel Underground Mine which commenced underground mining in 2008. The mine has an approved maximum production capacity of 6.1 million tonnes per annum (Mtpa) run-of-mine (ROM) coal and an operating life of greater than 20 years. The approved project allows for two different mining methods:

- Continuous miner based bord and pillar systems, using the pillar extraction technique. This method allows the amount of coal being extracted to be varied so that subsidence can be controlled and a range of surface features protected.
- Longwall and shortwall mining.

The Abel Coal Mine has been in care and maintenance since April 2016. The majority of Donaldson Coal Mine has been rehabilitated. Both mines now use the Abel surface facilities for administrative and care and maintenance activities.

Whilst in care and maintenance, the operation has minimal employees and is staffed five (5) days a week on day shift only. Noise generating activities are minimal with personnel only onsite between 7am and 7pm.

Water management is a key function of the current activities onsite. The pumping of water from the underground and from the Square and West Pits to the Big Kahuna continues during care and maintenance.

The underground lease area, shown on Figure 1, extends southwards from John Renshaw Drive towards George Booth Drive. It is bounded on the eastern side by the M1 Motorway and on the western side by a geological feature in the vicinity of Buttai Creek.

Coal is approved for extraction from the Upper Donaldson and Lower Donaldson coal seams. These seams dip downwards at approximately 5° towards the south of the lease area. Therefore, as mining progresses southwards, mining becomes deeper with the depth of cover ranging from 30 m in the northern area immediately adjacent to John Renshaw Drive, to 450 m at the southern boundary.

Access to the underground reserves is from the Donaldson West Pit high wall located north of John Renshaw Drive. ROM coal is transported via conveyor through the high wall to the stockpile areas located within the existing Donaldson West Pit.

From the stockpiles, coal is transported to the existing Bloomfield Coal Handling and Preparation Plant (CHPP) by truck, where it is processed and loaded onto rail. The Bloomfield CHPP also processes coal from its own open cut operation. The Mod 3 approval provided for the subsequent construction of a conveyor to replace truck haulage when production and market conditions justify its construction.

The major components of the Abel Coal Project are listed in Table 1.

Table 1: Abel Coal Project Major Components (MOD 3)

Aspect	Description
Mining and Reserves	Extraction from a number of adjacent groups of mining panels in the Upper Donaldson and Lower Donaldson Seams, using a combination of continuous miners in flexible bord and pillar systems with associated pillar extraction together with longwall/shortwall extraction in specific areas. Mineable reserve of 45-55 Mt and an underground mining area of around 2,750 ha.
Project Life	An expected project life of 21 years including 20 years of mining.
Coal Production	Abel Underground Mine can produce up to 6.1 Mtpa of ROM coal, which, following washing, can provide up to 5 Mtpa of product coal.
Coal Washing	The project approval included continued use and upgrading of the Bloomfield CHPP to allow total processing of up to 8.5 Mtpa. Total product coal from the CHPP would then be up to 6.5 Mtpa.
Construction	Donaldson Coal has approval to construct the following additional infrastructure for the Abel Underground Mine (Stage 2 of construction): • a higher capacity stackout conveyor and larger ROM coal stockpile in the open cut void; and • workshops, storage areas, offices, bathhouse and car parking facilities closer to the Abel Underground Mine portals. Donaldson Coal also has approval to construct and operate an overland conveyor from the ROM
Water Demand and Supply	Water supply for the Abel Underground Mine comprises surface runoff that is directed to a storage on site (Big Kahuna dam) and mine water from underground operators. Excess water from the Abel Underground Mine is currently transferred to Bloomfield CHPP under an agreement between the operations.
Mine Access	Access to mine surface facilities is via the existing Donaldson mine access road to John Renshaw Drive.

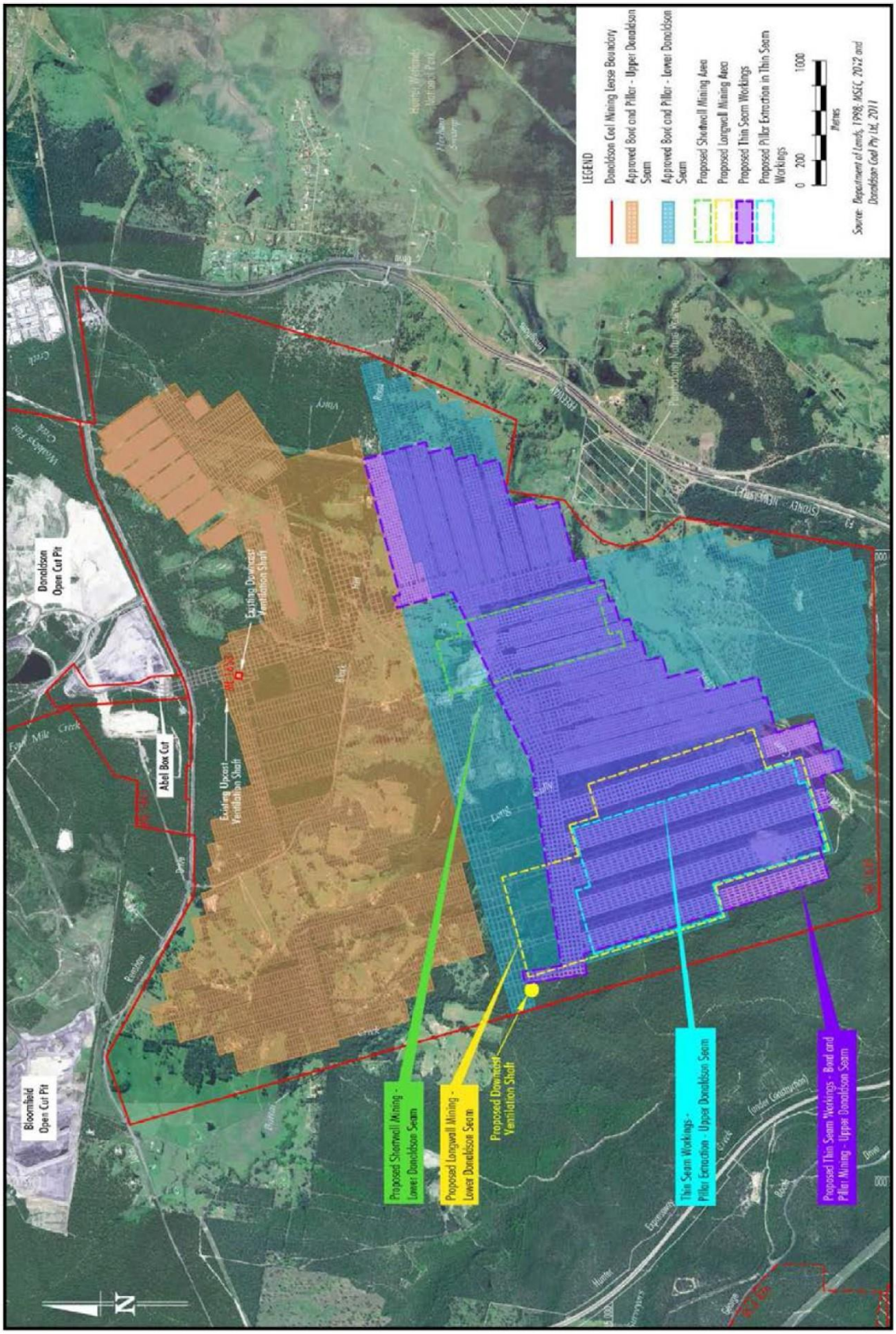


Figure 1: Abel Underground Mine Lease Area

1.3 Water Management Plan Objectives

The main objectives of this revised Water Management Plan are to:

- meet the Minister for Planning and Infrastructure's relevant Conditions of Approval (CoA) whilst in Care and Maintenance;
- describe how the relevant obligations and commitments identified in the Abel Underground Mine Environmental Assessment (EA), Modifications and Statement of Commitments are implemented during Care and Maintenance;
- identify and detail appropriate management measures for compliance with relevant environmental legislation; and
- identify and detail appropriate management measures for surface and groundwater related risks associated with the Care and Maintenance of the Abel Underground Mine.

1.4 Water Management Plan Requirements

1.41 Project Approval

Schedules 4 and 6 of Mod 3 CoA outline the Minister's requirements for a WMP for the Abel Underground Mine. The Mod 3 Approval is included in **Appendix A**, and the relevant requirements are reproduced in Table 2, together with a cross-reference to the location in this WMP where each requirement is addressed.

Table 2: Relevant Conditions of Approval

Condition of Approval Requirements	WMP Cross Reference
Schedule 4 Condition 17: Water Management Plan	
The Proponent shall prepare and implement a Water Management Plan for the project, for all areas that are not, or will not, be subject to condition 4 of schedule 3, to the satisfaction of the Director-General. This plan must be prepared in consultation with NOW and EPA, by suitably qualified and experienced persons whose appointment has been endorsed by the Director-General, and submitted to the Director-General for approval within 6 months of the date of approval of MOD 3. This plan must include:	Agency consultation - Section 1.6
(a) a comprehensive water balance for the project that includes details of: • sources and security of water supply; • water make in the underground workings; • water use; and • any water discharges; and	Section 3.3
(b) management plans for the Surface facilities sites, that include: • a detailed description of water management systems for each site, including: - clean water diversion systems; - erosion and sediment controls; and - any water storages; • measures to minimise potable water use and to reuse and recycle water; and • monitoring and reporting procedures.	Section 3.5
Schedule 6 Condition 2: Management Plan Requirements	

The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 3.6, Section 4.1
(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 project or any management measures;	Statutory requirements - Section 2 Performance measures / criteria - Section 3 and Section 4 Specific performance indicators - Table 19
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Detailed in Section 3 and Section 4, and Table 19.
(d) a program to monitor and report on the: (i) impacts and environmental performance of the project; (ii) effectiveness of any management measures (see c above);	Surface Water monitoring - Section 3.6 and management measures - Section 3.643.and Section 5 Groundwater monitoring - Section 4.2 and management measures –
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Contingency plans are summarised in Table 5.1. Contingency plans - Section 5.
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Addressed in Section 5
(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	Reporting protocols - Section 7.
(h) a protocol for periodic review of the plan.	Periodic review - Section 6.

1.42 Statement of Commitments

The relevant obligations and commitments in the EA and Statement of Commitments (listed in Appendix 5 of the Project Approval) are summarised in **Table 3**, together with a cross-reference to the location in this WMP where the requirement is addressed.

Table 3: Relevant Statements of Commitment

Commitment	WMP Cross Reference
5. Surface Water Management for subsidence impacts from underground mining that impact: • Schedule 1 Streams • Schedule 2 Streams • Pambalong Alluvium • Rainforest Communities • Surface Water Management Plan	Addressed by specific Surface Water Management Plans for each proposed area of mining. Base line data and monitoring requirements detailed in Section 3.6 and Section 4.2.
6. Surface Water Management – Bloomfield CHPP and the Abel Underground Pit Top Facilities	Section 3
7. Surface Water Monitoring Program	Section 3.6
8. Groundwater Monitoring Program	Section 4.2

1.5 Structure of this Water Management Plan

This WMP provides an overview of the conditions within and surrounding the mine in sufficient detail to provide the basis for the relevant management actions. Supporting technical details are provided in appendices. The WMP is structured as follows:

- Section 2: Statutory Requirements
- Section 3: Surface Water Management
- Section 4: Groundwater Management
- Section 5: Management Measures and Contingency Plan
- Section 6: Review and Improvement of Environmental Performance
- Section 7: Reporting
- Section 8: References

Supporting technical details for investigations and data collected since the submission of the EA in 2011 are provided in the following appendices:

- Appendix A Ministers Conditions of Approval (EA Mod 3)
- Appendix B Agency Consultation

1.6 Agency Consultation (To be updated following all comments)

Agency Consulted	Date	Nature of Consultation
NSW Office of Water		
Environment Protection Authority		

2. Statutory Requirements

Legislation, plans and policies relevant to this WMP include:

- Environmental Planning and Assessment Act 1979 (EP&A Act) administered by the Department of Planning & Environment (D0PE);
- Protection of the Environment Operations Act 1997 (POEO Act) administered by the NSW Environment Protection Authority (EPA);
- Water Act 1912, administered by NSW Office of Water (NOW);
- Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 (the HUAWSP) administered by NOW;
- Water Management Act 2000, administered by NOW; and
- NSW Aquifer Interference Policy, administered by NOW.

2.1 EP&A Act

The Abel Underground Mine was approved under Part 3A of the EP&A Act by the NSW Minister for Planning on 7 June 2007 (Project Approval 05_0136) and therefore constitutes a "transitional Part 3A project" pursuant to the savings and transitional provisions in Schedule 6A of the EP&A Act.

Clause 3 of Schedule 6A provides that Part 3A of the EP&A Act continues to apply to, and in respect of, "transitional Part 3A projects" following its repeal. That is, Part 3A of the EP&A Act continues to apply to the Abel Underground Mine, notwithstanding its repeal.

Approval for the Modification was granted as Modification 3 to the Abel Underground Mine Project Approval 05_0136 under section 75W of the EP&A Act in December 2013. The consolidated Ministers Conditions of Approval are provided in Appendix A.

2.2 Environment Protection Licence

Donaldson Coal holds two Environmental Protection Licences (EPLs) under the POEO Act:

- EPL 11080 Donaldson Open Cut Mine (version 2 December 2011); and
- EPL 12856 Abel Underground Mine.

For purposes of site water management and discharge, all relevant conditions are contained in EPL 11080. Discharge to Four Mile Creek is permitted under the following conditions:

- 40 ML each day for the 5 days following 10 mm of rain within 24 hours;
- Maximum salinity measured as Electrical Conductivity (EC) 2,000 µS/cm;
- pH range 6.0 – 8.0; and
- Total suspended solids (TSS) <50 mg/L.

2.3 Other Relevant Licences

Donaldson Coal currently holds Water Access Licences 41522 and 41525 issued under s87B of the Water Management Act which approves the access to 300 and 500 units respectively.

The Water Sharing Plan relevant to the Donaldson Coal Mining area is the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Source 2016. Licensing under this water source may be required where aquifer interference activities take flow from connected surface water sources.

3. Surface Water Management

3.1 Integration with Bloomfield Colliery and CHPP

The water management system for the Abel Underground Mine is integrated with the water management system on the adjacent Bloomfield Colliery that serves the mine itself and the Coal Handling and Preparation Plant (CHPP). ROM coal was previously transferred from Abel Underground Mine to Bloomfield for processing. Water from Abel is transferred to Bloomfield for use as part of the coal processing operations.

The Environmental Assessment for Mod 3 provided the interim option of storage of fine tailings from the CHPP being disposed of at the Donaldson Square Pit until the Bloomfield S-Cut (South) became available.

Formal agreements are in place between Donaldson Coal and Bloomfield including protocols relating to the transfer of water from Abel to Bloomfield.

3.2 Surface Water Management Principles

The surface water management principles for the Abel Underground Mine are detailed in the Statement of Commitments and summarised below:

- separation of clean and dirty water;
- minimisation of demand for fresh water supply by recycling water collected on the site;
- storage of recycled water on-site to reduce water consumption during operation of the proposed development;
- management and control of stormwater flows;
- minimisation of sediment generation, soil erosion and transport off-site;
- minimise discharge from water storages on the site; and
- discharge from licensed discharged points in accordance with licence conditions.

3.3 Surface Water Management System

Figure 2 below provides an overview of the current water management system for the Abel Underground Mine, including the relevant aspects of Bloomfield water management system, while Figure 3 shows the physical layout of the various mine pits and water storage dams.

The surface water management system for the Abel Underground Mine comprises the following aspects:

- All surface water runoff is directed to the Big Kahuna dam (400 ML) from:
  - Mine surface facilities area,
  - West Pit (containing ROM stockpiles) and
  - Square Pit;
- Until August 2013, all groundwater draining into the underground mine was pumped to a sump in the West Pit and then transferred to the Big Kahuna dam. During Care and Maintenance, water is pumped from the underground directly to the Big Kahuna Dam. The sites' water system does have the flexibility to pump from the underground to the west or square pit;
- Water for underground operational purposes is drawn from Hunter Water

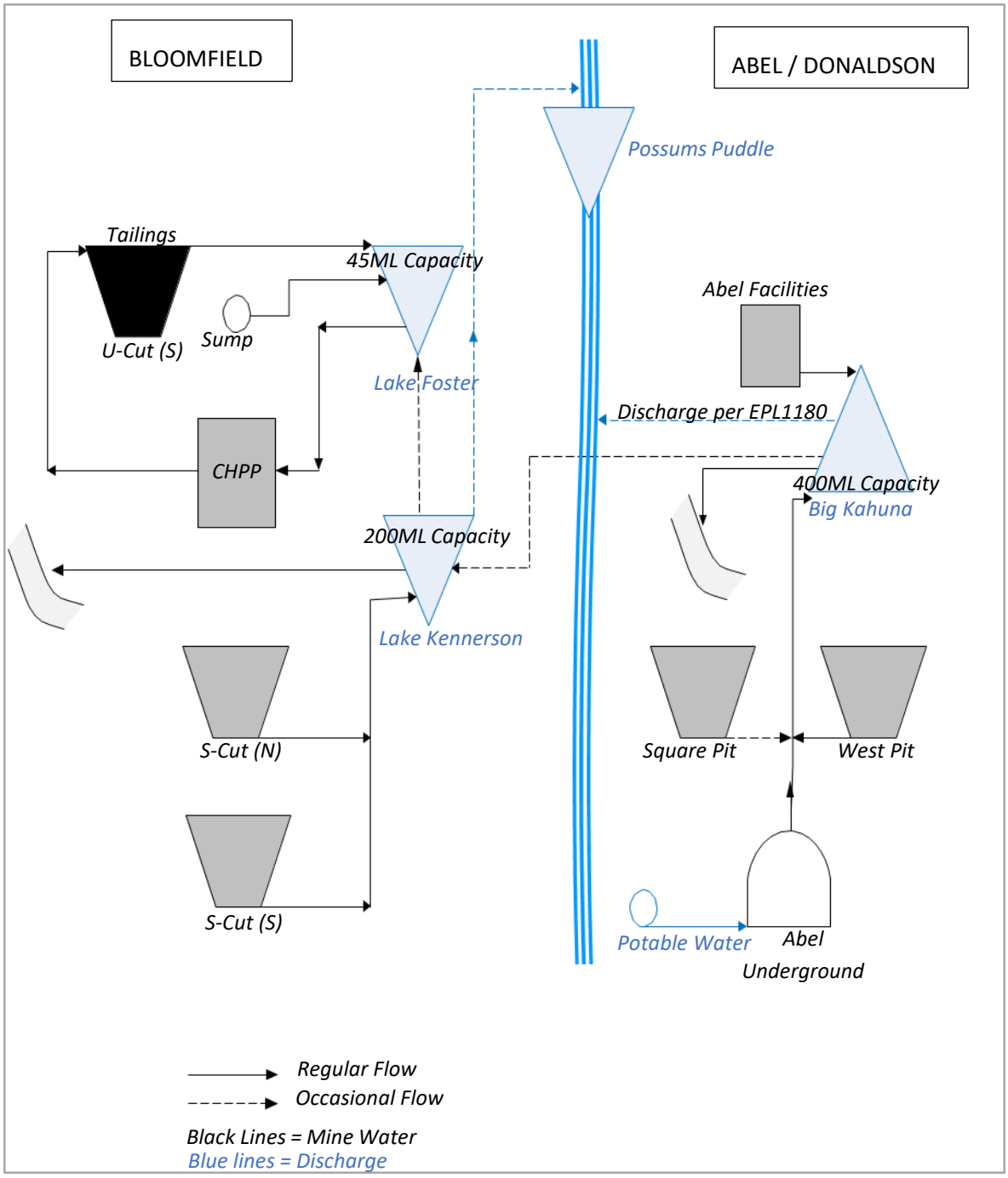
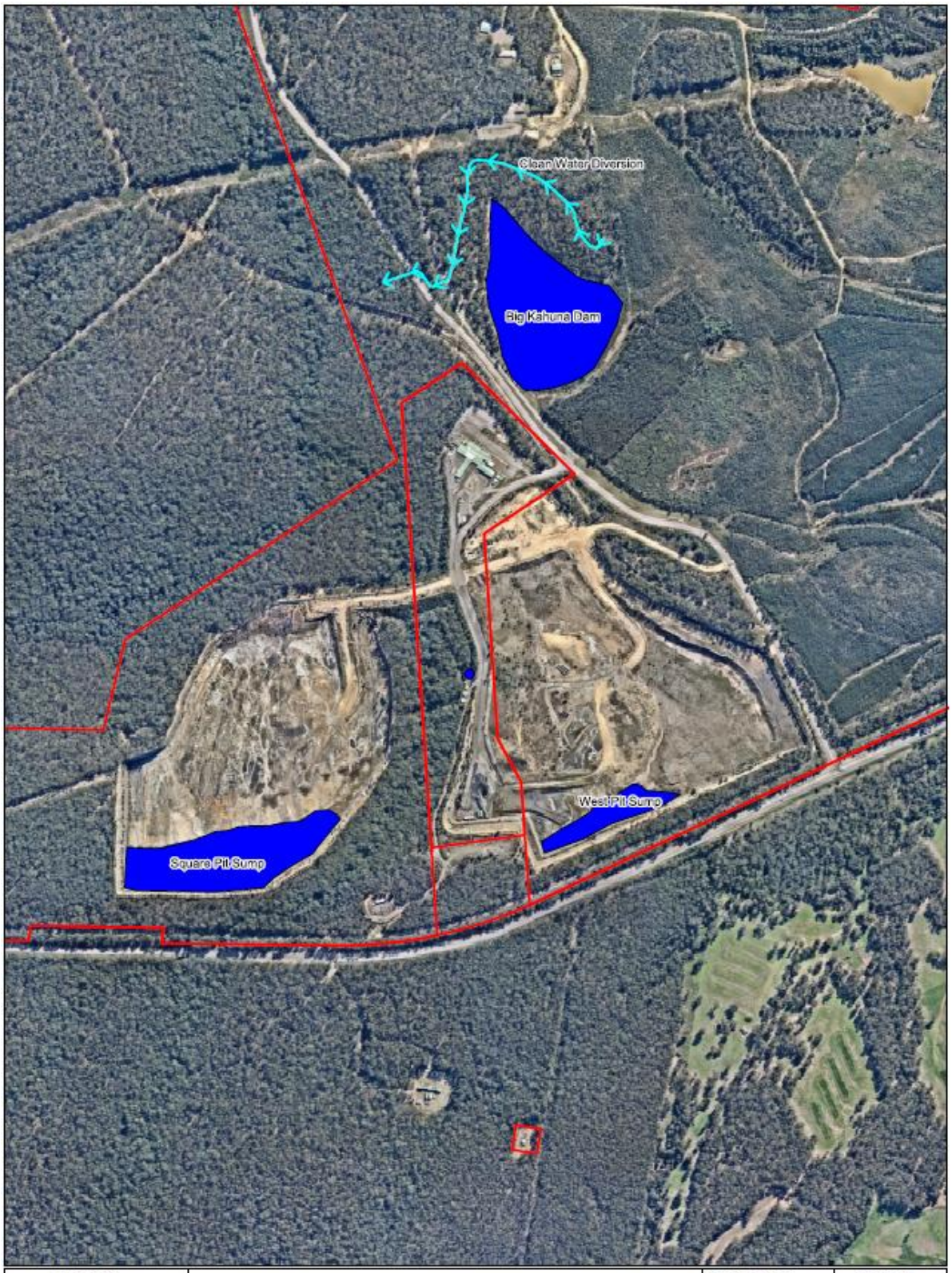


Figure 2 Existing Water Management System

Figure 3 ***Location of Current Water Storage Dams, Tailings Dam and Mine Pits***

*(**Note:** Since this photograph was taken, the Donaldson East Pit has been backfilled and rehabilitated)*



Legend
Water Storage
Clean Water Diversion
Mine Lease Boundary

Abel Mine Water Storages and Clean Water Diversion

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Figure 3.1

DONALDSONCOAL Part of the Yancoal Australia Group

3.4 Site Water Balance and Discharge

3.41 Rainfall and Evaporation

Average monthly rainfall and evaporation data in the vicinity of the Abel Underground Mine is provided in **Table 4**. This data demonstrates that at the Abel Underground Mine, (on average) evaporation exceeds rainfall by about 800 mm per year, and rainfall generally only exceeds evaporation in June.

Table 4 Average Monthly Rainfall and Evaporation Statistics

Month >	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm) (Morpeth PO May 1907 – Nov 2018)	93	98	112	83	72	83	62	55	57	63	66	88	934
Pan Evaporation (mm) (Williamtown 1974 - 2016)	214	174	155	114	84	75	81	112	141	174	189	223	1,734

3.42 Sources and Security of Water Supply

The water management system associated with the Abel Underground Mine utilises the Big Kahuna dam to store water for use by the mine and as a temporary store for either transfer to Bloomfield CHPP or discharge to Four Mile Creek when conditions permit.

The sources of water contributing to the Abel Underground Mine water balance are:

- Water make in the underground workings;
- Surface runoff from the surface operations (West Pit and Square Pit);
- Surface runoff from the Mine Facilities area (workshops and offices); and
- Direct rainfall and evaporation from the Big Kahuna dam.

While the mine water make has shown significant variation in recent years (see Section 3.43), it remains the dominant factor in the overall site water balance and ensures security of supply for the water needed for mine operations.

3.43 Water Make in the Underground Workings

The EA (Mod 3) Groundwater Assessment (Aquaterra, 2012) detailed the groundwater modelling undertaken for the Abel Underground Mine.

Since Abel entered Care and Maintenance, observations within the underground working is that there has been no additional water make. The original predictions (Aquaterra, 2012) were that water make would reach a peak of approximately 2,300 ML/year in about 2017 (see Figure 4). However, due to the site being in Care and Maintenance, this has led to a significant reduction in the rate of water make compared to predicted rates.

A further factor that has influenced the volume of water pumped out of the mine has been that water has been allowed to accumulate in parts of worked-out areas of the mine (Panels 1-9 and the East Mains) since August 2013. The total volume capable of being stored in the worked-out areas is estimated to be 390 ML, but the volume

accumulated to date is not known because that area of the mine has been closed off. However, once the water storage capacity is filled, the outflow from this section of the mine will continue to be pumped to the surface.

The mine meters the volume of water pumped into, and out of, the mine. The red line on Figure 4 shows the monthly volumes of net outflow (expressed as ML/year) for comparison with the modelled mine groundwater inflows. It can be seen that there is a significant discrepancy between the 2012 modelling and the volume actually pumped out as a result of:

- Reduced rate of mine expansion;
- Storage of water in old workings.

This discrepancy will be reviewed in the next review of the mine water model when underground mining recommences.

Figure 4, shows the recorded mine outflows and inflows since August 2012. Water into the mine dropped to insignificant levels when the site entered Care and Maintenance. Water pumped out has been variable and is subject to campaigns to reduce water levels in key inspection areas. The analysis is limited by the fact that the volume of water retained underground since August 2013 is unknown and accordingly the water make has been termed 'apparent'.

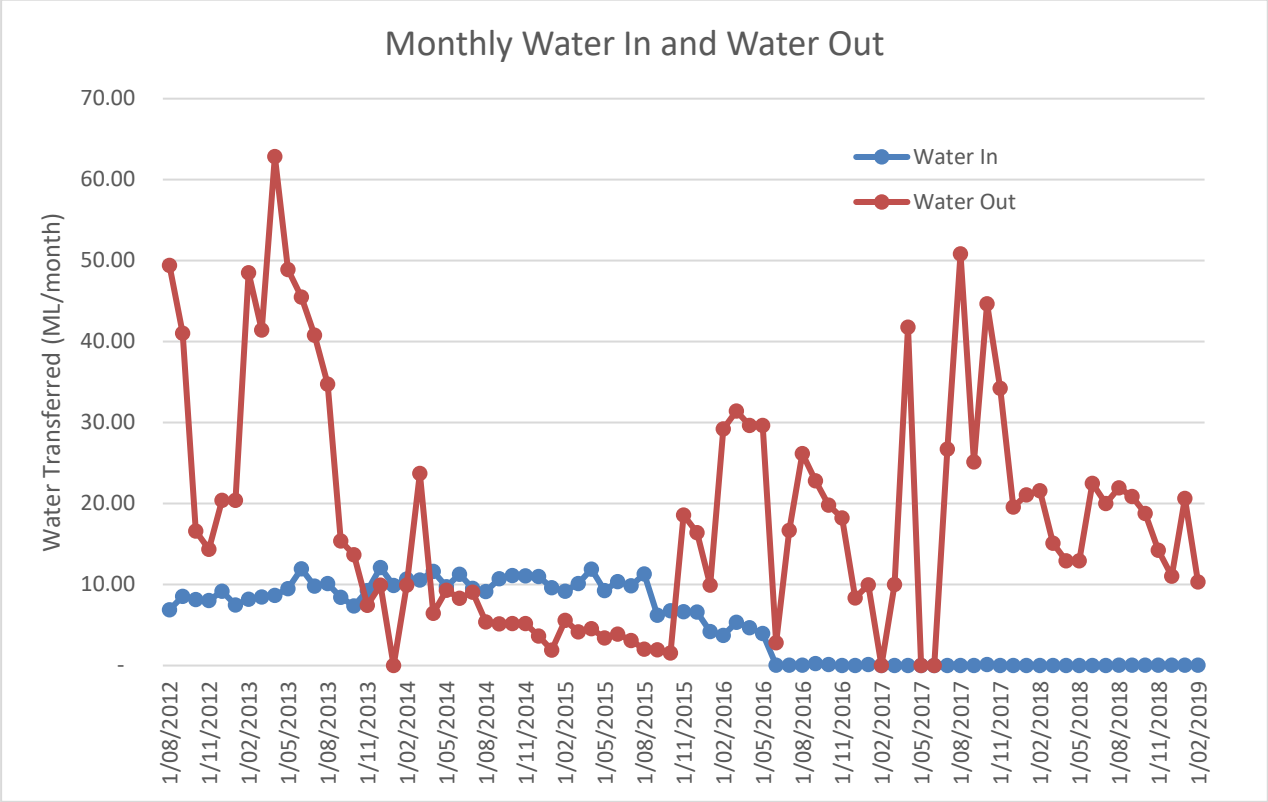

Figure 4 Water Transferred in Underground Workings

The salinity of the mine outflow is greater than 2,000 µS/cm and is therefore unsuitable for discharge to Four Mile Creek under the existing licence conditions without pre-treatment or shandying.

Although the current volume of water being pumped from the mine is significantly less than predicted by the groundwater modelling for the Environmental Assessment, for the reasons set out above, there remains a degree of uncertainty regarding the actual quantity of groundwater make that will need to be managed in the future.

Notwithstanding, to manage water make in the underground workings, Donaldson Coal will:

- Continue to monitor the quantity and quality of groundwater pumped from the underground workings;
- Assess the volume of water held in old workings;
- Recalibrate the groundwater model regularly (at a minimum every two years when mining during the period that inflows continue to increase); and
- Actively assess adaptive management strategies for storage, treatment and disposal of groundwater.

Donaldson Coal will further assess and implement options for treatment and disposal of excess mine water when underground mining recommences to ensure that there is no uncontrolled discharge to Four Mile Creek.

3.44 Water Use and Reuse

At full production, underground mining operations were expected to require approximately 1.8 ML/day (660 ML/year):

- Longwall mining - an average of 1 ML/day (not currently operating);
- Shortwall mining - an average of 0.5 ML/day (not currently operating); and
- Ongoing bord and pillar operations - an average of 0.3 ML/day.

It should be noted, however, that this water is effectively recycled apart from losses attributable to the increased humidity of the vent air compared to the inflow (estimated to be of the order of 55ML/year).

As described in Section 3.42, all stormwater runoff within the Abel Underground Mine operational areas is contained and directed to the Big Kahuna dam. The Big Kahuna dam is the main water source for all mine water.

Historically, water for underground mine use has been sourced from the Hunter Water supply at a rate of approximately 300 kL/d. This figure during Care and Maintenance has reduced to approximately 2kL/d.

During care and maintenance, potable water will continue to be minimised using the following strategies;

- Regular inspections of potable water lines underground to ensure no leaks or breaks.
- Potable water line is turned off and isolated when personnel are not underground.
- Daily monitoring of potable water usage to determine trends and identify elevated usage.
- Repairing leaks in the potable water system as soon as they are identified.

3.45 Water Discharge

Surface runoff and groundwater make to the Able Underground Mine are directed to the Big Kahuna dam. Discharge to Four Mile Creek from the Big Kahuna dam is permitted under EPL 11080 under conditions detailed in Section 2.2

Figure 5 shows the electrical conductivity and pH in Big Kahuna dam since mid-2004. Although underground mining commenced in 2008, it was not until 2010 that groundwater make became a significant contributor to the volume held in Big Kahuna dam that, until that point, had been primarily captured runoff from open-cut operations (now complete).

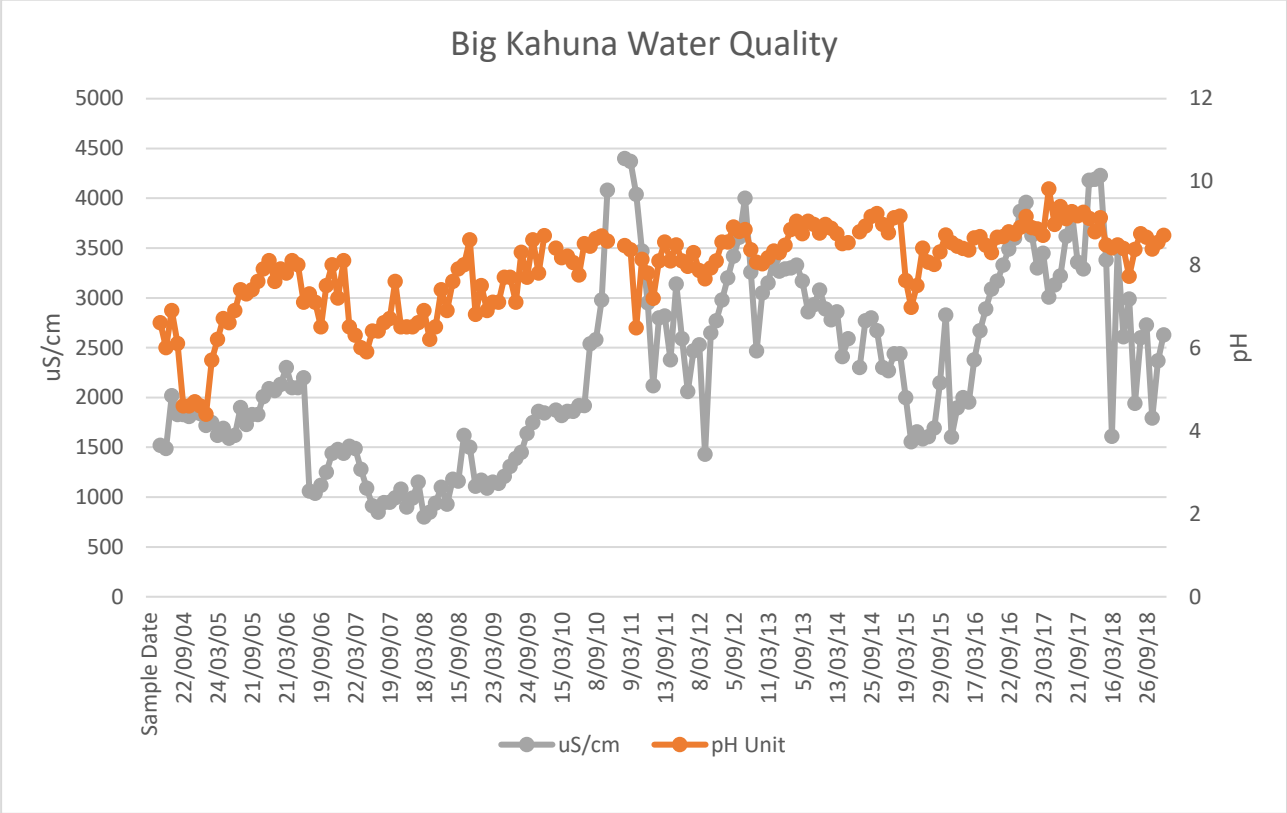

Figure 5 Electrical Conductivity and pH in Big Kahuna

As shown in Figure 5 the water quality in the Big Kahuna dam exceeds the EPL11080 discharge limits (salinity < 2,000 µS/cm, and pH 6.0 – 8.0) due to the high salinity and pH of the high proportion of groundwater.

Under the Integrated Water Management System, Donaldson Coal will continue to transfer water from the Big Kahuna dam to Lake Kennerson (Bloomfield) at an average rate of 420 ML/year.

3.46 Water Balance

Although, as shown in Figure 3, the mine water management system for the Abel Underground Mine is relatively simple, the day-to-day and month-to-month water balance is highly variable on account of:

- Climate variability leading to variability of rainfall runoff;
- Variation in mine water reporting to the surface resulting from variation in groundwater make depending on geological structures (dykes, etc) as well as the way water is managed and stored underground.

As shown in Figure 4, on a month-by-month basis the apparent mine water make is highly variable. However, on an annualised basis (Table 5) the main components of the underground mine water balance have been relatively constant since 2011. The reduction in the apparent groundwater make in 2014 and 2015 can be accounted for by the fact that from August 2013, water draining into some old workings was being retained within the mine and not pumped out.

Table 5 Annual Underground Water Balanced

Year	Water In (ML/year)	Water Out (ML)	Apparent Make (ML)
2011	113	431	330
2012	105	446	352
2013[1]	114	369	278
2014	126	91	-35
2015	108	67	-41
2016	22	245	223
2017	0.33	263	263
2018	0.25	213	213

Note 1: Does not account for underground storage of water commencing August 2013.

Based on the average inflow and outflow listed in Table 5, and the various water use and runoff estimates contained in Section 3.44, Table 6 provides an estimated water balance for 2018.

Table 6 - 2018 Water Balance

Source / Destination	Gains (ML)	Losses (ML)
Groundwater make to underground workings	213	
Potable supply to underground workings	0.25	
Losses from underground operations		55
Runoff from the West Pit	119	
Runoff from Abel Facilities	12	
Haul road dust suppression		25
Rainfall (Big Kahuna dam)	0	
Evaporation (Big Kahuna dam)		84
Discharged to Four Mile Creek		0
Sub-total	**344**	**164**
Transfer to Bloomfield		710
Decrease in storage		32
Balance	**376**	**916**

3.5 Erosion and Sediment Control

Erosion and sediment controls for the Abel Underground Coal Mine have been implemented for the following works:

Surface Facilities

Stormwater runoff from the operational roads and pit entrance drain to a sump in the West Pit from where it is transferred via pipeline to the Big Kahuna dam. The runoff from the Abel administration area including the workshop, car parks and hardstand area drains directly to the Big Kahuna Dam.

The open voids of the Square Pit and West Pit are internally draining. Topsoil bunding along the limits of disturbed areas prevent clean water entering disturbed lands. As all disturbed lands report to either the West or Square pits, there is not a requirement for sediment dams at Abel.

A clean water diversion around the Big Kahuna Dam limits the volume of clean water runoff entering the dam. This diversion is well vegetated and drains from east to west. This clean water diversion and water storages are shown in Figure 3.1.

Proposed Overland Conveyor

During Care and Maintenance of the Abel underground mine, there is no plan to construct the approved overland conveyor.

An Erosion and Sediment Control Plan (ESCP) will be prepared if a decision is made to construct the approved conveyor.

The ESCP will outline the measures that will be implemented to ensure that no undue pollution of Four Mile Creek occurs during construction of the conveyor between Abel and the Bloomfield CHPP. The ESCP will be prepared in accordance with guidelines contained in "Managing Urban Stormwater: Soils and Construction" (4th Edition) (Landcom, 2004).

3.6 Surface Water Monitoring Program

An Integrated Environmental Management Program (IEMP) was developed in 2007 to collect and share data between Donaldson, Abel, Bloomfield and Tasman Mines.

This section of the Water Management Plan focusses on the monitoring undertaken by Donaldson Coal for the Abel Underground Mine.

3.61 Surface Facilities Discharge

The Abel Underground Mine has one licensed discharge point under EPL 11080, being from the Big Kahuna dam (location shown on Figure 3).

As required by EPL 11080 in the event of any licenced discharge to Four Mile Creek surface discharges will be monitored as set out in Table 7 below.

Table 7 Discharge Event Monitoring Locations and Parameters

Site	Location	Frequency	Parameters
Big Kahuna dam	Discharge pipe at Four Mile Creek	Daily grab sample during discharge and laboratory analysis for the range of parameters listed.	• Total suspended solids (mg/L) • Total dissolved solids (mg/L) • pH • Conductivity (µs/cm)
EM2	Four Mile Creek Downstream (approx. 200 m downstream of discharge point)	Daily grab sample during discharge and laboratory analysis for the range of parameters listed.	• Non-filterable residue (NFR) • Turbidity (NTU) • pH • Conductivity (µs/cm) • Filterable iron (mg/L)

3.62 Water Quality Baseline

3.621 Existing Water Quality Monitoring Program

The Abel Underground Mine is located within the catchment of the Hunter River. As shown on Figure 6, there are five distinct sub-catchments across the Abel Underground Mine lease area:

- Four Mile Creek;
- Weakleys Flat Creek;
- Viney Creek;
- Buttai Creek; and
- Blue Gum Creek.

All of these main watercourses are classed as Schedule 1 Streams (as defined in Management of stream/aquifer systems in coal mining developments, DIPNR 2005).

Monitoring currently being undertaken by Abel Mine includes five sites specified in the Statement of Commitments, outlined in Table 8. The locations of these sites are shown on Figure 6.

Table 8 Water Quality Monitoring Sites and Locations

Site Identifier	Location	Commencement of monitoring	Commencement of mining in catchment
EM1	Four Mile Creek at John Renshaw Drive	July 2000	July 2013
EM3	Weakleys Flat Creek at John Renshaw Drive	July 2000	July 2010
Site 9	Blue Gum Creek at Stockrington Road u/s	June 2007	N/A
Site 10	Blue Gum Creek at Dog Hole Road	June 2007	N/A
Site 1	Buttai Creek at Lings Road	June 2007	N/A
Site 11	Viney Creek at John Renshaw Drive	June 2007	July 2010

The naming convention for the water quality monitoring sites set out in Table 8 is consistent with the naming conventions in the IEMP (2007). The Annual Review produced by Donaldson Coal have introduced an additional naming convention based on the catchment name, for example, Four Mile Creek Upstream (FMCU) corresponds with EM1. For consistency, the naming conventions used in the IEMP are used in this Water Management Plan.

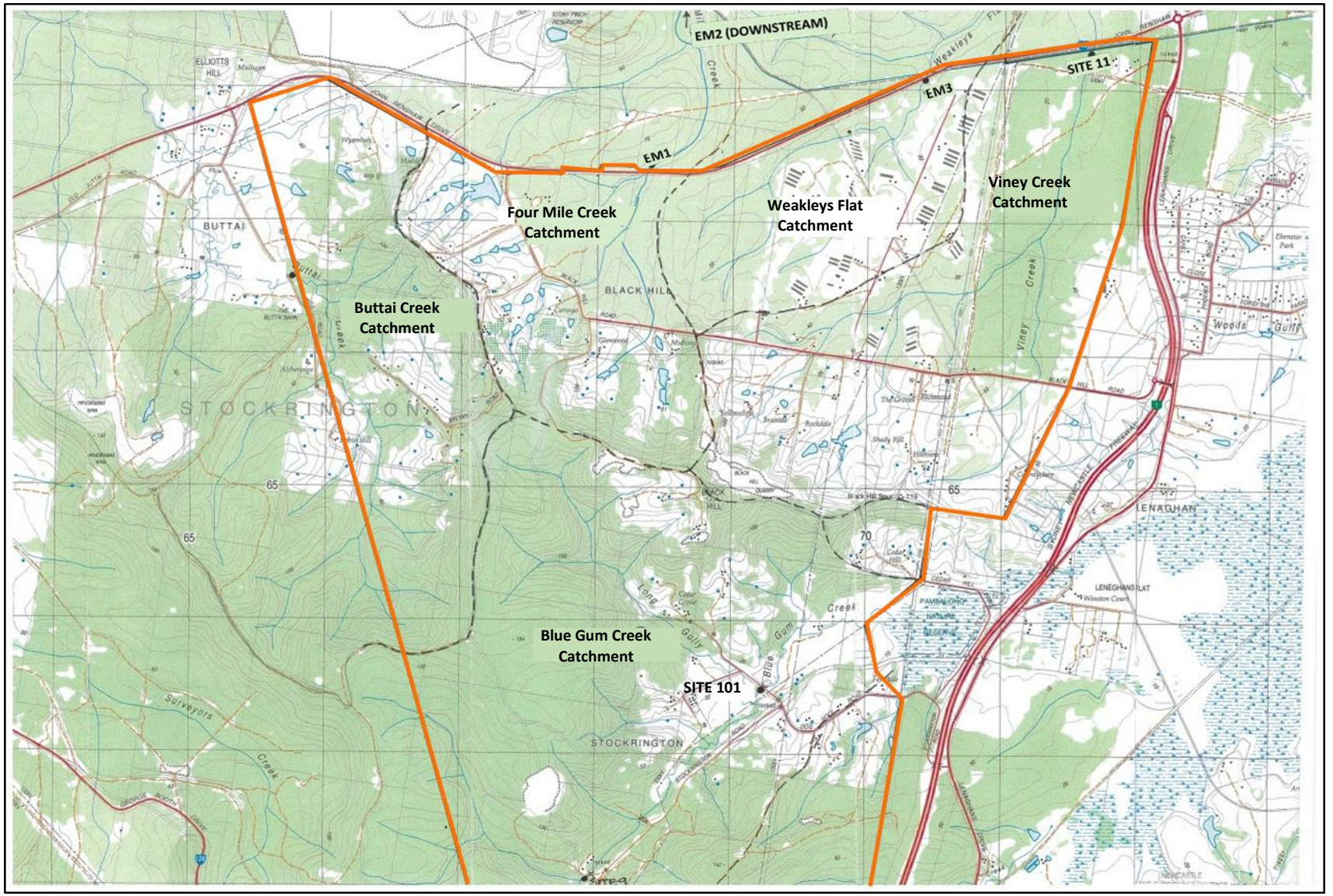

Figure 6 Abel Underground Mine Catchments and Surface Water Monitoring Sites

3.622 Environmental Performance Indicators

The ANZECC Guidelines for Fresh and Marine Water Quality 2000 (the Guidelines) set out the methodology for determining trigger values for assessing water quality impacts for watercourses. The Guidelines also state that two years of monthly sampling is regarded as sufficient to provide an indication of the local water quality variability and to provide a basis for derivation of 'trigger' values appropriate to conditions in a particular creek system. For physical and chemical stressors in slightly or moderately disturbed ecosystems, such as that surrounding the Abel Underground Mine, the Guidelines recommend the use of the 20th and 80th percentile values of the data obtained from an appropriate reference system as the basis for revised 'trigger' values.

Where more than 2 years of data has been collected in the catchments overlying the Abel Underground Mine lease area, a 'trigger' values has been calculated in accordance with the methods outlined in the ANZECC Guidelines. Table 9 below summarises the baseline water quality statistics.

Table 9 Summary of Historic Water Quality Statistics (Pre-mining)

	ANZECC Default trigger	Statistic	Four Mile Creek	Weakleys Flat Creek	Blue Gum Creek	Blue Gum Creek (Long Gully)	Buttai Creek	Viney Creek
			EM1	EM3	Site 9	Site 10	Site 1	Site 11
pH (pH Unit)	6.5 - 8.0 *	Number of samples	144	118	35	73	71	35
		Minimum	5.9	5.6	6.8	6.7	5.8	6.6
		20th Percentile	6.5	6.6	7.0	7.0	6.6	6.8
		Median	6.8	6.9	7.2	7.2	6.9	7.0
		Average	6.8	6.9	7.2	7.2	6.9	7.0
		80th percentile	7.1	7.2	7.3	7.5	7.1	7.1
		Maximum	7.9	7.7	7.7	7.8	7.4	7.5
EC (uS/cm)	125 - 2200 *	Number of samples	144	117	35	73	71	35
		Minimum	100	136	307	248	166	520
		20th Percentile	235	235	531	798	492	920
		Median	425	550	860	1210	699	1320
		Average	414	786	885	1175	759	1328
		80th percentile	580	1116	1144	1496	1060	1704
		Maximum	985	4810	1790	2120	1760	2300
TSS (mg/L)	N/A	Number of samples	141	116	35	73	71	35
		Minimum	1	1	2	2	2	2
		20th Percentile	8	3	4	5	5	6
		Median	16	11	8	9	12	10
		Average	27	28	20	23	21	13
		80th percentile	34	30	31	24	28	18
		Maximum	269	920	186	342	173	72
Al (mg/L)	0.055 *	Number of samples	47	39				
		Minimum	0.13	0.04				
		20th Percentile	0.35	0.10				
		Median	1.00	0.21				

ANZECC Default trigger		Statistic	Four Mile Creek EM1	Weakleys Flat Creek EM3	Blue Gum Creek Site 9	Blue Gum Creek (Long Gully) Site 10	Buttai Creek Site 1	Viney Creek Site 11
		Average	1.18	1.65				
		80th percentile	1.60	1.34				
		Maximum	4.50	33.00				
Mn (mg/L)	1.9#	Number of samples	47	39				
		Minimum	0.0	0.0				
		20th Percentile	0.0	0.0				
		Median	0.	0.				
		Average	0.	0.				
		80th percentile	0.5	0.5				
		Maximum	1.0	2.6				
Fe (mg/L))	N/A *	Number of samples	47	39				
		Minimum	0.72	0.26				
		20th Percentile	2.32	0.91				
		Median	3.60	1.70				
		Average	4.37	3.35				
		80th percentile	5.56	4.12				
		Maximum	20.0	24.00				

** ANZECC trigger values for lowland creeks with slightly disturbed ecosystems*
^ 95% Level of protection, slightly - moderately disturbed systems pH >6.5
 # 95% Level of protection, slightly - moderately disturbed systems

In accordance with the methods outlined in the ANZECC guidelines, the 80th percentile values of the historical data for the key water quality statistics have been calculated for use as trigger values for all parameters except pH and EC, for which the range of 20th to 80th percentile has been calculated. On the basis of the historical monitoring data, appropriate trigger values for the creeks are set out in Table 10.

For Buttai Creek, Blue Gum Creek and Viney Creek catchments, insufficient data has yet been collected to calculate the trigger values for metals.

Table 10 Water Quality 'Trigger' Values for Creeks

Parameter	Four Mile EM1	Weakleys Flat EM3	Blue Gum Site 9	Blue Gum Ck Site 10	Buttai Creek Site 1	Viney Creek Site 11
pH	6.5 - 7.1	6.6 - 7.2	7.0 – 7.3	7.0 - 7.5	6.6 - 7.1	6.8 – 7.1
EC (µS/cm)	235 - 580	235 - 1,116	531 - 1,144	798 - 1,496	498 - 1,060	920 - 1,704
TSS (mg/L)	34	30	31	24	28	18
Al (mg/L)	1.60	1.34				
Mn (mg/L)	0.46	0.47				
Fe (mg/L)	5.56	4.12				

As recommended in the ANZECC Guidelines, the trigger values in Table 10 do not represent 'limits'. Rather, they represent ranges in which the majority of observations can be expected, and provide triggers for further assessment

of potential impacts. Therefore, some future observations can be expected to fall outside the stated range on occasions.

A key indicator of any underground mining-induced water quality impacts would be changes in salinity (EC). This plan adopts the exceedance of the upper bound (80th percentile of baseline data) EC for a period of three consecutive months as the trigger to undertake further assessment of the metals (Fe, Al and Mn) to establish whether the change in EC is mining-induced.

Any significant changes in water quality will also be a trigger for an assessment of whether changes are attributable to land use effects. This additional assessment will occur only if mining has occurred in the same catchment as the sampling location.

3.63 Aquatic Ecology & Stream Health Baseline

A macroinvertebrate monitoring program has been established by Donaldson Coal as part of the IEMP. Baseline data has been collected bi-annually up to 2019 and analysed using the methods, summarised below:

SIGNAL Index

SIGNAL stands for 'Stream Invertebrate Grade Number – Average Level'. It is a simple scoring system for macroinvertebrate ('water bug') samples from Australian rivers. A SIGNAL score gives an indication of water quality in the river from which the sample was collected.

RCE Inventory

Riparian-Channel-Environmental (RCE) Inventory is an assessment that evaluates the condition of:

- Adjacent land;
- Banks;
- Channel and bed (includes in-stream vegetation and algae); and
- Riparian vegetation.

Macroinvertebrate and RCE monitoring has occurred at the three main streams that cross the site. The base line data is summarised in Table 11:

Table 11 Baseline Macroinvertebrate Data

Site	Baseline	SIGNAL	RCE
EM1: Four Mile Creek	2000 - date	5.1 - 6.0	Excellent - Good
EM3: Weakleys Flat Creek	2000 - 2010	4.3 – 5.7	Fair
Site 9: Blue Gum Creek at Stockrington Road	2009 - date	4.4 – 5.7	Fair - Good
Site 10: Blue Gum Creek at Dog Hole Road	2008 - date	4.4 – 5.8	Fair - Good
Pambalong Reserve	N/A	N/A	N/A

As shown in Table 11 above, baseline stream health monitoring within the catchments of the Abel Underground Mine area indicates that the water courses are generally in a fair to good condition, and that (with the exception of Four Mile Creek) over the monitoring period the results have not varied significantly.

The "Excellent" result for Four Mile Creek occurred early in the baseline surveys, and therefore a decline in the stream health is most likely attributable to land use changes within the catchment rather than mining-induced impact, as mining only commenced in the catchment in 2013.

Baseline ecological monitoring is yet to commence at Pambalong Reserve and is addressed in Section 3.643

3.64 Surface Water Monitoring Program Summary

3.641 Water Quality

The water quality monitoring parameters and frequency of monitoring is influenced by the progression of mining across the Abel Underground Mine lease area. Pre-mining, water quality monitoring is necessary to establish baseline data. This baseline has been established for all catchments with the exception of the metals analysis for Buttai Creek, Blue Gum Creek and Viney Creek sites. Commencement of monitoring within each catchment is outlined in Table 8.

The water quality analysis parameters have been grouped into two types: "basic" and "detailed with metals" to assist with distinguishing the monitoring events throughout the mine life. Table 12 details the parameters to be analysed.

During mining and post-mining, water quality monitoring will be undertaken to monitor the environmental performance resulting from underground mining in each catchment. The basic analysis will be undertaken monthly, and the metals analysis will continue on a quarterly basis. The frequency of water quality monitoring is detailed in Table 13.

Table 12 Water Quality Monitoring Analytes

Analysis Type	Parameters
Basic analysis	Temperature, pH, H+, EC, Turbidity, TSS, TDS, Sulphate
Detailed with metals analysis	Chloride, Alkalinity, Acidity, Calcium, Magnesium, Sodium, Potassium, Aluminium, Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Selenium, Zinc, Iron, Fluoride, Nitrate, Reactive Phosphorus

Table 13 Water Quality Monitoring Frequency

Monitoring Site	Monitoring Frequency [1]		
	Pre-mining [2]	During Care and Maintenance	
Analysis Type >	Basic & Detailed with Metals	Basic	Detailed with Metals
EM1	Quarterly	Six Monthly	Six Monthly
EM3	Quarterly	Six Monthly	Six Monthly
Site 9	Quarterly	Six Monthly	Six Monthly
Site 10	Quarterly	Six Monthly	Six Monthly
Site 1	Quarterly	Six Monthly	Six Monthly

1. Water quality monitoring will coincide with the biological monitoring that occurs every 6 months
2. It is recommended that six monthly monitoring commences once a baseline has been established from a 2 year monthly monitoring program.
3. Monitoring will continue for 12 months post mining in the catchment.

3.642 Biological and Geomorphological Monitoring

Biological and geomorphological monitoring has been undertaken at three sites, as outlined in Table 14. Monitoring at Pambalong Reserve has not yet commenced.

Table 14 Biological and Geomorphological Monitoring during Care and Maintenance

Site	Location	Commencement of Monitoring	Frequency	Parameters
EM1	Four Mile Creek d/s John Renshaw Drive	2000	Upon recommencement of mining #	• Macro-invertebrate sampling • AUSRIVAS assessment of biological health • SIGNAL Index • RCE Inventory
Site 9	Blue Gum Creek at Stockrington Road	2009		
Site 10	Blue Gum Creek at Dog Hole Road	2010		
	Pambalong Nature Reserve	N/A		

 # post mining monitoring has been conducted for 12 months

Assessment of stream fauna has been used to assess areas of environmental stress through the diversity of the macro-invertebrate population and the presence of pollutant-sensitive or pollutant-tolerant animals. Healthy systems are usually characterised by a high diversity but relatively low abundance. Conversely, stressed systems favour the growth of only a few pollution-tolerant organisms, which results in a lower diversity but often higher abundance. Also, as diversity and abundance are relatively slow to change when compared to chemical parameters, biological data has the advantage of reflecting the long-term average condition of a system rather than at a single point in time.

Since 2001, macro-invertebrate sampling has been undertaken at two locations in Four Mile Creek and two locations in Weakleys Flat Creek twice per year. As rehabilitation has now been completed and established for the Donaldson Open Cut mine, monitoring of Weakleys Flat Creek will no longer be relevant and will be discontinued.

For the Abel Underground Mine lease area, biological monitoring will cease until mining recommences. There has been 3 years of post-care and maintenance biological monitoring data collected that show minimal change in results.

3.643 Blue Gum Creek & Pambalong Nature Reserve

Select reaches of Long Gully, Blue Gum Creek and Pambalong Nature Reserve are classified as having "high conservation/ ecological value" as described in the ANZECC Guidelines. The water quality objective for such ecosystems of high conservation/ ecological value is to ensure that there is "*no detectable change (beyond natural variability) in the levels of the physical and chemical stressors" except "where there is considerable biological assessment data showing that such changes will not affect biological diversity in the system*".

The impacts of underground mining in the Blue Gum Creek catchment on the Pambalong Nature Reserve will be assessed against the relevant desired outcomes of the Pambalong Reserve Plan of Management (NPWS, 2006), namely:

- No evidence of increased sediment loads into the reserve from soil erosion in the upper catchment;
- No reduction in the water quality and health of watercourses in the reserve;
- Natural flow regimes are maintained where possible; and
- An increased knowledge and understanding of hydrological processes affecting the site.

Pambalong Nature Reserve will be protected in accordance with the goals and principles of the NSW Wetlands Management Policy (DLWC, 1996) which is a component policy of the State Rivers & Estuaries Policy (NSW Water Resources Council, 1993). The relevant principle of the Policy is that "*appropriate water regimes and water quality needed to maintain or restore the ecological sustainability of wetlands will be provided through the implementation of Water Management Plans*".

Water Quality and Ecology

As outlined in Sections 3.62 and 3.63 above, water quality and stream ecology data has been collected for the Blue Gum Creek Catchment since 2009. This baseline data indicate that the condition and ecology of Blue Gum Creek is fair to poor, indicating that this catchment is mildly to moderately impaired by existing land use.

Water Level and Flow

Donaldson Coal committed to undertaking flow monitoring in Blue Gum Creek and water level monitoring in Pambalong Reserve in accordance with undertakings in the EA (2006) and the Pambalong Reserve Plan of Management (NPWS, 2006).

Water level and flow monitoring is necessary to establish a baseline record for flows in the Blue Gum Creek catchment to compare with flow and water level data during mining and post mining in the Blue Gum Creek catchment. The baseline data will also be used to develop a hydrologic model for the Blue Gum Creek catchment if necessary, and to establish whether mining activities have any significant impact on catchment runoff to Pambalong Reserve.

Table 15 identifies the sites that Donaldson Coal will monitor prior to underground mining occurring in the Blue Gum Creek catchment.

Table 15 Water Level and Flow Monitoring

Site	Frequency	Parameters
Pambalong Nature Reserve at Cedar Hill Drive	Monthly	Water level

3.7 Subsidence Impacts on Creeks and Water Bodies

Subsidence caused by underground mining has the potential to change surface levels in the vicinity of watercourses and dams, and these changes could potentially result in increased scouring and therefore erosion of the bed and banks of watercourses.

Prior to underground mining in each area of the Abel mine lease, a Surface Water Management Plan (SWMP) will be prepared as part of the Extraction Plan as detailed in Schedule 3 of the Conditions of Approval (2013) and submitted to DP&E for approval. The SWMPs will include the monitoring requirements and management measures necessary for managing and rectifying any erosion due to scouring of stream beds and banks that are impacted by subsidence.

4. Groundwater Management

4.1 Groundwater System

The Abel Underground Mine is located within the Newcastle Coalfield of the Sydney Basin. The Permian aged coal reserves within the Donaldson Coal area are mostly within the Shortland Formation of the Hexham Sub-Group within the Newcastle Coal Measures.

The topography of the Abel Underground Mine area is dominated by Black Hill, an east-west trending ridge located near the centre of the Abel Underground Mine area. Black Hill is the highest topographic point at 210 m Australian Height Datum. The Abel Underground Mine area is characterised by undulating ridge-affected terrain and shallow, slope-wash filled gullies and foot slopes.

The majority of the Abel Underground Mine area either drains towards Hexham Swamp to the east, via Long Gully and Blue Gum Creek, or Woodberry Swamp to the north-east via Weakleys Flat Creek and Viney Creek. Other portions of the Abel Underground Mine area are located in the ephemeral headwaters of Four Mile Creek and Buttai Creek.

Two distinct aquifer systems are known to occur within the Abel Underground Mine area:

- A fractured rock aquifer system in the coal measures, with groundwater flow occurring mainly in the coal seams; and
- A surficial granular aquifer system in the alluvium associated with swamp, floodplain and estuarine sediments along the Wallis Creek and Hunter River systems and their tributaries.

Groundwater levels in the alluvium are closely related to topography, with flow patterns broadly similar to the surface flow patterns. Recharge occurs by rainfall infiltration, and flow down gradient towards the local surface drainages. In the most elevated areas, alluvium is absent, and the regolith is unsaturated. Occasional localised perched groundwater is found in the colluvium and weathered bedrock zone in lower-lying areas along creek lines.

Groundwater levels in the strata of the deeper Permian coal measures have a more regional pattern, and are controlled by the topographic elevations in areas where specific coal seams outcrop or subcrop and receive recharge, and the discharge zones to the east beneath the Hunter River estuary. Groundwater flows down gradient from the recharge zones towards the discharge areas, with a generally south-easterly flow direction.

The coal measures are highly laminar, sedimentary rocks, which mean that the majority of the permeability is parallel to bedding, and there is very little or no vertical flow across the bedding from shallow to deeper strata under natural conditions; flow is predominantly parallel to the bedding, and occurs mostly within the more permeable coal seams. This is evidenced by distinctly different groundwater levels, differences in groundwater quality, and differing responses to recharge or mining activity.

4.11 Groundwater Model

Groundwater modelling has been undertaken for predictive impact purposes since the projects inception. The groundwater model used for the simulation of impacts from the Abel Underground Mine for the project EA in 2006 was limited to the Donaldson seams and the coal measures stratigraphically overlying them. The model did not extend north of the sub -crop line of the Lower Donaldson Seam, and did not include all of the Bloomfield mining operation. This limitation was considered adequate for the purpose of predicting impacts from the Abel project for the environmental assessment (EA); however, it was a condition that the model be further developed.

To address the limitations of the pre-2006 model and in accordance with the groundwater monitoring conditions outlined in the 2008 Water Management Plan, an updated regional model was developed to examine synergistic impacts from open cut and underground operations across the area of relevance to the Donaldson and Bloomfield operations. This model allows for the transient calibration in relation to the impacts from the Donaldson open cut operation (now complete), the underground mining progress at Abel and Tasman Mines as well as open-cut operations at Bloomfield. It was also designed to address the issues highlighted by the independent reviewer (Kalf & Associates, 2006) engaged by the Department of Planning and Infrastructure at the time of submission of the 2006 Abel EA. In summary these were:

- The vertical hydraulic conductivity of the alluvial layers was excessively low. This was implemented for valid modelling reasons; caused by model simplicity and the minimal number of layers involved;
- There were concerns over the use of arbitrary General Head Boundaries relatively close to the eastern-most extent of the mining area; and
- There was no transient calibration of the model.

The Donaldson Regional Groundwater Model (DRGM) (RPS Pty Ltd, 2013) was then developed following the conditional approval for the Abel Underground Mine that required further development of the regional and local groundwater model where these earlier review outcomes were addressed. The model was designed to incorporate deeper layers and a larger regional extent that would integrate the Bloomfield Colliery operations and areas of possible future mine development by Donaldson Coal.

As well as these regulatory requirements, the model has been constructed with the capability to carry out mining simulation to enable the prediction of groundwater inflow rates at the mine site. These inflow rates inform the water balances involved in potential mine development scenarios across multiple seams and multiple areas.

Additional key refinements to the model included:

- Refinement of the model cell size to 50 m by 50 m within the mining areas;
- Redesign of the river features (required due to the refinement of the model cell size);
- Incorporation of updated mine plans within the Bloomfield and Donaldson Open Cut mine sites;
- Incorporation of the updated Abel mine plan; and
- Implementation of subsidence-related fracture zones.

There is currently a groundwater depression centred on the deepest part of current mining in the open cuts associated with Bloomfield Colliery, and the legacy from the now completed Donaldson Open Cut, both of which constitute regional groundwater sinks.

In addition, a groundwater depression is also centred on current underground mining at Abel

Underground Mine in areas where development has occurred in SMP Areas 1, 2 and 3.

The groundwater model will be required to be updated on a periodical basis to reflect the changing operational developments.

4.12 Mine Inflow Rate

A mine inflow rate substantially higher than predicted may indicate greater impacts on near-surface groundwater and/or the wetland environments. The inflow rate from the most recent modelling iteration undertaken for the modification of the development approval (2012) indicated a mine inflow rate was predicted to increase progressively from 0.3 ML/d (110 ML/year) in Year 1 (2011) to a maximum rate of 6.3 ML/d (2300 ML/year) in 2017 as shown in Figure 4-1. Water removed from the mine is also shown as measured mine outflow which is significantly less than that predicted during 21013-2014.

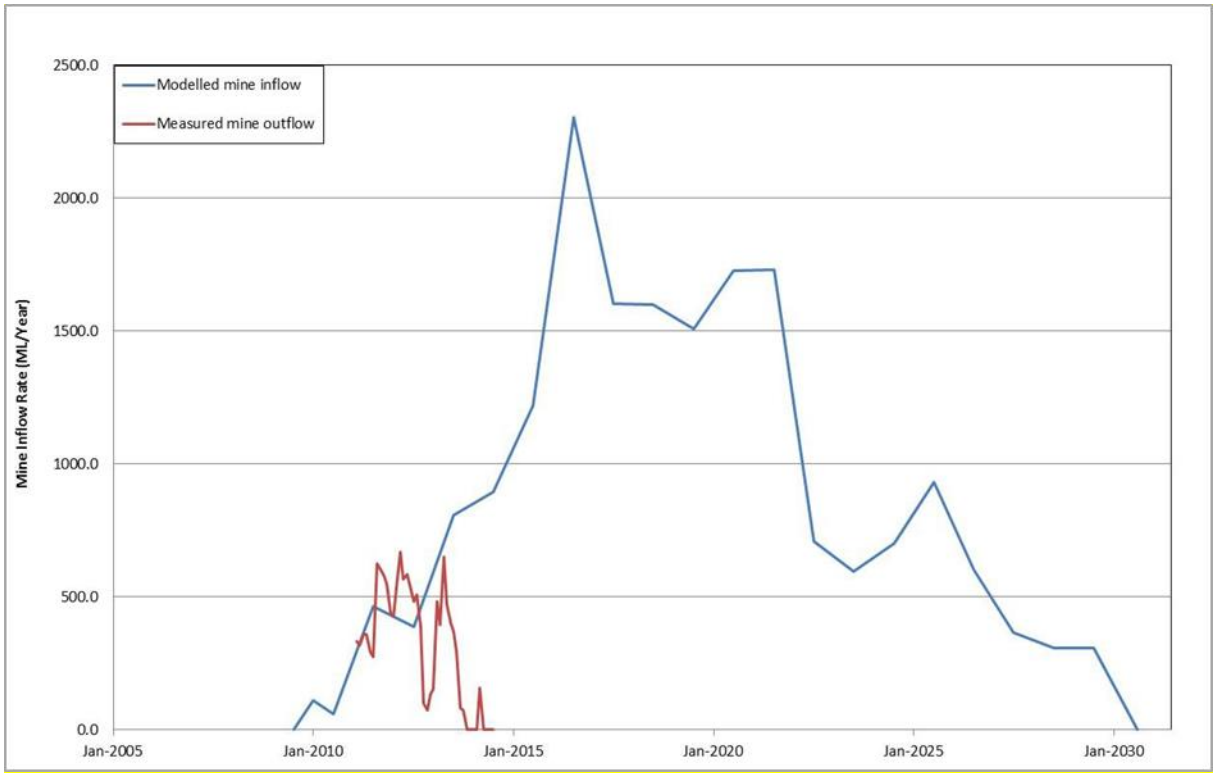

Figure 7 Predicted Mine Inflows and Measured Mine Outflows

It is important to note also that as the Abel Underground Mine has been in Care and Maintenance since April 2016, production has not occurred in line with the rates anticipated at the time of the most recent approval (Mod 3) and currently no production is occurring.

When Abel was operating, the annual coal production was significantly lower than predicted for the anticipated rate of expansion of the underground workings, and has consequently led to groundwater inflow being significantly less than projected at the time of the Environmental Assessment for Mod 3 in 2012.

However, the underground mine water management strategies that have been employed have also led to variability and a general reduction in outflow rates.

Following completion of mining within the Abel Underground Mine in the eastern area, it has since been used as an underground storage area for mine water. This area which encompasses the East

Mains, Panels 1 – 7, 15, 19, 19A and 20, (which constitutes the bulk of SMP Area 1), is currently the source of the bulk of groundwater seepage to the mine. Groundwater seepage to this area is currently being retained, and the rates at which water is being removed from the mine have been lowered significantly.

An increase in mine outflow which is significantly higher than predicted for sustained periods would require review by a hydrogeologist. However, assessing changes in inflow rates in the context of any unforeseen impacts needs to consider the underground water management strategy being implemented.

4.13 Groundwater Levels

Abel baseline groundwater monitoring commenced during the investigation program in 2005. The network has expanded as the operation has progressed to include 83 monitored intervals at 40 sites. Fifteen of the sites have multi-level piezometers installed.

The available groundwater baseline data includes monitoring records from Abel, as well as from Bloomfield, Donaldson and Tasman Mines. Groundwater monitoring data at Donaldson has been collected routinely since 2001, and at the Tasman mine since 2006.

4.14 Subsidence Impacts

The groundwater monitoring network also includes the impacts of strata fracturing resulting from underground mining progression.

The deeper groundwater within the Permian coal seams and interburden sediments is believed to be hydraulically isolated from the near-surface groundwater and surface water, except in areas where the particular coal seams or other permeable strata subcrop or outcrop. That is, there is limited connectivity vertically through the Permian strata, with groundwater flow occurring predominantly along the bedding, mainly within the coal seams.

However, subsidence-induced fracturing may cause some degree of vertical interconnection through the fractured strata. In places of relatively shallow cover depth, subsurface fracturing may provide connection through to the ground surface, or may allow intersection of sub-surface fracturing extending up from the goaf with surface fracturing extending downwards from the surface in areas of surface subsidence.

Complete connection to the surface may result in drainage of near-surface groundwater and/or creek stream flow into the underground workings. Partial connection may result in creek stream flow draining into the near-surface groundwater system, and/or to another aquifer at intermediate depth between the surface and the mine. Either outcome may result in an adverse impact on beneficial use of surface water or groundwater. These issues are addressed in the various monitoring activities (groundwater levels, mine inflow and surface water, etc), the associated response trigger levels and management actions set out in subsequent sections of this plan, particularly Table 19.

As the Abel underground mine is on Care and Maintenance, there are currently no activities that could lead to subsidence fracturing beyond that which occurred prior to April 2016.

4.15 Mine Outflow Water Quality

Groundwater inflow water quality is expected to be variable, and within the range of historical water quality measurements on Permian monitoring bores within the footprint of the Abel underground mine. These bores report EC in the range <1,000 to >10,000 µS/cm (approximately equivalent to TDS in the range 500 to 10,000 mg/L) and pH between 6.5 and 8.0. Initial inflows are expected to be similar to the historical inflows to the former Donaldson Open Cut, which had TDS in the range 1,500 to 2,000 mg/L, and pH around 7. Over time, a gradual increase in salinity may occur, to an eventual bulk salinity around 3,000-4,000 mg/L TDS.

A mine inflow water quality significantly different from the above likely range would not of itself be cause for concern, as the groundwater within the coal measures is highly variable, with measured TDS values ranging from 518 to 13,000 mg/L.

A rapid change to a significantly lower or higher salinity at any time might indicate that a source of surface water or near-surface groundwater may have been induced to inflow to the mine. Likewise a sudden change to the average pH of the mine inflow water may indicate the interception of a new source of water inflows. Such water quality changes provide the triggers for response and management actions set out in subsequent sections of this plan, particularly Table 19.

4.16 Pambalong Nature Reserve and Hexham Swamp

The Abel mining project is not expected to have a detectable impact on groundwater or surface water in either Pambalong Nature Reserve or Hexham Swamp. Specific monitoring piezometers have been installed to detect any unexpected impact on groundwater levels due to subsidence induced impacts on the shallow groundwater or surface water levels in either the Reserve or the Swamp. Monitoring of the piezometers commenced in 2006 and will recommence once mining recommences in order to establish trends in response to natural climatic influences.

A deviation from these trends after mining has commenced could indicate an unexpected adverse impact by the mining operation on the wetlands of the Pambalong Nature Reserve and/or Hexham Swamp. An additional drawdown of 0.5 m relative to normal seasonal and climatically influenced fluctuations in the near-surface groundwater levels would require a response action as set out in Table 19.

Donaldson has committed to install additional piezometers around Pambalong Nature Reserve and Hexham Swamp, to facilitate monitoring of potential impacts on the wetlands due to mining. The additional piezometers, including multi-level piezometers, are planned to be installed in order to monitor progression of the underground mining areas

and to assess any impacts of surface and sub-surface fracturing on both groundwater and surface water. These piezometers will be installed after mining recommences, prior to mining within the Pambalong Nature Reserve and Hexham Swamp catchments.

4.2 Groundwater Monitoring Program

Groundwater monitoring has been undertaken on the Abel Underground Mine site since September 2005 and at the Donaldson Mine since June 2000. The monitoring network (current layout shown on Figure 8) will remain unchanged throughout Care and Maintenance. A number of older monitoring sites have been removed over time as the Donaldson open cut has been exhausted; and additional bores added to the network as mining within the underground environment developed.

The representativeness of the piezometers has been reviewed annually, and an appropriate suite of piezometers has been selected for ongoing monitoring on the basis of this review. All piezometers currently located around Pambalong Nature Reserve will continue to be monitored through the life of the project.

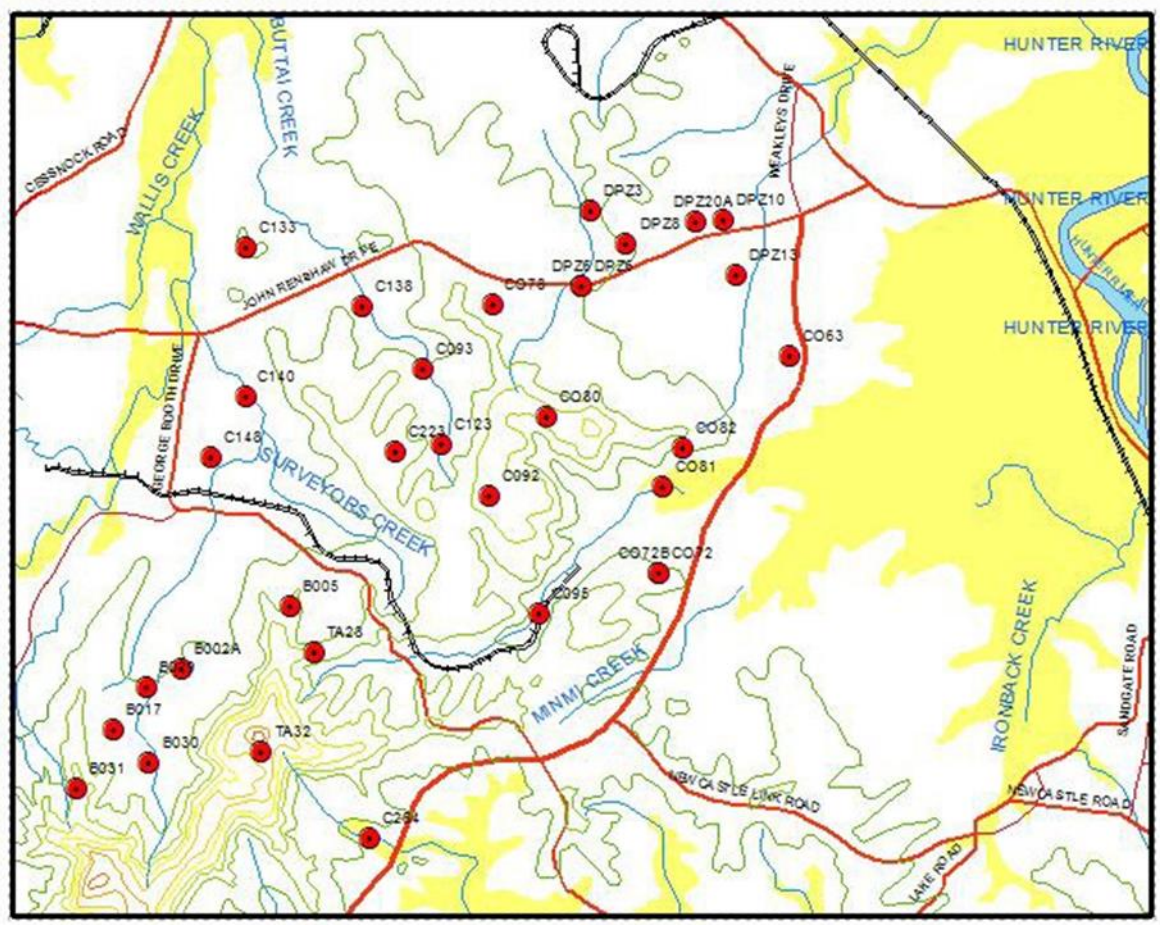

Figure 8 Groundwater Monitoring Network

The groundwater monitoring program for the Care and Maintenance period includes:

- Quarterly measurement of water levels in a representative network of piezometers above the Abel underground mine, and regional control bore REGDPZ1.

- Annual measurement of water levels in bores around the former Donaldson open cut, the Tasman and Tasman Extension areas, and bore CO72B (south of Abel underground mine area).
- Quarterly sampling of all accessible standpipe piezometers above the Abel underground mine area (DPZ8, JRD1 , JRD2, CO78A and B, CO80 and CO81B), for field analysis of EC, TDS and pH.
- Quarterly sampling of water pumped from the underground workings, for laboratory analysis of EC, pH and TDS.
- Annual collection of water samples from all standpipe piezometers for laboratory analysis of a broader suite of parameters:
    - Physical properties (EC, TDS and pH)
    - Major cations and anions (Ca, Mg, Na, K, Cl, SO4, HCO3 and CO3)
    - Nutrients (NO3, NH4)
    - Dissolved metals (Al, As, Ba, Cd, Cr, Co, Cu, Pb, Mn, Se, Zn, Fe)
- Weekly measurement of the volume of mine water pumped from the underground workings. Separate inflow rates will be monitored if two or more separate mining areas are active at any time.
- Periodic / opportunistic measurement underground of the EC, TDS and pH of the mine water during any short-term elevated inflow events encountered.

Table 17 identifies the frequency and parameters for the monitoring network for the Abel Underground Mine.

Table 16 Monitoring Bore Network and Monitoring

Monitoring	Frequency	Analysis Suite	Location
Groundwater Quality	Quarterly (January, April, July, October)	Field – pH, EC, TDS	DPZ-8, JRD2, CO78A and B, CO80 and CO81B. Water pumped from underground
	Annually (July)	Laboratory – pH, EC, TDS, Alkalinity, Sulphate, Chloride, Major Cations [Ca, Mg, Na, K], Dissolved Metals [Al, As, Ba, Cd, Cr, Co, Cu, Pb, Mn, Se, Zn, Fe]	DPZ-8, JRD2, CO78A and B, CO80 and CO81B Reg DPZ-1, DPZ-1A, DPZ-3, DPZ-6, DPZ-8, DPZ-10, DPZ-14A, DPZ-16A, DPZ-20, JRD2.
Groundwater Levels	Quarterly (January, April, July, October)	Standpipe Piezometers	Regional bore - Reg DPZ-1 Abel area – DPZ8, JRD2, CO78A and B, CO80 and CO81B
		Vibrating Wire Piezometers	Abel area – C063, C081A, C093, C133, C138 and C140.

	Annually (July)	Standpipe Piezometers	Donaldson area – DPZ-1A, DPZ-3, DPZ-6, DPZ-10, DPZ-14A, DPZ-16A, DPZ-20, and JRD2
		Vibrating Wire Piezometers	Tasman / Tasman Extension areas - B029, C284, TA24 and TA32.
Mine inflows	Weekly	Volume pumped into and out of underground mine	Total of all pumped inputs and outputs from mine

4.3 Groundwater Trigger Values

The groundwater monitoring triggers and management measures (see Table 19) have been developed to focus upon appropriate trigger and response actions for mitigation of impacts to natural environment as a result of the coal extraction.

The main effect of the underground mining upon the groundwater regime occurs due to changes in bulk rock mass permeability in the area immediately above the mine, caused by the fracturing associated with subsidence, and the subsequent pumping out of groundwater that enters the mine as a consequence. A mine inflow rate substantially higher than predicted by the modelling may indicate greater impacts on near-surface groundwater

Groundwater levels have been predicted to be eventually lowered to coal extraction levels during mining activities. To date, mining activities have caused a drawdown cone in line with expectations provided by predictive modelling results. This has confirmed the model prediction that the low permeabilities of coal measures stratigraphy limits the lateral propagation of drawdown impacts.

4.31 Mine Outflows

The trigger criteria for investigation during Care and Maintenance would be if groundwater outflows from the mine exceeded the model predictions of groundwater seepage inflows by 100 percent for at least three successive monitoring periods, or for at least 3 months.

4.32 Mine Outflow Water Quality

A mine outflow water quality significantly different from the likely range (up to 4,000 mg/L TDS – see Section 4.15) would not of itself be cause for concern, as the groundwater within the coal measures is highly variable. However, a rapid change to a significantly lower or higher salinity at any time might indicate that a source of surface water or near- surface groundwater may have been induced to inflow to the mine. Likewise a sudden change to the average pH of the mine inflow water may indicate the interception of a new source of water inflows. The average salinity and pH of groundwater inflow to the mine will be monitored throughout the mine life (see Table 17 above).

Given the known variability in water quality across the mining footprint, it can be expected that this will result in variability in quality of water extracted from the mine. Groundwater trigger criteria for response would be a progressive observed increase or decrease in salinity by more than 25%, sustained over a consecutive six-month period.

The variability in mine inflow rates due to management strategies to date has implications in determining appropriate trigger values for the water management plan. While stringent performance triggers for the monitoring network in general are still applicable, trigger levels for mine outflow need to be assessed in the context of underground water management and the current Care and Maintenance status of the mining operation.

4.33 Groundwater Levels

Groundwater levels have been predicted to be lowered eventually to coal extraction levels during mining activities. To date, mining activities have caused a drawdown cone in line with expectations provided by predictive modelling results.

The Abel mining project is not expected to have a detectable impact on either Pambalong Nature Reserve or Hexham Swamp. No mining is proposed beneath either the Pambalong Nature Reserve or Hexham Swamp. Specific monitoring piezometers are installed adjacent to both water bodies, and these will be maintained to detect any unexpected impact on groundwater levels due to subsidence induced impacts on the shallow groundwater or surface water levels in either the Reserve or the Swamp. These piezometers will continue to be monitored to establish baseline trends in response to natural climatic influences.

A deviation from these trends after mining has commenced could indicate an unexpected adverse impact by the mining operation on the wetlands of the Pambalong Nature Reserve and/or Hexham Swamp. An additional drawdown of 0.5 m relative to normal seasonal and climatically influenced fluctuations in the near-surface groundwater levels would require a response action.

To date, and throughout Care and Maintenance, there has been no adverse impact by mining on the Pambalong Nature Reserve or the Hexham Swamp.

5. Management Measures and Contingency Plan

Table 2 of Schedule 3 of the consolidated approval for the Abel Underground Mine sets out a range of subsidence impact performance measures. Table 18 below quotes the performance measures that are relevant to this Water Management Plan.

Table 17 Subsidence Impact Performance Measures Relation to Water Management

Water Resources	
• Hexham Swamp • Blue Gum Creek and Alluvium • Long Gully	• Negligible environmental consequences, including: – *negligible* reduction in the quantity of water entering the swamp or the creeks (ie baseflow or environmental flows); – *negligible* reduction in the quality of water entering the swamp or the creeks; – *negligible* reduction creek bed or bank stability. • No connective cracking between the surface and the mine.
All other watercourses in the mining area	No greater environmental consequences than predicted in the EA and EA (MOD 3)
Land	
Pambalong Nature Reserve	Negligible environmental consequences

Notes:

- *The Proponent will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this approval.*
- *Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Director-General will be the final arbiter.*

Donaldson Coal has reviewed the relevant section of the EA and EA (Mod 3) and prepared a summary of the relevant environmental performance objectives /indicators, monitoring requirements, triggers, and contingency measures which are set out in Table 19.

In the event of any exceedance of the adopted water quality trigger values or a significant trend in ecological health or fluvial geomorphic characteristics, the response actions listed below would be initiated.

- The nature of the suspected impact and all relevant monitoring data will be immediately referred to an independent qualified aquatic ecologist, fluvial geomorphologist, hydrologist or hydrogeologist (as relevant) for assessment.
- An assessment will be made to determine the reason for the exceedance, the potential magnitude of the impact and the level of future risk.
- If assessed as being caused by the mining operation, and it is further assessed to be likely to cause an adverse impact on an existing beneficial or environmental use of surface water, then an appropriate preventative and/or remedial strategy would be prepared for discussion with NOW, EPA and/or DPE-Resources Regulator as appropriate, which will comprise:
    - Additional monitoring;
    - Modification of mine water management procedures;
    - Modification to mine water management facilities; or
    - (If appropriate) no change to operations.
- A response/mitigation plan will be implemented to the satisfaction of NOW, EPA and/or DPE-Resources Regulator.

Table 18 Summary of Environmental Performance Measures, Indicators and Contingencies

Performance Objective/ Indicator	Monitoring of Environmental Consequences			Data Analysis to Assess against Trigger Level(s)	Trigger Level(s)	Assessment of Trigger Level(s)	Relevant Management and Contingency Measures
	Sites	Parameters	Frequency				
Negligible reduction to the quality of water resources	• Four Mile Creek (EM1) • Weakleys Flat Creek (EM3) • Blue Gum Creek (Site 9 and "downstream") • Long Gully Creek (Site 10) • Buttai Creek (Site 1) • Viney Creek (Site 11) • Pambalong Nature Reserve	As listed in Appendix B Surface Water Monitoring,	Six Monthly	Water quality analysed, following the receipt of laboratory data	80th percentile of baseline data	**Trigger Level 1** • Salinity (EC) levels above the trigger level occur for 3 consecutive samples **Trigger Level 2** • Fe, Al or Mn levels exceed the trigger level for 3 consecutive samples	**Trigger Level 1:** • Increase monitoring frequency of metals (Fe, Al, Mn) to quarterly to establish whether water quality is being impacted by underground mining. • Review impact assessment **Trigger Level 2:** • Investigate/identify any particular sources of metals. • Develop mitigation plan to manage and remediate if feasible/necessary.
Cracking in watercourses does not exceed minor cracking as detailed in the Land Management Plan (LMP)	• Four Mile Creek • Weakleys Flat Creek • Buttai Creek • Viney Creek • Blue Gum Creek	Stream cracking and drainage behaviour	Prior to mining commencement, immediately following mining and annually for at least two years following completion of mining	Longitudinal surveys of each creek bed (including photographic record with location coordinates)	Minor, moderate and major cracking as detailed in LMP	**Trigger Level 1** • Moderate cracking in creek bed / banks, surface irregularities (ie humps), unstable trees, scouring of bed / banks **Trigger Level 2** • Major cracking, surface irregularities (ie humps), major scouring of bed/ banks	**Trigger Level 1** (as per relevant Subsidence Management Plan / Extraction Plan) • In consultation with NOW, rehabilitate creek channel / banks and riparian ecosystem function to that of existing pre-mining • Review impact assessment based on observed damage **Trigger Level 2** (as per relevant Subsidence Management Plan / Extraction Plan): • Rehabilitate landform, land use and ecosystem function to that of existing pre mining in accordance with LMP in consultation with landowner • Update impact assessment based on observed damage • Provide ongoing resources to prevent access to the affected area until remediation plan can be enacted
Negligible change in drainage or ponding on land surface	Predicted locations of ponding, as detailed in subsidence studies	Land ponding and drainage behaviour	Prior to and after undermining	Comparison of baseline survey to post-mining survey	Significant change in drainage/ ponding	**Trigger Level 1** • Drainage or ponding impacts land use in a way it hadn't prior to subsidence or additional erosion due to change in water drainage patterns **Trigger Level 2**	**Trigger Level 1** (as per relevant Subsidence Management Plan / Extraction Plan): • Develop plan in consultation with landowner. • Remediate in accordance with LMP. **Trigger Level 2** (as per relevant Subsidence Management Plan / Extraction Plan): • Correct drainage to allow temporary access.

Performance Objective/ Indicator	Monitoring of Environmental Consequences			Data Analysis to Assess against Trigger Level(s)	Trigger Level(s)	Assessment of Trigger Level(s)	Relevant Management and Contingency Measures
	Sites	Parameters	Frequency				
						• Ponding prevents access to property	• Correct drainage flow to prevent future access issues.
Negligible impact to dam volume	All dams	• Current water storage level • Current water quality • Wall orientation relative to the potential cracking and differential subsidence • Wall size • Construction method and soil/ fill materials • Wall status • Potential for safety risk to people or animals • Downstream receptors • Potential outwash effects	Prior to and after undermining of dam	• Inspection of dams by qualified engineer • Photographs of each dam	Visual cracking	Inspection indicates surface cracking of dam wall or leakages	As per relevant Subsidence Management Plan / Extraction Plan • Prepare a risk assessment for individual dams. • If necessary to minimise risk at the time of undermining, manage dam water through: – Pumping to an adjacent dam to lower the water level to a manageable level that reduces the risk of dam wall failure, – Discharging to a lower dam via existing channels if the water cannot be transferred, or – Not transferring if the dam water level is sufficiently low at the time of undermining to pose a minor risk. • In the event of subsidence damage or significant reduction in the dam storage capacity, remediate damage and reinstate the dam in consultation with the Subsidence Advisory NSW.
No reduction in health of watercourses	• Four Mile Creek at Elwells Creek (WM3) • Viney Creek u/s John Renshaw Drive • Blue Gum Creek at Stockington Road	• Biological monitoring, including: – Macro-invertebrate sampling – Sightings of vertebrates – Relative abundance of algae and macrophytes • Detailed field observation sheet covering: – Riparian vegetation – Stream geomorphology	Nil – Recommence six monthly when mining recommences	• Biological monitoring and detailed field observation sheet	SIGNAL Index AusRIVAS index Riparian- Channel-Environmental Inventory	Significant trend in ecological health	• Assessment by an independent qualified aquatic ecologist • Preventative and/or remedial strategy, such as: – Additional monitoring – Investigation of cause (e.g. subsidence induced) – Identify remedial measures • Consultation with NOW, EPA and/or DPE-RR to implement a response/ mitigation plan

Performance Objective/ Indicator	Monitoring of Environmental Consequences			Data Analysis to Assess against Trigger Level(s)	Trigger Level(s)	Assessment of Trigger Level(s)	Relevant Management and Contingency Measures
	Sites	Parameters	Frequency				
		– Visual characteristics – Odour					
No reduction in health of Pambalong Nature Reserve and Blue Gum Creek Catchment	• Pambalong Nature Reserve • Blue Gum Creek (Dog Hole Road)	• Biological monitoring	Nil	• Biological monitoring and detailed field observation sheet	SIGNAL Index, AusRIVAS index, Riparian- Channel-Environmental Inventory	Significant trend in ecological health	• Assessment by an independent qualified aquatic ecologist • Preventative and/or remedial strategy, such as: – Additional monitoring – Identify whether due to subsidence or other change in catchment – Identify remedial measures • Consultation with NOW, EPA and/or DPE-RR to implement a response/ mitigation plan
No significant change in water level in Pambalong Nature Reserve	• Pambalong Nature Reserve	• Water level	Continuous	Baseline water level	Baseline water level and flow data	Significant trend in water level or flow	• Assessment by an independent qualified hydrologist • Preventative and/or remedial strategy, such as: – Additional monitoring – Identify whether due to subsidence or other change in catchment – Identify remedial measures • Consultation with NOW, EPA and/or DPE-RR to implement a response/ mitigation plan
No significant change in flow into Pambalong Nature Reserve from Blue Gum Creek	• Blue Gum Creek (Dog Hole Road)	• Flow	Continuous	Baseline flow	Baseline flow data	Significant trend in flow as demonstrated by comparison with the results of hydrologic modelling using a catchment runoff model calibrated using flow monitoring prior to the commencement of mining in the catchment	• Assessment by an independent qualified hydrologist • Preventative and/or remedial strategy, such as: – Additional monitoring – Identify whether due to subsidence or other change in catchment – Identify remedial measures

Performance Objective/ Indicator	Monitoring of Environmental Consequences			Data Analysis to Assess against Trigger Level(s)	Trigger Level(s)	Assessment of Trigger Level(s)	Relevant Management and Contingency Measures
	Sites	Parameters	Frequency				
							• Consultation with NOW, EPA and/or DPE-RR to implement a response/ mitigation plan
Mine inflow rate is not substantially higher than predicted by modelling		• Volume of mine water pumped from underground workings	Weekly	Mine inflow water volume. Separate inflow rates will be monitored if two or more separate mining areas are active at any time	Predicted inflow rates to Abel Underground Mine	An observed inflow rate 100% in excess of the predicted inflow rate at any stage during the mine life sustained over a consecutive 3 month period	**Trigger Level 1** • Assessment by independent hydrogeologist **Trigger Level 2** • Preventative and/or remedial strategy, such as: – Additional monitoring – Modification of mine water management procedures – Modification to mine water management facilities, or – Consultation with NOW and DPE-RR
Negligible reduction to the quality of groundwater mine inflow water	• Piezometers (at all sites)	• pH • Electrical conductivity (EC) • Total dissolved solids (TDS) • Major cations and anions (Ca, Mg, Na, K, Cl, SO_4, HCO_3 and CO_3) • Nutrients • Dissolved metals	• Mine inflow water – weekly • EC, TDS and pH quarterly sampling • Other parameters – annually	Water samples collected from standpipe piezometers	Historical/ baseline groundwater quality data	An additional drawdown of 0.5 m relative to normal seasonal and climatically influenced fluctuations in the near-surface groundwater levels	**Trigger Level 1** • Assessment by independent hydrogeologist **Trigger Level 2** • Preventative and/or remedial strategy, such as: – Additional monitoring – Modification of mine water management procedures – Modification to mine water management facilities, or – (If appropriate) no change to operations • Consultation with NOW and DPE-RR
Groundwater levels around Pambalong Nature Reserve and Hexham Swamp is not substantially drawn down	• Piezometers C081A, C081B, C082 • Multi-level piezometers to the west and north of Pambalong Nature Reserve • Piezometers C063A, C063B • Multi-level piezometers	Groundwater level	Quarterly, throughout life of the Project	Measurements of water level in piezometers	Historical/ baseline groundwater levels around Pambalong Nature Reserve and Hexham Swamp	An additional drawdown of 0.5 m relative to normal seasonal and climatically influenced fluctuations in the near-surface groundwater levels	**Trigger Level 1** • Assessment by independent hydrogeologist **Trigger Level 2** • Preventative and/or remedial strategy, such as: – Additional monitoring – Modification of mine water management procedures – Modification to mine water management facilities, or

Performance Objective/ Indicator	Monitoring of Environmental Consequences			Data Analysis to Assess against Trigger Level(s)	Trigger Level(s)	Assessment of Trigger Level(s)	Relevant Management and Contingency Measures
	Sites	Parameters	Frequency				
	along the eastern side of the Abel project area (3 sites between F3 Freeway and lease boundary)						– (If appropriate) no change to operations • Consultation with NOW and DPE-RR
Subsidence induced impacts on surficial groundwater levels and/or creek baseflows is non-substantial	Piezometers (at all sites)	Groundwater level	Bores installed prior to commencement of each extraction panel and monitored before, during and after extraction	• Multi-level piezometers • Shallow standpipe piezometers	Historical/ baseline groundwater levels above panels	Groundwater level in any shallow piezometer fall by at least 2 m relative to normal seasonal or climate-induced trends, or if base flow in any creek should be visibly diminished relative to normal seasonal patterns	**Trigger Level 1** • Assessment by independent hydrogeologist **Trigger Level 2** • Preventative and/or remedial strategy, such as: – Additional monitoring – Modification of mine water management procedures – Modification to mine water management facilities, or – (If appropriate) no change to operations • Consultation with NOW and DPE-RR

6. Review and Improvement of Environmental Performance

This management plan will be reviewed and updated in consultation with the Secretary prior to Abel changing from 'care and maintenance' to 'operational'.

6.1 Annual Review

In accordance with CoA 4 Schedule 6 of the Project Approval, Donaldson Coal has conducted an Annual Review of the environmental performance of the Project by 31 March each year.

The Annual Review will specifically address the requirements of the Water Management Plan and will:

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

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

   i. relevant statutory requirements, limits or performance measures/criteria;

   ii. requirements of any plan or program required under this approval;

   iii. monitoring results of previous years; and

   iv. relevant predictions in the EA and EA (MOD 3);

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

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

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

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

The Annual Review will be submitted to the Secretary of the DP&E.

In accordance with CoA 5 Schedule 6, this Water Management Plan will be reviewed within three months of the submission of the Annual Review and, if necessary, revised to the satisfaction of the Secretary. This is to ensure the WMP is updated on a regular basis and incorporates any recommended measures identified in the Annual Review to improve the surface water/groundwater performance of the Project.

In accordance with CoA 11 Schedule 6, the Annual Reviews will be made publicly available on the Donaldson Coal website http://www.doncoal.com.au/environment/abel/.

6.2 Independent Audit

In accordance with CoA 9 Schedule 6 of the Project Approval, by the end of March 2015, and every 3 years thereafter, unless the Secretary directs otherwise, Donaldson Coal will commission an Independent Environmental Audit of the Project. This audit will:

- be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary;
- include consultation with the relevant agencies;

- assess the environmental performance of the project and assess whether it is complying with the requirements in this approval and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals);
- review the adequacy of strategies, plans or programs required under the abovementioned approvals; and
- recommend appropriate measures or actions to improve the environmental performance and rehabilitation of the project while on care and maintenance or following mine closure.

The audit team will be led by a suitably qualified auditor and include experts in any fields specified by the Secretary.

In accordance with CoA 10 Schedule 6, within six weeks of the completion of the audit, Donaldson Coal will submit a copy of the audit report to the Secretary, together with its response to any recommendations contained in the audit report.

In accordance with CoA 5 Schedule 6, this WMP will be reviewed within three months of the submission of the Independent Audit and, if necessary, revised to the satisfaction of the Director- General. This is to ensure the WMP is updated on a regular basis and incorporates any recommended measures identified in the Independent Audit to improve the surface water/groundwater performance of the Project.

In accordance with CoA 11 Schedule 6, the Independent Audits and the Donaldson Coal response to the recommendations in any Audit will be made publicly available on Donaldson Coal's website http://www.doncoal.com.au/environment/abel/.

7. Reporting

7.1 Incidents

In accordance with CoA 7 Schedule 6, Donaldson Coal will notify, at the earliest opportunity, the Secretary of the DP&E and any other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. For any other incidents associated with the Abel Underground Mine, Donaldson Coal will notify the Secretary and any other relevant agencies as soon as practicable after Donaldson Coal becomes aware of the incident.

Within seven days of the date of the incident, Donaldson Coal will provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.

In accordance with CoA 5 Schedule 6, this WMP will be reviewed within three months of the submission of an Incident Report under CoA 7 and, if necessary, revised to the satisfaction of the Secretary of the DP&E. This is to ensure the WMP is updated on a regular basis and incorporates any recommended measures identified in the incident report to improve the surface water/groundwater performance of the Project.

7.2 Regular Reporting

In accordance with CoA 8 Schedule 6, Donaldson Coal will provide regular reporting on the environmental performance of the Project on its website, in accordance with the reporting arrangements in any plans or programs approved under the Project Approval.

7.3 Complaints

Donaldson Coal maintains a community complaints register that identifies actions required to resolve community issues. The main phone line advertised on the Donaldson Coal website (1800 111 271) is the designated community complaints line and is answered at all times during hours of operation. The complaints register records the following details:

- Complainant name and contact details;
- Nature of the complaint (noise, dust, traffic etc);

- Time and date of the complaint;
- Specifics of the complaint;
- Actions taken to resolve the complaint; and
- Confirmation that the complaint has been resolved.

In the event that an issue is unresolved, the register includes details of the outstanding issues and any actions that are required.

In accordance with CoA 11 Schedule 6, the Complaints Register will be updated monthly and made publicly available on Donaldson Coal's website http://www.doncoal.com.au/environment/abel/

In accordance with CoA 4 Schedule 6, Donaldson Coal's Annual Review (refer Section 6.1 above) will include a comprehensive review of the complaints records.

7.4 Non Compliance with Statutory Requirements

Donaldson Coal has developed a procedure for the managing and reporting of non-compliances with statutory requirements.

Compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed on or in association with the Abel Underground Mine.

The Mine Engineering Manager and/or Environment and Community Relations Superintendent will undertake regular inspections, internal audits and initiate directions identifying any remediation/rectification work required, and areas of actual or potential non-compliance.

As described in Section 7.1, Donaldson Coal will notify the Secretary of the DP&E and any other relevant agencies of any incident associated with the Abel Underground Mine and provide a detailed report on the incident.

7.5 Exceedances of Criteria

In accordance with CoA 3 Schedule 6, Donaldson Coal will assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in Schedules 3 and 4 of the Project Approval. Any exceedance of these criteria and/or performance measures constitutes a breach of the approval 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, Donaldson Coal will:

- take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the DP&E describing those options and any preferred remediation measures or other course of action; and
- implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.

The report will include:

- the date, time, and nature of the exceedance;
- the cause (or likely cause) of the exceedance;
- what action has been taken to date; and
- the proposed measures to address the exceedance.

8. References

ANZECC 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC, Canberra

Department of Planning and Environment 2013, *Abel Coal Project Modification 3 Conditions of Approval*

DIPNR 2005, *Management of stream/ aquifer systems in coal mining developments*

DLWC 1996, *NSW Wetlands Management Policy*

Donaldson Coal 2006, *Abel Underground Mine – Part 3A Environmental Assessment*

Donaldson Coal 2013, *Annual Environmental Management Report for the Abel Underground Coal Mine 1 June 2012 to 31 May 2013*

GSS Environmental 2007, *Abel Underground Coal (Integrated with Donaldson Open Cut, Tasman Underground and Bloomfield Open Cut Coal Mines) Integrated Environmental Monitoring Program, Donaldson Coal*

Kalf & Associates Pty Ltd 2006, *Review of Groundwater Impacts Abel Underground Mine*

Landcom 2004, *Managing Urban Stormwater: Soils and Construction* (4th Edition)

NOW 2009, *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources*

NOW 2013, *NSW Aquifer Interference Policy*

NPWS 2006, *Pambalong Reserve Plan of Management*

NSW Dam Safety Committee 2012, *Guidance Sheet: DSC3F - Tailings Dams*

NSW Water Resources Council 1993, *State Rivers & Estuaries Policy*

RPS Pty Ltd 2013, *Abel Upgrade Modification Environmental Assessment*

Appendix 1 Consultation Correspondence

YANCOAL 兖煤澳大利亚有限公司
DONALDSONCOAL Part of the Yancoal Australia Group

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30th April 2019

Mr. Jack Murphy
Environmental Assessment Officer
Resource Assessments, Planning Services
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Jack,

Re: Submission of Donaldson / Abel Draft Management Plans

Further to the Department's correspondence dated 6th December2018 regarding the above, we advise that the Abel Coal Mine submitted the Independent Environmental Audit (IEA) Report on 11th February 2019 to the Department's Singleton Compliance Unit.

The 2018 Abel IEA triggered the revision of several management plans that are attached with this correspondence in draft format for the Department's review. Donaldson Coal has also sought comment from relevant Agencies and interested parties. Several of the Management Plans required under both PA 05_0136 (Abel Underground Mine) and DAs 118/698/22 and 98/01173 (Donaldson Open Cut) have been integrated as the relevant management actions and mitigation measures are consistent across both projects. All Management Plans have been reviewed and those listed below have been updated to reflect the current status of the operations during care and maintenance.

Below is a list of submitted management plans, together with the relevant agency that has been asked to comment.

Management Plan	Relevant Agency
Air Quality and Greenhouse Gas Management Plan	EPA
Noise Management Plan	EPA, OEH
Flora and Fauna Management Plan	NRAR, OEH, Councils
Waste Management Plan	OEH, DoP-RR
Tetratheca juncea Management Plan	OEH
Water Management Plan	EPA, NRAR
Rehabilitation Management Plan	DoP-RR, OEH, NRAR and Councils
Aboriginal Management Plan	Aboriginal Community, Councils and OEH

Please note that Management Plans required under Schedule 3 of PA 05_0136 relevant to the Extraction Plan are current and have not been revised.

The Blast Management Plan required under the Donaldson Open Cut Consent (DAs 118/698/22 and 98/01173) has not been revised as there is no longer a requirement to conduct any future blasting at the rehabilitated Donaldson Open Cut Mine.

The submitted Management Plans cover the current period of Care and Maintenance and may be updated where required prior to the recommencement of operations at the Abel Mine.

Upon receiving feedback from DP&E and relevant agencies, Donaldson Coal will review comments received and resubmit these management plans for approval.

We would appreciate if you would provide feedback on these Management Plans by the 31st of May 2019.

If you have any questions or would like to discuss these management plans, please don't hesitate to contact the undersigned on 0439 909 952.

Yours sincerely

Phillip Brown
Environment & Community Relations Superintendent
Donaldson Coal Pty Ltd

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30th April 2019

Mr. Mitch Bennett
Environment Protection Authority
PO Box 488G,
NEWCASTLE NSW 2300

Via email: hunter.region@epa.nsw.gov.au

Dear Mitch,

Re: Submission of Donaldson / Abel Draft Management Plans

Donaldson Coal Pty Limited have recently reviewed a number of environmental management plans for the Donaldson Open Cut Mine and Abel Underground coal mines. Donaldson coal mine ceased mining operations in 2013 and Abel coal mine has been in care and maintenance since 2016, with limited activities now occurring across either site.

Several Management Plans required under both PA 05_0136 (Abel Underground Mine) and DAs 118/698/22 and 98/01173 (Donaldson Open Cut) have been integrated as relevant management actions and mitigation measures are consistent across both projects.

As the risk associated with operational mining has now been minimised, management plans have been updated to reflect the current non-operational status of the sites.

Donaldson Coal is seeking comments from the EPA for the following attached Management Plans:

- Air Quality and Greenhouse Gas Management Plan
- Noise Management Plan
- Water Management Plan

Please note that Management Plans required under Schedule 3 of PA 05_0136 relevant to the Abel Extraction Plan are current and have not been revised.

We would appreciate the provision of comments and feedback on these management plans by the 31st May 2019 to meet statutory reporting requirements under project approvals.

If you have any questions or would like to discuss these management plans, please don't hesitate to contact the undersigned on 0439 909 952.

Yours sincerely,

Phillip Brown
Environment & Community Relations Superintendent
Donaldson Coal Pty Ltd

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