PEABODY

WILPINJONG COAL
SURFACE WATER MANAGEMENT PLAN

(WI-ENV-MNP-0040)

June 2018

Document Owner		Document Approver
Environmental Representative		Environment and Community Manager
Version	Approval Date	Approver Name
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General Description of Changes from Previous Version

Document No.	Version	Date	Prepared/Reviewed By	Distribution	Description of Change
SWMMP-R01	G	February 2006	WCPL, Resource Strategies, Mr Lindsay Gilbert (Gilbert and Associates), Mr Ian Callow (AGE)	DNR, DP&I	Original plan - developed for initial development phase of the project
SWMMP-R01	H	6 March 2006	WCPL, Resource Strategies, Mr Lindsay Gilbert (Gilbert and Associates), Mr Ian Callow (AGE)	DP&I	Amended to address DP&I comments. This version was approved by DP&I.
SWMMP-R02	B	March 2009	WCPL, Resource Strategies	NOW	Periodic review
SWMMP-R02	C	December 2010	WCPL, Ms Sarah Gosling & Mr Brian Rusk (SKM), Mr Andrew Durick (AGE), Dr Steve Perrens (Evans and Peck)	OEH, NOW and DP&I	Revision following the August 2010 Modification and to address NOW comments
WI-ENV-MNP-0006	1	20 June 2014	WCPL, Palaris, Mr Anthony Marszalek (Gilbert & Associates Pty Ltd), Resource Strategies	OEH, NOW	Revised following approval of Mod 5 (PA 05-0021). New format. Forms appendix (Appendix 5) to Water Management Plan (WMP). Submitted to OEH and NOW for consultation
WI-ENV-MNP-0006	1.1	30 June 2014	WCPL, Palaris	DP&E, OEH and NOW	Minor amendments to address comments by Resource Strategies prior to submission to DP&E.
WI-ENV-MNP-0006	2	November 2014	WCPL, Palaris	DP&E, OEH and NOW	Minor amendments to address comments by DP&E.
WI-ENV-MNP-0040	1	June 2016	WCPL		Change of Document number match SAWOL MS number
WI-ENV-MNP-0040	2	August 2017	WCPL, Hatch	DP&E, DPI Water and EPA	Updated to reflect Development Consent (SSD-6764)
WI-ENV-MNP-0040	3	June 2018	WCPL	DP&E, DPI Water and EPA	Revised timing of Clean Water Diversions

CONTENTS

TABLES

FIGURES

1 Introduction

The Wilpinjong Coal Mine is owned and operated by Wilpinjong Coal Pty Ltd (WCPL), a wholly owned subsidiary of Peabody Energy Australia Pty Ltd (Peabody).

The Wilpinjong Coal Mine is an existing open cut coal mining operation situated approximately 40 kilometres (km) north-east of Mudgee, near the Village of Wollar, within the Mid-Western Regional Local Government Area, in central New South Wales (NSW). The Wilpinjong Coal Mine produces thermal coal products which are transported by rail to domestic customers for use in electricity generation and to port for export. Open cut mining operations are undertaken 24 hours per day, seven days per week.

The Wilpinjong Coal Mine originally operated under Project Approval 05-0021 that was granted by the NSW Minister for Planning under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) on 1 February 2006. Modification of the Project Approval subsequently occurred six times[1] with the most recent modification (Modification 7) approved in August 2016. The existing Site Water Management Plan (including an Erosion and Sediment Control Plan, Surface Water Management and Monitoring Plan, Groundwater Monitoring Plan and Surface and Ground Water Response Plan) was developed in accordance with NSW Project Approval 05-0021 and the last revision was approved on 20 March 2017.

On 24 April 2017, WCPL was granted Development Consent (SSD-6764) for the Wilpinjong Extension Project that provides for the continued operation of the Wilpinjong Coal Mine at rates of up to 16 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal out to 2033, and access to approximately 800 hectares (ha) of open cut extensions. Development Consent (SSD-6764) has superseded the Project Approval (Project Approval 05-0021). This Surface Water Management Plan (SWMP) has been prepared to satisfy the relevant conditions in Development Consent SSD-6764. Where relevant, this SWMP builds on the relevant components of the existing/approved Site Water Management Plan, including previous feedback from consultees and where relevant previously agreed trigger levels.

The Secretary of the NSW Department of Planning and Environment (DP&E) approved Jim Heaslop as a suitably qualified and experienced person for the preparation/review of the SWMP on 24 May 2017. This SWMP was prepared in consultation with Jim Heaslop.

[1] Mod 2 was withdrawn

2 Planning and Policy

2.1 Specific Development Consent Requirements

This SWMP has been prepared in accordance with Condition 30(d)(iii), Schedule 3 of Development Consent (SSD-6764). Table 1 presents these requirements and indicates where they are addressed within this SWMP.

Table 1
Specific SWMP Requirements

Development Consent (SSD-6764) Condition	SWMP Section
Water Management Plan	
30. Prior to carrying out any development under this consent, unless the Secretary agrees otherwise, the Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. …	
(d) … this plan must include a:	
(iii) Surface Water Management Plan that includes:	
• detailed baseline data on surface water flows and quality in creeks and other waterbodies that could potentially be affected by the development;	Section 4
• a program to augment the baseline data over the life of the project;	Section 8
• a detailed description of the water management system on site, including the	
○ clean water diversions;	Section 5.1
○ sediment dams and associated infrastructure;	Section 5.2
○ mine water management system;	Section 5.3
○ final voids; and	Section 5.4
○ reinstatement of drainage lines on the rehabilitated areas of the site;	Section 5.5
• detailed objectives and performance criteria, including trigger levels for investigating any potential or actual adverse impacts associated with the development, for:	
○ downstream surface water quality;	Section 6.1
○ stream and riparian vegetation health in Wilpinjong, Cumbo and Wollar Creeks;	Section 6.2
○ channel stability;	Section 6.3
○ design and management for the emplacement of coal reject, tailings materials and saline, sodic and PAF materials;	Section 6.4
○ reinstatement of drainage lines on the rehabilitated areas of the site; and	Section 6.5
○ control of any potential water pollution from the rehabilitated areas of the site;	Section 6.5
• a program to monitor and report on:	
○ the effectiveness of the mine water management system;	Section 8.2.1
○ surface flows and water quality, channel stability, stream and riparian vegetation health of Wilpinjong, Cumbo and Wollar creeks, including statistical trend analysis of salinity and other parameters;	Sections 8.2.2 & 8.2.3
○ the performance measures listed in Table 6;	Section 2.3
○ impacts on water users;	Section 7.3
• reporting procedures for the results of the monitoring program; and	WMP
• a plan to respond to any exceedances of the trigger levels/ and or performance criteria, and mitigate and/or offset any adverse surface water impacts of the development, including measures to provide compensatory water supply to any affected downstream water use under condition 24 of this schedule;	Section 7

2.2 General Management Plan Requirements

Condition 3, Schedule 5 of Development Consent (SSD-6764) outlines general management plan requirements that are applicable to the preparation of the SWMP. Table 2 presents these requirements and indicates where they are addressed within this SWMP.

Table 2
General Management Plan Requirements

Development Consent (SSD-6764) Condition	SWMP Section
Management Plan Requirements	
3. The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 4
(b) a description of:	
• the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 2
• any relevant limits or performance measures/criteria;	Section 2.3
• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 6
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 9
(d) a program to monitor and report on the:	Sections 8 & 10
• impacts and environmental performance of the development;	
• effectiveness of any management measures (see c above);	
(e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 7
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 10
(g) a protocol for managing and reporting any:	Water Management Plan
• incidents	
• complaints	
• non-compliances with statutory requirements; and	
• exceedances of the criteria and/or performance criteria; and	
(h) a protocol for periodic review of the plan.	Section 10

2.3 Water Management Performance Measures

Condition 29, Schedule 3 of Development Consent (SSD-6764) defines the water management performance measures for the Wilpinjong Coal Mine.

A summary of the relevant water management performance measures, and where they are addressed in this SWMP is provided in Table 3.

Table 3
Water Management Performance Measures

Feature	Performance Measure	SWMP Section
General	Maintain separation between clean, dirty and mine water management systems. Minimise the use of clean water on site. Design, install, operation and maintain water management systems in a proper and efficient manager.	Section 5 and SWB
Clean water diversion and storage infrastructure	Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site.	Section 5.1
Sediment dams	Design, install and/or maintain sediment dams to ensure no discharges to surface waters, except in accordance with an EPL or in accordance with Section 120 of the POEO Act.	Section 5.2
Mine water storages	Design, install and/or maintain mine water storage infrastructure to ensure no discharge of untreated mine water off-site. Discharge treated mine water in accordance with an EPL or in accordance with Section 120 of the POEO Act.	Section 5.3
Wilpinjong, Cumbo and Wollar Creeks	No greater impact than predicted for the development for water flow and quality.	Sections 6.1 and 8.2
Aquatic, riparian and groundwater dependent ecosystems	Negligible environmental consequences beyond those predicted for the development.	Sections 7.2 and 8.2.4
Flood mitigation measures	Ensure all open cut pits, CHPP, coal stockpiles and main mine facilities areas exclude flows for all flood events up to and including the 1 in 100 year ARI. All final voids designed to exclude all flood events up to include the PMF event.	Section 5.7
Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas or structures in accordance with relevant Australian Standards.	Section 9

2.4 Environment Protection Licence

The *Protection of the Environment Operations Act, 1997* (POEO Act) enables the government to set policies that provide environmental standards, goals, protocols and guidelines. The POEO Act also establishes a licensing regime for pollution generating activities in NSW. Under section 48 of the POEO Act, an environment protection licence (EPL) is required for “scheduled activities”, which includes coal mining.

The EPA issued EPL 12425 on 8 February 2006 under the POEO Act.

EPL 12425 currently regulates the discharge of water from the Wilpinjong Coal Mine via a water treatment facility. EPL 12425 was most recently varied in early 2017 to increase the volume of water permitted to be discharged.

As requested by the EPA, WCPL will apply as required to vary EPL 12425 to also incorporate any sediment dams that will discharge off-site (under specific water quality and/or rainfall conditions).

2.5 Specific Guidance from Regulatory Agencies

The approved Site Water Management Plan (including the relevant sub-plans) was prepared in consultation with EPA and DPI Water, as required by Condition 28, Schedule 3 of the Wilpinjong Coal Mine Project Approval 05-0021.

Consultation was also undertaken with a variety of Regulatory Agencies throughout the assessment and approval of the Wilpinjong Extension Project. A number of additional, specific requirements and commitments for this SWMP that arose from this consultation programme were subsequently reflected in Condition 30(d)(iii), Schedule 3 of Development Consent (SSD-6764). Table 4 presents these additional requirements/commitments and indicates where they are addressed in this SWMP.

Table 4
Specific Regulatory Agency Requirements

Regulator	Requirement	SWMP Section
DPI Water	Statistical analysis of Wilpinjong Creek salinity incorporating contemporary measured observations.	Section 4.2.1
	Consideration of the geomorphic framework in guiding salt suppression actions and promote recovery of linked pools and geomorphic features in Wilpinjong Creek.	Section 5.6
IESC	Annual stream health monitoring on Wilpinjong and Cumbo Creeks, including aquatic macroinvertebrate surveys in spring.	Section 8.2.4
	Establishment of an additional monitoring point on Wollar Creek.	Section 8.2.3
	Monthly and event-based metals monitoring and appropriate trigger values for select metals.	Section 8.2.3
	Characterise changes to flow regime in Wilpinjong Creek, particularly with regard to timing and seasonality of peak and low flows in Wilpinjong Creek.	Section 4.1.1

3 Surface Water and Environmental Setting

The Wilpinjong Coal Mine is located in the Upper Goulburn River catchment, which forms part of the Hunter River Basin. The Hunter River Basin drains some 22,000 square kilometres (km^2) of central-eastern NSW to the Pacific Ocean at Newcastle.

The Wilpinjong Coal Mine is located directly south of Wilpinjong Creek, a headwater tributary of Wollar Creek which joins the Goulburn River approximately 8 km to the north east. The catchment area of Wollar Creek at the confluence with the Goulburn River is approximately 530 km^2. The catchment area of the Goulburn River at the confluence with Wollar Creek is approximately 1,149 km^2.

At a local level, the Wilpinjong Coal Mine lies in the Wilpinjong Creek catchment. A number of local watercourses are tributaries of Wilpinjong Creek including Cumbo Creek, Planters Creek, Spring Creek and Bens Creek.

Wilpinjong Creek flows into Wollar Creek approximately 4 km downstream of the confluence of Cumbo and Wilpinjong Creeks. Wollar Creek flows into the Goulburn River National Park approximately 1 km downstream of the confluence with Wilpinjong Creek.

Wilpinjong Creek is incised into the valley floor and forms a series of semi-permanent soaks fed primarily from drainage from the surrounding alluvial plain and colluvium which is recharged by runoff. Wilpinjong Creek is generally a gaining stream, however, there have been occasions when in some sections there has been brief reversals of gradient.

Cumbo Creek, the largest tributary crossing the existing/approved Wilpinjong Coal Mine, is a 5th order stream, and has a pre-mine catchment area of approximately 70 km^2. The downstream reaches of Cumbo Creek are approved to be relocated and the existing creek alignment mined as part of approved mining operations.

Wilpinjong Creek and Cumbo Creek are naturally ephemeral. However, the approved release of water treatment facility into Wilpinjong Creek (in accordance with EPL 12425) does increase flow downstream of the release point when this occurs.

Spring Creek, Narrow Creek, Bens Creek and other unnamed drainage paths crossing the Wilpinjong Coal Mine are natural drainage lines which range from small ephemeral and semi-perennial spring fed streams in the upper reaches near the Munghorn Gap Nature Reserve to wide ill-defined ephemeral creeks in the lower reaches near Wilpinjong Creek. Most of these drainage lines have been either diverted or intercepted by the previous mining operations, and the pre-mine catchment areas of Wilpinjong and Cumbo Creeks are progressively reduced by the development of open cut pits as part of the approved Wilpinjong Coal Mine. Pre-mine catchments will be progressively restored as mining areas are rehabilitated.

The unnamed drainage line located west of Slate Gully Road is a 2nd order stream. The unnamed drainage line is ephemeral.

There are no private landholders downstream of the Wilpinjong Coal Mine on either Wilpinjong Creek or Wollar Creek. The nearest downstream private landholders are located on the Goulburn River, downstream of the Goulburn River National Park.

The potential impacts of the Wilpinjong Coal Mine (incorporating the Wilpinjong Extension Project) were considered by WRM Water and Environment (2015).

During active mining operations, the mine water management system will continue to capture runoff from areas that would have previously flowed to the receiving waters of Wilpinjong Creek and Cumbo Creek. In addition, open cut mining will also result in loss of groundwater discharge (or baseflow capture) to Wilpinjong Creek.

The expected reduction in groundwater baseflow to nearby streams due to the Wilpinjong Coal Mine (incorporating the Project) was modelled by HydroSimulations (2015).

The predicted maximum effect of runoff capture and potential reduction of baseflow on flows in Wilpinjong Creek and Wollar Creek (downstream of the confluence with Wilpinjong Creek) will result in approximately 37% more days with less than 0.1 ML/day flow in Wilpinjong Creek relative to pre mining conditions. However, the Wilpinjong Coal Mine results in negligible changes to the frequency of higher flows (e.g. greater than 1 ML/day).

While the Wilpinjong Coal Mine is anticipated to have some small incremental increase in the baseflow losses of Wollar Creek and the Goulburn River (HydroSimulations, 2015), the significant additional catchment of these larger streams means potential impacts on flow frequency are expected to be negligible.

Surface water runoff from disturbed areas could potentially contain sediments, dissolved solids, oil, grease, metals and salts. As described in Section 5.2, all future sediment dams will be sized to capture runoff from a 95th percentile rainfall event with a duration of five days (Landcom, 2004 and DECCW, 2008).

Some overflow of water from sediment dams may occur during wet periods that exceed the design standard of the sediment control system. Overflows will occur during significant rainfall events which would also generate runoff from surrounding undisturbed catchments. Hence, it is unlikely that sediment dam overflows will have a measurable impact on receiving water quality (WRM Water and Environment, 2015).

Contained water storages will continue to be managed and operated for no release to downstream watercourses (Section 5.3). The site water balance model results indicate that there will be no uncontrolled releases of mine water from the water management system (refer Site Water Balance).

WCPL will continue to undertake approved water discharges from the water treatment facility in accordance with EPL 12425. The EPL criteria have been selected such that the released water will generally be similar to or better than the receiving water quality. Water quality trigger levels for downstream water courses are discussed in Section 6.1.

DP&E reviewed the potential water quality impacts of the Wilpinjong Coal Mine as part of the assessment of the Wilpinjong Extension Project. In their recommendation to the NSW Planning Assessment Commission, DP&E concluded:

> *With these measures in place, the project is expected to have negligible impact on the quality of surface and groundwater resources in the area, and is predicted to result in a long-term increase in salinity levels of 0.8% in Wilpinjong Creek, which is below the minimal impact criteria in the AIP.*

4 Baseline Data

This section details available baseline data as well as a comparison of more recent data collected from the surface water monitoring network, where relevant.

The previous version of the Water Management Plan (approved in March 2017) established the baseline data set for the Wilpinjong Coal Mine as comprising data from pre-mining (2004) to the end of 2009 (prior to approval being granted for an increased mining rate in early 2010). The baseline period for this SWMP has been kept consistent with this previously agreed baseline period.

This section details available baseline data as well as a comparison of more recent data collected from the surface water monitoring network.

4.1 Streamflow

The nearest active streamflow gauging station operated by DPI Water is the Goulburn River at Coggan (210006) gauge located approximately 85 km downstream of the Wilpinjong Coal Mine. The gauge has been operating since 1913.

The flow frequency curve for the Goulburn River at Coggan (210006) indicates that daily streamflow has exceeded 4.9 ML/day for 90% of the flow record, and median daily flow is over 40 ML/day.

Streamflow was recorded for Wollar Creek at the Wollar Gauge (GS210082) between 1969 and 1997. Mean annual runoff at this gauge was estimated to be 2.4% of mean annual rainfall (WRM Water and Environment, 2014).

WCPL also maintains gauging stations on Wilpinjong Creek and Cumbo Creek. These gauging stations comprise automated stream depth monitors, with streamflow ratings to convert recorded depth to flow rate, as well as sensors which record electrical conductivity (EC), pH and temperature. Flow data is available from the upstream Wilpinjong Creek gauge (WILGSU) since mid-2007. Reliable flow data is available from the downstream Wilpinjong Creek gauge (WILGSD) since early-2012.

Flow data from WILGSU for the period 2007 to 2009 is presented on Figure 1.

4.1.1 Seasonality of Flows in Wilpinjong Creek

The IESC has requested that the update to the SWMP include a summary of the timing and seasonality of peak and low flows. Table 5 provides a summary of the percentage of low and high flow days in Wilpinjong Creek for each month. Table 6 provides a summary of rainfall statistics from 1901 to 2017 at the Wollar (Barrigan St) Weather Station (62032).

The rainfall statistics indicate that median rainfall is greater in Spring/Summer than Autumn/Winter. This trend is less pronounced in the high flow statistics for Wilpinjong Creek, likely due to the complex relationship between rainfall and surface water flow. The amount of rainfall that translates into flow in Wilpinjong Creek is dependent on a number of factors such as the nature of the runoff surface, time since last rainfall event (and therefore degree of saturation of the ground) and the intensity/duration of the rainfall event.

Low flows in Wilpinjong Creek appear to occur less frequently in Winter. This is consistent with the rainfall data which indicates that the 10th percentile rainfall is typically higher in Winter than the rest of the year.

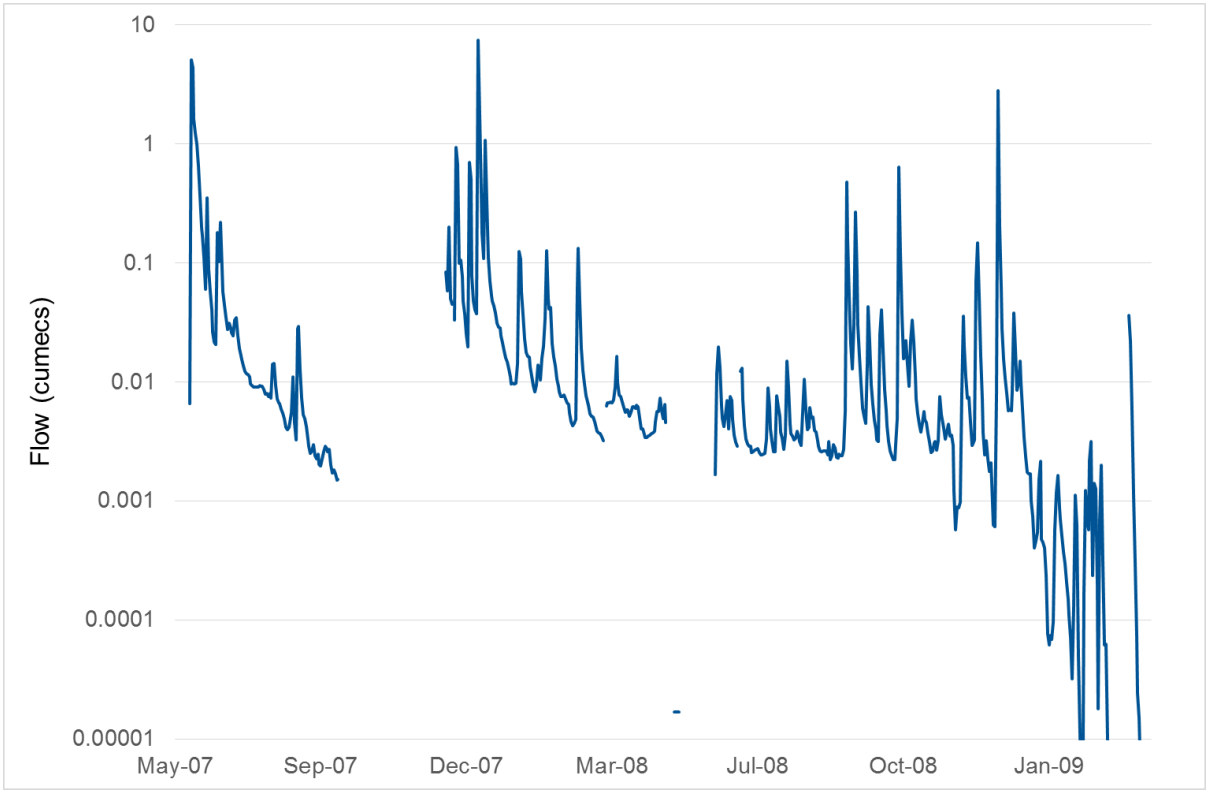

Figure 1: Recorded Streamflow Hydrograph – WILGSU 2007 – 2009

Flow data from WILGSU and WILDSG for the period 2012 to 2017 is presented on Figure 2.

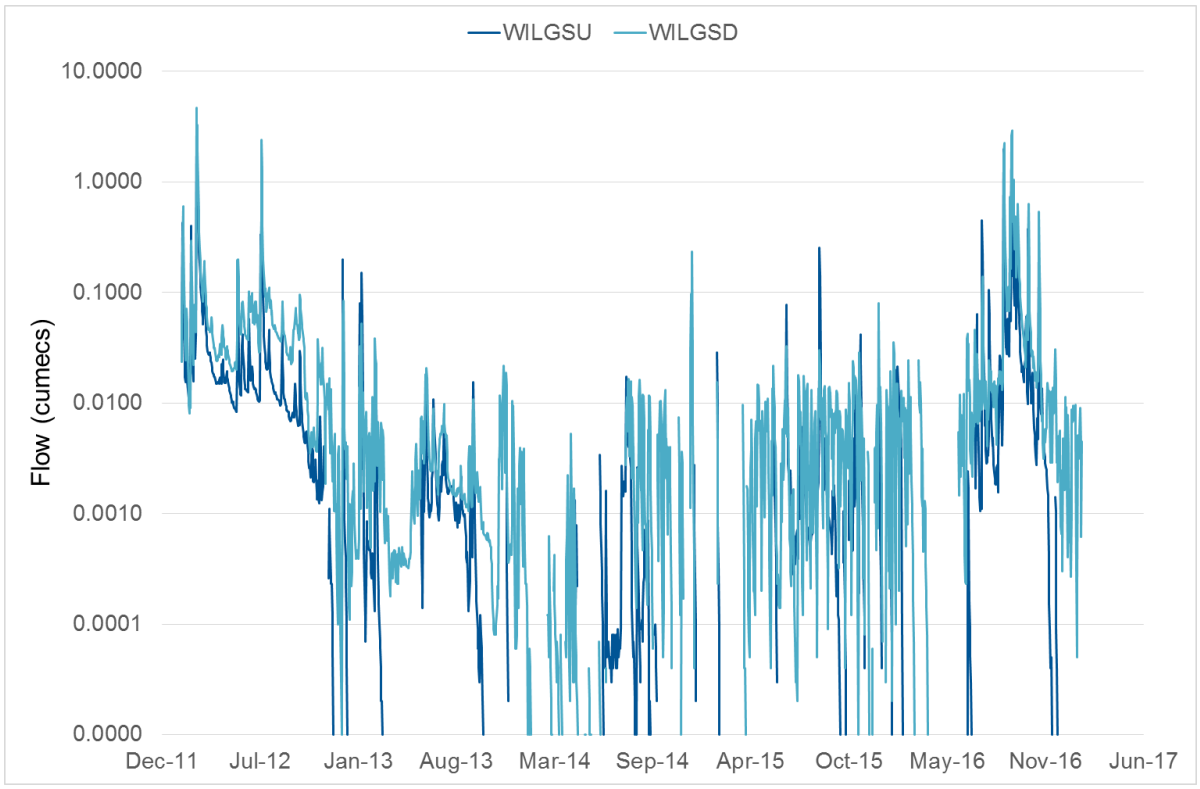

Figure 2: Recorded Streamflow Hydrograph – WILGSU and WILGSD 2012 – 2017

Table 5
Seasonality of Flow in Wilpinjong Creek

Month	2007 – 2009		2012 – 2017			
	WILGSU		WILGSU		WILGSD	
	Low Flows	High Flows	Low Flows	High Flows	Low Flows	High Flows
January	37%	2%	90%	0%	65%	0%
February	37%	4%	72%	3%	33%	4%
March	29%	0%	77%	6%	38%	9%
April	27%	0%	79%	0%	36%	0%
May	16%	0%	77%	0%	41%	2%
June	0%	22%	55%	0%	21%	0%
July	0%	0%	28%	5%	19%	6%
August	0%	2%	35%	1%	1%	0%
September	22%	3%	48%	9%	7%	15%
October	50%	3%	59%	2%	6%	5%
November	55%	2%	57%	1%	21%	1%
December	3%	21%	93%	1%	28%	1%

Low flows = less than 0.1 ML/day

High flows = greater than 10 ML/day

Table 6
Rainfall Statistics – Wollar (Barrigan St) Weather Station

Month	Mean (mm)	Lowest (mm)	10th Percentile (mm)	Median (mm)	90th Percentile (mm)	Highest (mm)
Jan	67	0	10.9	61.5	134	209.6
Feb	62.3	0	4.3	46.8	144.9	391.5
Mar	51.9	0	1.4	39.3	112.3	224.5
Apr	39.2	0	0.9	29.5	79.6	221.9
May	38	0	1.6	26.9	100.1	182.5
Jun	44.6	0	5.8	33.5	88.5	263.9
Jul	42.9	0	5.2	36.6	92.8	175.2
Aug	41.3	0	9.2	38.7	77.8	146.4
Sep	41.6	0	5.1	35.2	92.7	181.2
Oct	51.3	0	6.3	47.3	91.5	228.5
Nov	55.9	0	4	51.4	119.7	278
Dec	59.3	0	8.1	46	130.9	229.8
Annual	590.6	128.8	364.8	597.8	831.8	1205.3

4.2 Water Quality

WCPL has conducted an extensive water quality monitoring program; compiling a database of water quality observations with Mine site data from 2004 onwards. Monitoring locations include sites in Wilpinjong Creek, Cumbo Creek, Wollar Creek and site water storages. Water quality monitoring is undertaken by grab sampling at the majority of monitoring sites. However continuous monitoring of EC and pH occurs at the WCPL gauging stations on Wilpinjong Creek and Cumbo Creek.

The surface water quality monitoring locations are shown on Figure 3 and summarised in Table 7.

Baseline surface water quality data from the Wilpinjong Coal Mine database (i.e. pre mining to end of 2009) has been compared to the National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000) (herein referred to as the 'Guidelines') in Table 7. The Guidelines provide a framework for water quality assessment and management.

Table 8 provides a summary of baseline pH, EC and turbidity data relative to the guideline values for protection of aquatic ecosystems (south-eastern Australian upland rivers) and guideline values for Primary Industries water supplies (livestock drinking water quality).

GREATER WOLLAR CREEK CATCHMENT

WIL-12-11_EMS 2017_209A

LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Approved/Existing Open Cut and Contained Infrastructure Area

WCPL Monitoring

- Surface Water Monitoring Site
- WCPL Gauging Station
- EPL 12425 Licensed Discharge and Monitoring Point

Source: WCPL (2017); After DIPNR (2003); DPI Water (2015); NSW Land & Property Information (2013)

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WILPINJONG COAL MINE

Wilpinjong Coal Mine
Surface Water Monitoring Network

Table 7
Summary of Existing Water Quality Monitoring Data

Location Code	Site Description	Frequency	Period of Record
WIL-U	Wilpinjong Creek approx. 100m upstream of Planters Creek confluence	Monthly	20/2/2006 – 19/01/2017
WIL-U2	Wilpinjong Creek upstream of Planters Creek confluence	Monthly	4/1/2010 – 19/01/2017
WIL 1	Wilpinjong Creek downstream of Planters Creek confluence	Temporary	1/7/2004 – 20/1/2006
WIL-PC	Wilpinjong Creek at Planters Creek confluence	Monthly	20/2/2006 – 19/01/2017
WIL-NC	Wilpinjong Creek at Narrow Creek confluence	Monthly	4/1/2010 – 19/01/2017
WIL-D2	Wilpinjong Creek downstream of Cumbo Creek confluence	Monthly	4/1/2010 – 19/01/2017
WIL-D	Wilpinjong Creek downstream of Cumbo Creek confluence	Monthly	20/2/2006 – 19/01/2017
WIL 2	Wilpinjong Creek downstream of Cumbo Creek confluence	Temporary	30/6/2004 – 20/1/2006
WILGSU	Wilpinjong Creek upstream gauging station	Continuous	8/6/2006 – 19/01/2017
WILGSD	Wilpinjong Creek downstream gauging station	Continuous	3/8/2005 – 19/01/2017
CC1	Cumbo Creek at gauging station (approx. 500m upstream of confluence with Wilpinjong Creek)	Monthly	30/6/2004 – 19/01/2017
CC2	Cumbo Creek at ML 1573 upstream boundary	Monthly	30/6/2004 – 19/01/2017
CC3	Cumbo Creek at Wollar Road	Monthly	30/6/2004 – 19/01/2017
CC4	Cumbo Creek at Upper Cumbo Road	Temporary	30/6/2004 – 28/11/2005
CC5	Cumbo Creek between ML 1573 boundary and Wollar Road	Temporary	30/6/2004 – 11/11/2004
CCGSD	Cumbo Creek Gauging Station (Downstream)	Continuous	15/2/2006 – 19/01/2017
CCGSU	Cumbo Creek Gauging Station (Upstream)	Continuous	22/07/2015 – 19/01/2017
WOL1	Wollar Creek downstream of confluence with Wilpinjong Creek	Monthly	10/9/2004 – 19/01/2017
WOL2	Wollar Creek upstream of confluence with Wilpinjong Creek	Monthly	30/6/2004 – 19/01/2017
WOL3	Wollar Creek upstream of confluence with Barigan Creek	Temporary	12/7/2004 – 20/1/2006
SGC-1	Slate Gully Creek catchment	Monthly	18/02/2014 – 19/01/2017
Various	Sediment dams and mine water storages	Intermittent	23/1/2008 – 19/01/2017

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Table 8
Summary of Baseline Water Quality Data – Local Creeks

Monitoring Site[1]/Guideline		pH	EC (µS/cm)[2]	Turbidity (NTU)[2]
ANZECC (2000) Guideline Trigger Value	Protection of Aquatic Ecosystems	6.5-8.0	30-350	2-25
	Primary Industries (Livestock Drinking Water)	6-9	950	-
Wilpinjong Creek Upstream (Sites WIL-U2, WIL-U, WIL 1, WIL-PC)	Average	7	2435	20
	Minimum	5.7	450	6
	Maximum	9	12190	41
	No. Samples	49	49	5
	80th percentile	**7.7**	**4066**	**24**
	20th percentile	**6.9**	**-**	**-**
Wilpinjong Creek Downstream (Sites WIL-NC, WIL-D2, WIL 2, WIL-D)	Average	8	3531	22
	Minimum	6.7	680	4
	Maximum	9	7450	70
	No. Samples	55	55	9
	80th percentile	**7.9**	**5166**	**28**
	20th percentile	**7.4**	**-**	**-**
Cumbo Creek Upstream (Sites CC2, CC3, CC4, CC5)	Average	8	5303	11
	Minimum	6.8	100	5
	Maximum	9	10500	24
	No. Samples	70	70	15
	80th percentile	**8.2**	**6750**	**16**
	20th percentile	**7.4**	**-**	**-**
Cumbo Creek Downstream (Site CC1)	Average	8	6231	43
	Minimum	6.7	540	17
	Maximum	9	10470	94
	No. Samples	27	27	6
	80th percentile	**8.2**	**7510**	**77**
	20th percentile	**7.52**	**-**	**-**
Wollar Creek (Sites WOL 1, WOL 2, WOL 3)	Average	8	2311	16
	Minimum	6.5	90	2
	Maximum	8.4	6540	37
	No. Samples	90	90	20
	80th percentile	**8.0**	**3460**	**25**
	20th percentile	**7.4**	**-**	**-**

µS/cm = microsiemens per centimetre, NTU = Nephelometric Turbidity Units, mg/L = milligrams per litre

4.2.1 Wilpinjong Creek Salinity

DPI Water requested that the SWMP include statistical analysis of Wilpinjong Creek salinity using contemporary measured observations (Section 2.5).

Analysis of Wilpinjong Creek salinity was presented in the Wilpinjong Extension Project Environmental Impact Statement, Response to Submissions and subsequent advice provided to DPI Water. Additional analysis incorporating data collected more recently is also provided below.

HydroSimulations (2016) reviewed the salinity of Wilpinjong Creek when determining the potential level of impact to Wilpinjong Creek under the Aquifer Interference Policy. HydroSimulations found that the average salinity in Wilpinjong Creek (both upstream and downstream of the Wilpinjong Coal Mine) is considered to be marginal to brackish and highly variable.

An updated graph of Wilpinjong Creek salinity, incorporating more recent data is provided as Figure 4. Figure 4 indicates that Wilpinjong Creek salinity has remained low in the latter half of 2016 and early 2017 during a period of above average rainfall.

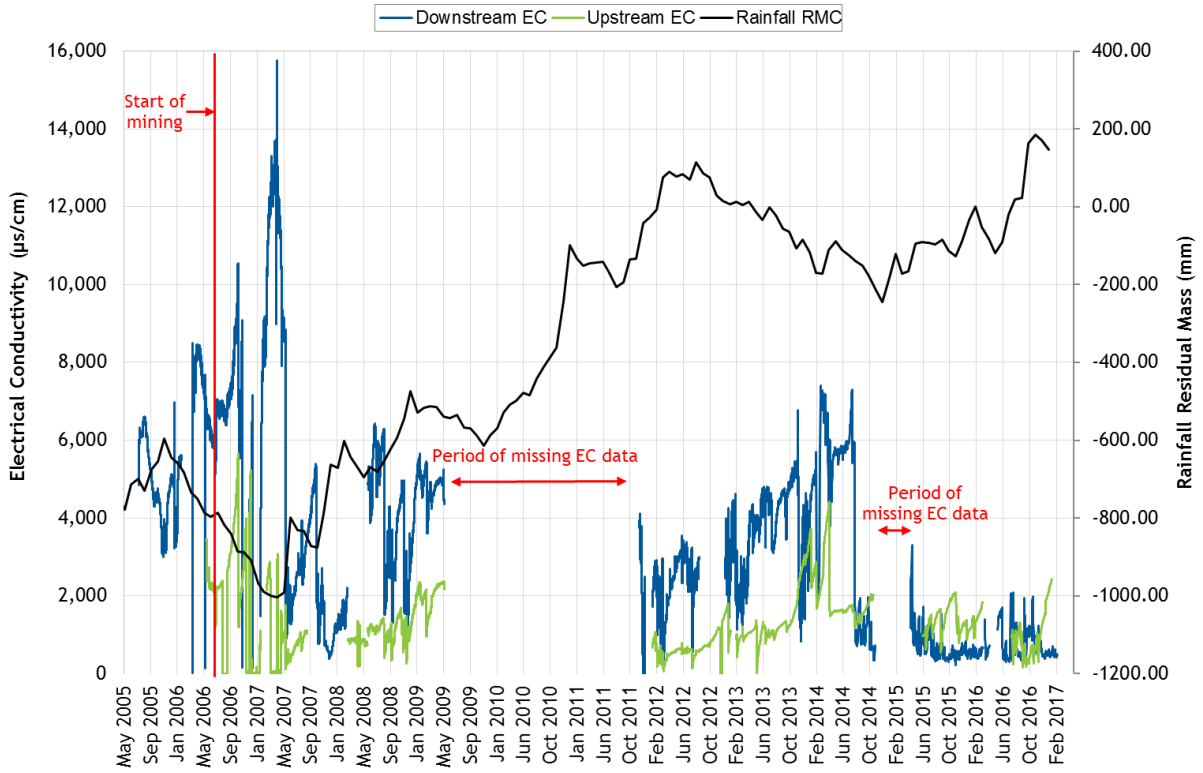


Figure 4: Wilpinjong Creek Salinity

As described in Section 4, the baseline data period for the Wilpinjong Coal Mine is considered to be up until the end of 2009. Statistical analysis of the baseline data period and active operational period is provided in Table 9. This analysis supports the conclusion made in the Wilpinjong Extension Project Response to Submissions document that continued water treatment facility discharge is resulting in a reversal of the consistent pre-mining trend of higher salinity in Wilpinjong Creek downstream relative to upstream (i.e. salinity in Wilpinjong Creek is improving downstream of the Wilpinjong Coal Mine as a result of water treatment facility discharges).

Table 9
Statistical Analysis of Wilpinjong Creek Salinity

Percentile	Baseline Data Period (2004 – 2009) (µS/cm)			Operational Data Period (2010 – 2017) (µS/cm)		
	Upstream	Downstream	Ratio	Upstream	Downstream	Ratio
Minimum	450	680	1.51	140	200	1.43
5th Percentile	702	961	1.37	320	340	1.06
20th Percentile	896	1,834	2.05	600	650	1.08
Median	1,470	3,670	2.50	1,020	1,950	1.91
80th Percentile	3,956	5,178	1.31	2,104	3,440	1.63
95th Percentile	5,390	6,126	1.14	3,941	4,690	1.19
Maximum	12,190	7,450	0.61	6,070	7,550	1.24

Ratio = downstream salinity / upstream salinity

4.3 Stream Health

Assessments of aquatic ecosystem health have been conducted at the Wilpinjong Coal Mine since 2004 (Table 10).

Table 10
Stream Health Surveys Carried Out at the Wilpinjong Coal Mine

Date	Survey Type	Number of Sites	Watercourses Sampled
25-27 May 2004	EIS baseline assessment	10	Spring, Planters, Wilpinjong, Cumbo and Wollar Creeks
Spring 2006 (dates unknown)	Annual Monitoring	12	Wilpinjong, Cumbo and Wollar Creeks
Spring 2008 (dates unknown)	Annual Monitoring	12	Wilpinjong, Cumbo and Wollar Creeks
October 2009 (dates unknown)	Annual Monitoring	12	Wilpinjong, Cumbo and Wollar Creeks
14-19 Sep 2010	Annual Monitoring	12	Wilpinjong, Cumbo and Wollar Creeks
11-17 Sep 2011	Annual Monitoring	13	Wilpinjong, Cumbo and Wollar Creeks
11-17 Sep 2012	Annual Monitoring	13	Wilpinjong, Cumbo and Wollar Creeks
1-5 Oct 2013	Annual Monitoring	13	Wilpinjong, Cumbo and Wollar Creeks
May 2014	Wilpinjong Extension Project	14	Wilpinjong, Cumbo and Wollar Creeks and one weir opportunistically surveyed for fish
January 2017	Annual Monitoring	13	Wilpinjong, Cumbo and Wollar Creeks

A baseline aquatic ecosystem assessment was undertaken by Bio-Analysis for the EIS (WCPL, 2005). There has been some variation in sampling sites between surveys since the baseline survey, however the 12 stream reaches adopted in the first annual monitoring survey following commencement of mining, in 2006, have been sampled in every subsequent survey.

From 2010 onwards, site codes at sites in Cumbo Creeks and Wollar Creek were changed, to be ordered from upstream to downstream, for reasons of consistency and convention. The sites, with contemporary naming conventions, are shown on Figure 5.

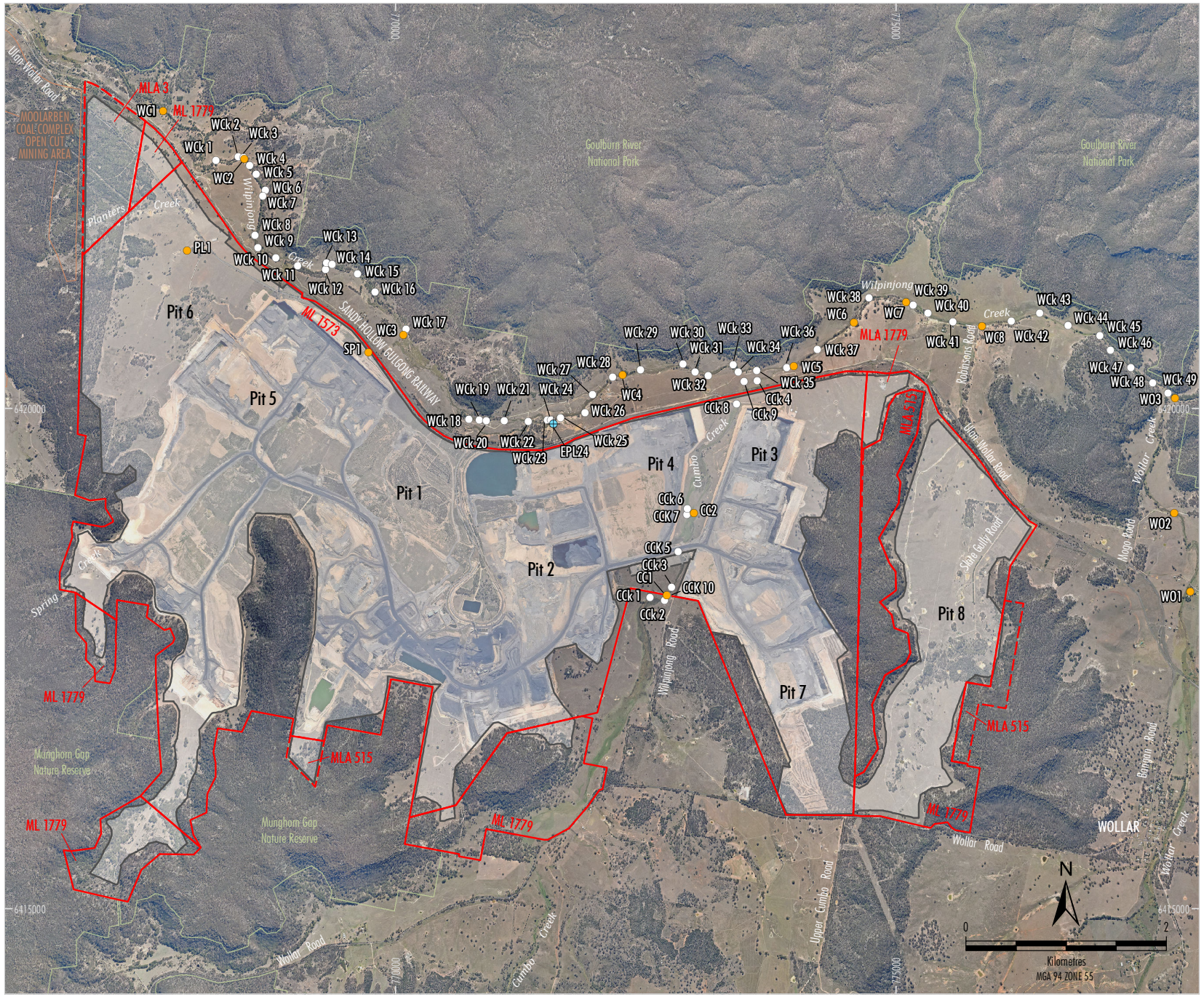
In 2011 an additional site in Wollar Creek, downstream of the junction with Wilpinjong Creek, was included in the monitoring program. This site had been included in the original EIS survey in 2004.

Of the 31 taxa recorded in the original EIS survey, all except two have been recorded in surveys since 2010. 30 of the 32 taxa that were recorded in the 2006, 2008 and 2009 surveys have been recorded in surveys since 2010. A total of 80 taxa have been identified in the surveys between 2010 and 2013 and 38 of these taxa were recorded in all four years.

Table 11 shows that total abundance of macroinvertebrates and total number of taxa collected in surveys since 2010 have been much greater than in earlier surveys. There are similarities between the most abundant macroinvertebrates reported by the earlier and later series of reports.

Table 11
Summary of Macroinvertebrates Collected in Stream Health Surveys

Date	Macroinvertebrates	Taxa	Most Abundant Taxa (in order of abundance)
25-27 May 2004 (EIS Baseline)	1065	31	*Hydrophilidae, Atyidae, Physidae*
Spring 2006			*Chironomidae, Dytiscidae, Atyidae*
Spring 2008			*Chironomidae, Atyidae, Dytiscidae*
October 2009	1353	36	*Chironomidae, Atyidae, Dytiscidae, Scirtidae*
14-19 Sep 2010	8430	51	*Chironomidae, Simuliidae, Lymnaeidae,Dytiscidae, Scirtidae*
11-17 Sep 2011	7781	57	*Hydropsychidae, Chironomidae, Simuliidae, Ostracoda, Scirtidae*
11-17 Sep 2012	10123	58	*Chironomidae, Simuliidae, Baetidae, Hydropsychidae, Leptoceridae*
1-5 Oct 2013	8433	56	*Chironomidae, Ostracoda, Simuliidae, Dytiscidae, Baetidae*
May 2014	1,146	30	*Atyidae, Corixidae, Chironomida, Dytiscidae and Notonectidae*
January 2017		42	*Leptoceridae, Dytiscidae, Atyidae and Chironomiae*



Peabody

WILPINJONG COAL MINE

Channel Stability and Stream Health Monitoring Locations

Figure 5

4.4 Channel Stability

A baseline channel stability assessment of Wilpinjong and Cumbo Creeks was undertaken by WCPL in August 2006 (WCPL, 2006) to characterize the existing condition of the Wilpinjong and Cumbo creek stream channels prior to mining.

The Wilpinjong Creek survey included 49 sites and extended 12.5 km from the upstream gauging station to the confluence with Wollar Creek to the east (Table 12).

The Cumbo Creek survey included 10 sites and extended 3 km from the southern boundary of ML 1573 north to the confluence with Wilpinjong Creek (Table 13).

Field surveys were conducted along the lengths of the two creek systems and involved the establishment of a series of monitoring points that could be revisited during subsequent follow up channel surveys. These monitoring points were made up of:

- transect sites;
- photo sites;
- waterholes;
- start and end points of creek reaches;
- confluences; and
- any other features of interest.

Table 12
Channel Stability Monitoring Sites – Wilpinjong Creek

Site No.[1]	Site Type	Description
WCk 1	Weir	WILGSU weir. Start of Reach 1. This section of the creek is relatively stable with natural rock armouring on bed and banks.
WCk 2	Reach	End of Reach 1 start of Reach 2.
WCk 3	Transect	Transect 1. Erosional transect monitoring site.
WCk 4	Transect	Transect 2. Erosional transect monitoring site.
WCk 5	Reach	End of reach 2 start of Reach 3. Well vegetated section of stream channel.
WCk 6	Photo	Well vegetated section of channel.
WCk 7	Photo	Typical Reach 3 vegetated section of channel.
WCk 8	Reach	End of Reach 3 start of Reach 4. Large in-channel waterhole.
WCk 9	Transect	Transect 3. Erosional transect site.
WCk 10	Track	Access track to Wilpin Farm.
WCk 11	Photo	Typical vegetated channel in Reach 4.
WCk 12	Transect	Transect 4. Erosional transect site.
WCk 13	Reach	End of Reach 4 start of Reach 5.
WCk 14	Photo	Typical Reach 5 well vegetated and relatively stable.
WCk 15	Reach	End Reach 5 start of Reach 6.
WCk 16	Water hole	Small waterhole in Reach 6. .
WCk 17	Water hole	Small in stream water hole suitable for aquatic fauna survey.
WCk 18	Water hole	Small in stream waterhole suitable for aquatic fauna survey.
WCk 19	Water hole	Small in stream waterhole suitable for aquatic fauna survey.
WCk 20	Transect	Erosional transect. Bank erosion present on northern bank.
WCk 21	Photo	Typical Reach 6. Relatively stable channel lined with reeds and other vegetation.
WCk 22	Photo	The main Wilpinjong Creek channel converges with another tributary inflowing from the south at this point.
WCk 23	Dry land Salinity	Degraded southern riparian area due to the effects of dryland salinity.
WCk 24	Reach	End Reach 6 start Reach 7. Southern bank is saline and degraded similar to and adjacent to site 23.
WCk 25	Photo	Typical reed lined channel in upper Reach 7 immediately downstream of the saline riparian area at sites 23 and 24.
WCk 26	Transect	Erosional transect on southern bank immediately below the Cumbo Creek property infrastructure.
WCk 27	Transect	Erosional transect on northern bank immediately below the Cumbo Creek property infrastructure.
WCk 28	Photo	Further active northern bank instability north east of the Cumbo Creek property infrastructure.
WCk 29	Photo	Further active northern bank instability north east of the Cumbo Creek property infrastructure.
WCk 30	Reach	End of Reach 7 start of Reach 8.

Table 12 (Continued)
Channel Stability Monitoring Sites – Wilpinjong Creek

Site No.[1]	Site Type	Description
WCk 31	Confluence	Confluence of small gully and Wilpinjong Creek.
WCk 32	Transect	Erosional transect site on southern creek bank.
WCk 33	Reach	End Reach 8 start Reach 9. "S bend" section of creek with small waterhole.
WCk 34	Transect	Erosional transect site on southern bank.
WCk 35	Photo	Typical Reach 9.
WCk 36	Photo	Confluence of Wilpinjong and Cumbo Creeks.
WCk 37	Transect	Active Erosional transect site on southern bank.
WCk 38	Reach	End of Reach 9 start of Reach 10.
WCk 39[2]	Photo	Erosional transect site.
WCk 40[2]	Dump	Dump site on the southern bank of the Smith property. Car bodies and miscellaneous refuse.
WCk 41[2]	Confluence	Confluence of Wilpinjong Creek and small north flowing gully.
WCk 42	Photo	Outcropping coal seam in southern bank of Wilpinjong Creek.
WCk 43	Reach	End of Reach 10 start of Reach 11.
WCk 44	Water hole	Waterhole below rural residence.
WCk 45	Reach	End of Reach 11 start of Reach 12. The creek passes close to the base of the Goulburn River National Park escarpment from this point onwards and the channel material is increasingly made up of rocky material. This has resulted in greater channel stability.
WCk 46	Water hole	Water hole below large sandstone torr.
WCk 47	Transect	Active erosional transect site on southern bank.
WCk 48	Photo	Depositional site on inside bend of low flow creek channel.
WCk 49	Confluence	Confluence of Wilpinjong and Wollar creeks.

[1] The site locations shown on Figure 5 are the original survey locations. Some of the current site locations have moved slightly from the original survey locations however they are generally in the same location as the original.

[2] These sites were previously located on private property and therefore access to these sites was not always possible for monitoring. WCPL has now acquired this property and therefore sites WCk39, 40 and 41 will be monitored in future.

Table 13
Channel Stability Monitoring Sites – Cumbo Creek

Site No.[1]	Site Type	Description
CC 1	Photo	This site is located immediately south of the southern boundary of ML 1573 and is the start of the channel stability monitoring for Cumbo Creek. Start of Reach 1.
CC 2	Photo	End of Reach 1 start of Reach 2.
CC 3	Transect	Transect site immediately below road crossing the creek.
CC 4	Photo	Typical Reach 2.
CC 5	Reach	End of Reach 2 start of Reach 3.
CC 6	Photo	The main eastern channel opens out at this point and is joined by a narrow shallow channel (2m wide * 1m deep) coming in from the west. The main channel opens out into a broad channel approximately 200m wide.
CC 7	Transect	Small western low flow channel.
CC 8	Transect	Site of the Cumbo Creek gauging station.
CC 9	Transect	Transect site on the final reach of Cumbo Creek before joining Wilpinjong Creek.
CC 10	Photo	Final reach of Cumbo Creek looking downstream towards the confluence with Wilpinjong Creek.

[1] The site locations shown on Figure 5 are the original survey locations. Some of the current site locations have moved slightly from the original survey locations however they are generally in the same location as the original.

The baseline survey concluded both Wilpinjong and Cumbo Creeks have been affected by pre-mining land management practices dominated by sheep and cattle grazing. These land management practices involved the clearing of riparian vegetation on both creeks to maximize grazing areas and stock access to drinking water. The clearing of this vegetation has contributed to bank instability. Wombat and rabbit burrows also contribute to instability problems. The survey noted that re-establishment of riparian corridors along the creek systems will provide a sustainable long term solution to current instability problems and that stabilization efforts should initially be focused on Wilpinjong Creek because of the higher degree of instability in this system.

Subsequent annual surveys have been undertaken to assess the ongoing stability of the Wilpinjong and Cumbo Creeks during mining. In 2010 Barnson developed a proforma to assist in the assessment of creek stability at each survey location and to enable comparisons to be made between annual surveys. For the 2013 survey an updated proforma was established, which includes the CSIRO Ephemeral Assessment Methodology and Bank Erosion Hazard Index (BEHI), as proposed by Heeren, D.M et al (2012).

Surveys undertaken since 2010 have found that the Wilpinjong Creek remains a highly degraded creek as a result of past land management practices, however there are areas of natural regeneration occurring that are related to stock access restriction from the riparian corridors. Cumbo Creek continues to lack structure and riparian features however it remains relatively stable. There is no visible evidence that mining within the vicinity of the creeks or discharge of water from the mine has resulted in creek bed lowering or increased erosion.

5 Water Management System

The sub-sections below provide a summary of the planned water management system for the Wilpinjong Coal Mine incorporating the Wilpinjong Extension Project, including relevant parts of the existing water management system on-site.

5.1 Clean Water Diversions

At the Wilpinjong Coal Mine, undisturbed area runoff is separated from disturbed area runoff by up-catchment diversions, where reasonable and feasible. Water that cannot be reasonably diverted (e.g. due to geotechnical/engineering limitations), is captured in the water management system. In accordance with EPL 12425, the Wilpinjong Coal Mine is permitted to discharge up to 15 ML/day of excess mine water to Wilpinjong Creek, providing the discharge meets certain requirements, including an upper limit on EC of 500 µS/cm.

Up-catchment diversion works will continue to be designed subject to site-specific review of soils and upslope catchment areas, with particular focus on channel stability and longevity. The design capacity of future up-catchment diversion works will depend on the size of the catchment, the design life of the up-catchment diversion and the potential consequences of a breach.

Stabilisation of the up-catchment diversions is achieved by the design of appropriate channel cross-sections and gradients and the use of channel lining materials such as grass or rock fill. In general, up-catchment diversions will be designed as 'contour' drains with low longitudinal gradients (e.g. 0.5%) to limit erosion potential.

Small parts of undisturbed catchment would lie between the planned up catchment diversion structures and the progressive extent of the Wilpinjong Coal Mine disturbance boundary. However, given the site-specific issues with constructing up-catchment diversion structures (e.g. the suitability of in-situ sandy soils in some areas and the associated engineering and materials selection and placement that may be required for these diversions), the proposed approach of establishing engineered diversions that would remain for extended periods until rehabilitated areas are suitable to become free draining is considered best practice (WRM Water and Environment, 2015).

Details of the key up-catchment runoff water control structures for the Wilpinjong Coal Mine (incorporating the Wilpinjong Extension Project) are described below. Up-catchment diversion dams will be used in areas where contour drains are impractical (e.g. due to topography). Accumulated water in up-catchment diversion dams will be discharged in between runoff events by either pumping or gravity flow through pipelines located either around or through the mining operations to stabilised outfalls, ultimately reporting to either Wilpinjong Creek or Cumbo Creek. Up-catchment diversion dams will be operated as dry detention basins and therefore are not required to be licensed.

Up-catchment diversions and associated dams/pipelines will be progressively developed as the Wilpinjong Coal Mine advances. Indicative timing for the establishment of diversions is provided on the staged plans in Appendix A of the SWB.

In practice, areas that are not intended to be developed in the immediate future (e.g. Pit 6 extension area) will continue to remain free-draining until the clean water diversions are required to be established.

Pit 1 Diversion

A diversion structure and transfer dam will be constructed to the south of the Pit 1 South Dam, with an associated pipeline to divert up-catchment runoff north to a drainage path in established rehabilitation.

The up-catchment diversions are shown conceptually on the progressive water management system snapshots in Appendix A of the SWB.

Completion of the Pit 1 diversion is scheduled for third quarter 2018.

Pit 2 Diversion

A diversion structure will be constructed to the south of Pit 2, diverting up-catchment runoff northeast toward Cumbo Creek.

Completion of the Pit 2 diversion is scheduled for third quarter 2018.

Pit 3 Diversion

A diversion structure and transfer dams will be constructed along the eastern boundary of Pit 3, with an associated pipeline to divert up-catchment runoff west of Pit 7. An additional transfer dam and pipeline will be constructed to divert up catchment runoff north of Pit 3 once mining progresses to the north-eastern portion of Pit 3.

Completion of the Pit 3 diversion is scheduled for fourth quarter 2018.

Pit 5 Diversions

Diversion structures and transfer dams will be constructed progressively in advance of the open cut mining operation, with associated pipelines to divert up-catchment runoff north either in advance of mining in Pit 6, or to a drainage path in the established rehabilitation of Pit 5.

Completion of the Pit 5 diversion is scheduled for fourth quarter 2018.

Pit 6 Diversions

Diversion structures will be constructed progressively in advance of the open cut mining operation in Pit 6, to divert up-catchment runoff north of the advancing pit.

Completion of the Pit 6 diversion is scheduled for third quarter 2018.

Pit 7 Diversion

A diversion structure, transfer dam and associated pipelines will be constructed along the eastern boundary of Pit 7, to divert up-catchment runoff west of Pit 7.

Completion of the Pit 7 diversion is scheduled for fourth quarter 2018.

Pit 8 Diversions

Diversion structures and transfer dams and associated pipelines will be constructed along the western boundary of Pit 8 to divert up catchment runoff to the north. Corresponding diversion structures will also be constructed progressively in advance of the open cut mining operation, to divert up-catchment runoff along the eastern boundary.

5.2 Sediment Dams and Associated Infrastructure

Sediment dams contain runoff from waste emplacement areas and topsoiled/partially rehabilitated mine areas that have been shaped to final profiles, covered with topsoil and seeded. Sediment dams allow for gravity settling of sediment prior to release off-site.

Sediment dams will be maintained until such time as vegetation successfully establishes on topsoiled areas and where runoff has similar water quality characteristics to areas that are undisturbed by mining activities.

All sediment dams that are designed to overflow to the environment would be designed and managed in accordance with the following sub-sections.

5.2.1 Design Criteria

Settling zone capacity, sediment storage zone capacity, and sediment dam capacity are calculated using equations 1, 2 and 3 below respectively (Landcom (2004) and DECC (2008)):

$$\text{Settling Zone Capacity } (m^3) = V_{settling} = 228.5 \times A \quad (1)$$

For catchments containing slopes less than 15%:

$$\text{Sediment Zone Capacity } (m^3) = V_{sediment} = 0.5 \times V_{settling} \quad (2a)$$

Otherwise:

$$\text{Sediment Zone Capacity } (m^3) = V_{sediment} = 134.9 \times A \quad (2b)$$

$$\text{Required Dam Capacity } (m^3) = V_{total} = V_{settling} + V_{sediment} \quad (3)$$

Where;

$V_{settling}$ = settling volume

$V_{sediment}$ = sediment storage volume

V_{total} = total volume

A = catchment area of the sediment dam (ha)

Equation (1) has been calculated from the equation given in Section 6.3.4 (i) (i) of Landcom (2004) and assuming a volumetric runoff coefficient (Cv) of 0.64 (Table F-2 of Landcom [2004]) assuming high runoff potential (default assumption per Section 6.1 of DECC [2008]). Historically, a 90th percentile, 5-day rainfall of 35.7mm (average of values for Scone and Dubbo from Table 6.3a of Landcom [2004]) has been adopted at the Wilpinjong Coal Mine. However, as requested by the EPA during consultation for the assessment of Wilpinjong Extension Project, WCPL will adopt a design rainfall depth of 44 millimetres for all future sediment dams, which is based on a 95th percentile 5 day rainfall event for the Central Tablelands area.

Equation 2b above has been calculated from the RUSLE equation as given in Section 6.3.4 (i) (ii) of Landcom (2004) and assuming:

- Rainfall erosivity factor (R) of 1396, calculated from Appendix A of Landcom (2004);
- Soil erodibility factor (K) of 0.05 (default assumption per Section 6.1 of DECC [2008]);
- Length-slope factor (LS) of 11.6 which is the maximum value for an 80-metre slope length (Table A1 of Landcom [2004]);

- Erosion control practice factor (P) of 1.3 (maximum value – Table A2 of Landcom [2004]); and
- Cover factor (C) of 1 (maximum value – Fig A5 of Landcom [2004]).

Outlet structures from sediment dams will also be designed in consideration of DPI Water's *Guidelines for Outlet Structures* (NSW Office of Water [NOW], 2010).

5.2.2 Sediment Dam Management

WCPL will implement the following management measures in relation to sediment dams:

- Within 5 days following a rainfall event, sediment dams will be dewatered to the mine water system or to well-grassed areas where sufficient grassed buffer exists to prevent the migration of sediments to watercourses. Grassed buffers must be located a minimum of 100 m from the high bank of the nearest watercourse (measured perpendicularly) and in consideration of any sensitive receptors.
- Sediment dams will be maintained in between rainfall events to ensure sufficient capacity is available to manage the required rainfall intensity.
- Sediment dam batters will be appropriately stabilised to assist with minimising the potential for erosion of dam batters.
- Sediment dams that have the potential to spill to the environment will be inspected monthly and immediately after rainfall events with more than 20mm in 24 hours. Dams will be inspected for capacity, structural integrity and effectiveness. Where inspections indicate substantial accumulation of sediment in a sediment dam, clean-out will be undertaken as soon as practicable so as to reinstate the minimum required volumes.

Each inspection will be documented with photographs and a summary of the identified maintenance requirements for each inspected dam. This information will be captured in the Wilpinjong Coal Mine's data management system to so that all required maintenance is tracked.

As requested by the EPA, WCPL will apply as required to vary EPL 12425 to incorporate any sediment dams that will discharge off-site under high intensity rainfall events. EPL 12425 would be updated to include sediment dams that would discharge off-site progressively, as appropriate waste emplacement areas and topsoiled/partially rehabilitated mine areas become available. This Surface Water Management Plan would be updated to describe these sediment dams and associated infrastructure when EPL 12425 is varied.

WCPL are currently managing sediment dams on-site to avoid discharges to the environment by directing all water back to the mine water management system.

5.2.3 Water Quality Considerations

Following feedback from the NSW EPA and the IESC, WCPL considered the potential for mobilisation of metals from sediment dams in the Wilpinjong Extension Project Response to Submissions.

The analysis found that concentrations of Molybdenum (Mo), Selenium (Se) and Arsenic (As) in existing Wilpinjong Coal Mine water storages were typically lower than the NHMRC (2011) human drinking water guideline value and recommended water quality trigger value for 99% species protection in freshwater aquatic ecosystems (ANZECC and ARMCANZ, 2000).

The storages considered in the Response to Submissions were typically mine water storages, or sediment dams that overflowed to mine water storages. It was noted that concentrations are expected to be lower in sediment dams established to collect runoff from rehabilitated areas than the already low observed concentrations in the mine water storages, which capture water that has been in contact with coal or coal reject material.

Notwithstanding, WCPL is undertaking ongoing sampling for these metals (Section 8.2.3).

5.2.4 Temporary Sediment Control Devices

Where a sediment dam is not required, temporary sediment control devices such as sediment fences will be installed in advance of surface disturbance works. These controls are designed for use in short-term projects such as exploration drill pads, erosion repairs, construction of temporary maintenance areas or where the construction of sediment dams or collection drains is considered impractical.

WCPL will implement the following management controls in relation to temporary sediment control devices:

- temporary controls will be implemented for disturbed catchment areas of less than 1ha only;
- temporary controls will be installed immediately downstream of the area to be disturbed;
- temporary controls will be installed along contour where practicable;
- sediment fences will be constructed using geotextile filter fabric with structural posts to be spaced no more than 2.5 metres apart (Appendix 1);
- sediment fences will not be installed in concentrated flow areas where the effectiveness of the fences may be impeded (e.g. perpendicular across waterways or drains);
- where practicable, the catchment areas managed by temporary controls will be limited by constructing the controls with small ‘returns’ at 20 metre intervals (maximum) to create smaller contributing sub-catchments; and
- temporary controls will be inspected monthly and immediately after rainfall events with more than 20mm in 24 hours. Where inspections indicate substantial accumulation of sediment or damage, clean-out or repairs/replacement will be undertaken as soon as practicable.

5.3 Mine Water Management System

The objectives of the mine water management system:

- to protect the integrity of local and regional water sources;
- to operate such that there was no contained water storage overflow;
- to maintain separation between runoff from areas undisturbed by mining and water generated within active mining areas; and
- to provide a reliable source of water to meet mine requirements (e.g. dust suppression).

Details regarding the mine water management system are provided in the Site Water Balance.

5.4 Final Voids

WCPL developed a final landform for the Wilpinjong Coal Mine in consultation with DP&E, DRE and the NSW Planning Assessment Commission during the assessment of the Wilpinjong Extension Project. This process included redesign of the Pit 8 final landform such that the southern end is wholly free draining (either north into Wilpinjong Creek, or west into the Cumbo Valley) and no longer includes a final void.

The two remaining approved final voids (Pit 2 and Pit 6) would both be groundwater sinks and are shown on the approved final landform figure (Appendix 8 of Development Consent SSD-6764).

Detailed mine planning towards the end of the mine life will seek to minimise the size of the final voids as far as reasonable and feasible. The final voids will be designed having regard to minimising highwall instability risk. A Final Void Management Plan will be developed in consultation with the DRE and other relevant authorities as a component of the Mine Closure Plan in advance of mine closure. The final void design and the Final Void Management Plan will be periodically reviewed in consultation with the DRE and other relevant authorities.

Condition 61, Schedule 3 of Development Consent (SSD-6764) requires preparation of a Rehabilitation Strategy. This Surface Water Management Plan will be reviewed and, if required, updated to reflect the approved Rehabilitation Strategy.

5.5 Reinstatement of Drainage Lines on Rehabilitated Areas

Conditions 26, Schedule 3 of Development Consent SSD-6764 specify that the Cumbo Creek relocation must be designed, constructed, maintained, and rehabilitated to the satisfaction of the Secretary of the DP&E.

WCPL will prepare a Cumbo Creek Relocation Plan in accordance with Condition 30(d)(iii), Schedule 3 of Development Consent (SSD-6764). The Cumbo Creek Relocation Plan will be prepared to satisfy Conditions 26 to 28, Schedule 3 of Development Consent SSD-6764 at a suitable time prior to mining of the current creek alignment as agreed by the Secretary of DP&E.

The Wilpinjong Coal Mine Rehabilitation Objectives (Condition 29, Schedule 3 of Development Consent SSD-6764) require that all other reinstated drainage lines are restored in accordance with the principles, concepts and techniques described in *A rehabilitation manual for Australian streams* (Rutherford,I; Jerie, K; Marsh, N 2000) (the Manual). The Manual acknowledges that it is seldom possible to successfully restore stream systems to their original pre-European state (restoration) so instead the typical goal is to return the stream to as much of the original state as possible (rehabilitation).

Riparian and instream habitats in the vicinity of the Wilpinjong Coal Mine have been substantially altered by historical and ongoing agricultural land use practices. These areas are considered to provide poor aquatic habitat due to a low diversity of aquatic plants, with some areas heavily infested by riparian and aquatic weeds; having macroinvertebrate assemblages generally dominated by pollution-tolerant taxa; and little to no ecological value for fish species (Bio-Analysis, 2015).

As described in the Manual, this is a result of historical stream management over-emphasising the importance of asset protection and economic production at the expense of the three other basic values for which streams are managed (cultural and social significance, recreation and environment).

WCPL's drainage line rehabilitation objectives adopt ecological values as core goals, consistent with the 'revolution' approach described in Section 2.12 of the Manual.

WCPL has engaged Alluvium Consulting Australia (Alluvium) to undertake a review of existing waterways and potential rehabilitation materials available on-site in order to develop a suitable final drainage system for the Wilpinjong Coal Mine final landform.

Alluvium's study is currently underway but feedback from initial site investigations indicates:

- The creeks which flow through the Wilpinjong Coal Mine area show limited evidence of regular surface flow. Surface flow may occur following very heavy rainfall or in isolated locations where springs seep into the drainage line.
- Within all valleys (excluding Cumbo Creek) there is minimal evidence of alluvial deposits within the valley floor or aquatic vegetation which is typical of swampy, discontinuous valley fill watercourses. Within Cumbo Creek the alluvial layer ranges from very shallow to non-existent.
- It is likely that geology of the region results in high rates of infiltration and sub-surface flow.
- With the existing (or pre-mine) vegetation characteristics the surface flow is unlikely to generate shear stress or stream power values which are able to scour a defined channel.

Based on the initial investigations, WCPL's conceptual approach is to create valley fill stream types along lines similar to the historical alignments. Surface flow will occur in the valley fill streams after the backfilled pit is saturated, or following large rainfall events where the infiltration rate is exceeded. This conceptual approach is generally consistent with the nature of the existing drainage lines at the Wilpinjong Coal Mine.

The Wilpinjong Coal Mine Rehabilitation Objectives require WCPL to restore:

- Rehabilitate at least 2,906 hectares of self-sustaining woodland ecosystem.
- Establish self-sustaining ecosystem function in areas of aquatic habitat, within diverted and/or re-established drainage lines.

The development of self-sustaining woodland ecosystems adjacent to the valley fill streams in combination with the establishment of self-sustaining aquatic ecosystems in-stream, will represent a significant improvement relative to the poor pre-mining aquatic habitat in the existing drainage lines.

Subject to the outcomes of Alluvium's study, preliminary water quality runoff criteria for rehabilitated areas include:

- pH (H_2O) 6.0 – 8.5;
- EC <1000µS/cm; and
- TSS <50mg/L.

5.6 Wilpinjong Creek Management Strategies

The banks of Wilpinjong Creek have been subject to erosion, grazing by cattle and invasion by weeds such as Blackberry (Rubus fruticosus) and a Rush (Juncus acutus) resulting in a deeply incised channel up to 4 m deep in some areas (Bio-Analysis, 2005). Generally, the riparian trees are sparse and discontinuous. There are patches of Typha and Phragmites rushes, both water dependent species, within Wilpinjong Creek. Other than these species, the vegetation along the creek has been substantially cleared (Bio-Analysis, 2005).

Riparian vegetation will be established along Wilpinjong Creek in the residual Regeneration Areas and the Enhancement and Conservation Areas through natural regeneration/selective planting. This will increase the quantity of riparian vegetation along Wilpinjong Creek and improve the condition of habitats available to aquatic biota. Approximately 10 km of the creek line along Wilpinjong Creek would be revegetated/enhanced by WCPL over a period of approximately 10 years.

Rehabilitating the mining areas located in the Wilpinjong Creek catchment to self-sustaining woodland ecosystems (i.e. as opposed to the pre-mining largely cleared nature of the mining area) in combination with the natural regeneration/selective planting in-stream, will represent a significant improvement relative to the poor pre-mining aquatic habitat in Wilpinjong Creek. It is anticipated that increased riparian vegetation would also lead to improvements in the geomorphic complexity of Wilpinjong Creek given vegetation growth has been shown to increase sediment trapping efficiency, promoting infilling (which leads to pooling) and increasing stream stability (Zierholz et al. 2001; Molina et al. 2009 in Streeton et al., 2013).

The revegetation of part of the Wilpinjong Creek catchment with native woodland is also anticipated to improve long-term salinity levels immediately downstream of the Wilpinjong Coal Mine, because trees and other native vegetation (Queensland Department of Environment and Resource Management, 2009):

- reduce the amount of water reaching the watertable in recharge zones;
- provide ground cover to reduce water loss to evaporation; and
- increase shallow ground water-use in transmission zones.

5.7 Flooding

Anecdotal advice provided by landholders indicates that major floods in the past have not resulted in extensive flooding outside the creek banks (Gilbert & Associates, 2005).

The largest flood in living memory occurred in February 1955. The available rainfall records for the area confirm that it would have been the largest event since rainfall records started late in the 19th century. Local knowledge confirms that there has not been any event since which has been particularly significant in terms of inundation or damage to property along Wilpinjong Creek (Gilbert & Associates, 2005).

The Sandy Hollow Gulgong Railway embankment was constructed during the Second World War and acts as an existing flood barrier between Wilpinjong Creek and the Wilpinjong Coal Mine (i.e. the embankment levels have been selected to provide immunity to floods significantly larger than the 1 in 100 year Annual Exceedance Probability [AEP] criteria used for culvert sizing). There is no anecdotal evidence of the railway embankment having been overtopped during the 1955 flood or at any other time since (Gilbert & Associates, 2005).

The Wilpinjong Coal Mine open cuts is located outside the extent of flooding from Wilpinjong Creek in the 1 in 1,000 AEP design flood. Flood mitigation works for open cut infrastructure in the vicinity of Cumbo Creek are already being implemented at the Wilpinjong Coal Mine and have been designed to a 1 in 100 AEP flood protection (WRM Water and Environment, 2015).

Consistent with Condition 29, Schedule 3 of Development Consent (SSD-6764), WCPL will maintain all open cut pits, CHPP, coal stockpiles and main mine facilities areas so that they exclude flows for all flood events up to and including the 1 in 100 year ARI.

The two final voids (Section 5.4) would be designed to exclude all flood events up to the probable maximum flood.

6 Surface Water Impact Trigger Values

Surface water impact trigger values for the Wilpinjong Coal Mine incorporating the Wilpinjong Extension Project are outlined in the following sub-sections.

Where applicable, these triggers remain consistent with the approved trigger levels previously agreed with DP&E and the relevant consultees in the Water Management Plan approved under Project Approval 05-0021.

6.1 Downstream Surface Water Quality

The ANZECC & ARMCANZ (2000) guidelines recommend that wherever possible, site-specific data is used to define trigger values for physical and chemical factors which can adversely impact the environment. Trigger values are not regarded as assessment criteria; rather they are used to initiate investigations into the surface water quality as reported by the monitoring program.

The approach recommended by ANZECC & ARMCANZ (2000) for developing site-specific trigger values for highly disturbed ecosystems is to formulate trigger values based on the 80th percentile of the site-specific monitoring data. The objective of this approach is to develop conservative, site-specific trigger values for use as a means to improve water quality in highly disturbed ecosystems. In accordance with Section 6.4.3.1 of the Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC and ARMCANZ, 2000b), site specific trigger levels for downstream water quality have been established based on a baseline monthly monitoring period of almost four years (i.e. in excess of the required 24 months of sampling data).

This approach to defining site-specific trigger values does not necessarily account for the water quality variability due to the properties of the waterways present in the region surrounding the Wilpinjong Coal Mine, which include upstream influences and the local effects of saline groundwater discharge associated with coal measures. Therefore, exceedance of an 80th percentile trigger value may not necessarily mean a mining-related impact has occurred. Instead, exceedances of the trigger will initiate investigations into surface water quality to determine whether the exceedance is a result of natural water quality variations, other upstream influences (e.g. saline groundwater discharge) and/or a mining-related impact. The investigation processes are described in Section 7.

The existing water quality in Wilpinjong Creek, Cumbo Creek and Wollar Creek is discussed in Section 4.2. Table 14 summarises trigger levels for EC, turbidity and pH (based on 80th and 20th percentile baseline data values) that have previously been agreed for the existing Wilpinjong Coal Mine (with the exception of EC). DPI Water has recommended a specific downstream EC trigger for Wilpinjong Creek (3,440 µS/cm) that incorporates the extended operational period of record (Table 9). This trigger should be applied cognisant of the fact that the operational data period includes a reduction in EC associated with operation of the existing RO Plant and excludes the extended period of high EC observed pre mining.

Table 14
Water Quality Impact Assessment Criteria

Creek	Monitoring Site	Parameter	Trigger[1]
Wilpinjong Creek (Downstream)	WIL_NC, WIL_D2, WIL_D, WIL_2	EC	If recorded value at the monitoring site is greater than **3,440 µS/cm** for 3 consecutive readings
		Turbidity	If recorded value at the monitoring site is greater than **24 NTU** for 3 consecutive readings
		pH (lower)	If recorded value at the monitoring site is less than **6.9 pH** for 3 consecutive readings
		pH (upper)	If recorded value at the monitoring site is greater than **7.7 pH** for 3 consecutive readings
Cumbo Creek (Downstream)	CC1	EC	If recorded value at the monitoring site is greater than **7,510 µS/cm** for 3 consecutive readings
		Turbidity	If recorded value at the monitoring site is greater than **77 NTU** for 3 consecutive readings
		pH (lower)	If recorded value at the monitoring site is less than **7.5 pH** for 3 consecutive readings
		pH (upper)	If recorded value at the monitoring site is greater than **8.2 pH** for 3 consecutive readings

[1] Trigger is only considered to have been exceeded if the recorded value at monitoring site is greater than (or less than for lower pH Trigger) all values from the upstream monitoring sites sampled on the same day. In the event that a single result is recorded above/below the 80th/20th percentile value, WCPL will undertake a preliminary investigation to ascertain whether the result was caused by an obvious anomaly or whether further testing is required.

6.2 Stream Health

Previous stream health monitoring has covered Wilpinjong, Cumbo and Wollar Creeks.

Annual stream health surveys will continue to comply with AUSRIVAS protocols for sampling edge and bed habitats so that surveys produce comparable results

Because flow conditions in local waterways are extremely variable there will always be a need for professional judgement in interpreting quantitative survey results; nonetheless quantitative criteria have been set which will serve as guideline trigger values for Wilpinjong, Cumbo and Wollar Creeks. On the basis of the results of previous stream health surveys, which have covered the range of normal seasonal conditions, the following approved trigger conditions have been adopted for all monitoring sites:

- Minimum taxon richness: 15 taxa; and
- Abundance weighted SIGNAL index: minimum value 3.0.

These values represent near to the lower limit of the common range of values recorded over the more recent historical surveys, and may be refined further as a percentile value after further annual survey results are added to the dataset. If survey results at any site fail to meet either of these criteria an investigation will be carried out to determine the nature and source of any environmental impacts at the site and propose remedial actions (Section 7).

Additional biotic indices as outlined in Section 8.2.4 may be used to supplement SIGNAL values and taxon richness as indicators of stream health, however there are insufficient baseline data to set trigger values based on these indices at this time.

Assessments will be made by compiling these indices for each site at each sample time, comparing the three site indices against indices compiled for other sites within each survey and assessing changes in the indices for each site over time (i.e., between surveys).

6.3 Channel Stability

The results from annual channel stability surveys are compared against the baseline survey and previous year's survey to determine if there has been any perceptible impact from mining on the Wilpinjong and Cumbo Creeks.

Parameters used to compare to the baseline survey include:

- bank height;
- bank angle;
- percentage of bank height with a bank angle greater than 80 degrees;
- evidence of mass wasting (percentage of bank);
- unconsolidated material (percentage of bank);
- streambank protection (percentage of streambank covered by plant roots, vegetation, logs, branches, rocks, etc.);
- established beneficial riparian woody vegetation cover; and
- stream curvature.

6.4 Geochemistry

The Wilpinjong Extension Project Geochemistry Assessment (GEM, 2015) indicated the presence of potentially acid forming (PAF) materials at the Wilpinjong Coal Mine. PAF material will be either well blended with non-acid forming (NAF) or acid consuming waste rock, producing an overall NAF material or buried under NAF waste rock.

NAF material will be placed on the outer 2 m of the backfilled mine voids and the outer 5 m of the approved elevated waste rock emplacement in Pit 2.

If PAF or potentially acid forming – low capacity material is exposed in the floor of any of the final voids, it will be either:

- covered with NAF waste rock to a minimum depth of 5 m;
- excavated and disposed of as PAF waste rock (as described above); or
- flooded with water from the site water management system.

WCPL will implement an ongoing waste rock testing program (i.e. minimum of two boreholes per annum to 2020) and associated management measures to confirm the waste rock scheduled to be placed within the final outer surface of the back-filled mine voids (i.e. outer 2 m) and the elevated waste rock emplacement (i.e. outer 5 m) is NAF.

Consistent with the outcomes of the Geochemistry Assessment (GEM, 2015), any weathered and/or alluvial materials, identified as potentially sodic, will be excluded from the surface of any waste rock emplacements. If the sodic materials occur within any of the final waste rock emplacement surfaces, they will be treated with materials containing soluble calcium such as gypsum, calcium chloride or limestone, in order to promote successful rehabilitation.

The Geochemistry Assessment (GEM, 2015) analysis of water extracts from selected waste rock and coal reject samples indicated most metals will be relatively insoluble under the prevailing neutral to slightly alkaline pH conditions. Mo and Se were however identified as likely to be soluble under these prevailing pH conditions. The Geochemistry Assessment (GEM, 2015) analysis of selected coal reject samples indicated that arsenic (As) is enriched in the Goulburn and Turill coal seams. However, analysis of water extracts indicated As will be insoluble under the prevailing neutral to slightly alkaline pH conditions.

Consistent with recommendations from the EPA and IESC received during the assessment of the Wilpinjong Extension Project, WRM Water and Environment (2015) considered the potential impacts of discharge in terms of the element enrichments and solubilities identified in the Geochemistry Assessment and concluded that the risk of elevated dissolved solids and other contaminants impacting downstream waters is considered to be low. Further analysis in the Wilpinjong Extension Project Response to Submissions found that concentrations of Mo, Se and As in existing Wilpinjong Coal Mine water storages were typically lower than the NHMRC (2011) human drinking water guideline value and recommended water quality trigger value for 99% species protection in freshwater aquatic ecosystems (ANZECC and ARMCANZ, 2000).

Notwithstanding, as recommended by the IESC, WCPL will undertake monthly monitoring at locations upstream and downstream of the mine in order to validate the outcomes of these assessments (Section 8.2). Consistent with DP&E's request, WCPL will develop an interim trigger based on all available Mo, Se and As data obtained up to the end of 2017 for inclusion in the next revision of this SWMP (i.e. to be prepared coincident with the Annual Review in March 2018). Once sufficient monitoring data exists, more robust trigger levels will be established for Mo, Se and As in accordance with the ANZECC & ARMCANZ (2000) guidelines. This is consistent with the approach previously undertaken to establish the approved trigger levels for EC, turbidity and pH (Section 6.1).

The management of the geochemical properties of waste materials is also considered in the Groundwater Management Plan.

6.5 Reinstated Drainage Lines

As described in Section 5.5, WCPL has engaged Alluvium to develop a suitable drainage system for the Wilpinjong Coal Mine final landform. As a component of this study, WCPL will develop appropriate trigger levels for the reinstated drainage lines over the course of 2017 and 2018. Once complete, this SWMP will be updated to include the trigger levels for the reinstated drainage lines.

Water quality triggers developed in accordance with Section 6.1 and 6.4 will continue to be used to monitor for potential effects of water runoff from the rehabilitated areas of the Wilpinjong Coal Mine.

6.6 EPL Discharge Conditions

As at 12 May 2017, Conditions L2.4 and L3.1 of EPL 12425 state the concentration and volume limits for discharge from the Wilpinjong Coal Mine water treatment facility (EPL Point 24). The discharge limits are as follows:

- the volume of water must not exceed 15 ML/day;
- EC must not exceed 500 µS/cm;
- oil and grease must not exceed 10 mg/L;
- pH must lie within 6.5 and 8.5; and
- TSS must not exceed 50 mg/L.

A TARP in the event a discharge from the water treatment facility fails to comply with these criteria is provided in Section 7.5.

7 Surface Water Response Plan

This section outlines WCPL's Trigger Action Response Plans (TARPs) in the event that trigger conditions established in Section 6 are exceeded.

Where applicable, these TARPs remain consistent with the approved protocols previously agreed with DP&E and the relevant consultees in the Water Management Plan approved under Project Approval 05-0021.

If at any time during the investigation protocol the trigger exceedance/complaint is deemed not to have occurred as a result of activities at the Wilpinjong Coal Mine, the response protocol can be ceased without completing the remaining steps.

7.1 Surface Water Quality

Triggers for surface water quality have been set for monitored EC, turbidity and pH for monitoring locations on Wilpinjong, Cumbo and Wollar Creeks (Section 6.1). These have been defined in terms of persistent statistical variation from baseline data and comparison with upstream monitored values. In the event that one of the water quality trigger levels are exceeded, the TARP in Table 15 will be implemented.

Table 15
Surface Water Quality TARP

TARP	
Trigger	• Three consecutive water monitoring results cause trigger to be exceeded (Section 6.1)
Action	1. Notify the WCPL ECM. 2. Check and validate the data which indicates the trigger conditions have been exceeded. 3. Notify DP&E, EPA, DPI Water and other relevant agencies as soon as that an exceedance of the trigger level has occurred and investigation will be undertaken. 4. Collect supplementary samples upstream and downstream of the Wilpinjong Coal Mine. 5. Assess any changes to WCPL activities and inspect all relevant Erosion and Sediment controls. 6. Assess conditions (climatic, hydrological, hydrogeological and changes in land use activities in the catchment – including other mining activities and riparian revegetation works), preceding and during the event and assess their impact. 7. Investigate changes in continuously recorded salinity values with time and between stream gauging stations to assess if any trends are evident. 8. Identify plausible and possible causes of the trigger. 9. Decide if the trigger was directly caused by or predominantly as a result of activities being undertaken by or directly related to the Mine. 10. If required, engage and suitably qualified aquatic ecologist or similar to determine if any material harm to the surface water ecosystems have occurred. 11. Provide a preliminary investigation report to DP&E, EPA, DPI Water and relevant agencies within 7 days of identifying the trigger.

Table 15 (Continued)
Surface Water Quality TARP

TARP	
Response	• Develop/design contingency and remedial measures based on the results of the above investigations. Contingency and remedial measures considered practical for implementation may include: ○ notification to landholders on the Goulburn River downstream of the Goulburn River National Park, if the exceedance is likely to affect them; ○ provide an alternative water source during the duration of the breach; ○ review and refine the Surface Water Monitoring Program; ○ review and refine processes for inspection, maintenance and siting of water management infrastructure (e.g. dams, pipelines, pumps); ○ repair, replace, or construct new water management infrastructure; and ○ develop and implement a training package specifically related to the cause of the incident/non-compliance.
Plan	• Communicate results of investigation, contingency and remedial measures to government agencies as required and summarise in the Annual Review. • If required, review and update the WMP and resubmit to DP&E. • Where an investigation determines that an exceedance of the water management performance measures in Table 6 of Development Consent SSD-6764, WCPL would (in accordance with Schedule 5, Condition 2 of Development Consent SSD-6747): ○ 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 Department describing those options and any preferred remediation measures or other course of action; and ○ implement reasonable remediation measures as directed by the Secretary.

7.2 Stream Health

Stream health assessment criteria have been developed on the basis of previous annual surveys (Section 6.2). In the event that one of the stream health trigger levels are exceeded, the TARP in Table 16 will be implemented.

7.3 Surface Water User

There are no private landholders downstream of the Wilpinjong Coal Mine on either Wilpinjong Creek or Wollar Creek. Notwithstanding, in the event that a surface water-related complaint is received from a local landholder further downstream (e.g. on the Goulburn River) in relation to a potential mine-related impact on their surface water supply, the response plan in Table 17 will be implemented.

Table 16
Stream Health TARP

TARP	
Trigger	• Deterioration of one of the indices below the trigger level.
Action	1. Notify the WCPL ECM or delegate. 2. Check and validate the data which indicates the trigger conditions were exceeded. 3. Notify DP&E, EPA and other relevant agencies as soon as practicable that an exceedance of the trigger level has occurred and investigation will be undertaken. 4. Collect supplementary samples upstream and downstream of the Mine. 5. Assess any changes to WCPL activities and inspect all relevant Erosion and Sediment controls. 6. Assess conditions (climatic, hydrological, hydrogeological and changes in land use activities in the catchment – including other mining activities and riparian revegetation works), preceding and during the event and assess their impact. 7. Check monthly recorded water quality data to see if any trend is evident. 8. Investigate changes in continuously recorded salinity values with time and between gauging stations to assess if any trends are evident. 9. Identify plausible and possible causative mechanisms and assess/quantify these against all relevant data and information to identify most likely causes. 10. Decide if the trigger was directly caused by or predominantly as a result of activities being undertaken by or directly related to the Mine. 11. If required, engage and suitably qualified aquatic ecologist or similar to determine if any material harm to the surface water ecosystems have occurred. 12. Provide a preliminary investigation report to DP&E, EPA and relevant agencies within 7 days of identifying the trigger.

Response	• Develop/design contingency and remedial measures based on the results of the above investigations. Contingency and remedial measures considered practical for implementation may include:
	  ○ undertake stream bed and bank remedial works including desilting and revegetation works;
	  ○ review and refine the stream health and surface water monitoring programs; and
	  ○ restrict stock access to affected areas of the stream.

Plan	• Communicate results of investigation and subsequent contingency and remedial measures to government agencies as required and summarise in the Annual Review.
	• If required, review and update the WMP and resubmit to DP&E.
	• Where an investigation determines that an exceedance of the water management performance measures in Table 6 of Development Consent SSD-6764, WCPL would (in accordance with Schedule 5, Condition 2 of Development Consent SSD-6747):
	  ○ 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 Department describing those options and any preferred remediation measures or other course of action; and
	  ○ implement reasonable remediation measures as directed by the Secretary.

Table 17
Private Surface Water User Complaint TARP

TARP	
Trigger	• Complaint by local landholder regarding surface water supply.
Action	1. Notify the WCPL ECM or delegate. 2. Check and validate the information provided with the complaint. 3. Collect supplementary samples upstream and downstream of the Mine. 4. Assess any changes to WCPL activities and inspect all relevant Erosion and Sediment controls 5. Assess conditions (climatic, hydrological, hydrogeological and changes in land use activities in the catchment – including other mining activities and riparian revegetation works), preceding the complaint and assess their potential impact. 6. Identify plausible and possible causative mechanisms and assess/quantify these against all relevant data and information to identify most likely causes. 7. Decide if the complaint is justified and solely attributable to activities being undertaken by or directly related to the Mine. 8. Notify owner of outcome of investigation. 9. Provide a preliminary investigation report to DP&E, EPA and relevant agencies within 7 days of receiving complaint.
Response	• If complaint is justified, develop/design contingency and remedial measures based on the results of the above investigations. Measures may include the following; ○ provide an alternative water source during the duration of the breach; ○ review and refine the surface and ground water monitoring programs; ○ review Site Water Balance and predictive groundwater model; and ○ review mine plan impacts on alluvial groundwater source.
Plan	• Communicate results of investigation and subsequent contingency and remedial measures to government agencies as required and summarise in the Annual Review. • If required, review and update the WMP and resubmit to DP&E. • Where an investigation determines that an exceedance of the water management performance measures in Table 6 of Development Consent SSD-6764, WCPL would (in accordance with Schedule 5, Condition 2 of Development Consent SSD-6747): ○ 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 Department describing those options and any preferred remediation measures or other course of action; and ○ implement reasonable remediation measures as directed by the Secretary.

7.4 EPL Non-Compliance

EPL 12425 includes a number of limits associated with surface water monitored at licensed discharge point (LDP) 24, including:

- monitoring requirements;
- volumetric discharge limit (15 ML/d); and
- concentration limits of pollutants (EC, oil & grease and pH).

In the event that a non-compliance with EPL surface water conditions at LDP 24 has been identified, the investigation and TARP in Table 18 will be initiated. The same TARP will be applied to maintain compliance with future EPL variations that relate to discharge from sediment dams under high intensity rainfall events.

Table 18
EPL Non-Compliance TARP

TARP	
Trigger	• Failure to monitor in accordance with the EPL. • Exceedance of volumetric discharge limit. • Exceedance of water quality concentration limits.
Action	1. Notify the WCPL ECM or delegate. 2. Immediately suspend discharge activities. 3. Check and validate the data which indicates an exceedance of the trigger conditions. 4. Notify DP&E, EPA and other relevant agencies as soon as practicable that an exceedance of the trigger level has occurred and investigation will be undertaken. 5. Investigate changes in recorded discharge monitoring and monitoring protocols and assess if any trends are evident. 6. Identify plausible and possible causative mechanisms and assess/quantify these against all relevant data and information to identify most likely causes. 7. Evaluate whether the non-compliance has resulted in a 'pollution incident' and, if necessary, implement the processes outlined in the Pollution Incident Response Management Plan. 8. Provide a preliminary investigation report to DP&E, EPA and relevant agencies within 7 days of identifying the exceedance.

Response	• Develop/design contingency and remedial measures based on the results of the above investigations. Contingency and remedial measures considered practical for implementation may include:
	  ○ review and refine the surface water monitoring program;
	  ○ review the operation and effectiveness of the water monitoring equipment (e.g. probes, RO Plant, power supply and communications);
	  ○ review and refine site water discharge and calibration processes; and
	  ○ develop and implement a training package specifically related to the cause of the incident/non-compliance.
	• Consider the appropriateness of the EPL conditions relating to offsite discharge.

Table 18 (continued)
EPL Non-Compliance TARP

TARP	
Plan	• Communicate results of investigation and subsequent contingency and remedial measures to government agencies as required and summarise in the Annual Review. • If required, review and update the WMP and resubmit to DP&E. • Where an investigation determines that an exceedance of the water management performance measures in Table 6 of Development Consent SSD-6764, WCPL would (in accordance with Schedule 5, Condition 2 of Development Consent SSD-6747): o take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; o consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and o implement reasonable remediation measures as directed by the Secretary.

7.5 Unauthorised Discharge

In the event that an unauthorised discharge occurs (e.g. the failure of erosion and sediment measures that result in water discharging to the natural environment), the investigation and TARP in Table 19 will be initiated.

Table 19
Unauthorised Discharge TARP

TARP	
Trigger	• Unauthorised discharge off site.
Action	1. Immediately cease, or implement measures to cease, the discharge. 2. Notify the WCPL ECM. 3. Notify DP&E, EPA and other relevant agencies immediately. 4. If deemed necessary, engage a suitably qualified aquatic ecologist to undertake a risk based monitoring program following cessation of discharge, including: o monitoring immediately upstream and downstream of the discharge point for pH, EC, sulphate and TSS; o photographic log of the discharge point and upstream and downstream; and o if water quality monitoring results indicate a clear deterioration in water quality downstream, undertake a risk based stream health survey downstream of the discharge point as soon as practicable to quantify the impact on stream ecology. 5. Evaluate whether the non-compliance has resulted in a 'pollution incident' and, if necessary, implement the processes outlined in the Pollution Incident Response Management Plan. 6. Provide a preliminary investigation report to DP&E, EPA and relevant agencies within 7 days of identifying the exceedance.

Table 19 (continued)
Unauthorised Discharge TARP

TARP	
Response	• Develop/design contingency and remedial measures based on the results of the above investigations. Contingency and remedial measures considered practical for implementation may include: ○ Develop and implement a remedial action plan in consultation with relevant government agencies; ○ Reinstate or install additional suitable erosion and sediment controls; ○ Review and refine the surface water monitoring programs; ○ Review and refine processes for inspection, maintenance and siting of water management infrastructure (e.g. dams, pipelines, pumps); ○ Construct new water management infrastructure (e.g. Diversion drains, sediment dams); ○ Review and refine environmental inspection regime to ensure the frequency of inspections is adequate and actions are implemented; and ○ Develop and implement a training package specifically related to the cause of the incident/non-compliance.
Plan	• Review the water management system, ESCP and associated procedures to prevent a re-occurrence. • Communicate results of investigation and subsequent contingency and remedial measures to government agencies as required and summarise in the Annual Review. • If required, review and update the WMP and resubmit to DP&E. • Where an investigation determines that an exceedance of the water management performance measures in Table 6 of Development Consent SSD-6764, WCPL would (in accordance with Schedule 5, Condition 2 of Development Consent SSD-6747): ○ 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 Department describing those options and any preferred remediation measures or other course of action; and ○ implement reasonable remediation measures as directed by the Secretary.

8 Surface Water Monitoring Program

8.1 Monitoring Standards

Surface water monitoring at the Mine will be undertaken in accordance with relevant Australian Standards, legislation and the NSW EPA approved methods for sampling, including (but not limited to):

- *Approved Methods for the Sampling and Analysis of Water pollutants in NSW (*DEC, 2004);
- *AS/NZS 5667.1:1998 Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples*; and
- *AS/NZS 5667.10:1998 Water Quality – Sampling – Guidance on Sampling of Waste Waters*.

8.2 Monitoring Program

This surface water monitoring program includes monitoring of the following elements of the Wilpinjong Coal Mine's water management system and surrounding creeks:

- water usage, pumped water transfer volumes and volumes of water stored on site;
- surface water quality in Wilpinjong Creek, Cumbo Creek, Wollar Creek and Slate Gully flow line;
- surface water flows in Wilpinjong Creek and Cumbo Creek;
- channel stability in Wilpinjong Creek and Cumbo Creek;
- stream health conditions in Wilpinjong Creek and Cumbo Creek;
- water quality and volume monitoring for licensed discharges; and
- water quality of stored mine water.

All equipment used in the surface water monitoring program will be maintained and calibrated in accordance with manufacturer's specifications and relevant guidelines and standards.

8.2.1 Water Management System Monitoring

WCPL undertake routine monitoring of water usage, volumes of water stored on site and volumes of water discharged via EPL 12425. The data is used to:

- monitor trends in water use and efficiency;
- check stored water inventory; and
- assist in future mine water supply and management planning by updating the site water balance model.

In addition, WCPL will undertake quarterly sampling of on-site water storages for water quality (including relevant metals). The selection of storages and parameters for monitoring will be informed by water management procedures at the time (e.g. pumping procedures and water held in storages) and the outcomes of downstream surface water quality monitoring (Section 8.2.3).

Table 20 provides a summary of monitoring undertaken for the mine water balance. WCPL would undertake further monitoring required by EPL 12425 if it is varied in future to incorporate sediment dams discharging off-site.

Table 20
Water Management System Monitoring

Parameter	Description	Location	Frequency
CHPP Water Usage	Water supplied to the CHPP from CWD and RWD	Flow meters at the CWD and RWD	Weekly
Pit Dewatering	Water volume pumped from the open cut operations to surface water storages	Flow meters at the open cuts	Weekly
Licensed Discharge	Water volume discharged to Wilpinjong Creek LDP24 under EPL 12425	Flow meter at LDP24	Weekly
Storage Volume	Water level	Individual main water storages	Weekly
Storage Volume	Level-volume relationships	Individual main water storages	As required
Water quality	Sampling of relevant water quality parameters (including metals)	Select water storages	Monthly

8.2.2 Streamflow

WCPL will continue to maintain gauging stations on Wilpinjong Creek at WILGSD, WILGSU and Cumbo Creek at CCGSD and CCGSU, to continuously monitor streamflow.

Stream flow data will be shared with Moolarben Coal Operations (MCO) and Ulan Coal Mines Limited (UCML), as requested, in accordance with a data sharing agreement between the three mines.

Rainfall monitoring will be undertaken at the on-site meteorological station.

8.2.3 Environmental Surface Water Quality

Surface water quality monitoring will be undertaken at the monitoring locations shown on Figure 3.

The monitoring parameters and frequency for each site is shown in Table 21. As requested by the IESC, WCPL will commence monthly monitoring of metals downstream and upstream on local creeks. Monthly monitoring of metals would be supplemented by event based monitoring, however, would be limited to a maximum of one round of metals analysis per month. In accordance with the recommendations in the Wilpinjong Extension Project Geochemistry Assessment, the monitoring programme specifically includes the following metals:

- Total alkalinity/acidity; and
- metals identified as elevated and/or soluble in waste/coal reject material (Se, As and Mo).

Water quality monitoring will continue to be undertaken in accordance with the ANZECC and ARMCANZ (2000) guidelines and the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DEC, 2004).

The IESC recommended that additional monitoring sites are established on Wollar Creek, downstream of the Wilpinjong Creek confluence, in order to monitor potential effects on the Goulburn River National Park. WCPL notes that the stretch of Wollar Creek between the Wilpinjong Creek confluence and the boundary of the Goulburn River National Park is approximately 1 km long. The existing monitoring site (WOL 1) is located approximately half way down this stretch. Therefore, additional monitoring sites are not considered to be warranted. An additional monitoring site (WILU3) will be established upstream of the Wilpinjong Extension Project Pit 6 extension by 31 December 2017, subject to a land access agreement being established with Moolarben Coal. In the interim, upstream monitoring data available from Moolarben Coal's monitoring sites on Wilpinjong Creek would be used to evaluate downstream monitoring results at the Wilpinjong Coal Mine.

Table 21
Environmental Surface Water Monitoring Program

Monitoring Locations		Frequency	Parameters[1]
Wilpinjong Creek	Licensed Discharge Point No. 24	Continuous (during discharge)	Volume of water discharged[3], EC and pH
		Weekly (during discharge)	Oil & Grease and TSS
	WIL-U, WIL-U2, WIL-PC, WIL-NC, WIL-D and WIL-D2	Monthly*	Field pH and EC, turbidity, and SO_4, Copper, Zinc, Iron, Aluminium, Nickel, Manganese, Barium, Strontium, Lead, As and Se, Total Alkalinity/acidity, Mo
	WILGSU and WILGSD (gauging stations)	Continuous	Flow rate, pH, EC and temperature
		Monthly	Field pH and EC, turbidity, and SO_4
		Following significant rainfall events[2]	pH, EC, TDS, TSS and sulphate
	WC1, WC2, WC3, WC4, WC5, WC6, WC7, WC8	Annually	Stream health monitoring
	Forty-nine survey points along Wilpinjong Creek	Annually	Channel stability monitoring (photo-points, description, stability)

Table 21 (Continued)
Environmental Surface Water Monitoring Program

Monitoring Locations		Frequency	Parameters[1]
Cumbo Creek	CC1, CC2 and CC3	Monthly*	Field pH and EC, turbidity, and SO_4, Copper, Zinc, Iron, Aluminium, Nickel, Manganese, Barium, Strontium, Lead, As and Se, Total Alkalinity/acidity, Mo
	CC3	Following significant rainfall events[2]	pH, EC, TDS, TSS and sulphate
	CCGSU and CCGSD (gauging stations)	Continuous	Flow rate, pH, EC and temperature
		Monthly	Field pH and EC, turbidity, and SO_4
		Following significant rainfall events[2]	pH, EC, TDS, TSS and sulphate
	CC1, CC2	Annually	Stream health monitoring
	Nine survey points along Cumbo Creek	Annually	Channel stability monitoring
Wollar Creek	WOL 1 and WOL 2	Monthly*	Field pH and EC, turbidity, and SO_4, Copper, Zinc, Iron, Aluminium, Nickel, Manganese, Barium, Strontium, Lead, As and Se, Total Alkalinity/acidity, Mo
	WO1, WO2, WO3	Annually	Stream health monitoring
Slate Gully Creek	SGC_1	Monthly*	Field pH and EC, turbidity, and SO_4, Copper, Zinc, Iron, Aluminium, Nickel, Manganese, Barium, Strontium, Lead, As and Se, Total Alkalinity/acidity, Mo
		Following significant rainfall events[2]	pH, EC, TDS, TSS and sulphate

[1] Parameters will be analysed provided water samples can be collected.

[2] Greater than 20 millimetres (mm) in 24 hours.

[3] Volume to monitored using flow meter and continuous logger.

* Monthly monitoring of metals would be supplemented by event based[2] monitoring, however, would be limited to a maximum of one round of metals analysis per month.

8.2.4 Stream Health Monitoring

An ongoing stream health monitoring program for Wilpinjong and Cumbo Creeks will continue to assist in determining the need for any maintenance and/or contingency measures.

Annual stream health monitoring includes the following components:

- Survey of aquatic macroinvertebrate assemblages in spring if streamflow or ponded water is present and access to the creeks is safe. In situ surface water quality sampling and analysis (pH, EC, temperature, dissolved oxygen, salinity and turbidity) is also conducted at each macroinvertebrate sampling site at the time of the survey to identify and characterise the possible stressors upon macroinvertebrate assemblages.
- Compilation of a variety of interpretive indices using the survey data to evaluate environmental quality at the survey sites.
- Comparing the site indices against indices compiled for other sites within each survey and assessing changes in the indices for each site over time, including assessment against a trigger level for further investigation (Section 7.2).

The Stream Health Monitoring Program includes monitoring locations both upstream and downstream of the mine in Wilpinjong, Cumbo and Wollar Creeks. The existing sites (Figure 3) are well situated relative to the mine and they will remain essentially the same in future surveys. It will be necessary, however, to relocate the downstream sampling site on Cumbo Creek (site CC2) to a point further downstream when mining activity is occurring nearby and Cumbo Creek is to be relocated. Site WC3 is situated in a very degraded section of creek where there is a very poorly defined flow channel and will also be relocated a short distance upstream if a site with a better defined channel can be accessed.

Routine annual monitoring surveys will continue at the same sites (subject to minor relocation as described above) at the same time in each year, usually in mid-September as this appears to be the most reliable time of year for sustained flow. Sampling should only be carried out when water has been present in the creek systems for at least a month, and this will necessitate some flexibility in survey timing.

The full range of bed and bank habitats at each site will be sampled in three replicate samples, using a standard AUSRIVAS approved sampling net and complying with New South Wales AUSRIVAS sampling protocol. Samples will be live picked in the field. Macroinvertebrates will be identified to the taxonomic level specified in the NSW AUSRIVAS Sampling and Processing Manual, i.e. all specimens to family level with the exception of: *Oligochaeta* (to class), *Polychaeta* (to class), *Ostracoda* (to subclass), *Nematoda* (to phylum), *Nemertea* (to phylum), *Acarina* (to order) and *Chironomidae* (to subfamily).

Survey reports will include full details of all macroinvertebrates collected in each sample and consideration of biotic indices which have been developed by aquatic ecologists as quantitative indicators of stream health. At a minimum, the report will include the calculation and interpretation of abundance weighted SIGNAL values for each sample.

Other biotic indices, as appropriate, will also be used to supplement the evaluation of SIGNAL index values. Biotic indices which are commonly used as indicators of environmental quality include AUSRIVAS models, several variations of EPT (Ephemeroptera Plecoptera Trichoptera) indices, and various taxonomic diversity indices including the Shannon- Wiener diversity index. These indices should be familiar to persons with expertise in macroinvertebrate based stream health surveys. It should be noted however that local watercourses do not meet habitat requirements for using AUSRIVAS riffle sampling models.

Vegetation monitoring to be undertaken along Wilpinjong and Cumbo Creeks is discussed in the Biodiversity Management Plan.

8.2.5 Channel Stability

The channel stability monitoring program aims to provide qualitative measures of stream bed and bank erosion and channel instability along Wilpinjong and Cumbo Creeks. Initial surveys were conducted to establish baseline conditions (Section 4.4) with subsequent surveys being conducted every year.

Channel stability monitoring undertaken at locations established during annual surveys includes the following:

- dimensions of significant erosional or depositional features, measured and documented such that any subsequent changes can be evaluated quantitatively;
- photographs and written descriptions of each site, focussing on evidence of erosion and exposed soils;
- assessment of the stability of Wilpinjong and Cumbo Creeks using rapid assessment methodology (Section 4.4); and
- compare visual channel stability at each of the pre-selected sites against previous surveys.

9 Surface Water Management Measures

WCPL has developed a range of surface water management strategies to comply with the relevant water management performance measures in Table 6 of Development Consent (SSD-6764). These include:

- periodic updates to the Site Water Balance Model to forecast the mine water balance;
- minimisation of water use (refer Site Water Balance for details);
- operation of the site Water Management System, which includes collection of runoff from areas of disturbance in mine water storages and diversion of upslope runoff around operation areas;
- treatment of runoff from workshops or other potentially contaminated areas in an oil and water separator, with oil and grease collected and disposed of off-site by a licensed waste contractor;
- monitoring of water quality (including relevant metals) in watercourses and on-site;
- management of off-site discharges in accordance with the conditions of EPL 12425;
- management of Water Treatment Plant brine by pumping to the Pit 1 South open cut void storage;
- irrigation of treated effluent in accordance with the DECC's *Environmental Guideline for the use of Effluent by Irrigation* (2004) at a rate that does not cause surface runoff;
- implementation of a erosion and sediment controls for the site (Section 5.2);
- minimisation of disturbance areas and progressive stabilisation and revegetation of disturbance areas;
- design and construction of infrastructure close to watercourses to relevant standards and guidelines;
- storage of chemical and hydrocarbon products in bunded areas in accordance with the relevant Australian Standards;
- chemical and hydrocarbon spill containment and prompt clean-up using mobile spill kits;
- notification to the EPA and other authorities of pollution incidents that have the potential to cause harm or pose a threat to the environment in accordance with an approved Pollution Incident Response Management Plan, Development Consent and EPL 12425; and
- in-pit emplacement of tailings (with any spill confined within the WMS) in accordance with the Life of Mine Tailings Strategy followed by capping and rehabilitation.

WCPL has developed a Ground Disturbance Permit (GDP) process to minimise disturbance at the Mine site and assess and manage potential risks associated with disturbance works. The GDP includes an assessment of potential surface water impacts. Prior to any new mine site disturbance site personnel responsible for the management of these works are required to implement appropriate erosion and sediment controls (Section 5.2).

Progressive rehabilitation of mined areas reduces the disturbed areas of the site, minimising the potential for surface water impacts from sediment-laden runoff. Progressive rehabilitation of mined areas is undertaken in accordance with the approved Mining Operations Plan.

Where relevant WCPL will design, install and maintain any infrastructure within 40 m of watercourses generally in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (DPI 2007), or its latest version. WCPL will design, install and maintain creek crossings generally in accordance with the *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries, 2003) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries 2003), or their latest versions.

PAF materials will be managed in accordance with the procedures described in Section 6.4.

10 Annual Review and Improvement of Environmental Performance

The results of surface water monitoring are reported in the Annual Review. Further reporting details are provided in the WMP.

Monitoring parameters and locations will be reviewed and may be altered or discontinued as a result of changes to operations. Any revisions to the monitoring program will also be described in the Annual Review and in future revisions of this SWMP.

10.1 DPI Water Recommendations

DPI Water recommended a number of additional investigations as part its review of the updated Surface Water Management Plan. In accordance with these recommendations, WCPL would undertake the following in consultation with DPI Water:

- Development of a salinity assessment strategy that considers geomorphic influences on salt migration and expression to surface waters in infilled and incised phases of Wilpinjong Creek.
- Preparation of a detailed drainage line and rehabilitation plan for the Wilpinjong project area by a suitably consultant with geomorphological experience (note Alluvium has been engaged to prepare this study as described in Section 5.5).
- Preparation of a mass salt and water balance for the upstream and downstream stream gauges that includes consideration of the volume and concentration of discharge from the RO Plant, relative salinity of the Wilpinjong and Cumbo Creek catchments and associated salt contributions.
- A review of the construction and operation of the upstream and downstream gauging stations on Wilpinjong Creek against the requirements of the Bureau of Meteorology (2013) *National Industry Guidelines for Hydrometric Monitoring*. Following completion of the review, WCPL would provide a report to DP&E outlining any material differences (if any) between the guideline and the streamflow monitoring undertaken at the Wilpinjong Coal Mine.
- A review of stream health monitoring methodology by a suitably qualified and experienced person (including consideration of statistical design and power analysis inclusive of reference sites) to identify any recommendations for future stream health monitoring to detect potential changes due to mine expansion.

The additional works described above will be undertaken prior to and reported in the 2017 Annual Review (required to be submitted by March 2018) or other such time as determined in consultation with DPI Water.

11 Responsibilities

Specific responsibilities for personnel in relation to this SWMP are provided in Table 22. General responsibilities for water management are contained within the WMP.

Table 22
Responsibilities

Responsibility	Task	Timing
General/ Mine Manager	Ensure that adequate resources are available to effectively implement requirements of this WMP	Ongoing and during budget planning
Environment and Community Manager	Develop and adopt suitable triggers for water quality, flow and stream health in conjunction with suitably quality experts.	SWMP review
	Oversee development of Site Water Management System.	Continuous
	Ensure disturbance areas are minimised and progressive rehabilitation is undertaken in accordance with the MOP.	Continuous
Environmental Representative	Coordinate surface water monitoring program.	Refer Section 8
	Review results from monitoring programs against Impact Assessment Criteria in Section 6.	Monthly
	Review and update the Site Water Balance Model (and life of mine water balance).	At least annually
	Review onsite water use and identify opportunities for water use efficiency improvement.	Annually
	Oversee offsite discharge in accordance with EPL 12425.	As required
	Coordinate management of brine from water treatment facility.	As required
	Ensure irrigation of effluent is undertaken in accordance with guidelines.	As required
	Ensure all personnel receive basic spill response training.	As required
	Ensure any contaminated material from spills is disposed of in accordance with Waste Management Plan.	As required
All employees and contractors	Ensure all chemicals and hydrocarbon products are stored correctly on site.	At all times
	Ensure minor spills are contained and cleaned up and reported to the Environmental Department.	As required

12 References

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